Developer's Guide

for The Major BBS®

Version 6.2
January 1994

Galacticomm, Inc. • 4101 SW 47th Avenue • Suite 101 • Fort Lauderdale, FL • 33314
Voice: (305) 583-5990 • U.S. Sales: (800) 328-1128 • Fax: (305) 583-7846
BBS: (305) 583-7808 • Technical Support: (305) 321-2404

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1. OVERVIEW

This guide could be useful to you in two ways:

Developing	Programming an Add-on Option for The Major BBS
Customizing	Custom tailoring the functionality of one specific BBS

The main purpose of this manual is to help developers create new products for The Major BBS. But it will also be helpful if you're running a BBS and you want to customize it by making changes or additions to the source code or other aspects.

This guide is written assuming:

- You have purchased The Major BBS and the Developer's C Source Kit.
- You have read the System Operations Manual for The Major BBS.
- You are proficient in using The Major BBS (via modem or other interface).
- You are proficient in operating The Major BBS (from the console).
- You are proficient in the C language (we recommend "The C Programming Language," by Kernighan & Ritchie).
- You are proficient at using DOS on the IBM PC and compatibles.

Knowing assembly language can be helpful too, but it's by no means required to make extensive use of this development environment.

Requirements

To set up your development environment for developing your own Add-on Options for The Major BBS, you will need:

- 80386, 486, or Pentium IBM style computer with at least 4 Megabytes memory (1 Mb real, 3 Mb extended)
- 60 Megabytes hard disk minimum, but you may want 100 Megabytes or more
- DOS version 3.3 or higher
- Borland C++ compiler version 3.1 (see page 21 for a discussion of versions)

- Phar Lap 286|DOS-Extender SDK V3.0 or higher

- The Major BBS version 6.2 or higher

- The Developer's C Source Kit for The Major BBS, which includes:
  - C source code for The Major BBS
  - supporting subroutine libraries
  - supporting batch, make, and other files

- The Extended C Source Suite for The Major BBS (optional), which includes:
  - C source code for the GCOMM.LIB subroutine library
  - C source code for numerous offline utilities and supporting programs

- A text file editor of your choice, such as:
  - KEdit, by the Mansfield Software Group
  - QEdit, by SemWare in Marietta, GA
  - Personal Editor, by Personally Developed Software
  - EDIT (comes with DOS 5.0 or later)
  - EDLIN (comes with all versions of DOS)

- Btrieve from Novell (optional; required if you need to create your own databases)

Except for the computer, Btrieve, and the text editor of your choice, all of these products are available from Galacticomm.

To develop Flash games for The Major BBS, contact Galacticomm. This does not require source code licenses.

Registering Names with Galacticomm

To avoid conflicts between the names used in Add-on Options for The Major BBS from various third party developers, Galacticomm will register the names used in your finished products. This starts with your Developer-ID (more below). Besides Developer-IDs, here are a few of the kinds of things that could run into naming conflicts:

- Module names (from .MDF files, see page 23)
- Text variable names (see page 73)
- New CNF levels (see page 55)
- Statistics screen names (see page 146)

Call Galacticomm at (305) 583-5990 and ask for Third-Party Developer Services to register your Developer-ID and other names you are using.

Choosing a Developer-ID

Galacticomm maintains a master list of 3-character Developer-ID's.

> All files that you supply on your product diskette (including compressed files and the files inside of compressed files) and that are created during the execution of the BBS should have names that start with your three-letter Developer-ID.
>
> See the exceptions for INSTALL.EXE and DISK1.DID, etc., below.

All files associated with running an Add-on Option for The Major BBS should strictly adhere to this convention to avoid file name collisions.

Source and object file names should ideally also use the Developer-ID prefix to avoid name collision. Even if you use a separate directory for your source files, your object files will reside in the same directory as all other object files from all other developers (\BBSV6\PHOBJ or \BBSV6\LOBJ).

You may choose not to use your Developer-ID prefix on source files. The need for unique source and object file names is not as strict as the need for unique names of files associated with *running* the BBS and Add-on Options. It would be a disaster for a BBS operator to buy two Add-on Options from different sources and have them not work because of a file name collision. It would be an annoyance for someone who buys your source code to run into name collisions. The latter is going to happen to a far smaller group of people, and those people (BBS developers or BBS customizers) are more likely to be able to recover from it themselves by manually renaming some of the files.

These Developer-ID's are reserved by Galacticomm:

```
BBS   Global or internal purposes
GAL   Standard and Add-on Options from Galacticomm

CNF  LOC  MTH   \
MAJ  EMU  MDF    \  other reserved prefixes
MJR  CAT         /
BTR  GP         /

INS   Reserved for INSTALL.EXE or INSTALL.BAT on the floppy disks
      that we ship, or that you ship
DIS   Reserved for DISKn.DID files on floppy disks
GHO   Reserved for Galacticomm Host program for Doors
```

In this manual we'll use "DDD" to represent an example of a Developer-ID:

```
DDD   example Developer-ID
```

For Sysops, or anyone developing something to run on one BBS only, the following Developer-ID is available:

```
ZZZ   Sysop Developer-ID
```

Installation

The following procedure has been designed to apply to everyone who purchases C source code from Galacticomm. It was designed for non-programmers, but it assumes you already have a way to edit text files like .BAT batch files.

There are several products discussed here, and several sections may or may not apply to you. Whether you're building a development environment for the basic BBS, or for a BBS with dozens of Add-on Options, including some of your own, please use this as your central reference, and follow the steps very carefully.

To create a development environment for The Major BBS on your computer:

1. Install The Major BBS. Put the first disk in your A: floppy drive and type:

   A:INSTALL

   We strongly recommend you use the default directory "\BBSV6" for your development environment. (If you use a different directory, you'll have to edit all the .BAT, .LNK, .MAK, .DEF, and .CFG files. See page 13.) The \BBSV6 directory will be created automatically for you if it does not already exist.

   You can install from a different floppy drive by typing:

   B:INSTALL

   or Q:INSTALL, or whatever. This will be true for installing software from *any* disks from Galacticomm, even though we'll just talk about A: in the rest of these steps.

   Before you install the source code and other items, it might be a good idea to try running The Major BBS and getting it on the air. See the System Operations Manual for details.

2. Install the Borland C++ Compiler. Put the INSTALL DISK in your A: floppy drive and type:

   A:INSTALL

   We recommend that you use the default directory "\BORLANDC". This directory will be created automatically for you if it does not exist already.

   After installing the compiler, create a TLINK.CFG file and a TURBOC.CFG file in your \BORLANDC\BIN directory (or replace them if they're there already) with these contents:

   TLINK.CFG
   ```
   -L\BORLANDC\LIB;\RUN286\BC3\LIB;\BBSV6\DLIB
   ```

   TURBOC.CFG
   ```
   -I\BORLANDC\INCLUDE;\RUN286\INC;\BBSV6\SRC
   -L\BORLANDC\LIB;\RUN286\BC3\LIB;\BBSV6\DLIB
   ```

3. Install the Phar Lap 286|DOS-Extender SDK. Put the Software Development Kit disk 1 in the A: floppy drive and type:

```
A:INSTALL
```

Use the default "\RUN286" directory (it will be created for you, as well as its subdirectories). When it comes time to choose what to install, pick these:

```
286|DOS Extender Binaries   YES
MS C Support                 NO
MS Fortran Support           NO
Borland C++ Support         YES
MS C Examples                NO
Borland C++ Examples         NO
```

4. Put the compiler and DOS-Extender BIN subdirectories and the \BBSV6\SRC directory in your path statement. For example, you could have something like this in your AUTOEXEC.BAT file:

```
AUTOEXEC.BAT
:
PATH=C:\DOS;C:\BORLANDC\BIN;C:\RUN286\BIN;C:\BBSV6\SRC
:
```

(If you make changes to AUTOEXEC.BAT, remember to reboot your computer so they take effect.)

5. Install Borland C Huge Model Support. Download the huge model support files from Phar Lap's BBS at (617) 661-1009. Look in the File Library in the "GALACT" LIB and download the file named "PLPAT2.ZIP".

Unzip the files in this ZIP file and run the MKLIB batch file:

```
CD \RUN286\BC3\LIB

   (download or copy PLPAT2.ZIP into this directory)

\BBSV6\PKUNZIP PLPAT2.ZIP
MKLIB H \BORLANDC\LIB
```

If MKLIB gives you a "file not found" message, it's OK.

6. Install The Major BBS Developer's C Source Kit. Put the first disk in your A: floppy drive and type:

```
A:INSTALL
```

If you have the Extended C Source Suite, do steps 7 and 8:

7. Install The Major BBS Extended C Source Suite. Put the first disk in your A: floppy drive and type:

```
A:INSTALL
```

8. For every new \BBSV6\SRC*.MAK file that comes with the Extended C Source Suite, insert the following lines at the end of the master make file \BBSV6\SRC\MAKEBBS.BAT:

```
cd \bbsv6\src
make -fbbsxyz.mak
```

(Instead of "bbsxyz.mak" use the name of each .MAK file that comes with the Extended C Source Suite.)

This step isn't critical, but you may find it handy to be able to run MAKEBBS to reliably compile and link whatever needs compiling and linking.

And if you purchase Btrieve from Novell (for your own databases), do step 9:

9. Install the Btrieve database development package from Novell.

If you have purchased the C source code for any Add-on Options from Galacticomm, do steps 10-12:

10. Install the Add-on Options. Put the first disk in your A: floppy drive and type:

```
A:INSTALL
```

11. Install the Add-on Option C Source code. Put the first disk in your A: floppy drive and type:

```
A:INSTALL
```

12. Add the appropriate lines to the end of \BBSV6\SRC\MAKEBBS.BAT to invoke the .MAK file for the option, such as:

```
cd \bbsv6\src
make -fgalxyz.mak
```

(Instead of "galxyz.mak" use the name of whatever .MAK file comes with the C source code of the Add-on Option.)

This step will allow you to use MAKEBBS to properly follow up on any and all changes you may make to the source files or other files in the Add-on Options.

To develop your own Add-on Option, you can either use our \BBSV6\SRC directory for your source and support files, or you can make your own subdirectory.

Choose one of these (either 13a or 13b):

13a. Put your C source code in \BBSV6\SRC.

Add lines onto the end of \BBSV6\SRC\MAKEBBS.BAT that invoke your make files, such as:

```
cd \bbsv6\src
make -fdddxyz.mak
```

(Instead of "dddxyz.mak" use the name of your .MAK file.)

or:

13b. Create a subdirectory for your source code with the same name as your Developer-ID. For example, if your Developer-ID is "DDD", create:

```
\BBSV6\DDD      C source code for your Add-on Option
```

You can also add lines onto the end of \BBSV6\SRC\MAKEBBS.BAT that invoke your make files, such as:

```
cd \bbsv6\ddd
make -fdddxyz.mak
```

(Instead of "dddxyz.mak" use the name of your .MAK file.)

Whichever method you choose: \BBSV6\SRC or \BBSV6\DDD for your source code, try to use unique names for your source files. Either way, all object files end up in \BBSV6\PHOBJ: yours, and those of other developers. To minimize the probability of name collisions, it's a good idea to use your Developer-ID as a prefix to all your source file names.

Now, test your development environment:

14. Run \BBSV6\SRC\MAKEBBS.BAT:

```
CD \BBSV6\SRC
MAKEBBS
```

This will compile and link \BBSV6\MAJORBBS.EXE, plus almost all \BBSV6*.DLL files, and some \BBSV6*.EXE offline utilities. The process may take many minutes depending on your computer's processing power. Keep a sharp eye out for warnings or error messages.

15. Bring up the BBS and exercise it (try a file transfer over the modem, or over the LAN, for example).

Congratulations! Your development environment for The Major BBS is up and running!

Installation Software for your own Add-on Option

The INSTALL.EXE program we use has some general purpose capabilities that make it useful for just about any Add-on Option for The Major BBS. As with all Galacticomm code, you can only use INSTALL.EXE in your product under special license arrangement with Galacticomm. Assuming you have reached such an arrangement, here are the technical details.

All files must be combined into .ZIP compressed files on your release floppy diskette(s), with only a few exceptions that we'll discuss here. For one, put on your first diskette a file called DISK1.DID, for example:

```
DISK1.DID
2 150 7000000
```

Here is what these three numbers represent:

2 - total number of diskettes for this Add-on Option

150 - total number of all files inside of the .ZIP files on all diskettes (inner .ZIP files are not unzipped)

7000000 - approximate total hard disk space that will be required to complete installation

Other disks must contain files named DISK2.DID, DISK3.DID, etc., but the contents of these files don't matter. If your .ZIP files require a certain version of PKUNZIP, then put PKUNZIP.EXE on the *last* disk in your set (outside of any .ZIP files of course).

To run your own batch file or program after INSTALL.EXE completes, be sure to include at least one .MDF file with an "Install:" directive (see page 24 for details) somewhere in one of your .ZIP files.

> Note: The BBS automatically deletes whatever file is named in an .MDF "Install:" directive after it's done running.

.RLN Release Notes

You can include release notes in an .RLN file in one of your .ZIP files. INSTALL will automatically display them to the operator. We use this to display BBSMAIN.RLN to Sysops when they first install the BBS. That file contains very up-to-date information and it makes sure the Sysop gets a chance to read it. *Note: be sure your lines are no more than 76 characters long.*

How .MSG files are Updated

Any .MSG files included in your .ZIP files are automatically merged with .MSG files that exist already on the Sysop's system. This way their offline CNF option settings are preserved when they update to a new version of your software.

See page 55 about creating .MSG files. Here's an example of how it works: Suppose you supply a DDDSAT.MSG file with an option named HOOPLA{}. If a DDDSAT.MSG file with a HOOPLA{} option already exists on the Sysop's BBS, then the contents of that option (what's between the curly braces) in the Sysop's old DDDSAT.MSG displace those from your release disks. In all other

respects (option type, description, help message), the contents of your DDDSAT.MSG file are updated on the Sysop's system.

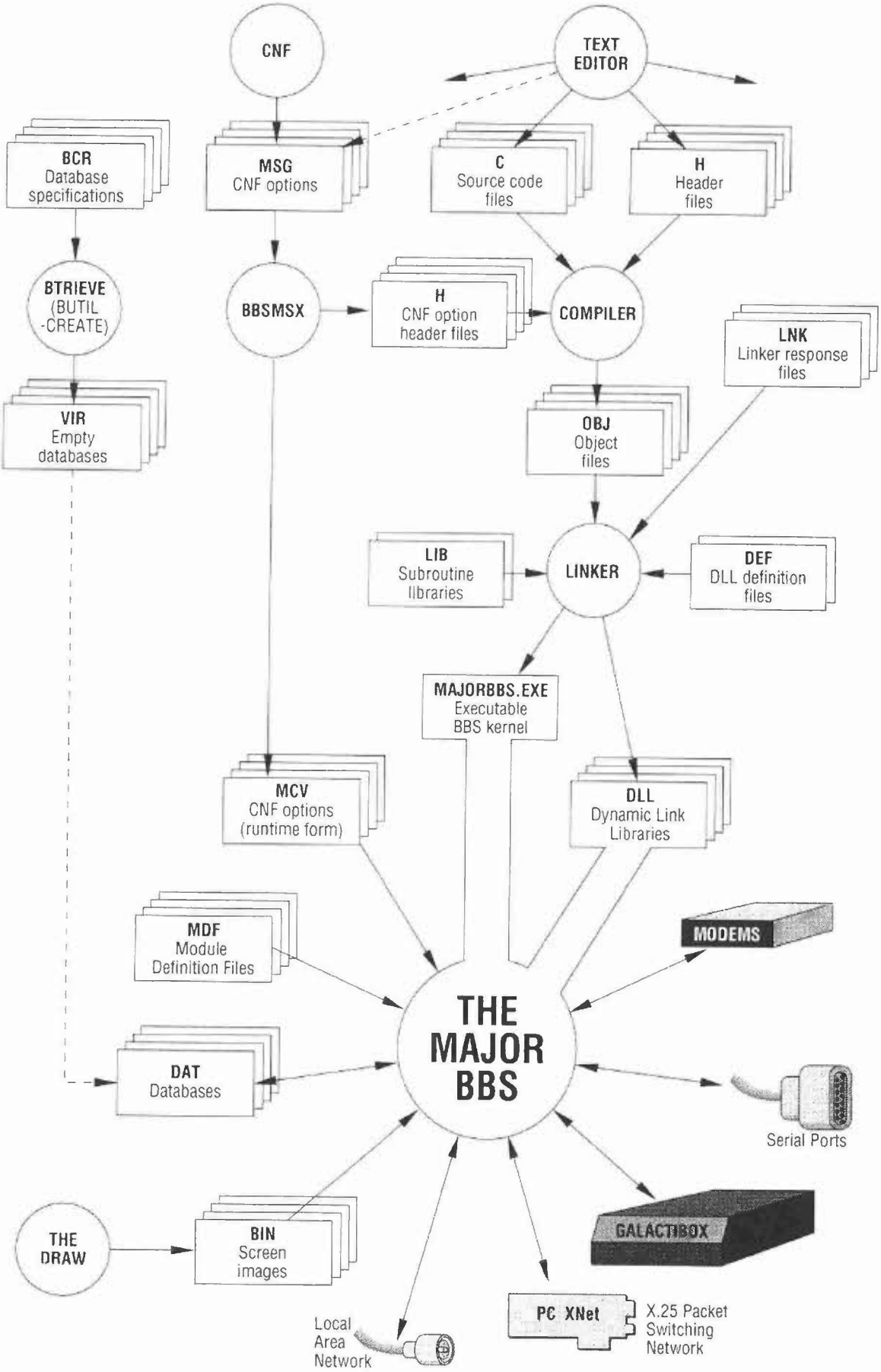
An alternate form of the .DID files on each of your release diskettes adds a language name at the end. For example:

```
DISK1.DID
2 150 7000000 English/RIP
```

This is used in certain special situations. When a language name appears as the fourth parameter in a .DID file, it tells the INSTALL program to be sure to force all text in that language onto the BBS, and not to mix it with any text the Sysop may already have in that language.

This is especially helpful, for example, with English/RIP text block design and updating. There are many cases where the function of one English/RIP text block depends on the contents of another text block, and a system with a mix of old and new English/RIP versions of text blocks won't work very well.

You can use this feature with any user-language, such as "Spanish/RIP" or "German/RIP". If you use this feature in your Add-on Option, the Sysop will be given the option (called "UPDATE NEW") of mixing his text in the specified user-language with yours, but he'll be strongly encouraged to allow all of your text to take precedence (that option being called "UPDATE ALL").

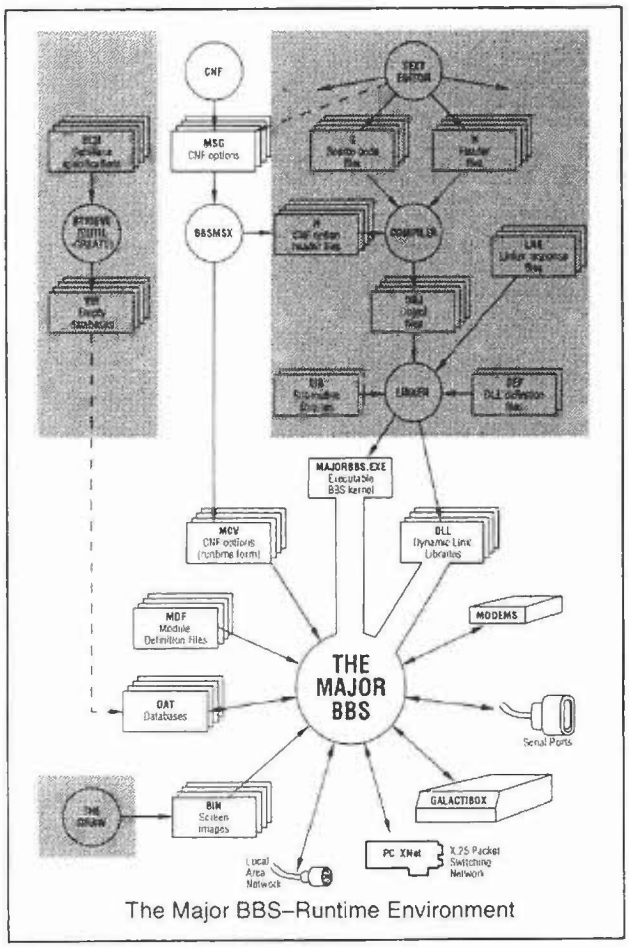


Development and Runtime Structure of The Major BBS

2. DEVELOPMENT ENVIRONMENT

The Runtime Environment

The Major BBS runs with a large supporting cast of disk files. MAJORBBS.EXE is the kernel of the BBS with multi-user support, user and console interfaces, security, accounting, menuing, and online services like file transfer and message editing, as well as numerous utility subroutines. .DLL (Dynamic Link Library) files contain software for various online services like Electronic Mail and Forums (together in GALMSG.DLL), Teleconferencing, File Library.



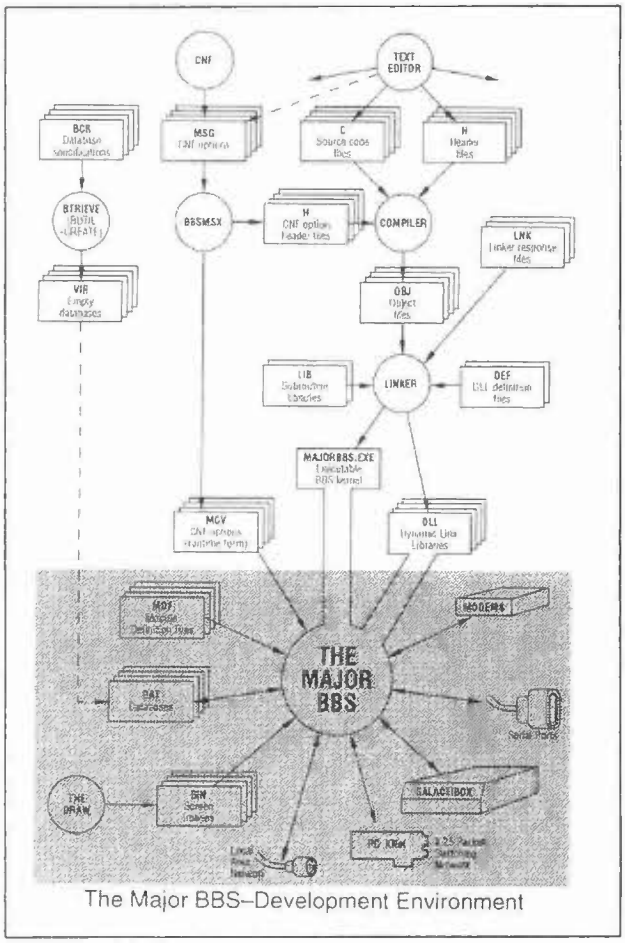
The Major BBS–Runtime Environment

.MDF files are Module Definition Files. These are the starting points for all operations of the BBS, specifying: what user services are available when Sysops design their Menu Trees; what text files to use for the BBSUSER.DOC online user manual; what databases, CNF options, text blocks, and utilities to use; and what happens at installation, at the nightly auto-cleanup, or at other timed events.

.DAT Databases maintain information on users, messages, online files and more. .MCV files store prompts, menus, and configuration options. .BIN files store screen image backgrounds or statistical graphs. You can edit .BIN files with a shareware program like TheDraw.

The Development Environment

Behind the scenes of the files that support *running* The Major BBS are a host of files on the development system. Almost everything starts with a text editor and a text file. Various programs (shown as circles) process text files and turn them into other things. At the heart of the matter, C source code in the .C and .H files gets compiled into object files. The object files get linked with each other and with subroutine libraries to form executable code: either in the MAJORBBS.EXE kernel, or the .DLL files.



The Major BBS–Development Environment

Also behind the scenes, .MSG files encode CNF options and text blocks. These are referenced in the source code using codes defined in .H files, and used online by reading from the indexed .MCV files. BBSMSX converts .MSG files into .MCV files.

If you're creating your own databases, you can use Btrieve from Novell to generate empty .VIR database files from the .BCR specifications. The install process first copies .VIR files to .DAT files to start off the databases (it knows to do this if the .DAT file doesn't exist yet).

See page 162 for the development environment for offline utilities.

Directory and File Structure

Directory Structure for The Major BBS Development Environment

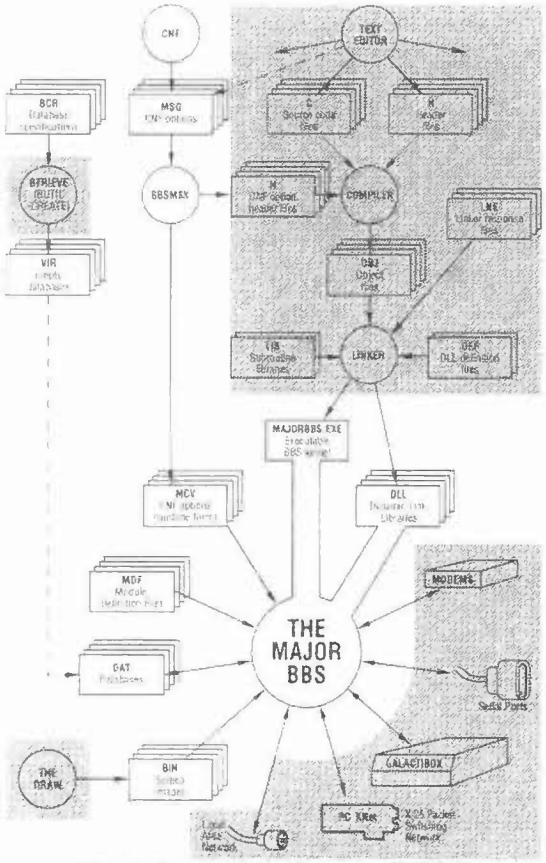
```
\BBSV6          Runtime directory for The Major BBS
   \HELLO       /Hello Forum message attachments
   \EMAIL       E-mail attachments
   \MAIN        Files in the MAIN LIB
   ...          Subdirectories for other Forums and LIBs

   \SRC         C source files (.C .H), Linker response files (.LNK)
   \PHOBJ       Object files for Phar Lap Huge model (.OBJ)
   \LOBJ        Object files for Large model (.OBJ)
   \DLIB        Libraries (.LIB) and DLL definition files (.DEF)
   \LIBSRC      C source files for PHGCOMM.LIB (extended source pkg)

\BORLANDC       \BIN        Compiler, linker, librarian, make, assembler (.EXE)
   \INCLUDE     Include files (.H)
   \LIB         Libraries (.LIB)
   ...

\RUN286         \BIN        Phar Lap 286 Loader programs
   \BC3\LIB     Libraries for Borland C++ version 3
   \SRC         Source code
   \INC         Include files
   ...
```

We recommend the directory name "\BBSV6" for running The Major BBS, but this is your option. You can easily run The Major BBS from any directory on any drive. However, when *developing* for The Major BBS, it's much more work to use a directory structure other than one that's based on \BBSV6. (If there are very good reasons why you *don't* want to use \BBSV6, you'll need to use a text editor to modify all batch files, link files, make files, and compiler configuration files (.BAT, .LNK, .MAK, .DEF, .CFG). Also, before you even install these files from the source diskette, you'll need to modify the INSTALL.BAT file on the source diskette to refer to the directory you're using that's other than "\BBSV6".)



Files in the Runtime Directory: \BBSV6

The Runtime Directory

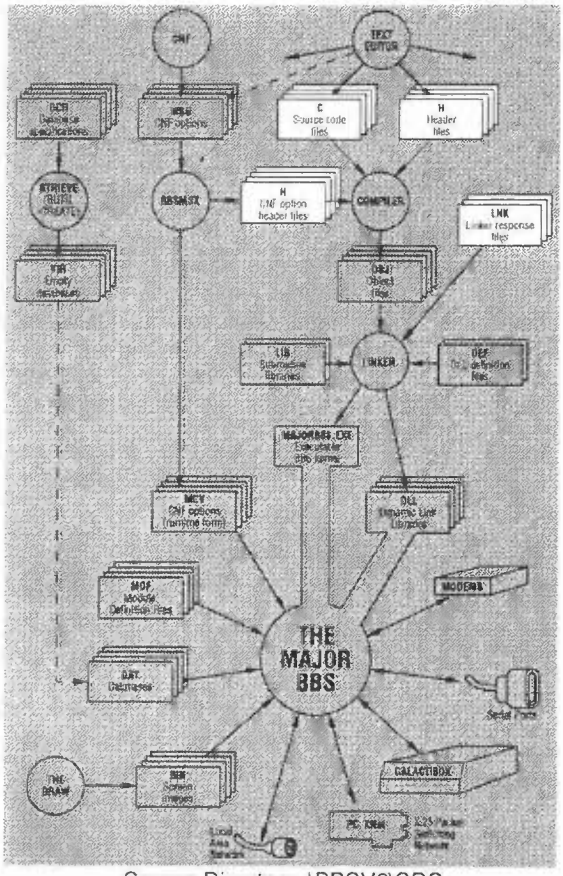
Almost all of the files that The Major BBS needs to run will be located in the \BBSV6 subdirectory. This includes the

main executable file (MAJORBBS.EXE), all dynamic link libraries (*.DLL), all databases (*.DAT), and all CNF options (*.MCV) plus many more. See page 3 for conventions on file naming with Developer-ID's. See page 15 for the conventions on file extensions. When you run The Major BBS, don't execute MAJORBBS.EXE directly, use BBS.BAT instead.

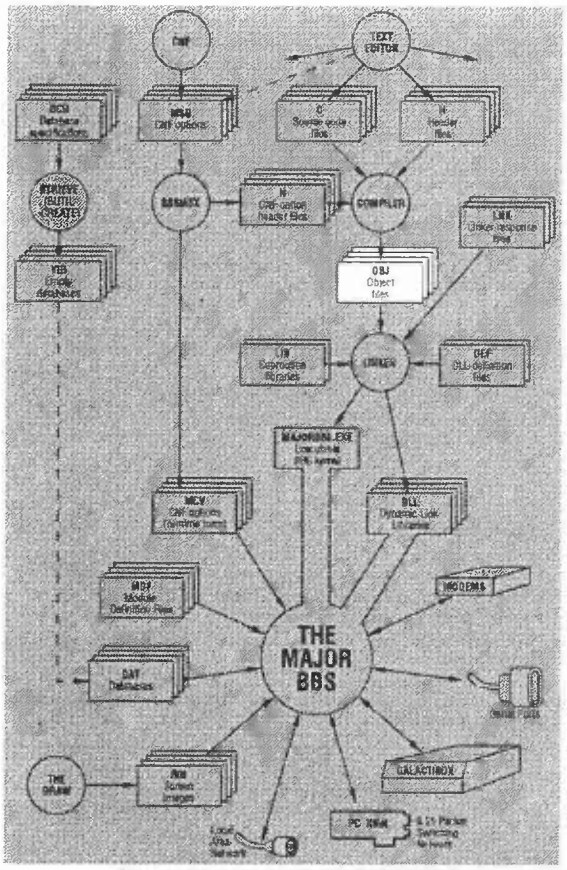
The Development Directories

For The Major BBS and all Add-on Options from Galacticomm, the sub-directory \BBSV6\SRC will hold the source files and \BBSV6\PHOBJ will hold the object files. For all online source code, the compiler huge model will be used, along with Phar Lap 286|DOS-Extender enhancements. Subroutine libraries are in \BBSV6\DLIB.

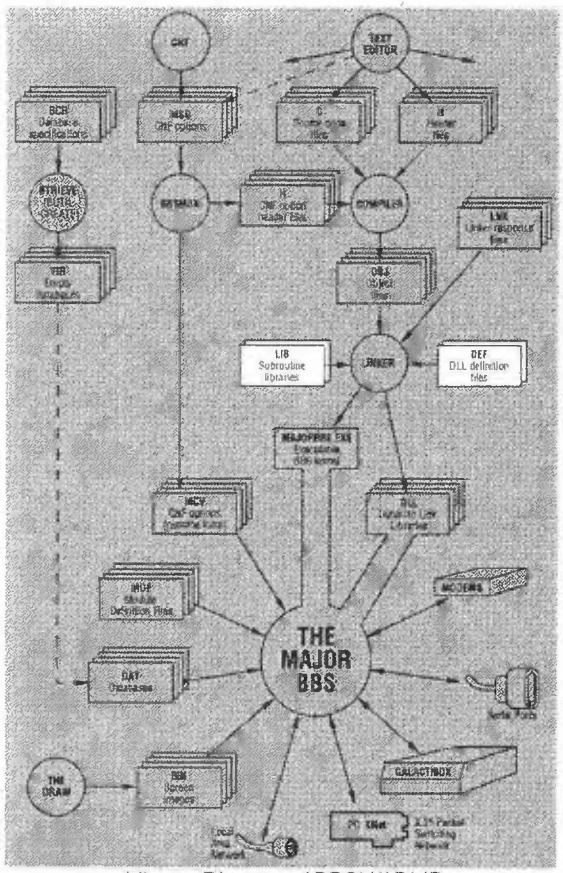
See page 162 about developing offline utilities.



Source Directory: \BBSV6\SRC



Object Directory: \BBSV6\PHOBJ



Library Directory: \BBSV6\DLIB

File Extensions

.ALT	Alternate sorting sequence for databases
.ANS	Text files with ANSI commands
.ASC	Text files without ANSI commands
.BAT	Batch files
.BCR	Btrieve database creation specifications
.BIN	Screen image files
.C	C-language source files
.CFG	Compiler and linker configuration files
.DAT	Btrieve databases
.DEF	Protected mode definition files -- used during linking to specify exported symbols, etc.
.DID	Installation specifications file on floppy disks
.DLL	Dynamic Link Libraries (linker output)
.DMD	Disabled .MDF file
.DOC	Documentation
.EXE	Executable files (linker output)
.FLG	Special purpose "flag" files
.H	C-language header files (some are generated by BBSMSX)
.HLP	Helpful text files
.IBM	Text file with ANSI commands and Extended ASCII characters
.IDX	Internal data file
.INS	Instructions
.LNK	Linker response files -- specifies all the object files that the linker needs to create an .EXE or .DLL file
.LOG	Capture of local or emulated sessions
.MAK	Make files
.MAP	Linker report output
.MCV	CNF options (runtime form)
.MDF	BBS module definition file
.MSG	CNF options (editable form)
.OBJ	Object files (compiler output)
.REF	Internal data file
.RLN	Release notes
.RPT	Reports
.SCN	Screen image files
.TXT	Text files for online viewing (sample Menu Tree file pages)
.VIR	Empty or starting-point databases
.ZIP	Files compressed and combined with PKZIP

See also page 3 on the use of Developer-ID's as file naming prefixes.

A few unique file names:

MAJORBBS.EXE	Main executable program
MJRBBS.CFG	Menu Tree generated list of DLLs, languages, MSG's, and other BBS requirements
GP.OUT	General Protection report file

To avoid conflicts between file names and directory names wherever possible:

> File names should have nonblank extensions and directory names should have blank extensions.

C Source Conventions

Here are a few of Galacticomm's in-house standards on the formatting of C source files:

- All C source files, after the comment header, should begin by including GCOMM.H:

  ```
  #include "gcomm.h"
  ```

  GCOMM.H is a header file that does several things, including:

  - Includes several of the standard Borland C++ header files for defining constants, data types, macros, and function prototypes:

stdio.h	dos.h	setjmp.h
stdlib.h	io.h	string.h
ctype.h	math.h	stdarg.h
dir.h	mem.h	time.h

  - Includes some special-purpose Galacticomm header files:

btvstf.h	Btrieve database functions
dosface.h	DOS time and date, file finding
dskutl.h	More DOS time and file functions
tfscan.h	Text File Scanning functions
lingo.h	Multilingual information
msgrdr.h	Reading .MSG files (for offline utilities)

  - Includes Phar Lap's header file phapi.h

  - Defines prototypes for the functions in GCOMM.LIB.

  - Defines constants for the second parameter of the fopen() function (see page 50).

  - Makes sure that the abs(), min(), and max() macros are defined.

  - Defines constants for special keystrokes, for example F1, ALT_P, and CTRLHOME (these are possible return values of getchc(), see page 144).

  - Defines other constants, data types, and macros.

- Galacticomm C Source code uses function prototypes. This means, among other things,

  - defining the return value and parameters
  - using "void" when a function doesn't return anything
  - using "void" when a function has no parameters
  - putting a prototype in a corresponding .H file if other files must use the function

NOTE: For functions with a variable argument list that are coded in C, we don't use prototypes for the argument list, just for the return value:

```
char *spr();
int tokopt();
```

With similar functions that are coded in assembly language, we go ahead and use as much prototyping as possible:

```
void prf(char *fmat,...);
void prfmsg(int msg,...);
```

There are shareware utilities like PROTOE that will help you generate prototypes for local-use functions in a .C file.

- Routines that are needed only within the .C file where they reside should be coded STATIC, as in:

```
STATIC void
localroutine(void)
{
    doessomething();
}
```

- Routines that need to be called from code in other C source files should be coded like normal:

```
void
globalroutine(void)
{
    doessomething();
}
```

- Your init_xxx() routines (page 29) should be coded as EXPORT, as in:

```
void EXPORT
init_routine(void)
{
    initsomething();
}
```

Rebuilding MAJORBBS.EXE and standard .DLL files

This section is mainly for customizing The Major BBS, not so much for developing new products for it.

When developing products for The Major BBS, we assume you won't be modifying any of the code that makes up MAJORBBS.EXE -- the BBS kernel. If you do, you're severely limiting your market to BBS operators who have purchased the Developer's C Source Kit for their own customization purposes.

When customizing The Major BBS to suit your needs, you may be modifying the C source files that make up MAJORBBS.EXE or the standard .DLL files.

If you do, just run the MAKEBBS.BAT file to recompile and link:

```
CD \BBSV6\SRC
MAKEBBS
```

This compiles and links what needs to be recompiled and relinked based on what files you have changed. The MAKE program, which comes with the Borland C++ compiler, only looks at the times and dates of the files, not at the actual changes you made. For example, if you change MAJORBBS.C, that file will be recompiled and relinked to form MAJORBBS.EXE. That makes sense. However, if you merely change an itty-bitty comment in GCOMM.H, then every single file in the standard package will be recompiled and relinked. MAKE sometimes does a little more work that it has to, but it's the safest way to be sure that you're running with the results of your latest source code changes.

You can always do the compiling and linking yourself.

To process a <*filename*>.MSG file into .MCV and .H files:

```
CD \BBSV6
BBSMSX <filename> -OSRC
```

To compile a <*filename*>.C source file that contributes to MAJORBBS.EXE:

```
CD \BBSV6\SRC
CTPH <filename>
```

(It's not a good idea to do "CTPH *" because different source files need to be compiled with different CTXXX.BAT files.)

To compile a <*filename*>.C source file that contributes to a .DLL file:

```
CD \BBSV6\SRC
CTDLL <filename>
```

It's very important to compile using the correct batch file (CTPH or CTDLL).

To relink MAJORBBS.EXE:

```
CD \BBSV6\SRC
LTPH
```

To relink any <*filename*>.DLL file:

```
CD \BBSV6\SRC
LTDLL <filename>
```

For developers: you'll be able to use many of these same steps for compiling and linking your own .DLL file for your own Add-on Option.

Creating a New .DLL File

Here are most of the administrative aspects of making a .DLL. The technical and algorithm considerations will be discussed in later sections.

1. Name your initialization routine starting with "init__" (that's two underscores), such as "init__colormod()". See page 29 for details.

2. The rest of the code in your C source file(s) will probably flow indirectly from what you do in your init__xxx() routine. For example, if you register a module, the text line input entry point will need to be coded (page 29). If you register a text variable, that routine will probably be in your C source files too.

3. Create a .LNK file for your .DLL. You can use the file \BBSV6\SRC\GALP&Q.LNK as an example:

```
\run286\bc3\lib\c0phdll     +
\bbsv6\phobj\galp&q
\bbsv6\galp&q
nul
phapi galimp msgimp gsblimp /Twd /s /n
\bbsv6\dlib\nodef
```

   This .DLL includes the code for the Polls and Questionnaires Add-on Option. Only one .OBJ file from the \BBSV6\PHOBJ directory is named: GALP&Q.OBJ. This .LNK file specifies the NODEF.DEF file, the one you're most likely to use (the .DEF extension is implicit)

   One example of a condition that would require you to design your own .DEF file is if your DLL had routines that other DLLs needed to call for some reason. In that case: you'd make a .DEF file for the DLL where the routines were *defined*; you'd use Borland's IMPLIB program to create a .LIB import library from the .DEF file; and you'd link the .LIB file in with the DLL where the routines are *referenced*.

   Read about TLINK in the Borland C++ Tools and Utilities Guide if you want to know more about .LNK files (linker response files) and .DEF files (module definition files, in Borland's terminology). See page 22 for how we use MAJORBBS.DEF to make GALIMP.LIB.

   Your DLL will be able to use routines in MAJORBBS.EXE by means of our import library \BBSV6\DLIB\GALIMP.LIB. Our import libraries use ordinal references to help with upward compatibility. Our intention is that your DLL files will continue to work with future versions of The Major BBS.

   If you use any routines from the Borland compiler library that we don't use in MAJORBBS.EXE and export in \BBSV6\DLIB\MAJORBBS.DEF, you will get undefined symbol errors. We use an awful lot of Borland library routines in The Major BBS, but naturally we don't use every single one. There are a couple of possibilities you may want to consider. It may be possible to simply include BCH286.LIB in the list of libraries in your .LNK file, for example:

```
phapi galimp msgimp gsblimp bch286 /Twd /s /n
```

But this doesn't always work. Many of the Borland library routines have interdependencies with other library routines or internal data structures. For example, if you use a memory allocation routine, or any kind of file I/O routine, conflicts could arise with the memory or I/O routines used in MAJORBBS.EXE. A truly independent routine will not have this problem, but the only way to know this for sure is if you have the compiler library source code.

The safest approach may be to find an alternative to using the routine. Perhaps you could write your own version of the routine (giving it a different name to avoid conflicts). Or redesign the calling routine.

4. The Major BBS makes no use of floating point numbers. Many of our Add-on Options don't either, but a few do. If your DLL uses floating point math at all, make these changes to your .LNK file:

   A. Add a second line that links in FPDMY.OBJ:

   ```
   \run286\bc3\lib\fpdmy        +
   ```

   B. Add a reference to the MATHH.LIB file just after that of PHAPI.LIB on the next-to-the-last line:

   ```
   phapi mathh galimp msgimp gsblimp /Twd /s /n
   ```

   C. Change the last line to refer to \BBSV6\DLIB\MATHDEF.DEF instead of \BBSV6\DLIB\NODEF.DEF. Compare the contents of those two files to see what the critical differences are.

   Your software uses floating point math if: you use "%f" in any control string (for sprintf(), spr(), remember that prf(), prfmsg() and printf() don't support "%f"); if you declare any floating point variables or constants; or if you use any floating point math operators or functions.

5. Make a .MAK make file with instructions for compiling and linking your .DLL file (and .MSG file indexing with BBSMSX, as required). Basically, you're telling MAKE about all the dependencies between files. See the .MAK files that we use (\BBSV6\SRC*.MAK) as a starting point, and see Borland's documentation on the MAKE utility.

6. You may want to add your .MAK file to the end of \BBSV6\SRC\MAKEBBS.BAT for convenient, centralized recompiling:

   ```
   cd \bbsv6\src          or        cd \bbsv6\ddd
   make -fdddxyz.mak                make -fdddxyz.mak
   ```

   where "dddxyz.mak" represents the name of your make file. (See step 13 on page 6 about whether to use \BBSV6\SRC or \BBSV6\DDD for your source directory.)

7. To try out your individual make file, just type the following, where *<program name>*.MAK is the name of your MAKE file:

   MKU *<program name>*

8. Name the .DLL file in the "DLLs:" line of your .MDF file (more later on page 23).

Rebuilding Your .DLL File

If you have made your own <*program name*>.MAK file, you can run that whenever you need to incorporate changes to your source code.

```
MKU <program name>
```

If you've called out your .MAK file in MAKEBBS.BAT, then run that.

```
MAKEBBS
```

On the other hand, here's how to do it a piece at a time:

To process a <*filename*>.MSG file into .MCV and .H files:

```
CD \BBSV6
BBSMSX <filename> -OSRC
```

To compile a <*filename*>.C source file that contributes to your .DLL file:

```
CD \BBSV6\SRC          or     CD \BBSV6\DDD    (as appropriate)
CTDLL <filename>              CTDLL <filename>
```

(It's not a good idea to do "CTDLL *" because different source files need to be compiled with different CTXXX.BAT files.)

To relink your <*filename*>.DLL file:

```
CD \BBSV6\SRC          or     CD \BBSV6\DDD     (as appropriate)
LTDLL <filename>              LTDLL <filename>
```

Versions

The development environment for The Major BBS depends on a number of software products, most importantly:

- Borland C++ Compiler
- Phar Lap 286|DOS-Extender SDK

These products are available from many sources, including Galacticomm.

These software packages are updated regularly (once or twice a year) and this causes a number of problems for Galacticomm, developers, and customizers of The Major BBS. We try to keep up with the latest versions, but what's available in the stores and mail-order houses, and what's compatible with what, isn't always within our control.

If you purchase these products on your own, you need to make sure that the versions are compatible with each other and with Galacticomm source code. When possible, call us and verify version compatibility *before* you buy these products. We also stock them to give you a minimum-hassle alternative.

Updating Software

When updating software from Galacticomm or other parties, be sure that your new combination of software is a compatible set.

Updating software from Galacticomm

1. Make a back-up copy of your entire hard disk.
2. If you've changed source code that the new update overrides, save your code somewhere handy.
3. Insert the first floppy diskette into your A: drive.
4. Type "A:INSTALL". (You can use B: and B:INSTALL if you need to.)
5. Resolve changes in your source code with changes that the update provides, possibly by "merging" the two together. The "MATCH" utility might aid in this effort. It's available in the UTILITY Library on the Galacticomm Demo System, at (305) 573-7808.
6. Run \BBSV6\SRC\MAKEBBS.BAT to recompile everything.

Updating your compiler or the Phar Lap DOS-Extender

1. Make a back-up copy of your entire hard disk.
2. Remove your compiler from your hard drive completely.
3. Remove Phar Lap from your hard drive completely.
4. Install the compiler, and Phar Lap, from scratch, following steps 2-4 on page 4.
5. Delete \BBSV6\MAJORBBS.EXE and all \BBSV6*.DLL files that you can recreate (probably all .DLL files except GALGSBL.DLL and BBSBTU.DLL).
6. Delete all object files in \BBSV6\PHOBJ*.OBJ and \BBSV6\LOBJ*.OBJ.
7. Run \BBSV6\SRC\MAKEBBS.BAT to recompile everything.

How we use MAJORBBS.DEF to make GALIMP.LIB

MAJORBBS.DEF contains a long list of symbols for variables and functions defined in MAJORBBS.EXE. It gets used in two ways to bridge the gap between the code in the DLLs and the code in MAJORBBS.EXE. (1) MAJORBBS.DEF is used when creating MAJORBBS.EXE to identify those symbols as "exported" so they are available to DLLs. (2) It's also used to make GALIMP.LIB, the import library that's linked with all DLL code, so that code can use those symbols.

To use MAJORBBS.DEF to create GALIMP.LIB, the following line must first be added to the beginning of MAJORBBS.DEF:

```
LIBRARY MAJORBBS
```

Then we use Borland's IMPLIB to create GALIMP.LIB

```
IMPLIB GALIMP.LIB MAJORBBS.DEF
```

Then we remove the LIBRARY command from MAJORBBS.DEF, restoring it to the form that's useful when linking MAJORBBS.EXE (via LTBBS.LNK)

3. OPERATING ENVIRONMENT

Module Definition Files (.MDF)

Module Definition Files are key to how The Major BBS recognizes many aspects of your Add-on Option:

- What .DLL files to load, and what module(s) the Sysop can use in Menu Tree module pages
- What .MSG files to include, providing CNF options
- Module dependency on other modules
- Module replacement of other modules
- Special installation processing
- Online users manual, to integrate into BBSUSER.DOC
- Btrieve database requirements
- Special processing at auto-cleanup, or at timed events
- Add-on utility (option 8 from the introductory menu)
- Language information
- Custom editors for CNF text blocks and Menu Tree custom menus

Here is the .MDF file for the Registry of Users:

```
; GALREG.MDF

Module Name: Registry of Users

Developer: Galacticomm

Requires:
Replaces:

Install:

Online user manual: GALREG.DOC

DLLs: GALREG
MSGs: GALREGIS

Btrieve page size: 1024
Btrieve files:     1

Cleanup:

Event-1:
Event-2:
Event-3:
Event-4:

Add-On Utility:
```

Here are some details about what to put in your .MDF file.

Comment Header
This is the name of the .MDF file.

Module Name
This description of the module appears when designing module pages in the Menu Tree. It will also appear on the miscellaneous statistics screen. (Use gmdnam() to read in this description -- see page 30.) The name may be up to 24 bytes long.

Developer
Your name or company name.

Requires
If your module will require that any other modules be "active", name them here. You might use this if that module exports symbols that you use. When several modules all require each other, use a circular definition. (For example GALFOR.MDF requires GALTLC.MDF which in turn requires GALEML.MDF which itself requires GALFOR.MDF again.) You can list up to five .MDF files.

Replaces
If you have a module that replaces another, name the other module here. For example, Galacticomm's Entertainment Collection has an Entertainment Teleconference that replaces the teleconference that comes with the standard version of The Major BBS. (Note: the "replaces" and "requires" logic work well together, such that if module A *requires* module B, and module C *replaces* module B, then module A's requirement is satisfied by module C being present.)

NOTE: be sure not to "replace" a module that has exported symbols, even if your module exports the same symbols.

Install
If any special installation procedures are required, call out the .EXE, .COM or .BAT file here (just the root of the file name, not the extension, like you'd type in a DOS command). This file will be run only when the module is first installed on a Sysop's computer, and then automatically deleted.

The presence of this file acts as a "flag" to find out whether installation is needed or not.

Online user manual
This should name a text file you write to orient new users to the online services your module provides. This text file will be automatically combined with others to form BBSUSER.DOC. That file is (by default) attached to the welcoming Electronic Mail message sent to all new users. It is also available online in the Information Center. The convention is to use the same name as the .MDF file with a .DOC extension.

DLLs
Name the Dynamic Link Library (or Libraries, up to five of them) for your module. See page 19.

MSGs
Name the .MSG files that contain CNF options (for the Sysop to manage in Hardware Setup, Security and Accounting, Configuration options, and Text Block Editing). More about CNF options starting on page 55.

Btrieve page size
If your Add-on Option uses any Btrieve databases of its own, you must name the maximum page size in bytes. This is also specified in the .BCR files for creating the databases. See the Btrieve documentation for more on page sizes.

Btrieve files
This is the number of .DAT Btrieve database files that your Add-on Option will have open at a time. (We keep all .DAT files open for the entire time the BBS is up.)

Cleanup
Name an .EXE or .BAT file to run when the BBS shuts down for auto-cleanup. You can have multiple "Cleanup:" lines with multiple DOS commands.

Event-1 through Event-4
Name an .EXE or .BAT file to run when the BBS shuts down for any of the timed events.

Add-On Utility
If you want an offline utility to appear in the menu from option 8 of the introductory menu, specify the .EXE, .COM or .BAT file and description of the option. For example:

```
Add-On Utility:  DDDANLYZ (analyze color reciprocity)
```

The file DDDANLYZ.BAT (or DDDANLYZ.EXE, etc.) will be run if the operator picks that option.

For aesthetics, we recommend that you fit the name within an 8-character left-justified field, capitalize the entire name, follow it with one space, and append a lower-case description in parenthesis. The description can be up to 40 characters long.

UNCONDITIONAL
If this word appears on a line by itself, anywhere in the .MDF file, then your module is loaded unconditionally (whether something in the operator's Menu Tree calls for it or not).

INTERNAL
If this word appears on a line by itself anywhere in the .MDF file, then your module won't appear in the list of choices for module pages. If your module is an INTERNAL module, you'll almost certainly want to make it also an UNCONDITIONAL module.

Language .MDF Files

Now, here is an example of an .MDF file for the "German/RIP" Alternate Language Add-on Option:

```
; GERMRIP.MDF (language file created by BBSLANG.EXE)

Module Name: German/RIP language

Developer: Sysop

Internal
Unconditional

Language: German/RIP
Language Description: Die deutsche Version von RIPscrip graphics
Language File Extension: .RIP
Language Editor: RIPAINT.DLL %s
Language Yes/No: JA/NEIN
```

This has a few additional constructs in it.

Language
The language name has a 1-8 character spoken language followed by a slash (/) and a 1-6 character terminal protocol. That's a total of up to 15 characters.

Language Description
This description can be up to 40 characters long. It shows up when picking a language out of a list, as in the CNF <F3> CHOOSE LANG softkey, or online when users pick a language.

Language File Extension
A file extension may be needed to store text for this language on disk. This comes up when customizing menus under Menu Tree or editing CNF options with certain custom editors.

For custom menus under the "/ANSI" languages, three file extensions apply:

.IBM	ANSI colors and cursor control with IBM extended ASCII
.ANS	ANSI colors and cursor control with standard ASCII
.ASC	Standard ASCII

When it comes time to use one of these files, here's the decision process that occurs in opnans() in MENUING.C:

```
If the user's terminal has ANSI capability
     If the user's terminal is an IBM PC
          Use the .IBM file (or .ANS or .ASC as required)
     otherwise
          Use the .ANS file (or .IBM or .ASC as required)
otherwise
     Use the .ASC file (or .ANS or .IBM as required)
```

For other editors, you'll probably want to specify a single file extension, such as .RIP for RIPaint.

When it comes time to custom design the way a menu looks, **Menu Tree** will present a list of file names with all of the extensions for all user-languages that are defined, as in:

```
Edit INFOMENU.IBM using BBSDRAW
Edit INFOMENU.ANS using BBSDRAW
Edit INFOMENU.ASC using BBSDRAW
Edit INFOMENU.RIP using RIPAINT
Edit INFOMENU.ZAP using ZAPDRAW
```

For CNF options, a temporary file is created for external editors when they specify a DOS command line. The Language File Extension will be used on that file.

Language Editor

There are two cases where an editor is needed: CNF text blocks and Menu Tree customized menus. BBSDRAW is the standard in-memory editor and is specified like this:

```
Language Editor:  BBSDRAW %s
```

Let's say you want to use an editor named "ZOGEDIT" that expects the file name as it's parameter and needs the "/A" switch for ANSI capabilities, you'd specify:

```
Language Editor:  ZOGEDIT %s /A
```

Then when it came time to edit an option or a menu, the %s would be replaced with a file name, and the above command executed as a DOS command. We use a system() call on this command line, so DOS will look for ZOGEDIT.BAT, ZOGEDIT.COM, or ZOGEDIT.EXE throughout the path.

The first word of the language editor command line should be the name of the editor. An optional extension could have special meanings:

<*name*>	to specify a DOS command line
<*name*>.EXE	to specify a DOS .EXE file that can be "spawned" as a daughter process (the daughter EXE file must have a very large capacity for file handles -- this is not usually the best approach)
<*name*>.DLL	to specify an editor in a DLL file (see page 169 about custom editors in DLLs that register themselves)

In all cases the <*name*> part is advertised as the name of the editor, both in CNF and in Menu Tree.

Any "%s" in the language editor command line gets replaced with the name of the file to be edited.

Language Yes/No

This line of the language .MDF file tells you what words to use for "yes" and "no" in the language. For example:

```
Language Yes/No: Affirmative/Negative
```

In this case the letters 'A' or 'N' will be expected in response to a yes-or-no question. Clearly the first letter of each word must be different.

There may be conflicts when certain prompts expect Y=yes, N=no or other special characters. First, you should avoid words that start with either '?' or 'X', as those characters have universal meaning on the BBS. Also, a yes or no word that started with 'R' would conflict with the highly visible exit-logoff-relog situation where users can choose (Y)es=logoff, (N)o=stay online, or (R)elog on.

The Language Yes/No directive also affects the operation of cncyesno(). If a user enters an 'A', cncyesno() will return 'Y'. That way, your code can always check cncyesno() for 'Y' or 'N' return values. See page 76.

Users can also type in the entire yes or no string. cncyesno() will take it all, and still return 'Y' or 'N'.

You can see that BBSMAI.MDF has the standard MDF information combined with language information for the "English/ANSI" language.

Initialization Routine (init__xxx())

The Major BBS will recognize any routine in your .DLL whose name starts with "init__" (that's two underscores) as an initialization routine, and call that routine when the BBS comes up. In your initialization routine, be sure to:

- Declare it as EXPORT (page 17).
- Register your module with register_module() (page 30).
- Open the CNF options file (.MCV in it's runtime form) using opnmsg() (page 65). You can read in options using routines like numopt() and ynopt().
- Open any Btrieve databases you're using with opnbtv() (page 150).
- Declare how much if any of the Volatile Data Area that you'll need to service users, using dclvda() (page 46).
- Allocate memory if you need it. (Try to use the Volatile Data Area if at all possible.)
- Register global commands with globalcmd() (page 96).
- Prepare enough VDA memory for any Full Screen Data Entry sessions using fsdroom() (page 103) and dclvda().
- Register text variables with register_textvar() (page 73).
- Kick off any rtkick() routines (page 177).

Modules

A module is the main mechanism for making your code run on The Major BBS while it's online. There are other ways to run online code, like text variables or global commands, but modules are by far the most powerful.

By registering a module, you complete one of the links necessary to make your service available to users online. The other link is completed by the Sysop, when he designs his Menu Tree. Remember that the Sysop ultimately decides who uses each service and how the menus leading to it are structured.

Here are the items to remember when making a module for The Major BBS:

- Put your initialization code in a routine whose name starts with "init__" (see above).
- In that initialization code, register your module using the register_module() function and a unique module structure.
- Compile and link your module code into a .DLL file (page 19).
- Identify the .DLL file in your .MDF file (page 23).

```
statecode=register_module(ptrmodule);    Register a module
int statecode;                             Value of usrptr->state
                                           whenever user will be "in"
                                           this module
struct module *ptrmodule;                  Pointer to your module
                                           structure
```

You might use the statecode in some circumstance to determine if the user is "in" your module (by comparing usrptr->state == statecode, for example). Each time you call register_module() you must pass a pointer to a unique module structure.

Here is the data structure for each module, consisting of a description and nine entry points (this comes from MAJORBBS.H):

```
extern
struct module {                    /* module interface block              */
     char descrp[MNMSIZ];          /*    description for main menu        */
     int (*lonrou)();              /*    user logon supplemental routine  */
     int (*sttrou)();              /*    input routine if selected        */
     void (*stsrou)();             /*    status-input routine if selected */
     int (*injrou)();              /*    "injoth" routine for this module */
     int (*lofrou)();              /*    user logoff supplemental routine */
     void (*huprou)();             /*    hangup (lost carrier) routine    */
     void (*mcurou)();             /*    midnight cleanup routine         */
     void (*dlarou)();             /*    delete-account routine           */
     void (*finrou)();             /*    finish-up (sys shutdown) routine */
} **module;
```

Here are some sample pieces of code for initializing a simple module:

```
int colorinp(void);
void clscol(void);

struct module colormod={       /* module interface block              */
     "",                       /*    name used to refer to this module */
     NULL,                     /*    user logon supplemental routine   */
     colorinp,                 /*    input routine if selected         */
     dfsthn,                   /*    status-input routine if selected  */
     NULL,                     /*    "injoth" routine for this module  */
     NULL,                     /*    user logoff supplemental routine  */
     NULL,                     /*    hangup (lost carrier) routine     */
     NULL,                     /*    midnight cleanup routine          */
     NULL,                     /*    delete-account routine            */
     clscol                    /*    finish-up (sys shutdown) routine  */
};
static
int colstt;                    /* ANSI color diagnostics, state no.    */

void EXPORT
init_colormod()                /* the module initialization routine    */
{
     strcpy(colormod.descrp,gmdnam("DDDCOLOR.MDF"),MNMSIZ);
     colstt=register_module(&colormod);
}
```

As this example shows, you should leave the description blank (a zero-length string) and read it in from your .MDF file during initialization. This example reads in the module description from the DDDCOLOR.MDF file, such as:

```
Module Name: ANSI color diagnostics
```

This way, your module name is only in one spot: the .MDF file. (If the description in the .descrp field disagrees with the one in the .MDF file, then the module won't be accessible: Menu Tree will call out one name, but the other will be registered online.)

Any of the entry points can be NULL if you don't need them except: **stsrou()** (make it "dfsthn" if you don't need special status handling, like in the above example); and sttrou() (make it point to a function that returns zero if your module has no menu-selectable interactive services). The above example sets up to call the colorinp() for text input and clscol() when the BBS shuts down.

Variables available to many of the entry points

The following global variables are set up by the executive before calling any of the entry points lonrou(), sttrou(), stsrou(), lofrou(), or huprou():

int usrnum;	the user number for the communications channel.
struct user *usrptr;	points to that channel's "user" struct (see MAJORBBS.H). For example, usrptr->baud is his baud rate, usrptr->substt is his substate, etc.
struct extusr *extptr;	points to extendable in-memory data for the channel. (For upward compatibility, new in-memory fields will be added here, and not to the user[] array.)
struct usracc *usaptr;	points to that channel's "usracc" struct (see page 158). For example, usaptr->userid is his User-ID, usaptr->usrpho is his phone number. This information is stored in a database.

Each user's session on the BBS is a procession through a series of states. The states distinguish conditions like "waiting for him to type in his User-ID", "waiting for him to type in his password", or "waiting for him to decide whether to thread forward or backward from this Forum message".

The usrptr structure contains this state information, represented by three variables (see MAJORBBS.H). These represent the "context" of the user:

usrptr->class Channel condition:

VACANT = 0	channel is not in use
ONLINE = 1	call has been answered (getting User-ID and password)
BBSPRV = 2	acts similar to ACTUSR, except credit deduction and time limits don't apply (a service might take advantage of this)
SUPIPG = 3	sign-up in progress (brand new user)
SUPLON = 4	supplemental log-on activity in progress (using the lonrou() entry point)
SUPLOF = 5	supplemental log-off activity in progress (using the lofrou() entry point)
ACTUSR = 6	logged on (using the sttrou()) entry point

(Don't confuse usrptr->class with the user classes that Sysops define from the Remote Sysop ACCOUNT menu CLASS command -- the concepts are not related.)

usrptr->state Module number in use, corresponding to the return value of register_module(). (This makes sense only when usrptr->class is one of the last three above values.)

usrptr->substt	Sub-state number within the module selected, if any. This is usually some number indicating the question last asked of the user. It's zero at the beginning of a series of calls to sttrou() (when entering a module page) or lonrou() (when logging on) or lofrou() (when logging off). If those entry points return 1, then they should also set usrptr->substt to a nonzero value, so that they can recognize the context when they are called again with a line of input from the user. More about this on page 33.

The following global variables are available for any entry point where user input is expected. This includes sttrou() for lines of text when the user is "in" the module, and lonrou() and lofrou() when you've set up some supplemental interaction during log-on or log-off (more on that below).

int margc;	the number of separate arguments (words) in the user's input line (see page 74)
char *margv[];	table of pointers to the "words" of the user's input line
char *margn[];	table of pointers to the ends of the input words
int inplen;	total length of the input line in bytes
int pfnlvl;	profanity level of the input (0 to 3, mild to severe)

The Volatile Data Area is maintained during any protracted interactive session, as with sttrou(), lonrou(), and lofrou(). So you can use the VDA for storing information to track that session. You can also use the VDA in your huprou() entry point, with restrictions (see page 47).

char *vdaptr;	points to the Volatile Data Area. This is memory allocated for a channel, and used by the routines of a module -- but used only while the module is selected for that channel.

lonrou() - log on input service routine

You can use this entry point to give a user some kind of notice when he is logging on, such as "Your stock rose 4 points last night". You can also use lonrou() for a protracted interactive session with the user -- a series of questions and answers, or prompts and commands that he goes through right after logging on, such as "would you like to purchase more shares now?", "Ok, how many?", etc. This all happens before the user has a chance to make a selection from the top menu.

The difference (one log-on message versus a series of log-on prompts and responses) lies in the lonrou() return value.

lonrou() returns 0	you're done with logging this user on
lonrou() returns 1	you're expecting the user to respond to a prompt that you just sent to him

To send one log-on message, just make lonrou() always return 0. To go through a series of prompts and responses, return 1 whenever you're expecting more input from the user. Then lonrou() will be called again when he types the next line of input.

When your lonrou() returns 0, the user will resume his log-on process. (Perhaps there are other modules with lonrou()'s of their own. Otherwise he's ready to get the top menu.)

You can tell the first lonrou() from subsequent lonrou() calls by the user's substate:

usrptr->substt == 0 on the first call to lonrou(). Your lonrou() routine should change it to something nonzero, and return 1.

usrptr->substt == nonzero on subsquent calls. Keep changing this substate between lonrou() calls. When done, return 0.

While you're lonrou() routine is "in effect" (until it returns 0), any status codes on the channel trigger a call to your stsrou() entry point.

Note: to intercept the moment when a user *first* connects to the BBS, use the handle-connect vector (*hdlcon)(). See page 84.

For special handling of new users who have just signed up, you could maintain your own separate database of User-ID-tagged information and, during lonrou(), look for the case when usaptr->userid isn't in your database yet. (And then insert it of course.)

sttrou() - module input service routine

sttrou() is the most heavily used entry point for most modules. It is first called when a user selects your module (selects a module page that refers to your module from a parent menu). After that, sttrou() is called each time a user enters a CR-terminated input line while "in" the module. He gets "out" of the module (returning to the parent menu) when the sttrou() routine returns 0.

You can keep track of the user's context with the usrptr->substt variable. This is always zero when the user first enters a module. You can set it to a different value for each prompt you send him, so that when you get his reply, you can interpret it in the proper context.

TIP: We use the CNF option number codes for double duty: identifying the prompt text block, and remembering the context (substate) of a reply.

Identifying the prompt text block: As you'll see on page 65, text blocks are identified (1) by their .MCV file (specified by setmbk()), and (2) by an integer sequence number defined in the .H file. That integer can be used in calls to prfmsg() to output the text block, for example:

```
setmbk(colmb);
prfmsg(PROMPT);
```

(colmb is returned by opnmsg(). PROMPT is from a BBSMSX-generated .H file.)

Remembering the context (substate) of a reply: We often use the integer sequence number defined in the .H file to remember the last prompt sent to the user:

```
usrptr->substt=PROMPT;
```

That way when he replies to the prompt, his reply can be handled in the proper context:

```
switch (usrptr->substt) {
     :
     :
case PROMPT:
     handleit(margc,margv[0]);
     break;
     :
     :
}
```

We recommend that whenever the user enters the single letter 'X', that he exits out of whatever he's doing and returns to a previous menu. If your module has it's own local menu (many do), then he returns to that menu, unless he's already there, in which case he returns to the parent menu page. We also recommend that whenever the user just hits <CR> all by itself (so that margc == 0), that you re-transmit the last prompt. See page 36 about handling asynchronous messages (such as user-to-user paging, Sysop-to-user messages, etc.) in the injrou() entry point or by checking the INJOIP flag.

Entering and Exiting a Module

Special things happen when a user first *enters* a module. The input string that's parsed into words in margv[] (see page 74) is a combination of three things:

- The select character that got the user into this module (that's the single-character menu selection that the user typed, as defined in Menu Tree Design for the parent menu page)
- The command string for the corresponding module page, if any (the Sysop specified this in offline Menu Tree Design)
- What the user typed *after* the select character, if anything

Also the substate (usrptr->substt) always starts at zero. The state (usrptr->state) is the value returned to you by register_module() when you registered your module.

The sttrou() entry point for your module keeps getting called with each new input line until your sttrou() routine returns a zero. That's your way to signify (to the BBS executive) that the user is exiting your module back to the parent menu.

See page 78 for more about whether to exit to a module's local menu or to the parent menu page.

stsrou() - status handler routine

The stsrou() entry point is invoked when the user is "in" the module (has selected a module page that's based on your module from some menu, or is in the module's log-on or log-off supplemental entry point), and the channel detects a status condition. Here are some of those status conditions (for more details, see the GSBL documentation):

Some values of the global variable "status"

5	Output to user has completed -- this status is intercepted by the executive when it results from an injoth() (an asynchronous message). In some cases however, an injoth() or other system operation will let a status 5 slip through to your stsrou() entry point. If you use status 5's yourself, turn them on with btuoes(usrnum,1) and then send your output. When you get the status 5, be sure to check context (such as a flag or substate code) before processing it (spurious status 5's should be ignored or passed to dfsthn()). After processing, turn off status 5's with btuoes(usrnum,0). If you don't turn them off, then you'll get a status 5 after every prompt from then on.
2,12,22	The GSBL routine btucmd() has been passed a command and that command has completed normally
240	Used by convention in The Major BBS for "cycle-mediated" tasks. This value is represented by the constant CYCLE in MAJORBBS.H. You can generate status 240's artificially with btuinj(usrnum,CYCLE). See page 48.
251	Data input overflow (usually harmless)
252	Echo buffer overflow
253	Data output overflow
254	Status input overflow (rather serious)
255	Command output overflow (rare)

Call dfsthn() (the default status handler) for status conditions your module is not specifically expecting.

injrou() - reprompting routine

There are many cases when the BBS needs to immediately send a user a brief message. An asynchronous message is one that interrupts the user's normal banter of prompts and commands. After the message is displayed, the user needs to see his current prompt over again.

The injoth() function (see page 72) is used to send asynchronous messages to a user's terminal, such as "SYSTEM GOING DOWN", "FRED SMITH IS PAGING YOU", or "YOUR FAX WAS SUCESSFULLY SENT". There are two ways your module could handle this.

Asynchronous message handling method 1: If the injrou field of your module structure is NULL, the executive just simulates a <CR> from the user's terminal to get the user's prompt back. If you need to use the condition of an empty input line for some purpose *other* than for reprompting (such as for default answers) then you can detect the use of injoth() with a test similar to this (this could be an excerpt of your sttrou() routine):

```
if ((usrptr->flags&INJOIP) == 0) {
     handlecommand();
}
else {
     reprompt();
}
```

Asynchronous message handling method 2: the injrou() entry point, if one exists in your module, is called when an asynchronous message needs to get through to the user. The message is already formatted in the prfbuf buffer and can be transmitted with btuxmn(). You should also resend the latest prompt. For example, here's an excerpt of a possible injrou() routine:

```
btuxmn(othusn,prfbuf);
btuoes(othusn,1);
user[othusn].flags|=INJOIP;
return(1);
```

In fact, this is exactly the code in dftinj() that get's executed when there is no injrou() entry point (except that dftinj() has no return value -- don't use it as your injrou() routine). There's little point to having an injrou() routine that's exactly the above, but you could make little modifications to it. The btuxmn() is used in place of an outprf(othusn), specifically so that a user <*Ctrl-O*> abort of text output doesn't clobber the message. You may have some other way of displaying the message (e.g. transmitting an ANSI sequence to pop up a window or something). Setting btuoes(othusn,1), and setting the INJOIP flag prepares for a future call to the sttrou() entry point with the INJOIP flag set, asking for a reprompt.

> Your injrou() entry point must not modify the prfbuf buffer contents. Those contents may be needed for output to other channels.

So to reprompt after displaying the asynchronous message, use btuoes() and INJOIP, as shown above.

Note the use of othusn instead of usrnum. Whatever *instigated* this asynchronous message, it probably didn't happen due to a process on the recipient's channel. It may be in response to a "/p" global page command from another users channel, or to a send-message softkey command from the Sysop's console. So the familiar usrptr is not defined at this point.

int othusn;	User number of the channel that is to receive the asynchronous message.

Remember that in your injrou() routine:

- Don't use usrnum, use othusn.
- Don't use usrptr->substt, use user[othusn].substt.
- Don't use usaptr->userid, use uacoff(othusn)->userid.
- Don't use extptr->lingo, use extoff(othusn)->lingo.

Your injrou() routine needs to return a value indicating whether the user got the message or not:

return 0 if the user could not be interrupted at the moment

return 1 if the message was sent to the user's terminal

This, quite logically is also the return value of injoth() (see page 72).

lofrou() - log off input service routine

You can use this entry point to give a user some kind of notice when he logs off, such as "Thank you for your purchase order of 12 items". You can also use lofrou() for a protracted interactive session with the user -- a series of questions and answers, or prompts and commands that he goes through just before logging off, such as "Would you like your order shipped to you within six hours by Lazer Express for an extra $29?", "Then we'll need your complete 9-digit ZIP+4 code:", etc. This all happens before the final "Are you sure you want to log off (Y/N)?" prompt.

The difference (one log-off message versus a series of log-off prompts and responses) lies in the lofrou() return value.

lofrou() returns 0 you're done with this user, he can log off

lofrou() returns 1 you're expecting the user to respond to a prompt that you just sent to him

lofrou() returns -1 user does not want to log off after all, return him to his most recent menu

To send one log-off message, just make lofrou() always return 0. To go through a series of prompts and responses, return 1 whenever you're expecting more input from the user. Then lofrou() will be called again when he types the next line of input.

When your lofrou() returns 0, the user will resume his log-off process. (Perhaps there are other modules with lofrou()'s of their own. Otherwise he's ready to confirm that he really wants to get disconnected.)

You can tell the first lofrou() from subsequent lofrou() calls by the user's substate:

usrptr->substt == 0 on the first call to lofrou(). (Change usrptr->substt to something else, and return 1.)

usrptr->substt == nonzero on subsequent calls to lofrou(), until lofrou() returns 0.

huprou() - user disconnect routine

Every module's huprou() entry point is invoked whenever a fully-logged-on user loses carrier. You can use this to de-allocate any resources you might have allocated for the user (be careful with the Volatile Data Area, see page 47). If NULL, no action is taken.

mcurou() - auto-cleanup routine

The mcurou() entry point of each module is invoked once per day, (default time: 3:00 AM). EMAIL.C uses this opportunity to scan the Electronic Mail database for stale messages (over 3 weeks old by default). This entry point may be NULL if the module has no need for auto cleanup processing. You can also use the "Auto Utility:" line of the .MDF file to specify offline processing during the auto-cleanup. See page 25.

dlarou() - delete user account routine

This entry point is called for all modules when a user account is deleted. A pointer to the User-ID of the account to be deleted is passed as an explicit parameter to this routine.

The dlarou() entry point exists so that if any special, module-specific actions are necessary when an account is deleted, they will get done. For example, the Registry module maintains a separate database, keyed by User-ID, containing all of the information the user had entered in response to the Registry questionnaire. When a user's account on the BBS is deleted, the corresponding Registry entry should be deleted from the Registry database too, so as not to waste disk space and create account-confusion problems. Therefore, the Registry's dlarou() entry point routine deletes the record for the user, if it exists, from the Registry database.

finrou() - system shutdown routine

Finally, the finrou() entry point is invoked as the system is shutting down and returning to DOS -- this is the place to flush buffers, close files, and so on. In general, you will be undoing whatever was fired up by the corresponding init_xxx() routine that registered your module. This entry point will be called when a "catastro" fatal error occurs (see page 51), in an attempt to save whatever can be saved before returning to DOS. This routine should be designed to safely execute in this kind of hostile situation. For example, say your init_xxx() had some code that did this:

```
if ((localfp=fopen("SOMEFILE.TXT",FOPWA)) == NULL) {
     catastro("Cannot create SOMEFILE.TXT!");
}
```

Then your finrou() entry point could do this:

```
if (localfp != NULL) {
     fclose(localfp);
     localfp=NULL;
}
```

That way, the fclose() is guaranteed to execute no more than once, and then only if the file had been opened in the first place.

Channel Numbering and Grouping

The Major BBS can handle up to 256 communication channels simultaneously. Channels are numbered in hexadecimal from 0 to FF.

Channel numbers are assigned to actual hardware devices in Hardware Setup, with the STARTx options (starting channel number for each group 1-16). See the System Operations Manual for The Major BBS. Channel numbers need not be assigned sequentially. The Sysop can have a GalactiBox on channels 10 to 1F, a PC Xnet card on channels E0 to FF, and a COM3 modem on channel 03.

Channel numbers control where an online user is indicated on the Summary and Online User Information screens. Channel numbers are also recorded in most audit trail messages.

> Channel numbers are used to identify channels for the Sysop.

The total quantity of channels that are defined adds up to an important value, called "nterms". Many data structures in The Major BBS are multiplied by this value.

```
int nterms;          total number of channels defined
```

Channel 00 is reserved for local Sysop emulation, and counts as one of the defined channels that add up to nterms.

User Numbers

Independent of channel numbering, there is an internal index called a user number. User numbers are assigned sequentially to each channel that is defined. So user numbers always run from 0 to nterms-1. The global variable "usrnum" is set to the user number of the user currently being serviced.

> User numbers are used internally to identify each channel.

usrnum has the following additional values for special occasions:

User number -1	Channel FFFF (hex)	Operator Console operations
User number -2	Channel FFFE (hex)	Auto-Cleanup operations
User number -3	Channel FFFD (hex)	Timed shutdown event

User numbers are used to index the arrays that are dimensioned by the value nterms. Almost all of the low-level hardware interface routines in the Galacticomm Software Breakthrough Library deal directly with a specific communications channel, and this channel is specified by this user number, *not* by the channel number that the Sysop assigns.

If you want to change the value of the usrnum variable, even temporarily, it's a good idea to use curusr() to do it. See page 73.

The array channel[] in MAJORBBS.C translates from user number to channel number:

channel[*<user number>*] == *<channel number>*

The function usridx(), also in MAJORBBS.C, does the reverse translation (or returns -1 for unassigned channel numbers):

usridx(*<channel number>*) == *<user number>*

User number nterms-1 is channel number 00, and is reserved for local Sysop emulation.

Group Numbers

The Major BBS can have up to 16 channel groups, nominally and internally numbered 1 to 16. (Use the constant NGROUPS for the number of groups).

grpnum[*<user number>*] == *<group number>*

You can use this to determine the channel type of a group using the grtype[] array:

grtype[*<group number>*] == *<group type code>*

Group Type Codes (from MAJORBBS.H)

```
#define GTMODEM  1          /* group type code:  Modem channels          */
#define GTMLOCK  2          /* group type code:  Locked modem channels   */
#define GTSERIAL 3          /* group type code:  Serial channels         */
#define GTX25    4          /* group type code:  X.25 channels           */
#define GTLAN    5          /* group type code:  LAN channels            */
#define GTNONE   0          /* group type code:  No channels defined     */
```

Here is an example of testing a channel's type:

```
if (grtype[grpnum[usrnum]] == GTLAN) {
     ... LAN channel type ...
}
else if (usrptr->flags&ISX25) {
     ... X.25 channel type ...
}
else {
     ... other channel type ...
}
```

Note that there are two ways to check for an X.25 channel. The flag check (when done by itself) takes less code.

Data Structures and Memory Allocation

The Major BBS has numerous ways of handling data, based upon how long the data must last (its lifetime) and upon how often, or in what manner, the data must be accessed.

DATA STRUCTURES AVAILABLE TO ALL MODULES

Structure	Lifetime	Access	See page
CNF options	Unlimited	Disk (direct)	55
Online User status and session information (usrptr)	User session	Memory	81
Online user detail (usaptr)	Unlimited	Memory	158
Offline user detail (BBSUSR.DAT)	Unlimited	Disk (indexed)	158
System variables (sv, sv2)	Unlimited	Memory	157

DATA STRUCTURES FOR USE BY A SPECIFIC MODULE

Structure	Lifetime	Access	See page
Volatile Data Area	Module active	Memory	46
alcmem() memory	BBS session	Memory	42
File opened using fopen()	Unlimited	Disk (sequential)	50
File opened using opnbtv()	Unlimited	Disk (indexed)	149

EXAMPLES OF DATA USED BY A SPECIFIC MODULE

Structure	Lifetime	Access
Electronic Mail message	21 days (default)	Disk (indexed)
Uploaded attachment to an E-mail message	14 days (default)	Disk (sequential)
Online user's Forum quick-scan configuration	Unlimited	Memory
User log-off record	BBS session	Memory

Lifetime	Explanation
o Unlimited	For the life of your hard disk (or until someone explicitly changes the information)
o BBS Session	While the BBS is "on-the-air"
o User Session	While a user is online
o Module active	Between the time a user selects a module from the Menu Tree, and exits that module

	Access	Explanation
o	Memory	Access is fastest
o	Disk (direct)	Access requires reading only a sector or two
o	Disk (sequential)	Access as a serial stream of bytes
o	Disk (indexed)	Access records by their content (using Btrieve)

You must take careful consideration of the scope of a variable before you use it. For example, some mistakes to watch out for:

- Referencing BBSUSR.DAT for account detail on a user who is online. If your application must deal with the accounting detail of a user, be sure to use uacoff() (page 82), for online users, or the "BBSUSR.DAT" database record for offline users (these have the same structure, see page 158). You can see how the module addcrd() in ACCOUNT.C makes this distinction when it adds credits to a user's account.

- Unconditional use of the Volatile Data Area in the huprou() entry point. If your module requests temporary use of the Volatile Data Area, your module can freely use the area in its sttrou() (line input) and stsrou() (status) entry points. But your module should not use the Volatile Data Area in the huprou() entry point unless the usrptr->state code is equal to the module's handle (return value of register_module()), i.e. unless the user hung up when he was "in" your module. See page 46 for more details.

- If you are developing a global command handler (page 96), be careful not to use the vdaptr memory area. This might conflict with the use of vdaptr by whatever module the user is working in, such as Electronic Mail. Use the vdatmp buffer only for one-shot ad hoc purposes (see page 47).

- Heeding all of these cautions, use the Volatile Data Area whenever you can, rather than alcmem()'ing your own memory region. This will keep the BBS's use of memory from getting out of hand.

```
region=alcmem(nbytes);          Dynamically allocate some memory
char *region;                     pointer to the region
unsigned nbytes;                  size of the region, in bytes
                                  (up to 65530)
```

This routine differs from the standard C malloc() allocation function, in that alcmem() NEVER returns the value NULL. Any memory allocation errors are handled by the shut-down routine memcata() (see page 52).

Since memory allocation is relatively time consuming, we recommend that you avoid using alcmem() for short-term solutions. The Volatile Data Area is better for data that is only needed while a user is in a specific module (see below).

Memory allocated using alcmem() is automatically deallocated when The Major BBS shuts down and returns to DOS. To deallocate yourself, you may use the standard Borland library routine free().

To move an already-allocated block of memory into bigger (or smaller) living quarters:

```
newspace=alcrsz(oldspace,oldsize,newsize);
                                    Reallocate space to a different size
char *newspace;                     new space
char *oldspace;                     old space
unsigned oldsize;                   old size
unsigned newsize;                   new size
```

The new space will have the same contents as the old space, up to the size of the smaller space. If oldspace is NULL, or oldsize is zero, then alcrsz() will act exactly like alcmem(newsize). Otherwise, the oldspace parameter should be the return value of an earlier call to alcmem() (or an equivalent routine, such as alcrsz() itself). Like alcmem(), alcrsz() will never return NULL (it will catastro() if it runs into trouble).

To allocate new space for an existing NUL-terminated string:

```
newspace=alcdup(string);          Allocate new space for a string
char *newspace;                     new space
char *string;                       old space
```

You might do this if the old space is volatile and about to be used for some other purpose. The alcdup() routine is similar to the Borland library function strdup(), except that alcdup() will never return NULL.

```
zregion=alczer(nbytes);           Allocate new memory and zero it out
char *zregion;                      address of new memory
unsigned nbytes;                    size in bytes
```

This routine is just like alcmem() except that the new memory is filled with zero bytes.

> If you're allocating an array of blocks, one per channel (that is, "nterms" of them), then you should only use alcmem() or alczer() if each block is smaller than 256 bytes. If the block is 256 bytes or larger, you should use alcblok() or alctile().

To allocate more than 64K worth of memory at a time, you'll need a way to break it down into smaller parts. There are two schemes for doing this that differ in how the memory is allocated, but are almost identical functionally. alctile() gives you a different selector for each of these smaller parts, and alcblok() crams as many parts into each selector as possible.

If you're allocating an nterms array (an array of structures, one per online user), and that structure is 256 bytes or larger, then the array could be 256 x 256 = 65,536 bytes or larger, and you need to use one of these schemes. The prime recommended method for allocating a region that is N x M bytes long is to use alcblok():

```
bigregion=alcblok(qty,sizblock);  Allocate a very large memory
                                    region, qty by sizblock bytes
void *bigregion;                    return value, for ptrblok() only
unsigned qty;                       number of "blocks"
unsigned sizblock;                  size of each "block"
```

The alcblok() routine never returns NULL (it calls catastro() in case of insufficient available memory). If qty x sizblock is less than about 64K, alcblok() only allocates one region. Otherwise it will allocate multiple regions of up to 64K each.

When you want to use one of the individual blocks, you have to pass the "bigregion" return value to ptrblok():

```
block=ptrblok(bigregion,unum);      Dereference an alcblok()'d region
void *block;                          pointer to an individual block
void *bigregion;                      return value from original alcblok()
unsigned unum;                        index, 0 to qty-1
```

The alcblok() return value can only be passed to ptrblok() and not dereferenced in any other way. You should store it in a variable declared to be type "void *". The ptrblok() return value on the other hand can be assigned or cast to the native type of your blocks (whatever it is you're allocating that has "sizblock" bytes). Typically you would cast it to a variable of type (struct *something* *).

This is roughly how we allocate memory in MAJORBBS.C for the Volatile Data Area, and in FILEXFER.C for the file transfer session control blocks.

The "unum" parameter is an index between 0 and qty-1 ("qty" was passed to the original alcblok()). ptrblok() returns a pointer to the block of memory sizblock bytes long corresponding to this index. Each value from 0 to qty-1 will give you a different block. You shouldn't count on any other aspect of the ptrblok() return values. For example, different values of unum might or might not produce pointers with different selectors.

In general you can count on ptrblok() never returning NULL. The only exception might be if you abusively call it with a NULL bigregion, or an out-of-range unum.

The other method for large memory allocation is alctile(). There is a corresponding ptrtile() routine, which is the only legal way for dereferencing alctile()'s return value, just like the alcblok()/ptrblok() cousins. In fact the calling parameters are identical too:

```
bigregion=alctile(qty,sizblock);    Allocate a very large memory
                                      region, qty by sizblock bytes
void *bigregion;                      return value, for ptrtile() only
unsigned qty;                         number of "tiles"
unsigned sizblock;                    size of each "tile"

block=ptrtile(bigregion,unum);      Dereference an alctile() region
void *block;                          pointer to a tile (offset always 0)
void *bigregion;                      return value from original alctile()
unsigned unum;                        index, 0 to qty-1
```

What's happening under Phar Lap is that the region is "tiled" into a series of regions that are each smaller than 64K. Each region gets a different selector, and its base offset is guaranteed to be zero.

You might need this special feature of alctile()/ptrtile(), but it is usually much better to use alcblok()/ptrblok() if at all possible, because of the latter routine's economy with selectors. Every computer has a rock-solid limit of 8192 selectors, no matter how much memory it has. (That limit is imposed by the number of possible 16-bit values with the three low order bits set to 111.) So selector economy is a very desirable thing.

By the way, there is no way to free the memory allocated by alcblok() or alctile() before the program terminates (at which time the memory is automatically freed, of course). It's assumed that you'll be keeping these very large regions of memory in use for the duration of the program.

We use the following routines for general purpose handling of memory regions:

```
movmem(source,destination,nbytes)  Move a block of memory
char *source;                        source block
char *destination;                   where to put it
unsigned nbytes;                     number of bytes, 1 to 65535

setmem(destination,nbytes,value)   Set a block of memory to a value
char *destination;                   pointer to the block
unsigned nbytes;                     number of bytes, 1 to 65535
char value;                          1-byte value or character

repmem(destination,pattern,nbyt)   Replicate a pattern in memory
void *destination;                   where to put it
char *pattern;                       NUL-terminated string
int nbyt;                            total number of bytes at dest
```

The repmem() function will replicate [nbyt/strlen(pattern)] copies of the pattern at the destination. (The '\0' terminator of pattern is not replicated.) If that quotient is not an integer, the last copy of the pattern will be truncated, but exactly nbyt bytes will be written. No NUL is ever written to destination.

```
chimove(source,destination,nbytes)
                                   Reentrant version of movmem()
char *source;                        source block
char *destination;                   where to put it
unsigned nbytes;                     number of bytes, 1 to 65535
```

The chimove() function can be called by interrupt routines as well as mainline routines without conflict.

```
memavl=sizmem();                   Find out how much memory is
                                     available
long memavl;                         number of bytes
```

Volatile Data Area

```
dclvda(nbytes);                    Declare size of the Volatile Data Area
int nbytes;                          size in bytes
```

This function should only be called by your init_xxx() routines (see page 29). The function declares the maximum size that the module will require of the Volatile Data Area. Each user online will be given a separate region of this size. When the user selects a module page from a menu option, the corresponding module may use that region until the user exits back to the parent menu again. For example, if the Electronic Mail module requires 1000 bytes and the Registry module requires 500 bytes of the Volatile Data Area, they should both declare these amounts in their init_xxx() routines. 1000 bytes will be allocated (the larger of the two).

```
char  *vdaptr;                     Points to the Volatile Data Area
```

This global variable points to a memory region that is allocated for each user who is online, and is used by the module that is in effect at the time. The variable vdaptr is set to point to the appropriate region upon each call to these entry points for the module:

```
sttrou()   character line input after user selects the module page
lonrou()   log-on message / line input during log-on
lofrou()   log-off message / line input during log-off
stsrou()   status input
```

Continuing the above example for dclvda(), each time that a user in E-mail types in a line, the sttrou() entry point for E-mail is invoked (see page 33) and the global variable vdaptr points to that user's Volatile Data Area. The E-mail software is free to store whatever it likes there for the duration of the user's stay in E-mail.

```
int vdasiz;                        The actual size of the Volatile
                                     Data Area.
```

Of course, vdasiz is only valid when all the voting is done -- that is, at any point other than your init_xxx() routine.

The entry point:

```
huprou()   hang up
```

may also use the Volatile Data Area under the condition that:

```
usrptr->state == <module number>
```

where <*module number*> is the return value of register_module() (page 30) of the module whose huprou() entry point has been called. In other words, huprou() may work with the Volatile Data Area if the user hung up while that module was active (while the corresponding menu option was selected). Remember that whenever a user logs off or hangs up, The Major BBS calls the huprou() entry point of *every* module, not just that of the module he was using. So if your huprou() entry point detects that the user who is logging off was inside of your module (using the above test), then huprou() may take appropriate steps to clean up any unfinished business in the Volatile Data Area. Otherwise, it must leave the VDA alone.

```
char  *vdatmp;                    Points to the ad hoc Volatile Data Area
```

This additional area is available after the initialization entry points have been called for all modules and the Volatile Data Areas (page 46) have been allocated for each channel. "vdatmp" is to be used for brief ad hoc purposes. You can't depend on the contents of the buffer it points to being preserved through any cycle of the BBS. You can only use vdatmp within a single call to any of the other entry points, or within a single rtkick() invocation, or within other routines for short-term purposes (but not within your init_xxx() routine).

For one example of vdatmp usage, see the implementation of the global "/r" registry lookup command in REGISTRY.C (function gloreg()).

```
char *vdaoff(unum);               Compute volatile data pointer for
int unum;                           some other user
```

This routine is used whenever you need to access the volatile data area of some user *other* than the one that you are directly servicing (the one referred to by the global variable "usrnum"). You might use this to check before a user deletes an item, to make sure that no other users are using it at the same time. Just remember that any module other than your module can make any use of the VDA that it pleases. You'll probably only want to use vdoff() on users who are also in your module.

Ways to Split up a Long Task

Since The Major BBS is a multi-user system, it cannot work on any one task for too long at a time. If it did, then some users would experience an annoying delay in the response time of the BBS. (By the way, this delay would not show up between character transmissions to the user through the modems -- those are interrupt driven. Echoes of user keystrokes are also interrupt driven. Rather, this kind of delay might show up in the time between a user typing in a line and receiving his next prompt.) A certain amount of delay cannot be avoided, particularly with disk I/O.

If you have a time-consuming task to perform, and if you can break that task down into chewable computation bites, then you can improve BBS response time in two ways:

Cycle Mediating	Simulating CYCLE status codes
Polling Routine	begin_polling() and stop_polling()

Cycle Mediating

The trick is this: perform a little bit of the task and then generate a status 240 condition. Channel status conditions are managed internally by the GSBL (Galacticomm Software Breakthrough Library). Then when that status 240 is reported back to you, do a little more work on the task, generate another status condition, and so on. This allows The Major BBS to service all other channels that are online, plus perform other housekeeping chores, while it's also working for the user in your module. (You will see in your GSBL manual that the status code we use for this "cycle mediating" purpose, status 240, is reserved for application program use.) In the source file MAJORBBS.H, the constant "CYCLE" is defined as 240. You can see how this scheme is used in the status handler for Electronic Mail and for Forums -- function emsthn() in ESGUTL.C.

As a simple example, suppose a module, when selected by a user, simply displayed four lines on the user's screen and then, after the user hit the return key, returned to the parent menu, as follows:

```
line 1
line 2
line 3
line 4

Hit RETURN  (wait until user hits return key)
back to menu...
```

(In practice, you would never split up such a small task.)

The task is split up into four sub-tasks using the "cycle-mediated" method. The following functions would be used for the sttrou() and stsrou() entry points:

```
STATIC int
sttexm(void)
{
     switch (usrptr->substt) {
     case 0:
          prf("line 1\n");
          outprf(usrnum);
          btuinj(usrnum,CYCLE);
          usrptr->substt=1;
          return(1);
     case 4:
          prf("back to menu...\n");
          outprf(usrnum);
          return(0);
     }
     return(1);
}

STATIC void
stsexm(void)
{
     if (status == CYCLE) {
          switch (usrptr->substt) {
          case 1:
               prf("line 2\n");
               usrptr->substt=2;
               btuinj(usrnum,CYCLE);
               break;
          case 2:
               prf("line 3\n");
               usrptr->substt=3;
               btuinj(usrnum,CYCLE);
               break;
          case 3:
               prf("line 4\n\nHit RETURN ");
               usrptr->substt=4;
               break;
          default:
               dfsthn();
               return;
          }
          outprf(usrnum);
     }
     else {
          dfsthn();
     }
}
```

Notes:

- usrptr->substt is used to keep track of the progress of each user that selects this module from a menu. It is always set to zero when a user first selects the module.

- prf() is like printf(), except that the converted text goes into a buffer. outprf() transmits the contents of that buffer to a specific user.

- stsexm() calls dfsthn() (the default status handler, in MAJORBBS.C) when stsexm() encounters a status code that it is not expressly designed to deal with.

Polling Routine

The other way to break a long task down into parts is by registering a polling routine. Each channel can have a polling routine that is called regularly. The actual polling rate depends on system loading, but it can be very rapid.

```
begin_polling(unum,rouptr);      Turn on polling for this channel
int unum;                          User number for the channel
void (*rouptr)(void));             Polling routine (no parameters,
                                   no return value)

stop_polling(unum);              Turn off polling for this channel
int unum;                          User number for the channel
```

To start, register the polling routine with begin_polling(). The stop_polling() function is often called by the polling routine itself, when it decides polling is over.

File Handles (fopen())

The Major BBS supports up to 256 users simultaneously. So it needs to have numerous files open simultaneously. Unfortunately, DOS "EXE" programs, and most compilers support only 20 file handles. To get around that limitation, we've included code in the PHGCOMM.LIB library that increases the file handling capacity. It's important that linker response files list PHGCOMM.LIB *before* the patched Borland library BCH286.LIB (as is done in LTBBS.LNK) for this to work.

This allows up to 254 total files to be open simultaneously, using either the standard "fopen()" or "open()" routines (we use fopen()).

The Major BBS as shipped from the factory was compiled and linked with these modified routines installed, so the MAJORBBS.EXE file can handle more file handles. If you're developing your own Add-on Option, your .DLL code will use the fopen() that's in MAJORBBS.EXE.

The Second Parameter of fopen()

Use the following constants for the second parameter of fopen(), depending on how you will use the file:

FOPRA	Read in ASCII mode
FOPRB	Read in Binary mode
FOPWA	Write in ASCII mode
FOPWB	Write in Binary mode
FOPAA	Append in ASCII mode
FOPAB	Append in Binary mode

Exception Handling (catastro())

```
catastro(ctlstg,p1,p2,...,pn)      "catastrophic" error, exit to DOS
char *ctlstg;                        control string for error message
TYPE p1,p2,...pn;                    parameters for error message
                                     (maximum 8 bytes of parameters)
```

This module is called under numerous failure mode conditions. You should remember that catastro() failure conditions are severe cases, such as missing databases, DOS errors, or illegal formatting in the CNF options (see page 52 about insufficient memory errors).

So, when to use catastro()? Most often, it's to give a bumbling Sysop a soft place to fall. There are many cases when *not* to. If it's a likely Sysop mistake, then the Sysop procedures need reworking. If it's a programming mistake, then you may need more safeguards. If it's the result of something bizarre that a non-Sysop user has done, you absolutely *must* keep the system up and not penalize innocent bystander users.

Typical catastro() events are things that should "never happen" under normal conditions. But when Murphy's Law prevails and they do happen, it should be orderly. It's good to use a catastro() when the alternative would be a chaotic hard-to-trace result that nobody in their right mind would want.

Say you're using two databases and you just *know* that if you pull a certain name from the A database, that the same name will appear in the B database one or more times. Well, the Sysop could trip you up by failing to properly restore both database files from a backup in tandem. The result should not be that the program destroys both databases.

When choosing the wording of your catastro() message, try to keep in mind honest mistakes the Sysop could make and use plain english to lead him toward a solution. A Sysop is more likely to be able to handle "Cannot find file XXXX.ZOO" than "fopen() is NULL on XXXX.ZOO". Here's the point: word Sysop-causable errors for Sysops and word errors that only a programming error could cause for programmers.

Often, rather than calling catastro(), you can just allow something unpleasant but isolated happen, like the user who triggered the unhappy event could get an empty list with no explanation (but not trash -- sending trash to the screen might have unpredictable consequences). For example, you should apply extra caution when processing strings that they don't overflow the destination buffer -- use strcpy(), or brutally chop off the source string if you have to.

Now, to make every function that deals with a pointer check for NULL is pretty silly, so a balance is needed. For example, whenever you use fopen() to open a file, always check for NULL, so that if a Sysop messes up his installation or runs out of disk space he get's something predictable and not a wild memory write followed by a computer lock-up. Nothing's worse than an intermittent lock-up.

A non-Sysop user should *never* be able to trigger a catastro() -- your customers' BBSes would vulnerable to hackers.

Here is an example of how you would use catastro() to handle the case of a missing file:

```
if ((fp=fopen("NEEDTHIS.FIL",FOPRA)) == NULL) {
     catastro("Cannot find the file \"NEEDTHIS.FIL\"!");
}
```

Note that the function for opening Btrieve databases, opnbtv() (page 150), has a built-in catastro() to handle the file-not-found condition (BTRIEVE OPEN ERROR 12).

The parameters are identical to those of the standard printf(), but no more than 16 bytes of parameters (that's not including the control string) can be passed. For example, each of the following would exhaust the parameter list p1,p2,...,pn, but they would work:

4 pointers to character strings
8 integers
8 characters (remember, a character parameter takes up 2 bytes)

Note: no long integer or floating point values can be used as parameters (i.e. your control string cannot contain "%ld" or "%f" directives). If you need to make such conversions, see about the l2as() and spr() functions starting around page 175.

All catastro() messages are written to the text file CATASTRO.TXT with a time and date stamp, assuming, of course, the system is still capable of writing to disk rationally.

Insufficient Memory (memcata())

All errors that result from a quantitative lack of memory should *not* call catastro(), they should call memcata():

`memcata();` — Generate a catastro() with a polite message about insufficient memory: "There is not enough memory to continue. Please either reduce your memory requirements or install more memory, and try again."

(The routines alcmem() and alczer() have their own internal calls to memcata(). They never return NULL.)

Languages

The Major BBS can support multiple spoken languages ("English", "French", "German"), multiple dialects ("Expert", "Tutorial"), and multiple terminal protocols ("ANSI", "RIP") for multiple users simultaneously. Language names consist of a 1-8 character spoken language, a slash, and a 1-6 character terminal protocol. That's a total of up to 15 characters. Some examples:

English/ANSI	Spanish/RIP	Expert/ANSI
English/RIP	German/ANSI	Staff/ANSI
Spanish/ANSI	German/RIP	Tutorial/RIP

The multilingual feature primarily allows different versions of *user output* to be defined for different languages. The BBS won't translate *user input* (e.g. menu selections and commands). For example, if a user has to type 'R' for read or 'W' for write, he'll have to do the same thing in all languages. The best way to handle this is in the way the prompts are worded, for example:

```
RDOWRT {(R)ead or (W)rite? },{(L)eer or (E)scribir?}      ..is wrong..

RDOWRT {(R)ead or (W)rite? },{R=Leer, W=Escribir?}        ..is right..
```

One exception: YES and NO responses can be translated. Different languages can mean that the BBS expects different strings for "yes" and "no". This affects the operation of the cncyesno() routine, and some other special cases. You can use lingyn() for those special cases: it translates a user's single-character response into 'Y' or 'N' depending on their language (see page 77).

When the BBS comes up it builds a list of the user-languages that are defined on the BBS and sets a few global variables:

nlingo	number of languages defined, always at least 1
clingo	language index, 0 to nlingo-1, for the current user
extptr->lingo	usually the same as clingo
extoff(n)->lingo	language index of user number n (where n is 0 to nterms-1)
languages[clingo]->name	name of the current user's language
languages[clingo]->desc	description of the current user's language

See LINGO.H for more fields in the languages[] array of language information structures.

The main function of clingo occurs when reading in the type "T" (text block) CNF options from disk. There can be a different version of each type "T" option for each language, and the value of clingo determines which version to read in. We'll get into this more on page 65.

To look up the index of a language by its name:

```
ilingo=lngfnd(lngnam);   look up a language by it's name
char *lngnam;              name of language, 1 to 15 characters long
int ilingo;                language index, 0 to nlingo-1, or -1=unknown
```

To show users a list of all languages for them to pick:

```
prf("\rWhich language/protocol would you prefer to use on this BBS?");
lnglist(1);
lngfoot(1);
```

You'd be better to use prfmsg() (page 65) than prf() of course, but using prf() is a better way to show you what's going on in this example. The "1" parameter to lnglist() and lngfoot() means offer *all* languages as options for the user to pick. Use a "0" instead to only offer those languages with the top voting confidence factors (more about that on page 88). Here's how you might put the user's choice into effect:

```
int ilingo;
:
:
if ((ilingo=cnclng()) != -1) {
     clingo=extptr->lingo=ilingo;
}
```

Either a number or a language name will satisfy cnclng(). After this, all future prfmsg() output on this channel will be in the new language.

Maximum Number of Languages

We claim that The Major BBS can support up to 50 simultaneous languages, but the practical limit is probably higher. The tightest constraint comes from the needs of a certain structure in each .MCV file. You can compute that limit like this:

```
language limit = 32767 / number of options in the .MSG file
```

There's actually a different language limit for each individual .MSG file. For example, BBSMAJOR.MSG has about 300 options in it, so it should be able to support over 100 languages. That means that each text block in BBSMAJOR.MSG could have 100 different versions. But if one Sysop's BBSMAJOR.MSG had 100 languages, then problems could occur if a future release of BBSMAJOR.MSG had more than 327 options. Hence the official limit of 50 languages.

If a Sysop exceeds the limit on the number of languages, then BBSMSX would report:

```
Too many options (starting at "XXXXXX")
or too many languages in XXXXXXXX.MSG.
```

Creating CNF Options

CNF options affect many aspects of the operation of The Major BBS. See the System Operations Manual. CNF options are are stored in .MSG files, converted to .MCV files, and read in, as needed, using a very quick direct indexed scheme. CNF options help in these ways:

- The Sysop who isn't a programmer can change numerous values, names, options, prompts, and messages that affect the operation of the BBS.
- A large volume of text is stored on disk, saving memory.

As a developer, you can specify your own CNF options in .MSG files. These are converted into a special form for use by The Major BBS at runtime -- the .MCV files. These sections will help you create new CNF options, and use them in The Major BBS.

The Major BBS Configuration Facility, CNF, requires special formatting information about each CNF option in the .MSG files. When the system operator uses CNF to change the value of a CNF option, then this information is used to make his job easier.

CNF type "text" options can be specified in different languages. The first line of an .MSG file defines the languages that may appear throughout the file, in this format:

```
LANGUAGE {<language 0>},{<language 1>},{<language 2>} ...
```

For example:

```
LANGUAGE {English/ANSI},{Spanish/ANSI},{French/ANSI}
```

Language 0 is always English/ANSI. Omitting the LANGUAGE{} pseudo-option is equivalent to including the line:

```
LANGUAGE {English/ANSI}
```

CNF options can be specified at different levels:

LEVEL1	Hardware Setup options
LEVEL3	Security and Accounting options
LEVEL4	Configuration options
LEVEL6	Editable Text Blocks

The levels are numbered to correspond with the numeric selections from the introductory menu.

Other special-purpose levels:

```
LEVEL8   Full Screen Editor help messages

LEVEL30  \
LEVEL31   \  Reserved for configuring the 16 databases of
:         /  The Major Database
LEVEL45  /

LEVEL96  Reserved for configuration options of the Major Gateway/
         Internet Add-on Option

LEVEL97  Reserved for options in the Entertainment Teleconference that
         cannot be edited by CNF, including "action" specifications

LEVEL98  Reserved for text that Sysops are not expected to want to view
         or modify using CNF

LEVEL99  Reserved for Full Screen Data Entry templates (which are not
         editable by CNF)
```

The .MSG files have the following format:

```
LANGUAGE {<language 0>},{<language 1>},{<language 2>} ...

LEVEL1 {}
<option specifier>
<option specifier>
:
LEVEL3 {}
<option specifier>
<option specifier>
:
LEVEL4 {}
<option specifier>
<option specifier>
:
LEVEL6 {}
<option specifier>
<option specifier>
:
```

Each section at any level may contain from zero up to any number of option specifiers. The "LEVELn {}" may be omitted for any section that contains no option specifiers.

Each <option specifier> has the following format:

```
<help paragraph> <option name> <version list> <hinge> <coding>
```

<help paragraph> Up to 12 lines of text describing the CNF option. This message appears on the CNF screen when the operator is in HELP mode. You should only use columns 2 through 60 of these 12 lines to give the paragraph the proper appearance on the CNF screen. (For best appearance, if you use less than 12 lines, add a blank line before the line with the option name. If you use all 12 lines, use no blank line.)

The <help paragraph> may be omitted. In that case, leave two blank lines in its place.

<option name> One to eight characters (capital letters or numbers). This same symbol will be used in the "C" language source code to refer to this CNF option. This is done with the .H file that BBSMSX generates.

<version list> The text of the option, perhaps with versions in multiple languages (for type "T" options only). There is always a version for language 0. All other languages may or may not have versions. Of course, there can't be more versions than there are languages, as defined by the LANGUAGE{} line at the start of the file.

In a 4-language file, here are the possibilities for encoding the 4 different versions:

```
{<version 0>}
{<version 0>},{<version 1>}
{<version 0>},{<version 1>},{<version 2>}
{<version 0>},,{<version 2>}
{<version 0>},{<version 1>},{<version 2>},{<version 3>}
{<version 0>},,{<version 2>},{<version 3>}
{<version 0>},{<version 1>},,{<version 3>}
{<version 0>},,,{<version 3>}
```

Notice that *empty* and *missing* are not the same thing. An empty option has nothing between the curly braces, but a missing option has no curly braces. See about *language subsets* in the System Operations Manual.

Only type "T" options can have multiple versions in multiple languages. Other types of options always have exactly one version.

<version n> This is a string of characters that are available to The Major BBS at runtime. This, and the option name is the only information that BBSMSX takes from the .MSG file to create the runtime .MCV file.

In the .MSG files:

```
"}"  is represented as  "~}"
"~"  is represented as  "~~"
```

The number of characters in each version is limited by the offline Configuration option OUTBSZ, which may be set to 4096, 8192 or 16384.

<contents> The <version 0> text for options of all types except type "T" is the <contents> of the option: what's between the curly braces.

<hinge> The hinge is an optional field that implies that a particular option "hinges" on another option. This mechanism is used to avoid contradictory combinations of options from appearing on the

CNF screen. You can use it to hide one option based upon the value of a preceding option. See page 62 for more details.

<coding> This information is used by the CNF utility to control the format and limitations on the option contents.

There are examples of CNF options on page 63. Also look in the .MSG files.

Option Coding Syntax

C	Character, ' ' through '~'
B	Binary ("YES" or "NO")
E <v1> <v2> ... <vn>	Enumerated (multiple choice)
N <min> <max>	Decimal numeric (%d)
L <min> <max>	Large decimal numeric (%ld)
H <min> <max>	Hexadecimal numeric (%x)
S <length> <descript>	String of characters (%s)
T <description>	Text (up to OUTBSZ-1 characters)

Type C: Character Configuration Options

The format of the <contents> for this type of option is:

<description> <character>

Where <character> is a single character, as for a menu selection, and <description> is a short description, for example:

```
This is the activation code letter for calibrating
uplink #3

UPSEL3 {Select character for uplink 3: G} C
```

Type B: Binary Configuration Options

The format of the <contents> for this type of option is:

```
<description> YES
      or
<description> NO
```

Where <description> is a short description, for example:

```
Answer YES to this question if you want
new users to be able to play in the
games. Answer NO to allow them to
watch, but not play.

NEWGAM {Allow new users to play games? NO} B
```

The YES or NO choices will show up as softkey selections under CNF.

Type E: Enumerated Configuration Options

The format of the <contents> for this type of option is:

<description> <choice>

Where <choice> is a one-word selection among a small set of possible answers. <description> is a short description. The set of possible answers is enumerated in the <coding>, for example:

```
How rough do you want users to be
able to play?

   EASY -- nobody loses too much
   NORMAL -- can lose your shirt
   ROUGH -- users can cheat
   BRAWL -- cheaters can be shot

PLALVL {Play difficulty: ROUGH} E EASY NORMAL ROUGH BRAWL
```

These four enumerated <choice>'s will show up as softkey selections under CNF.

Type N: Numeric Configuration Options

The format of the <contents> for this type of option is:

<description> <number>

Where <number> is a 16-bit integer between -32768 and 32767. A smaller set of limits may be specified in the <coding>, for example:

```
How many seconds should we
wait for a user's bet before
skipping him for the round?

PLWAIT {Wait for how many seconds? 30} N 5 3600
```

In this case, 5 and 3600 are the "permanent" inclusive limits on the value of the <number>. The operator, using CNF, can change the value of this option to something other than 30, but not to something outside of the range 5 to 3600. If you don't want any particular limits on a option, then you may specify "N -32768 32767"

Type L: Large Numeric Configuration Options

The format of the <contents> for this type of option is:

<description> <number>

just like for type N options, except that this <number> will be stored as a 32-bit integer. Limits are specified in the <coding>, for example:

```
How much should we allow a user
to bet during one round?

MAXBET {Maximum bet: 1000000} L 0 100000000
```

In this case, the value of the option is one million. The operator, using CNF, will not be able to make it larger than a hundred million. If you wish to have no particular limit on the option, you may code "L -2147483648 2147483647".

Type H: Hexadecimal Numeric Configuration Options

The format of the <contents> for this type of option is:

<description> <hexadecimal number>

The <hexadecimal number> is unsigned, and may be between 0 and FFFF. Smaller limitations may be encoded in the <coding>, for example:

```
What channel would you like to reserve
for your satellite uplink?

SATCHN {Channel for satellite uplink: 3F} H 0 3F
```

Type S: String Configuration Options

The <contents> for this type of option are the value of the string. The maximum length and description of the string are encoded in the <coding>, for example:

```
This string is the sign-on message for initiating
uplink using the 227.85-228.05 MHz "APLINK" band,
including your FCC registration number

UPSIGN {U905 Westar 7::88A,5932-051} S 30 Uplink sign-on command
```

This would appear on the CNF screen something like this:

```
UPSIGN    Uplink sign-on command ..... U905 Westar 7::88A,5932-051
```

If you use 0 as the length of the string, the maximum length will end up being used, as limited by the width of the CNF screen. Note: A longer <description> means a shorter <contents> length.

Type T: Text Configuration Options

The <version n> text for this type of CNF option may consist of up to OUTBSZ-1 characters.

BBSDRAW, the default editor for all "/ANSI" languages, can edit an image of up to 25 lines of 79 characters each. If you use all 25 lines, then the last line cannot end with a line terminator (i.e. no more than 24 line terminators may be in the <version n>). The <coding> field specifies a short description for the option, for example:

```
UPCOMP {
Uplink established, at %s on %s

*** BEGINNING UPLINK TRANSMISSION ***
} T Uplink established notification
```

Type T options are the most numerous. Almost all user prompts and messages are among the Editable Text Blocks, and are type T options.

If Sysops change the sequence of %-symbols in a type-T option, CNF will warn them about the consequences. Even so, The Major BBS tends to be tolerant of "%s" symbols that show up where they don't belong. In case of emergency, the BBS will try to convert the %s symbols into one of these strings:

<null pointer>	The pointer is NULL (all 4 bytes are zero)
<invalid pointer>	The pointer does not contain a valid selector, or the offset is too big for the selector

This may not always work, and it is possible that a misplaced %s will cause messy characters to show up on the user's terminal, or worse, the BBS could crash with a GP (general protection fault) when prfmsg() tries to use the pointer.

Hinge Specification

This feature keeps CNF from showing one option based upon the value of a preceding option. For example:

```
NEWGAM {Allow new users to play? NO} B
CHGGAM {Charge new users how much to play? 1000} N 0 32767
```

This combination of option settings does not make sense. How can you charge new users for playing if you never allow them to play? If these options were coded like this:

```
NEWGAM {Allow new users to play? NO} B
CHGGAM {Charge new users how much to play? 1000} (NEWGAM=YES) N 0 32767
```

then the second option would not even appear on the CNF screen, at least not as long as the value of the NEWGAM option was NO. Change NEWGAM to YES and CHGGAM appears.

> CAUTION: The hinge feature has no effect on the *contents* of the .MCV file, and thus no effect on the *execution* of The Major BBS. Your programming on The Major BBS must specially handle a situation such as the above to be sure that new users aren't charged for a game that they aren't allowed to play, or anything similar, where BBS operation would be out of sync with the CNF option settings.

You can also use the hinge specification to test for a set of values, for example:

```
(SATLINK=KBAND,QBAND,ZBAND)
```

This hinge will activate an option when the SATLINK option is *either* KBAND, QBAND, *or* ZBAND. On the other hand:

```
(GEOSYNC#90,105,120)
```

will activate an option when the GEOLINK option is *neither* 90, 105, *nor* 120.

You probably will not want to hinge on the value of a 'T' option. Any option that does so will always be inactive.

Examples

Here's an example of an option specifier:

```
If you want users to be able to change their date of birth,
answer this question with a YES.  If only you, as the
Sysop, want to have the option of changing a user's date
of birth after he or she signs up, answer this question
with a NO.  You can always change the date of birth from
the User Account Detail screen

CHGBDY (Allow users to change their date of birth? NO) (ASKBDY=YES) B
```

This option is named CHGBDY. It has six lines to its help message. (These appear while CNF is in help mode, per the <F1> key). This is a B-type option, which is a YES or NO option. It's current value is NO. It is hinged on the option named ASKBDY. CHGBDY appears only if ASKBDY is set to YES.

Here's another example of an option specifier in an .MSG file:

```
GREET (Hello),(Hola),(Bonjour) T Greetings for a user
```

This GREET{} option has no help text. It has three versions for languages 0, 1 and 2. Here are more examples, with other languages missing:

	language 0	language 1	language 2
GREET {Hello}	Hello	Hello	Hello
GREET {Hello},{Hola}	Hello	Hola	Hello
GREET {Hello},{Hola},{Bonjour}	Hello	Hola	Bonjour
GREET {Hello},,{Bonjour}	Hello	Hello	Bonjour

The first and last examples omit the Spanish (language 1) versions of GREET{}, so Spanish language callers will revert to the English version "Hello" (which is language 0). The last two examples omit the French (language 2) version of GREET{}.

A friendly reminder:

```
GREET ,{Hola},{Bonjour}          *** Not allowed!  It's never  ***
                                 *** legal to omit language 0. ***
```

Compiling CNF Options

The Major BBS makes sure it has all the .MCV files it needs to run by running BBSMSX with no arguments (this happens in BBS.BAT). That checks all .MSG files and makes .MCV files out of them if their time and date disagree. (After BBSMSX makes an .MCV file, its time and date are identical to that of the corresponding .MSG file.) That's fine, but if you insert or delete CNF options, you need a new .H file in the source directory. That should be taken care of with your .MAK file, or by specific steps in your development process (page 21).

If you're ever in doubt, here's how to run BBSMSX in a development environment:

```
CD \BBSV6
BBSMSX <filename> -OSRC
```

where <*filename*>.MSG is the name of your editable .MSG file. This puts the .MCV file into \BBSV6 and the .H file in \BBSV6\SRC where it can be used to compile the software that uses the options. (Of course, if you're putting your source code in a separate directory, you'll need "-ODDD" or something.)

BBSMSX has these alternative command syntaxes:

```
BBSMSX [-O<source directory prefix>]

BBSMSX @<list file> [-O<source directory prefix>]

BBSMSX <root filename> [-O<source directory prefix>]

BBSMSX <MSG file path> <MCV file path> <H file path>
```

The last syntax gives you complete control over what the files are named and where they go.

Using CNF Options

Files with .MCV extension contain the values of the CNF option for use at runtime. The Major BBS reads from these files at runtime to get the values of the options. Your source code can refer to the options by the <option name> that you used in your .MSG file, as specified on page 57. To do this, your source file will need to include the header file in your source file using the C language "#include" directive.

The symbols defined in this header file are often used for more than just referring to CNF options -- they also keep track of user substate. See page 33 for more on this.

```
prfmsg(msgnum,p1,p2,...,pn);      like prf, but the control string
                                    comes from an .MCV file
int msgnum;                         message number within current .MCV
                                    file
p1,p2,...,pn;                       just like printf()'s parameters
                                    (except no "longs" or "floats")
```

This function is just like prf() (page 69), in that the formatted text output goes into the prfbuf. However, with prfmsg(), the control string comes from a CNF text block. Be sure to call setmbk() to identify the appropriate .MCV file that the text block should come from *before* calling prfmsg() (more on setmbk() below). The global variable clingo defines the language that prfmsg() will read (page 53).

prfmsg() is used far more often than prf() for two reasons: (1) memory is saved by storing the text on disk, and (2) the Sysop can change the control string using CNF in offline Text Block Editing. Like prf(), there is no limit to the number of parameters (p1,p2,...,pn).

It's fine to use prfmsg() in cases where you're formatting text for the current user. When you're formatting text for another online user however, you need to consider what language that user has selected. Remember clingo is the language of the *current* user, and all prfmsg() calls depend on clingo. See page 70 for more about prfmsg()'s multilingual cousin, prfmlt().

The library PHGCOMM.LIB (and the source file MSGUTL.C, which is available with the Extended C Source Suite) has several utility routines for reading and processing CNF options from these .MCV files.

```
inimsg(maxsiz)                    initialize the message buffer
unsigned maxsiz;                    maximum number of bytes in any option
```

You'll only have to use inimsg() if you're writing an offline utility that reads .MCV files. Set maxsiz to 16384 if you need to be sure you're compatible with any .MCV file used on The Major BBS.

```
mbkptr=opnmsg(mcvfil);            open a new MCV file
FILE *mbkptr;                       MCV file identifier
char *mcvfil;                       filespec of MCV file ("xxxx.MCV")
```

This routine opens a file of CNF options for reading. An array of pointers is read in at this time so that when it comes time to read the actual value of an option from disk, access time is minimal.

MCV File Identifiers

The return value of opnmsg() is a pointer to type FILE. The value identifies a specific .MCV file -- a file containing CNF options. You should only need to use this value when you call the routines setmbk() and clsmsg(). The same type of value is also stored in the global variable curmbk (see below).

```
setmbk(mbkptr);                    set "current" MCV file block ptr
FILE *mbkptr;                        MCV file identifier (from opnmsg())
```

This important routine identifies the .MCV file to be used in subsequent calls to getmsg() or to prfmsg() (see above). When a file is opened, an implicit setmbk() takes place. See the above note on .MCV File Identifiers.

A common programming mistake is to forget to use setmbk() at the beginning of a series of prfmsg()'s. This can lead to a program that appears to work when you test it with one user, but fails with multiple users. The symptoms are usually quite obvious: messages are total nonsense, or you get a fatal error like "RAWMSG: MSG NO. <nn> OUT OF RANGE IN <filename>".

```
rstmbk();                          restore previous MCV file block ptr
                                     from before last setmbk() call
```

A typical usage of rstmbk():

```
setmbk(fbkmb);
prfmsg(AUXBEEP);
rstmbk();
```

Calls to setmbk() and rstmbk() can be nested up to 10 levels deep.

```
extern FILE *curmbk;               get the current MCV file identifier
```

This global variable contains the current MCV file identifier (see above) that was last set by opnmsg() or setmbk().

There is an alias for curmbk, called lclmbk, that allows you to get at the internal .MCV structure. It's the identical variable as curmbk, but recast to (struct msgblk *). For example, lclmbk->filnam is the name of the .MCV file. See \BBSV6\SRC\MSGUTL.H for details. To use lclmbk, include MSGUTL.H in your C source file.

```
bufadr=getmsg(msgnum);             read value of CNF option
char *bufadr;                        address of buffer with retrieved text
int msgnum;                          message number (use option name from
                                     the .H file)
```

This routine retrieves a CNF option into a buffer, and returns a pointer to the buffer. The same buffer is always used for option contents (and hence the same pointer is always returned by getmsg()), so you must finish using these contents before you execute another getmsg(), prfmsg(), rawmsg(), or getasc() call.

The "msgnum" parameter is the sequential number of the option within the .MCV file. In your source code, you can use the name of the option here. Your source file should include the appropriate header file using the "#include" directive. The .H header file was generated from the .MSG file by the BBSMSX utility.

getmsg() is called indirectly by prfmsg() (see page 65) for the most common usage of CNF options: user prompts and messages. These CNF options are type T. getmsg() does translate embedded text variables (page 73).

```
bufadr=getasc(msgnum);          read value of CNF option
char *bufadr;                     address of buffer with retrieved text
int msgnum;                       message number (use option name)
```

This variation on getmsg() returns text blocks with ASCII compatible line terminators (both CR and LF are on every line -- getmsg() uses an internal line terminator format where CR is a hard return, and LF is a soft return). getasc() does not interpret text variables (page 73).

```
bufadr=rawmsg(msgnum);          read value of CNF option
char *bufadr;                     address of buffer with retrieved text
int msgnum;                       message number (use option name)
```

This variation of getmsg() reads in the raw text from the .MCV file. Text variables, if any, are not translated, and the internal line termination scheme is used (CR = hard return or paragraph boundary, and LF = soft return).

```
clsmsg(mbkptr);                 close an MCV file
FILE *mbkptr;                     file identifier (from opnmsg())
```

This routine closes a CNF option file and deallocates the special structures allocated by opnmsg().

The following routines are used for reading in the values of CNF options other than of type T (text). To save time, these routines are usually called during initialization, and their values are stored in memory. This means that The Major BBS need not do a disk read every time it needs the value of the CNF option.

```
val=numopt(msgnum,floor,ceil)   get numeric option from MCV file
int val;                          value of option
int msgnum;                       message number (use option name)
int floor,ceil;                   Inclusive limits on the value
```

This function gets the value of a type N CNF option. If the value read from the file does not conform to the inclusive limits specified by "floor" and "ceil", then The Major BBS reports a "catastro" error message.

```
lval=lngopt(msgnum,floor,ceil)  get large numeric option from MCV
long lval;                        value of option
int msgnum;                       message number (use option name)
long floor,ceil;                  Inclusive limits on the value
```

This function gets the value of a type L CNF option. If the value read from the file does not conform to the inclusive limits specified by "floor" and "ceil", then The Major BBS reports a "catastro" error message.

```
hval=hexopt(msgnum,floor,ceil)    get hex option from MCV file
unsigned hval;                      value of option
int msgnum;                         message number (use option name)
unsigned floor,ceil;                Inclusive limits on the value
```

This function gets the value of a type H CNF option. If the value read from the file does not conform to the inclusive limits specified by "floor" and "ceil", then The Major BBS reports a "catastro" error message.

```
flag=ynopt(msgnum)                get yes/no option from MCV file
int flag;                           1 if var started with "Y", 0 if not
int msgnum;                         message number (use option name)
```

This function reads in a YES or NO CNF option (type B).

```
ch=chropt(msgnum)                 get single-character from MCV file
char ch;                            the character
int msgnum;                         message number (use option name)
```

This function reads in a type C CNF option.

```
string=stgopt(msgnum)             get a string from MCV file
char *string;                       pointer to newly allocated string
int msgnum;                         message number (use option name)
```

This function puts the contents of a type S CNF option into a newly allocated string that is just big enough to hold it. You could use free() if you ever needed to deallocate the string.

```
index=tokopt(msgnum,token1,token2,....,NULL)  multiple choice option
int index;                                      1=token1, 2=token2, 0=none
int msgnum;
char *token1;
char *token2;
:
```

This function checks a type E CNF option for one of several possible values. If the last word in the option specified by msgnum matches token1, then tokopt() returns 1, if token2, it returns 2, and so on. If the word matches none in the token list, tokopt() returns 0.

Don't forget to terminate the token list with a NULL parameter.

Changing Configuration Variables

If you understand the various roles of the .MSG, .MCV, and .H files you will see that changing the contents of an option without changing the *order* of the options has no effect on the .H file. This means that you do not need to recompile The Major BBS every time you change a CNF option. The CNF utility never changes option order. If you change the *order* of CNF options, either by adding, deleting, or just rearranging them, you must remember to regenerate the .H file (CNF does not do this -- use your .MAK file or the BBSMSX utility, page 64), and recompile all the source code that #include's this header file.

4. USER INTERFACE

User Output (prf(), prfmsg())

```
prf(ctlstg,p1,p2,...,pn);          prfbuf-directed printf-lookalike
char *ctlstg;                        printf-like control string
p1,p2,...,pn;                        just like printf()'s parameters
                                     (note: no "longs" or "floats")
```

This function has the same syntax as printf(). However, the formatted output of prf() goes into a global buffer pointed to by prfbuf. An internal variable "prfptr" keeps track of where prf() should write into prfbuf: prf() starts writing text at prfptr, terminates the text with a NUL ('\0'), and leaves prfptr pointing to the NUL when done. This means that the output of several prf()'s in sequence are concatenated together. outprf() is commonly used to transmit the results of one or more prf()'s to a specific user.

As with printf(), there is no limit to the number of parameters (p1,p2,..., pn) than you may pass to prf(). They should correspond one-for-one with the "%" directives in the control string, and you must be careful not to overflow the prfbuf. (Use PFBSIZ for the size of prfbuf, but it's not a constant. PFBSIZ is computed to be the same as the offline Configuration option OUTBSZ and is set by iniprf() at initialization time.)

See page 141 for the coding of ANSI directives that you can transmit to user screens. For example, you could use:

```
prf("\33[37;44;0mFiberlink 92 to Munich is condition \33[32;1mGREEN!");
```

This sends a message that starts out white on blue and ends up flashing bright green on blue.

See also page 65 about prfmsg(), the variation of prf() that reads text from an .MCV file. (prfmsg() is used far more often in the BBS code.)

```
outprf(unum);                      send prfbuf to a channel & clear
int unum;                            user number
```

This function transmits the contents of the prfbuf buffer to a specific user. When unum is anything other than usrnum, you should probably use outmlt() (page 70). The "prfptr" variable mentioned above is reset to the beginning of prfbuf. This means that several outprf()'s can be used to transmit the same text to different users, as long as no prf()'s intervene. But the next prf() will start at the beginning of prfbuf again.

```
clrprf();                          clear the prf buffer indep of outprf
```

This function resets the "prfptr" mentioned above to point to the beginning of prfbuf and stores a '\0' there.

```
char *prfbuf;                      output buffer of prf() and prfmsg()
```

This is the variable mentioned above that points to the buffer where user output is formatted. The contents of that buffer are transmitted by outprf() using the GSBL routine btuxmt().

```
char *prfptr;                      pointer to the current position
                                     in prfbuf
```

This pointer is updated by prf() and prfmsg() to point to the end of the formatted string in prfbuf. Both clrprf() and outprf() reset prfptr to the beginning of prfbuf.

Multilingual User Output

To review, if you want to format text for the current user, you use the prfmsg() and outprf() routines, remembering to call setmbk():

```
setmbk(appmb);
prfmsg(HOWAYA,usaptr->userid);
outprf(usrnum);
```

This code prepares to read from a specific .MCV file, reads the HOWAYA message from it and formats it with the current user's User-ID, and then sends the formatted message to the current user. If there are multiple versions of the HOWAYA text block for multiple languages, then the version corresponding to the current user's language will be read (or the most appropriate alternate -- see about *language subsets* in the System Operations Manual).

Things get a little tricky when you need to send a message to *another* user who is also online. Let's say your module had some scheme for pairing users, and when both partners logged on you wanted to notify them. To tell the first partner that the second partner had logged on you could code this:

```
if (onsys(partner(usaptr->userid))) {
     prfmsg(PNRHERE,usaptr->userid);
     outprf(othusn);
}
```

PNRHERE says something like, "Your partner, %s, just logged on." The problem is that the other user will get the message in the language of the current user. To avoid this:

```
if (onsys(partner(usaptr->userid))) {
     prfmlt(PNRHERE,usaptr->userid);
     outmlt(othusn);
}
```

There are four routines that have multilingual "cousins":

Monolingual	Multilingual
prfmsg()	prfmlt()
prf()	pmlt()
clrprf()	clrmlt()
outprf()	outmlt()

Each routine has the same parameters as its cousin. The critical routine is outmlt(). It transmits formatted information to one user. That information must have been formatted by prfmlt() or pmlt(), and not prfmsg() or prf(). By the same token, outprf() should not be outputting information formatted by prfmlt() or pmlt(). (If you combine prfmsg() and outmlt() then English/ANSI users will get text in the native language of the usrnum user, and all other users will get *nothing at all*. If you combine prfmlt() and outprf(), then all users will get the English/ANSI version.)

When clearing the formatted information, it would be nice to use clrprf() or clrmlt() as appropriate, but you can always use clrmlt() if you're in doubt (it does everything clrprf() does and more). clrmlt() is already called before every sttrou(), stsrou(), lonrou(), or lofrou() entry point, and also before every polling routine (page 50).

The monolingual routines are more efficient than the multilingual routines, so you should always use monolingual if you know you are outputting to the current user only. In most of Galacticomm's software the vast majority of text blocks go to the current user.

Whenever output goes to a user other than usrnum, the most convenient thing to do is to use the multilingual suite of routines. In the above case, when prfmlt() formats PNRHERE, it first checks what languages are represented online (including that of the current user) and then for each one, formats a version of PNRHERE for that language. There's actually a separate prfbuf-type buffer (page 70) allocated for each language. Here's how to get each buffer's address and pointer:

ptrtile(prfbuffers,ilingo)	the address of the prfbuf for language ilingo
prfpointers[ilingo]	the address within the ilingo'th prfbuf where we're currently formatting text.

The language 0 version goes in the first of the prfbuffers, which is prfbuf itself. If anyone is online with language 1 selected, then the language 1 version goes in the prfbuffers buffer number 1, and so forth, from 0 to nlingo-1. When formatting is done, then outmlt(othusn) sends the appropriate version of the text to user number othusn.

There is some work wasted here, in formatting text for languages that will never be sent to a user, but if you code multiple outmlt()'s, all those languages will come in handy. To save that unnecessary processing here's another way:

```
if (onsys(partner(usaptr->userid))) {
     clingo=extoff(othusn)->lingo;
     prfmsg(PNRHERE,usaptr->userid);
     outprf(othusn);
     clingo=extptr->lingo;
}
```

Here we've just changed the global variable clingo to the other user's language temporarily. If you're formatting text for only one other user, you can always set clingo like this.

But both of these methods (prfmlt/outmlt and changing clingo) have an important drawback -- they don't reprompt the other user. The other user was probably sitting at some prompt and it would be polite to show him that prompt again, after your interrupting message.

Here's the *best* way to send a message to another user who is online and may be using any service at all on the BBS:

```
got=injoth()                        inject a message to another user
                                      (implicit inputs:
                                         othusn ... channel # to inject to
                                         prfbuf ... message to be injected)
int got;                              1=user got it  0=user was busy
```

This routine is used to transmit an asynchronous message to a user. By asynchronous, we mean a message that does not follow from the question-answer-question-answer banter that normally goes on between each user and The Major BBS. This message is an interruption. injoth() is used, for example, for:

- o the Teleconference "page" feature or the global "/p" command
- o the Sysop send-message function
- o notifying online users that they have received Electronic Mail
- o notifying users that credits have been posted to their account

The message will not be injected if the recipient's NOINJO flag (in user[othusn]->flags) is set, as it is when he is downloading, in Sysop-chat mode, or is otherwise unavailable. The value returned by injoth() indicates whether or not this happened: 1=user got the message; 0=user did *not* get the message.

Now here's what we could do to tell both partners that the other is online:

```
if (onsys(partner(usaptr->userid))) {
     prfmlt(PNRHERE,usaptr->userid);
     if (injoth()) {
          prfmsg(PNRTOO,othuap->userid);
          outprf(usrnum);
     }
}
```

PNRTOO says something like, "Your partner, %s, is already online." The injoth() routine is compatible with both monolingual and multilingual formatting methods. It does the equivalent of an outprf() or outmlt() as appropriate to the othusn user.

> You should probably always use prfmlt() or pmlt() to format the text for injoth(), not prfmsg() or prf().

In the above example, prfmlt() generates the text for injoth(), but if prfmsg() had been used it would inject the text in the clingo language only.

By the way, notice how we can get away with prfmsg()/outprf() to the *current* user after using prfmlt()/injoth() on the *other* user? This does *not* violate the rules of mixing monolingual and multilingual user output routines.

Changing usrnum

One last point, if you ever change the value of usrnum, it's important to call curusr(). Suppose you're temporarily changing the user number to "userno" for some reason. Do it this way:

Right way

```
int unsave;
:
:
unsave=usrnum;
curusr(userno);
:
curusr(unsave);
```

Wrong way

```
int unsave;
:
:
unsave=usrnum;
usrnum=userno;
:
usrnum=unsave;
```

The curusr() routine sets up many global variables in tandem with the new user number, like usrptr, usaptr, and extptr. It also sets clingo to the new user's language index.

```
curusr(newunum);
int newunum;
```

Change to a different user number
new user number, 0 to nterms-1

Defining Text Variables

See the System Operations Manual for The Major BBS, in the BBSDRAW chapter about *using* text variables. Here we'll tell you how to program your own text variables. From a programming standpoint, a text variable is simply a function that has a name and returns a string of arbitrary length. (The length and justification issues arise when using the variable -- see BBSDRAW.)

1. Code a routine that returns a pointer to a string. (You're responsible for storing the string somewhere where it will be available for immediate use. Just about any buffer except an "automatic" (stack) array will do.) Example:

```
char *
tvar_nikei(void)
{
     return(l2as(nikeiaverage()));
}
```

2. Register the routine, along with the text variable's name, using the register_textvar() routine, as in:

```
register_textvar("NIKEI",tvar_nikei);
```

   You can do this in your init_xxx() initialization routine. Now you can use the text variable "NIKEI" when creating menus or text blocks.

Be careful about the context of using a text variable. Either you must code the routine so that it will produce valid results no matter when it's called, or you must be sure that when the Sysop uses the text variable in a particular text block or menu that the routine will work. See the context limitations on using some of the standard text variables in the System Operations Manual.

User Input

On The Major BBS, each time a user types a string of characters and hits <*Enter*>, a status 3 condition occurs on his channel. Whatever module is in effect for that channel processes the input through the sttrou() entry point for the module (see page 33).

The variables in this section are implicit inputs to the sttrou(), lonrou(), and lofrou() entry point routines for a module.

int **margc**;	number of words in user input line
char ***margv**[];	array of pointers to the words in user's input line (there are margc of these pointers)
char ***margn**[];	array of pointers to the *ends* of the words (to the terminating NUL's)

These variables are initialized by the function parsin():

parsin();	parse input line (insert '\0' after each word, compute margc and margv[])

The parsin() routine is always called before control is passed to your module through the sttrou() entry point. The user's input line is "parsed" into individual words, with the intervening spaces removed and '\0' terminators placed on each word. The global variable margc is the number of words, and margv[] is an array of pointers to those words. Each word contains no spaces and is terminated by NUL ('\0'). margc and margv[] work very much like the C language argc and argv[] work for command line parameters passed to the main() routine.

char **input**[];	user input line
int **inplen**;	total length of the input line in bytes
rstrin();	restore parsed input line (undo effects of parsin())

The rstrin() function restores the user's input to its original form (the NUL's are removed and the spaces restored), undoing the effects of parsin(). After calling rstrin(), you use the global variable input[] to refer to the user's entire input line.

For example, if a user types in the line "RAIN IN SPAIN" followed by <*Enter*>, then the sttrou() entry point of the current module is invoked with:

```
margc      is 3
margv[0]   points to "RAIN"
margv[1]   points to "IN"
margv[2]   points to "SPAIN"
```

If you call rstrin(), then:

```
input[]    contains "RAIN IN SPAIN"
```

Profanity

```
int pfnlvl;                    "profanity level" of the input (0
                                 means no profanity, 1 means mild,
                                 3 means very profane)
```

This global variable is based on the user input line in input[]. It is saturated at (it's never more than) the value of the offline Configuration option PFCEIL.

Echo

```
echon();                       Turn echo on for this channel
```

To turn echo off for a channel, use:

```
btuech(usrnum,0)               Turn echo off for this channel
```

Then use echon() to turn it on again. Don't use btuech(usrnum,1) to turn echo on. To echo "secret characters", such as "****" during password entry, use this routine:

```
echsec(c,width);               Echo secretly
char c;                          character to echo with every keystroke
int width;                       maximum number of characters expected
```

Then call echon() to make things normal again. The convention is to use "secchr" as the first parameter to echsec(). This is the setting of the offline Configuration option SECCHR, which defaults to "*".

Command Concatenation

This feature has two purposes on The Major BBS. (1) It allows the Sysop to define detailed subcommands within your online service. This comes up during Menu Tree design when the Sysop types in command strings for module pages that give users access your module. Look up module page design in the System Operations Manual for some examples of these strings from the standard modules of The Major BBS.

(2) Command concatenation allows an experienced user to type several commands at once. For example "ERT." from a menu that offers "E" for E-mail means: "E-mail / Read messages / To me / starting at the earliest message number".

From a programming perspective, the idea is to loop through the characters and parameters of the user's command. The global variable "nxtcmd" in CNCUTL.C keeps track of what has already been interpreted from the user's command -- it points to the rest of the command.

```
bgncnc();                      begin command concatenation
```

After calling bgncnc(), the command is unparsed (has spaces again, not separate words), and prepared for interpretation using the command concatenation utilities.

```
done=endcnc();                  are we done with the user's command?
int done;                         1=yes, done  0=no, there's more
```

After calling endcnc(), the rest of the command is put back into input[] and re-parsed (margc and margv[] are recomputed), just as if the user had typed in the rest of the command starting from this point. If anything is left from the command, this function returns false.

```
ch=morcnc();                    is there any more command?
char ch;                          next character ('\0' if none)
```

The morcnc() routine tells you if there are any more characters left in the command. It first skips any leading blanks and returns the next nonblank character. The character that is returned is NOT skipped. If you want to use this character, then call cncchr().

The remaining utilities read a single parameter (character, number, etc.) from the user's command string.

```
ch=cncchr();                    expect a character from the user
char ch;                          the next character ('\0' if none)
                                  (converted to upper case)

n=cncint();                     expect an integer from the user
int n;                            the integer (0 if none)

ln=cnclon();                    expect a long integer from the user
long ln;                          the long integer (0L if none)

n=cnchex();                     expect a hexadecimal number
int n;                            the number (0 if none)

ptr=cncnum();                   expect a decimal number
char *ptr;                        with optional '-' followed by
                                  decimal digits (no conversion takes
                                  place -- returns the ASCII string)

wrd=cncwrd();                   expect a space-delimited word
char *wrd;                        truncated if over 29 characters

uid=cncuid();                   expect a User-ID or Forum name
char *uid;                        the User Id or Forum name

signam=cncsig();                expect Forum name, with or without "/"
char *signam;                     prefix.  Always returns name with
                                  the "/" prefix.

yesno=cncyesno();               expect yes or no from the user
int yesno;                        'Y'=yes, 'N'=no
```

This routine translates the user's keystrokes from their selected language into 'Y' and 'N'. Suppose this line were in the French language .MDF file:

```
Language Yes/No:  OUI/NON
```

Then cncyesno() would work like this:

user inputs:	cncyesno() returns
o	Y
oui	Y
n	N
non	N
QUE?	Q
y	Y

The cncyesno() routine returns the next character from the command (and removes it from nxtcmd). This is also what cncchr() does. One difference: the translation described above. Another difference: if the user enters the entire word for yes or for no, then all of those characters are removed from nxtcmd too. But cncyesno() still only *returns* 'Y' or 'N' in those cases.

For cases when yes/no decisions are not made through cncyesno(), you could use lingyn():

```
yesno=lingyn(firstc);          translate user's yes/no into 'Y'/'N'
char yesno;                      'Y' if yes, 'N' if no, otherwise
                                 toupper(firstc)
char firstc;                     first character of user's response,
                                 should be the first character of the
                                 yes or no words in that user's
                                 language.

ilingo=cnclng();               expect a language name or language
                                 pick from numbered list (1 to nlingo)
int ilingo;                      returns language index, 0 to nlingo-1,
                                 or -1=invalid name or number

cncall();                      expect a variable-length word sequence
                                 (consume all remaining input)
```

Example of Command Concatenation

User session:

```
<...menu...> Q

QUIZ!
What is the first letter of the alphabet? A
How many fingers do you see? 0

END OF QUIZ!  You won!

<...menu...> QA0

END OF QUIZ!  You won!

<...menu...>
```

Source code of user input handler entry point:

```
int
sttqiz(void)
{
     int retcode=1;

     do {
          bgncnc();
          switch (usrptr->substt) {
          case 0:
               cncchr();          /* gobble the module select character */
               prf("\nQUIZ!\n");
               prf("What is the first letter of the alphabet? ");
               usrptr->substt=1;
               break;
          case 1:
               if (cncchr() == 'A') {
                    prf("How many fingers do you see?\n");
                    usrptr->substt=2;
               }
               else {
                    prf("\nThat's wrong!  You lose!\n");
                    cncall();
                    retcode=0;
               }
               break;
          case 2:
               if (morcnc() && cncint() == 0) {
                    prf("\nEND OF QUIZ!  You won!\n\n");
                    cncall();
                    retcode=0;
               }
               else {
                    prf("\nThat's wrong!  You lose!\n");
                    cncall();
                    retcode=0;
               }
               break;
          }
     } while (!endcnc());
     outprf(usrnum);
     return(retcode);
}
```

We've used prf()'s here instead of prfmsg()'s just to keep the example simple. In practice we'd probably use prfmsg()'s and put all this text into a .MSG file. See page 55.

Exiting to the Parent Menu, or to your Module's Menu

condex(); — conditional exit to parent menu for after handling concatenated commands

This routine can be used to return the user to the parent menu after the servicing of a string of concatenated commands that either came from the Sysop's module command string or from what the user typed.

To help handle these kind of situations, you may be able to make use of the CONCEX flag to give you fair warning of what condex() will do. Whenever a user enters a module from a Menu Tree menu, the (usrptr->flags&CONCEX) flag is:

Set if the EXICNC configuration option is set to YES *and* the user concatenated two or more command characters together; or

Cleared if EXICNC is NO or if he typed a single character.

The flag remains set (or cleared) throughout the user's activities in the module.

Now here's how you should use condex(): When your code would normally return the user to your *module's* internal menu (but not normally to the parent *Menu Tree* menu), then you can call condex(), to conditionally exit to the Menu Tree menu at that point. (By the way, condex() tests the CONCEX flag and does nothing if it is not set.) For example, you could code:

```
if (usrptr->flags&CONCEX) {
     prfmsg(X2MAIN);
     condex();
}
```

Now, the result (if any) of condex() is identical to the result of exiting from your module's sttrou() entry point while returning zero. The big difference is that you can call condex() anywhere, perhaps deep from some routine in your code, and the exit is taken immediately -- you will never "return" from condex(), if it takes any action at all. This feature is implemented using the setjmp() / longjmp() feature in the compiler library. See ESGUTL.C for a coding example.

User-ID Cross Referencing

When writing an Electronic Mail message, users can type in part of a User-ID and the BBS will present them with all User-IDs that resemble it. The user can type in a more exact User-ID, or just pick one of the alternatives by number.

To use this feature in your own program when you need the user to type in a User-ID, use the hdluid() routine:

```
rc=hdluid(string);              Find User-IDs that resemble a string
int rc;                           see below
char *string;
```

Return Codes

UIDFND — User-ID found, by exact match (case is unimportant), or picked by number. You should get the User-ID from uidxrf.userid, not from the string you passed to hdluid(). That string, even if it is an exact match, probably doesn't have the right case. And it could always be a number if the user ended up picking the User-ID from a list.

UIDPMT — More than one possible match, or no matches at all. You need to reprompt a short prompt asking for a User-ID. You should be able to use the same prompt you did just before you first called hdluid(). Then pass the string received from the user to hdluid() again.

If there were multiple possibilities, they've just been listed out. It should be obvious to the user in that case that he can just type in a number.

UIDCAL — Continue calling hdluid(), no prompting is necessary. The user has just specified an incomplete User-ID, there's only one possible match, and now we're asking the user to confirm yes-or-no.

Before you pass the string to hdluid() (which is usually the return value of cncall()) you should check it for special values like 'X' for exit or '?' for help. You may be accommodating other possible entries. Then as a last resort, try hdluid().

If you get the return value UIDPMT or UIDCAL, then hdluid() expects to get called again. If that doesn't happen for some reason (the user typed 'X' to exit and you intercepted it), then be sure to call clrxrf():

```
clrxrf();                          Abandon User-ID cross-referencing
```

The text output of hdluid() is in the prfbuf -- your calling program must do an outprf() eventually.

Default Selection Character

You can allow Sysops to configure the default response to your prompts by (1) putting the default character at the end of the prompt, (2) using getdft() just before you output the prompt, and (3) using chkdft() when you get the reply.

Here's an example of a text block with the default answer at the end:

```
ASKVOW {Pick a vowel: A} T Prompt asking for a vowel
```

This is a little misleading to Sysops in that we aren't going to send the "A" when we send the prompt. You could also do this:

```
ASKVOW {Pick a vowel (hit RETURN for "A"): A} T Prompt asking for a vowel
```

Here, if Sysops wanted to change the default to "E", they would need to change two things:

```
ASKVOW {Pick a vowel (hit RETURN for "E"): E} T Prompt asking for a vowel
```

What you want your code to do is to use that final character before the "}" curly brace to fill in for a user who doesn't pick any character and just hits <*Enter*>. Here are the tools:

```
dftchr=getdft();                   Get the default character & remove it
                                     from the output buffer
char dftchr;

chkdft(dftchr);                    Put the default character in the input
                                     buffer, if user just hit <Enter>
```

You call getdft() after you have prfmsg()'d the prompt and you're about to use outprf(usrnum) to send it to the user's terminal. getdft() strips the character out of the prfbuf buffer (so it never get's to the user's terminal) and returns it for you to hold onto. (You can also use the "final cursor position" feature of BBSDRAW and getdft() will work properly.)

The tricky part is that you need to save this default character between cycles somehow. You get the character from getdft() when you send the prompt, but you need to use it when the user gets around to typing in a reply.

Then after the reply comes in, chkdft() checks to see if the user hit just <*Enter*> and if so, makes the input variables look as if he had typed the character. Then your code can go about its business and parse the input.

User Status and Handling

```
ison=uinsys(usrid);                 determine if a user is online
int ison;                             true if user anywhere online
char *usrid;                          User-ID to be tested for

int uisusn;                         global variable, set to user number
                                      when uinsys() returns 1

ison=onsys(usrid);                  determine if a user is online
int ison;                             true if user online & logged on
char *usrid;                          User-ID to be tested for
```

The differences between uinsys() and onsys() are:

1. onsys() only returns true if the user has already logged on. uinsys() also catches that space of time between typing in User-ID and password when we *think* the user is about to log on.

2. uinsys() sets the global variable uisusn. onsys() sets othusn, othusp, and othuap (see below).

```
isin=instat(usrid,qstate);          see if a user is using a specific
                                      module
int isin;                             true if user is in the module
char *usrid;                          User-ID to be tested for
int qstate;                           state (module number returned
                                      by register_module())
```

If either instat() or onsys() return true, then the following global variables are also set:

```
int othusn;              the user number of the other user
struct user *othusp;     pointer to structure for that user in the
                         user[] array (see MAJORBBS.H)
struct extusr *othexp;   pointer to extendable in-memory structure
                         for that user (see extoff() on page 82)
struct usracc *othuap;   pointer to structure for that user in the
                         "usracc" structure (see uacoff() on page 82)
```

These variables are analogous to usrnum, usrptr, and usaptr, see page 33. To get the other users language index, use extoff(othusn)->lingo.

All of the above routines will return false, by the way, for a user with Sysop privileges when he has selected "/invis" to become invisible. If you

need to penetrate the Sysop invisibility veil for some reason you could use the following routines instead:

```
use   onbbs(usrid,1)    instead of   uinsys(usrid)   (anywhere online)

use   onsysn(usrid,1)   instead of   onsys(usrid)    (logged on)
```

This might be necessary if you were trying to decide whether to modify a user's account record in memory or on disk for example. There are several examples of this in ACCOUNT.C and ACCSCN.C.

To reference the user account information of someone who is online, don't use the usracc[] array directly. Since that array might be larger than 64K, you must use uacoff():

```
uaptr=uacoff(unum);              Get online user account info
struct usracc *uaptr;              pointer to in-memory acct info
int unum;                          user number
```

And similarly with the extended in-memory array, use extoff():

```
exptr=extoff(unum);              Get more online user info
struct extusr *exptr;              pointer to extendable in-memory info
int unum;                          user number


int ripdfd;                      1=at least one /RIP language is
                                   defined, or 0=none

int ripidx;                      Index of the first /RIP language,
                                   0 to nlingo-1, or nlingo if there
                                   are no /RIP languages

hasrip=isripu();                 Is this a /RIP user?
int hasrip;                        1=yes, 0=no

hasrip=isripo(unum);             Is that a /RIP user?
int hasrip;                        1=yes, 0=no
int unum;                          user number, 0 to nterms-1
```

Be careful not to use isripu() unless you know the "clingo" variable is available. For example, in an interrupt routine such as hpkrou() in MAJORBBS.C, only isripo() should be used.

Hanging up on a User

If you've decided, for whatever reason, to boot a user off of the BBS, call byenow():

```
byenow(msgnum,p1,p2,...,pn);        say good-bye to a user and disconnect
                                      (implicit input:
                                           usrnum ... channel to hang up)
int msgnum;                           message number in current .MCV file
                                      (don't forget setmbk(), page 66)
TYPE p1,p2,...,pn;                    parameters if any (max 12 bytes)
```

This routine will make reasonably sure that your good-bye message gets transmitted to his screen, and then his session will be terminated. You may still get status codes after calling byenow(), but you can check the usrptr->flags&BYEBYE flag to detect that situation. You will definitely get a call to your huprou() entry point.

If you need to do this for a user other than the one you're servicing (other than usrnum, that is), then you need to temporarily save usrnum and restore it, as in:

```
usnsave=usrnum;
usrnum=othusn;
byenow(LASERCEPT);
usrnum=usnsave;
```

This would do the dirty work for the othusn user. Note that usrptr and usaptr are not involved at this stage at all.

Intercepting User-Connect

You can intercept the moment that a user first connects to the BBS using the (*hdlcon)() handle-connect vector.

```
void (*hdlcon)();                Handle-connect vector
```

When any channel, modem, serial, X.25 or LAN, is done establishing connection with the user's terminal, then the function pointed to by this vector gets called. Here are the final events on the different types of channels that occur before the (*hdlcon)() vector gets called:

Modem channel	"CONNECT" received
Serial channel	Any <CR>-terminated string received
X.25 channel	X.3 programming complete (X.29 string sent)
IPX Direct channel	Any <CR>-terminated string received
IPX Virtual channel	Any packet received
SPX channel	Connection established

The (*hdlcon)() vector starts out pointing to the gtansi() routine which is an internal (static) function in MAJORBBS.C. Use (*hdlcon)() just like the parasitic way in which you would use an interrupt vector: save its value (the pointer to some old function), put a pointer to your *own* function in its place, and then when your own function gets called, make sure to call that function whose pointer you saved (unless you think of something better to do). Here's a simple example:

```
void (*hcsave)();     /* save location for old handle-connect vector */

void
brblast(void);         /* blast low-baud rate users on high channels */
{
     if (usrnum >= 32 && usrptr->baud < 9600) {
          setmbk(dddmbk);
          byenow(OTHERBAUD);
          rstmbk();
     }
     else {
          (*hcsave)();
     }
}

void
install_brblast(void);                    /* install baud-rate blaster */
{
     hcsave=hdlcon;
     hdlcon=brblast;
}
```

The brblast() routine hangs up on slow-modem callers on channels with user number 32 and higher. The install_brblast() routine should be called from your init_xxx() routine (exactly once, of course). It saves the current pointer in the handle-connect vector, and puts a pointer to brblast() in its place.

Now when anyone connects to the BBS, brblast() is called. If their user number is 32 or greater and their baud rate is less than 9600, it sends some goodbye message (politely saving and restoring the current .MCV file handle) and prepares to hang up on the user. Otherwise, the user gets online like normal.

The connect handler that you install by this method is limited in what it can do. Keep in mind that other modules might be intercepting the vector too, and you really shouldn't be depending on one to execute before the other. And if you want a user to log on, you should relinquish complete control and let the normal connect sequence proceed (in other words, call the function whose pointer you saved).

If you want to take over connect-time processing for *multiple status conditions*, then you'll need to set up your own class, state and substate. (Remember the three "context" variables described on page 31?)

```
:
usrptr->class=BBSPRV;
usrptr->state=mystate;
usrptr->substt=CONTSTEP1;
:
```

If you do this, then your sttrou() and stsrou() vectors will get called for future events (such as the user entering a line of text or a status condition on that channel). BBSPRV is a special class that allows your module entry points to get called without deducting credits or limiting inactivity, etc. -- you're on your own. The "mystate" variable is the handle for your module (the return value of register_module()). The substt value CONSTEP1 is a local constant so you can distinguish this type of event in your entry point routines.

When done, you can return control to the powers-that-be and continue with the standard connect process by restoring usrptr->class and calling the saved vector value:

```
:
usrptr->class=VACANT;
(*hcsave)();
:
```

Notice that it's important to resroc
Whatever a handle-connect routine does, you should be able to rely on it to either set the usrptr->state code or call byenow(). (gtansi() does assume you're still in the VACANT class in some cases.)

There are other moments in the connection process with vectors you can intercept:

```
void (*hdlrng)();                Handle-RING-string vector
```

This routine can be used for auxiliary handling of the "RING" that comes in on modem channels. The routine would get called on every "RING" before the "CONNECT" message. The "RING" and any text that might follow it are available by consulting margc and margv[].

```
void (*hdlnrg)();                Handle-non-RING-string vector
```

This vector is called when a string other than "RING" is received on a modem channel that is awaiting an incoming call. The string is available by consulting margc and margv[]. You might use this to handle strings other than "RING" in some special manner.

```
int (*hdlcnc)();                    Handle-CONNECT-string vector
```

This vector gets called on a modem channel when the first non-RING string is received. The string is available by consulting margc and margv[]. Return values are:

```
-1  Ignore the string
 0  Reset the channel and get ready to receive another incoming call
 1  Connection complete, the (*hdlcon)() vector will get called after
    a short pause
```

You might intercept (*hdlcnc)() if you wanted to handle the parameters of the "CONNECT" string in some special way, or if you were expecting legitimate messages other than "RING" or "CONNECT" to come in.

```
int (*hdlc25)();                    Handle-X.25-connection vector
```

This vector gets called at the beginning of every X.25 call. You could intercept it to process the parameters of the incoming X.25 call:

```
margv[0]        "RING"
margv[1]        Caller's network address
margv[2]        "CALLING"
margv[3]        Callee's network address (that of your BBS)
margv[4]        (optionally) User data field (NUL-terminated string)
```

margv[4] will only be available if margc >= 5 and if you have set the x25udt flag in advance (see the GSBL Reference Guide).

Looking through MAJORBBS.C, you may find that some of these vectors default to pointing to a routine that does nothing at all. If you change the value of one of these vectors, it is still good programming practice to call the routine it originally pointed to from inside of your new routine.

Autosensor Routines

Add-on Options may hook into the autosensing phase of the BBS session -- the very start when we probe the user's terminal for signs of intelligent life. If there are any autosensors active, the "Auto-sensing..." message appears and then all autosensing routines are run in parallel on that channel.

Add-on Options can register autosensing routines to test for particular features in each user's terminal and vote on which languages or protocols he should use. See the ansisns() routine in MAJORBBS.C for an example.

For another example, say that to automatically detect compatibility with the ZEBRATerm terminal software you want to send out a "Z" immediately upon connection, and then wait for a "!" reply. If the BBS gets the reply within 1 second, it knows it's talking to ZEBRATerm. But if it gets nothing for 1 second, it assumes not.

Here's how such a ZEBRATerm autosensor might be coded:

```
int
zebratest(
unsigned snccon,
char *incbuf,
int nbytes)
{
     if (snccon == 0) {
          btuxmt(usrnum,"Z");
     }
     else {
          while (nbytes--) {
               if (*incbuf++ == '!') {
                    zebra[usrnum]=1;
                    setbyprot("/ZEBRA",2);
                    return(1);
               }
          }
          if (snccon >= 16) {
               zebra[usrnum]=0;
               return(1);
          }
     }
     return(0);
}
```

To register your autosensor routine, you need to call regautsns() in your initialization code, for example:

```
:
regautsns(zebratest);
:
```

The code for regautsns() and related routines can be found in AUTSNS.C.

When a user first connects to a BBS all autosensor routines are called repeatedly. Each autosensor eventually returns 1 to indicate it is done, and from that point is no longer called for that session. When all autosensors are done, or 10 seconds elapse, whichever comes first, the autosensing phase is over.

Each autosensor routine will be called with the same three parameters as in the above zebraterm() example:

unsigned snccon	count of 1/16 seconds since connection was established with this channel -- the first call is always zero and each call after that is steadily increasing (and nonzero)
char *incbuf	buffer of incoming binary bytes on this channel -- this same data is shared by all autosensor routines
int nbytes	number of bytes in incbuf

As you can see in the example, usrnum is an implicit input to the autosensor, as well as usrptr and usaptr and other global session variables.

Your autosensor routine will need to return an "int" indicating whether the autosensing is done for that channel.

autosensor return value	1=done autosensing 0=still working on autosensing

You can count on the fact that the snccon parameter will be zero the very first time your autosensor is called for a session, and always nonzero after that for the same session. So use the (snccon == 0) case to initialize things if you need to. In every call after that, snccon will be at least one, even if it's 0.000001 second later. In the above example, we transmit the "Z" right off the bat and return 0 (0 because we know we're not done autosensing yet). Otherwise we check for incoming data.

This is a subtle but important point: autosensor routines should check for incoming data *before* they check for a timeout. This way, if the BBS happens to get tied up with the other channels for an unusually long period, then when it finally does get around to servicing the autosensing channel, it properly handles any data received in the interim. Suppose in the above example that within such a delay of a second or more, a "!" reply did come in. Then zebratest() gets called with *both* a timeout condition and data available. Clearly the data available condition should take precedence (as it does in this example).

After checking for incoming data, we take a glance at the watch. If our one second's up, we give up and assume that we're not connected to ZEBRATerm. Remember that other autosensor routines might be at work here so if we don't understand the incoming data we have to ignore it.

This autosensor's ultimate job, when it detects ZEBRATerm, will be to set the zebra[] array element for each user to indicate 1=ZEBRATerm, 0=not. It will also "vote" for the languages that end in "/ZEBRA" with a confidence factor of 3. We'll take a closer look at what this voting business is all about in the next section.

All autosensing is subjected to a 10-second master timeout, so if any autosensor takes more than 10 seconds for any reason, the autosensing period will end anyway. You can change this master timeout if you like by changing the value of the global *auswait* variable:

```
unsigned auswait;          master autosensing timeout, in 1/16
                             of a second (e.g. 160 = 10 seconds)
```

The healthiest way to change this is probably to be sure you only increase it, as in:

```
auswait=max(auswait,240);
```

Just setting auswait=240 (15 seconds) might cause a problem for another autosensor that needed the master timeout to be at least 320 (20 seconds).

Voting Confidence Factors

All languages start out with a confidence factor of 1. Any autosensor can change the confidence factor of any language to any number between 0 and 100. The voting confidence factors for all languages and users is stored in this 2D array:

```
char *poslng;              pointer to a 2D array of voting confidence
                             factors (varies fastest by language, then
                             by user number, has nlingo*nterms total
                             number of elements)
```

To set the voting confidence factor for the current user (usrnum) for the language ilingo to 5, you would code:

```
poslng[usrnum*nlingo+ilingo]=5;
```

You could vote on all languages with the same terminal protocol suffix with:

```
setbyprot(suffix,value);    set voting confidence factor by protocol
char *suffix;                 language name suffix
char value;                   voting confidence factor
```

This routine will find all languages with names that end in *suffix* and set their voting confidence factor to *value*. See the example call to setbyprot() in the zebratest() example, above.

At the end of the autosensing period, the language with the highest confidence factor automatically becomes the language for that channel. If there's a tie, as is often the case, then what happens next depends on the LANGOP offline Configuration option:

LANGOP=ASK - Display a numbered list of the languages that have the highest confidence factor, and ask the user which one he wants to use.

LANGOP=AUTO - Just go ahead and select one of the languages with the highest confidence factor (it picks the language with the lowest numbered index, but the Sysop can't count on which language that is, unless it's English/ANSI)

The voting confidence factors are available throughout a user's session. To determine the top factor, call

```
numcand=cntcand();          determine the maximum voting confidence
                              factor, among all the languages, and
                              how many languages have it
```

Here are the implicit return values of cntcand():

```
int maxcand;                maximum voting confidence factor among the
                            languages

int numcand;                1=one language is clearly the winner
                            >1=number of languages tied for first place
                            (numcand is a global variable and it's also
                            the return value of cntcand())

int fstcand;                the winner, or the first language (lowest
                            index) that is tied for first place
```

5. USER SERVICES

Security (Locks & Keys)

As explained in the System Operations Manual, security on The Major BBS is primarily controlled by locks and keys. Apply locks to features and issue keys to users. When a user requests to use a certain feature, find out if he has a key with the same name as the lock on that feature. A feature can have one or zero locks. A user can have a set of keys by virtue of the class he's in (the class keyring), or by individual ownership.

Note that the question "Can Fred open the SAMPLE lock?" is identical to the question "Does Fred have the SAMPLE key?"

Here is the most versatile routine for testing whether an online user has a specific key or not:

```
ok=gen_haskey(lock,unum,uptr);   Does this user have the key to this
                                 lock?
int ok;                          1=yes, let him in  0=no, deny access
char *lock;                      Name of lock on feature / key required
int unum;                        User number of online user
struct user *uptr;               User structure pointer of online user
```

What follows are some handy variations and alternatives to gen_haskey() that you'll probably use more often:

```
ok=hasmkey(msgnum);              Does the user have the key specified
                                 in this offline Security and
                                 Accounting option?
int ok;                          1=yes, let him in  0=no, deny access
int msgnum;                      Number of the CNF option
```

This routine checks whether the current user has a key specified by the Sysop in an offline Security and Accounting option. See page 55 for creating CNF options. You could make an offline Security and Accounting option that looks something like this key:

```
SAMPKY    Key required to log on to reserved channels ..... NORMAL
```

Now the Sysop can change this option so that another key is required. All you have to do is:

```
if (hasmkey(SAMPKY)) {
     welcomemyfriend();
}
else {
     sorrynocigar();
}
```

By convention, all CNF options pertaining to Security are stored in level 3 -- Security and Accounting. If you specify any locks of your own in offline Security and Accounting options, we recommend that you try to use one of the four pre-defined lock names for the default values of your option when you can:

DEMO	Everybody gets this key, it's the only one new sign-ups get
NORMAL	Approved users
SUPER	Supervisors or trusted assistants
SYSOP	Top-level access to the BBS

```
ok=haskey(lock);                Does the user have this key?
int ok;                           1=yes, let him in  0=no, deny access
char *lock;                       Name of lock on feature / key required
```

This routine checks if the current user has the specified key. You might store the string in memory with stgopt() and haskey() (instead of reading it each time you need it with hasmkey()) for quicker response.

```
ok=othkey(lock);                Does the other user have this key?
int ok;                           1=yes, let him in  0=no, deny access
char *lock;                       Name of lock on feature / key required
```

This routine checks if the user specified by othusn (user number) and othusp (pointer to user data structure) has a certain key. You can call this routine right after you call instat(), onsys(), or onsysn() (see page 81).

```
ok=uidkey(uid,lock);            Does the (offline) user have this key?
int ok;                           1=yes, let him in  0=no, deny access
char *uid;                        User-ID
char *lock;                       Name of lock on feature / key required
```

This routine checks on the access capabilities of a user who is not online at the time.

```
ok=uhskey(uid,lock);            Does the user have this key?
int ok;                           1=yes, let him in  0=no, deny access
char *uid;                        User-ID
char *lock;                       Name of lock on feature / key required
```

This routine is universal -- it will tell you if the user has this key, and it will work whether the user is online or not.

Registerable Pseudo-Keys

You can create your own pseudo-keys for users. Say you want to give users access to some feature based upon something. The standard method of locks and keys allows Sysops to make up key names and issue keys either directly to individual users, or to classes of users via the class keyring. But some situations require more flexibility. For example, the "_PORT#xx" pseudo-key implicitly gives each user a special key based upon the BBS channel number they are using for their current session. Here's the corresponding pseudo-key routine from MAJORBBS.C:

```
STATIC int
prtpsk(unum,lock)                   /* validate the _PORT# pseudo-key      */
int unum;                               /* user number, 0 to nterms-1      */
char *lock;                             /* lock name that the key is for   */
{
     int chn;

     sscanf(lock,"_PORT#%x",&chn);
     return(channel[unum] == chn);
}
```

and here's how it gets registered:

```
register_pseudok(prefix,rouputr);     Register a pseudo-key routine
char *prefix;                           prefix of the pseudo-key
int (*rouptr)(unum,lock);               pointer to handler routine
int unum;                               user number being checked
char *lock;                             full name of the key required
```

For example:

```
register_pseudok("_PORT#",prtpsk);
```

The registration call says in effect "If anyone asks about users having a key that starts with '_PORT#', then let me make the determination". Now suppose there's some code somewhere like this:

```
haskey("_PORT#2C");
```

Then prtpsk() swings into action and determines whether this user happens to be on BBS channel 2C hexadecimal or not.

See MAJORBBS.C for the other pseudo-key routines for channel group number, spoken language, and terminal protocol.

By convention, and for Sysop sanity, all pseudo-keys start with the "_" underscore character, but nothing enforces this.

Accounting (credits)

User connect time can be controlled or measured with the system commodity called "credits". Credits typically refer to seconds of privileged connect time: If an "approved" user is online for an hour he consumes 3600 credits. A new user doesn't consume credits and can't access many of the features of the system.

There are many other ways credits are used. Certain actions "cost" the user a fixed amount of credits. And credit consumption can vary depending on what service the user is in.

Charging Users

To charge a user credits, you can make use of the dedcrd() and tstcrd() routines in ACCOUNT.C:

	Credit testing and charging routines	Actually deducts credits?	Subtracts credits if user is "Exempt" from credit charges?	Will automatically "borrow" credits if user can go into debt?	User
*	dedcrd()	YES	NO	YES	current
	rdedcrd()	YES	YES	NO	current
	odedcrd()	YES	optional	optional	any online
	ndedcrd()	YES	optional	optional	any offline
	ldedcrd()	YES	optional	optional	any
*	gdedcrd()	YES	optional	optional	any
*	tstcrd()	NO	NO	YES	current
	rtstcrd()	NO	YES	NO	current
	otstcrd()	NO	optional	optional	any online
	ntstcrd()	NO	optional	optional	any offline
	ltstcrd()	NO	optional	optional	any
*	gtstcrd()	NO	optional	optional	any

* = routines you're most likely to want to use

All of the dedcrd() routines return 1 if sufficient credits were available, or 0 if there weren't enough. The last parameter, "asmuch", decides what to do if there weren't enough: 1=take whatever the user has, reducing his balance to the minimum, or 0=don't take anything.

The tstcrd() routines act just like the corresponding dedcrd() routines, except that no credits are actually deducted. Use the tstcrd() routines if you need to specially handle the case of insufficient credits before any are deducted (for example by exiting a service or issuing a warning).

```
enuf=dedcrd(amount,asmuch);       Deduct credits from current user's acct
int enuf;                           1=had enough, 0=didn't
long amount;                        number of credits to deduct
int asmuch;                         if not enough:  1=take all, 0=none


enuf=rdedcrd(amount,asmuch);      Deduct real credits from online acct
int enuf;                           1=had enough, 0=didn't
long amount;                        number of credits to deduct
int asmuch;                         if not enough:  1=take all, 0=none


enuf=odedcrd(unum,amount,real,asmuch);
                                  Deduct credits from an online account
int enuf;                           1=had enough, 0=didn't
int unum;                           user number
long amount;                        number of credits to deduct
int real;                           1=don't put into debt
int asmuch;                         if not enough:  1=take all, 0=none


enuf=ndedcrd(userid,amount,real,asmuch);
                                  Deduct credits from an offline account
int enuf;                           1=had enough, 0=didn't
char *userid;                       User-ID
long amount;                        number of credits to deduct
int real;                           1=don't put into debt
int asmuch;                         if not enough:  1=take all, 0=none


enuf=ldedcrd(uptr,amount,real,asmuch);
                                  Deduct credits from an "active" user
                                  account structure residing in memory
int enuf;                           1=had enough, 0=didn't
struct usracc *uptr;                pointer to active user structure
long amount;                        number of credits to deduct
int real;                           1=don't put into debt
int asmuch;                         if not enough:  1=take all, 0=none


enuf=gdedcrd(userid,amount,real,asmuch);
                                  Deduct credits from any user's account
int enuf;                           1=had enough, 0=didn't
char *userid;                       User-ID
long amount;                        number of credits to deduct
int real;                           1=don't put into debt
int asmuch;                         if not enough:  1=take all, 0=none
```

```
enuf=tstcrd(amount);                Test if user has enough credits
int enuf;                             1=had enough, 0=didn't
long amount;                          number of credits (don't deduct)


enuf=rtstcrd(amount);               Test if user has enough real credits
int enuf;                             1=had enough, 0=didn't
long amount;                          number of credits (don't deduct)
                                      (won't take debt or exemptions into
                                      account)

enuf=otstcrd(unum,amount,real);     Test if user has enough credits
int enuf;                             1=had enough, 0=didn't
int unum;                             user number
long amount;                          number of credits (don't deduct)
int real;                             1=don't take debt or exemptions into
                                      account

enuf=ntstcrd(userid,amount,real);
                                    Test if offline user has enough credits
int enuf;                             1=had enough, 0=didn't
char *userid;                         User-ID
long amount;                          number of credits (don't deduct)
int real;                             1=don't take debt or exemptions into
                                      account

enuf=ltstcrd(uptr,amount,real);
                                    Test if user account structure has
                                    enough credits
int enuf;                             1=had enough, 0=didn't
struct usracc *uptr;                  pointer to active user structure
long amount;                          number of credits (don't deduct)
int real;                             1=don't take debt or exemptions into
                                      account

enuf=gtstcrd(userid,amount,real);
                                    Test if any user has enough credits
int enuf;                             1=had enough, 0=didn't
char *userid;                         User-ID
long amount;                          number of credits (don't deduct)
int real;                             1=don't take debt or exemptions into
                                      account
```

Credit Consumption Rate

To change a user's credit consumption *rate*, you can set usrptr->crdrat to the credits to consume per minute. For example:

```
usrptr->crdrat=120;        /* consume credits at twice the normal rate */
```

Whenever a user exits a module of The Major BBS, his credit consumption rate is restored to the default value (as specified by the Sysop in the MMUCRR offline Security and Accounting option).

Global Commands

Global commands are commands that users can enter from almost any prompt on the BBS. (One exception is: you can't use global commands while inside the Full Screen Editor.) Making your own global command means two things: making a handler routine, and registering the routine. The handler routine intercepts every line of user input and, if it recognizes your special global command, responds to it and returns true (otherwise returns false). Registering the routine allows the mainline program to call it with each line of user input.

The handler routine has at its disposal all the global variables associated with line input, including margc, margv, input, and so on (see page 74), in addition to global variables for user session information such as usrptr->, and usaptr-> fields (see USRACC.H and MAJORBBS.H).

> *IMPORTANT:* The global command should be coded efficiently. It must very quickly reject user input (return false) when it doesn't recognize the command. For example, the global command handler should probably never access a database in the quiescent (return false) case.

Here's an example of a global command called "/now" to tell the time of day:

```
int
glotime(void)          /* global command for telling the time of day */
{
     if (margc == 1 && sameas(margv[0],"/now")) {
          prf("At the tone, the time will be %s\7\r",nctime(now()));
          outprf(usrnum);
          return(1);
     }
     return(0);
}
```

The check for (margc == 1) is necessary, because margv[n] is undefined when n >= margc. The sameas() check is case-ignoring so users can also type "/NOW". The routine returns a 1 if it recognizes the user's input as the global command it's looking for, or a 0 if it does not.

Here are all the possible return values for the global command handler:

0 **Command not recognized.** Executive will pass entire command on to some module's input handler (sttrou(), lonrou(), or lofrou(), as appropriate). You must always return 0 when you don't recognize the incoming command, and especially when margc == 0.

1 **Command recognized and processed.** Executive will ask the module in effect to reprompt by simulating a <CR> from the user, calling the module's sttrou(), lonrou(), or lofrou() routine with margc == 0. The (usrptr->flags&INJOIP) flag will be set so the routine could recognize this condition. If you have any prf() or prfmsg() output, you must do an outprf(usrnum) before you return the 1 (as in the glotime() routine, above).

-1 **Command recognized and processed -- don't reprompt.** Executive will not reprompt the user. This is also a return value where no outprf() is likely to take place unless you do it yourself.

-2 **Command recognized and processed -- don't reprompt, but do prf() or prfmsg().** Executive will not ask the module to reprompt, but it *will* assume you have something in the prfbuf and will do an outprf() for you.

You can look at the hdlinp() routine in MAJORBBS.C for exactly how these return values are used.

The next step is registering the global command as part of your initialization routine (page 29):

```
int glotime(void);                          /* this is the prototype */
:
:
void EXPORT
init__myroutine()                 /* the module initialization routine */
{
     :
     globalcmd(glotime);
     :
}
```

TIP: The global command feature has possible utility beyond defining global commands for users. For example, you could make a routine to intercept all user input for diagnostic or management purposes.

You can define up to 25 global command handler routines using this function:

```
globalcmd(rouptr)                define global command handler routine
int (*rouptr)();                   pointer to routine
```

All global command handlers can be temporarily disabled for a channel by setting the special NOGLOB flag, as in:

```
usrptr->flags|=NOGLOB;
```

and later cleared with:

```
usrptr->flags&=~NOGLOB;
```

This is done during teleconference chat modes, for example.

Here are a few examples of global commands and where they're coded:

Command	Purpose	Source code
/R <userid>	registry report	REGISTRY.C
/P <userid> <message>	page	MJRTLC.C or ENTTLC.C
/#	who's online	MJRTLC.C or ENTTLC.C
/L <userid>	lookup user account	MAJORBBS.C
/INVIS	invisible sysop	MAJORBBS.C
/GO <page-name>	global Menu Tree "GO"	MAJORBBS.C and MENUING.C
/RECENT	recent logoffs	GALGLO.C

The following commands are *not* registered global commands. These are special commands available from all menu pages:

Command	Purpose	Source code
FIND	Search menu pages	MENUING.C and MAJORBBS.C
DISABLE *(Sysop only)*	Disable a page	MENUING.C and MAJORBBS.C
ENABLE *(Sysop only)*	Enable a page	MENUING.C and MAJORBBS.C

Full Screen Editor

The Full Screen Editor is a sub-service used by Electronic Mail and Forums for message editing. It allows a user to edit a block of text of a certain number of 80-column lines. See the Operations Manual for instructions on using the editor from the user's point of view.

There are actually two editors, the Full Screen Editor and the Line Editor that depend on whether the user's terminal has ANSI capability or not. Fortunately for you, the developer, this distinction is transparent. The bgnedt() routine will make use of what the BBS already knows about the user's terminal, and fire up the appropriate editor.

```
bgnedt(siz,buf,tsiz,topic,whndun,flags)
                                    begin editing a message
int siz;                              max size of text
char *buf;                            buffer for text
int tsiz;                             maximum size of topic (incl NUL)
char *topic;                          buffer for topic (NULL if no topic)
int (*whndun)(int quitex);            routine to call when done editing
int flags;                            special editor option bits
```

An excerpt from MAJORBBS.H, defining the bits of the last parameter:

```
                        /* flags that can be passed to bgnedt()      */
#define ED_READON    2  /*   "read only" mode                        */
#define ED_CLRTOP    4  /*   clear topic buffer upon entry           */
#define ED_CLRTXT    8  /*   clear text buffer upon entry            */
#define ED_FILESD   16  /*   use "file" flavor of editor             */
#define ED_LINEMO   32  /*   force use of the line editor            */
#define ED_FIXTOP   64  /*   don't allow changing of the topic field */
```

(Note: the ED_FILIMP flag that appears in MAJORBBS.H is not supported.)

Call bgnedt() to allow the user to begin entering text. You might as well make the siz parameter a multiple of 80 bytes plus 1 -- only an integral number of 80-column lines will be available to the user. The buffer should be somewhere that will stay active and available throughout the editing process (a subset of the Volatile Data Area is ideal for this -- just make sure you've allowed enough room with dclvda()). If you want a topic field, allocate another buffer for it (up to 51 bytes long) that has the same durability (for example, another portion of the Volatile Data Area).

After you call bgnedt(), the editor will usurp your state and substate code for the entire editing session. That means, for example, that your module's hang-up entry point, huprou(), will get called with the editor's state in effect in the event that the user hangs up while still in the editor.

If you want to detect that condition (and the editor is active on the channel due to your module's invocation, of course), you need to set it up somehow. Remember that your huprou() entry point will be called regardless of what state or module the user is in. You can detect that the user was editing on your behalf by setting a flag when you call bgnedt() and clearing it when your (*whndun)() routine gets called.

```
edtimr(imradr)                    specify import message routine
int (*imradr)();                    address of import message routine

got=(*imradr)(msgno);             call to import routine ("New" command)
int got;                            1=message imported 0=error
long msgno;                         number of message to import
                                    (user typed this in)
```

The editor may be set up to allow users to import other messages into the message that they are editing. This is done by calling the edtimr() routine immediately after calling bgnedt(). Then when a user specifies *<Ctrl-N>* for "new" in the editor, he has a choice of importing another message or clearing the current message buffer. The "imradr" routine is passed the message number specified by the user, and is expected to do the actual import by filling the editor buffer (and possibly setting the topic and other items).

Your (*whndun)() routine must restore your state and substate (usrptr->state and usrptr->substt) to values for your own module, and prompt the user for the next action (the next question after the editor is over).

The (*whndun)() routine is passed one of these values:

0	user wants to save the editing he's done
ED_QUITEX	user wants to quit and abandon the results of his editing

You should check this flag to see if your code should save the buffer or discard it. (You must remember where the buffer is, it's what you passed to bgnedt() in the buf parameter.)

The return value of (*whndun)() can be one of these:

1	Ok, exiting the editor (I've restored my state and substate and prompted the user).
0	Exit the editor, and exit this module too (your sttrou() should return 0, and we should exit to the parent menu).

Here's an example of a Sysop Feedback Forum using the Full Screen Editor:

```
/*****************************************************************************
 *                                                                           *
 *   GALFBK.C                                                                *
 *                                                                           *
 *   Copyright (C) 1989-1994 GALACTICOMM, Inc.      All Rights Reserved.     *
 *                                                                           *
 *   Feedback to Sysop (sample module discussed in the                       *
 *                      Developer's Guide for The Major BBS)                 *
 *                                                                           *
 *                                          - RNStein, January 1989          *
 *                                                                           *
 *****************************************************************************/

#include "gcomm.h"
#include "majorbbs.h"
#include "galfbk.h"

STATIC int fbkinp(void);
STATIC int fbkdun(int flags);
STATIC void fbkfin(void);

int fbkstt;                     /* Feedback module state number         */
FILE *fbkmb;                    /* feedback configuration variables     */
FILE *fbkfp;                    /* feedback text file                   */

struct module fbkmodule={       /* module interface block               */
     "",                        /*    name used to refer to this module */
     NULL,                      /*    user logon supplemental routine   */
     fbkinp,                    /*    input routine if selected         */
     dfsthn,                    /*    status-input routine if selected  */
     NULL,                      /*    "injoth" routine for this module  */
     NULL,                      /*    user logoff supplemental routine  */
     NULL,                      /*    hangup (lost carrier) routine     */
     NULL,                      /*    midnight cleanup routine          */
     NULL,                      /*    delete-account routine            */
     fbkfin                     /*    finish-up (sys shutdown) routine  */
};
```

```
#define TPCSIZ 40                   /* maximum characters in topic          */
#define FBKSIZ 1921                 /* max chars in feedback (for 24 lines) */

struct fbkusr {                     /* feedback to sysop user data block    */
     char text[FBKSIZ];             /*   text buffer                        */
     char topic[TPCSIZ];            /*   topic buffer                       */
};

#define fbkptr ((struct fbkusr *)vdaptr)

void EXPORT
init__feedback()                         /* initialize feedback stuff       */
{
     stzcpy(fbkmodule.descrp,gmdnam("GALFBK.MDF"),MNMSIZ);
     fbkstt=register_module(&fbkmodule);
     fbkmb=opnmsg("GALFBK.MCV");
     dclvda(sizeof(struct fbkusr));
}

STATIC int
fbkinp(void)                             /* feedback handler                */
{
     setmbk(fbkmb);
     if (margc == 1 && sameas(margv[0],"X")) {
          return(0);
     }
     do {
          bgncnc();
          switch(usrptr->substt) {
          case 0:
               cncchr();
               prfmsg(HELLO);
               outprf(usrnum);
               bgnedt(FBKSIZ,fbkptr->text,
                      TPCSIZ,fbkptr->topic,fbkdun,ED_CLRTOP+ED_CLRTXT);
               break;
          }
     } while (!endcnc());
     outprf(usrnum);
     return(1);
}

STATIC int
fbkdun(                                  /* feedback editing when-done      */
int quitex)
{
     char *cp;

     usrptr->state=fbkstt;
     setmbk(fbkmb);
     if (quitex == 0) {
          for (cp=fbkptr->text ; *cp != '\0' ; cp++) {
               if (*cp == '\r') {
                    *cp='\n';
               }
          }
          if ((fbkfp=fopen("GALFBK.TXT",FOPAA)) == NULL) {
               catastro("Cannot open GALFBK.TXT for append!");
          }
          fprintf(fbkfp,"*** From %s on %s at %-5.5s   %s\n%s\n\n\n",
                  usaptr->userid,ncdate(today()),nctime(now()),
                  fbkptr->topic,fbkptr->text);
          fclose(fbkfp);
          prfmsg(THANKS,usaptr->userid);
          outprf(usrnum);
     }
     return(0);
}

STATIC void
fbkfin(void)                             /* feedback shutdown               */
{
     clsmsg(fbkmb);
}
```

Here are the offline Text Blocks that go with this example:

```
LEVEL6 ()


HELLO (<ESC>[0;1;32m
Hello, and welcome to the Sysop Feedback Forum.  This service is provided
to encourage your comments and criticisms.

When you are done typing, you can hit <ESC>[37m<Ctrl-G><ESC>[32m to save your comments.

) T Feedback welcome message


THANKS (<ESC>[0;1;32m
Thank you for taking the time to leave your comments, <ESC>[33m%s<ESC>[32m!
) T Feedback thanks for comments
```

This source code and all support files are available on the Galacticomm Demo System, (305) 583-7808, in a file named GALFBK.ZIP. (Note: <ESC> represents the ASCII escape code '\x1B'.)

When a user selects this service, he is introduced to it with the HELLO{} message, and a "(N)onstop, (Q)uit or (C)ontinue?" choice. Then he enters the Full Screen Editing mode, where he types in a topic and a message. When the user hits <Ctrl-G>, the topic and message (along with other information) are appended onto the end of the text file GALFBK.TXT. The Sysop can periodically read this file and delete it.

struct module fbkmodule

This module structure defines the text-line input entry point (fbkinp()), the status handler (the standard system default status handler dfsthn()), and a shutdown routine (fbkfin()).

struct fbkusr

This is the structure template for this module's use of the Volatile Data Area. The body and topic of the feedback will be stored here. The "fbkptr" macro casts vdaptr into a pointer to an fbkusr structure, for convenient coding.

init_feedback()

This initialization routine registers the feedback module and opens the GALFBK.MCV file with the text blocks for the module. The call to dclvda() declares this module's requirements for the size of the Volatile Data Area.

fbkinp()

This is the input text line handler for the module. It is coded with the standard command concatenation and "X"-to-exit features, although neither of them are actually used. They're in there to make it easier for you to edit this source code into a module of your own. But the only action happening in fbkinp() is this: when the user enters the module, he's greeted, and then shuffled straight off to the Full Screen Editor.

fbkdun()

This function is the when-done routine associated with the module's invocation of bgnedt(). (Notice how it's identified in the bgnedt() call?) If the user did not <*Ctrl-O*> quit the editing, then the text is written to disk. First the '\r' line-terminators that the FSE uses are translated into the '\n' line-terminators that fprintf() likes. Then the file GALFBK.TXT is opened in append-ASCII mode. Then the User-ID, date, time, topic and message body are written to the file. Finally the user is thanked for his efforts. Returning 0 means to return to the parent menu page, as opposed to staying in this module.

Full Screen Data Entry

FSD can perform the following functions:

- Display data
- Enter data, full-screen mode
- Enter data, linear mode

Full-screen entry mode requires ANSI capability and a large enough user screen to hold the entire template. Data displaying, or linear entry, can take place whether the user has ANSI capability or not. To use FSD with The Major BBS, you'll need to create these:

- Template (in .MSG file, level 99)
- Field specification string (usually in memory)
- Memory for the session's variable-length data structures
- Default answer string (usually created on the fly)
- Field-verification routine (optional)
- When-done routine (process answers, restore state/substate)
- Calls to FSDBBS.C routines

Procedure:

1. Create a Template in an .MSG file. (See UEDANSI{} in BBSSUP.MSG for an example. See FSD.H for a complete definition of the template format. FSDBBS will automatically translate to \r\n terminators.) You will probably have a different template for ANSI users than for non-ANSI users.

2. Make a permanent copy of a Field Specification String in memory. (See uinfsp[] in UINFED.C for an example. See FSD.H for the complete specifications of this format also.)

3. Find out how much memory to allocate:

Make a call like this:	If the template is for an:
nbytes=fsdroom(tmpmsg,fldspc,0);	Entry session
nbytes=fsdroom(tmpmsg,fldspc,-1);	Displaying

   Make a call like this from your init_routine() and identify the above Template and Field Specification strings (after opening the appropriate .MCV file of course). This will tell you the size of the region you must provide to support data entry or display. Call fsdroom() for all templates/field specification combinations you will be using to make sure you'll have enough room for all of them.

4. Allocate the space fsdroom() requires. (You can use dclvda() to put it in the Volatile Data Area.)

   (By the way, fsdroom() will need to be called again, immediately before the display or entry session begins.)

5. Format your default or original answers into an Answer String or use "" to default to all blank. (See the use of uinfmt[] in UINFED.C for an example. See FSD.H for the specifications of an answer string.) The answer string can come from getmsg(), but it cannot be in the prfbuf. vdatmp is a good candidate, making sure it's big enough. Be sure to use only legal values in your default answer string (per your own field specifications string and validation routine).

6a. To display data call:

```
fsdroom(tmpmsg,fldspc,-1);
fsdapr(sesbuf,seslen,answers);
fsddsp(fsdrft());
```

6b. To begin a full-screen entry session, call:

```
fsdroom(tmpmsg,fldspc,1);
fsdapr(sesbuf,seslen,answers);
fsdrhd(title);
fsdbkg(fsdrft());
fsdego(fldvfy,whndun);
```

6c. To begin a linear entry session, call:

```
fsdroom(tmpmsg,fldspc,0);
fsdapr(sesbuf,seslen,answers);
fsdego(fldvfy,whndun);
```

Notes:

Fields are numbered 0 to N-1. How do you tell FSD what N is? N is computed from the field specs by fsdroom() and stored in fsdscb->numfld. The number of fields that are also represented in the template is fsdscb->numtpl, which usually equals but never exceeds N. (You can't display or enter a field outside the range 0 to fsdscb->numtpl-1.)

tmpmsg is the code for the template stored in the level 99 option in the .MSG file.

For entry sessions, you can supply a custom field-verification routine.

Remember that fsdroom() in step 6 outputs a bunch of stuff to the prfbuf. This stuff must be untouched between fsdroom() and fsdapr() calls.

The results of fsdapr() are all in the sesbuf. The seslen parameter is the size of sesbuf. This means that after calling fsdroom() and fsdapr(), you can call the other routines (fsddsp(), fsdrft(), fsdrhd(), fsdbkg(), fsdego()) any time later and in any order as long as you maintain the sesbuf passed to fsdapr().

If you have any prf'ing you want to show up immediately before the entry/display, be sure and do it AFTER the call to fsdapr(), which leaves the prfbuf empty.

vdaptr, or a subset of vdaptr, is a good thing to use for sesbuf.

The (*whndun)() routine must restore your usrptr->state and usrptr->substt codes, as well as handle the end of the session.

The title in fsdrhd() is only for smooth operation for RIPscrip users -- this should simply be a character string title for viewing above the entry screen, for example "Contact Datbase".

Avoiding Fields

If your program needs to conditionally blank out some fields in the display, you need to (1) modify the template, and (2) flag the appropriate fields as "avoid". For (1), use the tpwipe() routine on the results of fsdrft() (before passed to fsddsp()) to modify the supporting text for the appropriate fields of the template. For (2), set the FFFAVD flag for the fields to be avoided (see FSD.H) after calling fsdapr().

For example, to display all data but blank out field 5 and some of the supporting text surrounding field 5, you could code something like:

```
char *tp;

fsdroom(tmpmsg,fldspc,0);
fsdapr(sesbuf,seslen,answers);
tp=fsdrft();
tpwipe(tp,5,1,1);
fsdscb->fldat[5].flags|=FFFAVD;
fsddsp(tp);
```

This works almost identically for "avoiding" fields in a full screen entry mode, except you need to intercept things before fsdbkg() is called (instead of before fsddsp()). On the other hand, to show a "protected" field that the user can see but can't change, the FFFAVD flag should be set *after* fsdbkg() is called, but *before* fsdego(), and don't call tpwipe() at all.

In linear entry mode, you just need to set the FFFAVD flag for the appropriate fields after calling fsdapr().

Getting Answers After a Session

After an entry session is over there are a few ways to get the answers. See FSD.H for more details.

```
stg=fsdnan(fldno);              Get a field's answer
char *stg;                        pointer to answer
int fldno;                        field number 0 to N-1

fsdfxt(fldno,buffer,maxlen)     Store answer for field into buffer
int fldno;                        field number 0 to N-1
char *buffer;                     store the answer here
int maxlen;                       don't use more than this many bytes

index=fsdord(fldno)             Find index of multiple choice answer.
                                  Returns -1 if the answer was not one
                                  of the ALT='s.
int index;                        the index, 0 to N-1, for the answer
                                  according to the N possible "ALT="
                                  alternate values for the field
int fldno;                        field number 0 to N-1
```

Handling Answers at Other Times

After a session, the data structures allocated by fsdapr() allow quick access to pieces of the answer string. But at other times, the following routines from FSD.C can be used to deal with answer strings (see FSD.H for more details):

```
length=stranslen(answers);      Find length of an answer string
int length;                       length including final double '\0'.
char *answers;                    answer string

value=fsdxan(answers,name);     Get the value of a field of an answer,
                                  returning "" if not found.
char *value;                      pointer to answer string value
char *answers;                    answer string
char *name;                       name of answer

fsdpan(answers,name,value);     Put a new value into an answer string.
char *answers;                    answer string
char *name;                       name of answer
char *value;                      pointer to answer string's new value

fsddan();                       Delete the answer fsdxan() just found
```

Here's an example of creating an answer string from scratch using sprintf():

```
sprintf(answers,"NAME=%s%cRANK=%s%cSERIALNO=%s%c",name,'\0',
                                                  rank,'\0',
                                                  serno,'\0');
```

For an example of a simple module that uses Full Screen Data Entry, download the file GALCTX.ZIP from the Galacticomm Demo System at (305) 583-7808.

Uploads

Assuming that you've already taken care of all interactive aspects of your application (if you haven't, see about creating interactive modules on page page 29), then here are the steps to take to add file uploading capability:

1. In your source code, include the following special-purpose header file:

   ```
   #include "filexfer.h"
   ```

2. Code your own upload handler routine. The upload handler routine includes all the ways that the file transfer service will be asking you for assistance after you've turned control over to it. This is most of the work, and it's discussed in detail below.

3. Call fileup() when you want to begin an upload, or to present the user with his protocol choices.

   ```
   fileup(filnam,prot,fuphdl);      File upload
   char *filnam;                      name of file (""=multi)
   char *prot;                        protocol code
   int (*fuphdl)(int fupcod));        upload handler routine
   ```

   The filnam parameter is only used for indicating single file ("FILENAME.EXT") or multiple files (""), and for inclusion in some user prompts. Your upload handler routine will have to come up with the full file path in the FUPPTH, FUPBEG, and FUPEND cases. (If you do get a file name in ftfscb->fname, it came from the protocol, otherwise you'll get "".)

   Invalid values for prot are handled appropriately, so you can pass unedited user input in the protocol parameter. The last parameter to fileup() is the address of your upload handler routine.

   Calling fileup() usurps your state and substate (usrptr->state and usrptr->substt). It's up to your FUPFIN exit point to restore them. (More on this subject below.)

Upload Protocol Codes
single-file: "A" "M" "C" "1" "V"
single-file or multi-file: "B" "G" "Z" "K"
to log off after uploading: append "!" to any of the above
menu of download protocols: "?" or ""

To validate an upload protocol code, you could use valupc():

```
ok=valupc(prot);                    Is this a valid upload protocol?
int ok;                               1=valid, 0=invalid
char *prot;                           protocol code string
```

Upload Handler Routine

This routine is a collection of what we call "exit points". After your special-purpose module hands control over to the general-purpose file transfer service, FTF, there are several cases when FTF is going to need to consult back with your application.

Imagine you hire a decorator to remodel your house, and you move out temporarily so you're not in his way. He'll still need to get back in touch with you to go over the pool plans, verify the wallpaper, get your plumber's phone number, and most importantly, to tell you when you can move back in. This handler routine is the means for the FTF to "get back in touch with" your application, for all kinds of specific reasons.

For example there are three occasions when your application needs to come up with the file's full DOS path name:

case:	FTF service needs the DOS path in order to:
FUPBEG	create the file
FUPEND	update the file's time and date
FUPPTH	check if there's an existing file that's older or smaller (for ZMODEM features)

Other exit points are cues for your application to verify that the file name is valid, check if the user has authorization to upload it, handle a completed upload, handle an aborted upload, to "import" a file that's already available on disk, and most important of all, when the file upload session is over, for your application to prompt the user and resume control of his channel.

Here's an informal pseudo-code template for an upload handler routine. This is mostly in C code, but it's liberally laced with English descriptions where appropriate.

```
int
fupxxx(                                 /* Handle the application-specific */
int fupcod)                             /* aspects of your uploads         */
{                                       /* (fupcod=code for each aspect)   */
     int rc=0;

     setmbk(whatever your application uses);
     (be sure to set any other appropriate globals)
     switch(fupcod) {
     case FUPPTH:                       /* Where would we put this file?   */
          sprintf(ftfbuf,"<DOS path for the file>",ftfscb->fname);
          rc=<resume upload> ? 2 : 1;
          break;
     case FUPBEG:                       /* Begin uploading this file       */
          if (user can't upload this file) {
               sprintf(ftfbuf,"He can't upload this file because.");
          }
          else {
               sprintf(ftfbuf,"<DOS path for the file>",ftfscb->fname);
               reserve file
               rc=1;
          }
          break;
```

```
        case FUPREF:                        /* Refer to file, don't upload it  */
             strcpy(<somewhere>,ftfbuf);
             break;
        case FUPEND:                        /* This file uploaded successfully */
             unreserve file
             record a completed upload
             sprintf(ftfbuf,"<DOS path for the file>",ftfscb->fname);
             break;
        case FUPSKP:                        /* This file upload aborted        */
             unreserve file
             record an aborted upload
             break;
        case FUPFIN:                        /* End of uploading session        */
             usrptr->state=your state
             usrptr->substt=your substate
             prompt(whatever comes next);       /* (don't call outprf())      */
             rc=1;
             break;
        case FUPHUP:                       /* Channel hanging up               */
             the FUPFIN exit point never got called, clean up as req'd
             break;
        }
        return(rc);
}
```

You might find it handy to download FUPXXX.C from the Galacticomm Demo System, (305) 583-7808, which contains the above pseudo-code, and then edit it line-by-line into what your upload handler will need.

In addition to the fupcod input to your upload handler routine, there are several global variables that you can always assume will be available: usrnum, usrptr, usaptr, and vdaptr. In addition, these FTF variables are available:

`struct ftfscb *ftfscb;`	Session Control Block (see FTF.H) for the current file transfer session
`struct ftfpsp *ftfpsp;`	protocol specifications (see FTF.H) for the current file transfer session
`char *ftfbuf;`	multi-purpose buffer (context dependent)

If you need any other global variables, be sure to set them up in your routine. The meaning of your routine's return value depends on the type of exit point (which is coded in fupcod). These will be discussed individually for each exit point. In some cases, no return value is expected. You should return 0 in each of those cases to allow for future expansion.

Now we'll go into each of the exit points in detail. To simplify the discussion, we'll pretend that FTF is a person telling your application what it needs.

```
I,me,my   =  FTF file transfer service
You,your  =  application software
```

From the remodeling analogy, this is like the decorator talking to the homeowner.

FUPPTH - Where would we put this file?

Tell me what DOS path you plan to use for this file coming up, and store that path in ftfbuf. If the protocol was capable of telling us a file name, I've put it in ftfscb->fname, otherwise ftfscb->fname is "". Usually you'll return 1 in this case.

On the other hand, if you have a file fragment left behind from an earlier aborted upload of the same file, then give me the path for that file fragment and return 2. I may try to resume the upload if the protocol is capable (e.g. ZMODEM). You should only return 2 if you're reasonably confident that the existing file is the result of an aborted upload. Otherwise, a useless mix of two different files might end up on the disk.

You could also just return 0 (and skip putting the path in ftfbuf) if you don't plan on supporting file upload resume after abort, and don't plan on supporting the upload-if-exists/newer/bigger options that ZMODEM is capable of.

FUPBEG - Begin uploading this file

Verify whether the user is allowed to upload this file. See ftfscb->fname and ftfscb->estbyt for the file name and size, if the protocol has supplied them. The file time and date may be in one of three forms:

Protocol provides:	ftfscb->dosdat,dostim	ftfscb->unxtim
No information about date & time	0,0	0L
DOS time and date formats	date,time	0L
UNIX seconds since 1/1/70	0,0	UNIX time

See page 178 about time and date formats and handling routines. See page 182 for routines to read and set file time and date. After the file is uploaded I'll stamp this time and date on the file (if any), as long as you provide me with the proper path in the FUPEND exit point.

The main reason for the FUPBEG exit point is for you to check this user's upload permission and any other possible restrictions. Here are some things you might check for:

- Does the file name have the proper syntax?
- Does the file name conflict with a reserved name? (For example, CON.TXT is an alias for the Sysop's console!)
- Does this user have permission to upload this file?
- Does this user have permission to overwrite an existing file?
- Are too many users opening files at once (thereby using up all file handles)?
- Will users be able to use up all available disk space?
- Will users be able to upload a very large number of small files, making directory access very slow?
- If charges are associated with upload, can the user afford to pay?
- Could this file name possibly conflict with one of the other online users who are also using your application?
- Will other users online be able to see/download/modify this file while this user is in the process of uploading it?

If it's not OK to upload, return 0 and put an explanation of some kind in ftfbuf. The explanation should be a complete sentence (begining with a capital letter and ending with a period), for example "You don't have access rights to that file.". The explanation can be up to 79 characters long, not including the terminating NUL '\0'.

If it's OK to upload, return 1 and tell me what DOS path to use for the file (store it in ftfbuf). Specify the maximum allowable size for this file, in bytes, in ftfscb->maxbyt. If there truly is no maximum size limit, then just leave ftfscb->maxbyt at the default value MAXLONG (about 2 gigabytes, see FTF.H).

You can check ftfscb->estbyt yourself if you like, and call things off if the file's going to be too big, or you can leave this work to me. Either way, you should put some kind of size restriction in ftfscb->maxbyt. Hacked terminal software could theoretically claim to be uploading a 1000-byte file then proceed to upload a 1,000,000,000-byte file.

Setting ftfscb->maxbyt does two things for you. I'll immediately make sure that ftfscb->estbyt doesn't exceed your limit (and abort the transfer if it does). And I'll also keep tabs on the size of the file while it's being uploaded, and abort if the limit is exceeded.

An important feature of the file uploading service is that you can count on the fact that for every FUPBEG call, there will be exactly one call to either FUPSKP (upload of this file aborted) or FUPEND (upload of this file was successful), except in extreme cases such as power loss.

FUPREF - Refer to file, don't upload it

You'll never get this case if you haven't willingly and knowingly set the ftuptr->flags|=FTFREF flag after you called fileup(). This all has to do with uploading a file "by reference". Electronic Mail and the Forums have this ability. The Sysop can "upload" a file that already exists on the BBS's disk using the "F" file-import protocol. The file may stay where it is, and the E-mail or Forum message that it's attached to just "refers" to the real location of the file.

You identify your application's capacity for upload-by-reference by setting the ftuptr->flags|=FTFREF flag immediately after you call fileup(). By the way, that's *all* you identify by setting FTFREF -- your capacity for upload by reference. You don't have to be concerned with the user's authority to use file importing. I'll only allow this if he has the key specified by the offline Security and Accounting option FIMLOCK, which is SYSOP by default.

Here's the situation if I ever happen to get around to calling the FUPREF exit point: The user hit the "F" protocol, and either the path he specified had no colon in it (in which case I assumed upload by reference was desired), or I confirmed with him that it would be OK to import this file by reference instead of actually making a copy of it.

I'm not going to use the return value from your FUPREF exit point, but you should still return 0 to allow for future features. If I call FUPREF at all, I'll only call it after a FUPBEG where you returned 0, and immediately before I call FUPEND. When FUPREF is called, ftfbuf contains the path just as your FUPBEG handler left it. This is your baby now -- you asked for it -- so do whatever you have to do to keep track of this uploaded-by-reference file.

FUPEND - This file uploaded successfully

The file was uploaded successfully. The actual size of the final file is available to you in ftfscb->actbyt. (If the upload was resumed, using ZMODEM's resume-after-abort feature, ftfscb->actbyt is the *total* bytes in the file, not just the portion stuck on in this session. There's no way to find out whether a resume took place or not, or to figure the size of the portion.)

I need to know the DOS path for this file one more time (again, store it in ftfbuf) so I can set its time and date. If you don't want me to store the time and date, just put an empty string in ftfbuf.

If you're in the habit of checking against conflicts or collisions with other users, now's the time to recognize that this user is all done with this file. So you can "unreserve" it if you did any reserving in the FUPBEG exit point.

I'm not expecting any return value from either your FUPEND or FUPSKP exit points, so you should return 0.

FUPSKP - This file upload aborted

The current file upload has been aborted for some reason. The size of the fragment is available to you in ftfscb->actbyt. If you don't want fragments of aborted uploads lying around you need to delete the file now. You can do this by coming up with the file path name and passing it to unlink().

Here also, if you've been reserving the file name or a file handle since FUPBEG, now's the time to unreserve it.

FUPFIN - End of uploading session

This step winds up the upload session and returns control to your regularly scheduled program. This is distinguished from FUPEND which only winds up from the upload of a single file. So for multiple file uploads there could be several FUPBEG/FUPEND pairs (or FUPBEG/FUPSKP if things didn't work out).

In ftfscb->actfil you'll find a count of the total number of files successfully uploaded. In ftfscb->tryfil is the total files that we *tried* to upload. Of course it's always the case that actfil <= tryfil. When actfil < tryfil, not all the files made it. I've already told the user all about this, including why the last transfer aborted, or why the last of possibly several files were skipped.

Since you're taking back control of this channel, it's up to you to set things straight for what's up next for this user. Here are two alternatives:

You want control back	You want to return to the parent menu
o Restore your usrptr->state	o Restore your usrptr->state
o Restore your usrptr->substt	o Say bye to the user if you wish (you don't need to call outprf())
o Prompt the user (you don't need to call outprf())	o Return 0
o Return 1	

Either way, if you're prompting or saying goodbye using prfmsg(), you need to be sure to set your message block pointer using setmbk().

The pseudo-code for FUPFIN handling on page 108 assumes you want to take control back. Here's an alternative pseudo-coding of the FUPFIN exit point to allow you to exit to your module's parent menu page:

```
case FUPFIN:                        /* End of uploading session      */
     usrptr->state=your state
     prompt(exiting);                    /* (don't call outprf())     */
     rc=0;
     break;
```

This may be appropriate if your module really doesn't want to regain control of the channel when the upload is done. In this case you only need to restore the user's state code (module number), not the substate. Your module never actually regains control of the user's channel. You can prompt him with some parting words, but you don't need to. For consistency you should do whatever you normally do when the user exits from your module to the parent menu.

In the case where you're supposedly retaking control, you may have to call condex(), and possibly wind up returning control to your parent Menu Tree menu afterall. This would be the case if you were about to return to your module's own internal main menu, and you found out you had gotten where you are through command concatenation. See page 78 about this whole condex() business.

Another handy feature of the file transfer service is that each fileup() invocation is followed (eventually) by exactly one FUPFIN or FUPHUP exit point invocation, except in dire cases (power loss for example).

FUPHUP - Channel hanging up

This is the alternative to FUPFIN that occurs when the user or the channel is hanging up for some reason in the middle of the upload session. No return value is expected, so you should return 0. You don't need to worry about termination of the individual *file* upload, if one had been in progress, because FUPSKP will have been called already. But if there's any session-level (as opposed to file-level) cleanup to be done, now's your chance. For example, in ESGUTL.C, FUPHUP is used to store the user's Forum quickscan information back to disk.

This brings up a tricky point that you may want to be aware of. When a user disconnects in the middle of one of your uploads, your module's own hang-up entry point (see page 38) will be called eventually, as it always is at logoff. But you may not be able to recognize that the user was "in" your module because his usrptr->state will be that of the file transfer's state code. One way out of this is your FUPHUP exit point. When the file transfer service's own huprou() get's called, it will call your FUPHUP exit point in your upload handler routine. That's when you can do your module's last minute housekeeping on this channel.

Uploading Example #1

Here's a very simple example of a module that uploads files on a BBS. Many shortcuts have been taken in this code for the sake of brevity. It uses a minimum of features, has few conveniences, and has none of the security precautions that should be in place before putting software online for users to access. It's sole purpose is to introduce you to the components of file uploading. You can download the source code and other files relavent to this example from the Galacticomm Demo System at (305) 583-7808. Look for GALUPX.ZIP in the File Libraries.

```
/*****************************************************************************
 *                                                                           *
 *   GALUPX.C                                                                *
 *                                                                           *
 *   Copyright (C) 1994 GALACTICOMM, Inc.    All Rights Reserved.            *
 *                                                                           *
 *   Uploading example.                                                      *
 *                                                                           *
 *                                              - R. Stein  12/6/93          *
 *                                                                           *
 *****************************************************************************/

#include "gcomm.h"
#include "majorbbs.h"
#include "filexfer.h"

STATIC int uplinp(void);
STATIC int fupupl(int fupcod);

int uplstt;                             /* Uploading module state number   */
struct module uplmodule={"",NULL,uplinp,dfsthn);

void EXPORT
init_uploader(void)                     /* Uploader initialization         */
{
     stzcpy(uplmodule.descrp,gmdnam("GALUPX.MDF"),MNMSIZ);
     uplstt=register_module(&uplmodule);
     mkdir("UPLDIR");
}

STATIC int
uplinp(void)                            /* Uploader input handler          */
{
     switch (usrptr->substt) {
     case 0:
          prf("Name of file to upload: ");
          usrptr->substt=1;
          break;
     case 1:
          if (margc == 0) {
               return(0);
          }
          fileup(strcpy(vdaptr,margv[0]),"?",fupupl);
     }
     outprf(usrnum);
     return(1);
}

int
fupupl(                                 /* Handle the application-specific */
int fupcod)                             /* aspects of the upload example   */
{                                       /* (fupcod=code for each aspect)   */
     int rc=0;

     switch(fupcod) {
     case FUPBEG:                       /* Begin uploading this file       */
     case FUPEND:                       /* This file uploaded successfully */
          sprintf(ftfbuf,"UPLDIR\\%s",vdaptr);
          rc=1;
          break;
     case FUPFIN:                       /* End of uploading session        */
          usrptr->state=uplstt;
     }
     return(rc);
}
```

This module allows users to upload files into the UPLDIR subdirectory of the BBS. As is the case with most modules, Sysops need to create a module page somewhere in their Menu Tree that uses it, normally the child page of some menu. When users are online and choose this service they are asked to type in a file name. When they do, control is turned over to the upload service and the user chooses a protocol. After the upload is complete, the user is returned to the parent menu page. Here is a discussion of the major components of this program.

struct module uplmodule

This module identifies only one custom entry point: uplinp() for the sttrou() text line input handler. The default status handler, dfsthn() is the stsrou() entry point for unusual status conditions.

init_uploder()

The initialization routine for this module registers the module, using the description in the corresponding module definition file. It also creates the UPLDIR subdirectory to store the uploaded files, if one doesn't exist already.

uplinp()

This routine handles text line input from the user after he selects this upload service. Upon entry, the user is prompted to enter a file name. If the user just hits RETURN, he is returned to the parent menu without uploading. If he types in a file name, that name is stored in his Volatile Data Area, and then he is handed over to the file transfer service. The middle parameter to fileup() is "?" to give the user a list of available upload protocols.

fupupl()

This is the upload handler routine as described starting on page 108. The FUPBEG and FUPEND exit points are used by FTF to get the file's full path name for opening the file, and for setting its time and date. The FUPFIN exit point merely retores the upload service's state code and returns 0, which requests that the user be returned to the parent menu page. All other exit points simply return 0

Potential Improvements to Upload Example #1

Here are some of the features left out of this brief example that you should consider if you are using uploads in your application:

- Limits on file size and quantity in the upload directory
- Checking for conflicts between the file name and DOS devices
- Deleting the fragment left behind from an aborted upload
- Multiple-file uploads
- Sysop-configurable prompts in an .MSG file
- Sysop-configurable upload directory
- Formal declaration and limitation on VDA usage
- Command concatenation
- Automatic reprompt after "/p" page command, etc.
- Full module structure in source code, with comments

All of these features are included in upload example #2.

Uploading Example #2

```
/*****************************************************************************
 *                                                                           *
 *   GALUPX2.C                                                               *
 *                                                                           *
 *   Copyright (C) 1994 GALACTICOMM, Inc.    All Rights Reserved.            *
 *                                                                           *
 *   Uploading example II                                                    *
 *                                                                           *
 *                                          - R. Stein  12/6/93              *
 *                                                                           *
 *****************************************************************************/

#include "gcomm.h"
#include "majorbbs.h"
#include "filexfer.h"
#include "galupx2.h"

STATIC int uplinp(void);
STATIC void uplfil(char *filnam,char *protoc);
STATIC int fupupl(int fupcod);
STATIC void uplfin(void);

int uplstt;                         /* Enhanded uploader module state number*/
static FILE *uplmb;                 /* file pointer for GALUPX2.MCV         */
char *upldir;                       /* UPLDIR upload directory              */
long uplbmax;                       /* max bytes allowed in UPLDIR          */
long uplfmax;                       /* max files allowed in UPLDIR          */

struct module uplmodule={           /* module interface block               */
     "",                            /*    name used to refer to this module */
     NULL,                          /*    user logon supplemental routine   */
     uplinp,                        /*    input routine if selected         */
     dfsthn,                        /*    status-input routine if selected  */
     NULL,                          /*    "injoth" routine for this module  */
     NULL,                          /*    user logoff supplemental routine  */
     NULL,                          /*    hangup (lost carrier) routine     */
     NULL,                          /*    midnight cleanup routine          */
     NULL,                          /*    delete-account routine            */
     uplfin                         /*    finish-up (sys shutdown) routine  */
};

void EXPORT
init_uploader(void)                 /* Uploader initialization              */
{
     strcpy(uplmodule.descrp,gmdnam("GALUPX2.MDF"),MNMSIZ);
     uplstt=register_module(&uplmodule);
     uplmb=opnmsg("GALUPX2.MCV");
     mkdir(spr("%s.",upldir=stgopt(UPLDIR)));
     uplbmax=lngopt(UPLBMAX,0,2147483647L);
     uplfmax=numopt(UPLFMAX,0,32767);
     dclvda(8+1+3+1);
}

STATIC int
uplinp(void)                        /* Uploader input handler               */
{
     setmbk(uplmb);
     if (margc == 1 && sameas(margv[0],"X")) {
          return(0);
     }
     do {
          bgncnc();
          switch (usrptr->substt) {
          case 0:
               cncchr();
               prfmsg(usrptr->substt=UPLNAME);
               break;
          case UPLNAME:
               if (usrptr->flags&INJOIP) {
                    prfmsg(UPLNAME);
                    break;
               }
               cncall();
               parsin();
```

```
                switch (margc) {
                case 0:
                     uplfil("","?");
                     break;
                case 1:
                     uplfil(margv[0],"?");
                     break;
                default:
                     uplfil(margv[0],margv[1]);
                }
                break;
           }
      } while (!endcnc());
      outprf(usrnum);
      return(1);
}

STATIC void
uplfil(                                   /* upload file(s)                  */
char *filnam,                             /* file name, or "" for multi-file */
char *protoc)                             /* protocol, or "?" for list       */
{
      if (sameas(filnam,"*")) {
           filnam="";
      }
      if (rsvnam(filnam)
       || strchr(filnam,':') != NULL
       || strchr(filnam,'\\') != NULL
       || strstr(filnam,"..") != NULL) {
           prfmsg(UPLRSV);
           prfmsg(UPLNAME);
      }
      else {
           strcpy(vdaptr,filnam,8+1+3+1);
           fileup(filnam,protoc,fupupl);
      }
}

int
fupupl(                                   /* Upload handling routine         */
int fupcod)
{
      int rc=0;

      setmbk(uplmb);
      switch(fupcod) {
      case FUPBEG:                  /* Begin upload, check permission, reserve */
           if (vdaptr[0] == '\0' && rsvnam(ftfscb->fname)) {
                strcpy(ftfbuf,"File name is a reserved DOS device name.");
                break;
           }
           cntdir(spr("%s*.*",updir));
           if (numfils >= uplfmax) {
                strcpy(ftfbuf,"Upload directory is full.");
                break;
           }
           ftfscb->maxbyt=uplbmax-numbyts;
           sprintf(ftfbuf,"%s%s",updir,vdaptr[0] == '\0' ? ftfscb->fname
                                                         : vdaptr);
           rc=1;
           break;
      case FUPEND:                /* End complete upload of a file, unreserve */
           sprintf(ftfbuf,"%s%s",updir,vdaptr[0] == '\0' ? ftfscb->fname
                                                         : vdaptr);
           break;
      case FUPSKP:                          /* Skip incomplete upload of a file */
           unlink(spr("%s%s",updir,vdaptr[0] == '\0' ? ftfscb->fname
                                                     : vdaptr));
           break;
      case FUPFIN:                               /* Finish file upload session */
           usrptr->state=uplstt;
           if (ftfscb->actfil >= 1) {
               prfmsg(UPLTHX);
           }
           break;                   /* rc == 0, so we exit to parent menu page */
      }
      return(rc);
}
```

```
STATIC void
uplfin(void)                        /* Finalize uploading example      */
{
     clsmsg(uplmb);
}
```

Here are the CNF options for upload example #2:

```
LEVEL4 ()

 This is the directory where the files will go.
 Be sure to specify a proper path PREFIX (e.g.
 ending with a backslash, or whatever)

UPLDIR (UPLDIR\) S 0 Upload directory:

 This is the maximum number of files allowed in the
 upload directory.

UPLFMAX (Maximum files allowed in upload directory: 1000) N 0 32767

 This is the maximum number of bytes (the total of all
 files) allowed in the upload directory.

UPLBMAX (Maximum bytes allowed in upload directory: 1000000) L 0 2147483647


LEVEL6 ()

UPLNAME (<ESC>[0;1;36m
Name of file to upload (or "*" for multiple files): ) T Upload example II file name

UPLRSV (<ESC>[0;1;35m
That's a reserved or invalid DOS file name, please choose another name.
) T Upload example II file name collides with device list

UPLFUL (<ESC>[0;1;35m
The upload directory is full.
) T Upload example II too many files

UPLTHX (<ESC>[0;1;32m
Thanks for uploading.
) T Upload example II finished
```

This code, plus support files, is available for download on the Galacticomm Demo system in the file GALUPX2.ZIP. (Note: <ESC> represents the ASCII escape code '\x1B'.) Here's what the module would look like online:

```
TOP (TOP)
Make your selection (T,I,F,E,L,A,P,R,D,O,W,U,N,S,? for help, or X to exit): U

Name of file to upload (or "*" for multiple files): COLDEMO.EXE

To start uploading COLDEMO.EXE, type:

   A ... ASCII                          B ... YMODEM Batch
   M ... XMODEM-Checksum                G ... YMODEM-g
   C ... XMODEM-CRC                     Z ... ZMODEM
   1 ... XMODEM-1K                      K ... Kermit / Super Kermit

   (Add '!' to automatically log off when done)

Your choice (or 'X' to exit): Z

(Hit Ctrl-X a few times to abort)
Beginning ZMODEM upload of the file COLDEMO.EXE
**B0100000023be50
```

(uploading takes place)

```
***  UPLOAD COMPLETE  ***

Thanks for uploading.

TOP (TOP)
Make your selection (T,I,F,E,L,A,P,R,D,O,W,U,N,S,? for help, or X to exit): _
```

Assuming that the menu selection to invoke the uploading service is "U", the user can enter any of the following concatenated commands from that menu:

U	Enter the upload service
U <*filename*>	Upload a specific file, prompt for protocol
U <*filename*> <*protocol*>	Upload a file using a protocol
U *	Upload multiple files, prompt for protocol
U * <*protocol*>	Upload multiple files using a protocol

struct module uplmodule

In this example, the module structure is fleshed out with a helpful comment for each field. An uplfin() routine has been added to clean up before shutdown.

init_uploader()

The initialization routine does the same work as does the one in the first example, plus it also supports a Sysop-configurable directory for uploads, and reads in Sysop-configurable byte and file limits. The dclvda() call formally declares the need for enough space in the VDA to store a file name.

uplinp()

Some immediately obvious renovations are the checking for "X" to exit, and the use of command concatenation routines (bgncnc(), cncxxx(), endcnc()). When first entering this module, the cncchr() call helps with concatenated commands the user could have entered from the parent menu page. The user is prompted to enter a name for the uploaded file.

The UPLNAME substate handles the reaction to the upload file name prompt. The user can respond by hitting "*" or RETURN to signify that multiple files will be uploaded. But the first special case we handle is when the INJOIP flag is set, meaning we need to reprompt after a "/p" page message or other unexpected event. After that, parsin() reparses the input into separate margv[] words (see about how bgncnc() unparses on page 75). These are passed to an internal function, uplfil(), with default values for protocol and file name as appropriate.

uplfil()

This function translates "*" for filename into the "" that the first parameter of fileup() needs to signify multiple file uploads. It then proceeds to check the file name for dangerous characters like ":", "\" and "..". There are many other (less dangerous) illegal characters for file names, but most of these are caught eventually when FTF tries to create the file. If the file name is safe, it's stored in the VDA and fileup() is called. Notice that the file name is checked for size limitations before writing to the VDA. Avoiding buffer overruns is a wonderful habit to get into, although we're not exactly at high risk here.

fupupl()

In the FUPBEG exit point, we recheck for reserved names. This is necessary for multi-file uploads when we don't know the names until this point. We also need to check file size and quantity limits since these too are dynamic. This may be a little impolite to the user to bring up this file quantity limitation so late in the game, but it must be checked for each file in a multi-file upload, so it needs to be in FUPBEG anyway.

Even this check is not completely air-tight: if two users started uploading 5-Megabyte files at the same time, and the UPLBMAX setting is 6-meg, they will probably both be allowed to complete their uploads. That's because the directory contents are measured only at the beginning of each upload, without taking into account uploads that are already underway.

uplfin()

This routine politely closes the GALUPX2.MCV file when the BBS shuts down.

ASCII Downloads

To dump an ASCII file to the user's terminal, you can use:

```
listing(path,whndun);          list an ASCII text file to the
                                 user's terminal
char *path;                      DOS path of the file (must be
                                 a permanent storage location)
void (*whndun)(all));            restore state & substate, prompt the
                                 user for what to do next
int all;                         1=all of file was output, 0=aborted
```

The "path" parameter must point to a location where the file's full path specification will reside throughout the listing. For example, a region of the volatile data area, a private malloc()'d region, a literal file name, etc. Do not use spr(), a portion of input[], an automatic (stack) buffer, or any other location where the contents will change before the (*whndun)() routine gets called.

The listing() routine will usurp the channel's state and substate (usrptr->state and usrptr->substt). It's up to the (*whndun)() routine to restore your state (return value from register_module()) and substate. The (*whndun)() routine gets passed a single parameter which is 1=all of the file was downloaded, or 0=file was aborted by the user.

The listing() function will not be able to operate if the user has tagged too many files for download (see about ftgnew() on page 121).

An example initiation of an ASCII download:

```
listing("E:\DOC93\SATNAV.HLP",lstback);
```

An example (*whndun)() routine:

```
void
lstback(int all)
{
     usrptr->state=snstate;
     prfmsg(usrptr->substt=all ? FULLPMT : SHORTPMT);
}
```

Note that the (*whndun)() routine does not need to call outprf(). (If it does call outprf() for any reason, it should then call clrprf() to avoid double prompting.)

Downloads

Assuming that you've already taken care of all interactive aspects of your application, then here are the steps to take to add file downloading capability:

1. In your source code, include the following special-purpose header file:

   ```
   #include "filexfer.h"
   ```

2. Define your own "tagspec" data structure. This can be up to 17 bytes of data for storing information on your file, in any format you choose. A tagspec may refer to a single file or to multiple files (for example you could store "FILE.TXT" or "*.TXT"). To allow your files to be tagged for later download, you'll need to store enough information in this 17-byte structure to later reconstruct the file's DOS path, and any security and accounting information. We'll talk more about tagspec's below.

3. Code your own download handler routine. This routine will be called by the file transfer service to perform application-specific tasks throughout the download session. This is usually where your most work is, and it will be discussed in detail below.

4. Call ftgnew() to reserve an entry in the tag table.

   ```
   navail=ftgnew();              Reserve space in the tag table
   int navail;                     Number of spaces available

   struct ftg *ftgptr;             tag table entry
   ```

   Each user has his own row of entries in the 2D tag table, the length of each row being specified by the offline Configuration option MAXTAGS. All downloads, whether explicitly tagged or not, are handled via an entry in the tag table. If ftgnew() returns 0, there is no room. If it returns nonzero, then that's the number of spaces available, and ftgptr will point to your spot in the user's tag table.

5. Now fill in the tag table entry. Store your tagspec in ftgptr->tagspc, a 17-byte character array. Again, you know the format of what's stored here, the file transfer service doesn't care. Set ftgptr->flags according to the flags: FTGWLD (multi-file), and FTGABL (whether possible to tag or not). And set ftgptr->tshndl to point to your tagspec handler routine.

6. Call the ftgsbm(prot) routine to submit the tagspec.

```
usurp=ftgsbm(prot);     Submit the tagspec for download
int usurp;                1=FTF has usurped control of session
                          0=you still have control of session
char *prot;               protocol code
```

Download Protocol Codes
single-file for immediate download: "M" "C" "1" "V"
single-file or multi-file for immediate download: "L" "A" "B" "G" "Z" "ZR" "K"
to log off after downloading: append "!" to any of the above
tag for later download: "T" tag (quietly) for later download: "TQ"
for compressed file viewing: "V"
menu of download protocols: "?" or ""

You can use the "TQ" protocol internally to tag a file without notifying the user. It's otherwise an invalid protocol though: users are not not able to specify it.

To validate a download protocol code, you can use valdpc():

```
ok=valdpc(prot);          Is this a valid download protocol?
int ok;                     1=valid, 0=invalid
char *prot;                 protocol code string
```

The return value of ftgsbm() tells you whether or not FTF has taken control of your session.

ftgsbm() returns 0 in these cases:
ftgsbm(anything), after ftgnew() has returned 0, outputs a warning
ftgsbm("T") tags a file for download & notifies the user
ftgsbm("TQ") silently tags a file for download
ftgsbm(protocol) when your TSHVIS routine reports that your file is invisible (in this case, ftgsbm() calls your TSHFIN exit-point)

ftgsbm() returns 1, and changes usrptr->state,substt in these cases:
ftgsbm("?") changes state/substt to prompt for protocol/options
ftgsbm(protocol) changes state/substt to proceed with download
ftgsbm(trash) rebuffs, and then does the same thing as ftgsbm("?")

Here's what you can count on:

> If ftgsbm() returns 1, then it has changed the usrptr->state, and either TSHFIN or TSHHUP will get invoked exactly once eventually. If ftgsbm() returns 0, then usrptr->state and usrptr->substt have either not been changed, or already restored by the TSHFIN exit point of your download handler routine.

Tagspecs

A tagspec is a 17-byte application-specific structure for keeping track of each file downloaded. Its main purpose is to allow file tagging, where a user identifies a file for download at some later time. But all files that are downloaded use tagspecs, even if they aren't explicitly tagged.

These 17-byte tagspecs were designed as small as possible so that users could have room to tag numerous files without wasting large amounts of memory. There's just enough room for a 4-byte pointer and a 12-character file name plus its NUL terminator. The 4-byte pointer could be used to refer to some directory, Forum, Library, category, or other structure somehow. For example, you could store a 32-bit absolute database pointer here. You can use any format you need for the 17 bytes, as long as you keep in mind the asynchronous nature of file tagging (identifying the file now, downloading it later).

You must take special care that your application can handle file tagging before you set the FTGABL (tagable) flag in ftgptr->flags (see step 5 above). For one example of a disaster waiting to happen, suppose you store the 12-character file name in the tagspec, and a 60-character path prefix in your Volatile Data Area. In some of your download handler exit points (TSHVIS, TSHBEG and possibly TSHSCN and others) you assemble these two things together to get the DOS path for the file. This will work just dandy if the user never tags these files.

But if you set ftgptr->flags|=FTGABL and the user picks "T" to tag a file in your module, you're probably in for big trouble. For one thing, if he tags two files from different directories, and then downloads them both, they will both use the path prefix meant for the second file. For another, the user may be off in some other module, with entirely different data stored in the Volatile Data Area, when he gets around to downloading his tagged files Then when your download handler routine gets called, and goes to the Volatile Data Area for that 60-character prefix, something rather unexpected may be there in its place. This is the worst kind of bug to have on your hands -- intermittant cause and unpredictable effect.

Possible corrections to this kind of bug are either to find somewhere else to store the path prefix, or to rethink the strategy. You could store the path prefix in a database and store a database pointer in the tagspec. Or perhaps you could restrict your application to using the same path prefix for all files. If you were desperate to give users the ability to tag up to MAXTAGS number of files, each with an arbitrary path prefix, then your application could allocate a monster 3D array, 61 bytes by MAXTAGS by nterms, and store all the path prefixes there.

Download Handler Routine

This routine is a collection of "exit points" for all the application-specific tasks that need to be done during the general-purpose downloading session. See page 108 for a discussion of the concept of exit points as regards the *upload* handler routine.

This pseudo-code template roughly outlines the tasks expected at each of the exit points.

```
int
tshxxx(                                 /* Handle the application-specific */
int tshcod)                             /* aspects of your downloads       */
{                                       /* (tshcod=code for each aspect)   */
     int rc=0;

     setmbk(whatever your application uses);
     (be sure to set any other appropriate globals)
     switch(tshcod) {
     case TSHDSC:                       /* Describe the file(s) in English */
          sprintf(tshmsg,"app-specific description of file",ftgptr->tagspc);
          break;
     case TSHVIS:                       /* Visible to this user?           */
          if (file exists, or user is allowed to know it doesn't) {
               open & read first TSHLEN bytes into tshmsg, as in:
               if ((fp=fopen("<DOS path for the file>",FOPRB)) != NULL) {
                    fread(tshmsg,1,TSHLEN,fp);
                    rc=1;
               }
          }
          break;
     case TSHSCN:                       /* Break down multiple filespec    */
          if (there's at least one file in this multi-file tagspec) {
               store tagspec for the individual file in tshmsg
               rc=1;
          }
          break;
     case TSHNXT:                       /* Next file in multi-file spec    */
          if (there are more subfiles) {
               store tagspec for the individual file in tshmsg
               rc=1;
          }
          break;
     case TSHBEG:                       /* Begin downloading this file     */
          if (file can't be downloaded by this user) {
               sprintf(tshmsg,"You can't download the file because...");
          }
          else {
               reserve it
               sprintf(tshmsg,"<DOS path for file>",ftgptr->tagspc);
               strcpy(ftfscb->fname,"<file name for the protocol>");
               rc=1;
          }
          break;
     case TSHEND:                       /* File download was successful    */
          unreserve it
          record a completed download
          break;
     case TSHSKP:                       /* This file download aborted      */
          unreserve it
          record an aborted download
          break;
     case TSHFIN:                       /* End of downloading session      */
          usrptr->state=your state
          usrptr->substt=your substate
          prompt (you don't need to call outprf here)
          rc=1;
          break;
     case TSHHUP:                       /* Channel hanging up              */
          the TSHFIN exit point never got called, clean up as req'd
          break;
     }
     return(rc);
}
```

This code is available on the Galacticomm Demo System, (305) 583-7808. You may want to download it and use it as a template to write your own download handler routine.

The global variables usrnum, usrptr, usaptr, and vdaptr are available for all exit points of the download handler routine. In addition, these FTF variables are available:

`struct ftfscb *ftfscb;`	Session Control Block (see FTF.H) for the current file transfer session
`struct ftfpsp *ftfpsp;`	protocol specifications (see FTF.H) for the current file transfer session
`struct ftg *ftgptr;`	current tag table entry
`ftgptr->tagspc`	current tagspec
`char *tshmsg;`	multi-purpose buffer (context-dependent)

If you need any other global variables, be sure to set them up in your routine. The meaning of your routine's return value depends on the type of exit point (which is coded in tshcod). These will be discussed individually for each exit point. In some cases, no return value is expected. You should return 0 in each of those cases to allow for future expansion.

TSHDSC - Describe the file(s) in English

Format a description for the single file or multiple files in the tshmsg buffer. You should word the description so that it looks right when following the word "the", as in "Do you want to download the %s (y/n)?" (see offline Text Block SRETRYV).

The tagspec you originally submitted is in ftgptr->tagspc. This exit-point must work with a multi-file tagspec, as well as the single-file tagspec's that you'll be breaking it down into. The return value doesn't matter, but it's a good practice to return 0 for future expansion.

TSHVIS - Visible to this user?

Is this file visible? Return 1=visible to user, or 0=not visible.

This exit-point should handle multi-file tagspecs (which are not now checked for visibility, but may be in future versions) as well as single-file tagspecs. Return 1 if the user is allowed to know whether this file exists.

The purpose of this exit point is to allow you to decide to totally restrict access to a given file, to the point where certain users don't even know it exists. It also allows you to break-down multi-file tagspecs in TSHSCN and TSHNXT without doing any security checks.

If the file is visible, read the first TSHLEN bytes (80 bytes) into the tshmsg buffer. This will allow tests for a compressed file, such as a .ZIP file, to know whether or not to present the user with the "V" protocol choice. If you don't read in the first TSHLEN bytes of this file, then the "V" protocol will never be available.

TSHSCN - Break down multiple filespec

If you submit a multi-file tagspec (by setting ftgptr->flags|=FTGWLD), then you'll be asked to break it down into single-file tagspecs when the time comes for downloading.

If the multi-file tagspec refers to one or more files, then return 1 and store the tagspec for the first file in the tshmsg buffer. Return 0 if the multi-file tagspec ends up referring to no files at all. You can also return 2 to indicate that there may be files available, but that you aren't supplying a tagspec in tshmsg yet -- you'll do that in TSHNXT.

TSHNXT - Next file in multi-file spec

This continues the work that TSHSCN started. Return 1 if there are more single-file tagspecs, and store the next one in tshmsg. Return 0 if there are no more files. Return 2 if there may be more files, but you want to be called again to make a tagspec out of them. This may help simplify certain multi-file breaking-down schemes.

See the example module source code starting on page 131 for a way to do TSHSCN and TSHNXT with fndlst() and fndnxt() (see page 183 about the routines themselves). For your convenience, ftuptr->fb is a user-specific "fndblk" structure that you can use with fndlst() and fndnxt() in this context.

TSHBEG - Begin downloading this file

Verify that the user is allowed to download this file. If not, put a reason in tshmsg (a complete sentence, as in "You don't have access rights to that file.") and return 0.

Here are some things you might check for:

- Does the file name have the proper syntax?
- Does the file name conflict with a reserved name?
- Does the user have permission to download this file?
- Are too many users opening files at once (thereby using up all file handles)?
- Can this user afford the download charges, if any?
- Is another user currently modifying/uploading/deleting this file?

If downloading is OK, store the DOS path for the file in tshmsg and return 1. In case this protocol can communicate file names, put the file name into ftfscb->fname. For example, if downloading with ZMODEM, this file name will be the one used on the user's terminal. It doesn't have to be the same as the one used on the BBS, but it usually is.

There is another special option in the TSHBEG exit point. You can return -1 to indicate "the file is not yet available for download, but it will be later". The file won't be downloaded during *this* download session, but it will remain tagged for download, and can be downloaded later. This is used to accomodate files that are not instantly available, such as those on a multi-disk CD ROM drive (as opposed to those that are, such as on your hard disk).

TSHEND - File download was successful

You may wish to record the download, or charge the user for it at this point. Use this exit point to cancel whatever reserving was done in the TSHBEG entry point. For example, if you had some scheme for preventing the Sysop from deleting this file while this user was downloading it, now's the time to recognize that it's OK to delete the file. The return value doesn't matter, but it's a good practice to return 0 for future expansion.

You can count on the fact that for every TSHBEG call there will be exactly one TSHEND or TSHSKP call. The only exception would be a very abrupt termination like a power-loss.

TSHSKP - This file download aborted

Here you'll need to do the same "unreserving" that is done in the TSHEND exit point. You may also wish to make some record of the aborted download.

TSHFIN - End of downloading session

This is the most important exit point -- the one where FTF turns control back over to your application. Be sure to restore your usrptr->state and usrptr->substt, and prompt the user for what comes next.

If your application supports file tagging, you should recognize that TSHFIN only means that the file transfer service is done controlling this user's session for the moment. The user may still cause your your download handler to get called for this same tagspec later, with any of the cases *except* TSHFIN and TSHHUP. This could happen for example when the user tries to log off, and is given a chance to download all files that he has tagged.

In ftfscb->actfil you'll find a count of the total number of files successfully downloaded. In ftfscb->tryfil is the total files that we *tried* to download. Of course it's always the case that actfil <= tryfil. When actfil < tryfil, not all the files made it. The user has already seen a report about this, including why the last transfer aborted, or why the last of possibly several files were skipped.

Since you're taking back control of this channel, it's up to you to set things straight for what's up next for this user. Here are two alternatives:

You want control back

- Restore your usrptr->state
- Restore your usrptr->substt
- Prompt the user (you don't need to call outprf())
- Return 1

You want to return to the parent menu

- Restore your usrptr->state
- Say bye to the user if you wish (you don't need to call outprf())
- Return 0

Either way, if you're prompting or saying goodbye using prfmsg(), you need to be sure to set your message block pointer using setmbk().

The pseudo-code for TSHFIN handling on page 124 assumes you want to take control back. Here's an alternative of the TSHFIN exit point to allow you to exit to your module's parent menu page:

```
case TSHFIN:                        /* End of downloading session      */
     usrptr->state=your state
     prompt (exiting);                   /* (don't call outprf())      */
     rc=0;
     break;
```

This may be appropriate if your module really doesn't want to regain control of the channel when the download is done. In this case you only need to restore the user's state code (module number), not the substate. Your module never actually regains control of the user's channel. You can prompt him with some parting words, but you don't need to. For consistency you should do whatever you normally do when the user exits from your module to the parent menu.

In the case where you're supposedly retaking control, you may have to call condex(), and possibly wind up returning control to your parent Menu Tree menu afterall. This would be the case if you were about to return to your module's own internal main menu, and you found out you had gotten where you are through command concatenation. See page 78 about this whole condex() business.

Another handy feature of the file transfer service is that each ftgsbm() invocation that returns 1 is followed (eventually) by exactly one TSHFIN or TSHHUP exit point invocation, except in dire cases (power loss for example).

TSHHUP - Channel hanging up

Use this exit point to clean up your affairs in case the user hangs up or the channel disconnects while the user is in the download session. This only occurs in place of a TSHFIN, and will probably not be called if one of your files is tagged for download and the actual download is interrupted by a disconnect. In that case, TSHFIN had long since been called, after the user tagged the file.

If a disconnect occurs in the middle of downloading a file the user *didn't* tag for download (he asked to download it immediately), then a TSHSKP exit point will be called first, to properly terminate the download, before TSHHUP is called.

See the discussion on the upload handler exit point FUPHUP on page 113 about making sure your module's cleanup code executes exactly once for users in your module.

Downloading Example #1

```
/*****************************************************************************
 *                                                                           *
 *   GALDNX.C                                                                *
 *                                                                           *
 *   Copyright (C) 1994 GALACTICOMM, Inc.    All Rights Reserved.            *
 *                                                                           *
 *   Downloading example.                                                    *
 *                                                                           *
 *                                          - R. Stein  12/6/93              *
 *                                                                           *
 *****************************************************************************/

#include "gcomm.h"
#include "majorbbs.h"
#include "filexfer.h"

STATIC int dnlinp(void);
STATIC int tshdnl(int tshcod);

int dnlstt;                             /* Downloading module state number */
struct module dnlmodule={"",NULL,dnlinp,dfsthn,NULL,NULL,NULL,NULL,NULL,NULL};

void EXPORT
init_downloader(void)                   /* Downloader initialization       */
{
     strcpy(dnlmodule.descrp,gmdnam("GALDNX.MDF"),MNMSIZ);
     dnlstt=register_module(&dnlmodule);
}

STATIC int
dnlinp(void)                            /* Downloader input handler        */
{
     int rc=1;

     switch (usrptr->substt) {
     case 0:
          prf("Name of file to download: ");
          usrptr->substt=1;
          break;
     case 1:
          if (margc == 0) {
               rc=0;
          }
          else if (ftgnew() == 0) {
               ftgsbm("");              /* use warning feature of ftgsbm() */
               rc=0;
          }
          else {
               strcpy(ftgptr->tagspc,margv[0],TSLENG);
               ftgptr->tshndl=tshdnl;
               ftgsbm("?");
          }
     }
     outprf(usrnum);
     return(rc);
}

int
tshdnl(                                 /* Handle the application-specific */
int tshcod)                             /* aspects of your downloads       */
{                                       /* (tshcod=code for each aspect)   */
     int rc=0;

     switch(tshcod) {
     case TSHVIS:                       /* Visible to this user?           */
          rc=1;
          break;
     case TSHDSC:                       /* Describe the file(s) in English */
          sprintf(tshmsg,"file %s",ftgptr->tagspc);
          break;
     case TSHBEG:                       /* Begin downloading this file     */
          sprintf(tshmsg,"DNLDIR\\%s",ftgptr->tagspc);
          strcpy(ftfscb->fname,ftgptr->tagspc);
          rc=1;
          break;
     case TSHFIN:                       /* End of downloading session      */
          usrptr->state=dnlstt;
```

```
        }
        return(rc);
    }
```

This simple module allows users to download files from the DNLDIR subdirectory of the BBS. Users of this service type in a.file name (that they must know somehow), and choose a protocol to download it.

init_downloader()

This routine registers the downloading module using the description in the GALDNX.MDF file.

dnlinp()

This routine handles text line input from the user after he selects this download service. Upon entry, the user is prompted for the file name. If he types RETURN, he's returned to the parent menu page without any downloading. If there is no room to download any more files because the user's tag table is completely full, then the user is notified (ftgsbm() does this) and he's also returned to the parent menu.

Otherwise, the tagspec structure is simply the file name, and it's copied to the tagspec in the current tag table entry that ftgnew() identified for us. Neither the FTGWLD nor FTGABL flags are set, indicating that these will be single-file non-taggable downloads. The call to ftgsbm() turns control over to the file transfer service and a list of protocols is presented to the user.

tshdnl()

The TSHVIS exit point declares that all files are visible if they exist. The description for the file will be "file <*filename*>". In the TSHBEG exit point the path and protocol names are passed to FTF. There are no TSHEND, TSHSKP, or TSHHUP exit points coded, because they only need to return 0 and do nothing else. TSHFIN restores the usrptr->state and returns 0, telling FTF to return control to the parent menu.

Potential Improvements to Download Example #1

Here are some of the features left out of this brief example that you should consider if you are using downloads in your application:

- Viewing the contents of compressed files, such as .ZIP files
- Multiple-file downloads
- Checking for conflicts between the file name and DOS devices
- Checking for attempts to download files like DNLLIB\..\BBS.BAT
- File tagging
- Concatenated commands
- Allowing "X" to exit
- Telling the user what files are available in the directory
- Sysop-configurable prompts an .MSG file
- Sysop-configurable download directory
- Full module structure in source code, with comments

All of these features are included in download example #2.

Downloading Example #2

```
/*****************************************************************************
 *                                                                           *
 *   GALDNX2.C                                                               *
 *                                                                           *
 *   Copyright (C) 1994 GALACTICOMM, Inc.    All Rights Reserved.            *
 *                                                                           *
 *   Downloading example.                                                    *
 *                                                                           *
 *                                          - R. Stein  12/6/93              *
 *                                                                           *
 *****************************************************************************/

#include "gcomm.h"
#include "majorbbs.h"
#include "filexfer.h"
#include "galdnx2.h"

STATIC int dnlinp(void);
STATIC int fllist(void);
STATIC int tshdnl(int tshcod);
STATIC void dnlfin(void);

int dnlstt;                         /* Downloading module state number      */
static FILE *dnlmb;                 /* file pointer for GALDNX2.MCV         */
char *dnldir;                       /* DNLDIR download directory            */

struct module dnlmodule={           /* module interface block               */
     "",                            /*    name used to refer to this module */
     NULL,                          /*    user logon supplemental routine   */
     dnlinp,                        /*    input routine if selected         */
     dfsthn,                        /*    status-input routine if selected  */
     NULL,                          /*    "injoth" routine for this module  */
     NULL,                          /*    user logoff supplemental routine  */
     NULL,                          /*    hangup (lost carrier) routine     */
     NULL,                          /*    midnight cleanup routine          */
     NULL,                          /*    delete-account routine            */
     dnlfin                         /*    finish-up (sys shutdown) routine  */
};

void EXPORT
init_downloader(void)               /* Downloader initialization            */
{
     strcpy(dnlmodule.descrp,gmdnam("GALDNX2.MDF"),MNMSIZ);
     dnlstt=register_module(&dnlmodule);
     dnlmb=opnmsg("GALDNX2.MCV");
     dnldir=stgopt(DNLDIR);
}

STATIC int
dnlinp(void)                        /* Downloader input handler             */
{
     int rc=1;

     setmbk(dnlmb);
     if (margc == 1 && sameas(margv[0],"X")) {
          return(0);
     }
     do {
          bgncnc();
          switch (usrptr->substt) {
          case 0:
               cncchr();
               if (!fllist()) {
                    cncall();
                    rc=0;
               }
               prfmsg(usrptr->substt=FLNAME);
               break;
```

```
            case FLNAME:
                 cncall();
                 parsin();
                 if (margc == 0 || sameas(margv[0],"?")) {
                      fllist();
                      prfmsg(FLNAME);
                 }
                 else if (rsvnam(margv[0])
                       || strchr(margv[0],':') != NULL
                       || strchr(margv[0],'\\') != NULL
                       || strstr(margv[0],"..") != NULL) {
                      prfmsg(FLRSV);
                      prfmsg(FLNAME);
                 }
                 else if (ftgnew() == 0) {
                      ftgsbm("");          /* use ftgsbm() to say out-of-tags */
                      rc=0;
                 }
                 else {
                      stzcpy(ftgptr->tagspc,margv[0],TSLENG);
                      ftgptr->tshndl=tshdnl;
                      ftgptr->flags=FTGABL;
                      if (strchr(margv[0],'?') != NULL
                       || strchr(margv[0],'*') != NULL) {
                          ftgptr->flags|=FTGWLD;
                      }
                      rc=ftgsbm(margc > 1 ? margv[1] : "?");
                 }
            }
       } while (!endcnc());
       outprf(usrnum);
       return(rc);
}

STATIC int
fllist(void)                              /* Display listing of files       */
{
       struct fndblk fb;

       if (!fnd1st(&fb,spr("%s*.*",dnldir),0)) {
            prfmsg(FLNONE);
            return(0);
       }
       prfmsg(FLHEAD);
       do {
            prfmsg(FLLINE,fb.name,l2as(fb.size),ncdate(fb.date),nctime(fb.time));
       } while (fndnxt(&fb));
       return(1);
}

int
tshdnl(                                   /* Handle the application-specific */
int tshcod)                               /* aspects of your downloads       */
{                                         /* (tshcod=code for each aspect)   */
       int rc=0;
       FILE *fp;

       setmbk(dnlmb);
       switch(tshcod) {
       case TSHDSC:                       /* Describe the file(s) in English */
            sprintf(tshmsg,"file %s",ftgptr->tagspc);
            break;
       case TSHVIS:                       /* Visible to this user?           */
            if (ftgptr->flags&FTGWLD) {
                 rc=fnd1st(&ftuptr->fb,ftgptr->tagspc,0);
                 break;
            }
            if ((fp=fopen(spr("%s%s",dnldir,ftgptr->tagspc),FOPRB)) != NULL) {
                 fread(tshmsg,1,TSHLEN,fp);
                 rc=1;
            }
            break;
       case TSHSCN:                       /* Break down multiple filespec    */
            if (fnd1st(&ftuptr->fb,spr("%s%s",dnldir,ftgptr->tagspc),0)) {
                 strcpy(tshmsg,ftuptr->fb.name);
                 rc=1;
            }
            break;
```

```
        case TSHNXT:                        /* Next file in multi-file spec    */
             if (fndnxt(&ftuptr->fb)) {
                  strcpy(tshmsg,ftuptr->fb.name);
                  rc=1;
             }
             break;
        case TSHBEG:                        /* Begin downloading this file     */
             sprintf(tshmsg,"%s%s",dnldir,ftgptr->tagspc);
             strcpy(ftfscb->fname,ftgptr->tagspc);
             rc=1;
             break;
        case TSHFIN:                        /* End of downloading session      */
             usrptr->state=dnlstt;
        }
        return(rc);
}

STATIC void
dnlfin(void)                                /* Finalize downloading example    */
{
     clsmsg(dnlmb);
}
```

Here are the CNF options for download example #2:

```
LEVEL4 ()

 This is the directory for the files to download.
 Be sure to specify a proper path PREFIX (e.g.
 ending with a backslash, or whatever)

DNLDIR (DNLDIR\) S 0 Download directory:


LEVEL6 ()


FLHEAD (<ESC>[0;1;32m
Files available:

) T Download example II file listing header


FLLINE (<ESC>[0;1;36m%-12.12s<ESC>[33m %10s %8s %-5.5s
) T Download example II file listing line


FLNONE (<ESC>[0;1;35m
No files are available for download.
) T Download example II no files available


FLNAME (<ESC>[0;1;36m
Name of file(s) to download: ) T Download example II file name prompt


FLRSV (<ESC>[0;1;35m
That's not a valid file name
) T Download example II file name invalid
```

This code, plus support files, is available for download on the Galacticomm Demo system in the file GALDNX2.ZIP. (Note: <ESC> represents the ASCII escape code '\x1B'.)

Here's what the module would look like online:

```
TOP (TOP)
Make your selection (T,I,F,E,L,A,P,R,D,O,W,U,N,S,? for help, or X to exit): D

Files available:

LOADER.BAT          1524 11/26/93 20:00
DPATCH.ZIP         57001 12/07/93 12:26
GALCONDL.ZIP        4162 12/07/93 16:05
DINSTALL.BAT         237 12/02/93 13:31

Name of file(s) to download: *.ZIP

   L ... Listing (a screen at a time)    Z ... ZMODEM
   A ... ASCII (continuous dump)         ZR... ZMODEM (resume after abort)
   B ... YMODEM Batch                    K ... Kermit / Super Kermit
   G ... YMODEM-g
   T ... Tag file(s) for later download

   (Add '!' to automatically log off when done)

Choose a download option (or 'X' to exit): Z

(Hit Ctrl-X a few times to abort)
Beginning ZMODEM download of the file *.BAT
rz
**B00000000000000
```

(downloading takes place)

```
***  DOWNLOAD COMPLETE  ***

TOP (TOP)
Make your selection (T,I,F,E,L,A,P,R,D,O,W,U,N,S,? for help, or X to exit): _
```

init_downloader()

This function registers the GALDNX2 module, opens the GALDNX2.MCV file, and reads in the Sysop-configured download directory prefix.

dnlinp()

This text-line input handling function returns to the parent menu if the user enters "X" and otherwise uses command concatenation routines to parse user input. When a user enters this module he's given a list of the files available (more on fllist() below), and asked to type in the name of a file, or file specification with wildcards, to download.

If he replies with "?" he's given the list of files again. If the name he gives is reserved, like "CON.TXT", then he is warned and reprompted for a file name.

An entry in the tag table is obtained, if available, by ftgnew(). In this example, the use of wildcard characters '?' or '*' in the file name signifies a multi-file download, and the FTGWLD flag is set. The FTGABL flag is always set. If the user concatenated a protocol code after his file specification, that is passed to ftgsbm(). Otherwise, a list of protocols is requested. FTF will handle invalid protocol codes with a warning and a list of the available codes.

fllist()

This function scans through the files in the download directory and lists them on the user's terminal, with file size, date, and time.

The size of the output buffer (offline Hardware Setup option OUTBSZ) effectively limits the number of files that can be put online for download. With OUTBSZ set to 4096, you can probably handle somewhere around 100 files. Much more than that, and the output buffer will overflow.

tshdnl()

Here the description is the same simple "file <*filename*>". Multi-file tagspecs are "visible" if any matching files exist. Single-file tagspecs are visible if the file can be opened, and if so, the first TSHLEN bytes are read in so the "V" protocol can be supported.

The TSHSCN and TSHNXT exit points use the classic technique for breaking down multi-file tagspecs into single files: fndlst() and fndnxt(). In each case a single-file tagspec (the file name) is copied into tshmsg.

There are no security restrictions on the files in the download directory. In the TSHBEG exit point, the path is constructed in tshmsg, and the protocol name is copied to ftfscb->fname.

The TSHFIN exit point just restores the state code and returns 0, indicating that control should return to the download module's parent menu page when downloading is complete.

File Transfer Protocol

To define a file transfer protocol for The Major BBS:

1. Define a file transfer protocol specification structure. Here is an example of the structure for XMODEM-CRC downloads.

```
struct ftfpsp ftpxcx={                          /* XMODEM-CRC transmitting */
     NULL,
     "C",                                  /* 1-3 code letters for protocol */
     "XMODEM-CRC",                                    /* name of protocol */
     FTFXMT+FTFXTD,                              /* protocol capability flags */
     sizeof(struct xymdat),          /* total length of session control block */
     3*16,       /* .byttmo                            default byte timeout */
     10*16,      /* .paktmo                          default packet timeout */
     10,         /* .retrys                            default max retries */
     1L,         /* .window   max window size (packets/bytes as appropriate) */
     128,        /* .paksiz                        packet size 0=auto-figure */
     xyxini,     /* .initze()    Initialize this protocol (recompute scblen) */
     xcxsrt,     /* .start()                                  Start a transfer */
     xyxctn,     /* .contin()              Continuously call, 1=more, 0=done */
     xyxinc,     /* .hdlinc()                      Handle one incoming byte */
     NULL,       /* .hdlins()                  Handle incoming line of text */
     ftfabt,     /* .term()         Initiate graceful termination of transfer */
     ftfxca,     /* .abort()  Immediately unconditionally abort the transfer */
     ftfinbc,    /* .hdlinb()               Handle an array of incoming bytes */
     "",         /* .secur                 App-specific security of some kind */
     {0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0}
};
```

Here are the protocol capability flags:

```
/*--- File Transfer Protocol Capability and Characteristic Flags ---*/

#define FTFXMT 0x01                     /* Transmit protocol (versus receive) */
#define FTFASC 0x02                  /* ASCII-session (versus binary-session) */
                                    /* where '\r' is the sole line terminator */
                                 /* note: ASCII sessions do not detect errors */
#define FTFMUL 0x04                           /* capable of multiple files? */
#define FTF7BT 0x08                    /* capable of using 7-bit data path? */
#define FTFASF 0x10                      /* ASCII-file (versus binary-file) */
                                    /* where '\n' is the sole line terminator */
#define FTFAFN 0x40                    /* abort is final, don't ask "try again?" */
#define FTFXTD 0x80             /* extended ftfpsp structure (flags2 & hdlinb) */
```

See FTF.H for more details. See FTFXYMD.C for the full implementation of XMODEM. See FTF*.C for examples of the implementation of other file transfer protocols. The 'F' file import/export file transfer "protocol" is implemented in FILEXFER.C with lots of cheating.

2. Register the structure in your init_xxx() routine using ftplog():

```
ftplog(fptr);
```

where fptr is a pointer to the structure from step 1. The new protocol will appear in the appropriate lists with all the other protocols.

6. OPERATOR INTERFACE

Video Output (printf())

Every DOS program that has any need for speed must write directly to the video screen memory. Our method is to replace the standard library version of the "printf()" function with our own. We also provide windowing, cursor positioning, colors, invisible screen-image updating (so that, for example, we can update both the main console and two channel emulation screens simultaneously), and a few other miscellaneous functions. All of these routines are available in GCOMM.LIB.

```
printf(ctlstg,p1,p2,...,pn);     substitute for standard printf()
char *ctlstg;                      control string, functions
                                      supported are %s,%c,%d,%u,%x,
                                      all of them with field len,
                                      zero or blank fill, left/right
                                      justification options.
TYPE p1,p2,...,pn;                 just like printf/cprintf parms.
                                      (note: no "longs" or "floats")
```

There is no limit to the number of parameters (p1,p2,...,pn) than you may pass to printf(). They should correspond one-for-one with the "%" directives in the control string. See page 141 for a description of the ANSI graphics capability of printf().

```
setatr(attrib);                  sets video attributes
int attrib;                        attribute code: sum of...
                                          0x80 = blink foreground
                                          0x40 = red background
                                          0x20 = green background
                                          0x10 = blue background
                                          0x08 = bright foreground
                                          0x04 = red foreground
                                          0x02 = green foreground
                                          0x01 = blue foreground
```

Another way to compute the attribute is to add together three numbers, one from each of these columns:

Foreground Attribute	+	Background Attribute	+	Blink
0x00 Black		0x00 Black		0x00 non-blinking
0x01 Dark blue		0x10 Dark blue		0x80 blinking
0x02 Green		0x20 Green		foreground
0x03 Cyan (blue-green)		0x30 Cyan (blue-green)		
0x04 Red		0x40 Red		
0x05 Magenta (purple)		0x50 Magenta (purple)		
0x06 Brown		0x60 Brown		
0x07 Grey		0x70 Grey		
0x08 Dark Grey				
0x09 Bright blue				
0x0A Bright green				
0x0B Bright cyan				
0x0C Bright red				
0x0D Bright magenta (pink)				
0x0E Bright yellow				
0x0F Bright white				

This function affects subsequent printf()'s. You can change the background color of the entire screen, for example to magenta, by coding:

```
setatr(0x5E);
printf("\f");
```

Then all subsequent printf()'s will show bright yellow on magenta. The clreol() function also sets the background color for the remainder of the line according to the latest setatr() attribute.

See page 142 for converting IBM screen attribute codes into ANSI color coding sequences.

See page 164 for what setatr() does on monochrome screens.

```
setwin(scn,xul,yul,xlr,ylr,sen); set window parameters
char *scn;                         seg:off start addr of screen
                                      (if NULL, default display)
int xul;                           upper left x coord
int yul;                           upper left y coord
int xlr;                           lower right x coord
int ylr;                           lower right y coord
int sen;                           scroll enable (1=yes)

rstwin();                        restore previous window parameters
```

The setwin() function defines a window on the screen. All coordinates are inclusive (they are inside the window). The "scn" parameter can be used to direct all subsequent screen output to a SCNSIZ-byte buffer (SCNSIZ is 4000) instead of to the visible video memory. Make "scn" NULL for the default condition of writing directly to video memory. The "sen" parameter, when 1, means that when you printf() a newline ('\n') on the last line of the window, the entire window gets scrolled up one line (and the bottom line is filled with the current setatr() background attribute). When "sen" is 0, then a newline has the same effect as a carriage return ('\r') on the bottom line of the window. The rstwin() function undoes the effect of the most recent setwin() call.

```
scnstt=frzseg();                    get video ram base address
char *scnstt;                         seg:off start addr of screen

unfrez();                           release video ram address (in a
                                      multitasking environment).
```

The frzseg() function returns a pointer to the physical video memory (or in some multitasking environments, to the "hidden" screen).

The unfrez() function releases the memory indicated by frzseg() (that is, the "scnstt" return value of frzseg() should not be used after calling unfrez()). This is only required in certain multitasking environments that permit writing directly to screen memory. Even so, since printf() calls both frzseg() and unfrez() (when the first parameter in the most recent call to setwin() was NULL), you may not need to call unfrez() at all -- just wait until the next printf().

To blank out a SCNSIZ-byte screen buffer area:

```
scblank(buffer,attr);               Blank the screen buffer memory
char *buffer;                         SCNSIZ-byte buffer (4000 bytes)
char attr;                            Attribute to use
```

2000 spaces with the specified attribute are written to the buffer.

```
scnstt=auxcrt();                    get auxiliary CRT address
char *scnstt;                         pointer to auxiliary screen address

locate(x,y);                        move cursor to x,y
int x;                                dest x (0=left-most column)
int y;                                dest y (0=top line)

rstloc();                           restore previous cursor location

x=curcurx();                        get current cursor x coordinate
int x;

y=curcury();                        get current cursor y coordinate
int y;
```

The locate() function moves the video cursor to a new location. Even if setwin() has directed video output to an invisible buffer, the visible cursor may still move to track the locate() function (see cursact() on page 140). The rstloc() function undoes the effect of the most recent locate() call. All cursor positions are relative to the upper left corner of the display buffer (not to the upper left corner of the setwin() window).

```
clreol();                           clear to end of line (in window)
```

This function clears from the cursor position to the right margin of the current window, setting the background attribute for this line segment to the current setatr() attribute.

```
printfat(x,y,ctlstg,p1,...,pn);  combination of locate() and printf()
                                   into one routine (saves code space)
int x,y;                           screen coordinates
char *ctlstg;                      control string
p1,...,pn                          parameters (max 8 bytes)
```

This routine is just like printf(), except that the control string is preceded by a screen position. The parameters (p1,...,pn) can be no more than 8 bytes.

The following routines are like printfat(), except you can set an origin and specify offsets:

```
proff(xbase,ybase);              set origin for prat() locations
int xbase,ybase;

prat(x,y,ctlstg,p1,...,pn);      combination of locate() and printf()
int x,y;                           screen coordinates (relative to
                                   the most recent proff() setting)
char *ctlstg;                      control string
p1,...,pn                          parameters (max 12 bytes)
```

The explode() family of routines (page 162) calls proff() to set the upper left corner of the exploded region. Then the choose() family (page 166) and edtval() (page 164) routines use prat() so that their coordinates are relative to the upper left corner of the exploded region.

```
cursact(movit);                  enable moving of blinking cursor
int movit;                         1=move blinking cursor, 0=still
```

This routine selects whether the locate() routine will move the actual visible cursor or not. Whatever you pass to cursact(), locate() will still select the location written to by printf(), etc. But with cursact(0), the blinking cursor will remain stationary. cursact(1) is the default condition.

```
belper(pitch);                   beep the operator console
int pitch;                         0=silent 200-1000 high-low pitch
```

This routine defines the handling of printf() when sending an ASCII BEL character to the operator console. This will probably be a much shorter beep than DOS uses. For example:

```
belper(200);
printf("\7");       /* high-pitched beep */
belper(1000);
printf("\7");       /* low-pitched beep */
belper(150);
printf("\7");       /* very high-pitched beep */
belper(0);
printf("\7");       /* silent */
```

The belper() routine is used in The Major BBS to set the signup notification (SGNBEL), the page-sysop warning (SOPBEL), and the emulation screen beep (EMUBEL).

```
ansion(on);                      enable/disable ANSI graphics
int on;                            1=process ANSI graphics sequences
                                   0=ignore ANSI graphics sequences
                                     (display as literal)
```

This function turns on or off the interpretation by printf() of ANSI graphics characters embedded in the text stream. The following ANSI commands are supported when ansion(1) (the non-default condition) is in effect:

<ESC> [<row> ; <column> H	Move cursor to <row>,<column>
<ESC> [<row> ; <column> f	Move cursor to <row>,<column>
<ESC> [<nrows> A	Move cursor up <nrows> rows
<ESC> [<nrows> B	Move cursor down <nrows> rows
<ESC> [<ncols> C	Move cursor forward <ncols> columns
<ESC> [<ncols> D	Move cursor backward <ncols> columns
<ESC> [s	Save cursor position
<ESC> [u	Restore cursor position
<ESC> [2 J	Erase display
<ESC> [K	Erase to the end of the current line
<ESC> [0 m	Normal display attribute
<ESC> [1 m	Bold display attribute
<ESC> [4 m	Underscore display attribute
<ESC> [5 m	Blink display attribute
<ESC> [7 m	Reverse display attribute
<ESC> [8 m	Invisible display attribute
<ESC> [3 0 m	Black foreground
<ESC> [3 1 m	Red foreground
<ESC> [3 2 m	Green foreground
<ESC> [3 3 m	Yellow foreground
<ESC> [3 4 m	Blue foreground
<ESC> [3 5 m	Magenta foreground
<ESC> [3 6 m	Cyan foreground
<ESC> [3 7 m	White foreground
<ESC> [4 0 m	Black background
<ESC> [4 1 m	Red background
<ESC> [4 2 m	Green background
<ESC> [4 3 m	Yellow background
<ESC> [4 4 m	Blue background
<ESC> [4 5 m	Magenta background
<ESC> [4 6 m	Cyan background
<ESC> [4 7 m	White background

Notes

None of the above commands include any spaces.

<ESC> the ASCII escape code '\x1B'.

<row> one or two ASCII digits representing the screen row, between 1 and 25. Defaults to 1 if omitted.

<column> one or two ASCII digits representing the screen column, between 1 and 80. Defaults to 1 if omitted.

<nrows> one or two ASCII digits representing the number of screen rows, between 1 and 25. Defaults to 1 if omitted.

<ncols> one or two ASCII digits representing the number of screen columns, between 1 and 80. Defaults to 1 if omitted.

The ";" may be omitted if the <column> parameter is omitted.

The "m" commands (display attribute) may be combined using semicolons. For example:

```
<ESC> [ 1 m <ESC> [ 3 3 m <ESC> [ 4 5 m
```

has the same effect as:

```
<ESC> [ 1 ; 3 3 ; 4 5 m
```

Both of these set the display attribute to bright yellow on magenta. You could use the following code to display a message with these settings in the current display window:

```
printf("\33[1;33;45mWafer yield for the 128 MHz 80586:  95%");
```

The individual characters of the above commands may be split across different calls to printf(). There may even be intervening calls to printf() as long as the intervening calls have ansion(0) (ANSI graphics disabled). Also, the display attribute is preserved across calls to setatr() when ansion(0). All of these features enable the emulation of a single user's channel with ANSI graphics while The Major BBS simultaneously updates various other information on the console. For more on how The Major BBS emulates *multiple* screens at once, see page 143.

Note: the move cursor command is relative to the upper left corner defined in the most recent call to setwin() (not to the upper left corner of the screen buffer, as is the locate() function).

To convert IBM display attributes into ANSI sequences, use ibm2ans():

```
bufptr=ibm2ans(attr,buffer);        Convert IBM attribute to ANSI colors
char *bufptr;                       copy of buffer
char attr;                          attribute (see page 138)
char *buffer;                       where to put ANSI sequence (up to
                                    15 bytes, including terminator)
```

The following coded example shows some of these video routines in action. The zipred() function makes a red box with an exclamation point zip across the screen from left to right, and then disappear. Note that the image (of the original screen with a red box on it) is constructed in a buffer and then copied to the visible screen, so the red box does not "flicker".

```
void
zipred(void)
{
     static char savebf[4000]; /* buffer to save original screen image */
     static char drawbf[4000];     /* buffer to use as a drawing board */
     char *frzseg();               /* frzseg() returns a char pointer! */
     int savx,savy;                          /* to save cursor position */
     int x;

     savx=curcurx();                           /* save cursor position */
     savy=curcury();
     movmem(frzseg(),savebf,4000);               /* save screen image */
     setatr(0x4F);                             /* bright white on red */
     for (x=0 ; x < 70 ; x++) {                /* From left to right... */
          movmem(savebf,drawbf,4000);          /* prepare drawing board */
          setwin(drawbf,x,9,x+10,15,0);    /* define an 11 by 7 window */
          printf("\f");                          /* fill it with red */
          locate(x+5,12);                       /* and in the center */
          printf("!");                               /* put an "!" */
          rstwin();                        /* (restore window settings) */
          movmem(drawbf,frzseg(),4000);    /* make this picture visible */
     }
     movmem(savebf,frzseg(),4000);    /* restore original screen image */
     locate(savx,savy);                    /* restore cursor position */
     setatr(0x07);                                 /* white on black */
     unfrez();
}
```

To read from the video screen or buffer, you can use scnoff():

```
offset=scnoff(x,y);              Compute the offset
int offset;
int x,y;
```

For example, to find the character and attribute at the lower right corner of a SCNSIZ-byte screen buffer:

```
lrchar=scnbuf[scnoff(79,24)];
lrattr=scnbuf[scnoff(79,24)+1];
```

Writing to Several ANSI Screens at Once

To support ANSI capability on several screens at once, you must save some internal variables. The printf() routine only supports one screen and can keep track of partial ANSI commands. To support several screens, you must save the entire curatr structure. (Note that curatr is the name for a structure type as well as the name of an instance of that structure type.)

For example, you could maintain an array of curatr structures and make one of them "active" whenever you wrote to one of the screens.

```
struct curatr ansave[NUMSCNS];
:
movmem(&ansave[actscn],&curatr,sizeof(struct curatr));
printf(ANSI commands to screen);
movmem(&curatr,&ansave[actscn],sizeof(struct curatr));
```

The first movmem() puts the curatr structure for the active screen where printf() will use it and update it. The second movmem() saves it away again.

(Note: curatr.attrib is the attribute setting of the most recent setmbk.)

Keyboard Input (getchc())

```
yes=kbhit();                    Has the operator hit a key?
int yes;                          1=yes 0=no
```

After checking the standard library routine kbhit(), The Major BBS uses this routine to input a single keystroke.

```
char=getchc();                  Get a keystroke from the keyboard
int char;
```

Note that getchc() returns a 16-bit value. GCOMM.H contains numerous constants for the return value of getchc(). The values are either extended ASCII in the lower 8 bits, or the keyboard scan code in the upper 8 bits.

Here are appropriate constants for representing the return values of getchc() (you can use these in the C-language cases of a switch statement):

```
' ' through '~'          (for the printable ASCII characters)

'\x00' through '\xFF'    (for all extended ASCII characters)
```

F1	SHIFT+F1	CTRL+F1	ALT+F1
F2	SHIFT+F2	CTRL+F2	ALT+F2
F3	SHIFT+F3	CTRL+F3	ALT+F3
F4	SHIFT+F4	CTRL+F4	ALT+F4
F5	SHIFT+F5	CTRL+F5	ALT+F5
F6	SHIFT+F6	CTRL+F6	ALT+F6
F7	SHIFT+F7	CTRL+F7	ALT+F7
F8	SHIFT+F8	CTRL+F8	ALT+F8
F9	SHIFT+F9	CTRL+F9	ALT+F9
F10	SHIFT+F10	CTRL+F10	ALT+F10

HOME	CTRLHOME	BAKTAB
END	CTRLEND	INS
PGUP	CTRLPGUP	DEL
PGDN	CTRLPGDN	TAB
CRSRLF	CTRLLF	ESC
CRSRRT	CTRLRT	
CRSRUP	CTRLUP	
CRSRDN	CTRLDN	

ALT_A	ALT_K	ALT_U	ALT_0
ALT_B	ALT_L	ALT_V	ALT_1
ALT_C	ALT_M	ALT_W	ALT_2
ALT_D	ALT_N	ALT_X	ALT_3
ALT_E	ALT_O	ALT_Y	ALT_4
ALT_F	ALT_P	ALT_Z	ALT_5
ALT_G	ALT_Q		ALT_6
ALT_H	ALT_R		ALT_7
ALT_I	ALT_S		ALT_8
ALT_J	ALT_T		ALT_9

The codes that these constants represent are used in many contexts, online and offline. See AIN.H for converting incoming ANSI sequences into these keystroke codes.

Cursor

To control the video screen cursor:

```
cursiz(howbig);                 Set the size of the video cursor
int howbig;                       NOCURS    cursor disappears
                                  LILCURS   small standard cursor
                                  BIGCURS   big insert-mode cursor

rstcur();                       Restore the cursor to the size
                                  it was before the last cursiz()

howbig=curcurs();               Find out how big the current cursor
                                  is.
int howbig;                       NOCURS, LILCURS, or BIGCURS
```

7. OPERATOR SERVICES

Statistics

You can add your own statistical graphs to those already available on the operator console. There are two parts to this:

1. Generating the graph
2. Displaying the graph

The first part is up to you. You could create a 4000 byte file that stores the exact display image of the statistics screen. Only a 42 by 17 character portion of that screen may be used for your graph:

> Statistics Sub-Screen
> columns 15 through 56, inclusive, out of 0 through 79
> rows 1 through 17, inclusive, out of 0 through 24

You'll create this file offline, perhaps during the nightly auto-cleanup (that's when we create the standard screens used in DFTSTATS.C).

Or you could just create a "background" file. At the moment when the Sysop brings up your screen, you can have special code that fills in all the figures or draws some kind of drawings.

The second part is up to the Sysop to do, and you to prepare for. Use the function register_stascn() to register your statistics screen. Then your screen will be available on the scrolling menu of the Statistics and Graphs screen when the BBS is on the air.

So, to register your screen:

1. Create one copy of the statsc data structure in your online code. This structure is defined in STATSCNS.H. Here is an example, with the blanks filled in:

```
struct statsc mygraph={          /* statistic screen interface structure */
     "Sat activity",             /*   name of statistic screen           */
     "DDDSTA1.BIN",              /*   file name to get screen from       */
     NULL,                       /*   initialize (bring up scn) routine  */
     NULL,                       /*   key hit handler routine            */
     NULL,                       /*   occasional update (every 60 secs)  */
     NULL,                       /*   once-per-cycle routine             */
     NULL                        /*   take down screen routine           */
};
```

The "name" appears in the menu of choices on the Statistics and Graphs screen. The 42 by 17 region of the file is displayed first (as background, or as your finished display) when the Sysop calls up your screen. Note that the statistics screen file has the Developer-ID prefix on it. All the NULLs are the non-implementation of five special purpose routines for your screen.

Here are what these routines can do:

`void (*inirou)();`	A routine to call whenever your screen should appear. The routine could make computations and display them on your screen. Of course, you should only write to the 42 by 17 character area reserved for your screen as shown above.
`unsigned (*keyhit) (unsigned scncod);`	This routine is called with each and every keystroke from the Sysop when your screen is on display. The parameter of the routine is the same as the getchc() return value (page 144). The routine should either handle the keystroke and return 0, or just return the keystroke value if it doesn't know what to do with it.
`void (*occrou)();`	This routine will get called every 60 seconds that your screen is on display. You can update your display with the up-to-the-minute information.
`void (*cycrou)();`	This routine gets called about 16 times a second when your screen is on display. If you use it (put something other than NULL here), be sure that it executes fast, so the system doesn't get bogged down updating your display.
`void (*finrou)();`	This routine gets called when your display goes away. It gets called once for each call to the inirou() routine.

2. Register the statistics screen in your initialization routine.

```
register_stascn(&mygraph);
```

This all swings into place when the Sysop switches to the statistics screen (by typing <*Alt-T*>) and selecting your statistics screen from the list of choices.

Audit Trail

To display a message in the audit trail:

```
shocst(tex1,tex2,p1,...,pN);
char *tex1;
char *text;
p1,...,pN
```

Enter a string into the Audit Trail
summary string (up to 32 chars long)
detail string, as in printf()
parameters for control string
The detail string can be up to 65 characters long. The parameters passed can take up to 12 bytes on the stack.

This function makes an an entry in the audit trail. Just the date, time and summary information appear on the Summary screen. The summary, detail and source information, along with time and date, appear on the Audit Trail Detail screen, and get written to the Audit Trail database.

Sources for Audit Trail messages
Cleanup
Event N (1 to 4)
Console
Chan NN (00 to FF)

The global variable "usrnum" is an implicit input to shocst(). It must be set to a valid user number (0 to nterms-1) or -1 to -3 (see page 39).

Channel Status Reporting

```
shochl(legend,sing,attr)

char *legend;
char sing;

int attr;
```

Show a line on the Online User Info screen
information, up to 29 characters
single-character indicator for the user matrix (Summary screen too)
IBM color display attribute

If your Add-on Option does not manage sessions or connections in some way, you probably don't want to use this routine. The convention is that the User-ID appears on the Online User Information screen and a double-arrow appears in the user matrix there and on the Summary screen.

One of the conventions of the Online User Information screen is to color-code the information based on the user's baud rate. You can do this by computing the last parameter of shochl() using baudat() (as we do many times in MAJORBBS.C).

```
attr=baudat(baud,blink)

int attr;
unsigned baud;
int blink;
```

Compute the display attribute based on the user's baud rate
IBM 8-bit display attribute
baud rate, 300 to 38400
1=give us a blinking attribute

8. DATABASES

Database Functions (xxxbtv())

Btrieve, by Novell, Inc., provides a powerful collection of database-management primitives. The Major BBS has a plethora of routines that provide a smooth C language interface.

Btrieve File Identifiers

The functions opnbtv(), setbtv(), and clsbtv() are the only functions that explicitly deal with a single database. All other database functions *implicitly* deal with a single database using the file identified by the most recent setbtv(). A Btrieve file identifier is a pointer to a structure defined in BTVSTF.H:

```
struct btvblk {                     /* btrieve file data block def   */
     long posblk[128/4];            /*   position block              */
     char *filnam;                  /*   file name                   */
     int reclen;                    /*   record length               */
     char *key;                     /*   key for searching, etc.     */
     char *data;                    /*   actual record contents      */
     int lastkn;                    /*   last key number used        */
     int keylns[SEGMAX];            /*   lengths of all possible keys*/
};

#define BTVFILE struct btvblk       /* shorthand for btrieve file id */
```

opnbtv() is the source of all Btrieve file identifiers. setbtv() is used to set the Btrieve file for all subsequent database functions.

> WARNING: You must be careful not to forget to use setbtv(). If you do, your program might seem to work fine when you test it with a single user, but fail insidiously when you try it with multiple users.

Many of the database functions have an explicit "recptr" parameter for specifying where to get or put a record for writing or reading. If you use NULL for this value then you may use a default buffer specified in the btvblk "data" field.

There are three flavors of database record read procedures. All specify a record according to a "key" or according to the order by a key.

get	Read the record. If missing, bomb (with "catastro" message)

```
query      Find out if the record is in the database
acquire    Find out if the record is in the database, and if so, read it
```

Here are synopses of the routines in PLBTVSTF.C:

```
omdbtv(mode);                          set mode for next opnbtv() call
int mode;                                see codes below
```

This routine sets the Btrieve file mode for subsequent database files opened by opnbtv(). The following mutually exclusive values for the "mode" parameter are defined in BTVSTF.H:

```
PRIMBV     default, pre-image (data integrity) mode
ACCLBV     accelerated (faster write) mode
RONLBV     read-only mode
VERFBV     write-with-verify mode
EXCLBV     exclusive (non-sharing) mode
```

```
bbptr=opnbtv(filnam,reclen);       open a Btrieve file for I/O
BTVFILE *bbptr;                      file identifier
char *filnam;                        filespec
int reclen;                          record length in bytes
```

If the file is not found, a "catastro()" error message (BTRIEVE OPEN ERROR 12) is generated automatically by opnbtv() -- you never have to check the return value for error conditions.

```
setbtv(bbptr);                         set BTVFILE ptr for subsequent ops
BTVFILE *bbptr;                          file to be used hereafter
```

This important utility specifies the Btrieve database for all other -- btv utility functions (except opnbtv() and clsbtv()). See about Btrieve File Identifiers, above.

```
rstbtv();                              restore the current BTVFILE to what
                                         it was before the corresponding
                                         recent setbtv()
```

Calls to setbtv()/rstbtv() make use of a "stack" so they can be nested up to 10 levels deep.

```
is=qrybtv(key,keynum,qryopt);      query whether a record exists
int is;                              1 if record exists, else 0
char *key;                           key to be used for lookup
int keynum;                          key position number to use
int qryopt;                          search option (used via macro)

getbtv(recptr,key,keynum,getopt); get a record (bomb if not there)
char *recptr;                        destination record buffer ptr
                                     (NULL to use bbptr->data)
char *key;                           key to be used for lookup
int keynum;                          key position number to use
int getopt;                          search option (used via macro)
```

```
is=obtbtv(recptr,key,keynum,obtopt); acquire a record (if you can)
int is;                               1 if record exists, else 0
char *recptr;                         destination record buffer ptr
                                      (NULL to use bbptr->data)
char *key;                            key to be used for lookup
int keynum;                           key position number to use
int optopt;                           search option (used via macro)
```

The above three routines are almost exclusively called out in the source code only by using macros that are defined in BTVSTF.H. For example, all the q--btv() "functions" are actually macros that generate special-purpose calls to qrybtv().

```
abspos=absbtv();                      find current "absolute" position
long abspos;                            "absolute" (direct) file position

gabbtv(recptr,abspos,keynum);         get a record by "absolute" position
char *recptr;                           destination record buffer ptr
                                        (NULL to use bbptr->data)
long abspos;                            "absolute" (direct) file position
int keynum;                             key number to establish there

is=aabbtv(recptr,abspos,keynum);      acquire a record by "absolute" position
int is;                                 1 if record could be read, else 0
char *recptr;                           destination record buffer ptr
                                        (NULL to use bbptr->data)
long abspos;                            "absolute" (direct) file position
int keynum;                             key number to establish there
```

The return value of absbtv() may be used to identify the "physical" position of a record in a database. The record may be accessed using gabbtv() or aabbtv() with that position. This type of access is much faster than any of the keyed access methods. We have determined that this absolute position value is never zero for a legitimate record. Therefore, we sometimes use 0L as a special value to represent a pointer to no record at all.

```
is=slobtv(recptr);                    Read the physically first record in
                                        the database
int is;                                 1=there was one 0=database empty

is=snxbtv(recptr);                    Read the physically next record in
                                        the database
int is;                                 1=there was one 0=already read last

is=sprbtv(recptr);                    Read the physically previous record
                                        in the database
int is;                                 1=there was one 0=already read first

is=shibtv(recptr);                    Read the physically last record in
                                        the database
int is;                                 1=there was one 0=database empty
```

These routines search the database in the physical order in which records are stored. The sequence defined by the database *keys* usually doesn't matter in this case, and neither does chronology -- records could appear in

any order. The advantage of the snxbtv()/sprbtv() routines over the qnxbtv()/qprbtv() routines (which are keyed-sequential -- see page 153) is their speed: physical access can be about eight times as fast as keyed-sequential.

Database Update Routines

```
updbtv(recptr);                 update current record
char *recptr;                     replacement record buffer ptr
                                  (NULL to use bbptr->data)

ok=dupdbtv(recptr);             (more tolerant) update current record
int ok;                           1=updated 0=duplicate collision
char *recptr;                     replacement record buffer ptr
```

These functions must be called immediately following a get-record call of some kind (queries are not enough, but gcrbtv() will suffice after a query). updbtv() and dupdbtv() are the same except that when the new record contents produce an illegally duplicate key, updbtv() bombs with a catastro() error, while dupdbtv() simply returns a 0. These routines cannot be called on a database with variable length records. Instead, use upvbtv():

```
upvbtv(recptr,length);          update variable length record
char *recptr;                     replacement record buffer ptr
                                  (NULL to use bbptr->data)
int length;                       number of bytes for new record contents
```

Database Insert Routines

```
insbtv(recptr);                 insert new fixed-length record
char *recptr;                     new record buffer ptr
                                  (NULL to use bbptr->data)

ok=dinsbtv(recptr);             (more tolerant) insert new record
int ok;                           1=inserted 0=duplicate collision
char *recptr;                     new record buffer ptr
                                  (NULL to use bbptr->data)
```

insbtv() will automatically generate a fatal error (BTRIEVE INSERT ERROR 5) if you try to insert a record with the same key as another record in a database (if that key does not allow duplicates). dinsbtv() will simply return a 0 in that case. Otherwise, the routines have identical effects.

```
invbtv(recptr,length);          insert variable length record
char *recptr;                     new record buffer ptr
                                  (NULL to use bbptr->data)
int length;                       number of bytes for new record
```

Deleting a Database Record

```
delbtv();                       delete current record
```

This function must be called immediately following a get-record call of some kind (queries are not enough, but gcrbtv() will suffice after a query).

Variable Record Length -- Just how long was it?

```
reclen=llnbtv();                    find the record length of the most
                                      recently read record
```

This function is handy after reading a variable length record to find out how many bytes are actually in the record. In that case, this is the same value that was passed to invbtv() or upvbtv() as the length parameter when the record was put into the database.

Closing a Database File

```
clsbtv(bbptr);                      close a Btrieve file when finished
BTVFILE *bbptr;                       file identifier (from opnbtv())
```

Database Query Routines

The following database utilities are implemented as macros (defined in BTVSTF.H). They actually generate calls to functions qrybtv(), getbtv(), and others.

```
is=qeqbtv(key,keynum);              query for "equal to" spec'd key
int is;                               1 if record exists, else 0
char *key;                            key specification
int keynum;                           key number involved

is=qnxbtv();                        query for "next" record in seq
int is;                               1 if record exists, else 0

is=qprbtv();                        query for "previous" record
int is;                               1 if record exists, else 0

exists=qgtbtv(key,keynum);          query for "greater than" key
int exists;                           1 if record exists, else 0
char *key;                            key specification
int keynum;                           key number involved

exists=qgebtv(key,keynum);          query for "greater/eq (>=)" key
int exists;                           1 if record exists, else 0
char *key;                            key specification
int keynum;                           key number involved

exists=qltbtv(key,keynum);          query for "less than" key
int exists;                           1 if record exists, else 0
char *key;                            key specification
int keynum;                           key number involved

exists=qlebtv(key,keynum);          query for "less/equal (<=)" key
int exists;                           1 if record exists, else 0
char *key;                            key specification
int keynum;                           key number involved

exists=qlobtv(keynum);              query for lowest record present
int exists;                           1 if record exists, else 0
int keynum;                           key number involved
```

```
exists=qhibtv(keynum);          query for highest record present
int exists;                       1 if record exists, else 0
int keynum;                       key number involved
```

The above query routines set the "key" buffer reserved for the database. For example, the following code might be used to find out if there are any users in the Registry database whose User-ID starts with the letter "Q" (see REGISTRY.C for the variables and structure of this database -- the "regrec" structure).

```
setbtv(regbb);
if (qgebtv("Q",0) && regbb->key[0] == 'Q') {
     prf("Warning!  Someone named \"%s\" is in the registry!",regbb->key);
}
```

Database Get Routines

```
geqbtv(recp,key,keynum);        get record "equal to" spec'd key
char *recp;                       destination record buffer ptr
char *key;                        key specification
int keynum;                       key number involved

gnxbtv(recp);                   get "next" record in sequence
char *recp;                       destination record buffer ptr

gprbtv(recp);                   get "previous" record in seq
char *recp;                       destination record buffer ptr

ggtbtv(recp,key,keynum);        get first record > spec'd key
char *recp;                       destination record buffer ptr
char *key;                        key specification
int keynum;                       key number involved

ggebtv(recp,key,keynum);        get first record >= spec'd key
char *recp;                       destination record buffer ptr
char *key;                        key specification
int keynum;                       key number involved

gltbtv(recp,key,keynum);        get highest record < spec'd key
char *recp;                       destination record buffer ptr
char *key;                        key specification
int keynum;                       key number involved

glebtv(recp,key,keynum);        get highest record <= spec'd key
char *recp;                       destination record buffer ptr
char *key;                        key specification
int keynum;                       key number involved

globtv(recp,keynum);            get lowest record present
char *recp;                       destination record buffer ptr
int keynum;                       key number involved

ghibtv(recp,keynum);            get highest record present
char *recp;                       destination record buffer ptr
int keynum;                       key number involved
```

```
gcrbtv(recp,keynum);              get (or re-get) "current" record
char *recp;                         destination record buffer ptr
int keynum;                         key number to establish
```

The above "get" routines read in a full record from a database. By contrast, the query routines simply tell you if the record is there, and read in the key fields.

In all of these routines you may specify where to put the data, using the "recp" parameter. You may also pass NULL for this parameter, and the data record will go into the standard data buffer for the database. Expanding upon the query example, gcrbtv() can be used to read in a database record that passed the query test:

```
setbtv(regbb);
if (qgebtv("Q",0) && regbb->key[0] == 'Q') {
     gcrbtv(NULL,0);
     prf("Warning!  Someone named \"%s\" is in the registry!",regbb->data);
     prf("\nAnd he has this to say about himself:\n\"%s\"\n",
         ((struct regrec *)regbb->data)->sumlin);
}
```

This technique of "casting" the data buffer to a special purpose structure is usually required to use this buffer, because the data field of the btvblk structure (see page 149) is just a general purpose character pointer -- you must overlay the structure of the actual database record.

Database Acquire Routines

```
is=acqbtv(recptr,key,keynum);     "acquire" record with spec'd key
int is;                             1 if record exists, else 0
char *recptr;                       destination record buffer ptr
char *key;                          key value to search for
int keynum;                         key number

is=agtbtv(recptr,key,keynum);     acquire first record > key
int is;                             1 if record exists, else 0
char *recptr;                       destination record buffer ptr
char *key;                          key specification
int keynum;                         key number involved

is=agebtv(recptr,key,keynum);     acquire first record >= key
int is;                             1 if record exists, else 0
char *recptr;                       destination record buffer ptr
char *key;                          key specification
int keynum;                         key number involved

is=altbtv(recptr,key,keynum);     acquire highest record < key
int is;                             1 if record exists, else 0
char *key;                          key specification
int keynum;                         key number involved

is=alebtv(recptr,key,keynum);     acquire highest record <= key
int is;                             1 if record exists, else 0
char *recptr;                       destination record buffer ptr
char *key;                          key specification
int keynum;                         key number involved
```

```
is=alobtv(recptr,keynum);          acquire lowest record in database
int is;                              1 if record exists, else 0
char *recptr;                        destination record buffer ptr
int keynum;                          key number involved

is=ahibtv(recptr,keynum);          acquire highest record in database
int is;                              1 if record exists, else 0
char *recptr;                        destination record buffer ptr
int keynum;                          key number involved
```

These routines combine a query and a get into the useful combination where you want to see if a record is in a database, and if it is, to read it. Using these routines we could code:

```
setbtv(regbb);
if (agebtv(NULL,"Q",0) && regbb->data[0] == 'Q') {
     prf("Warning!  Someone named \"%s\" is in the registry!",regbb->data);
     prf("\nAnd he has this to say about himself:\n\"%s\"\n",
         ((struct regrec *)regbb->data)->sumlin);
}
```

Here are two special-purpose acquire routines:

```
is=aqnbtv(recptr);                 "acquire next" record in sequence
int is;                              1 if another record exists, else 0
char *recptr;                        destination record buffer ptr

is=aqpbtv(recptr);                 "acquire previous" record in sequence
int is;                              1 if previous record exists, else 0
char *recptr;                        destination record buffer ptr
```

Use these routines only for databases with a single non-unique key that's a NUL-terminated string. Each of these routines returns false if the two records (the "current" one and the "next/previous" one) compare unequal (case-sensitive) when treated as strings.

Creating your own Databases

If you purchase the Btrieve development kit from Novell, you can use the following command to create new databases:

```
BUTIL -CREATE <filename>.VIR <filename>.BCR
```

The .BCR file is an editable text file that you will define that specifies the format of your database. See the Btrieve manual. (Tip: use the "zstring" format for NUL-terminated string fields.) The .VIR is an empty "virgin" form of the database that you'll always keep online. During the installation process, an empty .VIR file is copied to a .DAT file if no .DAT file exists.

System Variables Database

The Major BBS maintains several variables on disk in BBSVBL.DAT. These are available at runtime, are changed as necessary, and are automatically saved back to disk every 300 seconds (default value of SVRATE). The following code from MAJORBBS.H shows the fields of the system variables in sv, sv2 and sv3:

```
extern
struct sysvbl {                         /* system-variable btrieve record layout*/
     char key[4];                       /*    4-character dummy key of "key"    */
     char dspopt[6];                    /*    display options by position number*/
     long calls[8];                     /*    number of calls this month/baud rt*/
     char lonmsg[MTXSIZ];               /*    log-on message in effect          */
     long dwnlds;                       /*    total downloads to date           */
     long uplds;                        /*    total uploads to date             */
     long msgtot;                       /*    msg (E-mail/Forums) total to date */
     unsigned emlopn;                   /*    E-Mail open at the moment         */
     unsigned sigopn;                   /*    Forum messages open at the moment */
     int hisign;                        /*    highest Forum number used to date */
     char monmal;                       /*    Aux. CRT display selector         */
     char savmin;                       /*    Minutes to save screen            */
     long oldsec[8][24];                /*    old sec/grp/hr (now in sv3.secghr)*/
     char spare[1300-1230];             /*    spare space for graceful upgrades */
} sv;

extern
struct sysvb2 {                         /* second system variable btrieve layout*/
     char ky2[4];                       /*    4-character dummy key of "ky2"    */
     unsigned matrix[NCOMTY][NAGEBK];   /*   matrix of accts (computer/age)*/
     long oldcrd[8][24];                /*    old crd/grp/hr (now in sv3.crdghr)*/
     int nliniu[48];                    /*    number of lines in use per hlf/hr */
     int lstzer;                        /*    date of last zeroing of stats     */
     long x25kps;                       /*    X.25 kilopackets sent or received */
     unsigned x25ps;                    /*    fractional X.25 kilopackets       */
     long x25mbs;                       /*    X.25 megabytes sent or received   */
     long x25bs;                        /*    fractional X.25 megabytes         */
     unsigned numact;                   /*    total number of user accounts     */
     unsigned numfem;                   /*    number of female users            */
     unsigned numcor;                   /*    number of corporate users         */
     unsigned numans;                   /*    number of ANSI users              */
     unsigned long paidpst;             /*    credits paid-for so far           */
     unsigned long freepst;             /*    credits given away free so far    */
     long totcalls;                     /*    total calls-to-date               */
     int lastmcu;                       /*    date of last midnight cleanup     */
     char spare[1300-986];              /*    spare space for graceful upgrades */
} sv2;

extern
struct sysvb3 {                         /* third system variable btrieve layout */
     char ky3[4];                       /*    4-character dummy key of "ky3"    */
     long secghr[NGROUPS-1][24];        /*    seconds used (channel grp/hr)     */
     long crdghr[NGROUPS-1][24];        /*    credits consumed (channel grp/hr) */
} sv3;
```

User Account Database

The following code from USRACC.H shows the fields of the user accounting database, BBSUSR.DAT. This same structure is used for the dynamically allocated usracc[] array, which stores the information in memory for users who are online. (Note: that array may be bigger than 64K. Use uacoff() to get information on online users -- see page 82).

```
struct usracc {
     char userid[UIDSIZ];      /* user-id                                    */
     char psword[PSWSIZ];      /* password                                   */
     char usrnam[NADSIZ];      /* user name                                  */
     char usrad1[NADSIZ];      /* address line 1 (company)                   */
     char usrad2[NADSIZ];      /* address line 2                             */
     char usrad3[NADSIZ];      /* address line 3                             */
     char usrad4[NADSIZ];      /* address line 4                             */
     char usrpho[PHOSIZ];      /* phone number                               */
     char systyp;              /* system type code                           */
     char usrprf;              /* user preference flags                      */
     char ansifl;              /* ANSI flags                                 */
     char scnwid;              /* screen width in columns                    */
     char scnbrk;              /* screen length for page breaks              */
     char scnfse;              /* screen length for FSE stuff                */
     char age;                 /* user's age                                 */
     char sex;                 /* user's sex ('M' or 'F')                    */
     unsigned int credat;      /* account creation date                      */
     unsigned int usedat;      /* date of last use of account                */
     int csicnt;               /* classified-ad counts used so far           */
     int flags;                /* various saved bit flags                    */
     int access[AXSSIZ];       /* array of remote sysop access bits          */
     long emllim;              /* e-mail limit reached so far (new/old bdy)  */
     char prmcls[KEYSIZ];      /* class to return user to if necessary       */
     char curcls[KEYSIZ];      /* current class of this user                 */
     long timtdy;              /* time user has been online today (in secs)  */
     unsigned int daystt;      /* days left in this class (if applicable)    */
     unsigned int fgvdys;      /* days since debt was last "forgiven"        */
     long creds;               /* credits available or debt (if negative)    */
     long totcreds;            /* total credits ever posted (paid & free)    */
     long totpaid;             /* total credits ever posted (paid only)      */
     char birthd[DATSIZ];      /* this user's birthday date                  */
     char spare[USRACCSPARE]; /* spare space, for graceful upgrades          */
};

                               /* ansifl bit definitions                     */
#define ANSON       1         /*   ANSI on=1; off=0                         */
#define ANSMAN      2         /*   ANSI manual override (0=auto sensing)    */

                               /* flags bit definitions                      */
#define HASMST      1         /*   user has the "MASTER" key for the BBS    */
#define UNDAXS      2         /*   this account cannot be deleted           */
#define SUSPEN      4         /*   this account is "suspended"              */
#define DELTAG      8         /*   this account is tagged for deletion      */
#define GOINVS      16        /*   this account is "invisible" upon logon   */

                               /* usrprf bit definitions                     */
#define PRFLIN      1         /*   always use line editor?   yes=1          */
```

User Class Database

This database records information on the user classes. Classes are defined by the Sysop using the Remote Sysop ACCOUNT menu, CLASS command.

```
extern
struct acclass {                /* accounting class structure                */
     char clname[KEYSIZ];       /*   class name                              */
     char nxtcls[4][KEYSIZ];    /*   class to return to when expires         */
     int limcal;                /*   limit per call (-1=no limit)            */
     int limday;                /*   limit per day (-1=no limit)             */
     int dftday;                /*   default days before expiring (-1=never) */
     long dbtlmt;               /*   debt limit (0=none)                     */
     int fgvday;                /*   wait how many days before "forgiving"   */
     int idlday;                /*   inactive days before delete (-1=never)  */
     int flags;                 /*   general bit flags                       */
     long seconds;              /*   seconds used so far this month          */
     unsigned users;            /*   total number of users in this class     */
     char msgs[2][XMSGSZ];      /*   exiting class messages                  */
     char spare[2032-2022];     /*   spare space - decrease when needed      */
};
                                /* indexes for nxtcls[] when a user...       */
#define DOUTTIM 0               /*   is out of time for the day              */
#define DLOAFER 1               /*   hasn't logged in for x number of days   */
#define DEXPIRE 2               /*   has been around x number of days        */
#define DCREDIT 3               /*   has/doesn't have credits                */

                                /* struct acclass bit flag definitions       */
#define KCKOFF 1                /*   out of time: knock the user offline     */
#define CLSCHG 2                /*   out of time: temporarily change class   */
#define NOCRED 4                /*   expire when: credits < 1                */
#define DBTLMT 8                /*   expire when: user reaches a debt limit  */
#define HASCRD 16               /*   expire when: credits > 0                */
#define DAYEXP 32               /*   expire when: x number of days passes    */
#define IDLEXP 64               /*   expire when: no log on for x # of days  */
#define MONDAY 128              /*   forgive: every Monday                   */
#define FSTMTH 256              /*   forgive: on the first of each month     */
#define NUMDAY 512              /*   forgive: every x number of days         */
#define HITLMT 1024             /*   forgive: when they hit their debt limit */
#define REPDBT 2048             /*   report debt when forgiven?              */
#define CRDXMT 4096             /*   this class exempt from credit charges?  */
```

Using Spare Space in Galacticomm Databases

If you're developing your own Add-on Option for The Major BBS, you should make your own databases rather than add onto the spare spaces in Galacticomm databases. Otherwise you'll run into conflicts with other developers trying to use the same space.

On the other hand, if you're customizing your own BBS, and you want to add fields to a database, there might be a way. Add your fields *after* the spare[] field.

> When customizing the database on your BBS, add fields at the *end* of the structure -- between the spare[] field and the "}" -- and decrease the spare size accordingly, so the size of the overall structure is unchanged.

In new versions of the BBS, Galacticomm will try to add new fields *before* the spare[] field.

Be conservative and use as few bytes as possible. If you use a lot of bytes in a database, and Galacticomm eventually uses them too, you're going to be in for some complex conversion activity to be able to update to a new release of The Major BBS.

Generic User Database

This database, BBSGEN.DAT, may be used by any application to store information about users. To create your own records in BBSGEN.DAT, first define a structure. The first two fields should be User-ID and module name. Say you wanted to store a user's score in a game:

```
struct bggame {                 /* generic user data records for my game     */
     char userid[UIDSIZ];           /* User-ID                                */
     char modnam[MNMSIZ];           /* Module Name ("My Game")                */
     int score;                     /* score                                  */
};
```

This sure beats making a whole separate .DAT file for one measly integer.

To store a record for the current user, with a score of 50, you could code:

```
struct bggame bgbuff;
:
:
strcpy(bgbuff.userid,usaptr->userid);
strcpy(bgbuff.modnam,"My Game");
bgbuff.score=50;
setbtv(genbb);
invbtv(&bgbuff,sizeof(bgbuff));
```

Notice how the module name was *not* obtained from the "descrp" field of your module structure (see page 30 about gmdnam()). That field is a copy of the module name in your .MDF file. If the Sysop innocently edits the .MDF file to change the module name, you probably don't want him to suddenly be missing all of your records in BBSGEN.DAT. That's why it might be a good idea to hard-code your module name in your records of BBSGEN.DAT.

The global variable genbb is declared in MAJORBBS.H.

To read the current user's score, you could code:

```
struct bggame bgbuff;
:
:
strcpy(bgbuff.userid,usaptr->userid);
strcpy(bgbuff.modnam,"My Game");
setbtv(genbb);
if (acqbtv(&bgbuff,&bgbuff,0)) {
     prf("Score: %d",bgbuff.score);
}
else {
     prf("No score recorded");
}
```

9. OFFLINE UTILITIES

This section covers routines that are used in the offline utilities and nowhere else. The offline utilities also make use of several routines that are used for the online operator interface, starting on page 137.

Most offline utilities have a basic background screen design which stays in view whenever the Operator is using that utility. These screens can be designed using TheDraw, and saved as 4000 byte .BIN files. For a utility to read a screen into memory at runtime, it uses iniscn():

```
iniscn(filspc,where)              Read an 80x25 character color
                                    screen from a .BIN file
char *filspc;                       DOS path for the file
void *where;                        buffer or video memory
```

The "where" parameter can be either an in-memory buffer (allocated by alcmem(SCNSIZ), where SCNSIZ is defined as 4000 in GCOMM.H), or the actual video RAM address (see page 139 about frzseg()).

See page 164 for what iniscn() does on monochrome screens.

Window output (explode())

To make a window "pop up" on the screen, we use explode():

```
explode(sctptr,wulx,wuly,wlrx,wlry)
                                    Pop up a window on the CRT
char *sctptr;                       screen image (from iniscn())
int wulx,wuly;                      window upper left corner
int wlrx,wlry;                      window lower right corner
                                    (inclusive)
```

You can use TheDraw to design a pop-up window background in a .BIN file, then read it in with iniscn(), possibly modify it with setwin() and printf(), and display it with explode().

The four windowing parameters in the explode() function define both where to read the image (relative to sctptr) and where to display it (on the CRT). So you really design where to put the pop-up window in the .BIN file with TheDraw, and just tell explode() what you came up with.

Or, you can pack many window backgrounds on a single .BIN screen and use explodeto() to put them anywhere on the CRT:

```
explodeto(sctptr,fux,fuy,flx,fly,tux,tuy)
                                    Pop up a window on the CRT
char *sctptr;                       screen image (from iniscn())
int fux,fuy;                        source window upper left corner
int flx,fly;                        source window lower right corner
                                    (inclusive)
int tux,tuy;                        dest. window upper left corner
```

If you don't like shadows, use nsexploto() instead of explodeto(), with the same parameters.

> A call to any of the explode() family of routines automatically calls proff() with the tux,tuy parameters, so that you can use calls to prat() relative to where you put the window on the screen (see page 140 about proff() and prat()). This affects future operation of the choose() and edtval() routines (see below).

All X coordinates range from 0 to 79, left to right, and Y coordinates range from 0 to 24, top to bottom.

The global variable explodem defaults to 1 for an animated exploding effect, but may be set to 0 to make the windows pop up instantly.

```
int explodem;                       animate the exploding window?
                                      1=animate, 0=instant
```

A "shadow" of one cell vertically and two cells horizontally is automatically applied to the bottom and right edges of each pop-up window.

When you're ready to pop up a window, first save the current screen image so you can restore it when you make the window disappear. For example:

```
char *scnsav;
:
movmem(frzseg(),scnsav=alcmem(SCNSIZ),SCNSIZ);
```

This allocates 4000 bytes and moves the current screen image to it. When done with the window, just restore the saved image back, as in:

```
movmem(scnsav,frzseg(),SCNSIZ);
free(scnsav);
```

Pop-up windows can be popped on top of one another. This means you'll need to have a series of saves and restores nested in one another, like this:

```
save background
pop-up #1
save window #1
pop-up #2
save window #2
pop-up #3
restore window #2
restore window #1
restore background
```

To be compatible with both monochrome and color screens, you can call monorcol():

```
monorcol()                      Determine monochrome versus color,
                                  based on the offline Hardware Setup
                                  option CRT (which is set to COLOR,
                                  MONO or AUTO)

imonorcol()                     Determine monochrome versus color
                                  based on BIOS settings only.  This is
                                  equivalent to monorcol() when CRT is
                                  set to AUTO.  We use this routine in
                                  cases where we don't want to be
                                  depending on the BBSMAJOR.MCV file.

int color;                      1=operator's screen is color
                                0=monochrome
```

If you don't want to depend on the CRT offline option, you could compute color automatically by some other method as in:

```
color=(FP_SEG(frzseg()) != 0xB000);
```

Don't define your own "color" variable -- use the global variable from GCOMM.LIB.

The color variable has a global effect on iniscn() and setatr() -- if color is set to zero, those routines will translate color values into reasonable monochrome values:

Automatic translation of color to monochrome
Any attribute with a white background becomes black on white
    (inverse video).
Otherwise, the attribute becomes white on black,
    preserving blinking and/or brightness, if they are present.

Window input (edtval(), choose())

If you want the operator to enter something, you can use explode() to pop up a window (see the previous section), and then edtval() to handle his entry session.

```
save=edtval(sx,sy,maxlen,sval,valrou,flags)
                                edit a string field on the screen
int save;                         0=ESC hit, 1=Enter, Tab, Shift-Tab,
                                  cursor up or cursor down was hit
int sx,sy;                        starting point for the field on
                                  the screen (sx is 0-79, sy 0-24)
int maxlen;                       maximum size of string (including
                                  NUL -- maxlen-1 is field width)
char *sval;                       default value / return value
int (*valrou)();                  validation routine
int flags;                        options
```

The sx,sy coordinates are relative to the tux,tuy coordinates of the most recent call to the explode() family of routines (page 162). This is done via the proff() and prat() routines (page 140).

Put a default value in the sval buffer if you want one (the cursor will start at the right end of the value), or fill sval with a zero-length string to start from scratch. Either way, you have to have maxlen bytes available at sval. Here are the bit flag options for the last parameter of edtval():

```
#define MCHOICE     1     /* multiple choice question, hide cursor */
#define ALLCAPS     2     /* convert all chars to capital letters  */
#define USEPOFF     4     /* use proff() x,y base coord offsets    */
#define MULTIEX     8     /* allow multiple field-exit conditions  */
```

The operator can type in a new value, move the cursor right or left, insert or delete characters, hit home or end, and when finally done, hit <*Enter*>, <*Tab*>, <*Shift-Tab*>, <*up*> or <*down*> to save or <*Esc*> to abort. Actually it's up to you how you handle the difference between all these exit methods. You can tell whether it was <*Esc*> or not by edtval()'s return value. You can distinguish among the other cases using the edtvalc global variable:

```
int edtvalc;                    Keystroke that ended edtval()
```

After edtval() returns, you can get the entry results in the buffer that the sval parameter pointed to.

While edtval() is running, the entry field will use setatr() attribute of 0x0F (bright white on black). For this reason, your pop-up window should probably have a background color other than black. When edtval() completes normally it restores the original attribute. If it completes with the <*Esc*> keystroke, the entry field stays visible.

The valrou parameter is the address of a keystroke validation function. It will be called each time the operator hits a key other than one of the exit keys (see the return value "save" above). The function is passed the code for the key pressed (see about key codes on page 144) and the buffer contents so far (NUL-terminated, without that keystroke). Your function should return a 1 to accept the keystroke or a 0 to reject it. Here are a few validation functions from GCOMM.LIB that you can use:

```
isok=validig(c,sval);          digit validation routine
int isok;                        1=it's a digit, 0=reject
int c;                           key code (ala getchc())
char *sval;                      string entered so far

isok=validyn(c,sval);          yes/no validation routine
int isok;                        1=it's a digit, 0=reject
int c;                           key code (ala getchc())
char *sval;                      string entered so far
```

Here's the source code for these routines:

```
int
validig(c,sval)              /* is c a valid decimal digit?          */
int c;
char *sval;
{
     return(c >= '0' && c <= '9');
}

int
validyn(c,stg)               /* validate c as yes/no (for edtval())  */
int c;
char *stg;
{
     if (tolower(c) == 'y') {
          strcpy(stg,"Yes");
     }
     else if (tolower(c) == 'n') {
          strcpy(stg,"No");
     }
     return(0);
}
```

Notice how you can allow a single character to change the entire entry string -- just write to the buffer pointed to by the sval parameter. The routine calling your validation routine adds the character to the buffer if your routine "accepts" it, and doesn't otherwise. Either way, the entire string is redisplayed after each keystroke.

When using validyn(), maxlen must be at least 4.

The following routine allows an offline operator to make a multiple-choice selection using a scrolling window, with up and down arrow keys highlighting the different choices, and <*Enter*> making the final choice:

```
choice=choose(nchoices,choices,upx,upy,lox,loy,escok);
                                   Pop up a window of choices
int choice;                        index of choice 0..nchoices-1
                                   or -ESC if operator escaped
int nchoices;                      number of choices
char *choices[];                   array of choice
int upx,upy;                       upper left corner of window
int lox,loy;                       lower right corner of window
int escok;                         allow ESC? 1=yes 0=no
```

The upx,upy coordinates are relative to the tux,tuy coordinates of the most recent call to the explode() family of routines (page 162). This is done via the proff() and prat() routines (page 140).

The window boundaries are inclusive. The window does not have to be big enough to hold all your choices, and if it isn't, choose() will show "(more)" at the bottom and scroll when the operator moves the cursor down. A few global variables are controlling the display attributes:

```
int selatr;                  Attribute for scrolling choice bar
int nslatr;                  Attribute for the other choices
```

There are some alternatives and variations to choose(). The first is choowd():

```
choice=choowd(choices,first,upx,upy,lox,loy,escok);
                                        Pop up a window of choices
int choice;                             index of choice 0..nchoices-1
                                        or -ESC if operator escaped
char *choices[];                        array of choice, after the last of
                                        which is a NULL
int first;                              index of the "default" choice
int upx,upy;                            upper left corner of window
int lox,loy;                            lower right corner of window
int escok;                              allow ESC? 1=yes 0=no
```

Here too, upx,upy are relative to the window established by explode().

The two differences between choowd() and choose() are: choowd() uses a NULL to terminate the choices[] array while choose() passes the quantity nchoices; and choowd() allows you to specify a default starting point in the choice array, while choose() always starts you at index 0.

The third alternative is to break the choosing up into two pieces:

```
supchc(nchoices,choices,upx,upy,lox,loy,escok);
choice=choout();
```

This does exactly what choose() does, with the same parameters and return value, but you get the chance to sneak some processing in between the startup and the choosing session. You would only do this if you had knowledge of some of global variables in CHOOSE.C from the Extended C Source Suite.

The fourth alternative is to break the choosing up into many pieces. You'd need to do this in a multitasking environment so that you could be working on other tasks while waiting for keystrokes from the operator. Or you'd need this if you wanted to take some special action on certain keystrokes. Here you get the best of choose() and choowd() in kit form, with some assembly required. Here's the equivalent of choose() (with an optional starting point like choowd()):

```
supchc(nchoices,choices,upx,upy,lox,loy,escok);
jmp2chc(first);                                  <- this line is optional
dspchc();
cursiz(NOCURS);
do {
     choice=hdlchc(getchc());
while (choice == nchoices);
rstcur();
```

The jmp2chc() routine establishes the default or starting point, as does the "first" parameter in choowd(). The new routine dspchc() displays the background of the choice window after startup. Notice it's polite to turn the cursor off for the choosing session. The hdlchc() routine handles operator keystrokes. Of course, you could set things up to be doing other things while kbhit() is false, and only call getchc() when kbhit() is true. The hdlchc() routine has the same return value as choose() and choout(), except it may return nchoices to indicate that the choosing session isn't over yet.

Large Model Programming

Most offline utilities from Galacticomm use the Large memory model of Borland C++ and do not make use of the Phar Lap DOS-Extender. This is a less complicated development environment than what we use to make MAJORBBS.EXE and all the .DLL files. These .MAK files come with The Major BBS Developer's C Source Kit:

BBSRPT.MAK	Offline reports (option 9 from the introductory menu, includes all eight reports)
GALP&QR.MAK	Offline polls & questionnaires analysis (GALP&QR selection from option 7 of the introductory menu)

Many more .MAK files come with The Major BBS Extended C Source Suite. These make files call out linker response files too. Remember to use the large model libraries for offline utilities.

Here are the most important differences in large model programming versus protected mode programming:

- Smaller memory limits on the program (640K or so total, up to 64K static data)
- Object files reside in \BBSV6\LOBJ instead of \BBSV6\PHOBJ.

To do the compiling and linking steps piece by piece:

To compile a <*filename*>.C source file that contributes to an .EXE offline utility program:

```
CD \BBSV6\SRC          or        CD \BBSV6\DDD    (as appropriate)
CTL <filename>                   CTL <filename>
```

(It's not a good idea to do "CTL *" because different source files need to be compiled with different CTXXX.BAT files.)

To relink a <*utility name*>.EXE file:

```
CD \BBSV6\LOBJ
LNK <utility name> <other file 1> <other file 2>

    or, as appropriate

CD \BBSV6\DDD
LNK <utility name> <other file 1> <other file 2>
```

Look in the corresponding .MAK file for the utility for the exact way to link it.

Language Editor DLLs

When you define a language, you can also define a custom editor program for editing text or other information in that language. Usually a custom editor will be associated with the protocol portion of the language, for example BBSDRAW for all languages that end in "/ANSI", or RIPaint for all "/RIP" languages.

Language Editors are used by CNF to edit text blocks and by Menu Tree to create and edit custom menus. Language Editor DLLs will run in protected mode, and they must behave appropriately. See page 186 for more on running in protected mode.

To create your own language editor DLL:

1. In your language .MDF file (page 26), use the name of your .DLL file in the language editor command line, as in:

   Language Editor: TESTIT.DLL %s

   This one directive can do up to three different things. First it declares that this editor is a DLL editor (as opposed to an editor that's an .EXE file or a .BAT file). Second, it specifies TESTIT.DLL as the DLL that should be loaded in order to run the editor. And third, your language editor handler routine may be able to use it to recognize when text should be edited in your language. When it comes time to edit something, the language editor command will be passed to *all* editor handler routines, and *your* editor handler routine will need to decide between "Hey, I'm supposed to edit the text," or "Nah, some other editor is supposed to edit the text, not me." More on this later.

   By the way, for consistent selection of the proper editor under Menu Tree, a unique language editor should be associated with a unique language file extension. For example, the language editor command line "RIPAINT.DLL %s" should be associated with, and only with, the language file extension ".RIP". This comes up when you're trying to define multiple RIP languages (English/RIP, Spanish/RIP, German/RIP, etc.).

2. Create an editor handler routine. A simple example:

```
int
tstedt(
char *command,
char *txtbuf,
unsigned sizbuf)
{
     if (!sameto("TESTIT.DLL",command)) {
          return(EONOTME);
     }
     return(edit(txtbuf,sizbuf) ? EOSAVE : EONOCHG);
}
```

   In this example, edit() is your function for editing the text, and it returns 1 if it wants to change the text or 0 if it doesn't.

As mentioned, whenever the Sysop wants to edit some text (when he types <F2>=EDIT in CNF, or he chooses to "Edit the way this menu looks" in Menu Tree), the language editor command line from the appropriate language .MDF file is formatted and passed to all registered editor handler routines. Each editor handler has the responsibility to look at the command and either (A) get to work (in the above example, to call edit(), and return either EOSAVE or EONOCHG) or (B) pass the buck (to return EONOTME -- effectively saying "it's not my job").

Here are the meanings of the parameters that will be passed to your editor handler routine:

command This is the formatted language editor command line from the appropriate language .MDF file. You would typically look at the first word of this command to find out if your editor should be working on this text. If not, you need to return EONOTME. (See below for all possible return values.)

The "%s" from the language editor command line has been replaced by a file name by the time it gets to you in the form of this command parameter. You probably don't care about that file name unless txtbuf is NULL.

txtbuf If non-NULL, this is the address of the text in memory, and also where you should put the text after it has been edited. This is how CNF will call your language editor.

If NULL, you should get the text from the file identified in the command, and write the edited text back there too. This is how Menu Tree will call your language editor.

sizbuf This is the maximum size the text should attain. In no event should your editor handler write outside of the inclusive memory range txtbuf[0] to txtbuf[sizbuf-1]. (sizbuf does include the room for the terminating NUL.)

The possible return values of your editor handler routine are:

EONOTME	This command is for another editor
EOERROR	Error occurred (details in edterr[])
EOABORT	Operator aborted, recover old data
EONOCHG	No change to data, don't update
EOTRUNC	Data truncated (ibsize=original size)
EOSAVE	Done editing, save data
EOSAVE+EOPGUP	Save data, skip to option above
EOSAVE+EOPGDN	Save data, skip to option below
EONOCHG+EOPGUP	No change to data, skip to option above
EONOCHG+EOPGDN	No change to data, skip to option below

These constants are defined in EDTOFF.H. If you can't decide which return value to use among EOSAVE, EOTRUNC, and EONOCHG, use EOSAVE.

Here are some global variables associated with editors:

`char edterr[];`	where to put an error message (used only when you return EOERROR)
`long ibsize;`	size of original text before it was truncated (used only when you return EOTRUNC)

The wording of the edterr[] message should be such that it fits well into a message like "This CNF Editor command <*edterr*>: <*editor command from .MDF file*>". For example, some appropriate wordings of edterr[] might be "cannot create CNF00000.FRC", or "requires more real-mode memory", or "erased the SAVE.TXT file". We suggest you test each of your error messages with CNF to make sure they look right.

Your editor handler routine and associated code will need to be in a C source file that includes:

```
#include "gcomm.h"
#include "edtoff.h"
```

3. Register your editor handler routine. Make a function whose name starts with "init__". It gets passed the address of the routine to register editor handler routines, and should be declared EXPORT. The function doesn't return anything. Here's an example:

```
void EXPORT
init__testit(regrou)
void (*regrou)(EDTHANDLER *edthdl);
{
    (*regrou)(tstedt);
}
```

This function will get called the first time someone tries to use your editor, so you may want to include some more initialization code here.

A key strategy with each language editor DLL is not to load any DLL until and unless it's actually needed. So the *first* time the Sysop edits some text that's associated with a given language editor DLL is when that DLL is loaded and initialized.

You may be thinking there's a paradox here ("How can the Sysop pick my editor before I've even registered it?!?"). The resolution is in the multiple purposes of the language editor command line in the .MDF file. The first time the Sysop tries to edit something associated with your language editor DLL, your editor handler routine has not even been registered. But a special editor handler routine (dlload() in EDTOFF.C) will (1) recognize this condition, (2) notice that your command line "TESTIT.DLL <*temp file*>" calls out a DLL, (3) load and initialize your DLL, and (4) allow you to get to work editing the text. From then on, your registered editor handler will respond to all text edit sessions where your language is in effect.

4. Compile your program using CTPH.BAT, for example:

```
CTPH TESTIT
```

5. Make a linker response file:

TESTIT.LNK

```
\run286\bc3\lib\c0phdll     +
\bbsv6\phobj\testit
\bbsv6\testit
nul
plhide phapi cnfimp /Twd /s /n
\bbsv6\dlib\nodef
```

And use it to make your .DLL file:

```
TLINK @TESTIT.LNK
```

If you get undefined symbols for Borland Library routines, you may have to find alternatives to using those routines. See page 20 about the perils of linking BCH286.LIB in a DLL.

6. Install your .DLL file, and the language .MDF file, on the BBS computers where you want the editor to be available.

.MSG File Reading and Writing

If your offline utility needs to examine the value of a CNF option direct from the .MSG file, as opposed to the compiled .MCV file, you can use msgscan().

```
value=msgscan(filnam,name);      Read a CNF option from an .MSG file
char *value;                       value of option (or NULL=can't find)
char *filnam;                      file (include .MSG extension)
char *name;                        name of option
```

To read the option from the .MCV file, use the getmsg() and xxxopt() routines, described starting on page 65. It's usually more convenient to use getmsg() or the xxxopt() routines if you are reading a .MSG file that's part of the same product release. That is, if your .MSG file and your offline utility are sold and updated as a package.

On the other hand, if your product's utility is reading *another* product's .MSG file, msgscan() should be used. An example would be any offline Add-on utility that needs to know the values in BBSMAJOR.MSG. Using msgscan() allows your utility to continue to work even after the .MSG file is updated to a new version (as long as the option you're changing has not been obsoleted of course).

If you're writing an offline utility and you need to *change* the value of CNF options, you could use the setcnf() and applyem() functions.

```
setcnf(name,value);              Specify a CNF option change
char *name;                        name of the option
char *value;                       new value for the option


applyem(filnam);                 Set the CNF options in this file
char *filnam;                      file (include .MSG extension)
```

Here's an example of using these routines to set the values of several CNF options in different .MSG files.

```
setcnf("GROUP3","MODEM");
setcnf("BAUD3","19200");
setcnf("LOCK3","YES");
setcnf("INIT3","AT&FE0S0=0S2=255X6&R0B1");
setcnf("SUPCLS","PROSPECT");
applyem("BBSMAJOR.MSG");
applyem("BBSSUP.MSG");
```

When you bring the BBS up again, new .MCV files will automatically be generated by BBSMSX.

Up to 100 setcnf() changes can be accumulated before you call applyem(). If you want to change more than 100 options, you can specify them in lots of 100 or fewer. (Calling applyem() sets things up so that the *next* call to setcnf() starts with a clean slate of specified changes.)

As you can see, you can specify changes to several different options in several different files. Then you can call applyem() on the file(s) where the options are stored. If you accumulate option changes for multiple files, beware of options with the same names in two different .MSG files (applyem() would change them both to the same value).

You can change the value of any *type* of CNF option with setcnf() and applyem(). But if you change the value of a type 'T' text option, only the language 0 version will be affected.

10. MORE ROUTINES AND VARIABLES

Character and String Routines

```
match=sameas(stg1,stg2);          case-ignoring string match
int match;                          return code: true if strings are same
char *stg1,*stg2;                   strings to test for matching
```

sameas() returns true if the two strings are the same, ignoring letter case, for example sameas("Fred W. Jones","FRED W. JONES") == 1.

```
match=sameto(shorts,longs);       case-ignoring substring match
int match;                          true if shorts = first part of longs
char *shorts;                       "short string": entirety must match
char *longs;                        "long string": may have excess on end
```

The sameto() function is like sameas(), but it allows the first parameter to be just a portion of the second. For example:

```
sameto("good","gooder") == 1
sameto("good","good enough") == 1
sameto("best","best") == 1

sameto("badder","bad") == 0
sameto("women","womanhood") == 0
```

Another variation:

```
match=samend(longs,ends);
```

The samend() routine compares endings of strings, asking if the first string ends with the second string, ignoring case. Examples:

```
samend("the end","end") == 1
samend("dogs","s") == 1
samend("gooder","ER") == 1

samend("end","the end") == 0
samend("sheep","s") == 0
```

We remember the parameter order for sameto() and samend() by thinking of the prefix (shorts) sitting next to the prefix side of the long string (longs), therefore to the left of it in sameto().

In samend(), we think of the suffix (ends) sitting next to the suffix side of the long string (longs), therefore to the right of it. This way sameto("beg","beginning") and samend("ending","ing") are both true.

```
found=samein(subs,string);        Search a string for a substring
                                    (case-ignoring)
int found;                          1=found 0=not
char *subs;                         substring
char *string;                       string
```

This function searches the string for any occurance of the substring, and returns 1 if it finds any. Examples:

```
samein("good","gooder") == 1
samein("s","UNITED STATES") == 1

samein("can't","cannot") == 0
samein("badder","bad") == 0
```

```
sprstg=spr(ctlstg,p1,p2,...,pn);  sprintf-like string formatter utility
char *sprstg;                       result string ptr (max 120 bytes)
char *ctlstg;                       control string (%l, etc. allowed)
TYPE p1,p2,...,pn;                  sprintf-type parameters (max 12 bytes)
```

This routine is frequently used itself as an argument to prf(), prfmsg(), catastro(), or other "printf" format functions. Those functions do not support long integer or floating point conversions ("%ld" or "%f"), but spr() does. Warning: the string created by spr() must not exceed 120 bytes, including the terminating '\0'. Violation of this rule may have insidious results.

```
stzcpy(dest,source,nbytes);       Copy a string, with limit
char *dest;                         where to put it
char *source;                       the string
int nbytes;                         size of dest, including '\0'
```

if the source string takes up more than nbytes of space (including its NUL), then a truncated version is copied to dest. If the source takes up less, then the remaining bytes of dest are filled with NUL's. The dest buffer always gets at least one NUL at the end (assuming nbytes > 0 -- if nbytes <= 0, then stzcpy() does nothing). Exactly nbytes bytes are written to dest (if nbytes > 0).

Use the following routines for parsing character strings of one or more "words" separated by whitespace characters:

```
pastwhite=skpwht(string);         Skip past whitespace
char *pastwhite;                    pointer to the first NUL or non-
                                    whitespace character in the string
char *string;                       NUL-terminated character string

pastword=skpwrd(string);          Skip past non-whitespace
char *pastword;                     pointer to the first NUL or
                                    whitespace character in the string
char *string;                       NUL-terminated character string
```

```
stg=l2as(lnum);                 convert a long integer to an ASCII
                                  decimal string of digits
char *stg;                        where to store the result
long lnum;                        input long integer
```

This function converts a 32-bit signed integer to a decimal character string. Note that:

```
spr("%ld",lnum)      .. is the same as ..      l2as(lnum)
```

Both spr() and l2as() use a 4-stage rotating-buffer technique to avoid the problem of multiple calls pointing to the same physical location. This means you can have up to 4 calls in a single parameter list before overlap will cause difficulties. For example:

```
prf("Shares traded today: %s %s %s",l2as(nyex),l2as(amex),l2as(otc));
```

Each of the three calls to l2as() will return the address of a different buffer -- not overlap three conversions into the same buffer. (Would you have thought of this problem? If not, be careful! Myself, I cannot answer whether this feature first came about by shrewd foresight or humbling debug.)

```
ptr=lastwd(stg);                get the last word of a string
char *ptr;                        pointer to the last word
char *stg;                        the input string
```

lastwd() finds the last "word" in a string. The return value points to the last nonblank character preceded by a blank (or it points to the beginning of the string if it can't find this).

```
xltctls(txtbuf);                translate ASCII control characters
char *txtbuf;                     text buffer (input and output)
```

This routine translates ^ preceded letters into control characters. For example, the two-character sequence "^G" will be translated, in-place, to the single CTRL-G (ASCII BEL) character.

```
valid=isselc(c);                is c a valid menu-select character?
valid=istxvc(c);                is c a valid text-variable character?
valid=isuidc(c);                is c a valid user-ID character?
int valid;                        1=yes 0=no
int c;                            character (all routines will return
                                  false for non-ASCII values of c)
```

These are the routines we use for checking input strings for valid characters. International characters in the extended ASCII set are supported here.

Here are some more character-handling and string-handling routines:

```
yes=alldgs(string);             Is this string all decimal digits?
int yes;                          1=yes 0=no, has other characters
char *string;                     NUL-terminated string
```

```
oddparity=odd(somebyte);          Compute odd parity
char somebyte;                      a byte
char oddparity;                     a byte with odd parity and with
                                    the same lower 7 bits as somebyte

rmvwht(string);                   Remove all whitespace characters
char *string;                       string (conversion is in-place)

nremoved=depad(string);           Remove trailing blanks from string
int nremoved;                       number of blanks removed
char *string;                       NUL-terminated string

bufptr=unpad(string);             Remove trailing blanks from string
char *bufptr;                       copy of string pointer
char *string;                       NUL-terminated string

sortstgs(strings,nstrings);       Sorts a bunch of strings by re-
                                    arranging an array of pointers
char *strings[];                    array of pointers to the strings
int nstrings;                       number of strings
```

See also the memory handling routines movmem(), setmem(), and repmem() on page 45.

Real-Time Routines (rtkick(), rtihdlr(), interrupts)

```
rtkick(time,rouptr)               "kick off" routine after time delay
int time;                           number of seconds before "kickoff"
void *rouptr();                     pointer to routine to be kicked off
```

Naturally the time delay here is not wasted. Control returns to your calling routine almost instantly, and the specified number of seconds later (plus or minus a few), the specified routine is invoked. The invocation actually takes place at the call to prcrtk() found near the bottom of the main loop in main() in MAJORBBS.C.

To make a routine get called at regular intervals, your initialization code could call rtkick() on the routine, and then the routine could call rtkick() on itself. Use time=60 for the routine to run once a minute, or time=1 for once a second.

```
rtihdlr(rouptr);                  Register a real-time routine
void (*rouptr)(void);               routine to call at 18 Hz
```

If you have a routine that you need to execute more often than once a second, you could register it with rtihdlr(). Once you start this, it runs the entire time the BBS is up (don't keep calling rtihdlr() on the routine like you could do with rtkick()). This routine will be running at interrupt level, so don't try any DOS or GSBL calls except the chixxx() routines (see the GSBL manual). And be sure the routine uses as short a time as possible, or the BBS will lose its real-time responsiveness.

```
dsairp()                        Disable interrupts
enairp()                        Enable interrupts
```

These routines can be used to disable interrupts for *very brief* sequences of code. Warning: disabling interrupts for too long can cause you to lose incoming characters at high baud rates. For example, 300 microseconds is too long for 38,400 baud.

```
tix64k=hrtval();                Read the free-running 65KHz timer
unsigned long tix64k;             upper word counts seconds,
                                  lower word counts 1/65536 seconds
```

This routine reads the GSBL long integer variable btuhrt while interrupts are disabled, in order to avoid skew. You should almost always use hrtval() in place of referencing btuhrt. To measure the time between two events you can call hrtval() at each event and compute the difference between the values (later value minus earlier value). The result will be a count, in 1/65536 second units, of the time between the two events. Of course, this won't work if more than 65536 seconds elapse between calls (about 18 hours).

Time and Date Routines

```
date=today();                   Find out today's date
int date;                         YYYYYYYMMMMDDDDD coding for today
```

This returns today's date in the format that DOS uses for dates:

```
YYYYYYY---------   (Year-1980) * 512    Representing 1980 through 2107
-------MMMM-----   Month * 32           Representing 1 through 12
-----------DDDDD   Day of month         Representing 1 through 31

YYYYYYYMMMMDDDDD                       Code for date
```

```
day=daytoday();                 Find out what day of the week it is
int day;                          0=Sunday 6=Saturday

time=now();                     Find out what time of day it is
int time;                         HHHHHMMMMMSSSSS coding for time
```

This returns the time of day in the format that DOS uses for time:

```
HHHHH-----------   Hour * 2048          Representing 0 through 23
-----MMMMMM-----   Minute * 32          Representing 0 through 59
-----------SSSSS   2-second intervals    Representing the even num-
                                         bers 0 through 58

HHHHHMMMMMMSSSSS                       Code for time
```

```
ascdat=ncdate(date);            Encode date into "MM/DD/YY"
char *ascdat;                     local buffer for date
int date;                         YYYYYYYMMMMDDDDD coding (see above)
```

```
asctim=nctime(time);          Encode time into "HH:MM:SS"
char *asctime;                  local buffer for time
int time;                       HHHHHMMMMMSSSSS coding (above)


ascdat=ncedat(date);          Encode date into "DD-MMM-YY"
                                (European style)
char *ascdat;                   local buffer for date
int date;                       YYYYYYYMMMMDDDDD coding (see page 178)

date=dcdate(ascdat);          Decode date from "MM/DD/YY"
int date;                       YYYYYYYMMMMDDDDD coding (see page 178)
                                or -1=invalid date format
char *ascdat;                   date string

time=dctime(asctim);          Decode time from "HH:MM:SS"
int time;                       HHHHHMMMMMSSSSS coding (see page 178)
                                or -1=invalid time format
char *asctime;                  time string


count=cofdat(date);           Count of days since 1/1/80
int count;                      number of days since 1/1/80
int date;                       YYYYYYYMMMMDDDDD coding (see page 178)


date=datofc(count);           Compute DOS date
int date;                       YYYYYYYMMMMDDDDD coding (see page 178)
int count;                      number of days since 1/1/80
```

See also page 182 for reading and setting a file's time and date.

Numeric Routines

```
smaller=min(a,b);             Find the smaller of two numbers
bigger=max(a,b);              Find the larger of two numbers

                                Since these are implemented as
                                macros, the numbers can be all int,
                                all unsigned, or all long.

absval=abs(signednum);        Find the absolute value of a
                                signed integer (int or long)


newcrc=calcrc(oldcrc,ch);     Iteratively calculate a 16-bit CRC
int newcrc;                     CRC on N+1 bytes
int oldcrc;                     CRC on N bytes
char ch;                        N+1'th byte
```

This routine calculates a 16-bit CRC based upon the polynomial x^16+x^12+x^5+1. This routine is used to support the flash protocol for games like Flash Attack! (tm). (Flash game capability is available with the Games and Entertainment Collection.) This is the same CRC as is computed for the XMODEM-CRC protocol.

Text File Scanning

This suite of routines can be handy for scanning one or more text files, especially if you're looking for lines that start with some prefix string. We use these routines to scan all .MDF files for all the lines we're interested in. (For a really thorough demo of the tfsxxx() routines, see how this is done in INTEGROU.C.)

This is not a good thing to be doing for online user processing however. For one thing, the work is unbounded (how many files? how many lines?) so it could hold up the BBS for an unacceptably long time. For another, you can't have multiple text file scanning operations going on at once -- they work off of global variables in TFSCAN.C (available with the Extended C Source Suite).

But the text file scanning routines can be real handy for offline processing, for initializing things before the BBS comes up, or for nightly cleanup operations.

```
nfiles=tfsopn(filespec);          Prepare to scan 1 or more text files
char *filespec;                     file spec (may contain wildcards)
int nfiles;                         number of files matching file spec

tfs=tfsrdl();                     Read next line from file(s)
int tfs;                            returns latest value of tfstate

int tfstate;                      Scanning state, with these values:

     TFSBGN    tfsopn() was just called, identifying 1 or more files
     TFSBOF    preparing to scan a file (name can be found in tfsfb.name)
     TFSLIN    scanning lines of a file (line is in tfsbuf)
     TFSEOF    done scanning a file
     TFSDUN    all files have been scanned

char *tfsbuf;                     Line read in by tfsrdl(), if tfsrdl()
                                    returned TFSLIN
```

When you call tfsrdl(), the state value can be found either from its return value, or from the global tfstate variable. You should keep calling tfsrdl() until it returns TFSDUN. Other than that, the most interesting state/return value is TFSLIN. This means tfsrdl() has done it's duty and retrieved a line of text from the file or set of files. That line is available in tfsbuf. The return values TFSBOF and TFSEOF could be useful if you needed to do know when the scanning reached file boundaries.

If you're looking for a specific prefix, or set of prefixes, you can use tfspfx() to find it and to isolate what follows the prefix:

```
found=tfspfx(prefix);             Is the current line prefixed with this?
char *prefix;                       Prefix string
int found;                          1=yes, 0=no
                                    if yes, tfspst points to what follows
                                    the prefix

char *tfspst;                     pointer to string following the prefix,
                                    with preceding white space removed
```

For example, if the line you read in was "DLL=GALBLAST", then tfspfx("DLL=") would return 1 and tfspst would point to "GALBLAST".

Suppose you needed to scan all .MDF files on the BBS and pass all module names through a routine called modnam() and all developer names through another routine called develn().

```
if (tfsopn("*.MDF") > 0) {
     while (tfsrdl() != TFSDUN) {
          switch(tfstate) {
          case TFSLIN:
               if (tfspfx("Module Name:")) {
                    modnam(tfspst);
               }
               else if (tfspfx("Developer:")) {
                    develn(tfspst);
               }
               break;
          }
     }
}
```

Notice how one or more spaces may follow the colons in the .MDF files, but they are skipped by tfspst.

If you have multiple levels of prefixes, this routine might be handy:

```
tfsdpr();                          strip the prefix off of tfsbuf and
                                     prepare for sub-prefixes (the dpr
                                     stands for "deeper")
```

This routine is used in INTEGROU.C to isolate all of the "Language" lines in the .MDF files with one tfspfx() call, and then handle them individually with more tfspfx() calls on the sub-prefixes.

If you don't need to exhaustively scan *all* of the file(s) (say you're only interested in one occurance of line starting with a certain prefix), you can abort scanning with tfsabt():

```
tfsabt();                          abort text file scanning
```

This just makes sure that if a file is opened that it gets closed, which is usually a good idea. Otherwise, you need to keep calling tfsrdl() until it returns TFSDUN.

Disk I/O

```
bufptr=mdfgets(buffer,size,fp);  Read a line of text from a file
char *bufptr;                      copy of buffer
char *buffer;                      where to store the line
int size;                          maximum size, including '\0'
FILE *fp;                          file (from fopen())
```

This is just like the standard fgets(), except it uses '\r' as a line terminator (a hard carriage return on The Major BBS), and it won't have a line terminator on the last line if the file doesn't have it.

```
got=fgetstg(buffer,size,fp);     Read a NUL-terminated string from file
int got;                           1=got it OK, 0=error or EOF
char *buffer;                      where to store the line
int size;                          maximum size, including '\0'
FILE *fp;                          file (from fopen())
```

This reads a NUL-terminated string from what's obviously not strictly an ASCII text file, and stores it in the buffer. The NUL is stored too, but the string will never take up more than *size* bytes. If it's too big, it will be truncated with a forced NUL at buffer[size-1].

```
nbytes=getdfre(diskno);          Find out how many bytes are free
                                   on disk
long nbytes;                       number of bytes
int diskno;                        disk number (0=default 1=A: 2=B:)

cntdir(path);                    Count a set of files
char *path;                        path specification (wildcards ok)
long numfils;                      total number of files counted
long numbyts;                      total number of bytes counted
long numbytp;                      greater number of bytes occupied by
                                   the files, considering cluster size

drive=drvnum(path);              Determine drive number from the path
int drive;                         0=current, 1=A:, 2=B:, 3=C:,...
char *path;                        any DOS file specification

clbyts=clsize(drive);            How big are the clusters on disk?
unsigned clbyts;                   number of bytes per cluster
int drive;                         0=current, 1=A:, 2=B:, 3=C:,...

realsiz=clfit(siz,clbyts);       Total space used by a file
long realsiz;                      siz rounded up to the next cluster
long siz;                          useful size of file
unsigned clbyts;                   cluster size (from clsize())

ok=setdtd(fname,time,date);      Set the time and date for a file
                                   (file must not be open at the time)
int ok;                            1=ok 0=couldn't find file.
char *fname;                       file path
int time;                          HHHHHMMMMMSSSSS coding (see page 178)
int date;                          YYYYYYYMMMMDDDDD coding (see page 178)

ok=settnd(fname,gmt70);          Set the time and date for a file
                                   (file must not be open at the time)
int ok;                            1=ok 0=couldn't find file.
char *fname;                       file path
long gmt70                         Number of seconds since midnight
                                   1/1/1970, GMT

timendate=getdtd(handle);        Get a file's time & date
long timendate;                    32-bit number encoding date<<16
                                   and time:
                                   HHHHHMMMMMSSSSS coding (see page 178)
                                   YYYYYYYMMMMDDDDD coding (see page 178)
int handle;                        file handle from an fopen()'d file
                                   (returned by fileno(fp))
```

```
gmt70=gettnd(handle);          Get a file's time & date
long gmt70                       Number of seconds since midnight
                                 1/1/1970, GMT
int handle;                      file handle from an fopen()'d file
                                 (returned by fileno(fp))

root=fnroot(filnam);           Extract 1-8 char file root
char *root;                      extension and path prefix removed
char *filnam;                    file name or entire file path

fnam=fnwext(filnam);           Extract file name with extension
char *fnam;                      name after the path prefix
char *filnam;                    file name or entire file path

rsvd=rsvnam(filnam);           Check if a file name is reserved
int rsvd;                        1=reserved, don't use, 0=OK to use
char *filnam;                    file name or complete file path
```

This routine checks through the DOS list of device drivers and other reserved names to make sure a proposed file name will not be misinterpreted as a device. It's a great idea to use this routine especially if the file name is something a user typed (even if it's the Sysop user). Did you know that writing to "PRN.TXT" will output to your printer? Calling rsvnam("PRN.TXT") will return 1 and catch this and other disasters.

The following routines can be used to find out if a file exists, or to get help from DOS with breaking down a wildcard file specification (such as "*.EXE") into its component files.

```
yes=fndlst(&fb,filespec,attr);   Any files in this filespec?
int yes;                           1=one or more, 0=none
struct fndblk fb;                  "findblock" structure
char attr;                         attribute mask (see below)

yes=fndnxt(&fb);                 Any more files in this filespec?
int yes;                           1=yes 0=no more
struct fndblk fb;                  same structure passed to fndlst()
```

The fndlst() and fndnxt() functions make use of the following data structure, defined in DOSCALLS.H:

```
struct fndblk {                 /* used by fndlst,fndnxt in datntim.c   */
    char junk[21];              /*                                      */
    char attr;                  /* file attribute (see masks below)     */
    unsigned time;              /* time in HHHHHMMMMMMSSSSS format      */
    unsigned date;              /* date in YYYYYYYMMMMDDDDD format      */
    long size;                  /* size in bytes                        */
    char name[12+1];            /* name of file "FFFFFFFF.EEE"          */
};
```

After either routine returns 1, you can consult the name, size, date and time fields of the fb structure for information on the file.

The attr paramter to fndlst() restricts the search to certain types of files (or more accurately directory entries -- fndlst() and fndnxt() are really directory scanning routines). Here are the possible bit components to the attr parameter of fndlst(), and to the attr field of the fndblk structure. These are also defined in DOSCALLS.H:

```
#define FAMRON 0x01     /* File attribute:  read only              */
#define FAMHID 0x02     /* File attribute:  hidden                 */
#define FAMSYS 0x04     /* File attribute:  system                 */
#define FAMVID 0x08     /* File attribute:  volume id              */
#define FAMDIR 0x10     /* File attribute:  sub-directory          */
#define FAMARC 0x20     /* File attribute:  archive                */
```

The only useful values we ever found for the attr parameter of fndlst() are 0, meaning roughly to scan for files only, not subdirectories or volume ID's, or FAMDIR, meaning to check if a given directory name exists. You can refer to a DOS technical manual on interrupt 21H, function 4EH, for details on the other bits.

Everything Else

```
cpu=cputype();
int cpu;
```

Returns 88, 186, 286, 386 depending on what type of processor you run it on (486's return 386)

```
setcrit();
```

Set the DOS critical error handler to a routine that pops up a window and is loads more friendly than "Abort, Retry, Fail". For real mode only -- don't use with Phar Lap.

```
pascrit();
```

Set the DOS critical error handler to a routine that retries three times then pops up a friendly window. Must run with the GSBL (Software Breakthrough).

11. RELIABILITY

Some Philosophy on Debugging

Your best debugging work takes place long before you test-run any of your software. A programming task that's well thought through and meticulously coded has the best chance of long term success.

- Design with vision and foresight.
- Code with attention to detail.
- Test thoroughly.

Debugging work is inevitable. But you can save yourself lots of time and grief if you avoid slipping into the habit of using debugging as a programming tool. Routines should account for all possible conditions and be 100% predictable in the mind of the programmer before they are executed.

You're probably trying to increase your programming speed just like we are. Nothing will help your overall productivity more than an ingrained habit of completing highly reliable foundations before you proceed to use them. There are many techniques for making your foundations highly reliable: code walk-throughs, rigorous testing by the developer, line-by-line testing of source code, branch-by-branch testing, routinely retesting "repaired" code, alpha-testing (in-house), beta-testing (by motivated customers). The goal is to get software done fast, put it to use, and move on to other projects, without your customers having to find the problems and you solving them over the phone.

Programming Tips for The Major BBS

There are several unique things about the programming environment of The Major BBS. The multi-user single-tasking aspects mean that your code can't wait very long for any one thing to happen.

Once you become proficient in programming for The Major BBS, there are a few classes of problems you'll want to be on guard against. If you review these problems and develop an eagle eye for them, then your code can be much more reliable and free from frustrating bugs.

Don't forget to set the message pointer with setmbk():

Wrong way

```
int
hdlstt(void)
{
     prfmsg(NOTAVAIL);
     return(0);
}
```

Right way

```
int
hdlstt(void)
{
     setmbk(lclmb);
     prfmsg(NOTAVAIL);
     return(0);
}
```

(lclmb is the return value of the original call to opnmsg())

Remember to set the database pointer with setbtv():

Wrong way

```
int
lookup(char *name)
{
     return(qeqbtv(name,0));
}
```

Right way

```
int
lookup(char *name)
{
     setbtv(gnfbb);
     return(qeqbtv(name,0));
}
```

(gnfbb is the return value of the original call to opnbtv())

Don't call outprf() multiple times (resulting in double prompts):

Wrong way

```
prfmsg(GREETING);
if (problem) {
     prfmsg(WARNING);
     outprf(usrnum);
}
outprf(usrnum);
```

Right way

```
prfmsg(GREETING);
if (problem) {
     prfmsg(WARNING);
}
outprf(usrnum);
```

General Protection Faults

The best thing and the worst thing about protected mode operation is the "General Protection" fault, or GP. Protected mode is designed to halt at the slightest sign of a program gone awry. The first time you try to unravel and debug a GP will be an adventure. But after all the work of tracking it down, it will probably lead you direct to a bug in your code.

What is a GP?

A General Protection fault is the computer CPU's way of saying "I give up" or "I can't do this". Usually it has to do with an invalid or restricted memory address. (There are other GP causes, like privilege violation, executing the wrong code, or "switching to a busy task", whatever that is. If you're getting one of these, your program has probably gotten pretty out of control.)

GP's don't catch every bug, not by a long shot. But they can catch certain thorny problems way before they get out of hand. The worst kinds of bugs to find are interrmittent with inconsistent symptoms: you can't make them happen when you want to, and it's always something different when they go wrong. Or this variation: you make what *should* be an irrelevant modification, perhaps to add some debugging or probing code, and the symptoms change. This is exactly what can happen from random unintentional memory reads or writes, and this is exactly the kind of thing that a GP is likely to catch in the act, with a bull's-eye on the instruction that made the memory reference. With some patience, you can sift through the clues at the scene of the crime and find out exactly what went wrong. This chapter is all about helping you get started with GP detective work.

Kinds of GP's

Illegal memory accesses can happen in hundreds of squirrely little ways, some of which may even be completely harmless in a program running in real mode. In protected mode, however, they cause a GP fault. Here are three common programming errors that can result in GP's.

A. NULL passed to a routine that uses it as a pointer

For example, consider the following code fragments:

```
...
     blah(margv[0],NULL);
...
blah(stg1,stg2)
char *stg1,*stg2;
{
     if (strcmp(stg1,stg2) == 0) {
          ...
```

This will cause a GP when strcmp() is called, because although NULL is not an illegal *value* for a pointer, to *access* memory through it is an illegal operation. Right? When you pass NULL as a pointer, you never mean "go to the memory at absolute memory location zero and look at whatever bytes are there." You mean "this here is the absence of a pointer". This is not a problem in real mode ordinarily because absolute memory location zero has some garbage in it that is unlikely to match a normal string. Referring to NULL may be similar to referring to the empty string, "", and it is possible, when writing real mode programs, to form the bad habit of using the two interchangeably. Protected mode is not going to let you get away with this.

A special case of this class of problem worth noting is the use of any of the macros from STDIO.H: getc, putc, getchar, putchar, ferror, feof, or fileno, with a NULL file pointer. You might think that attempting to do file I/O with a NULL or garbage file pointer would have no result. It turns out that it results in arithmetic being done on some illegal location in memory, which, in protected mode, will cause an immediate GP.

B. Accessing off the front or end of an array

The most common way this happens in practice is if you use invalid array indices. However, not every invalid array

access attempt will cause a GP. It is complicated, because protected mode will only detect an attempt to go outside a whole segment, and one segment may contain several arrays, variables, structures, etc. A classic example of this kind of bug is the innocent looking little binary search routine in none other than Kernighan & Ritchie's revered tome "The C Programming Language", first edition, page 129 (we reformatted the code to match our own formatting standards):

```
 1   struct key *binary(word,tab,n)
 2   char *word;
 3   struct key tab[];
 4   int n;
 5   {
 6        int cond;
 7        struct key *low,*mid,*high;
 8
 9        low=&tab[0];
10        high=&tab[length-1];
11        while (low <= high) {
12             mid=low+(high-low)/2;
13             if ((cond=strcmp(word,mid->keyword)) < 0) {
14                  high=mid-1;
15             }
16             else if (cond > 0) {
17                  low=mid+1;
18             }
19             else {
20                  return(mid);
21             }
22        }
23        return(NULL);
24   }
```

This code begins to come unglued if the sought keyword fits sequentially before all entries in the sorted tab[] array, and the tab[] array just happens to physically reside at the beginning of a segment or selector (that is, its offset is 0x0000). Then the instruction in line 14 eventually does this: high=&tab[-1]. That pointer computation results in an offset of 0xFFFF or thereabouts. This does not generate a GP yet, because the "high" pointer is not dereferenced.

But now things go from bad to worse, because the test in line 11, which is supposed to fail and halt the loop, instead succeeds, and mid is inexorably dragged upward until it points beyond the end of the region allowed for the selector. Finally, a GP occurs in the strcmp() routine invoked in line 13.

To fix this code, you could put the following three lines between lines 13 and 14:

```
13.1           if (mid == low) {
13.2                break;
13.3           }
```

And, to be truly thorough about it (in protected mode this tends to be a good idea), you can guard against the possibility that the top of the table is flush up against the high bound of a

full 64K data segment by inserting the following between lines 16 and 17:

```
16.1            if (mid == high) {
16.2                 break;
16.3            }
```

Another example of this is a situation in which you wish to truncate a string to a certain maximum length, without knowing in advance just how much storage has been allocated for the string. Consider the following code fragments:

```
...
     speak("hi there");
...
speak(stg)
char *stg;
{
     char temp;

     temp=stg[20];
     stg[20]='\0';
     printf(stg);
     stg[20]=temp;
}
```

In real mode, this is not a problem because even if the memory location that is 20 beyond the start of stg is in some other segment, you are putting it back to what it was when you are through. In protected mode, though, this type of thing can generate an immediate GP, depending on how close the "hi there" string is to the end of the segment in which it is allocated.

C. Too few arguments in a call to printf() or prf() or prfmsg()

If your control string has more %s place-holders in it than there are pointers in your argument list, the machine will find itself picking up random stack contents as a pointer, and accessing memory there. Actually, the mere loading of a random stack value into a selector register is likely to generate a GP right off; if not, then accessing memory through a random offset is likely to exceed the length bounds of the selected segment.

Sysop GP Handling

When a Sysop of The Major BBS wants maximum up-time for his BBS, he sets the offline Hardware Setup option GPHDLR to YES:

```
GPHDLR    Continue operation after "GP" errors? ..... YES
```

This causes the BBS to attempt to recover from GP errors after reporting them in the Audit Trail (see the System Operations Manual for details). To be on the safe side, the user being serviced at the time of the GP is logged off immediately, and his channel is reset. But the BBS stays up and running (or tries to).

This also helps with hacker protection if a user discovers a way to generate an otherwise harmless GP: with GPHDLR set to YES, a GP simply logs him off.

Developer GP Handling

But developers should use GP's on their demo or support BBS to maximum advantage for tracking down bugs.

GPHDLR Continue operation after "GP" errors? ..... NO

In this mode, extensive information on the GP is captured in a text file \BBSV6\GP.OUT.

Reading a GP.OUT Report

A GP is a software interrupt 13 (coincidence?). You could also get other software interrupts for other disastrous conditions like interrupt 12 for a stack fault. (One possible cause of interrupt 12 is an infinitely recursive routine.) But only a GP can provide you with a lengthy report.

Keep in mind that GP.OUT *accumulates* reports, so you'll want to look at the bottom of the file.

Here is an example of one report in a GP.OUT file:

```
BBS GP @ 2d4f:031a EC 0000 (recorded 12/16/93 17:11:17)
GP'ed between 2d4f:0000 _INIT__TELECON and 0000:0000 Unknown
AX=0000 BX=0000 CX=0000 DX=0787 SI=0005 DI=0054 BP=2a88 ES=0000
DS=2d57 Flags=3246
Current CS:IP==>26 83 0f 01 b8 f7 04 8e c0 26 c4 1e 87 08 26 c7

BBS Version: 6.20
User 3  channel 00  User-ID "Sysop"  status 3
Online level 6, state 5, substate 0
MSG:galtlc.mcv/-1
Module "Teleconference"
Input "T"

0167=C:\BBSV6\MAJORBBS.EXE
0717=C:\BBSV6\GALGSBL.DLL
073f=C:\BBSV6\BBSBTU.DLL
075f=C:\BBSV6\DOSCALLS
2a5f=C:\BBSV6\GALMSG.DLL
2cff=C:\BBSV6\GALRSY.DLL
2d3f=C:\BBSV6\GALTLC.DLL
2d6f=C:\BBSV6\GALTXV.DLL
2d97=C:\BBSV6\GALUIE.DLL
2dbf=C:\BBSV6\GALXIT.DLL
2de7=C:\BBSV6\GALTST.DLL
Stack:
0707:2a78  04ff  0746  04ff  0054  2f47  04ff  0054  0005
0707:2a88 >2aaa< 0ba3  0197  04ff  0000  098a  0197  04f7
0707:2a98  0000  4f54  0050  2aaa  0029  039f  0074  0065
0707:2aa8  04f7 >2ac0< 529a  018f  0039  28ef  0001  0000
0707:2ab8  04f7  1b32  0003  0000 >2ace< 3579  018f  04f7
0707:2ac8  000e  4f84  018f >2b30< 3099  018f  04f7  022f
0707:2ad8  018f  0707  1b14  0000  0000  0000  0000  0000
0707:2ae8  0000  0000  0000  011f  96c7  0017  0006  0000
0707:2af8  0707  0000  011f  966b  0017  0e29  0000  0e29
0707:2b08  0000  2b36  0707  0707  0001  1330  26cc  0147
0707:2b18  1b32  0707  1b32  1b14  2b36  4c48  016f  0578
0707:2b28  0707  0587  0707  000f >0000< 014f  016f  0000
0707:2b38  0000  0000  fdcc  077f  ----  ----  ----  ----
0707:2b48  ----  ----  ----  ----  ----  ----  ----  ----
0707:2b58  ----  ----  ----  ----  ----  ----  ----  ----
0707:2b68  ----  ----  ----  ----  ----  ----  ----  ----
0707:2b78  ----  ----  ----  ----  ----  ----  ----  ----
0707:2b88  ----  ----  ----  ----  ----  ----  ----  ----
Routines:
0197:07c5 _GOPAGE        <   0197:0ba3   <   0197:0e3d _DSPMNU
018f:4e23 _NXTLOF        <   018f:529a   <   018f:53be _CURUSR
018f:3487 _HDLINP        <   018f:3579   <   018f:35e4 _CLRXRF
018f:2502 _KILETC        <   018f:3099   <   018f:3145 _CONDEX
0000:0000 Unknown        <   016f:014f   <   016f:0155 __CLEANUP
```

GP Location

The first line of GP.OUT has the CPU instruction pointer CS:IP contents, which reflect the location (address) of the fault. Usually this points to an instruction that the CPU refused to execute for some reason. This line also tells you when the GP occurred. If you see GPCNT here, then the Sysop has GPHDLR set to YES and the GP reported is not the first (and perhaps not the most informative -- have them set GPHDLR to NO and get you another GP.OUT).

GP Vicinity

The second line of GP.OUT attempts to place the CS:IP between two public symbols that you can search for in your source files. Only symbols declared EXPORT are included here though. The only EXPORT routine in your whole DLL is probably your init_xxx() routine (page 17). If the GP occurred in a source file with no EXPORT routines, you're likely to see some irrelevant addresses. You can still get an idea what file the GP is in from the DLL list. More on that below.

For a reproducible GP (one you can make happen any time you want), you might declare some routines EXPORT just to get more information here. Often, narrowing the problem down to one routine is enough to start studying the routine and to find the problem.

Registers

This section shows the contents of the assembly language registers right when the GP occurred.

Code at the GP Location

Here on the fifth line of GP.OUT are 16 bytes of executable code starting from the GP location. This includes the actual instruction that caused the GP. This object code can come in handy when searching for the exact locations in an assembly listing (more below).

User Conditions

The next section of GP.OUT show information on the most recent BBS activity on a user's channel.

BBS Version: 6.20	BBS software version
User 3	User number (usrnum, see page 39)
channel 00	Channel number (hexadecimal, page 39)
User-ID "Sysop"	User-ID on channel most recently serviced
status 3	Status code from the channel
Online level 6	usrptr->class, 6 is "ACTUSR" -- online and active
state 5	usrptr->state (see page 31)
substate 0	usrptr->substt
MSG:galtlc.mcv	the current .MCV file being read
/-1	the last message read from this file (-1=none)
Module "Teleconference"	From the usrptr->state code (5 in this example)
Input "T"	Most recent status-3 input line on the BBS

The usrptr->state code represents the module the user was in. Sysops choose the module by name when they create a module page during offline Menu Tree Design. Module names are also listed in the Miscellaneous Statistics screen of the BBS console.

In many cases this information at the top of a GP report can be very helpful. But don't trust it too much. The most recent user activity is not necessarily related to the GP at all. In fact, you should carry a highly skeptical attitude into all of your debugging efforts, always seeking a thorough and precise understanding of what your program is doing, while understanding thoroughly how it is *supposed* to work.

To put more debugging information into GP.OUT, you can carefully add some code to the lower part of appgprept() in PLBBS.C. You'll see the fprintf() calls that formatted all of this information, along with careful checking in case pointers are not usable. (Using a bad pointer inside the GP report routines is like accidentally exploding a bomb at the crime scene -- you'll lose the evidence from the original crime due to the new one on your hands.)

DLL Selectors

This is a list of the starting selectors for each of the DLL's you have loaded on the BBS. You can find out in which DLL the GP occurred by finding the highest DLL starting selector that is less than the GP selector.

In the example above, the GP occurred at address 2d4f:031a. That's somewhere in GALTLC because GALTLC.DLL starts at 2d3f and the next one, GALTXV starts at 2d6F. There's a little more you can find out here. Selectors are created in increments of 8 hexadecimal.

```
2d3f   GALTLC starting selector
2d47   \run286\bc3\lib\c0phdll.obj
2d4F   \bbsv6\phobj\mjrtlc.obj
2d57   \
2d5f    > (other selectors used by GALTLC)
2d67   /
2d6f   GALTXV starting selector
2d77   :
2d7f   :
```

After the starting selector, selectors are created for each of the .OBJ files in the order they are listed in the .LNK file. In GALTLC.LNK there are two .OBJ files. The GP occurred in the code from MJRTLC.OBJ, which of course comes from MJRTLC.C. The offset starts at 0000 in the code from that file, so the error occurred 031a bytes into the object code produced from MJRTLC.C.

Note: This selector counting falls apart if you see a .LIB file called out in the .LNK file -- this may link the equivalent of several .OBJ files and use up several selectors. There is a .LIB file linked among the .OBJ files in LTBBS.LNK, for example, the linker response file that goes into making MAJORBBS.EXE.

Once you get a feel for these things you'll know that 031a should be pretty near the beginning of a file as big as MJRTLC.C.

Stack Dump

The stack dump is very relevant to "the crime" of the GP, and it's rich with information -- too rich. Let's jump ahead to the "Routines" section with the return address chain at the bottom. That's where the most meaningful information is pulled from the stack dump and given symbols from the source code where possible. We'll come back to the stack dump later.

Routines in the Return Address Chain

At the bottom of GP.OUT are the chain of return addresses pulled from the stack. These reflect the nesting of subroutines that the CPU was executing at the moment of the GP. The first one in the list, 0197:0ba3, is pulled from the stack at 0707:2A8A or at SS:BP+2. If you know how C language subroutines are implemented in assembly language, it's not hard to realize that this is the return address to some ancestor routine that called (perhaps indirectly) the routine in MJRTLC.C where the GP was triggered.

The first thing that happens in some subroutines is "PUSH BP" then "MOV BP,SP". This means the 2 bytes at [BP+0] are the old BP, and the 4 bytes at [BP+2] are the return address. But not all routines save and reload BP. Since it's the chain of *BP's* in the stack that we trace, not actually the *return addresses*, some routines get "skipped". If a routine doesn't save and reload BP, we won't find the return address to its parent that was pushed when the routine was called. So its parent will appear to be skipped in the list of routines at the bottom of GP.OUT.

So far we know:

1. Somewhere in a routine early in MJRTLC.C a GP was triggered.

2. That routine was called (perhaps indirectly) by a routine between gopage() and dspmnu().

A "grep" of source files turns up gopage() and dspmnu() in MENUING.C. The call to the routine in MJRTLC.C must be somewhere between these points. That is, in one of the routines gopage(), gomodl(), gocond(), gomenu(), or gofile(). (The call couldn't be in dspmnu() itself because 0197:0ba3 is *less* than 0197:0e3d, the start of dspmnu().)

The call must be in gomodl(), because that fires off the sttrou() entry point for a module page (page 33), and early in MJRTLC.C is telecn(), the sttrou() entry point for the Teleconference module.

The next ancestor of gomodl() shown in the return address chain is between nxtlof() and curusr(). This has a different selector than gomodl() (018f versus 0197) so it must come from a different file. In fact it comes from MAJORBBS.C. You'll notice that there's no calls to gomodl() in all of MAJORBBS.C, but there's one in MENUING.C inside of gopage(). Hmm, this is making sense. There are reams of calls to gopage() in MAJORBBS.C for menu tree pages in general. And gopage() calls gomodl() for module pages in particular. gopage() was skipped in the return address chain. That's probably because gomodl(), after various compiler optimizations and shenanigans, didn't need to save and reload BP.

Stack Dump, Revisited

The notations like >2aaa< in the stack dump are BP save locations. When traversing the chain of saved and loaded BP's to generate the return address chain at the bottom of GP.OUT, the BP save locations are flagged with little "> <" symbols. The return addresses shown at the bottom immediately follow each of the "> <" symbols. For example, the ">2aaa<" is followed by 0ba3 and 0197. 0197:0ba3 is the first return address in the list.

Close scrutiny of the stack dump can help us determine the values of parameters passed between routines, and the values of automatic stack variables. In some cases, the values of pushed registers are also of some help in investigating the circumstances of the crime. But to do any of this, we have to look at the assembly language listing of the code where the GP happened and where the ancestor routines did their subroutine calling. And an assembly language listing lets us find out the exact instruction that caused the GP. Let's start with the routine where the GP occurred, probably telecn(), definitely in MJRTLC.C.

Assembly Listing

To get the assembly language listing of MJRTLC.C, we have to generate assembly source code and then assemble it and make a listing:

```
CD \BBSV6\SRC
CTDLL -S MJRTLC
CD \BBSV6\PHOBJ
TASM MJRTLC,NUL,MJRTLC;
```

(Use "CTPH -S" for getting the assembly listing of files that are part of the kernel -- that go to make up MAJORBBS.EXE.) The "-S" parameter (capital S, not small s) asks for an .ASM assembly source file to be output instead of an .OBJ. Then TASM assembles \BBSV6\PHOBJ\MJRTLC.ASM and makes a listing file in \BBSV6\PHOBJ\MJRTLC.LST. (The NUL means don't generate an .OBJ file from the .ASM file.) That .LST file is pretty big. It's where the offsets and object code can be found. To find what we're looking for, there are two clues: The GP location is 2d4f:031a, so we can look in the vicinity of the offset 031a. And the code somewhere near there should be 26 83 0f 01 .... (from the fifth line of GP.OUT). Turns out, it's somewhere *exactly* at 031a:

```
Turbo Assembler        Version 3.1       07/13/92 11:19:52      Page 10
mjrtlc.ASM

    530                                 ;
    531                                 ;       case 0:
    532                                 ;            tptr->flags|=NOPAGE;
    533                                 ;
    534 0316  C4 1E 0077r                    les     bx,dword ptr tptr
    535 031A  26: 83 0F 01                   or      word ptr es:[bx],1
    536                                 ;
    537                                 ;              usrptr->substt=1;
    538                                 ;
    539 031E  B8 0000s                       mov     ax,seg _usrptr
    540 0321  8E C0                          mov     es,ax
    541 0323  26: C4 1E 0000e                les     bx,dword ptr es:_usrptr
    542 0328  26: C7 47 08 0001              mov     word ptr es:[bx+8],1
```

Notice that the sixteen bytes of code don't match exactly where "0000s" goes with "f7 04"? Those "0000s" and "0000e" symbols means that the exact object code is not known at compile (or assembly) time. It will take linking and loading to find out those exact values. So, the object code does confirm that we're looking at the right instruction (the "or" instruction).

So, here's the crime scene, what was the crime? The instruction was "or word ptr es:[bx],1". That's a bitwise OR of the value 1 into some memory location. Notice that the very helpful assembly comments show the original C source code near the relevant assembly code. Turns out the NOPAGE constant is 1, so "tptr->flags|=NOPAGE" is for sure the guilty instruction. A quick look at the registers in line 3 of GP.OUT shows that es:bx is 0000:0000. That's pretty wild, isn't it?. OR'ing to the location addressed by NULL is definitely GP territory. From MJRTLC.C we see that "flags" is the first field of the tlc structure (tptr is type "struct tlc *"), so tptr itself must be NULL.

A scrutiny of the C source logic reveals that tptr is not expected to be initialized here: it's just a low-level looping pointer. We cheated of course; this is exactly the line we inserted to make this GP happen.

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