Chapter 15: Tape Handling

In this chapter we discuss the principal tape handling software and facilities available at Fermilab. Start-up information for running and monitoring **OCS** tape mounts is provided, and the **OCS** X interface is introduced. Several tape I/O packages are briefly described.

OCS manages tape drive allocations and operator-assisted mounts, whereas **RBIO** and **DAFT** are tape I/O packages. **FTT** is a low-level C subroutine library common to **OCS**, **RBIO** and **DAFT**; it can also be used directly for tape I/O and tape drive testing. **FMB** includes features for both tape mounting and I/O. These are all **UPS** products, and are accessible in the standard way via the **`setup`** command.

Since many groups and experiments have customized their tape-handling routines, some or all of the applications described here may not be available or appropriate for you. Contact your group leader to find out what procedures have been established for your group.

15.1 Operator Communications Software (OCS)

OCS is a package that performs and manages tape drive allocations, operator-assisted tape mounts and tape drive use statistics. Its logical-to-physical tape device name translation helps not only human communication, but hides many platform-specific idiosyncrasies from users. The latest version as of this writing is v3.0.

OCS is not a tape I/O package. It works well *with* such packages (e.g., **RBIO**, **FMB**, **DAFT**).

OCS functions are available via three separate interfaces:

- FORTRAN/C library of subroutines
- Command line tools
- X Motif tools

The features available in each of these interfaces overlap to a great extent. However, since the different interfaces are by their nature geared towards different uses, the functionality is not 100% duplicated across them. The FORTRAN/C subroutines provide the most flexibility and functionality for users requiring multiple mount requests, the command line tools are generally used in shell scripts, and the X interfaces are very useful for monitoring tape drive statistics.

The X interfaces are fairly intuitive, so we give you enough information to bring them up (section 15.1.2), but we do not describe them in detail.

The **OCS** functions are fully described in the *OCS Reference Guide*, document number GA0012, available on the Web. The reference guide and other documents are also available wherever **OCS** is installed and setup, in the directory `$OCS_DIR/doc`.

15.1.1 OCS Basics

Monitoring Tape Mounts

During the course of your work, you may need to monitor different aspects of the job and possibly contact the operators. **OCS** provides functionality to perform these job management activities. For your convenience, we list the appropriate command next to the function in the table below, and indicate whether you can perform the function using one of the X interfaces. You will need to see the *OCS Reference Guide* for usage information on these commands and for the associated FORTRAN/C subroutines.

Function	Command	X interface
Mark a tape drive broken so that it will not be allocated until it is repaired	**ocs_broken**	**xocs**
Log statistics as to how much the drive was used	**ocs_report_stat** **ocs_init_stat**	
Send an attention message to the operator	**ocs_message**	
Send a request to the operator to run a cleaning tape through a tape drive	**ocs_clean_it**	
Display status of tape drives in the **OCS** database	**ocs_tape**	**xocs**
Display pending mounts	**ocs_pending**	**xocs** **xtapeview**
Display tape drive statistics	**ocs_devstat** **ocs_stats**	**xocs**
Display tape mount log	**ocs_mrlog**	**xocs**
Display tape drives that may need to be cleaned	**ocs_clean_list**	**xocs**

Sample Tape Mounting Process

Here is a sample tape mounting process using the command line tools. Read through it to see what steps are involved and what kind of response to expect from the system at each step. Note that the **OCS** commands come with many options that are not shown here.

First, display the list of available tape drives:

% ocs_tape

```
HOSTNAME DEVICE   TYPE     ALLOCATED STATUS  VSN            USERNAME UID   AUTH
bastet   dumdlt4  DLT4000  allocated working -              root     0        n
bastet   isis2    EXB-8505 unalloctd working -              -        -        n
bastet   horus    EXB-8200 unalloctd working -              -        -        y
```

Request allocation of a tape drive so no other user may access it (notice only one device shows authorization as “yes”):

% ocs_allocate

```
bastet horus
```

Send a request to the operations staff to mount a tape on the drive you have allocated:

% ocs_request -t horus -w -v FGMS04

```
ocs_request: success
```

Verify that the tape was mounted correctly:

% ocs_check_label -t horus -w -v FGMS04

```
ocs_check_label: Success
```

Set the tape drive characteristics according to your needs (we recommend that you always do this; don't assume the drive has been left in any particular state):

% ocs_setdev -t horus

Request the appropriate device file for reading and/or writing the tape according to the characteristics you've set:

% ocs_devfile -t horus

```
/dev/rmt/tps0d3nrv
```

Perform your task on the loaded tape. Normally this involves running a program that calls tape I/O routines from **RBIO** or another I/O package. For simplicity in this example, we just use the UNIX **dd** utility to get the tape contents (we have loaded an ANSI initialized tape with no data):

% dd if=/dev/rmt/tps0d3nrv conv=unblock cbs=80

```
VOL1FGMS04              ftt                                                  4
HDR1
0+2 records in
0+1 records out
```

A useful feature to include in this example is the device statistics function. It provides more detailed information for the end user than the X interface implementations, which were designed more for administrative purposes.

% ocs_devstat -t horus

```
----------------------------------------------------------------------------
Collecting Tape Drive Statistic ------------------- Thu Oct  2 12:43:27 1997
----------------------------------------------------------------------------
Host Name            = bastet
Device Name          = horus
Device Filename      = /dev/rmt/tps0d3
Device Type          = EXB-8200
Controller           = SCSI
Vendor Id            = EXABYTE
Product Id           = EXB-8200
Firmware Id          = 268N
Serial Number        = -
Number of Hours On   =         -1   In Motion =         -1
Count/KBytes    Read =       2200       Write =         -1
Errors          Read =          0       Write =         -1
Comp Ratio      Read =         -1       Write =         -1
Compresion           = NO
Density              = 8200
Media Type           = 133
Block Size           = 0
Block Total          = 2294048
Count Origin         = Exabyte_Extended_Sense
Remain Tape/KBytes   = 2290569
SCSI Sense Code      = 0
```

```
SCSI ASCQ            = 0
Track Retry          = -1
Stop/Start Count     = -1
SCSI Test Unit Ready = 0
SCSI Sense Key       = NO_SENSE
----------------------------------------------------------------------------
Tape Not Present:  N | Write Prot:   N | Clean Bit:    N | Drive Cleaned: N
Beginning of Tape: N | At File Mark: N | End of Media: N | End of Tape:   N
Ready Bit:         Y | Power Fail:   N | SCSI ILI Bit: N |
----------------------------------------------------------------------------
```

Dismount the tape (i.e. rewind and unload it):

`% ocs_dismount -t horus`

```
ocs_dismount: Success
```

Finally, deallocate the tape drive so that someone else can use it:

`% ocs_deallocate -t horus`

```
ocs_deallocate: Deallocated :horus
```

Tape Mounts with Batch Jobs

☞ Most of the time, users run tape mounts in conjunction with batch jobs. We strongly recommend that you include the tape mount allocation, mount request, dismount and deallocation *within* your batch job. If you don't, you risk preventing others from using the tape drive while your job is waiting to run and after it has finished. A **`-q`** option is provided for the **`ocs_allocate`** command to allow you to queue for tape drive allocation so that your job won't fail if a drive isn't immediately available when it starts to run.

Here is a sample batch job script that incorporates these recommendations:

```
#!/bin/csh
setup ocs
set td=`ocs_allocate -q -h localhost -d exabyte_850x | cut -f2 -d" " -`
if ( $status != 0 ) then
     echo ocs_allocate failed with message: $td
     exit 1
endif
set drive=`echo $td | cut -f2 -d" " -`
ocs_request -t $drive -v fr3147 -r
if ( $status != 0 ) then
     echo ocs_request failed
     ocs_deallocate -t $drive
     exit 1
endif
set dfile=`ocs_devfile -t $drive`
if ( $status != 0 ) then
     echo ocs_devfile failed with message: $dfile
     ocs_dismount -t $drive
     ocs_deallocate -t $drive
     exit 1
endif
ocs_setdev -t $drive -v -d 8500
if ( $status != 0 ) then
     echo ocs_setdev failed
     ocs_dismount -t $drive
     ocs_deallocate -t $drive
     exit 1
endif
setenv MY_DEVFILE_VAR $dfile
e831job.run
ocs_dismount -t $drive
ocs_deallocate -t $drive
```

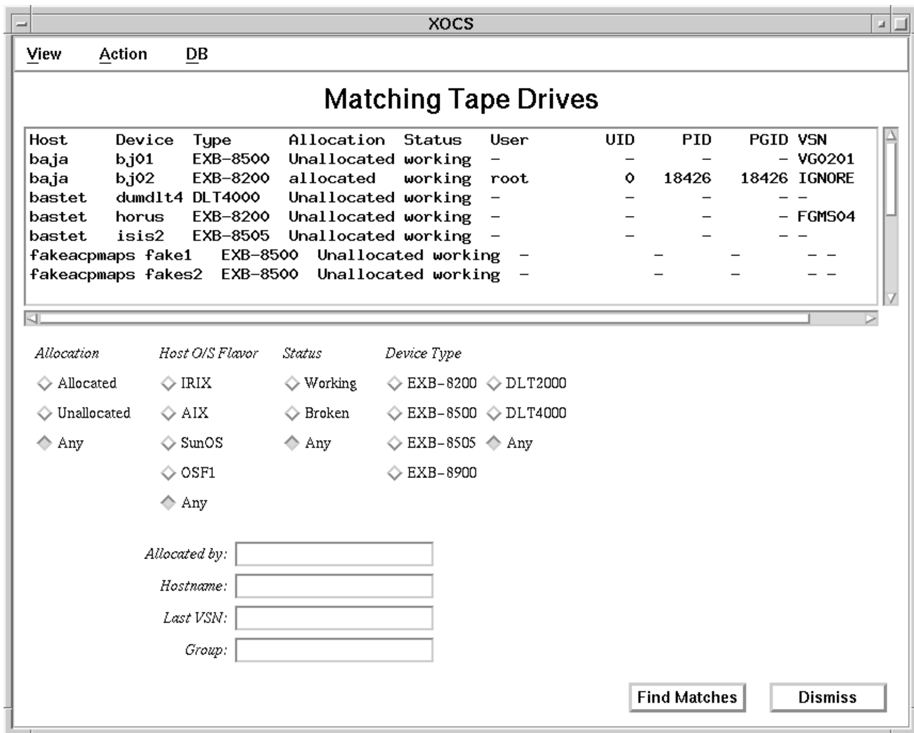
```
exit 0
```

15.1.2 The OCS X Interfaces

Remember that your *DISPLAY* environment variable needs to be set properly for X windows applications (see section 9.2).

xocs

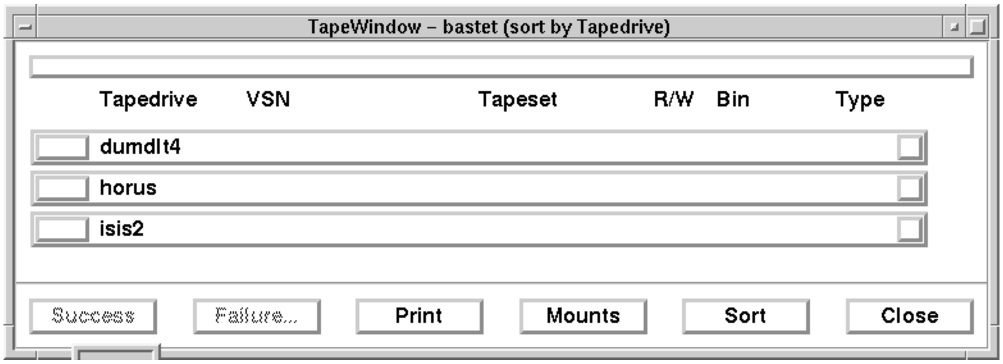
xocs is an X interface that you may find useful for viewing tape statistics and history. It allows you to perform a subset of the functions available through text commands. After setting up **OCS**, enter **`xocs`** at the command line. You'll see the following screen (shown for version v3.0):



The menu options under View and Action include most of the features you will need.

xtapeview

Another X interface to **OCS** which allows you to view pending mount requests is **xtapeview**. As a user, you are not permitted to respond to mount requests, only view them. Invoke this interface with the command **`xtapeview`**. A window will appear from which you can choose a node. Click on the node you want, then you'll see a window like the one below which shows the drives associated with that node, and any pending mounts.



If you have a color screen, the banner at the top is blue when no mounts are pending, and red if one or more are. The status button (to the left of the drive name) will be red if a mount is pending on that drive. If you don't have a color screen, there are gray-tone representations of blue and red. See `$OCS_DIR/doc/xtape.ps` (recall that *$OCS_DIR* is defined during setup) for a full description of this application, and to see how to customize the color scheme.

15.1.3 Using Provided Examples to Get Started

Examples are provided in the `$OCS_DIR` directory (defined during setup). You can look at `$OCS_DIR/doc/viewgraphs.ps` for more single-command examples and their expected output.

The directory `$OCS_DIR/examples` provides sample programs for FORTRAN, C and Bourne shell script which are intended to help you understand how **OCS** works. The executables are named `ocs_ctest`, `ocs_ftest`, and `ocs_btest` for C, FORTRAN and Bourne shell, respectively. Each program carries almost identical functionality. You may want to use the source of these programs (`ocs_ctest.c`, `ocs_ftest.fs` and `ocs_btest.sh`) as an aid in developing your own programs. The `$OCS_DIR/examples/README` file explains how to use the examples.

These example programs can actually send a mount request to operations staff: please keep this in mind if you experiment with OCS on Fermilab Computing Division systems such as FNALU.

15.2 Raw Buffered I/O (RBIO)

The **RBIO** (Raw Buffered I/O) library provides an I/O interface that is FORTRAN- or C-callable, medium-independent, and UNIX flavor-independent. It allows your FORTRAN or C program to perform buffered I/O on a file object, which may be a regular file or a labeled tape. The **RBIO** library is used in the compilation, linkage, and execution phases. The actual reading/writing level is at the primitive logical record level; **RBIO** does not understand record contents.

RBIO is documented in the *RBIO User's Guide*, document number SU0033.

15.3 DAta From Tape (DAFT)

DAFT (DAta From Tape) consists of a set of routines written by the DART collaboration to provide event-level reading and writing from DART-formatted records to/from disk and tape. Information on DART can be found under *Projects & Working Groups* on the Computing Division home page.

DAFT performs the following functions:

- retrieve data written on tape or disk in the format used by DART
- write data on tape or disk in the DART format

The routines in **DAFT** are widely portable, and currently run on the supported UNIX platforms IRIX, Solaris, AIX and OSF1. They offer a FORTRAN interface.

DAFT was written in two layers to allow for a lower level that is easily portable. Therefore, two sets of access routines are provided:

- a “low-level” set that embeds the different levels of platform-dependence and delivers records to the higher level routines
- “high-level” routines that unpack events from the records and provide the event interface

The DART on-line format packs events into logical records, where each record may contain more than one event, in order to keep the drives streaming at full speed. The routines handle large events spanning records (the maximum record length is 64 Kbytes), and correct the byte ordering of data on platforms of different *endianship*.

For more information on **DAFT**, see the *DAFT (DAta From Tape) User’s Guide*, document number PN504.

15.4 Fermi Tape Tools (FTT)

The Fermi Tape Tools (**FTT**) product is a low-level C subroutine library. It provides:

- basic tape I/O
- support for obtaining and tracking available tape statistics
- a set of informational and support subroutines for tools that allocate and control tape usage (i.e. **OCS**)

FTT has been designed to provide platform- and drive-independent I/O on the UNIX platforms supported at Fermilab. It has also been designed to be portable to other platforms and drives. In addition to its use as a transparent layer of software in several products (namely **DAFT**, **OCS**, and **RBIO**), the **FTT** subroutine library can be called directly by user-written programs. **FTT** also includes an interactive test program which, among other things, can verify that tape drives are behaving properly.

FTT is documented in the *Fermi Tape Tools Library User’s Guide*, document number PU0236.

15.5 Fermi Modular Backup (FMB)

The Fermi Modular Backup (**FMB**) system is a locally-written set of utility scripts used for backup, restore, and other similar administrative tasks. It was designed for use on the supported UNIX flavors. **FMB** uses short, simple-to-write *modules* to provide different tape rotation schemes, tape mount systems, archive formats, and so on. It also supports backup of remote machines, and/or remote tape drives.

See the *Fermi Modular Backup System User’s Guide*, document number PU0164.