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VAX/VMS
Training

# VAX/VMS
# Device Driver
## Driver Incorporation

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# DRIVER INCORPORATION

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# INTRODUCTION

After a driver is written, it must be assembled, linked, and integrated (loaded) with the system for testing, and final operation. A driver can be loaded into the system any time after the system is bootstrapped. If the driver contains an error which does not crash the system, the error may be corrected, and a new version of the driver reloaded. This module examines the commands and procedures for assembling, linking, and loading drivers.

# OBJECTIVES

Upon completion of this module, you will be able to:

1. Assemble and link a user-written driver at a terminal.
2. Use the SYSGEN commands LOAD, CONNECT, SHOW and RELOAD to integrate a user-written driver with the system.

# RESOURCES

1. Guide to Writing a Device Driver for VAX/VMS
2. PDP-11 Peripherals Handbook
3. VAX-11 Software Installation Support Manual

## TOPICS

- Creating an Executable Driver
  - Assembling
  - Linking
- Integrating a Driver with VMS
  - SYSGEN Utility
  - SYSGEN COmmands
  - Examples

## ASSEMBLING A DRIVER

```
$MACRO/LIST full-driver-file-spec+SYS$LIBRARY:LIB/LIB
```

Example:

```
$MACRO/LIST DB0:[XDIR]XXDRIVER+SYS$LIBRARY:LIB/LIB
```

- Since drivers invariably invoke many system macros, it is essential that the system macro library (SYS$LIBRARY:LIB/LIB) be assembled with drivers.
- The listing file (xxDRIVER.LIS) is essential when debugging the driver.

## LINKING A DRIVER

Format:

```
MYDRIVER.OPT
BASE=Ø


$ LINK/NOTRACE/MAP/FULL XXDRIVER1 [,XXDRIVER2,....],-
$_MYDRIVER/OPTIONS,-
$_SYS$SYSTEM:SYS.STB/SELECTIVE
```

- The DCL continuation mark (-) is used here for convenience only.
- MYDRIVER.OPT is an option file that specifies a zero base for the executable image.
- If the driver consists of multiple source files, XXDRIVER1 must contain the driver prologue table.
- The image file created is XXDRIVER1.EXE. The map file created is XXDRIVER1.MAP.
- It is normal to see the following message displayed at LINK time: "XXDRIVER1 has no user transfer address".
- The map file is essential when debugging the driver.
- If the /SELECTIVE qualifier is omitted, the entire system symbol table is included (which makes for extremely large map files).
- It is suggested that you write a command procedure to assemble and link your driver.

## INTEGRATING A DRIVER WITH THE SYSTEM

```
$ RUN SYS$SYSTEM:SYSGEN
SYSGEN> COMMAND
SYSGEN> EXIT
```

| Function | Command | Example |
|---|---|---|
| Load driver code into nonpaged pool | LOAD | Load DBAØ:[MARSH]mydriver.exe |
| Create I/O data structure(s) | CONNECT | CONNECT LPAØ/qualifiers |
| Replace a driver with another | RELOAD | RELOAD LPDRIVER |
| Display information | SHOW/qualifier | |
| Devices | /DEVICES | SHOW/DEVICES [=DB] |
| Configuration | /CONFIGURATION | SHOW/CONFIGURATION |

Privilege Requirements vs Commands

CMKRNL: Load, Connect, Reload

CMEXEC: SHOW

## COMMANDS

LOAD

LOAD driver_filespec

- Allocates nonpaged pool
- Bring driver image into memory
- Unload old driver image if existent and if possible

Defaults: Directory = SYS$SYSTEM
File_type = Exe

CONNECT

- Load driver, if not already in memory
- Allocate nonpaged pool
- Build I/O data base
  - If first unit on controller create UCB, IDB, DDB
  - If not first unit, create UCB only

Example:

```
SYSGEN>CONNECT LPA0/Adapter=3/CSR=%O777514/VECTOR=%O200
```

Defaults: /DRIVER=LPDRIVER
/NUMVEC=1
/ADPUNIT=0

DEVICE NAME

devcu
dev = device type
c = alphabetic controller designation
u = unit number (0-7)

Dev and c must specify a unique and accurate combination. If the specified combination already exists, no new control blocks are created. If not accurately specified, spurious blocks may be created.

Paper Tape Punch Example

```
SYSGEN>LOAD [DRIVER1]PPDRIVER.EXE
SYSGEN>CONNECT DPA0/CSR=%/0777554/VECTOR=%074/ADAPTER=UB0
```

## CONNECT QUALIFIERS

| Qualifier and Purpose | Usage/Comment |
|---|---|
| /Adapter = tr_number UBØ | Required for connecting all units |
| /VEC = vector_addr %07Ø | Required for connecting first unit |
| /NUMVEC = # of interrupt vectors 2 | 2 for PT driver<br>Required for connecting first unit |
| /CSR = UNIBUS addr of CSR %0777550 | Required for connecting first unit |
| /DRIVER = name (as specified in DPT) | Default = aa driver (aa is device type) |
| /ADPUNIT = unit # of device on controller (MASSBUS only) | Default = Ø |
| /MAXUNITS = # (Max units/controller) | Default = 8 or value in DPTAB macro (first unit only) |

RELOAD

RELOAD driver_filespec

Same as LOAD except no check is made to see if driver_filespec = driver_name is list of DPTs.

If DPT$M_NOUNLOAD bit is set in flags parameter to DPTAB macro, driver cannot be reloaded.

Can be used to recover nonpaged pool by RELOADing a large infrequently used driver with a dummy driver. However, the best way to get rid of a driver is to reboot.

## The SHOW Command

Displays the values of system parameters in the SYSGEN work area, plus the I/O driver database.

Format:

```
SHOW parameter-name
SHOW /qualifier
```

| Information Displayed | Qualifier |
|---|---|
| Devices by name, number of units, nexus number, adapter type, and CSR and vector addresses. | /CONFIGURATION (CMEXEC privilege required, see note below) |
| Displays the device data base. | /DEVICE[=device-driver] (CMEXEC privilege required) |
| The beginning and ending addresses of the drivers. | /DRIVER[=device-driver] |

NOTE

Also accepts /ADAPTER = adapter-spec, /OUTPUT = filespec, as well as /COMMAND_FILE, which formats all the devices as CONNECT commands to allow a complete reconfiguration of a system's UNIBUS without the use of AUTOCONFIGURE.

```
$ RUN SYS$SYSTEM:SYSGEN
SYSGEN>  SHOW/DEVICES

__Driver_____Start____End____Dev___DDB______CRB______IDB_____Unit__UCB____
DZDRIVER    8008CE20 8008D890
                             TTA 80106480 800E78C0 801064E0
                                                          0 8008D890
                                                          1 8008D990
                                                          2 8008DA90
                                                          3 8008DB90
                                                          4 8008DC90
                                                          5 8008DD90
                                                          6 8008DE90
                                                          7 8008DF90
LPDRIVER    8008C9A0 8008CE20
                             LPA 80106240 801062A0 80106300
                                                          0 800E7280
DRDRIVER    800B4A90 800B5401
                             DRA 80000C6C 800FFA00 800FFA60
                                                          0 80000CA0
                                                          2 8008C8E0
TTDRIVER    800B2770 800B4A85
OPERATOR    800012E6 80001AB6
                             OPA 80000D9C 80000F10 80000F64
                                                          0 80000DD0
NLDRIVER    800012AD 80001850
                             NLA 80001144 8000122C 8000122C
                                                          0 80001178
MBDRIVER    80001274 800017EF
                             MBA 80000F84 8000122C 8000122C
                                                          1 8000103C
                                                          2 800010C0
                                                          4 800E23C0
                                                          5 800E2460
                                                          8 800E4A80
                                                         10 800E1D80
                                                         11 800E2500
SYSGEN>
```

Example 4-1 SYSGEN SHOW/DEVICES Command

| Output Heading | Meaning |
|---|---|
| DRIVER | Driver name |
| START | Starting virtual address of DPT |
| END | Ending virtual address of driver |
| DEV | Generic device/controller name |
| DDB<br>CRB<br>IDB | Virtual address of controller data structures |
| Unit | Unit number of device |
| UCB | Virtual address of Unit Control Block |

```
$RUN SYS$SYSTEM:SYSGEN

SYSGEN> SHOW/CONFIG

        System CSR and Vectors on  2-JUL-1982 12:35:41.94

 Name: DRA  Units: 2  Nexus:4  (MBA)
 Name: LPA  Units: 1  Nexus:8  (UBA) CSR: 777514  Vector1: 200  Vector2: 000
 Name: TTA  Units: 8  Nexus:8  (UBA) CSR: 760100  Vector1: 300  Vector2: 304

SYSGEN> SHOW/CONFIG/COMMAND
$ RUN SYS$SYSTEM:SYSGEN
AUTOCONFIGURE 4
CONNECT LPA0 /ADAP=8 /CSR=%O777514 /VECT=%O200 /NUMV=01 /DRIVER=LPDRIVER
CONNECT TTA0 /ADAP=8 /CSR=%O760100 /VECT=%O300 /NUMV=02 /DRIVER=DZDRIVER
CONNECT TTA1 /ADAP=8 /CSR=%O760100 /VECT=%O300 /NUMV=02 /DRIVER=DZDRIVER
CONNECT TTA2 /ADAP=8 /CSR=%O760100 /VECT=%O300 /NUMV=02 /DRIVER=DZDRIVER
CONNECT TTA3 /ADAP=8 /CSR=%O760100 /VECT=%O300 /NUMV=02 /DRIVER=DZDRIVER
CONNECT TTA4 /ADAP=8 /CSR=%O760100 /VECT=%O300 /NUMV=02 /DRIVER=DZDRIVER
CONNECT TTA5 /ADAP=8 /CSR=%O760100 /VECT=%O300 /NUMV=02 /DRIVER=DZDRIVER
CONNECT TTA6 /ADAP=8 /CSR=%O760100 /VECT=%O300 /NUMV=02 /DRIVER=DZDRIVER
CONNECT TTA7 /ADAP=8 /CSR=%O760100 /VECT=%O300 /NUMV=02 /DRIVER=DZDRIVER
EXIT
```

Example 4-2  SYSGEN SHOW/CONFIG Command

```
$MCR SYSGEN
SYSGEN> LOAD SYS$SYSTEM:FMDRIVER
SYSGEN> SHOW/DEVICE=FM

__Driver_____Start____End____Dev___DDB______CRB______IDB_____Unit__UCB____
FMDRIVER   8008E150 8008E6B0

SYSGEN> CONNECT FMA0/ADAPTER=UB0/VECTOR=%O500/CSR=%O777514-
/DRIVER=FMDRIVER

SYSGEN> SHOW/DEVICE=FM

__Driver_____Start____End____Dev___DDB______CRB______IDB_____Unit__UCB____
FMDRIVER   8008E150 8008E6B0
                            FMA 80102940 80102880 801029A0
                                                        0 800E64C0

SYSGEN> CONNECT FMA1/ADAPTER=UB0/CSR=%O777514/DRIVER=FMDRIVER

SYSGEN> SHOW/DEVICE=FM

__Driver_____Start____End____Dev___DDB______CRB______IDB_____Unit__UCB____
FMDRIVER   8008E150 8008E6B0
                            FMA 80102940 80102880 801029A0
                                                        0 800E64C0
                                                        1 800E6600

SYSGEN> CONNECT FMA2/ADAPTER=UB0/CSR=%O777514/DRIVER=FMDRIVER

SYSGEN> SHOW/DEVICE=FM

__Driver_____Start____End____Dev___DDB______CRB______IDB_____Unit__UCB____
FMDRIVER   8008E150 8008E6B0
                            FMA 80102940 80102880 801029A0
                                                        0 800E64C0
                                                        1 800E6600
                                                        2 800E6880
```

Example 4-3 SYSGEN Commands vs. Driver Incorporation

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