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Comparing Tru64 UNIX & HP-UX System Management Tools

Presented by

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Tru64 UNIX to HP-UX Transition; System Management Tools (Webinar Topics)

Topics to be covered

- License Management (Tru64 UNIX, HP-UX)
- sysman review (Tru64 UNIX)
- sam review (HP-UX)
- hwmgr review (Tru64 UNIX)
- dsfmgr review (Tru64 UNIX)
- ioscan review (HP-UX)
- insf review (HP-UX)
- mksf review (HP-UX)
- rmsf review (HP-UX)
- lssf review (HP-UX)
- lsdev review (HP-UX)

Tru64 UNIX to HP-UX Transition; System Management Tools (License Management)

License Management (Tru64 UNIX and HP-UX)

License: Product or feature that grants use to a given application, product or platform.

An operating system license may be required for:

Extended Software Capabilities

(Example: RAID implementations in software)

Extended Hardware Capabilities

(Example: Symmetric Multi-processing)

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX, LMF)

The License Management Facility, a.k.a. “lmf” (Tru64 UNIX)

Contains a Product Authorization Key (PAK), which records the following information:

- License information (The name and version number of the product).
- The product release date.
- The date after which the license expires (if any).
- The amount of use allowed by the license (i.e. How many **units** allowed).

The license database (/var/adm/lmf/ldb):

- The license database stores information about all licenses registered on a system.
- LMF creates the license database the first time a license is registered.

lmf features (/usr/sbin/lmf):

- Facilitates License Management on a Tru64 UNIX system.
- Can register licenses on a system.
- Can load, un-load, and/or remove licenses on a system.
- An actual executable program, unlike “**lmfsetup**” (more on **lmfsetup** to follow).

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX LMF usage)

Example use of lmf:

```
lanier@beagle in /usr/users/lanier --> lmf list | wc -l
       740       ←Est. number of licenses installed.

lanier@beagle in /usr/users/lanier --> lmf list | head -1;lmf list |
   tail -5

Product                    Status                    Users: Total
   Active
ACAS                        active                        unlimited
ABDAS-U                    active                       unlimited
2020-UR                     active                         unlimited
LSM-OA                      active                         unlimited
OSF-BASE                   active                       unlimited

lanier@beagle in /usr/users/lanier --> lmf list full LSM-OA
Invalid argument lsm-oa                          ←Pilot error
Usage : lmf list [ full ] [ ldb|cache|all ] [ for <product> [
   <producer> ] ]
```

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX LMF usage)

Example use of lmf (cont.):

```
lanier@beagle in /usr/users/lanier --> lmf list full for LSM-OA

           Product Name: LSM-OA
               Producer: DEC
                 Issuer: DIGITAL-IM&T
   Authorization Number: BIR-PK-97349-1-CXO-VTERRE-518
        Number of units: 1100
                Version:
   Product Release Date:
   Key Termination Date:
Availability Table Code: H
    Activity Table Code:
            Key Options: ALPHA
          Product Token: *TEMPORARY LICENSE*
            Hardware-Id:
         License status: active
      Cancellation Date:
        Revision Number: 0
                Comment:
      Cache Total Units: 1100
        Activity Charge: 0
```

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX LMF usage)

lmfsetup (/usr/sbin/lmfsetup)

An alternative to the **lmf** utility for registering licenses.

/usr/sbin/lmfsetup: /usr/bin/ksh shell script

Prompts for input from the user (interactive script).

License Unit Requirement Table (LURT)

- Specifies how many license units are needed to run a product on a particular model of hardware.
- Different models of hardware require a different number of license units to allow a product to run (see the "**SMP**" discussion from earlier).
- The license unit is a measure of software use.
- License Unit Requirement Tables are internal to LMF and cannot be displayed or modified.

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX Lic. Management)

License Management (HP-UX)

The HP-UX Operating System does not always require a software license – new systems purchased include a Foundation Operating Environment (OE) license per processor. Upgrades to other OE's are licensed on a per processor basis. See http://docs.hp.com/en/5187-2725/apds01.html for more information on OE's.

However:

- Some application software products may require a software license
- Depending on the OE, individual product licenses might not be needed for HP products.
- Some HP software products are shipped on CDROM as "protected" products.
- A license password (also referred to as a "code word") is needed for such products.
- Protected products cannot be installed or copied unless a code word and customer ID are provided.
- Software that is unlocked by a codeword can only be used on computers for which you have a valid license to use said software.
- It is the responsibility of the system administrator to ensure proper use of protected software and associated code words.
- Code words are found on a CDROM certificate provided by HP.
- The certificate shows the code word & customer ID for which the code word is valid.

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX Lic. Management)

License Management (HP-UX; cont.)

- One code word often times unlocks all the products on the CDROM that was purchased.
- When additional HP protected software is purchased, an additional code word will be provided by HP as well.
- New code words and customer ID's will be merged with any previously entered code words.
- A code word for a given customer ID and CDROM need only be entered once per target system.
- The code word and customer ID are stored in **/var/adm/sw/.codewords**

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX Lic. Management)

Some more information on license-specific syntax in HP-UX:

root@merc72 in / --> **man -k license**

stlicense(1M) - server access control program for X
vxlicense(1M) - VxFS and VxVM licensing key utility
vxlicinst(1) - Installs a VERITAS license key
vxlicrep(1) - Reports all VERITAS license keys installed on the system
vxlictest(1) - Identifies whether a VERITAS product feature is licensed on the system

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX Lic. Management)

License Management (HP-UX; cont.)

```
root@merc72 in / --> vxlicense
vrts:vxlicense: TO FIX: Usage:
        vxlicense [-cptu] [-H]
vrts:vxlicense: INFO:
For detailed help use: vxlicense –H                    ←Pilot error..

root@merc72 in / --> vxlicense -H
vrts:vxlicense: INFO: vxlicense - Administer key file for VERITAS products
vrts:vxlicense: INFO: Usage:
        vxlicense [-cpt] [-H]
vrts:vxlicense: INFO: Options are:
-c              create a license key file
-p              print license details
-u              print Host ID
-t feature      test a license
-H              print this message
```

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX Lic. Management)

License Management (HPUX; cont.)

```
root@merc72 in / --> vxlicense –p          ← Print license details.
vrts:vxlicense: INFO: No valid license installed


root@merc72 in / --> vxlicrep                    ← Reports all VERITAS
   license                                           keys installed on the
   system.

VERITAS License Manager vxlicrep utility version 3.01.001
Copyright (C) VERITAS Software Corp 2002. All Rights reserved.

Creating a report on all VERITAS products installed on this system
Error: There are no valid VERITAS License keys installed in the system.
```

(NOTE: Since Veritas is functioning properly and with no noticeable problems, either licenses aren't required or we haven't (yet) run up against any functionality restrictions.)

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX; “sysman”)

SYSMAN (TRU64 UNIX)

A GUI or Character Cell interface for invoking various system administration/management services, which include the following:

SysMan Menu

A menu driven, task oriented system management tool. SysMan Menu and its associated tasks can run on a character cell terminal, an X Windows display, from a PC, or from a Web browser.

SysMan Station

A graphical interface for monitoring and managing a single or clus-ter system. The SysMan Menu and its specific tasks can be launched from the SysMan Station.

SysMan Command Line Interface

Provides a generic command line interface to the System Management (SysMan) data.

SysMan Cloning

Saves certain SysMan configuration information from a previously configured system and replicate that configuration information across one or more clients.

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX; “sysman”)

SYSMAN (TRU64 UNIX; cont.)

Commands (and associated man pages) available in **Sysman** are as follows:

sysman_menu(8)
sysman_station(8)
sysman_cli(8)
sysman_clone(8)

(Where ”(8)” = Man page section where information about said command resides.)

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX; “sysman”)

Invoking sysman from a shell prompt:

```
root@beagle in / --> sysman
.........
SysMan Menu on beagle.parsec.com
Tru64 UNIX system management tasks:
+-------------------------------------------------------------------------------+
|>+ Accounts
| + Hardware
| + Mail
| + Monitoring and Tuning
| + Networking
| + Printing
| + Security
| + Software
| + Storage
| + Support and Services
| + General Tasks
+-------------------------------------------------------------------------------+
            Select                 Find...            Help On Item

         ================ <CTRL-G> FOR KEYBOARD HELP ==================
              Exit               Options...              Help
```

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX; “sam”)

SAM (HP-UX)

- A menu-driven **System Administration Manager (SAM)** program for performing system administration tasks.
- **SAM** discovers many aspects of a system's configuration through automated inquiries and tests.
- Help menus describe how to use **SAM** and perform various management tasks.
- Press the **F1** function key for help on a currently highlighted field.
- **SAM** updates the user who invoked it via status messages and a log file monitor.

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX; “sam”)

SAM (HP-UX; cont.)

SAM has been tuned to run in the **Motif** environment, but it can be run on **text terminals** or via the **command-line interface (curses/character-cell)** as well.

To run SAM in the Motif environment:

- Be sure that **Motif** has been installed on your system.
- Assure that the **DISPLAY** environment variable is set to the system name on which the SAM screens should be displayed (or use the **-display** command line option).

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX; “sam”)

Invoking sam from a shell prompt: (note the similarities to sysman)

```
root@merc72 in / --> sam
Starting the terminal version of sam...
.........
¦File View Options Actions                                        Help
¦Press CTRL-K for keyboard help.
¦SAM Areas
¦  Source   Area
¦¦ SAM      Accounts for Users and Groups ->
¦¦ SAM      Auditing and Security         ->
¦¦ SAM      Backup and Recovery           ->
¦¦ SAM      Disks and File Systems        ->
¦¦ SAM      Display                       ->
¦¦ SAM      Kernel Config (kcweb)
¦¦ SAM      Networking and Communications ->
¦¦ SAM      Partition Manager
¦¦ SAM      Performance Monitors          ->
¦¦ SAM      Peripheral Devices            ->
¦¦ SAM      Printers and Plotters         ->
¦¦ SAM      Process Management            ->
¦¦ Other    Resource Management           ->
¦¦ SAM      Routine Tasks                 ->
```

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX; “hwmgr”)

/sbin/hwmgr review

- Enables the management of hardware components.
- Also enables management of software subsystems that maintain information about the hardware components **(EX: Information about a given Network Interface Card such as MAC address, speed, I/O rates, modes, etc.).**

A hardware component can include:

- Storage peripherals (such as a disk or tape).
- System components (such as CPU (**OLAR**) or SCSI bus).
- See “**man olar_intro**” for information on “**O**n**L**ine **A**ddition & **R**eplacement” (**not applicable to all Alpha systems**).

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX; “hwmgr”)

/sbin/hwmgr review (cont.)

The **hwmgr** command has an extensive suite of commands and sub-commands. The following man pages detail the functionality of **hwmgr**:

hwmgr_view(8)
hwmgr_get(8)
hwmgr_show(8)
hwmgr_ops(8)

- Prior to **hwmgr** in T64 V5.x, a utility called **scu (SCSI CAM Utility)** was the primary tool used to manage hardware components.
- The **scu** utility is still around, but not used as much for device management.
- The **scu** utility still has many practical purposes, but does not get the same exposure in lieu of **hwmgr.**

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX; “hwmgr”)

To get a listing of all devices known to the system:

```
root@beagle in / --> hwmgr view devices
 HWID: Device Name          Mfg      Model            Location
 ------------------------------------------------------------------------------
    3: /dev/dmapi/dmapi
    4: /dev/scp_scsi
    5: /dev/kevm
   33: /dev/disk/floppy0c             3.5in floppy     fdi0-unit-0
   45: /dev/disk/dsk0c      DEC       RZ1DB-BS (C) DEC bus-2-targ-0-lun-0
   60: /dev/random
   61: /dev/urandom
   69: /dev/disk/dsk1c      DEC       RZ1DB-BS (C) DEC bus-2-targ-2-lun-0
   72: /dev/disk/dsk2c      DEC       RZ1CB-BA (C) DEC bus-2-targ-1-lun-0
   73: /dev/disk/cdrom0c    TOSHIBA   CD-ROM XM-6202B  bus-0-targ-0-lun-0
   86: /dev/ntape/tape0     SUN       DLT7000          bus-2-targ-3-lun-0
```

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX; “hwmgr”)

To get a listing of all attributes for a given hardware subsystem/category:

```
root@beagle in / --> hwmgr get attr -cat network
17:
  name = tu0
  category = network
  sub_category = Ethernet
  model = 21143
  hardware_rev = 3.0
  firmware_rev =
  MAC_address = 00-00-F8-75-BF-11
  MTU_size = 1500
  media_speed = 10
  media_selection = Set by SRM Console
  media_type = Unshielded Twisted Pair (UTP)
  loopback_mode = 0
  promiscuous_mode = 0
  full_duplex = 0
.........
```

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX; “hwmgr”)

To get a hierarchical view of the relationship between devices and the system’s bus layout/configuration:

```
root@beagle in / --> hwmgr view hierarchy
HWID:   hardware hierarchy
-------------------------------------------------------------------------------
   1:   platform Digital Personal WorkStation 600au
   2:     cpu CPU0
   6:     bus pci0
   7:       connection pci0slot3
  17:         network tu0
   9:       connection pci0slot4
  18:         ide_adapter ata0
  19:           scsi_bus scsi0
  73:             disk bus-0-targ-0-lun-0 cdrom0
.....
```

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX; “hwmgr”)

To get a very detailed view of all devices known to the system:

```
root@marquis in / --> hwmgr show scsi -full

                  SCSI                          DEVICE    DEVICE     DRIVER  NUM  DEVICE    FIRST
 HWID:  DEVICEID HOSTNAME   TYPE      SUBTYPE OWNER  PATH FILE        VALID PATH
-------------------------------------------------------------------------------------------------------------------------------
   37:  0        marquis    disk      none    2      1    dsk0   [0/0/0]

      WWID:0410002c:"Maxtor  53073W6         K60L9YQC            "

      BUS   TARGET  LUN   PATH STATE
      ----------------------------------
      0     0       0     valid
……
                  SCSI                          DEVICE    DEVICE     DRIVER  NUM  DEVICE  FIRST
 HWID:  DEVICEID HOSTNAME   TYPE      SUBTYPE OWNER  PATH FILE       VALID PATH
-------------------------------------------------------------------------------------------------------------------------------
   86:  4        beagle     tape      none    0      1    tape0  [2/3/0]

      WWID:04100022:"SUN     DLT7000         CXA14S5847"


      BUS   TARGET  LUN   PATH STATE
      ------------------------------
      2     3       0     valid
……
```

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Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX; “hwmgr”)

To get a more detailed view of the Tru64 UNIX SCS → disk relationship:

```
root@marquis in / --> hwmgr show scsi -type disk

            SCSI                                    DEVICE    DEVICE    DRIVER   NUM  DEVICE FIRST
 HWID:  DEVICEID HOSTNAME   TYPE      SUBTYPE OWNER  PATH FILE       VALID PATH
-------------------------------------------------------------------------------------------------
    ------------------------------
    37:      0        marquis     disk      none       2        1     dsk0   [0/0/0]
   39:      2        marquis     disk      none       2        1     dsk1   [2/0/0]
   42:      5        marquis     disk      none       2        1     dsk4   [2/3/0]
   43:      6        marquis     disk      none       2        1     dsk5   [2/4/0]
   44:      7        marquis     disk      none       0        1     dsk6   [2/5/0]
   52:      3        marquis     disk      none       0        1     dsk3   [2/2/0]
   54:      4        marquis     disk      none       2        1     dsk2   [2/1/0]
```

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX; “hwmgr”)

To get a more detailed view of the Tru64 UNIX SCSI → tape relationship:

```
root@beagle in / --> hwmgr show scsi -full -type tape

                SCSI                                DEVICE    DEVICE    DRIVER NUM
   DEVICE FIRST
 HWID:  DEVICEID HOSTNAME   TYPE      SUBTYPE OWNER  PATH FILE     VALID

   PATH
-------------------------------------------------------------------------------
   ---------------------------------
   86:             4        beagle               tape        none              0
   1       tape0  [2/3/0]

      WWID:04100022:"SUN     DLT7000         CXA14S5847“

      BUS   TARGET  LUN   PATH STATE
      ------------------------------
      2     3       0     valid
```

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX; “hwmgr”)

You can also use **hwmgr** to “**redirect**” the hardware characteristics of one disk to another disk. This may be necessary when:

Replacing a failed disk:

A **pre-step** when migrating/restoring data from one disk to another.

Lab:

- Create a file domain & fileset using **dsk3c**:
  #mkfdmn /dev/disk/dsk3c test_domain
  #mkfset test_domain test_fset
- Mount/un-mount the test domain.
- Redirect the hardware attributes from **dsk3** to **dsk6.**
- Verify that this occurred successfully.

```
root@marquis in / --> df -h /test
Filesystem                             Size        Used   Available
Capacity  Mounted on
test_domain#test_fset       4092M        411M       3675M    11%
/test
root@marquis in / --> umount /test
```

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX; “hwmgr”)

Lab (cont.)

```
root@marquis in / --> hwmgr show scsi
                  SCSI                        DEVICE    DEVICE   DRIVER NUM  DEVICE FIRST
HWID:  DEVICEID HOSTNAME   TYPE      SUBTYPE OWNER  PATH FILE   VALID

    PATH
------------------------------------------------------------------------------------------
    -----------------
.........
44:  7        marquis    disk      none    0      1    dsk6   [2/5/0]
52:  3        marquis    disk      none    0      1    dsk3   [2/2/0]

root@marquis in / --> hwmgr redirect scsi -src 3 -dest 7
hwmgr: Redirect operation was successful

root@marquis in / --> hwmgr show scsi
                  SCSI                              DEVICE  DEVICE  DRIVER NUM  DEVICE FIRST
HWID:  DEVICEID HOSTNAME   TYPE      SUBTYPE OWNER  PATH FILE   VALID

    PATH
------------------------------------------------------------------------------------------
    -----------------
.........
52:  3        marquis    disk      none    0      1    dsk3   [2/5/0]
```

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX; “hwmgr”)

Note what happens when I try to re-mount the filesystem afterwards:

```
root@marquis in / --> mount test_domain#test_fset /test
test_domain#test_fset on /test: No such domain, fileset or mount directory
```

Hmm, well the domain structure hasn’t changed:

```
lrwxr-xr-x   1 root     system        15 Sep 13 11:49
/etc/fdmns/test_domain/dsk3c -> /dev/disk/dsk3c
```

As pointed out in the previous example, the I/O paths (among other things) have changed; see “**man hwmgr_ops**” for all of the things that get changed.

Before:

```
44:  7        marquis    disk      none    0      1    dsk6   [2/5/0]
52:  3        marquis    disk      none    0      1    dsk3   [2/2/0]
```

After:

```
52:  3        marquis    disk      none    0      1    dsk3   [2/5/0]
```

NOTE: No device with a path of 2/2/0 now

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX; “hwmgr”)

Remember, this exercise was aimed at pointing out how one can go about either replacing a failed disk or migrating data from one disk to another.

Based on our previous steps, we are assuming that dsk3 has failed. Since we have redirected the attributes from dsk3 to dsk6, let’s assume that we have now replaced dsk3 and want to redirect our attributes from dsk6 back to dsk3.

First, we need to scan the SCSI bus to find our “replaced” disk:

```
root@marquis in / --> hwmgr scan scsi
hwmgr: Scan request successfully initiated
root@marquis in / --> hwmgr show  scsi
```

Note that we now have a new disk (**dsk8**) known to the system:

```
52:  3        marquis    disk      none    0      1    dsk3   [2/5/0]←The new dsk3
55:  7        marquis    disk      none    0      1    dsk8   [2/2/0]←Path to our “old” dsk3
```

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX; "hwmgr" and "dsfmgr")

To fix this, I'll use the **dsfmgr** command to "exchange" the device name of dsk8 for dsk3:

```
root@marquis in / --> dsfmgr -e dsk8 dsk3
root@marquis in / --> hwmgr show scsi
                  SCSI                                    DEVICE    DEVICE   DRIVER  NUM  DEVICE FIRST
 HWID:  DEVICEID HOSTNAME   TYPE      SUBTYPE OWNER  PATH FILE      VALID PATH
-------------------------------------------------------------------------------------------------
---------------------------
   37:  0        marquis    disk      none    2      1    dsk0   [0/0/0]
   38:  1        marquis    cdrom     none    0   1    cdrom0 [1/0/0]
   39:  2        marquis    disk      none    2      1    dsk1   [2/0/0]
   42:  5        marquis    disk      none    2      1    dsk4   [2/3/0]
   43:  6        marquis    disk      none    2      1    dsk5   [2/4/0]
   52:  3        marquis    disk      none    0      1    dsk8   [2/5/0]   ←Now just an unused,
spare disk
   54:  4        marquis    disk      none    2      1    dsk2   [2/1/0]
   55:  7        marquis    disk      none    0      1    dsk3   [2/2/0]   ←The original path to
dsk3
```

No errors when I mount the domain this time:

```
root@marquis in / --> mount test_domain#test_fset /test
root@marquis in / →
```

NOTE: If the disk had truly been replaced in this case (no SW or HW RAID redundancy), I would not be able to mount the filesystem afterwards; it would have to be recreated & restored from backup.

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX; “dsfmgr”)

/sbin/dsfmgr review

- **dsfmgr:** command used to manage device special files.
- Manages device-special files using the file naming format introduced in Version 5.0.
- Also used to create and maintain device special files according to the previous (i.e. “legacy”) device naming format (“rz*” for disks, “tz*” for tapes).
- **On standalone systems, previous device special files can co-exist with the new device special files.**
- **Co-existence is not supported on clustered systems.**

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX; “dsfmgr”)

/sbin/dsfmgr review (cont.)

Device name comparisons (Tru64 UNIX Pre-V5 and V5)

Disks (Pre-Tru64 UNIX V5):

/dev/rz* (block/”cooked” device files)
/dev/rrz* (character/”raw” device files)

Disks (Tru64 UNIX V5):

/dev/disk/dsk* (block/”cooked” device files)
/dev/rdisk/dsk* (character/”raw” device files)

Tapes (Pre-Tru64 UNIX V5):

/dev/rmt* (auto-rewind at EOF)
/dev/nrmt* (no auto-rewind at EOF)

Tapes (Tru64 UNIX V5):

/dev/tape/tape* (auto-rewind at EOF)
/dev/ntape/tape* (no auto-rewind at EOF)

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX; “dsfmgr”)

/sbin/dsfmgr review (cont.)

As shown in an earlier example, **dsfmgr** can be used to **exchange (-e)** and also **move (-m)** device-special files as a means of preserving device naming; this becomes critical when dealing with **filesystems** (UFS or AdvFS) that require a certain device name before it can be mounted.

Differences between **exchanging** and **moving** device-special files are described below:

-e (exchange): Used to reassign device special files by exchanging or "swapping“ them.

Devices must be of the same type and the first named device must be an active (known) device.

-m (move): Used to reassign device special files, such as assigning the device special files from a failed disk device to its replacement. Devices must be of the same type (**note that the first named device does not have to be an active/known device**).

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX; “dsfmgr”)

Example: Using **dsfmgr** to get overall device file status:

```
root@beagle in / --> dsfmgr -vV
dsfmgr -vV
  Secure Session Lock. At Wed Sep 14 11:16:11 2005
dsfmgr: verify all datum for system (5.1B-0 2650) at /
Default File Tree:
    OK.
Device Class Directory Default Database:
    OK.
Device Category to Class Directory Database:
    OK.
Dev directory structure:
    OK.
Device Status Files:
    OK.
Dev Nodes:
    OK.
Release Session Lock at Wed Sep 14 11:16:11 2005
```

(“-v” =Verification checking; “-V”=verbose mode)

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Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX; “dsfmgr”)

Example: Using **dsfmgr** to create/fix device special files:

```
root@marquis in / --> cd /dev/disk
root@marquis in /dev/disk --> ls
cdrom0a   dsk0g     dsk1g     dsk2g     dsk3g     dsk4g     dsk5g     dsk6g
cdrom0c   dsk0h     dsk1h     dsk2h     dsk3h     dsk4h     dsk5h     dsk6h
dsk0a     dsk1a     dsk2a     dsk3a     dsk4a     dsk5a     dsk6a     floppy0a
dsk0b     dsk1b     dsk2b     dsk3b     dsk4b     dsk5b     dsk6b     floppy0c
dsk0c     dsk1c     dsk2c     dsk3c     dsk4c     dsk5c      dsk6c
dsk0d     dsk1d     dsk2d     dsk3d     dsk4d     dsk5d     dsk6d
dsk0e     dsk1e     dsk2e     dsk3e     dsk4e     dsk5e     dsk6e
dsk0f     dsk1f     dsk2f     dsk3f     dsk4f     dsk5f           dsk6f
root@marquis in /dev/disk --> rm dsk6*          ←Purposefully cause a problem.
root@marquis in /dev/disk --> ls
cdrom0a   dsk0f     dsk1e     dsk2d     dsk3c     dsk4b   dsk5a     dsk5h
cdrom0c   dsk0g     dsk1f     dsk2e     dsk3d     dsk4c   dsk5b     floppy0a
dsk0a     dsk0h     dsk1g     dsk2f     dsk3e     dsk4d     dsk5c     floppy0c
dsk0b     dsk1a     dsk1h     dsk2g     dsk3f     dsk4e     dsk5d
dsk0c     dsk1b     dsk2a     dsk2h     dsk3g     dsk4f     dsk5e
dsk0d     dsk1c     dsk2b     dsk3a     dsk3h     dsk4g     dsk5f
dsk0e     dsk1d     dsk2c     dsk3b     dsk4a     dsk4h     dsk5g
……
```

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX; “dsfmgr”)

```
root@marquis in /dev/disk --> dsfmgr -v
dsfmgr: verify all datum for system (5.1B-0 2650) at /
Default File Tree:
    OK.
Device Class Directory Default Database:
    OK.
Device Category to Class Directory Database:
    OK.
Dev directory structure:
    OK.
Device Status Files:
    OK.
Dev Nodes:
    ERROR node does not exist: /dev/disk/dsk6a    ←dsfmgr found a problem..
    ERROR node does not exist: /dev/disk/dsk6b
    ERROR node does not exist: /dev/disk/dsk6c
    ERROR node does not exist: /dev/disk/dsk6d
    ERROR node does not exist: /dev/disk/dsk6e
    ERROR node does not exist: /dev/disk/dsk6f
    ERROR node does not exist: /dev/disk/dsk6g
    ERROR node does not exist: /dev/disk/dsk6h
  Errors:   8
……
```

Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX; “dsfmgr”)

```
root@marquis in /dev/disk --> dsfmgr –vF←Verify and fix errors found.
dsfmgr: verify with fix all datum for system (5.1B-0 2650) at /
Default File Tree:
    OK.
Device Class Directory Default Database:
    OK.
Device Category to Class Directory Database:
    OK.
Dev directory structure:
    OK.
Device Status Files:
    OK.
Dev Nodes:
    WARNING node does not exist: /dev/disk/dsk6a
    WARNING node does not exist: /dev/disk/dsk6b
    WARNING node does not exist: /dev/disk/dsk6c
    WARNING node does not exist: /dev/disk/dsk6d
    WARNING node does not exist: /dev/disk/dsk6e
    WARNING node does not exist: /dev/disk/dsk6f
    WARNING node does not exist: /dev/disk/dsk6g
    WARNING node does not exist: /dev/disk/dsk6h ←No longer being reported as errors.
    OK.
Total warnings:   8
……..
```

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Tru64 UNIX to HP-UX Transition; System Management Tools (Tru64 UNIX; “dsfmgr”)

The disks are back now:

```
root@marquis in /dev/disk --> ls dsk6*
dsk6a  dsk6b  dsk6c  dsk6d  dsk6e  dsk6f  dsk6g  dsk6h
```

Re-run dsfmgr to verify the device tier:

```
root@marquis in /dev/disk --> dsfmgr -v

dsfmgr: verify all datum for system (5.1B-0 2650) at /

Default File Tree:
    OK.
Device Class Directory Default Database:
    OK.
Device Category to Class Directory Database:
    OK.
Dev directory structure:
    OK.
Device Status Files:
    OK.
Dev Nodes:
    OK.
……
```

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX; “ioscan”)

/usr/sbin/ioscan review (HP-UX)

The ioscan utility scans the following components:

- System hardware.
- Usable I/O system devices.
- Kernel I/O system data structures (as appropriate).
- Lists the results after the initial scan.

By default, the ioscan command displays the following:

- Hardware path to the hardware module.
- Class of the hardware module.
- A brief description for each hardware module on the system.

The ioscan command scans the system and lists all reportable hardware found. The types of hardware reported include:

- Processors
- Memory
- interface cards
- I/O devices

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX; “ioscan”)

/usr/sbin/ioscan review (HP-UX; cont.)

- **NOTE:** Scanning the hardware may cause drivers to be un-bound and others bound in their place in order to match actual system hardware.
- NOTE: Entities that cannot be scanned are not listed; use the “**ioscan –u**” option to display a list of **usable** system I/O devices, versus **all available hardware**.
- The **ioscan** command can be used to force the specified software driver into the kernel I/O system at the given hardware path and to force said driver to be bound. This can be used to make the system recognize a device that cannot be recognized automatically; for example, if a device has not yet been connected to the system, does not support auto-configuration, or because diagnostics need to be run on a faulty device.
- A non-root user can use “**ioscan –k**” to display the kernel hardware tree.
- **Driver binding and actual hardware scanning is restricted to the root user.**

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX; “ioscan”)

Some of the more common switches to ioscan:

-f Generate a **full** listing, displaying the module's class, instance number, hardware path, driver, software state, hardware type, and a brief description.

-u Scan and list **usable** I/O system devices instead of the actual hardware. Usable I/O devices are those having a driver in the kernel and an assigned instance number.

-n List **device file names** in the output. Only special files in the /dev directory and its subdirectories are listed.

-C *class* Restrict the output listing to those devices belonging to the specified **class**.

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX; “ioscan”)

EXAMPLE: Use **ioscan** to scan & print out info. about all disks known to the system:

```
root@merc72 in / --> ioscan -funC disk
Class     I  H/W Path       Driver     S/W State   H/W Type     Description
==========================================================================
disk      0  0/0/2/0.0.0.0  sdisk      CLAIMED     DEVICE       TEAC    DV-28E-C
                           /dev/dsk/c0t0d0   /dev/rdsk/c0t0d0
disk      1  0/1/1/0.0.0    sdisk      CLAIMED     DEVICE       HP 36.4GST336607LC
                           /dev/dsk/c2t0d0     /dev/rdsk/c2t0d0
                           /dev/dsk/c2t0d0s1   /dev/rdsk/c2t0d0s1
                           /dev/dsk/c2t0d0s2   /dev/rdsk/c2t0d0s2
                          /dev/dsk/c2t0d0s3   /dev/rdsk/c2t0d0s3
```

……..

Class=Device category.

I = Instance number associated with the device or card; a unique number assigned to a card or device within a class.

H/W Path = String of numbers representing the location of a device in a system **(more to follow).**

Driver = Device driver that controls the hardware component.

S/W State = Whether or not a device is bound to/claimed by a software device driver.

H/W Type = Category of hardware component (device, unknown, interface card, etc.)

Description = A description of the device.

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX; hardware paths)

Hardware Paths (HP-UX)

As previously indicated, a hardware path represents a string of numbers indicating the location of a device in a system. In looking at the following device name (per **ioscan**), we can come up with the following:

```
Class     I  H/W Path       Driver     S/W State   H/W Type     Description
=======================================================
 disk      1  0/1/1/0.0.0    sdisk      CLAIMED     DEVICE       HP 36.4GST336607LC
                           /dev/dsk/c2t0d0     /dev/rdsk/c2t0d0
                           /dev/dsk/c2t0d0s1   /dev/rdsk/c2t0d0s1
                           /dev/dsk/c2t0d0s2   /dev/rdsk/c2t0d0s2
                           /dev/dsk/c2t0d0s3   /dev/rdsk/c2t0d0s3
```

……

0/1/1 = **0/=**bus 0; **1/=**bus converter number; **1/=**adapter number.
The first 0. = Address of the SCSI adapter on the bus.
The second 0. = The address of the disk connected to that SCSI adapter.
The third 0 = The Logical Unit Number (LUN) of the disk.

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX; device file names)

Device Special File Names (HP-UX)

As with hardware paths, device special files in HPUX follow a certain ordering scheme and are given their names based on this. By looking at the disk in the previous example, we can up with the following:

```
Class     I  H/W Path       Driver     S/W State   H/W Type     Description
===================================================
 disk      1  0/1/1/0.0.0    sdisk      CLAIMED     DEVICE       HP 36.4GST336607LC
 /dev/dsk/c2t0d0       /dev/rdsk/c2t0d0
 /dev/dsk/c2t0d0s1   /dev/rdsk/c2t0d0s1
 /dev/dsk/c2t0d0s2   /dev/rdsk/c2t0d0s2
/dev/dsk/c2t0d0s3   /dev/rdsk/c2t0d0s3
```

……

/dev/dsk = Block (**cooked**) device files; I/O buffering used to retain data in cache.
/dev/rdsk = Character (**raw**) device files; no I/O buffering used.
c2 = **C**ard/**C**ontroller to which the disk is connected.
t0 = **T**arget number for the disk (each disk has a unique target number).
d0 = **D**evice (hardware) unit number.
s1, s2, s3 = Section (a.k.a. "**Slice**") number for the disk.

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX; dev. special file management)

insf, mksf, rmsf, lssf, lsdev (HP-UX)

- **insf -** Install special (device) files for new devices (i.e., those devices for which no special files have been previously created).
- **mksf -** Make a special (device) file for a device that already exists (i.e., a device that already has been assigned an **Instance Number**).
- **rmsf -** Remove a special (device) file.
- **lssf -** List a special file.
- **lsdev** – Lists device drivers in the system.

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX; dev. special file management)

LAB #1: Using rmsf/mksf/lssf to remove, create, & verify device special files.

1. First, remove the device files for a disk that I am not using:

```
root@merc72 in / --> rmsf /dev/dsk/c3t2d0

root@merc72 in / --> ioscan -funC disk
Class     I  H/W Path       Driver     S/W State   H/W Type     Description
=======================================================

.........

disk      4  0/1/1/1.2.0    sdisk      CLAIMED     DEVICE       DEC     RZ1CB-CA
 (C) DEC
                     /dev/rdsk/c3t2d0 ←Character file remains; block file removed.

.........
```

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX; dev. special file management)

```
root@merc72 in / --> rmsf /dev/rdsk/c3t2d0
root@merc72 in / --> ioscan -funC disk

Class     I  H/W Path       Driver     S/W State   H/W Type     Description
=================================================
.........
disk      4  0/1/1/1.2.0    sdisk      CLAIMED     DEVICE       DEC     RZ1CB-
   CA
 (C) DEC
.........
```

Now, recreate the device files that I removed:

```
root@merc72 in / --> mksf /dev/dsk/c3t2d0
mksf: Must specify device with -d, -C, -H ,-P and/or -I options      ←Pilot
   error..
usage: mksf [-d driver | -C class] [-H hw_path] [-I instance] [-D dir] [-q|-v]
   [ driver_options... ]
or: mksf [-d driver | -C class] [-H hw_path] [-I instance] [-D dir] [-q|-v] [-
   r] -m minor special_file
```

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX; dev. special file management)

```
root@merc72 in / --> mksf -C disk /dev/dsk/c3t2d0
root@merc72 in / --> mksf -C disk /dev/rdsk/c3t2d0
root@merc72 in / --> ioscan -funC disk

Class     I  H/W Path       Driver     S/W State   H/W Type     Description
=============================================================================
.........
disk      4  0/1/1/1.2.0    sdisk      CLAIMED     DEVICE       DEC     RZ1CB-CA
 (C) DEC
.........                                          ← (They're still not here !!??)

OK, let's try this again but also include the INSTANCE number for the device(s):
root@merc72 in / --> rmsf /dev/dsk/c3t2d0
root@merc72 in / --> rmsf /dev/rdsk/c3t2d0
root@merc72 in / --> mksf -C disk -I 4 /dev/rdsk/c3t2d0
root@merc72 in / --> mksf -C disk -I 4 /dev/dsk/c3t2d0
root@merc72 in / --> ioscan -funC disk

Class     I  H/W Path       Driver     S/W State   H/W Type     Description
=============================================================================
disk      4  0/1/1/1.2.0    sdisk      CLAIMED     DEVICE       DEC     RZ1CB-CA
 (C) DEC
      /dev/dsk/c3t2d0   /dev/rdsk/c3t2d0          ←(OK, they're back now.)
```

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX; device management/troubleshooting)

Now, I want to test that I can actually use this disk afterwards:

```
root@merc72 in / --> vgscan -v

Couldn't stat physical volume "/dev/dsk/c0t0d0":  Invalid argument<--we'll troubleshoot this in a bit..
Physical Volume "/dev/dsk/c2t0d0s2" contains no LVM information
Physical Volume "/dev/dsk/c3t1d0" contains no LVM information
Couldn't stat physical volume "/dev/dsk/c3t2d0":  Invalid argument<--This is the disk.  What causes
    this
error?
Physical Volume "/dev/dsk/c3t3d0" contains no LVM information
Physical Volume "/dev/dsk/c3t4d0" contains no LVM information
Physical Volume "/dev/dsk/c3t5d0" contains no LVM information
Scan of Physical Volumes Complete.

root@merc72 in / --> lssf /dev/dsk/c3t2d0
sdisk card instance 3 SCSI target 2 SCSI LUN 0 section 0 at address 0/1/1/1.2.0
/dev/dsk/c3t2d0       ←Seems OK, from this..

When we try to create a filesystem, we get this error:

root@merc72 in / --> newfs -F vxfs /dev/dsk/c3t2d0
vxfs newfs: /dev/dsk/c3t2d0 is not a character device  ←Expected error..

root@merc72 in / --> newfs -F vxfs /dev/rdsk/c3t2d0
vxfs newfs: /dev/rdsk/c3t2d0 is not a character device ←NOT expected!
```

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX; device management/troubleshooting)

Troubleshooting:

```
root@merc72 in / --> cd /dev/rdsk
root@merc72 in /dev/rdsk --> ls
c0t0d0    c2t0d0s1  c2t0d0s3  c3t1d0    c3t3d0    c3t5d0
c2t0d0    c2t0d0s2  c3t0d0    c3t2d0    c3t4d0
root@merc72 in /dev/rdsk --> file *
c0t0d0:         character special (188/0)
c2t0d0:         character special (188/131072)
c2t0d0s1:       character special (188/131073)
c2t0d0s2:       character special (188/131074)
c2t0d0s3:       character special (188/131075)
c3t0d0:         character special (188/196608)
c3t1d0:         character special (188/200704)
c3t2d0:         block special (31/204800)       <--OOPS, not a character (raw) device.
root@merc72 in /dev/rdsk --> cd /dev/dsk
root@merc72 in /dev/dsk --> file *
c0t0d0:         block special (31/0)
c2t0d0:         block special (31/131072)
c2t0d0s1:       block special (31/131073)
c2t0d0s2:       block special (31/131074)
c2t0d0s3:       block special (31/131075)
c3t0d0:         block special (31/196608)
c3t1d0:         block special (31/200704)
c3t2d0:         block special (31/204800)         <--This looks OK.
```

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX; device management/troubleshooting)

```
root@merc72 in /dev/rdsk --> man mksf              ← To the man pages!

.........
-r      Create a character (raw) special file instead of a block (default) special file.
.........

OK, so the syntax needs to be as follows:
root@merc72 in /dev/rdsk --> rmsf /dev/rdsk/c3t2d0
root@merc72 in /dev/rdsk --> mksf -r -C disk -I 4 /dev/rdsk/c3t2d0
root@merc72 in /dev/rdsk --> file *
c0t0d0:          character special (188/0)
c2t0d0:          character special (188/131072)
c2t0d0s1:        character special (188/131073)
c2t0d0s2:        character special (188/131074)
c2t0d0s3:        character special (188/131075)
c3t0d0:          character special (188/196608)
c3t1d0:          character special (188/200704)
c3t2d0:          character special (188/204800)  ←That's much better!
c3t3d0:          character special (188/208896)
c3t4d0:          character special (188/212992)
c3t5d0:          character special (188/217088)
```

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX; device management/troubleshooting)

Verify things with lssf again:

```
root@merc72 in / --> lssf /dev/dsk/c3t2d0
sdisk card instance 3 SCSI target 2 SCSI LUN 0 section 0 at address 0/1/1/1.2.0
/dev/dsk/c3t2d0
root@merc72 in / --> lssf /dev/rdsk/c3t2d0
sdisk card instance 3 SCSI target 2 SCSI LUN 0 section 0 at address 0/1/1/1.2.0
/dev/rdsk/c3t2d0
```

Now we can create the filesystem & mount it without a problem:

```
root@merc72 in /dev/rdsk --> newfs -F vxfs /dev/rdsk/c3t2d0
    version 5 layout
    4190040 sectors, 4190040 blocks of size 1024, log size 16384 blocks
    unlimited inodes, largefiles not supported
    4190040 data blocks, 4172536 free data blocks
    128 allocation units of 32768 blocks, 32768 data blocks
    last allocation unit has 28504 data blocks

root@merc72 in / --> mount /dev/dsk/c3t2d0 /mnt
root@merc72 in / --> bdf /mnt
Filesystem          kbytes    used   avail %used Mounted on
/dev/dsk/c3t2d0    4190040   17496 3911767    0% /mnt
```

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX; device management/troubleshooting)

Lab #2: Remember that error we encountered before?:

```
........
Couldn't stat physical volume "/dev/dsk/c0t0d0":  Invalid argument
........

root@merc72 in / --> file /dev/dsk/c0t0d0
c0t0d0:          block special (31/0)
root@merc72 in / --> file /dev/rdsk/c0t0d0
/dev/rdsk/c0t0d0:        character special (188/0)
root@merc72 in / --> diskinfo /dev/rdsk/c0t0d0
diskinfo: can't open /dev/rdsk/c0t0d0: Device busy          ←(hmm?)

Let's see what ioscan can tell us about this device:
root@merc72 in / --> ioscan -funC disk|more

Class     I  H/W Path       Driver     S/W State   H/W Type     Description
=======================================================
.............
disk      0  0/0/2/0.0.0.0  sdisk      CLAIMED     DEVICE       TEAC    DV-28E-C ←
                           /dev/dsk/c0t0d0   /dev/rdsk/c0t0d0
.............
(Looks like my DVD-ROM drive)
```

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX; device management/troubleshooting)

It's not showing up in the mount table, so not sure about the "device busy" error:

```
root@merc72 in / --> bdf | grep c0t0d0
root@merc72 in / -->
```

Physically checking to see if there was a CD/DVD in the drive shows it empty. When a DVD is placed in the drive, the same "device busy" error shows up.

Trying to mount a DVD in the drive, also gets a "device busy" error:

```
root@merc72 in / --> mount /dev/dsk/c0t0d0 /mnt
/dev/dsk/c0t0d0: Device busy
```

Same result if the device files are deleted and re-created:

```
root@merc72 in / --> rmsf /dev/dsk/c0t0d0
root@merc72 in / --> rmsf /dev/rdsk/c0t0d0
root@merc72 in / --> mksf -C disk -I 0 /dev/dsk/c0t0d0
root@merc72 in / --> mksf -r -C disk -I 0 /dev/rdsk/c0t0d0
.........
```

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX; device management/troubleshooting)

……

```
root@merc72 in / --> ioscan -funC disk | head -5
Class     I  H/W Path       Driver     S/W State   H/W Type
   Description
==========================================================
disk      0  0/0/2/0.0.0.0  sdisk      CLAIMED     DEVICE       TEAC
   DV-28E-C
                           /dev/dsk/c0t0d0   /dev/rdsk/c0t0d0
```

……

```
root@merc72 in / --> diskinfo /dev/dsk/c0t0d0
diskinfo: can't open /dev/dsk/c0t0d0: Device busy

root@merc72 in / --> mount -r /dev/dsk/c0t0d0 /mnt
/dev/dsk/c0t0d0: Device busy

root@merc72 in / --> mount /dev/dsk/c0t0d0 /mnt
/dev/dsk/c0t0d0: Device busy
```

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX; device management/troubleshooting)

The fuser command isn't finding anything that has a lock on this file:

```
root@merc72 in / --> fuser -c /dev/dsk/c0t0d0
/dev/dsk/c0t0d0: fuser: could not find file system mounted at /dev/dsk/c0t0d0.

root@merc72 in / --> fuser -f /dev/dsk/c0t0d0
/dev/dsk/c0t0d0:

root@merc72 in / -->
```

Resolution:

Rebooted the system (“**shutdown -ry 0**”) and now the DVD is able to be mounted:

```
root@merc72 in / --> mount /dev/dsk/c0t0d0 /cdrom
root@merc72 in / -->
root@merc72 in /tools --> bdf /cdrom
Filesystem          kbytes    used   avail %used Mounted on
/dev/dsk/c0t0d0     635320  635320       0  100% /cdrom
```

(Must have been a lock on that file that fuser was unable to clear or find.)

Tru64 UNIX to HP-UX Transition; System Management Tools (HP-UX; device management/troubleshooting)

Lab #3: Use output from the ***lsdev*** command to get more specific Information from ***ioscan*** about the **lan** configuration on this system:

```
root@merc72 in / --> lsdev -C lan                    → Just list info. for category "lan".
    Character     Block       Driver          Class
       98                -1         fddi4           lan
      104               -1         pcitr           lan

(NOTE:  "-1" in either the block or character column means that a major
number does not exist for that device driver type.)

root@merc72 in /--> ioscan –funC lan
Class     I  H/W Path  Driver  S/W State   H/W Type     Description
=====================================================
lan       0  0/0/3/0   intl100 CLAIMED     INTERFACE    Intel PCI Pro 10/100Tx
                                                         Server Adapter
lan       1  0/1/2/0   igelan  CLAIMED     INTERFACE    HP PCI 1000Base-T Core
```

REFERENCES

Tru64 UNIX Online Documentation (all versions):

http://h30097.www3.hp.com/docs/pub_page/doc_list.html

HP-UX Online Documentation (HPUX 11i V2):

http://docs.hp.com/en/hpux11iv2.html

Combined Tru64 UNIX & HP-UX Documentation:

http://docs.hp.com/en/index.html

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Questions & Answers

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