Hardware Management unter Tru64 UNIX

Dirk Albrecht
Consultant Tru64 UNIX Solution Center
Hewlett-Packard GmbH
dirk.albrecht@hp.com

Agenda

- Hardware Management Overview
- Hardware Management Databases and Data files
- Troubleshooting Techniques
- Examples
- Resources

Vocabulary

- CDSL – **Context Dependent Symbolic Link; unique file for each cluster member**
- Hardware Set – **An in-memory repository of hardware that is currently present and known to the system**
- HWC Module – Hardware Component Module – **provides kernel services for hardware management**
- KSM – Kernel Set Manager – **provides access to kernel data from user space**
- devt – **unique identifier associated with a device special file; composed of 2 numeric values: major number identifies driver; minor number identifies device instance**
- hwmgr – **CLI to manage system hardware**
- dsfmgr – **CLI to manage device special files**

Agenda

- Hardware Management Overview
- Hardware Management Databases and Data files
- Troubleshooting Techniques
- Examples
- Resources

IT-Symposium 2004 20.04.2004

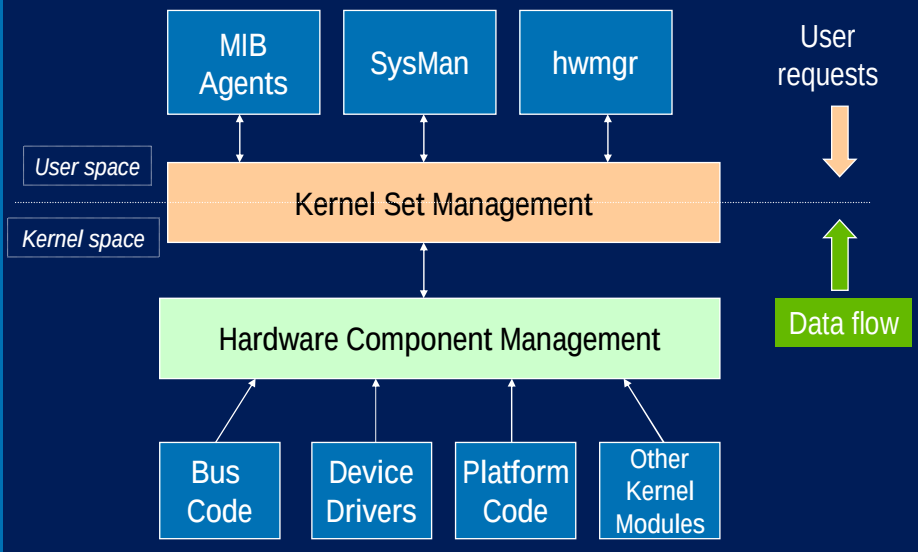
Hardware Management Overview

- What services does hardware management provide ?
  - Automatic Device Recognition
  - Device Special File (Cluster-wide unique/accessible)
  - Per-device properties (attributes)
  - Topology information (hierarchy)
  - Category (type-based)
  - MIB Relationships
  - Online Addition and Replacement (OLAR)
  - Hardware Databases

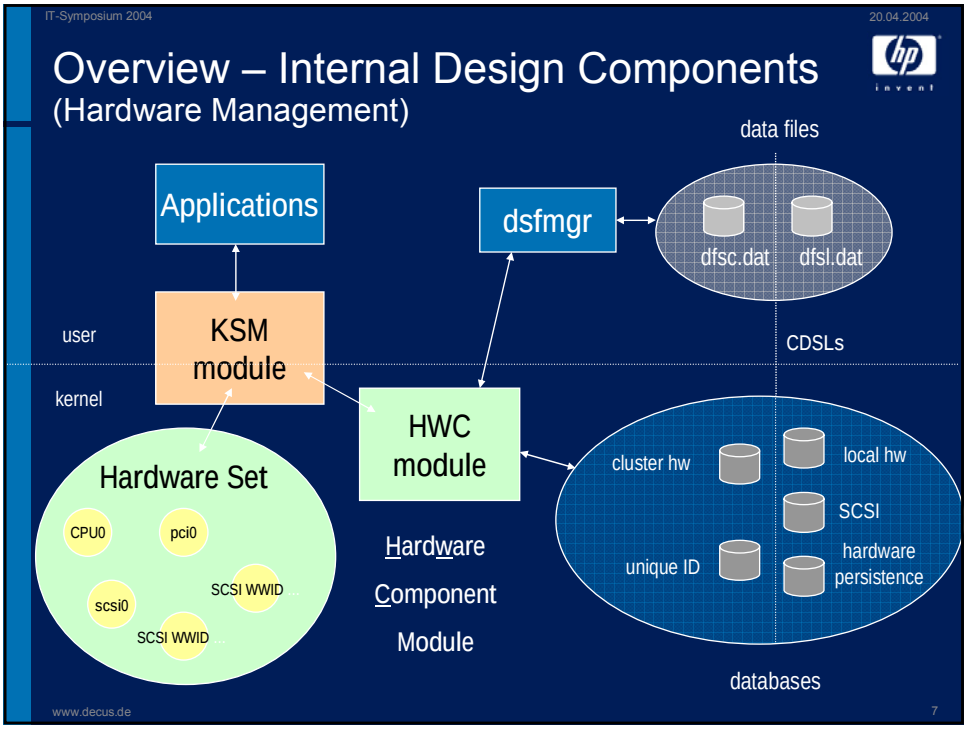
www.decus.de 5

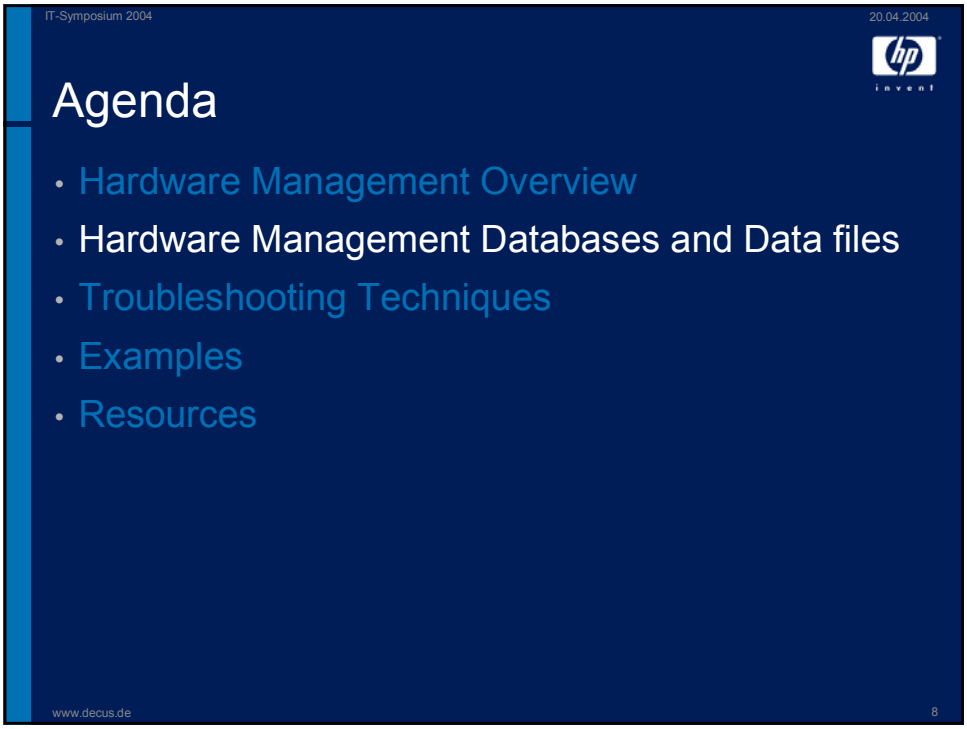
IT-Symposium 2004 20.04.2004

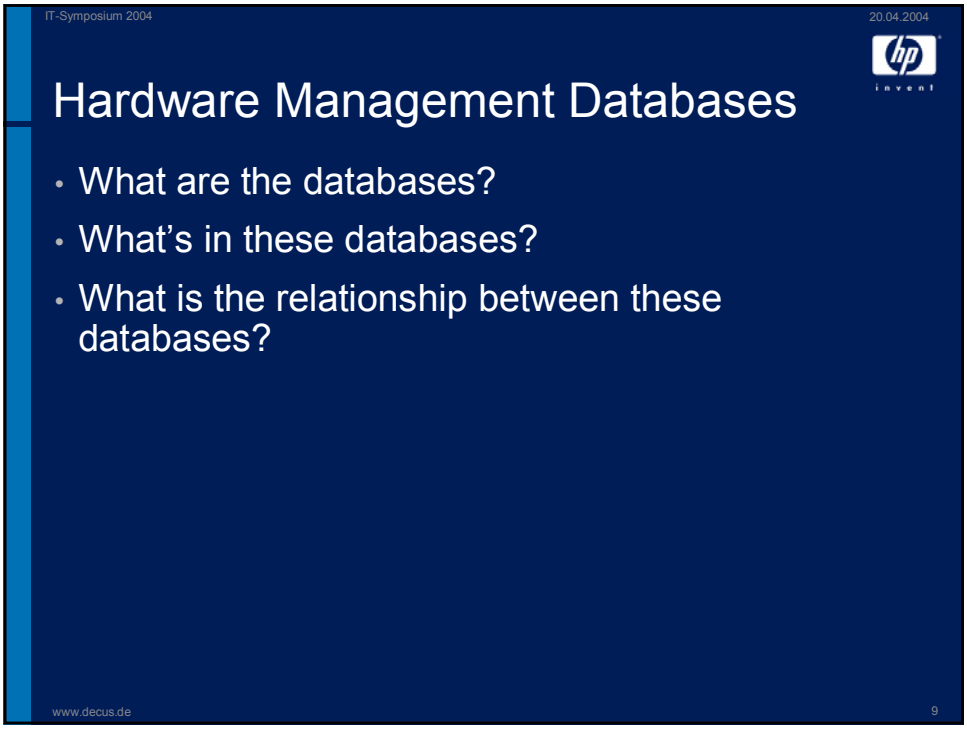
Overview – Functional Design
(Hardware Management)



www.decus.de 6


IT-Symposium 2004
20.04.2004
Overview – Internal Design Components
(Hardware Management)
data files
Applications
dsfmgr
dfsc.dat
dfsl.dat
user
KSM module
CDSLs
kernel
HWC module
Hardware Set
CPU0
pci0
SCSI WWID
scsi0
SCSI WWID
Hardware Component Module
cluster hw
local hw
SCSI
unique ID
hardware persistence
databases
www.decus.de
7


IT-Symposium 2004
20.04.2004
Agenda
• Hardware Management Overview
• Hardware Management Databases and Data files
• Troubleshooting Techniques
• Examples
• Resources
www.decus.de
8


IT-Symposium 2004
20.04.2004
Hardware Management Databases
• What are the databases?
• What's in these databases?
• What is the relationship between these databases?
www.decus.de
9


IT-Symposium 2004
20.04.2004
Hardware Databases
• Hardware Component Databases
– /etc/dec_hwc_ldb (binary) (CDSL)
– /etc/dec_hwc_cdb (binary) (Cluster)
• SCSI Device Database
– /etc/dec_scsi_db (binary) (CDSL)
• Hardware Persistence Database
– /etc/dec_hw_db (binary) (CDSL)
• Device Special File Data Files
– /etc/dfsl.dat (text) (CDSL)
– /etc/dfsc.dat (text) (Cluster)
• Device Switch Table Database
– /etc/dec_devsw_db (binary) (CDSL)
• Unique ID Database
– /etc/dec_unid_db (binary) (Cluster)
www.decus.de
10

Hardware Component Databases

- Provides persistent registry for system hardware
- Local Database: **/etc/dec_hwc_ldb** (binary)
  - Contains all the hardware components that have *ever* been registered on this system/member
- Key Command
  - hwmgr –show component
- Cluster Database: **/etc/dec_hwc_cdb** (binary)
  - Contains all the hardware components that are accessible by all members within the cluster
- Key Command
  - hwmgr –show component -cluster

SCSI Device Database

- File: **/etc/dec_scsi_db** (binary, CDSL)
- stores the world-wide identifier (WWID) of SCSI devices and enables CAM to track all SCSI devices that are known to the system
- owned by SCSI/CAM
- Key Command
  - hwmgr –show scsi
  - hwmgr –show scsi –id <#> -full
- Example
  - The way to remove a stale scsi path
    - hwmgr –refresh scsi

There is a deficiency in the current scsi database where the first path
*even if **stale** will not be removed !*

Hardware Persistence Database
(Name Database)

- File: **/etc/dec_hw_db**(binary, CDSL)
- contains hardware persistence information. Generally, this refers to hardware such as buses or controllers
- Used by hardware discovery process to provide permanence to bus/slot based hardware
- Key Command:
  - hwmgr –show name

Device Special File Data Files

- Files (text)
  - **/etc/dfsc.dat** (Cluster)
  - **/etc/dfsl.dat** (CDSL)
- Contains devt (device type) and device special file informations
- Key Command
  - dsfmgr –s

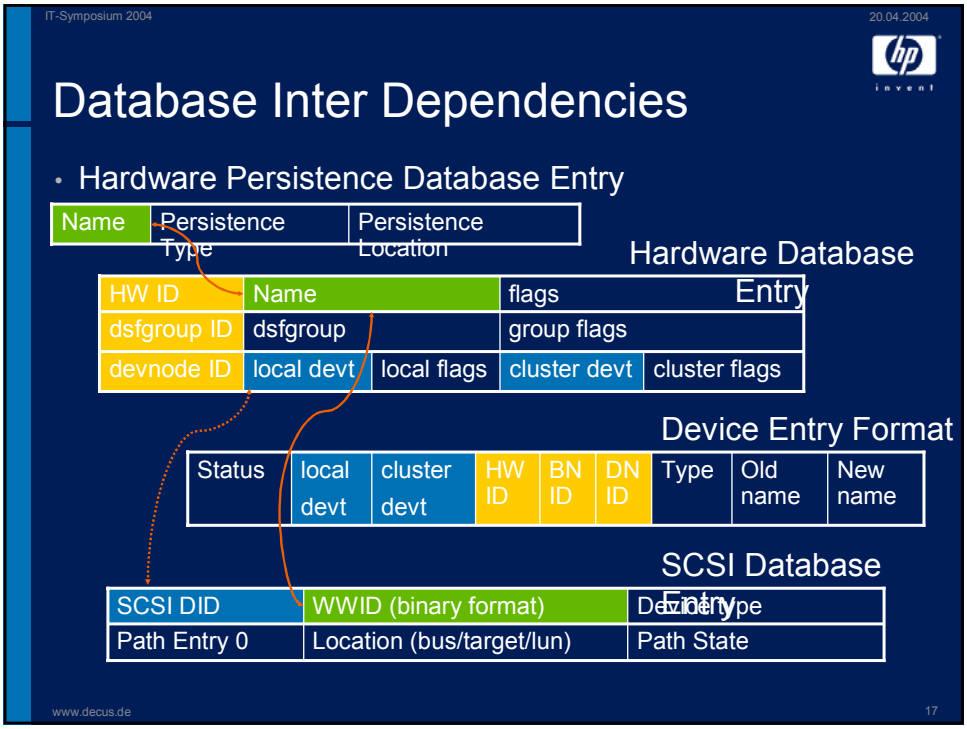
It is not recommended that these files are edited by hand due to the interdependencies and the hardware databases !

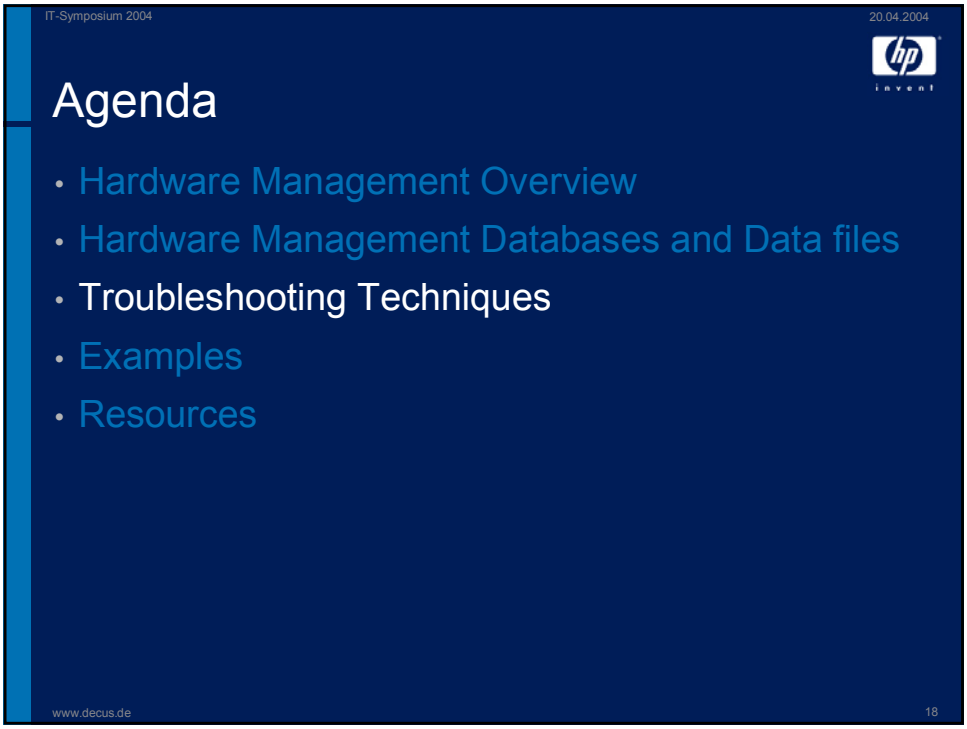
Device Switch Table Database

- File: **/etc/dec_devsw_db** (binary, CDSL)
- keeps track of the driver major numbers and driver switch entries
- owned by the kernel dev switch code
- Key Command
  - devswmgr -getnum

Unique ID Database

- File: **/etc/dec_unid_db** (binary, Cluster)
- stores the preceding highest hardware identifier (HWID) assigned to a hardware component
- database is used to generate the next HWID to be assigned to a newly-installed hardware component.


IT-Symposium 2004
20.04.2004
Database Inter Dependencies
Hardware Persistence Database Entry
Name
Persistence Type
Persistence Location
Hardware Database Entry
HW ID
Name
flags
dsfgroup ID
dsfgroup
group flags
devnode ID
local devt
local flags
cluster devt
cluster flags
Device Entry Format
Status
local devt
cluster devt
HW ID
BN ID
DN ID
Type
Old name
New name
SCSI Database Entry
SCSI DID
WWID (binary format)
Device type
Path Entry 0
Location (bus/target/lun)
Path State
www.decus.de
17

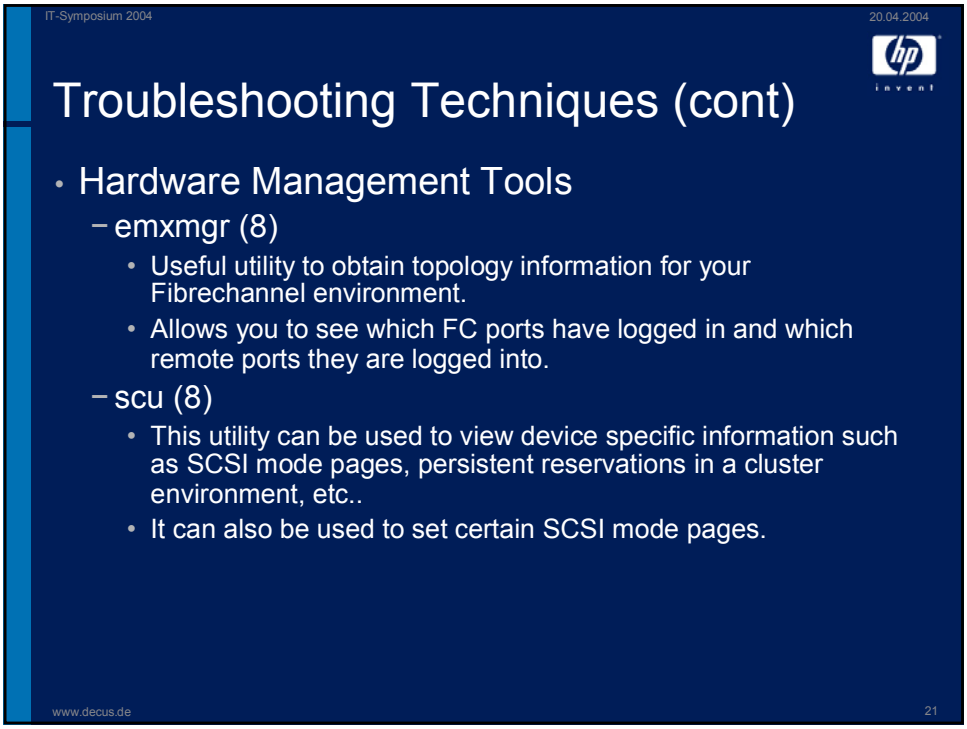

IT-Symposium 2004
20.04.2004
Agenda
Hardware Management Overview
Hardware Management Databases and Data files
Troubleshooting Techniques
Examples
Resources
www.decus.de
18

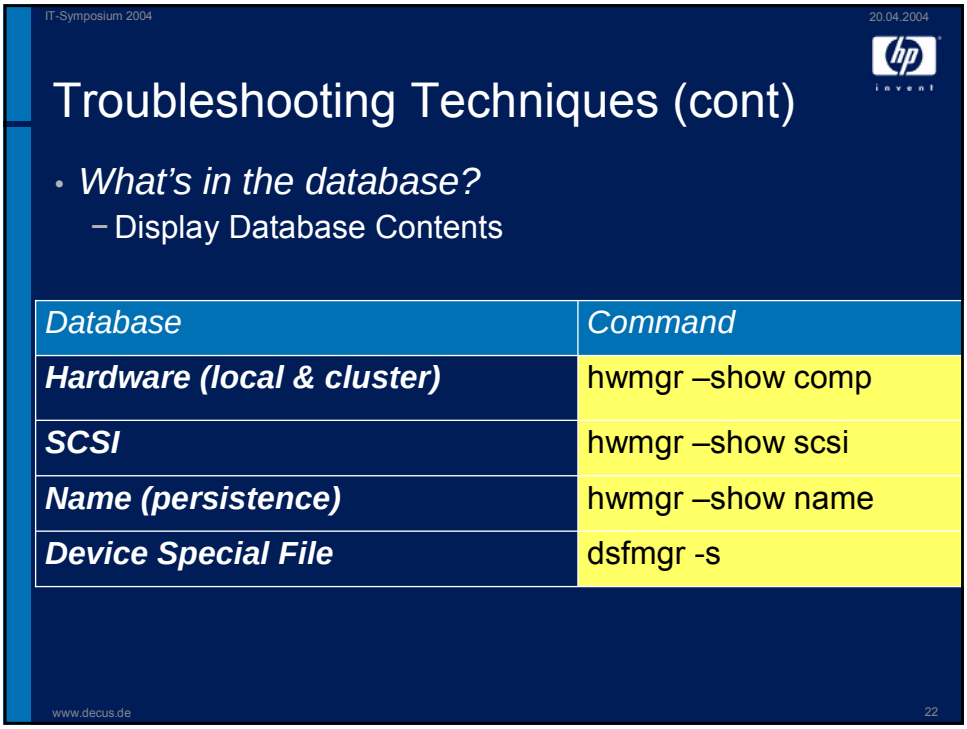
Troubleshooting Techniques

- *Hardware Management Tools*
  - *hwmgr (8)* *(most important)*
  - *dsfmgr (8)* *(most important)*
  - *emxmgr (8)*
  - *scu (8)*
- *What's in the database?*
  - Displaying database contents
- *Are the databases ok?*
  - Validating databases
  - Correcting/cleaning databases
- *More information?*
  - Hardware Component information
  - SCSI information
  - Hardware Configuration changes
  - Device Special File information

Troubleshooting Techniques (cont)

- Hardware Management Tools
  - hwmgr (8)
    - hwmgr is the command which can be used to view, add, replace and troubleshoot devices.
    - Used to manage your hardware components.
    - Never automatically invoked.
    - Provides a command line interface.
  - dsfmgr (8)
    - Used to manage your device special files.
    - Invoked during installation and each boot.
    - Provides a command line interface.


IT-Symposium 2004
20.04.2004
Troubleshooting Techniques (cont)
• Hardware Management Tools
– emxmgr (8)
• Useful utility to obtain topology information for your Fibrechannel environment.
• Allows you to see which FC ports have logged in and which remote ports they are logged into.
– scu (8)
• This utility can be used to view device specific information such as SCSI mode pages, persistent reservations in a cluster environment, etc..
• It can also be used to set certain SCSI mode pages.
www.decus.de
21


IT-Symposium 2004
20.04.2004
Troubleshooting Techniques (cont)
• What's in the database?
– Display Database Contents
Database
Command
Hardware (local & cluster)
hwmgr –show comp
SCSI
hwmgr –show scsi
Name (persistence)
hwmgr –show name
Device Special File
dsfmgr -s
www.decus.de
22

Display contents of Hardware Database
(Example)

```
tagque> hwmgr -show comp

HWID:  HOSTNAME   FLAGS SERVICE COMPONENT NAME
--------------------------------------------
    1:  tagque     r---- none    COMPAQ AlphaServer DS10 466 MHz
    2:  tagque     r---- none    CPU0
    3:  tagque     r-d-- none    scp
    4:  tagque     r-d-- none    kevm
    5:  tagque     r---- none    pci0
    6:  tagque     r---- none    pci0slot1
    7:  tagque     ----- none    Unconfigured-device-(<NULL>)-at-pci0slot1
   25:  tagque     r---- none    isa0
   26:  tagque     r---- none    isa0slot0
   36:  tagque     r---- none    fdi0
   37:  tagque     r-d-- iomap   FDI-fdi0-unit-0
   38:  tagque     r---- none    tu0
   40:  tagque     r---- none    ata0
   41:  tagque     r---- none    scsi0
   42:  tagque     r---- none    scsi1
   43:  tagque     ----- none    itpsa0
   44:  tagque     r---- none    scsi2
   50:  tagque     r-d-- iomap   SCSI-WWID:0710002c:"COMPAQ   CDR 8435:d05b000t00000100000"
   51:  tagque     rcds- iomap   SCSI-WWID:0c000008:0020-37ff-fe5f-66cc
   52:  tagque     rcd-- iomap   SCSI-WWID:0c000008:4d41-4739-d301-8034
   53:  tagque     rcd-i iomap   SCSI-WWID:0c000008:4d41-4739-d301-8037
   54:  tagque     -cd-- iomap   SCSI-WWID:0c000008:0020-37ff-fe5e-2280
   57:  tagque     r---- none    itpsa1
   61:  tagque     -cd-- iomap   SCSI-WWID:0c000008:0020-37ff-fe5e-2632
```

Hardware database is a correlated output of both the cluster and local database.
In a cluster the " –cluster " option will coalesce the database information for the entire cluster
(I.e. merge in all the local hardware databases and the cluster database in one output).

Display contents of SCSI Database
(Example)

tagque# **hwmgr -show scsi**

```
        SCSI                 DEVICE    DEVICE  DRIVER NUM  DEVICE FIRST
 HWID:  DEVICEID HOSTNAME    TYPE      SUBTYPE OWNER  PATH FILE   VALID PATH
-------------------------------------------------------------------------------
    0:  6        tagque      cdrom     none    0      1    (null)
   50:  0        tagque      cdrom     none    0      1    cdrom0 [0/0/0]
   51:  1        tagque      disk      none    0      1    dsk0   [2/0/0]
   52:  2        tagque      disk      none    2      1    dsk1   [2/1/0]
   54:  4        tagque      disk      none    0      1    (null)
   61:  5        tagque      disk      none    0      1    (null)
   62:  3        tagque      disk      none    0      1    dsk2   [2/2/0]
```

tagque# **hwmgr -show comp -nr**

```
 HWID:  HOSTNAME   FLAGS SERVICE COMPONENT NAME
-----------------------------------------------
    1:  tagque     ----- none    COMPAQ AlphaServer DS10 466 MHz
    7:  tagque     ----- none    Unconfigured-device-(<NULL>)-at-pci0slot1
   17:  tagque     ----- none    Unconfigured-device-(<NULL>)-at-pci0slot14
   45:  tagque     ----- none    isp0
   54:  tagque     -cd-- iomap   SCSI-WWID:0c000008:0020-37ff-fe5e-2280
   57:  tagque     ----- none    itpsa1
   58:  tagque     ----- none    isp1
   61:  tagque     -cd-- iomap   SCSI-WWID:0c000008:0020-37ff-fe5e-2632
```

Troubleshooting Techniques (cont)

- *Are the databases ok?*
  - Validating databases

Database	*Command*
Hardware (local & cluster)	hwmgr –show comp –i hwmgr –show comp –i -full
Device Special File	dsfmgr -v

Troubleshooting Techniques (cont)

- *Are the databases ok?*
  - Correcting/cleaning databases

Description	*Command*
Fix inconsistencies in the Device Special File data files	dsfmgr –vF
Remove entry from all databases and data files	hwmgr –delete comp –id <#>
Purge all non-registered entries from every database and data file **CAUTION !**	hwmgr –refresh comp hwmgr –refresh scsi

Troubleshooting Techniques (cont)

- **Hardware Component Specific Commands**

Description	*Command*
Display extended hardware database information	hwmgr –show comp –id<#> -full
List component attributes/properties	hwmgr –get attr –id<#>
Display the Hardware Set *(hierarchy view)*	hwmgr –view hierarchy
Display components in the Hardware Set with device special files	hwmgr –view devices

Troubleshooting Techniques (cont)

- **SCSI Device Specific Commands**

Description	*Command*
Display extended SCSI	hwmgr –show scsi -full
Database information	hwmgr –show scsi –did<#> -full
Displays SCSI WWID in text	hwmgr –show scsi –id <#> -full
Displays SCSI Path information	
Remove stale paths **CAUTION !**	hwmgr –refresh scsi

Troubleshooting Techniques (cont)

- **Device Special File Specific Commands**

Description	*Command*
Remove Device Special File entry	dsfmgr –R hwid <#>
Rename Device Special Files -m move -e exchange	dsfmgr –m <bn_1> < bn_2> dsfmgr –e <bn_1> <bn_2>
List devt information *-l cluster devt (if available)* *-ld local devt*	ls –l <device_special_file> ls –ld <device_special_file>

Agenda

- Hardware Management Overview
- Hardware Management Databases and Data files
- Troubleshooting Techniques
- Examples
- Resources

Example 1

- Commands to build a new HW-DB on a single system
  - boot -fl s <bootdisk>
  - mountroot
  - rm /etc/dec* /etc/dfsc* /etc/dc*
  - cd /cluster/members/member/dev/; ./MAKEDEV std
  - rm /cluster/members/member/etc/dfsl*
  - rm /cluster/members/member/.Booted
  - cd /devices
  - rm -rf disk rdisk tape ntape cport dmapi changer
  - init 0; boot -fl s <bootdisk>
  - mountroot
  - dn_setup –init
  - dsfmgr –K
  - dsfmgr –v # optionally –vF
  - hwmgr -show scsi
  - bcheckrc # fix if necessary links in /etc/fdmns
  - lmf reset
  - cdslinvchk # Fix problems NOW
  - init 3

Example 2

- How to rebuild HW-DB on single system with LSM
  - boot -fl s <bootdisk>
  - bcheckrc
  - volplex -v <root-volume> dis <root-plex> # (remove plex from root)
  - rm /etc/dec* /etc/dfsc* /etc/dc*
  - cd /cluster/members/member/dev/
  - ./MAKEDEV std
  - rm /cluster/members/member/etc/dfsl*
  - rm /cluster/members/member/.Booted
  - cd /devices
  - rm -rf disk rdisk tape ntape cport dmapi changer
  - init 0

Example 2 (cont.)

- boot -fl s <bootdisk>
- mountroot
- dn_setup –init
- dsfmgr –K
- dsfmgr –v # optionally –vF
- hwmgr show scsi
- mknod /dev/volconfig c 41 0
- mknod /dev/voltrace c 41 1
- mknod /dev/voliod c 41 2
- mknod /dev/volinfo c 41 3
- bcheckrc # fix if necessary links in /etc/fdmns
- lmf reset
- volplex att <root-volume> <root-plex>
- cdslinvchk # Fix problems NOW
- init 3

Agenda

- Hardware Management Overview
- Hardware Management Databases and Data files
- Troubleshooting Techniques
- Examples
- Resources

Resources

- Tru64 UNIX Online Documentation
- Tru64 UNIX / TruCluster Patchkit Documentation
- Tru64 UNIX Best Practices Documentation
- IT Resource Center (ITRC)
- Tru64 UNIX Latest Patchkit on ITRC


invent