Legato NetWorker technical update „3E03“

26.DECUS München e.V. Symposium 2003 in Bonn

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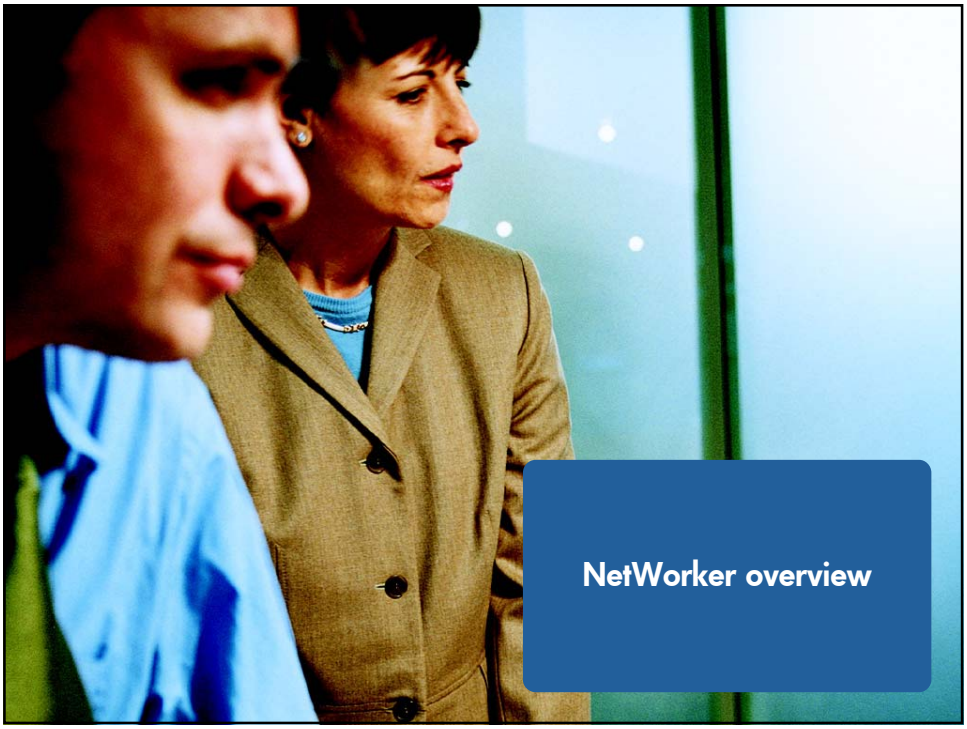
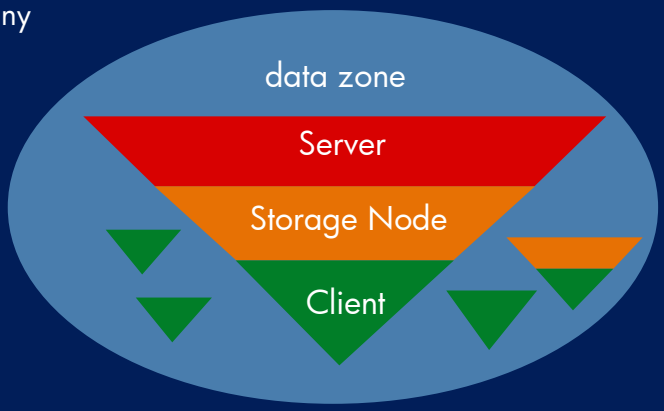
Agenda

- NetWorker overview
- library sharing and clusters
- V6.1.x new features
- openVMS support
- NetWorker V7



Legato NetWorker overview

- three-tier any-to-any architecture
  - server
  - storage node
  - client

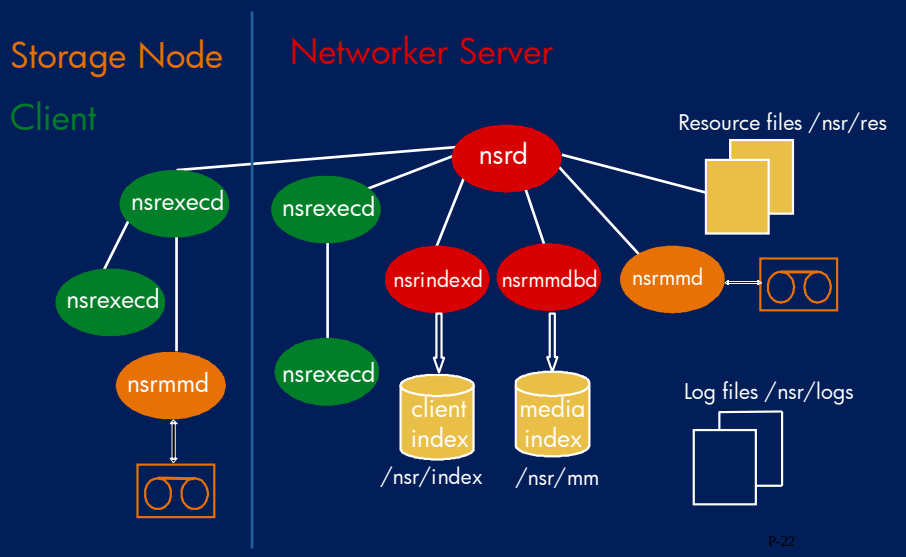


- comprehensive multi-platform data protection and application support

NetWorker features

- central management through GUI or scriptable commands
- browse and retention policies (based on savesets)
- policy based scheduling
- flexible grouping of clients
- full, incremental, level 1-9, skip & consolidated levels
- directives – backup all, but....
- pre- and post- processing
- automatic and manual initiated cloning
- multi-tier staging
- archiving
- hierarchical storage management
- ad-hoc user backups
- user initiated and directed recovers

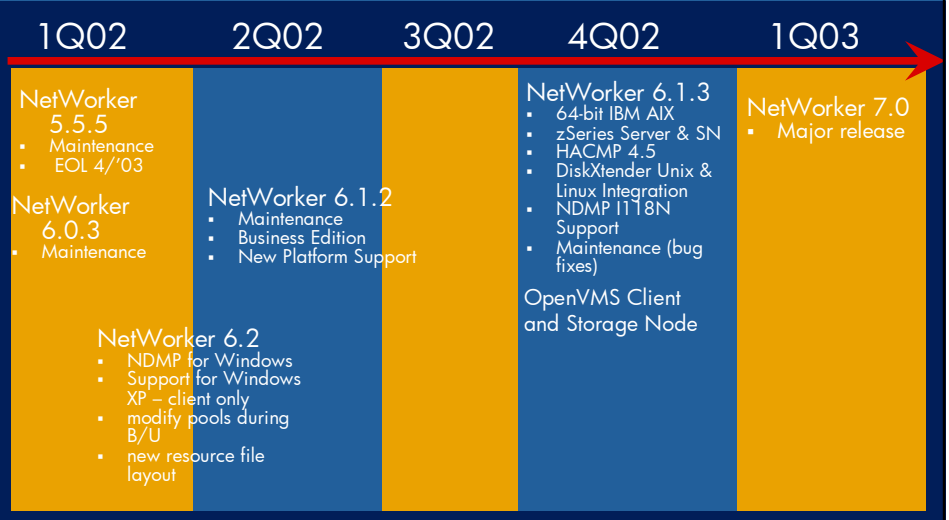
NetWorker architecture



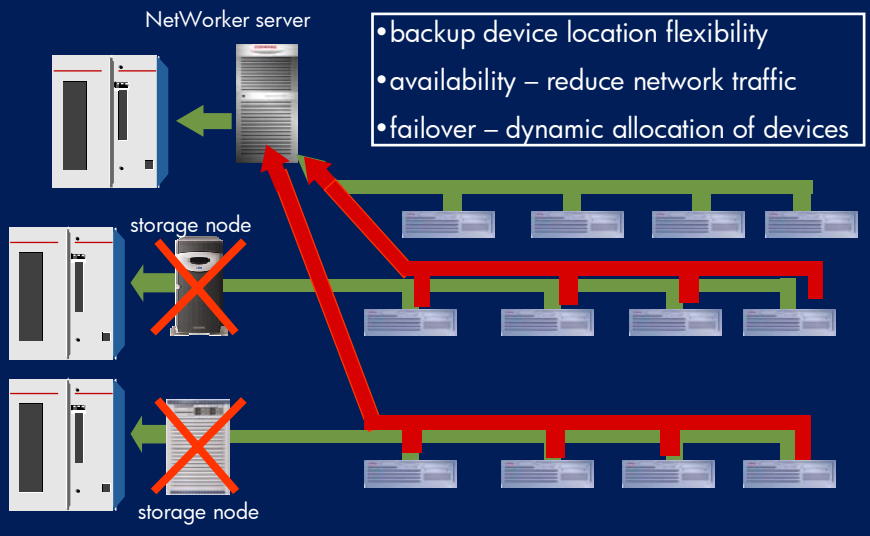
NetWorker data flow

- parallelism
  - multiple data streams from client
- multiplexing
  - Multiple data streams written to one or multiple tape drives

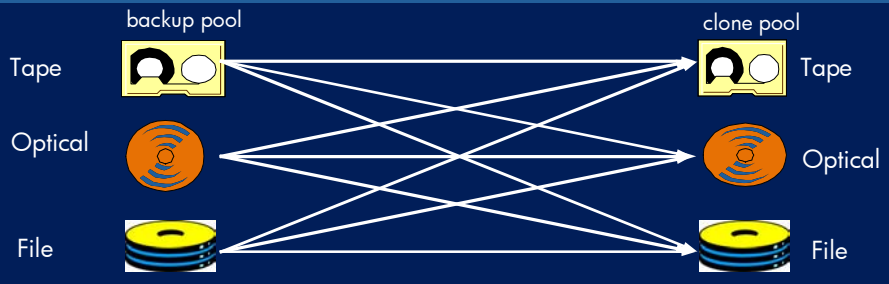
Release roadmap



NetWorker scalability and availability

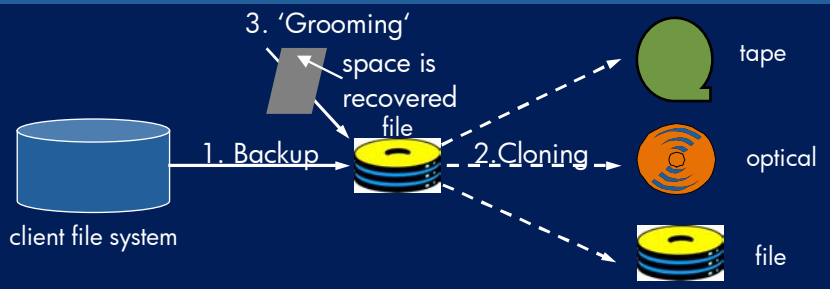


saveset cloning



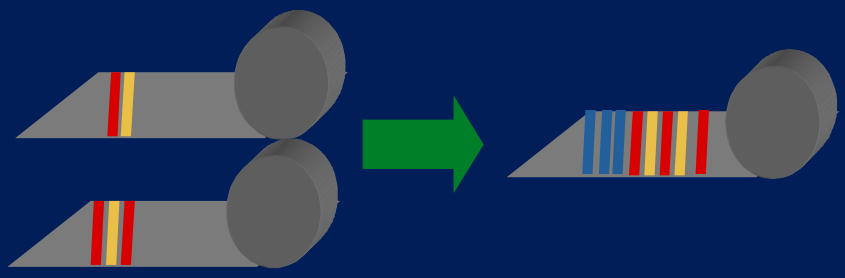
- Duplicate saveset for offsite vaulting
- Backup operation reads filesystem once
- Recover can use original or clone
- Automatic scheduled or user initiated on demand

saveset staging

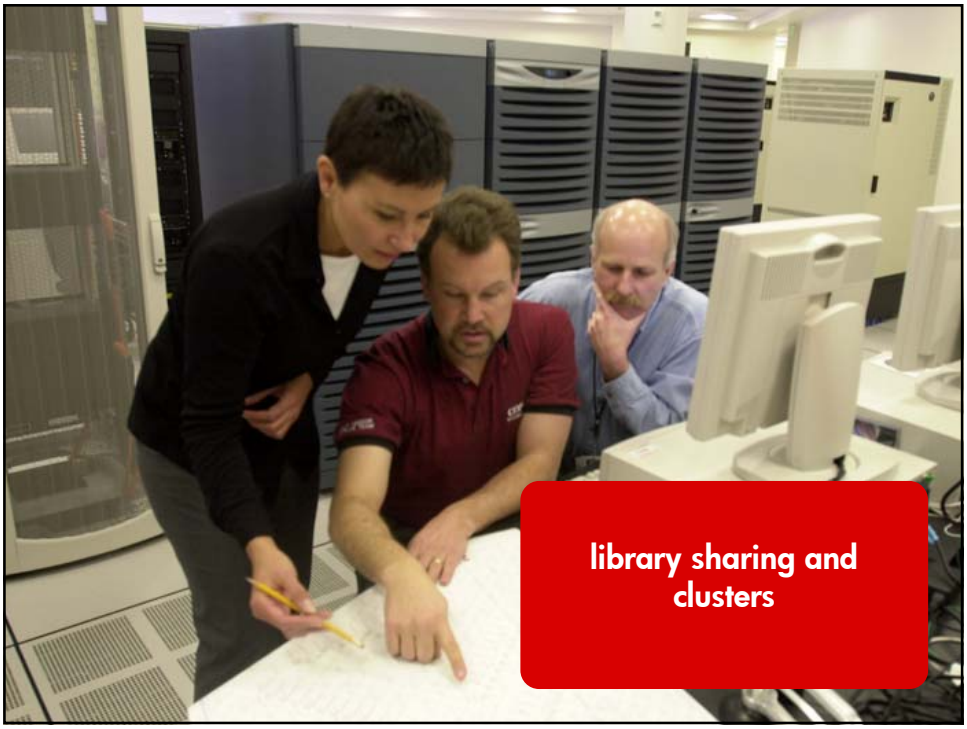


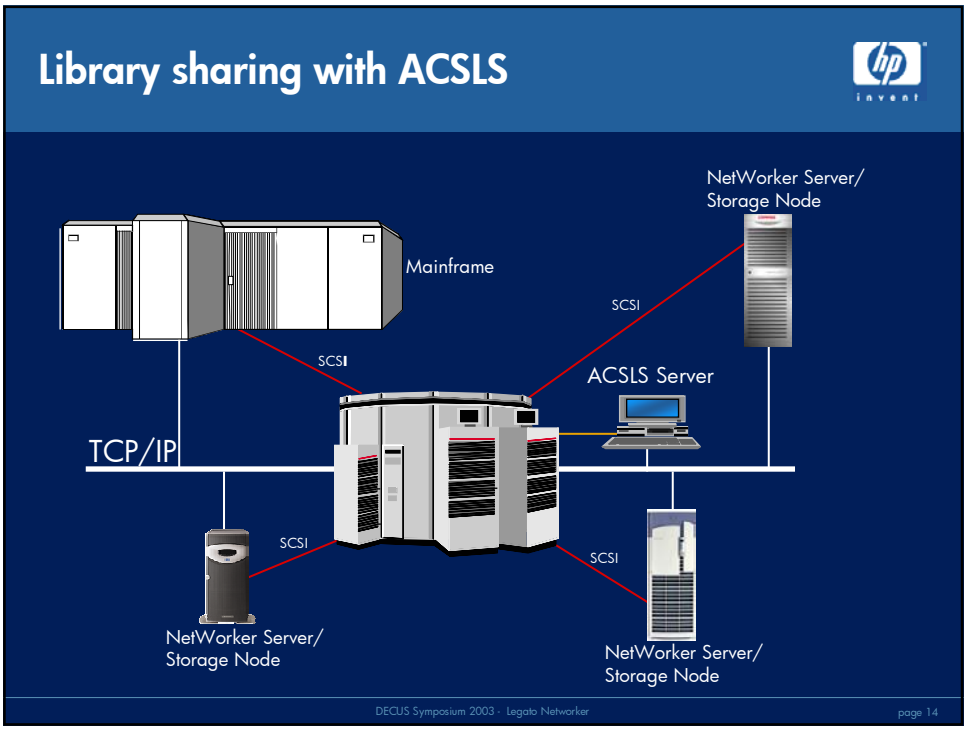
- initial backup to intermediate high speed devices
- when stage area reach preset threshold, NW can automatically stage data to removable media
- Interim recovery operations occurs at disk speed
- staging can be initiated manually by means of nsrstage

saveset staging – cartridge consolidation



- free almost unused volumes
- evacuate savesets to a different type of media


library sharing and clusters


Library sharing with ACSLS
NetWorker Server/ Storage Node
Mainframe
SCSI
SCSI
ACSLS Server
TCP/IP
SCSI
SCSI
NetWorker Server/ Storage Node
NetWorker Server/ Storage Node
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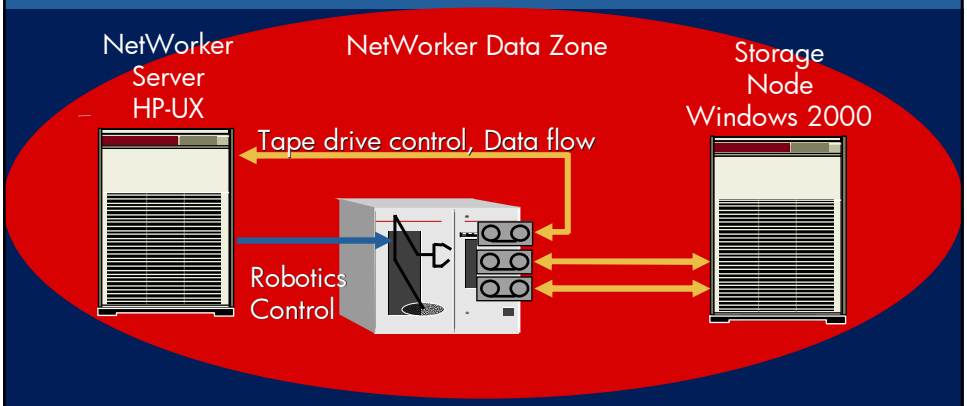
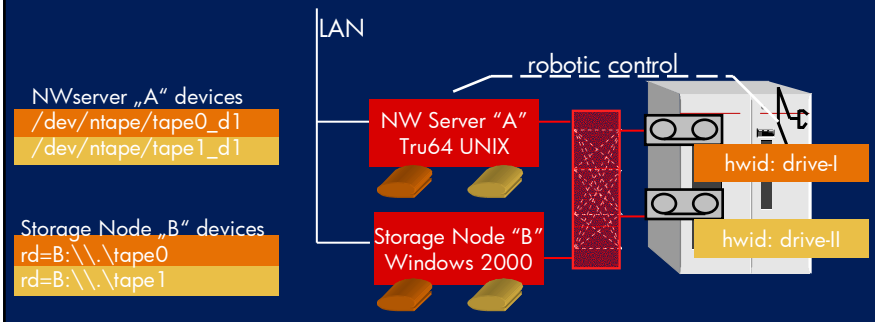
static library sharing



- Jukebox is shared among one NetWorker Server and /or multiple Storage Nodes
- a tape drive is used by one NW Server/SN only

dynamic device sharing (DDS)



- available since NW V6.1
- device allocation is controlled by NW server
- a physical tape drive is given a hardware id
- each logical device is linked to the physical drive by means of the hardware id

DDS (cont)

- nsrjb
  - . . . slot/volume info . . . (unchanged)
  - drive 1 (/dev1) slot :
    - (rd=sn1:/dev1) slot :
  - drive 2 (/dev2) slot :
    - (rd=sn1:/dev2) slot :
- nsrwatch & nwadmin

Device	type	volume	
/dev1	sdlt	(none)	1:enabled
/dev2	sdlt	serv.1	2: mounted sdlt tape serv.1
rd=sn1:/dev1	sdlt	(none)	1: enabled
rd=sn1:/dev2	sdlt	(none)	2: shared drive in use

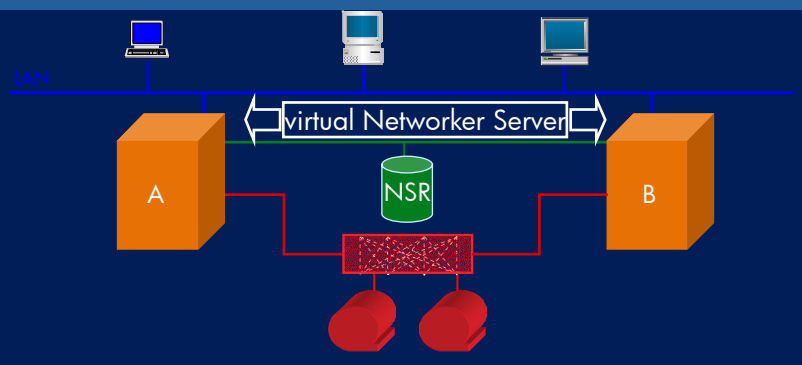
DDS licensing

- licensing is based on no. of phys. drives being shared
- Example:
  - 1x Networker Server
  - 1x Storage Node
  - 3 of 8 tape drives in one jukebox shall be shared
  - enablers required
    - Networker base enabler
    - storage node option
    - jukebox option (slot dependant)
    - 3x shared device options

DDS interoperability

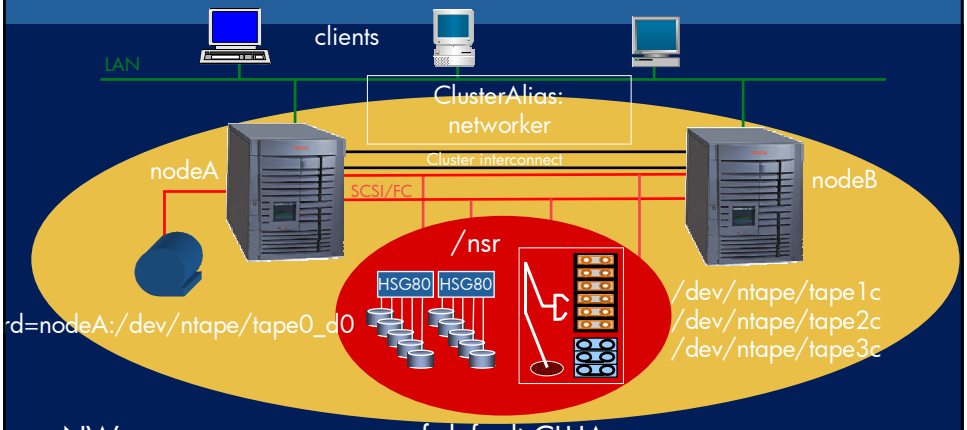
- maximum blocksize may differ on different O/S
  - Tru64 UNIX
    - device type: DLT7000 blocksize used: 96 kB
    - TZ89 256 kB
    - SDLT 128 kB
  - Windows 2000
    - some HBA's only support 64kB only
      - depends on REGISTRY setting for the scather/gather logic of the HBA
- in order to use a common blocksize on all systems sharing a jukebox set
  - NSR_DEV_ BLOCK_SIZE_DEVICE_NAME=blocksize-to-use
  - e.g. NSR_DEV_ BLOCK_SIZE_DLT7000=64 → 64kB

Networker Cluster support



- all popular cluster environments are supported
  - HP-UX MC/ServiceGuard
  - Microsoft Cluster
    - tapes are not supported on a shared bus and each phys. node is configured as a storage node

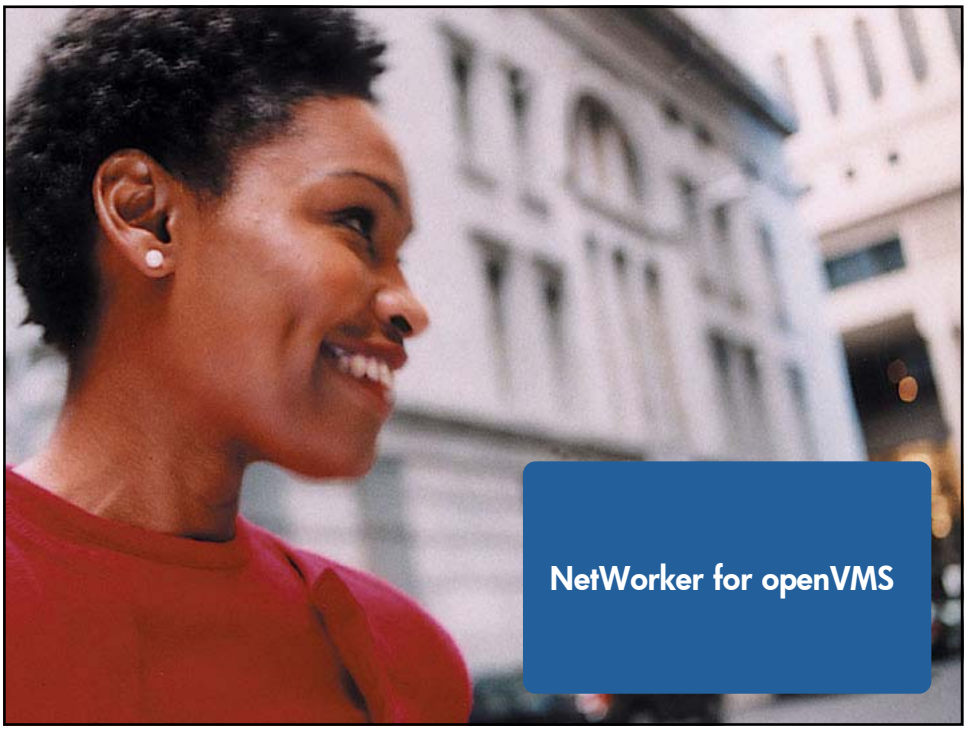
Networker Server – Tru64 UNIXTruCluster V5



- NW server assumes name of default CLUA
- runs as a CAA application (resource)
- only one Index (default ClusterAlias) stores file entries of *all* filesystems
- shared /nsr -> /cluster/members/{memb}/nsr -> /<ClusterAlias>/nsr

V6.1.x new features

- V6.1
  - dynamic device sharing
  - savegrp parallelism (in addition to server/client parallelism)
  - extended platform releases, cluster and hardware support
- V6.1.3
  - device service mode
    - when set while active session are ongoing
      - active save / recover jobs are completed
      - device does no longer accept new save / recover sessions
    - offers limited functionality with –f option (maintenance mode) to
      - inventory magacine
      - label new volumes
      - volume verification
      - scanner



NetWorker for OpenVMS client

- supports openVMS data being stored in heterogeneous fibre- based SAN environments, including library and tape drive sharing
- supports openVMS cluster
- protects openVMS server to locally attached tape libraries reducing network traffic and improving backup and recovery performance (storage node only)
- allows for a centrally managed backup and recovery solution for OpenVMS systems that exist within a mixed UNIX, Windows, Netware and Linux environment

NetWorker for OpenVMS client (cont)

- Client
  - ODS-2 File System
  - OpenVMS clusters
  - Legato - OpenVMS on Alpha V7 and above
  - Wumpusware NOC on VAX 5.5-2HW and above
  - HP's TCP/IP Services (UCX), Multinet, TCPware
  - Archiving (Legato Client)
  - Co-exists with OpenVMS Shelving (HSM)
- Storage Node
  - Tape devices and Libraries supported by the OpenVMS SCSI tape driver
  - Library Sharing
  - DDS
    - NW V6.1 and above server and library controlled by NW 6.1 server or Storage Node.
    - Fibre Channel Requires OpenVMS V7.2-2 and above
  - Disk to Disk Backup

NOC (cont)

- installs through POLYCENTER Software Installation utility
- NetWorker programs are defined as foreign commands
- online help integrated into native openVMS help
- openVMS specific directives available
  - nolock /ignore=interlock
  - skip_alias , copy_alias
  - skip_shelved , unshelved
  - ignobackup /ignore=nobackup
  - record /record
- NOC specifics
  - have a tape pool especially for openVMS
    - OpenVMS allows a max block size of 64K –1 byte, so the max block size for a device is 63K (default).
  - if you want to share tapes, the max block size will be 32k
    - non-optimal performance on all OS'
  - Not all the NetWorker commands are the same as they trip over reserved OpenVMS commands

NetWorker V7.0

- NetWorker V7 is a customer-driven release enabling enterprises to further simplify, centralize and automate data protection across heterogeneous environments

- major objectives
  - enhanced storage network & platform capabilities
  - backup to disk enhancements
  - improved NetWorker core attributes
  - intelligent device management

- Licensing
  - a new update enabler is necessary to update an existing environment

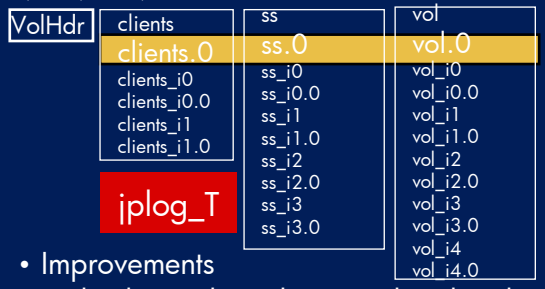
new platforms

- IA-64
  - HP-UX 11i
  - Linux (SuSE and Red Hat)
  - Windows 2003 (.NET)
    - Microsoft SharePoint Portal Server Support
      - web server for Office 10 (XP)
      - web storage system „filesystem“
      - an additional license is required
- Linux Enterprise Support
  - Red Hat
  - SuSE
- Apple MAC OS X client support

see software compatibility guide for details

improved NetWorker core attributes - WISS

- increased media db resiliency
- /nsr/mm/mmvolume6



- only the „*.#“ files contain important data
- all other files can be rebuild if required
- The maximum data size of *.1, *.2 is 2GB
- If all space is consumed a new segment file is started

- Improvements
  - checksums have been updated at the record level
  - journaling protects data at the record level. WISS buffering
  - jplog_T is a new internal file to store un-committed data records
  - nsrck –m to check consistency of media db
  - NWlogfiles will now report improper shutdown & inconsistencies

RAP database V6 and earlier

- V6 resource file layout
  - /nsr/res
  - client side
    - nsrla.res
  - server side resource files were flat ascii files
    - nsr.res
    - nsrjb.res
    - empty lines used as a separator

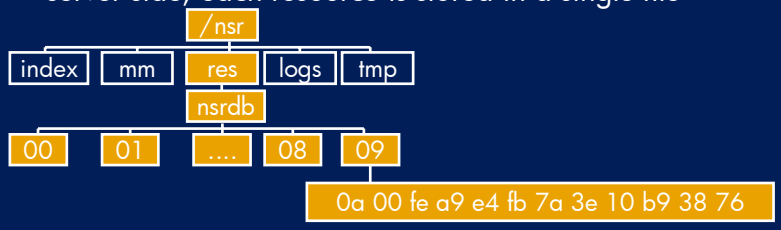
```
action: /usr/bin/logger -p daemon.notice;
administrator: root@minos.fkr.cpqcorp.net;
event: Media, Savegroup, Index, Server, Registration, Device cleaned,
Device cleaning required, Cleaning cartridge required,
Cleaning cartridge expired, Migration, Device Disabled;
name: Log default;
priority: emergency, alert, critical, waiting, warning, notice, info;
type: NSR notification;
resource identifier: 5.0.245.239.8.101.128.61.16.204.230.19(34)

action: "/usr/bin/mailx -s \"registration status for minos\" root";
administrator: root@minos.fkr.cpqcorp.net;
event: Registration;
name: Registration;
priority: emergency, alert, critical, waiting, warning, notice;
type: NSR notification;
resource identifier: 6.0.245.239.8.101.128.61.16.204.230.19(35)
```

RAP database (resource files)

- RAP = Resource Administration Protocol
  - mechanism used to receive, store and change NetWorker resource configurations
- in big data zones nsr.res and nsrjb.res grow very large resulting in
  - slow queries and updates, because text files were searched sequentially
  - only one resource per file could be processed at a time
  - one „inconsistent“ resource could corrupt the whole configuration of a data zone

RAP database changes (resource files)

- V7 resource file layout
  - /nsr/res/nsrdb
    - client side /nsr/res/nsrla.res remains unchanged
    - server side, each resource is stored in a single file



- resource identifier: 10.0.254.169.118.251.122.62.16.185.56.118

```
action: /usr/bin/logger -p local0.alert;
comment:;
event: Media;
name: Tape mount request 2;
priority: critical;
type: NSR notification;
resource identifier: 10.0.254.169.228.251.122.62.16.185.56.118(1)
```

NetWorker DiskBackup V6

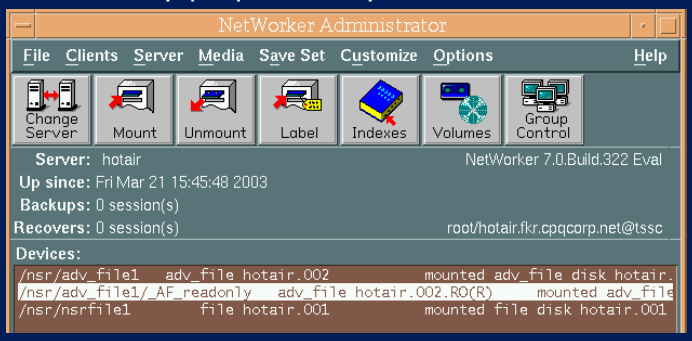
- backup to disk (file device) supported since V5.0 (1997)
- any type of storage may be used
  - DAS (SCSI RAID)
  - NAS (SCSI & ATA-RAID on network)
  - SAN (RAID, JBOD on FC)
- file device is actually a directory (e.g. /nsrdev01)
- device is treated like a tape
  - one file per saveset
  - no automatic deletion of aborted and expired savesets

NetWorker DiskBackup V7

- V7 comes with two types of file devices
  - file enhanced known file device
  - adv_file the new Advanced File device type
- New feature for the File device type
  - removal of aborted and expired save set from disk (nsrim)
- Major features of the Advanced file device type
  - is designed for very large disk devices (multiple TB's)
  - read from and write to disk simultaneously
  - recover data from devices engaged in backups
  - removal of aborted and expired save set from disk
  - perform staging/cloning operations and backup in parallel
  - will always stay appenable, filesystem full triggers notification
    - 1st action reclaims space by deleting expired savesets
    - 2nd action send email and waits for available space on disk

NetWorker Advanced file device

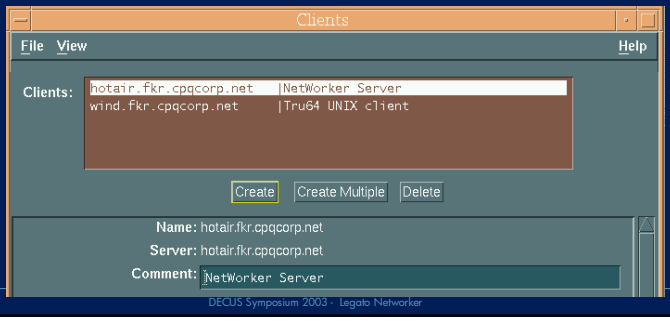
- label operation on an adv_file type device will automatically create, label and mount a second device
  - for read-only purposes only



- an additional license is required for both file and adv_file type device

improved NetWorker core attributes

- cross-platform client file index (CFI) browsing
- disable directed recover at client side
  - /nsr/res/nsrla.res
    - disable directed recover: [Yes, No];
- NSR Group: last end time
- new comment field in client resource



improved NetWorker core attributes (cont)

- file level browse and retrieve for UNIX archives
- auditing: resource update logging
  - if enabled, will write changes to /nsr/res/rap.log
  - enabled in NetWorker server resource
- client resource storage node affinity list enhancement
  - new keyword curphyhost (current physical host)
  - directs the virtual client backup to the storage node on the physical node on which the virtual client currently resides
  - does not replace „nsrserverhost“ and „physical hosts“
- NDMP
  - now supported on Tru64 UNIX and AIX
  - NDMP V4 support
  - NDMP tape cloning
  - Windows NDMP recovery GUI

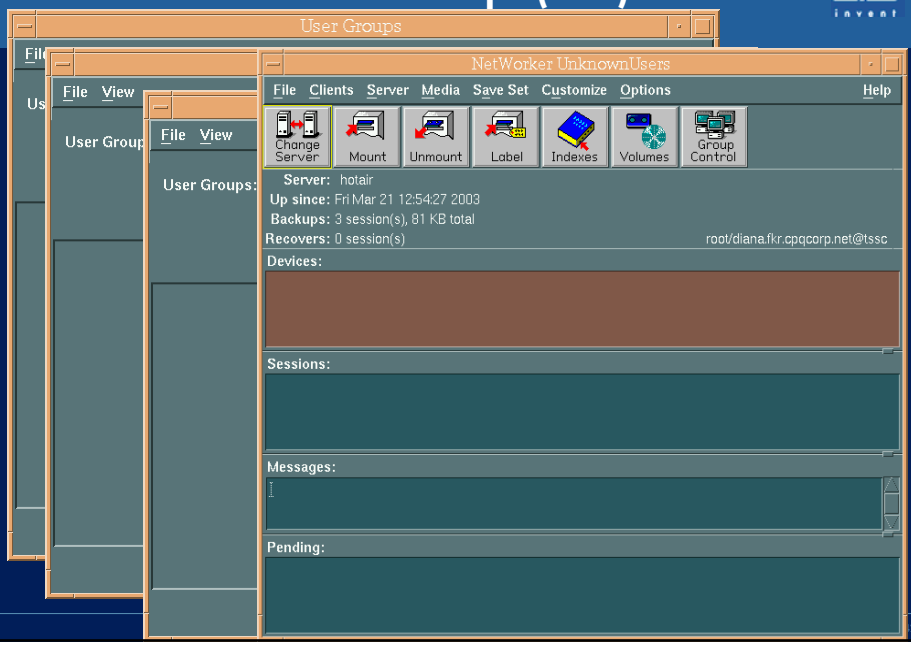
improved NetWorker core attributes (cont)

- new volume cloning behaviour
  - V6 cloned all savesets that were found on the volume
  - V7 only clones all savesets that were started on this volume
- pools can now be created /changed at any time
- staging intervals have a finer granularity for more frequent operations
  - max storage period: days / hours
  - recover space/ file system check interval: hours / mins
  - after processing all savesets „file“ dev become appendable automatically
- reverse striped recovery
  - recovers from multiple volumes simultaneously
  - e.g. „full“ and „incr“ if saved to different volumes are recovered in parallel
  - turned off by default
    - enable: touch /nsr/debug/striped_recover
    - disable: touch /nsr/debug/no_striped_recover

Access Control – User Groups

- V6 known user
  - NetWorker user
    - local backup and recover operation permitted and monitoring
  - NetWorker Administrator
    - all operations
  - no customization possible
- V7 features a new user group resource
  - 2 user groups by default (basically representing the V6 users)
  - Windows GUI allows the creation of additional user groups
  - UNIX GUI does not permit the creation of new user groups
  - use nsradmin on UNIX
    - nsradmin> create type: NSR usergroup; name: usergroup

Access Control – User Groups (cont)



unique device identification

- inquire command has been enhanced to uniquely identify devices
  - it displays (if applicable)
    - manufacturer
    - product id
    - serial number
    - WWN (name) and WWPN (portname)

```
# inquire
scsidev@1.0.0:COMPAQ  DATA ROUTER     1187|(Unknown Device Type c), /dev/***/scp2
                                S/N:   3441303444524D314256464D202020202020202000
scsidev@2.0.1:DEC     HSG80           V86P|Disk, /dev/rdisk/dsk39c
                     S/N:     ZG94115504
                     WWNN:60001FE10004EDC00009941155040008
scsidev@1.0.4:DEC     TL810    (C) DEC2.41|Autochanger (Jukebox), /dev/changer/mc0
                                 S/N: 2G01CBB2H010
scsidev@1.0.5:DEC     TZ89     (C) DEC2561|Tape, /dev/ntape/tape0_d1
                                 S/N: PXA41S1673
scsidev@1.0.6:DEC     TZ89     (C) DEC2561|Tape, /dev/ntape/tape1_d1
                                   S/N: CX902S0581
scsidev@1.0.7:DEC     TZ89     (C) DEC2561|Tape, /dev/ntape/tape2_d1
                                   S/N: PXB15S2014
```


unique device identification (cont)

- a new command „sjisn“ has been added
  - sjisn displays the attached devices in the order of their element connection
  - jukebox hardware must support sjisn

```
# ./sjisn scsidev@1.0.4
Serial Number data for scsidev@1.0.4 (DEC     TL810    (C) DEC):
        Library:
                Serial Number: 2G01CBB2H010
        Drive at element address 128:
                Serial Number: PXA41S1673
        Drive at element address 129:
                Serial Number: CX902S0581
        Drive at element address 130:
                Serial Number: PXB15S2014
```

  - the output of both commands can be accessed by jbconfig

jukebox configuration changes

- Intention: simplify the installation with jbconfig
  - eliminate redundant questions
  - automate configuration where possible
  - specific and informational error messages
- automatic assignment of DDS hardware ids
  - may be changed later by nwadmin on demand
- jukebox configuration verification
  - if a invalid name of a jukebox is entered, jbconfig now prompts for a new name instead of just exiting.
- device configuration verification
  - if a non-existent or invalid path for a drive is inputed, jbonfig prompts for a new path instead of just existing
  - additionally, error-checking for valid device names and paths and other user input has been added througout
- support to share a NetWorker jukebox with Windows 2000 RSM

jbconfig example

```
DOS> jbconfig
        1) Configure an AlphaStor/SmartMedia Jukebox.
        2) Configure an Autodetected SCSI Jukebox.
        3) Configure an Autodetected NDMP SCSI Jukebox.
        4) Configure an SJI Jukebox.
        5) Configure an STL Silo.
        6) Configure a Microsoft Removable Storage Jukebox.

What kind of Jukebox are you configuring [1] 2
Installing "Standard SCSI Jukebox" jukebox - scsidev@2.3.0.

What name do you want to assign to this jukebox device? jbox
Turn NetWorker auto-cleaning on (yes / no) [yes]? yes

The following drives have been detected in this auto-changer:
 1> dlt @ 2.4.0 ==> \\.\Tape0
 1> dlt @ 2.5.0 ==> \\.\Tape1
These are all the drives that this auto changer possesses.

do you want to change the model(s) or configure them as shared or
NDMP drives? (yes / no) [no] no

Jukebox has been added successfully

<<<summary of the jukebox resource which has been configured>>>

DOS>
```

option 6 is only available on Windows 2000

Common Device Interface (CDI)

- current implementation
  - standard jukebox interface (SJI) for libraries
  - magnetic tape input/output (MTIO) for the devices
  - limitations:
    - it is difficult to collect good status and error info
    - it is impossible to use many (advanced) features of tape drives
    - the current implementation needs specific code on different platforms
  - the solution
    - common device interface
    - it allows to send any SCSI command to SCSI connected tapes drives
    - CDI remove the limitation to use only MTIO functions present on all UNIX platforms
    - UNIX and Windows use the same code path
    - it allows the usage of TapeAlert

Common device interface (cont)

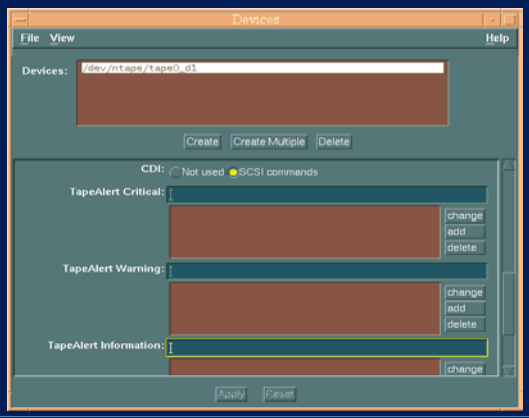
- CDI is controlled by a new attribute in the device resource
  cdi: defaults to „SCSI commands“ – it is active by default
  cdi: not used for non-CDI storage nodes, disk, file & NDMP devs
- sends SCSI commands through the OS's tape driver passthrough mechanism
- new shared library on some platforms libcdi.xxx
  - extension depends on OS
- new binaries added primarily for technical support use
  - cdi_* (.exe)
  - generate_test_tape (.exe)
  - read_a_block (.exe)

TapeAlert

- An HP idea for intelligent tape drive management
- basically an extension to the SCSI error system
- major benefits
  - it allows to see drives developing some problems before they become severe
  - it permits demand-based auto-cleaning
- Specification:
  - ftp://ftp.t10.org/t10/document.02/02-142r0.pdf
- TapeAlert messages will be logged in both NW logfiles
- TapeAlert Flags
  - are saved in the device resource to assist in diagnosing intermittent problems
  - are cleared in the tape drive when nsrmmd reads them

TapeAlert flags

- cleaning notices also go into the logs
- get handled automatically by setting the „Cleaning required“ attribute for the device



Tape Alert example

daemon.log
03/26/03 11:36:49 nsrd: media info: dlt7000 tape will be over-written
03/26/03 11:36:49 nsrd: media critical: TapeAlert flag „Read failure“
has been posted for /dev/ntape/tape0_d1
03/26/03 11:36:50 nsrd: media critical: TapeAlert Flag „Clean now“ has
been posted for /dev/ntape/tape0_d1
03/26/03 11:36:50 nsrd: media warning: TapeAlert flag „Hard error“
has been posted for /dev/ntape/tape0_d1
:
:
:
03/26/03 11:38:41 nsrd: media critical: TapeAlert flag „clean now“
has been cleared for /defv/ntape/tape0_d1

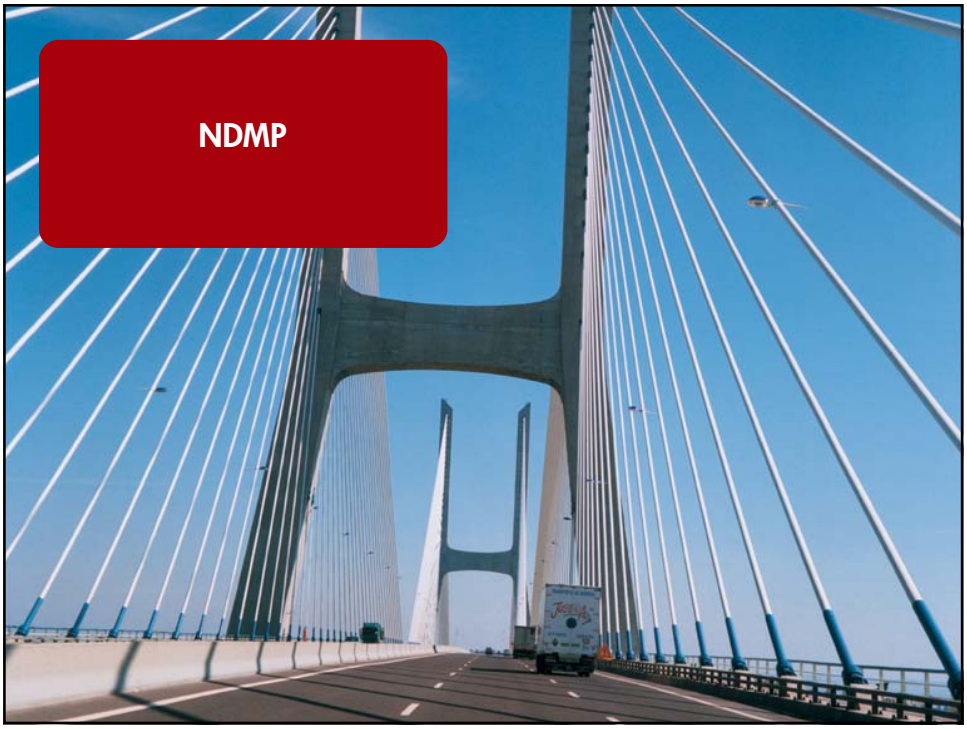
NetWorker database reporting

- nsrinfo and mminfo used to be human readable only
- V7 separates the report format from the output format
  - XML format (-xm)
  - Character Separated Values (CSV) output format (-xc<separator>)
- Example:

```
# mminfo -av -xm
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE mminfo-tabular-report [
<!ELEMENT result (field*)>
<!ELEMENT field (annotation | attributes | avail | barcode | browse-time | capacity | client | client-ID
| clone-flags | clone-id | clone-time | continued | copies | date-time | expires | family | files-saved
:
# mminfo -av -xc,
volume,client,date-time,sum-size,ssid,flags,level,name
hotair.001,hotair.fkr.cpqcorp.net,03/25/03 14:38:50,68 KB,4219493354,cr,full,bootstrap
hotair.001,hotair.fkr.cpqcorp.net,03/25/03 14:38:33,96 MB,4253047769,cb,full,/
```

installation / update

- an update enabler is required
- V7 does no longer support Tru64 UNIX V4*
- Microsoft Windows
  - NW V5 does not support Windows 2000
  - NW V7 does not support Windows NT
  - update from NT / NW V5 to V7
    - must upgrade to V6 first
    - upgrade O/S from NT to Windows 2000
    - update NW from V6 to V7
- no problem on UNIX to update NW V5 to V7 directly
- resource files and media db are converted during update
- no default device created on new installations
- file type devices no longer work with V7 without proper enabler recover still possible (mount read-only)



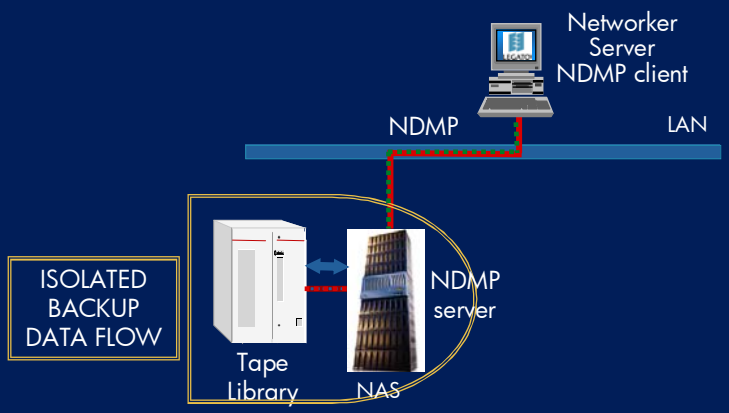
What is NDMP

- Network Data Management Protocol
  - NDMP specification can be found at
    - www.ndmp.org
- Network attached storage support (NAS)
- „The Network Data Management Protocol is a network protocol that specifies the communication between the server and the backup software“
- Open source API co-developed by Legato Systems and Network Appliance

Terminology

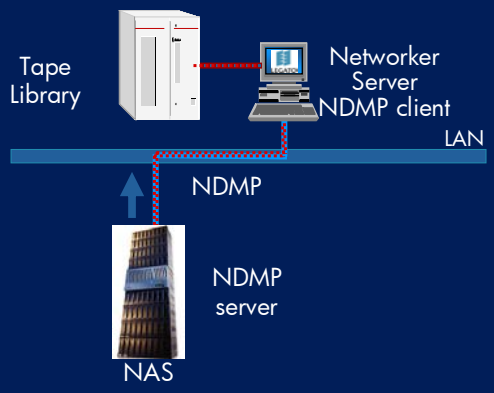
- NDMP server
  - NDMP disk server
    - generates the backup data
    - restores the backup data to disk
    - hosted on backup client
  - NDMP tape server
    - controls tape device
    - receives the backup data and writes to tape
    - reads the backup data from tape and sends to data server
    - hosted on the backup device host
- NDMP client
  - The backup application controls the NDMP server through NDMP protocol
  - e.g. NetWorker

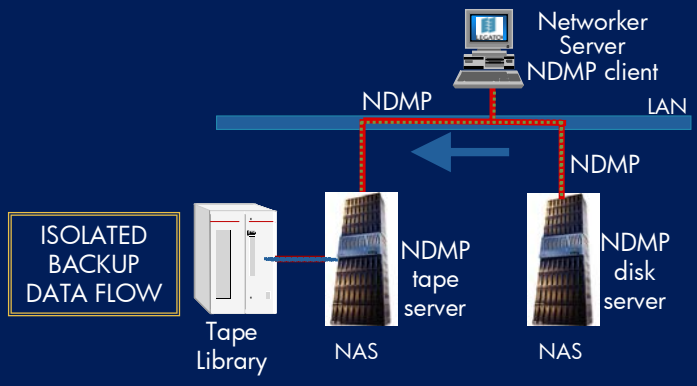
NDMP local backup



NDMP remote backup

- Backup through the network to server attached library



NDMP „3 party“ backup

- filers with low capacity do not need a library