What's New with HP's HA Clustering Solutions in 2001

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agenda

HA Overview

- market trend
- cost and causes of downtime
- hp's ha strategy

MC/ServiceGuard Review

What's New with HP's HA Clustering Solutions

- What's new in MC/ServiceGuard
- What's new in ServiceGuard OPS Edition
- What's new with Disaster Tolerant Solutions
- HA Clusters with SuperDome

Summary

Questions

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HA Overview

High Availability is…

- built, managed, and measured
- hardware, system software, applications, and IT processes designed to minimize both planned and unplanned downtime

business drivers for increasingly higher levels of availability

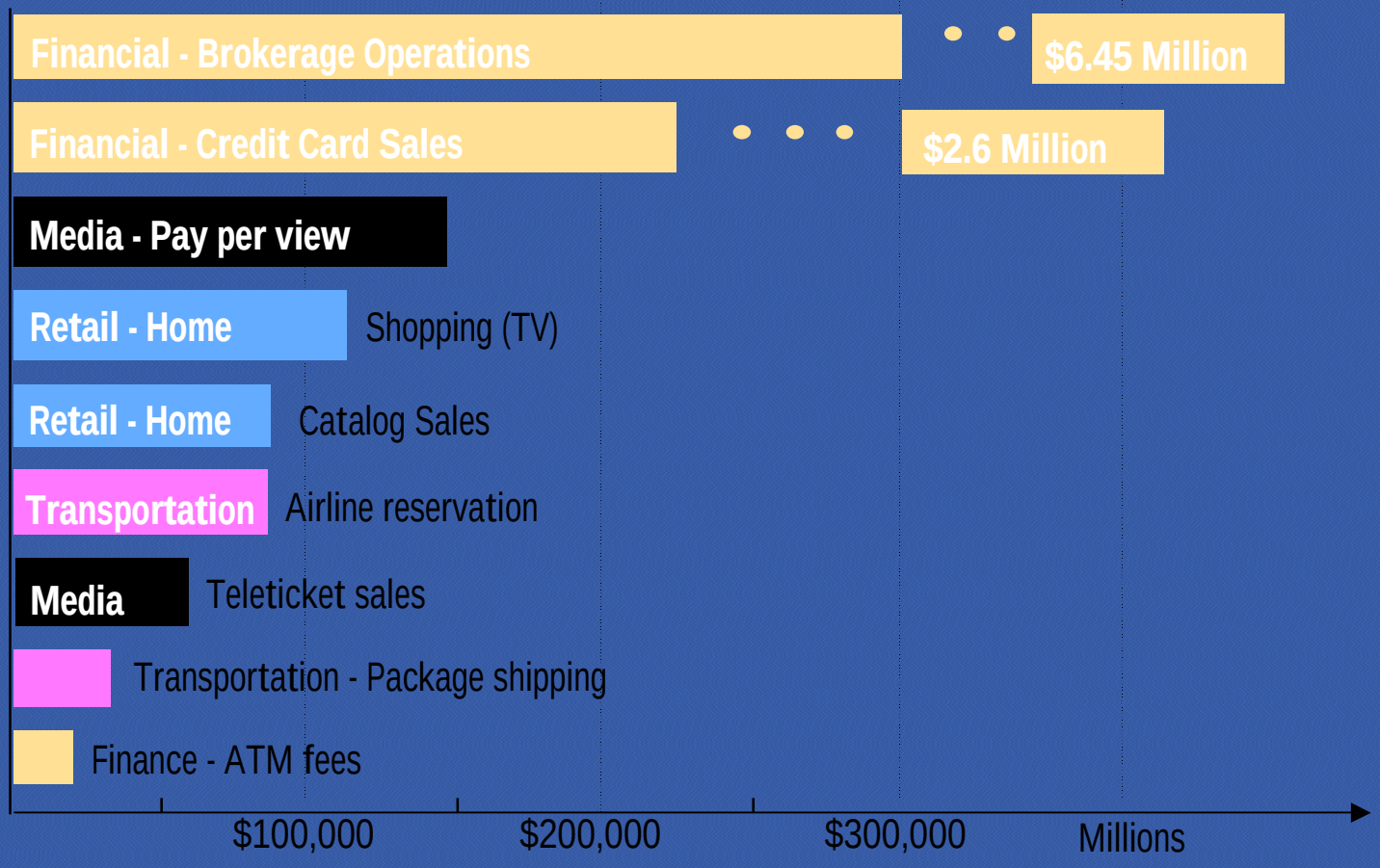
- Growing customer demand for fast, easy, and continuous access to information & services
- Business processes are dependent on IT infrastructure. No manual backups: when the infrastructure stops working, the business stops working
- Increased competitive pressures
- Globalization of services
- Society and businesses are moving toward a more dynamic and continuously online world
- E-commerce

HA Overview

***business challenge*: develop flexible, scalable, and highly available infrastructure that allows IT to meet the demands of today's and tomorrow's business drivers**

Average Cost per Hour of Downtime

HA Overview



Source: Dataquest Perspective, Sept. 1996

what will your investment yield?

HA Overview

Example: **Improving availability from 99.9% to 99.99% with application downtime impact of $100K/hour**

Yields: $788,400

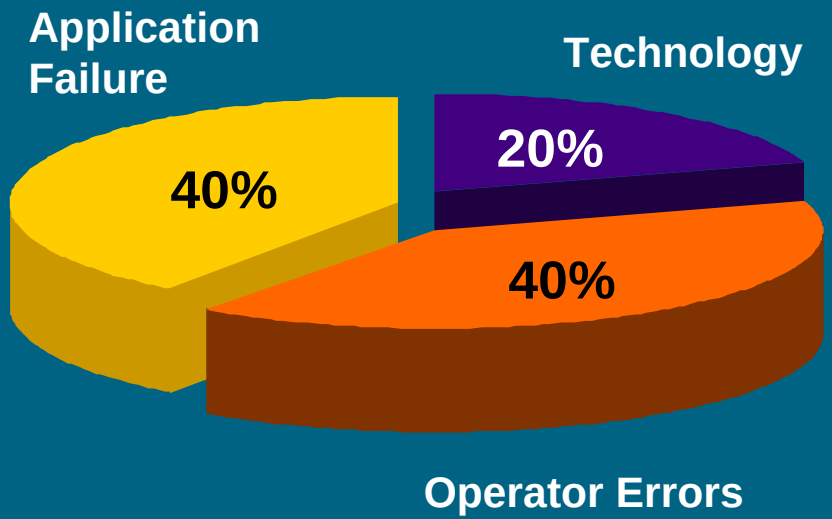
Availability	*Hours Unavailable*	*$10K Outage/Hr*	*$50K Outage/Hr*	*$100K Outage/Hr*	*$500K Outage/Hr*
99%	87.6 (3.65 Days)	$876K	$4.38M	$8.76M	$43.8M
99.9%	8.76	$87.6K	$438K	$876K	$4.38M
99.95%	4.38	$43.8K	$219K	$438K	$2.19M
99.99%	0.876	$8.76K	$43.8K	$87.6K	$438K
99.999%	0.0876	$0.87K	$4.38K	$8.76K	$43.8K

Application ($ impact) x (hours downtime)

downtime can mean headlines

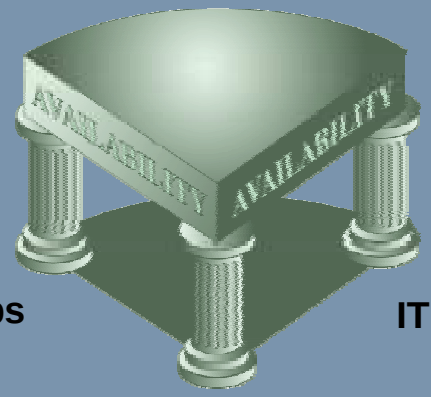
HA Overview

industry reports on causes of unplanned downtime



Source: GartnerGroup, October 1999

HA Overview

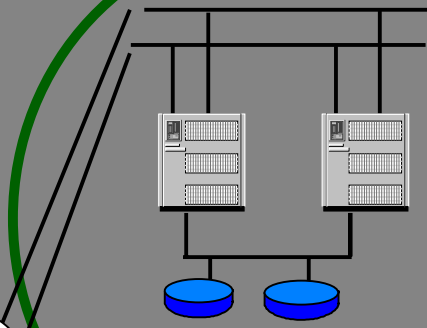


hp's high availability strategy

HA technology components

HA Overview

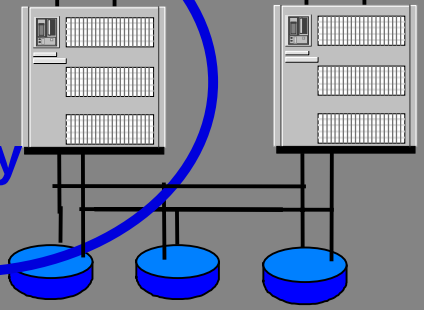
Availability through Manageability:
- Mainframe capabilities
- Monitoring & Mgmt
- Ease of Use



Disaster Tolerance

WAN

Single system Availability



Multi-system Availability

NW
Web
App
DB

Work with partners to improve end-to-end availability including application stack

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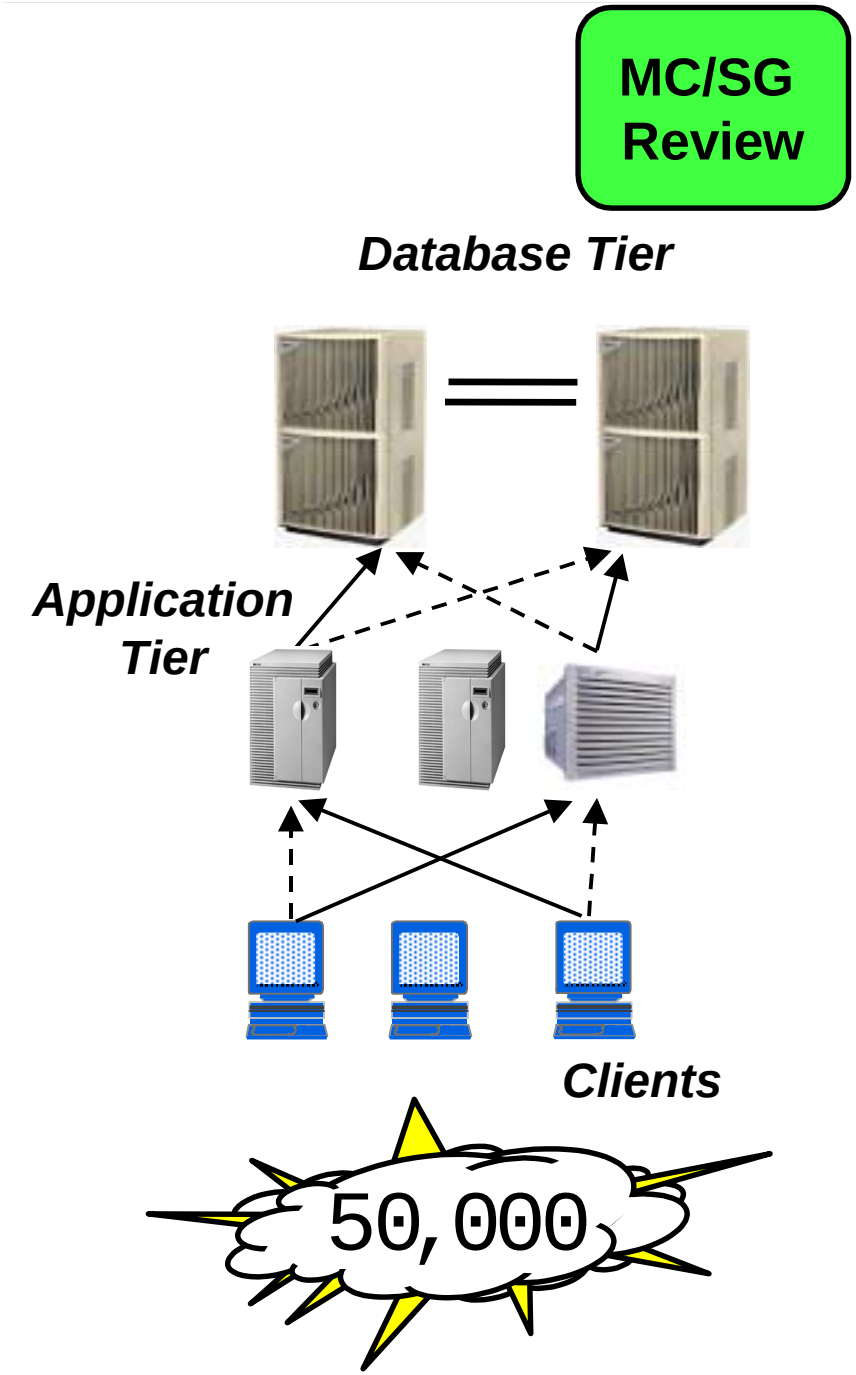
improved customer service with mc/serviceguard

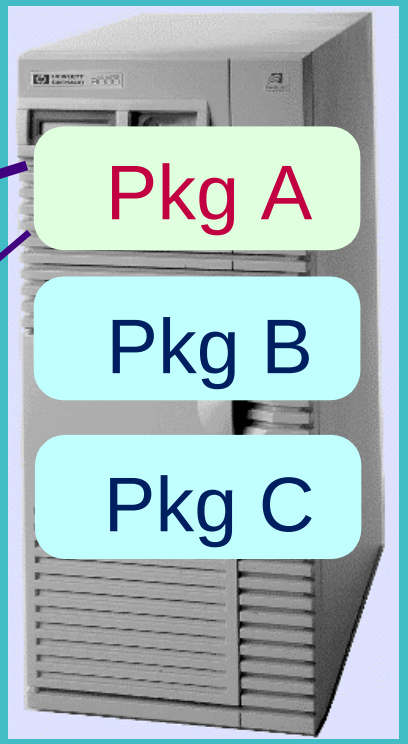
- Features:
  - Multi OS
  - One-stop GUI
  - Rolling upgrade
  - Tape sharing
  - 16 nodes
  - No idle system
  - Online reconfiguration
  - Automatic Failback
  - Rotating standby
- Closely integrated with OS



hp mc/serviceguard: application packages

MC/SG Review

- Simple, flexible framework for managing application resources



Node 1

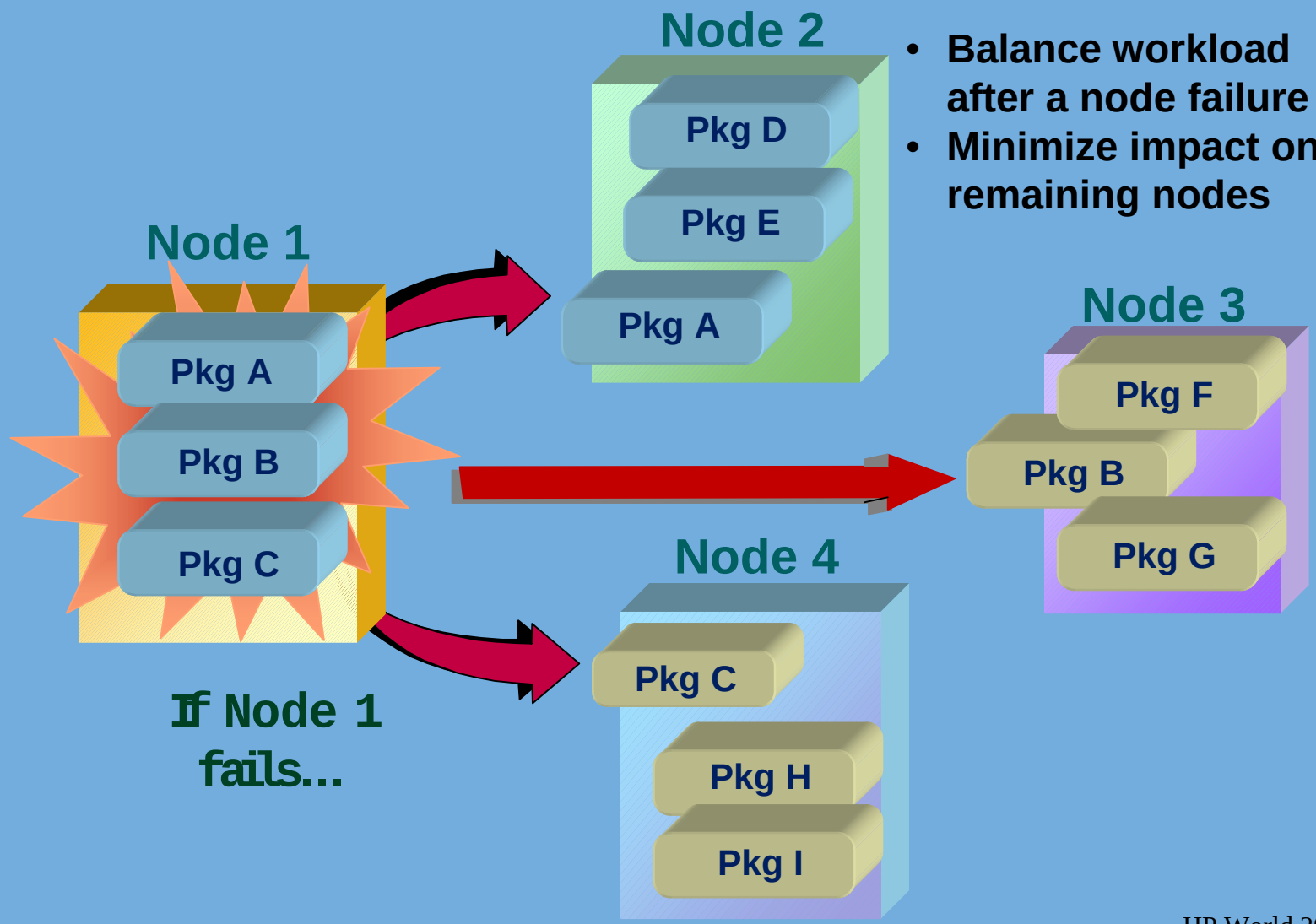
Processes:
- App_Process_1
- App_Process_2
- Middleware_1
- Middleware_2

Disks:
- lvol_data1
- lvol_data2

Network:
- IP 56.23.101.44

hp mc/serviceguard and built-in workload balancing

MC/SG Review



- Balance workload after a node failure
- Minimize impact on remaining nodes

PRM with mc/serviceguard: superior load balancing

MC/SG Review

100%

80%

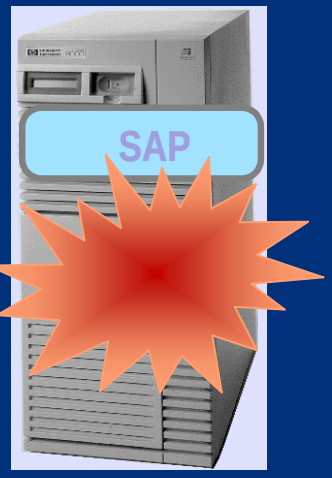
20%

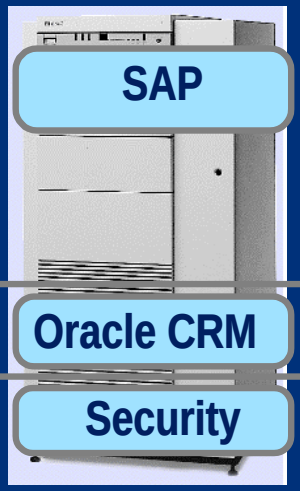
- Dynamic allocation of system resources
- Load balancing for normal and post-failure operation

Node 1

Node 2

If Node 1 fails





70%

20%

10%

Node 1

Node 2

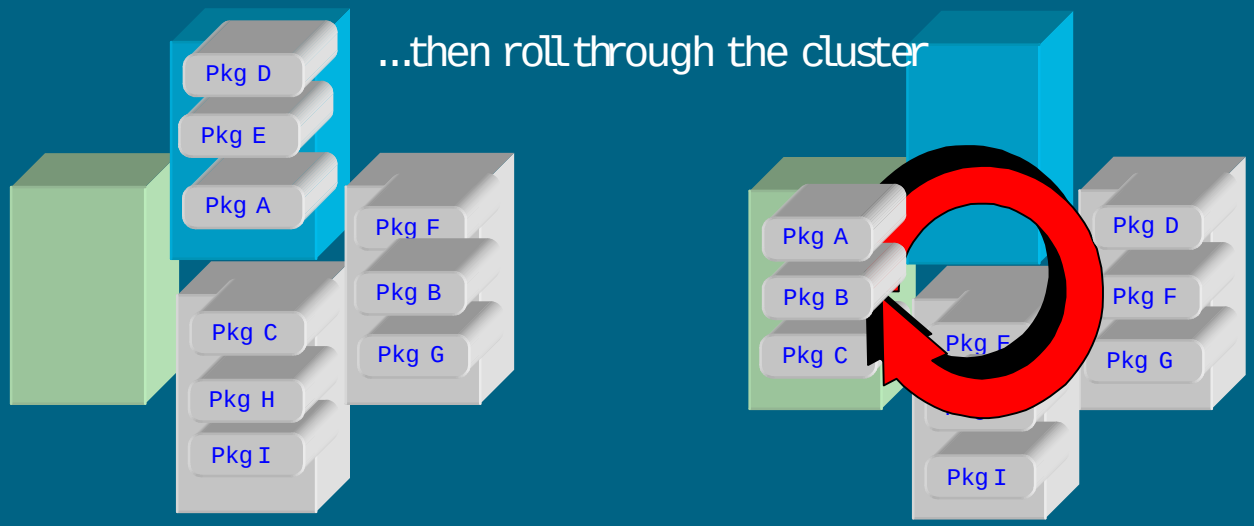
mc/serviceguard: rolling upgrade

MC/SG Review

- Rolling upgrade: minimize planned downtime
- Maximize application uptime
- Cluster remains up

Backward compatibility:
- Operating system
- MC/ServiceGuard

Hardware or software upgrades...



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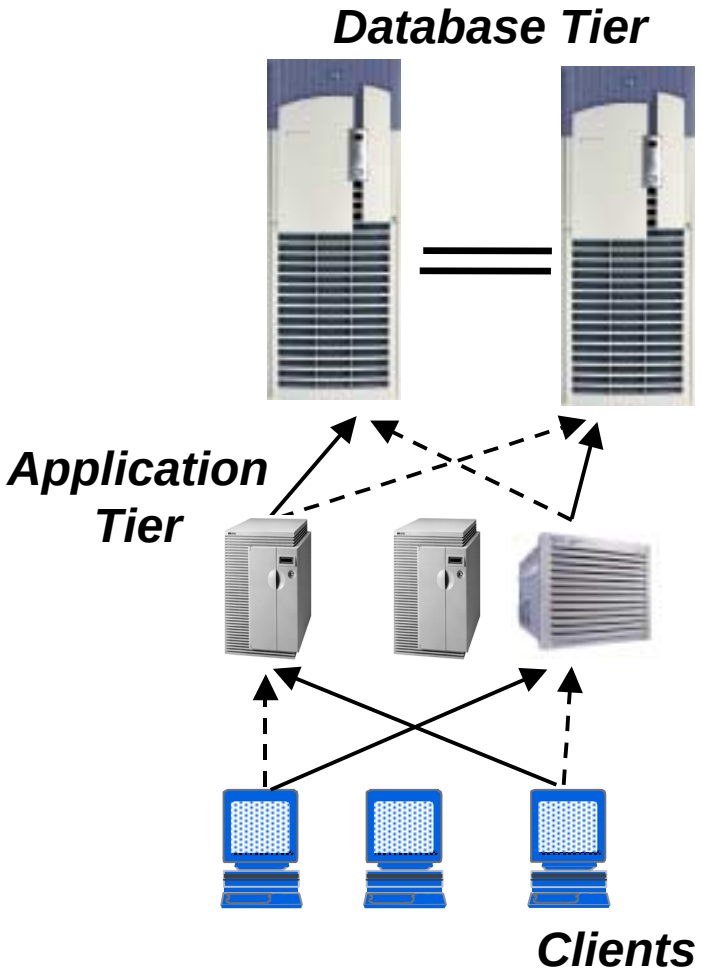
mc/serviceguard enhancements

- New Hardware Support
  - SuperDome support
  - XP48 support
  - HA SAN support
  - Cascaded Switches support
  - DWDM support
- Mixed clusters supported (11.0 and 11i nodes)
- VERITAS Volume Manager support
- Max packages increased to 60
- ServiceGuard Manager (GUI)

➢ MC/ServiceGuard Linux (2h01)

MC/SG what's new



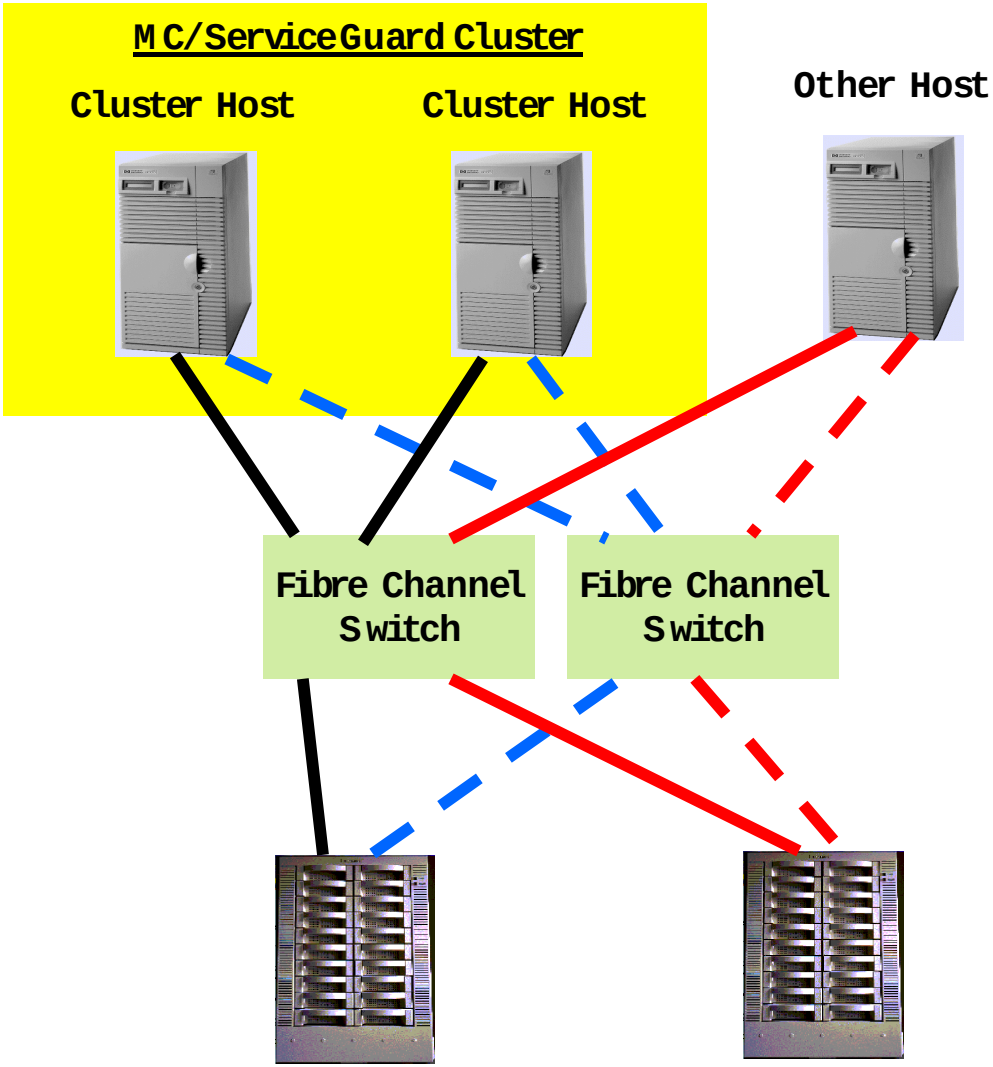
SAN and HA

MC/SG what's new

- Up to two Fibre Channel switches may be cascaded
- Fabric Login with Zoning (or SecureManager XP software) is required for LUN isolation between cluster and non-cluster nodes
- Only certain Fibre Channel Switches support Fabric Login with Zoning
- Each MC/ServiceGuard cluster must be in a separate zone
- Non-clustered nodes must not be in the same zone as clustered nodes
- Now supported with a Campus Cluster using two cascaded switches (max of 2 switches).

Fabric Login with MC/ServiceGuard and Zoning

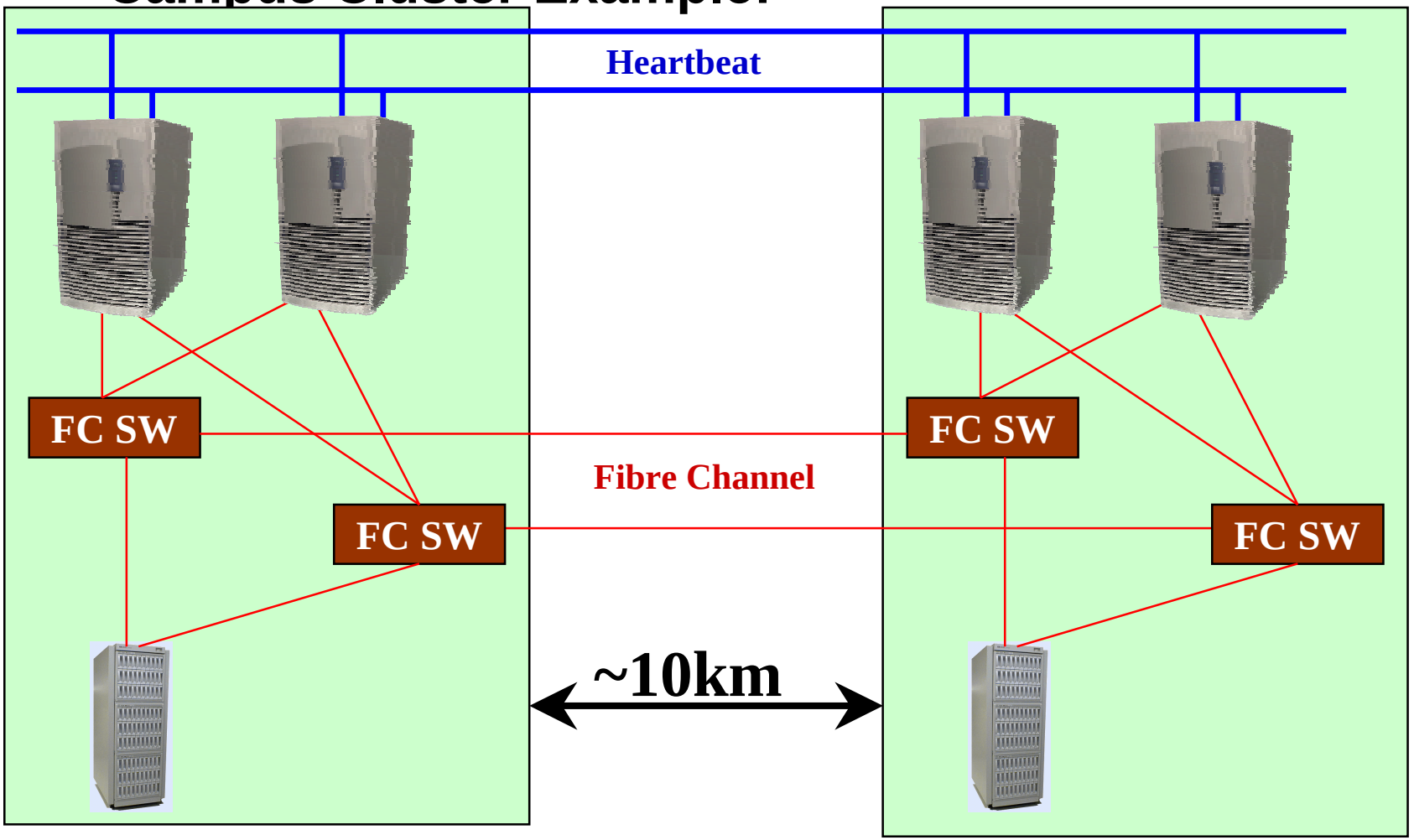
MC/SG what's new



ServiceGuard and Cascaded Fibre Channel Switches

MC/SG what's new

- Campus Cluster Example:



What is DWDM

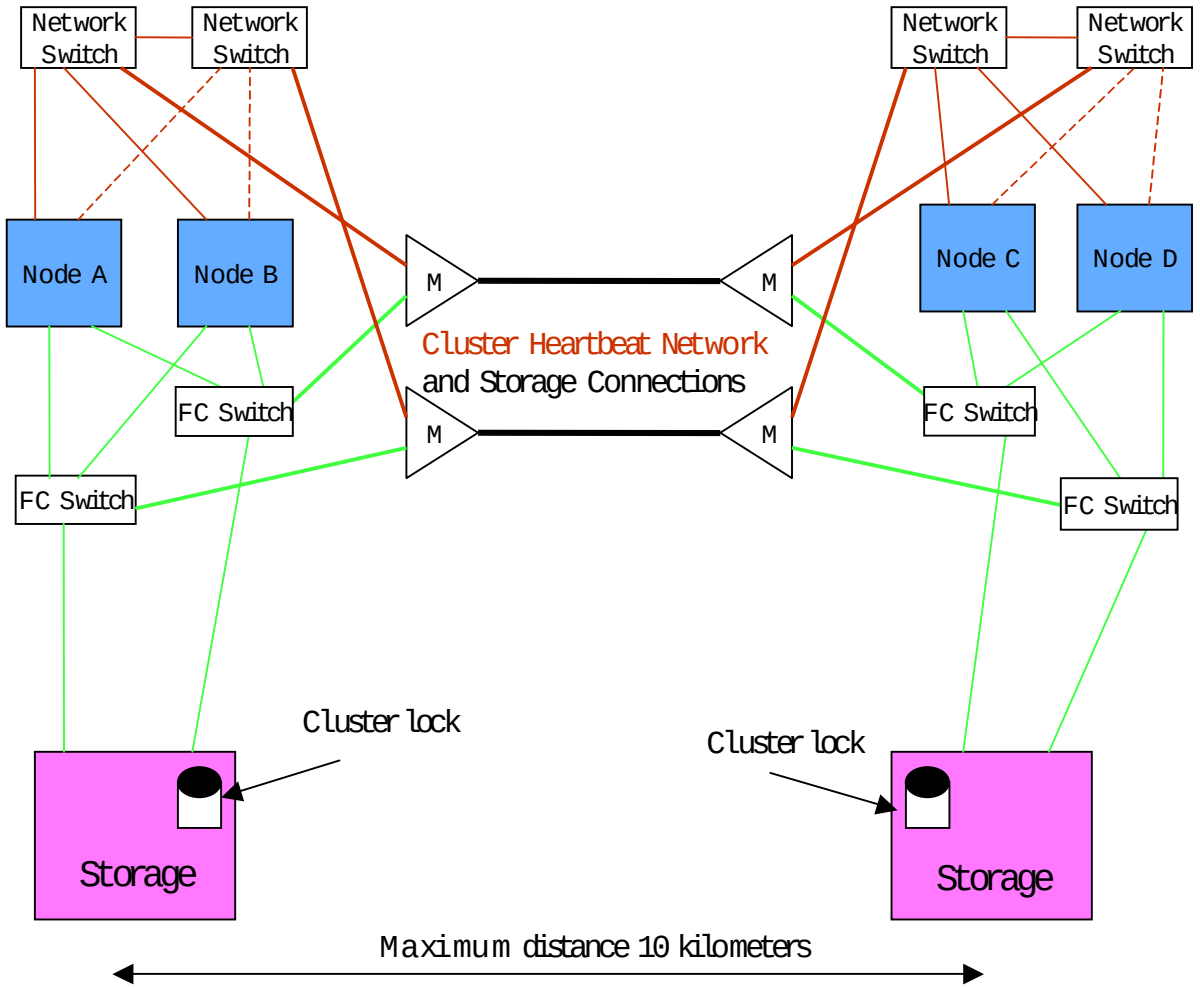
MC/SG what's new

- **Dense Wavelength Division Multiplexing**
  - **Opto-electronic technology**
  - **Can simultaneously transmit multiple separate optical signals through a single optical fiber**
  - **Accomplished by changing the wavelength of the incoming optical signals so they can all exist on a common fiber concurrently**
  - **Similar to TV broadcasting over a single cable where each station broadcasts on a different frequency**

- **What are DWDM devices?**
  - **The DWDM device multiplexes several of these converted optical inputs over the same fiber optic cable**
  - **The destination DWDM device reverses the process. It de-multiplexes the signals and converts them back to their original wavelength.**

Campus Cluster with Storage Connections and Cluster Heartbeat Network over DWDM

MC/SG what's new



M: DWDM device

Network switch: 100B-T or 1Gb Ethernet switch. The connection between the switch to DWDM has to be fiber optic

FC switch: Brocade-2800 switch w/ firmware version 2.1.9 or later

Storage: Any HP's storage that is supported by MC/SG and SAN. This includes:
- XP48, XP256, XP512
- FC10, FC60
- Symmetrix

Remote data replication: MirrorDisk/UX

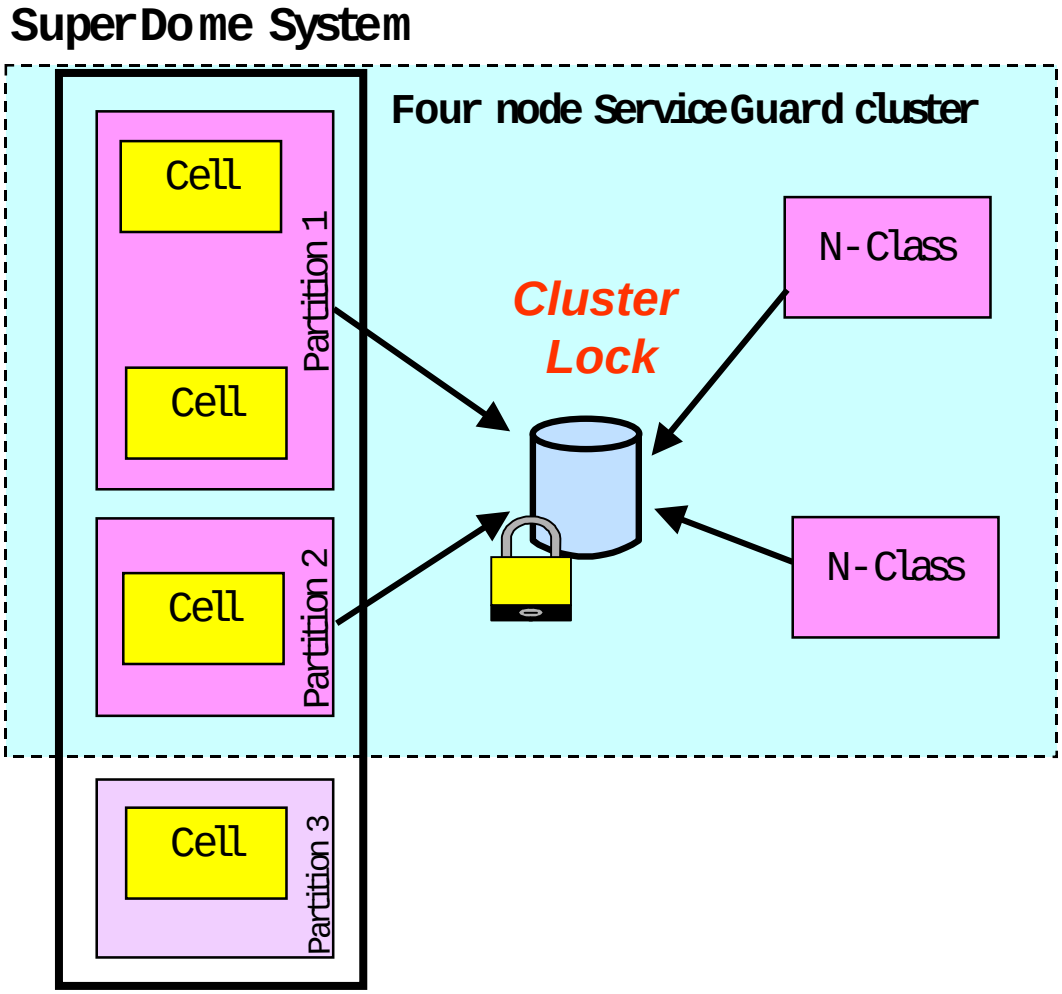
Max Distance between sites: 10km

Mixed Clusters with 11.0 and 11i *Supported*

MC/SG what's new

- Mixed clusters where some nodes are running HP-UX 11.0 and some nodes running HP-UX 11i is supported – requires all nodes running the same SG revision (e.g. 11.09)

- EXAMPLE where two nodes in a SuperDome are running HP-UX 11i and two N-class nodes are running 11.0



ServiceGuard A.11.13 Feature: VxVM Support

MC/SG what's new

- VERITAS VxVM 3.1 was integrated and released with HP-UX 11.11 in Dec. 2000

- VxVM integration with ServiceGuard and ServiceGuard OPS Edition:
  - ServiceGuard & SG/OPS A.11.09
  - HP-UX 11i (VxVM V.03.10.5 or later)
  - PHSS_23511 patch or later

- ServiceGuard and ServiceGuard OPS/Edition A.11.13 (AR0901) will have full support for VxVM & CVM

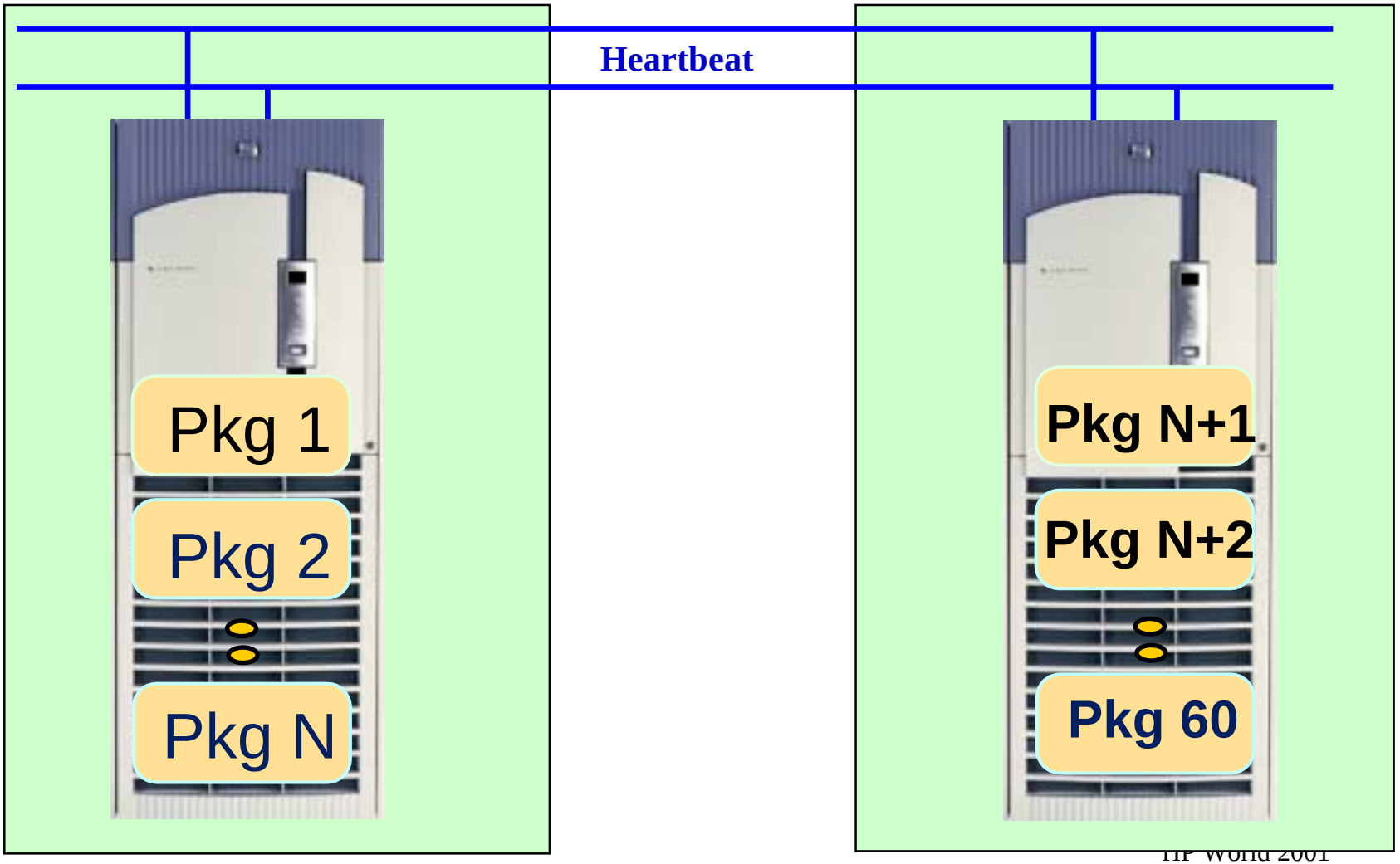
VxVM Product Structure

MC/SG what's new

Product Number	Product Name	Initial Product Availability	Licensing
B7961AA	Base HP VERITAS Volume Manager	11i AR	Free of charge
B9116AA	HP VERITAS Volume Manager	11i AR	Add-on, pay for license
B9117AA	HP VERITAS Cluster Volume Manager	AR0901	Add-on, pay for license
B9118AA	HP VERITAS Volume Manager FastResync Option	AR0301	Add-on, pay for license

MC/ServiceGuard
A.11.13 Feature: Max Packages 60

MC/SG what's new



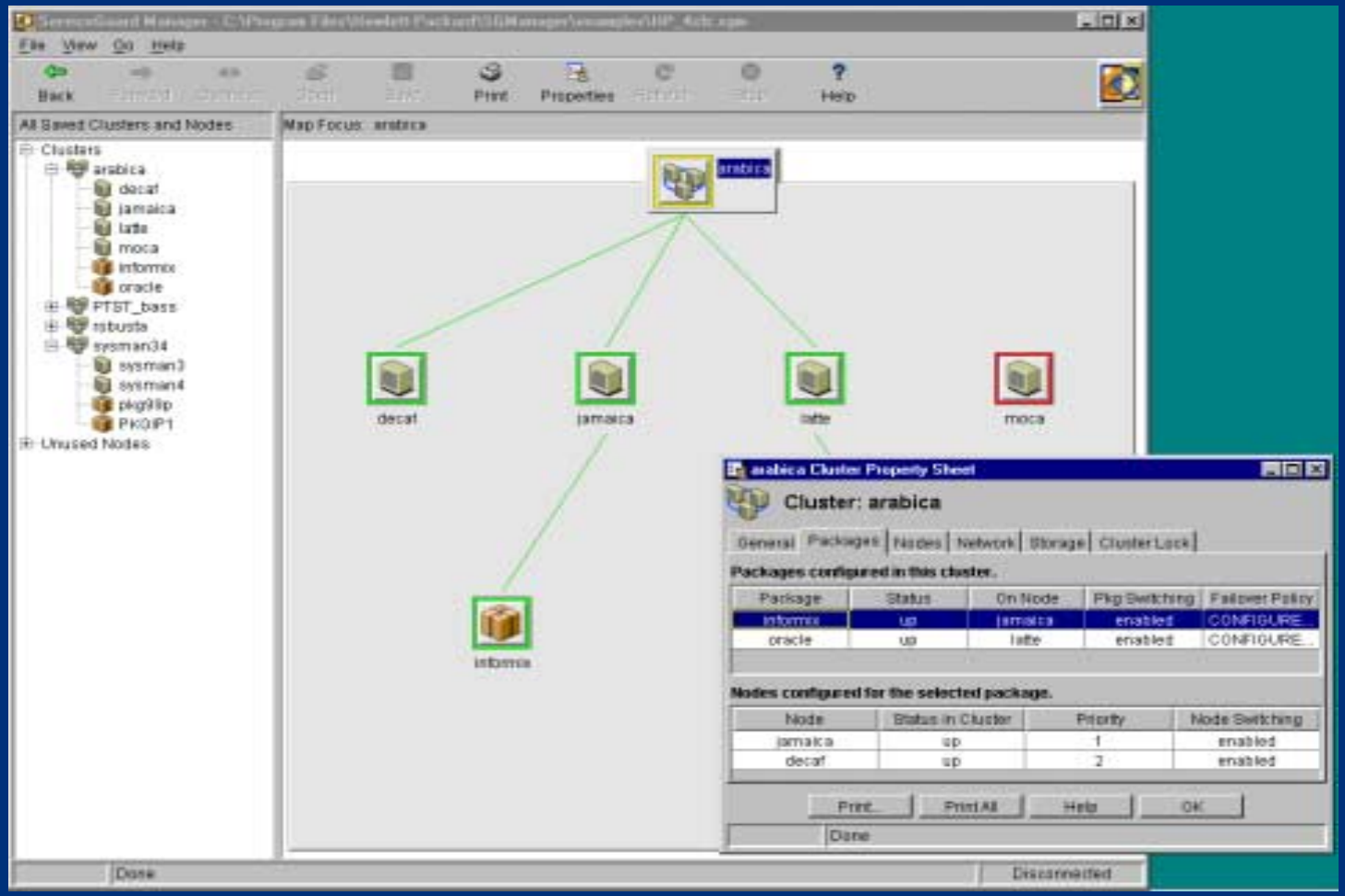
serviceguard manager

MC/SG what's new

- An intuitive and easy-to-use Java™-based GUI
- Provides a visual tool to display HP ServiceGuard clusters.
- Uses color-coded icons to show status information about a cluster, node or package
- Subsequent releases will provide configuration and administration capabilities

serviceguard manager sample

MC/SG what's new



MC/SG what's new

features	benefits
Uses color-coded, graphically-intuitive icons to visually present topology, online status, and configuration information for multiple clusters, their member nodes, and packages	Enables IT staff to quickly identify problems and dependencies with drill-down screens for more than one HA cluster
Saving status and configuration "snapshots" to be used for support or analysis	System administrators can validate the current Serviceguard cluster, node, and package configuration through visualization
Requires minimal training to remotely display clusters from multiple management stations running HP-UX 11.x, Microsoft® Windows NT® 4.0 (Service pack 5 or later), or Windows® 2000 Professional Edition	Minimizes operator training requirements
Comprehensive online help	Enables operators to quickly know HP Serviceguard status
Standalone or integrated with Openview	Provides flexibility in monitoring configuration
Auto-Refresh of status and cluster configuration	Obtain real-time status updates including opened property sheets
Dynamic scoping of clusters	Allows user to specify which clusters to view

MC/SG what's

	hp serviceguard manager	hp clusterview plus
Product Dependencies	Does not require HP OpenView	Requires HP OpenView or Network Node Manager
Product Support	Display HP MC/ServiceGuard and OPS Edition clusters	Monitor & manage HP MC/ServiceGuard and OPS Edition clusters
Charge to Customer	Will be delivered free with MC/ServiceGuard and OPS Ed.	Requires separate purchase by customer
Technology Base	Java-based application is platform independent	HP OpenView application dependency; runs on UNIX only
Property Sheets	Property sheets feature allows the user to drill down into the cluster, node and package for detailed status information	Limited on detailed status information regarding cluster, node and package

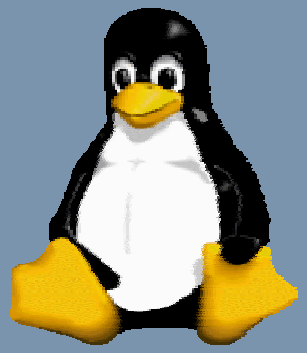
serviceguard manager enhancements (version A.01.02)

MC/SG what's new

- Multi-platform support (Linux, HP-UX, Windows)
- Menus reorganized similar to HP Openview
- Enhanced property sheets
- SG Status Tooltips
- More explicit map views
- Enhanced integration with HP Openview (incl. Japanese Ver.)
- Integration with HP Service Control Manager

For more information, attend the ServiceGuard Manager Tutorial on Friday Aug. 24

MC/SG Linux

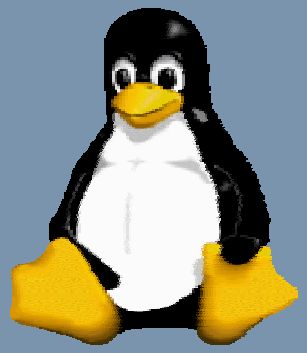


mc/serviceguard linux
(available 2h01)

Supported OS and Hardware

- RedHat 7.1 distribution (2.4 kernel)
- Netservers
  - ✓LC2000r
  - ✓LP2000r
  - ✓LT6000r
  - ✓LXr8500
- HBAs – Mass Storage:
  - ✓SCSI
  - ✓fibre channel
- Mass storage
  - ✓SCSI: RS12
  - ✓FC: VA 7100, XP48, XP512
  - ✓Hub and switch support
- HBAs – Networking:
  - ✓ integrated Dual Port NIC

MC/SG Linux



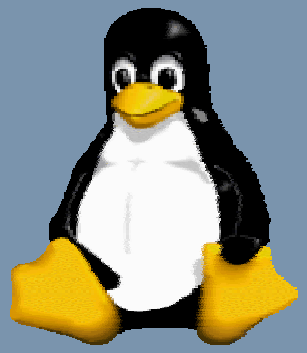
mc/serviceguard linux

(available 2h01)

SG features on Linux

- ✓2-node SCSI & 4-node FC
- ✓Online reconfiguration for
  - ▪Cluster nodes
  - ▪packages
- ✓Support up to 30 packages/30 services per package
- ✓Package failover
  - ▪Node failure
  - ▪Network failure
  - ▪Package/Service failure
- ✓Quorum server
- ✓Local network failover (bonding)
- ✓Heartbeat over ethernet (up to seven heartbeat subnets)
- ✓Software mirroring (linux LVM)
- ✓Rolling upgrade infrastructure
- ✓ServiceGuard Manager (GUI)

MC/SG Linux



mc/serviceguard linux

(available 2h01)

ServiceGuard Manager

- ✓Monitoring clusters,nodes,packages
- ✓Polling
- ✓Localizable
- ✓Display quorum server
- ✓Support linux clusters and hp-ux clusters from same gui

Application Integration:

- ✓NFS Toolkit
- ✓MC/ServiceGuard extension for sap (SGeSAP)

NSSO Embedded Solution:

- ✓SG embedded in an Enterprise NAS (Network-Attached Storage) solution delivered by NSSO.

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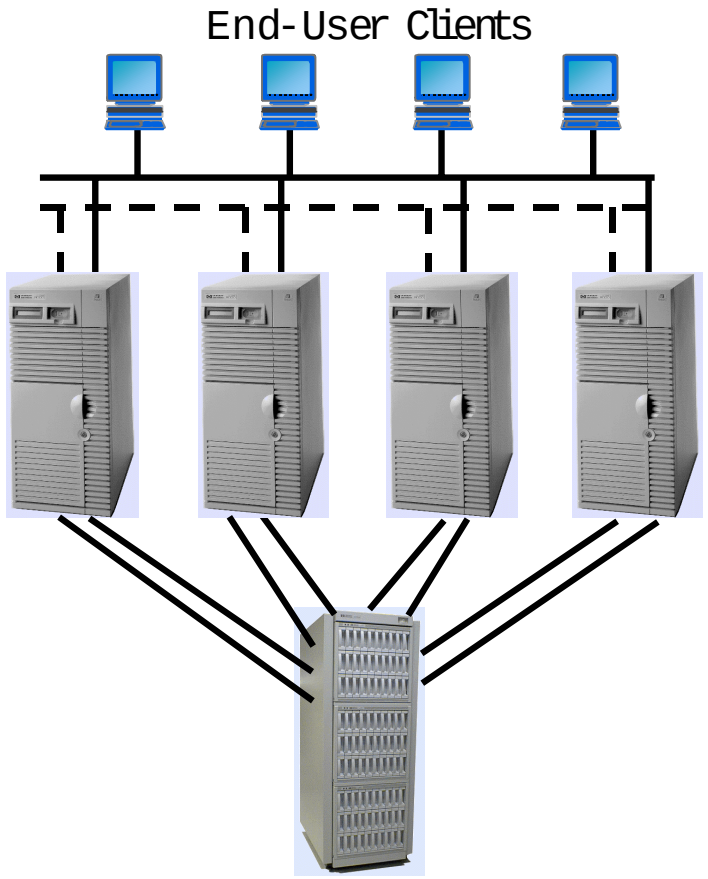
serviceguard ops edition

- Same protection & functionality for applications as MC/SG
- Additional protection for Oracle database
- Parallel database environment for increased availability and scalability

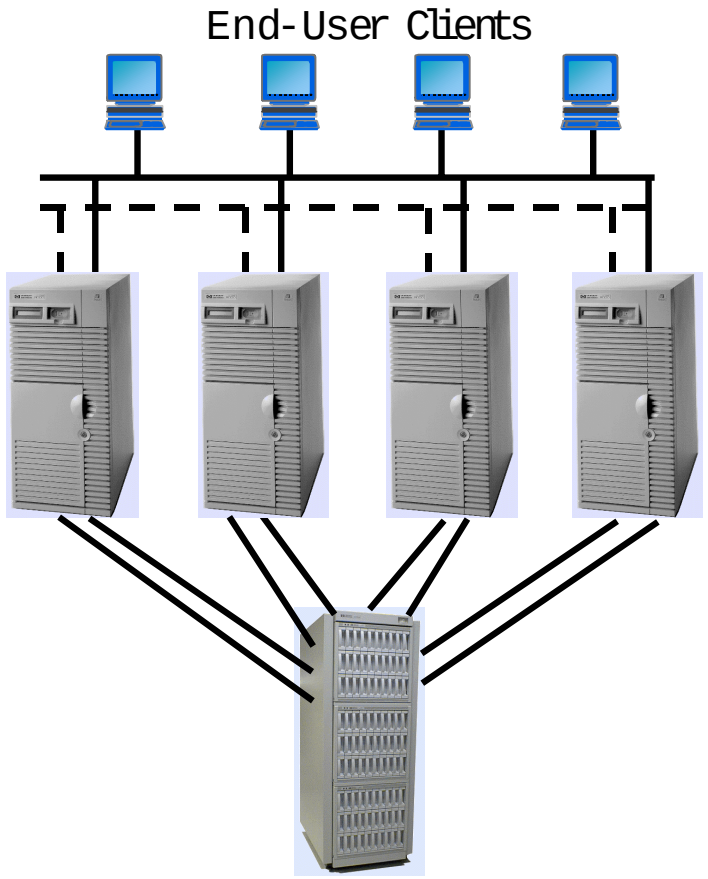
SG/OPS what's new



serviceguard ops edition enhancements

- New Hardware Support
  - SuperDome, XP48, SAN, Cascaded Switches support
- OPS 8.1.7 (11.0, 11i)
- OPFS support (versions 1 & 2)
- VERITAS VxVM/CVM support
- 9i RAC support
- ATS support
- Maximum packages increased to 60
- Online add/delete nodes
- 16 nodes support
- ServiceGuard Manager (GUI)

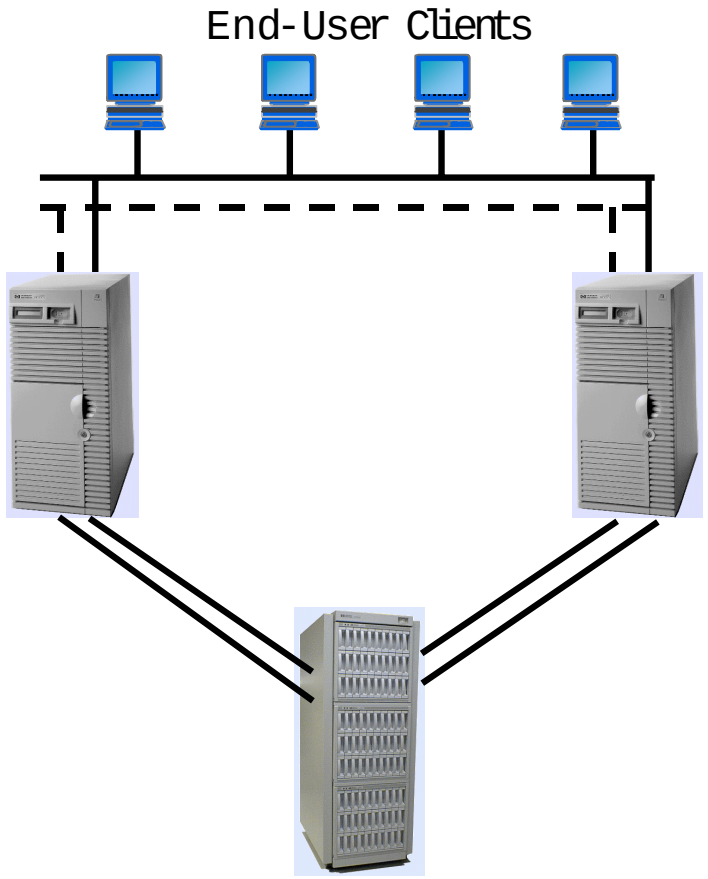
SG/OPS what's new



Oracle Parallel Fail Safe

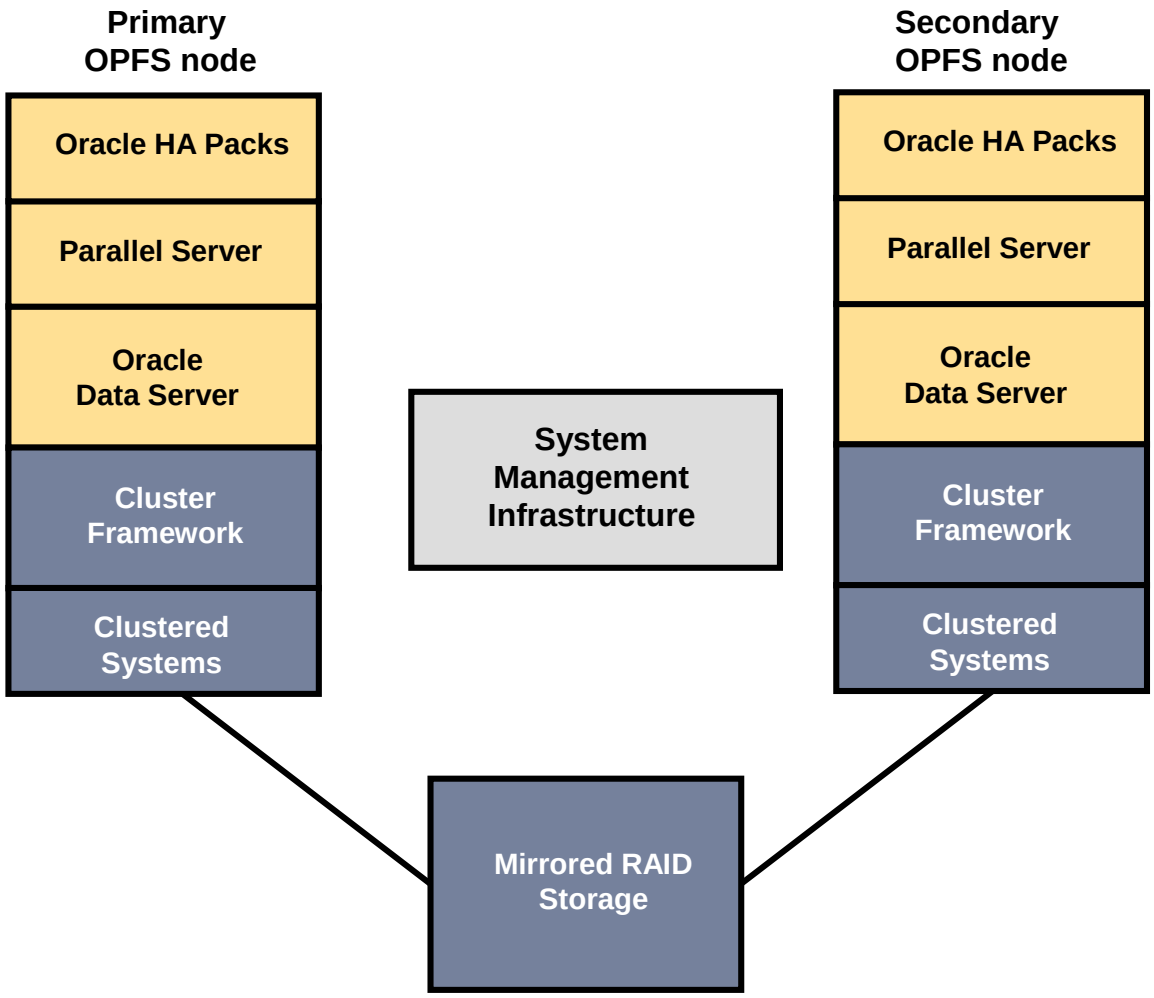
- Special High Availability configuration of Oracle Parallel Server with ServiceGuard OPS Edition
- HP and Oracle jointly developed the software
- Active/Standby cluster configuration
- Most applications don't need to be OPS aware to take advantage of Parallel Fail Safe
-

SG/OPS what's new



Oracle Parallel Fail Safe Architecture

SG/OPS what's new



OPFS description

SG/OPS what's new

- Build upon Oracle Parallel Server
- All connections to database through the primary node
- Runs in a primary/secondary configuration
- Secondary node serves as a backup
- Works with all applications designed to work with a single instance Oracle
- Can not benefit from the scalabiltiy features of OPS, because just one OPS instance is used
- Consists of OPS plus 5 HA packages (2 node cluster)
- Uses Net8 service registration to ensure primary/secondary access to the database

OPFS description (cont.)

SG/OPS what's new

- Includes database monitoring tools that verify the database is functioning
- Monitoring of Oracle Backround processes
- Tool to monitor Oracle at the application level. Runs on each node and connects to Oracle as Net8 client. It runs a user supplied PL/SQL Procedure
- Tools collect diagnostic data to help identify the root cause of a failure

SG/OPS what's new

Latest News

- OPFS v1:
  - 5 pack version
  - 8.0.6 patch 1 supports 8.0.6
  - 8.1.6 patch 4 supports both 8.1.6 and 8.1.7

- OPFS v2:
  - 2 pack version
  - available April'01
  - support 8.1.7 and 9i

Ordering Parallel Fail Safe

SG/OPS what's new

- Order OPFS direct from Oracle
  - OPFS is a free upgrade to OPS and is downloadable from the Oracle web site with a key issued by Oracle
  - HP and Oracle Consulting for OPFS is orderable and delivered from either company
- HP components and support ordered from HP
- Oracle Database, OPS, and support ordered from Oracle

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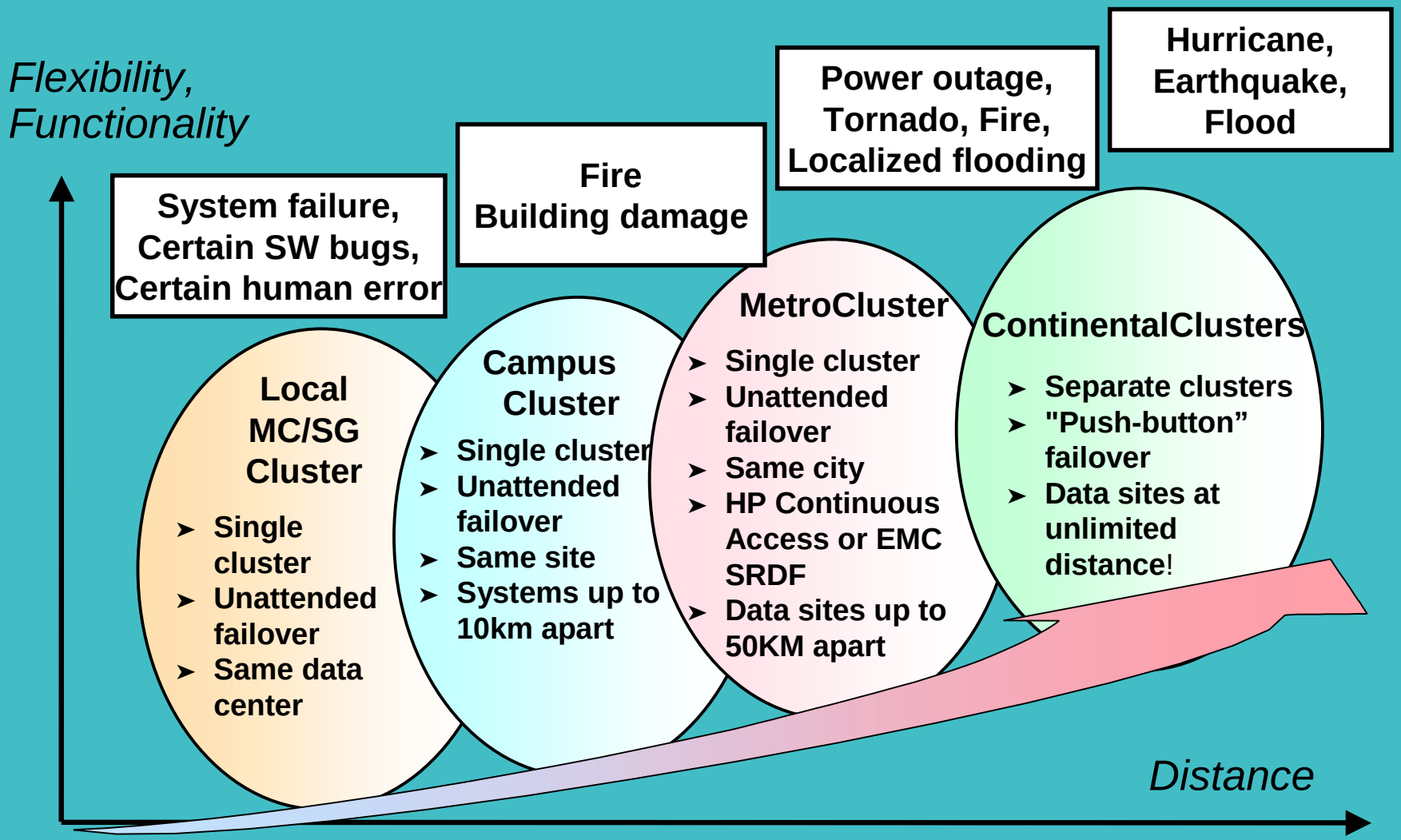
DT Sol. what's new

disaster tolerant solutions

hp's full-range disaster tolerant solutions

DT Sol. what's new

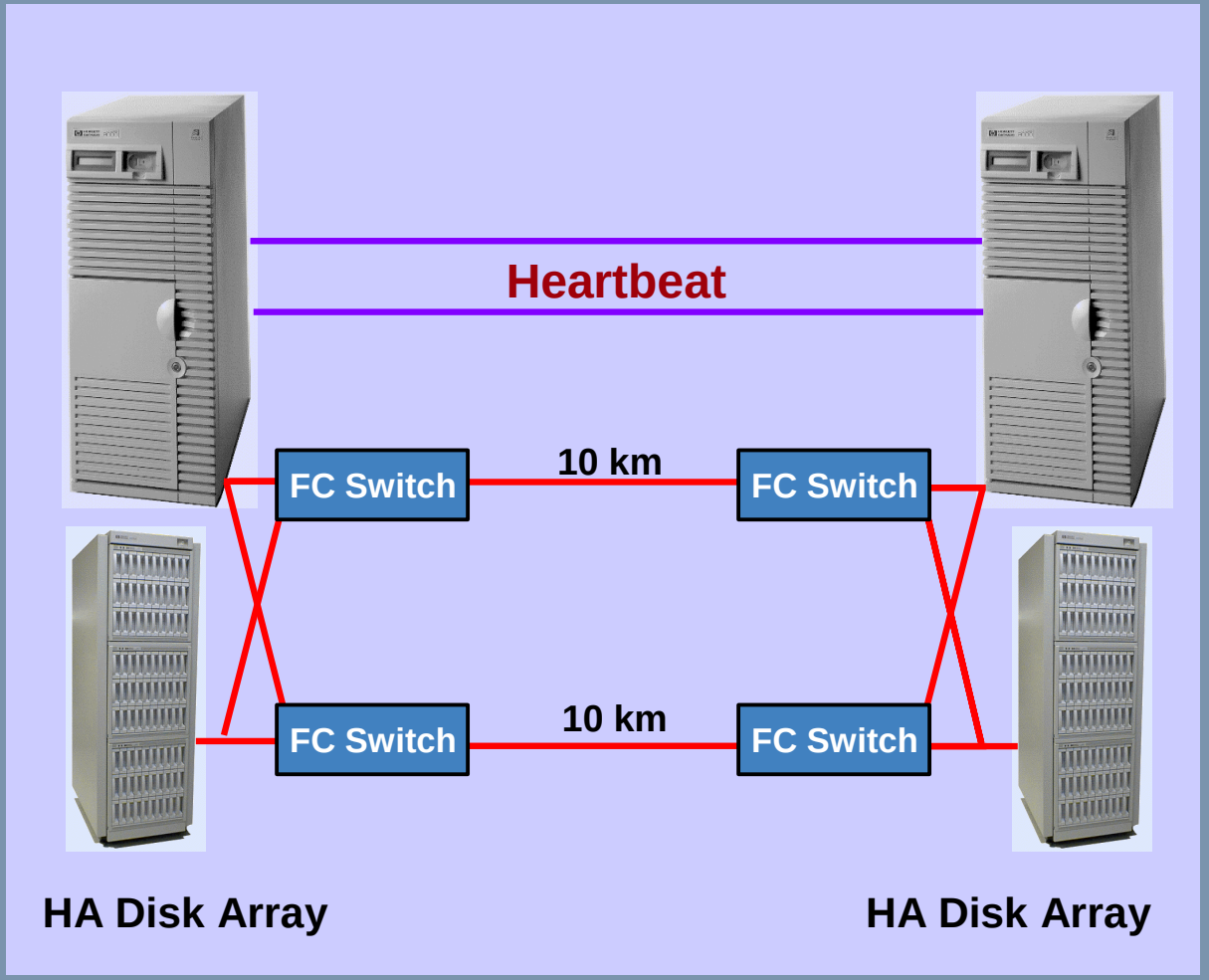


campus clusters

Fast, flexible, and local area disaster protection!

DT Sol. what's new

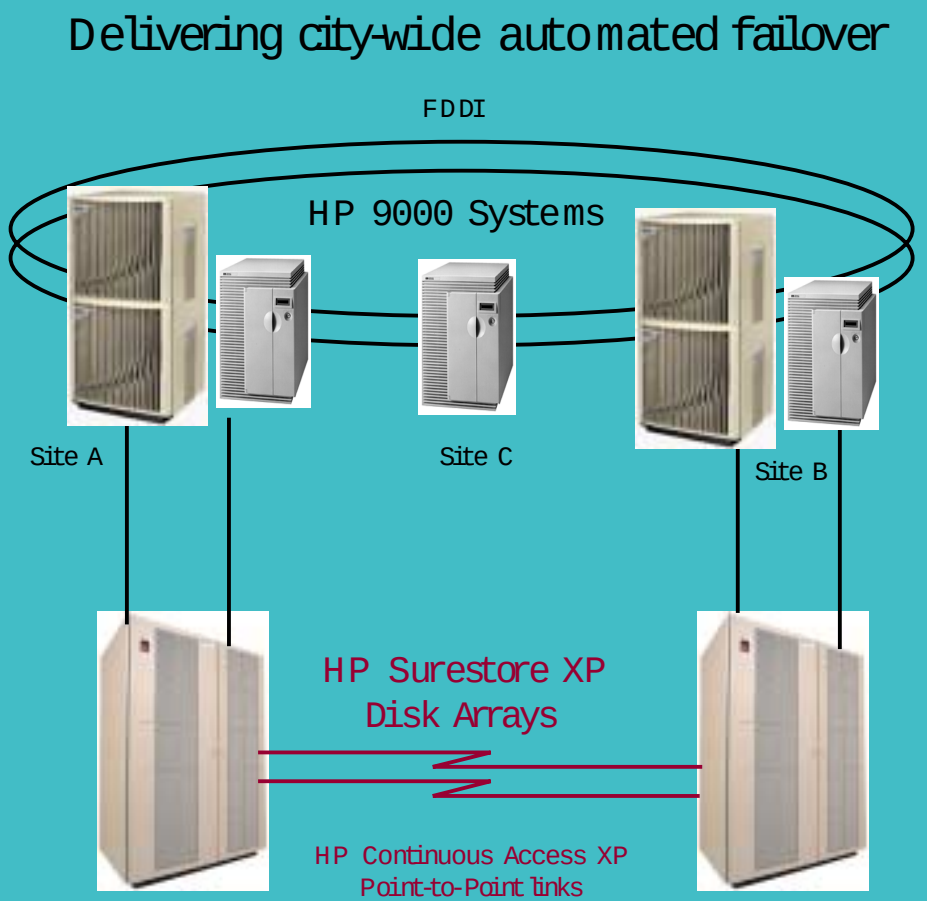
- Builds on MC/SG capabilities
- Single cluster, multiple sites
- Continuous site-to-site data mirroring
- Based on Fibre Channel for speed and up to 10 km distance



metrocluster with continuous access XP

DT Sol. what's new

- Protect against tornadoes, fires, floods
- Rapid, automatic site recovery without human intervention
- Effective between systems that are up to 50km apart
- Provides very high cluster performance
- Backed by collaborative implementation, training, and support services from HP



metrocluster with EMC SRDF

DT Sol. what's new

- Protect against tornadoes, fires, floods
- Rapid, automatic site recovery without human intervention
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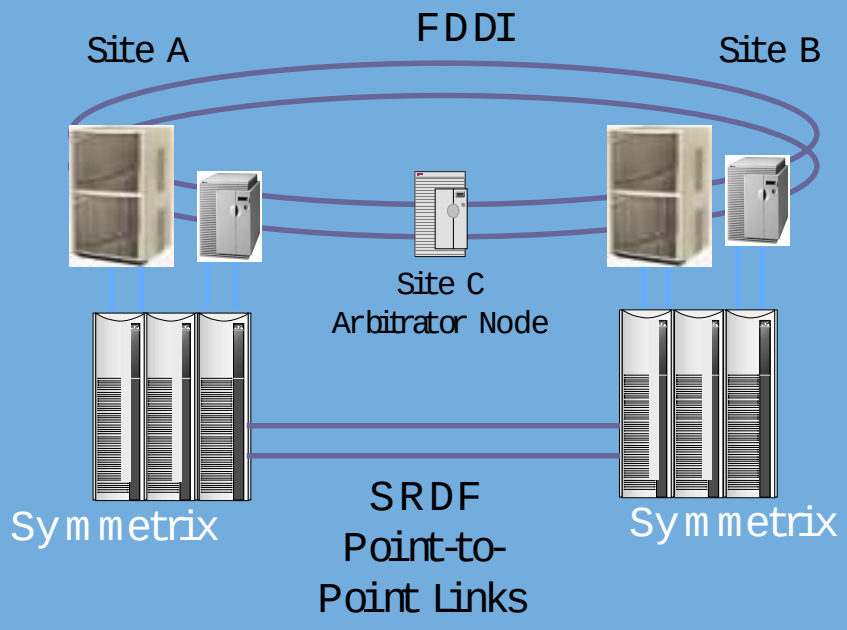
- Provides very high cluster performance
- Backed by collaborative implementation, training, and support services from HP



more on metrocluster . . .

DT Sol. what's new

Features MetroCluster enables:	*Benefits* For the organization, this means:
Bi-directional failover within a single, geographically dispersed MC/SG cluster	Flexibility in data center configuration
Distance limited by network (100 km loop) and data replication link (50 km)	Flexibility in data center location
Unattended, completely automated failover	Automatic failover (including enabling the remote array) eliminates operator error
Heartbeat support for Ethernet or FDDI networks	Choice in network infrastructure
Support for existing MC/SG clusters in production mode	Disaster protection can be added without interrupting existing mission critical environment

more on metrocluster . . .

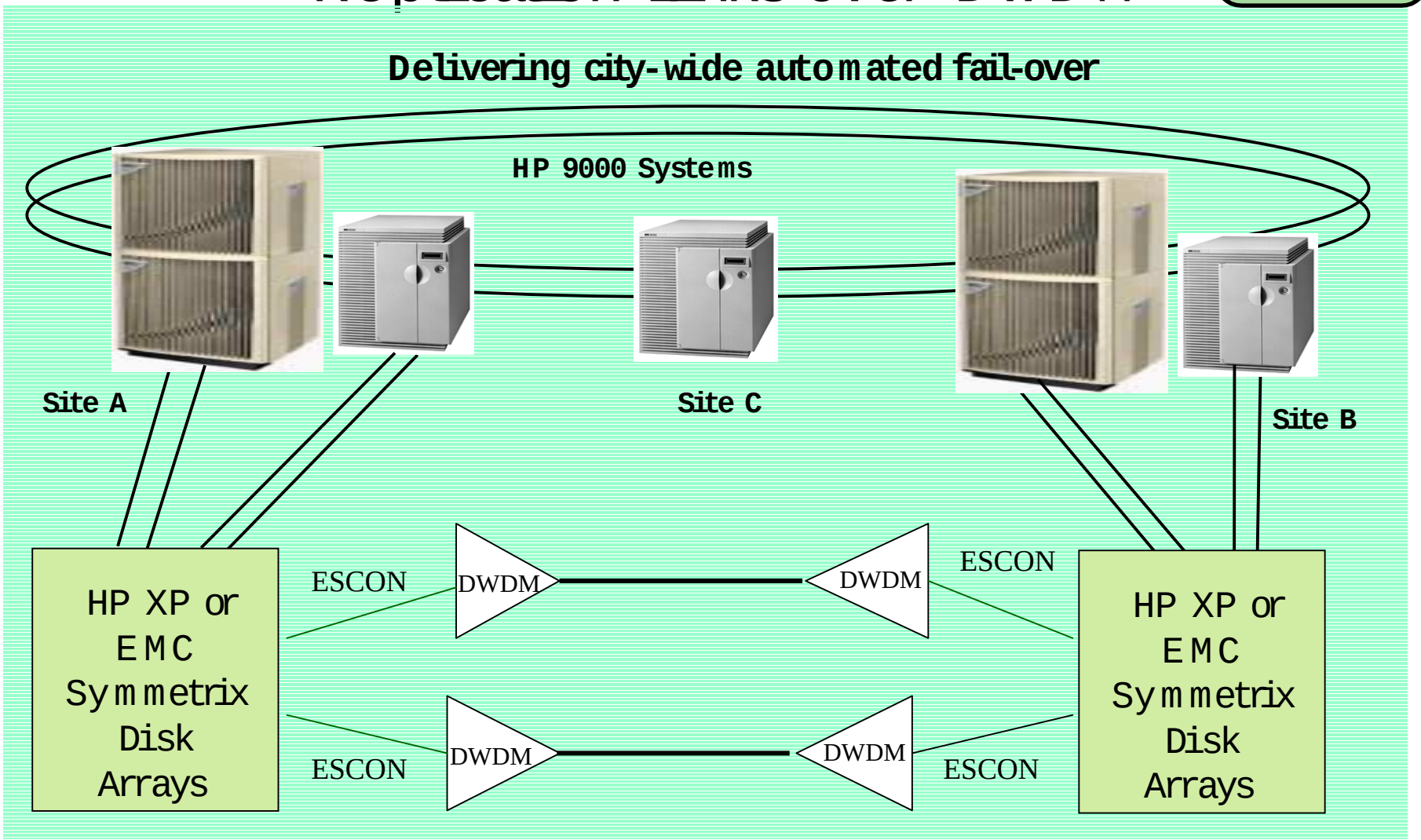
DT Sol. what's new

Features MetroCluster enables:	*Benefits* For the organization, this means:
Continuous Access and SRDF over DWDM (Dense Wavelength Division Multiplexing)	Provides cost-efficient solution for customers who need access to a leased network to support mirroring operations
Integration with EMC Symmetrix and HP XP family (XP 256/**512/48**)	Choice of disk array solution
Asynchronous (with HP XP family) and synchronous data replication	Provides choice between performance versus data currency
Transparency to application	Preserves MC/ServiceGuard capabilities
Fast failover time (1.1 X MC/SG)	Rapid application recovery time on the secondary system minimizing downtime
Fast Failback	Minimizes restart time of the primary site

Latest enhancements

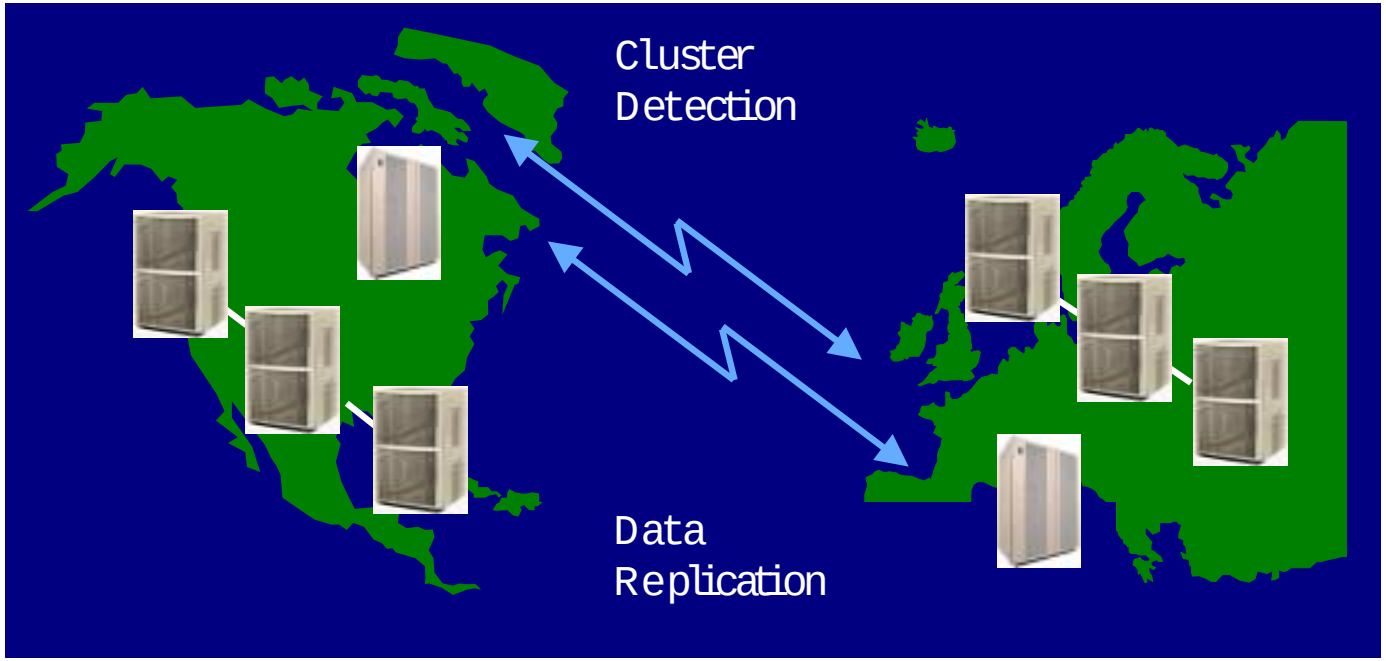
MetroCluster with ESCON Data Replication Links over DWDM

DT Sol. what's new



continentalclusters

DT Sol. what's new



- **Highest levels of availability and disaster tolerance**
- **Reduces downtime from days to minutes**
- **Locate data centers at economically and/or strategically best locations**
- **Transparent to applications and data**
- **Push-button failover across 1000s of km**
- **Supports numerous wide-area data replication tools for complete data protection**
- **Comprehensive Support Services and Business Recovery Services for planning, design, and support**

more on continentalclusters ...

DT Sol. what's new

Features ContinentalClusters enables:	*Benefits* For the organization, this means:
Failover between 2 MC/SG clusters of same or different sizes (primary/recovery configuration)	Flexibility in data center configuration
No limitation on failover distance	Flexibility in data center location
Support for all TCP/IP networks (WAN, LAN, etc ...)	Choice in network infrastructure
Failover notification (console, e-mail, pager, IT/O, SNMP, ...)	Alert IT managers of error(s) detected in primary cluster, backup cluster, and network
Push-button failover	User has complete control to validate disaster before initiating application failover
Configuration tools	Simpler implementation of valid configuration at primary and backup sites
Transparency to application	No application change needed

more on continentalclusters ...

DT Sol. what's new

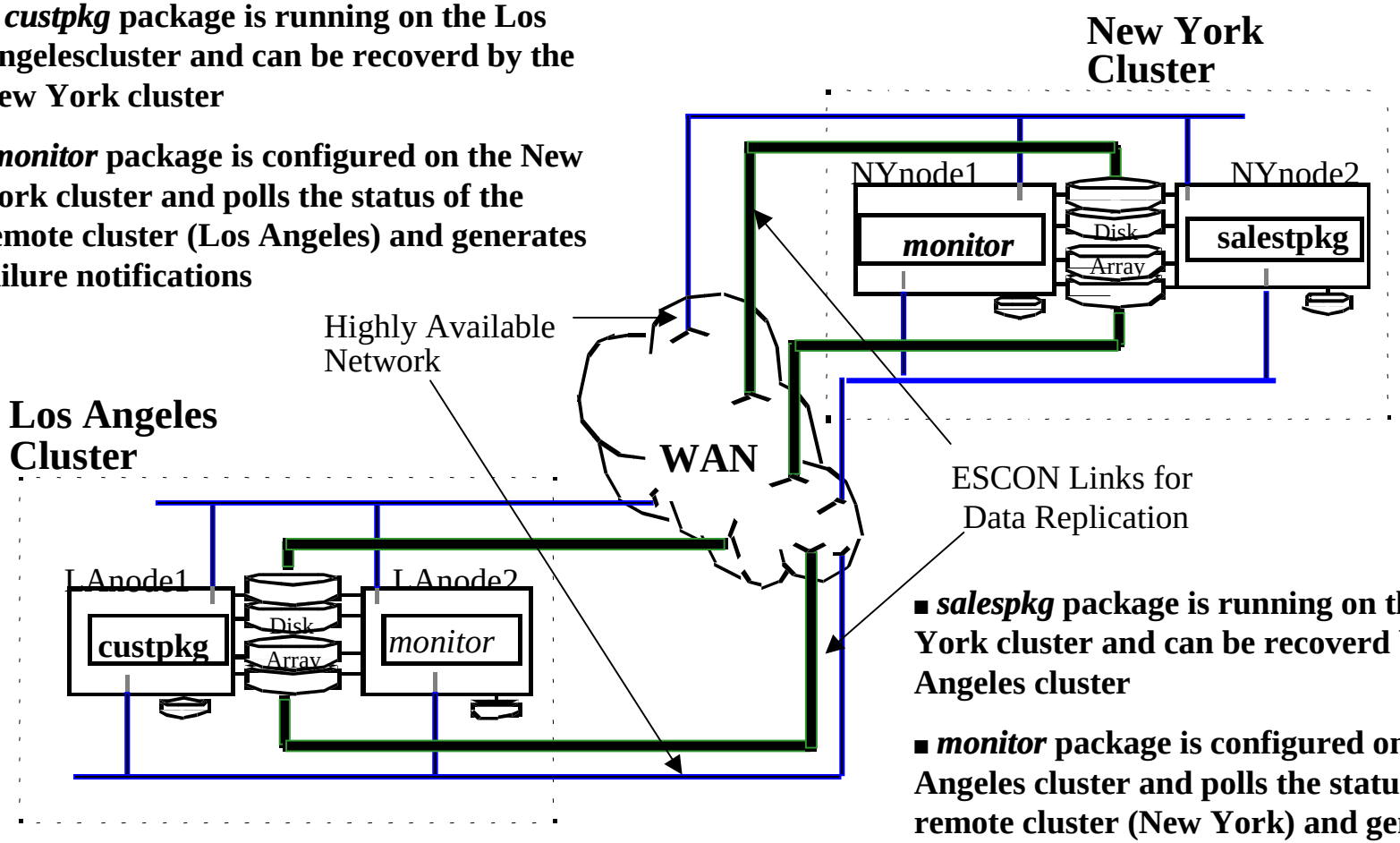
Features ContinentalClusters enables:	*Benefits* For the organization, this means:
Bi-directional failover	Allows both data centers to be active, protected and capable of handling package failover to each other
Fast failover time (1.5X MC/SG)	Fast backup cluster start-up and rapid application recovery from primary cluster
Fast Failback	Minimizes restart time of the primary site after a disaster
Asynchronous and synchronous data replication	Provides choice between performance versus data currency
Cascading Failover *(with EMC Symmetrix only)*	Applications are configured to automatically failover first between nodes within primary cluster
Support for existing MC/SG clusters in production mode	Disaster protection can be added without interrupting existing mission critical environment

Latest enhancements

DT Sol. what's new

Example ContinentalClusters Mutual Recovery Configuration

- ***custpkg*** **package is running on the Los Angelescluster and can be recoverd by the New York cluster**
- ***monitor*** **package is configured on the New York cluster and polls the status of the remote cluster (Los Angeles) and generates failure notifications**

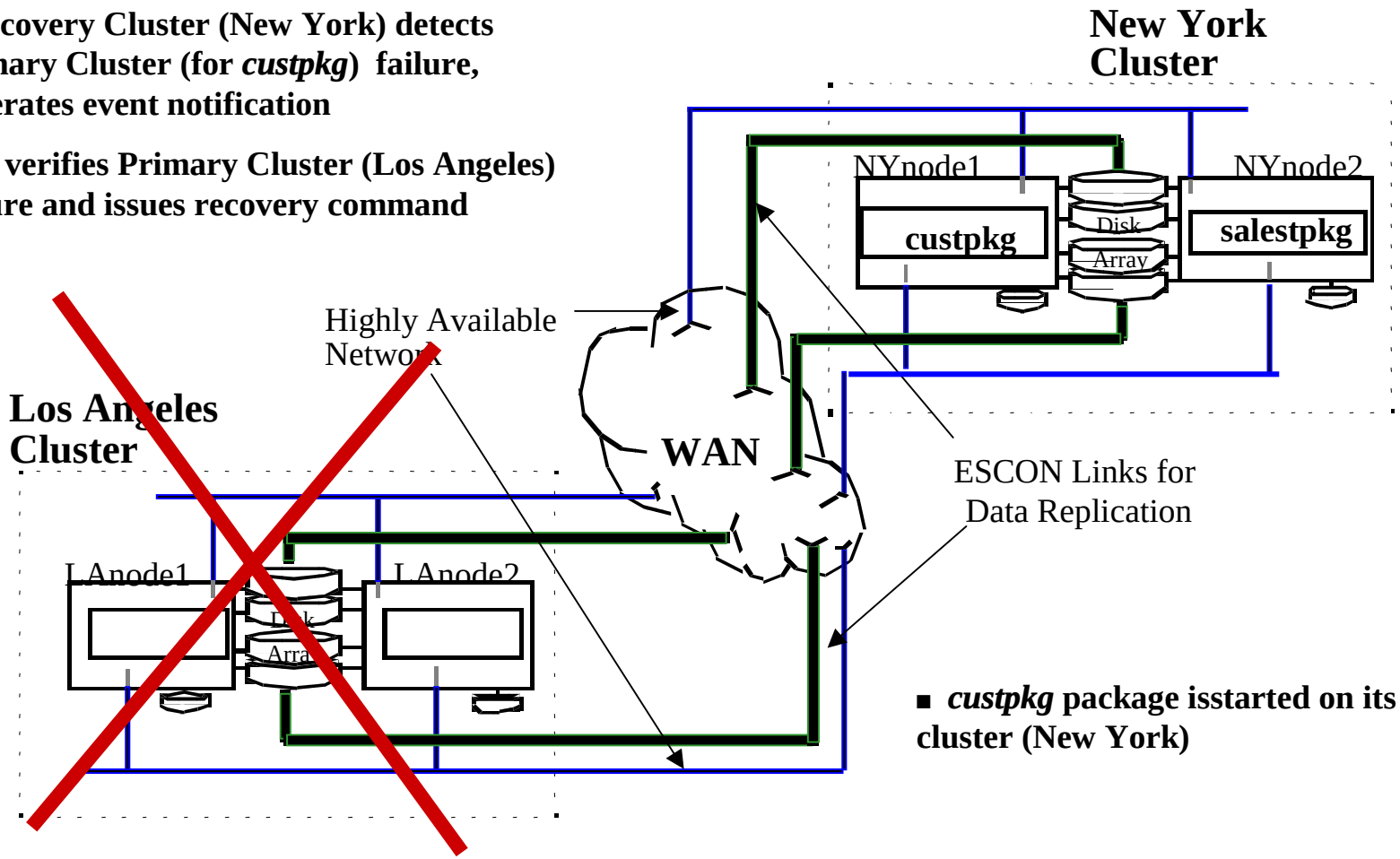


- ***salespkg*** **package is running on the New York cluster and can be recoverd by the Los Angeles cluster**
- ***monitor*** **package is configured on the Los Angeles cluster and polls the status of the remote cluster (New York) and generates failure notifications**

DT Sol. what's new

Example ContinentalClusters Mutual Recovery Configuration

- **Recovery Cluster (New York) detects primary Cluster (for *custpkg*) failure, generates event notification**
- **IT verifies Primary Cluster (Los Angeles) failure and issues recovery command**



- ***custpkg* package isstarted on its recovery cluster (New York)**

agenda

HA Overview

- market trend
- cost and causes of downtime
- hp's ha strategy

MC/ServiceGuard Review

What's New with HP's HA Clustering Solutions

- What's new in MC/ServiceGuard
- What's new in ServiceGuard OPS Edition
- What's new with Disaster Tolerant Solutions
- HA Clusters with SuperDome

Summary

Questions

hp superdome

HA Clusters w/SD

performance & scalability
- single cabinet:
  - 16, 32, 64 CPUs
  - 64, 128, 256 GBs
- 48, 96, 192 PCI slots
- HP-UX 11i OS
- management, security and e-services software

partitioning continuum
- hp hyperplex
- nPartitions
- virtual partitions
- resource management

utility technology & pricing
- iCOD
- utility pricing

high availability
- N+1 OLR fans
- N+1 OLR power supplies
- dual power source
- OLAR CPU, memory
- OLAR PCI I/O cards
- parity protected I/O data paths
- ECC on all CPU and memory paths
- dynamic processor resilience
- dynamic memory resilience

built for the future
- initial release: PA-8600
- future releases: PA-RISC & IA-64
- Multi-OS: HP-UX, Linux and Windows

differentiation in all major areas.

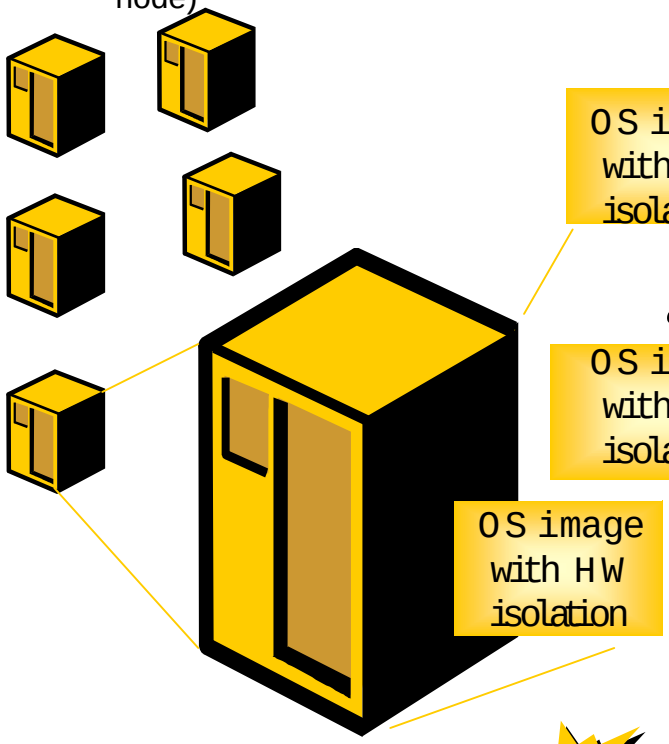
HP Partitioning Continuum for Always On

Hard Partitions with multiple nodes
(at least 1 OS image per node)

Hard Partitions within a node
(multiple OS images with HW isolation)

Virtual Partitions within a hard partition
(multiple OS images with SW isolation)

Resource Partitions within an OS image
(resource allocation by app)



OS image with HW isolation

OS image with HW isolation

OS image with HW isolation

hard partition

OS image with SW isolation

OS image with SW isolation

OS image with SW isolation

1 OS image

Application 1 with guaranteed compute resources

Application 2 with guaranteed compute resources

Application n with guaranteed compute resources

Based on SLOs or percentages

HyperPlex

New!

nPartitions

New!

Virtual partitions

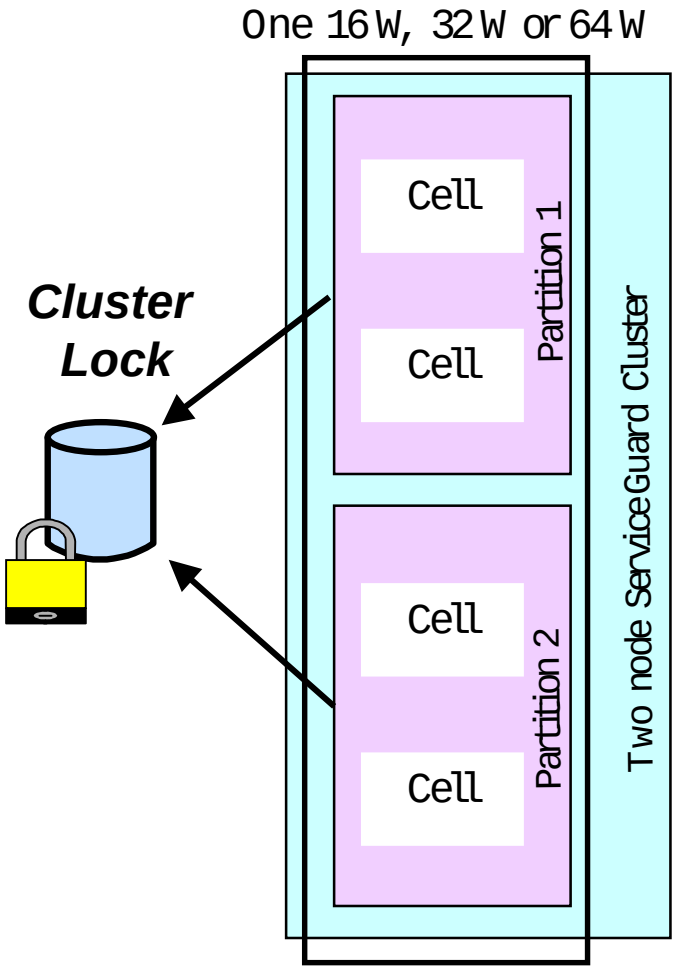
New release!

PRM (Process Resource Manager)

HP-UX WLM (Workload Manager)

HA Single Cabinet Configuration "Cluster in a Box"

HA Clusters w/SD

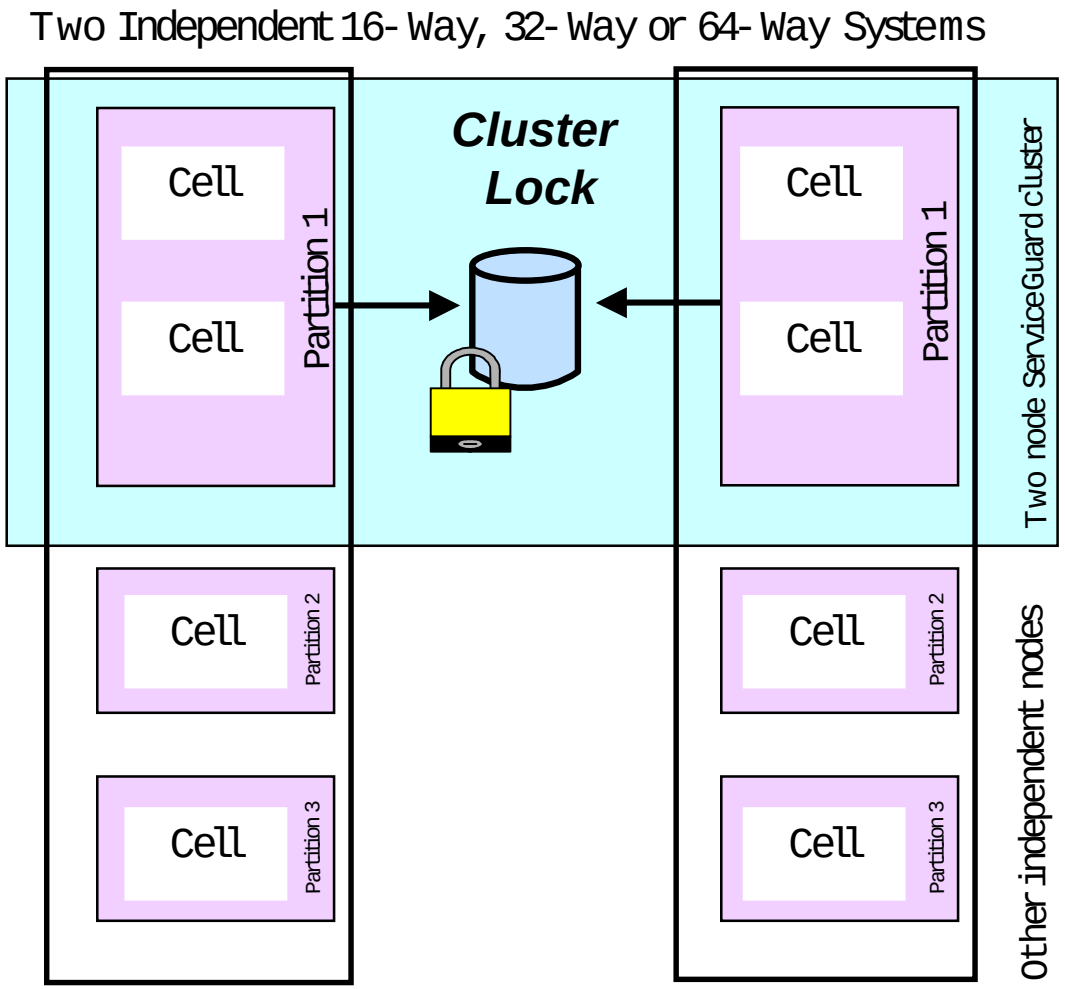


Notes:

- ***Considered a "Single System" HA solution***
- Up to a four node (four partition) cluster is supported within a 16-Way capable SD.
- Up to an eight node (eight partition) cluster is supported within a 32-Way SD.
- Up to a sixteen node (sixteen partition) cluster is supported within a 64-Way SD.
- Clusters that span two independent 32-Way cabinets are preferred to clusters that are wholly contained within a 64-Way cabinet.
- Cluster lock required for two partition configurations
- Cluster lock *must* be powered independently of the cabinet.
- N+1 power supplies required (included in base price of SD)
- Dual power connected to independent power circuits required
- Root volume mirrors *must* be on separate power circuits.

HA Multi Cabinet Configuration

HA Clusters w/SD



Notes:

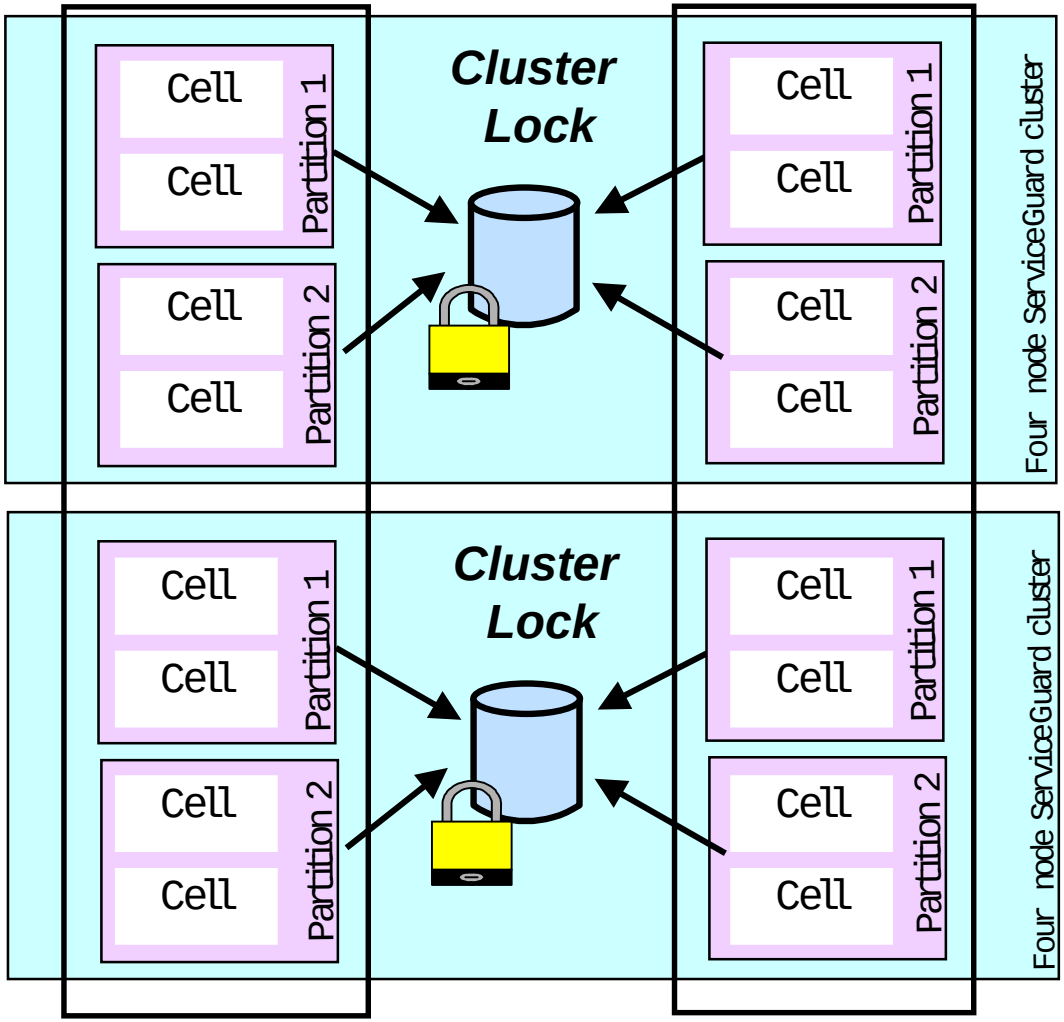
- Cluster lock is *required* if cluster is wholly contained within two 16-Way, 32-Way, or 64-Way systems (due to possible 50% cluster membership failure).
- ServiceGuard only supports cluster lock up to four nodes, thus *two cabinet solution is limited to two or four node clusters*.
- Two cabinet configurations, *must* evenly divide nodes between the cabinets (i.e.. 3 and 1 is not a legal 4 node configuration).
- Cluster lock *must* be powered independently of either cabinet
- N+1 power supplies required
- Dual power connected to independent power circuits required.
- Root volume mirrors *must* be on separate power circuits

HA Multi Cabinet Configuration

HA Clusters w/SD

Two Independent 32-Way Systems

Two 4-node clusters – could not be one 8-node cluster!



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HA Multi Cabinet Configuration

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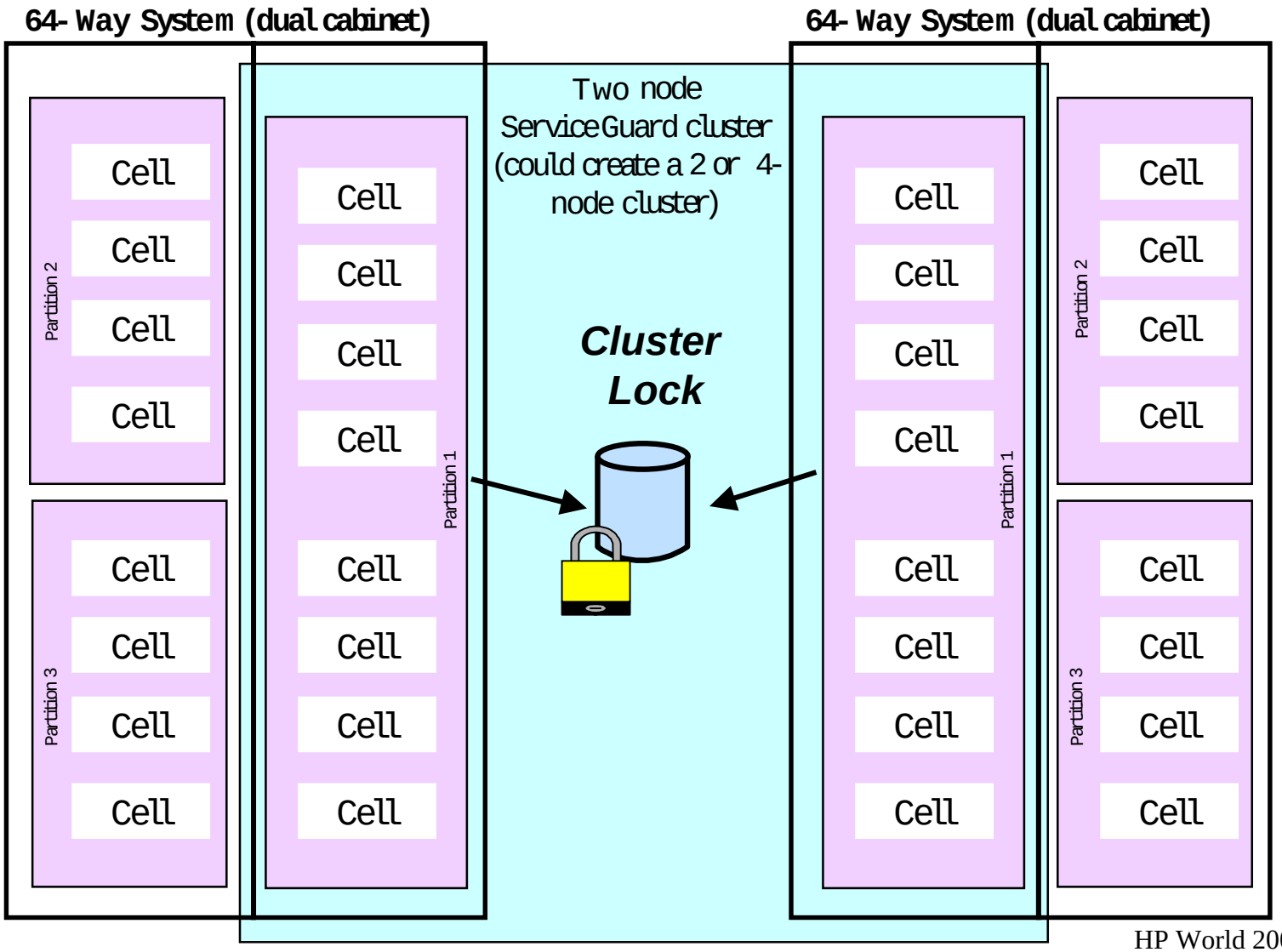
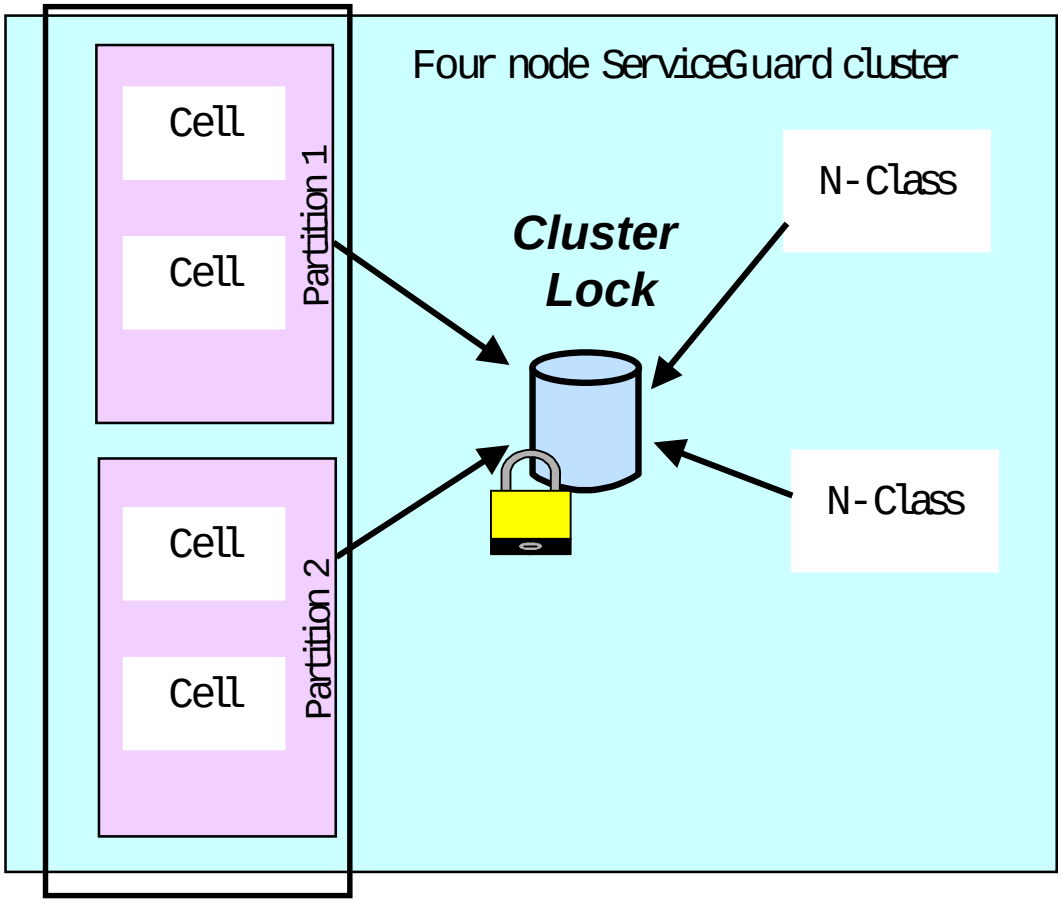


HA Mixed Configurations

HA Clusters w/SD

16-Way, 32-Way or 64-Way System and other HP9000 servers

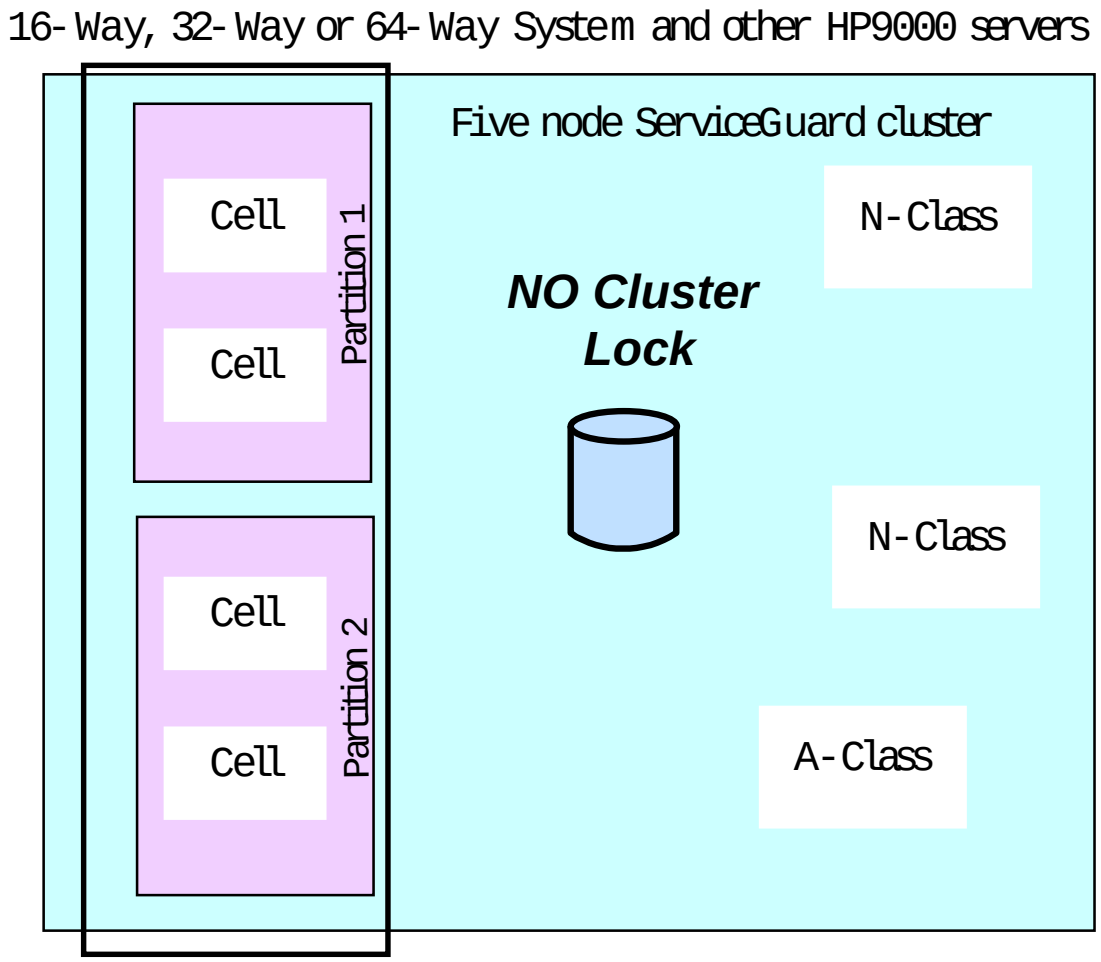


Notes:

- Cluster configuration can contain a mixture of SD and non-SD nodes.
- Care must be taken to maintain an even or greater number of nodes outside of the SD cabinet.
- Using an even number of nodes within and outside of the SD requires a cluster lock (only a two or four-node cluster).
- Cluster lock is not supported for clusters with greater than four nodes.
- ServiceGuard supports up to 16 nodes
- A cluster size of greater than four nodes requires more nodes to be outside the SD.
- Without a cluster lock, beware of configurations where the failure of a SD cabinet will cause the remaining nodes to be 50% or less quorum - the cluster will fail!

HA Mixed Configurations

HA Clusters w/SD



Notes:

- Cluster configuration can contain a mixture of SD and non-SD nodes.
- Care must be taken to maintain an even or greater number of nodes outside of the SD cabinet.
- Using an even number of nodes within and outside of the SD requires a cluster lock (maximum cluster size of four nodes).
- Cluster lock is not supported for clusters with greater than four nodes.
- ServiceGuard supports up to 16 nodes
- A cluster size of greater than four nodes requires more nodes to be outside the SD.
- Without a cluster lock, beware of configurations where the failure of a SD cabinet will cause the remaining nodes to be 50% or less quorum - the cluster will fail!

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for more information…

http://www.hp.com/go/ha

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