

High Availability...Virtually

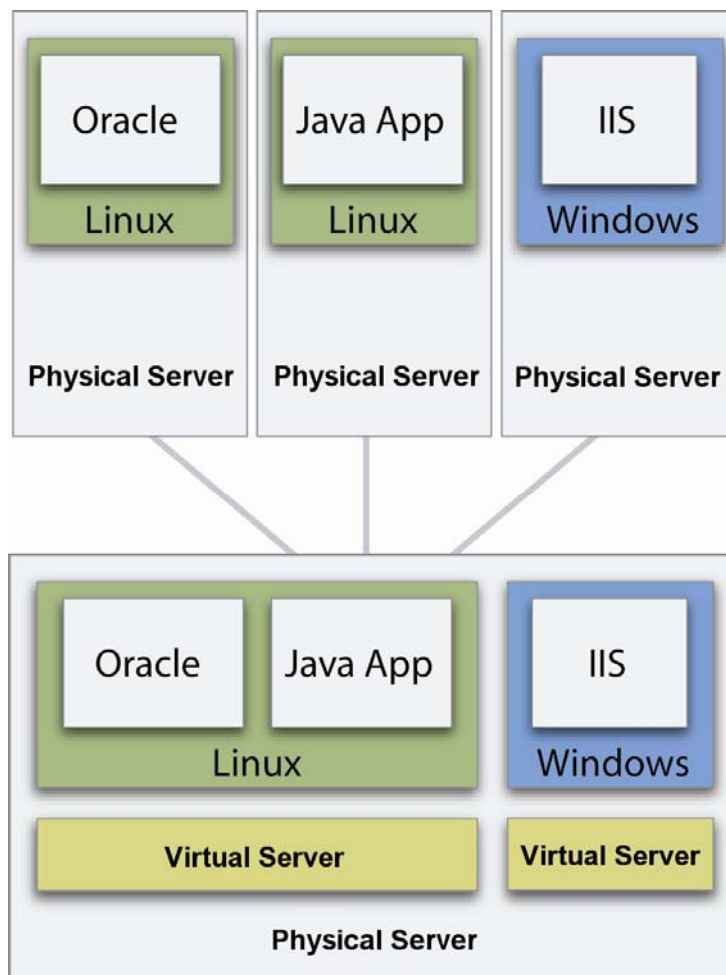
George Wu, Director of Software Business
NEC Corporation of America



Virtual System Consolidation

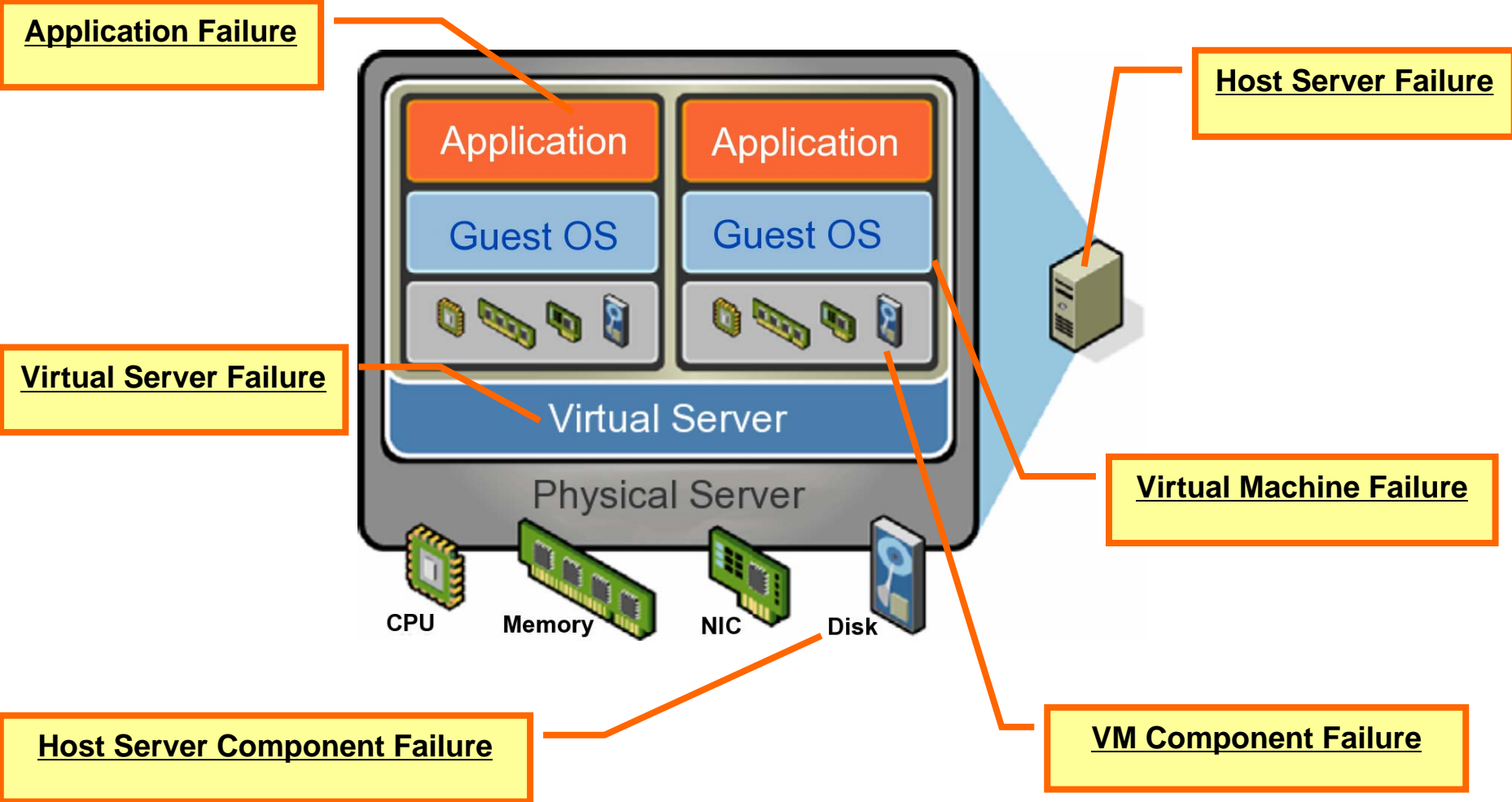
Virtualization Brings Benefits and Risks

- **Pros: Less Costs, More Efficiency**
 - ✓ **Reduced Physical Server Acquisition Costs**
 - ✓ **Reduced Physical Server Management Costs**
 - ✓ **Improved Physical Server Utilization**
- **Cons: Downtime Impact, Potential Performance Issues**
 - ✗ **Increased Physical Server Downtime Impact**
 - ✗ **Increased Workload Resource Management**
 - ✗ **Potential Workload Performance Bottlenecks**



Virtual System Continuity Risks

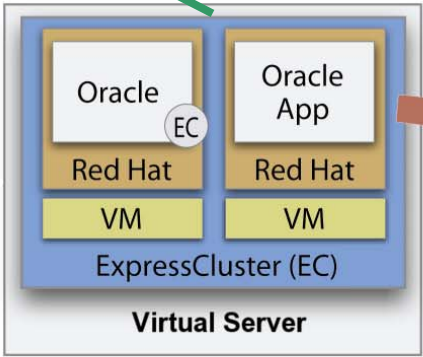
Many Potential Virtual System Service Outage Causes



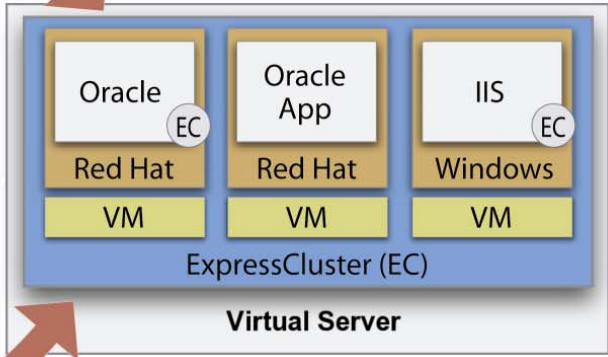
Real-World Virtual System Continuity Needs

Flexible and Comprehensive Solutions

Supports popular virtual servers (VMware, Microsoft)



Fast integrated application and data recovery to ensure system continuity



Flexible deployment options for optimized solutions

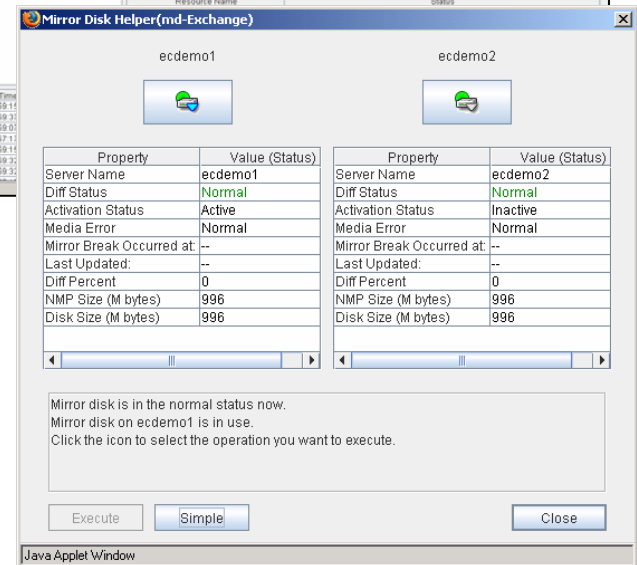
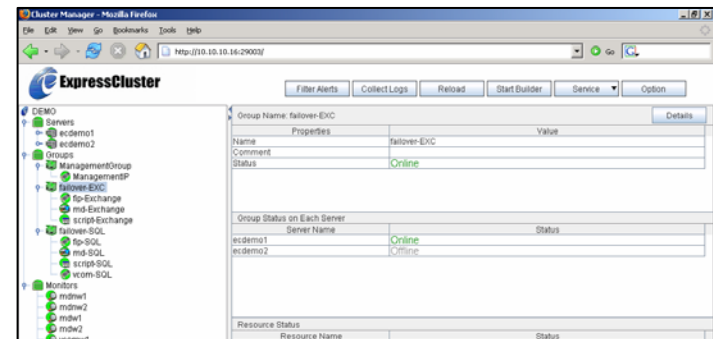


Unified solution for heterogeneous virtual and physical server environment

NEC ExpressCluster

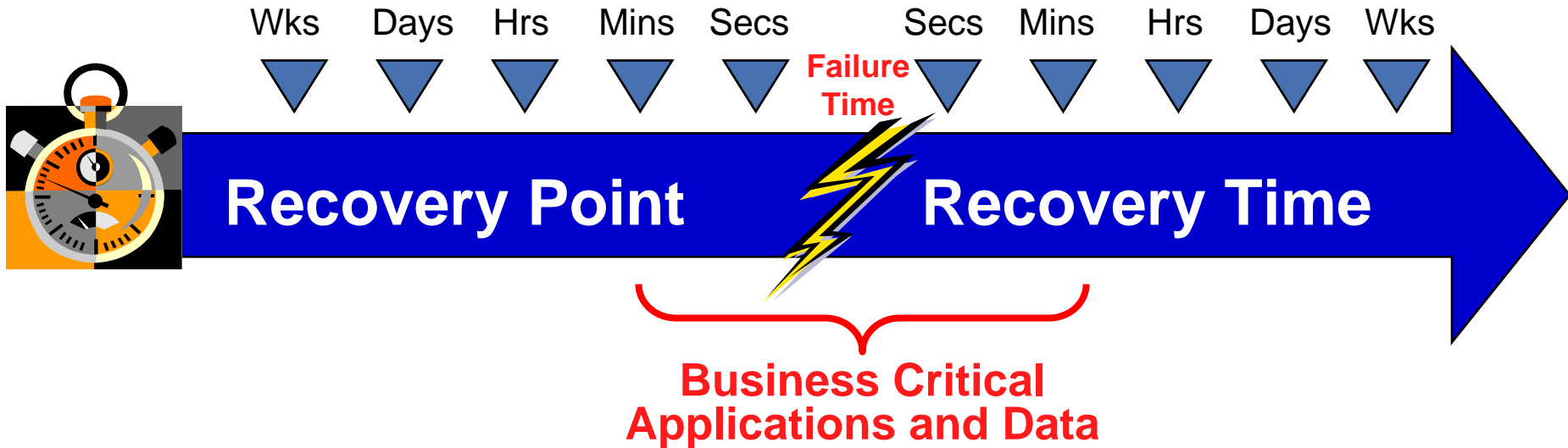
Integrated Application and Data Availability Solution

- Continuous Protection and Near-Instant Recovery of Business Critical Applications and Data
- Mature and Robust Technology
- Volume Platform Support
 - 32-bit (IA32), 64-bit (EM64T & Itanium)*
 - Microsoft Windows, Linux
 - VMware ESX, VMware Server, Microsoft Virtual Server
- Standard Applications Support
 - Database: MS SQL, Oracle DB, IBM DB2, MySQL, PostgreSQL
 - Email: MS Exchange, Sendmail, Lotus Notes
- Award-winning Product Line



*Limited Release

System Continuity Concepts



- **Recovery Point Objective (RPO)** – Point in time at which applications data must be recovered to resume business transactions

*How far back from **Failure Time** must system state be recovered?*

- **Recovery Time Objective (RTO)** – Maximum elapsed time required to complete recovery of application data

*How long from **Failure Time** does it take to recover system?*

$$\text{OUTAGE} = \text{RTO} + \text{RPO}$$

Demand Drivers for System Continuity Solutions

- Rising Business Impact of Downtime
- System Failures
 - Hardware (disk, power supply, adapters)
 - Software (memory leak, OS panic)
- Natural and Man-made Disasters
 - Terrorism
 - Network Disruption
 - Earthquakes
- Regulatory Compliance
 - HIPAA
 - Sarbanes-Oxley

Hourly Downtime Cost

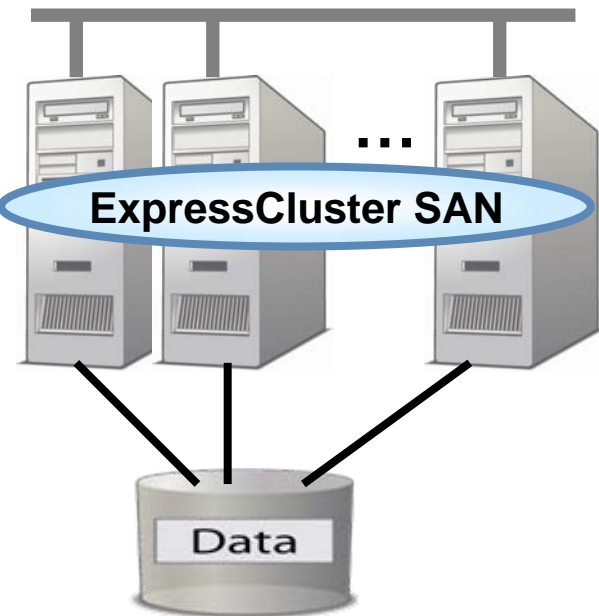
Brokerage	\$6.45M
Credit Card	\$2.6M
Advertisement	\$200K
Pay-per-view	\$150K
Airline reservations	\$90K

(Contingency Planning Research)

SEC Interagency Paper (File No. S7-32-02) calls for organizations to have a 200- to 300-mile separation between primary and backup sites

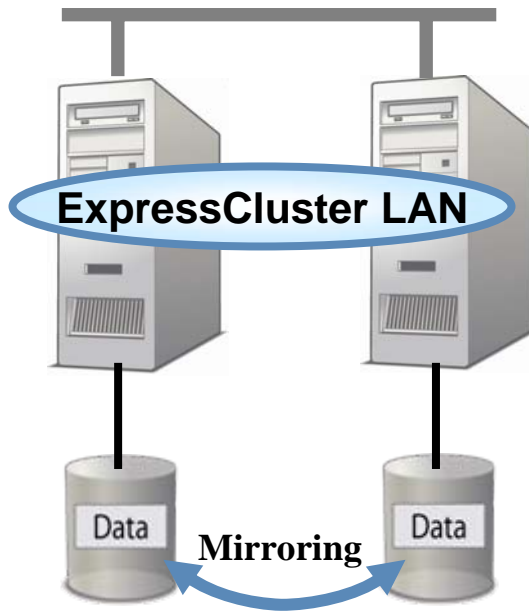
ExpressCluster Product Line

ExpressCluster SAN



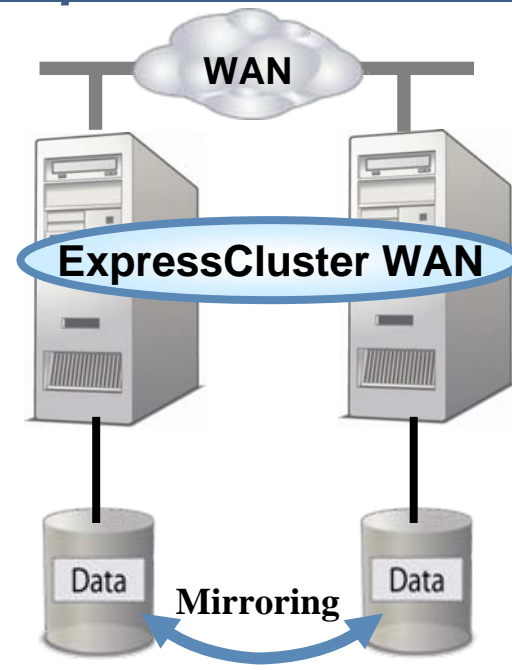
- **Shared-Disk LAN Cluster**
 - Shared storage for data protection
 - JBOD/SAN/NAS
 - Large scale high availability

ExpressCluster LAN



- **Mirrored-Disk LAN Cluster**
 - No shared storage required
 - RAID1 via LAN
 - Low cost high availability

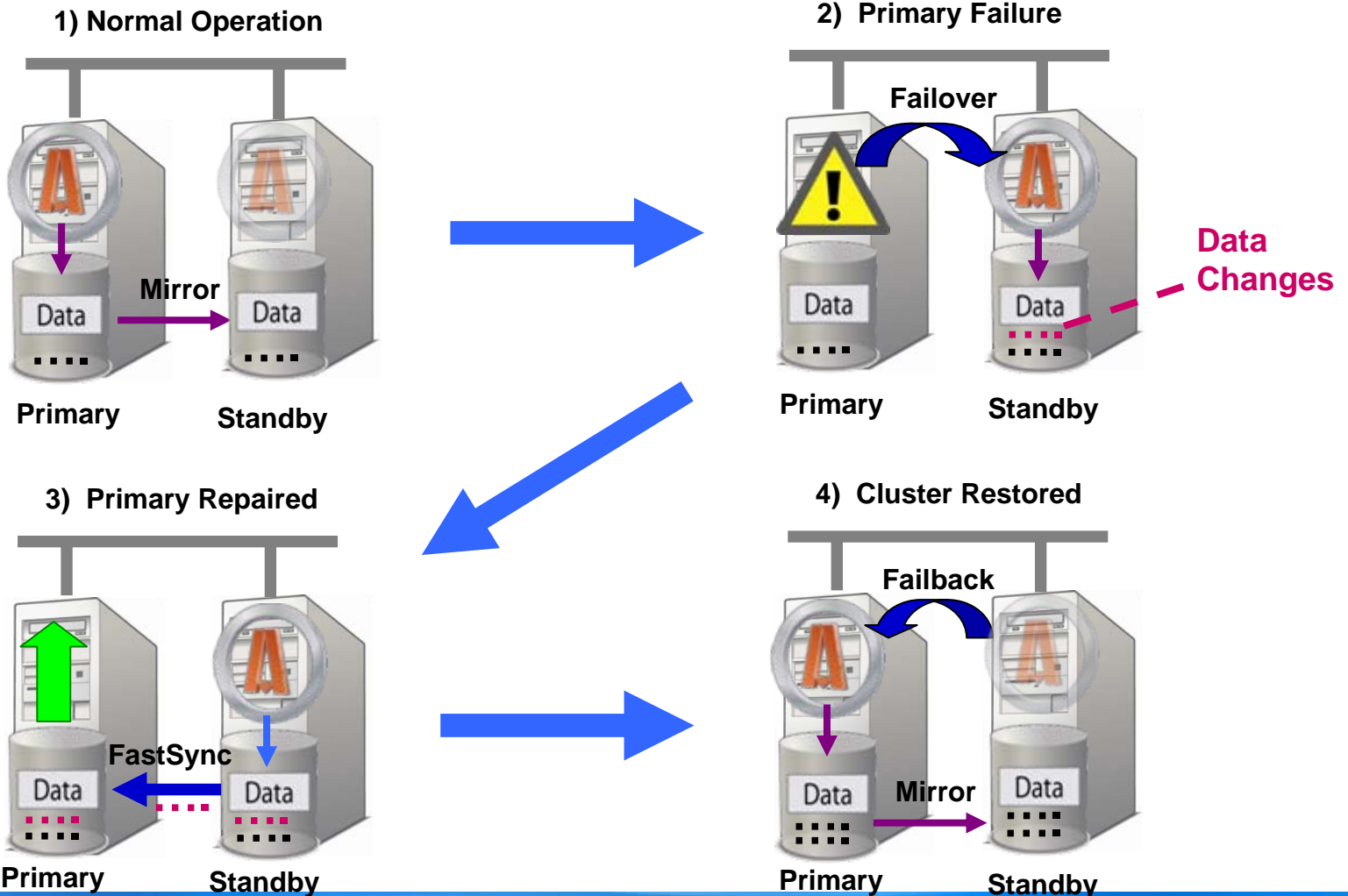
ExpressCluster WAN



- **Mirrored-Disk WAN Cluster**
 - System disaster recovery
 - Tx data integrity protection
 - Low bandwidth and long distance WAN support

Minimize Unplanned Downtime

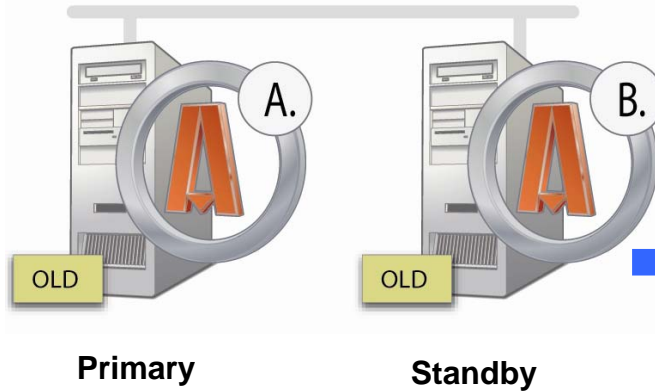
Fast Automatic Recovery from Hardware, Software and Site Failures



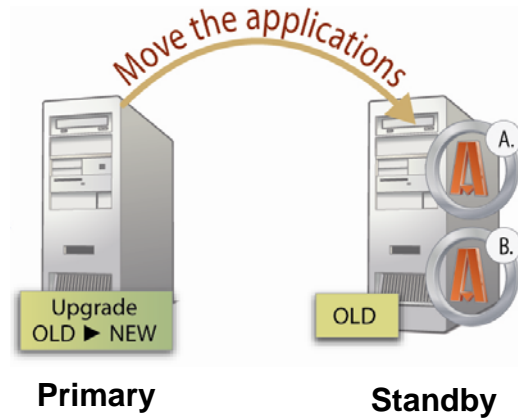
Minimize Planned Downtime

Easy Workload Migration for Planned Maintenance

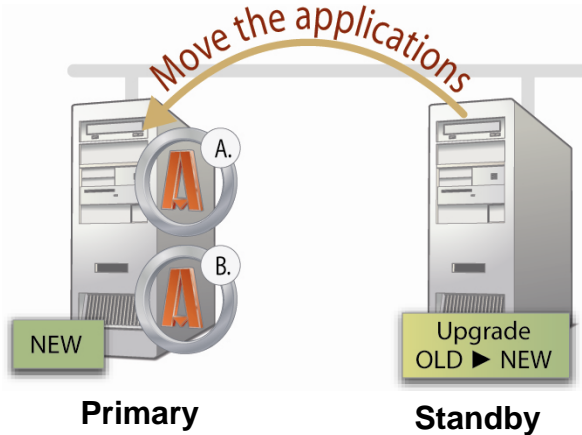
1) Before Upgrade Maintenance



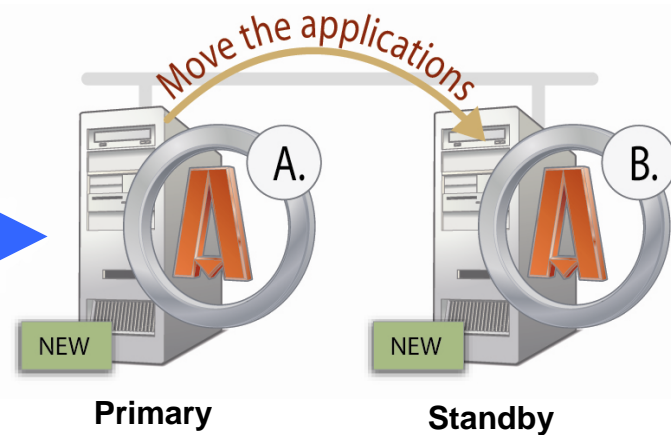
2) Primary Upgrade



3) Standby Upgrade



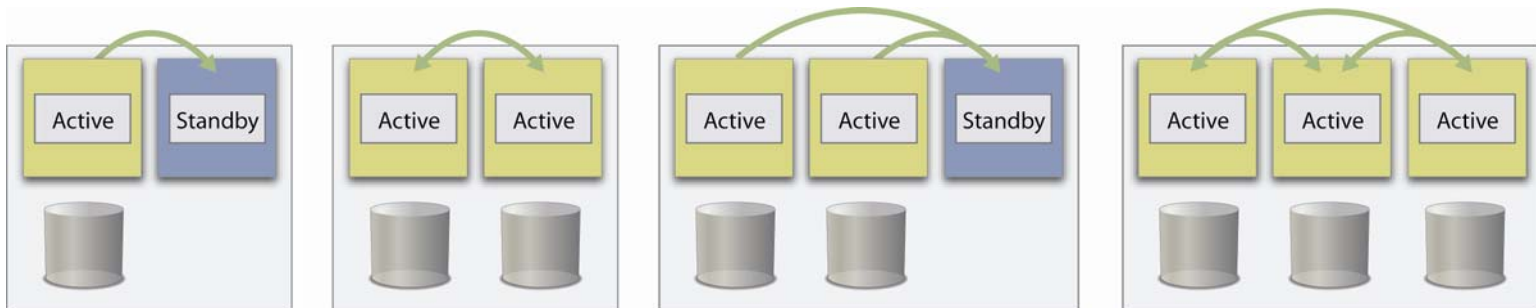
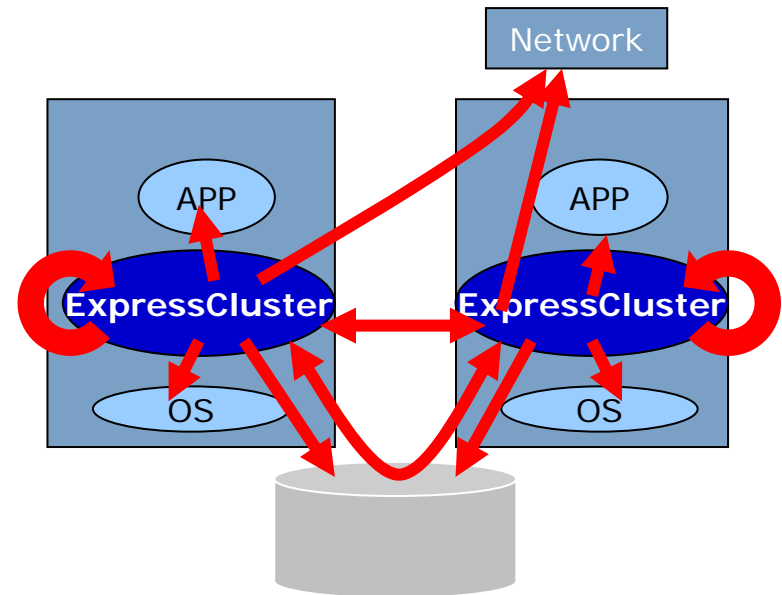
4) After Upgrade Maintenance



Extensive Functionality

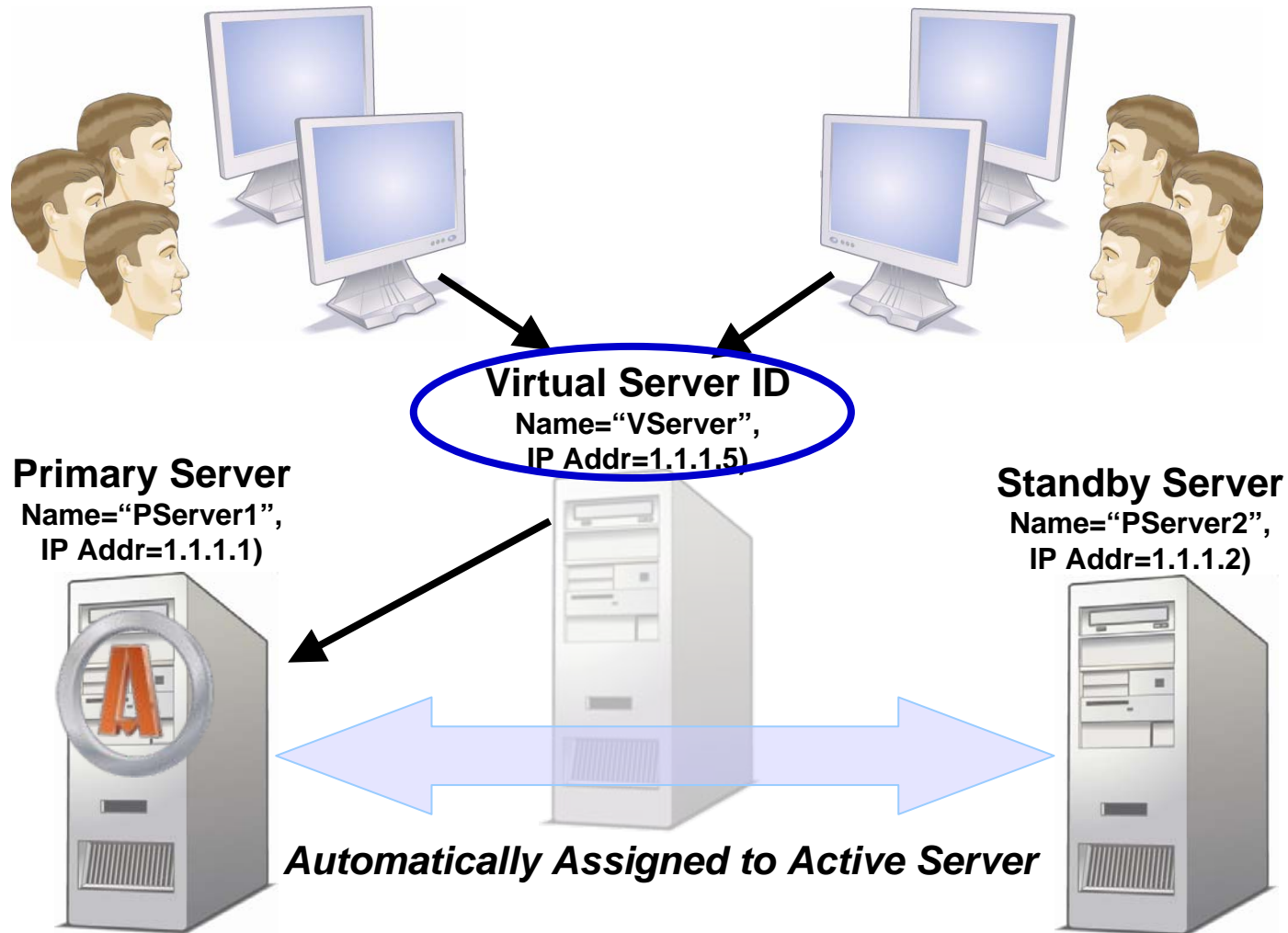
Rich and Flexible Capabilities Accommodate Diverse Needs

- *Extensive Resource Management*
 - **Rich Resource Monitoring**
 - Application and services
 - Network interface and nodes
 - Disk I/O
 - ExpressCluster components
- *Flexible Cluster Configuration*
 - Active/Standby or Active/Active
 - N:1 Standby
 - N Node Multi-Directional Standby



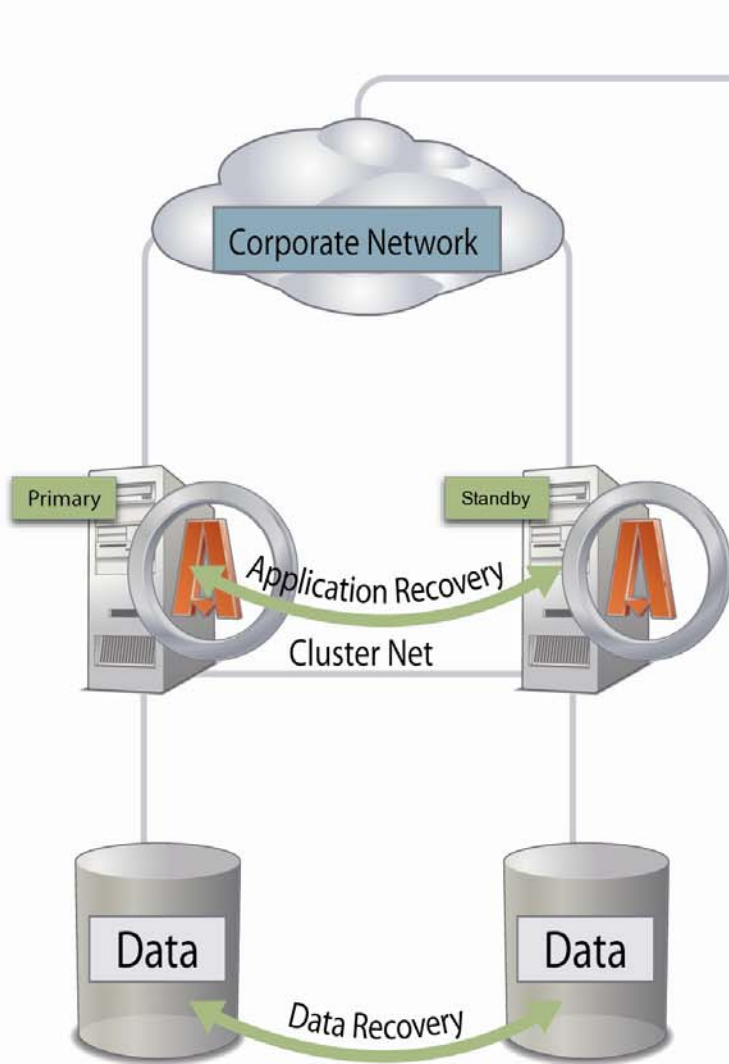
Virtual Server Identity

Eliminates Client System Reconfiguration



Integrated Application and Data Recovery

Minimized Deployment and Operational Costs



The right side of the image shows a computer monitor displaying two screenshots from a management console. The top screenshot is a "NET Operational Monitor" window showing a list of resources and their status. The bottom screenshot is a "Mirrored disk details" window showing the status of two mirrored disks, CPDEMO1 and CPDEMO2.

Resource Name	Resource type	Resource utilization	Status	Description	Processor name
CPDEMO1	Monitoring resource		Online	Monitor	CPDEMO1
CPDEMO2	target		Online	Monitor	CPDEMO2
CPDEMO3	Mounting IP	10.10.10.74.70	Online	Mount	CPDEMO3
CPDEMO4	Switch-remote disk	Remote server: 10.10.10.74.70	Online	Mount	CPDEMO4
CPDEMO5	Virtual computer name	cpdemo5	Online	Mount	CPDEMO5

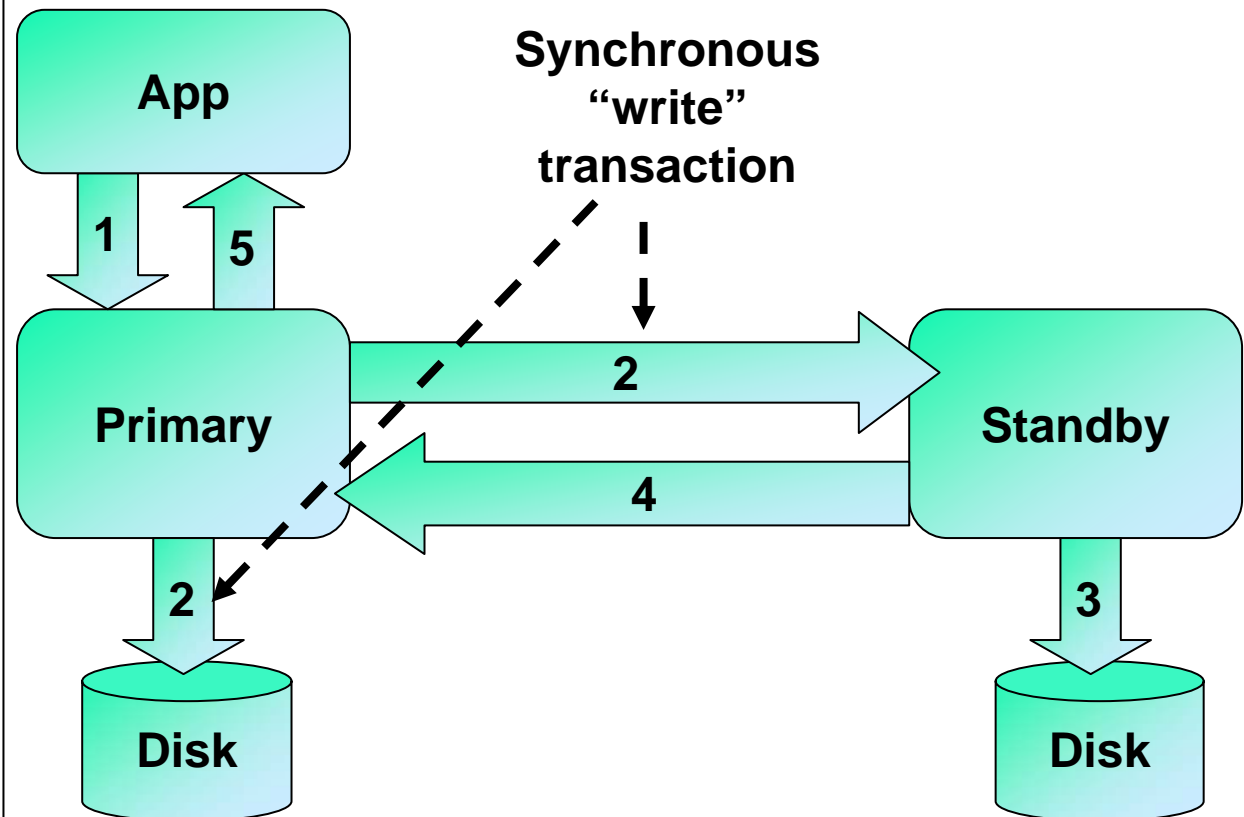
Server Time	Error	Message	ID
2008-08-15 16:45:00	CPDEMO2	CLUSTERINFO Service Service has started successfully.	1008
2008-08-15 16:45:00	CPDEMO2	The previous system shutdown was performed across CLUSTERINFO.	1008
2008-08-15 16:45:00	CPDEMO2	Mounting of remote disk has completed. (SUA_1008000)	1008
2008-08-15 16:45:00	CPDEMO2	Outgoing of mirror disk has completed. (RCA_1008000)	1008
2008-08-15 16:45:00	CPDEMO2	Server CPDEMO2 has returned to the cluster.	1008
2008-08-15 16:45:00	CPDEMO2	Drive array has been checked manually by the manager.	1008
2008-08-15 16:45:00	CPDEMO2	Group set was moved from server CPDEMO1 to server CPDEMO2.	1008
2008-08-15 16:45:00	CPDEMO2	Remote disk connection is disconnected.	1008
2008-08-15 16:45:00	CPDEMO2	Server CPDEMO2 was down.	1008
2008-08-15 16:45:00	CPDEMO2	Failure of group set has occurred.	1008
2008-08-15 16:45:00	CPDEMO2	Completed failure of server CPDEMO1.	1008
2008-08-15 16:45:00	CPDEMO2	A new issue of CLUSTERINFO was detected.	1008
2008-08-15 16:45:00	CPDEMO2	A new issue of CLUSTERINFO was detected.	1008
2008-08-15 16:45:00	CPDEMO2	CLUSTERINFO Service Service has started successfully.	1008
2008-08-15 16:45:00	CPDEMO2	Outgoing of mirror disk has completed.	1008

Information	Value (Status)	Information	Value (Status)
<Status>		<Status>	
MirrorStat.	Normal	MirrorStat.	Normal
ActiveStat.	Active	ActiveStat.	Inactive
MediumErr.	None	MediumErr.	None
<Timestamp>		<Timestamp>	
MirrorBreak	++--	MirrorBreak	++--
LastUpdate	++--	LastUpdate	++--
<Device Info>		<Device Info>	

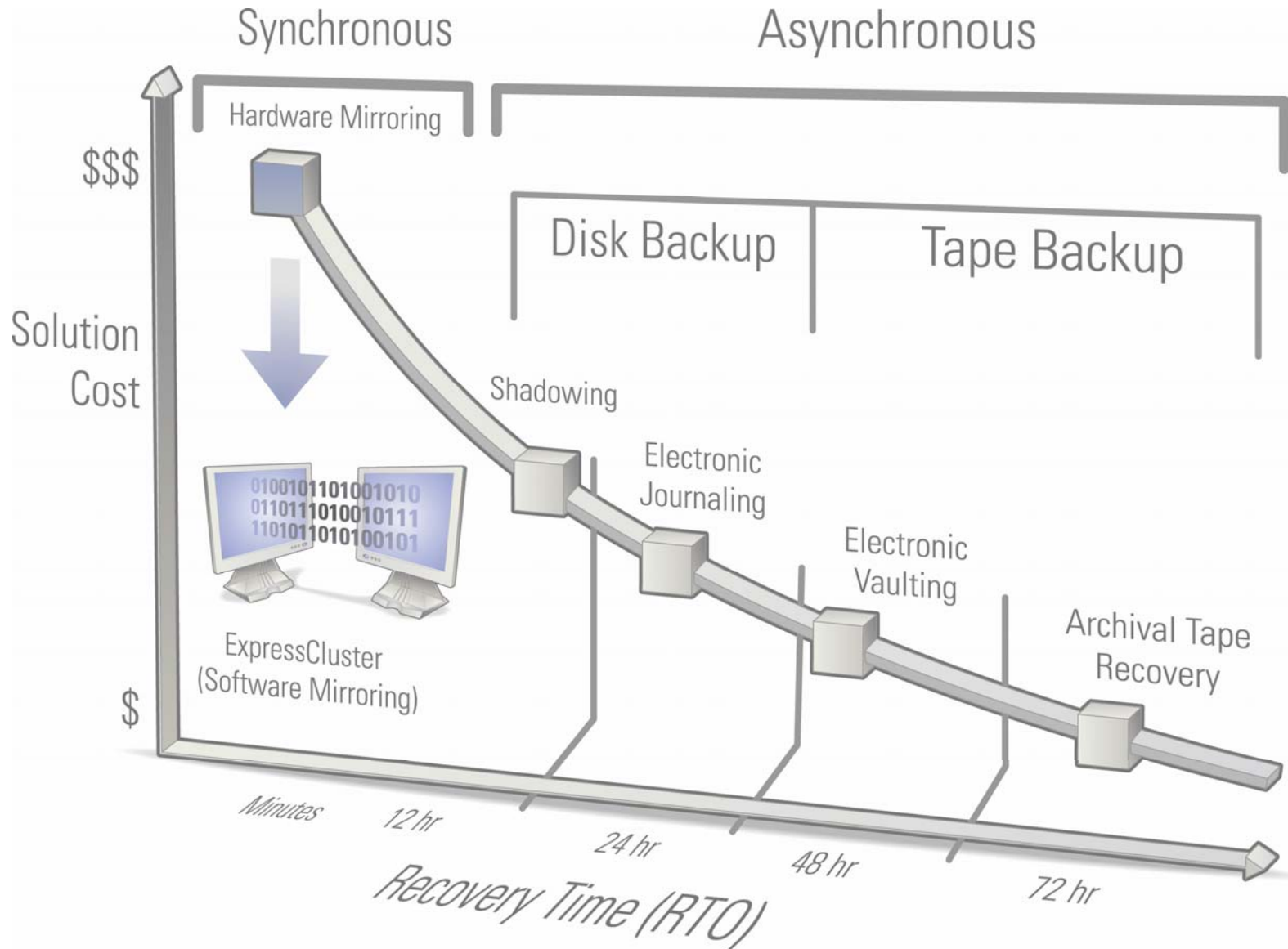
Synchronous Data Mirroring

Full Data Protection in LAN and WAN* Environment

1. **Primary** receives “write” request from **App**
2. **Primary** writes data to disk and forward it to **Standby**.
3. **Backup** writes data to its own disk.
4. **Backup** sends the result to **Primary**.
5. **Primary** receives the result from **Backup** and return the result of the “write” back **App**.



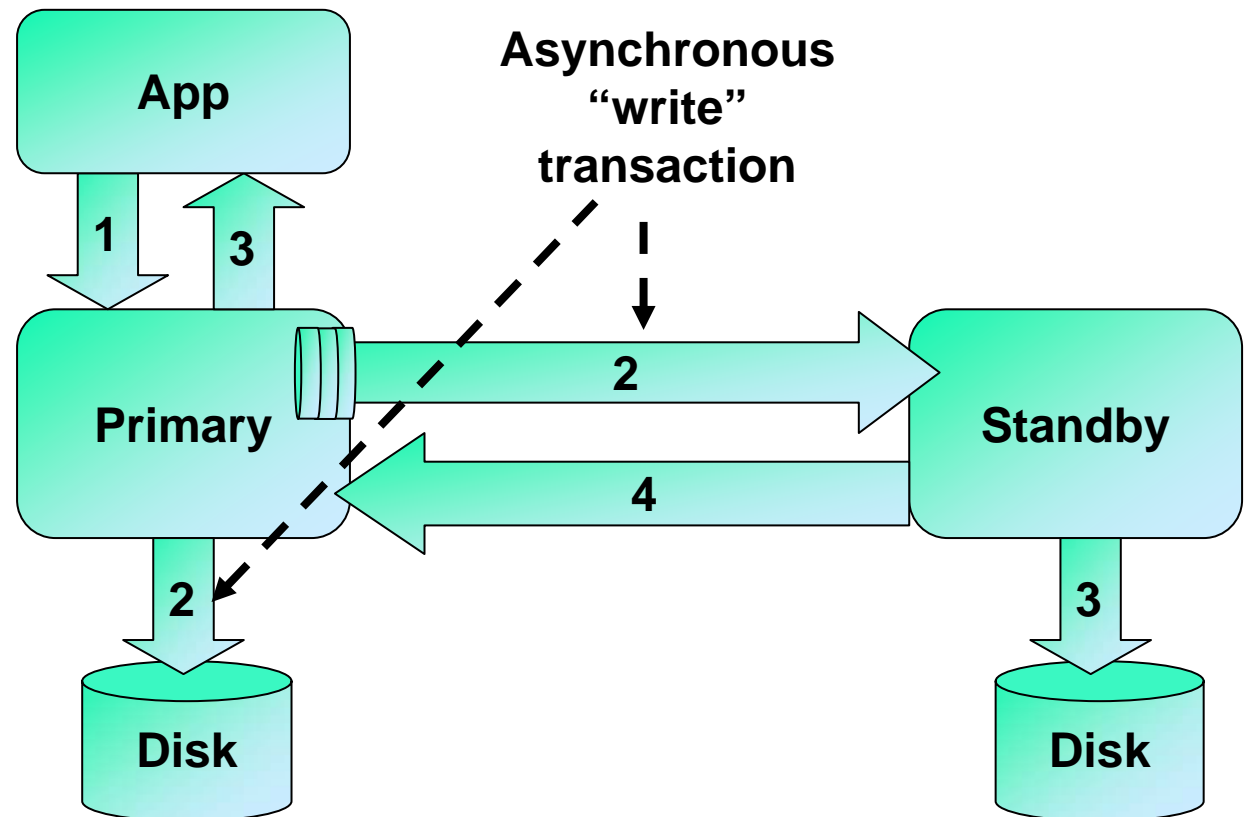
Superior Data Protection Value



Asynchronous Data Mirroring

Minimized Network Requirements for Even Lower TCO

1. **Primary** receives “write” request from **App**
2. **Primary** writes data to its disk and forward it to **Standby**.
3. **Primary** receives the result from its disk and returns result and control back **App** while **Standby** continues to write data to its disk
4. **Standby** sends the result to **Primary**



Virtual System Continuity Approaches

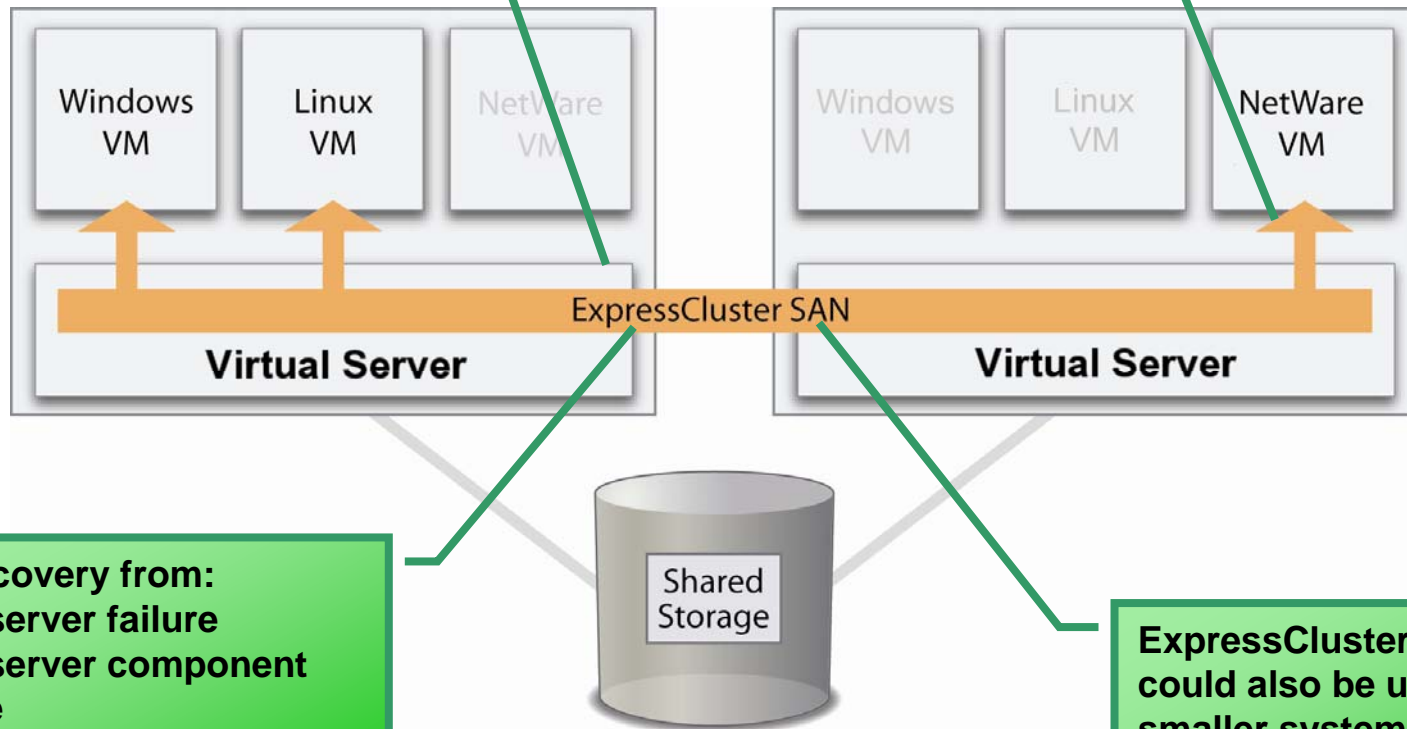


Virtual System Continuity Template (1)

Virtual Server Clustering

Deploy on target virtual servers to protect all VMs against basic system failures

Guest OS independent support



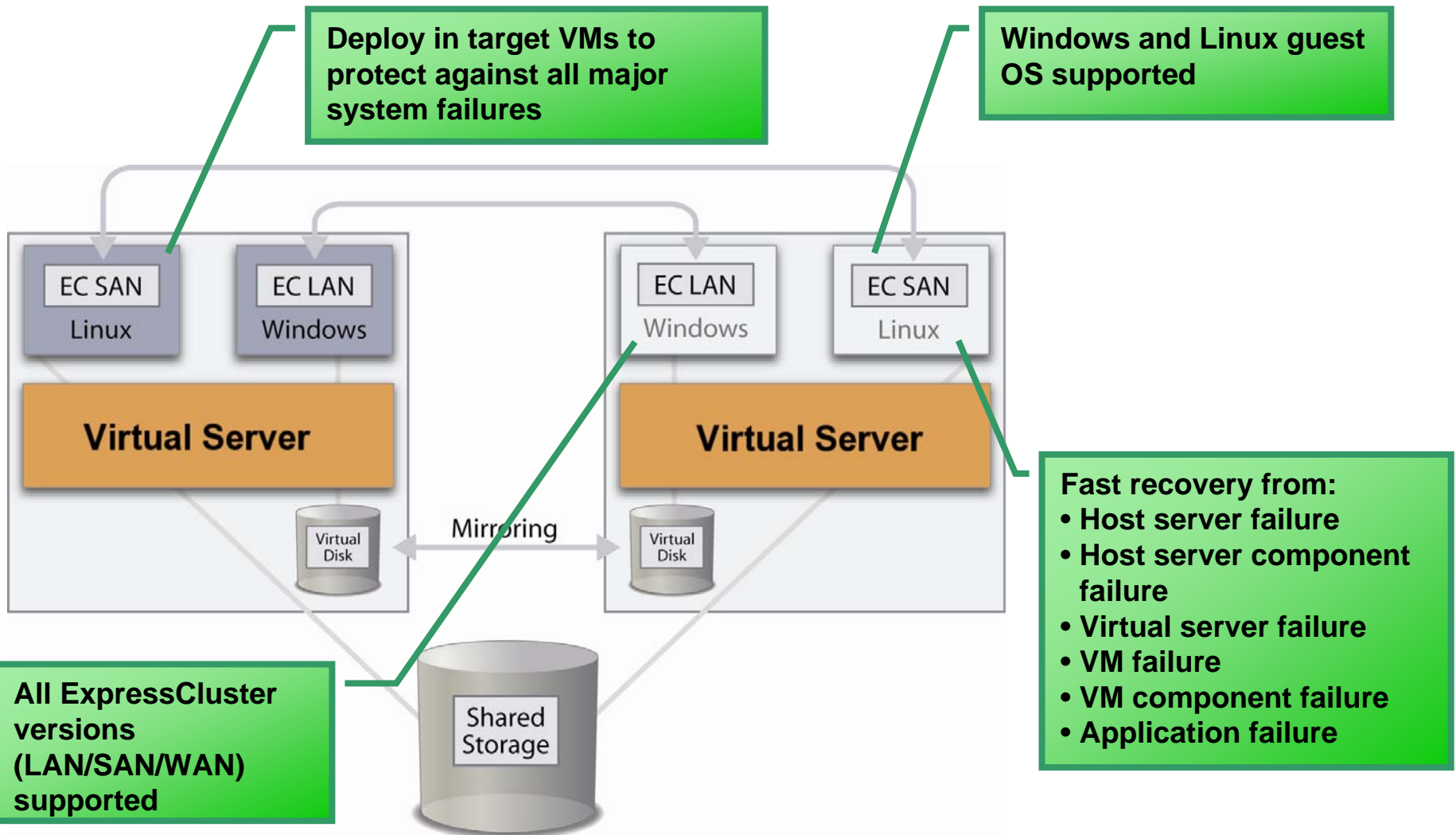
Fast recovery from:

- Host server failure
- Host server component failure
- Virtual server failure
- VM failure

ExpressCluster LAN could also be used for smaller system configurations without shared storage

Virtual System Continuity Template (2)

Virtual Machine Clustering

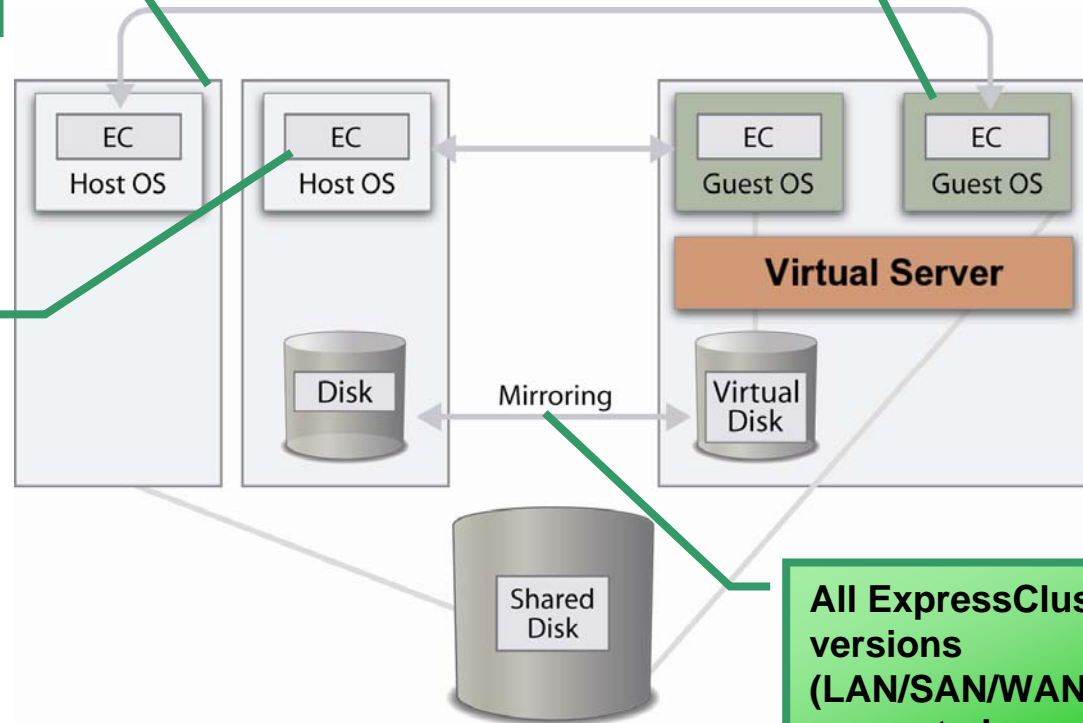


Virtual System Continuity Template (3)

Physical and Virtual Machine Clustering

Deploy in target physical servers and VMs to protect against all major system failures

Windows and Linux guest and physical server OS supported



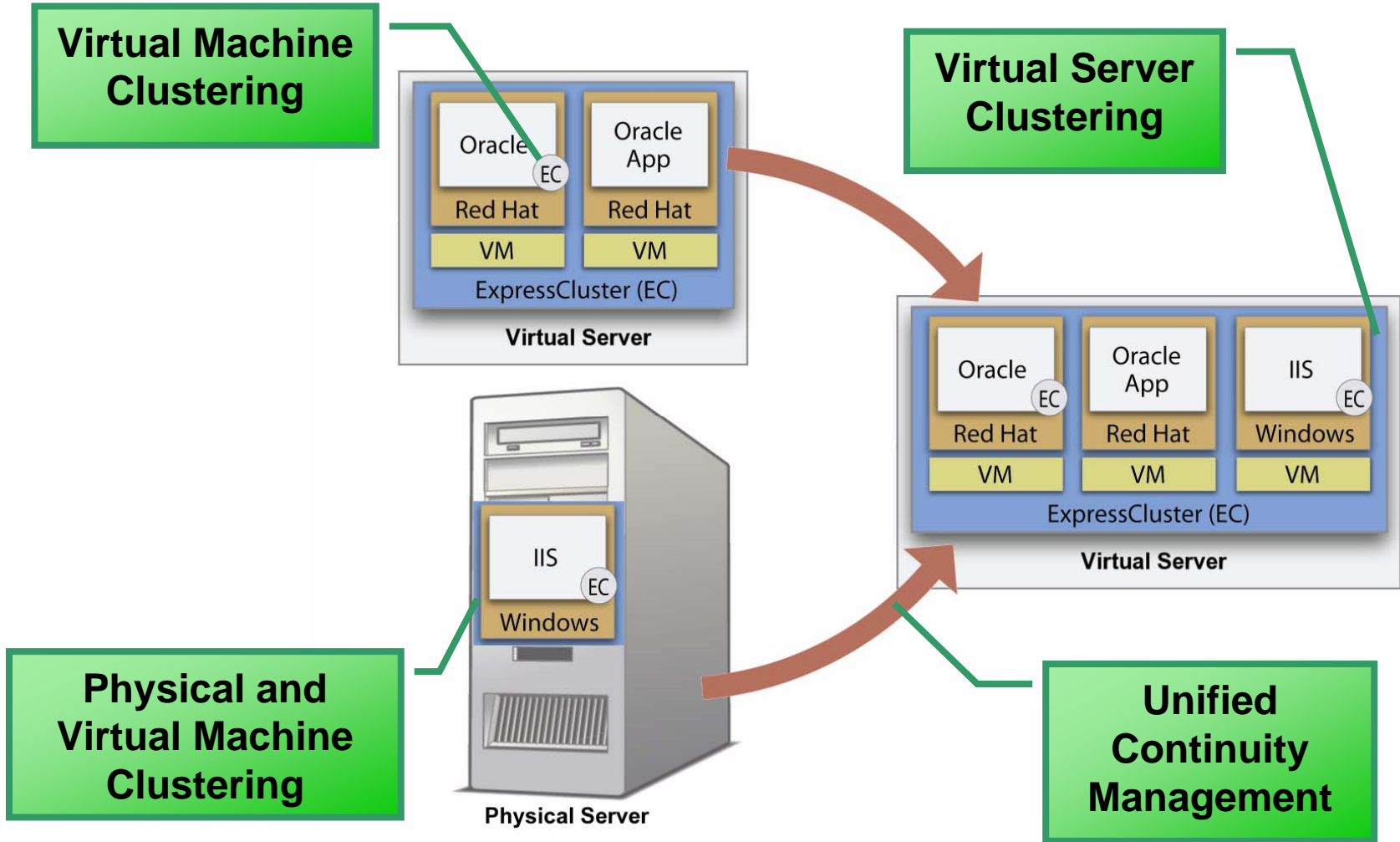
Fast recovery from:

- Host server failure
- Host server component failure
- Virtual server failure
- VM failure
- VM component failure
- Application failure
- Physical server failure
- Physical server component failure

All ExpressCluster versions (LAN/SAN/WAN) supported

ExpressCluster for Virtual System Continuity

Flexible and Comprehensive Solutions



ExpressCluster Summary

Integrated Application and Data HA/DR Solutions

- **Superior Performance**
 - Fast and automatic system recovery
 - Real-time transactional data mirroring
- **Superior Usability**
 - Unified management of all protected applications and data stores
 - Transparent virtual server identity migration requires no client reconfiguration
- **Superior Cost of Ownership**
 - Standard OS/applications support
 - Low bandwidth network support
 - Active/active configurations support

The image displays two screenshots from the ExpressCluster management environment. The top screenshot shows the ExpressCluster web interface in a Mozilla Firefox browser. The interface includes a navigation tree on the left with categories like Servers, Groups, and Monitors. The main content area shows details for a 'failover-EXC' group, including its name, comment, status (Online), and a table of server statuses for 'ecdemo1' and 'ecdemo2'. The bottom screenshot shows the 'Mirror Disk Helper(md-Exchange)' utility window. It displays two server icons, 'ecdemo1' and 'ecdemo2', and two tables of properties. The 'ecdemo1' table shows properties like Server Name, Diff Status (Normal), Activation Status (Active), and Media Error (Normal). The 'ecdemo2' table shows similar properties, with Diff Status (Normal) and Activation Status (Inactive). Below the tables is a message box stating 'Mirror disk is in the normal status now. Mirror disk on ecdemo1 is in use.' and buttons for 'Execute', 'Simple', and 'Close'.

Property	Value (Status)	Property	Value (Status)
Server Name	ecdemo1	Server Name	ecdemo2
Diff Status	Normal	Diff Status	Normal
Activation Status	Active	Activation Status	Inactive
Media Error	Normal	Media Error	Normal
Mirror Break Occurred at:	--	Mirror Break Occurred at:	--
Last Updated:	--	Last Updated:	--
Diff Percent	0	Diff Percent	0
NMP Size (M bytes)	996	NMP Size (M bytes)	996
Disk Size (M bytes)	996	Disk Size (M bytes)	996



NEC



- Revenues: \$40 billion
- Employees: More than 154,000 Worldwide
- \$3B + in research and development
- 15 R&D centers worldwide
- Patents: 48,000 worldwide; including annual top rankings of U.S. patents for the last 12 years
- Fortune Global 500: Ranked 159th
- 69th Largest Manufacturer Worldwide

Global Rankings

- #1 in worldwide enterprise telephony sales
- #3 in worldwide microcontroller sales
- #12 in worldwide semiconductor sales

North American Rankings

- #1 in sales of commercial large-screen LCDs
- #2 in sales of commercial plasma displays
- #2 in sales of professional projectors

Our Vision

*Empowering Our Customers Through 100 Years
of Expertise in IT and Networking*



The global convergence of IT and Networking

Empowered by Innovation

NEC