

# Windows Clustering (Failover Clustering)

<http://www.cs.vsb.cz/navrat>

*Jan Žák*

Správa počítačových systémů  
(SPS)

**Microsoft**  
**CERTIFIED**  
Systems Engineer

**Microsoft**  
**CERTIFIED**  
Trainer

# Microsoft cluster technologies

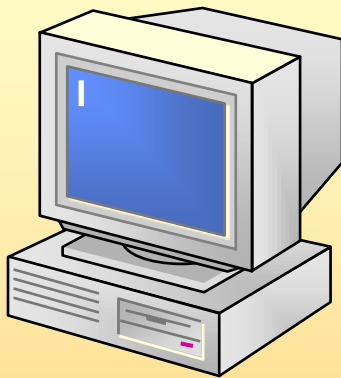
- Microsoft Cluster Service (MSCS)
- Component Load Balancing (CLB)  
(part of Application Center 2000)
- Network Load Balancing Services (NLB)

Note: Windows Server 2008 uses name Failover Clustering

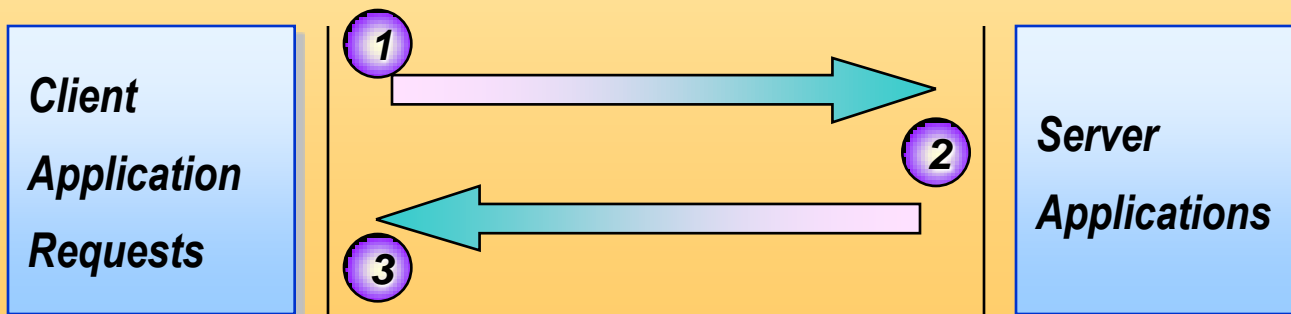
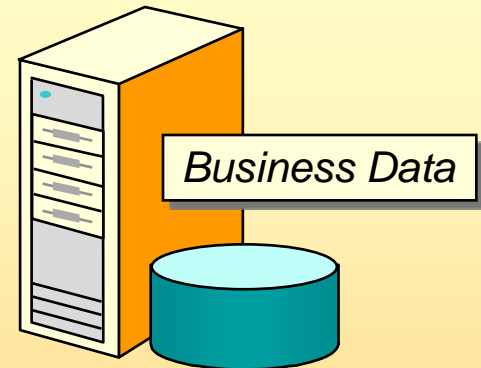
# ◆ **Introducing Application Architecture**

	<b><i>Two-Tier Thin Client</i></b>	<b><i>Two-Tier Fat Client</i></b>	<b><i>Three-Tier</i></b>	<b><i>N-Tier</i></b>
<b><i>User Services</i></b>	<b><i>User Interface Microsoft Win32®</i></b>	<b><i>User Interface Win32  Most Business Logic</i></b>	<b><i>User Interface Win32  Browser</i></b>	<b><i>User Interface Win32 Browser DHTML, XML</i></b>
<b><i>Business Services</i></b>			<b><i>Business Logic COM Objects</i></b>	<b><i>User Interface ASP  Business Logic COM Objects</i></b>
<b><i>Data Services</i></b>	<b><i>Storage RDBMS  All Business Logic (SP)</i></b>	<b><i>Storage RDBMS  Min Business Logic (SP)</i></b>	<b><i>Storage RDBMS  Min Business Logic (SP)</i></b>	<b><i>Storage RDBMS  Min Business Logic (SP)</i></b>

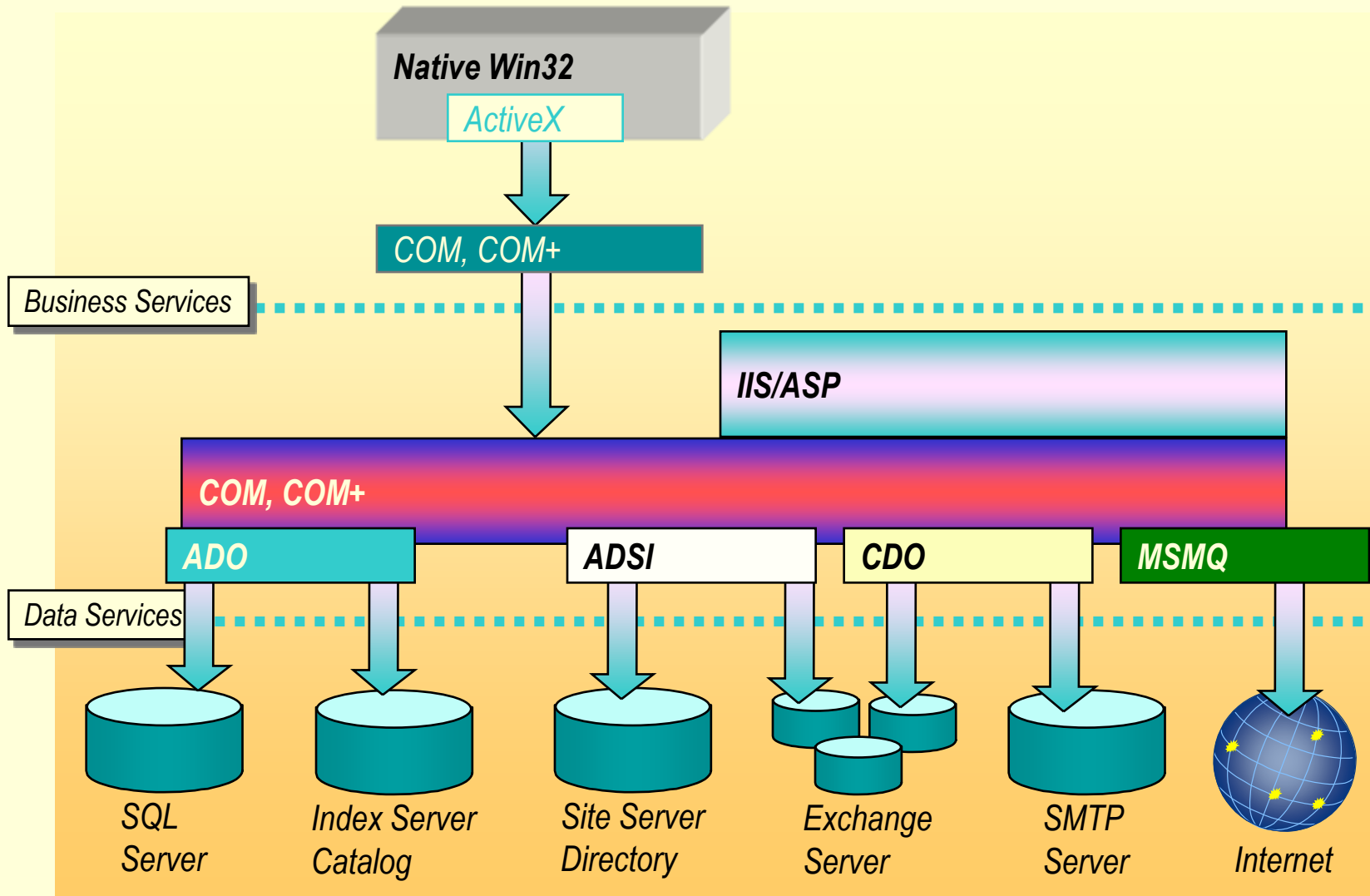
# Client Server



1. Client requests data
2. Server fulfills request
3. Client receives data



# Three-Tier

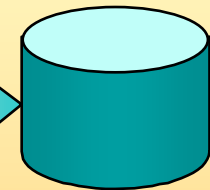
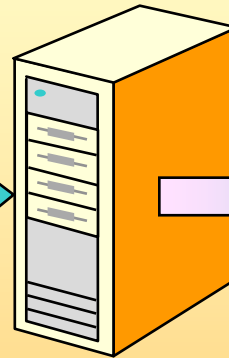
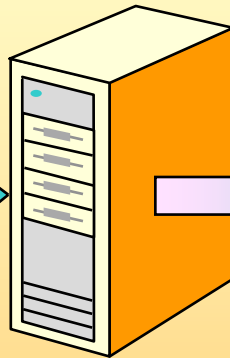
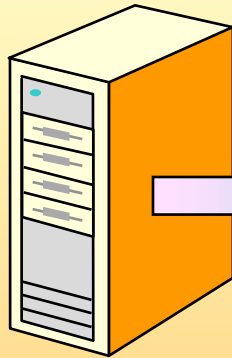


# N-Tier

*Examples: HTML,  
XML, Java applets,  
client side script*

*Examples:  
DCOM.ASP, MTS  
MSMQ*

*Examples: SQL,  
Exchange, SMTP*



**User Services**

**Business  
Services Server**

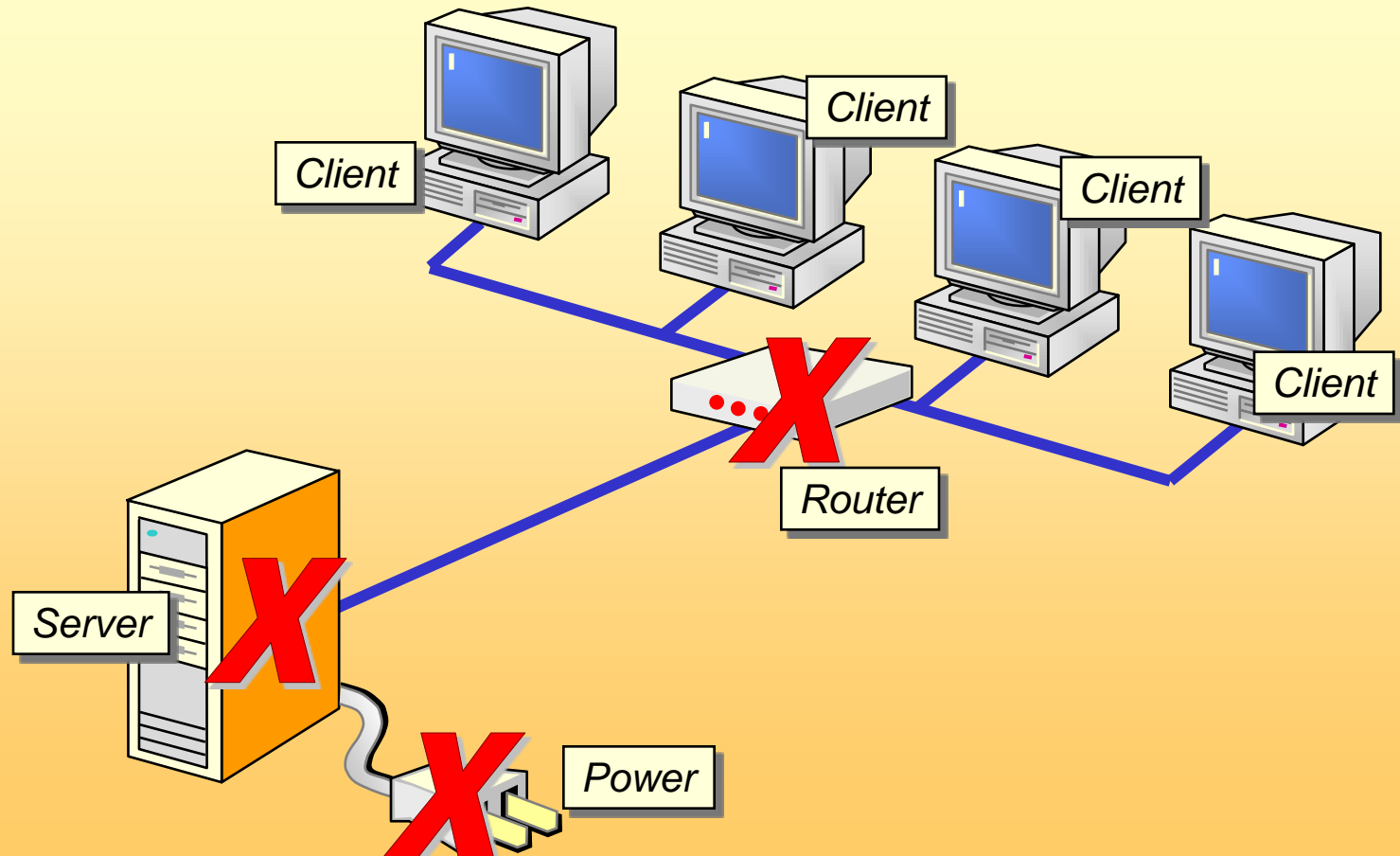
**Data Services  
Server**

**Business Data**



# Assessing Risks

## *Performing a Risk Audit*



# High Availability vs. Scalability

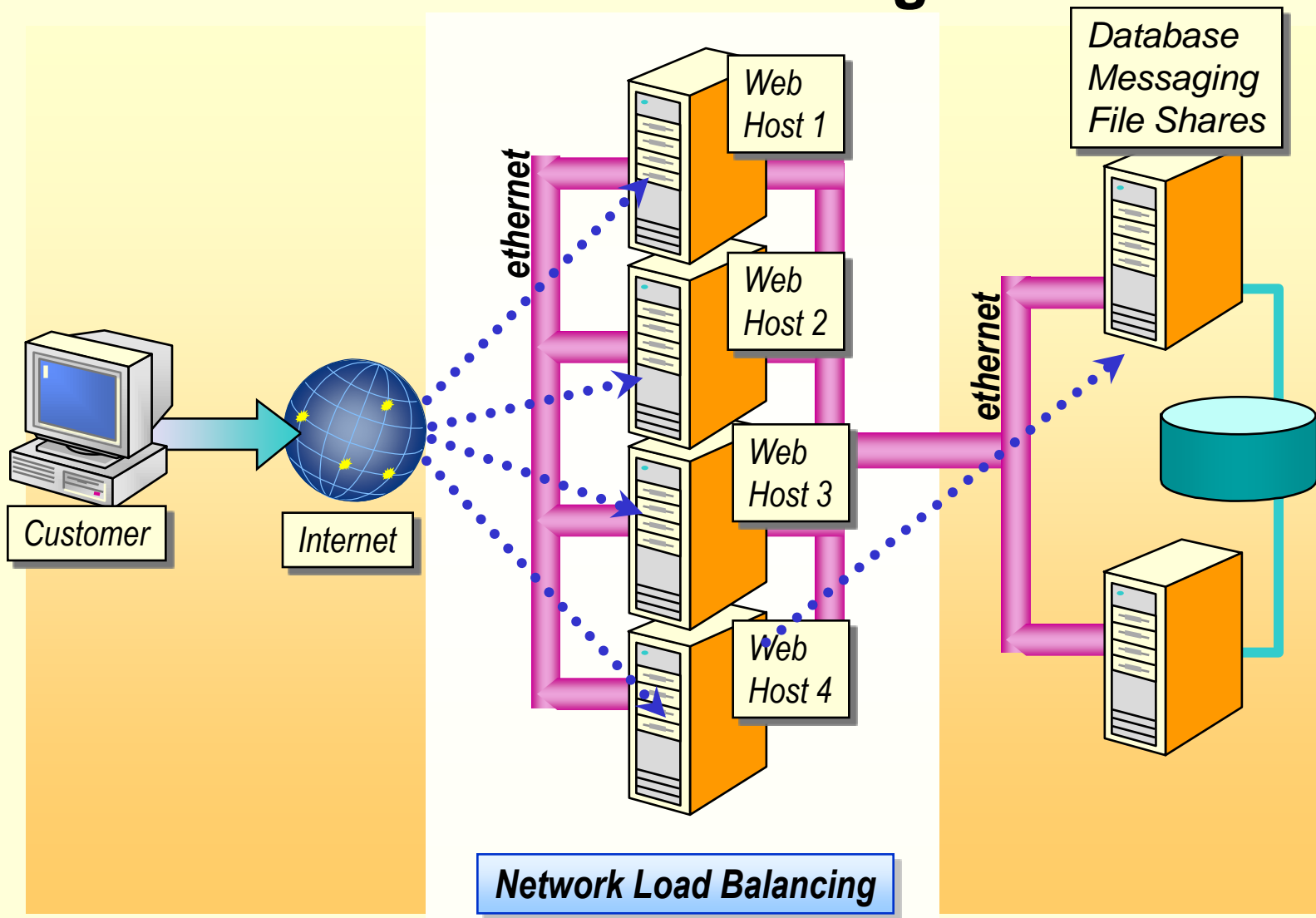
- Availability
    - Cluster Service Improves Availability of Applications and Services
  - Scalability
    - Cluster Service Improves Scalability by Adding More Computers to the Cluster
  - Measuring High Availability (%)
  - Cluster Service
  - Network Load Balancing
- vs.
- Enhanced Symmetric Multiprocessing
  - Cluster Service
  - Network Load Balancing



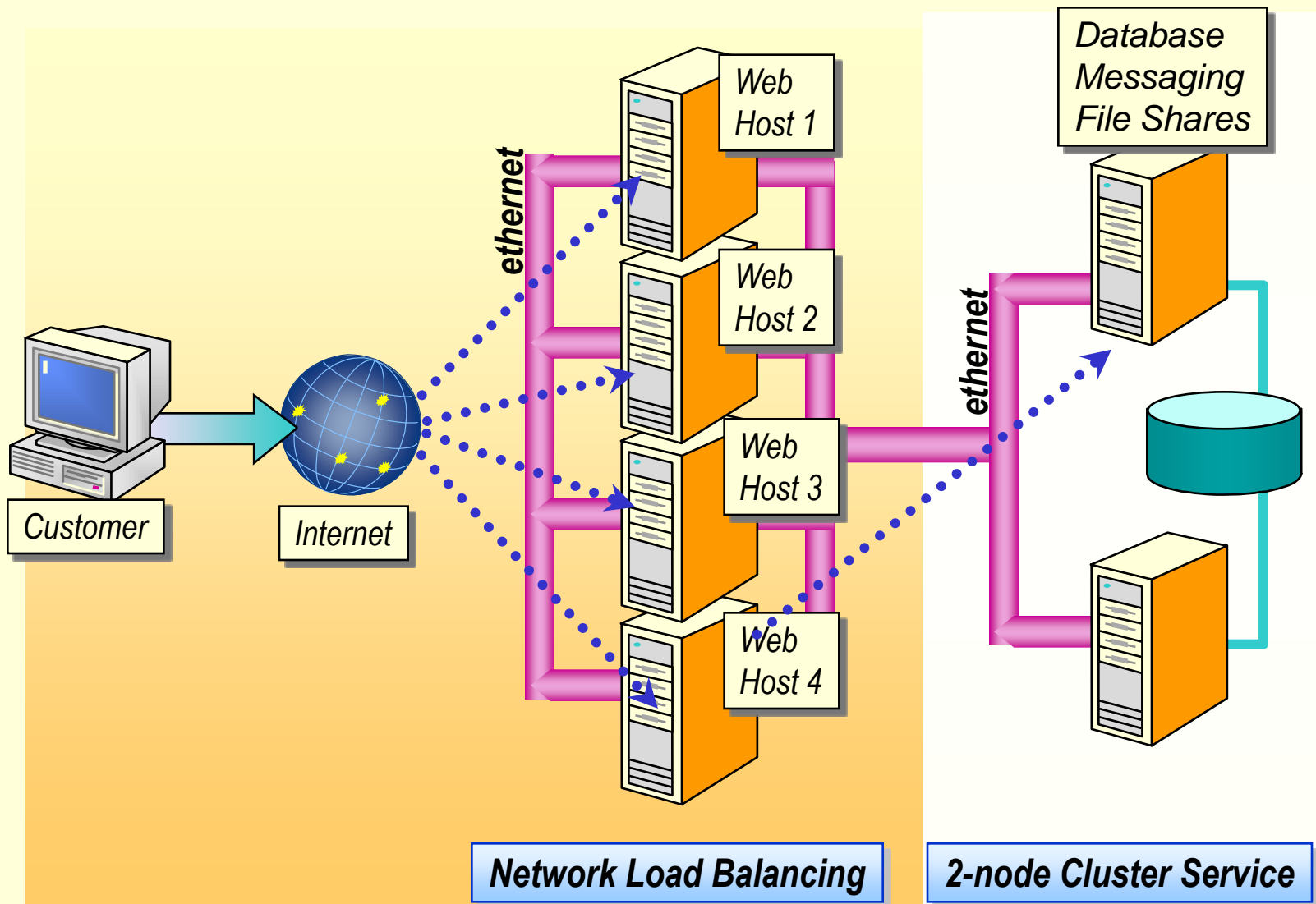
# Availability percentage calculation

Availability %	Downtime per year	Downtime per month*	Downtime per week
90%	36.5 days	72 hours	16.8 hours
95%	18.25 days	36 hours	8.4 hours
98%	7.30 days	14.4 hours	3.36 hours
99%	3.65 days	7.20 hours	1.68 hours
99.5%	1.83 days	3.60 hours	50.4 minutes
99.8%	17.52 hours	86.23 minutes	20.16 minutes
99.9% ("three nines")	8.76 hours	43.2 minutes	10.1 minutes
99.95%	4.38 hours	21.56 minutes	5.04 minutes
99.99% ("four nines")	52.6 minutes	4.32 minutes	1.01 minutes
99.999% ("five nines")	5.26 minutes	25.9 seconds	6.05 seconds
99.9999% ("six nines")	31.5 seconds	2.59 seconds	0.605 seconds

# Network Load Balancing Service



# Cluster Service



# Comparing Network Load Balancing to Cluster Service

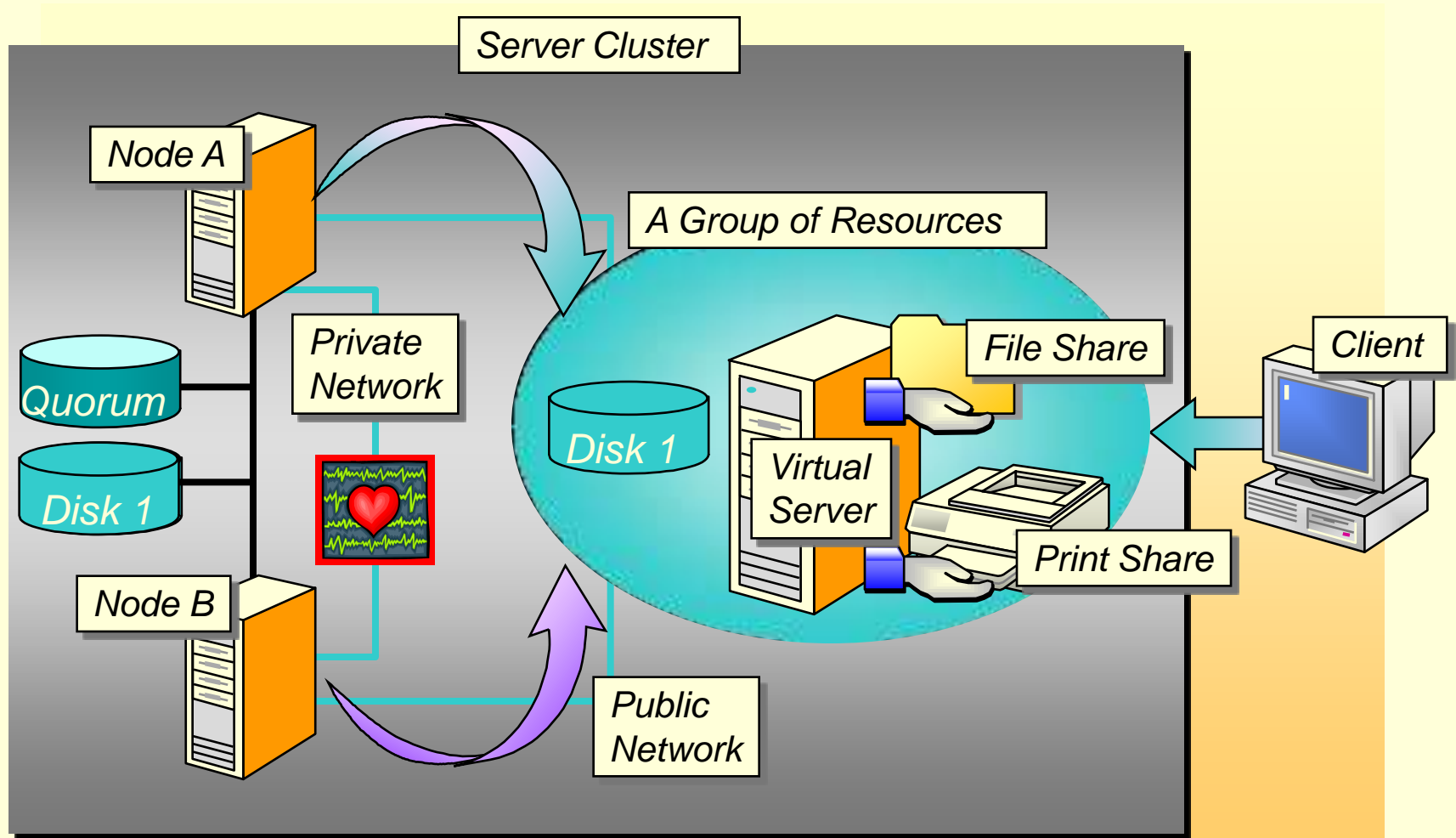
*Which Clustering Technology Should be Used for Your Application?*

<b>Technology Scenario</b>	<b>Cluster Service</b>	<b>Networking Load Balancing</b>	<b>Benefits</b>
<b>Web Server Farm</b>		✓	<ul style="list-style-type: none"> <li>✓ Quickly expand your capacity</li> <li>✓ Minimize site downtime</li> </ul>
<b>Terminal Services</b>		✓	<ul style="list-style-type: none"> <li>✓ Quickly expand your capacity</li> <li>✓ Minimize effects of server failures</li> </ul>
<b>File/Print Servers</b>	✓		<ul style="list-style-type: none"> <li>✓ Minimize service downtime</li> <li>✓ Ensure data consistency after failover</li> </ul>
<b>Database/ Messaging</b>	✓		<ul style="list-style-type: none"> <li>✓ Minimize application downtime</li> <li>✓ Ensure data consistency after failover</li> </ul>
<b>E-Commerce Sites</b>	✓	✓	<ul style="list-style-type: none"> <li>✓ Quickly expand your capacity</li> <li>✓ Minimize effects of server/app. downtime</li> </ul>

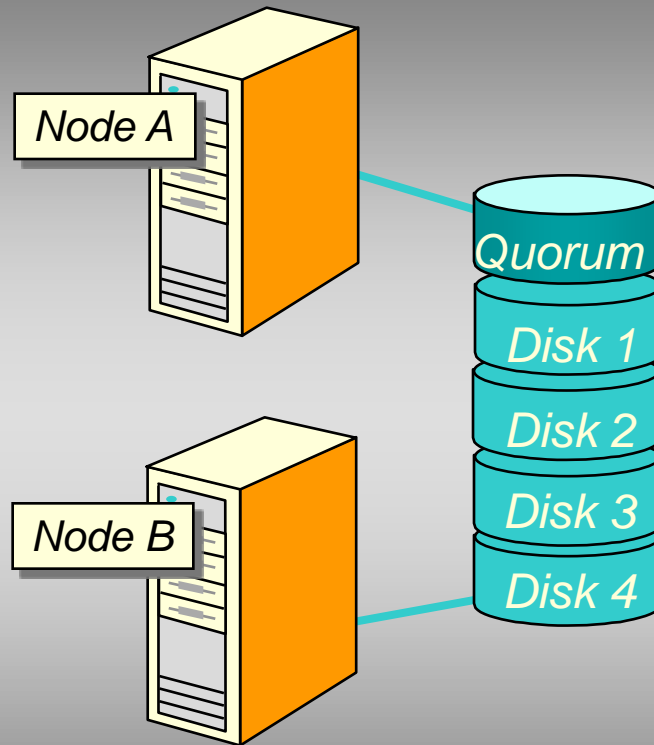
# Clustering Techniques

- Shared Everything Model
- Mirrored Servers
- **Shared Nothing Model**

# Key Concepts of a Server Cluster



# Cluster Disks



# Quorum Resource

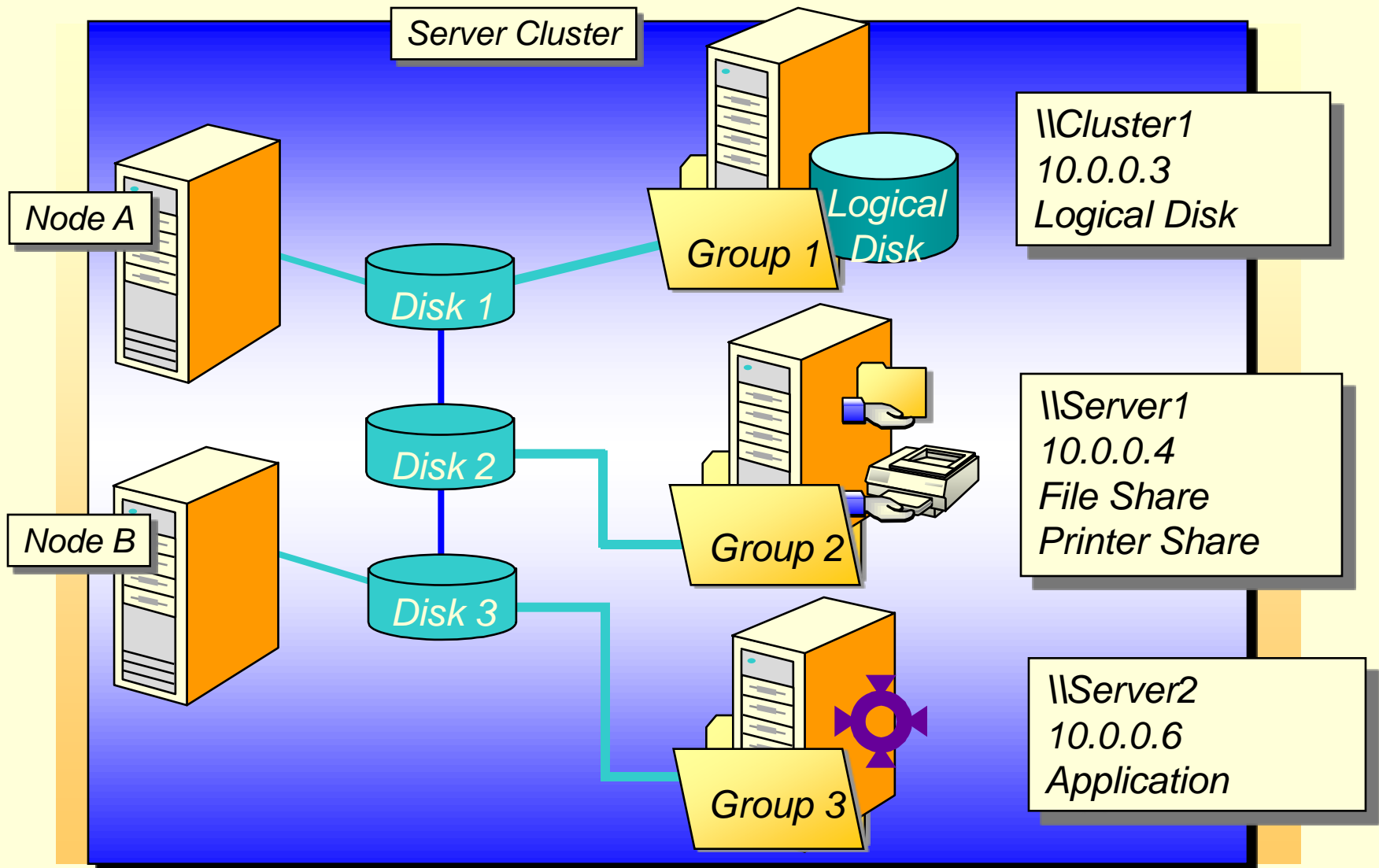
- Data Storage
- Arbitration
- Quorum Ownership
- Updates for Nodes Coming Online

## **Majority Node Set (MNS) Clusters**

- Geographically dispersed clusters
- No shared disks
- ...

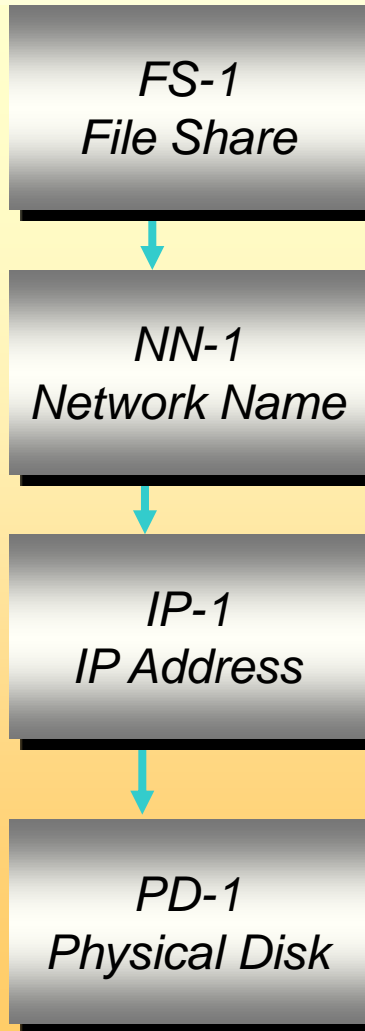


# Groups and Resources

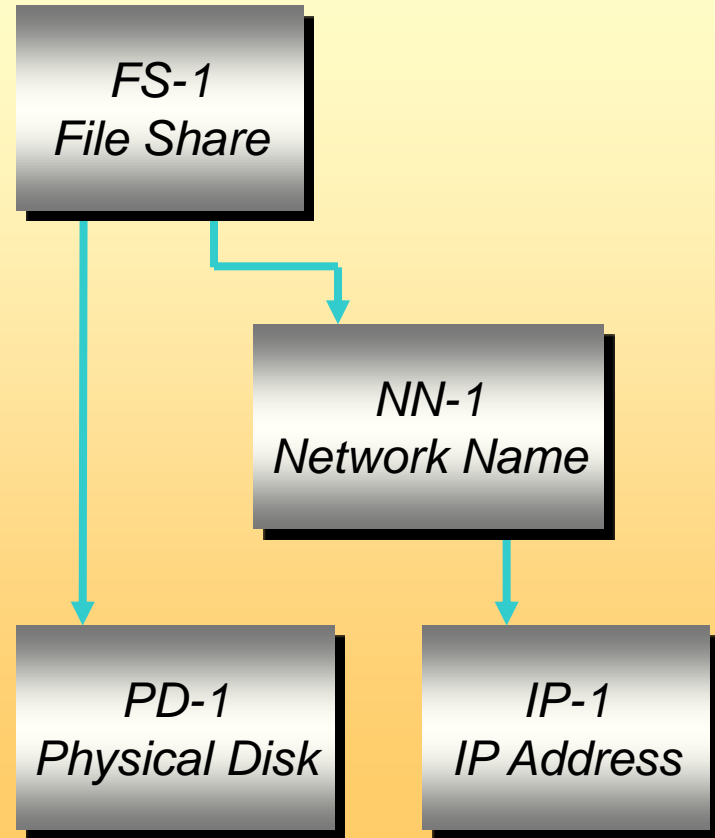


# Resource Dependencies

*Recommended  
Vertical  
Dependency*



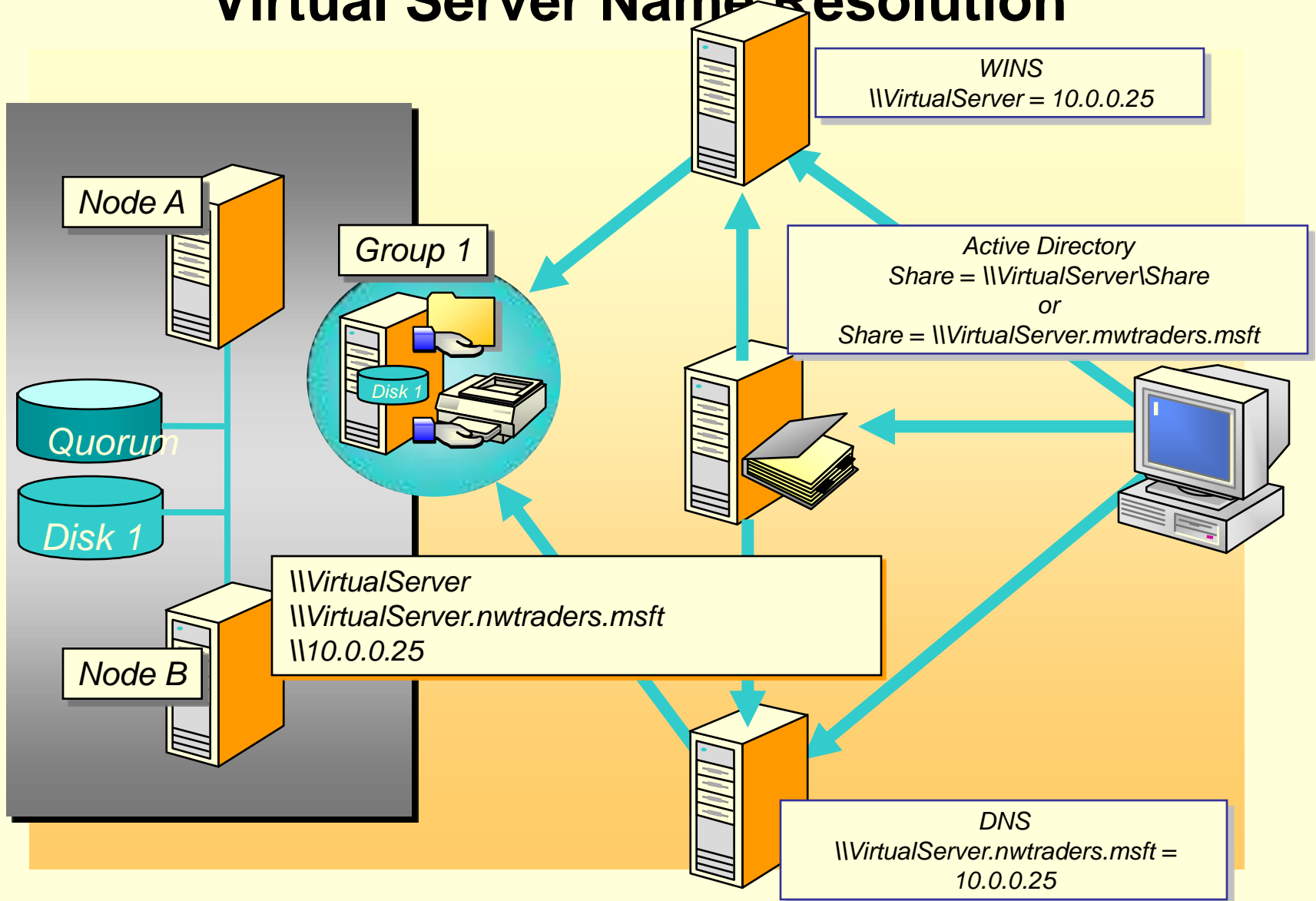
*Not Recommended  
Forking Dependency*



# Virtual Servers

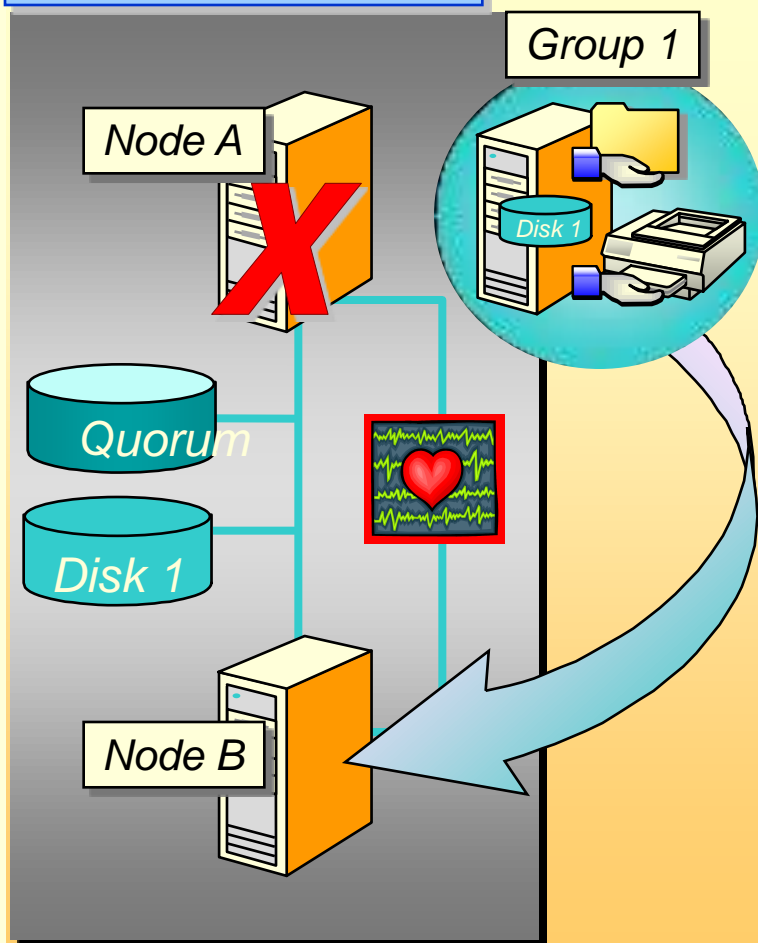
- Client Access to Virtual Servers
- Virtual Server Environment
  - Virtual Server Naming
  - Named Pipe Remapping
  - Registry Replication

# Virtual Server Name Resolution

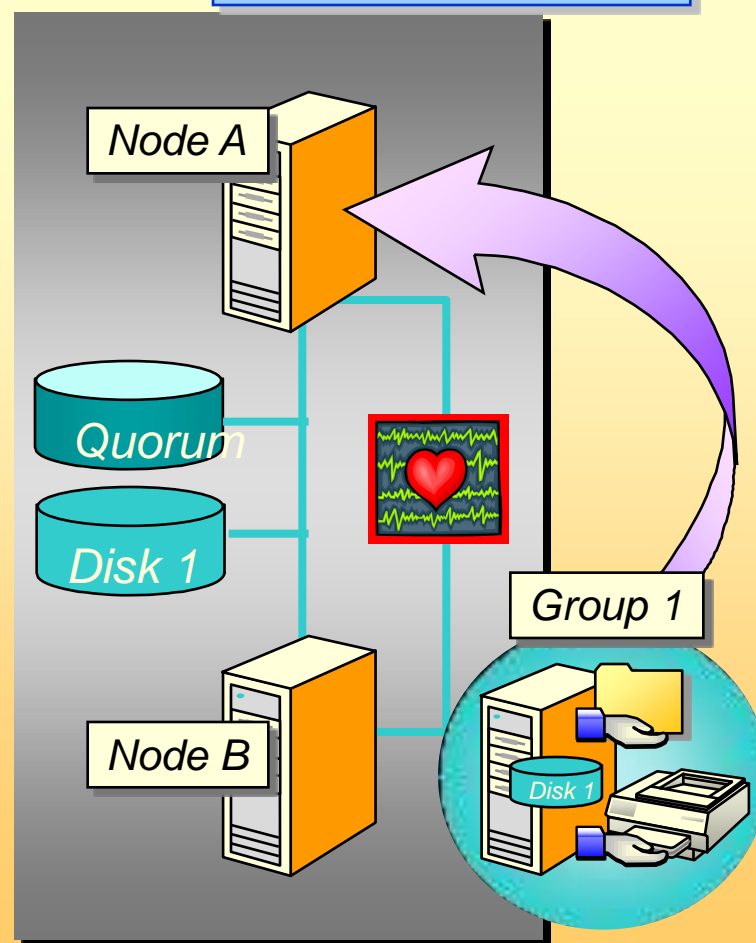


# Failover and Failback







*Failover*



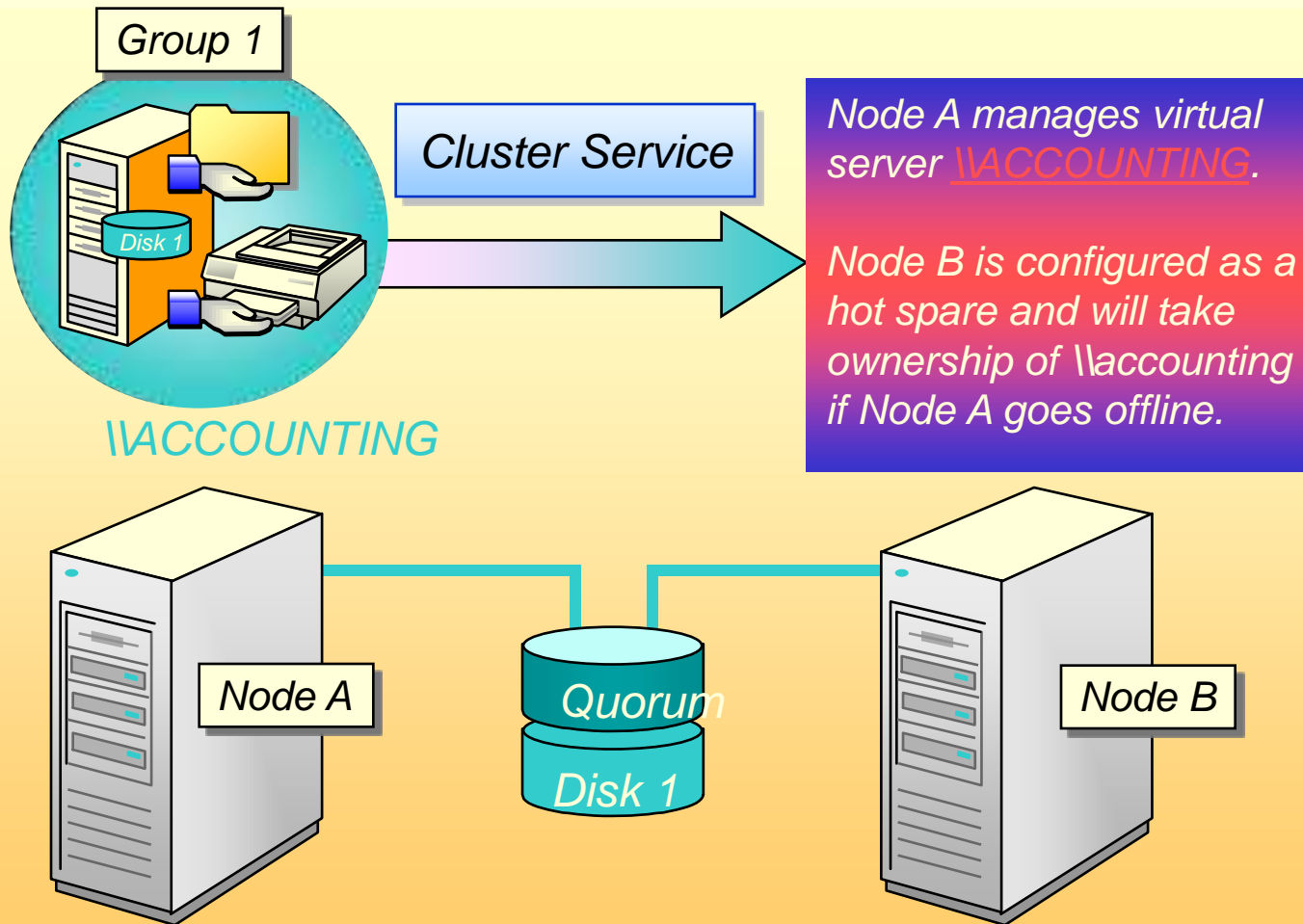
*Failback*



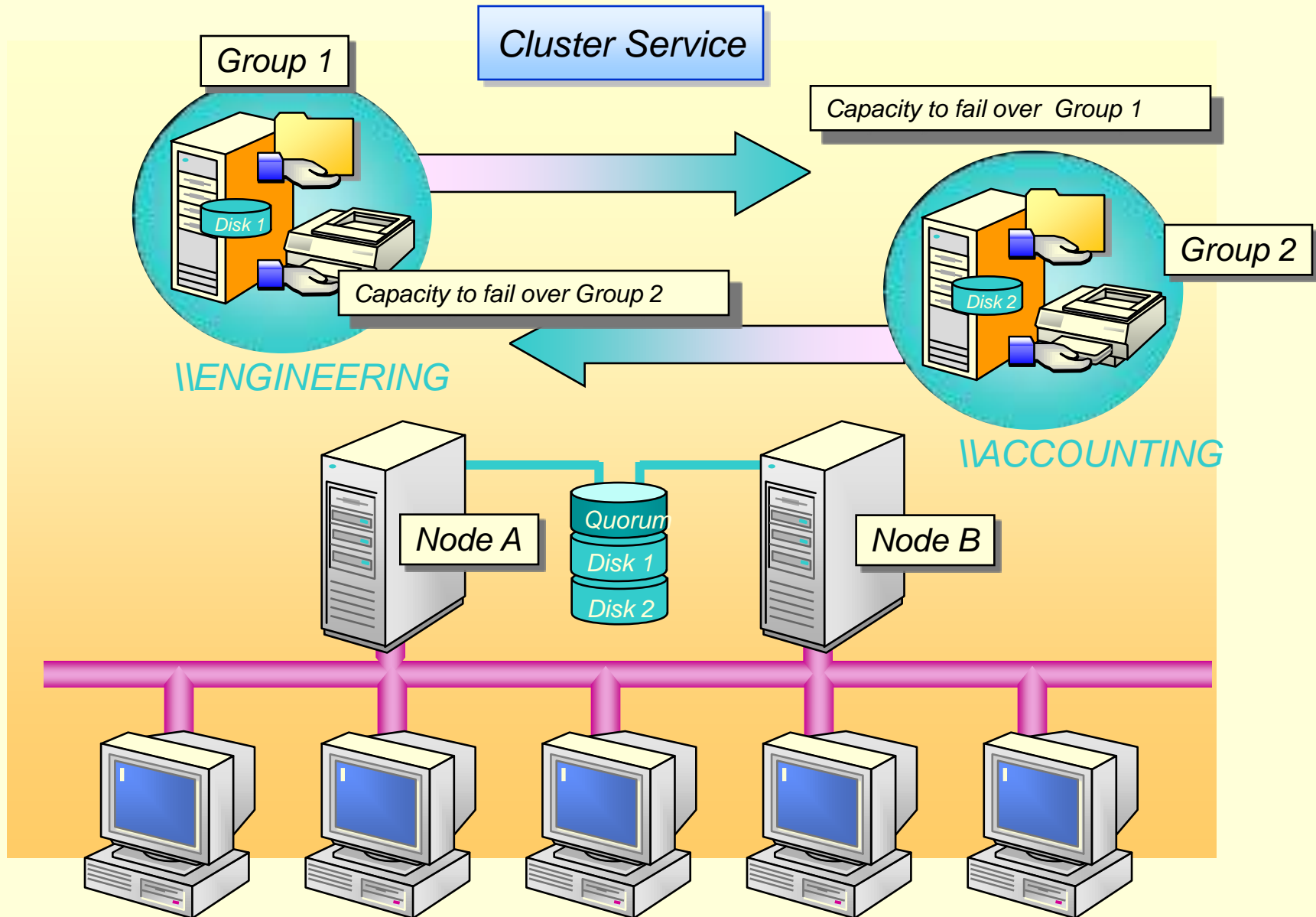
## ◆ Choosing a Server Cluster Configuration

<i>Virtual Server</i>	<i>Failover Capability</i>	<i>Performance Considerations</i>	<i>Cluster Configuration</i>
			<i>No Cluster Needed</i>
			<i>Single Node Virtual Server</i>
			<i>Active/Passive</i>
			<i>Active/Active</i>

# Active/Passive Configuration

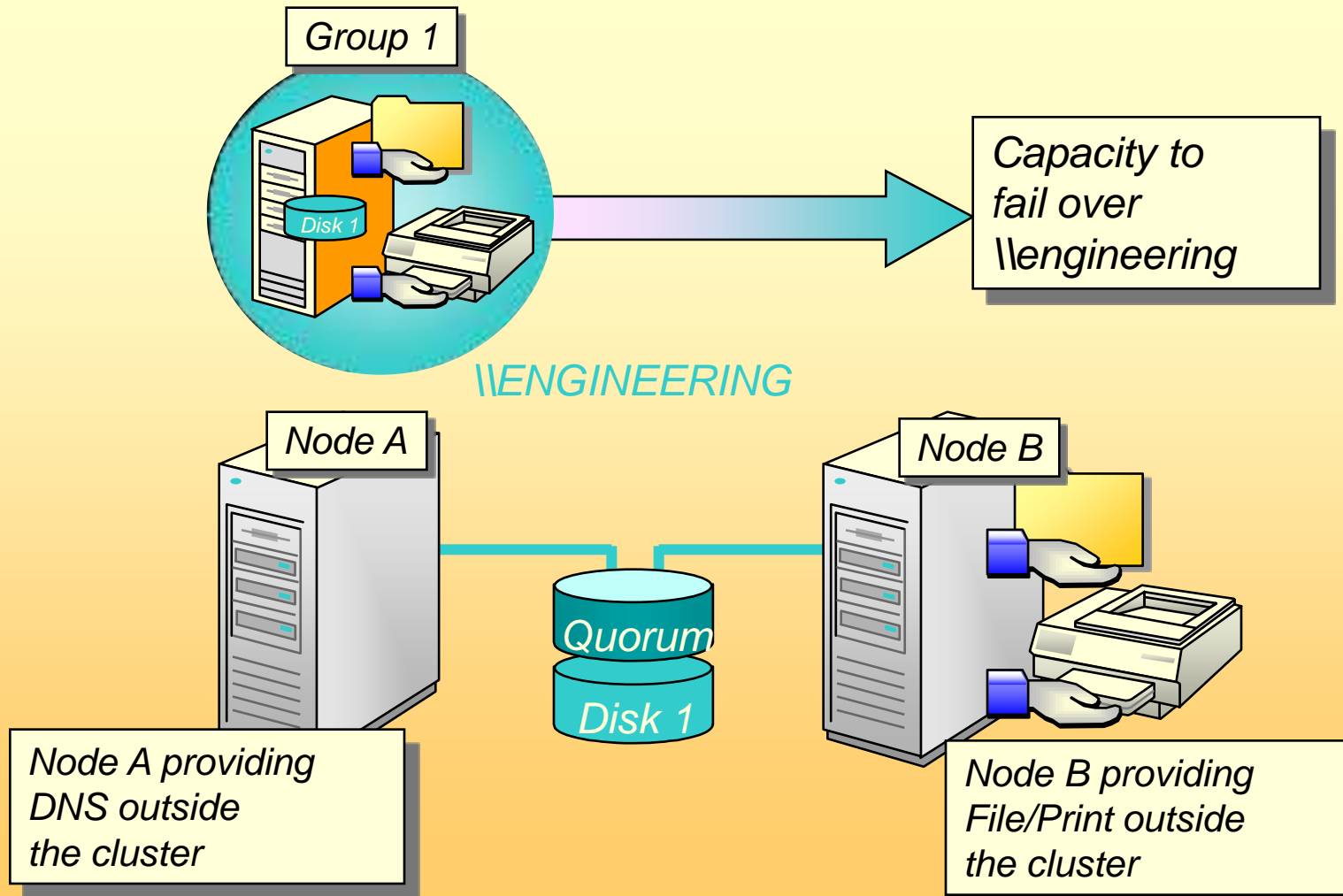


# Active/Active Configuration

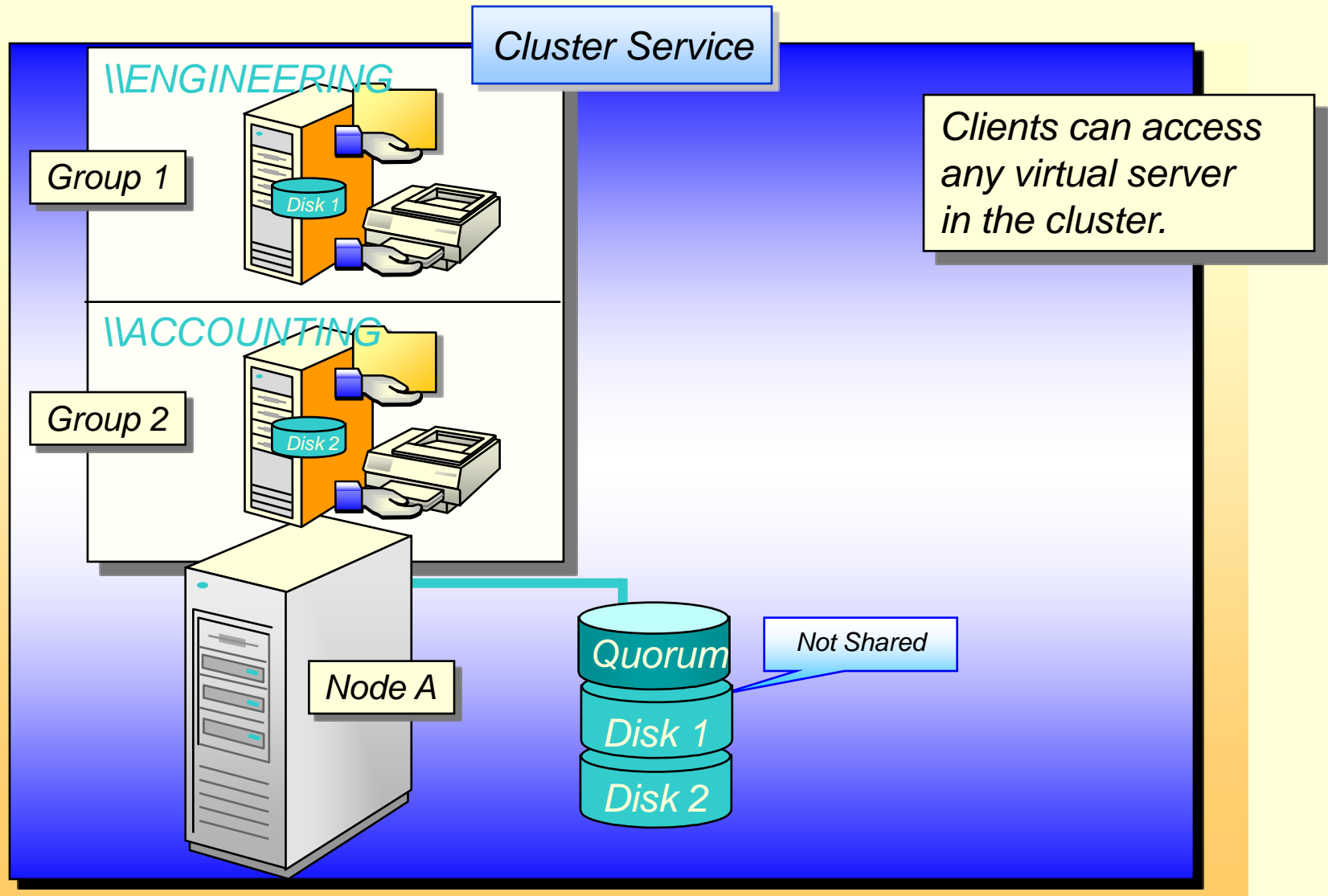




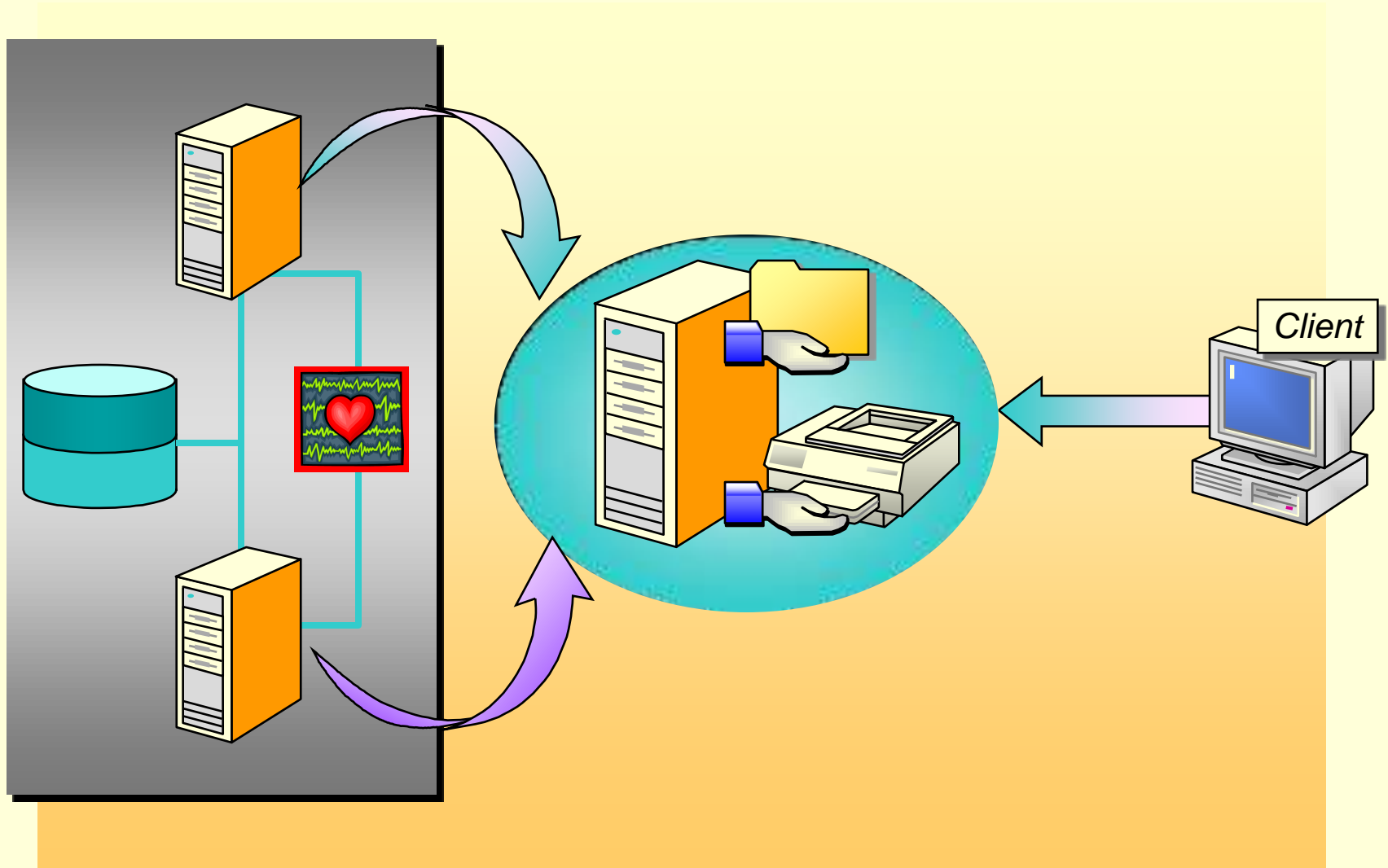
# Hybrid Configuration



# Single Node Virtual Server

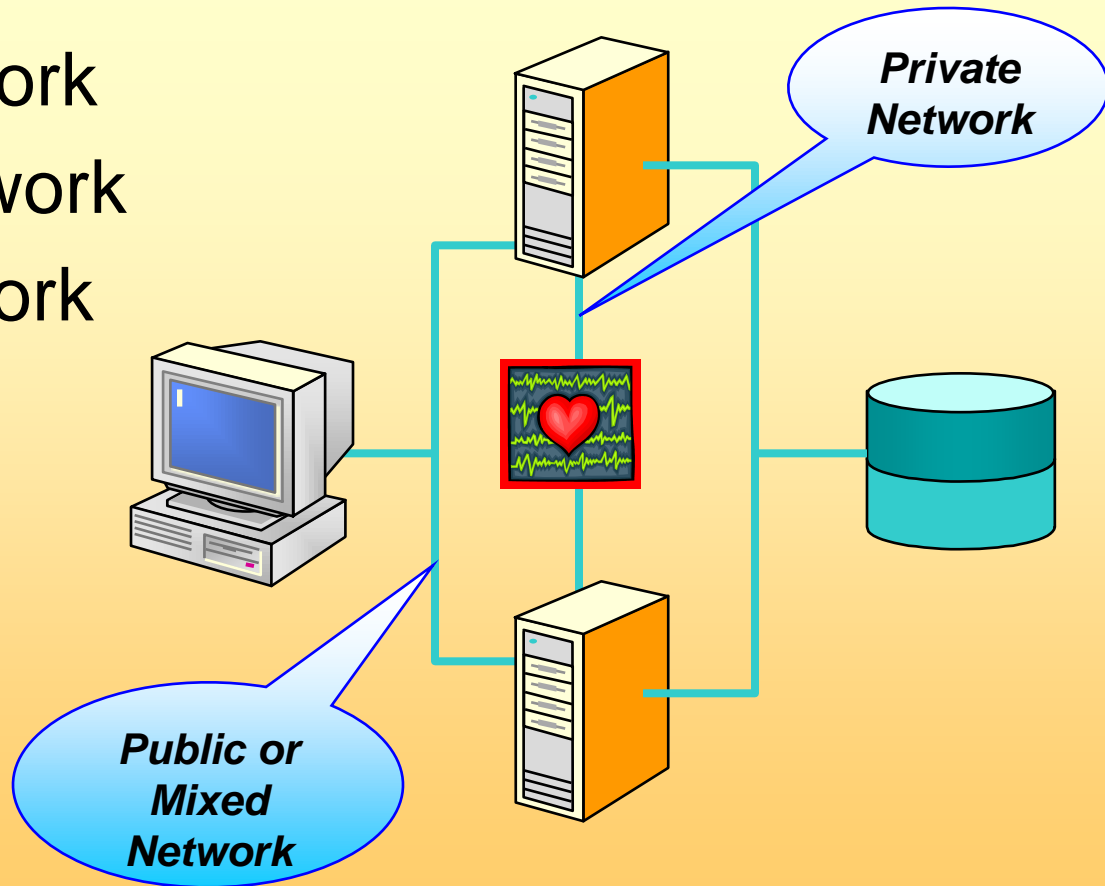


# File and Print Shares



# Cluster Network Requirements

- Public Network
- Private Network
- Mixed Network



# Cluster Disk Requirements

- All Disks on Shared Bus
- Disks Can Be Seen from All Nodes
- Basic Disks, not Dynamic
- All Disk Partitions must be NTFS
- Hardware RAID not Software RAID

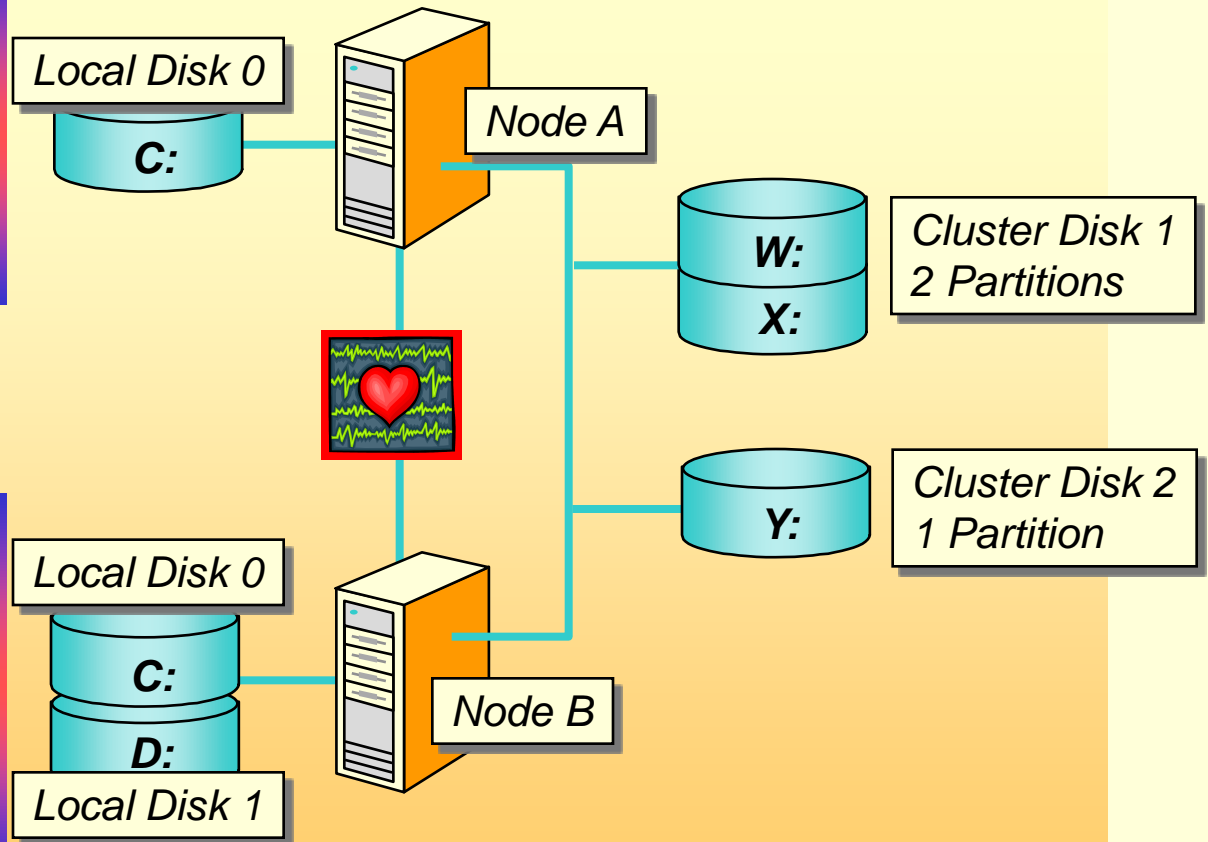
# Data Storage Requirements

## Node A Disk Configuration:

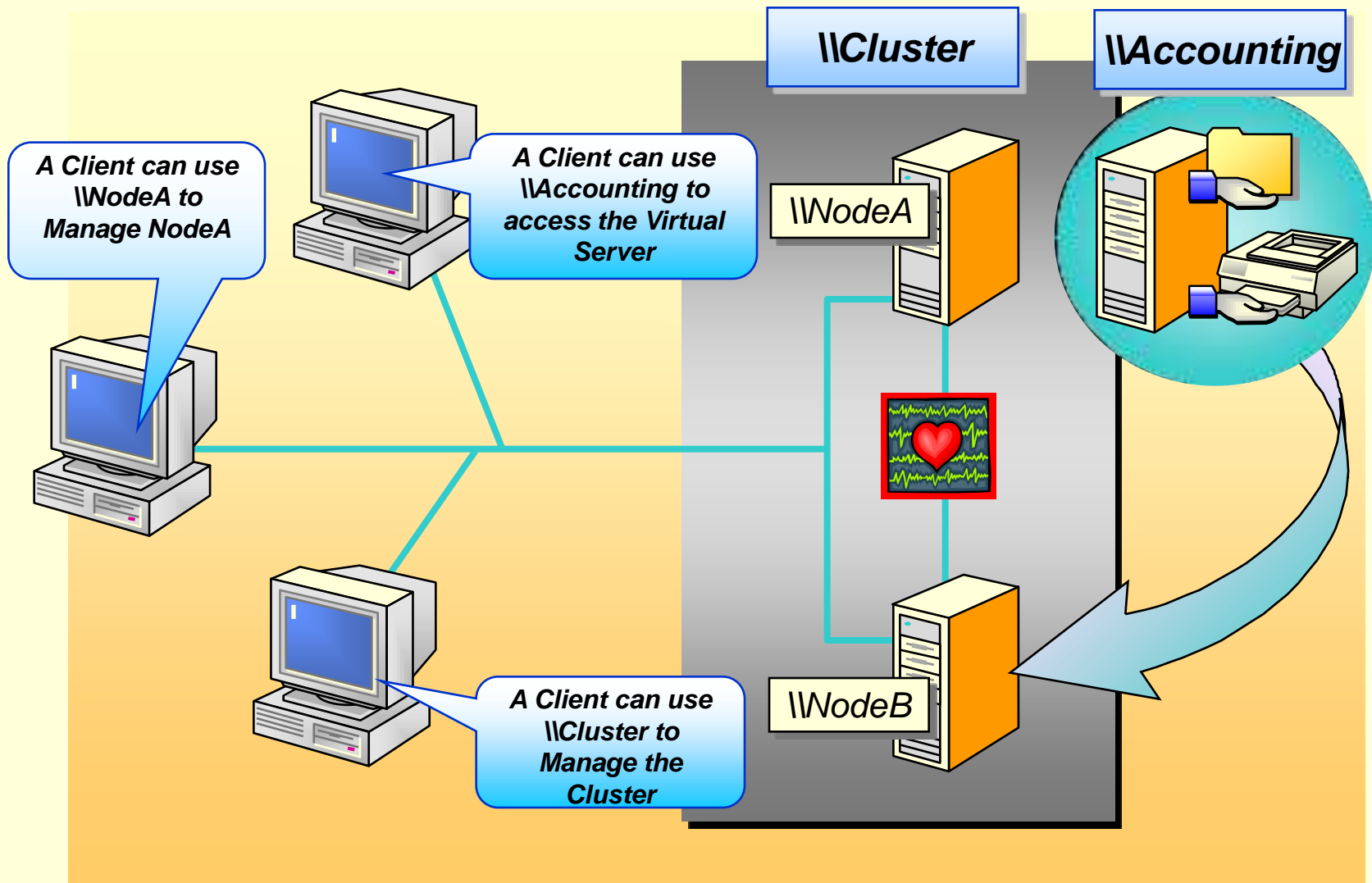
C: = Local Disk 0  
W: = Cluster Disk 1  
X: = Cluster Disk 1  
Y: = Cluster Disk 2

## Node B Disk Configuration:

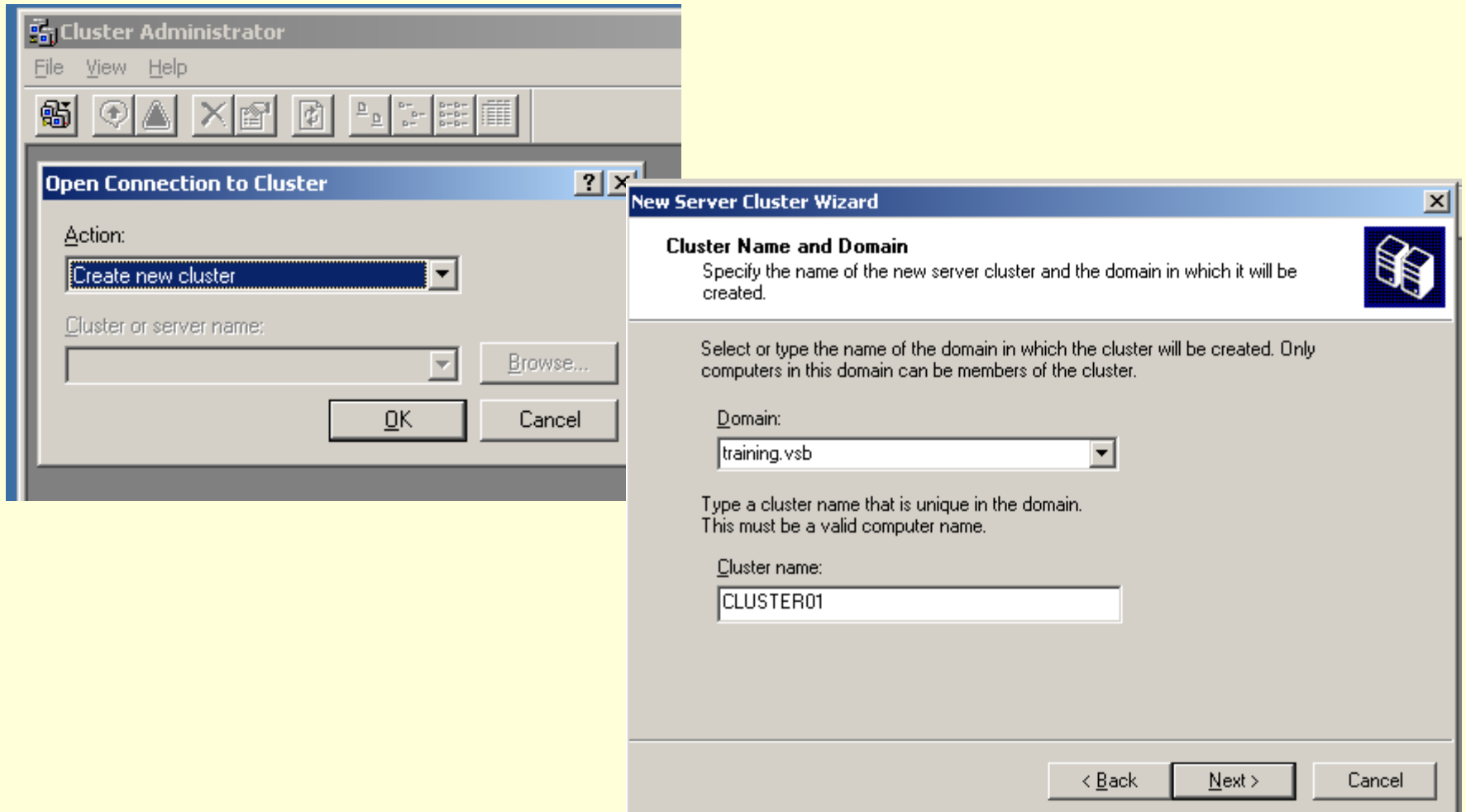
C: = Local Disk 0  
D: = Local Disk 1  
W: = Cluster Disk 1  
X: = Cluster Disk 1  
Y: = Cluster Disk 2



# Assigning Names Within a Cluster

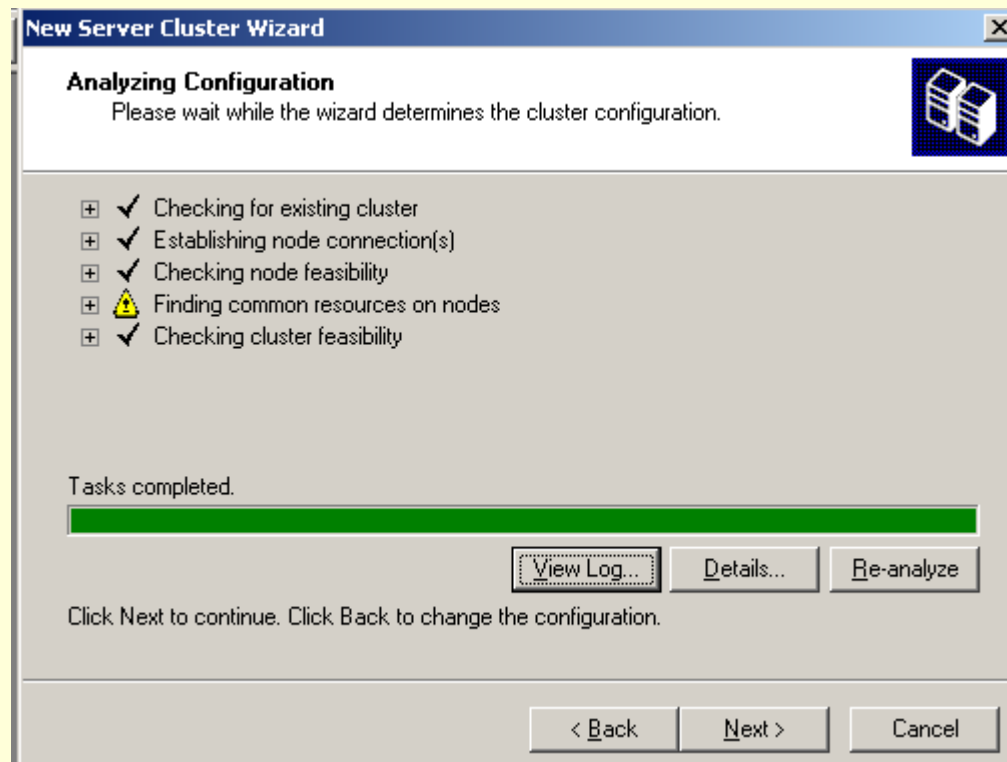


# Installing Cluster Service

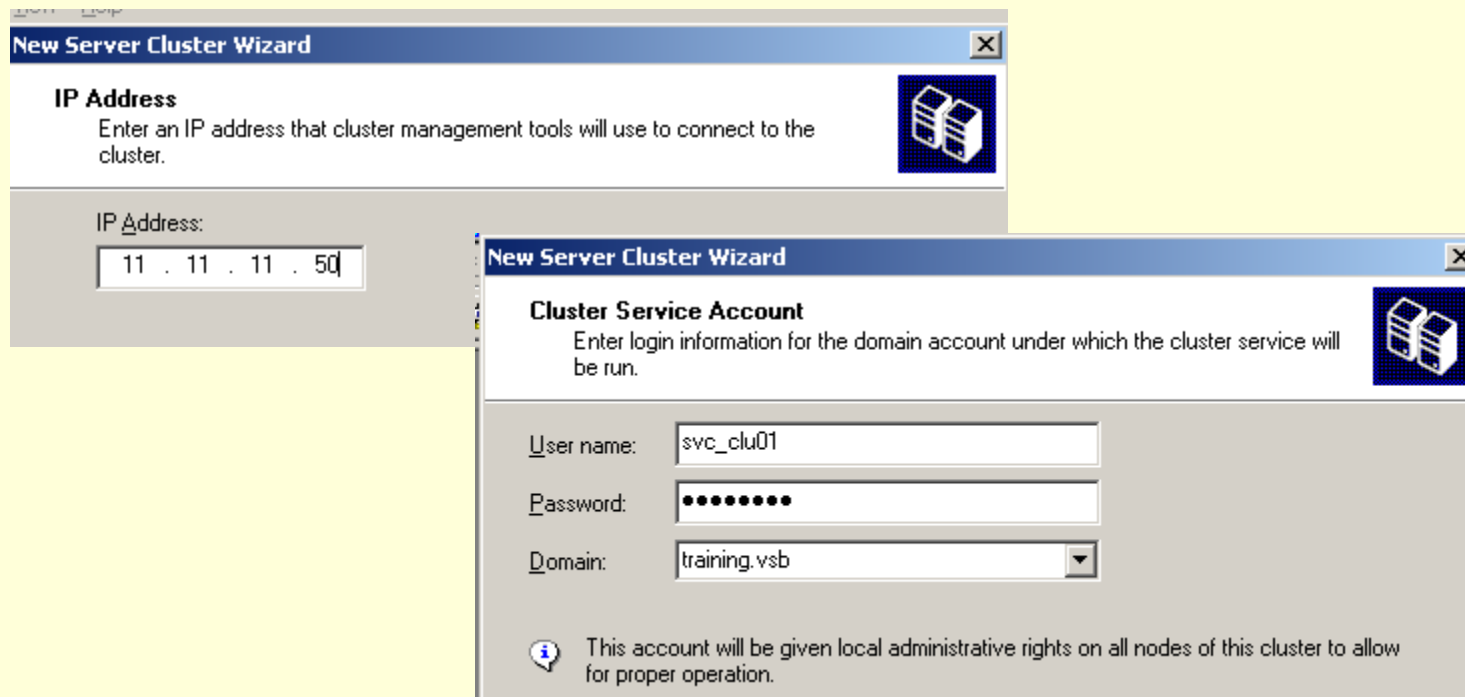




# Initial configuration check



# IP, Cluster Service Account



**New Server Cluster Wizard**

**IP Address**  
Enter an IP address that cluster management tools will use to connect to the cluster.

IP Address: 11 . 11 . 11 . 50


**New Server Cluster Wizard**

**Cluster Service Account**  
Enter login information for the domain account under which the cluster service will be run.

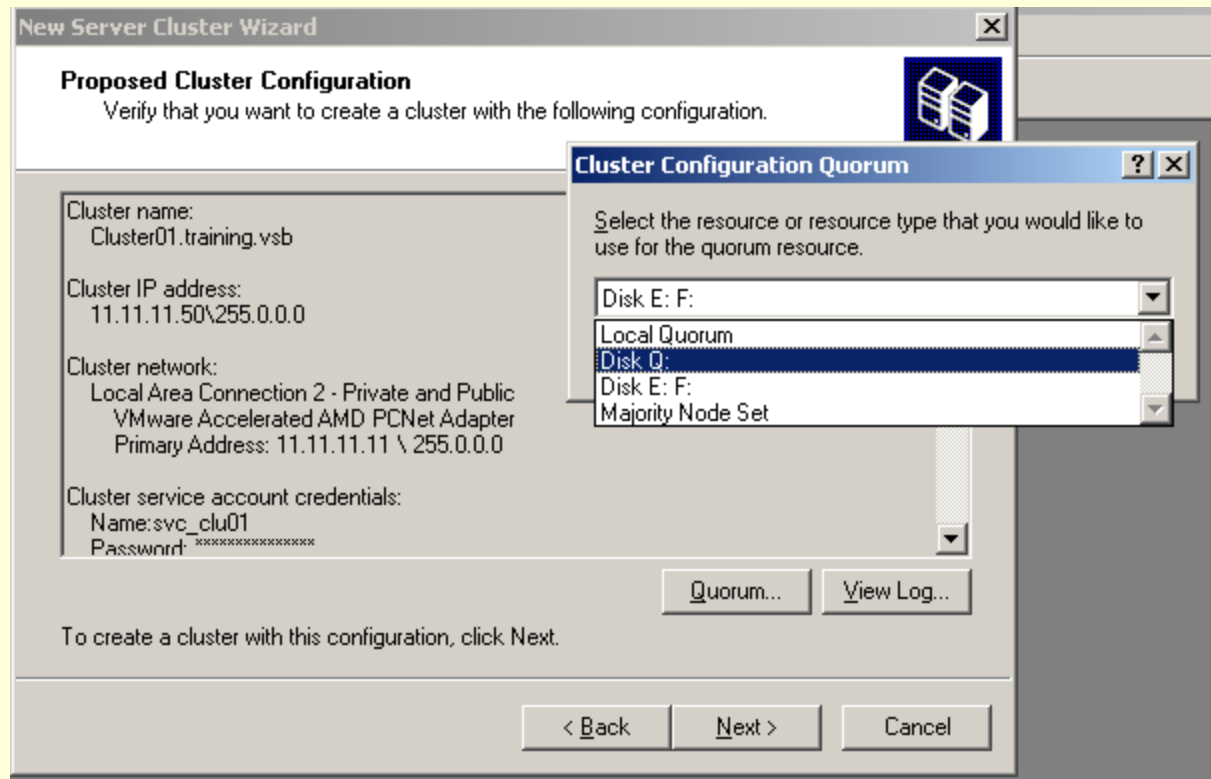
User name: svc\_clu01

Password: ••••••••

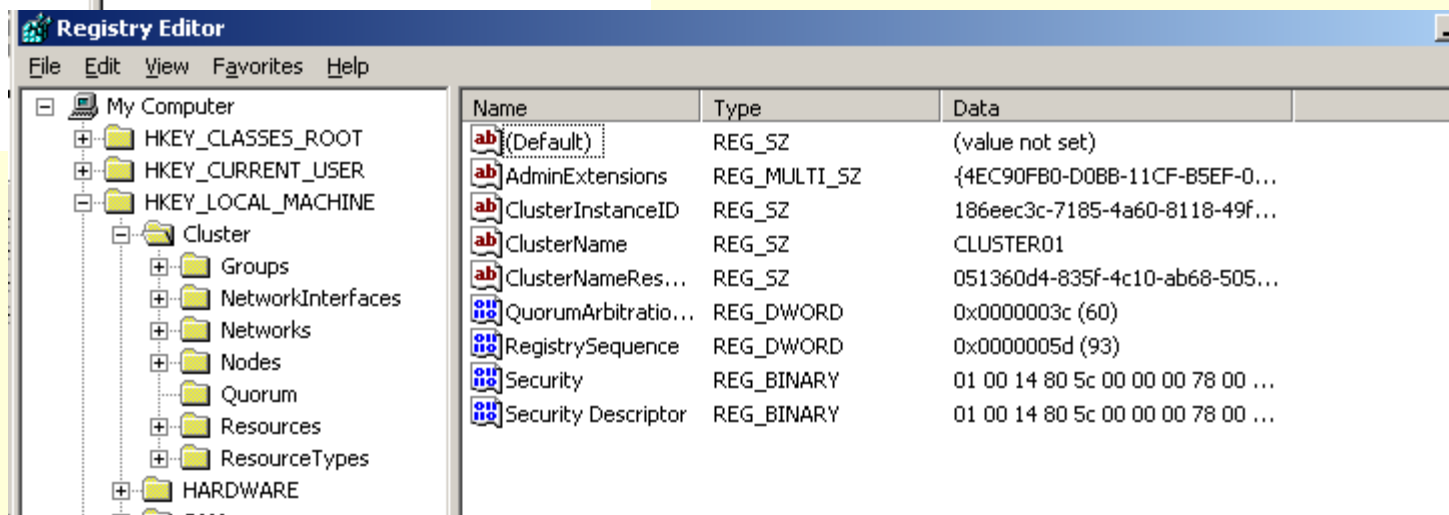
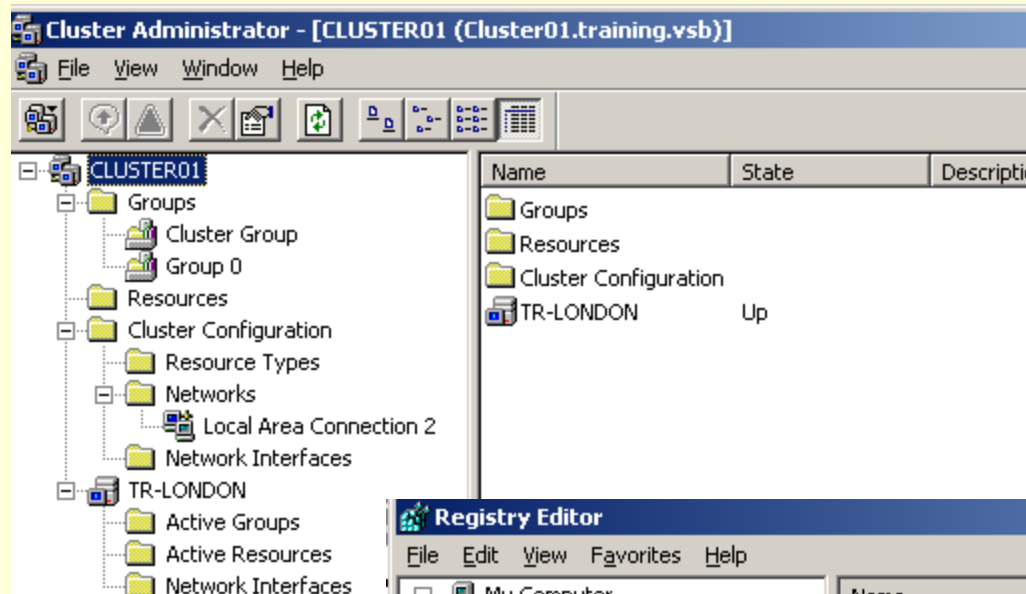
Domain: training.vsb

 This account will be given local administrative rights on all nodes of this cluster to allow for proper operation.

# Verify settings, Quorum selection

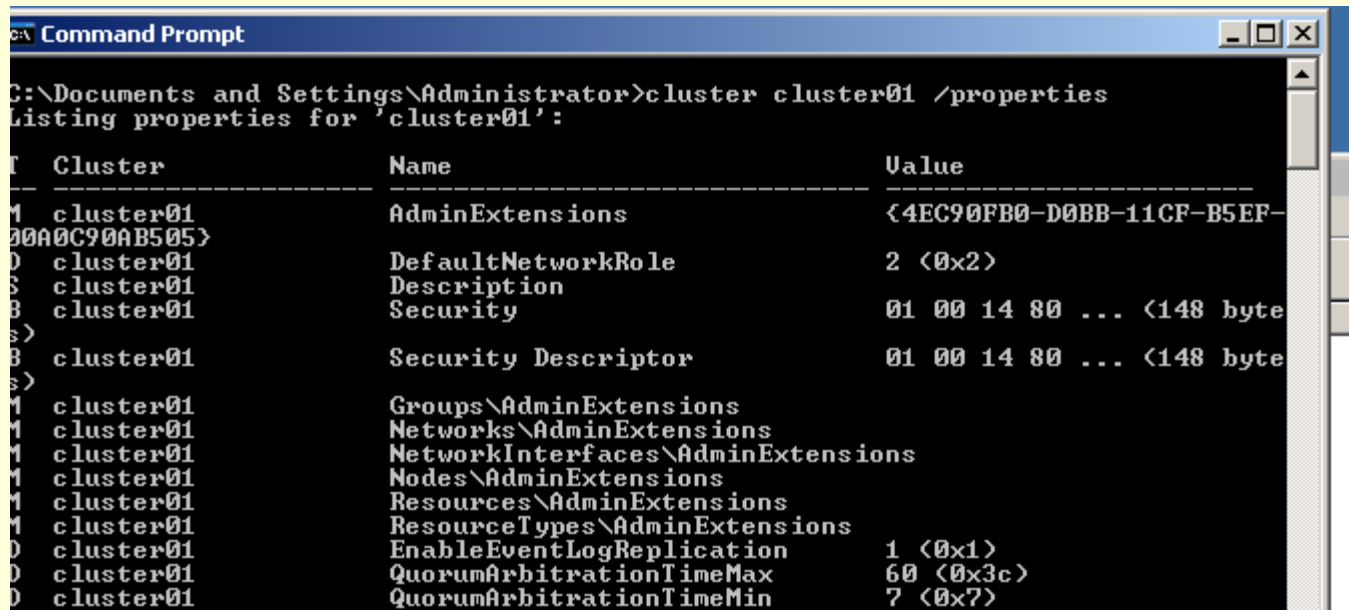


# New Cluster, Registry settings



# Administration Tools

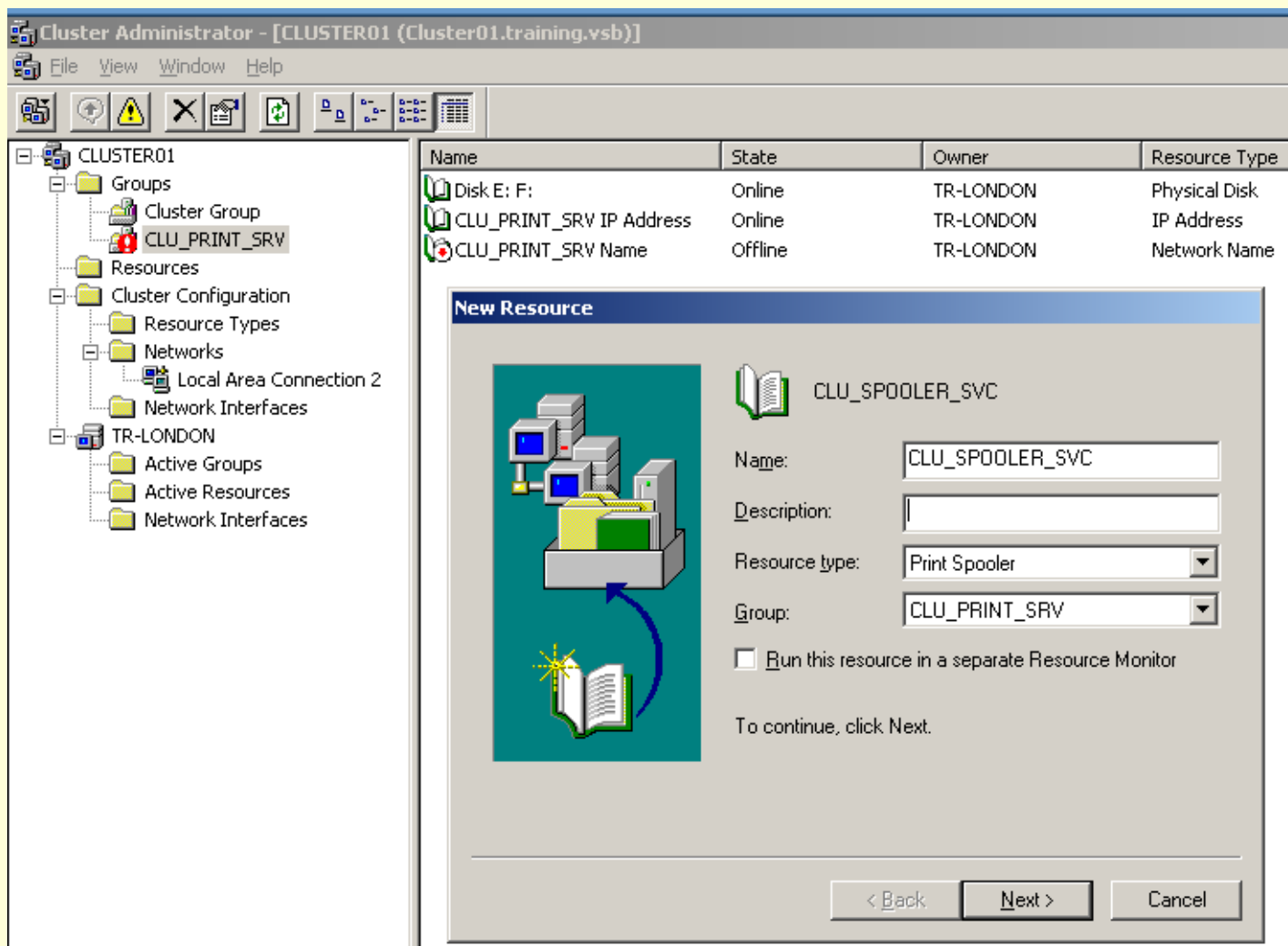
- Using Cluster.exe
- Using Cluadmin.exe



```
C:\Documents and Settings\Administrator>cluster cluster01 /properties
Listing properties for 'cluster01':
```

Cluster	Name	Value
cluster01	AdminExtensions	<4EC90FB0-D0BB-11CF-B5EF-00A0C90AB505>
cluster01	DefaultNetworkRole	2 (0x2)
cluster01	Description	
cluster01	Security	01 00 14 80 ... (148 byte)
cluster01	Security Descriptor	01 00 14 80 ... (148 byte)
cluster01	Groups\AdminExtensions	
cluster01	Networks\AdminExtensions	
cluster01	NetworkInterfaces\AdminExtensions	
cluster01	Nodes\AdminExtensions	
cluster01	Resources\AdminExtensions	
cluster01	ResourceTypes\AdminExtensions	
cluster01	EnableEventLogReplication	1 (0x1)
cluster01	QuorumArbitrationTimeMax	60 (0x3c)
cluster01	QuorumArbitrationTimeMin	7 (0x7)

# Creating virtual server



Správa počítačových systémů  
(SPS)

# Resources properties

The screenshot displays the Cluster Administrator interface for a cluster named CLUSTER01. The left pane shows a tree view with folders for Groups, Resources, Cluster Configuration, Networks, and TR-LONDON. The right pane shows a list of resources with columns for Name, State, Owner, Resource Type, and Description. A dialog box titled 'CLU\_SPOOLER\_SVC Properties' is open, showing the General tab. The dialog contains fields for Name, Description, and Possible owners, along with a checkbox for 'Run this resource in a separate Resource Monitor'. At the bottom, there are buttons for OK, Cancel, and Apply.

Name	State	Owner	Resource Type	Description
Disk E: F:	Online	TR-LONDON	Physical Disk	
CLU_PRINT_SRV IP Address	Online	TR-LONDON	IP Address	
CLU_PRINT_SRV Name	Online	TR-LONDON	Network Name	
CLU_SPOOLER_SVC	Online	TR-LONDON	Print Spooler	

**CLU\_SPOOLER\_SVC Properties**

General | Dependencies | Advanced | Parameters

CLU\_SPOOLER\_SVC

Name:

Description:

Possible owners:

☐ Run this resource in a separate Resource Monitor


Resource type: Print Spooler  
Group: CLU\_PRINT\_SRV  
State: Online Pending  
Node: TR-LONDON

Správa počítačových systémů  
(SPS)

# Resources properties



**CLU\_SPOOLER\_SVC Properties**

General Dependencies Advanced Parameters

 CLU\_SPOOLER\_SVC


Specify which resources the Cluster Service must bring online before this resource can be brought online.

Resource dependencies:

Name	Resource Type
 CLU_PRINT_SRV Name	Network Name
 Disk E: F:	Physical Disk

**CLU\_SPOOLER\_SVC Properties**

General Dependencies Advanced Parameters

 CLU\_SPOOLER\_SVC

☐ Do not restart

☒ Restart

☒ Affect the group

Threshold:  Period:  seconds

"Looks Alive" poll interval:

☒ Use value from resource type

☐ Specify value:  milliseconds

"Is Alive" poll interval:


☒ Use value from resource type

☐ Specify value:  milliseconds

Pending timeout:  seconds

**CLU\_PRINT\_SRV IP Address Properties**

General Dependencies Advanced Parameters

 CLU\_PRINT\_SRV IP Address

Address:

Subnet mask:

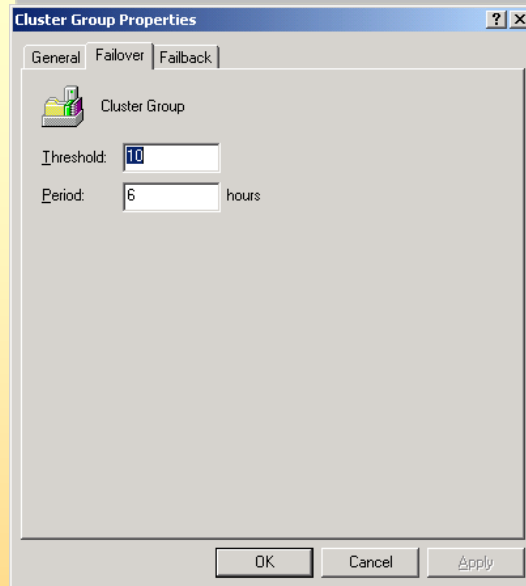
Network:

☒ Enable NetBIOS for this address



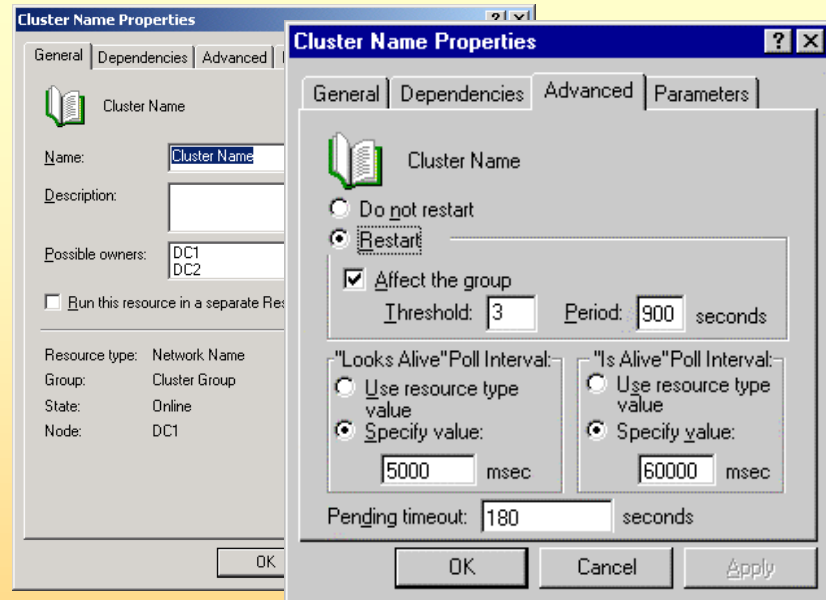
# Configuring Failover

## Group Configuration



Cluster Group Properties dialog box, Failover tab. The dialog shows a 'Cluster Group' icon and two input fields: 'Threshold' set to 10 and 'Period' set to 6 hours. At the bottom are 'OK', 'Cancel', and 'Apply' buttons.

## Resource Configuration



Two overlapping Cluster Name Properties dialog boxes. The background box shows the 'Dependencies' tab with fields for 'Name' (Cluster Name), 'Description', 'Possible owners' (DC1, DC2), and a checkbox for 'Run this resource in a separate Res'. The foreground box shows the 'Advanced' tab with radio buttons for 'Do not restart' and 'Restart' (selected). Under 'Restart', there is a checked checkbox for 'Affect the group' and fields for 'Threshold' (3) and 'Period' (900 seconds). Below these are two sections for 'Poll Interval': 'Looks Alive' and 'Is Alive', each with 'Use resource type value' and 'Specify value' options. The 'Specify value' options are set to 5000 msec and 60000 msec respectively. A 'Pending timeout' field is set to 180 seconds. At the bottom are 'OK', 'Cancel', and 'Apply' buttons.

<b>Failover Configuration</b>	<b>Groups</b>	<b>Resources</b>
<b>Possible Owner</b>		<b>X</b>
<b>Failover Policy</b>	<b>X</b>	
<b>Restart Policy</b>		<b>X</b>

# Configuring Failback

## Group Configuration



<b><i>Failback Configuration</i></b>	<b><i>Groups</i></b>	<b><i>Resources</i></b>
<b><i>Preferred Owner</i></b>	<b><i>X</i></b>	
<b><i>Failback Policy</i></b>	<b><i>X</i></b>	

# Causing and Monitoring Failover

- Online
- Online Pending
- Offline
- Offline Pending
- Failed

# Microsoft BackOffice Applications

- Microsoft SQL Server Enterprise
- Microsoft Exchange Server Enterprise Edition
- Microsoft Internet Information Services (IIS)
- Message Queuing