To SAN or Not to SAN: When is the Best Time to Move to a Storage Network?

To SAN or Not to SAN

- Bill Denninger
  - Hewlett-Packard Company

Agenda

- Class Schedule
  - First Semester
    - Challenges
      - Mid Term
  - Second Semester
    - How To get There
      - Final
  - Capstone

What's in a Name?

- SAN = Storage Area Network
- NAS = Network Attached Storage

Or are they both members of a Storage Network?

Storage Network

The explosive growth of data and information

Need to implement a scalable, modular and open storage network not tied to specific systems or applications

First Quiz

- To SAN or Not to SAN

– Explosive Growth of data	YES	NO
– Need for Modular Storage	YES	NO
– Need for Scalable Storage	YES	NO

Goal

To create a single, centrally managed data repository that is securely accessible by any system, application or person across the entire company

The Shared Storage Challenge

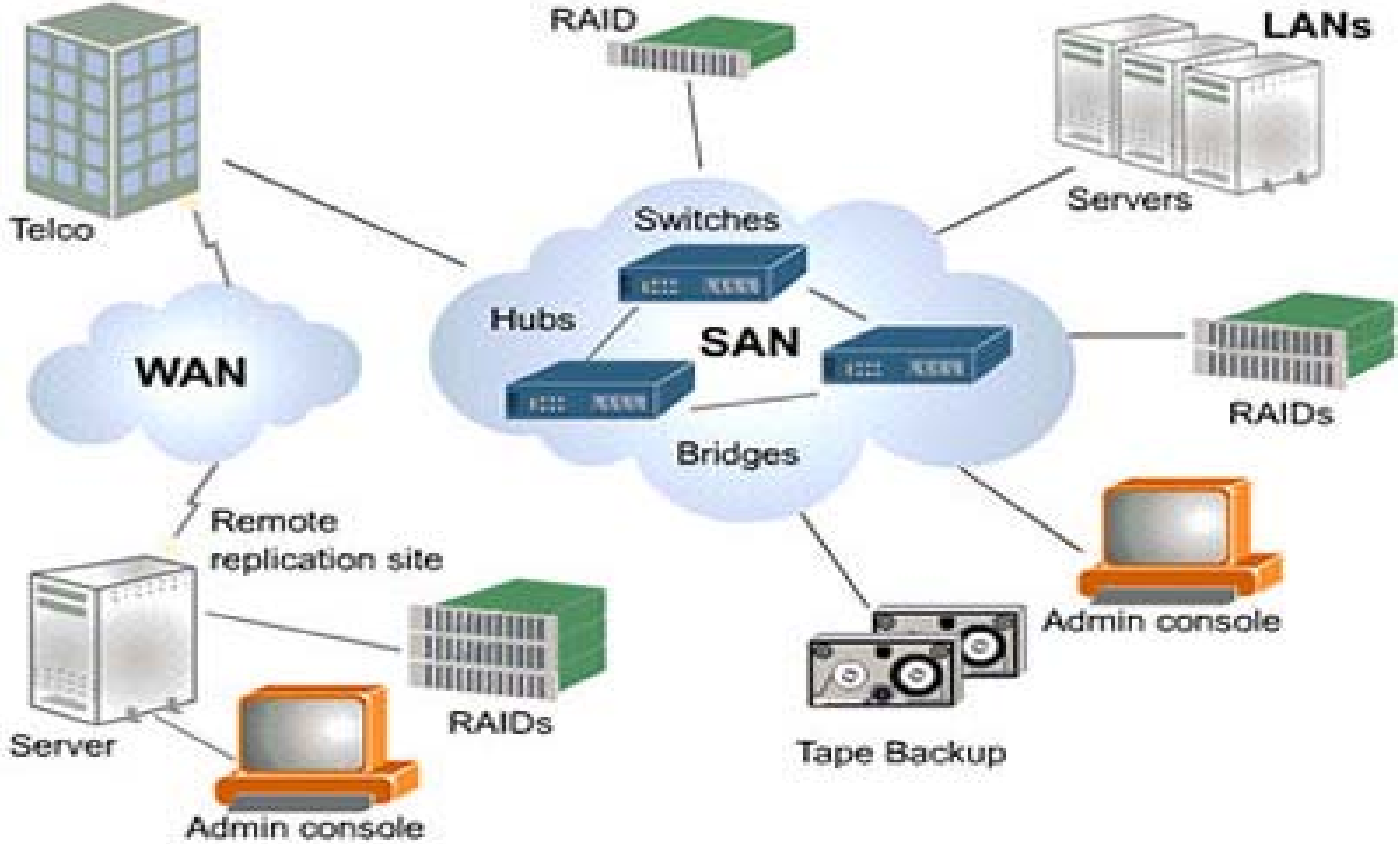
The addition of a SAN into your current environment means that you are now sharing the resources of your storage.

You may be sharing the resources not only with multiple servers but also with multiple Operating Systems, which do not necessarily share the same file structures.

Quiz 2

Can you move to Centrally managed Storage?

What is a Storage Network ?

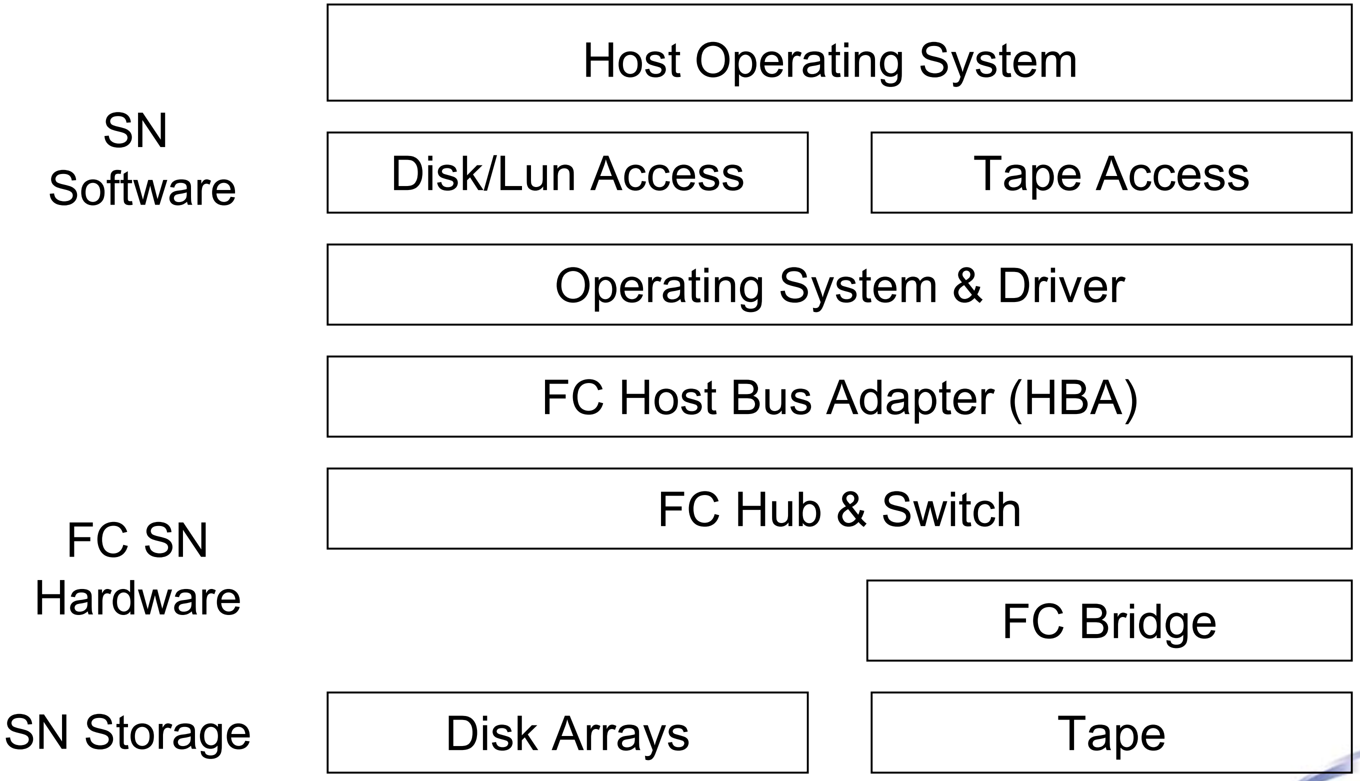

RAID
LANs
Telco
Switches
Servers
Hubs
SAN
WAN
RAIDs
Bridges
Remote
replication site
Admin console
RAIDs
Server
Tape Backup
Admin console

Storage Network

- A high availability, high-performance dedicated storage network that connects servers and storage in a secure, flexible and scalable architecture.
- A pool of storage devices that can be used by any host within the storage network.
- Fibre Channel is the lower level transport currently used, with SCSI-3 providing the upper layer protocol.

Storage Network

Components of a SN

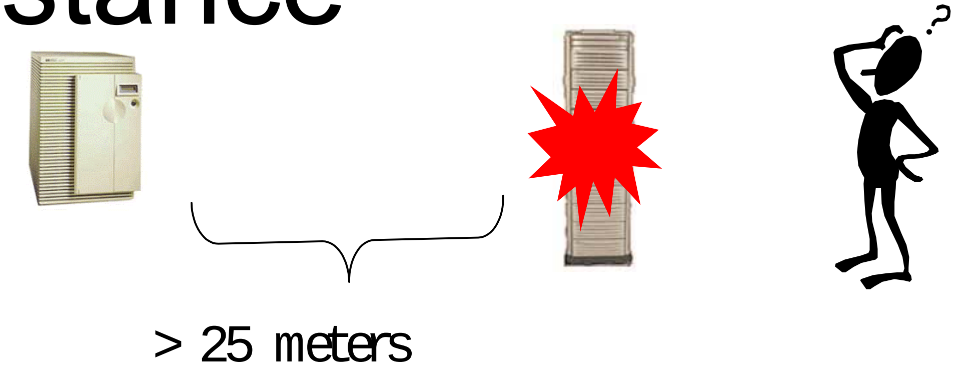

Host Operating System
SN Software
Disk/Lun Access
Tape Access
Operating System & Driver
FC Host Bus Adapter (HBA)
FC Hub & Switch
FC SN Hardware
FC Bridge
SN Storage
Disk Arrays
Tape

What Business Problems are solved by Storage Network?

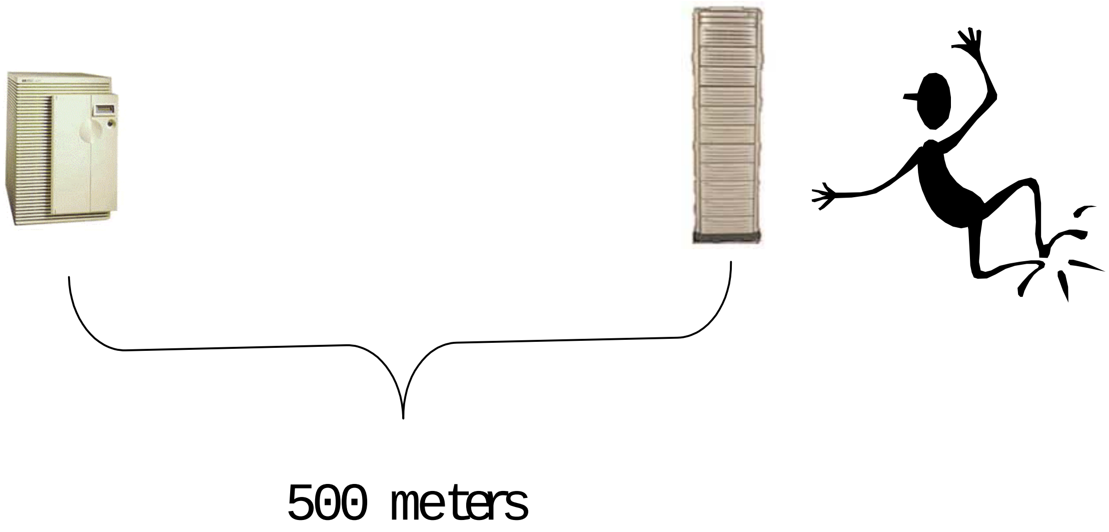
- **Distance** – short-wave or long-wave, inter-cabinet up to 10 km. Transcontinental solutions exist also.
- **Performance** – Far greater performance than legacy SCSI.
- **Connectivity** – scalable from 2 to 14,000,000 ports in one system, with multiple topology choices
- **I/O operations** – multiple protocols on a single interface. Full-duplex operation is possible.
- **Manageability –** Elimination of Storage ‘Silos’
- **Investment Protection**
  - Serverless Backup
  - Tape Library Sharing
  - Port Consolidation

Distance

- SCSI is limited to 25m

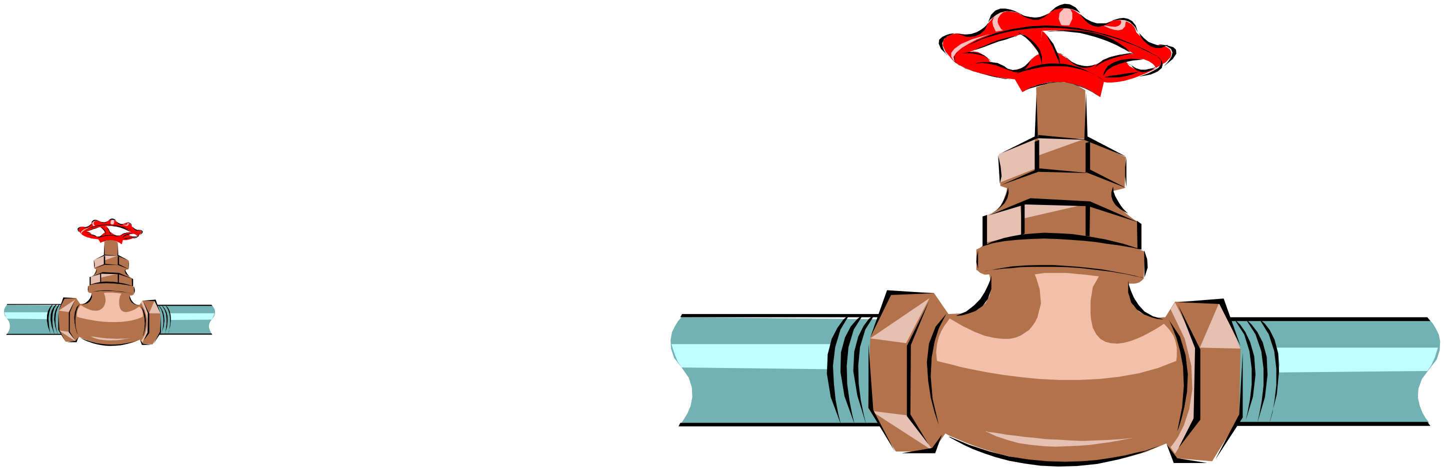


- A FC cable can span 500m between host and device
    - Further if switches are used

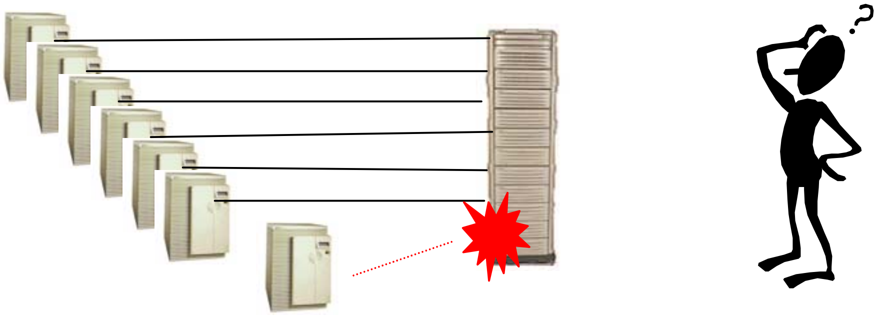


Performance

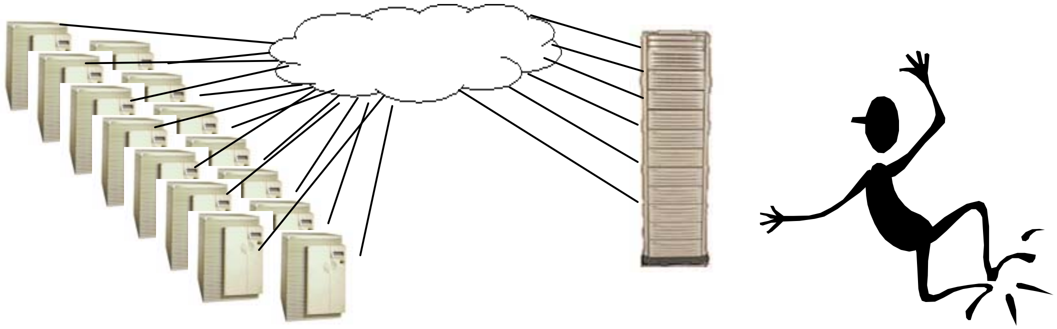
- Fibre supports 2Gb/sec – 200MB/sec
- Four to five times faster than SCSI
- Fibre Channel is a full-duplex protocol



Connectivity



- SCSI storage is host-centric; One hba to one storage adapter.



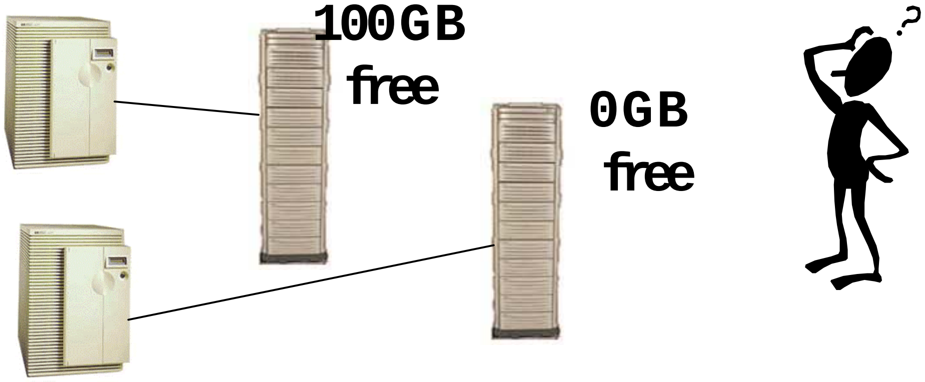
- SNs allow many more hosts to connect to a storage subsystem, leveraging the storage investment.

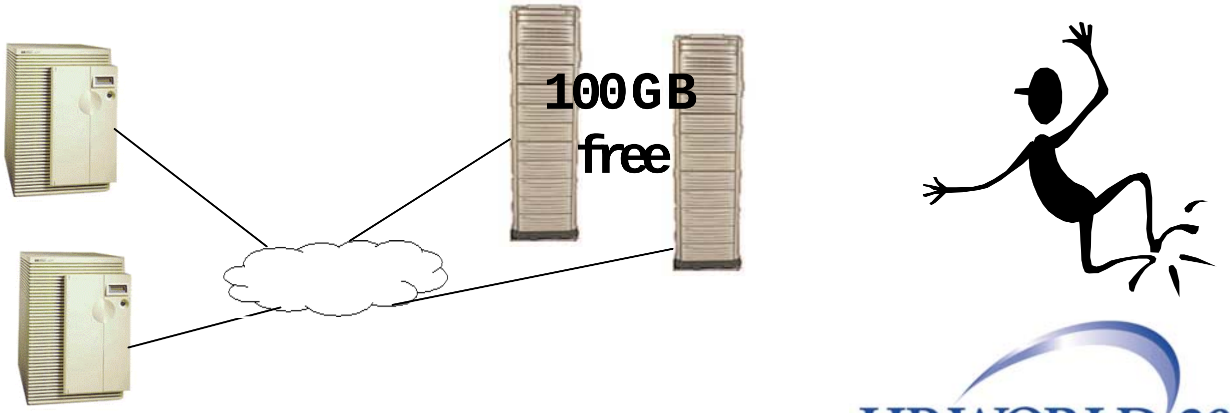
I/O Operations

- Provides communication between system units and storage devices
- Transports existing protocols
  - SCSI
  - IP
  - HIPPI
  - IPI
  - IEEE 802.2
- All on a single Host Bus Adapter (HBA)!

Elimination of Storage Silos

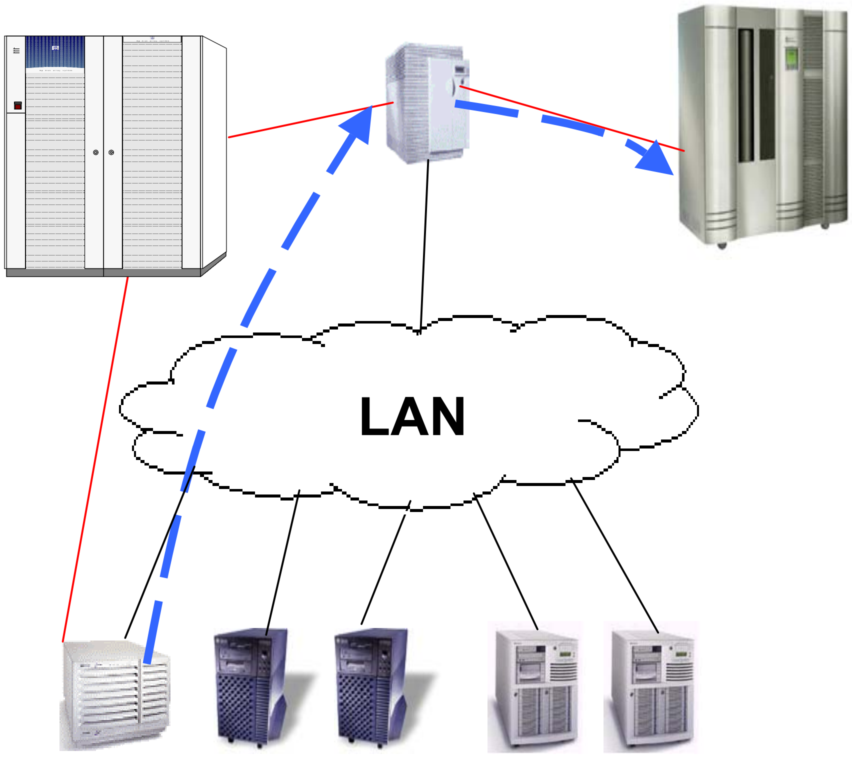
- Storage resources are pooled in a SN


100GB free
0GB free
?



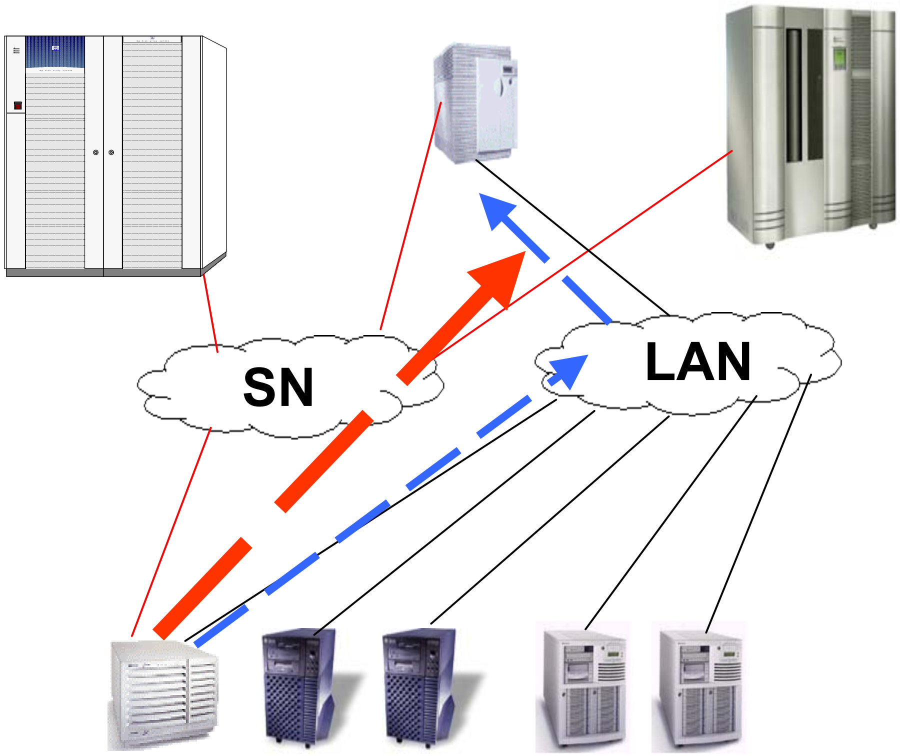
LAN Backup … Current state

- Legacy LAN Backup
  - LAN Bandwidth is small, and congested.
  - Shrinking backup windows.
  - All data is passed over the messaging network (LAN).
  - All data passes through the backup server host



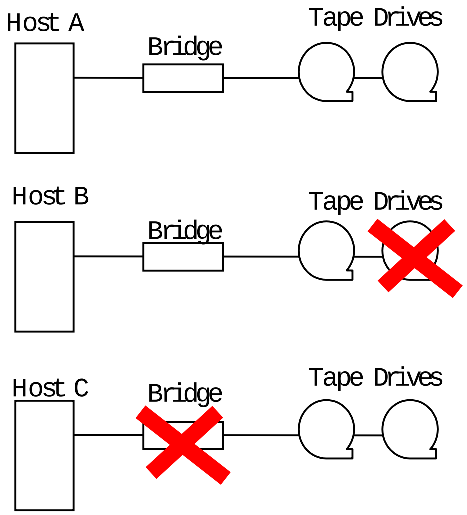
LAN free Backup via SN

- **LAN-free Backup**
- **Messaging network is used to pass metadata only from backup client to backup server.**
- **Backup Client data is passed directly from SN attached disk to SN attached tape.**



Tape Library Sharing: Tapes are not shared.

When Tape drives are not shared:


Host A
Bridge
Tape Drives
Host B
Bridge
Tape Drives
Host C
Bridge
Tape Drives

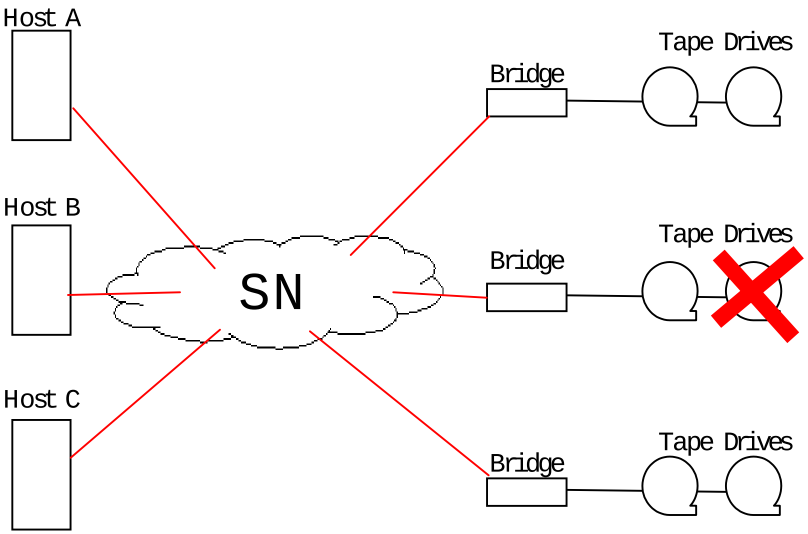
- **Any single tape drive failure will reduce a host’s tape capabilities by 50%.**

- **A bridge failure will eliminate all tape access to a single host!**

Tape Library Sharing: Shared drives

When Tape drives are shared on a network:

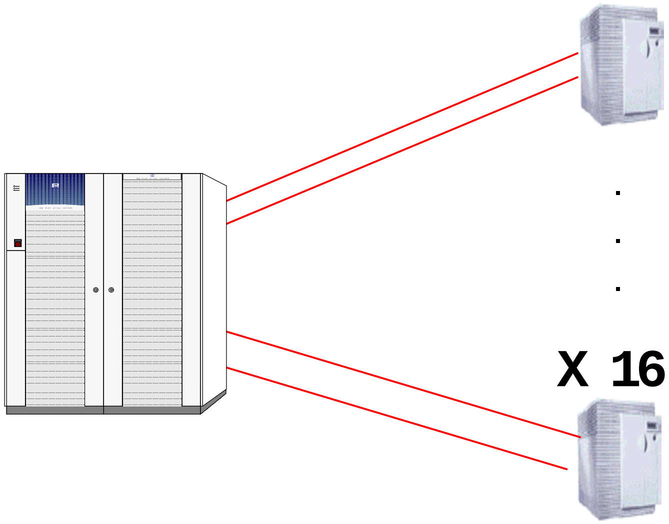
- **The elimination of any hardware component has a much smaller impact on host tape access.**


Host A
Host B
Host C
SN
Bridge
Bridge
Bridge
Tape Drives
Tape Drives
Tape Drives

Port Consolidation: Direct Attach w/o Switches

Number of interfaces on a disk array dictate the number of hosts.

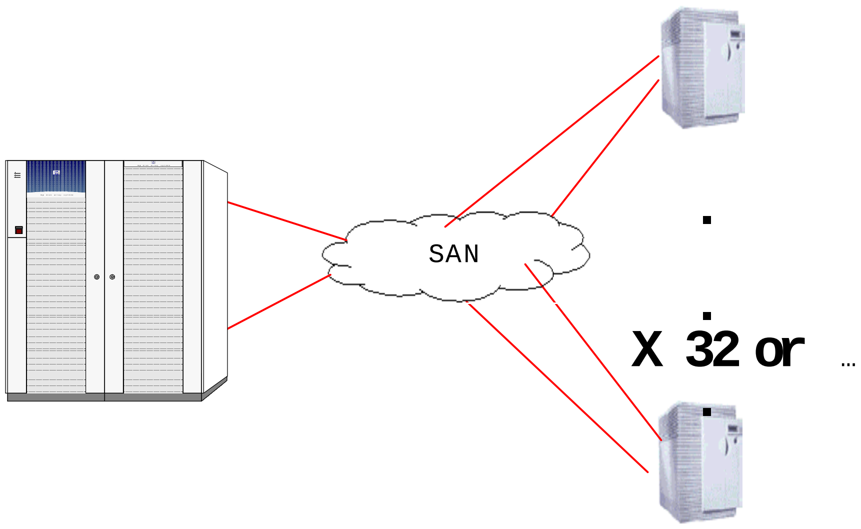
- **Traditionally, a one-to-one relationship between HBAs and FCAs.**
- **Low-bandwidth hosts require FCA's**



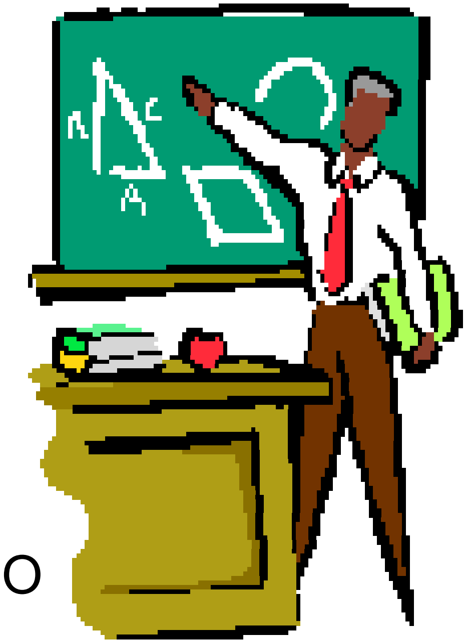
Port Consolidation: Many-to-one connections possible

Fewer disk interfaces required.

- **Multiple hosts may share the same FCA, yielding many host connections for each disk connection.**
- **LUN masking or security required.**

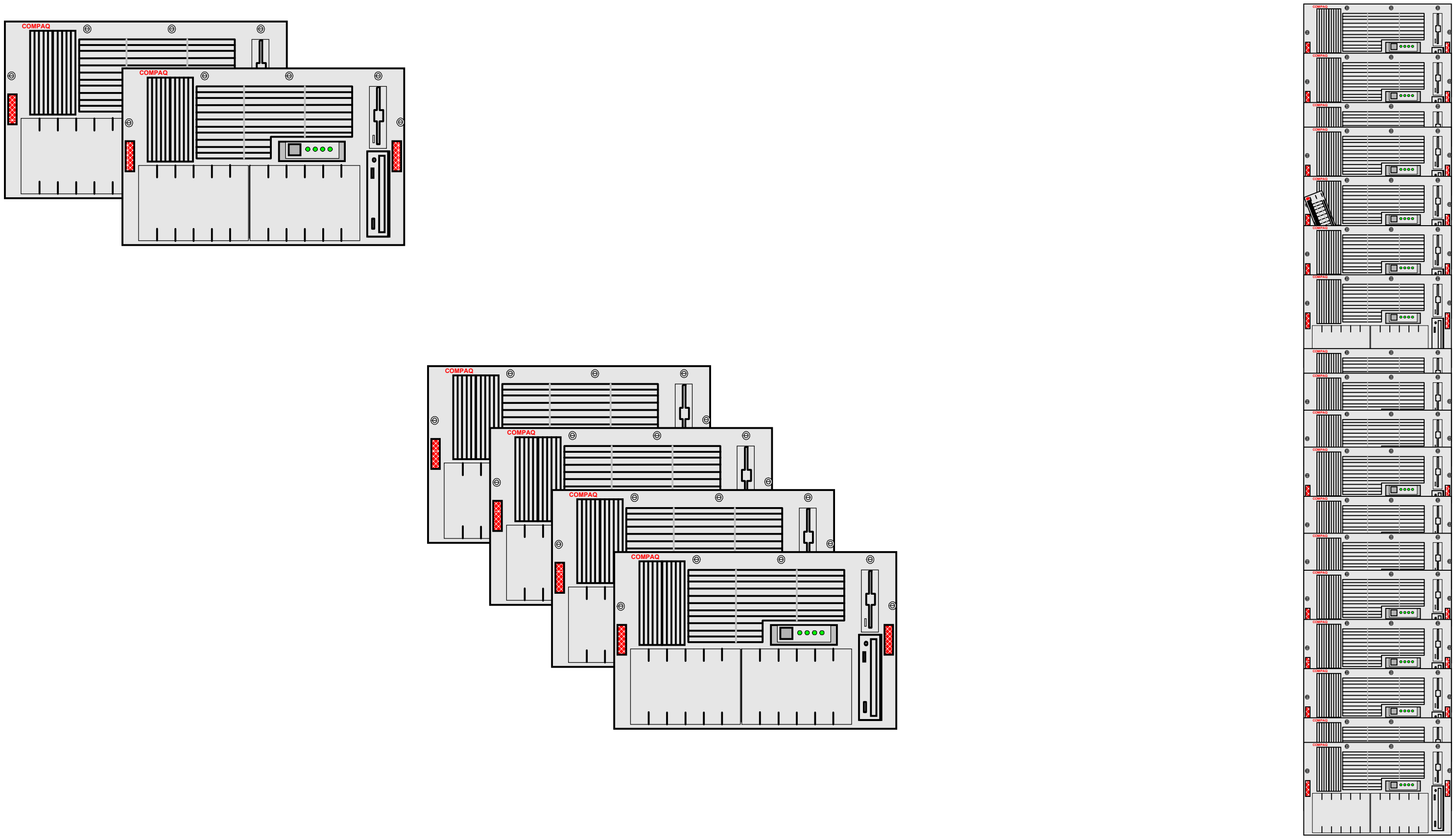


Quiz 3

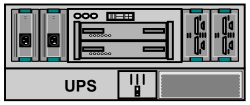


- Business Drivers
  - Performance Issues YES NO
  - Connectivity Issues YES NO
  - Backup Issues YES NO
  - Storage Silos YES NO

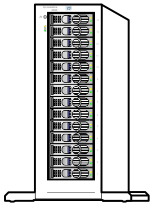
How many Servers?


COMPAQ
COMPAQ
COMPAQ
COMPAQ
COMPAQ
COMPAQ

How much Storage?

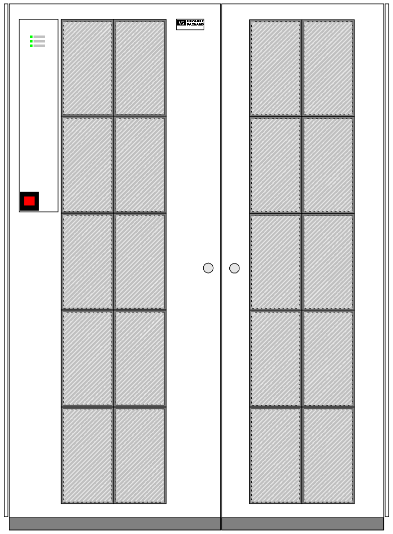


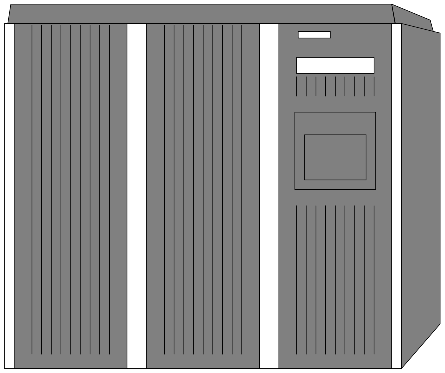
JBOD



DAS

FC/AL

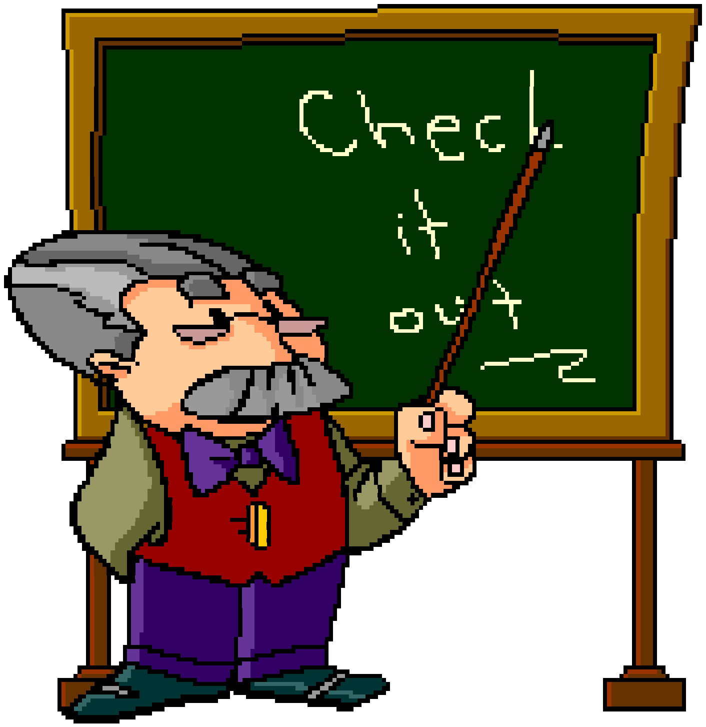




SCSI Array

Where are we?

Do you need a Storage Network?

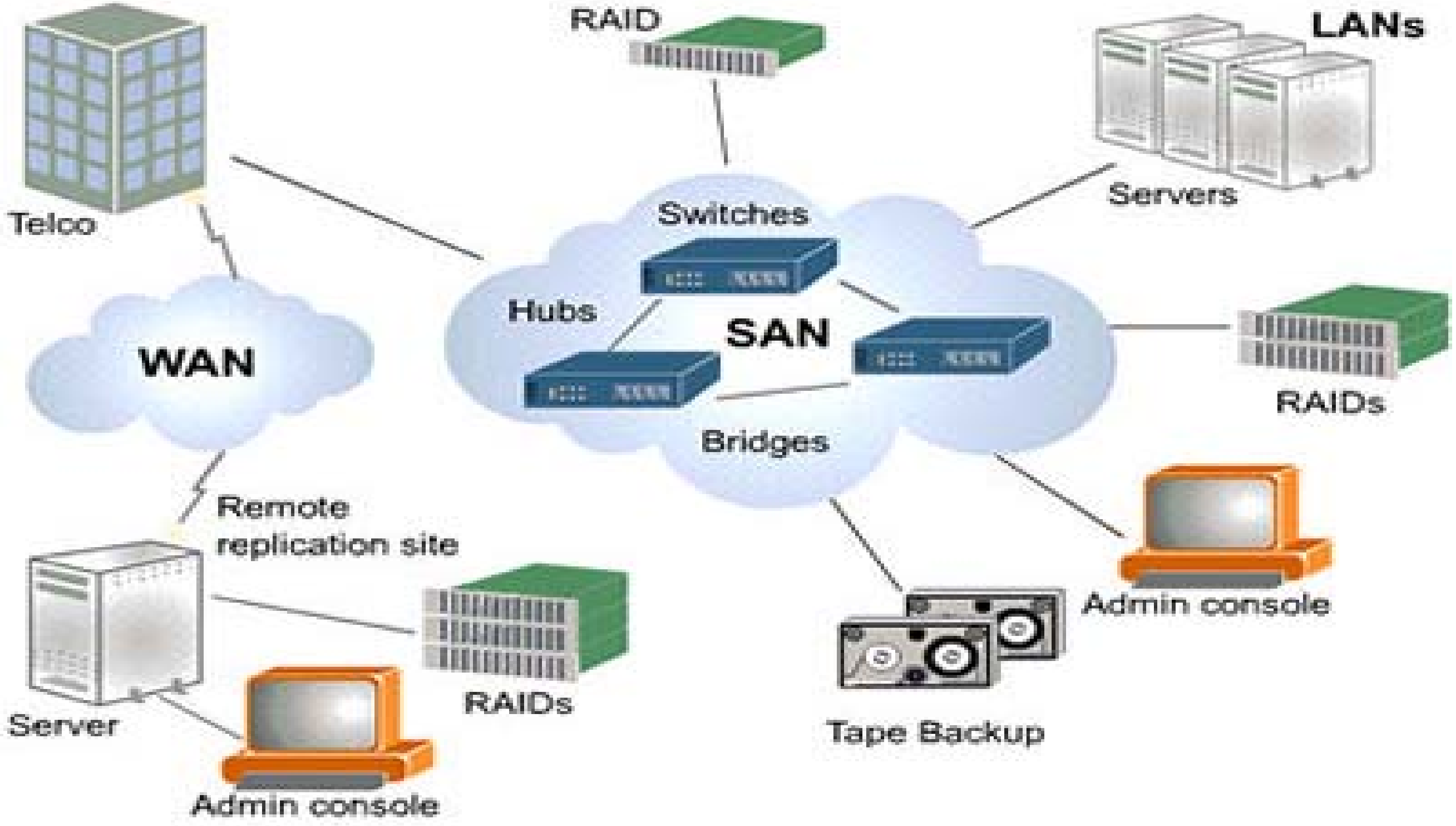


- Midterm
  - Growth, Modular, Scalable Storage
  - Can you move to Centrally managed Storage?
  - Are the business drivers there, performance, connectivity, backup or silos?

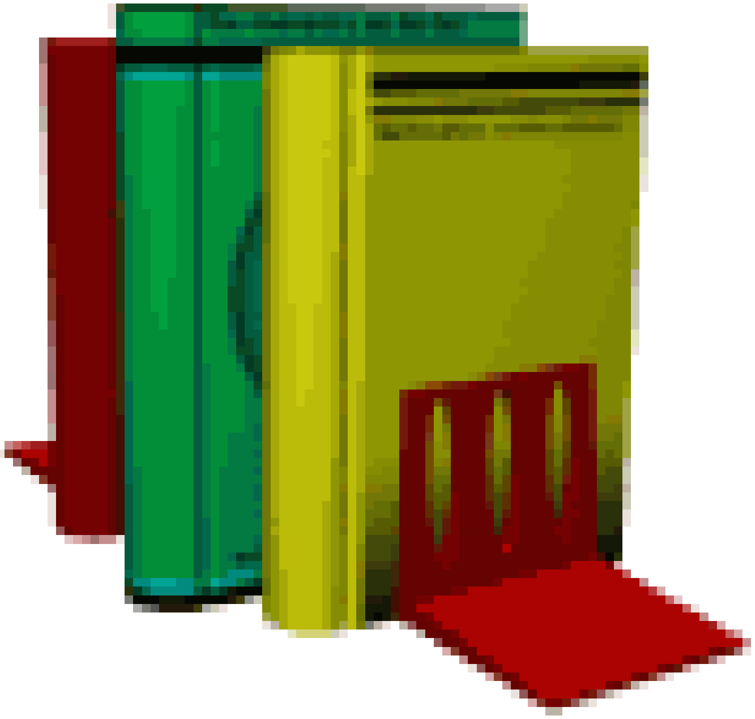
What's Your Score?

- All questions have to be answered with a resounding YES
- There are no Bogeys or gimme's in Storage Networks

Storage Network might be right for us


RAID
LANs
Telco
Switches
Servers
Hubs
SAN
WAN
RAIDs
Bridges
Remote
replication site
Admin console
Server
RAIDs
Tape Backup
Admin console

Where do we go from here?



Phases

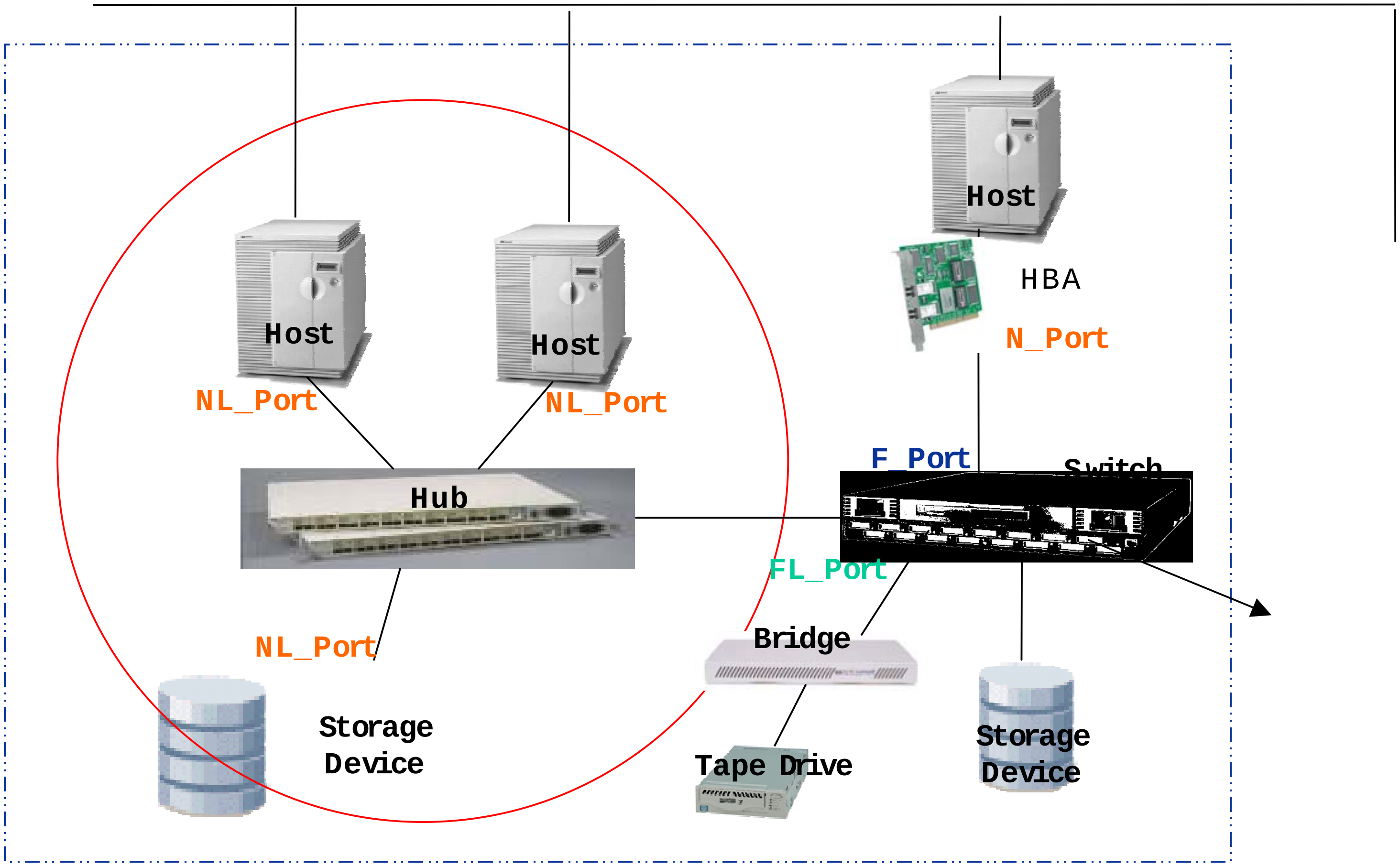
Phases of Storage Network Planning

- Technical
- ROI
- TCO
- People

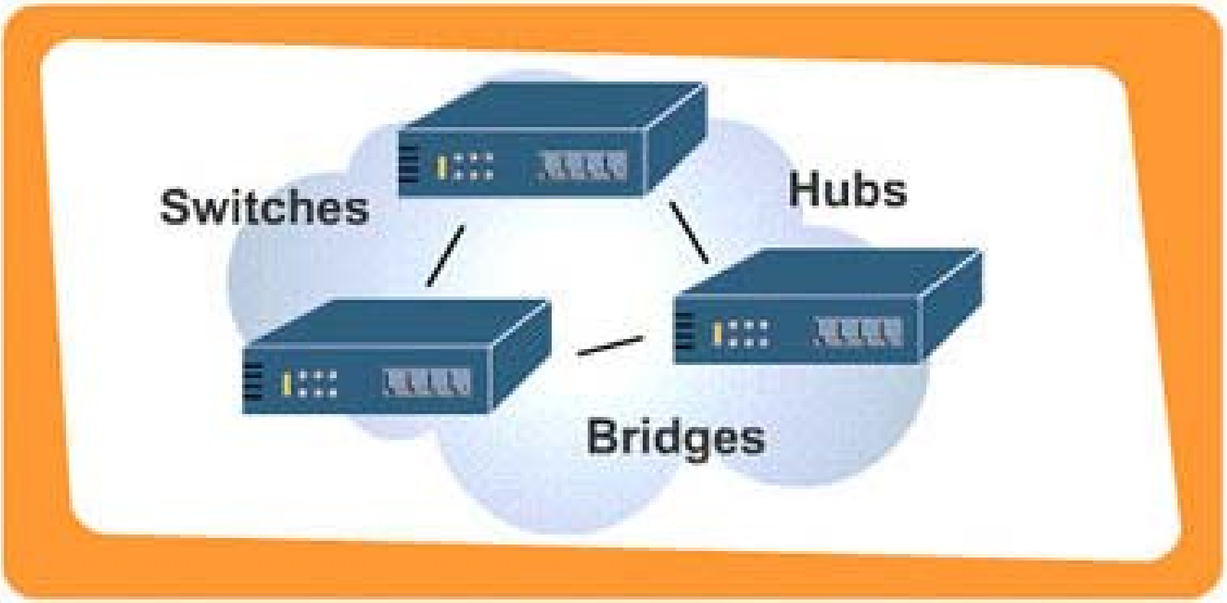
Phase 1- Technical

- Most popular
- Most written about
- Most talked about

SAN Components


Host
HBA
N_Port
Host
Host
NL_Port
NL_Port
F_Port
Switch
Hub
FL_Port
NL_Port
Bridge
Storage
Device
Tape Drive
Storage
Device

Hubs, Switches and Bridges


Switches
Hubs
Bridges

What is a Bridge?

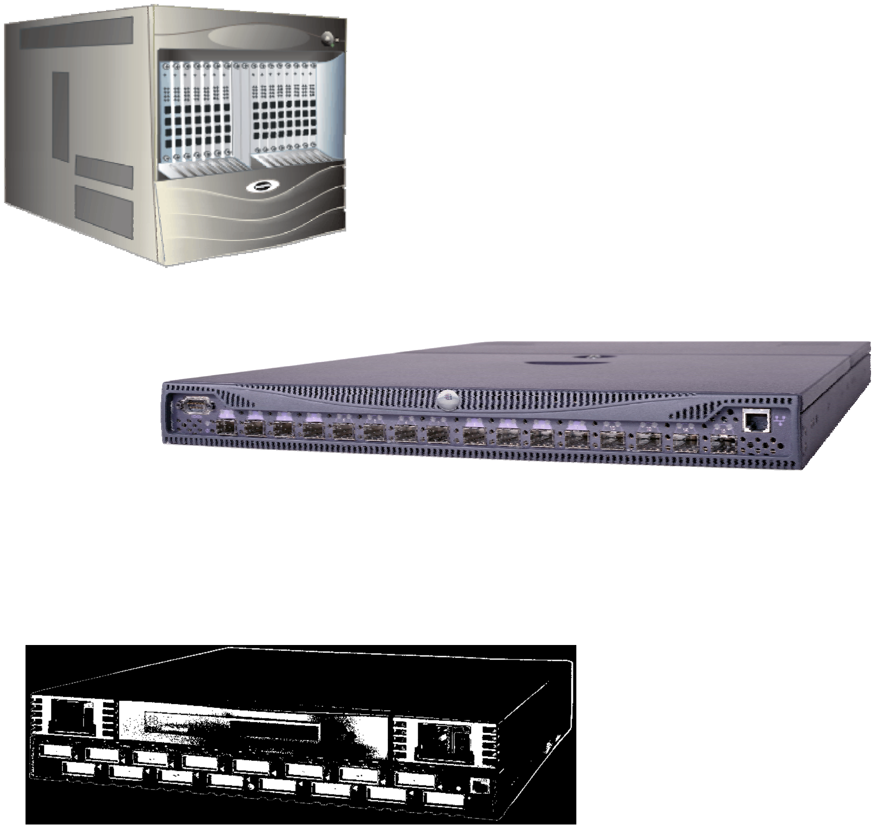
- A bridge is a device which is used to attach non-Fibre Channel devices to a Fibre Channel network.
- Bridges perform a protocol conversion function between SCSI and Fibre Channel.

What is a Hub?

- A hub provides the wiring environment to implement an arbitrated loop.
- A hub provides 'by-pass' circuitry for better resilience to faults.
- A hub is typically 'transparent' on the network with little, if any, management capability.

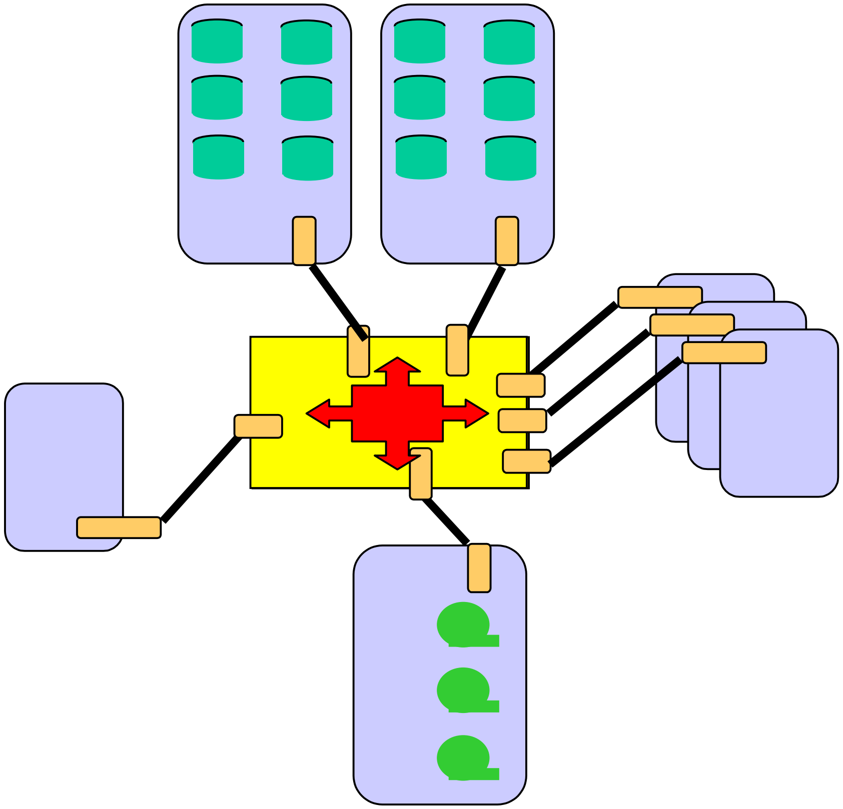
What is a Switch?

- A switch is a high performance device for routing frames within a Fibre Channel network.
- 'Fully non-blocking' switches can make multiple, simultaneous, gigabit connections to route frames between servers and storage.
- Switches contain substantial management capability.

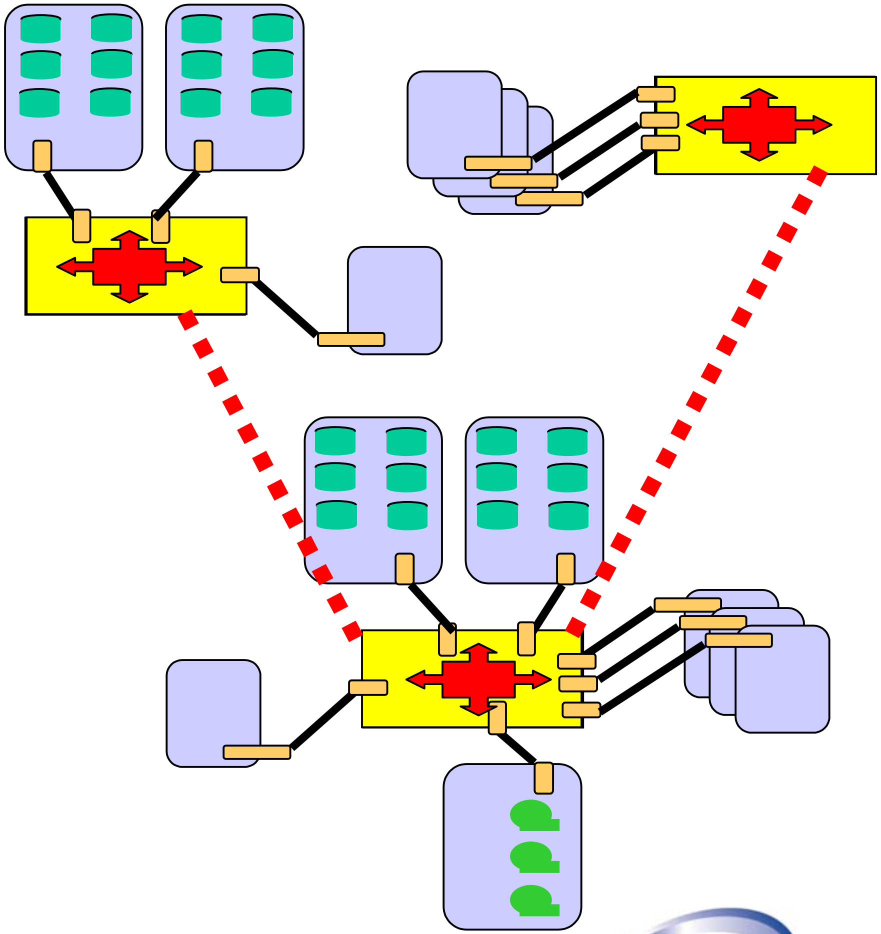


Switched Fabric

- **N-port to F-port connections**
- **Any host can initiate I/O to any device (many-to-many)**
- **Adding a port actually increases aggregate bandwidth**
- **The fabric assigns address to each node**



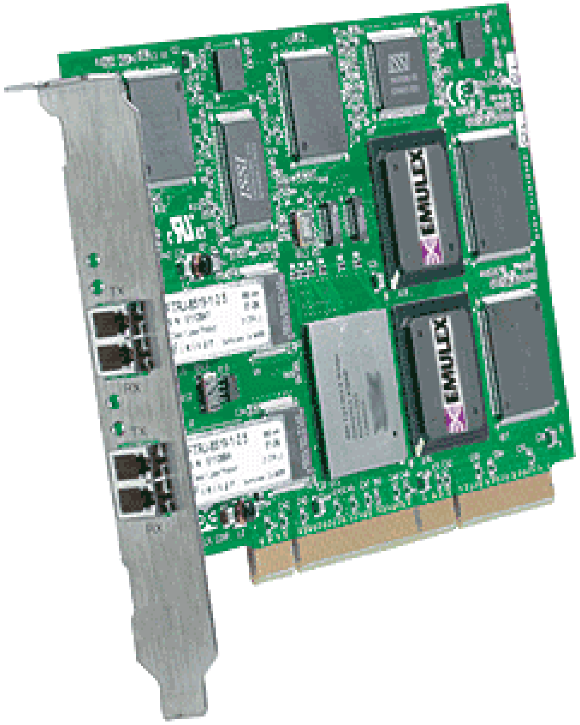
Switched Fabric



- **Multiple switches may be connected to create a larger fabric**
- **Hosts may share storage resources**
  - **Tape drives**
  - **Disk ports**

What is a Host Bus Adapter (HBA)?

- Similar in concept to 'network interface card‘ (NIC), a HBA is used to interface a specific host type to a Fibre Channel link.
- HBAs incorporate processors to perform protocol conversion and I/O operations to off-load these duties from the host CPU.



Real Technical View

- Client Data
  - Databases
  - File

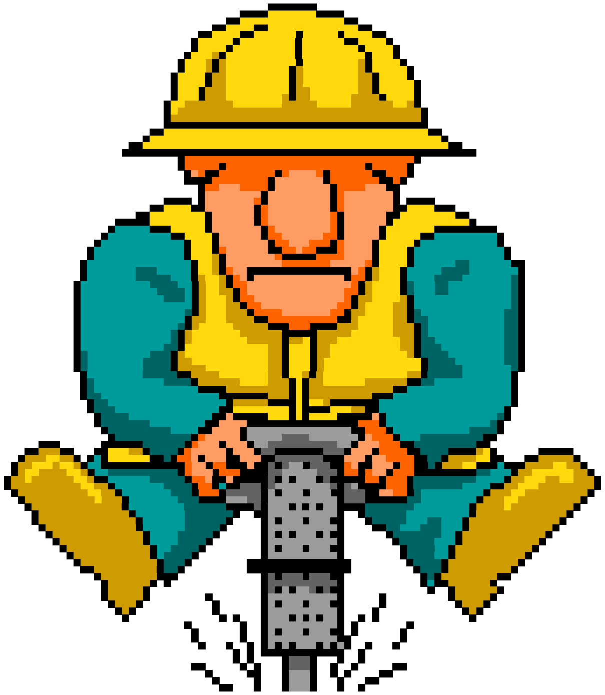
Databases

- Block data
- Sequential

File

- Burst
- Small and Large reads and writes
- Users tolerate some delays

Design to Maximum



- 80% of Data use
- Not to 80% users

Quiz 4

- Do you understand what the SN components are?
- Do you understand what your data requirements are?

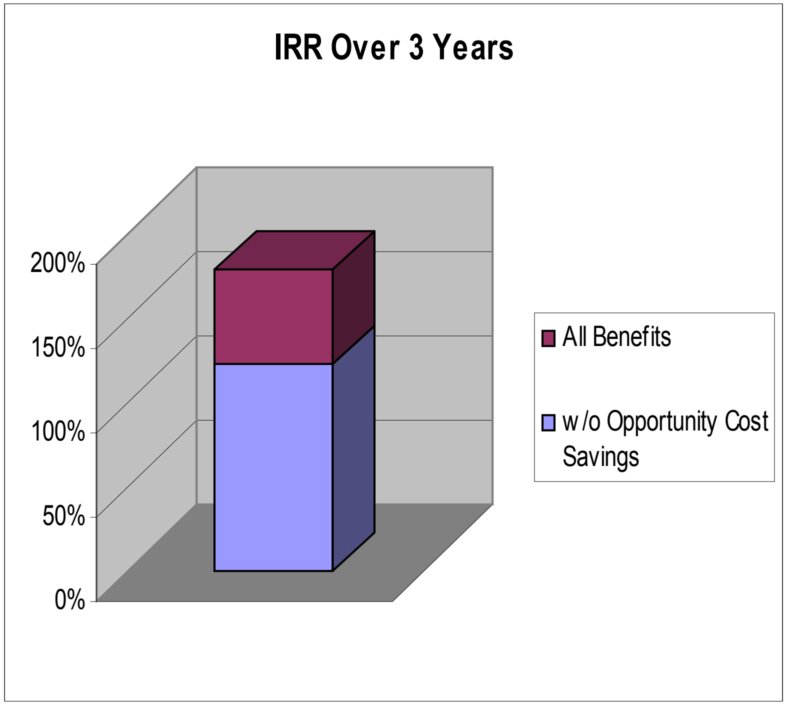
ROI

- Short term

- Specific solution
- Payback
- cost , savings and gains for the solution

ROI

- To demonstrate that what they are doing is bringing value back into the enterprise
- Clarifies in non-technical financial terms what a storage network brings
- May quantifies the financial benefits of SN to help the business decision of the buyer



Calculating Benefits

- Hard Benefits
  - Capital expenditures
  - Operational budget savings
  - Staff productivity increases
- Soft Benefits
  - Opportunity costs
    - Cost of downtime
    - Backup Windows
    - Data restore times

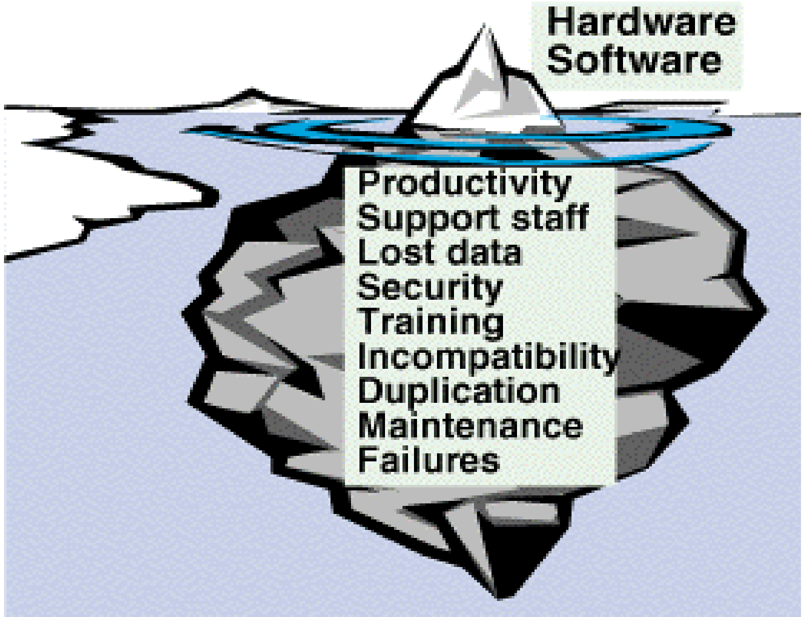
Determining Costs

- Produce a “straw man” SN Architecture to implement configurations which result in the benefits
  - For budget purposes only
  - More accurate costs will be determined by a proper architecture
  - Sufficient detail to produce budgetary estimates
- Scenarios treated as discreet ROI calculations
  - Architectures contain duplicated elements because they stand on their own
  - Aggregate ROI is better than the sum of the individual ROIs

Quiz 5

- Does the ROI match what your company's needs?
- Do you believe in the Return on Investment?

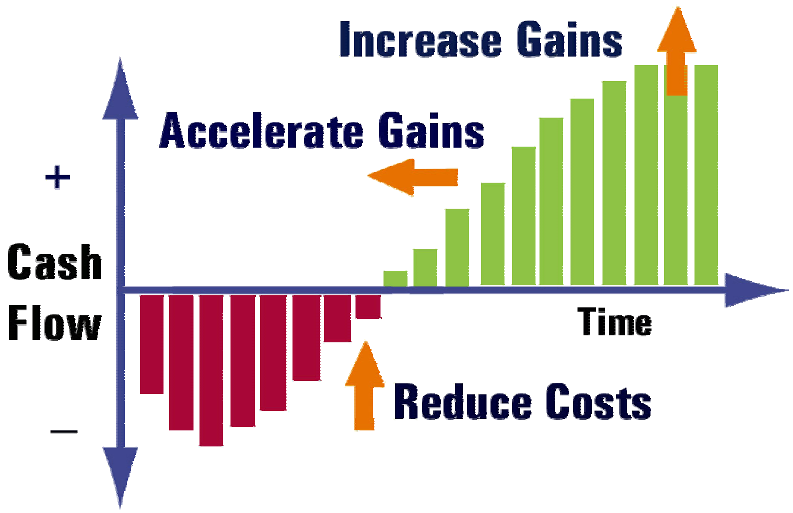
TCO


Hardware
Software
Productivity
Support staff
Lost data
Security
Training
Incompatibility
Duplication
Maintenance
Failures

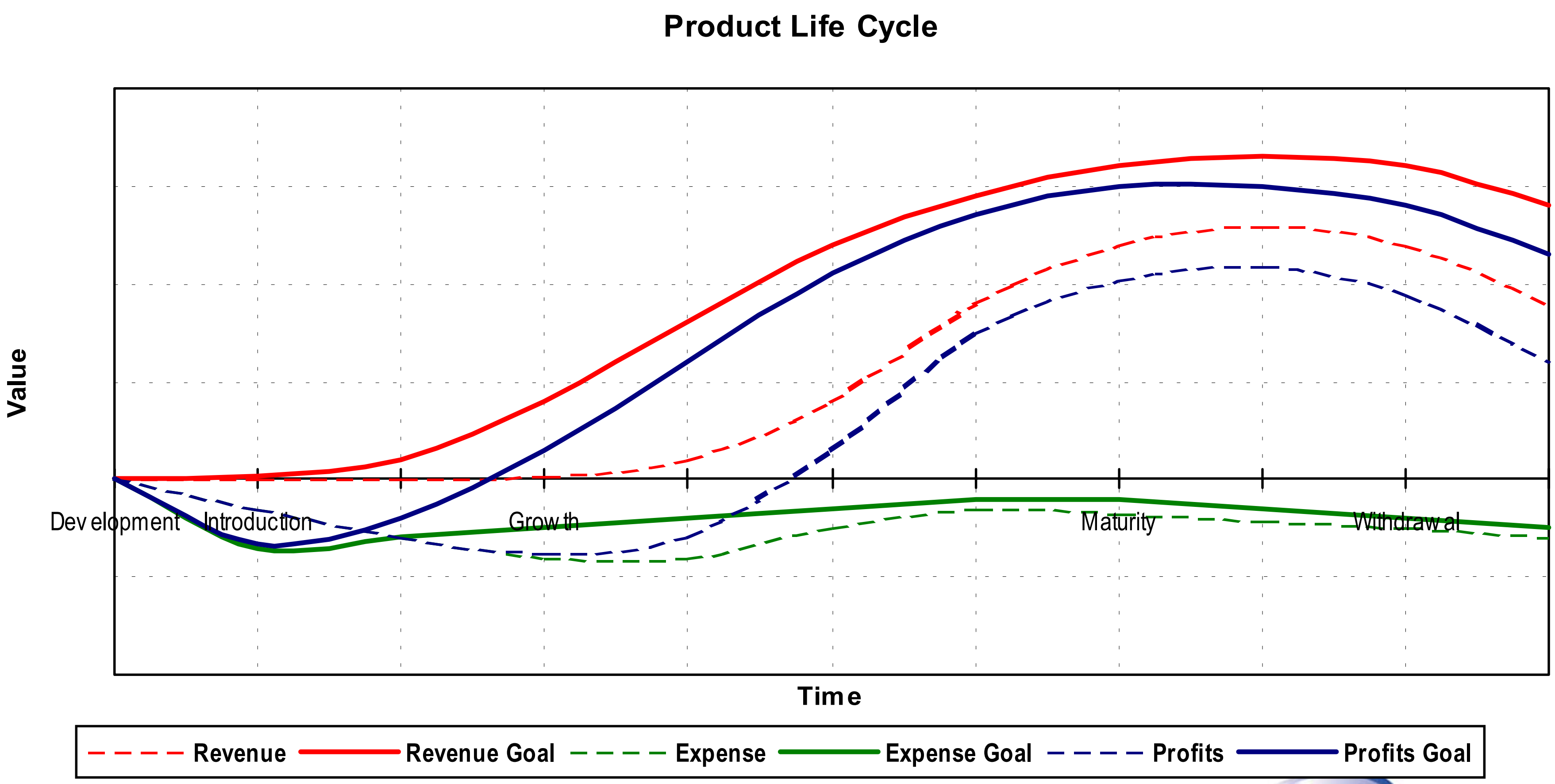
- Looks at overall business issues
- Total storage
- Long term
- Product, administration and data unavailability costs

TCO

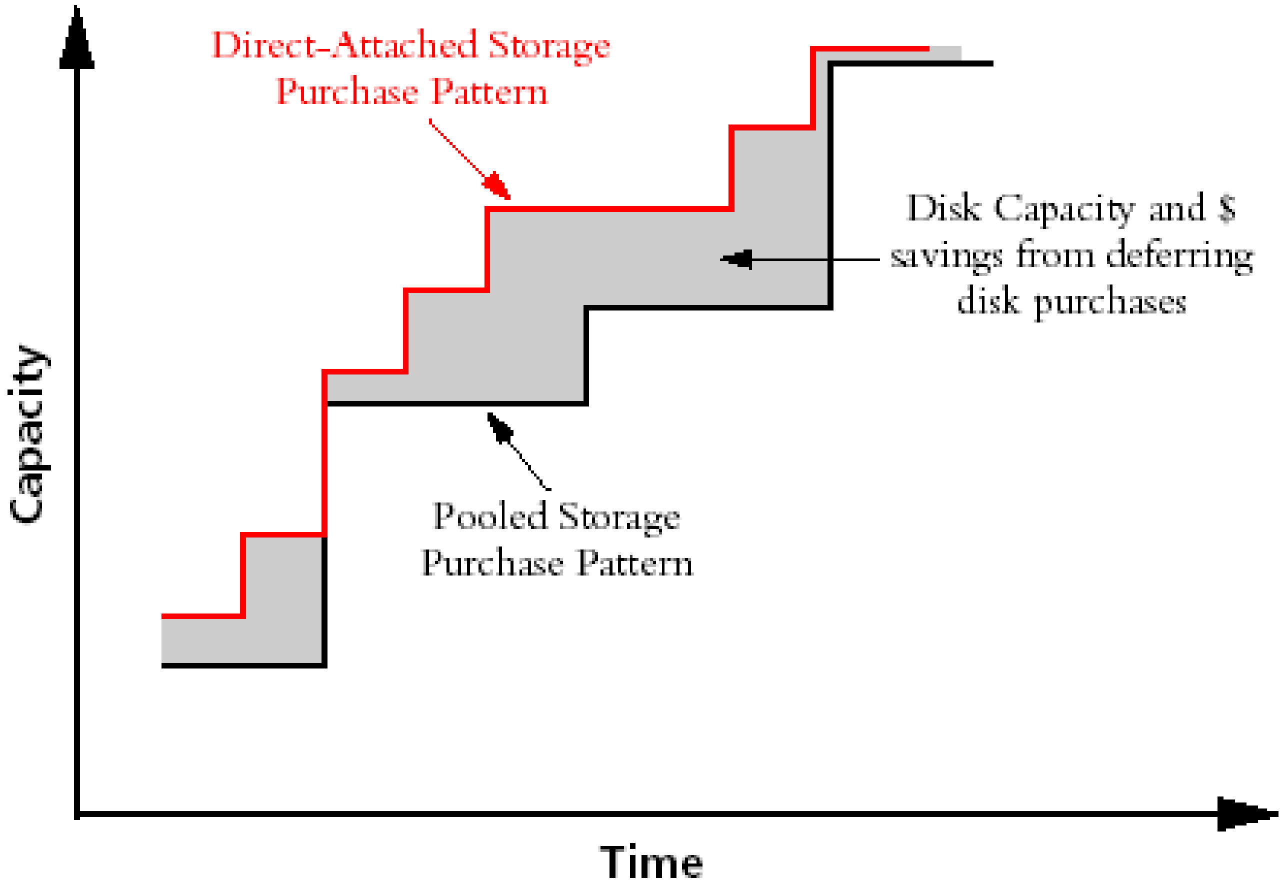
- Acquisition
- Installation
- Operation
- Management
- Training
- Service
- Growth



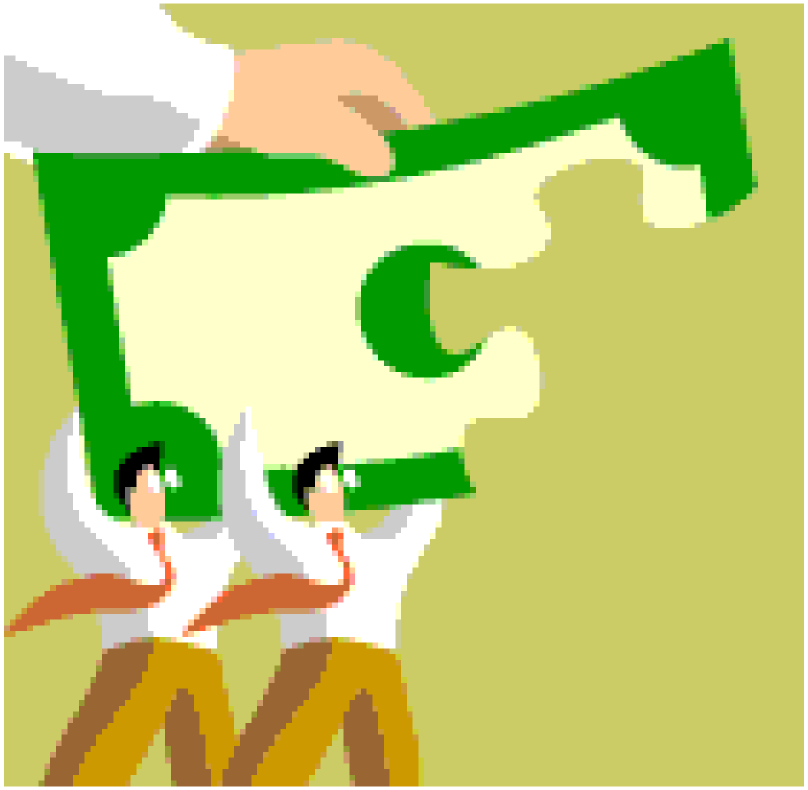
TCO


Product Life Cycle
Value
Time
Development
Introduction
Growth
Maturity
Withdrawal
Revenue
Revenue Goal
Expense
Expense Goal
Profits
Profits Goal

TCO


Direct-Attached Storage Purchase Pattern
Disk Capacity and $ savings from deferring disk purchases
Pooled Storage Purchase Pattern
Capacity
Time

Quiz 6

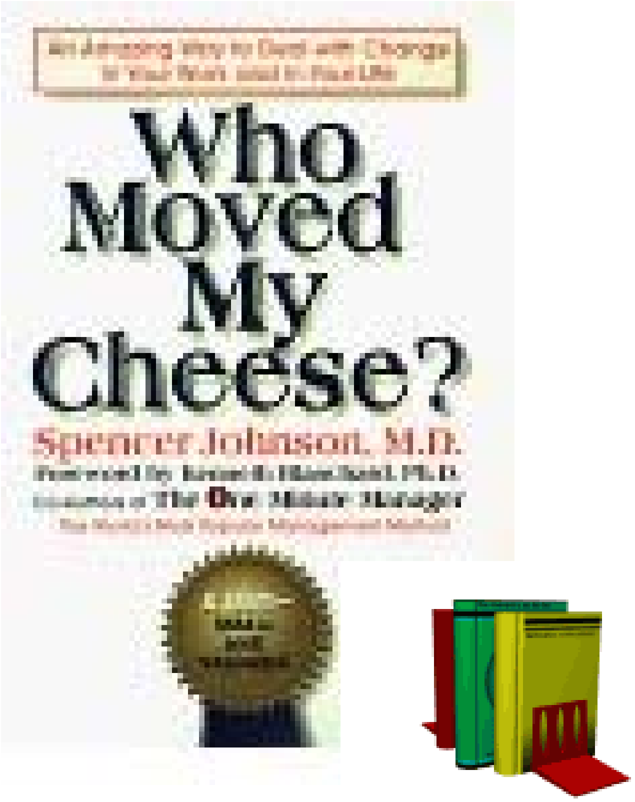


- Do you know all the costs associated with your data network?
- Do you know how much those costs are going to be in a SN?

People

- Protection of current investments in people skills
- Integration of new technologies into the existing environment
- Although the concept is simple and well known from the networking technologies it is not very easy to get there today

Change


Who Moved My Cheese?
Spencer Johnson, M.D.
The One Minute Manager

- Who Moved My Cheese? An Amazing Way to Deal with Change in Your Work and in Your Life, by Spencer Johnson, Kenneth H. Blanchard

Best Practice

- Shared storage should be put under the control of a single management structure.
- You need to put storage management practices in place.

Storage Management

- Allocate storage to all operating systems attaching to the SN.
- Manage all storage assets online, near line and offline.
- Track usage of storage by all applications (bill if appropriate).
- Institute and manage all backups and disaster recovery plans.

Storage Management

- Add/remove/assign storage to all servers and applications attaching to or removing from the SAN.
- Manage storage capacity usage and balance the load across systems.
- Set storage capacity thresholds for all applications and users.
- Manage and control storage trends effectively. Communicate those facts, trends, and analysis concerning an organization's storage resources to upper management. Manage Just-In-Time purchase of additional storage resources.

Storage Management

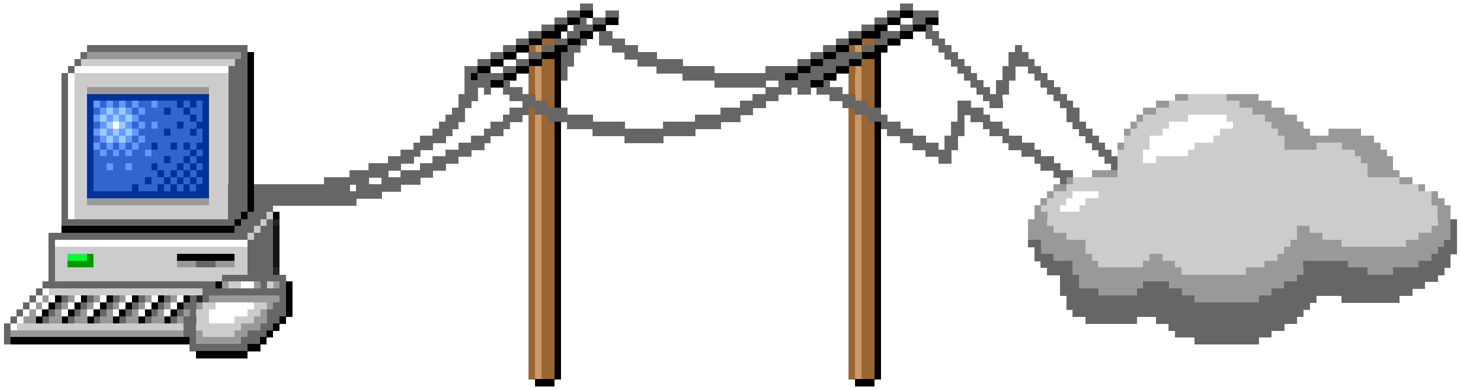
- Set and manage performance thresholds alerts. They would proactively assure SN service levels by being alerted to potential SN service slowdowns before they happen.
- Set and control standards of how servers and storage assets are attached to and managed on the SN

Quiz 7

- Are your people ready for the change that a Storage Network is going to bring?
  YES NO
- Are you willing to set up a Storage Management Position?
  YES NO

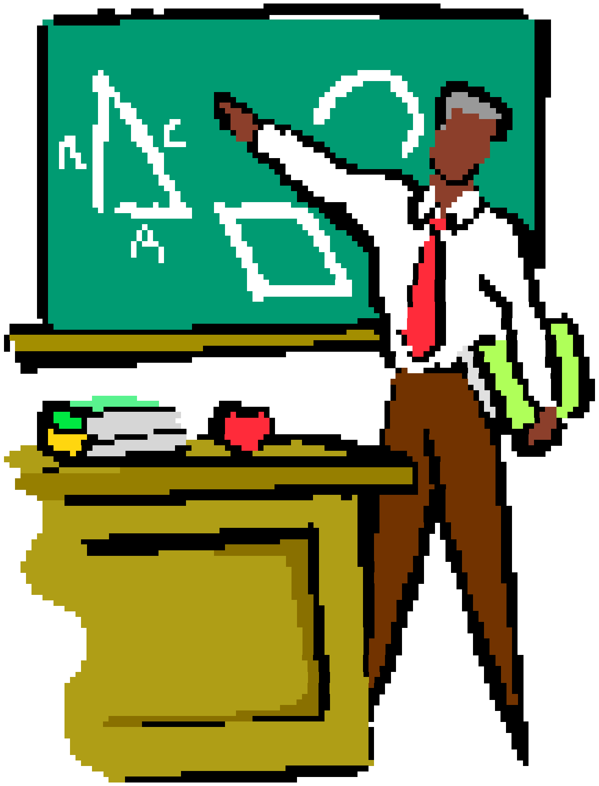
HP WORLD 2002 Conference & Expo

Ready for the Final?



When is the Best Time to Move to a Storage Network?

- When you have an Explosive Growth of Data
- When you have a need for Modular Storage
- When you have a need for Scalable Storage
- When you can move Centrally managed Storage



When is the Best Time to Move to a Storage Network?

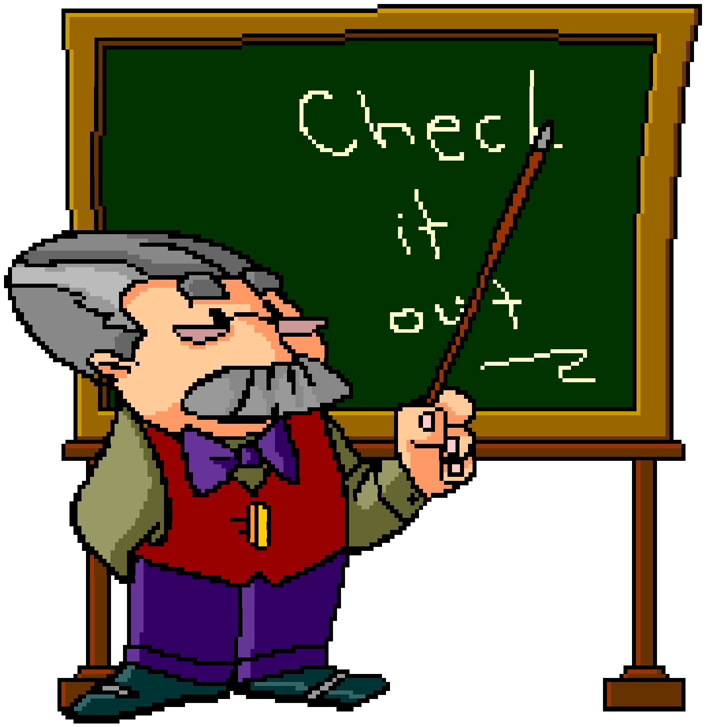
- The Business Drivers are there: Performance, Connectivity, and Backup Issues
- You face an issue with Storage Silos
- You understand what the SN components are and how they will fit in your environment

When is the Best Time to Move to a Storage Network?

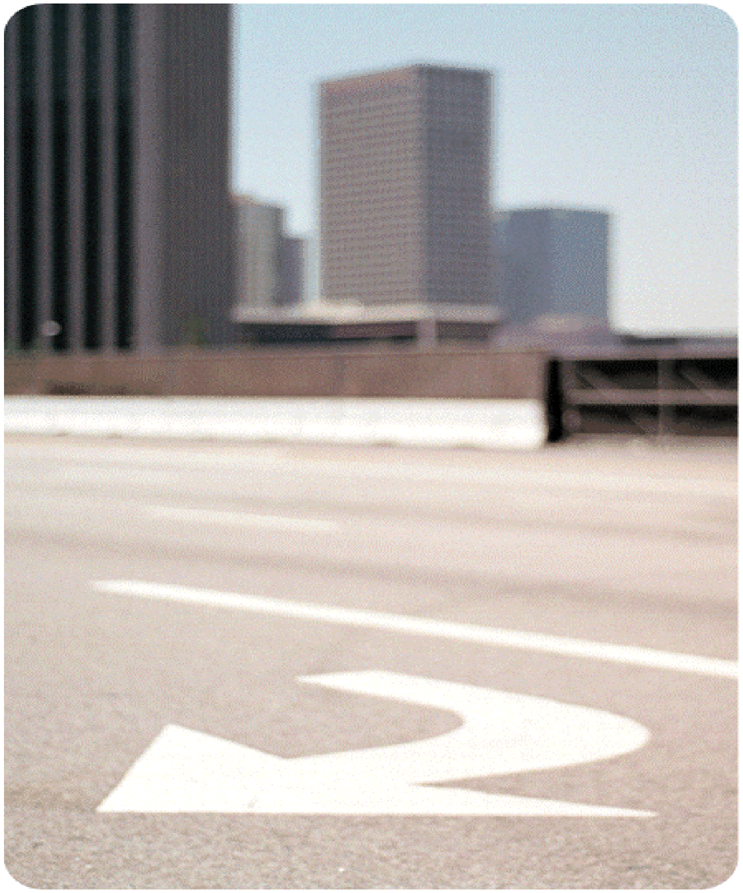
- You understand what your data requirements are and how they impact the users
- The ROI matches what your company's needs

When is the Best Time to Move to a Storage Network?

- You know the costs associated with your data network
- You can get your people ready for the change that a Storage Network is going to bring



Where do we go from here?



Capstone

What's Next?

- Never to soon to start…
- Technology is changing, stay tuned…
- Standards are forming. SNIA.

Welcome to the World of Storage Networks!

Thanks for your time

To the world of Storage Networks

HP WORLD 2002

Conference & Expo