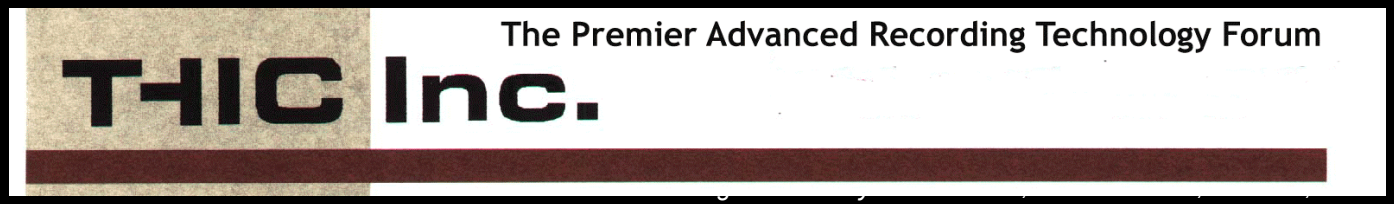
# Storage Networking – What is a SAN anyway?

Jim Tummins
Storage Tek
1 Storage Tek Drive, Louisville CO 80028
Phone: +1-303-673-7527
E-mail: james_tummins@stortek.com

Presented at the THIC Meeting at the Embassy Suites Hotel Denver South
Englewood CO 80112
June 28, 2000



# Storage Networking

## *What is a SAN, anyway?*

James Tummins
1 StorageTek Drive
Louisville, CO 80028-0096

Phone: +1-303-673-7527
email: james_tummins@stortek.com

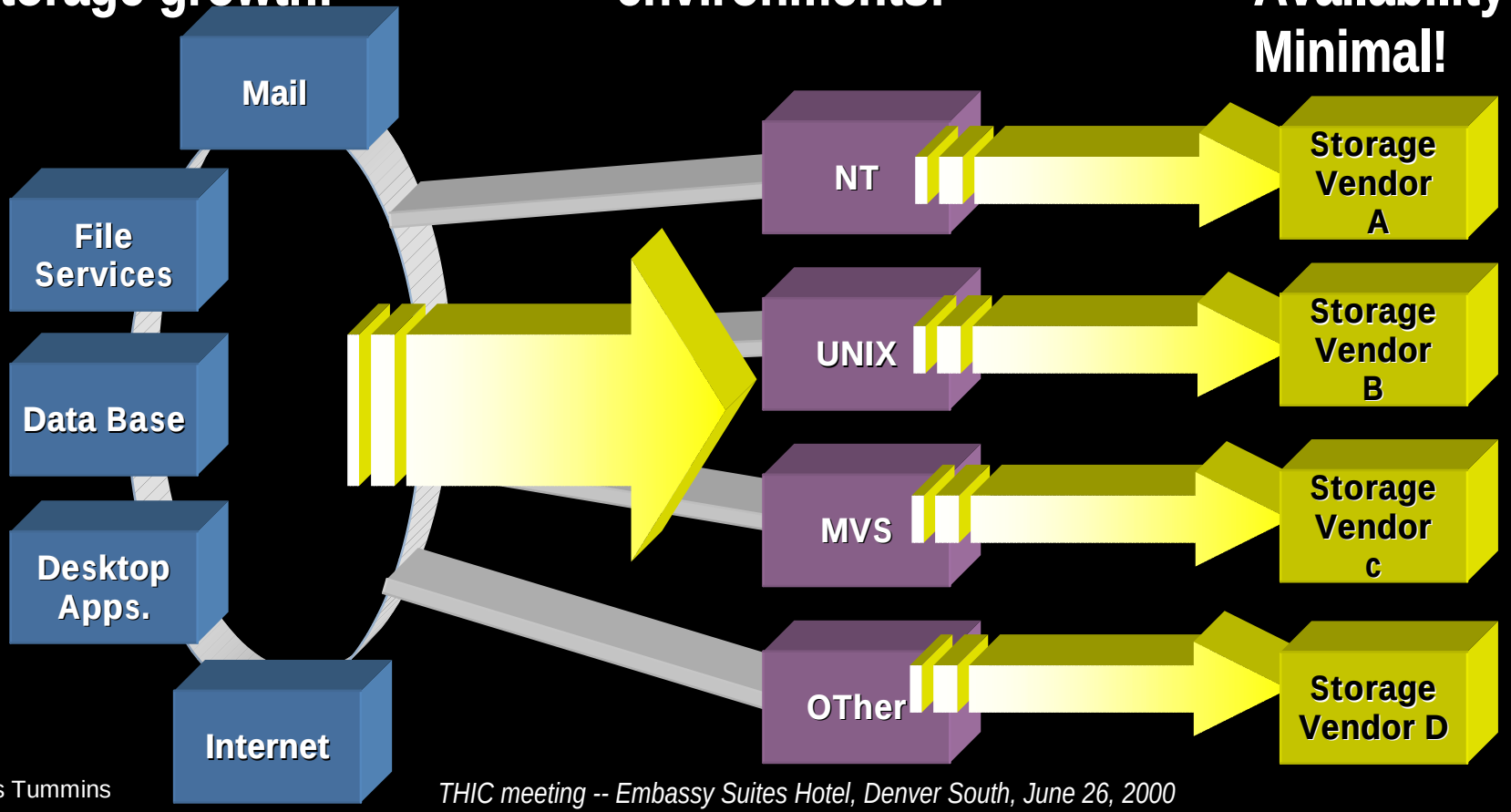
*Presented at the THIC meeting*
*at the*
*Embassy Suites Hotel, Denver South, June 26, 2000*

# What We'll See

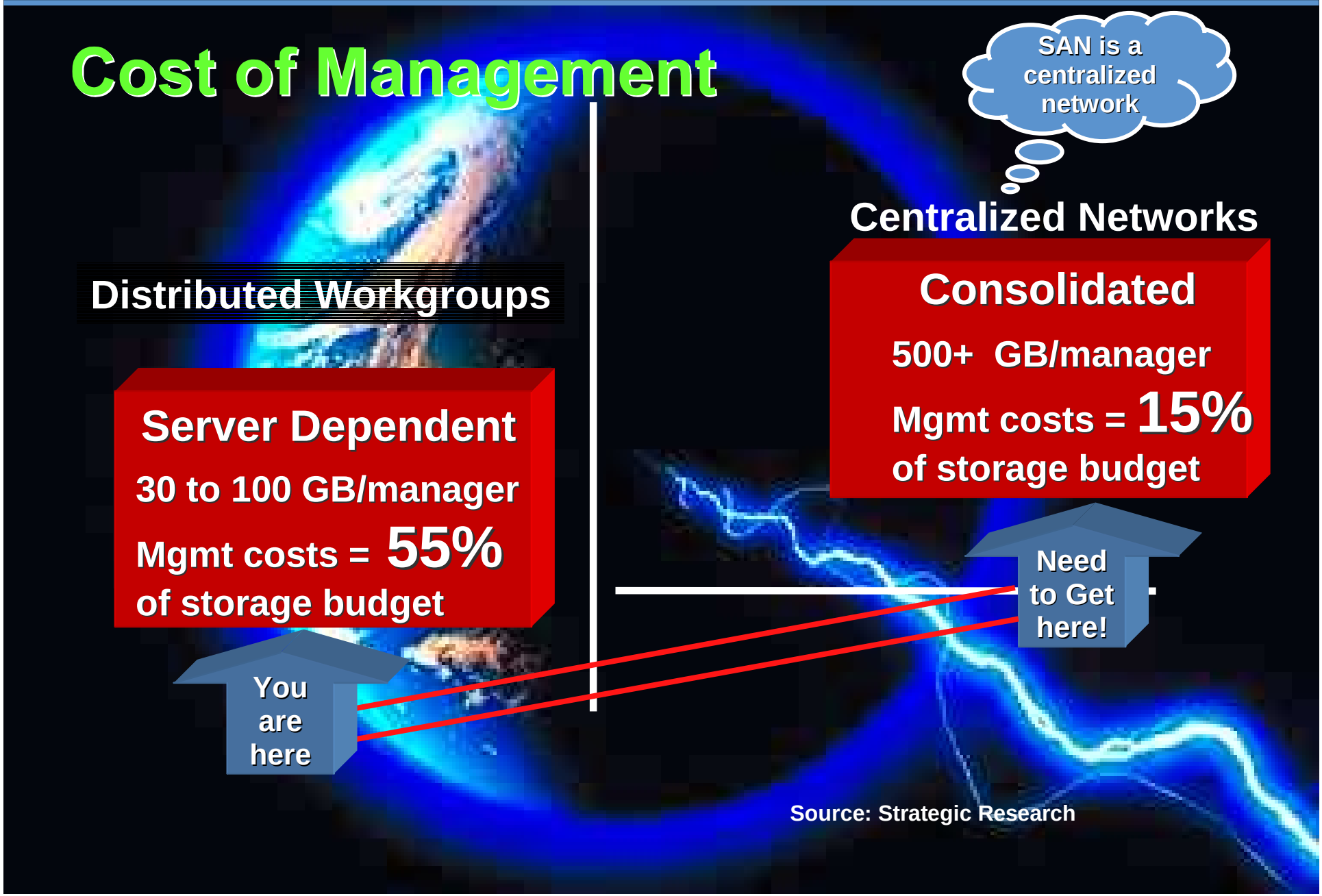
- Why storage networks
  - Business problem
- Definition and examples
- Fibre Channel Topologies
- Storage network benefits
- Planning considerations
- StorageTek on Storage Networking
- Storage Network evolution
- Things to watch

# The Business Problem… the cost of unmanaged growth!

1. Digital Sources are fueling unpredictable storage growth!
2. Managed within complex heterogeneous environments!
3. Where Resource Sharing & Availability are Minimal!



# Cost of Management



# Cost of Management

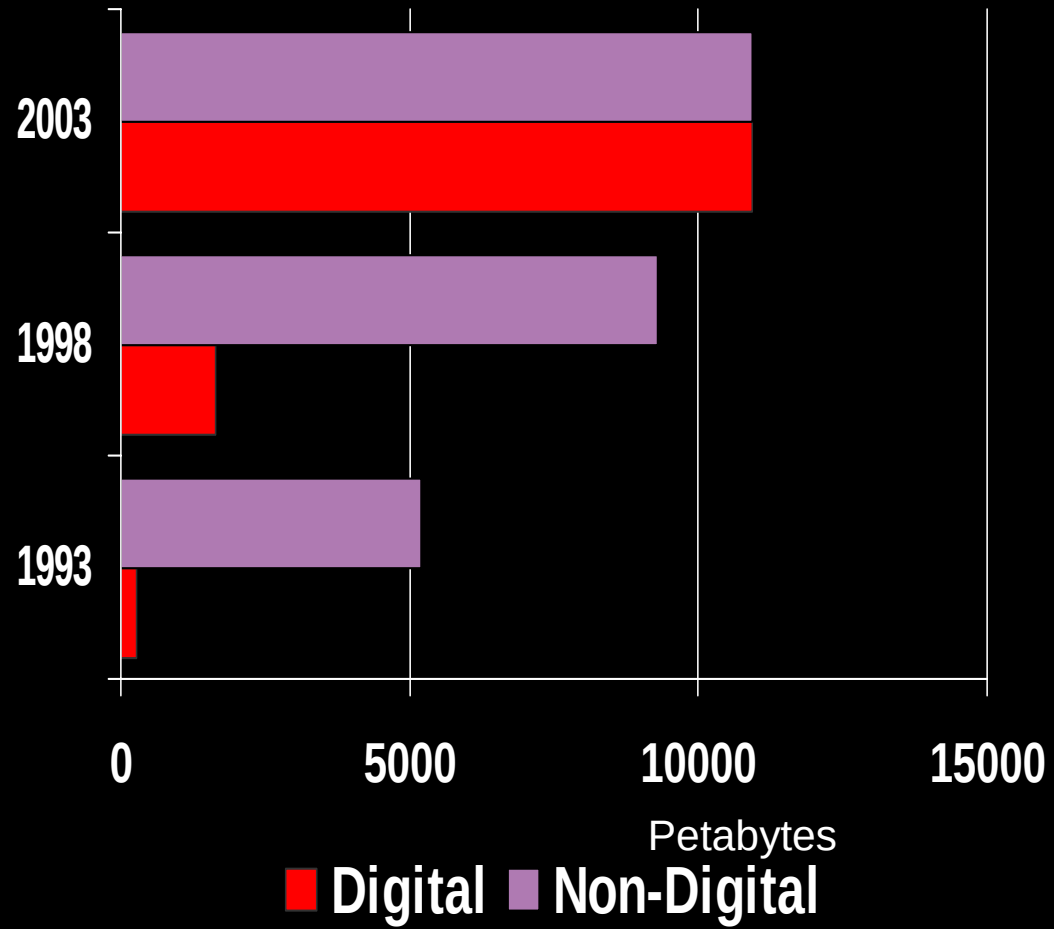
## Cost of System Downtime

| Application | Hourly Cost |
|---|---|
| Brokerage | $6.45 Million |
| Credit Card / Sales | $2.6 Million |
| Pay-Per-View | $150 Thousand |
| Home Shopping (TV) | $113 Thousand |
| Catalog Sales | $90 Thousand |
| Airline Reservations | $89.5 Thousand |

**Source: Contingency Planning Research**

# What's the Crisis?

## The Growth of Digital Information is Out of Control



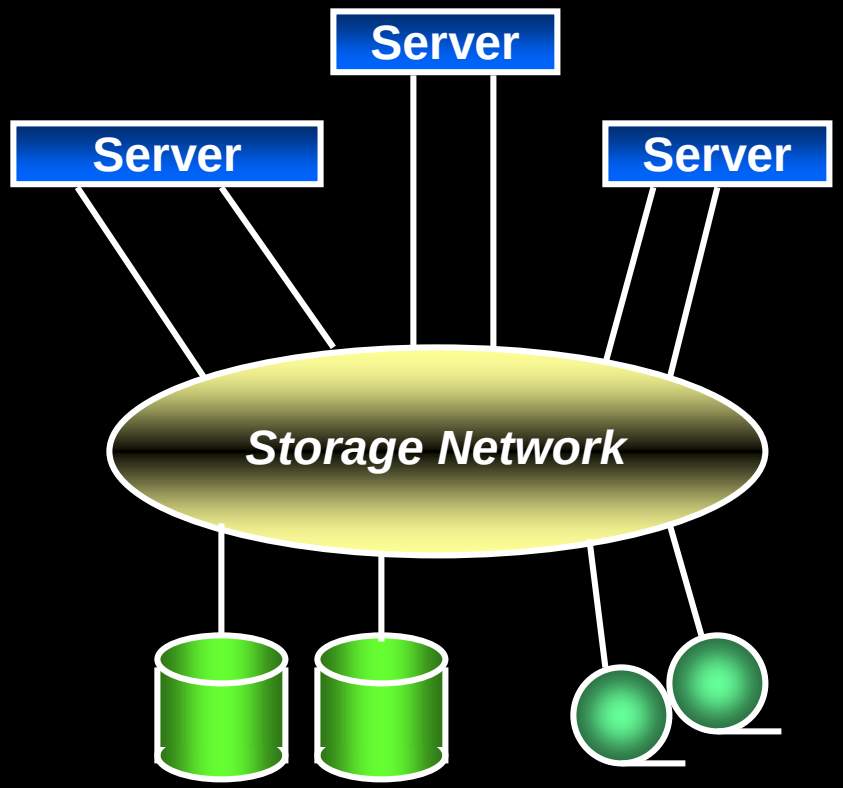

**… And,**

**There's No End**

**in Sight !**

**Source:** IDG
James Tummins

# Network Storage is ...

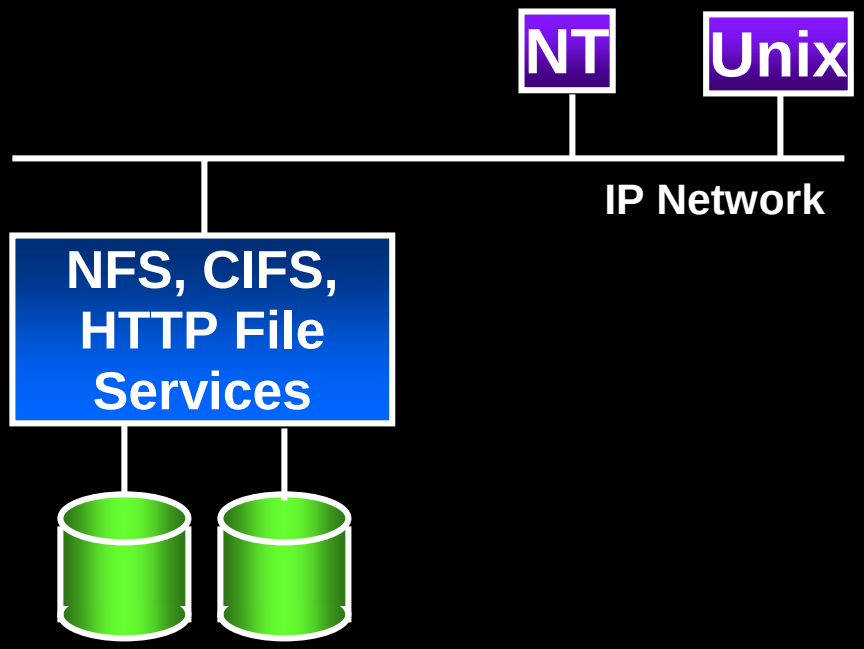



**… an architecture which includes a network between the server and the storage.**

***The server does not own the storage***

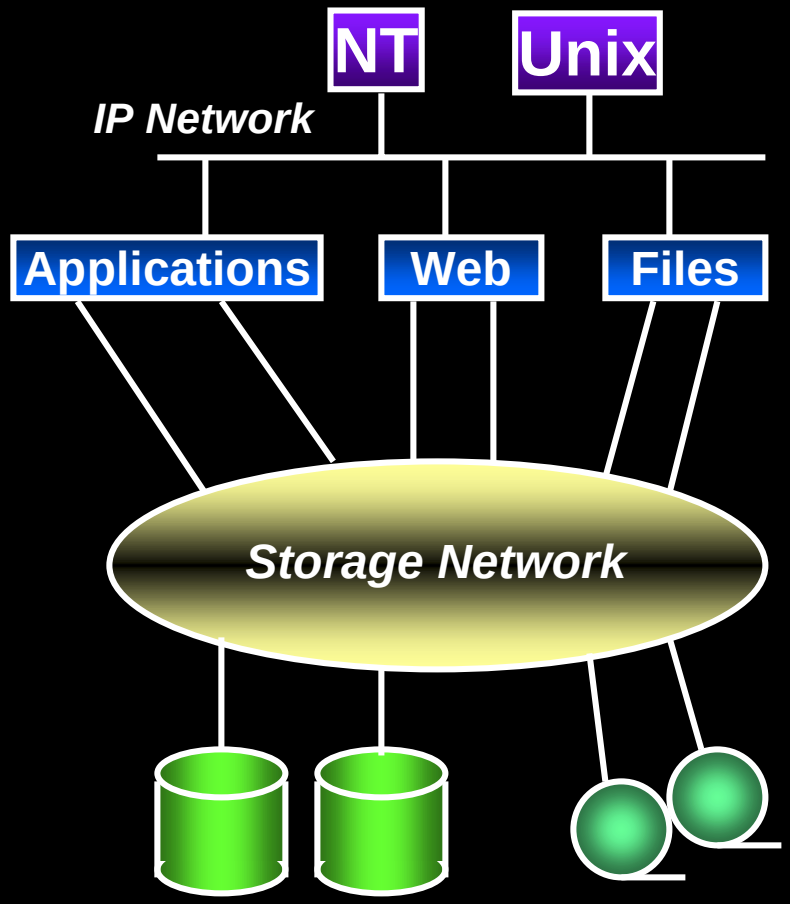
# Network Attached Storage -- NAS

- IP access directly from network clients
- File services
  - NFS
  - CIFS
  - HTTP
  - FTP



# Storage Area Network -- SAN

- Network between hosts and storage
- Multiple, heterogeneous hosts attach to any given storage device
- Layered
  - Client
  - Server
  - Storage
- Support more storage per host

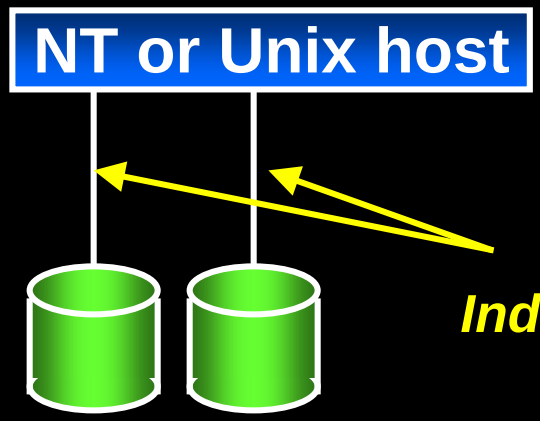


# Fibre Channel Characteristics

- ANSI standard protocol
- Operates over copper or optical links
  - Copper
    - Electrical
  - Optical
    - LED (single mode)
    - Laser (multi-mode)
- High speed data transfer
  - 133 Mbps - 1 Gbps
  - plans for 2 Gbps, 10 Gbps
- Extended Communication Distances
  - Copper
    - 30 meters
    - cannot support 10 Gb
  - Optical
    - LED
    - Laser
      - 10 kilometers
- Layered Architecture
- Multiple Topologies

# Fibre Channel Point-to-Point

- Dedicated link between two devices




*Independent FC links*

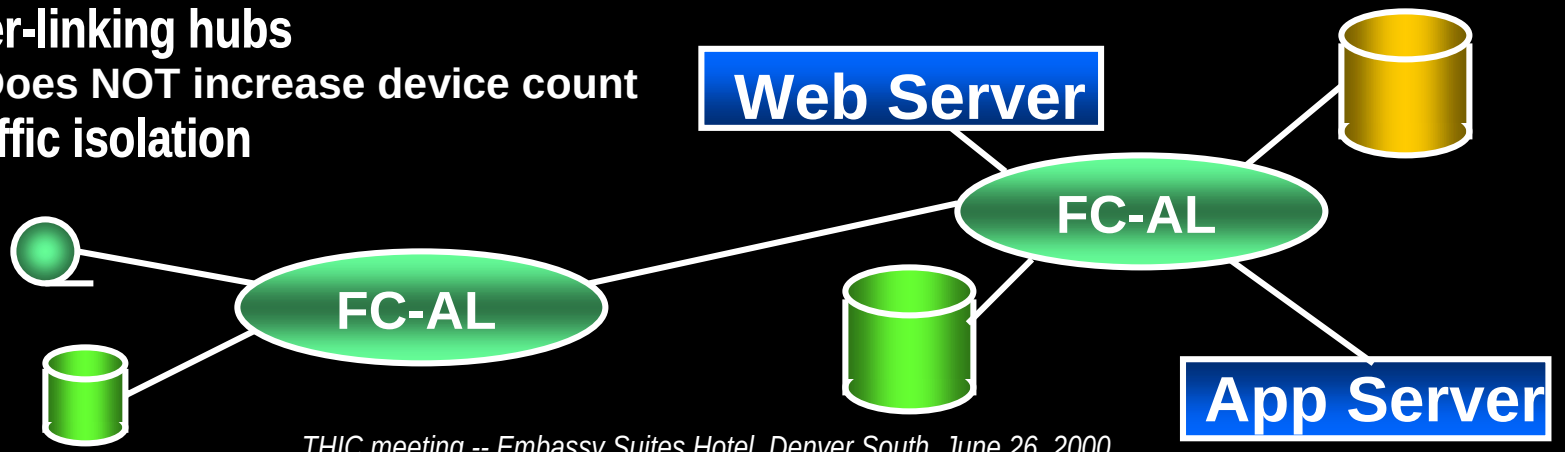
- **Advantages**
  - Full bandwidth always available
  - Simple implementation
  - Extended channel distances
- **Limitations**
  - Limited scalability
  - Increased network complexity for adding devices
    - HBAs
    - Links

***Not very interesting for a SAN implementation***

# Fibre Channel Arbitrated Loop

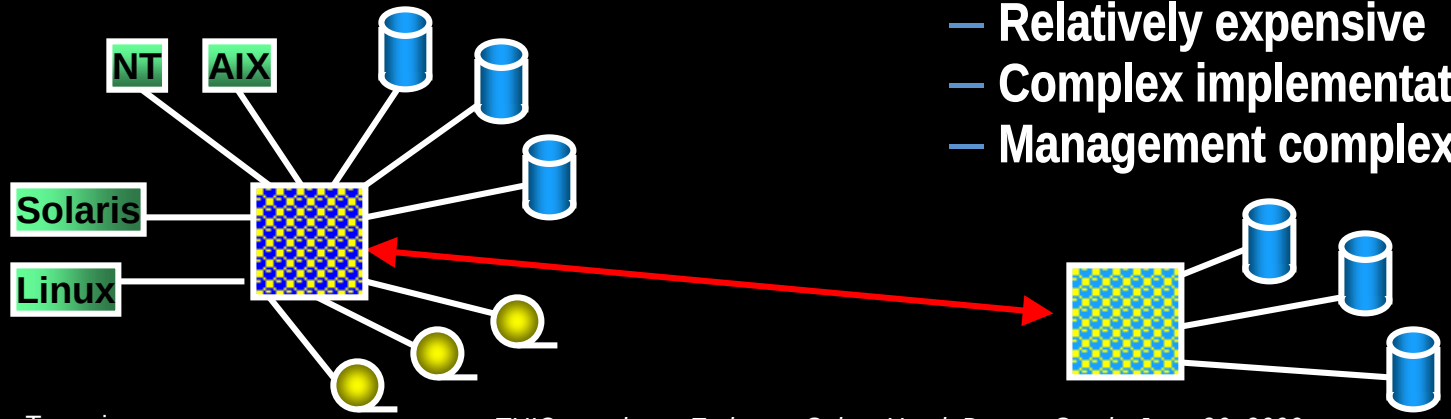
- Ring topology
- Up to 125 devices
- Network access is managed through arbitration
- Frequently implemented with hubs
  - Networks can be extended by inter-linking hubs
    - Does NOT increase device count
  - Traffic isolation

- **Advantages**
  - Increased scalability
  - Simpler than fabrics
- **Limitations**
  - Relatively low number of supported devices
  - Performance limitations due to shared media



# Switched Fibre Channel

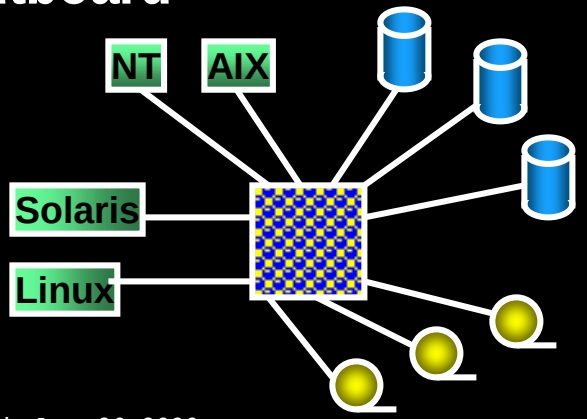
- Multiple devices interconnected through a switch
- Multiple point-to-point connections
  - Star topology
  - Many-to-many device relationship
- 15 million devices




- **Advantages**
  - Highest bandwidth available between nodes (dedicated)
  - Maximum device connectivity
  - Reduced host complexity (single HBA)
  - Maximum network distances
- **Limitations**
  - Relatively expensive
  - Complex implementation
  - Management complexity

# On-site Storage Management

- Backup and recovery
  - 24x7 operations limit traditional backup window
  - Moved outboard of the host
  - Dynamic backup, or continual backup *in the SAN*
- Hierarchical storage management (HSM)
  - Intelligent SAN
  - Policy definition and implementation outboard
  - Data movement on demand
- Capacity Planning
  - LUN management
  - Disk-on-Demand allocation



# Off-site Storage Management

- Business Continuance
  - Remote mirroring
    - FC and Gb-ethernet support telecommunication over considerable distances
    - Uptate commit time should be considered in planning
  - Automatic fail-over
    - Host
    - Storage
      - RAID storage, local and remote

# Benefits …

- Cost/Benefit is targeted at meeting identified requirements
- Reduced reserved disk
- Increased accessibility from multiple hosts
- Additional functionality
  - Enhanced storage management in the SAN
  - Example:
    - Primary requirement is shorter backup and recovery window
    - Secondary benefits are offsite vaulting and higher application performance
      - Backup processing is removed from the application host

# Storage Network Planning

- Standards
  - Consortia are pressuring ANSI
    - Fibre Channel Alliance
    - Storage Network Industry Association (SNIA)
    - Jiro
  - Change is inevitable as standards evolve
- Wiring
  - Distance
  - Node limitations
  - Right-of-way
- Topology
  - Node support
    - Understand the limitations of hubs and switches
    - Performance?
    - Connectivity?
  - FC-AL
    - Loop resets (adding a device) can interrupt streaming applications
- Training support personnel
  - FC architecture
  - Storage management
  - Alternatives

# Vendor Selection

- Special programs
  - Partnership programs
  - Service guarantee
  - Spare parts availability
- Standards compliance
  - Interoperability
  - "open"
- Industry reputation
  - Service
  - Product Upgrades
  - Participation in Industry Consortia
- Professional services
  - Large installations may be complex
  - New technology requires more expertise

*May be the most important consideration*

# "SAN Ready" Storage devices

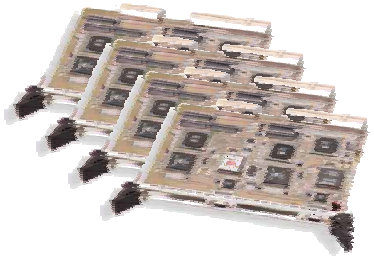
- Tape libraries and drives
  - Aegis architecture and 9840 tape drive
  - Native Fibre Channel attachment
- Fibre Channel Disk offering
  - OpenStorage 9176
    - Controller based LUN masking
    - Controller based LUN partitioning
  - SVA9500
    - Snapshot for instant copy
    - Dynamic LUN management

# StorageNet - An Interconnect Family

## A complete family of interconnect products to build Storage Area Networks

**3100/3200**
Fibre channel bridges

**Access Hub**
Multi-loop hub
32 ports



**HBA's**
JNI,
Emulex,
QLogic

**1000**
Fibre channel hub

**41XX**
Fibre channel switches
8 and16 ports

# Sounds good, however …

- There is a big difference between SAN point products and SAN solutions
- The cost of multi-product administration is high.
- Development, adoption, and deployment of “standard” methods occurs over time.
- Solutions need to address both legacy and new technologies.

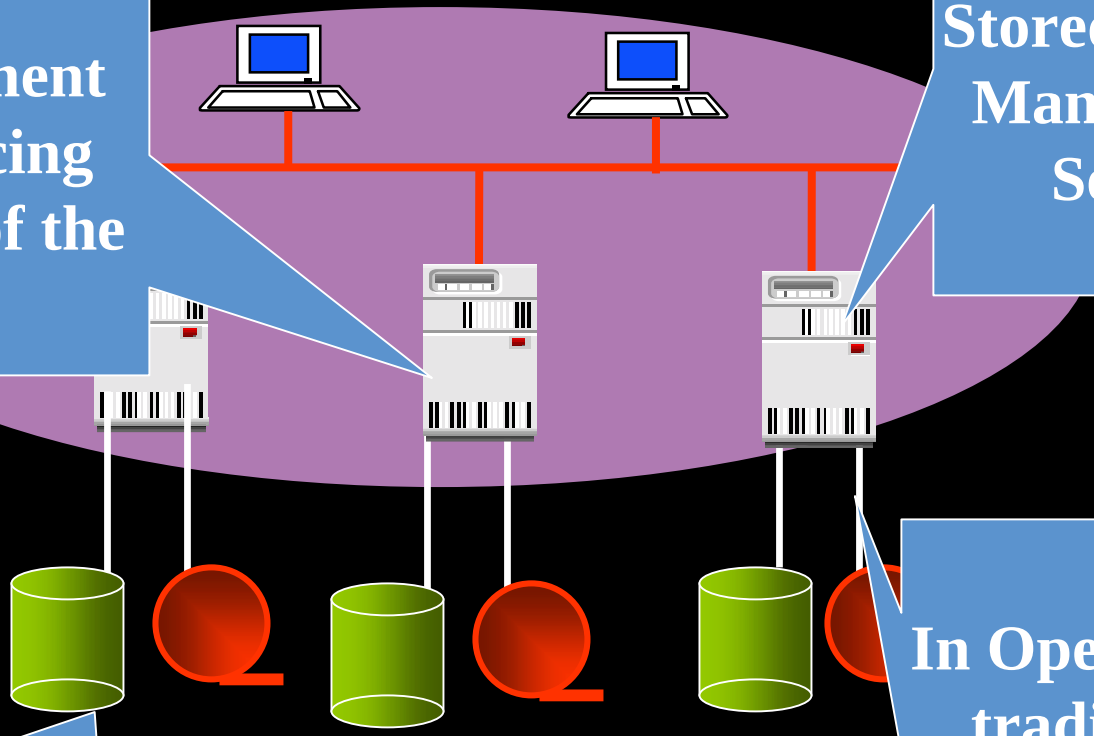
# Creating …

- Opportunity to leverage StorageTek’s integration and interoperability expertise
- Opportunity to leverage partnerships
- Goal to deploy Open, Intelligent and Integrated SAN solutions.

# c Approach

Application servers must also be Storage Management Platforms, reducing the performance of the Application

Control Information Stored on and Managed by Server

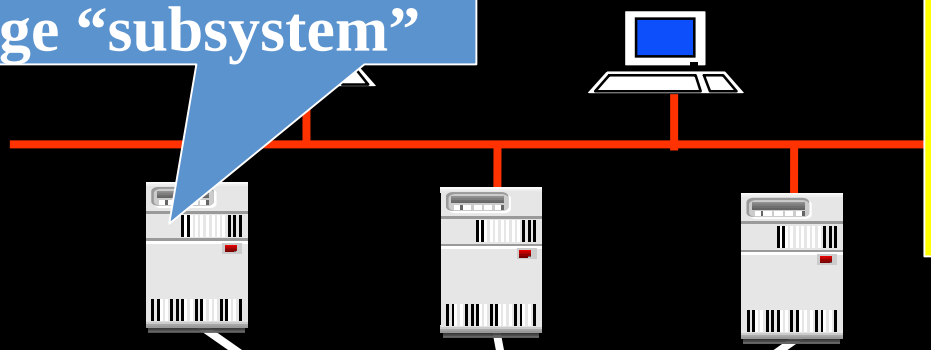


Scalability Limited to the number of available storage connection slots on the server

In Open Systems, traditionally, direct attachment between server and storage

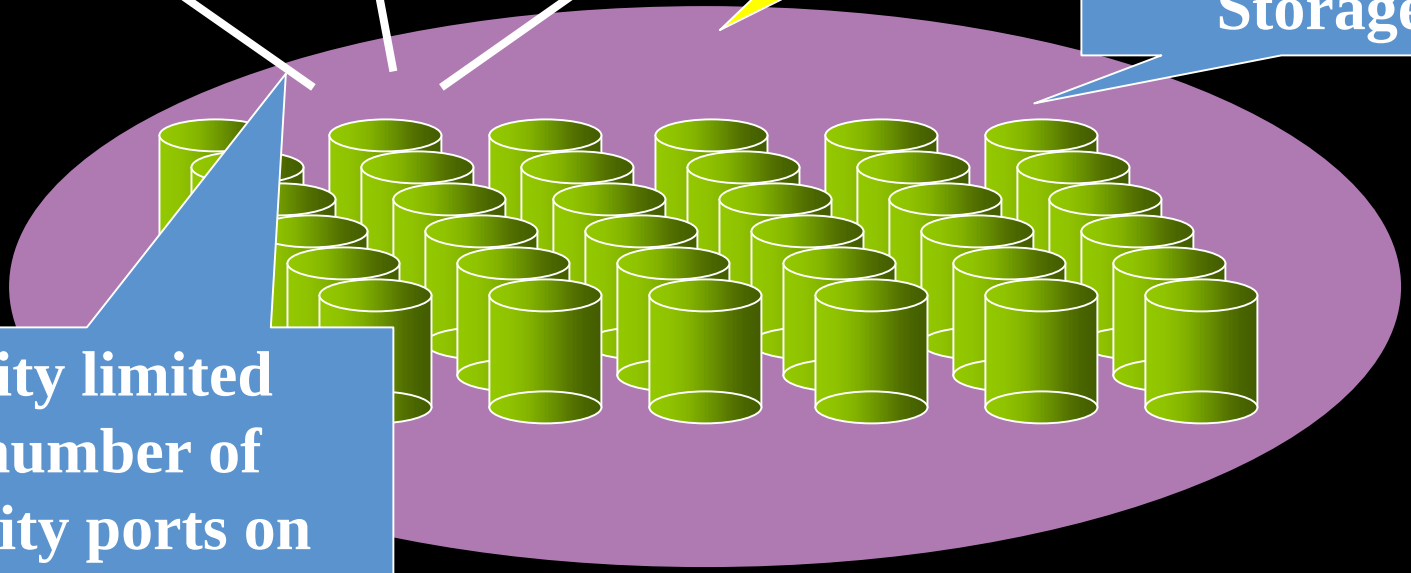
# c Approach

Only a few heterogeneous hosts can connect to one storage "subsystem"



One Storage Management Interface for heterogeneous hosts!

Homogeneous Storage

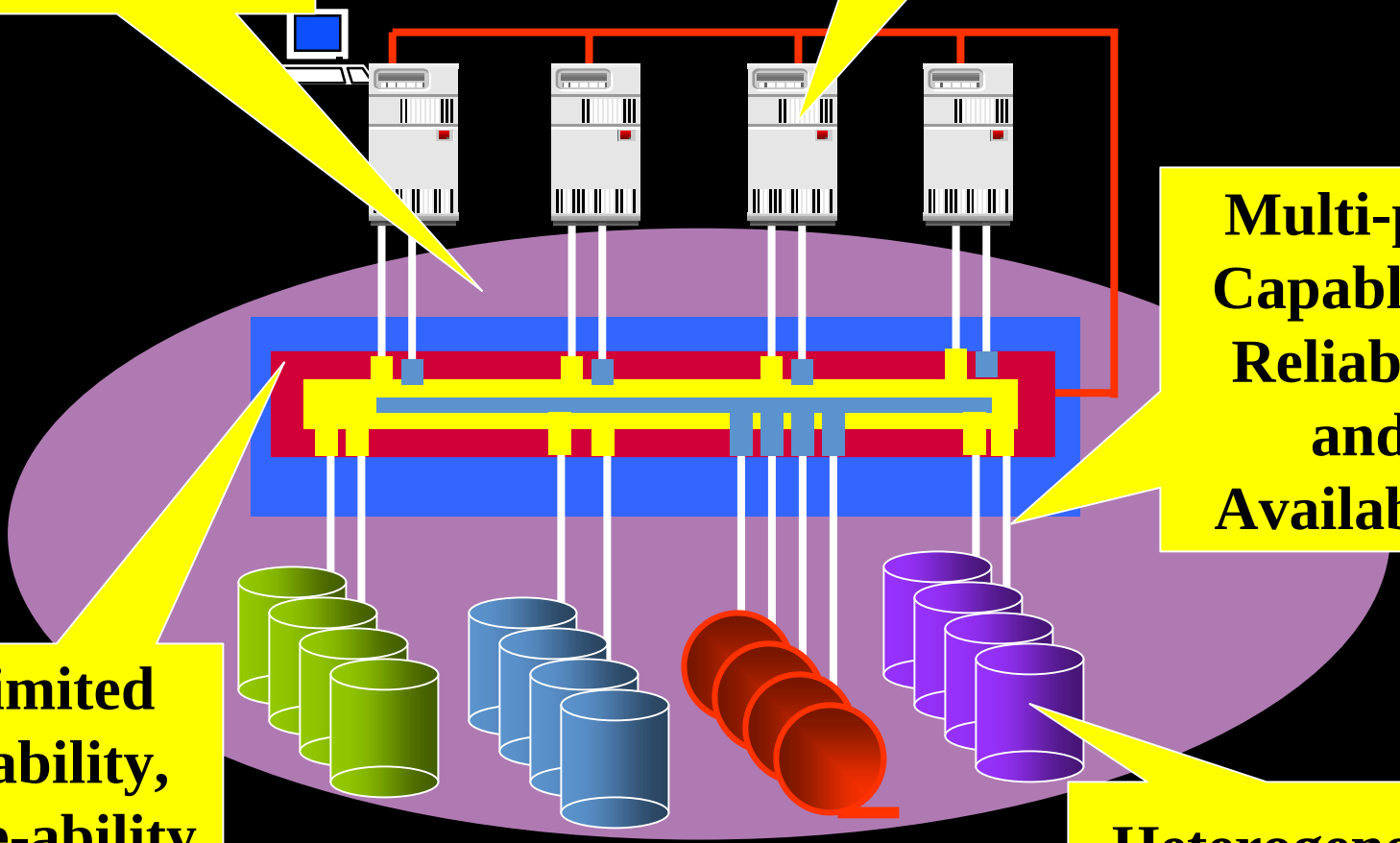


Scalability limited by the number of connectivity ports on the storage "subsystem"

# ntric Approa

Centralized Management

Heterogeneous Server Support



Multi-path Capable for Reliability and Availability

Unlimited Scalability, Severe-ability, Extensibility

Heterogeneous Storage Support

# StorageTek SN6000 Foundation

## *The Enterprise SAN Platform*

***Lower Acquisition Costs***

- Storage virtualized at the SAN
- Switch & share any resource (even ESCON)
- Dynamically balance any resource

***Improved Availability/Uptime***

- Total fault tolerance (dual fabrics)
- Hot swappable everything
- SAN-based processing for data movement

***Lower TCO***

- SAN platform for Storage Service Levels
- Automate the mundane

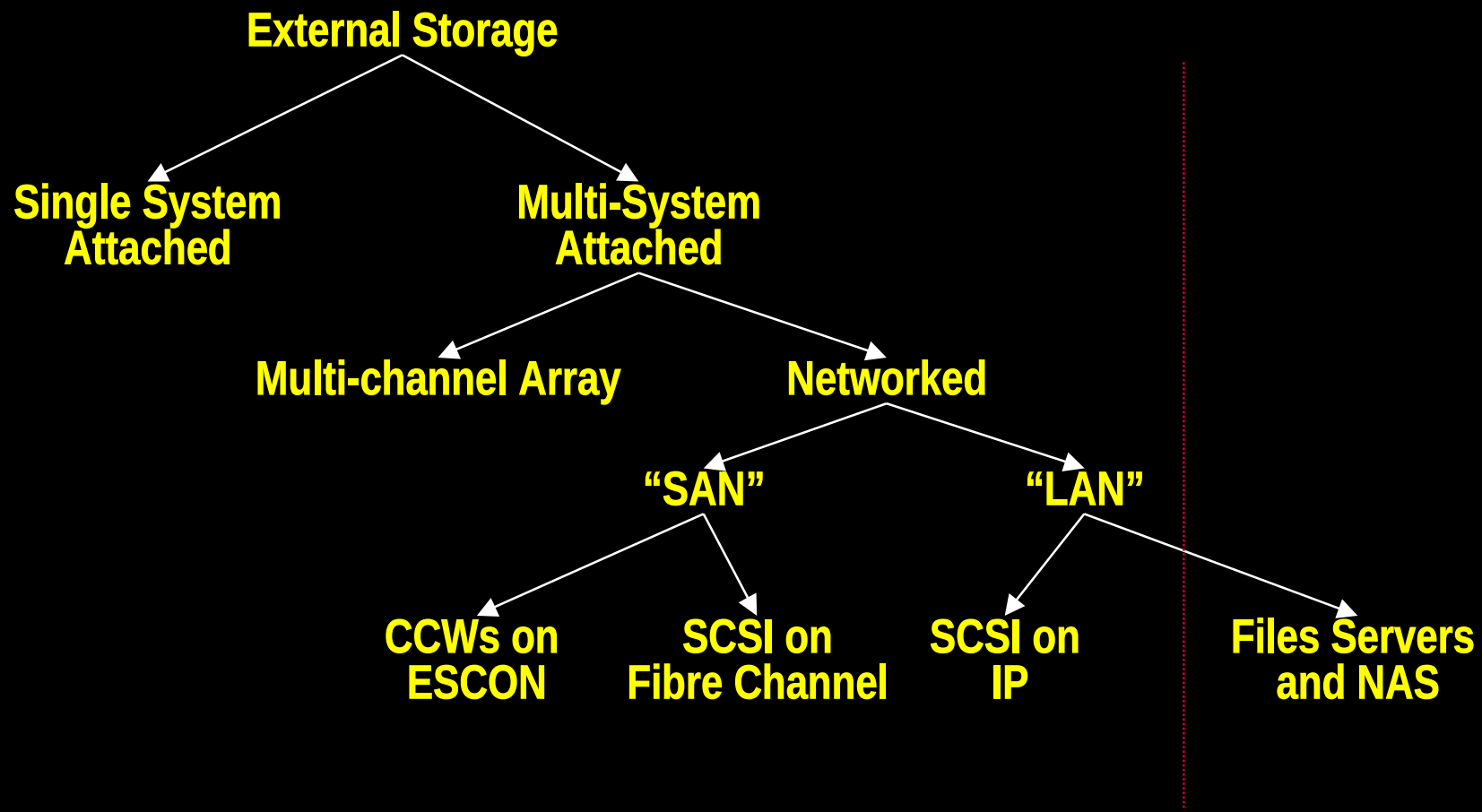
***Investment Protection***

- Massive scalability from 4-64 ports
- Management Suite
- ESCON, Fibre, WAN, LAN

# Network Storage Evolution

- Network Attached Storage
  - File services
- Switched Fabric Storage Network
  - Storage attached to multiple hosts through FC switches
- Intelligent Storage Networks
  - Storage Management in the network
  - Switches replaced with “intelligent switches”
  - Storage allocation and partitioning managed in the network
  - Backup and recovery management in the network
  - File systems and file services in the network

# Storage Genealogy



# Emerging Technologies

- Infiniband
  - Computer interconnect
  - Switched fabric
  - IPv6
- Gb Ethernet
  - Continually increasing in performance
  - Replacement for Fibre Channel?
    - Provides single network protocol, end-to-end
- Cost of integrated circuits
- Demand for shared data from new applications

# SAN opportunities

- Advances in storage technologies provide more storage behind a single host
- Cost containment demands dynamically shared storage
- Storage administration is moving into the SAN
  - Removes burden from hosts
  - Simplifies administration effort

# More Information...

***Web***

**Cern Fibre Channel Overview**

**http://hsi.web.cern.ch/HSI/fcs/spec/overview.htm**

***Books***

**Benner, Alan F. *Fibre Channel Gigabit Communications and I/O For Computer Networks.* New York, NY McGraw Hill, 1996.**

**Clark, Tom. *Designing Storage Area Networks.* Reading, MA Addison-Wesley 1999.**

***Associations***

**Storage Network Industry Association (SNIA)**

**http://www.snia.org/**