Storage Area Networks - A New Performance Paradigm

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Large data sets and client-server networking

- Large data sets
  - File sizes 100's of MB into the GBs
  - On-line storage in the TBs
  - Typical of visual and scientific computing
    - Entertainment, medical, DoD, remote sensing, simulation/visualization, geosciences
- Shared storage
  - Data generation or capture
  - Processing
  - Display, viewing, output
  - Archive

Large data sets and client-server networking

◆ **Shared storage insulated from clients**

◆ **Data movement from storage to client in 'small' chunks**
  - ● **~64K disk I/O**
  - ● **Smaller network packets**

◆ **Overhead dramatically lowers bandwidth**
  - ● **10 MB/s or less typical**

◆ **Application I/O requests don't track physical I/O**

File Server

LAN

Client Workstations
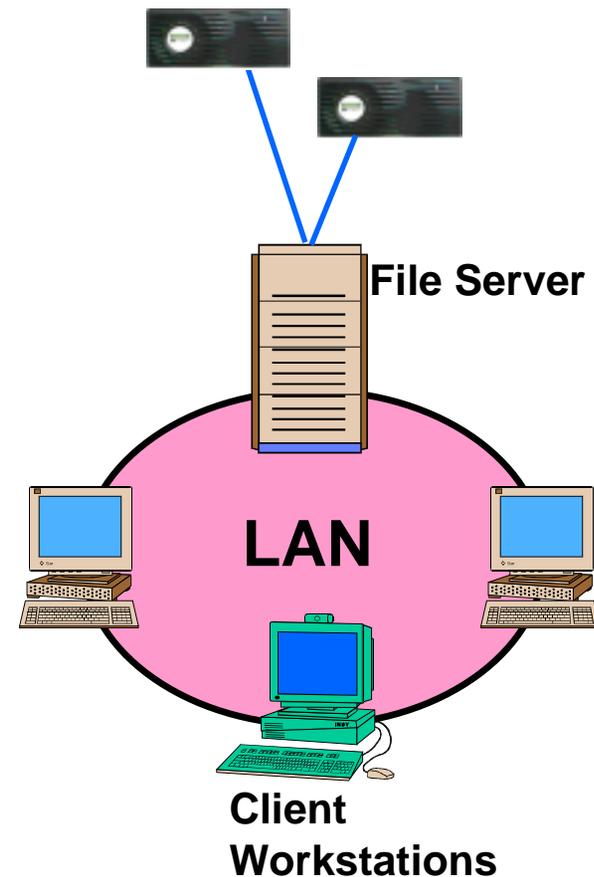
Storage performance potential

- **High-bandwidth RAID devices saturate channel I/F**
- **100 MB/s for Fibre Channel**
- **Ideal for large data set applications**

**Ciprico 7000 Series RAID with "Cuda 9's"**

Performance (MB/S) vs Request Size (KB)

Target Performance Range

Typical Workstation Bandwidth Across Network

— Sequential Read — Sequential WCE
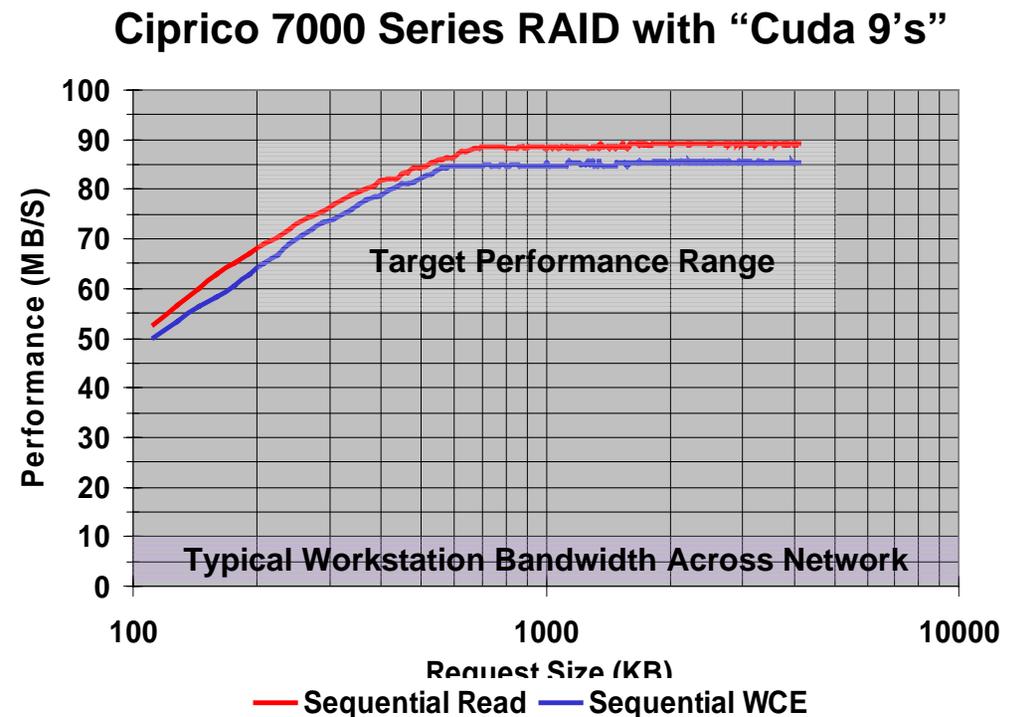
Storage Area Networks (SAN)- Getting Everything from Your Storage

SAN Characteristics

**Availability
of Components**

**Channel I/F
for storage communications**

Distance

**Bandwidth to support
storage at device rates**

**Scaleability for capacity
and performance**

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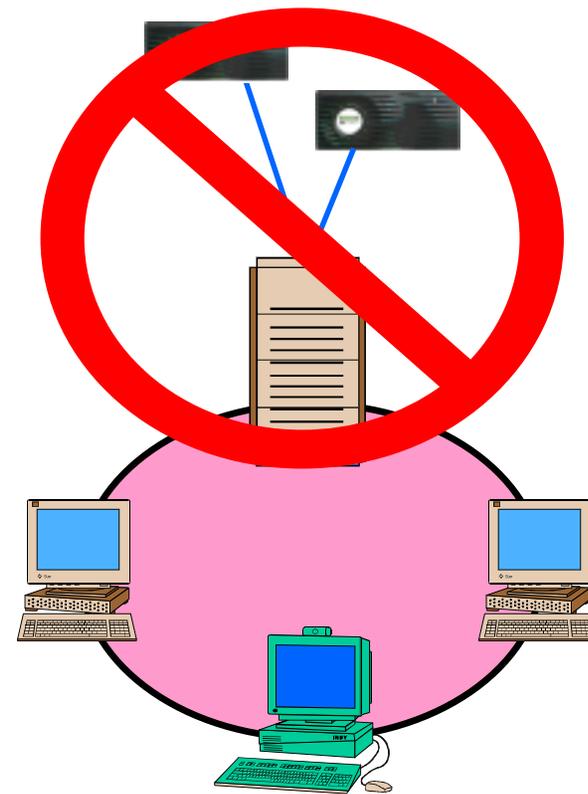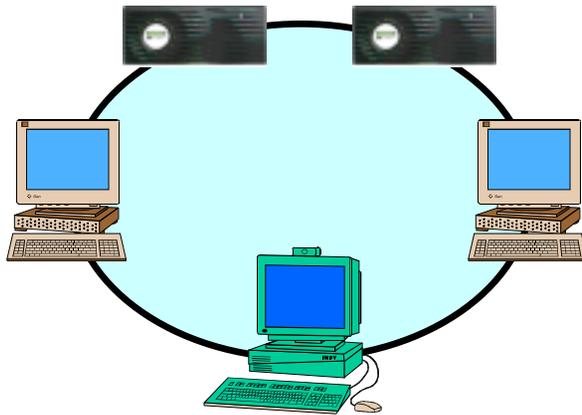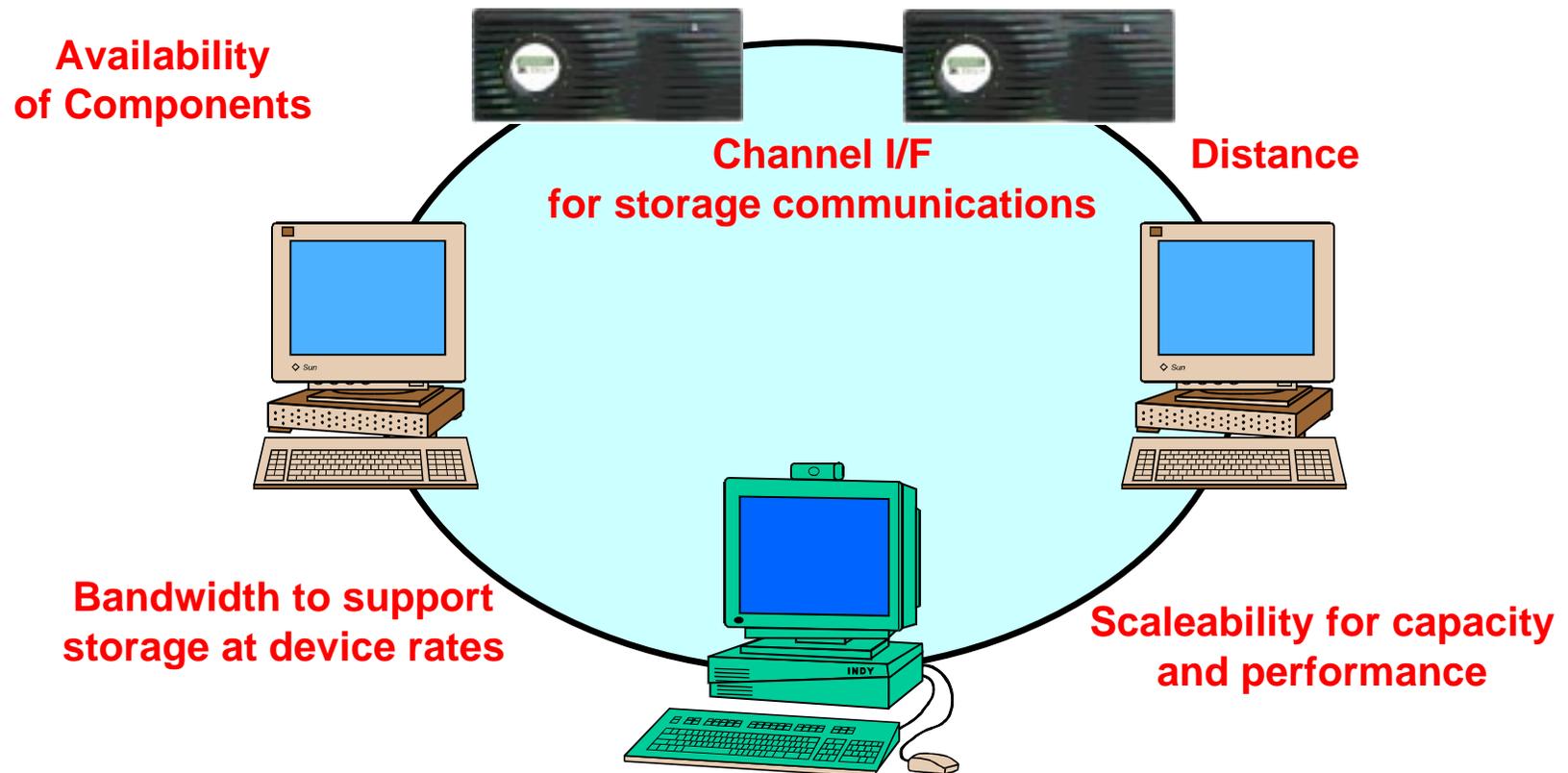
Fibre Channel for SANs

◆ **Bandwidth:** 100 MB/s per connection

◆ **Channel interface:** SCSI for storage

IP for networking

◆ **Scaleability:** Multiple topologies

Fabric switching

Arbitrated Loop

◆ **Distance:** Fibre optics for long distances

Copper for the computer room

◆ **Availability:** Storage - RAID & disks

Networking - hubs & switches

Host connections - adapters

S E E   A S   F A S T   A S   Y O U   T H I N K .

Software for SANs

- ◆ **Direct access of client to storage device**

- ◆ **Multiple access of common files**

  - ● **Metadata locking to ensure file system integrity**

  - ● **Low overhead distributed access control**

- ◆ **Cross-platform heterogeneous operations**

- ◆ **Striping for high-bandwidth**

- ◆ **Automatic re-direction of I/O requests through redundant paths**

Sample SAN Configuration

Global File System (GFS)
Demonstration at NAB '97

Ciprico 7000 RAID disk arrays

HIGHLIGHTS
- *Serverless operations*
- *High-bandwidth*
- *60+ MB/s per connection*
- *Fibre Channel network*

Fibre Channel Fabric

Brocade switch

O2 network monitor

Film preview on two Onyx workstations

Ethernet for activity monitoring

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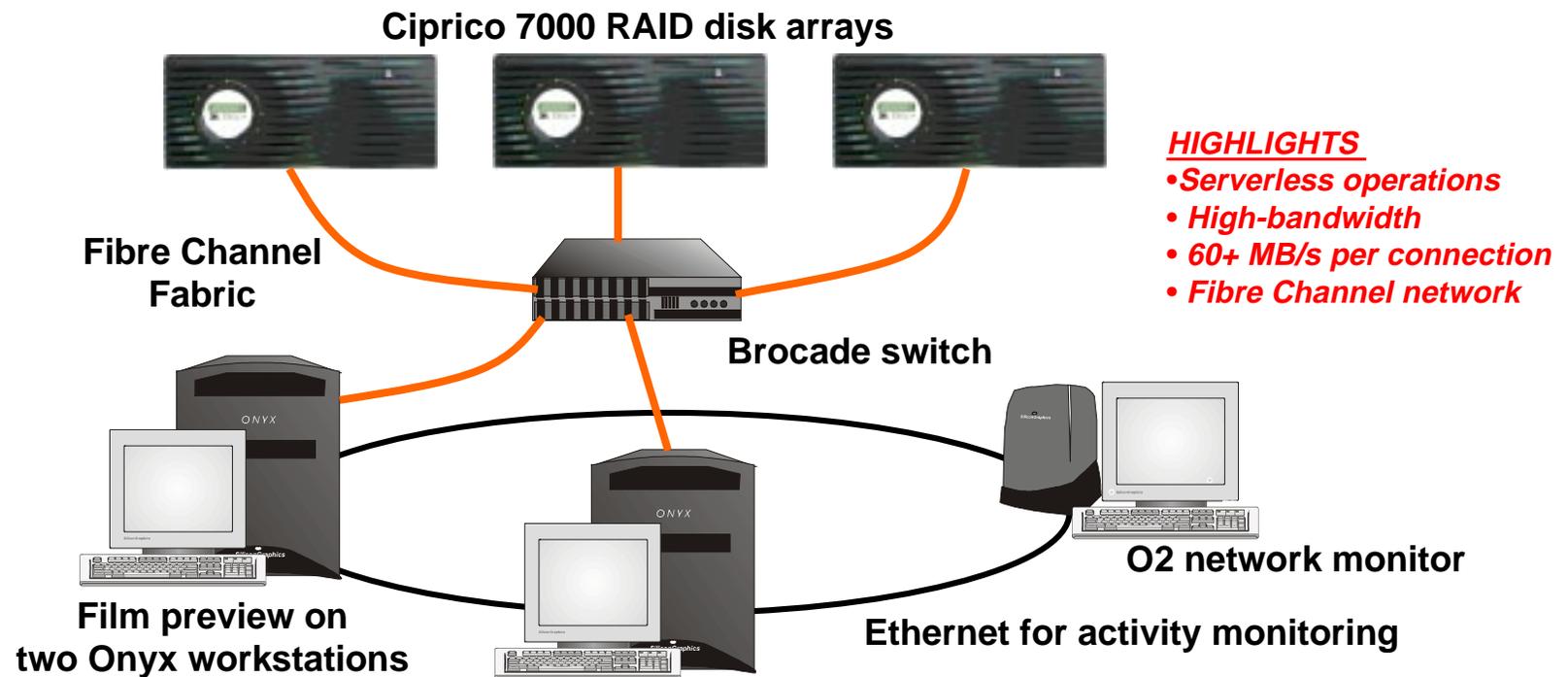
Ciprico's SANity Solution

- **Family of Fibre Channel SAN solutions**
  - **Fabric support**
- **SANity-DSA mid-1998**
  - **Direct storage access**
  - **NTFS file system**
  - **Heterogeneous NT/IRIX operations**
- **SANity-DFS early 1999**
  - **Distributed file system without servers**
  - **Heterogeneous NT/IRIX/Solaris operations**
  - **System level striping**
  - **Guaranteed bandwidth management**