



*National Digital Preservation Programme  
Indo – US Workshop on  
International Trends in Digital Preservation  
March 24 – 25, 2009  
Pune, India*

## **Data Repository and Preservation Storage Architecture using Open Solutions**

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# Agenda

- **Long Term Preservation – Storage Archive Features**
- **Building Preservation Storage Architecture**
- **Repository Solutions**
- **Components of the Storage Architecture**
  - > **Hardware**
  - > **Tiered Storage Consolidation with Sun Infinite Archive System**
  - > **Software**
- **Benefits of the Storage Architecture**
- **Useful Links**



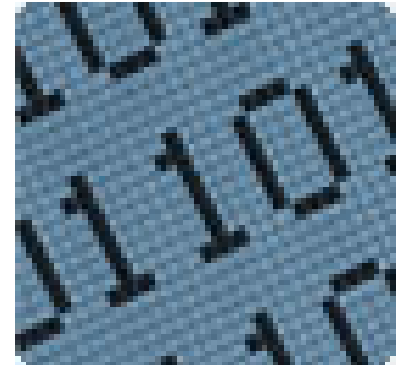
# Long Term Preservation – Storage Archive Features

- **Security** (*Encryption, Identity Management*)
  - > Protection from inappropriate access, viewing, change, copying or misuse of data
  - > Audited controls on data access, integrity and authenticity to ensure that data is secure and not compromised
  
- **Accessibility** (*Snapshot/Mirror, Replication*)
  - > Data highly available in storage tiers based on access patterns and criticality (High Speed Disk to Low Cost Disk or Tape)
  - > Policy to create local copies and replica of data in a remote site for disaster recovery



# Long Term Preservation – Storage Archive Features

- **Integrity** (*Continuous Data Protection - SAM-QFS/ZFS*)
  - > Regular Backup and Filesystem Validation (256 bit checksum in ZFS)
  - > Data Redundancy features to ensure data safety (RAID-Z, RAID 5, RAID 6)
  
- **Scalability** (*Scalable Tiered Storage, SAM-QFS/ZFS*)
  - > Storage tiers capable of scaling cost effectively and efficiently on requirement
  - > ZFS – 128-bit filesystem 16 billion times the capacity of 32-bit or 64-bit filesystems



# Long Term Preservation – Storage Archive Features

- **Open Solutions** (*Open Systems, OpenSolaris, SAM*)
  - > Long-term usability of hardware and software
  - > Open access, community based development and support
  - > Data recovery with or without proprietary methods
  - > Smooth Migration and Limits “Cost of Exit”
- **Cost Effective & Eco-Responsible** (*Eco Friendly*)
  - > Energy efficient components reduces energy cost and increases system operational efficiency
  - > Open storage systems reduce traditional storage cost by up to 75% without compromising on performance
  - > Data Migration to storage solutions like tape limits storage cost and energy cost



# Building Preservation Storage Architecture

## Factors to consider

- Business process assessment and incorporating it to archive architecture design
- Longevity of information stored in the digital repository
  - > Strategies: Refreshing, Migration, Replication, Emulation, Metadata Attachment and Trustworthy Digital Objects
- Security, Storage and Application Interoperability
- User specific requirements
- Content Types that will be stored in the archive
  - > e-Books, e-Journals, Government Documents, Images, Maps, Manuscripts, Newspapers, Scientific/Research Data, Web Documents etc.,
- Funding
  - > For Operation and Upgrade cycles of the architecture



# Repository Solutions

- **FEDORA**

- > Developed by the Fedora Commons non-profit organization
- > Open source repository solution
- > Platform to preserve digital content for intellectual, organizational, scientific and cultural heritage

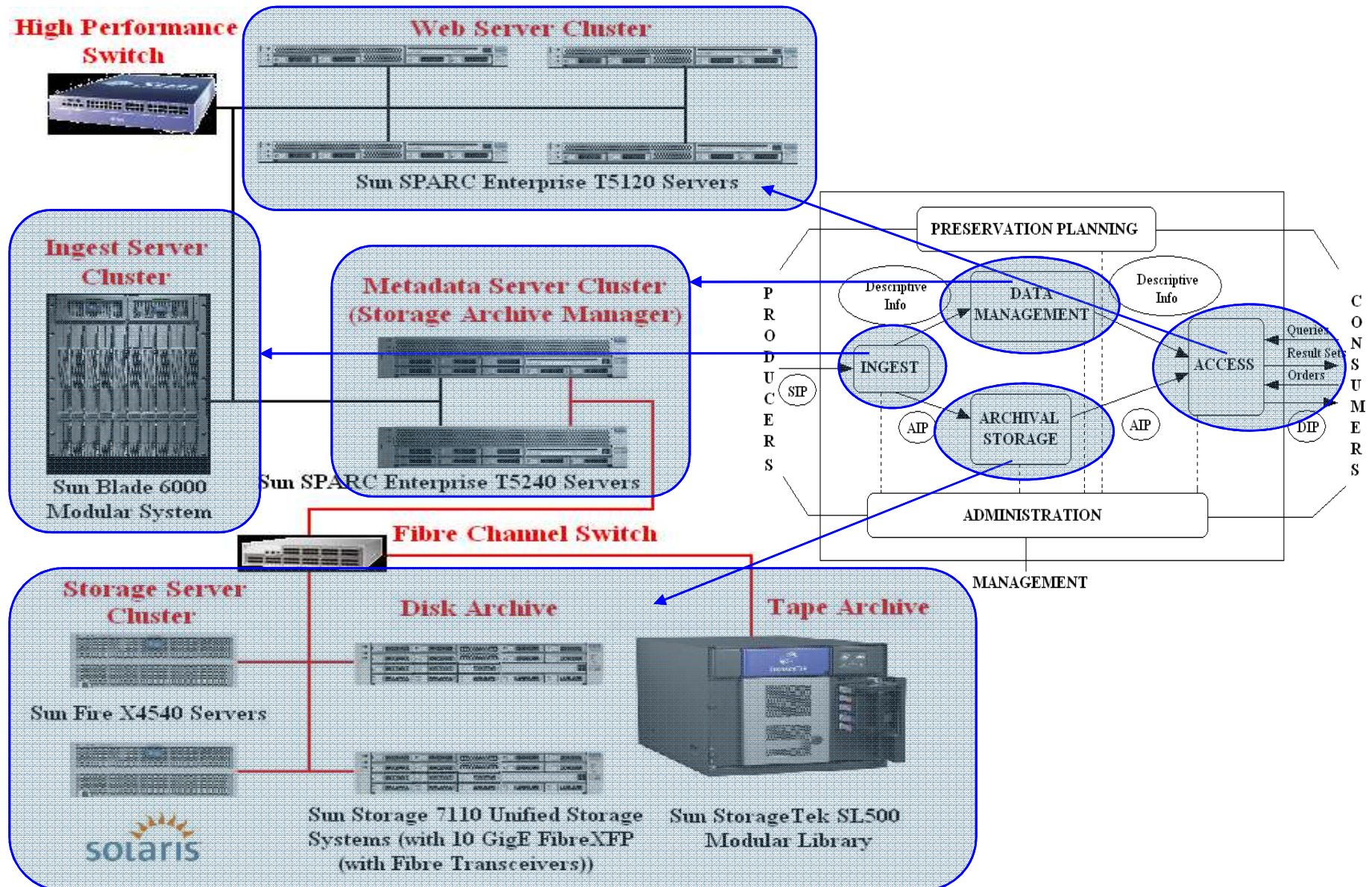
- **DSpace**

- > Supports archiving of wide variety of data including books, theses, 3D objects digital scan, photo, film, video, research data sets etc.,
- > Developed as joint effort between MIT Libraries and HP
- > Freely available under BSD open source license

- **EPrints**

- > Primarily used for institutional repositories and scientific journals
- > Developed at the University of Southampton School of Electronics and Computer Science and is released under GPL license

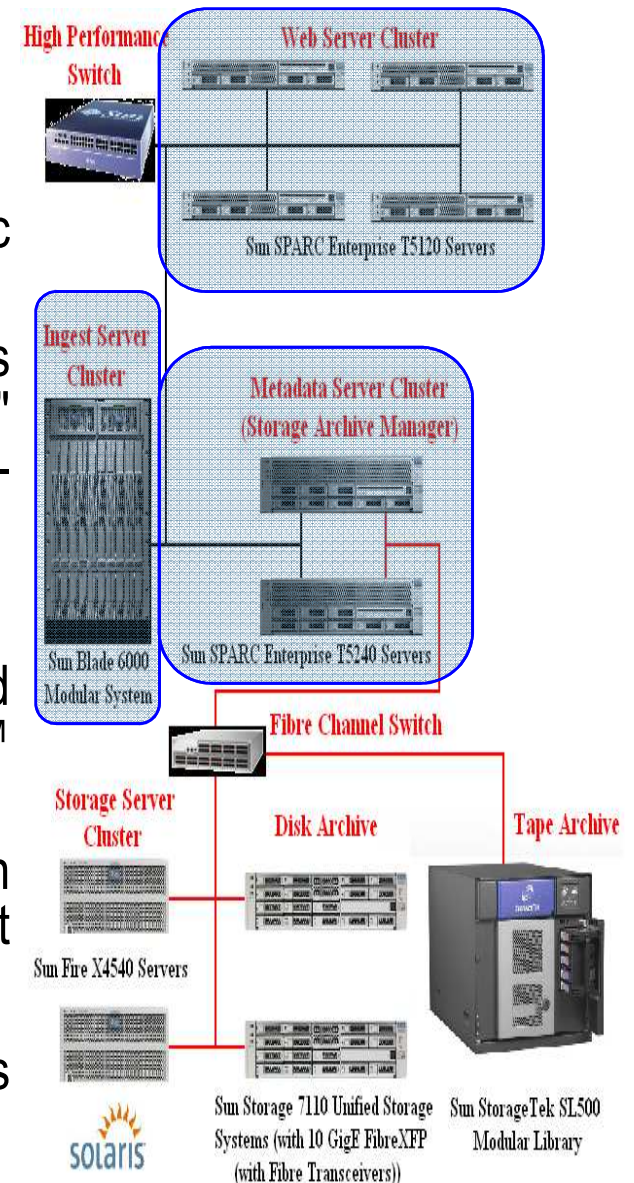
# Components of the Storage Architecture



# Components of the Storage Architecture

## Hardware

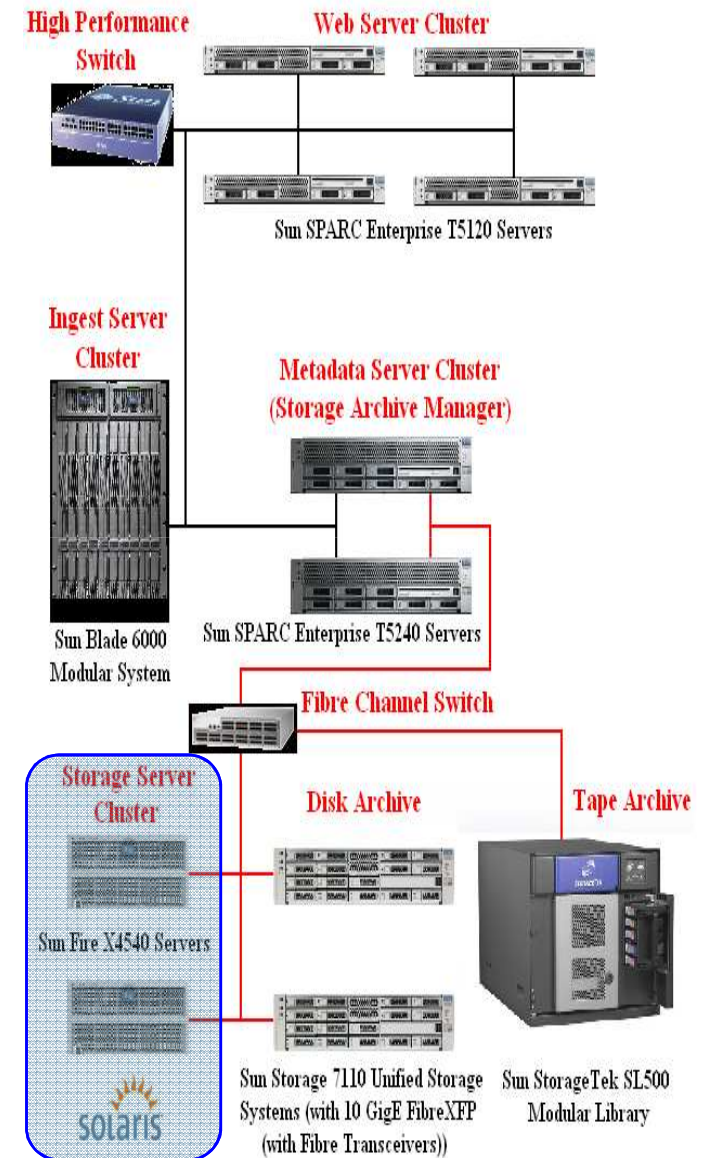
- **Sun SPARC Enterprise (CoolThreads™) Servers**
  - > Delivers break through performance with dramatic space and power efficiency
  - > Powered by the UltraSPARC® T2 or T2 Plus processor, the industry's first "system on a chip" packing the most cores and threads of any general-purpose processor available
- **Sun Blade 6000 Modular Systems**
  - > Ability to support AMD Opteron™, Intel® Xeon, and UltraSPARC® T1 processors with CoolThreads™ technology
  - > Reduces power and cooling footprint when compared to the corresponding number of rack-unit servers
- Ideal for meeting the demands of ingest, web services and metadata management



# Components of the Storage Architecture

## Hardware

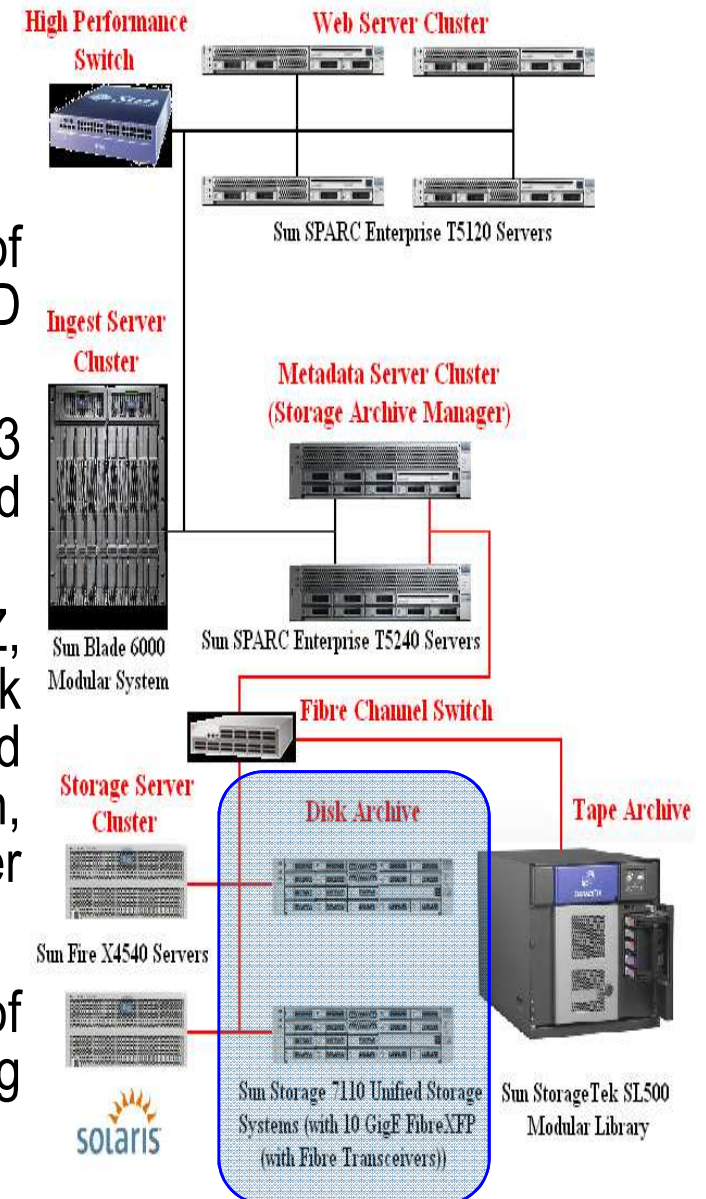
- **Sun Fire X4540 Servers**
  - > Provides virtually unlimited scalability with the highest end-to-end data integrity and near-zero administration when combined with OpenSolaris and ZFS
  - > First open storage server gives the power of two quad-core AMD Opteron™ processors with up to 64GB memory and highest throughput rates (2 GB/s from disks to network, 3GB/s disks to memory)
- These servers are ideal for formatting, storing and faster retrieving of data from various storage tiers



# Components of the Storage Architecture

## Hardware

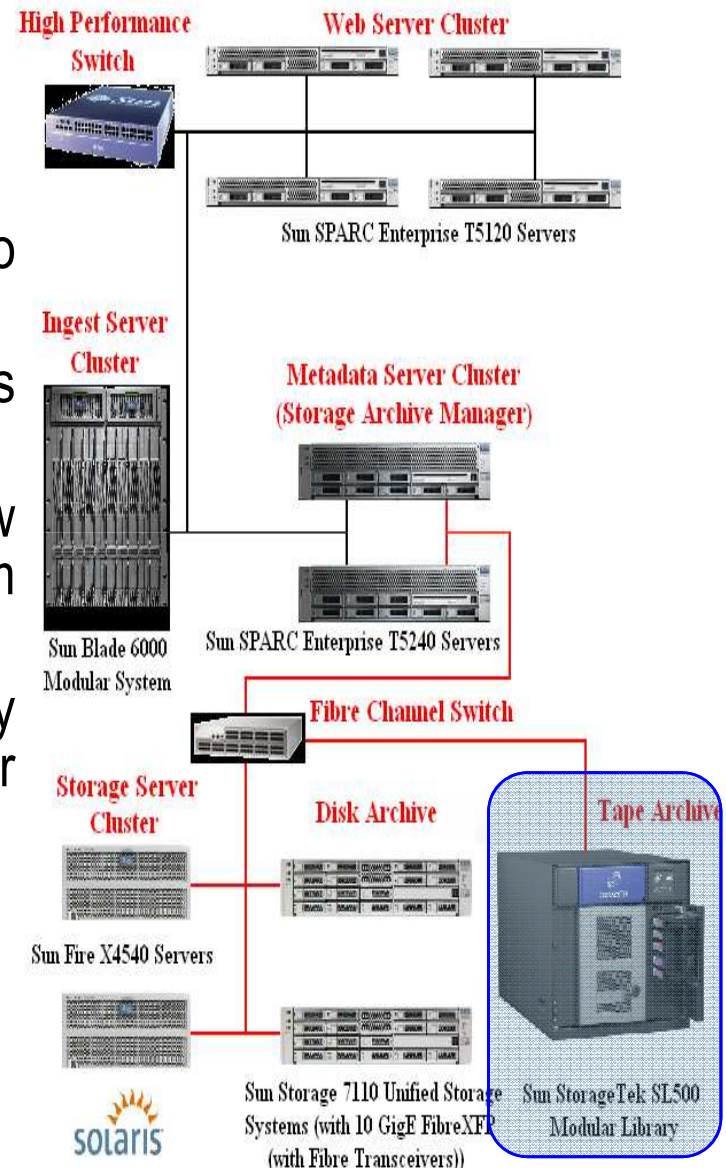
- **Sun Storage Unified 7000 Storage Systems**
  - > Open storage solution offering up to 576 TB of storage capacity using combination of SSD and HDD
  - > Supports various data protocols like NFS v3 and v4, CIFS, iSCSI, HTTP, WebDAV and FTP
  - > Provides various data services like RAID-Z, RAID5 and RAID6, Mirrored and Striped Disk Configurations, Unlimited Read-Only and Read-Write Snapshots, Data Compression, Remote Replication of Data for Disaster Recovery etc.,
- Provides effective long-term archiving, retrieval of data and also supports wider system access using commonly used data protocols



# Components of the Storage Architecture

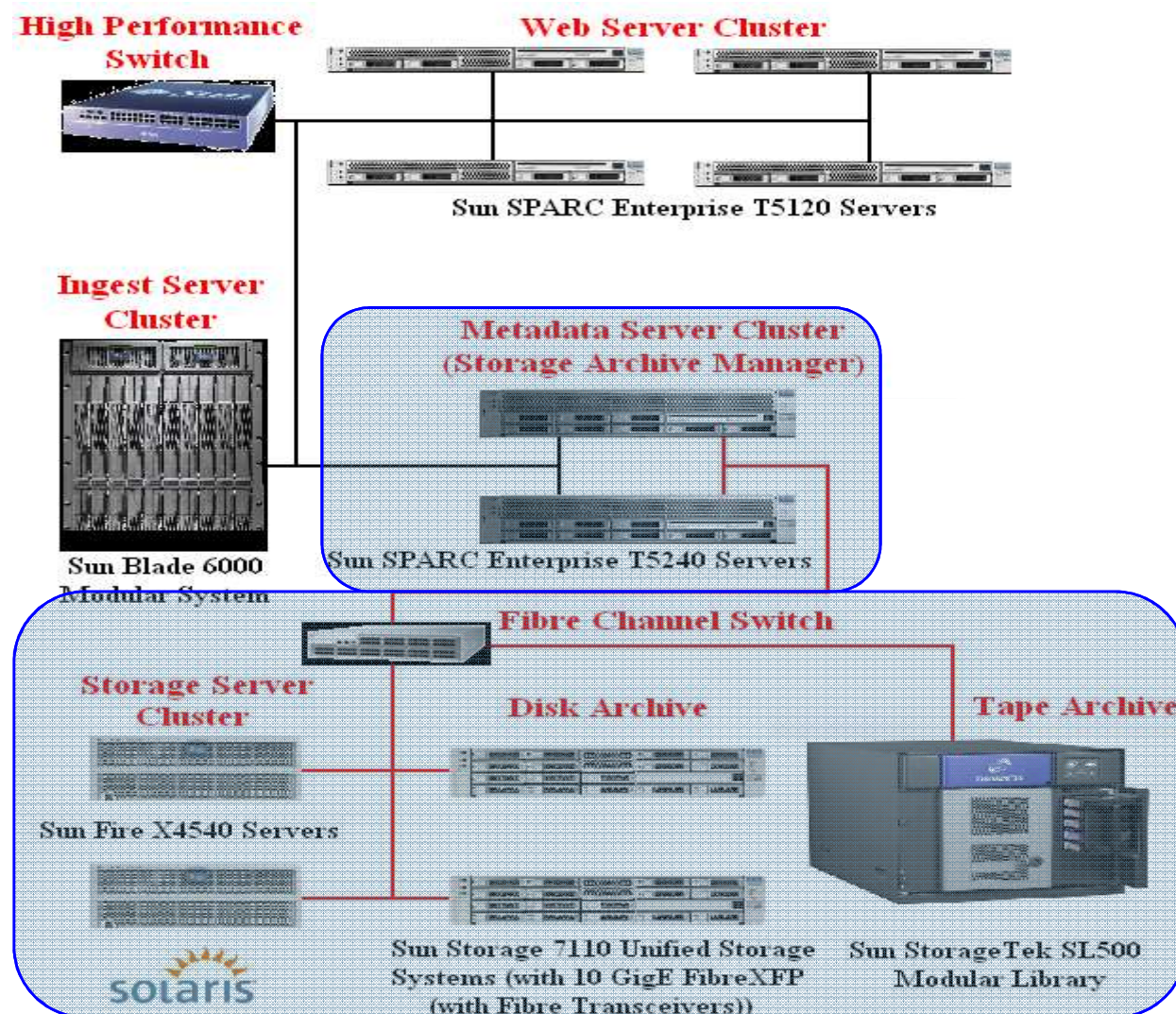
## Hardware

- **Sun StorageTek Modular Library System**
  - > Most scalable solution in market with up to 56 PB and 70,000 tape slots
  - > Complemented by Sun StorageTek VTL Plus or VTL Value Virtual solutions
  - > VTL enables tape consolidation with low cost, cartridge removability and long-term retention capabilities
  - > This tiered storage solution managed by policies on the VTL reduces labor costs for virtual and physical tape management



# Components of the Storage Architecture

## Tiered Storage Consolidation with Infinite Archive System

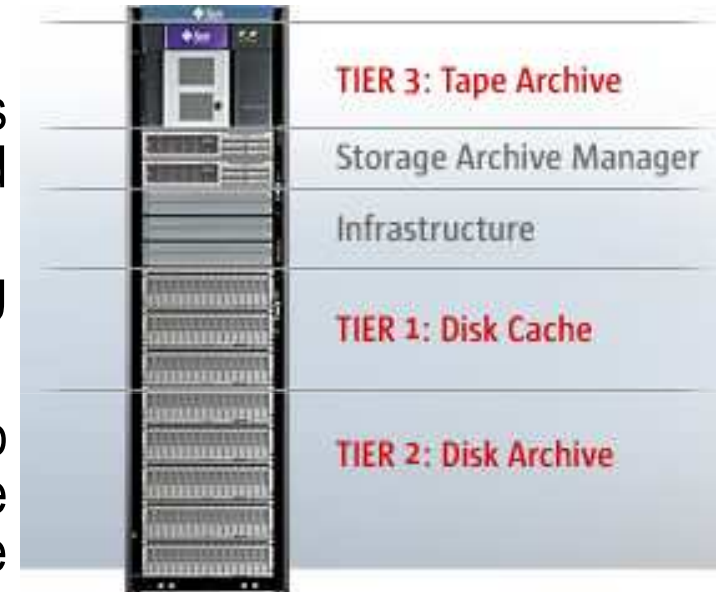


# Components of the Storage Architecture

## Tiered Storage Consolidation with Infinite Archive System

- **Sun Customer Ready Infinite Archive System**

- > Ready to deploy solution which reduces complexity and administration of multi-tiered storage archive environment
- > Designed with proper amount of CPU bandwidth to handle huge data loads
- > Easy expansion by adding more storage to any of the storage tiers and can upgrade servers with fast processors or add more nodes
- > Provides 3 tiered storage system with disk cache, disk archive and tape archive
- > Takes advantage of SAM (Storage Archive Manager) software to manage the placement and retention of data for cost effective use of storage resources



# Components of the Storage Architecture

## Software

- **Solaris**
  - > Supported in x86(Intel, AMD) and SPARC Systems
  - > Provides numerous technical advantages like Virtualization, Security, Networking and Availability
  - > Solaris comes with advanced features like:
    - ZFS
    - DTrace (Dynamic Tracing)
    - Predictive Self Healing
  - > Complements well with the applications around hierarchical storage management
  - > Freely downloadable from Sun Microsystems

# Components of the Storage Architecture

## Software

- **Sun Identity Management Solutions**
  - > Streamlines and simplifies user identity management across a variety of applications
  - > Identity Manager provides comprehensive user provisioning and identity auditing for efficient management of profiles and permission across enterprise
  - > Directory Server Enterprise provides secure, highly available, scalable and easy to manage directory infrastructure for growing and dynamic environments
  - > OpenSSO (Single Sign On) provides secure web access management, centralized access control and single sign-on in an unified solution

# Components of the Storage Architecture

## Software

- **Sun StorageTek Storage Archive Manager (SAM)**
  - > Provides data classification, centralized meta-data management, policy based data placement, protection, migration, long-term retention and recovery
  - > Effectively manages and utilize data across multiple storage systems with high speed disk, low cost disk or tape
  - > Enables users to reduce the cost of storing vast data repositories by providing a powerful, cost-effective way to access, retain and protect business data over its entire life cycle
  - > Provides application transparent migration between media during hardware replacement cycles

# Components of the Storage Architecture

## Benefits of the Storage Architecture

- **Reduced TCO**
  - > Due to tiered storage approach, the total cost of ownership is reduced without compromising on faster access and also provides transparent access across multiple tiers of storage
- **Improved Reliability and Availability**
  - > Systems used in the architecture uses redundant components and automated fail over sequences which ensures that the downtime of the system is minimal in the event of any failure
- **Scalability**
  - > Storage requirements for a growing archive solution can be easily addressed because of the modular approach used in various storage tiers in the architecture
- **Reduced Risk and Complexity**
  - > Use of pre-configured, pre-tested, complete solution reduces risk, complexity and deployment time of multi-tiered storage environments

## Useful Links

- SUN-PASIG (Sun Preservation and Archiving Special Interest Group): <http://www.sun-pasig.org>
- A case study on Digital Preservation at the National Library of New Zealand: <http://www.sun-pasig.org/pdf/NLNZ%20Case%20Study.pdf>
- Open Repositories: <http://www.openrepositories.org>
- FEDORA: <http://www.fedora-commons.org>
- DSpace: <http://www.dspace.org>
- EPrints: <http://www.eprints.org>



**Thanks for your time**

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