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NATIONAL SCIENCE LIBRARY
BEIJING, CHINA

THE CHRONOPOLIS DEMONSTRATION PROJECT:

A GRID-BASED DIGITAL
PRESERVATION ENVIRONMENT

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Outline

- **SDSC at a Glance**
 - Data-Cyberinfrastructure
 - Leveraged Resources
 - Digital Preservation Initiatives
- **Chronopolis**
 - A Conceptual Preservation Framework
 - A Federated Partnership
 - Grid-Enabled Preservation
 - Grid Map
 - Collaborators
- **Chronopolis Demonstration Project**
 - Design Feasibility
 - Networking
 - Replication - Tape
- **Chronopolis Next Steps**
 - 2007-2008 NDIIPP
 - 2007-2008 Mass Transit

SDSC at a Glance

- **One of original 5 NSF supercomputer centers (1985)**
- **Supports High Performance Computing Systems and Data Intensive Computing**
- **Supports Data Applications for Science, Engineering, Social Sciences, Cultural Heritage Institutions**
 - 3 PB Disk Storage
 - 25 PB Tape Storage



Acronyms

- **HPSS** – one of two archival storage systems at SDSC. Manages 6 StorageTek tape silos (25 PB).
- **SAM-QFS** – one of two archival storage systems at SDSC. Manages disk and tape storage resources at SDSC.
- **SRB** – Storage Resource Broker – middleware for managing data grid federations and heterogeneous storage hardware and software resources.
- **iRODS** – open source version of SRB with automated rules based storage management.
- **MCAT/iCAT** – metadata catalog for SRB and iRODS data management.
- **TeraGrid Network** – Dedicated 100G connectivity for NSF funded shared computing and storage resources on the TeraGrid.
- **I2 Abilene Network** – U.S. based dedicated educational network. Can have dedicated network bandwidth of 10G or 100G connectivity.

SDSC and Data Cyberinfrastructure

- The mission of the San Diego Supercomputer Center (SDSC) is to empower communities in **data-oriented research, education, and practice** through the innovation and provision of Cyberinfrastructure*

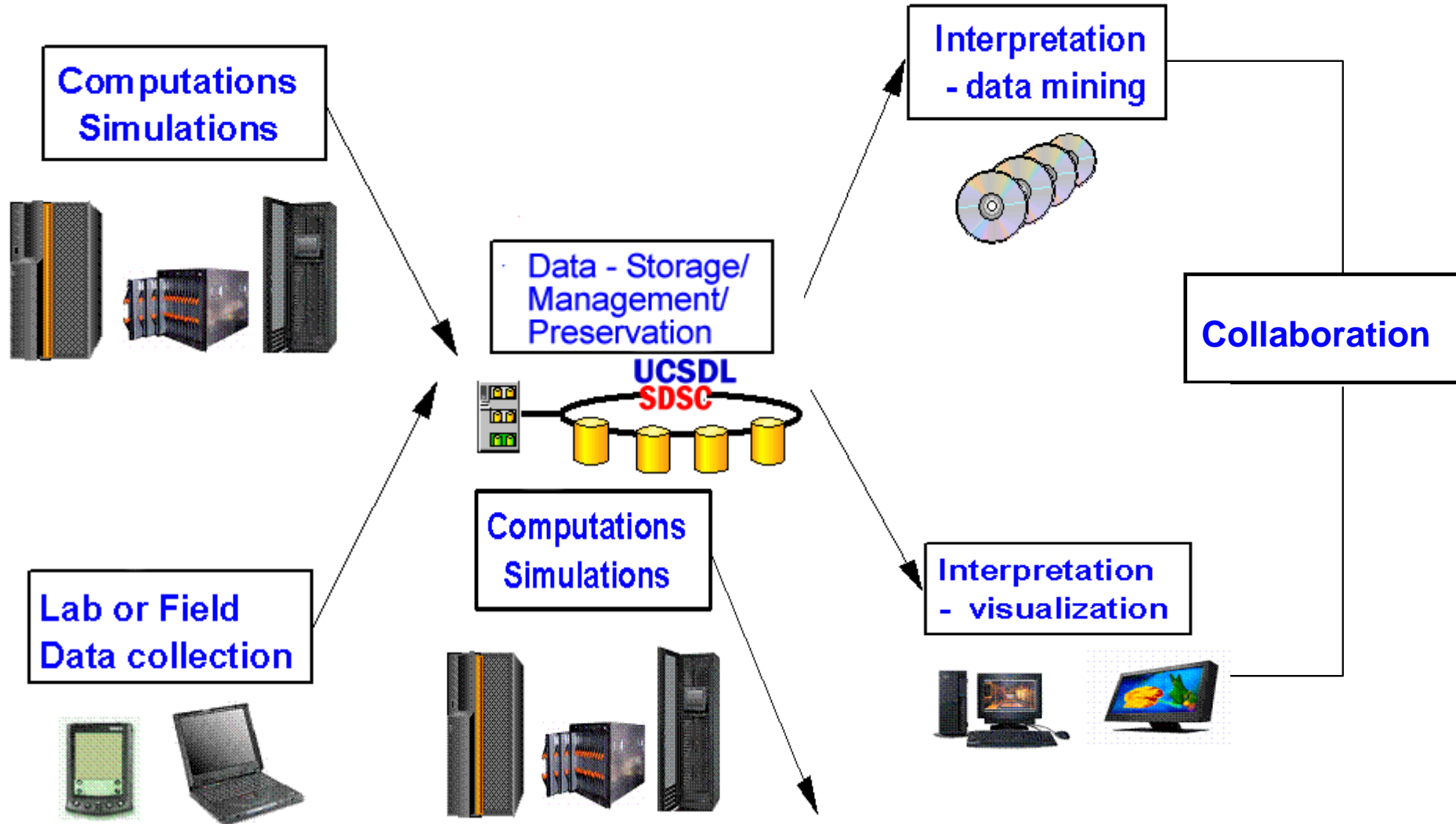
Cyberinfrastructure =
resources

(computers, data storage, networks, scientific instruments, experts, etc.)

+ “glue”

(integrating software, systems, and organizations).

Virtually all modern research and education efforts are enabled by information and computational infrastructure

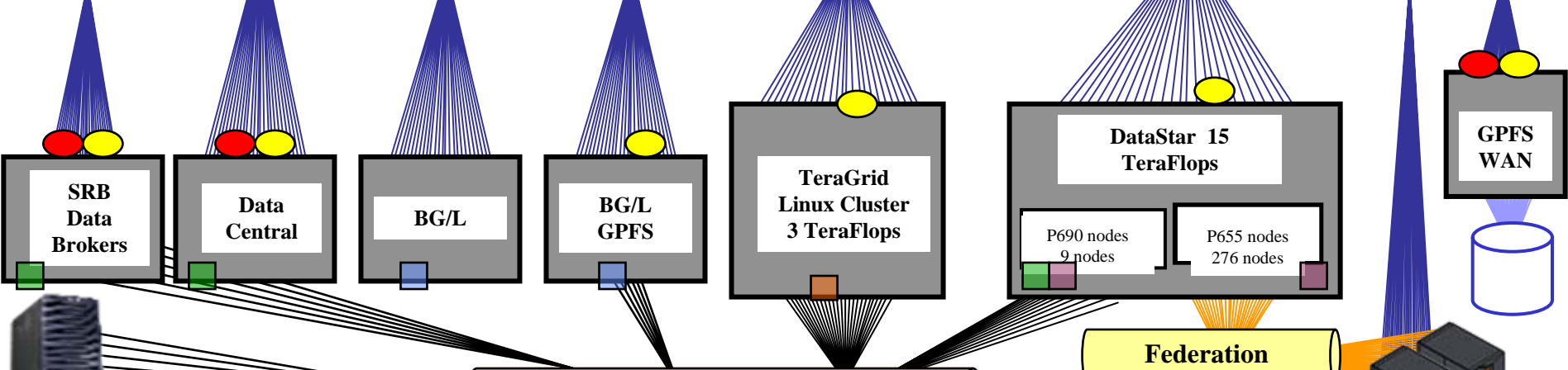


SDSC Centralized SAN and Storage Architecture

Courtesy B. Banister

- SRB Service
- GridFTP Service

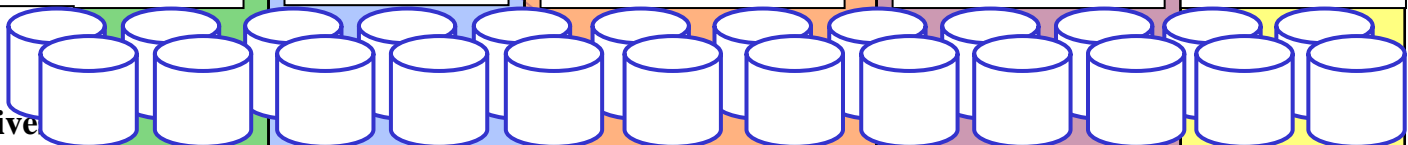
NCSA, ANL, PSC, ORNL, TACC, IU



SF 15K SAMQFS Server

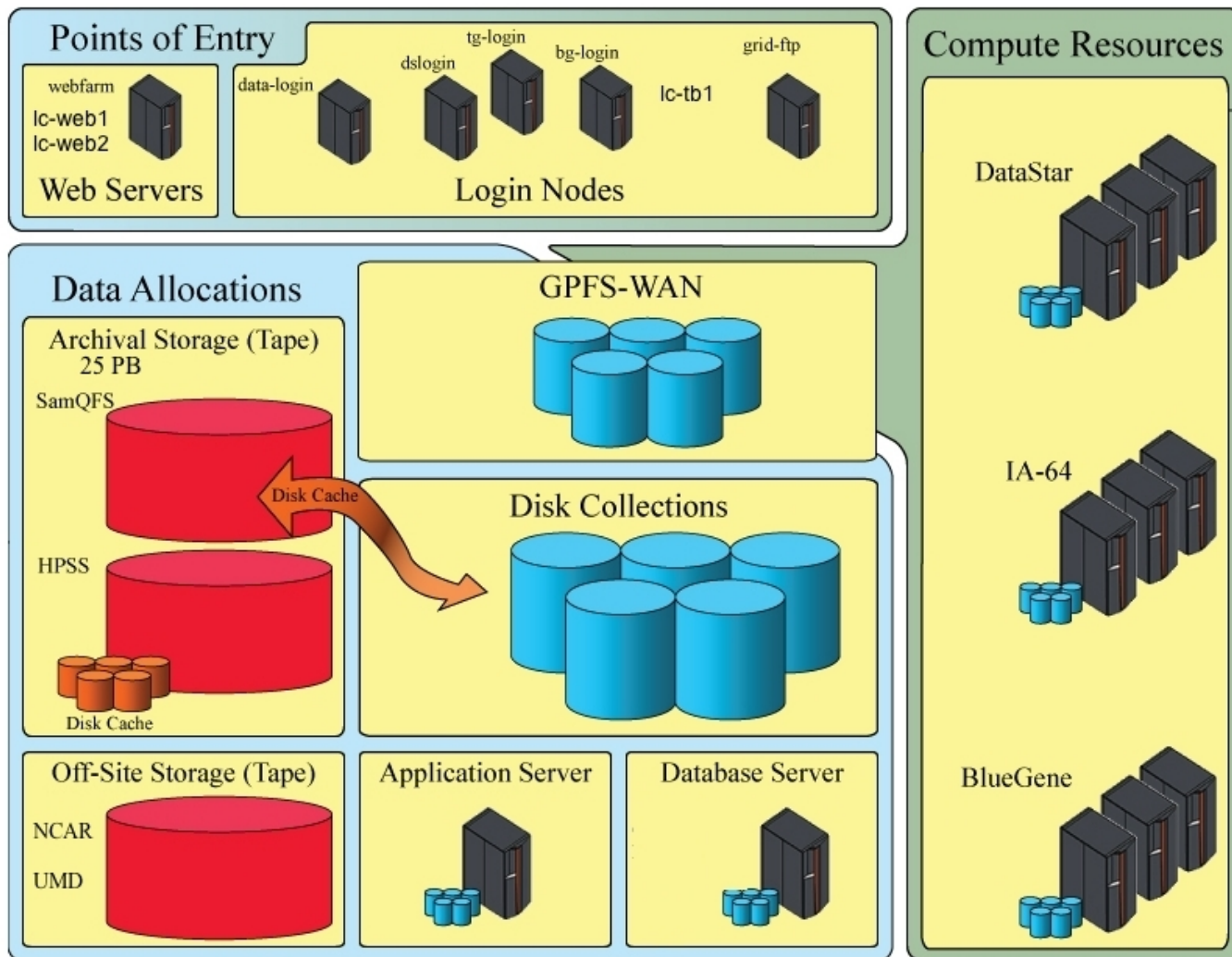


6 StorageTek Silos
25 PB storage capacity
100 Fibre Channel Tape Drive



540 TB Sun FC, 1400 TB DDN SATA, 450 TB IBM SATA, 5000+ drives

Data Structure at SDSC

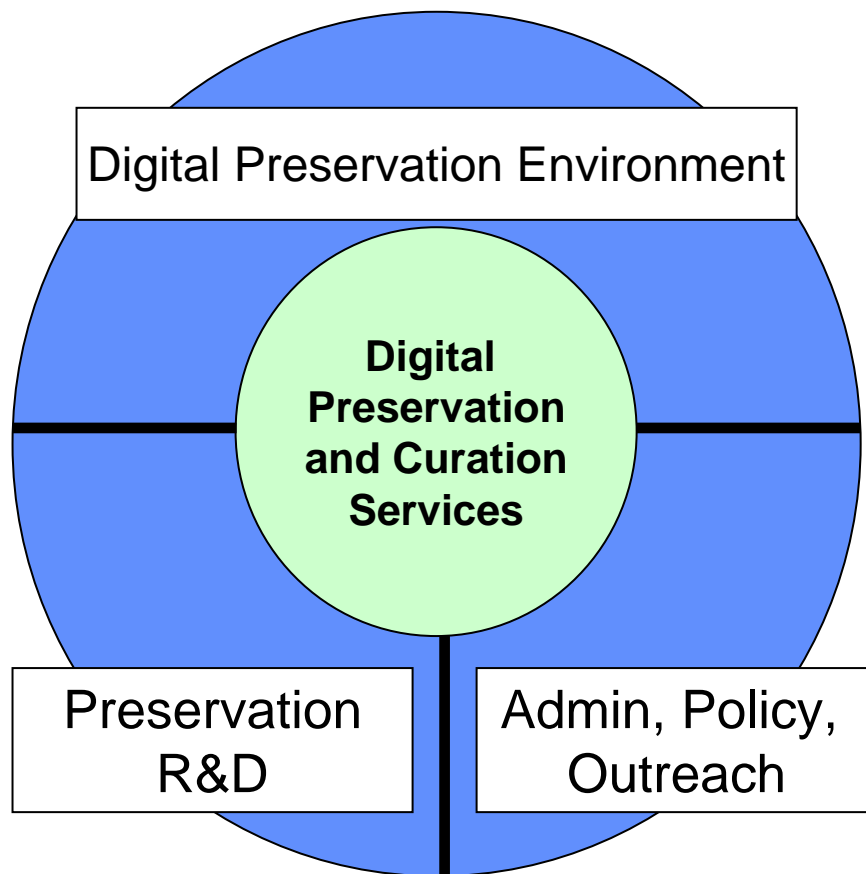


DPI at SDSC

- **Preservation Group within Production Systems Division at SDSC**
 - Charged with Developing and Supporting Digital Preservation Services for SDSC and projects supported by SDSC within the production systems division.
 - LC/NDIIPP
 - LC DATA Pilot Project
 - Content Transfer
 - Formalized Trust Relationships
 - NDIIPP Chronopolis Technical Architecture
 - Partnerships with:
 - CDL – California Digital Library
 - ICPSR – Interuniversity Consortium for Political and Social Science Research
 - California Digital Library (CDL)
 - Mass Transit Project

Chronopolis A Preservation Framework

- **Scaleable Production Digital Preservation Environment**
- **Digital Preservation Research and Development (R&D) Laboratory**
- **Management Framework for Preservation Administration, Policy, and Outreach**



A Federated Partnership

- Chronopolis is being developed by a national consortium led by SDSC and the UCSD Libraries.
- Initial Chronopolis provider sites include:
 - *SDSC and UCSD Libraries at UC San Diego*
 - *University of Maryland*
 - *National Center for Atmospheric Research (NCAR) in Boulder, CO*



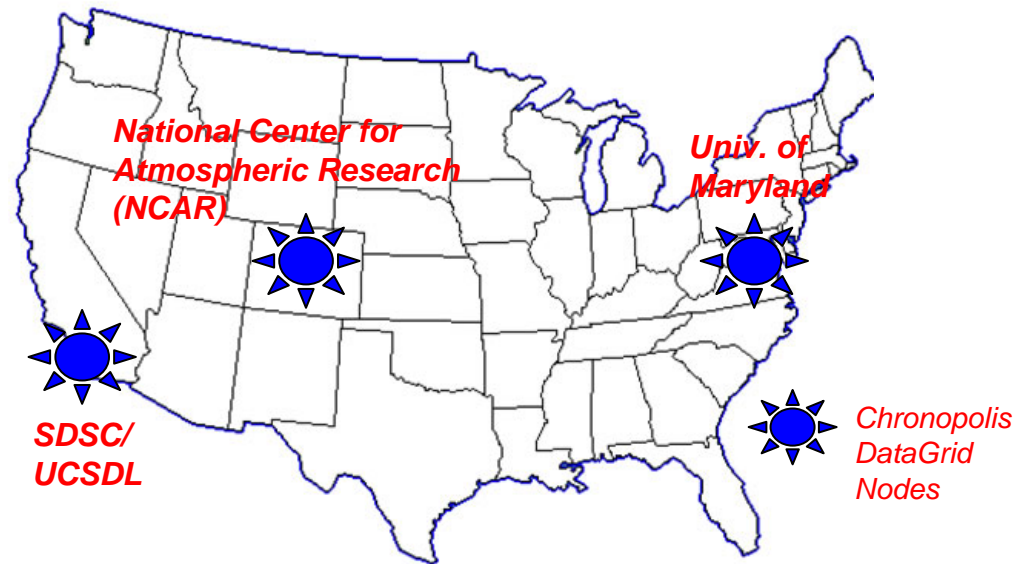
NCAR

Chronopolis Focus Areas

- Assessment of the needs of potential user communities and development of **appropriate service models**
- Development of **roles and responsibilities of providers, partners, users**
 - Development of Memoranda of Understanding (MOUs), Service Level Agreements (SLAs), etc. to formalize trust relationships and manage expectations
- Assessment and prototyping of **best practices** for bit preservation, authentication, metadata, etc.
- Development of appropriate **cost and risk models** for long-term preservation
- Development of appropriate **success metrics** to evaluate usefulness, reliability, and usability of infrastructure

Chronopolis Demonstration Data Grid

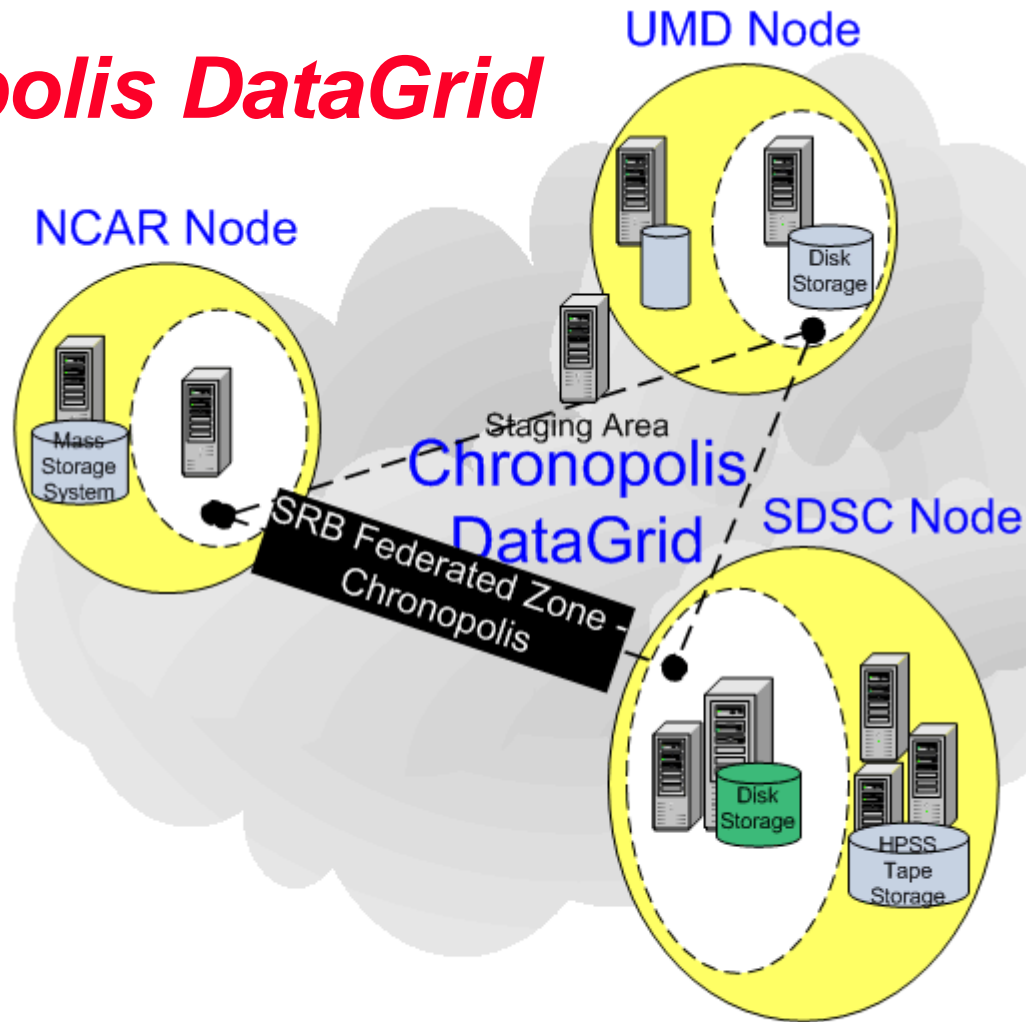
- The Chronopolis demonstration Data Grid is composed of 3 geographically distributed Chronopolis provider sites.
- Each provider takes on different roles with respect to a set of demonstration collections.



Demonstration collections include:

- National Virtual Observatory (NVO) [3 TB Digital Palomar Observatory Sky Survey]
- Library of Congress Image Collection [1 TB]
- Copy of Interuniversity Consortium for Political and Social Research (ICPSR) data [1 TB Web-accessible Data]
- NCAR Observational Data [3 TB of Observational and Re-Analysis Data]

Chronopolis DataGrid

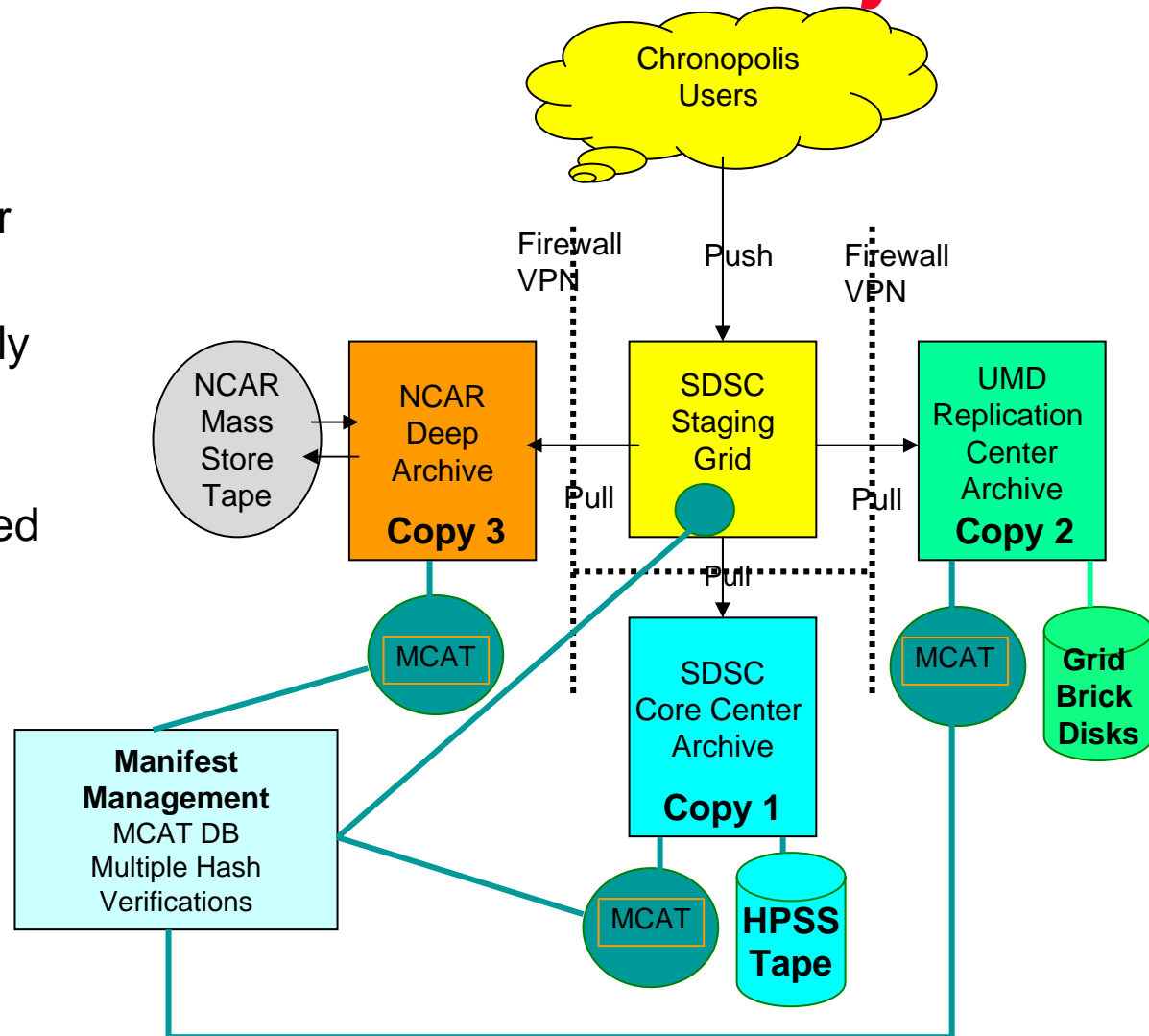


● Grid Node

----- Grid

Chronopolis Demonstration Project

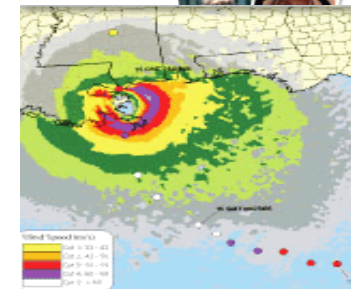
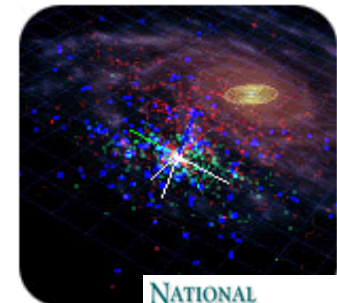
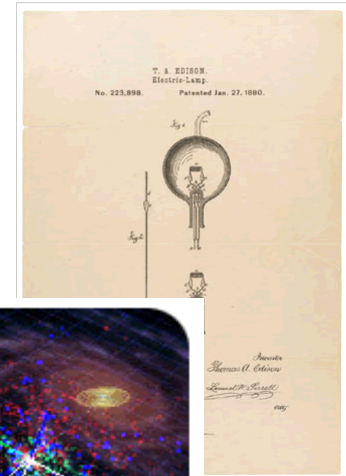
- Linked by main staging grid where data is verified for integrity, and quarantined for security purposes.
- Collections are independently “pulled” into each archive system.
- Manifest layer provides added security for database management and data integrity validation.
- **Benefits**
 - 3 independently managed copies of collection.
 - High availability
 - High reliability



Chronopolis™ Demonstration Project Collections

- **National Virtual Observatory (NVO)**
 - Hyperatlas Images 3TB (partial collection)
- **Interuniversity Consortium for Political and Social Research (ICPSR)**
 - 2TB Web Accessible Data
- **Library of Congress PG Image Collection**
 - 1TB Prokudin-Gorskii Image Collection
- **NCAR Observational Data**
 - 3TB Observational Re-Analysis Data

Thomas Edison's Patent Application for the Light Bulb



Current Geographic Replications in Demonstration Project



GRID PRESERVATION ENVIRONMENT

California

- **SDSC Node (10 TB)**
 - Library of Congress PG Image Collection
 - ICPSR Collection
 - NVO DPOSS Collection
 - NCAR Collection

Colorado

- **NCAR Node (10 TB)**
 - Library of Congress PG Image Collection
 - ICPSR Collection
 - NVO DPOSS Collection
 - NCAR Collection

Maryland

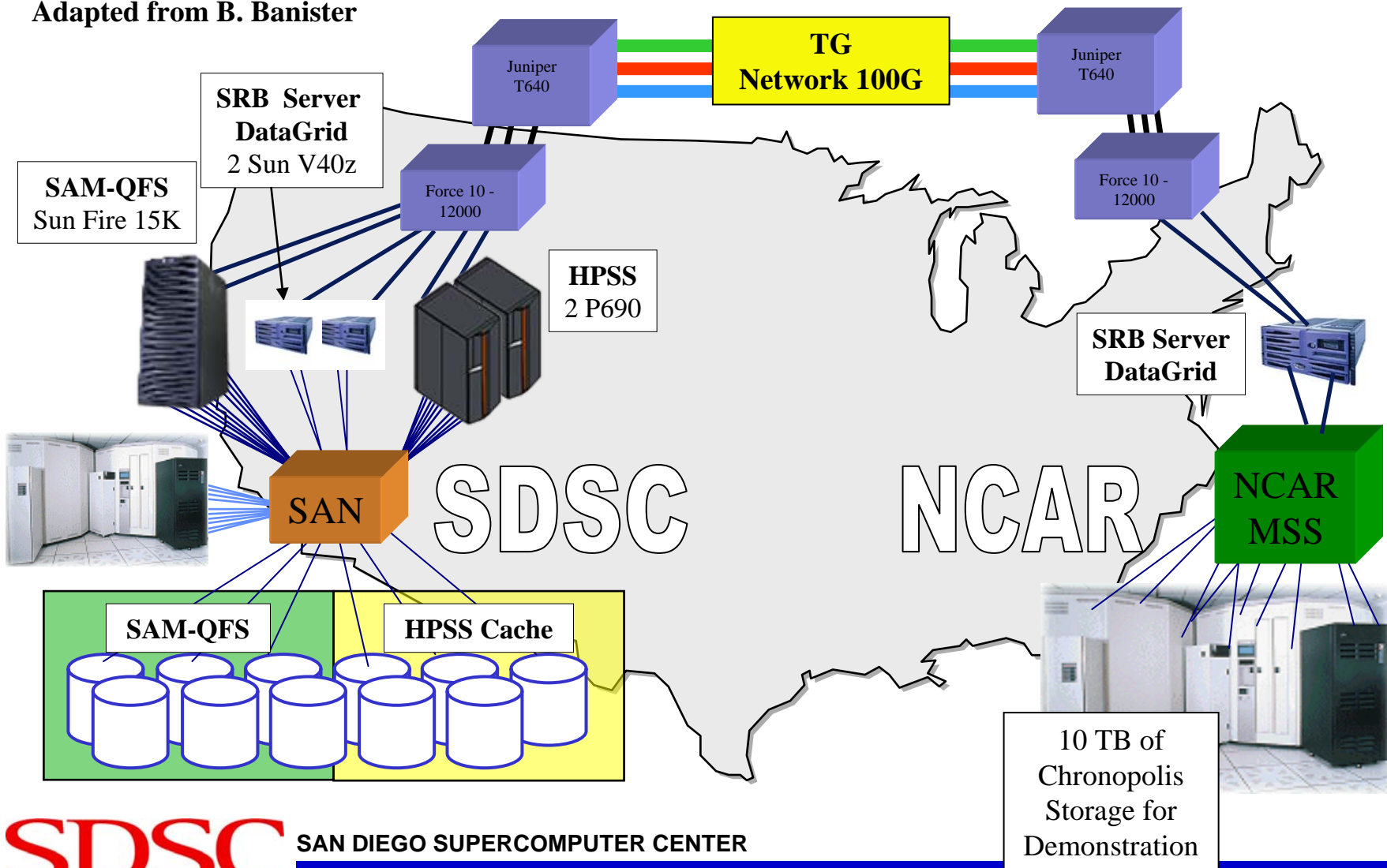
- **UMD Node (5.5 TB)**
 - Library of Congress PG Image Collection
 - ICPSR Collection
 - NVO DPOSS Collection

Chronopolis Learning Curve

- **Studying Multiple Transmission Tools for Transferring Data**
- **Providing Ways to Improve High Speed Network Transmission**
 - Packaging for Content Transmission
 - Dissemination Information Package (DIP) that is fine tuned for high-speed transmission
- **Working on issues of data authenticity/provenance between federated archives**
- **Developing NARA/RLG TRAC Audit for Chronopolis Federation**
- **Creating a METS Profile for Preservation Metadata**
 - PREMIS compliant

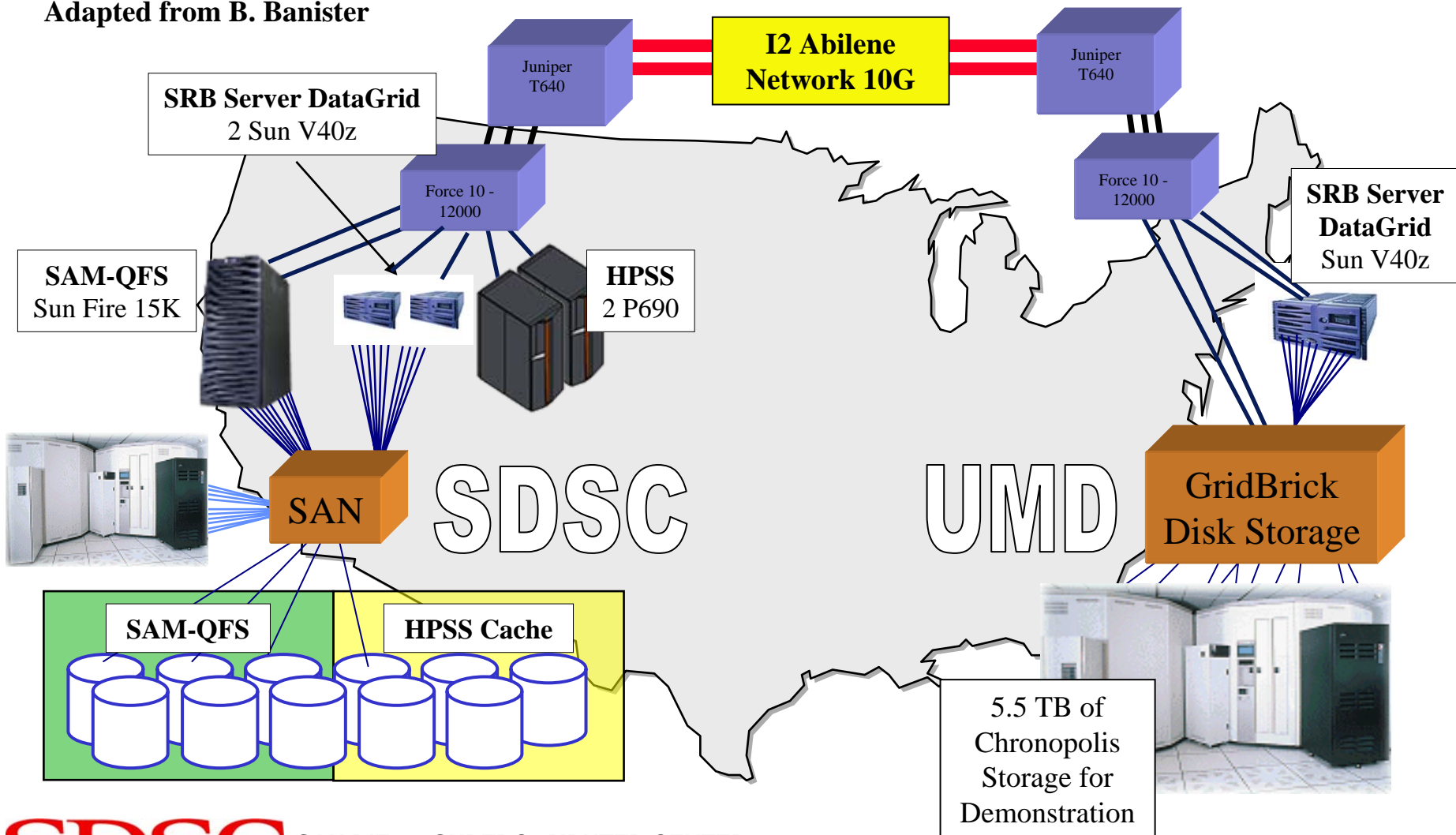
Chronopolis Architecture SDSC to NCAR

Adapted from B. Banister

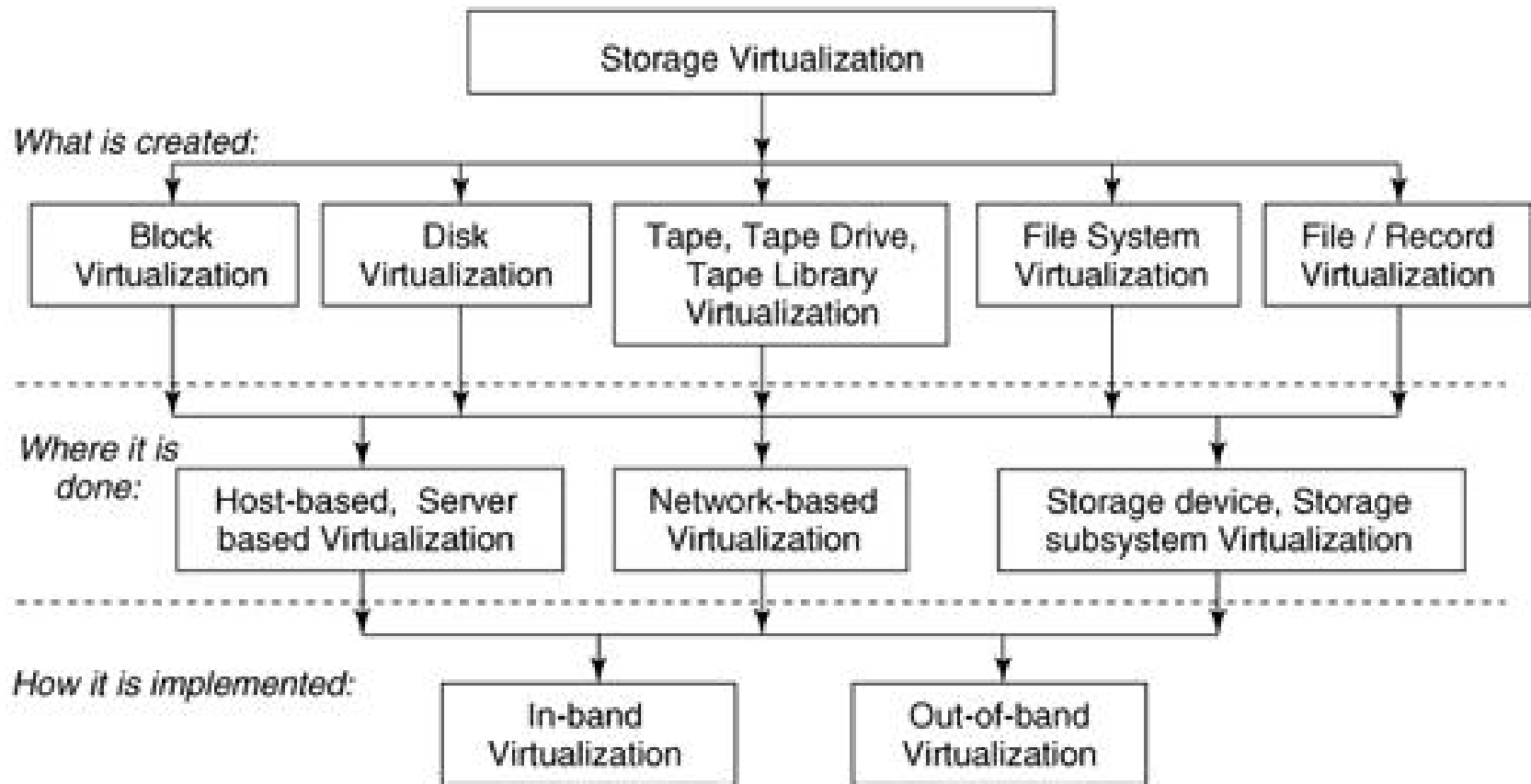


Chronopolis Architecture SDSC to UMD

Adapted from B. Banister

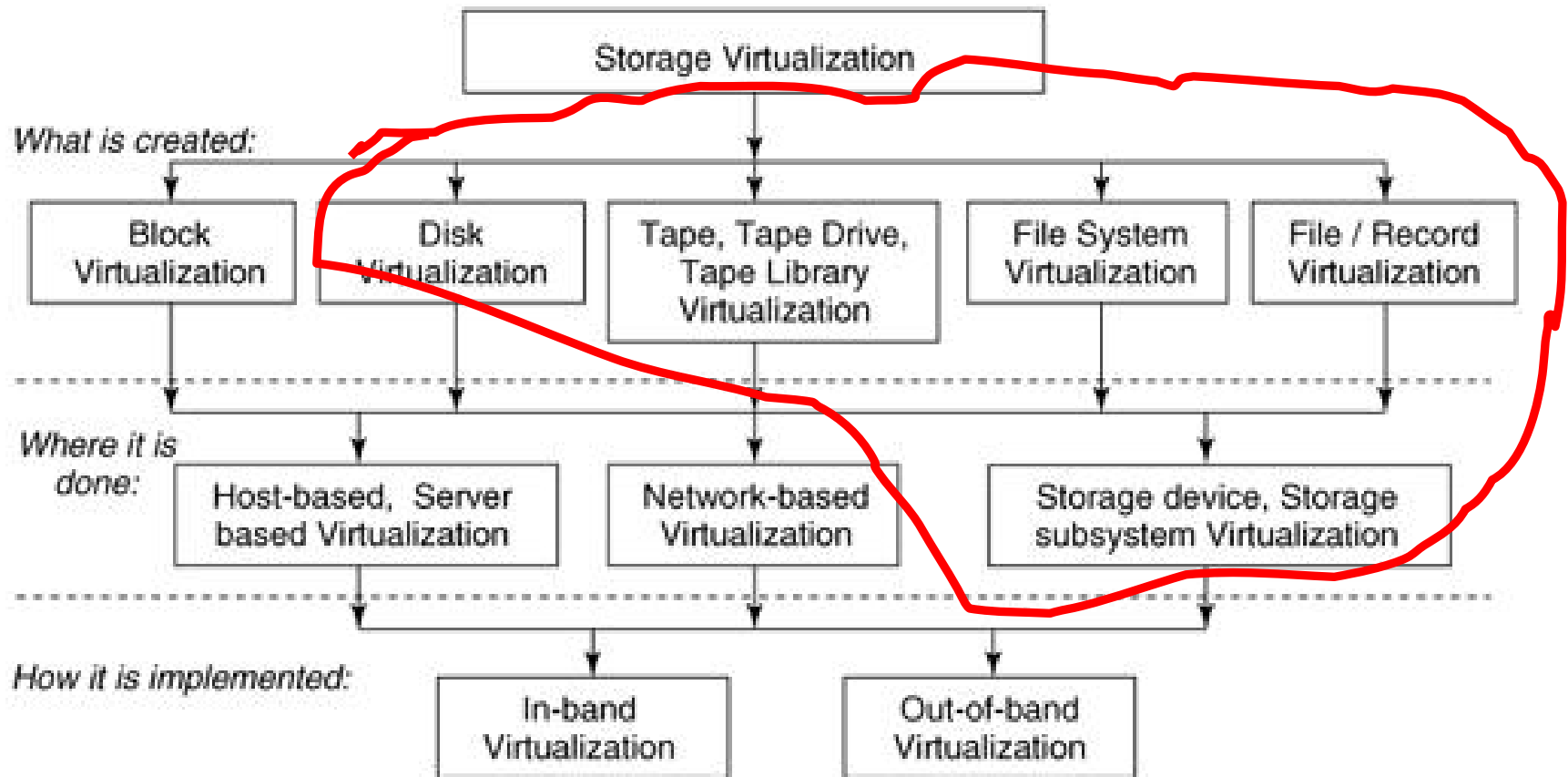


SNIA Storage Abstraction Layer



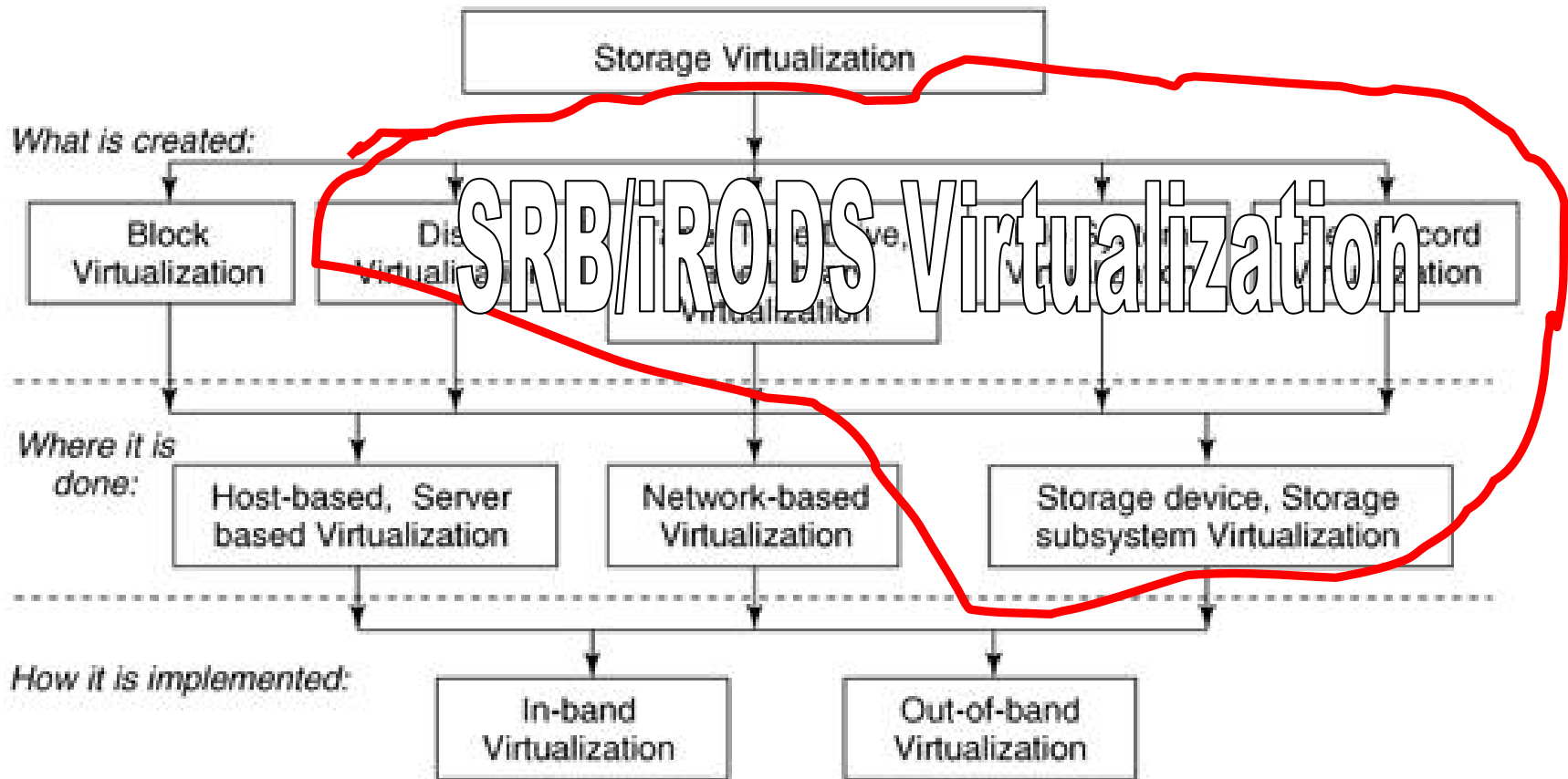
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SNIA Storage Abstraction Layer



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SNIA Storage Abstraction Layer



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Chronopolis 2007-2008

- **Library of Congress NDIIPP Chronopolis Program**
 - Build Production Capable Chronopolis Grid (50 TB)
 - Further define transmission packaging for archival communities
- **California Digital Library (CDL) Mass Transit Program**
 - Enables UC System Libraries to transfer high-speed mass digitization collections across CENIC
 - Develop transmission packaging for CDL content
- **Migration Path for SRB/iRODS**
- **Interoperability with Community Based Archival Systems/Standards**
- **Interoperability with Network Virtualization Storage Layer**

Chronopolis Digital Preservation DataGrid

Administration for Policy and Outreach

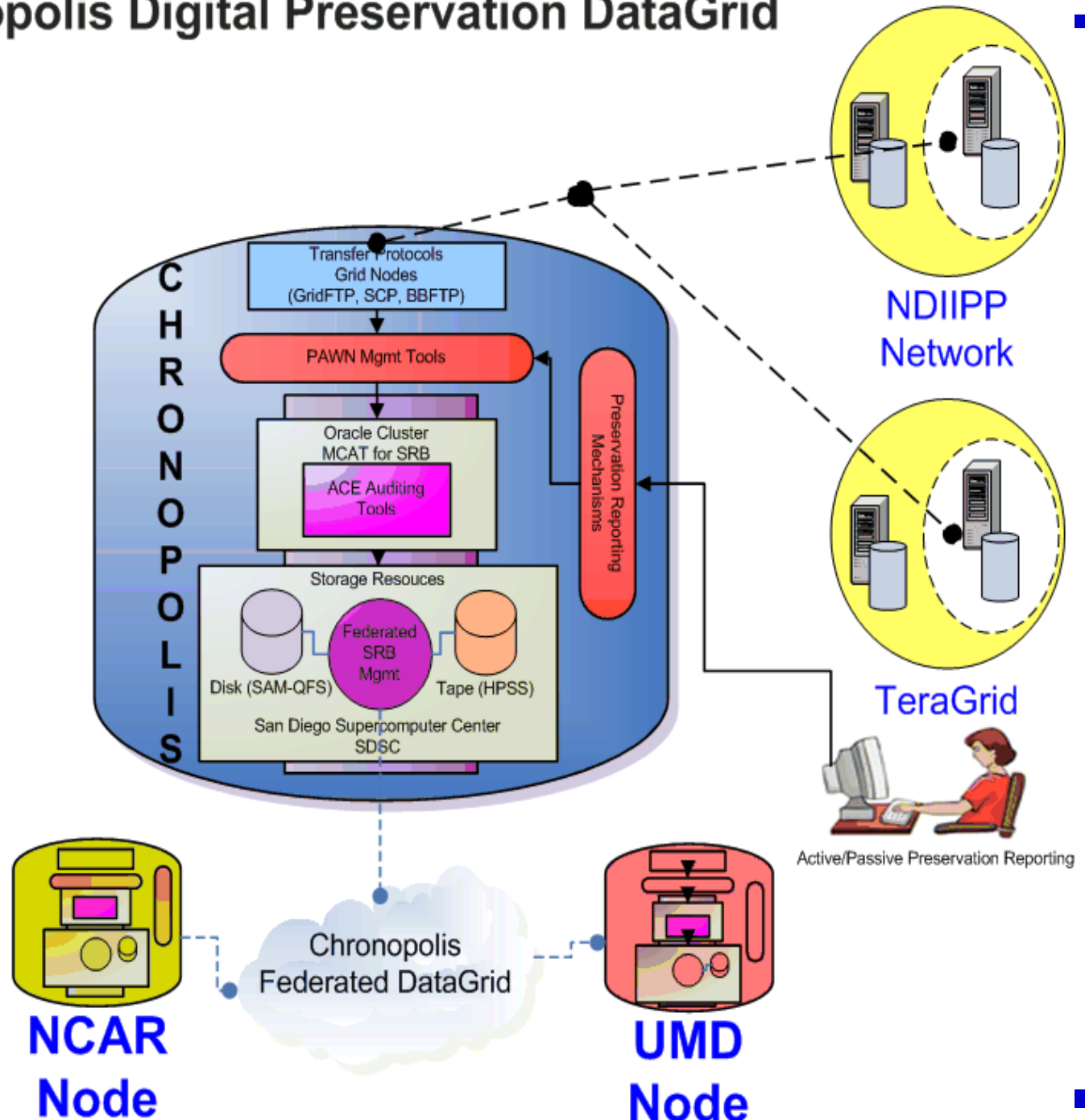
(Supports the overall partnerships and mgmt for preservation services and works as a liaison with Chronopolis partners and other regional and national preservation programs)

Research and Development

(Research and development for rules-based preservation mgmt and technology forecasting for continual technology migration and mgmt)

Production Digital Preservation

(Long-term preservation with geographic replications and preservation services)



Chronopolis Collaborators

SDSC

**Fran Berman
Richard Moore
Reagan Moore
Arcot Rajasekar
David Minor
Chris Jordan
Robert McDonald
Bryan Banister
Sheau Yen-Chen**

NCAR

**Don Middleton
Michael Burek**

UMD

**Joseph JaJa
Mike Smorul
Mike McGann**

UCSD Libraries

**Brian Schottlaender
Luc Declerck
Ardys Kozbial**

Questions?

