A Pilot Persistent Archive: Partnership Between SDSC, UMD, and NARA

Reagan Moore (SDSC)
Joseph JaJa (UMD)
Robert Chadduck (NARA)

Overall Goals:

- Advanced research on digital archiving and long-term preservation based on emerging web technologies and services, with a particular focus on NARA-type records and collections.

- Build a large scale pilot persistent archive to test and validate overall architecture and related ingestion and preservation processes.

Digital Preservation

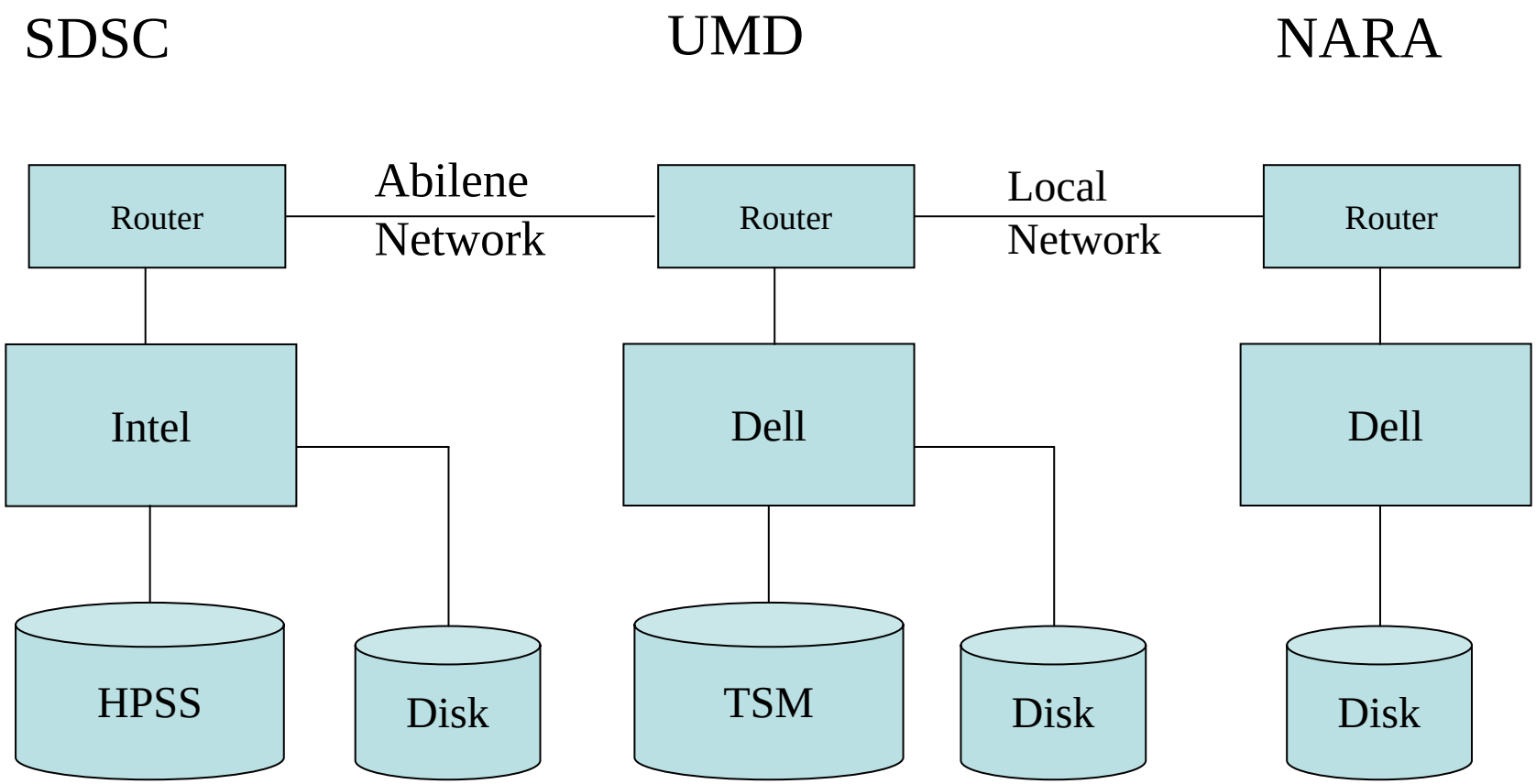
- Management of Technology evolution:
  - Storage, Information Management, Representation, and Access.
- Risk Management and Disaster Recovery:
  - Technology degradation and failure;
  - Natural disasters such as fires, floods, etc.
  - Human-induced operational or malicious errors.
- Ensuring long term authenticity of and access to electronic records

Persistent Digital Archive: Overall Architecture

- Digital object model that encapsulates content, structural, descriptive, and preservation metadata.
- Layered software architecture based on three levels of abstraction: data, information, and knowledge.
- Distributed architecture based on data grids (Storage Request Broker – SRB)

Current Hardware Prototype:

Heterogeneous “Grid Bricks” with over 12 TB Disk Storage and Substantially More Back-up Storage



Some Observations

- Commodity grid bricks provided:
  - Low cost disk storage:
    - $4,000/TB in 2003 -- $2,000/TB in 2004.
  - Adequate performance for TCP/IP and data manipulation procedures

- They required:
  - a detailed understanding of the low-level system properties.
  - higher operational vigilance. RAIDs were monitored daily in order to resolve all problems as soon as they occurred.

Software Configuration

- The SRB provides the middleware for integrating storage into a global address space and for incorporating replication and migration mechanisms.
- The Grid Security Infrastructure (GSI) supports uniform cross-site authentication through a Certificate Authority run by NARA.
- Separate heterogeneous databases supporting Metadata Catalogs (MCAT) at each site. SDSC and NARA run Oracle, and UMD runs Informix.

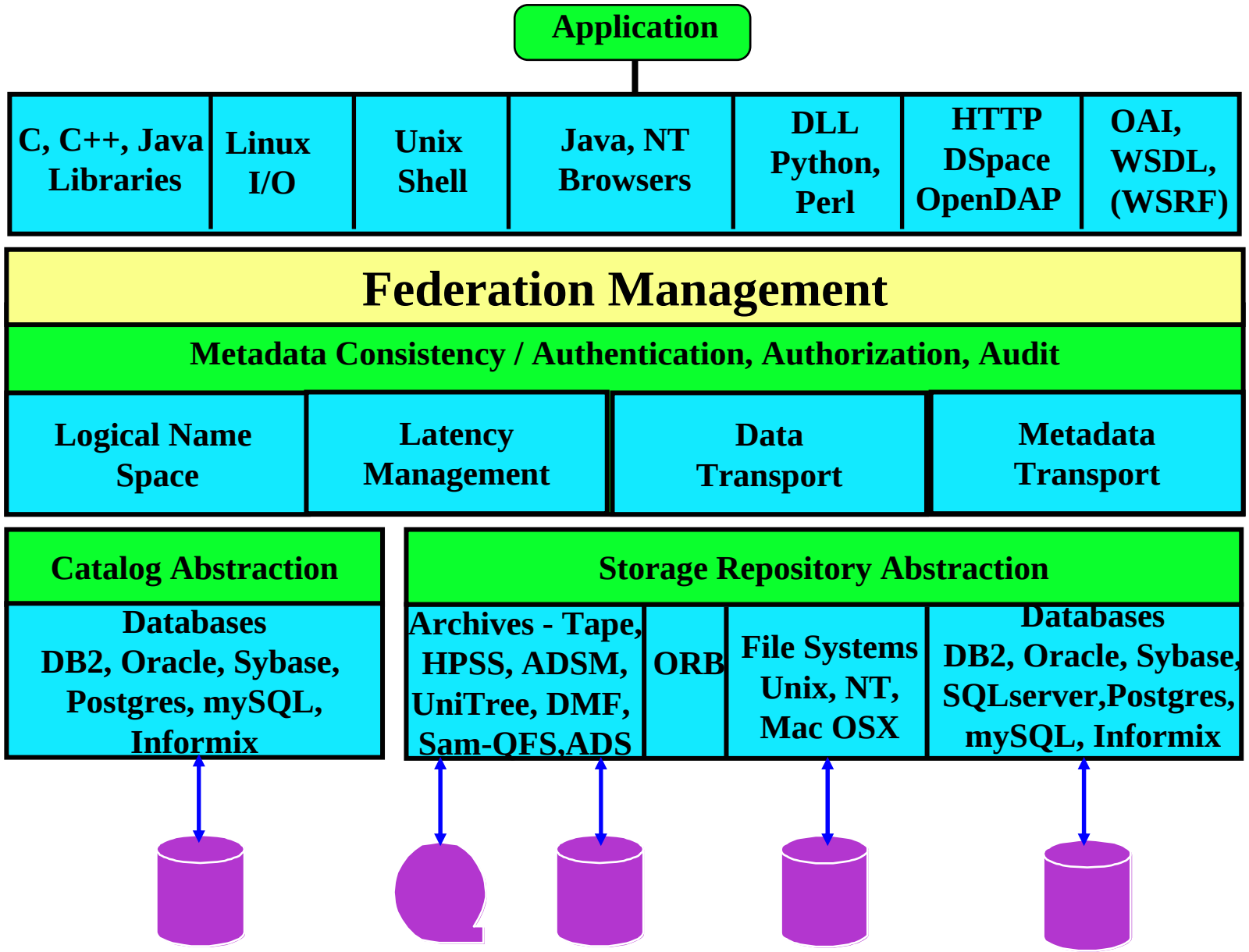
Data Grids

- Manage data in a distributed environment
  - Logical name spaces, provide global identifiers for records, users
  - Data access through storage system abstraction
  - Replication for disaster back up
  - Uniform access, common user interface across file systems, archives, and databases
  - Single sign-on for users, authentication across administration domains
- Data grid federation
  - Replicate records and preservation metadata between data grids

Data Grids as Core Infrastructure for Persistent Archives

- Technology Evolution Management
  - Storage system abstraction, support data migration across storage systems
  - Information repository abstraction, support catalog migration to new databases
  - Logical name space, support global persistent identifier
- Risk Management
  - Distributed architecture, logical name space, and data/information abstractions enable graceful handling of media degradation, natural disasters, and operational/malicious errors.

Storage Resource Broker - Data Grid Federations



Selected Collections Available on the Prototype

Collection	Size	# Files	Original Media
NARA Accessioned Holdings	38 GB	540	3480 Tape
Presidential Web Sites	11 GB	15,000	Web
Image EAP	1.3 TB	124,000	WORM

Clinton Government Web Snapshot

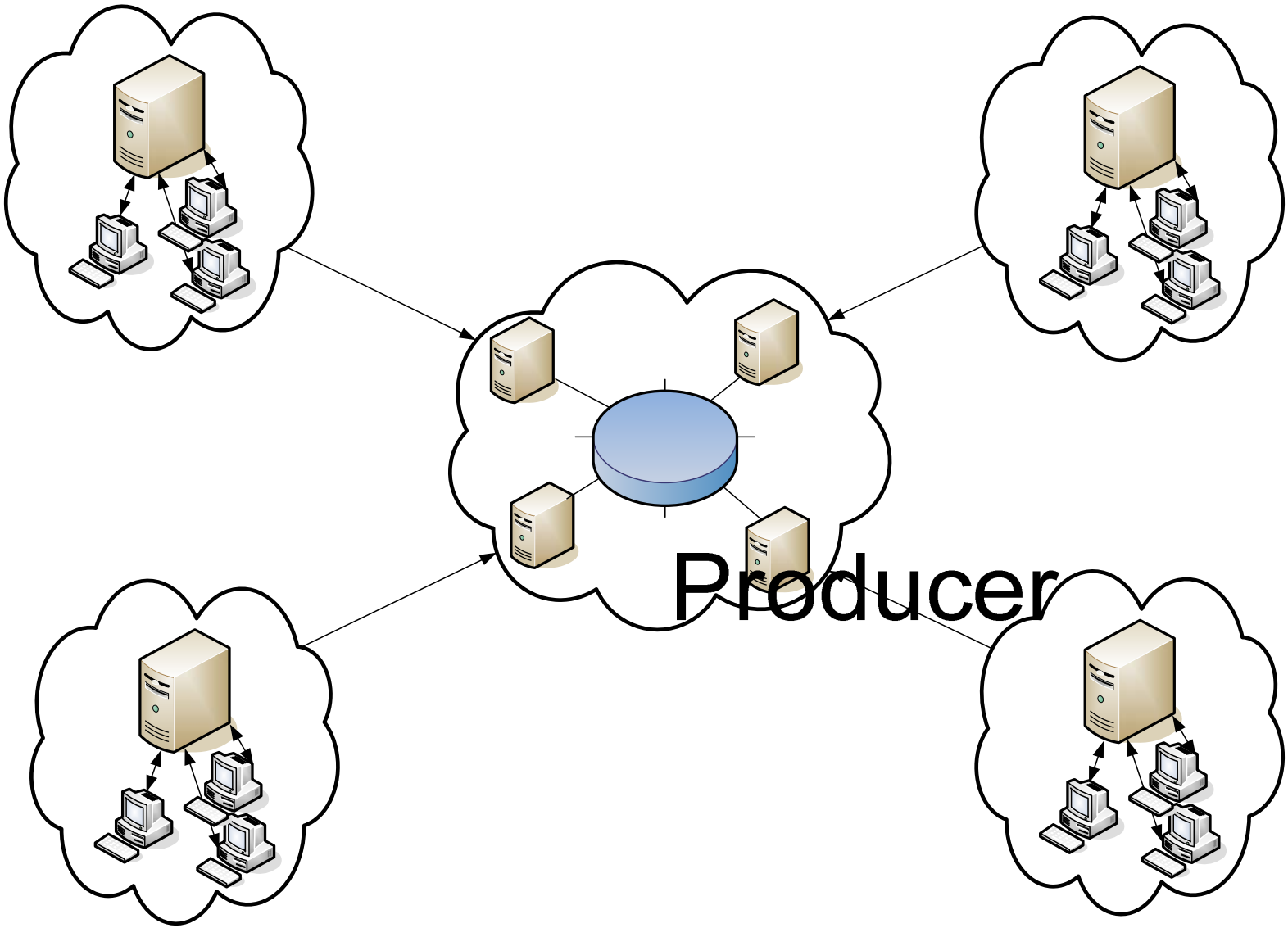
NCES Statistics
83 file types
53.5 GB total
2,767 folders
175,968 files

File Type	Percent of files
html	39%
csv	26%
jpg	13%
gif	12%
pdf	3%
asp	2%
xls	1%
shtml	1%

Producer – Archive Workflow Network (PAWN)

- Consistent with the Open Archival Information System (OAIS) model
- Use of web/grid technologies – platform independent
- Ease of integration with current pilot system based on the SRB
- XML Representation of metadata and bitstream
  - Self describing bitstream submissions
- Accountability of transfer and guarantee of data integrity

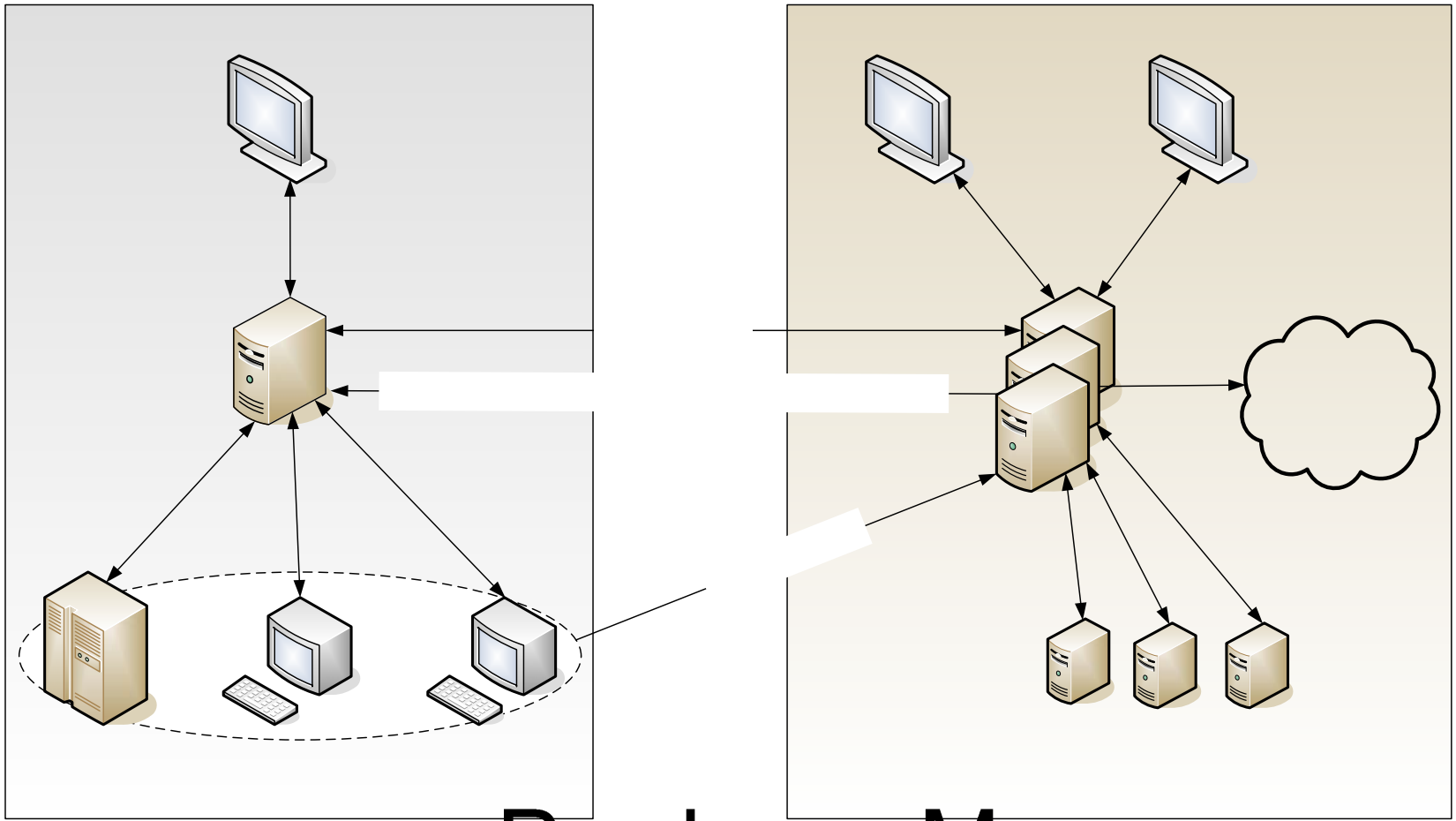
Distributed Ingestion



Distributed Ingestion

- Each Producer registers and arranges files locally prior to transport.
- Multiple distributed archival receiving stations.
- X.509 based authentication between sites.
- Independent Certificate Authorities at each Producer.
- Persistent archive is geographically distributed and managed by a data grid.

PAWN Architecture



Producer Management In

On-going Efforts

- Expand the pilot persistent archive to include grid bricks at Stanford and Georgia Tech.
- Design and prototype registries for preservation processes and format changes.
- Expand the SRB infrastructure to include a “deep archive” at SDSC.
- Use PAWN to ingest significantly more collections into the persistent archive.