Rights Management for Shared Collections

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Abstract

- **National and international collaborations create shared collections that span multiple administrative domains.**
- **Shared collection are built using:**
  - Data virtualization, the management of collection properties independently of the storage system.
  - Trust virtualization, the ability to assert authenticity and authorization independently of the underlying storage resources.
- **What rights management are implied in trust virtualization?**
- **How are data integrity challenges met?**
- **How do you implement a “Deep Archive”?**

State of the Art Technology

- **Grid - workflow virtualization**
  - Manage execution of jobs (processes) independently of compute servers
- **Data grid - data virtualization**
  - Manage properties of a shared collection independently of storage systems
- **Semantic grid - information virtualization**
  - Reason across inferred attributes derived from multiple collections.

Shared Collections

- **Purpose of SRB data grid is to enable the creation of a shared collection between two or more institutions**
  - Register digital entity into the shared collection
  - Assign owner, access controls
  - Assign descriptive, provenance metadata
  - Manage audit trails, versions, replicas, backups
  - Manage location mapping, containers, checksums
  - Manage verification, synchronization
  - Manage federation with other shared collections
  - Manage interactions with storage systems
  - Manage interactions with APIs

Trust Virtualization

- **Collection owns the data that is registered into the data grid**
  - Data grid is a set of servers, installed at each storage repository
  - Servers are installed under a SRB ID created for the shared collection
  - All accesses to the data stored under the SRB ID are through the data grid
  - Authentication and authorization are controlled by the data grid, independently of the remote storage system

Rights Management

- **Shared collection approach**
  - Manage authentication of all users who will have privileges beyond that of public “read”
  - Map users to groups
  - Provide access controls on users and groups
- **Virtual Organization Management approach (VOM)**
  - Authenticate users, and provide certificate asserting membership in a group
  - Manage access controls on groups
  - Provide rules for access based on membership in a group

Authentication / Authorization

- Collection owned data
  - At each remote storage system, an account ID is created under which the data grid stores files
- User authenticates to the data grid
- Data grid checks access controls
- Data grid server authenticates to a remote data grid server
- Remote data grid server authenticates to the remote storage repository
- SRB servers return the data to the client

Authentication Mechanisms

- **Grid Security Infrastructure**
  - PKI certificates
- **Challenge-response mechanism**
  - No passwords sent over network
- **Ticket**
  - Valid for specified time period or number of accesses
- **Generic Security Service API**
  - Authentication of server to remote storage

Trust Implementation

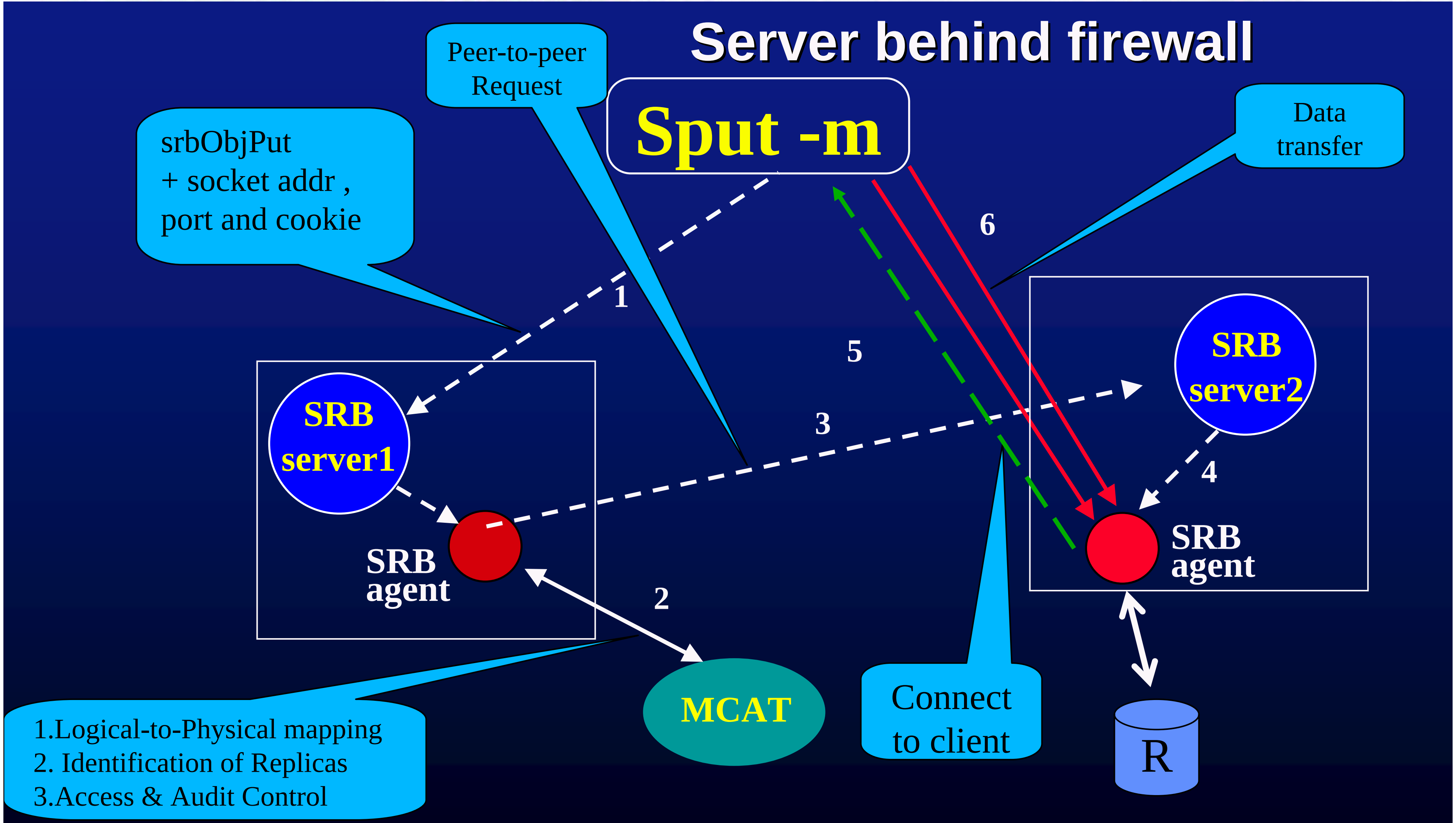
- **For authentication to work across multiple administrative domains**
  - Require collection-managed names for users
- **For authorization to work across multiple administrative domains**
  - Require collection-managed names for files
- **Result is that access controls remain invariant. They do not change as data is moved to different storage systems under shared collection control**

Network Devices

- **Access to data must handle security requirements of network devices**
  - Firewalls - typically requires access be initiated from within a firewall
  - Network routers - location of data may change based on load leveling
  - Private virtual network - location of data not known explicitly known
- **Handled by creating network transport protocols to meet requirements of each network device**

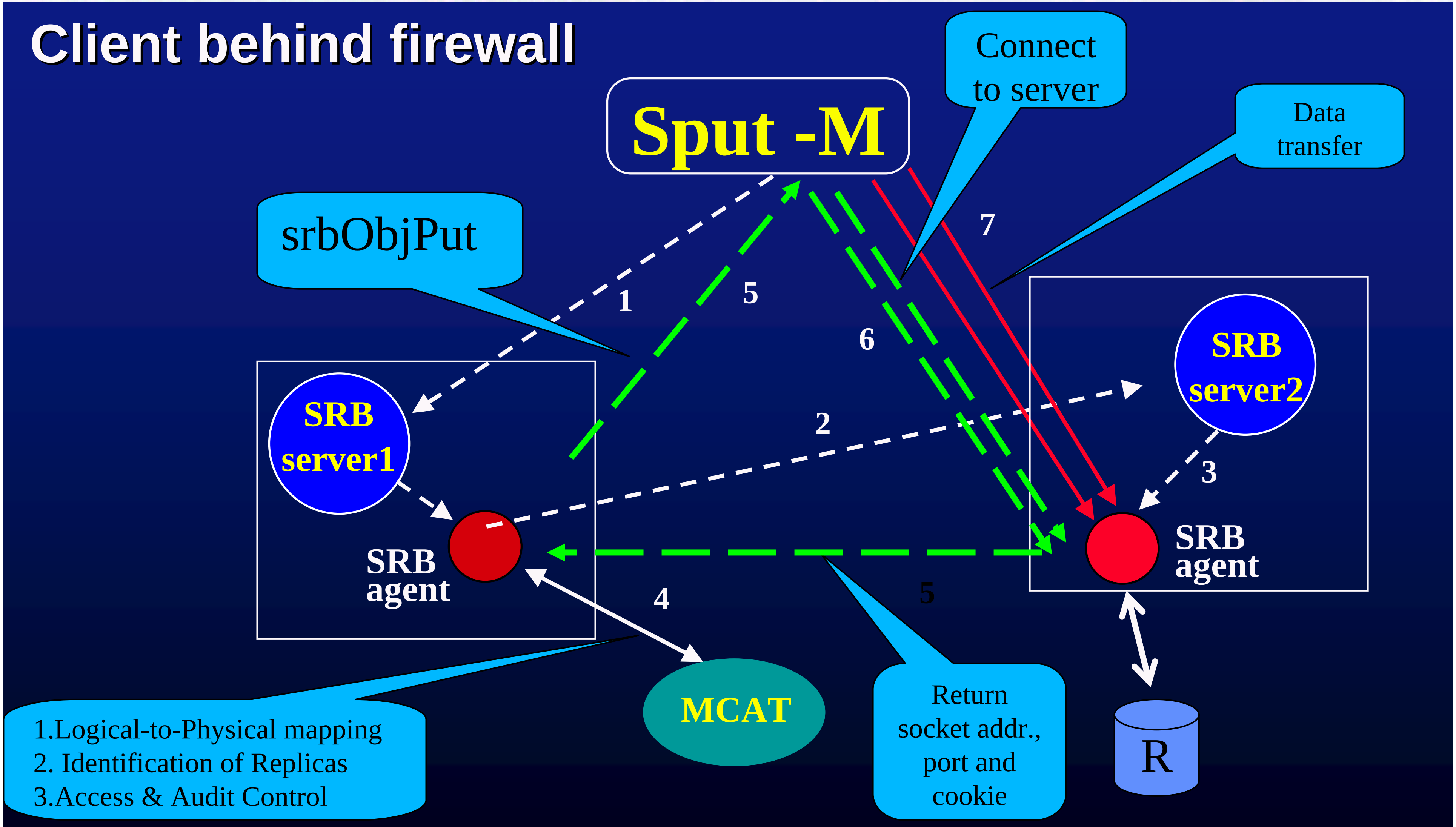
Parallel mode Data Transfer – Server Initiated

Server behind firewall



Parallel mode Data Transfer – Client Initiated

Client behind firewall



1.Logical-to-Physical mapping
2. Identification of Replicas
3.Access & Audit Control

UCSD

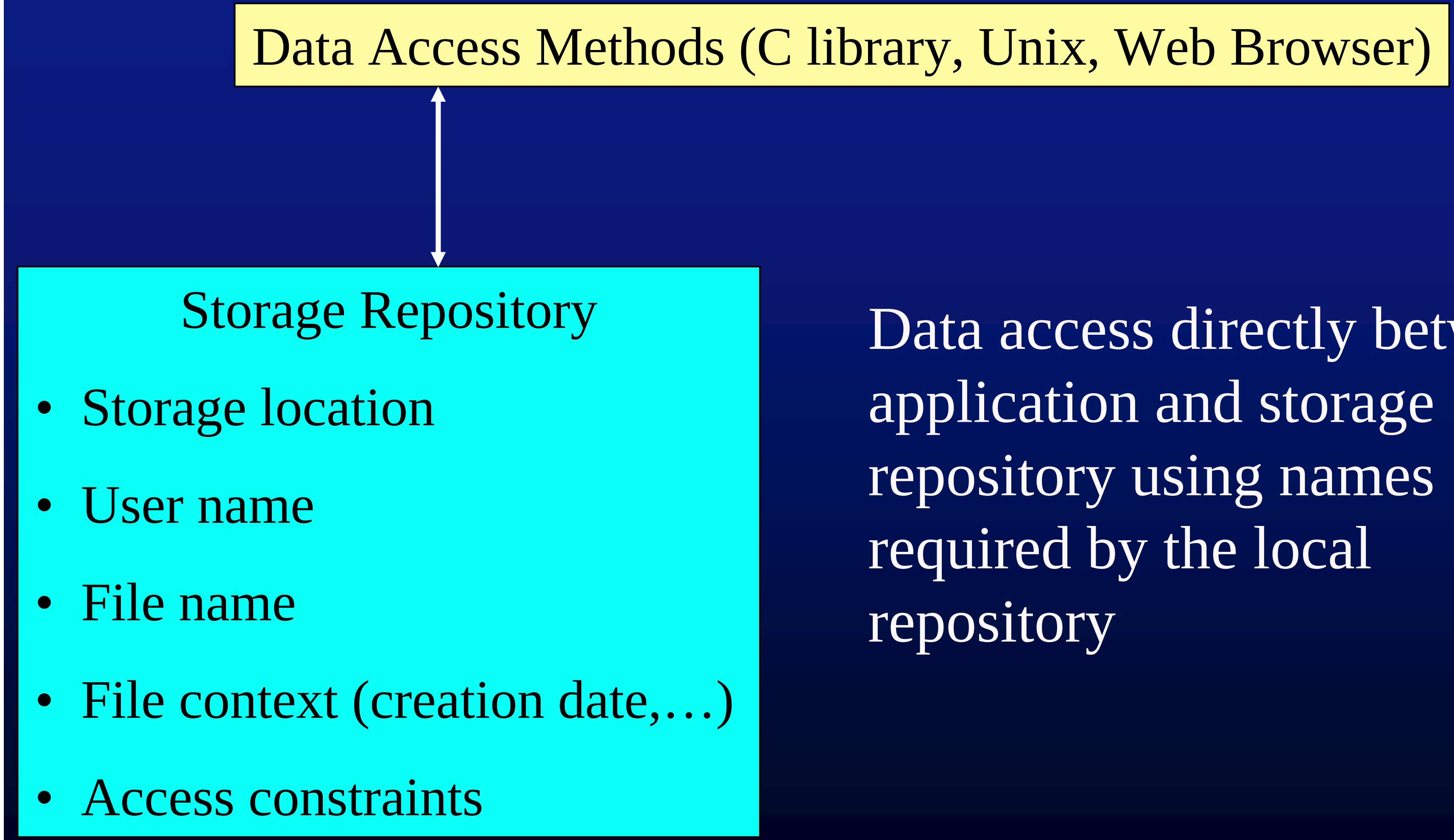
SDSC

HIPAA Patient Confidentiality

- Access controls on data
- Access controls on metadata
- Access controls on storage systems
- Audit trails
- End-to-end encryption (manage keys)
- Localization of data to specific storage

- Access controls do not change when data is moved to another storage system under data grid control

Logical Name Spaces



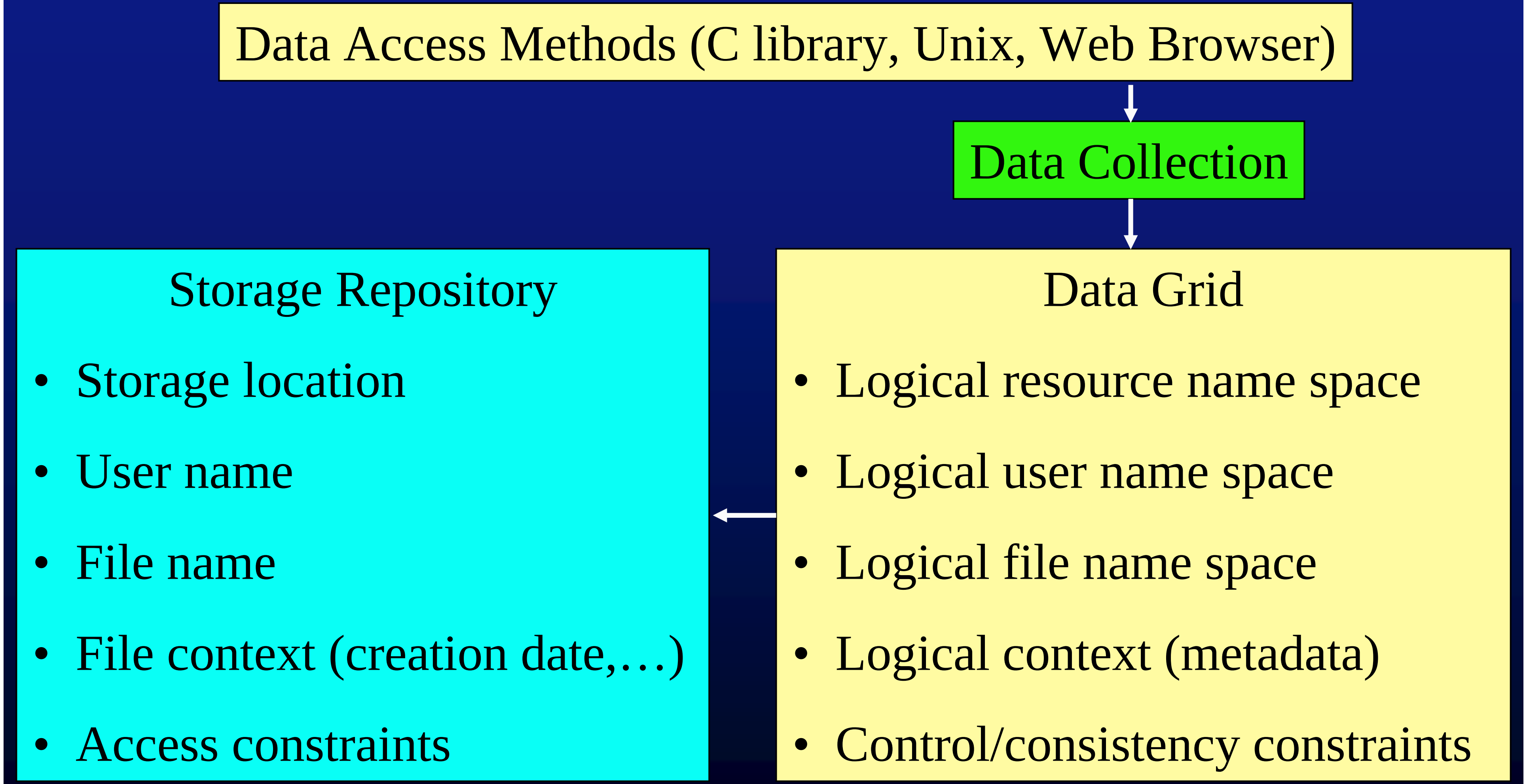
Data Access Methods (C library, Unix, Web Browser)

Storage Repository

- Storage location
- User name
- File name
- File context (creation date,…)
- Access constraints

Data access directly between application and storage repository using names required by the local repository

Logical Name Spaces



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Data Collection

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- Storage location
- User name
- File name
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Data Grid

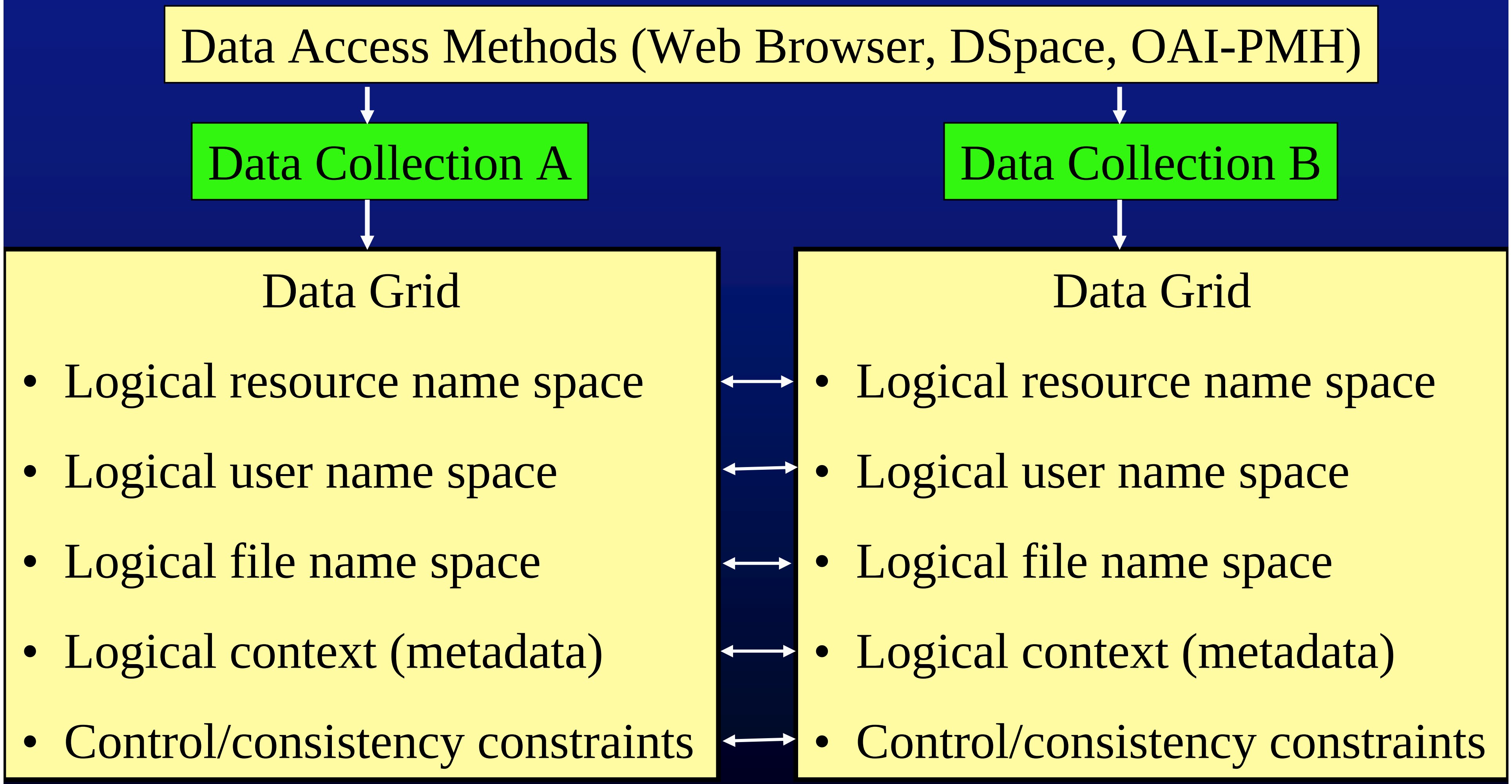
- Logical resource name space
- Logical user name space
- Logical file name space
- Logical context (metadata)
- Control/consistency constraints

Data is organized as a shared collection

Logical Resource Names

- **Logical resource name represents multiple physical resources**
- **Writing to a logical resource name can result in:**
  - Replication - write completes when each physical resource has a copy
  - Load leveling - write completes when the next physical resource in the list has a copy
  - Fault tolerance - write completes when “k” of “n” resources have a copy
  - Single copy - write is done to first disk at same IP address, then disk anywhere, then tape

Federation Between Data Grids



Data Access Methods (Web Browser, DSpace, OAI-PMH)

Data Collection A

Data Collection B

Data Grid

- Logical resource name space
- Logical user name space
- Logical file name space
- Logical context (metadata)
- Control/consistency constraints

Data Grid

- Logical resource name space
- Logical user name space
- Logical file name space
- Logical context (metadata)
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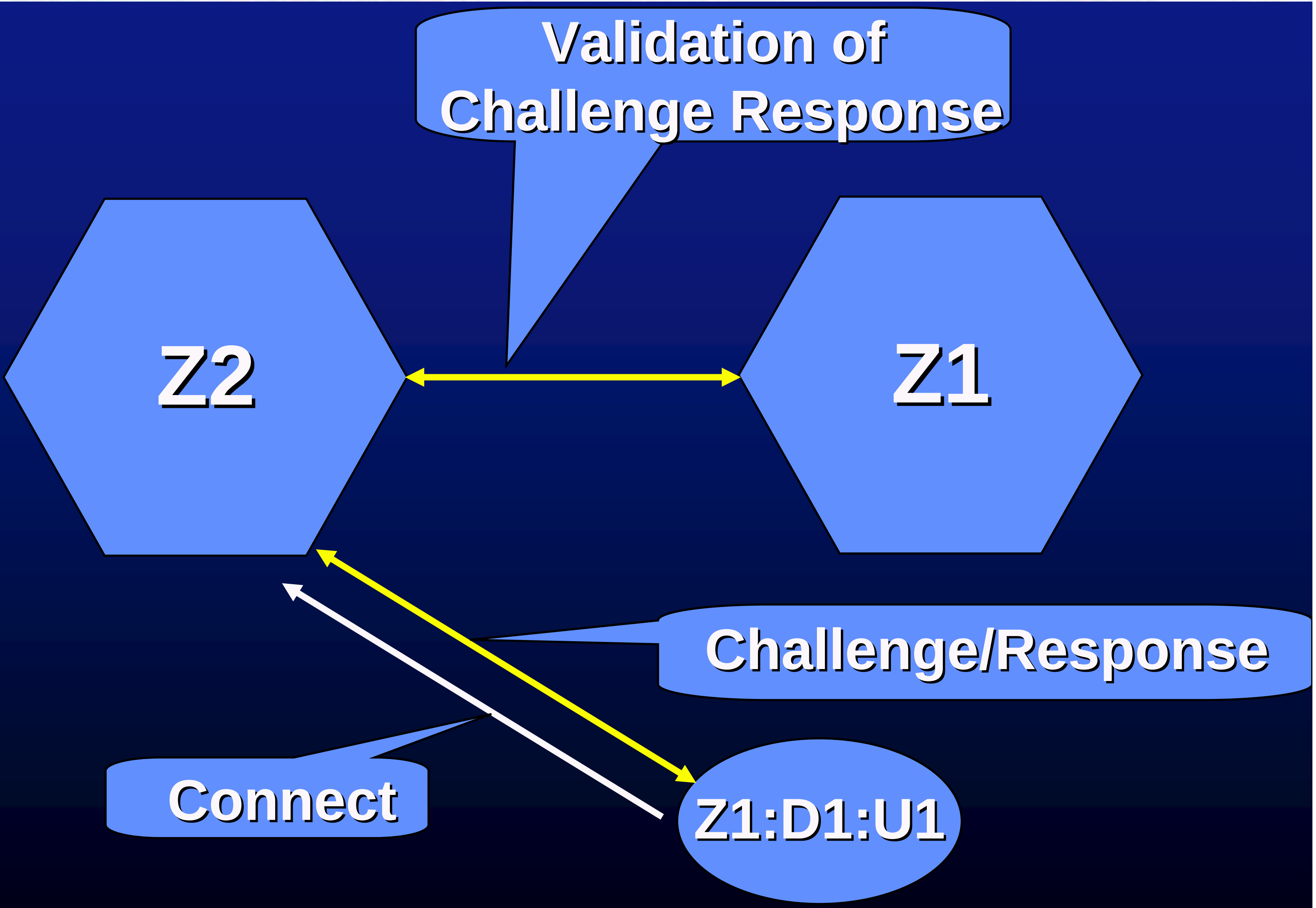
Access controls and consistency constraints
on cross registration of digital entities

Authentication across Zones

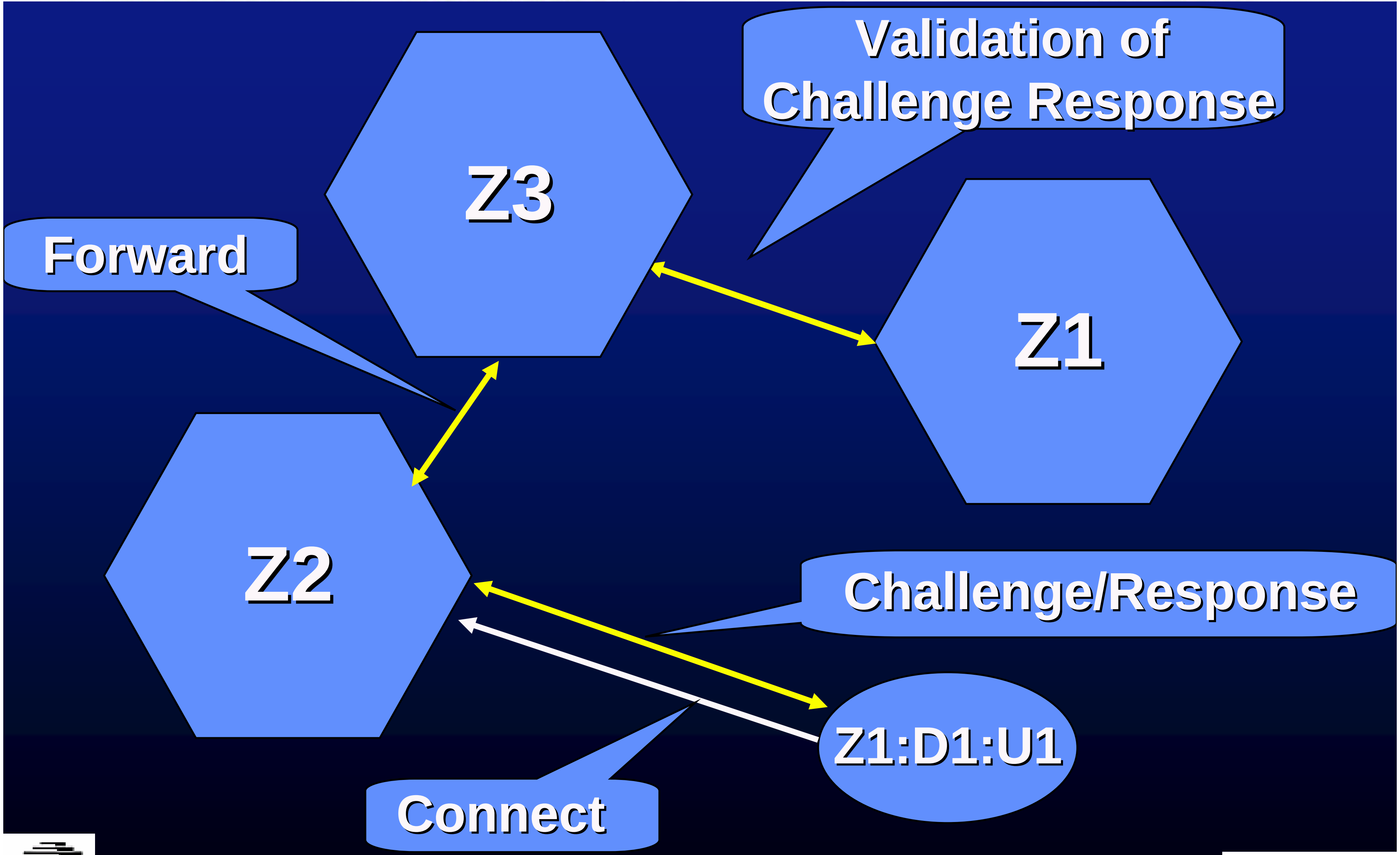
- **Follow Shibboleth model**
- **A user is assigned a “home” zone**
  - User identity is

    Home-zone:Domain:User-ID
- **All authentications are done by the “home” zone**

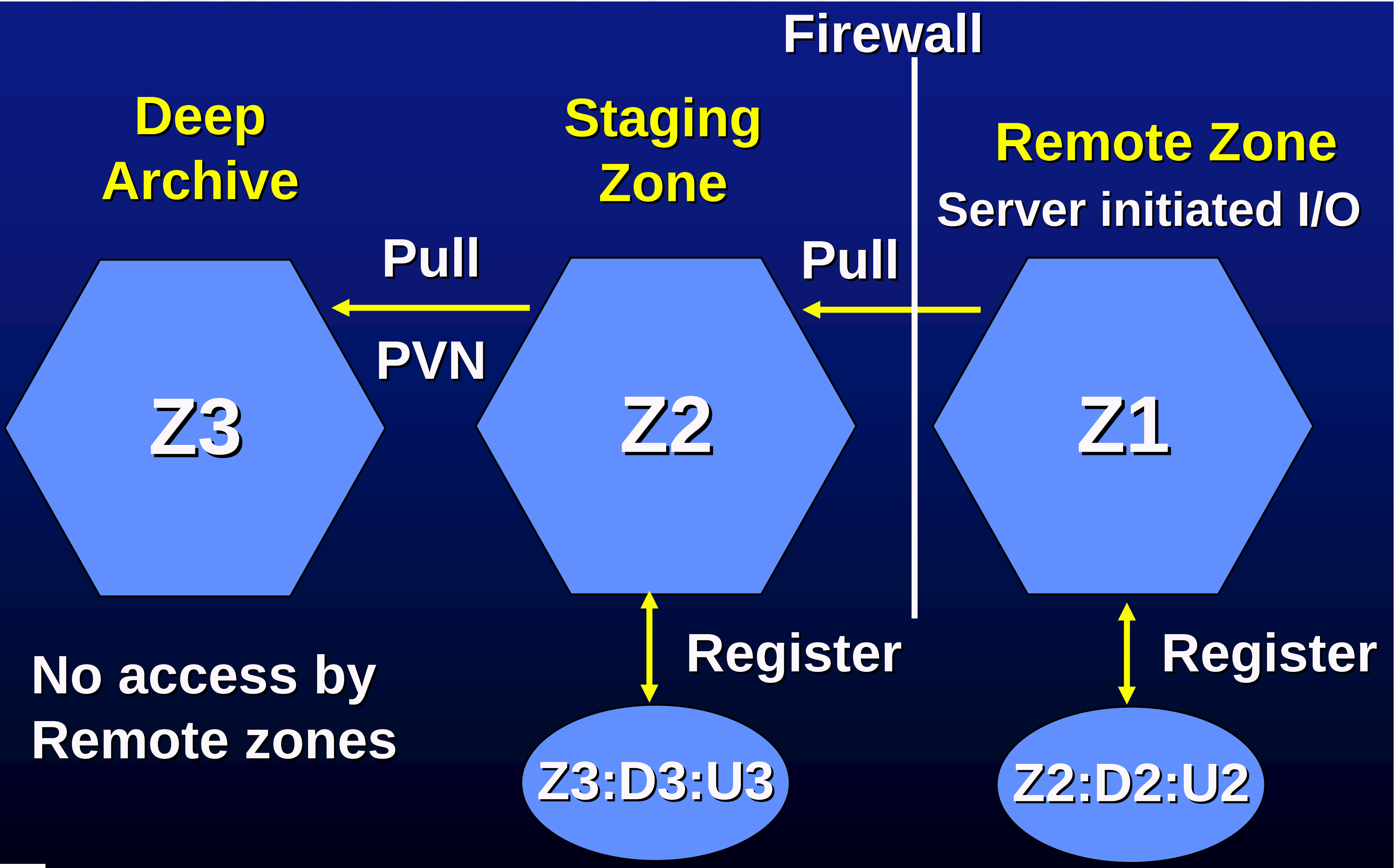
User Authentication



User Authentication



Deep Archive

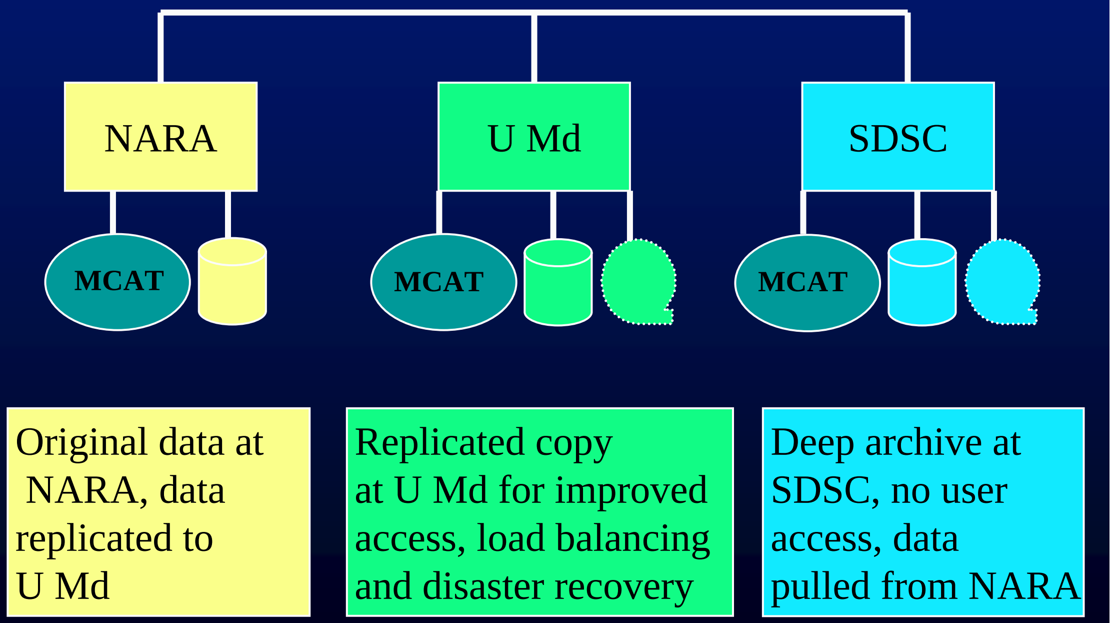


NARA Persistent Archive

Demonstrate preservation environment

- Authenticity
- Integrity
- Management of technology evolution
- Mitigation of risk of data loss
  - Replication of data
  - Federation of catalogs
- Management of preservation metadata
- Scalability
  - Types of data collections
  - Size of data collections

Federation of Three Independent Data Grids



Original data at NARA, data replicated to U Md

Replicated copy at U Md for improved access, load balancing and disaster recovery

Deep archive at SDSC, no user access, data pulled from NARA

For more Information on Storage Resource Broker Data Grid

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