

Handle System Overview

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Corporation for National Research Initiatives

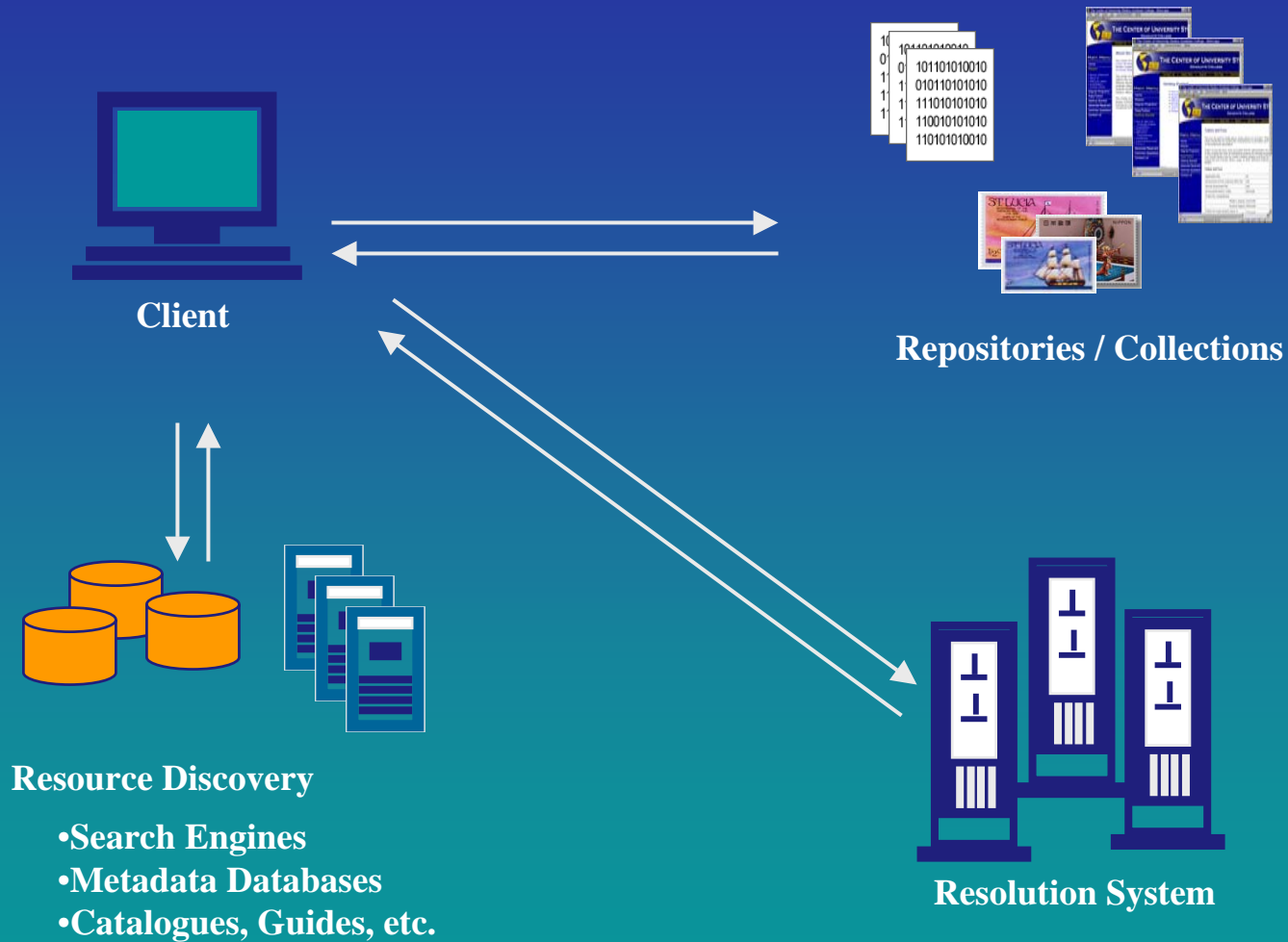
<http://www.cnri.reston.va.us/>

<http://www.handle.net/>

Digital Object Architecture - Goals

- Framework for managing Digital (Information) Objects
- Give it a name and talk to it
 - Don't worry about where it is
 - Don't worry about what it's made of
- Rise above details of application versions and content formats

Digital Object Architecture

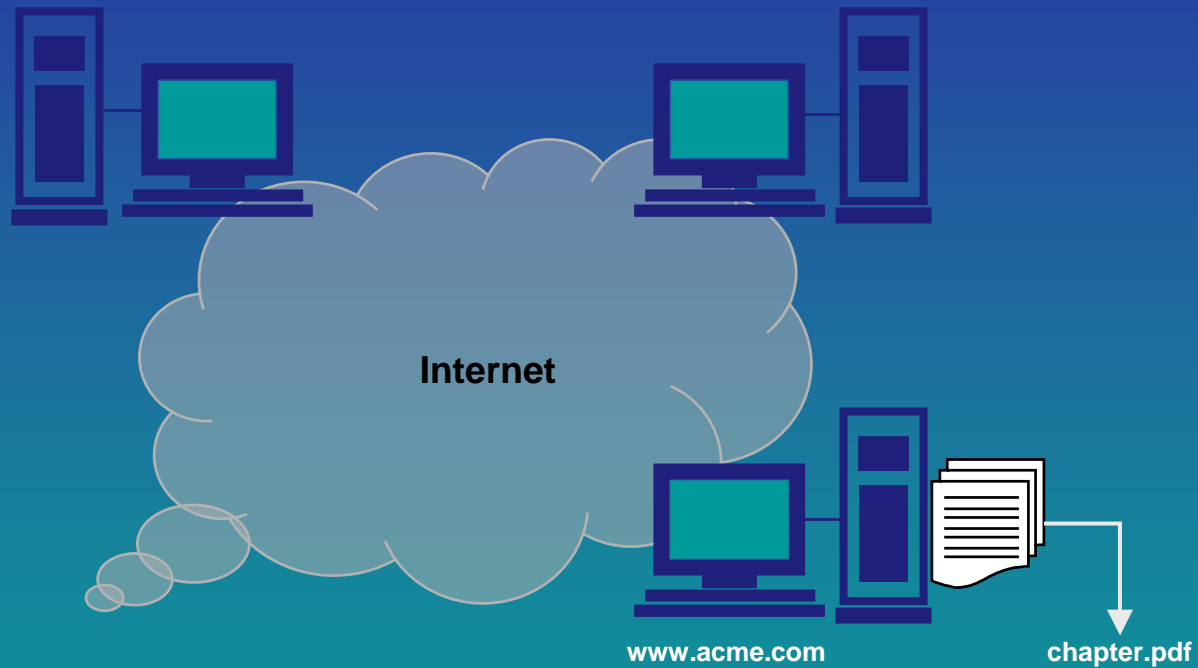


Digital Object Architecture Components Handle System

- Go from name to attributes
- Fundamental indirection system for Digital Object management on the net
- No free lunch
 - Added layer of infrastructure
 - Must be managed

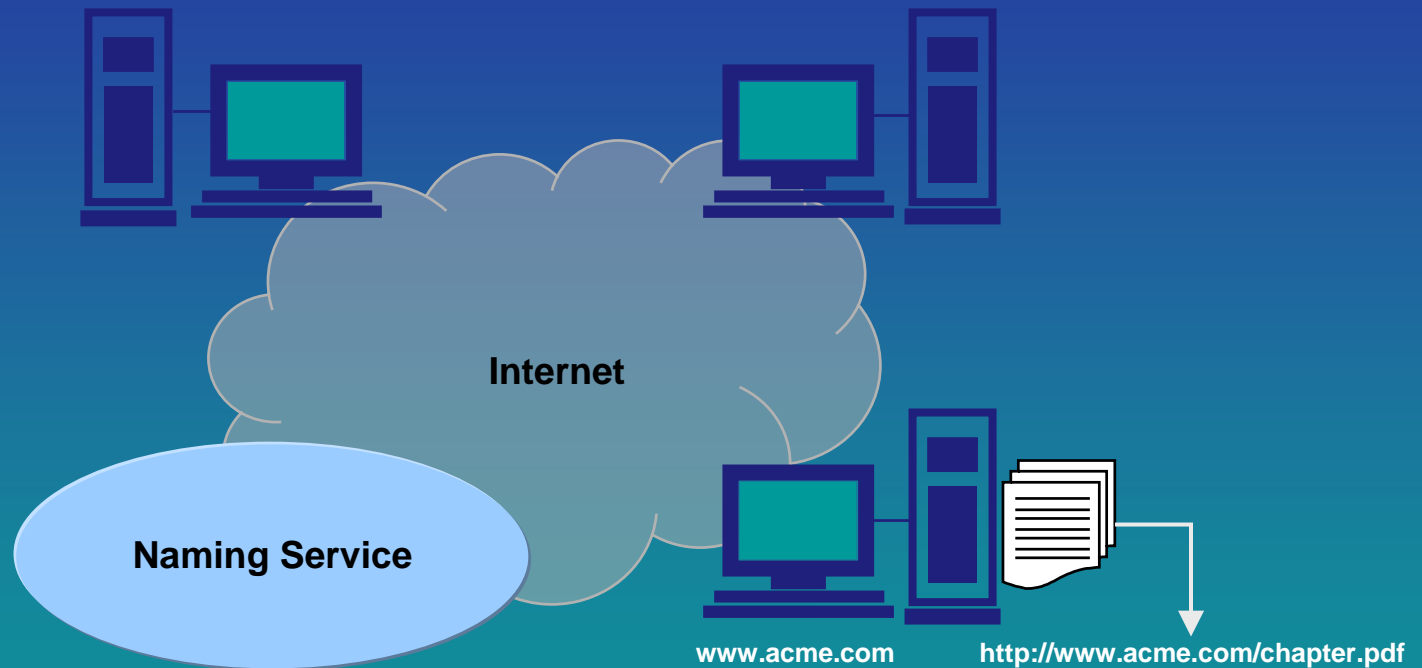
Naming Resources on the Net

The Problem



Naming Resources on the Net

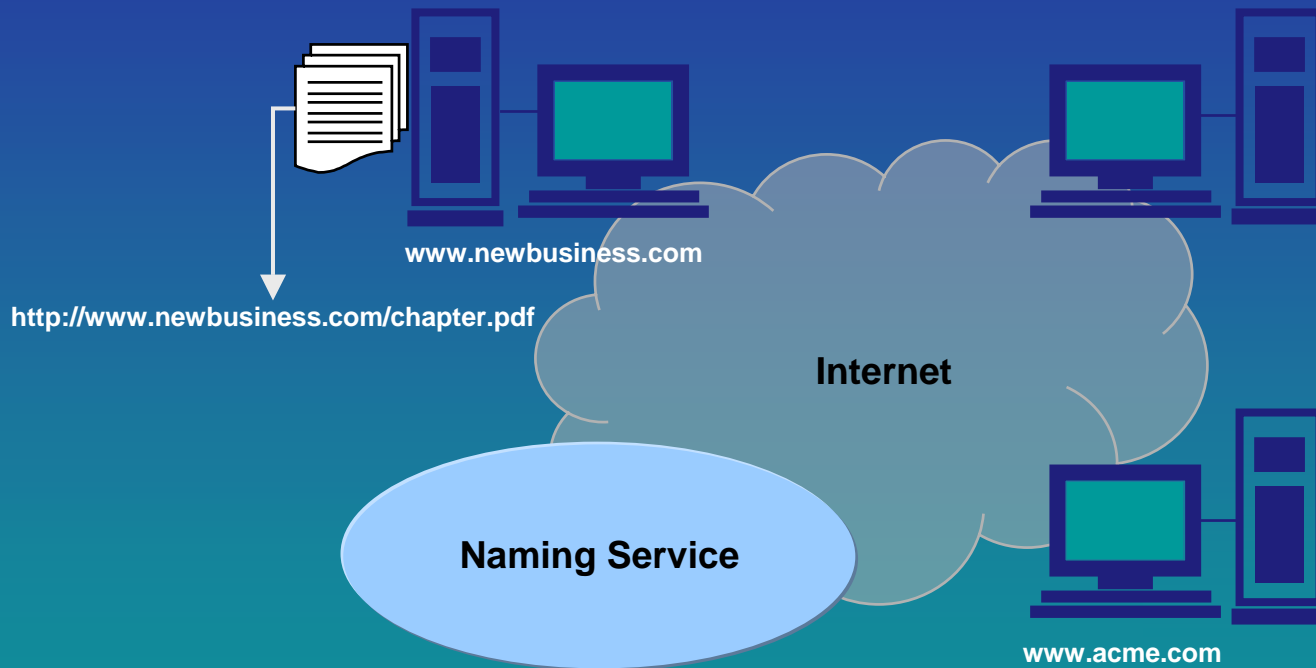
The Solution



Name = Value(s)
10.123/xyz = http://www.acme.com/chapter.pdf

Naming Resources on the Net

The Solution



Name = Value(s)

10.123/xyz = http://www.newbusiness.com/chapter.pdf

CNRI Handle System

- Distributed, scalable, secure
- Enforces unique names
- Enables association of one or more typed values, e.g., URL, with each name
- Optimized for speed and reliability
- Open, well-defined protocol and data model
- Provides infrastructure for application domains, e.g., digital libraries, electronic publishing ...

Handle System Usage

- Library of Congress
- DTIC (Defense Technical Information Center)
- IDF (International DOI Foundation)
 - CrossRef (scholarly journal consortium)
 - Enpia (Korean content management technology firm)
 - CDI (U.S. content management technology firm)
 - LON (U.S. learning object technology firm)
 - CAL (Copyright Agency Ltd - Australia)
 - TSO (U.K. publisher & info mgmt service provider)
 - MEDRA (Multilingual European DOI Registration Agency)
 - Nielsen BookData (bibliographic data - ISBN)
 - R.R. Bowker (bibliographic data - ISBN)
 - Office of Publications of the European Community (applied)
- NTIS (National Technical Information Service)
- DSpace (MIT + HP)
- ADL/SCORM: new CORDRA effort
- Various digital library production and research projects

Handles Resolve to Typed Data

Handle	Data type	Index	Handle data
10.123/456	URL	1	http://acme.com/...
	URL	2	http://a-books.com/...
	DLS	9	acme/repository
	HS_ADMIN	100	acme.admin/jsmith
	XYZ	12	1001110011110

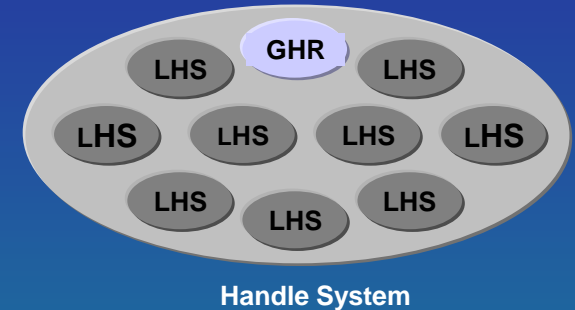
The Two Types of Handle Query

1. Request all data

Give me **all data** associated with handle 10.1000/123.



Handle	Index	Type	Data
10.1000/123	3	URL	URL1 (Server in US)
	2	URL	URL2 (Server in Asia)
	5	URL	URL3 (Server in Europe)
	10	PK	public key
	9	EM	email address
	4	IP	rights data

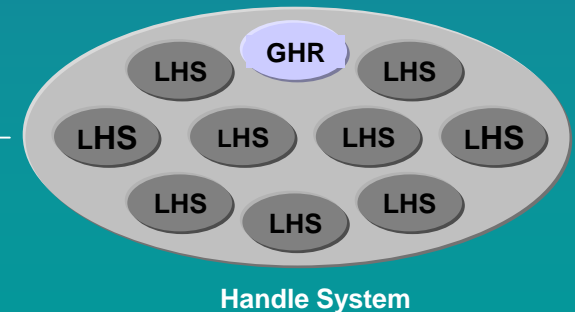


2. Request all data of a given type

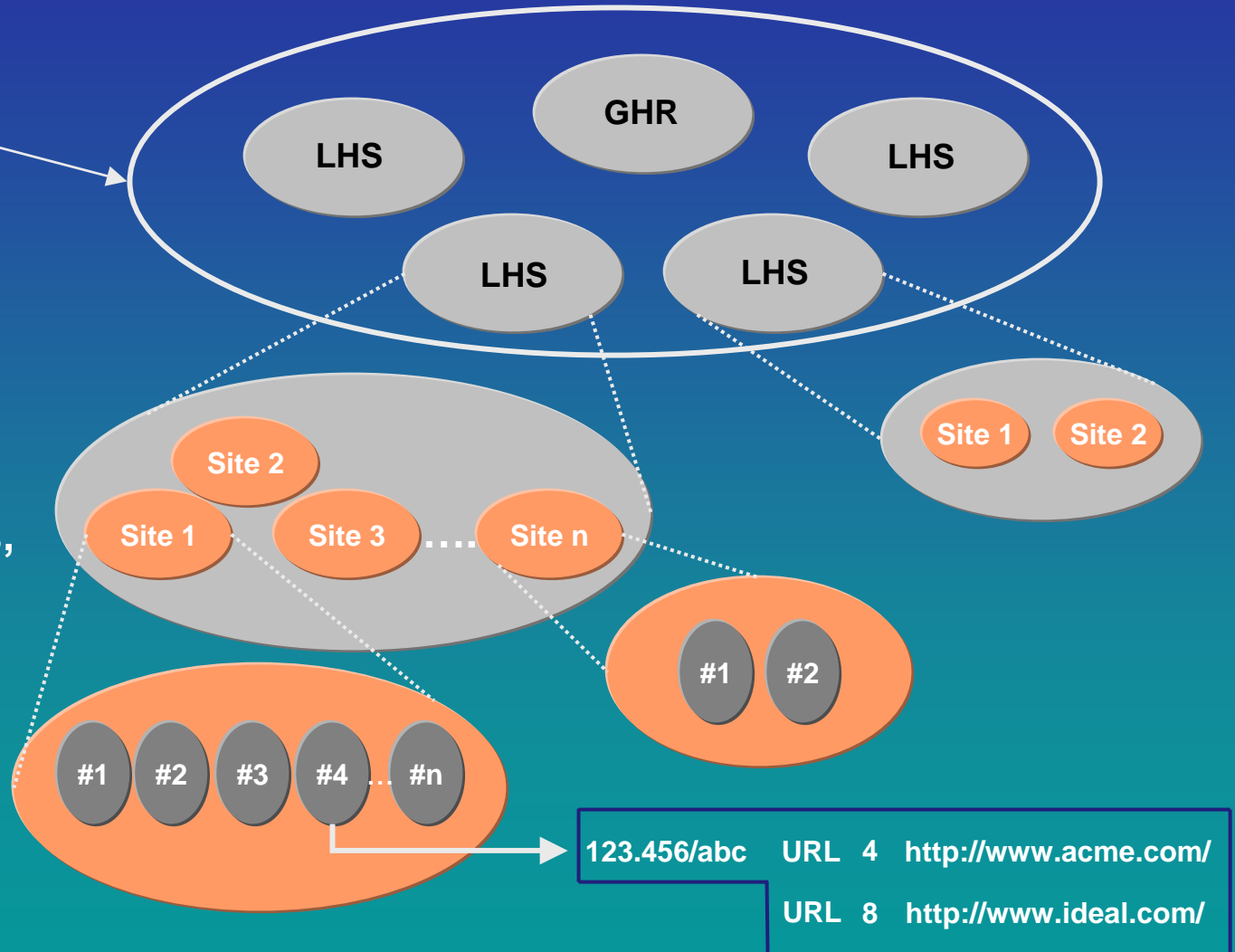
Give me **all data of type URL** associated with handle 10.1000/123.



Handle	Index	Type	Data
10.1000/123	3	URL	URL1 (Server in US)
	2	URL	URL2 (Server in Asia)
	5	URL	URL3 (Server in Europe)



Handle Resolution



The Handle System is a collection of handle services, each of which consists of one or more replicated sites, each of which may have one or more servers.

Handle Clients

Request to Client:
Resolve hdl:10.1000/1



Client

1. Sends request to Global to resolve 0.NA/10.1000 (naming authority handle for 10.1000)



Handle Clients

Request to Client:
Resolve hdl:10.1000/1



Client

2. Global Responds with
Service Information for 10.1000



Global Handle
Registry

xcccXV	xC	xC	xC	..
xcccXV	xC	xC	xC	..
xcccXV	xC	xC	xC	..
xcccXV	xC	xC	xC	..
xcccXV	xC	xC	xC	..
xcccXV	xC	xC	xC	..

Service Information
Acme Local Handle Service

Handle Clients

XCCCXV	XC	XC	XC	...
XCCCXV XCCX XCCX	XC XC XC	XC XC XC	XC XC XC
XCCCXV XCCX XCCX	XC XC XC	XC XC XC	XC XC XC
XCCCXV XCCX XCCX	XC XC XC	XC XC XC	XC XC XC

	IP Address	Port #	Public Key	...
Primary Site				
Server 1	123.45.67.8	2641	K03RLQ...	...
Server 2	123.52.67.9	2641	5&M#FG...	...
Secondary Site A				
Server 1	321.54.678.12	2641	F^*JLS...	...
Server 2	321.54.678.14	2641	3E\$T%...	...
Server 3	762.34.1.1	2641	A2S4D...	...
Secondary Site B				
Server 1	123.45.67.4	2641	N0L8H7...	...

Service Information - Acme Local Handle Service

Handle Clients

XCCCXV	XC	XC	XC	...
XCCCXV XCCX XCCX	XC XC XC	XC XC XC	XC XC XC
XCCCXV XCCX XCCX	XC XC XC	XC XC XC	XC XC XC
XCCCXV XCCX XCCX	XC XC XC	XC XC XC	XC XC XC

	IP Address	Port #	Public Key	...
Primary Site				
Server 1	123.45.67.8	2641	K03RLQ...	...
Server 2	123.52.67.9	2641	5&M#FG...	...
Secondary Site A				
Server 1	321.54.678.12	2641	F^*JLS...	...
Server 2	321.54.678.14	2641	3E\$T%...	...
Server 3	762.34.1.1	2641	A2S4D...	...
Secondary Site B				
Server 1	123.45.67.4	2641	N0L8H7...	...

Service Information - Acme Local Handle Service

Handle Clients

XCCCXV	XC	XC	XC	...
XCCCXV XCCX XCCX	XC XC XC	XC XC XC	XC XC XC
XCCCXV XCCX XCCX	XC XC XC	XC XC XC	XC XC XC
XCCCXV XCCX XCCX	XC XC XC	XC XC XC	XC XC XC

	IP Address	Port #	Public Key	...
Primary Site				
Server 1	123.45.67.8	2641	K03RLQ...	...
Server 2	123.52.67.9	2641	5&M#FG...	...
Secondary Site A				
Server 1	321.54.678.12	2641	F^*JLS...	...
Server 2	321.54.678.14	2641	3E\$T%...	...
Server 3	762.34.1.1	2641	A2S4D...	...
Secondary Site B				
Server 1	123.45.67.4	2641	N0L8H7...	...

Service Information - Acme Local Handle Service

Handle Clients

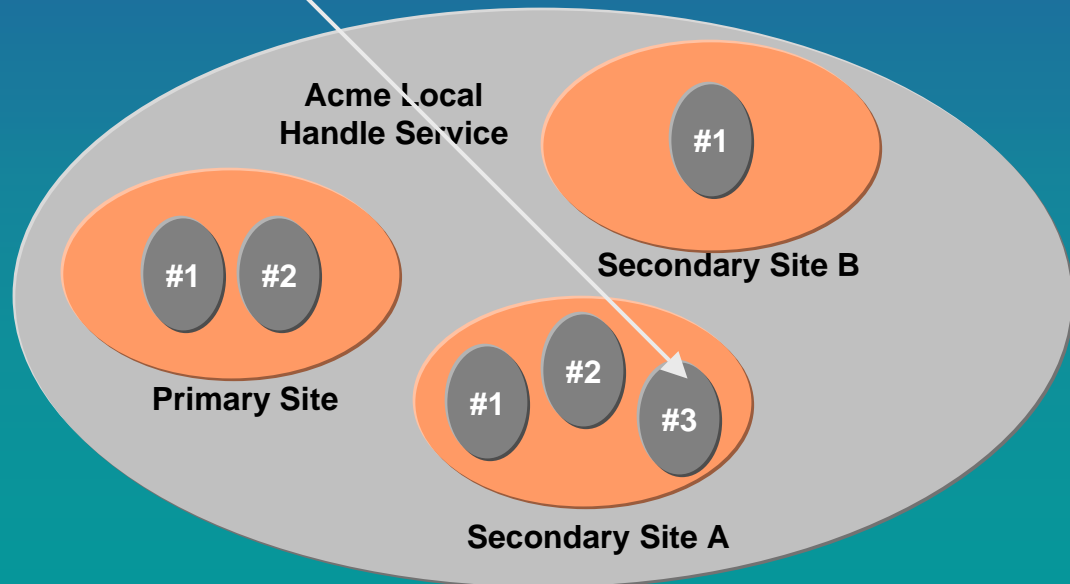
Request to Client:
Resolve hdl:10.1000/1



Client

3. Client queries Server 3
in Secondary Site A
for 10.1000/1

Global Handle
Registry



Handle Clients

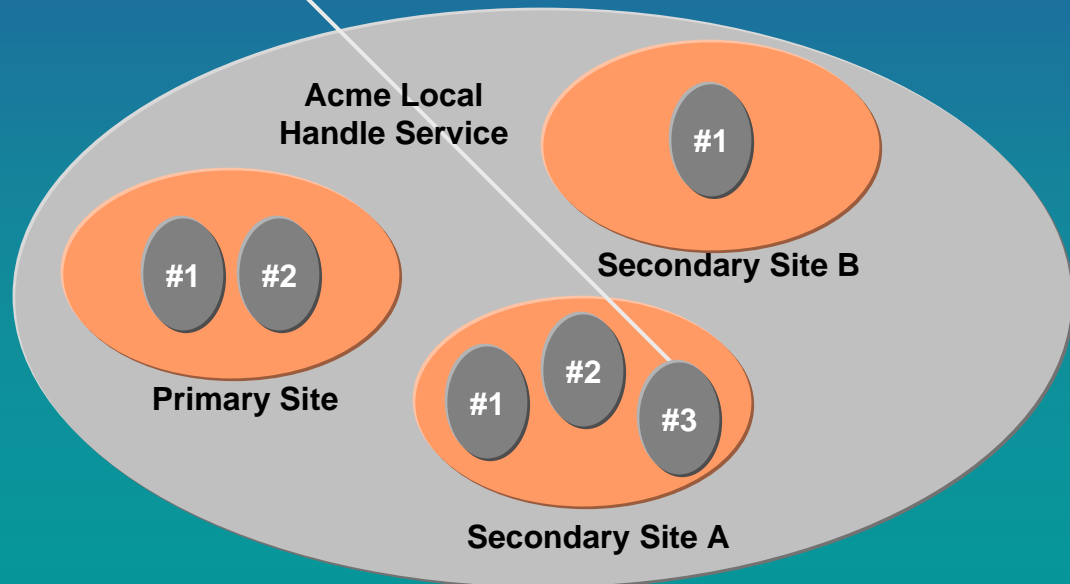
Request to Client:
Resolve hdl:10.1000/1



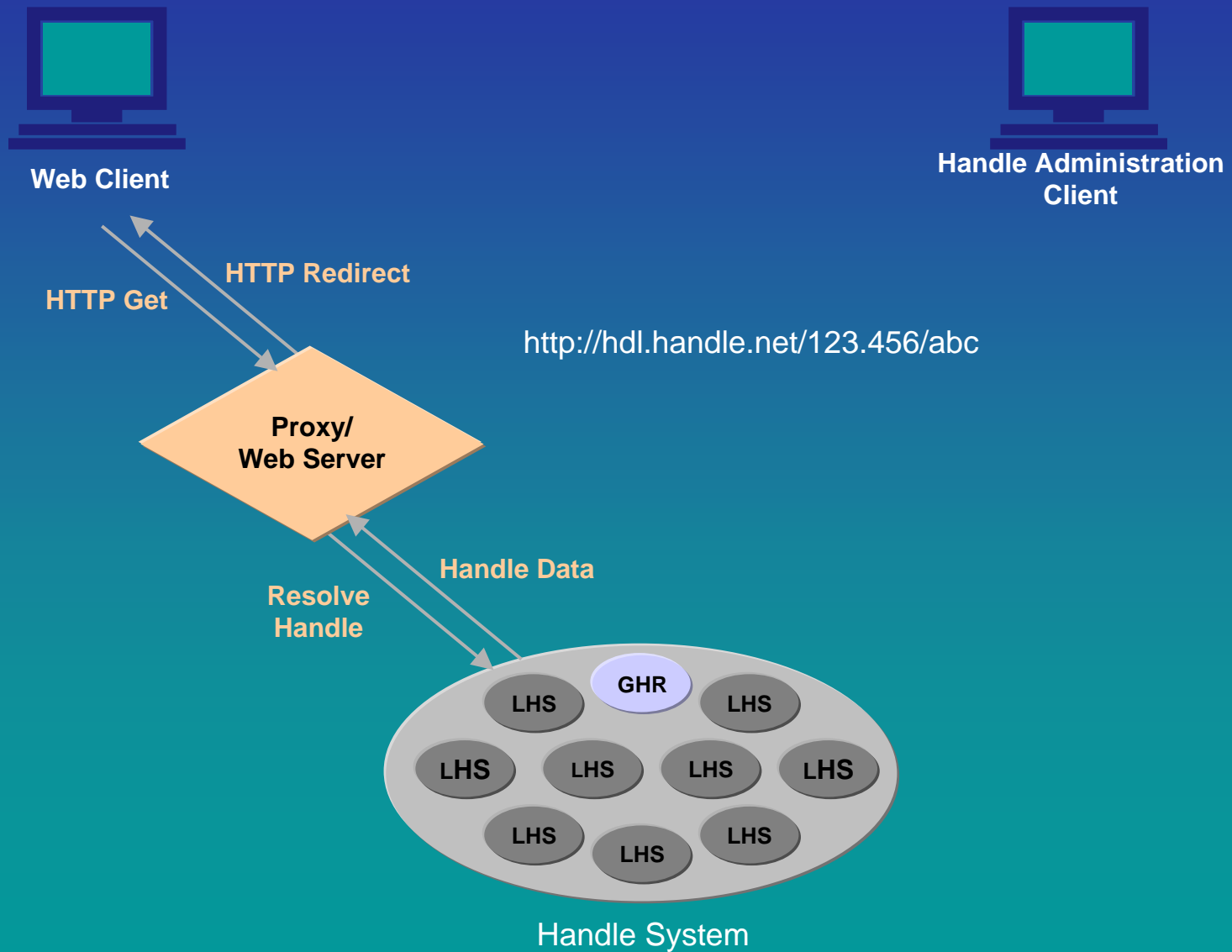
Client

Global Handle Registry

4. Server responds with
handle data



Handle Clients



Handle Clients



Web



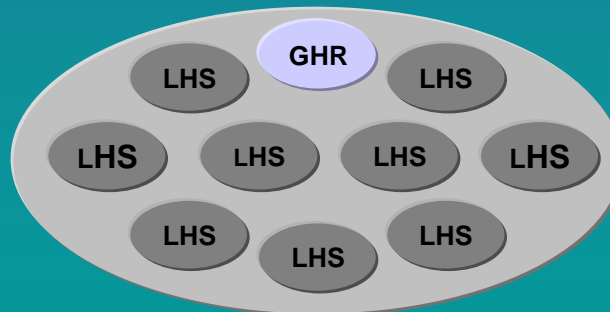
Handle Administration Client

HTTP



Admin Forms

Handle Admin API

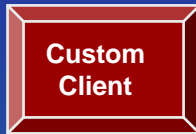


Handle System

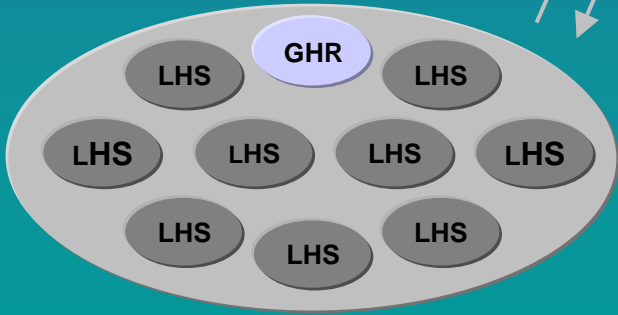
Handle Clients



Web



Handle Administration Client



Handle System

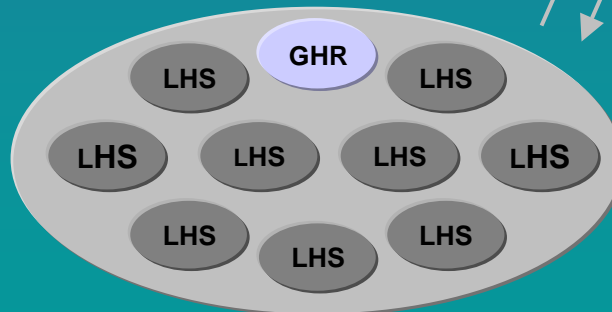


Handle Clients



Web

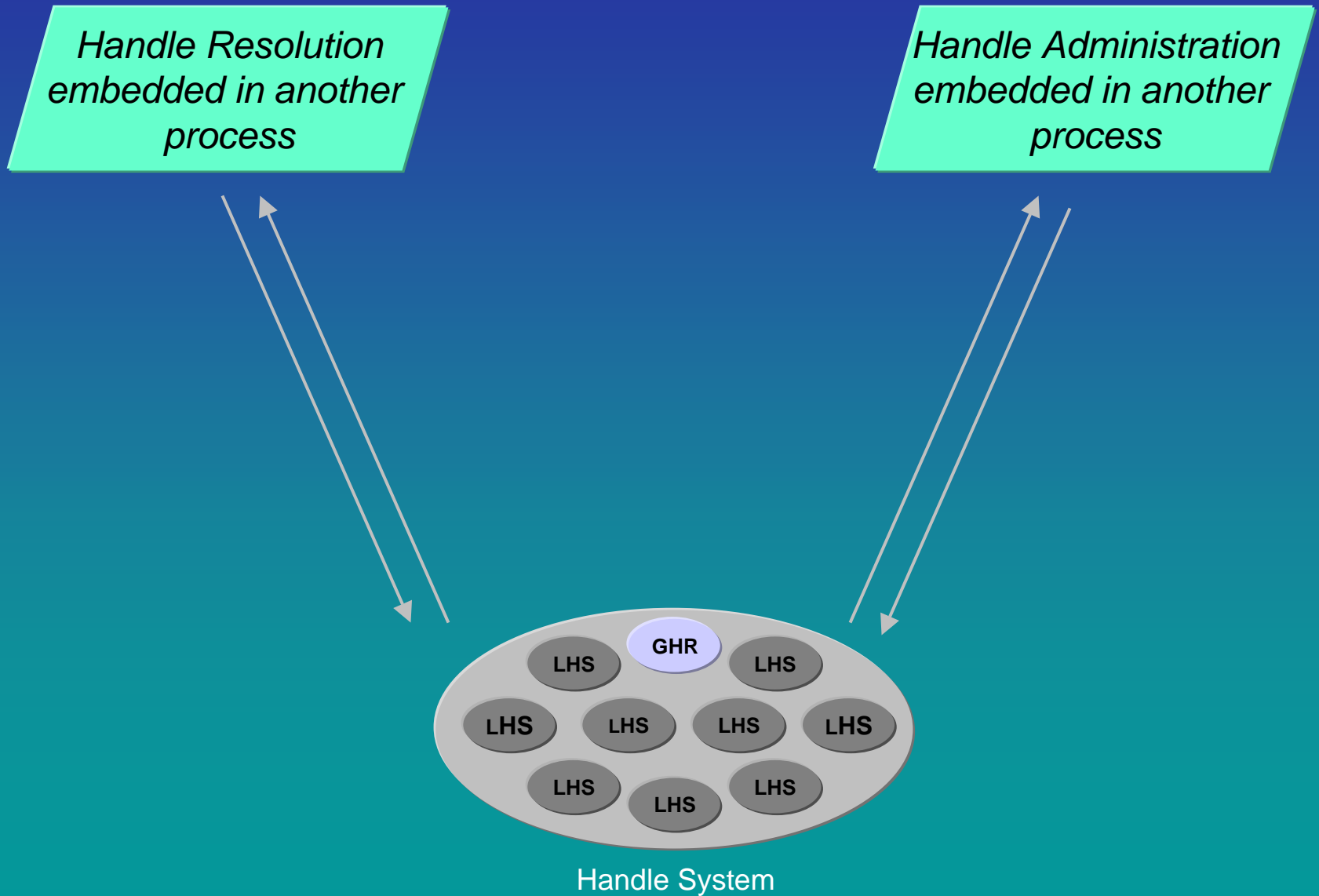
*Handle Administration
embedded in another
process*



Handle System



Handle Clients



HS Administration

- Ownership is at the handle level
- Administrators defined by handles
- Administrator handles contain keys
- All admin transactions validated via challenge/response from server to client
- Allows distributed administration

Handle System Usage

- Prefixes
 - DOI - 700
 - Other - 300
- Handles
 - DOI - 12M
 - Other - unknown
- Global
 - Three service sites (all currently in VA)
 - 10M resolutions last month

Handle System Management and Standards

- Specification
 - RFC 3650: Overview
 - RFC 3651: Namespace and Service Definition
 - RFC 3652: Protocol
- HSAC - Handle System Advisory Committee
- URI/URL/URN
 - IETF votes for URN, we don't see any advantage
 - Extra layer of indirection, still need the native protocol
 - What are the practical implications
 - INFO submission from OpenURL group (also not faring well in the IETF)
 - Open to advice

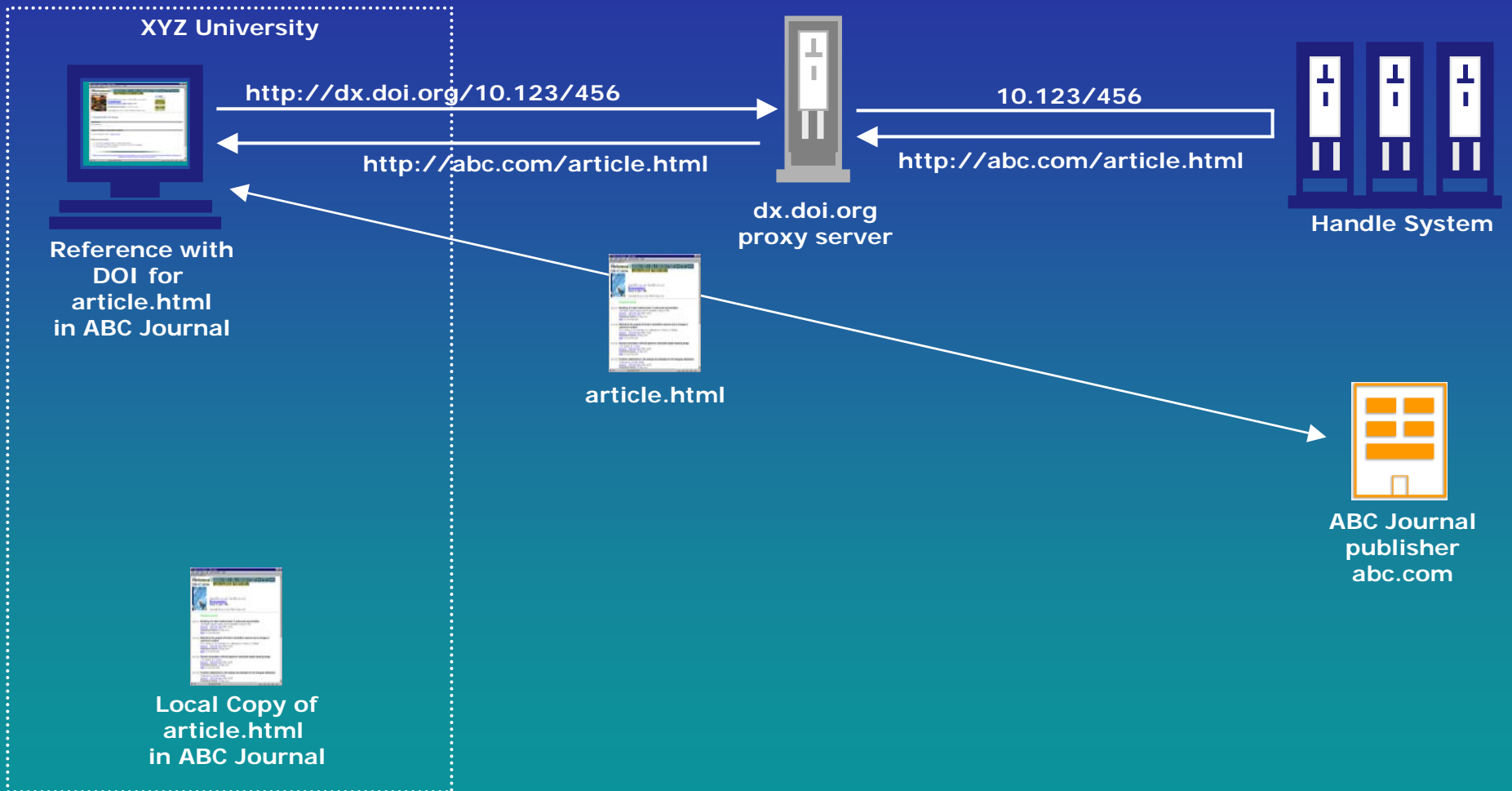
HS Developments

- DOI AP/Services evolution
 - Son of Appropriate Copy
 - Rights Clearance services
- GRID computing - Globus Toolkit
- Licensing
- Delegation
- Renewed Repository/Registry work

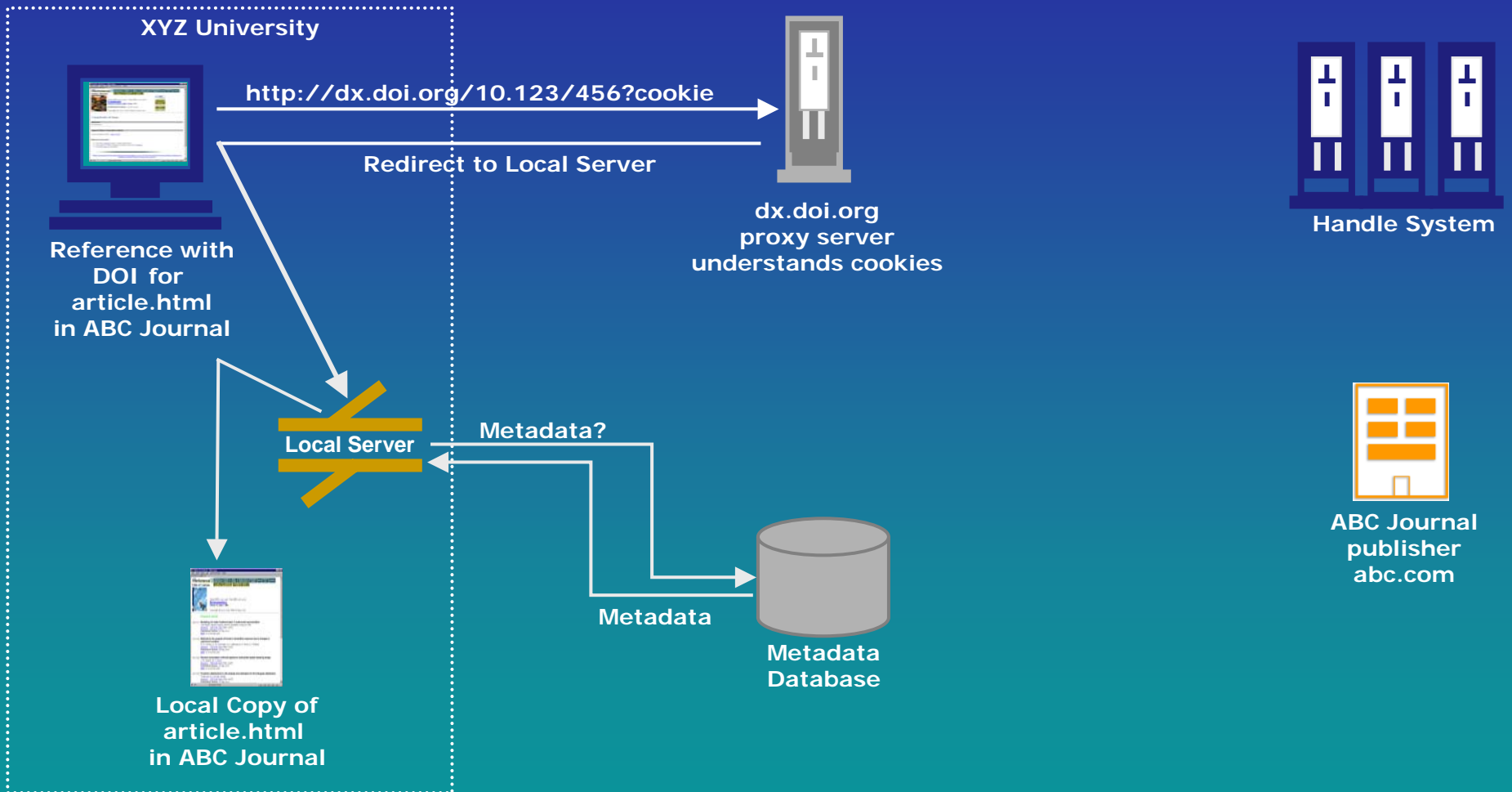
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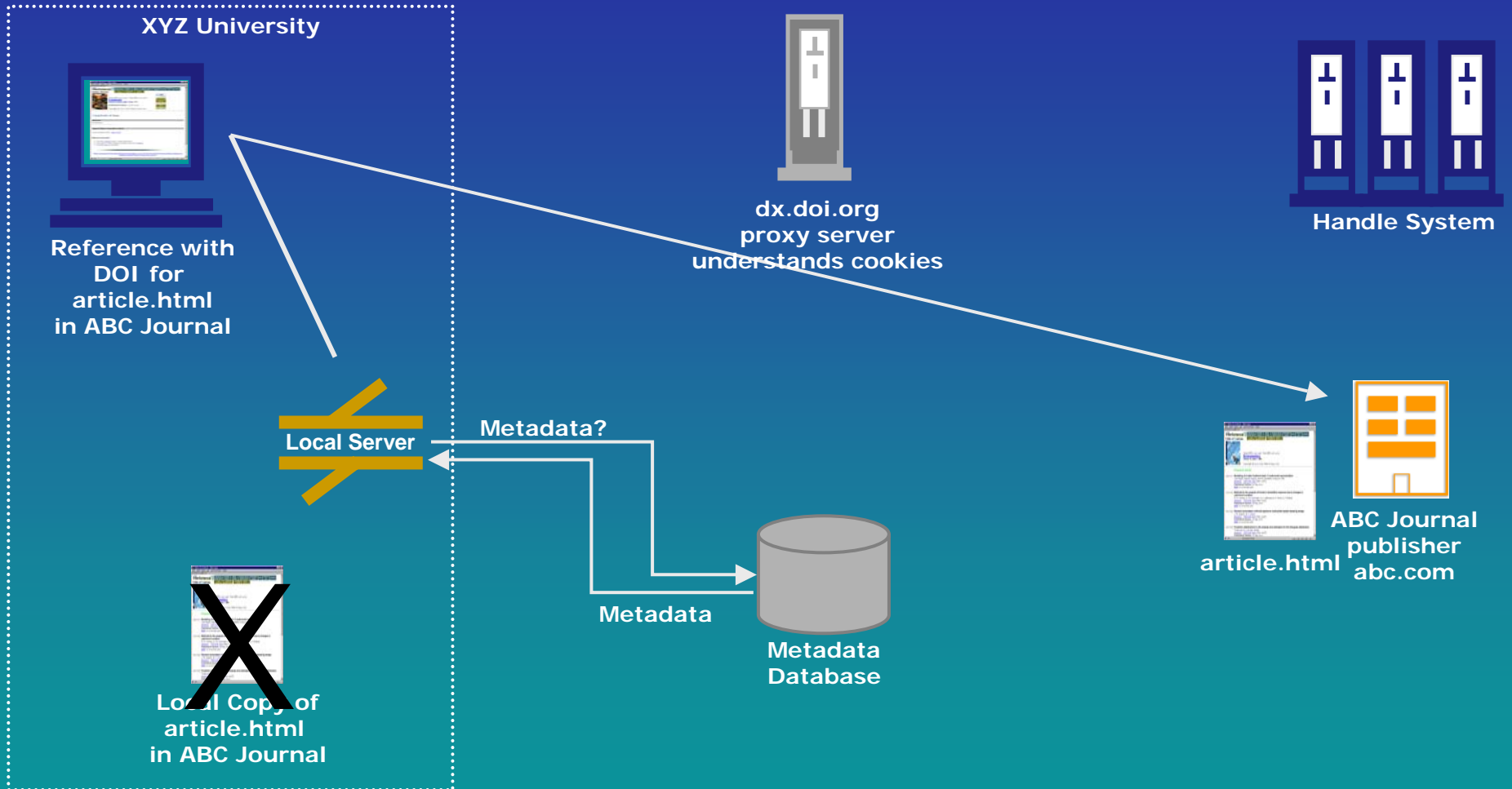
Appropriate Copy Problem



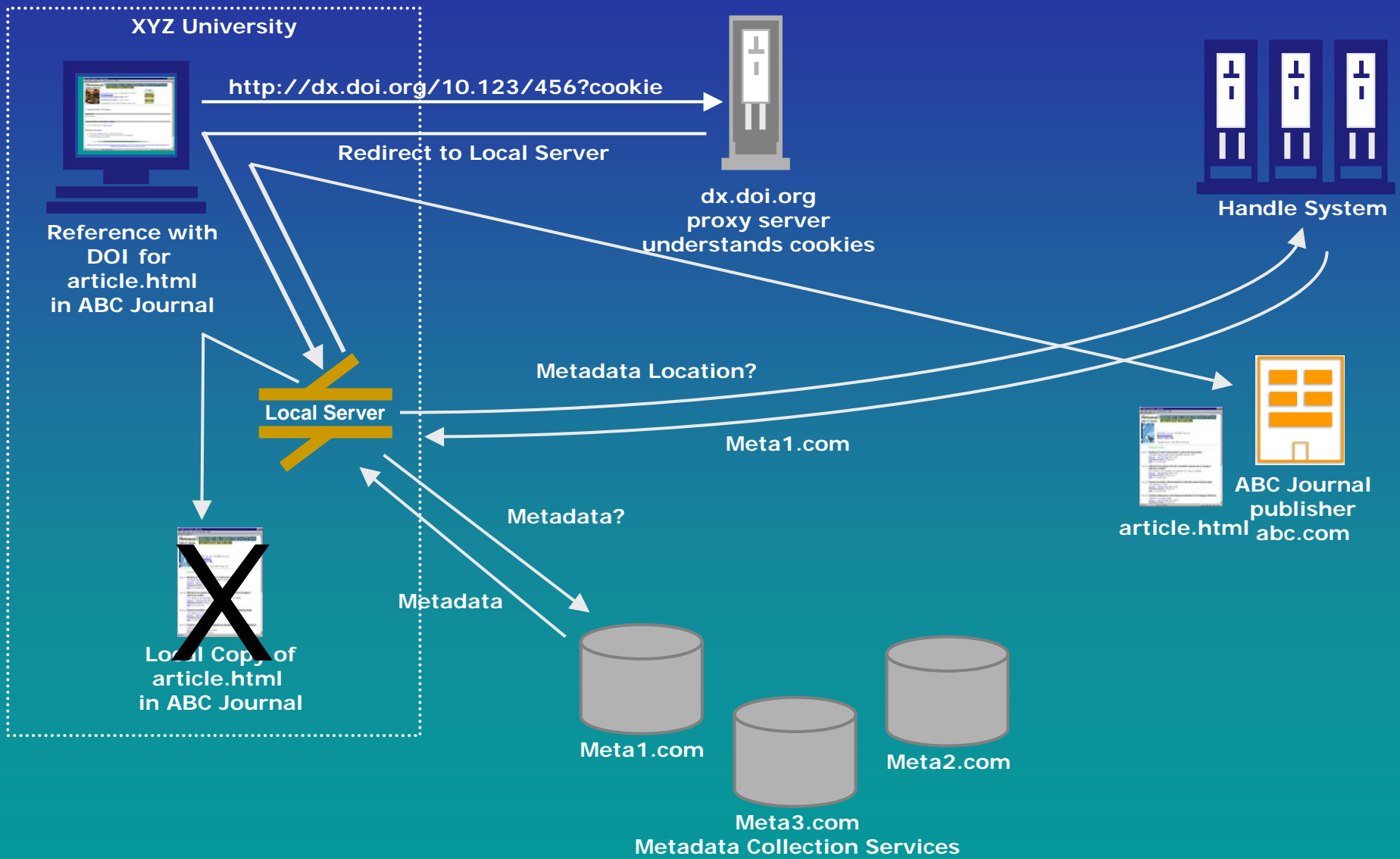
Appropriate Copy Problem: solved



Appropriate Copy Problem solved w/o local copy

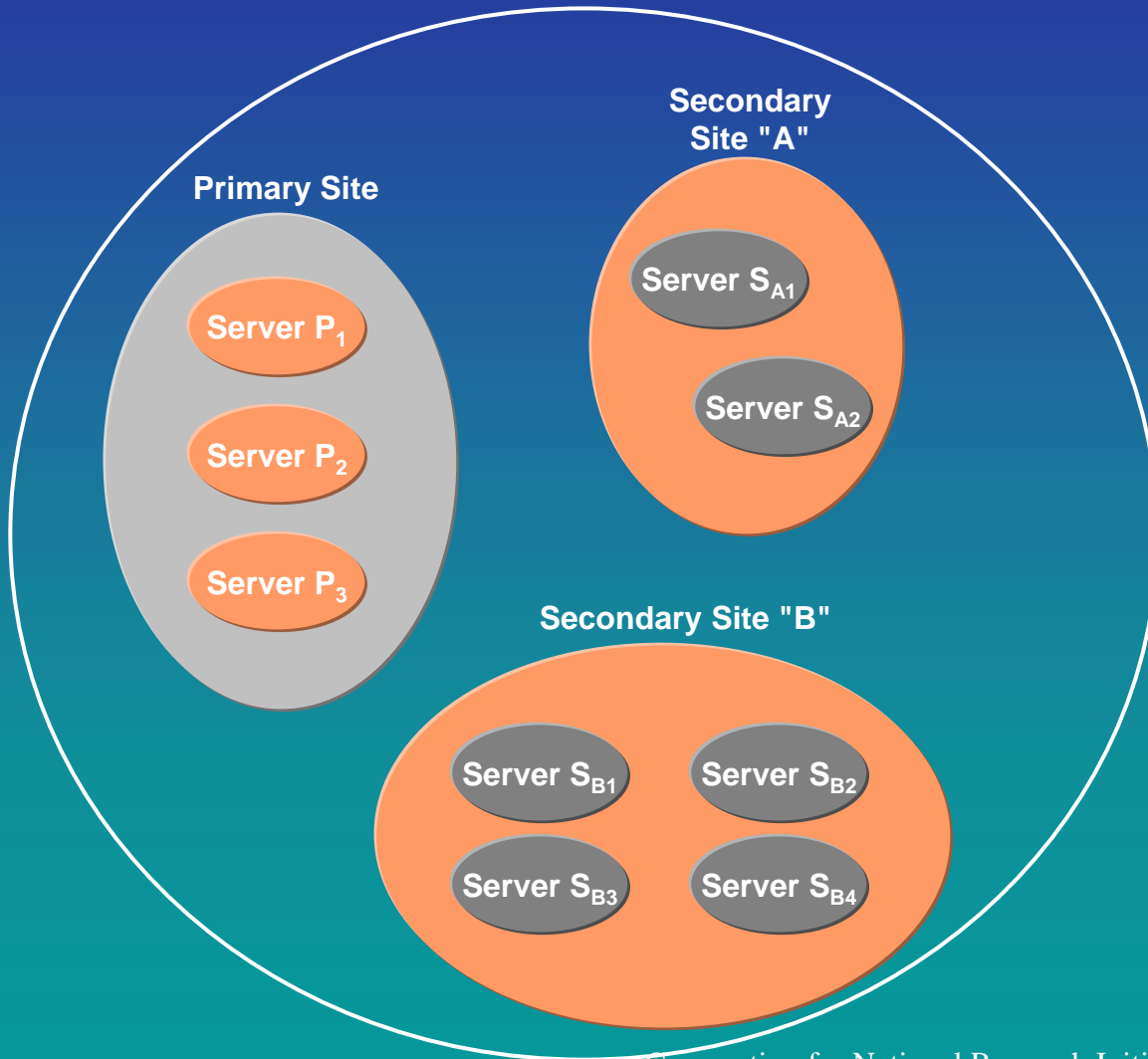


Appropriate Copy Problem extensible solution



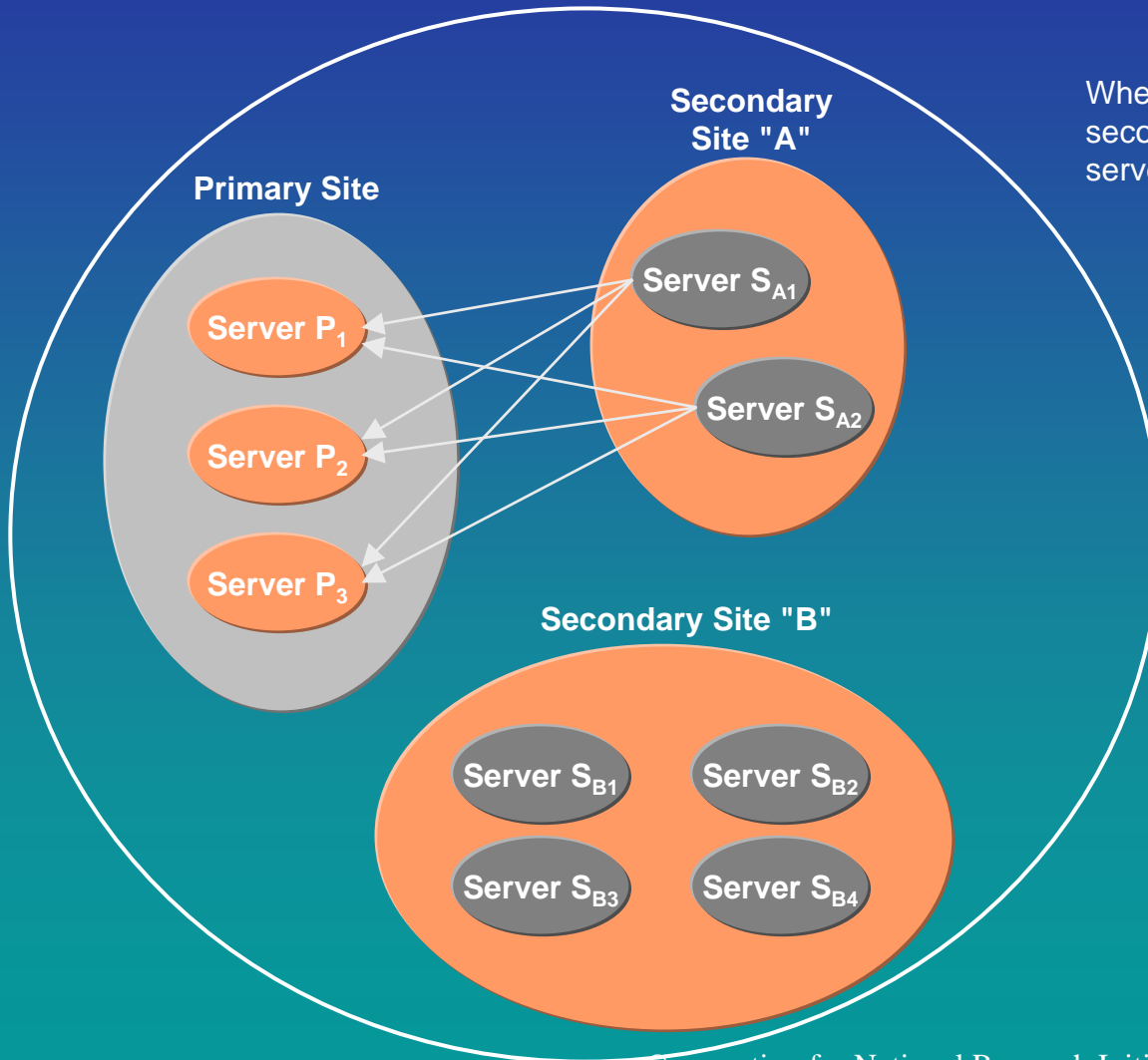
Mirroring

Local Handle Service



Mirroring

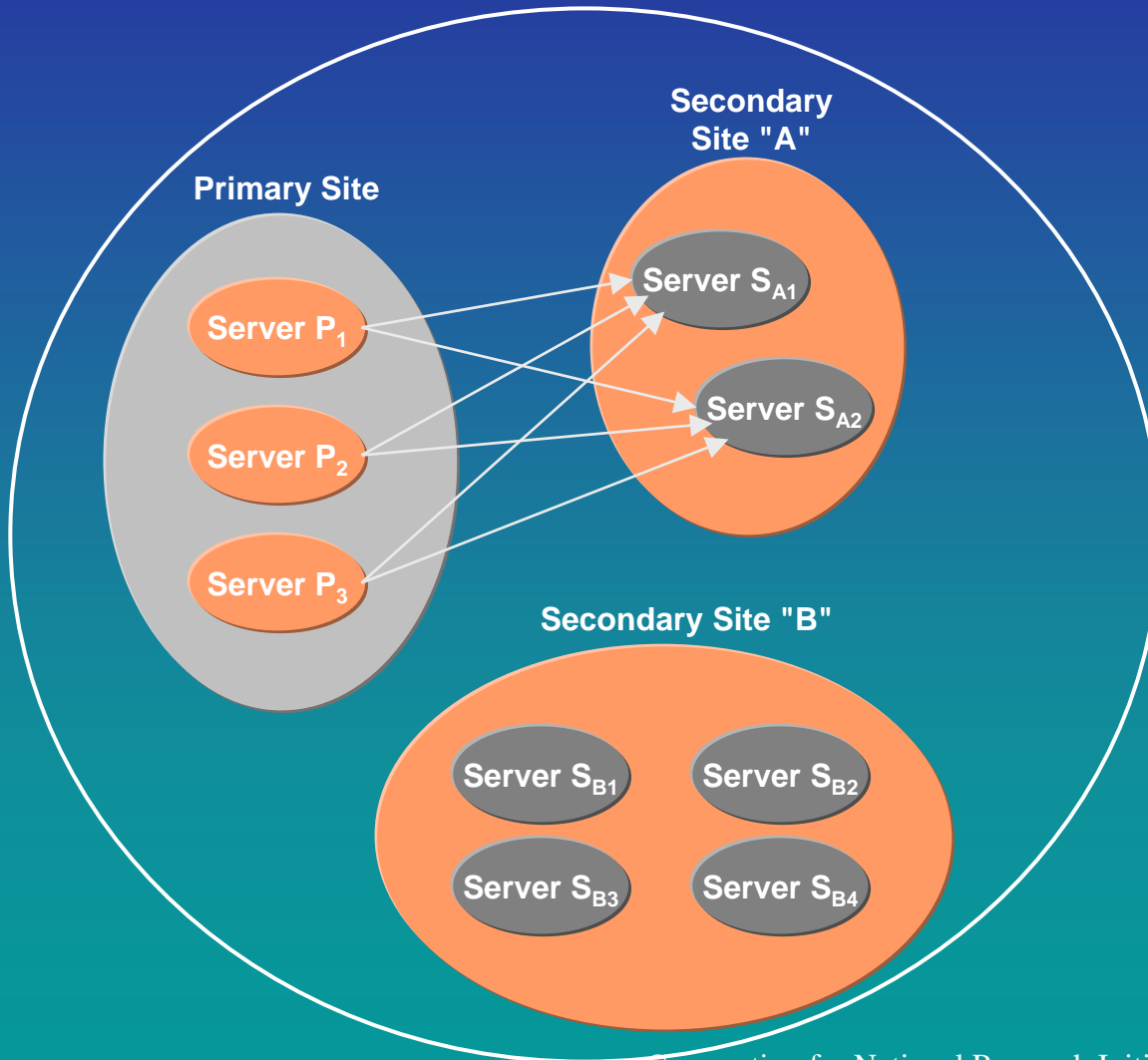
Local Handle Service



When Secondary Site "A" started running, each secondary server sent a request to each server in the Primary Site asking for updates.

Mirroring

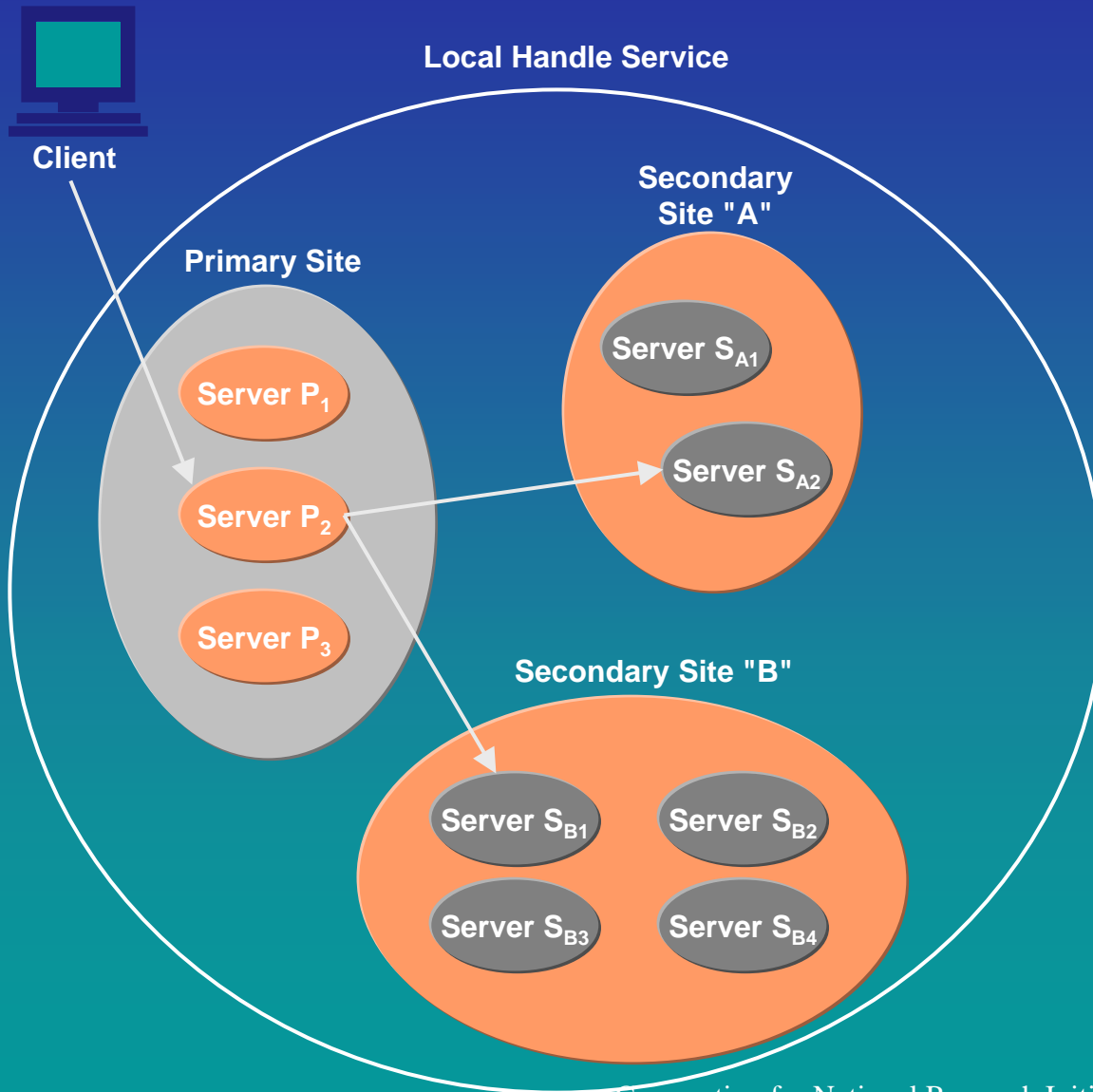
Local Handle Service



Each server P_1, P_3 "knows" which handles in its transaction log hash to which secondary server, and sends them.

Each secondary will continue to request updates on a regular basis. The request is made in the form of "all transactions since transaction X".

Mirroring



For example, for a given new administrative action, the admin client knows, because of hashing, that the action is performed on Primary Server P₂.

Server P₂ then knows to send that action to Secondary Site "A" Server S_{A2} and to Secondary Site "B", Server S_{B1}.