Repository Interoperability and Preservation: The Hub and Spoke Framework

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What Is Hub and Spoke?

- Repository Interoperability Architecture
- Process
- Preservation of Digital Objects

This Road to Preservation…

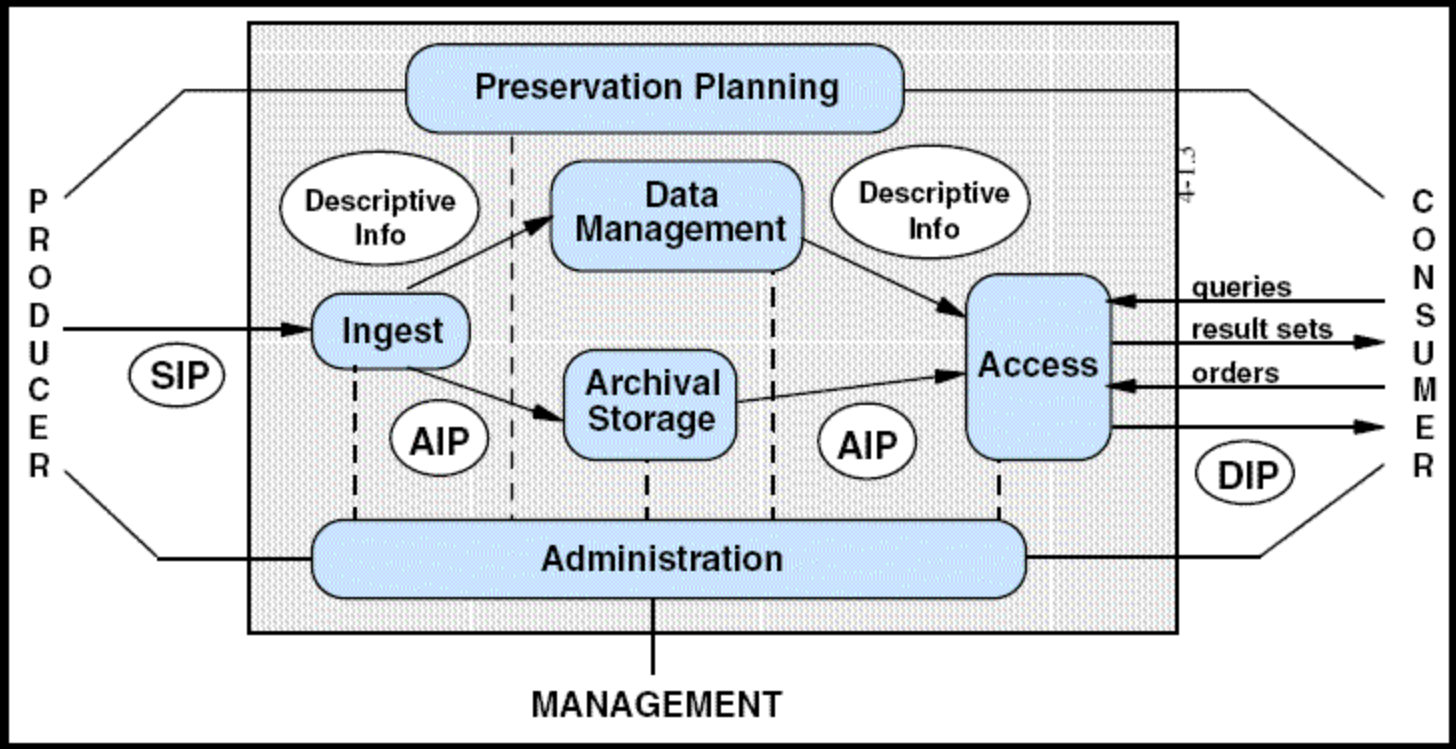
Digital PRESERVATION

National Digital Information Infrastructure & Preservation Program:
A Collaborative Initiative of the Library of Congress

Foundation of Preservation

Open Archival Information System (OAIS)

OAIS archive: An organization of people and systems that will preserve information and make it available for designated communities.



Evaluation of Repositories

- What we started with
  - Sample data & digital repositories: DSpace, FEDORA, EPrints and Greenstone

- What we continued with
  - In context of preservation, developed checklist
  - Moving sample data between digital repositories

- What we ended with
  - Beginnings of Hub and Spoke architecture
  - No long-term preservation archive out there….

Limitations of Digital Repository

- Propriety storage
- No guaranteed viability or interoperability of software
- Little or no Intellectual Property Rights management
- Little or no Provenance
- Unsupported Digital Objects
- Not OAIS compliant

Conclusion…

Repository interoperability is essential for the preservation of digital objects

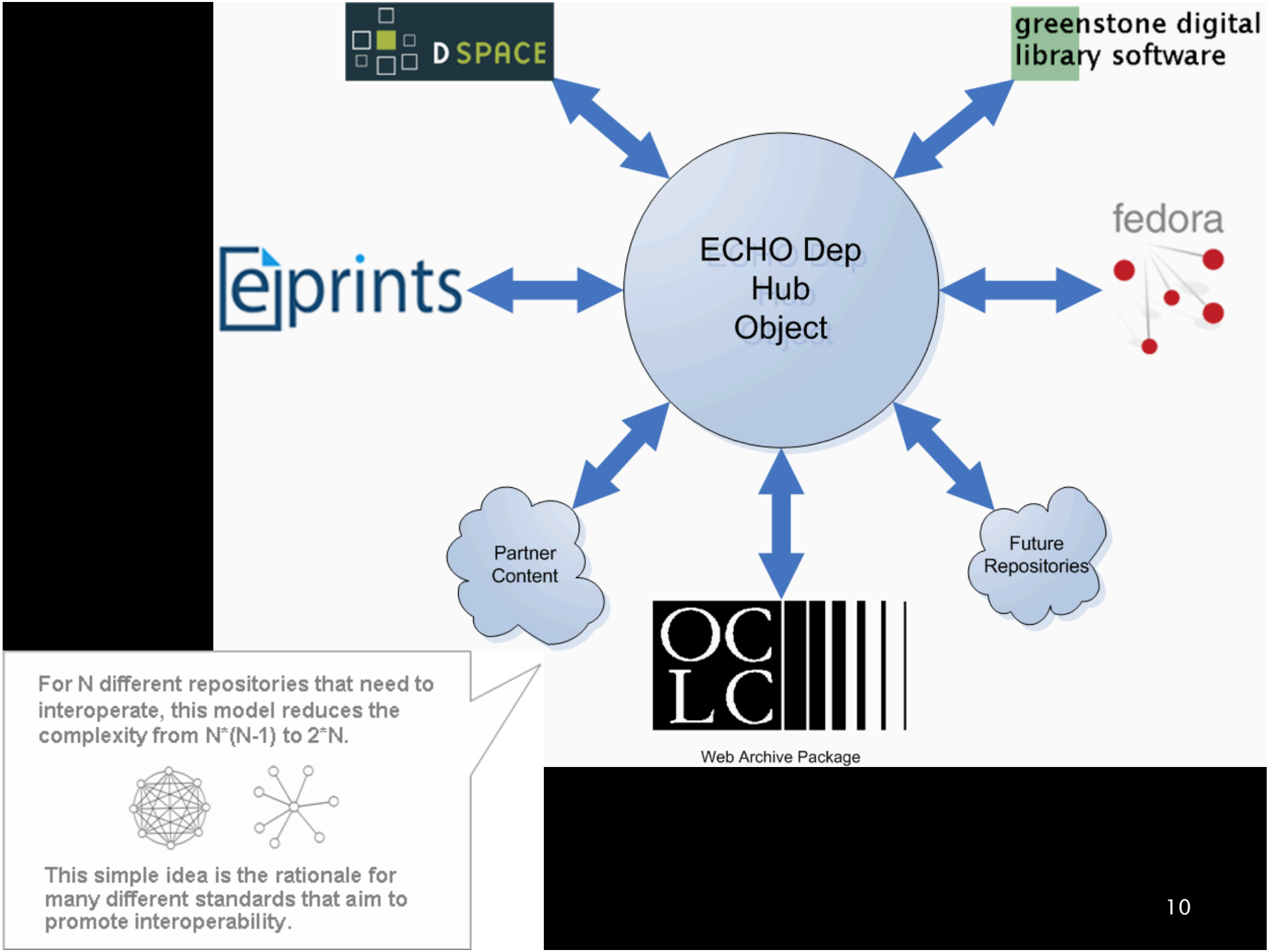
What We Have…

- Plethora of repositories
- Overabundance of data sources
- Current integration solutions are local and ad hoc
- Not much preservation

A Solution: The Hub & Spoke…

- Preservation is taken into account
- Builds on existing infrastructure

- A common METS-based profile
- A standard programming API
- A series of scripts that use the API and METS profile for creating AIPS as well as SIPs & DIPs which can be used across different repositories



For N different repositories that need to interoperate, this model reduces the complexity from N*(N-1) to 2*N.

This simple idea is the rationale for many different standards that aim to promote interoperability.

Hub and Spoke METS Profiles

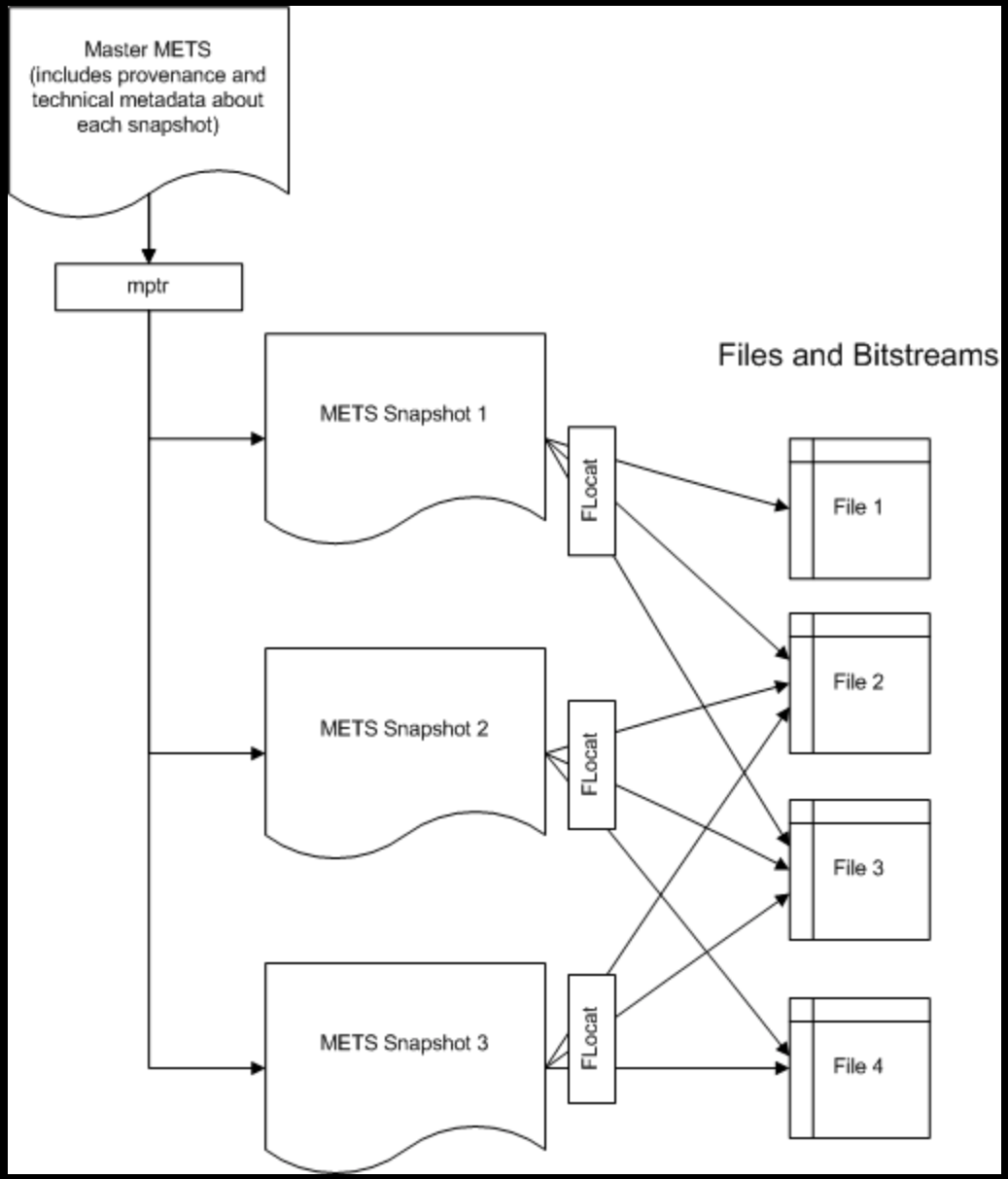
Preserving the Representations of Intellectual Entities

- Representations are encapsulated in:
  - structMap
  - structLink
  - dmdSec
  - fileSec
  - behaviorSec
- Metadata about representations:
  - metsHdr
  - amdSec
  - Various attributes of the structMap, structLink, dmdSec, fileSec, and bahaviorSec

Hub and Spoke METS Profiles

- Non-prescriptive in regards to structure or file formats
- Intended to overlay other profiles which specify case-specific needs (i.e. web captures)
- PREMIS
- MODS
  - Must conform to the DLF Aquifer profile
- File-format specific technical metadata
  - MIX, VIDEOMD, AUDIOMD, others as appropriate

Master METS + Snapshots



Technical Metadata

Generation/Augmentation

- JHOVE Output + Custom XSLT
- Java "Applicators" for specific technical metadata schemas
  - MIX
  - TEXTMD
  - AUDIOMD
  - PREMIS
  - Class hierarchy to support new Applicators

METS Programming API

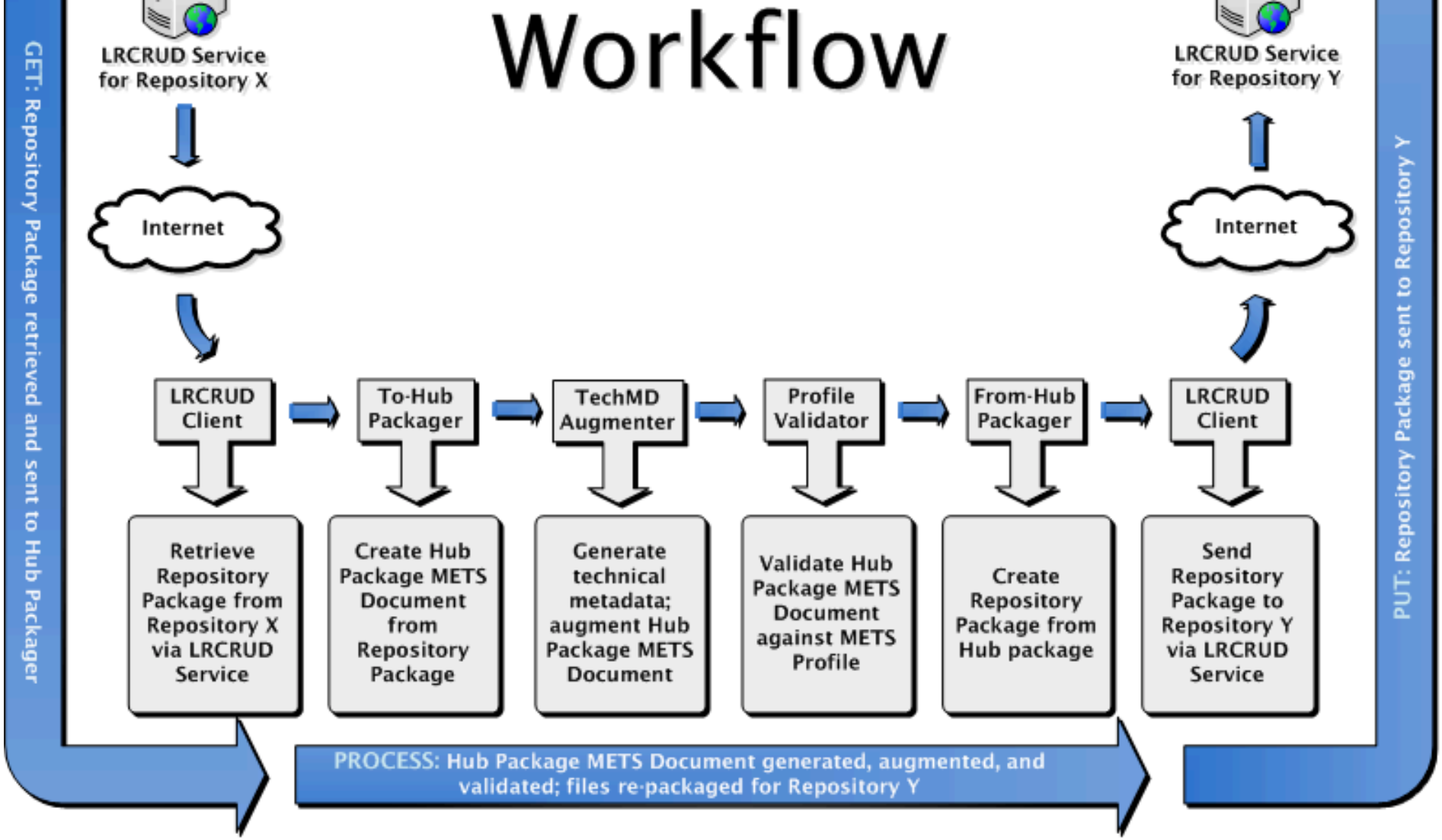
- Open Source
- Java
- XMLBeans
- Download http://sourceforge.net/projects/echodep/

METS Profiles

- Generic
  - http://www.loc.gov/standards/mets/profiles/00000015.xml
- Web Capture
  - http://www.loc.gov/standards/mets/profiles/00000016.xml
- Master METS – (not yet registered)
  - http://dli.grainger.uiuc.edu/echodep/METS/DRAFTS/MasterMETSProfile.xml

Technical Overview

Workflow


LRCRUD Service for Repository X
Internet
LRCRUD Client
To-Hub Packager
TechMD Augmenter
Profile Validator
From-Hub Packager
LRCRUD Client
LRCRUD Service for Repository Y
Internet
Retrieve Repository Package from Repository X via LRCRUD Service
Create Hub Package METS Document from Repository Package
Generate technical metadata; augment Hub Package METS Document
Validate Hub Package METS Document against METS Profile
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Send Repository Package to Repository Y via LRCRUD Service
GET: Repository Package retrieved and sent to Hub Packager
PUT: Repository Package sent to Repository Y
PROCESS: Hub Package METS Document generated, augmented, and validated; files re-packaged for Repository Y

LRCRUD

Service

Lightweight
Repository
Create
Retrieve
Update
Delete

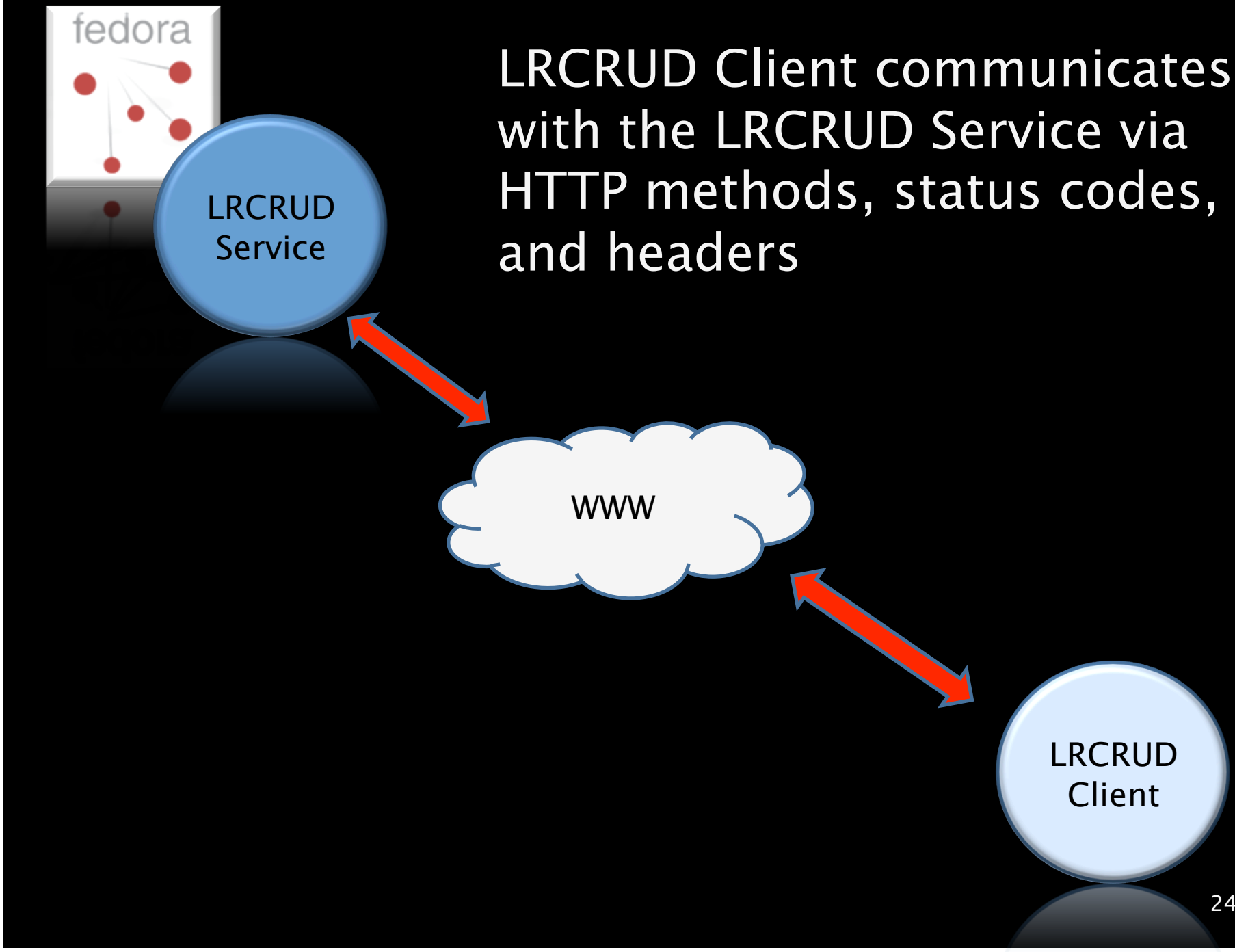
REST

Representational State Transfer

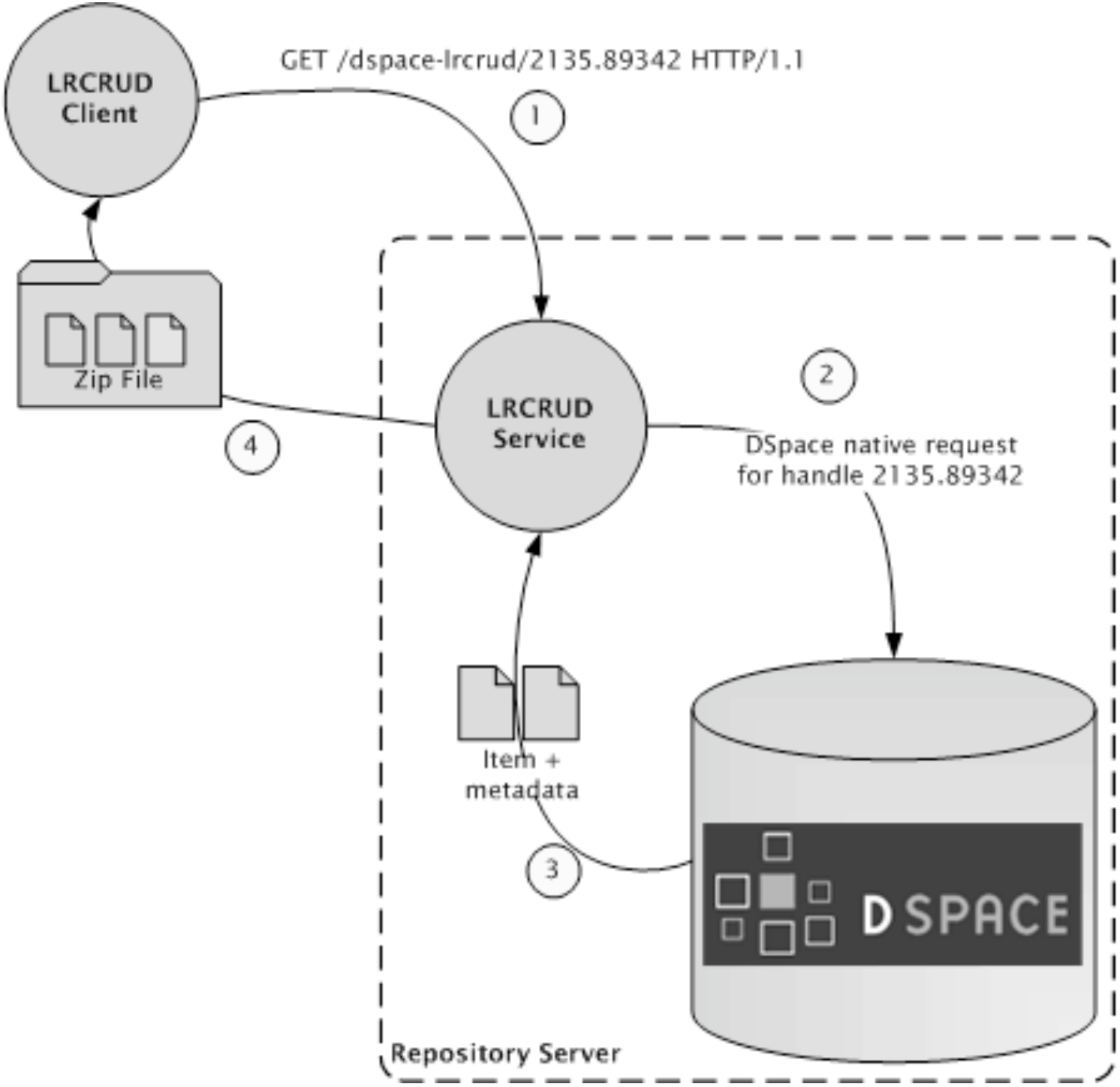
LRCRUD Web Service HTTP Methods

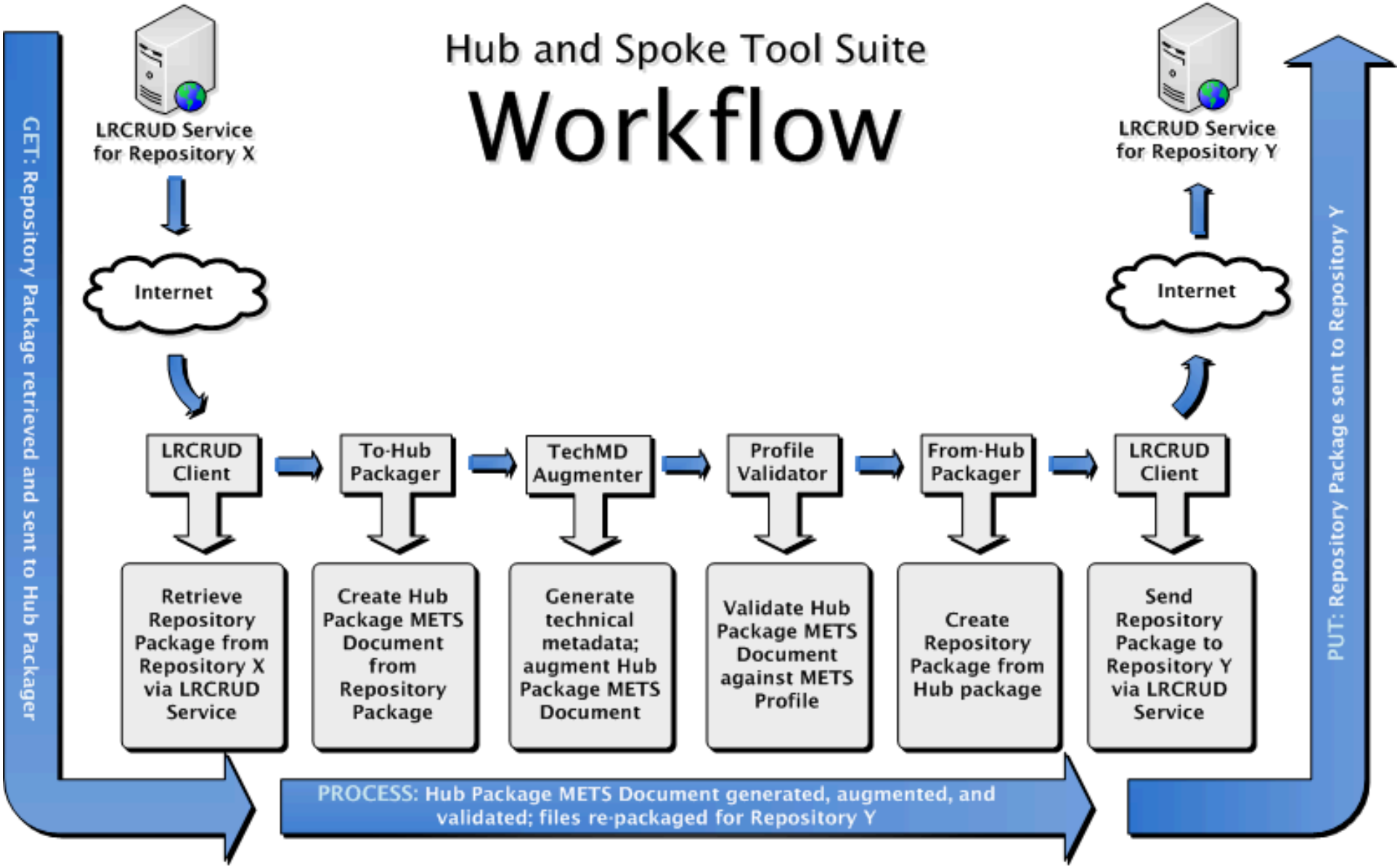
CRUD Action	HTTP Method	URL Path
Create	POST	/collection_id
Retrieve	GET	/item_id
Update	PUT	/item_id
Delete	DELETE	/item_id

LRCRUD
Client



LRCRUD Client communicates with the LRCRUD Service via HTTP methods, status codes, and headers


LRCRUD Client
GET /dspace-lrcrud/2135.89342 HTTP/1.1
1
Zip File
LRCRUD Service
2
4
DSpace native request for handle 2135.89342
Item + metadata
3
DSPACE
Repository Server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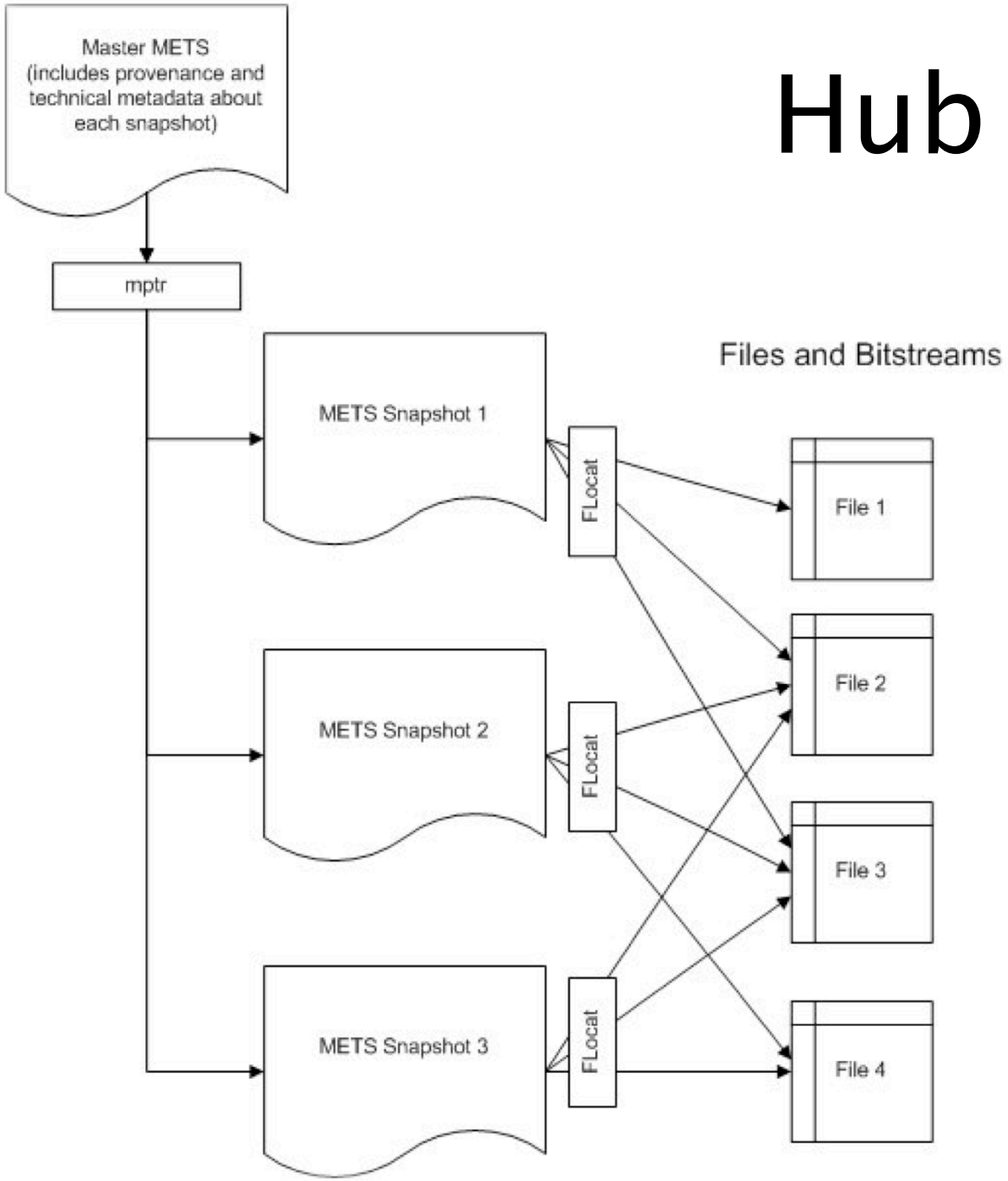
To-Hub Packager

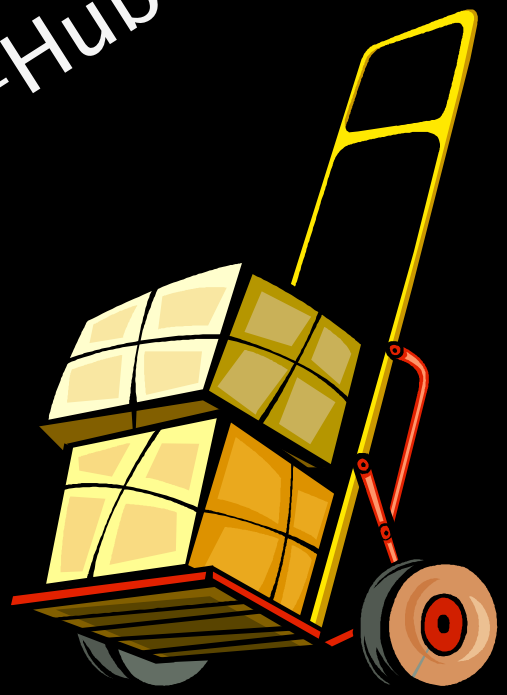
Hub Package


Master METS
(includes provenance and technical metadata about each snapshot)
mptr
Files and Bitstreams
METS Snapshot 1
METS Snapshot 2
METS Snapshot 3
FLocat
FLocat
FLocat
File 1
File 2
File 3
File 4

To-Hub Packagers

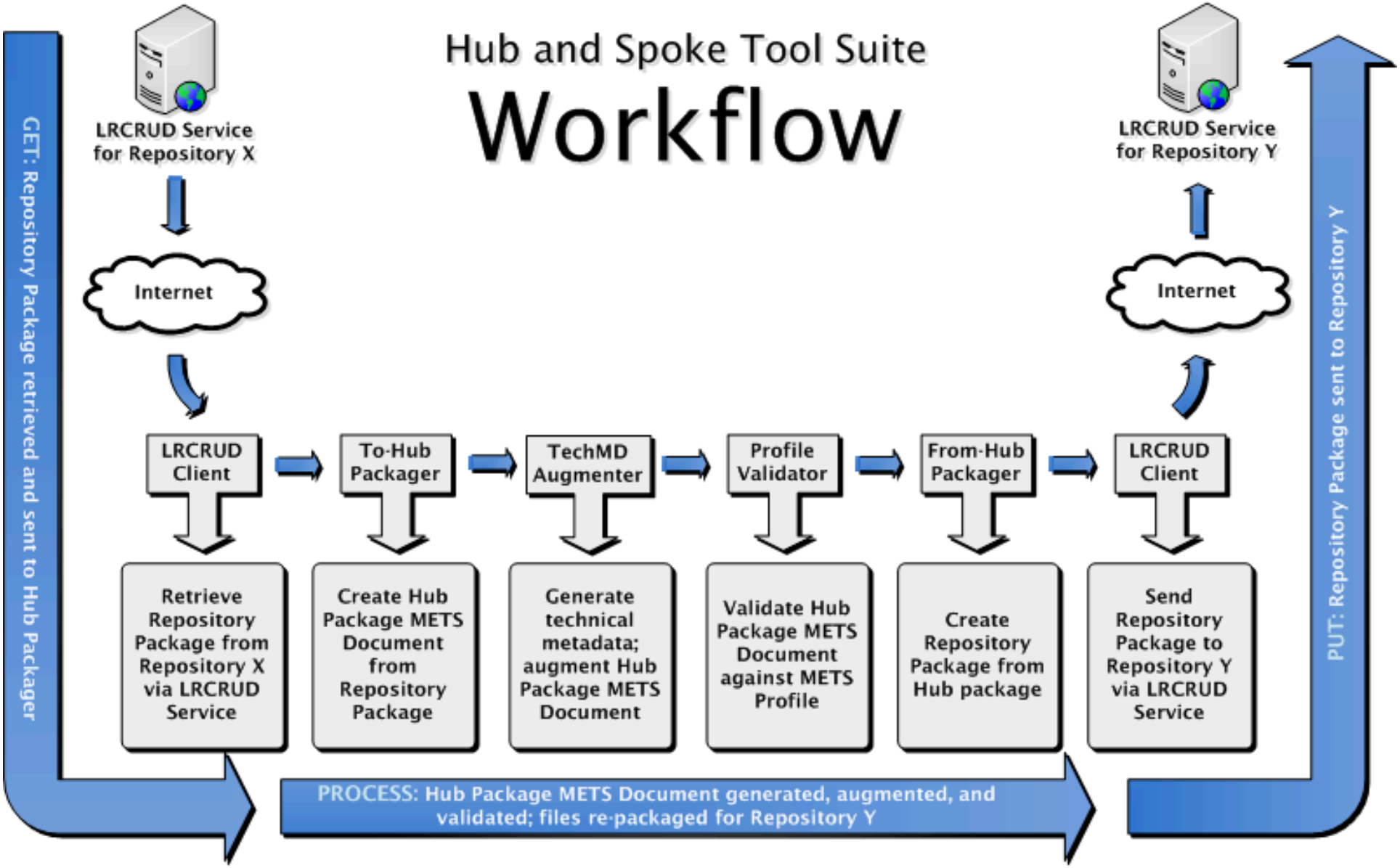
DSpace-to-Hub

EPrints-to-Hub



Fedora-to-Hub

Directory-to-Hub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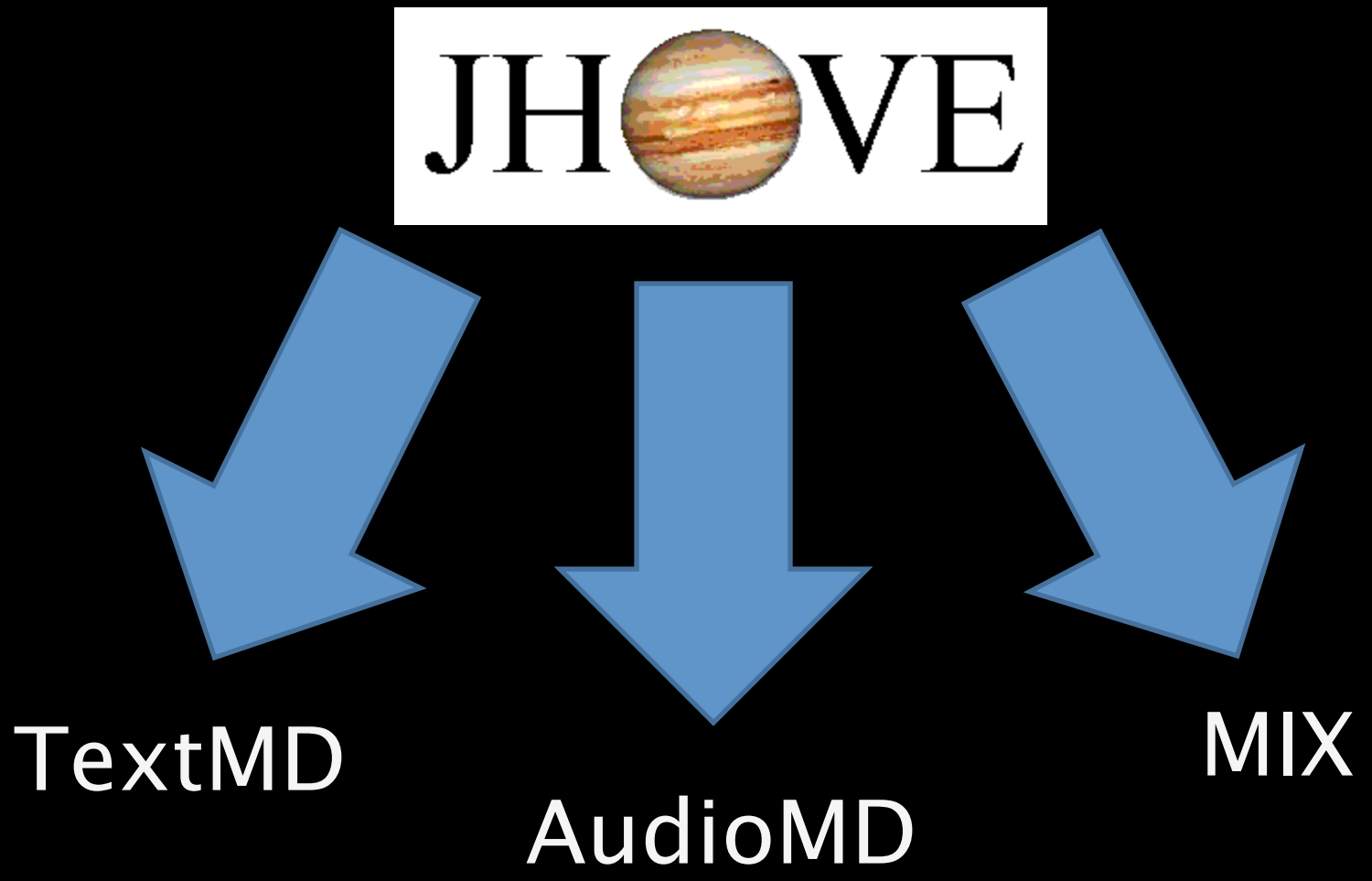
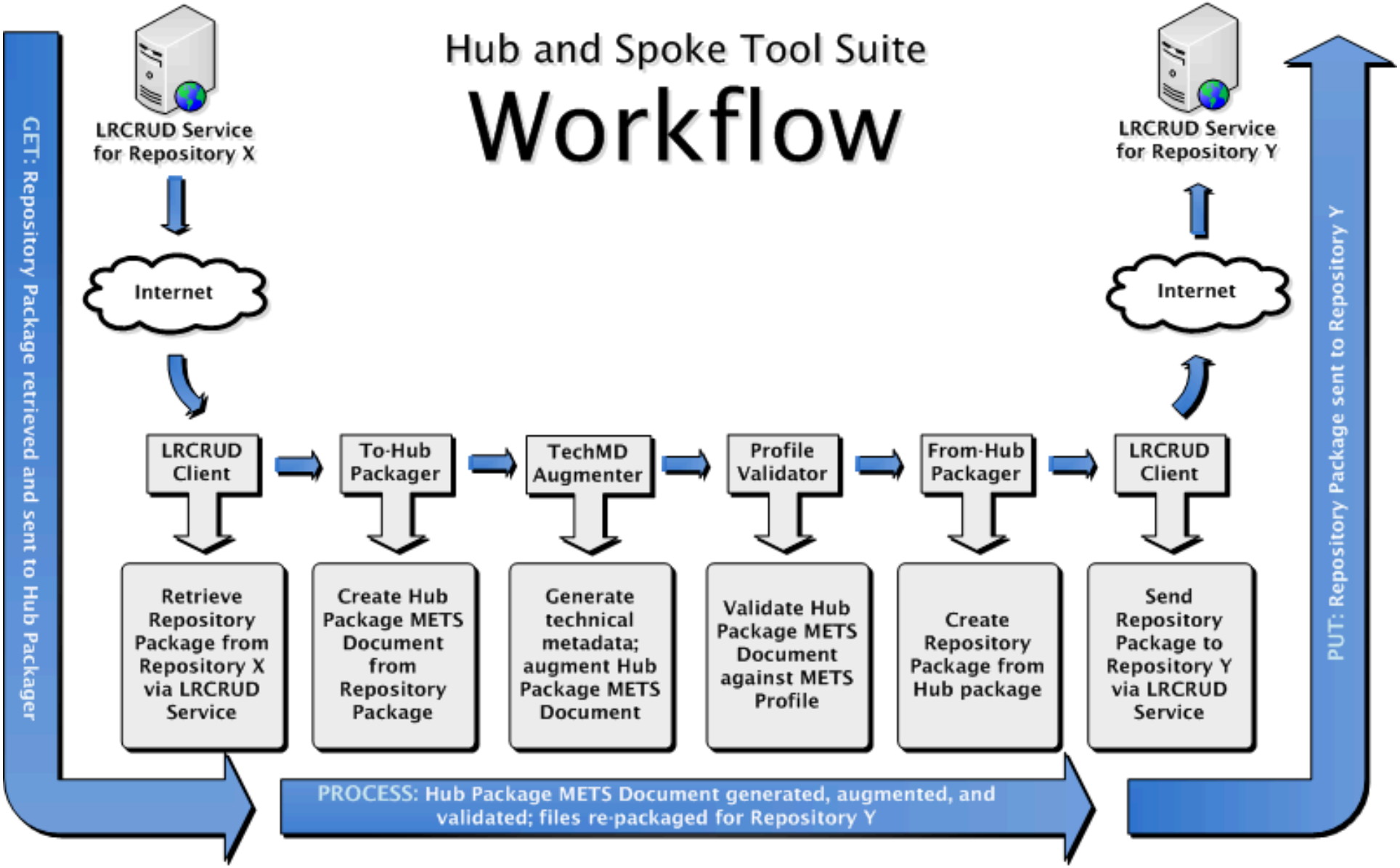
TechMD Augmenter

JSTOR/Harvard Object Validation Environment (JHOVE)



Saved in METS as PREMIS object technical metadata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Profile Validator

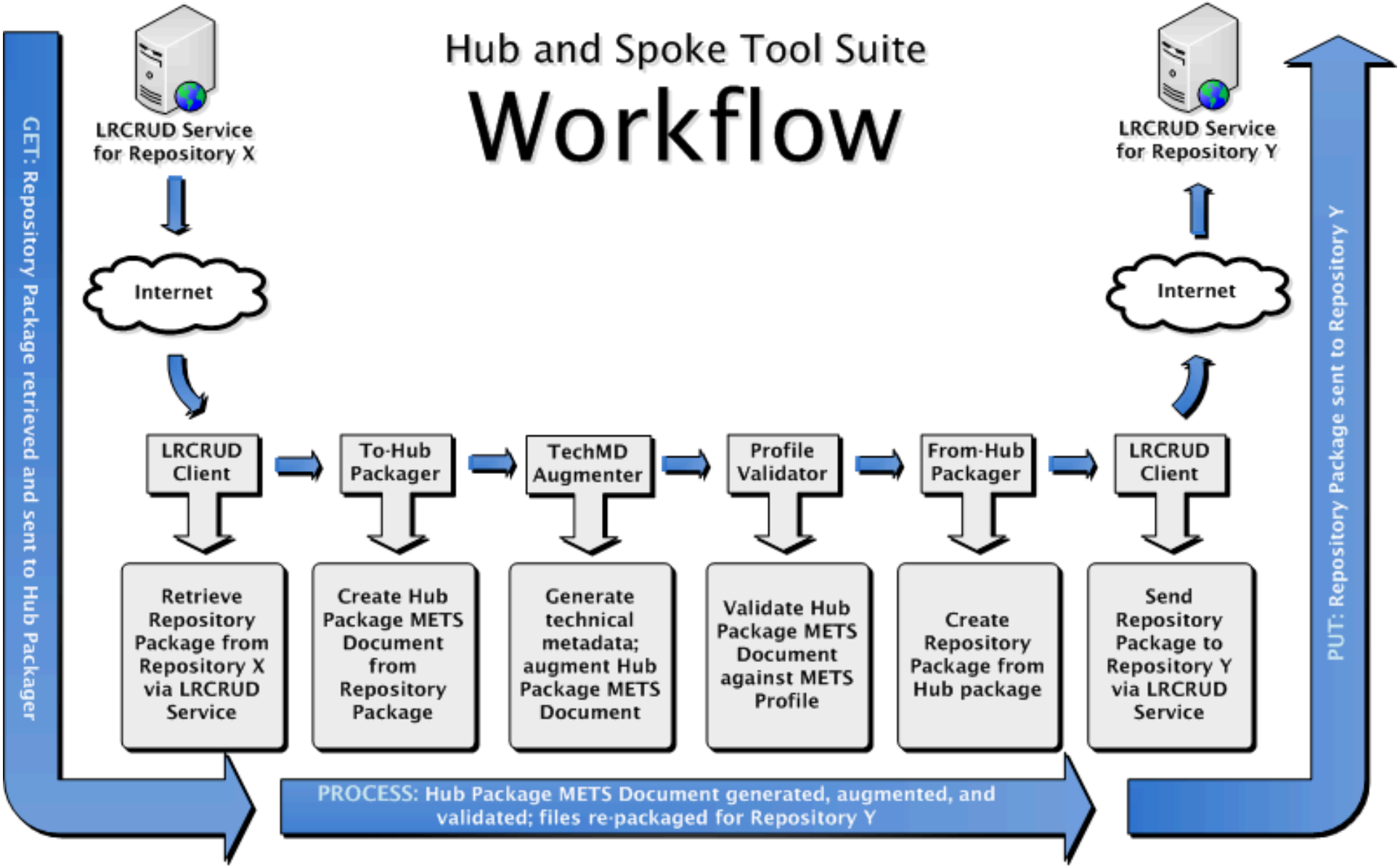
Valid Hub & Spoke METS files:

Aquifer MODS as primary descriptive metadata

PREMIS object technical metadata for each file

Valid PREMIS event elements for provenance metadata

Every referenced file is present and has correct checksum, file-size, and mime-type values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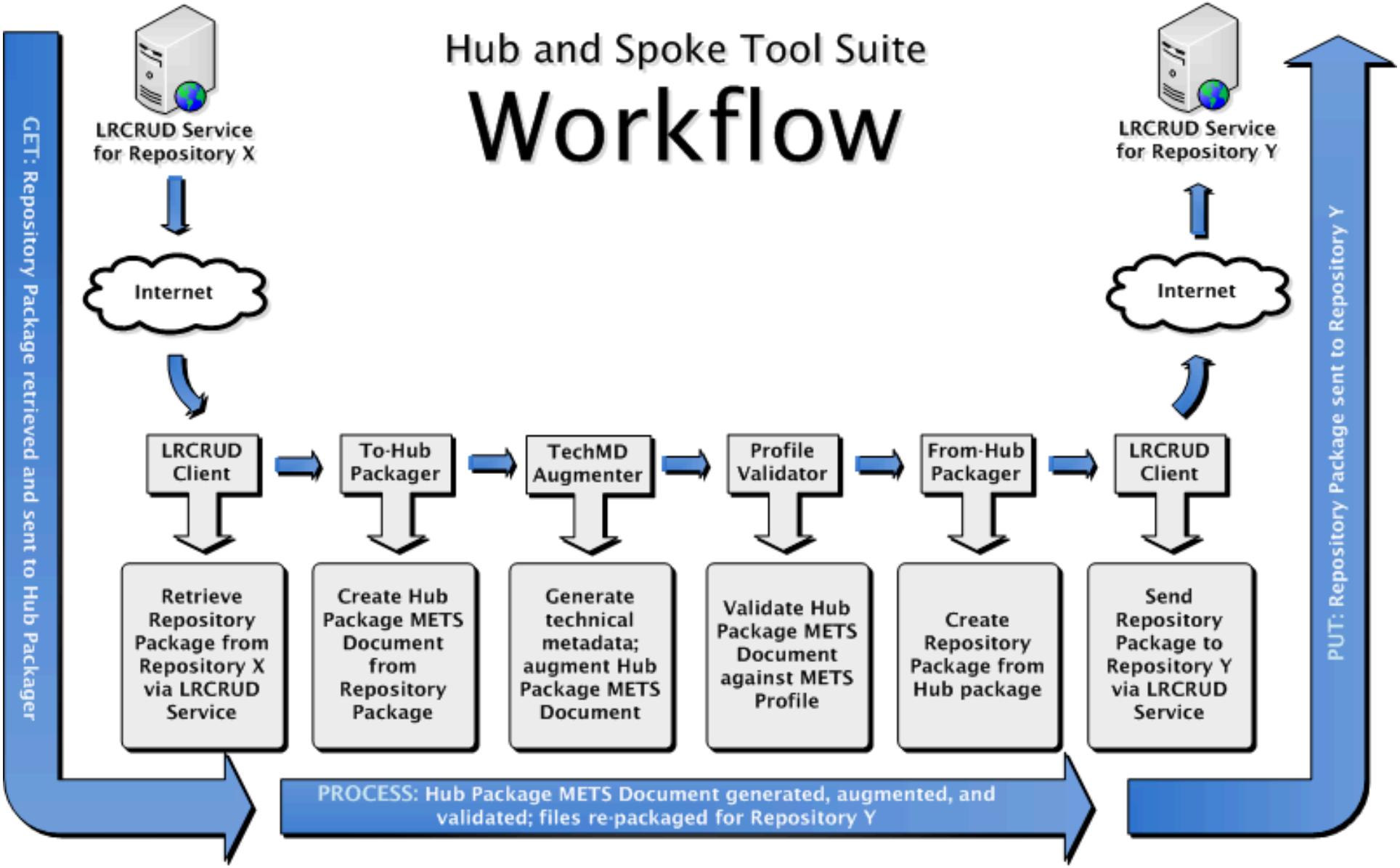
From-Hub Packager

From-Hub Packagers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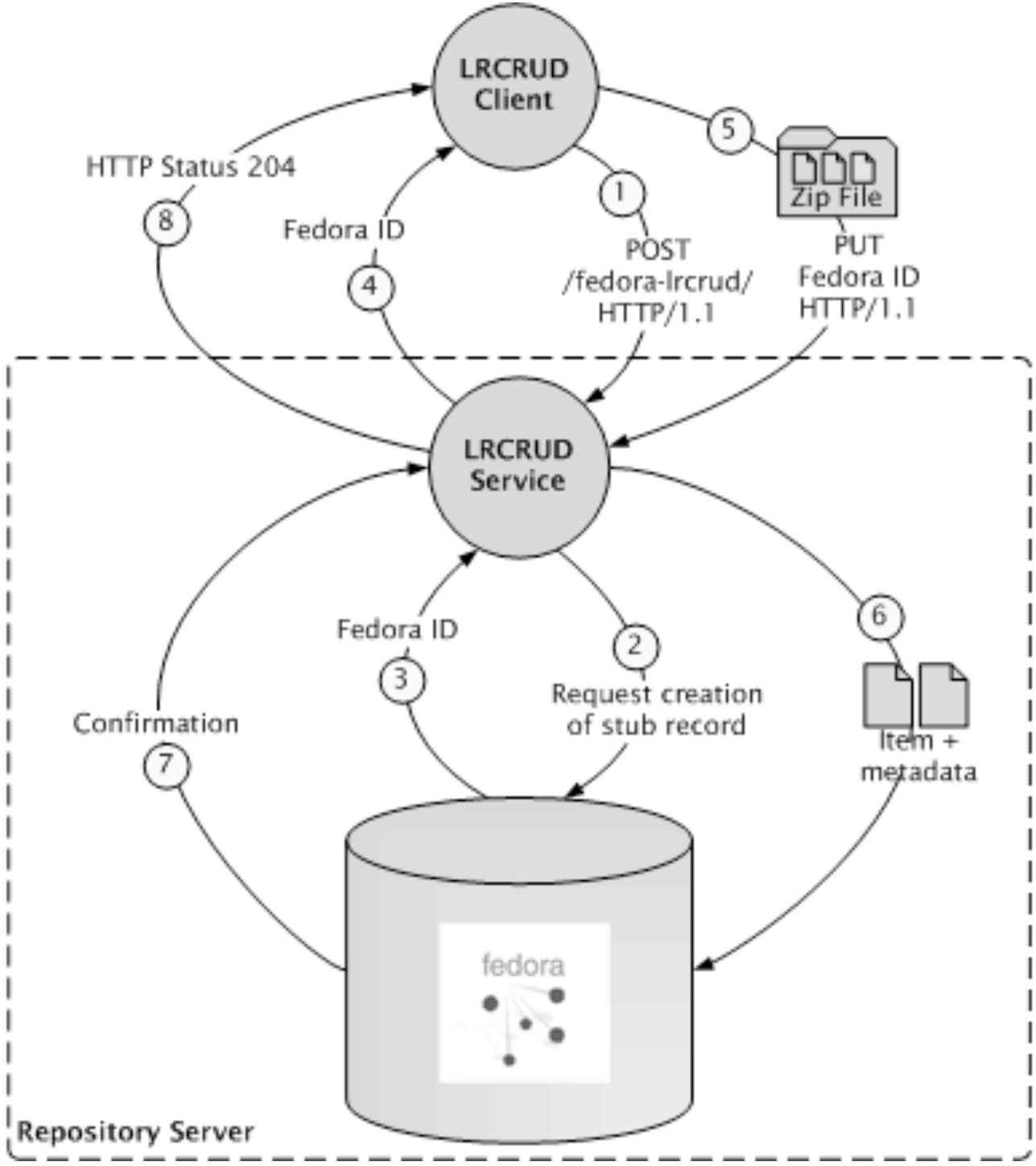
LRCRUD

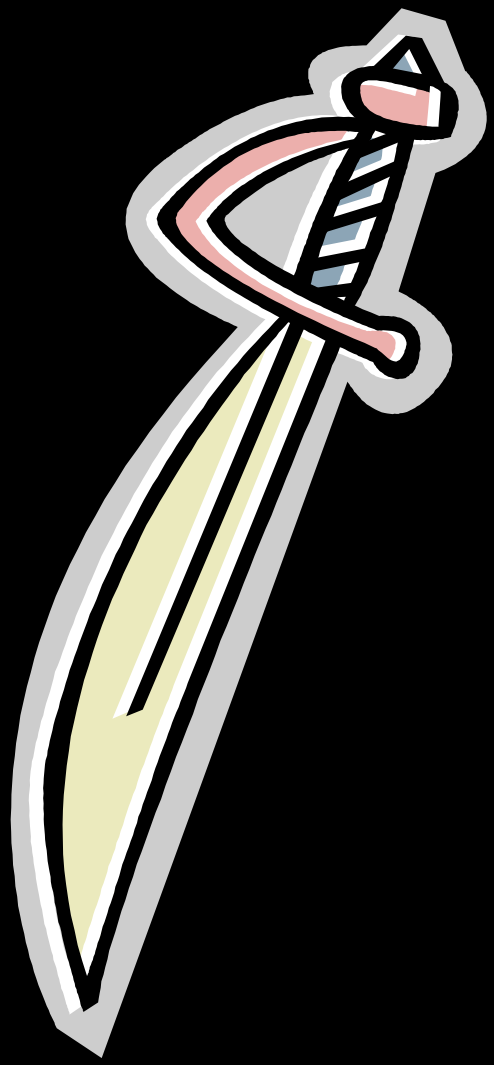
(again)


LRCRUD Client
HTTP Status 204
8
Fedora ID
4
1
POST /fedora-lrcrud/ HTTP/1.1
5
Zip File
PUT Fedora ID HTTP/1.1
LRCRUD Service
Fedora ID
3
2
Request creation of stub record
6
Item + metadata
Confirmation
7
fedora
Repository Server

DEMO

SWORD

Simple
Web-service
Offering
Repository
Deposit



Hub-to-SWORD Packager

- application/zip
  - METS
  - SWAP metadata
  - Content files

SWAP: Scholarly Works Application Profile

Got SWORD?
Enter SWAP!

Scholarly
Works
Application
Profile

SWAP: Scholarly Works Application Profile

- What it describes
- What it enables
- Context for purpose
  - Intute repository search service (http://www.intute.ac.uk/)

SWAP Application Model

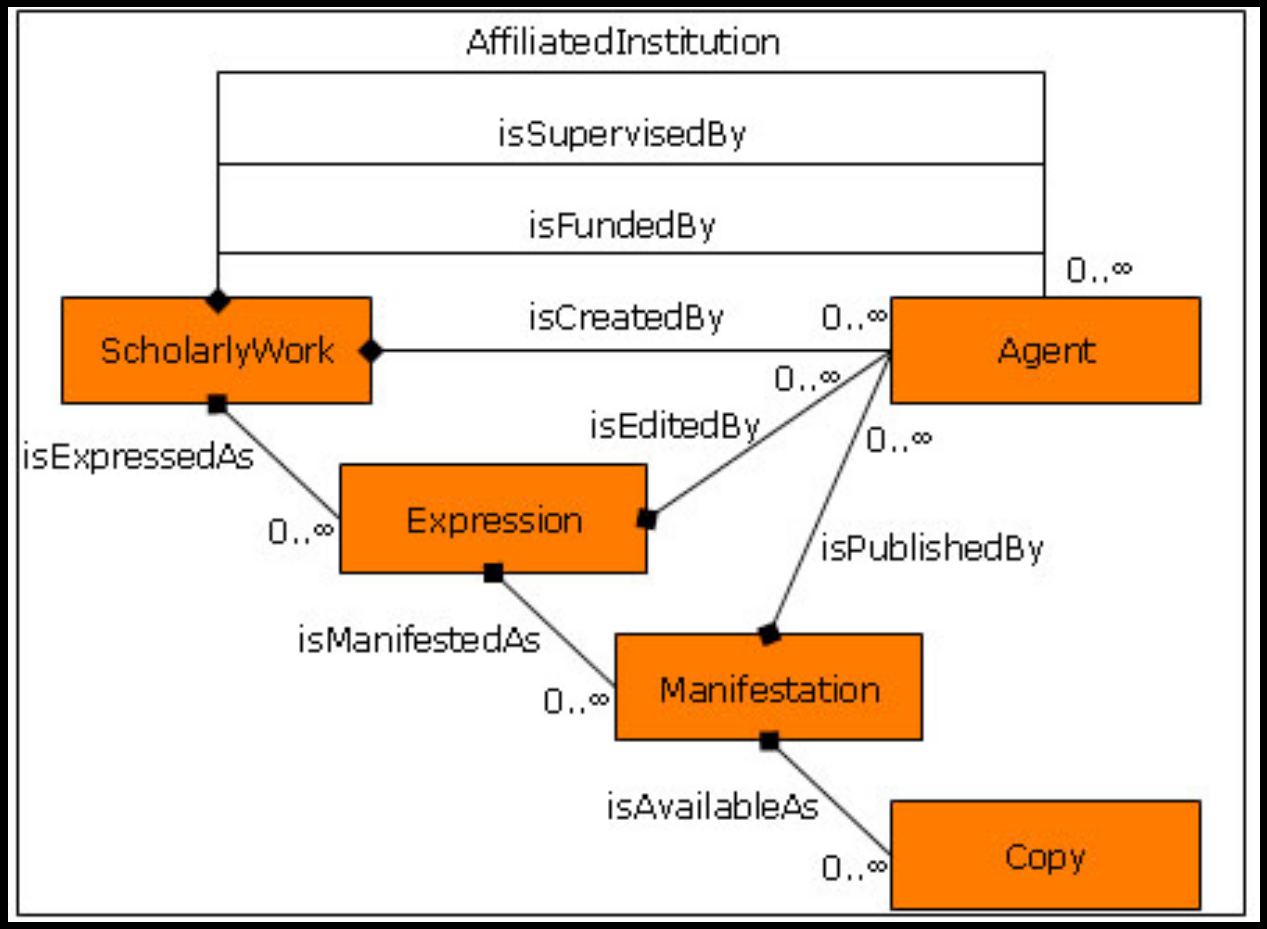
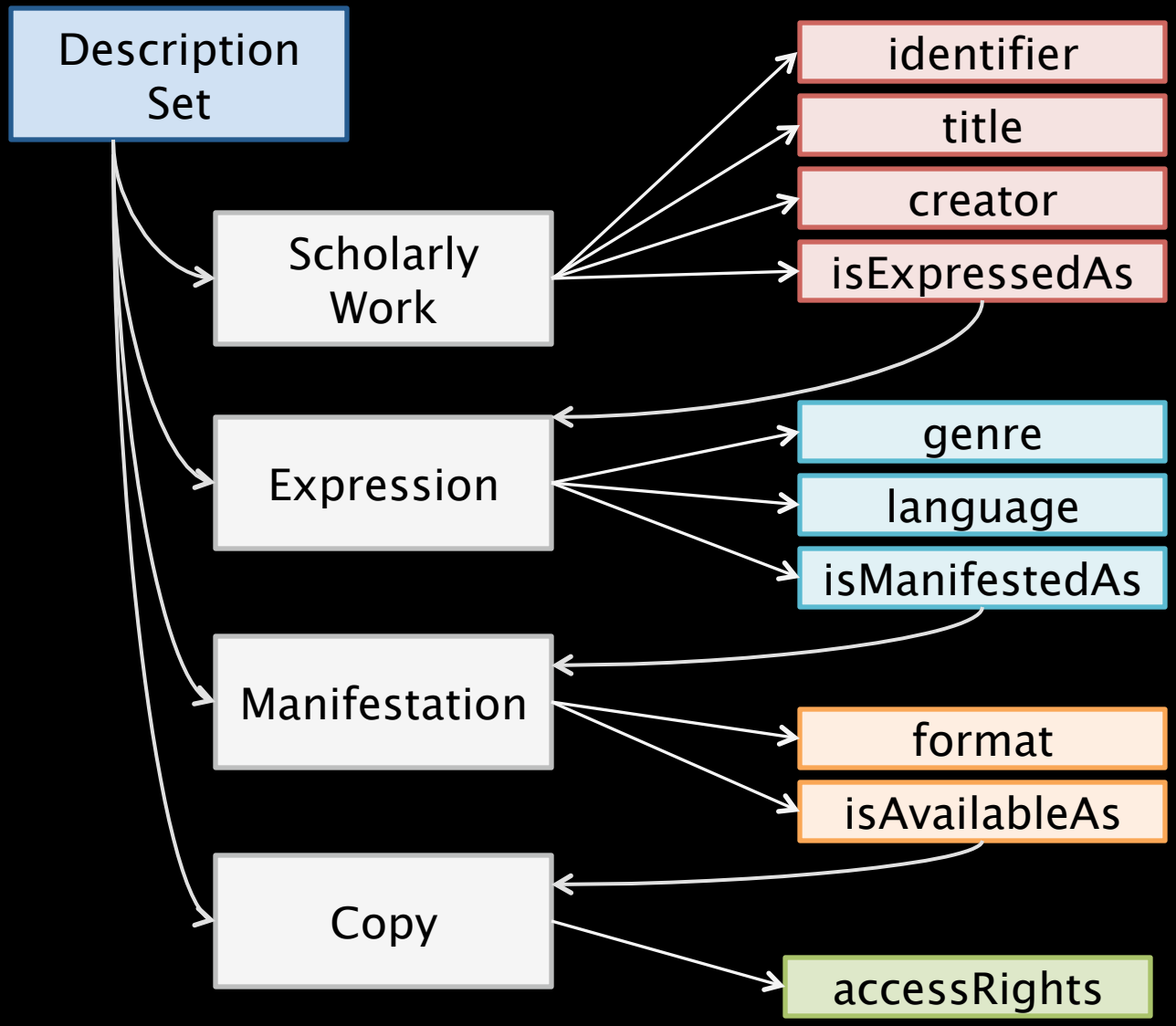


Diagram from: J. Allinson, P. Johnston & A. Powell. (2007). "A Dublin Core application profile for scholarly works." *Ariadne* (50). Retrieved April 26, 2009 from http://www.ariadne.ac.uk/issue50/allinson-et-al/.

Negotiating a Crosswalk

MODS → SWAP

SWAP Visualized



MODS to SWAP

MODS	DC/QDC	FRBR Level
<titleinfo> <title>	<title>	Work
<subject> <topic> <temporal> <geographical>	<subject>	Work
<genre>	<type>	Expression
<mimeType>	<format>	Manifestation
<accessCondition>	<accessRights>	Expression (but maybe Item)

Element Crosswalk Examples

Observations Post-Crosswalk

- Need for more use cases
- SWAP and FRBR
  - Works in progress
  - FRBR – geared toward monographs
- Hub and Spoke preservation packages – variety of content, not just scholarly works.

Conclusion

Repository systems provide low out-of-the-box support for interoperability and emerging preservation standards

Being able to move digital packages between repositories facilitates the long-term preservation of those objects

Conclusion

Hub and Spoke tool suite facilitates content management across multiple repository systems while preserving valuable preservation metadata

It uses a common packaging format in which METS files containing PREMIS metadata are treated as first class objects that are preserved along with the content

Hub and Spoke (HandS) Project Team

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