A Format-Registry-Based Automated Workflow for the Ingest and Preservation of Electronic Journals

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This Presentation

- Our current project
- E-journal ingest workflow
- Format and tools registry implementation
- Some interesting issues concerning formats and format registries

Portico: Business Summary

- A long-term preservation archive
  - www.portico.org
- Initial funding by Andrew W. Mellon Foundation, JSTOR, Ithaka, and Library of Congress NDIIPP (starting in 2006)
- Goal is to be a trusted third party archive for electronic journals
  - Operational in 2006; publishers committed
- Source file archiving
  - Not web renditions per se
  - SGML/XML, graphics, page renditions, etc.
  - Normalize to standard XML DTD for long-term maintenance
  - HTML as last resort
- Get content into system
  - As cost-effectively as possible
  - Minimal intervention
  - “Archive” not “aggregate” or “re-publish”

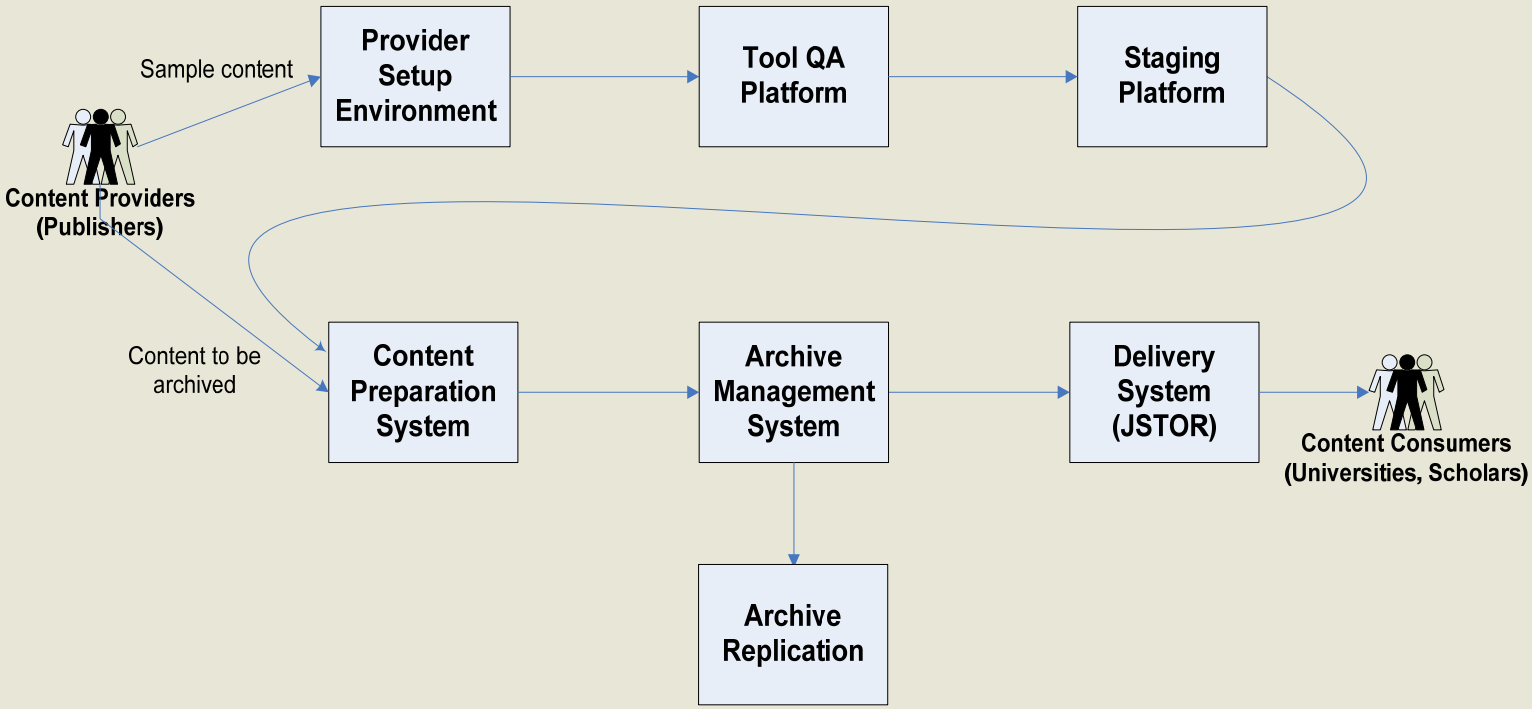
Portico: Technology Summary

- Planning began in early 2003
- Key technical influences:
  - GDFR, PreMIS, METS, MPEG-21, ARK, OAIS
- Key technologies:
  - Service-oriented architecture
  - XML, XML schema, Schematron, JHOVE, NOID
  - Documentum, Oracle, Java, JMS, LDAP
- Design goals:
  - Pluggable tools to facilitate new providers and replacement tools
  - Clean separation of process view and structural view of content model
  - Configurable workflows for different content types
- Building a system that can manage non-trivial intervention in the content prior to archiving and preserve the record of the source data, the normalized data, and everything that happened during the normalization is a big step toward managing future migrations!

Electronic Journal Data Issues

- Inputs
  - Per article: one text or metadata file, zero or more other files
  - Arbitrary (publisher-specific) collections of data
    - Proprietary file & directory naming conventions
    - Proprietary formats
  - Undocumented business rules hidden in the data
- Outputs
  - Normalized content
  - Metadata: technical, descriptive, events
  - Packaged in Portico METS
- Workflow goals
  - Taking apart and reassembling the submission package
  - Managing the normalization of proprietary formats
  - Validating formats
  - Extracting and collecting metadata
  - Assigning preservation levels based on policies
  - Match content with contracts (agreements)

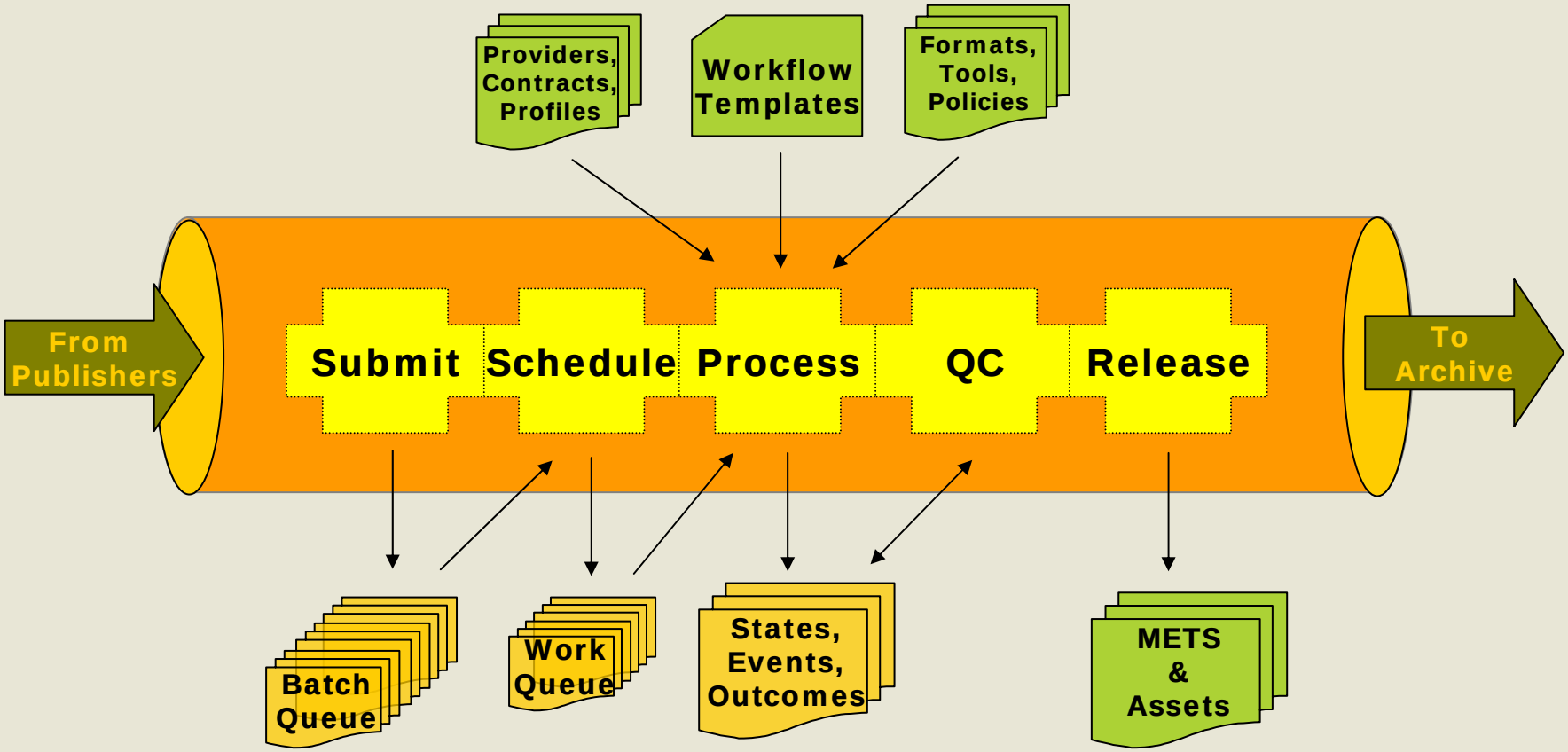
Process Overview



System Components

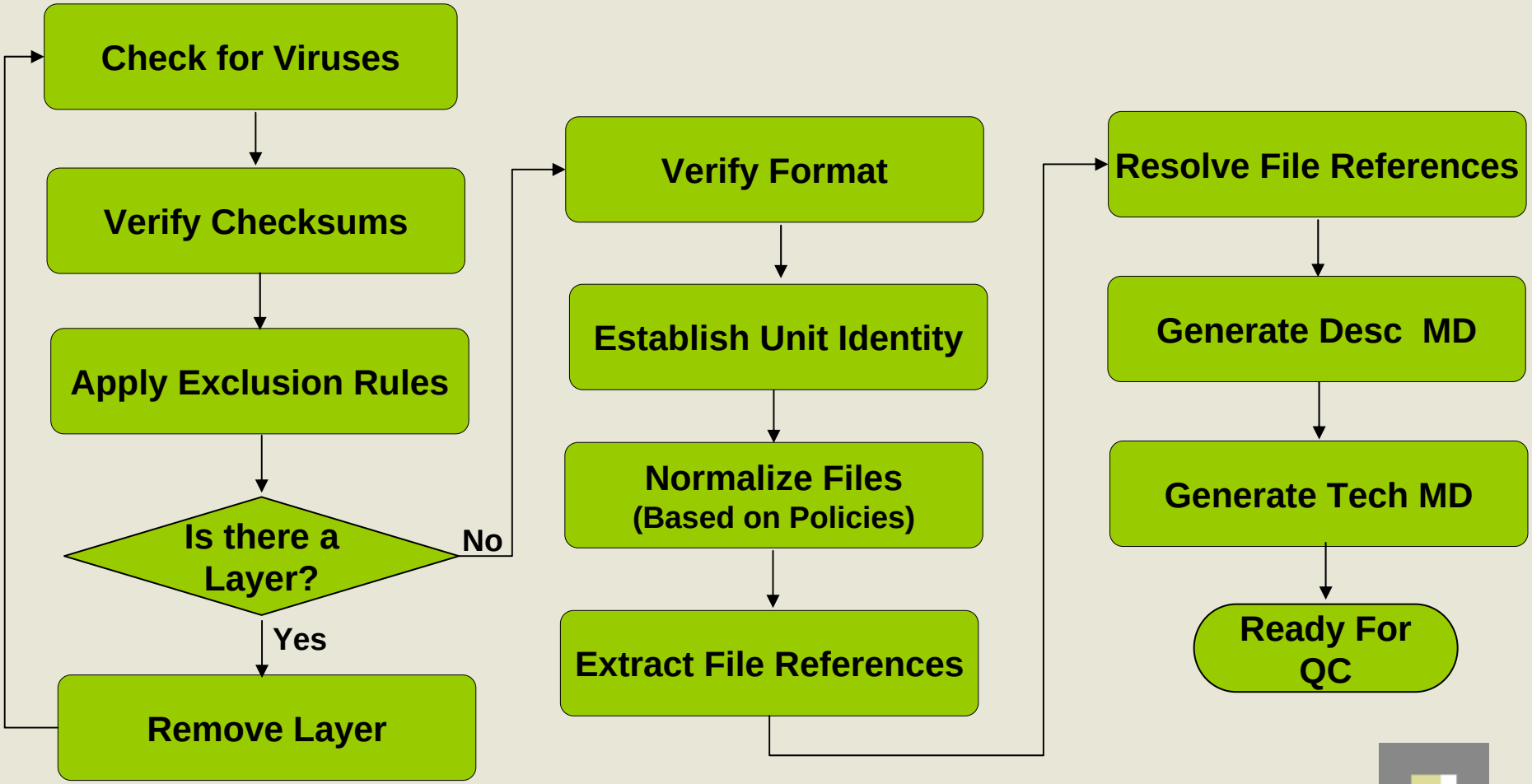
- Workflow
  - Per content type (E-Journals, Business artifacts, Technical artifacts)
  - New and updated content
- Profiles (per provider)
  - Provider-specific rules and policies
  - Packaging rules
  - File name extract rules
- Format registry
  - List of formats known to the archive
  - Links to policy documents, technical documentation, and “required files”
- Preservation policy registry
  - What promises can the archive make for a given format?
- Tools registry & Tools service
  - What tools for which formats?
  - Where are they located?
  - How are they invoked?

Process View



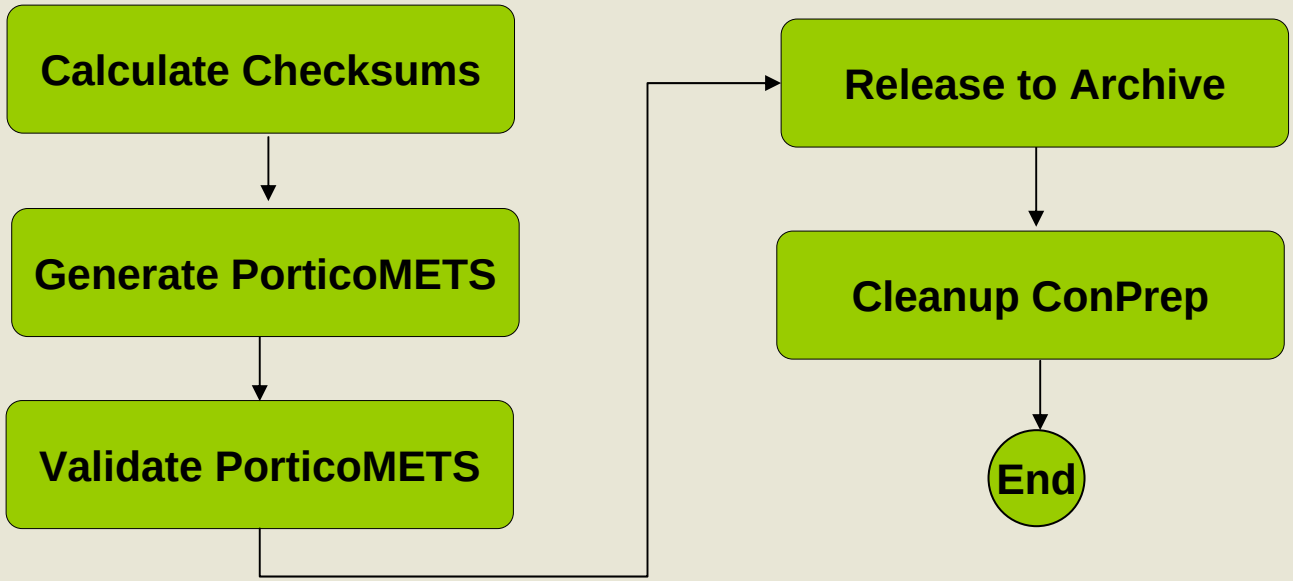
Automated Processing for E-Journal Content

(high-level summary)

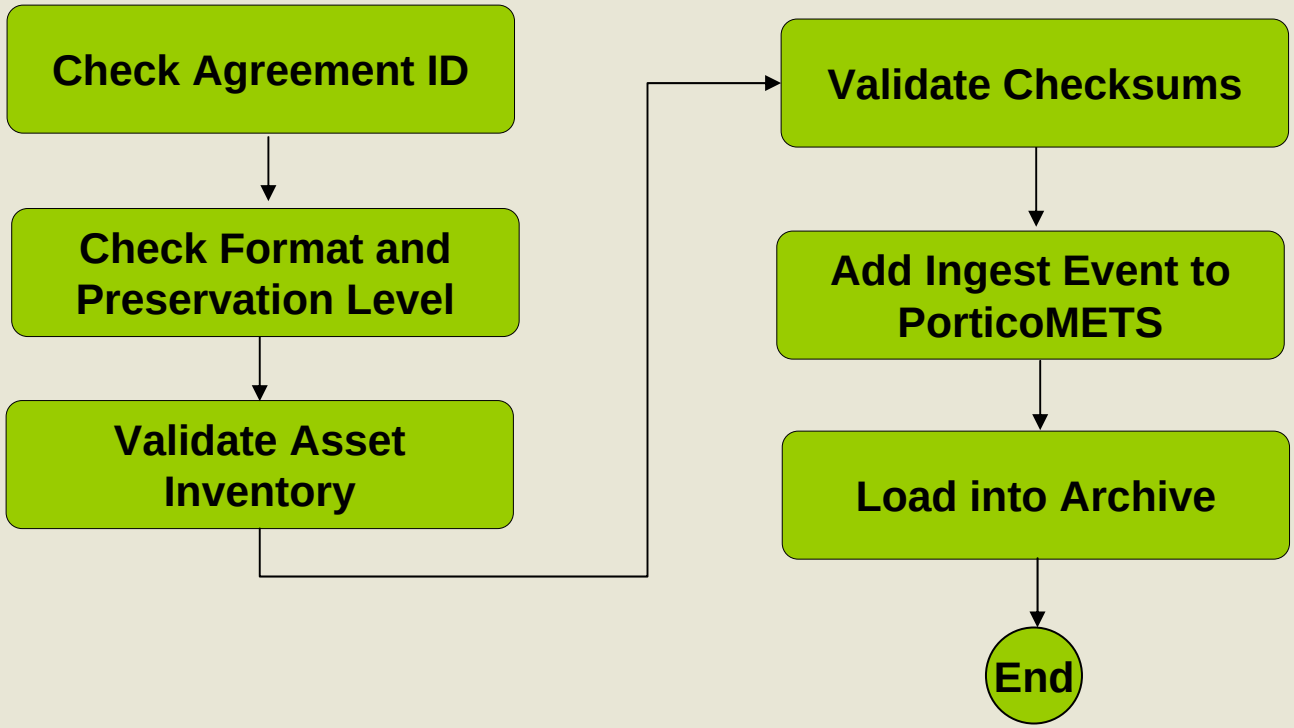


Automated Processing after QC

(for all content types)



Archive Ingest Processing



The GDFR Context

- Global Digital Format Registry meetings in 2002, 2003
  - hul.harvard.edu/gdfr/
- Use cases from Stephen Abrams:
  - Identification
    - "I have an object; what format is it?"
  - Validation
    - "I have an object purportedly of format *F*; is it?"
  - Characterization
    - I have an object of format *F*; what are its salient properties?"
  - Assessment
    - "I have an object of format *F*; is it at risk of obsolescence?"
  - Processing
    - "I have an object of format *F*; how can I perform operation *X* on it?"

  (*The Role of Format Registries in Digital Preservation,* 2004)
- GDFR still in the future
  - We built assuming that it would be there someday soon

Portico Format Registry Implementation

- Light-weight; we expect to redesign after GDFR becomes a reality
- Information per format:
  - Portico unique name
  - Description
  - Owner
  - Maintainer
  - Default Mime Type
  - Default File Extension
  - Category (for our own reporting)
  - Preservation strategy set
    - List of preservation planning documents
  - Required File set
    - Lists of required files stored in archive
  - Registered name set
    - Lists of external identifiers
- A flat list, not hierarchic; a simplifying assumption for v1.0

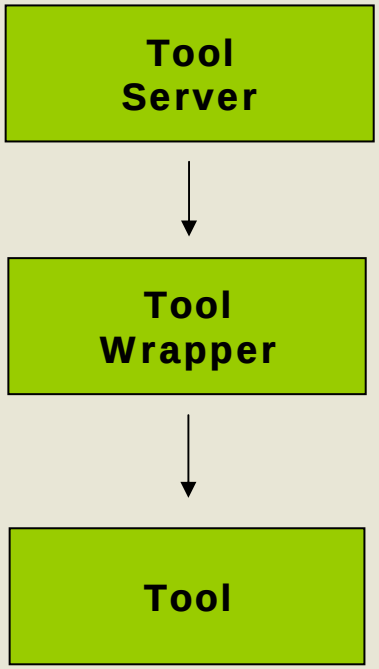
Portico Tools Services

- Format-neutral services:
  - Virus check (ClamAV)
  - Checksum (various)
  - Identification (JHOVE, BSD file; returns a format ID and/or MIME type)
- Format- or MIME type-specific services:
  - Validation (JHOVE)
  - Characterization (JHOVE)
  - Layer removal (e.g., unzip)
  - Transformation (XSLT; per source format and destination format)
- DTD-Specific XML services:
  - Descriptive metadata extraction (XSLT)
  - HTML rendition (XSLT)
  - Descriptive metadata curation (java & XSLT)
  - File reference extraction (XSLT)
  - File reference replacement (XSLT)
  - QC errors & warnings (Schematron)
- And more to come

Tool Registry & Services Implementation

- Registry provides information about tools utilized to process content
- Registry does not know whereabouts of tools or itself offer services
- Supports invocation strategies – collective, conditional, and selective
- Loose coupling of tool and format registries to facilitate independent evolution

Tool Services

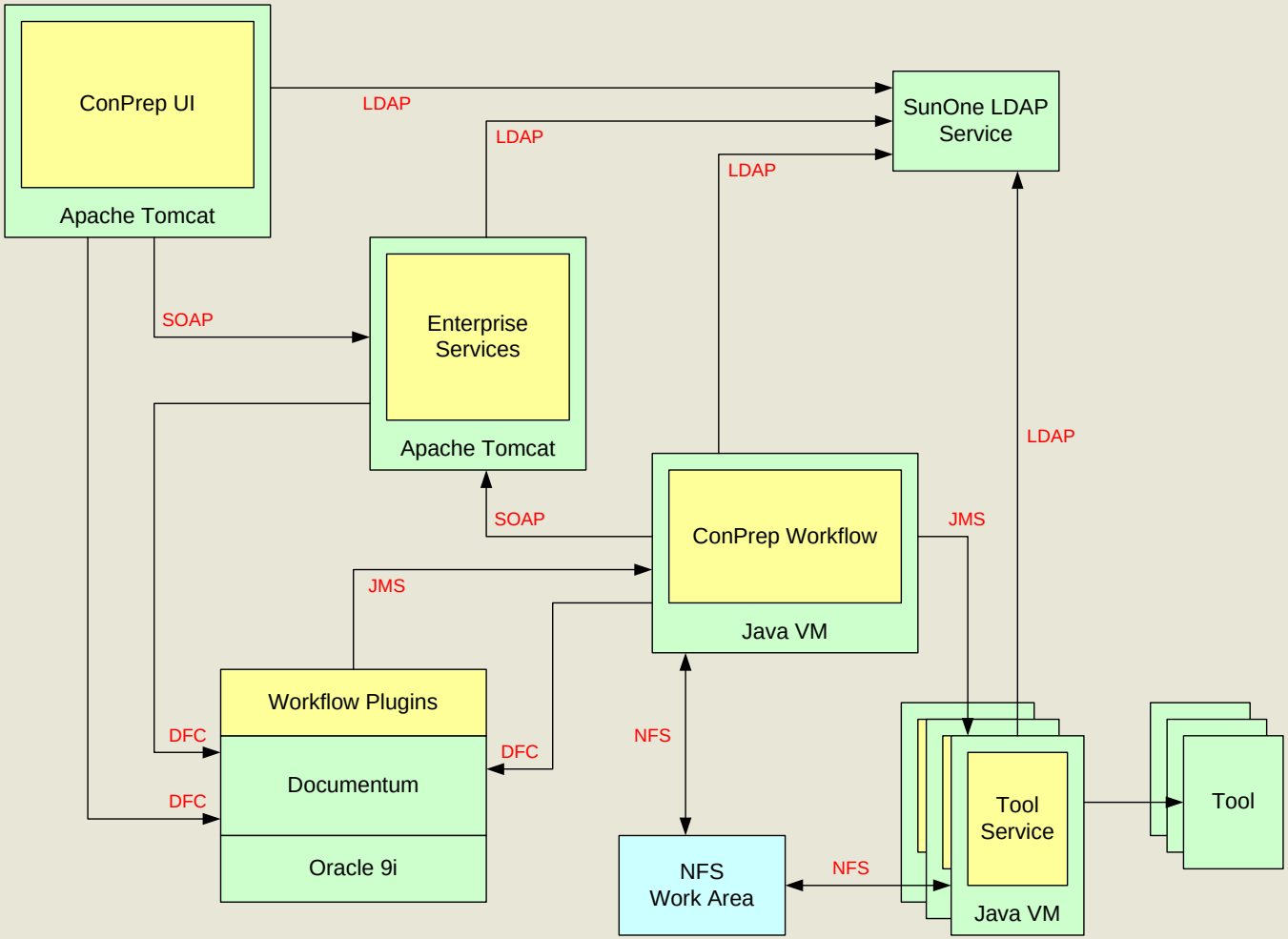


- Dispatcher that listens for requests; upon arrival, spawns a worker thread to process

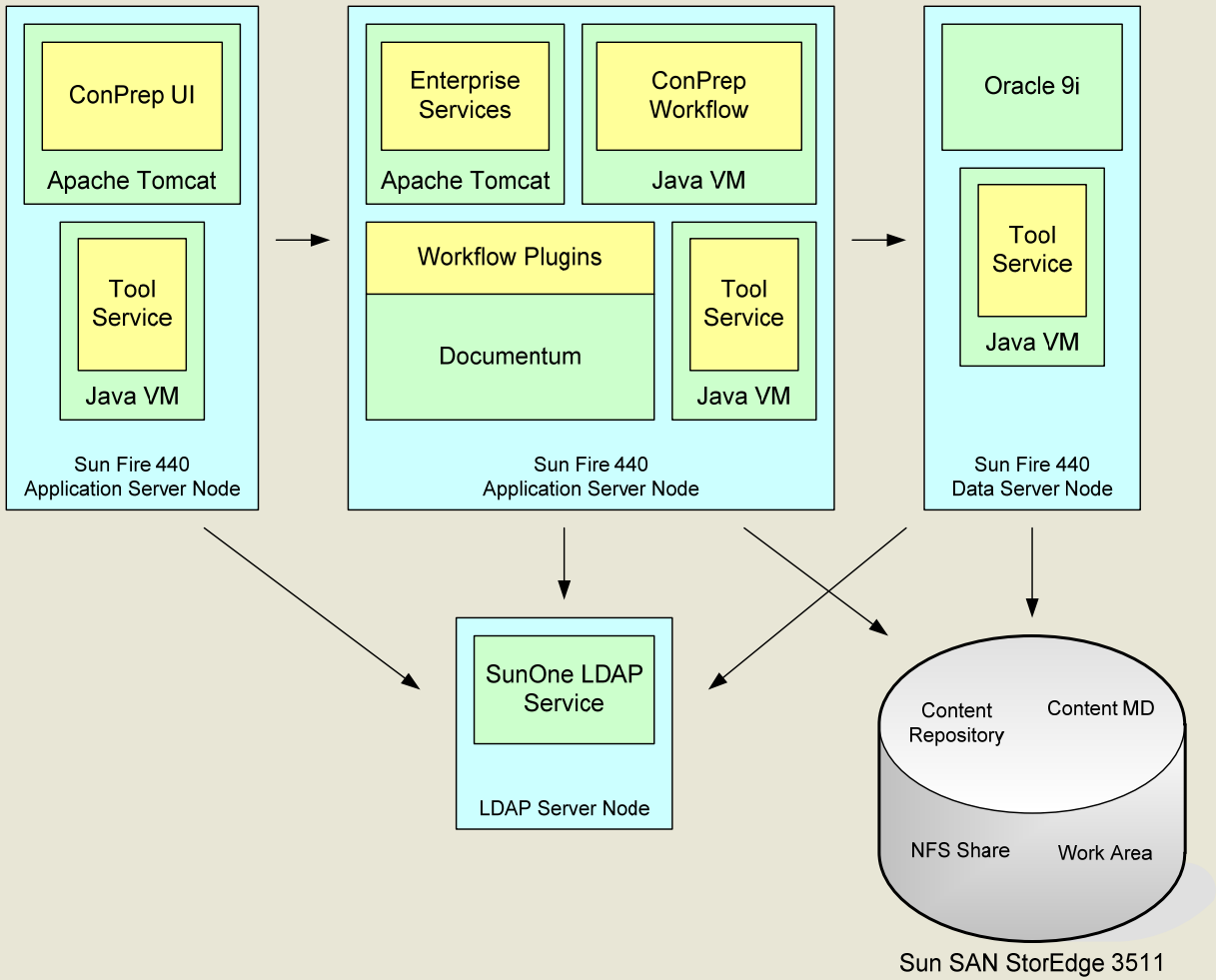
- Adapter that hides tool-specific behavior and converts tool-specific interface to tool-neutral interface
  - –e.g., maps specific return values to standard values

- A COTS product, open-source, or custom software that provides a specific service
  - –e.g., JHOVE, ClamAV, gzip

Component View



Deployment View



Some Interesting Implementation Issues

- What granularity?
  - Every DTD version a separate format
    - Helps with version control
    - Helps make transforms into format-based services
- What about system formats?
  - Did not include system schemas unless used in archival content
  - XML schemas used in system not included
- What about format hierarchy and relationships?
  - Not in version 1.0
  - DTD XYZ => XML => ASCII not helpful
  - PDF 1.0 <=> 1.2 <=> 1.3 maybe in the future
- Do we need all that technical metadata?
  - We trim the output of JHOVE
  - Sometimes a synoptic statement is more valuable than the details:
    - Are all fonts embedded (yes/no) rather than a list of embedded fonts
  - We ignore embedded XMP metadata…at least for now

A Major Issue: Varying Degrees of Badness

"Repositories need to ensure that…digital object content streams are valid with respect to their formats" (Abrams, 2004)

- What format is a defective file?
  - The purported format? The actual format?
  - Format "Re-identified" (a business concern as well as technical)
- Can a file be damaged but still usable?
  - XML: No, we have to have valid XML file to extract metadata!
  - PDF: Yes, Acrobat reader can read some WFNV or NWF PDF?
- On what do you base the preservation policy for a bad file?
  - The actual format?
  - Best-effort on purported format?
  - What about well-formed but not valid?
- Some use cases:
  - Defective file (varying degrees)
  - Purported format is in error (e.g. wrong extension)
  - Both of the above

Bad File and Mislabeled File Use Cases

Expected MIME type or Format	Verified Format	Verified Format Status	Identified Format	Identified Format Status	Format in METS	Format Status in METS	Re-Identified Flag	Preservation Level
PDF	PDF 1.4	WFV			PDF 1.4	WFV		FULL
PDF	PDF 1.4	WFNV			PDF 1.4	WFNV		BYTE-PRESERVE
PDF		NWF	PDF 1.4		BYTESTREAM	WFV	Yes	BYTE-PRESERVE
PDF		NWF	TIFF 6.0	WFV	TIFF 6.0	WFV	Yes	FULL
PDF		NWF	TIFF 6.0	NWF	BYTESTREAM	WFV	Yes	BYTE-PRESERVE
PDF		NWF	BYTESTREAM	WFV	BYTESTREAM	WFV	Yes	BYTE-PRESERVE
TIFF	TIFF 6.0	WFV			TIFF 6.0	WFV		FULL
TIFF		NWF	TIFF 6.0		BYTESTREAM	WFV	Yes	BYTE-PRESERVE
TIFF		NWF	PDF 1.4	WFV	PDF 1.4	WFV		FULL
TIFF		NWF	PDF 1.4	WFNV	PDF 1.4	WFNV	Yes	BYTE-PRESERVE
TIFF		NWF	GIF 87	WFV	GIF 87	WFV	Yes	FULL
TIFF		NWF	GIF 87	NWF	BYTESTREAM	WFV	Yes	BYTE-PRESERVE
TIFF		NWF	BYTESTREAM	WFV	BYTESTREAM	WFV	Yes	BYTE-PRESERVE
XML w/DTD	XML 1.0	WFV			XML 1.0 w/DTD	WFV		FULL
XML no DTD	XML 1.0	WF			XML 1.0 no DTD	WF		FULL
XML w/DTD	XML 1.0	WFNV			XML 1.0 w/DTD	WFNV		BYTE-PRESERVE
XML (any)		NWF	XML 1.0	NWF	BYTESTREAM	WFV	Yes	BYTE-PRESERVE
XML (any)		NWF	UTF-8	WFV	UTF-8	WFV	Yes	BYTE-PRESERVE
XML (any)		NWF	BYTESTREAM	WFV	BYTESTREAM	WFV	Yes	BYTE-PRESERVE

Verification / Identification Sequence

To distinguish between bad files and mislabeled files:

- Verify purported format (MIME type)
- If verification succeeds
  - Record format
  - Capture technical metadata
- If verification fails, do identification
- If identified format is same as purported format
  - File is bad
- If identified format is not same as purported format
  - Might be mislabeled
- Verify identified format
  - If fails again, file is bad

More Implementation Issues of interest

- MIME Type is still useful
  - Even when you have a format registry
  - To interact with the outside world
  - When you have incomplete information
- “Purported format” can be
  - Purported MIME type
    - e.g., PDF but unknown which version
  - Purported Format
    - e.g., Profile expects a specific DTD (format)
- Is a format registry
  - A database or a document?
  - How volatile? How granular?
- Problems we haven’t dealt with yet
  - Embedded formats
    - E.g., LaTeX as an XML/SGML notation
  - XML instances that conform to more than one schema

Another Interesting Issue: Not Yet Supported Formats

- What do we do when we don't have tools yet?
  - What preservation commitment?
  - What values for format and validity?
- Some use cases:
  - Purported MIME Type
  - Purported Format
  - Completely unknown
- Some possibilities:
  - Record MIME type in lieu of a format?
  - Create generic formats in the format registry?
    - e.g., "PDF of unknown version"
  - Allow format validity of "unknown"?
  - Preservation level of "Byte Preserve Pending"
  - Don't allow the content into the archive
    - Ideal solution!

Some Lessons Learned

- Format registry is a powerful concept
  - We are eager for the GDFR work to take off
- MIME type is still useful
  - Somewhat to our surprise
  - A surrogate for relationships between formats?
- XML / SGML DTDs (structured markup) feel very different from graphics formats
  - Does one size fit all types of formats, as it were?
  - Well-formed
- JHOVE and the JHOVE framework work really well
  - Please contribute modules!
  - We are working on one for SGML

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