Planning for the next generation

A summary of recommendations for the next DSpace architecture

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Open Repositories 2007

January 23, 2007

Why a new DSpace architecture?

- Use, scale, and dependence on DSpace growing
  - New applications continue to develop
  - Repositories growing older (with preservation needs growing too)
  - Patching, ad-hoc development only gets you so far (and may lead you into dead ends)
- Architectural needs
  - Set priorities for DSpace development, functionality
  - Handle the variety of content, metadata institutions manage
  - Make it easier to develop, customize, compose with other systems
  - No DSpace is an island
- Set directions for an evolutionary, practical system design
  - Serves community needs for several years, but take no more than a couple of years to produce

Architecture review group

- John Mark Ockerbloom, Penn (chair)
- Tim Di Lauro, Johns Hopkins
- Mark Diggory, MIT
- John Erickson, Hewlett Packard
- Jim Downing, Cambridge University
- Henry Jerez, CNRI
- Richard Jones, Imperial College
- Gabriela Mircea, University of Toronto
- Scott Phillips, Texas A&M University
- Richard Rodgers, MIT
- Mackenzie Smith, MIT
- Robert Tansley, Google
- Graham Triggs, Biomed Central

The process

- DSpace 2 discussions started in 2004
- In summer 2006, group chosen to review complete architecture
  - From DSpace committers, major developers, other stakeholders and architectural experts
- Online discussion
  - On Wiki, DSpace-devel and review group list
  - Manifesto, issues lists, survey
- Week-long "summit"
  - October 2006, Cambridge, MA
  - Came up with recommendations, proposals for DSpace 2
- Follow-on activity
  - Subgroups to address workflow, extension framework issues
  - Further development of data model, development roadmap
  - Report and presentation <-- (You Are Here)

Survey

- Questions and comments about use and customization of DSpace repositories
  - Reponses solicited on DSpace mailing lists
  - 116 responses in one week
- Adaptation common
  - Many customize metadata
  - About 1/4 change database schema
  - 1/2 made significant code changes
  - Problems keeping customizations, new versions in sync
- Commonly desired
  - Better modularity
  - More customizable UI
  - Complex objects
  - Versioning
- Full results, comments on DSpace Wiki

DSpace architecture manifesto: Part 1: DSpace nature

1. DSpace is primarily open source software for building digital repositories.
   -- Avoid scope creep (e.g. into general purpose CMS, Wiki…)
2. DSpace will be usable based purely on free and open source software.
   -- Avoid proprietary dependencies
   -- May still support closed source as option (e.g. Oracle)
3. DSpace will have a decoupled, stable, and application-neutral core,
   -- Not the full distribution
   -- Applications and extensions built on it
4. While usable for a variety of applications, DSpace will retain useful "out-of-the-box" functionality for common use cases.
   -- Standard distribution includes full open access archive

DSpace architecture manifesto: Part 2: DSpace development

5. DSpace will employ and support existing, open standards where possible and practical.
   -- Makes DSpace easier to develop, interoperate
   -- May make it easier to integrate other open source SW
6. DSpace releases should be minimally disruptive.
   -- Keep repositories stable
   -- Ease customization, maintenance
7. DSpace will support an exit strategy for content.
   -- "It's the content, stupid."
8. DSpace will continue to evolve.
   -- Because what DSpace users do and need to do evolves

Scalability

- Three scale dimensions of primary concern
  - Size of repository
  - Intensity of use
  - Rate of ingestion, other processing
- Group did not see major architectural limits to scale
  - but revisions need to accommodate large scale use
- Desired performance goals:
  - 10M items
  - 10 simultaneous depositors, 100 simultaneous users
  - 1 sec addition overhead at full size scale
  - Accommodation of clusters, unlimited size files
  - Ponies for everyone! (Okay, maybe not that…)

Interoperability

- **Aspects of interoperability**
  - **Data interoperability (can I reuse, import, export info)**
  - **Service interoperability (protocols others can invoke)**
  - **API-level interoperability (extensions, new implementations)**
- **Needed for this:**
  - **Published concrete data model for content and metadata, fully exportable and importable**
  - **Published, documented, stable core interface**
    - » **Designed with extensions in mind**
  - **Common, standard protocols supported in standard distribution**

DSpace 2 highlights

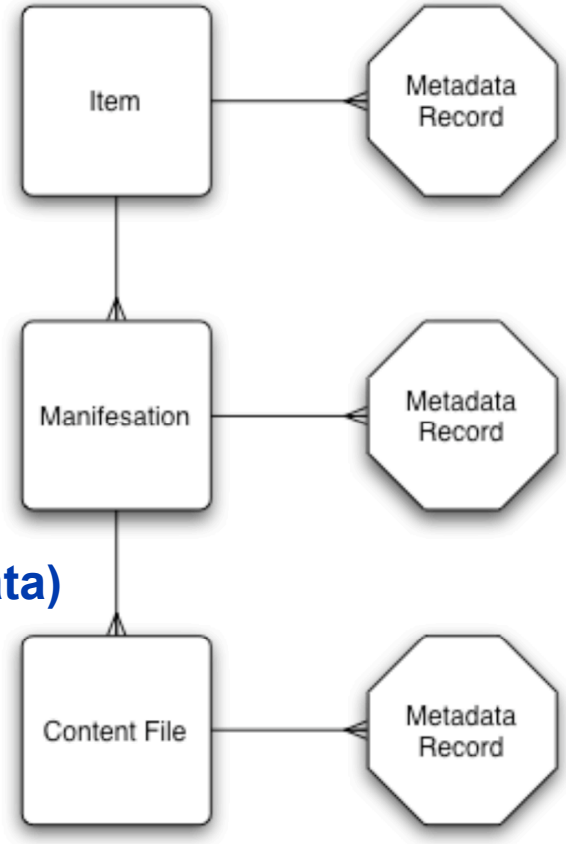
- More powerful, flexible data model
- Shift in user interface model
- Core overhaul, documentation
  - to make extensions, customizations easier to add, maintain
- Focus on extended lifecycle of content
- More reuse of third-party development
  - Extension frameworks, workflow managers

Revised Item data model

Can have multiple metadata records, attached to Items or sub-components

Manifestations:
Replace Bundles, used for content only (some old Bundles would become metadata)

Content Files:
Replace Bitstreams



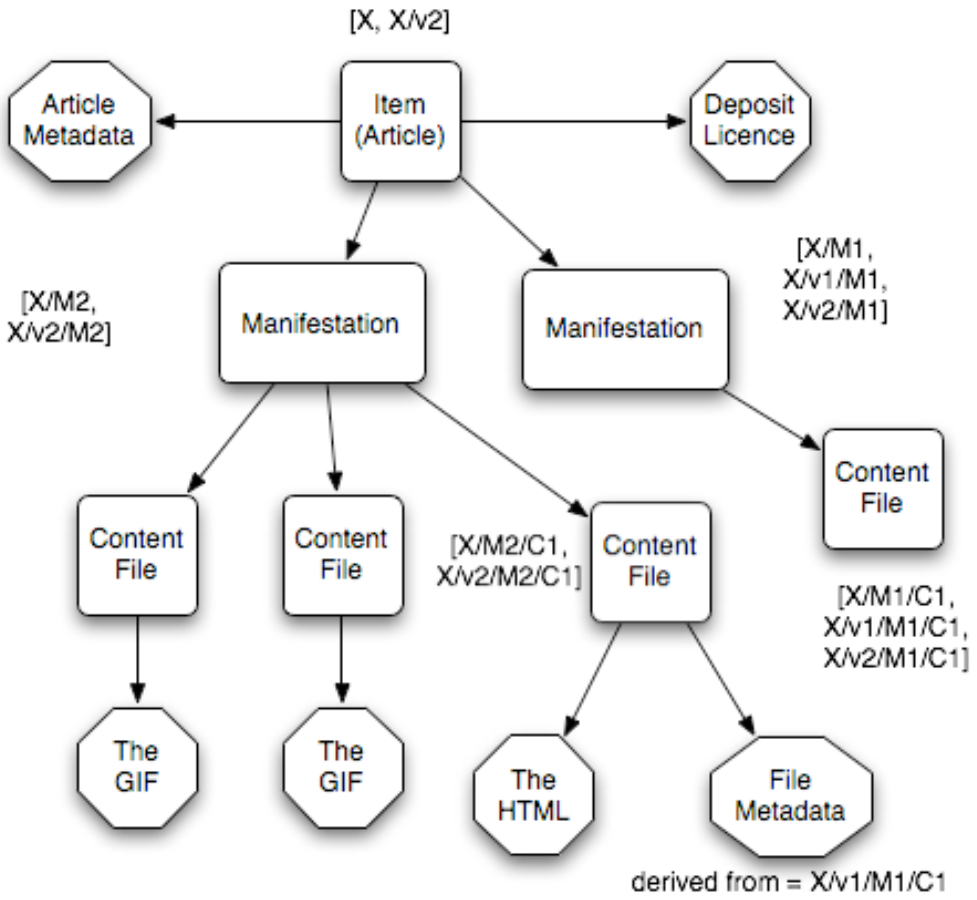
Identifiers

- Handles still default identifiers for content, but system should support others
- Persistent identifiers for Epeople
- Components within items should also have persistent identifiers
  - Proposal: URIs based on the Item identifier, with various qualifiers for Manifestation, Content File, and Version

Versioning

- Used for non-semantic revisions of content and metadata
  - Format migrations
  - Revised metadata
  - Possibly minor content corrections (typos, etc.)
- Semantic revisions (e.g. published vs. pre-print) can be separate items with Relation metadata to link
  - Not enforced by the system, but makes citation clearer
  - Will need metadata, UI support for ease of use
- Versions have their identifiers
  - No version specified = use latest version
- Retention of old versions matter of repository policy
  - But can be cheap to retain if not much changes

An example Item Version and its identifiers



Further data model recommendations

- **Metadata made more flexible, preservable**
  - **Managed and preserved in the persistent store**
  - **Multiple records supported**
  - **Serializable**
  - **Not constrained to be flat**
  - **Default schemas for Items, Content files…**
  - **Views of metadata can be projected into DB schemas for efficiency of access**
- **Separate abstract data model from concrete data storage**
- **Generalize Collections, Communities**
  - **But not yet recommending mixed-content Containers**

User interface

- **We like Manakin**
  - **XML-based interface makes it easier to customize, pipeline DSpace**
- **Recommend adding it to DSpace 1 standard distribution**
- **Should become standard UI for DSpace 2**
- **Requires an add-on mechanism to integrate**
  - **There's a simple one now published for this purpose**
  - **But a more generalized approach could make it easier to add new DSpace applications, customizations…**

Extension frameworks

- Extension or add-on mechanisms needed to integrate certain components (like Manakin)
- Reusing existing one preferred over doing one from scratch
  - There are a number of possible candidates (OSGi and Spring have come up as possibilities)
  - Requirements, discussion on Wiki
  - Implementation work, community input helpful in settling on one
- In the meantime, simple add-on mechanism released for handling Manakin and similar packages

Event mechanism

- Core should include event notification mechanism
  - Allows loosely coupled, open-ended components
  - Can be used to support history mechanism, view maintenance, UI
- How it works
  - Listeners register interest in certain types of events
  - Changes in data, other phenomena, raise events that notify appropriate listeners
- Prototype system developed under DSpace 1
  - Led by Larry Stone at MIT
- Details of DSpace 2 implementation may depend on decisions made for implementation frameworks

Workflow

- It's not just for ingestion any more
- Again, can be supported by existing packages instead of rolling our own
  - Open WFE, OSWorkflow, jBPM identified as promising candidates
  - Other profiles, discussion on DSpace Wiki
- Better tools for specifying, modifying repository workflows needed in DSpace
  - Like user interfaces for non-programmers

The road to DSpace 2

- Core group (~3 people) does detailed specs of core, documentation, reimplementation
  - Not from scratch, but review needed of all core interfaces in light of new design
  - Goal: Have working DSpace 2 core within 2 years. Would not be responsible for entire standard distribution
- Architectural oversight committee (different from review group, but some overlap) monitors progress
- Wider community supports DSpace distribution effort
  - developing extensions, applications, supporting and giving feedback to core group's specs and docs
- DSpace 1 continues to evolve in the meantime
  - Manakin, Events, etc.
- Help build the next generation!
  - See full report, discussion on http://wiki.dspace.org/