The OAIS Reference Model: current implementations

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Presentation outline

- The OAIS Reference Model (brief)
  - Background
  - Definitions
  - Functional Model
  - Information Model
- Implementing the model:
  - Preservation metadata
  - System design
  - Conformance and certification

The OAIS reference model (1)

- Background:
  - *Reference Model for an Open Archival Information System (OAIS)*
  - Development led by the Consultative Committee for Space Data Systems (CCSDS)
  - Adopted as ISO 14721:2003
  - Establishes a common framework of terms and concepts
  - Identifies the basic functions of an OAIS
  - Defines an information model
  - www.ccsds.org/documents/650x0b1.pdf

The OAIS reference model (2)

- Provides definitions of terms that need to have well-defined meanings, e.g.:
  - Archival Storage, Content Data Object, Designated Community (key term), Ingest, Metadata, Representation Information, etc.
  - OAIS = "An archive, consisting of an organization of people and systems, that has accepted the responsibility to preserve information and make it available for a Designated Community" (OAIS 1.7.2)

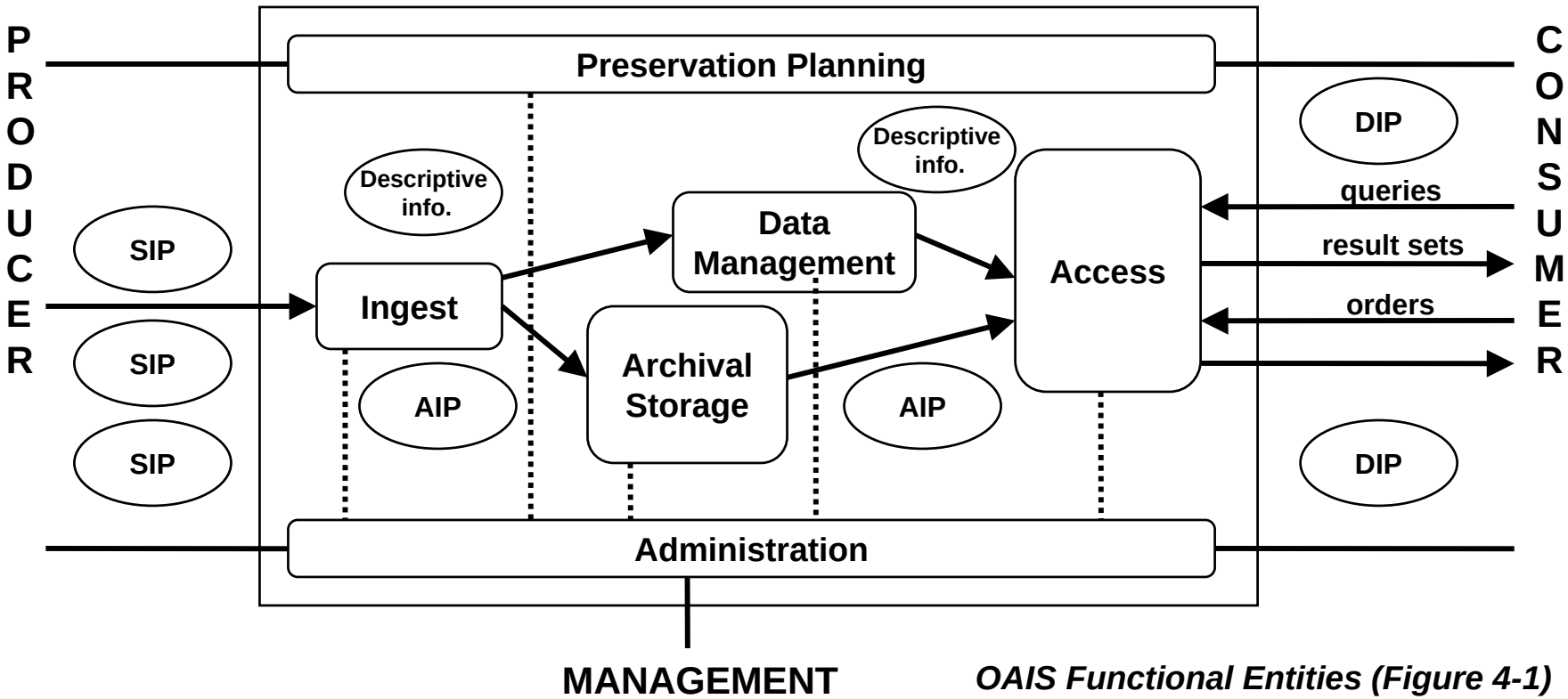
The OAIS reference model (3)

- High level concepts, e.g.:
  - The *environment* of an OAIS (Producers, Consumers, Management)
  - Definitions of *information*, Information Objects and their relationship with Data Objects
  - Definitions of *Information Packages*, conceptual containers of Content Information and Preservation Description Information
- OAIS Responsibilities

The OAIS reference model (4)

- Functional Model:
  - Six entities
    - Ingest
    - Archival Storage
    - Data Management
    - Administration
    - Preservation Planning
    - Access
  - Described using UML diagrams

The OAIS reference model (5)



OAIS Functional Entities (Figure 4-1)

The OAIS reference model (6)

- Information model:
  - Information Object (basic concept):
    - Data Object (bit-stream)
    - Representation Information (permits “the full interpretation of Data Object into meaningful information”)
  - Information Object Classes:
    - Content Information
    - Preservation Description Information (PDI)
    - Packaging Information
    - Descriptive Information

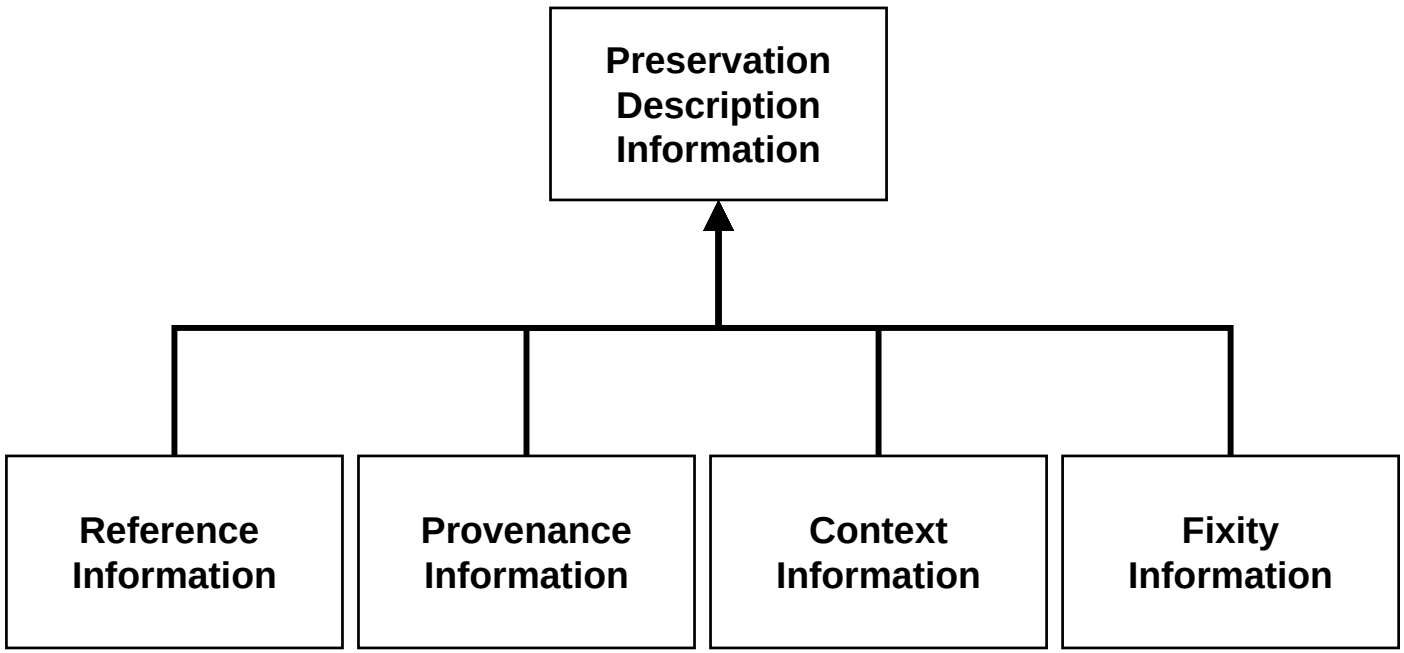
The OAIS reference model (7)

- Information model (continued):
  - Information package:
    - Container that encapsulates Content Information and PDI
    - Packages for submission (SIP), archival storage (AIP) and dissemination (DIP)
    - AIP = "... a concise way of referring to a set of information that has, in principle, all of the qualities needed for permanent, or indefinite, Long Term Preservation of a designated Information Object"

The OAIS reference model (8)

- Archival Information Package (AIP):
  - Content Information
    - Original target of preservation
    - Information Object (Data Object & Representation Information)
  - Preservation Description Information (PDI)
    - other information (metadata) “which will allow the understanding of the Content Information over an indefinite period of time”
    - A set of Information Objects
    - Based on categories discussed in CPA/RLG report: *Preserving Digital Information* (1996)

The OAIS reference model (9)



PDI Preservation Description Information (Figure 4-16)

The OAIS reference model (10)

- There is much, much more …
  - The Archival Information Unit and Archival Information Collections
  - Data transformations
  - Digital Migration
  - Preservation of look and feel (e.g., emulation, virtual machines)
  - Interoperability

Implementing OAIS (1)

- Fundamentals:
  - OAIS is a reference model (conceptual framework), NOT a blueprint for system design
  - It informs the design of system architectures, the development of systems and components
  - It provides common definitions of terms … a common language, means of making comparison
  - But it does NOT ensure consistency or interoperability between implementations

Implementing OAIS (2)

- ISO 14721:2003 published in early 2003
- However, earlier versions of the model made available by the CCSDS informed implementations long before then
- Three broad areas of influence:
  - Preservation metadata schemas
  - Architecture and system design
  - Conformance criteria

Implementing OAIS - metadata (1)

- The OAIS Information Model has been used to inform the development of preservation metadata schemas, e.g.:
  - Draft schemas developed by the National Library of Australia, Cedars project, NEDLIB project, etc.
  - Information Model used for the conceptual structure of the OCLC/RLG Metadata Framework (2002)
  - PREMIS working group

Implementing OAIS - metadata (2)

- The Metadata Encoding and Transmission Standard (METS)
  - An XML-based metadata framework for the association of digital object content with metadata
  - An XML 'wrapper' combining 'buckets' of descriptive, administrative and structural metadata
  - For object transfer or presentation
  - METS objects can be seen as an implementation of OAIS Information Packages (SIP, AIP, and DIP)

Implementing OAIS - systems (1)

- Two main uses (to date):
  1. To analyse existing preservation management practices
     - Helps with the comparison of repositories and the identification of important gaps
  2. "It is assumed that implementers will use this reference model as a guide while developing a specific implementation to provide identified services and content" (OAIS 1.4)
     - Some examples …

Implementing OAIS - systems (2)

- Ensuring Access to Mathematics Over Time
  - Cornell University Library and SUB Göttingen
  - Stated aim to "develop and implement a system that adheres to the principles put forth in the Open Archival Information System (OAIS) Reference Model."
  - Maintains directory of OAIS functions
  - www.library.cornell.edu/dlit/EATMOT/

Implementing OAIS - systems (3)

- Stanford Digital Repository
  - Stanford University Libraries & Academic Information Resources
  - Designing "OAIS-compliant" system for managing digitised objects, publications (e.g. from HighWire Press), electronic records, software, etc.
  - "… a means to gather and protect every facet of the University's organizational memory and intellectual capital."
  - Needs to scale to petabytes
  - www.diglib.org/pubs/news04_01/stanford.htm

Implementing OAIS - systems (4)

- OCLC Digital Archive Service
  - Subscription service provided by OCLC Online Computer Library Center, Inc.
  - Objects harvested from Web or can be submitted in batch (ingest)
  - Integrated with cataloguing workflows
  - OCLC preservation metadata specification
  - "Based on OAIS"
  - www.oclc.org/digitalarchive/

Implementing OAIS - systems (5)

- Many other examples:
  - Cedars project distributed archive prototype
    - Representation nets
  - Harvard University Library
    - XML-based Submission Information Package for e-journals
  - DSpace
  - KB *e*-Depot

Implementing OAIS - conformance (1)

- Many repositories claim OAIS compliance:
  - e.g., DSpace, OCLC Digital Archive, METS, etc.
  - Also, the LOCKSS System has produced a "formal statement of conformance to ISO 14721:2003" (lockss.stanford.edu/)
- The OAIS model claims to be a basis for conformance (OAIS 1.4), e.g.:
  - Supporting the information model (OAIS 2.2),
  - Fulfilling mandatory responsibilities (OAIS 3.1)

Implementing OAIS - conformance (2)

- OAIS Mandatory Responsibilities:
  - Negotiating and accepting information
  - Obtaining sufficient control of the information to ensure long-term preservation
  - Determining the "designated community"
  - Ensuring that information is "independently understandable"
  - Following documented policies and procedures
  - Making the preserved information available

Implementing OAIS - conformance (3)

- OCLC/RLG Digital Archive Attributes Working Group
  - Trusted Digital Repositories report (2002)
  - Recommended the development of a process for the certification of digital repositories
    - Audit model
    - Standards model
  - Goes well beyond OAIS mandatory responsibilities
    - e.g., administrative responsibility, organisational viability, financial sustainability, system security, etc.

Implementing OAIS - conformance (4)

- RLG/NARA Task Force on Digital Repository Certification
  - Research Libraries Group (RLG) and the US National Archives and Records Administration (NARA).
  - To define certification model and process
    - Identify those things that need to be certified (attributes, processes, functions, etc.)
    - Develop a certification process (organisational implications)
    - Draft proposal to be issued later in 2004

Summing up

- The OAIS model is a foundation stone for current and future digital preservation efforts
- It is already widely used to inform the development of preservation tools and repositories
- It could be used in the future as a basis for conformance, but its mandatory responsibilities do not identify all relevant criteria
- There may be a need for periodic revision, some clarification of definitions, possibly some comment from the archives world

Key links:

- OAIS Reference Model: http://www.ccsds.org/documents/650x0b1.pdf
- DPC Technology Watch Report on OAIS model by Brian Lavoie (OCLC Research): http://www.dpconline.org/
- RLG/NARA Task Force on Digital Repository Certification: http://www.rlg.org/

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