Digital Preservation Metadata and Improvements to PREMIS in Version 3.0

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Agenda

- Digital preservation metadata
  - Why is it needed and what does it look like?
- PREMIS
  - What is it?
  - Data model
  - How to use it
- From V2 to V3

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What is digital preservation metadata?

- Digital preservation metadata =

  metadata that is considered necessary
  to ensure long-term accessibility
  of digital resources

- Digital objects must be self-descriptive

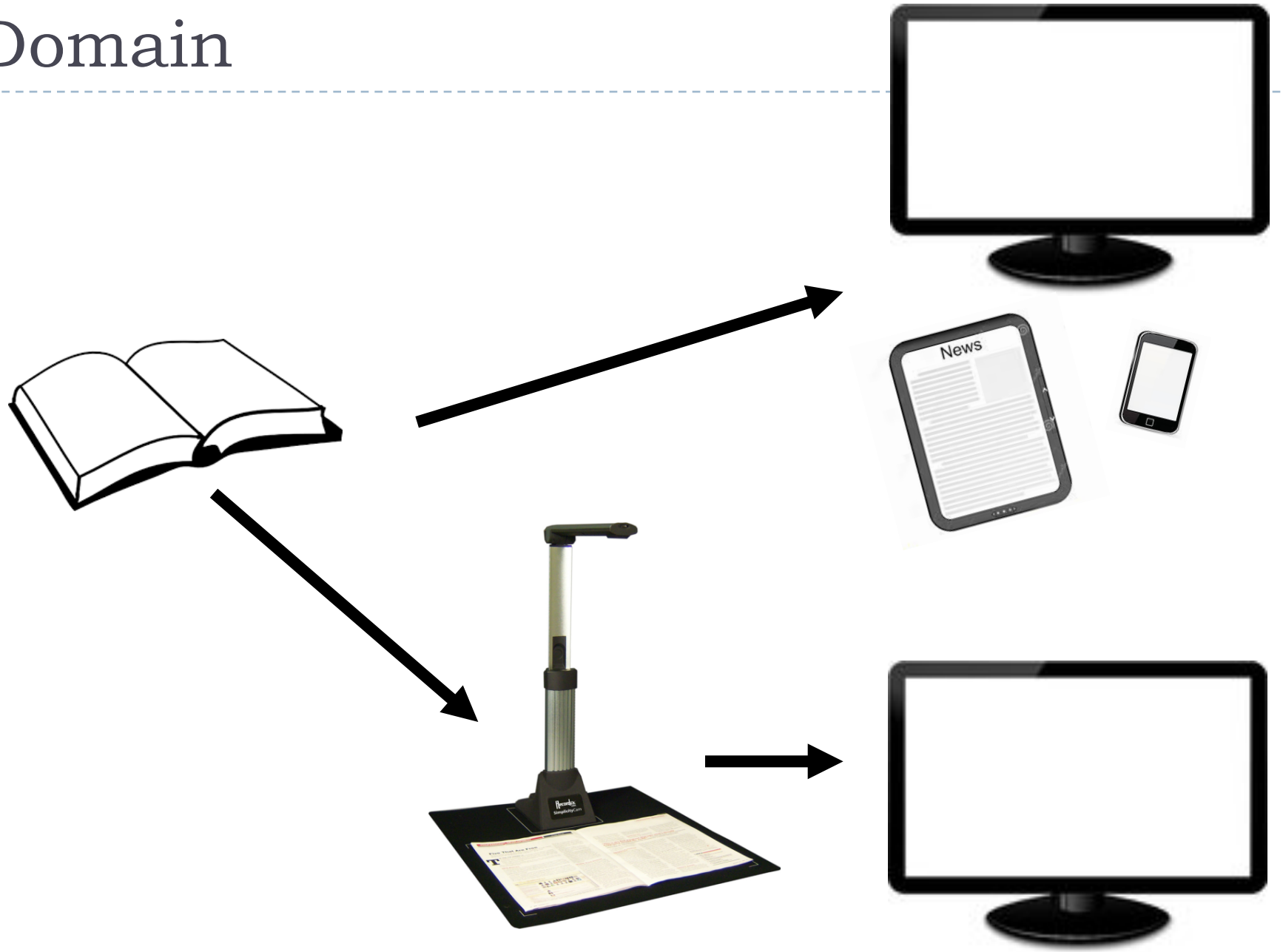
- Must be able to exist independently from the systems which were used to create them

  XML (machine and human readable)

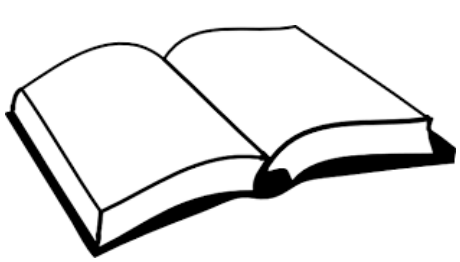
DP metadata supports preservation goals

Preservation Pyramid
(from Priscilla Caplan)

Domain



Technology dependence



digital

No direct access

Complex environments

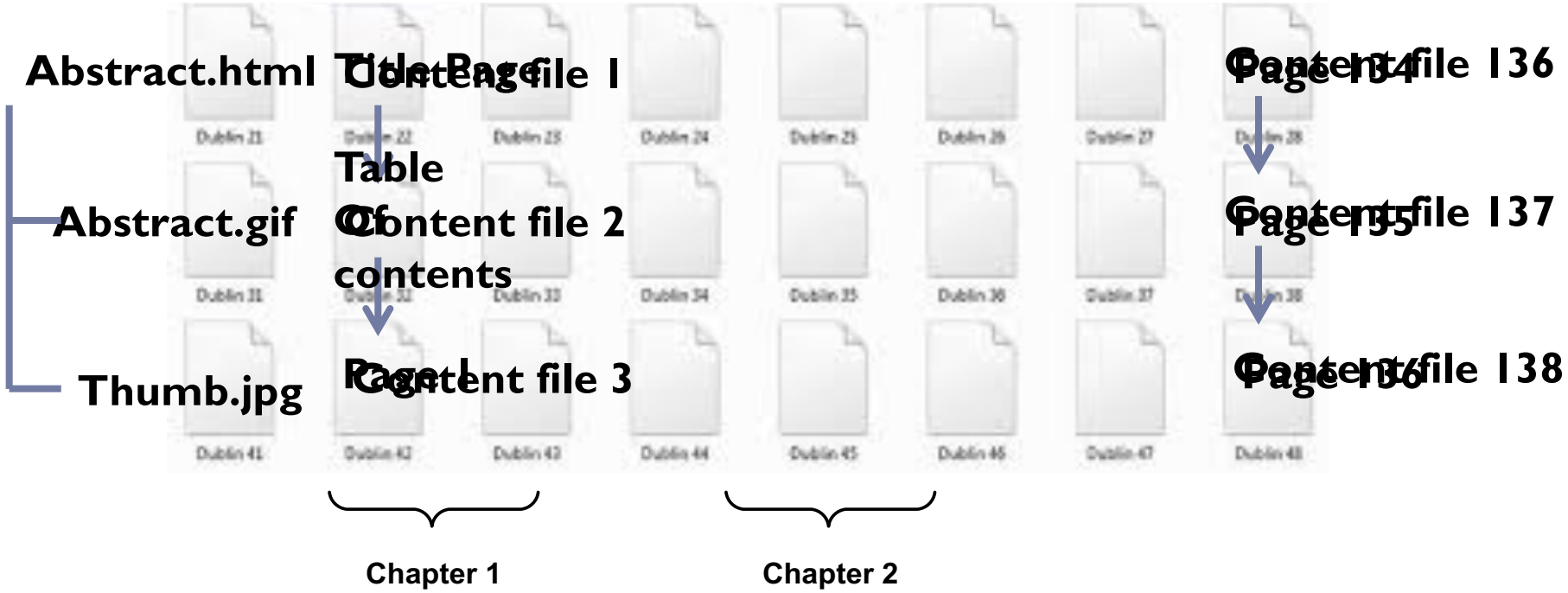
- Not self-descriptive
- Complex formats

Technology dependence

Metadata:

- Format information
- Rendering information
  - Software
  - Hardware
  - Other dependencies: schemas, style sheets, encodings, etc.

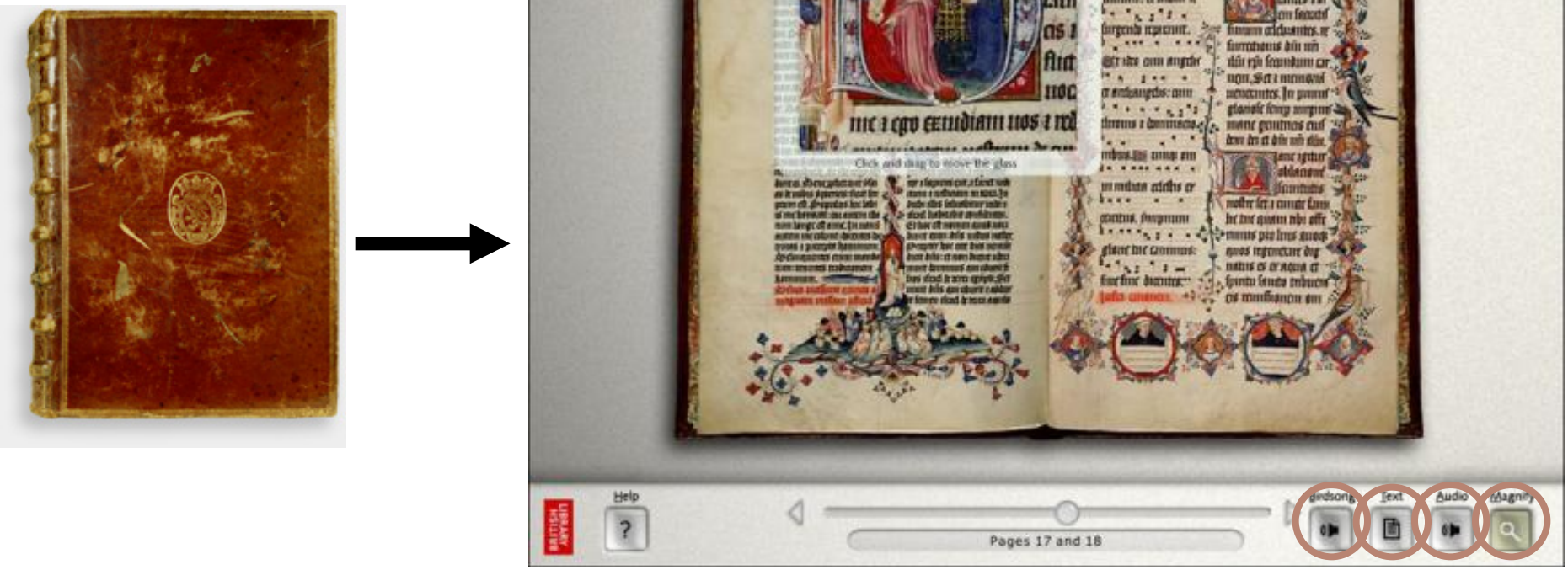
Complex structures



Metadata

- Physical structural relationships
  - Embedded files
  - File sequence
- Logical structural relationships

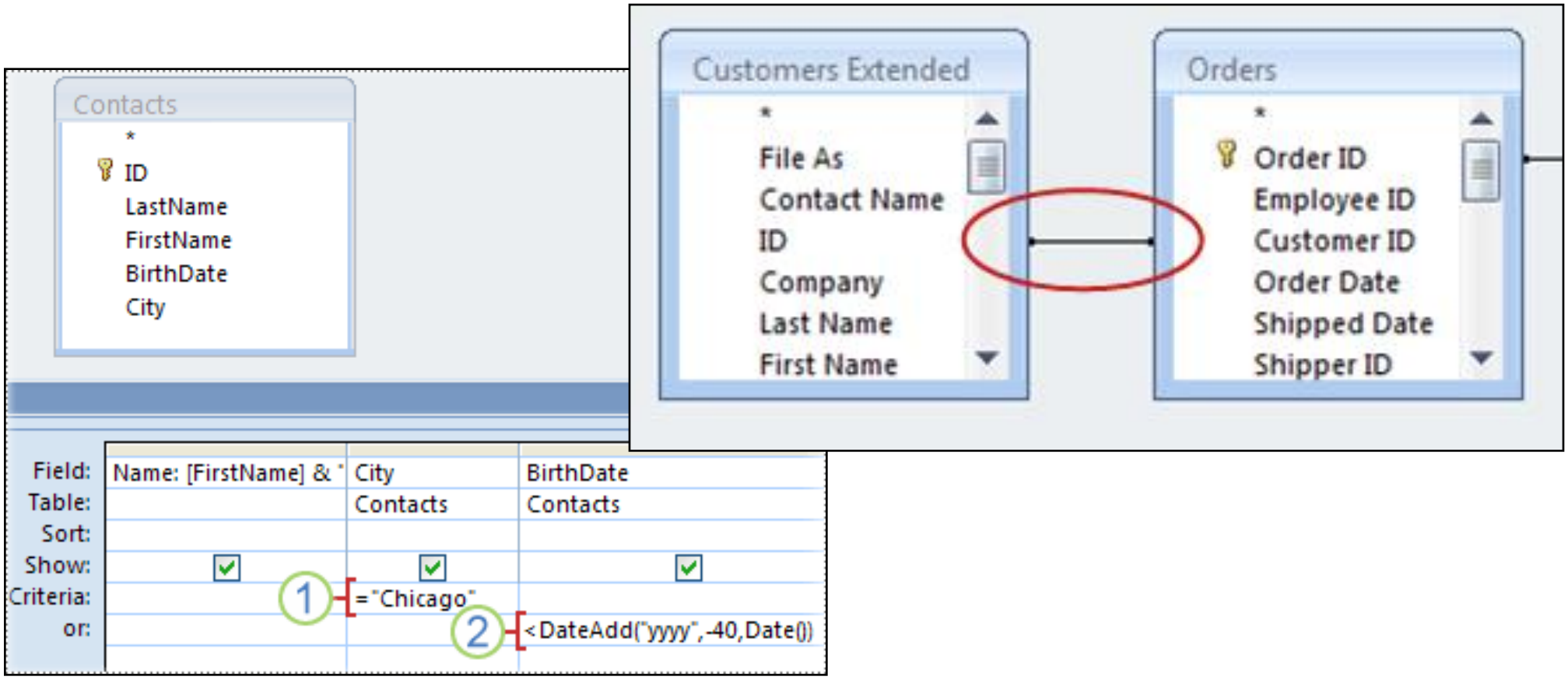
Supporting features



Metadata:

Semantic information for the designated community

Supporting features



Metadata:

Semantic information for the designated community

Obsolescence

-> object transformations

Support

- Pre-emptive preservation actions
  - Bit migration
  - Content migration
- Forensic transformation actions

Obsolescence / object transformations

Goals

- Avoid rights violations
- Prove authenticity
  - ❑Events
  - ❑Changes and decisions
  - ❑Agents (decision maker + tools used)
  - ❑Dates

Metadata

- Rights information for preservation actions during copyright / license period
- Provenance metadata:
  - History of all actions performed on the resource
  - History of custodianship

Obsolescence / object transformations

Goals

- Demonstrate degree of authenticity
- Manage potential loss of object characteristics
- Explain descisions
  - ❑ Documentation

Metadata

- Significant characteristics = business requirement
- Technical and content characteristics of objects before and after preservation actions
- Business rules guiding preservation actions

Mutability

- Intentional or accidental change
- Decay: rapid and potentially complete

Goals

- Viability: the object is readable
- Fixity: the object is unchanged

Metadata

- Data carrier metadata
  - Type of medium
  - Its preservation characteristics
  - Age of medium
  - Date of recording
  - Usage patterns
- Checksums, message digests
- Event creating them
  - Hash algorithms creating them
  - Date/time
  - Originator

Mutability

- Intentional or accidental change
- Decay: rapid and potentially complete

Goals

- Integrity: the object is whole and unimpaired
- Authenticity: the object is what it purports to be

Metadata

- Event information for format identification and validation events (= provenance)
- Structural metadata
- Provenance metadata
- Digital signatures
- Access rights

recto verso recto verso verso

Context descriptions

Metadata:

Context descriptions

- Original source
- Related items (e.g. migration source)

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The PREMIS standard

- International standard for metadata to support the preservation of digital objects and ensure their long-term usability.
  - Information you need to know for preserving digital documents

    Preservation Metadata: Implementation Strategies
- Developed by an international team of experts.
- Implemented in digital preservation projects around the world.
- Incorporated into commercial and open-source digital preservation tools and systems.

The PREMIS standard

- Data Dictionary (PREMIS 2.2)
  - http://www.loc.gov/standards/premis/v2/premis-2-2.pdf
  - Version 3 will be released this summer – major release
- XML schema
- OWL ontology
- Supporting documentation

Activities

- The PREMIS Editorial Committee
  - Coordinates revisions and implementation of the standard
- PREMIS Implementors' Group forum (pig@loc.gov)
  - Email message to listserv@loc.gov:
    Text: subscribe pig <your name>
- PREMIS Implementation Fair (PIF)
  - User group meetings (@iPres)

Scope

- What PREMIS DD is:
  - Common data model for organizing/thinking about preservation metadata
  - Implementable
  - Standard for exchanging information packages between repositories
  - Technically neutral
  - Core metadata

Scope

- What PREMIS DD is not:
  - Out-of-the-box solution
  - All needed metadata
  - Lifecycle management of objects outside repository
  - Rights management

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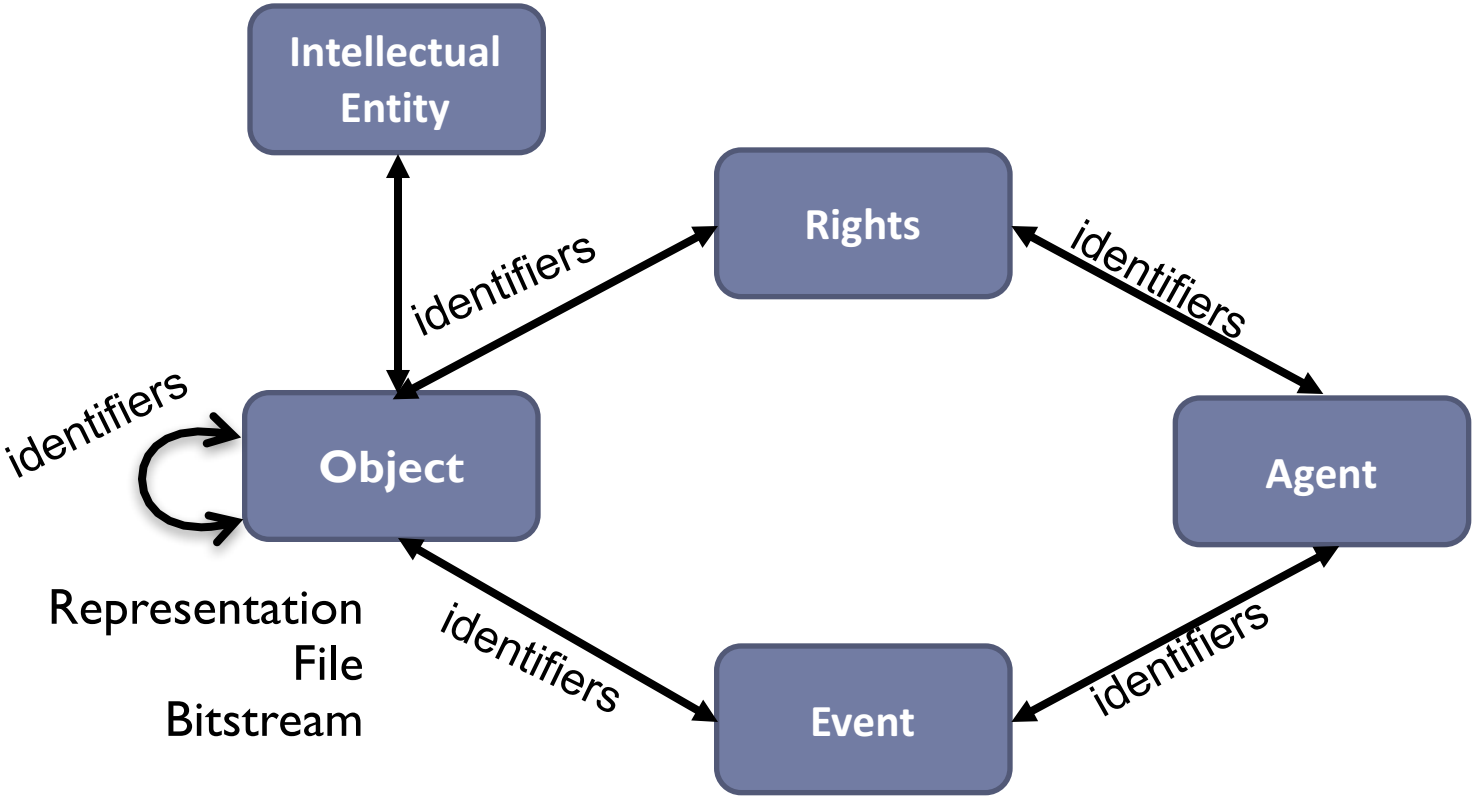
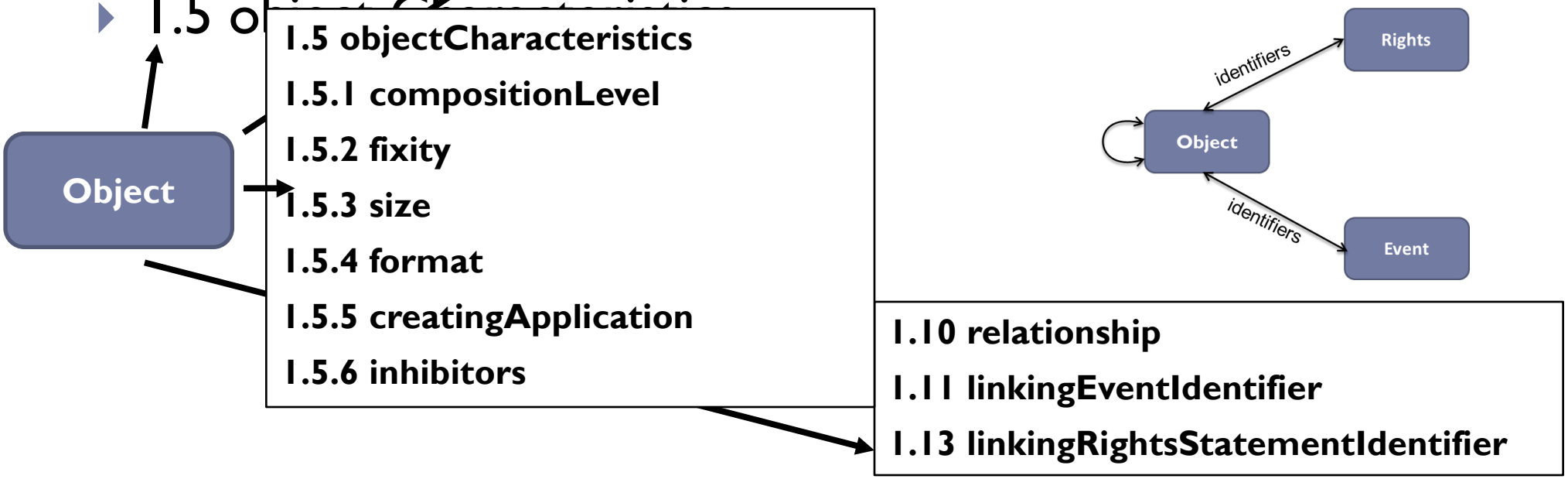
Data Model in PREMIS Version 2

- Entities: "things" relevant to digital preservation that are described by preservation metadata
- Relationships between Entities ⟷
- Properties of Entities (semantic units)

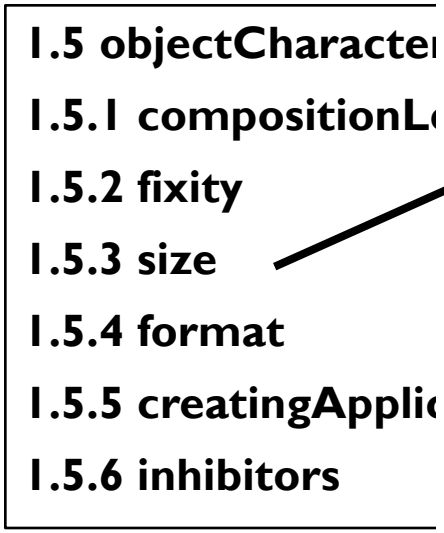


Example: Object Entity semantic units

- 1.1 object Identifier
- 1.2 object Category
- 1.3 preservation Level
- 1.4 significant Properties
- 1.5 object Characteristics
- 1.6 original Name
- 1.7 storage
- 1.8 environment
- 1.9 signature Information



Sample Data Dictionary Entry



Semantic unit	size		
Semantic components	None		
Definition	The size in bytes of the file or bitstream stored in the repository.		
Rationale	Size is useful for ensuring the correct number of bytes from storage have been retrieved and that an application has enough room to move or process files. It might also be used when billing for storage.		
Data constraint	Integer		
Object category	**Representation**	**File**	**Bitstream**
Applicability	Not applicable	Applicable	Applicable
Examples		2038927	
Repeatability		Not repeatable	Not repeatable
Obligation		Optional	Optional
Creation/ Maintenance notes	Automatically obtained by the repository.		
Usage notes	Defining this semantic unit as size in bytes makes it unnecessary to record a unit of measurement. However, for the purpose of data exchange the unit of measurement should be stated or understood by both partners.		

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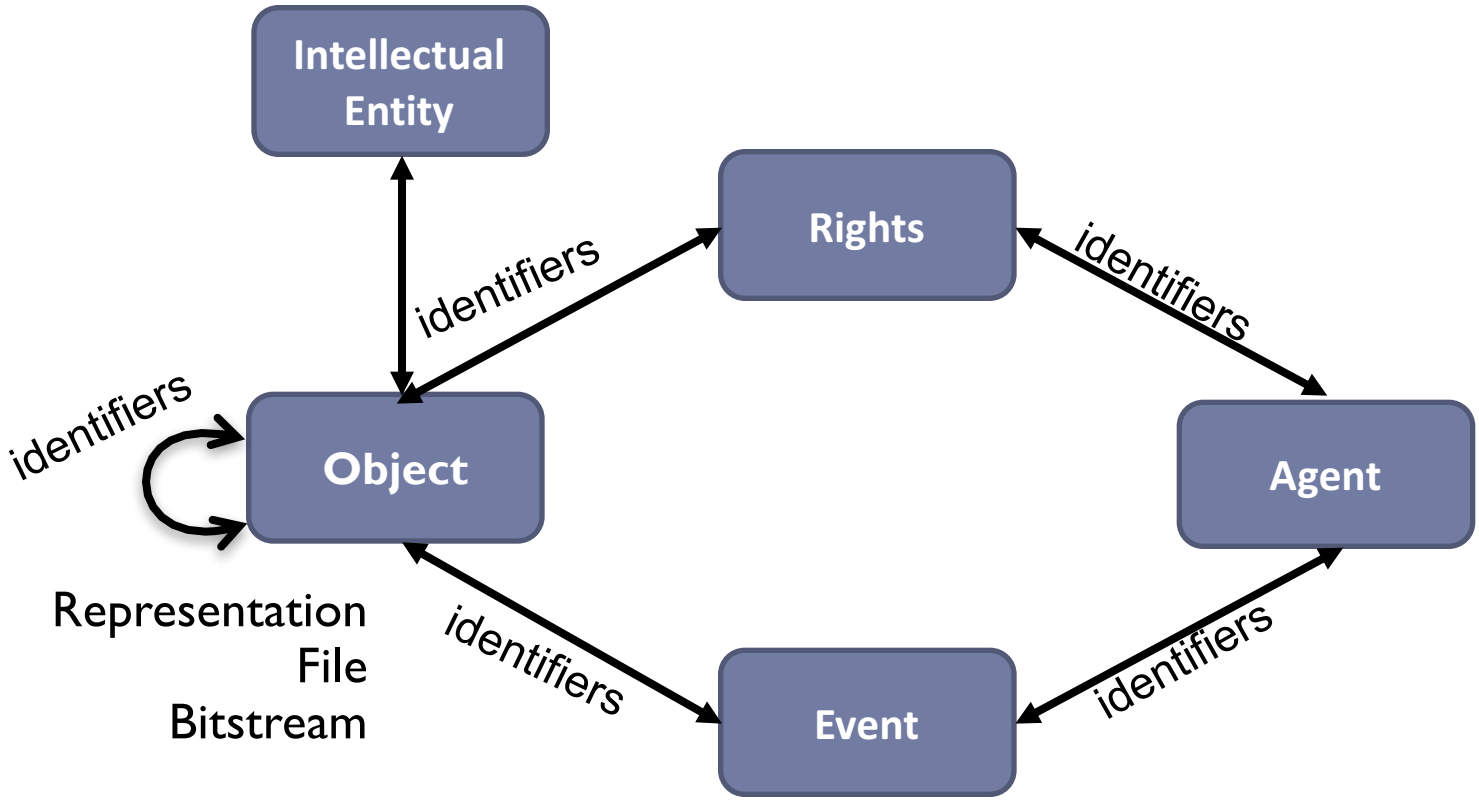
Tayloring PREMIS to needs

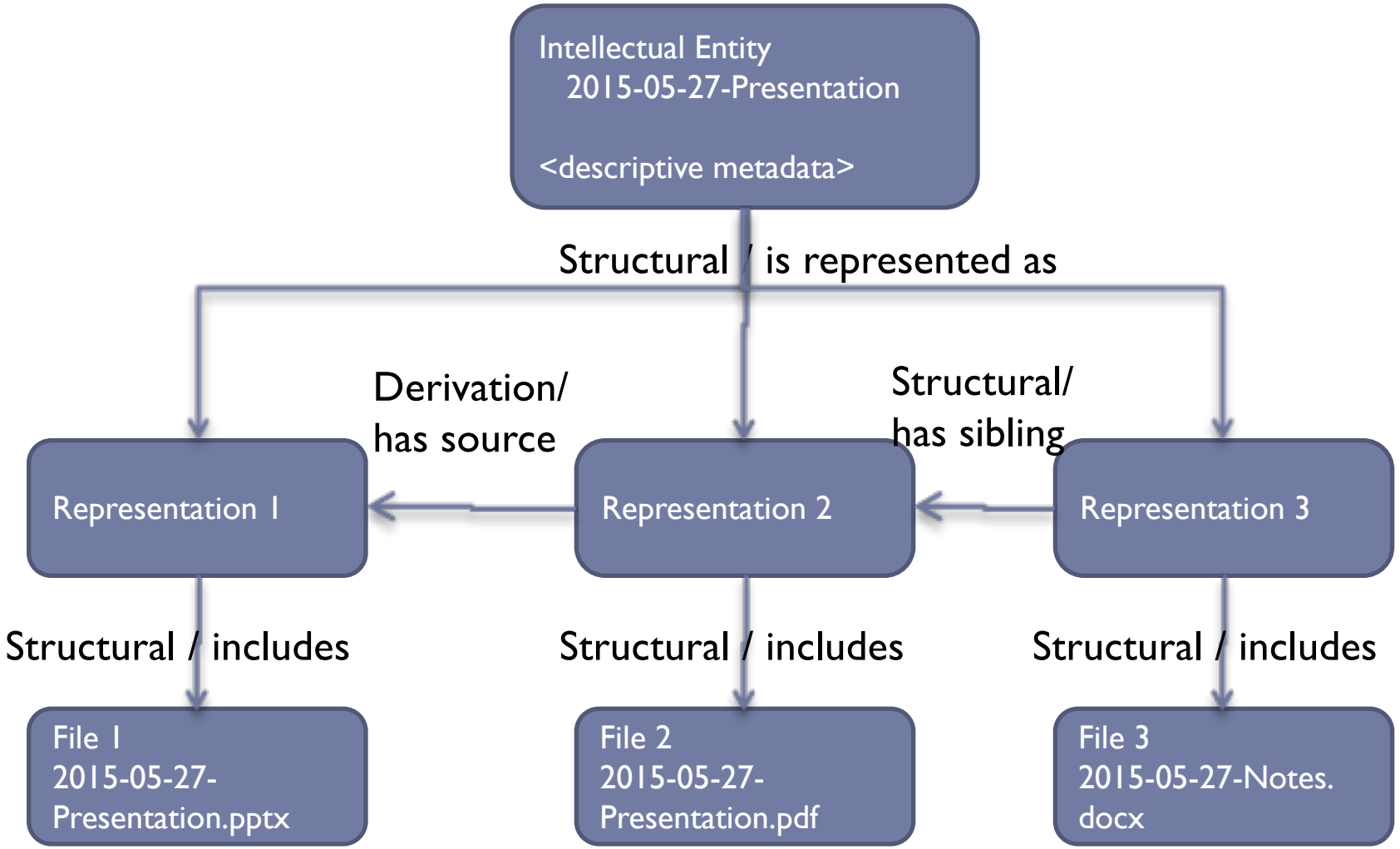
- Increasing experience ensuring the longevity of digital objects
- Changing future technical possibilities
- Changing future legal framework

- Tayloring solutions from core metadata
  - Varying needs
    - Content-types
    - Institutional policies
    - Intended use

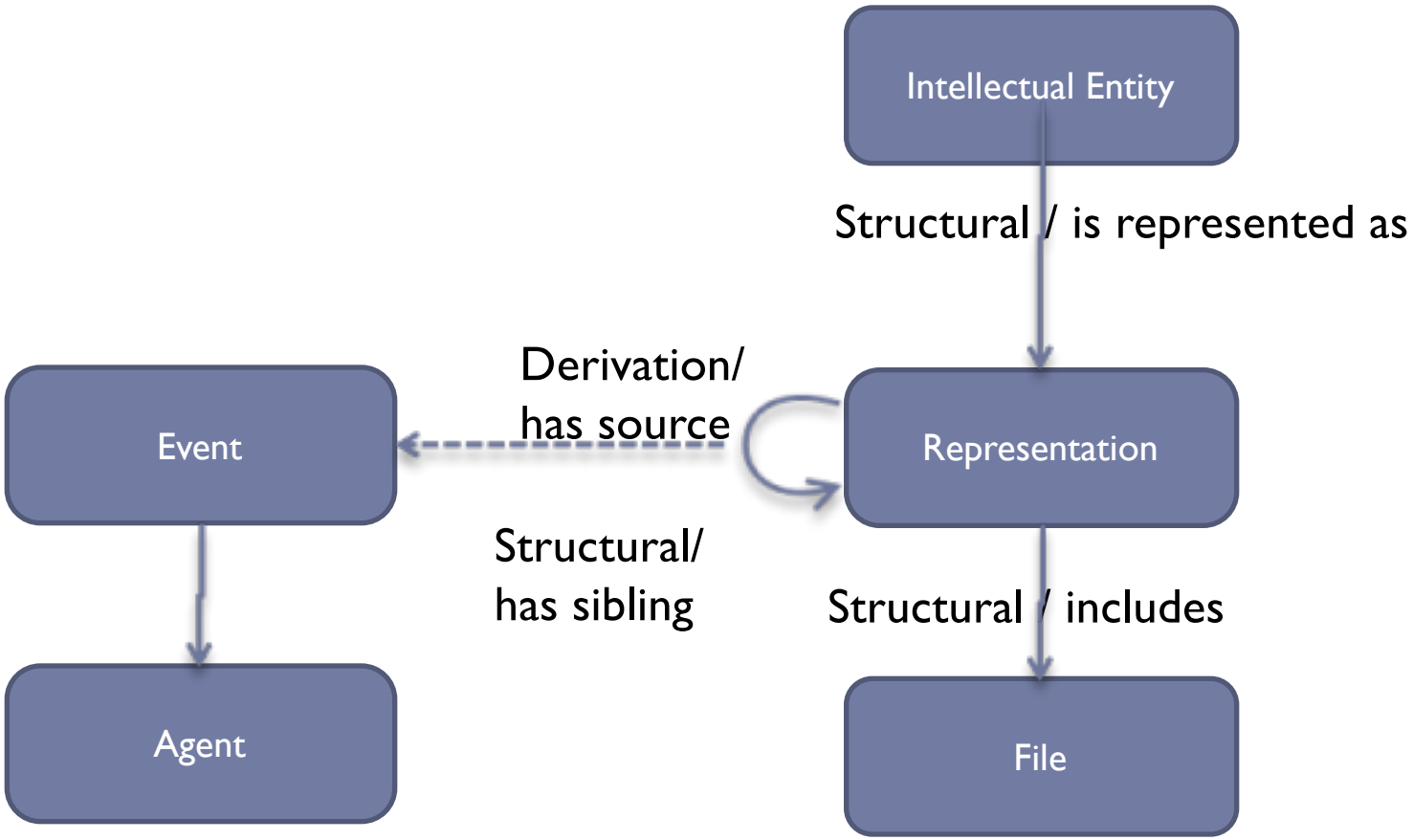
From here to an implementation …

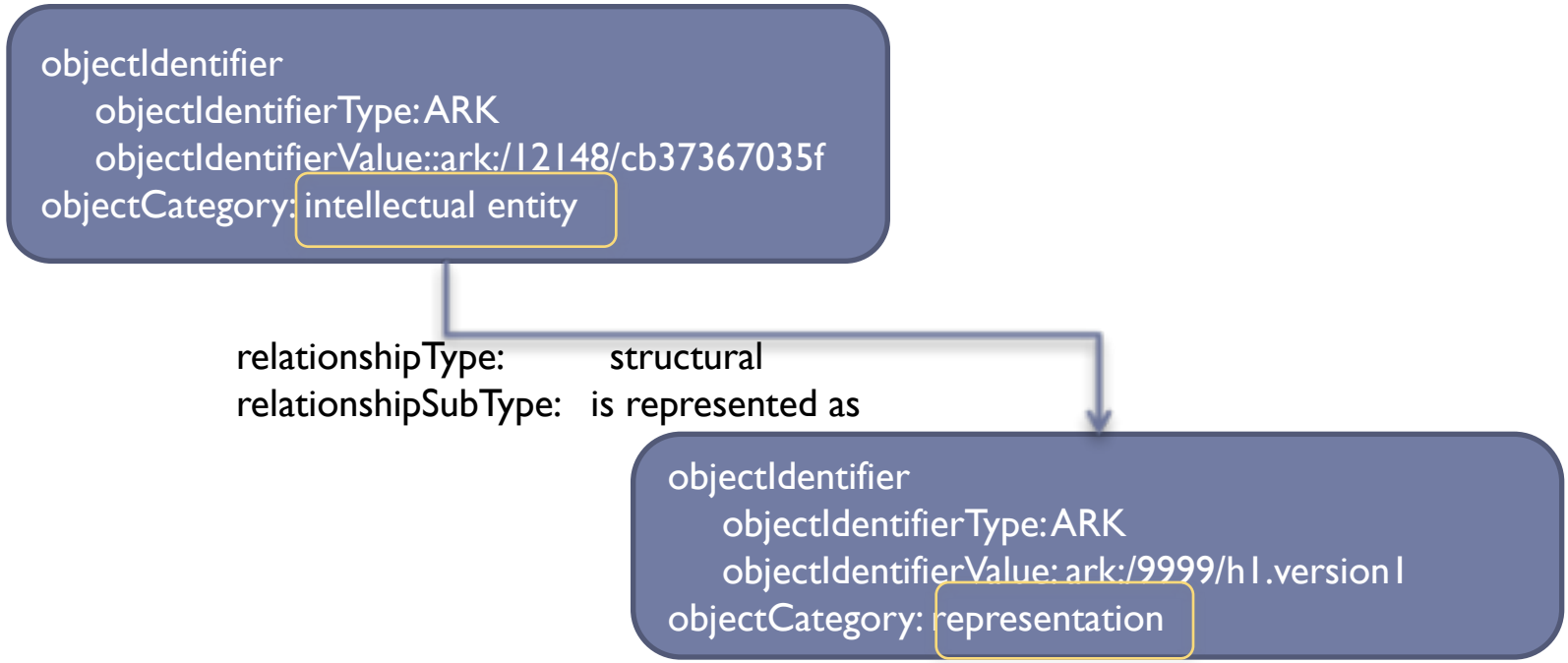


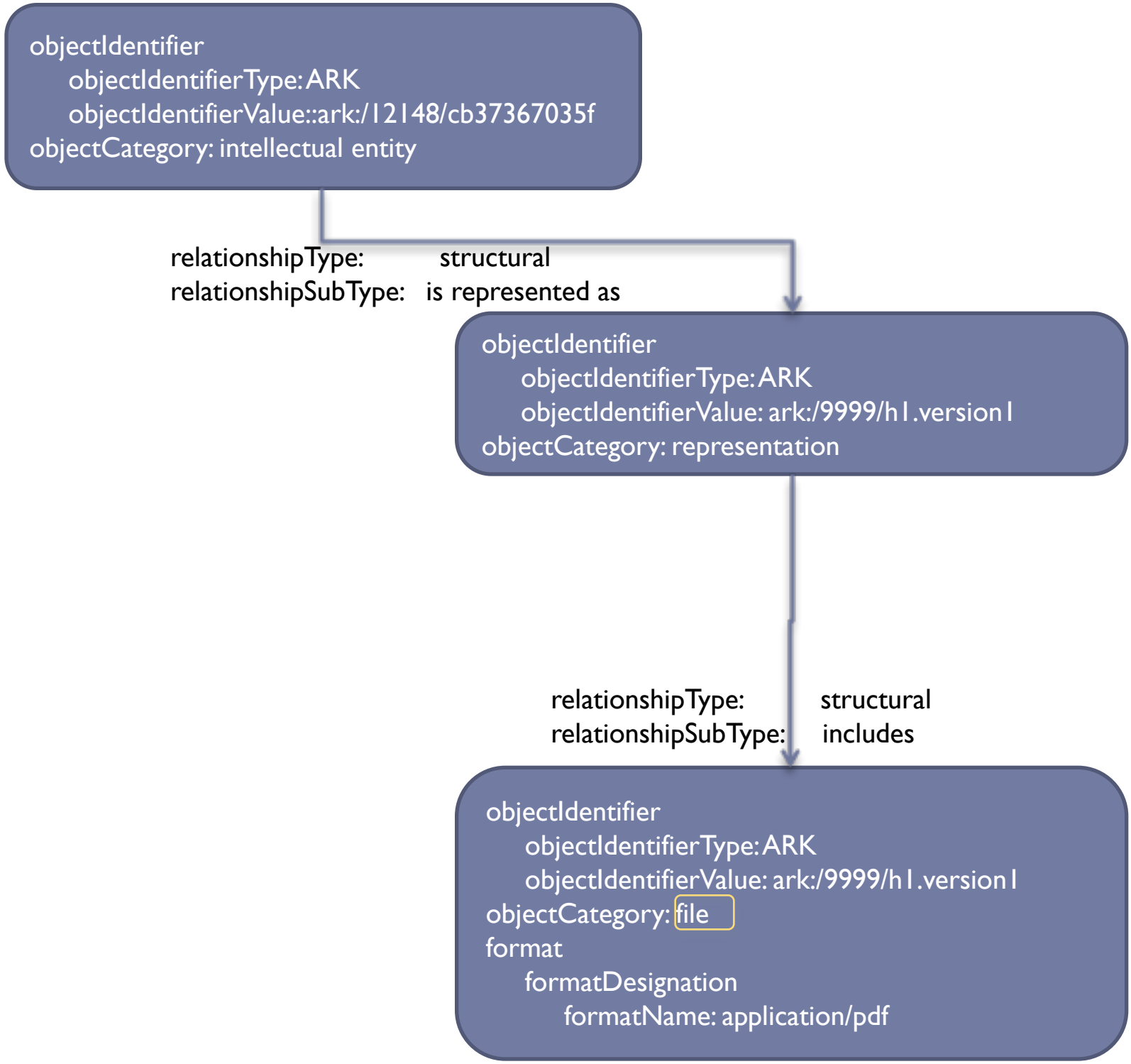
Example: Document in 3 representations



Example: Data model




objectIdentifier
objectIdentifierType: ARK
objectIdentifierValue::ark:/12148/cb37367035f
objectCategory: intellectual entity
relationshipType: structural
relationshipSubType: is represented as
objectIdentifier
objectIdentifierType: ARK
objectIdentifierValue: ark:/9999/h1.version1
objectCategory: representation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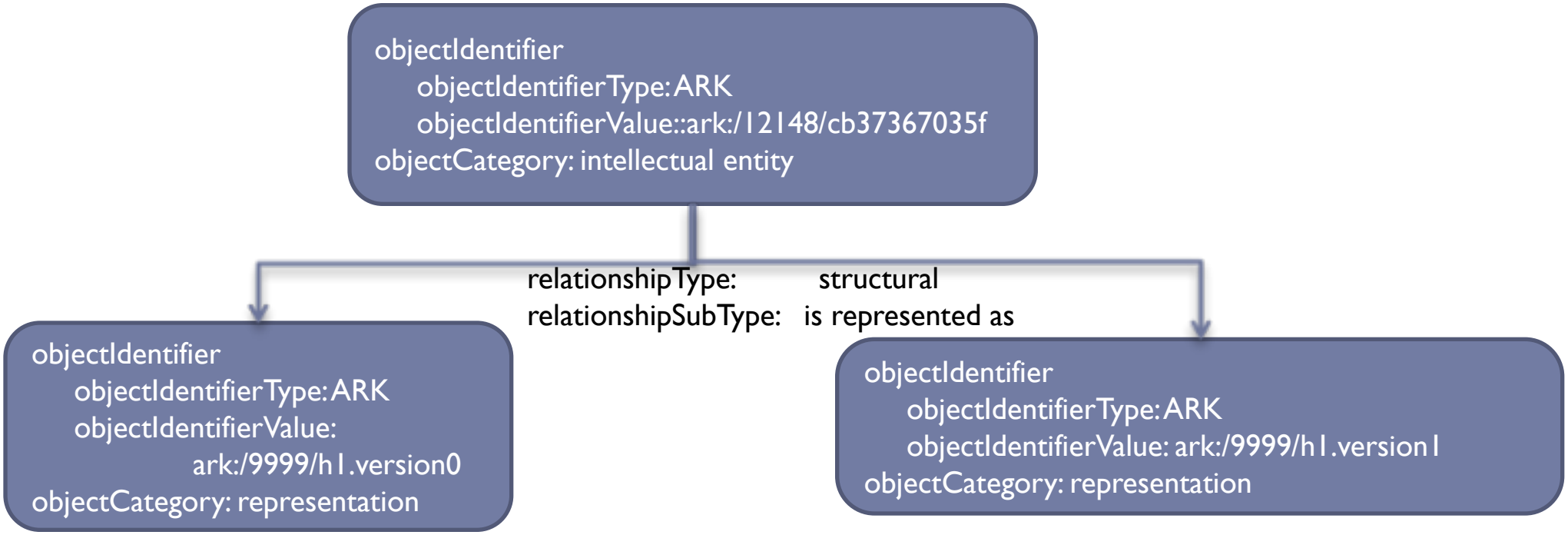
objectIdentifierValue::ark:/12148/cb37367035f
objectCategory: intellectual entity
relationshipType: structural
relationshipSubType: is represented as
objectIdentifier
objectIdentifierType: ARK
objectIdentifierValue: ark:/9999/h1.version1
objectCategory: representation
relationshipType: structural
relationshipSubType: includes
objectIdentifier
objectIdentifierType: ARK
objectIdentifierValue: ark:/9999/h1.version1
objectCategory: file
format
formatDesignation
formatName: application/pdf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objectIdentifier
objectIdentifierType: ARK
objectIdentifierValue:
ark:/9999/h1.version0
objectCategory: representation
objectIdentifier
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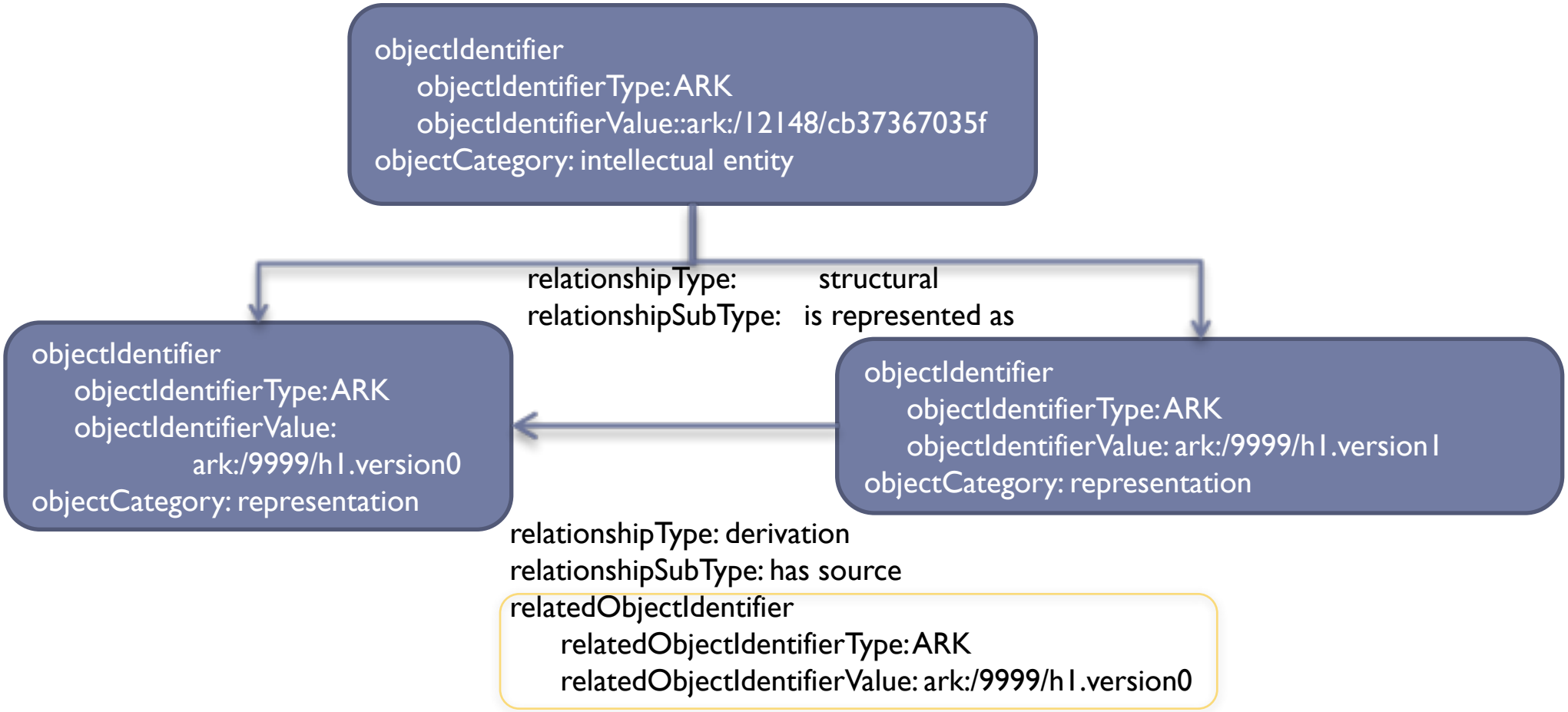
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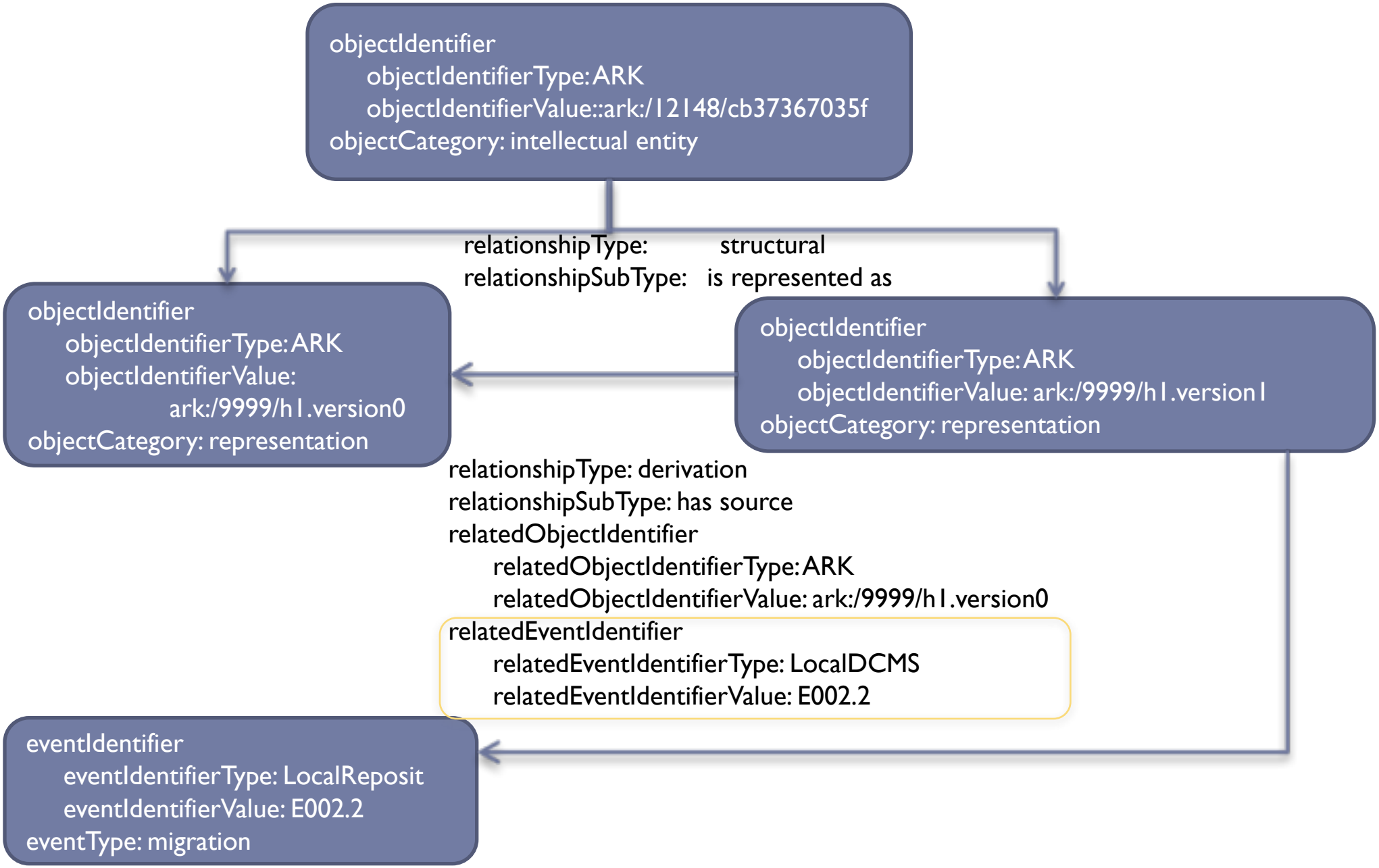
objectIdentifierValue: ark:/9999/h1.version0
objectCategory: representation
objectIdentifier
objectIdentifierType: ARK
objectIdentifierValue: ark:/9999/h1.version1
objectCategory: representation
relationshipType: derivation
relationshipSubType: has source
relatedObjectIdentifier
relatedObjectIdentifierType: ARK
relatedObjectIdentifierValue: ark:/9999/h1.version0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objectIdentifier
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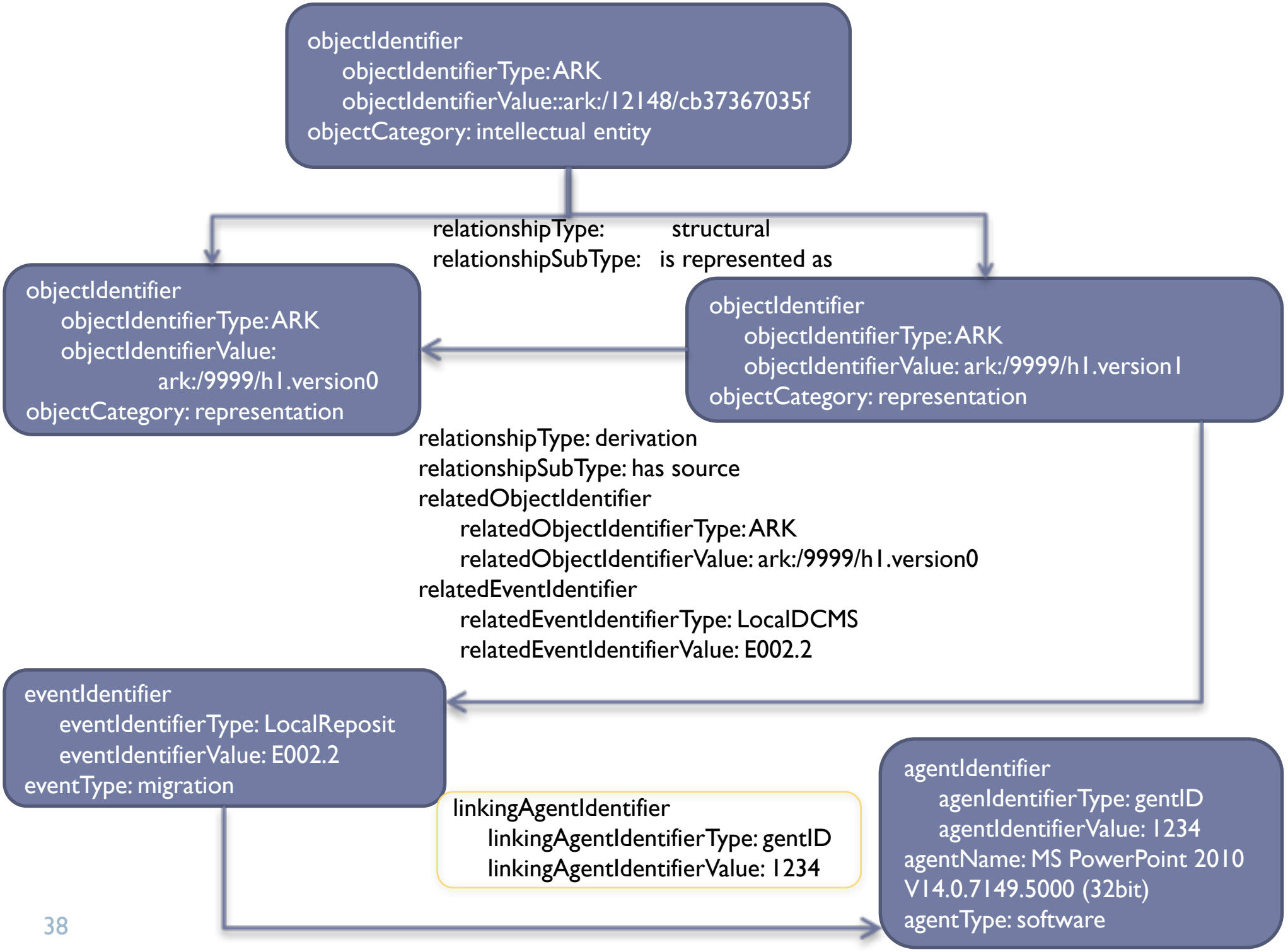
objectIdentifierValue: ark:/9999/h1.version0
objectCategory: representation
objectIdentifier
objectIdentifierType: ARK
objectIdentifierValue: ark:/9999/h1.version1
objectCategory: representation
relationshipType: derivation
relationshipSubType: has source
relatedObjectIdentifier
relatedObjectIdentifierType: ARK
relatedObjectIdentifierValue: ark:/9999/h1.version0
relatedEventIdentifier
relatedEventIdentifierType: LocalDCMS
relatedEventIdentifierValue: E002.2
eventIdentifier
eventIdentifierType: LocalReposit
eventIdentifierValue: E002.2
eventType: migration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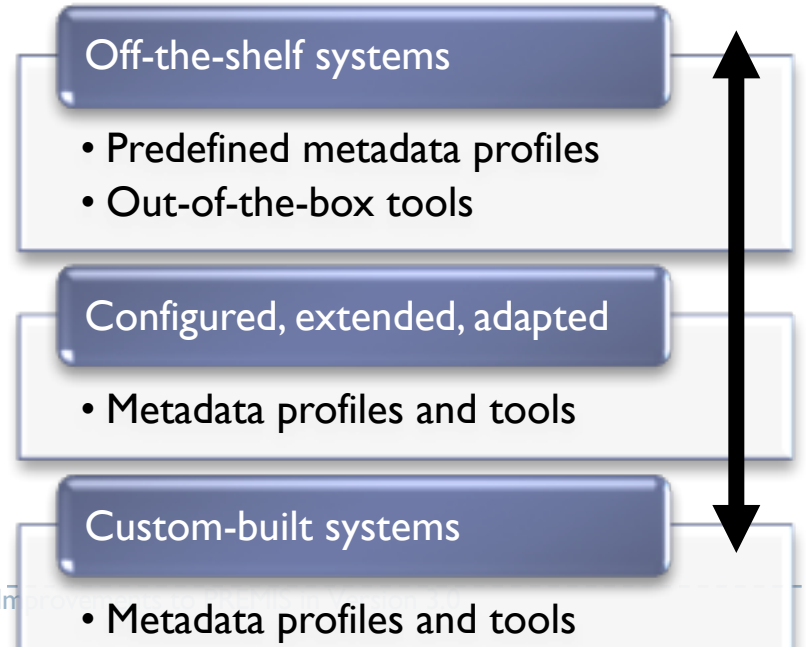
objectIdentifier
objectIdentifierType: ARK
objectIdentifierValue: ark:/9999/h1.version1
objectCategory: representation
relationshipType: derivation
relationshipSubType: has source
relatedObjectIdentifier
relatedObjectIdentifierType: ARK
relatedObjectIdentifierValue: ark:/9999/h1.version0
relatedEventIdentifier
relatedEventIdentifierType: LocalDCMS
relatedEventIdentifierValue: E002.2
eventIdentifier
eventIdentifierType: LocalReposit
eventIdentifierValue: E002.2
eventType: migration
linkingAgentIdentifier
linkingAgentIdentifierType: gentID
linkingAgentIdentifierValue: 1234
agentIdentifier
agenIdentifierType: gentID
agentIdentifierValue: 1234
agentName: MS PowerPoint 2010 V14.0.7149.5000 (32bit)
agentType: software

Tayloring PREMIS to needs

- We cannot know for sure
  - Increasing experience ensuring the longevity of digital objects
  - Changing future technical possibilities
  - Changing future legal framework

- Tayloring solutions from core metadata
  - Varying needs
    - Content-types
    - Institutional policies
    - Intended use
  - Off-the-shelf (OS / commercial) or custom-built



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- From V2 to V3

PREMIS: From V2 to V3

- Next major version of the PREMIS Data Dictionary
- Released by July 2015
- Still in proof-reading phase

PREMIS: From V2 to V3

- Improving PREMIS based on user needs

- Add preservationLevelType semantic unit
- Add agentVersion semantic unit
- Add eventDetailInformation semantic unit
- Add "unknown" values

minor

- Add authority for controlled vocabulary

bonus

- Make Intellectual Entity an Object category
- Make Environments independent Objects
- Add physical Objects

major

- Update conformance statement

clarification

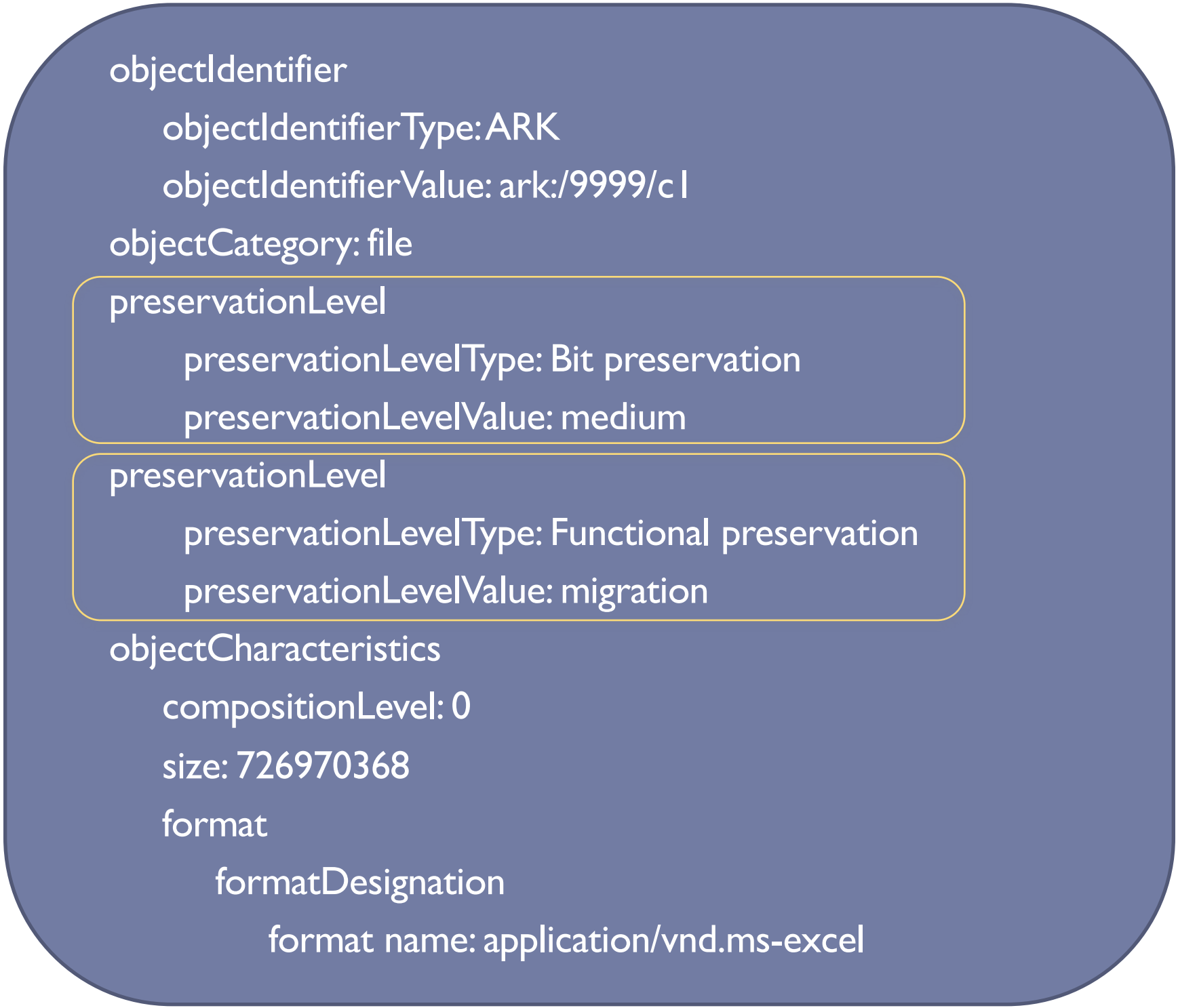
Approved Changes:
Add preservationLevelType semantic unit

- 1.3 preservationLevel
-
- 1.3.1 preservationLevelValue
- 1.3.2 preservationLevelRole
- 1.3.3 preservationLevelRationale
- 1.3.4 preservationLevelDateAssigned

Approved Changes:
Add preservationLevelType semantic unit

- 1.3 preservationLevel
- 1.3.1 preservationLevelType
- 1.3.2 preservationLevelValue
- 1.3.3 preservationLevelRole
- 1.3.4 preservationLevelRationale
- 1.3.5 preservationLevelDateAssigned

- Associate type of preservation function with preservation level.


objectIdentifier
objectIdentifierType: ARK
objectIdentifierValue: ark:/9999/c1
objectCategory: file
preservationLevel
preservationLevelType: Bit preservation
preservationLevelValue: medium
preservationLevel
preservationLevelType: Functional preservation
preservationLevelValue: migration
objectCharacteristics
compositionLevel: 0
size: 726970368
format
formatDesignation
format name: application/vnd.ms-excel

Approved Changes: Add agentVersion semantic unit

- If agentType is software,
  - agentVersion can be used to refine agentName.

- 3.1 agentIdentifier
- 3.2 agentName
- 3.3 agentType

- 3.4 agentNote
- 3.5 agentExtension
- 3.6 linkingEventIdentifier
- 3.7 linkingRightsStatementIdentifier
-

Approved Changes: Add agentVersion semantic unit

- If agentType is software,
  - agentVersion can be used to refine agentName.

- 3.1 agentIdentifier
- 3.2 agentName
- 3.3 agentType
- 3.4 agentVersion
- 3.5 agentNote
- 3.6 agentExtension
- 3.7 linkingEventIdentifier
- 3.8 linkingRightsStatementIdentifier
- 3.9 linkingEnvironmentIdentifier

Approved Changes:
Add eventDetailInformation semantic unit .

- 2.1 eventIdentifier
- 2.2 eventType
- 2.3 eventDateTime
- 2.4 eventDetail

- 2.5 eventOutcomeInformation
- 2.6 linkingAgentIdentifier
- 2.7 linkingObjectIdentifier

Approved Changes:
Add eventDetailInformation semantic unit .

- 2.1 eventIdentifier
- 2.2 eventType
- 2.3 eventDateTime
- 2.4 eventDetailInformation
- 2.4.1 eventDetail
- 2.4.2 eventDetailExtension
- 2.5 eventOutcomeInformation
- 2.6 linkingAgentIdentifier
- 2.7 linkingObjectIdentifier

Approved Changes: Unknown compositionLevel and format

compositionLevel and format:

- A value of *unknown* added if the information is not available.

Implementation specific change: Add authority for controlled vocabulary

- Record the name of the authoritative list used
- Expressed as a string or as a unique URI
  - http://id.loc.gov/vocabulary/preservation/eventType
  - UC San Diego Rights Basis Vocabulary
- Usable in semantic units that suggest use of controlled vocabularies under data constraint.

- Changes only to the XML schema
- complexType 'stringPlusAuthority' is xs:string with the three new attributes:
  - **authority:** name of a controlled vocabulary as a string
  - **authorityURI:** name of a controlled vocabulary as URI
  - **valueURI:** value from a controlled vocabulary that is in the form of a URI.
- Some controlled vocabularies as Linked Data at id.loc.gov: http://id.loc.gov/vocabulary/preservation

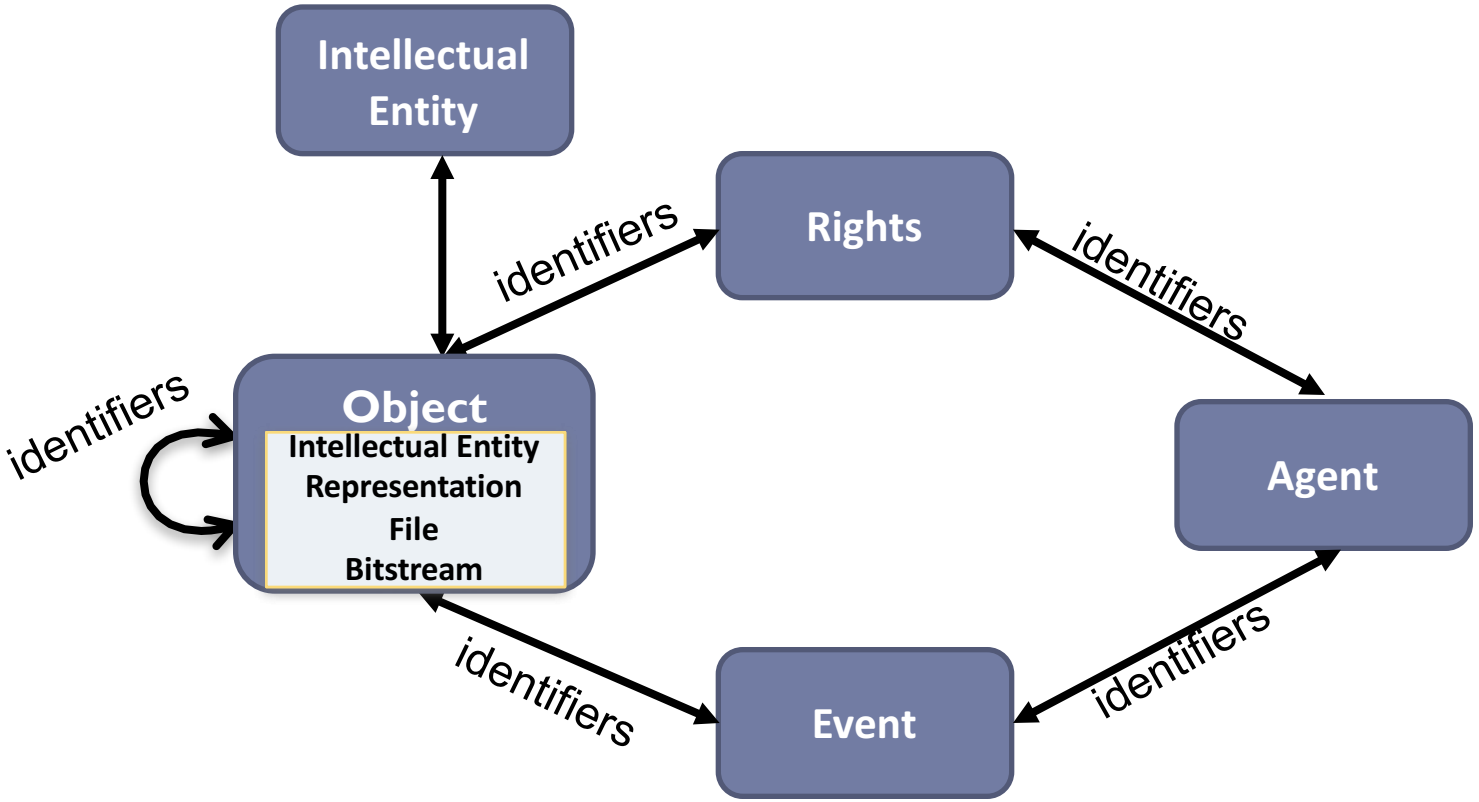
eventIdentifier:
    eventIdentifierType: UUID
    eventIdentifierValue: 908985d3-9600-4da4-a7e7-c6e9508bf24c
eventType: validation

authority="premisEventType"
authorityURI= "http://id.loc.gov/vocabulary/preservation/eventType.html"
valueURI= "http://id.loc.gov/vocabulary/preservation/eventType/val.html

eventDateTime: 2014-07-03T23:18:19
eventDetailInformation:
    eventDetail: program="Jhove"; version="1.5"
eventOutcomeInformation:
    eventOutcome: fail
    eventOutcomeDetail:
        eventOutcomeDetailNote:
                format="JPEG"; version="1.02"; re

capture
deletion
digital signature validation
fixity check
ingestion
message digest calculation
migration
normalization
replication
validation
virus check

Approved Changes:
Make Intellectual Entity an Object category



V2:

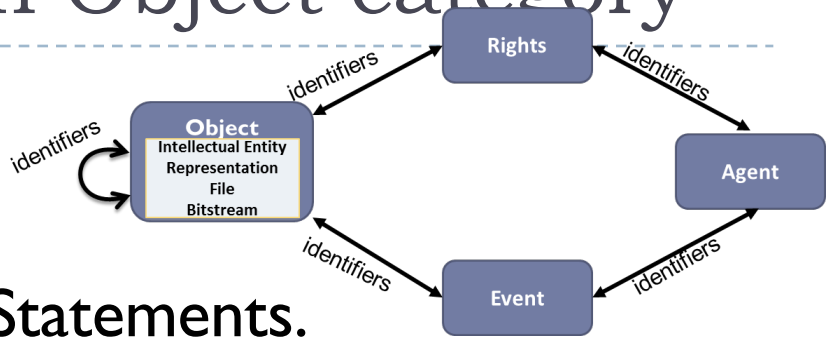
- Assumed to be held in a container metadata schema
- No Intellectual Entity semantic units
- Exception: identifier to describe intellectual entities

V3:

- Possibility to enable linking to a description
- PREMIS Objects
- Same semantic link for it units as Representations

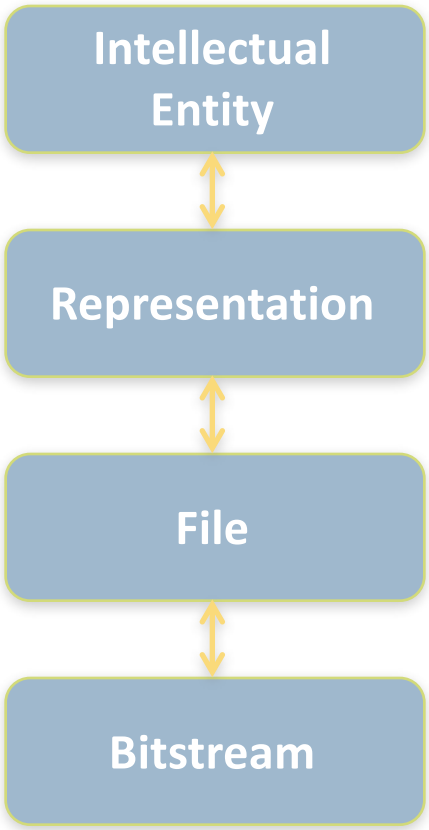
- A set of content that is considered a single intellectual unit for purposes of management and description
- For example, a particular book, map, photograph, or database.
- An Intellectual Entity can include other Intellectual Entities;
  for example, a Web site can include a Web page; a Web page can include an image.

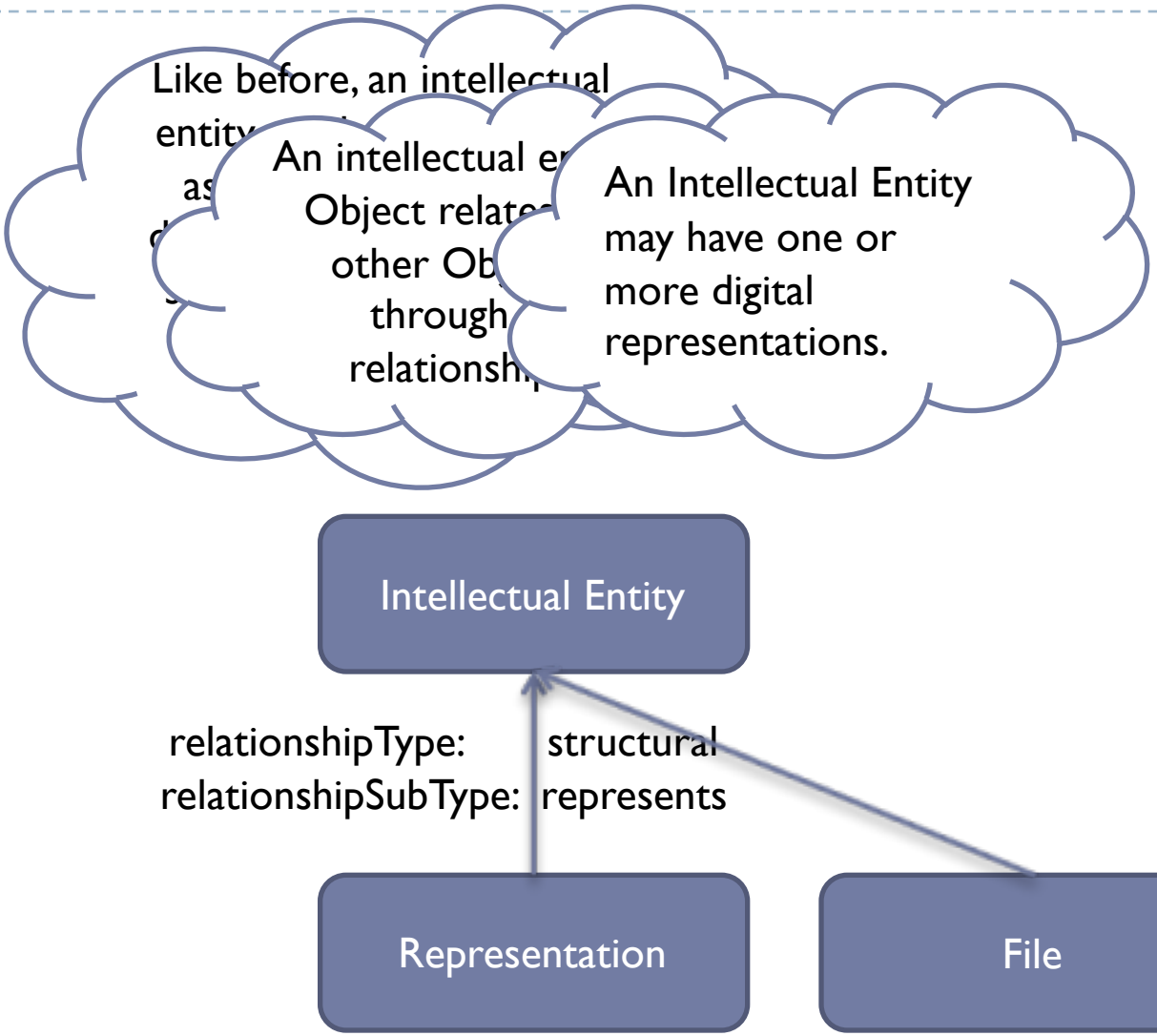
Approved Changes:
Make Intellectual Entity an Object category



- Relate to PREMIS Events and RightsStatements.
- Support structural and derivative relationships with Objects.
- Represent an aggregate, such as a collection, FRBR work, FRBR expression, fonds or series.
- Capture versioning information and metadata update events at the Intellectual Entity level
  as core provenance preservation metadata
- Associate business requirements with them.
  - Significant characteristics, risk definitions, guidelines for preservation actions, etc..

Approved Changes:
Make Intellectual Entity an Object category





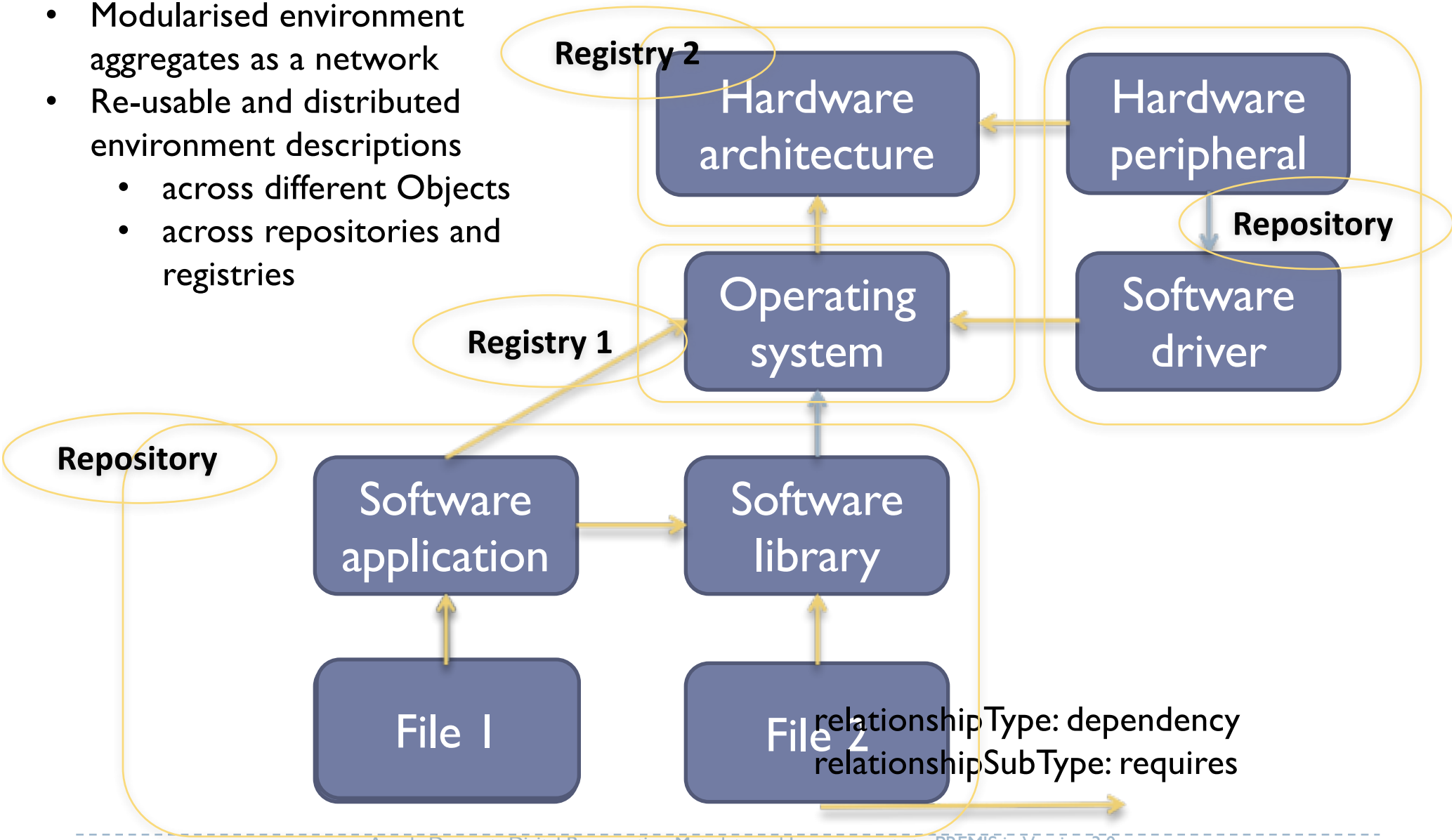
Approved Changes: Make Environments independent Objects

- What is needed to render or use an object
  - Operating system
  - Application software
  - Computing resources

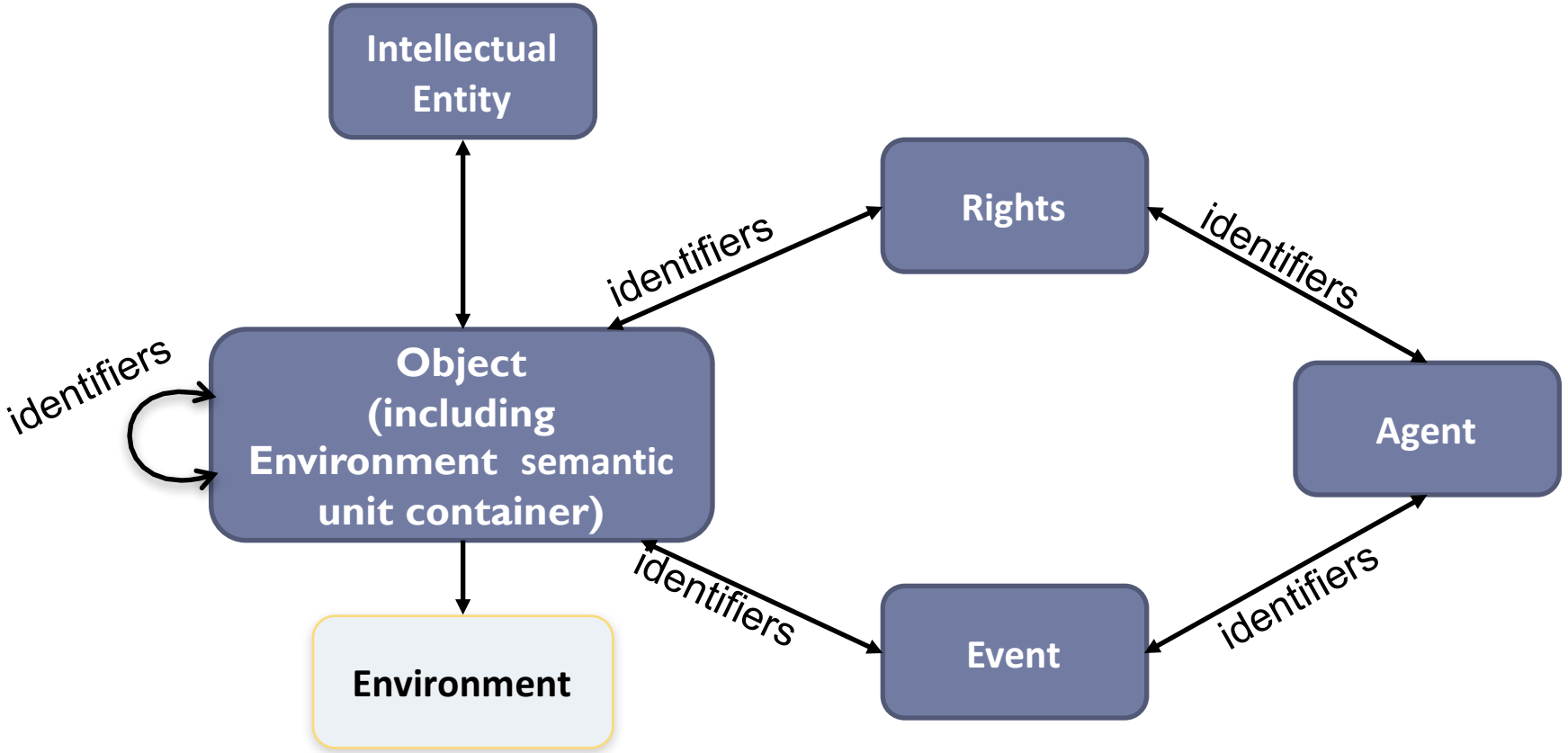
- A high-level data model
- **No** detailed characteristics specific to an environment type
- A standardized way of treating environments
- Sharable and exchangeable

Example: Environment stack and dependency relationships

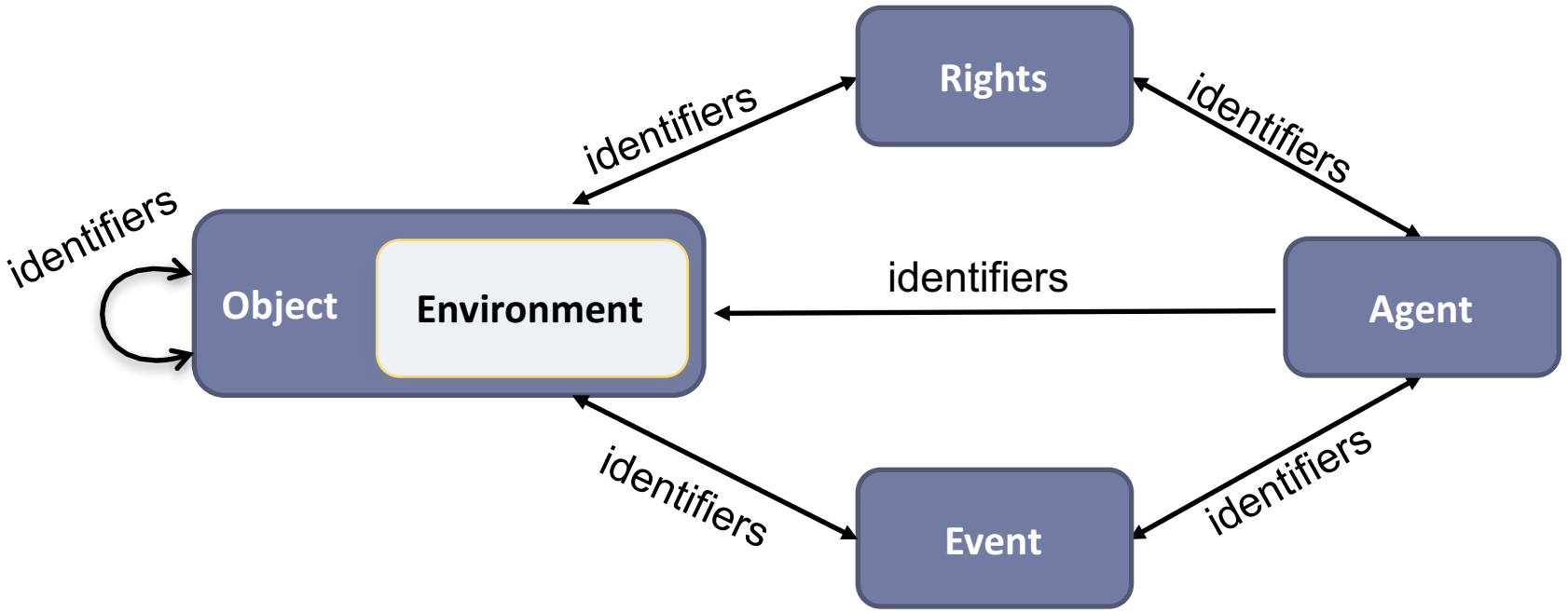
- Modularised environment aggregates as a network
- Re-usable and distributed environment descriptions
  - across different Objects
  - across repositories and registries



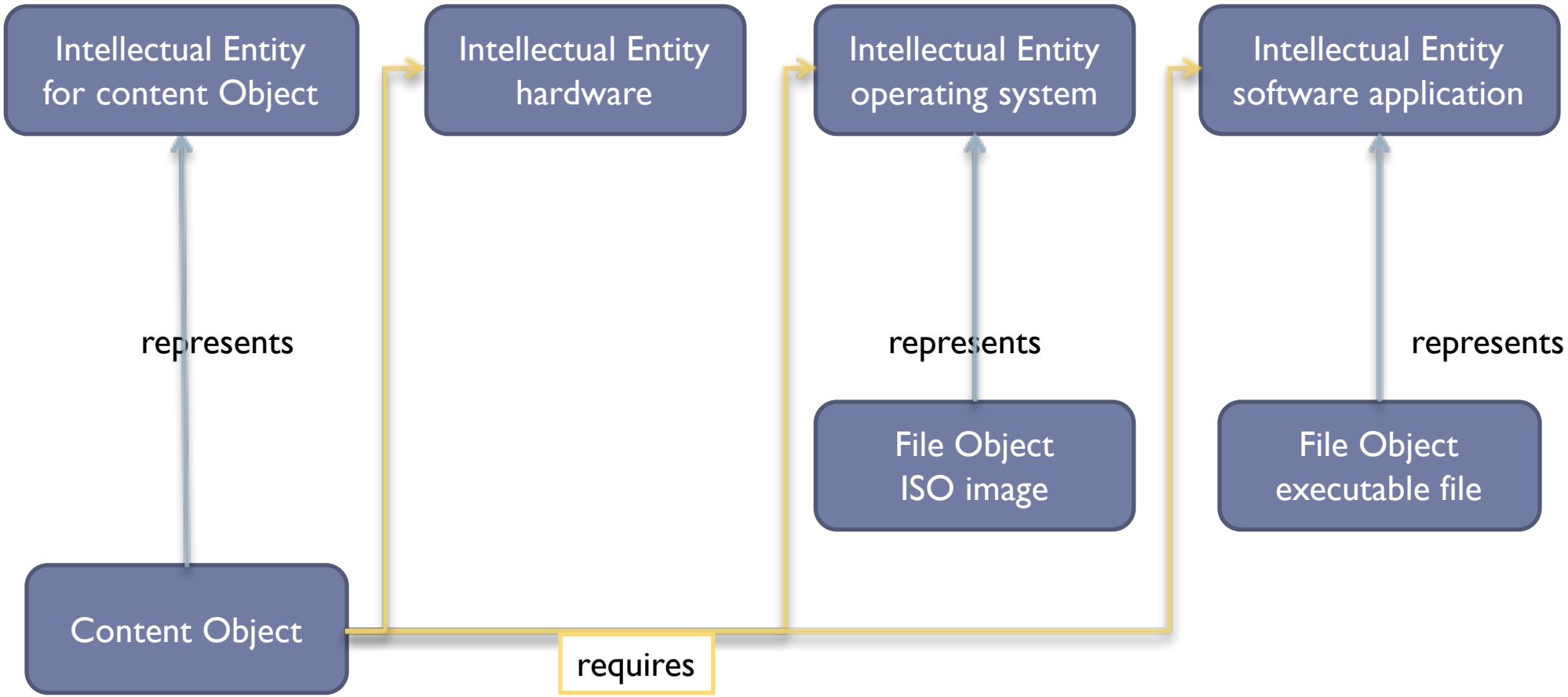
Data Model in PREMIS V2



Data Model in PREMIS V3

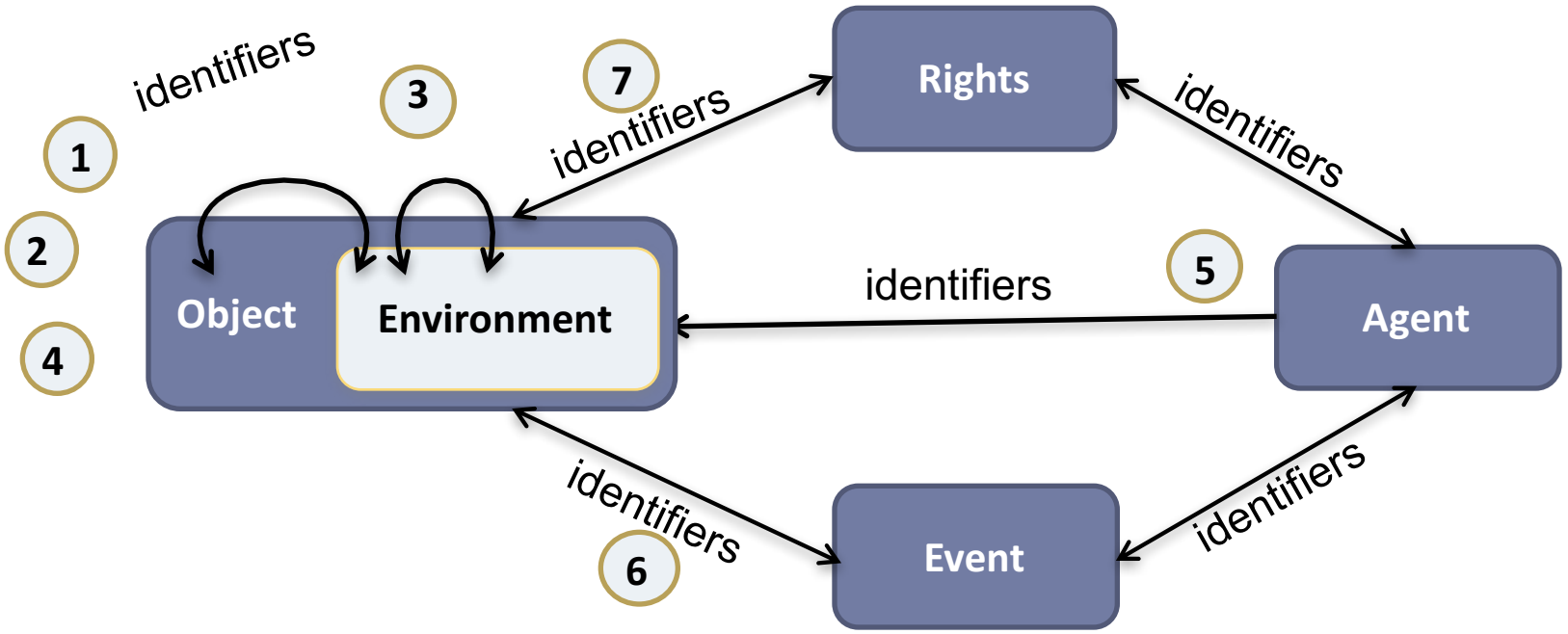


Example:
An object and its rendering environment



represents =
relationshipType: structural
relationshipSubType: represents

requires =
relationshipType: dependency
relationshipSubType: requires



1. Object to environment - specify computational context
2. environment to Object - documentation, specifications, surrogates
3. environment to environment - inclusion, dependency, derivation,other
4. environment is an Object – preserved software source code
5. Agent to Environment - role of an Agent
6. environment to Event - environment specific Events (provenance)
7. environment to RightsStatement - software license, policy

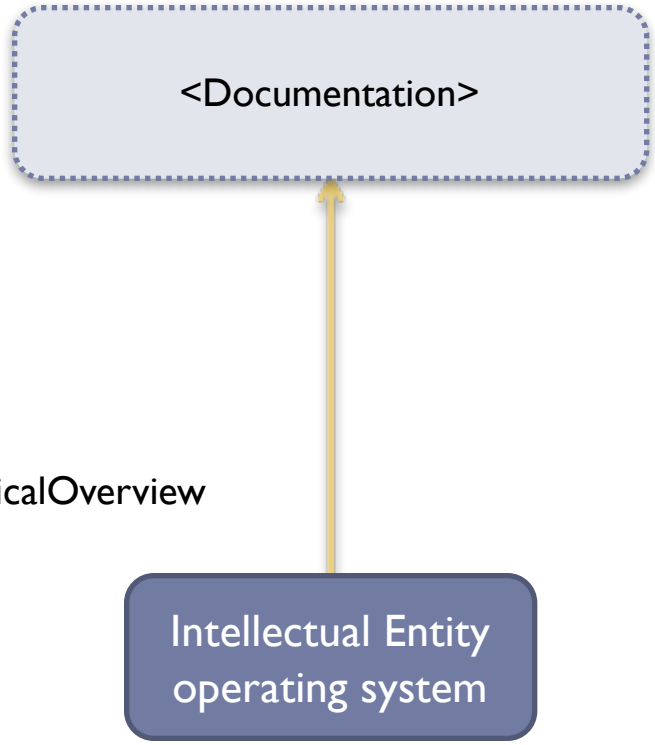
"Object": here a traditional content Object

Expanded relationship types for environment Objects

- Dependency
  - Requires, is required by
  - Is deployed on
- Derivation
  - Is source of, has source
- Logical
  - generalises,
    is generalised by
- Reference
  - Documents,
    is documented in
- Replacements
  - Supercedes,
    is superceded by
- Structural
  - Includes, is included in
  - Represents,
    is represented as

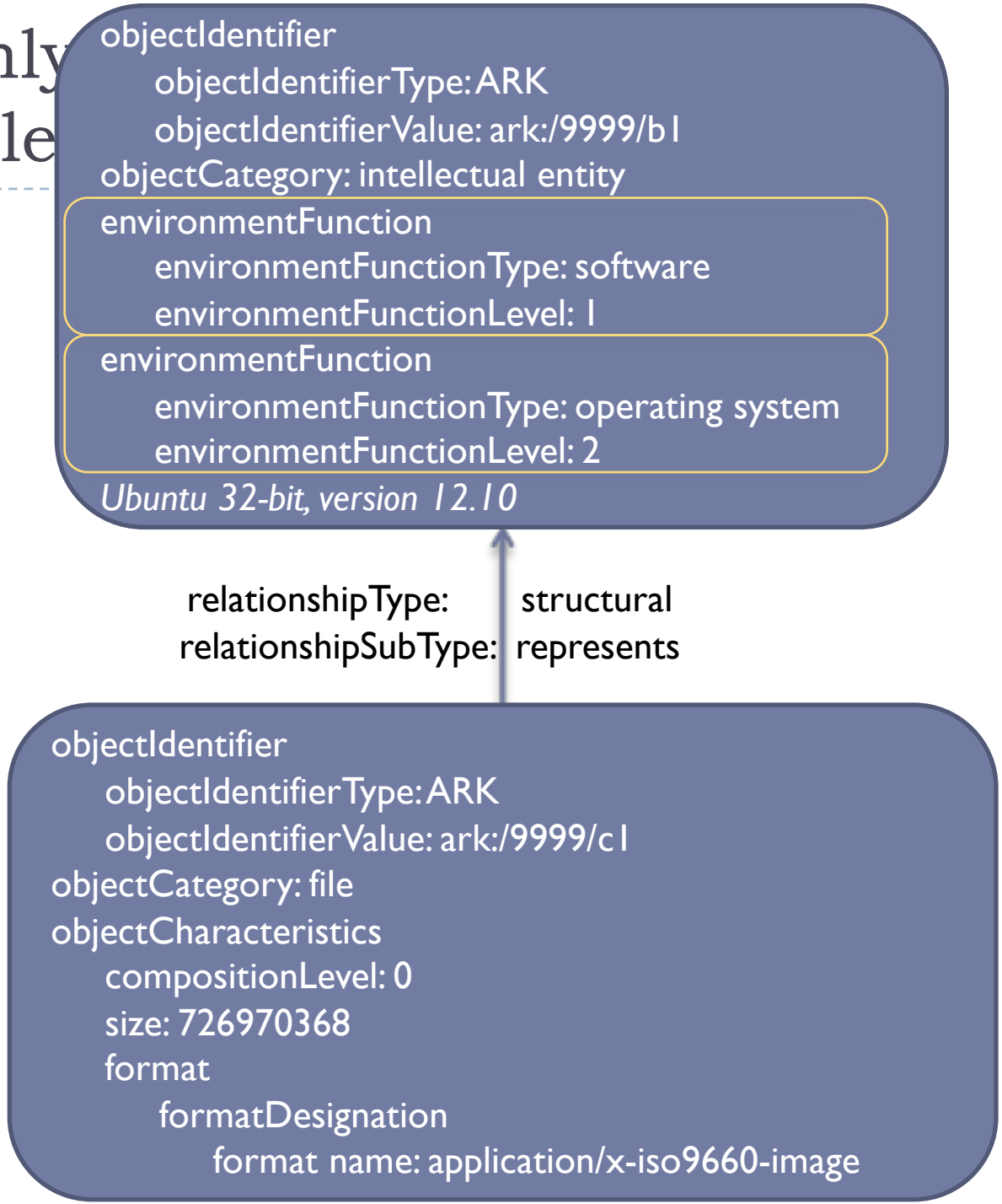
Expanded relationship types for environment Objects

relationshipType: reference
relationshipSubType: is documented in
relatedObjectIdentifier
    relatedObjectIdentifierType: URL
    relatedObjectIdentifierValue:
https://wiki.ubuntu.com/QuantalQuetzal/TechnicalOverview



Semantic units only environment Intelle

- 1.9 environmentFunction
  - environmentFunctionType
  - environmentFunctionLevel



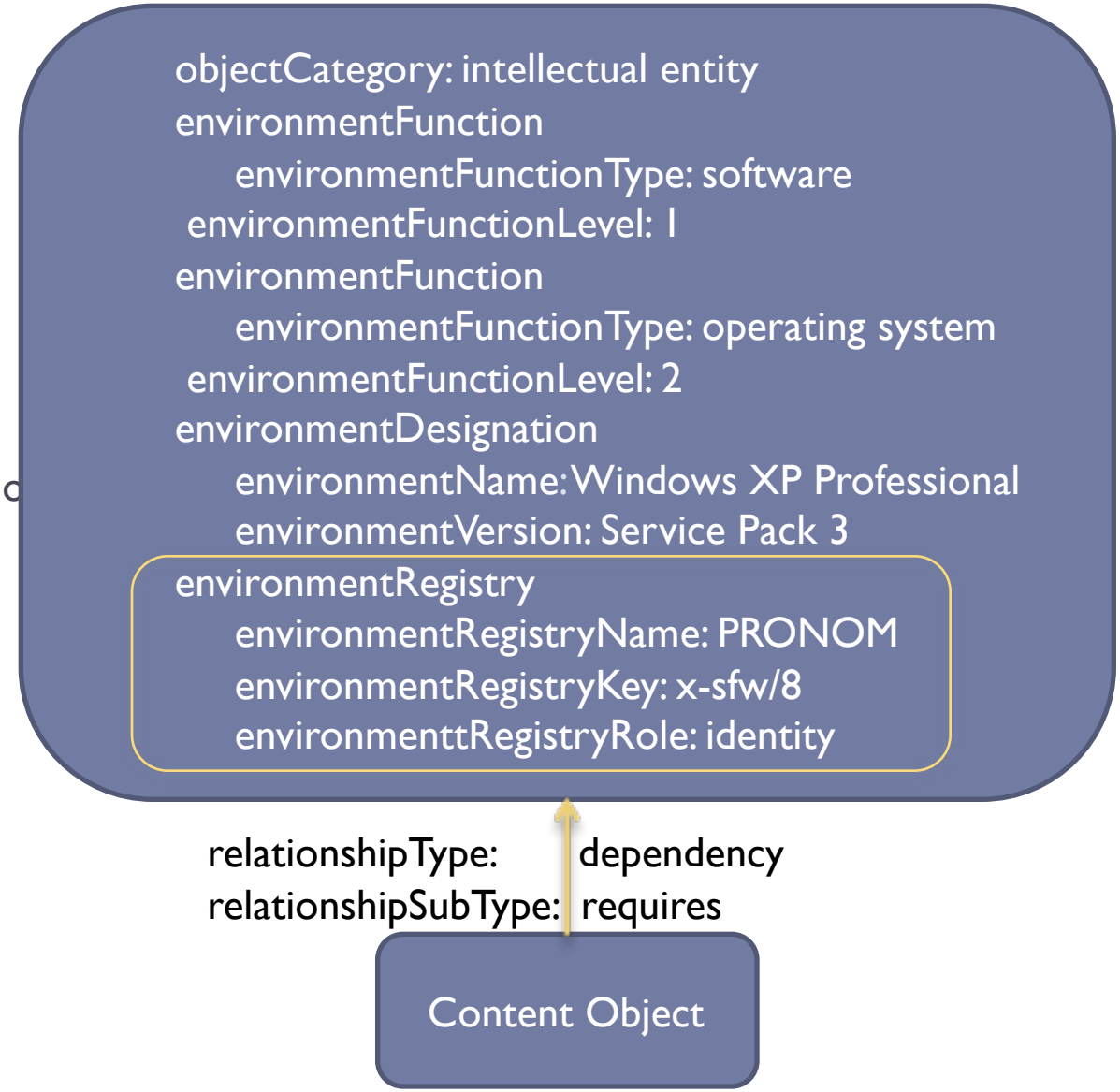
Semantic units only applicable to environment Intellectual Entities

- 1.9 environmentFunction
  - environmentFunctionType
  - environmentFunctionLevel
- 1.10 environmentDesignation
  - environmentName
  - environmentVersion
  - environmentOrigin
  - environmentDesignationNote
  - environmentDesignationExtension

objectCategory: intellectual entity
environmentFunction
environmentFunctionType: software
environmentFunctionLevel: 1
environmentFunction
environmentFunctionType: operating system
environmentFunctionLevel: 2
environmentDesignation
environmentName: Ubuntu
environmentVersion:Version: 12.10
environmentDesignationNote: 32-bit version
environmentDesignationNote: maintenance deadline: 2014-04
environmentDesignation
environmentName: Ubuntu
environmentVersion: Quantal Quetzal

Semantic units only applicable to environment Intellectual Entities

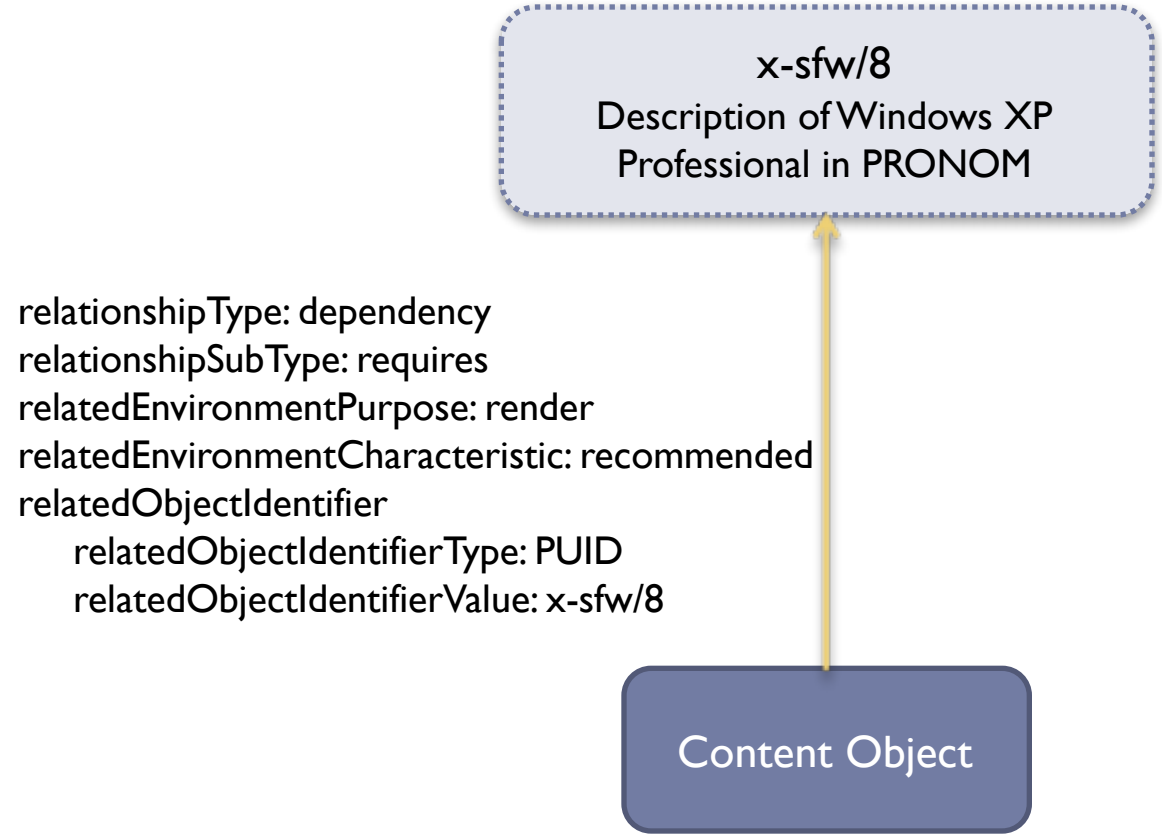
- 1.9 environmentFunction
  - environmentFunctionType
  - environmentFunctionLevel
- 1.10 environmentDesignation
  - environmentName
  - environmentVersion
  - environmentOrigin
  - environmentDesignationNote
  - environmentDesignationExtensio
- 1.11 environmentRegistry
  - environmentRegistryName
  - environmentRegistryKey
  - environmentRegistryRole



Semantic units only applicable to environment Intellectual Entities

- 1.9 environmentFunction
  - environmentFunctionType
  - environmentFunctionLevel
- 1.10 environmentDesignation
  - environmentName
  - environmentVersion
  - environmentOrigin
  - environmentDesignationNote
  - environmentDesignationExtension
- 1.11 environmentRegistry
  - environmentRegistryName
  - environmentRegistryKey
  - environmentRegistryRole
-
-
  -
  -

Alternative:
Link to an external registry



Semantic units only applicable to environment Intellectual Entities

- 1.9 environmentFunction
  - environmentFunctionType
  - environmentFunctionLevel
- 1.10 environmentDesignation
  - environmentName
  - environmentVersion
  - environmentOrigin
  - environmentDesignationNote
  - environmentDesignationExtension
- 1.11 environmentRegistry
  - environmentRegistryName
  - environmentRegistryKey
  - environmentRegistryRole
- 1.12 environmentExtension
- 1.13 relationship

…

  - relatedEnvironmentPurpose
  - relatedEnvironmentCharacteristic

objectCategory: intellectual entity
environmentFunction
environmentFunctionType: software
environmentFunctionLevel: 1
environmentFunction
environmentFunctionType: software application
environmentFunctionLevel: 2

Firefox 10.0

objectCategory: intellectual entity
environmentFunction
environmentFunctionType: software
environmentFunctionLevel: 1
environmentFunction
environmentFunctionType: software application
environmentFunctionLevel: 2

BlueGriffon 1.6

relationshipType: dependency
relationshipSubType: requires
relatedEnvironmentPurpose render
relatedEnvironmentCharacteristic: known to work

relationshipType: dependency
relationshipSubType : requires
relatedEnvironmentPurpose: create

1.13 relationship

- …
- relatedEnvironmentPurpose
- relatedEnvironmentCharacteristic

objectCategory: file
size: 72943
format
formatDesignation
formatName: text/html

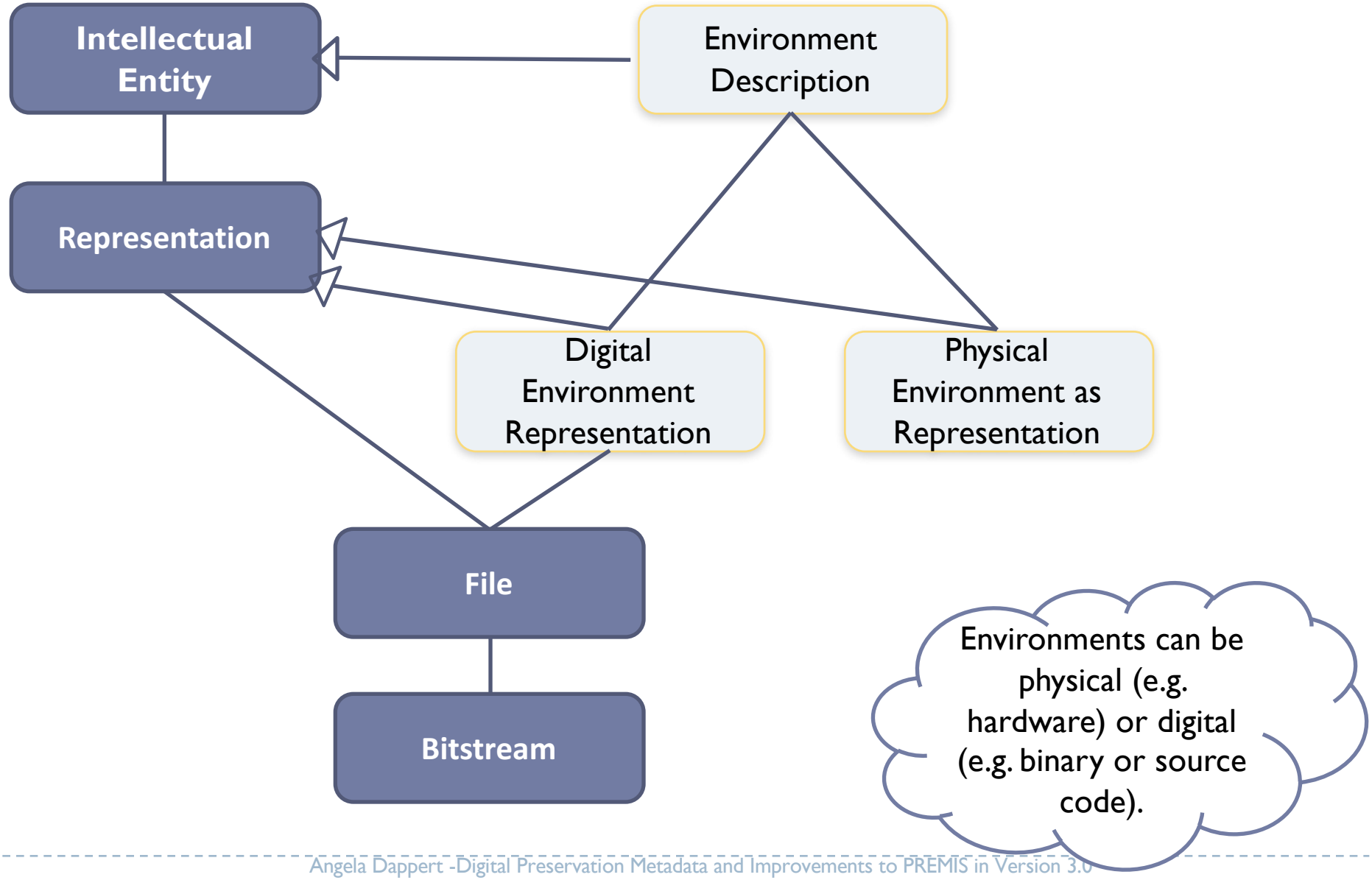
Approved Changes: Make Environments independent Objects

- Environments: i.e. hardware and software needed to use digital objects
- Described and preserved reusing the Object entity,
- Described as Intellectual Entities, preserved as Representation, File or Bitstream.
- Semantic units that are specific to Environment descriptions
  - Capture the function and designation of the Environment,
  - Link to descriptions in external registries.
- Represented as
  - Aggregate environments or as
  - Individual components of an environment (e.g. an executable file, a stylesheet);
- Relationships become important.
- Direct relationship between Agents and Objects to capture the Environment that acted as the Agent in an Event.

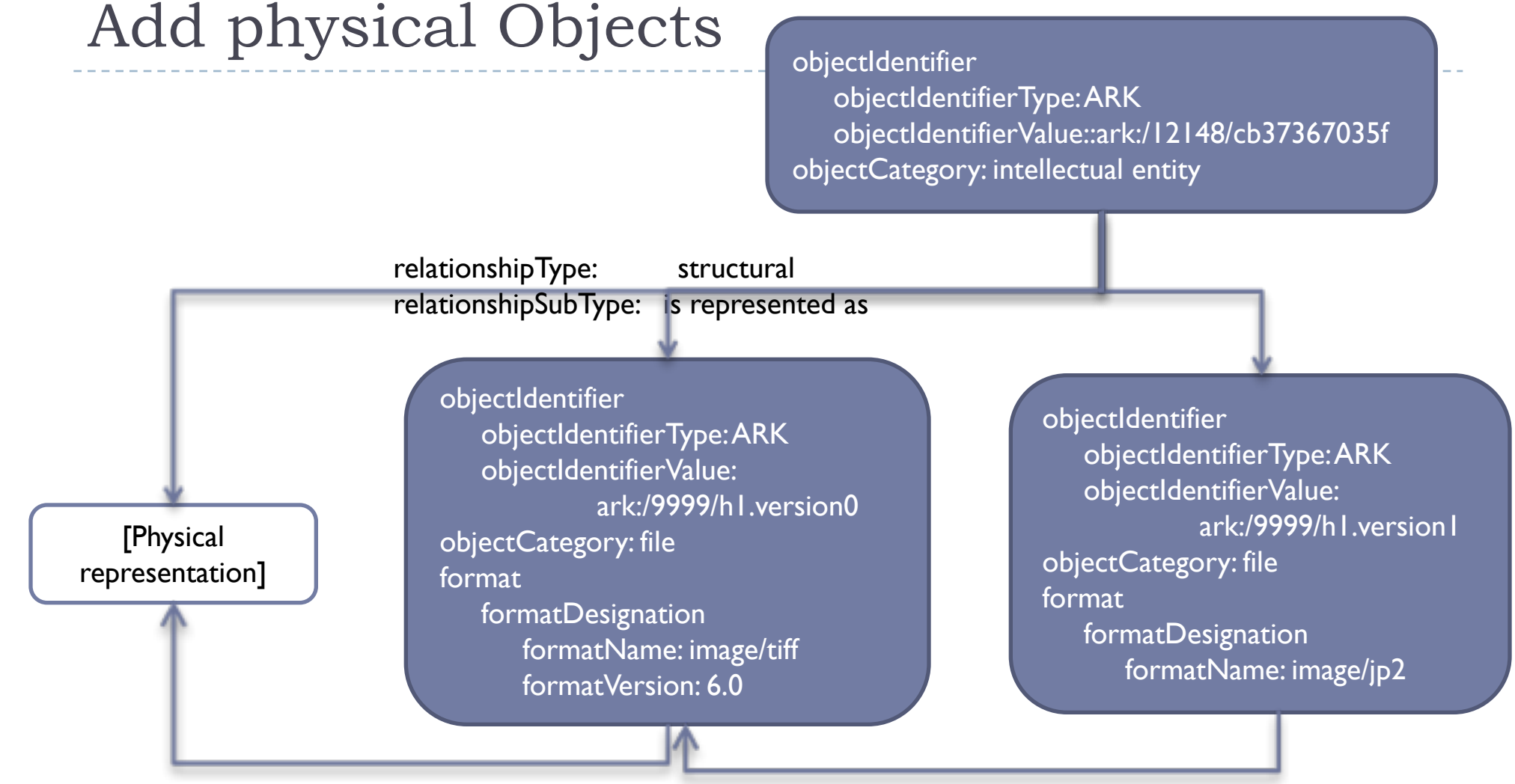
Approved Changes: Add physical Objects

- A physical Object is
  - A content Object, such as a manuscript, or printed document
  - An environment Object, such as a physical hardware device.
- Representation: A digital or physical Object
- Either one instantiates or embodies an Intellectual Entity
- Digital and non-digital Objects can be captured uniformly.
- Physical Objects can relate to digital Objects and other physical Objects.
- *In V3 storage* is applicable to Representations. For physical Representations: the physical location, e.g. a shelf location.

Approved Changes: Add physical Objects



Approved Changes: Add physical Objects



Approved Changes: Update conformance statement

- **Conformance statement**

Thank you!

- Resources: http://www.loc.gov/standards/premis/
- PREMIS Implementors Group Forum: PIG@listserv.loc.gov

55 minutes:

120 minutes: What is DP METADATA

15 minutes: what is PREMIS + examples of use

20 minutes: new features