e-Learning Context

E1. REPURPOSE—PRESERVE LINEAGE

A new learning object is generated. It is based on an extant learning object, but has a new authority and a new domain of application: it does not supplant the original object, because it no longer has the same function. The lineage of the document is preserved.

- A digital object is created and deposited.
- The digital object is assigned a (rigid) persistent identifier.
- A new digital object is created by a distinct author, with a distinct purpose, but based on the first object. The object content is revised to accommodate the new purpose. (This corresponds to the FRBR Work–to–Work relation Adaptation.)
- The new object metadata is revised to accommodate the new purpose. Unlike the UPDATE DRAFT—PRESERVE LINEAGE scenario, there is no need for an aggregate object encompassing both objects; the new object is truly distinct.
- A versioning/lineage service connects the two objects through their resolvable identifiers.
- The service can be queried by an end user to determine the provenance of an object.
    - The service may be queries by an end user in reverse, to list the objects derived from the source object. This is one type of "related object" query.

E2. CUSTOMISE—PRESERVE LINEAGE

A new learning object is generated. It is based on an extant learning object. The content is substantially the same, and the same document authority is maintained; but the content has a different expression, specific to a new locale. This can include changed cultural references, dialect adjustment, or language translation. The lineage of the document is preserved.

- A digital object is created and deposited.
- The digital object is assigned a (rigid) persistent identifier.
- A new digital object is created by a distinct author, but with the same purpose and (substantially) content, and based on the first object. This is a distinct expression of the same work, e.g. in a different language, or with different branding..

- The new object metadata is (minimally) revised to reflect the localisation.
- Like the UPDATE DRAFT—PRESERVE LINEAGE scenario, there may be a need for an aggregator object encompassing the two objects as the one FRBR Work.
- A versioning/lineage service connects original and localisation, and optionally their superordinate object, through their resolvable identifiers.
- The service can be queried by an end user to determine the provenance of an object.

Note

Such customisation is often call "localise" in e-Learning, but customisation is not limited to localisation.

This corresponds to the FRBR Expression–to–Expression relation Adaptation. FRBR distinguishes between adaptations and transformations, but transformations only involve change of literary form (e.g. novelisation, dramatisation). Customisation of learning object still results in something that is clearly a learning object, so there is no change in genre of the object.

E3. RELATED OBJECTS—PREREQUISITES

More generally than REPURPOSE, a commenter can decide that two objects are related through a chosen relation; e.g. prerequisite courses. The relation between the objects can be expressed through their identifiers, and exposed to query (e.g. through LOM Relation field).

- Two courses are digital learning objects with global identifiers.
- A teaching authority identifies course A as a prerequisite for course B in the context of curriculum C.
- This relation between A, B and C is stored as a relation between course and curriculum identifiers. (The relation corresponds to the FRBR relation Successor.)
- The relation is exposed to query on B, C: given a course and a curriculum, there is a service which will return all prerequisite courses.
- The query service is exposed to end users of the course repository. The metadata for a course exposed to the end user includes the prerequisite courses, not as static metadata embedded in the repository, but discovered through the discovery service.
- The service can have its own identifier. This means the service itself can be parameterised.

E4. OBJECT CERTIFICATION

A certification agency can certify particular digital objects, at a minimum through a yes/no service on the object identifier. As long as a range of certifiers use the same protocol, their services can be passed into a second order service (e.g. a federated search of certifications).

- A digital object is created and deposited, with an identifier.
- A certification agency accesses the object, and decides it meets their certification requirements.
- The agency informs the world of this by presenting a service. This certification service takes an object identifier, and returns whether it is certified by the agency.
- The object repository can use the certification service to display whether the object has been certified by the given agency.
- The services have their own identifiers; they resolve to the service accessor protocol, with a placeholder for the object identifier parameter.
- A series of certification authorities is known, each offering its own certification service. Each service has its own identifier.
- The repository, given the object identifier, can iterate through the identifiers for the individual certification services, to construct a separate certification service request for each agency.

E5. ANNOTATION

An object is in a repository, which also stores certain metadata about the object. Someone annotates the object, contributing additional metadata. This annotation is entered into the repository, and is keyed to its referent through the object identifier. (Value-added metadata also follows this scenario.)

- A digital object is created and deposited, with an identifier.
- A commenter access the object through the identifier.
- The commenter writes new metadata about the object, following a given metadata scheme.
- The metadata is stored in the repository.
- The metadata is linked to the item it refers to through the item identifier.
- Queries targeting the annotation metadata will resolve to the item they refer to.

E6. THIRD-PARTY REVIEW

The National Library has created identifiers for several books, which are discoverable. A third party book review site can use those identifiers as the parameters of a service resolving to its book reviews about the respective books. Those reviews are metadata about the content object; but unlike ANNOTATION, the object and metadata do not reside in the same repository, nor do they lie under the same authority. This allows third parties to construct their own metadata about an object, without any dependence on the object repository.

- The book *A Short History of Arrows* comes out from Arrow Press.
- The book is assigned an identifier by some authority.
- Someone writes a review of the book on the review site reviewsRus.com.
- The review site offers a service whereby the book's NLA identifier is mapped to the site's review.
    - The review, as data, may have its own identifier. The review is brought up through a service operating on the book's identifier; but that service could act as a resolver to the review identifier. E.g. my review of the book doi:12.73/27830 could be called up as http://reviewersRus.com/doi/12.73/27830 .
- The third-party metadata enabled through global identifiers allows mashups. I can use the common identifier to create a portal showing both Amazon and reviewersRus.com reviews for the same book; or both OCLC and NLA bibliographical records.

E7. PERIPATETIC ACADEMIC

An academic changes institutions. They reuse a digital object they've originally created in the Learning Management System (LMS) at their new job. This is a derivative work (localisation), preserving the same author, but with a different authority (different employer).

- Academic Jane creates a learning object at Duck Uni. It is deposited at the Duck U LMS with a global identifier.
- Jane retains the rights to create derivative works.
- Jane's contract concludes, and she ends up at Gander Uni.
- Jane has an (unofficial) copy of her learning object, which she customises (localises) to Gander Uni requirements.
- Jane publishes the customised object at the Gander Uni LMS, with a distinct identifier.

- Per CUSTOMISE scenario, the provenance of the Gander Uni object from the Duck Uni object is acknowledged, and discoverable through a Relationship Service.
- The Relationship Service does not provide accessioning: a student at Duck Uni can discover that there is a more up-to-date version of the object now at Gander U, but they are not allowed to access it.
- Either Jane or Duck Uni pull the Duck Uni course from the Duck U LMS. The provenance is preserved in the relationship service, because the identifier is persistent and has not been destroyed. The metadata about the obsoleted course may still exposed, though the learning object itself is not.
- Jane's course goes commercial: her new employer gets the exposed metadata about her old course pulled, to preserve market advantage. The identifier still survives in the wild; though it is no longer actionable, and the provenance may still be reconstructed.

E8. DIGITAL SIGNATURE

In digital rights management, identifiers are rigid, and cannot point to any unauthorized modifications of the thing identified. Persistence of association is vital to the business model (I need to verify that this identifier is used to point to my version of the content, before I release my metadata about it). To that end, a hash function can be used on the authorized document version to generate a message digest, which can be encrypted into a digital signature (http://www.youdzone.com/signature.html). Both the message digest and the digital signature can be treated as metadata, accessed via a digital signature service, and dynamically updated while being kept apart from the document itself.

- A digital object is created and has a rigid identifier assigned to it.
- A message digest of the digital object datastream is created through hashing, and encrypted.
- The public key for the message digest encryption, and the encrypted digest itself, are metadata.
- A digital signature resolution service is provided, mapping object identifier to digital signature of object (as metadata).
- An end user can access the digital signature of the object via the resolution service, and determine the integrity of the object.

Note

Beyond digital rights management, digital signatures can be used whenever the integrity of an object needs to be assured. For instance, for accountability in e-Research, all digital objects used (including logs and observations) need to be signed and logged.

E9. ASSETS INTO LEARNING OBJECT

An instructor uses an asset with a global identifier in a learning object. The instructor queries the policy for fair use of the asset. The asset can only be used excerpted: 5 mins out of the movie. The movie clip is a distinct digital object from the original movie, but they are related, and that relation must be queryable for policing rights management (rights ownership discovery, rights clearance, rights usage reporting).

- I wish to use *Apocalypse Now* in my course on film cliché. *Apocalypse Now* has an identifier.
- The Uni copyright office has a service whereby the fair use policies for a given learning asset can be queried.
- I query the service on the *Apocalypse Now* ID, and discover I can only use two clips adding up to 10% of the movie.
- I create two clips, adding up to 9%. Each is a distinct digital object, and each gets its own ID. The ID must be persistent, since the LMS keeps migrating.
- The clips are distinct expressions of the work, not new works. (According to the FRBR standard, extracts do not involve "a significant degree of independent intellectual or artistic effort", which define a new work). Their provenance from the original work must be discoverable for reasons of copyright compliance.
- A relationship service, given the ID of the clip, provides the ID of the original work (or whatever work/expression/manifestation is subject to copyright), and for the purposes of the particular copyright policy, time length proportional to the original.
- Copyright owners must be able to discover, for every online course offered in the LMS:
  - The IDs of the learning assets.
  - The IDs of the copyright objects they derive from.
  - Whether, within the given course, the assets add up to less than the fair use percentage.
  - The ID must be resolvable by the copyright enforcer, given the concern over substantiality of the excerpt (http://en.wikipedia.org/wiki/Fair_use#Amount_and_substantiality): the enforcer must determine for themselves whether the excerpt is substantial enough that it still violates fair use, as a qualitative rather than quantitative evaluation.

Note

There is no reason to think that, once we get into the commercial domain, a single identifier scheme will have universal application, however widely used it is. For instance, the music industry has already come up with a Global Release Identifier (GRId) for electronically distributed music

(http://212.134.114.163/grid/grid-faq.html) . It would be pointless and infeasible for a national identfier system to gather up all pertinent GRId identifiers, and rebrand them as Handles. The compliance policies of the rights holder may demand use of the pre-existing commercial identifier in pertinent services, especially if the identifier is used in content fingerprinting.

The use of common identifiers between metadata schemes reduces $O(n^2)$ mappings between metadata schemes required in policing digital rights to O(n), as Paskin points out (sect. 3.3).

E10. IDENTIFY RIGHTS-HOLDER

If a digital media object is identified for the purpose of enforcing digital rights, the digital rights-holder must also be identified, and the mapping of object to rights-holder available as a service to the agency collecting royalties revenue. (Paskin Use Case #9)

- Digital object has global identifier used to police digital rights management.
- The party claiming revenue on object use is identified by the rights enforcer as the legal person to receive the revenue.
- Since the party is identified, the party has an identifier.
- As part of its business, the rights enforcer can identify the rights-holder of any object in its jurisdiction. That means there is a service mapping object identifier to rights-holder identifier. That service is accessible to the rights enforcer.
- The rights enforcer can resolve the rights-holder identifier to attributes useful to them; this would normally be a contact address.
- The service mapping object to rights-holder need not be exposed to the public.

Note

Paskin identifies the scenario for disambiguating digital rights holders (the "which John Williams?" problem: http://en.wikipedia.org/wiki/John_Williams_%28disambiguation%29) as a gap in the DRM system. The desired International Standard Interested Party Identifier has still not been realised, and is subject to privacy concerns.

Fedmark is a Handles-based initiative out of Redmond to identify digital rights-holders, applied to digital photos in the first instance.

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