

An e-Learning Framework

A Summary

A Paper prepared on behalf of

DEST (Australia), JISC-CETIS (UK), and Industry Canada

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1 Developing an e-Learning Framework

This Framework began life within JISC as a way of making sense of its funded development activities within the learning and teaching space, and to focus future efforts. In May 2004, JISC, DEST and Industry Canada agreed to collaborate on testing the potential of an expanded JISC framework with a view to becoming an international e-Learning Framework. A meeting convened under this agreement at the end of May (including Dan Rehak from the Carnegie-Mellon Learning Systems Architecture Lab) resulted in a revised version of the framework, taking into account a broader set of use cases.

This e-Learning Framework is based on a service-oriented factoring of a set of distributed core services required to support e-Learning applications, portals and other user agents. Each service defined by the Framework is envisaged as being provided as a networked service within an organisation, typically using either Web Services or a REST-style HTTP protocol.

The ultimate aim of the Framework is, for each identified service, to be able to reference one or more open specifications or standards that can be used in the implementation the service, and also to be able to provide open-source implementation toolkits such as Java and C# code libraries to assist developers in creating instances of the service.

The intention is not to provide a blueprint for an open-source solution, but rather to facilitate the integration of commercial, home-grown, and open source components and applications within institutions and regional federations, by agreeing upon common service definitions, behaviours, data models, and protocols.

This paper provides a quick overview of the services identified so far within the e-Learning Framework activity. To see the current state of the e-Learning Framework, and look at the details of the service definitions, go to <http://www.cetis.ac.uk:8080/frameworks>

2 Overview of services

The framework is based on a service-oriented approach. The collaborating partners believe that this approach best supports the business goals of the framework to provide benefits to teachers, learners, administrators and institutions. The accompanying paper "Service-Oriented Frameworks: Modelling the infrastructure for the next generation of e-Learning" explains the benefit to be expected from the approach, and the additional activities required to realise these benefits. The model on the following page (Figure 1) shows the set of services defined within the framework. The upper sets of boxes identify services specifically within the domain of e-learning; the lower sets identify services that may be common across multiple application domains. The services are clustered into logical groups to aid readability, however there are no dependencies or explicit associations between service definitions¹.

The full framework documentation includes the context of applications which utilise these services and supporting infrastructure.

¹ In practice, if several services with similar capabilities are exposed in an environment, the service interfaces may be realized using a shared implementation; for example, Presence, Context, Chat, and AV Conferencing services could all be managed using a single Jabber server.

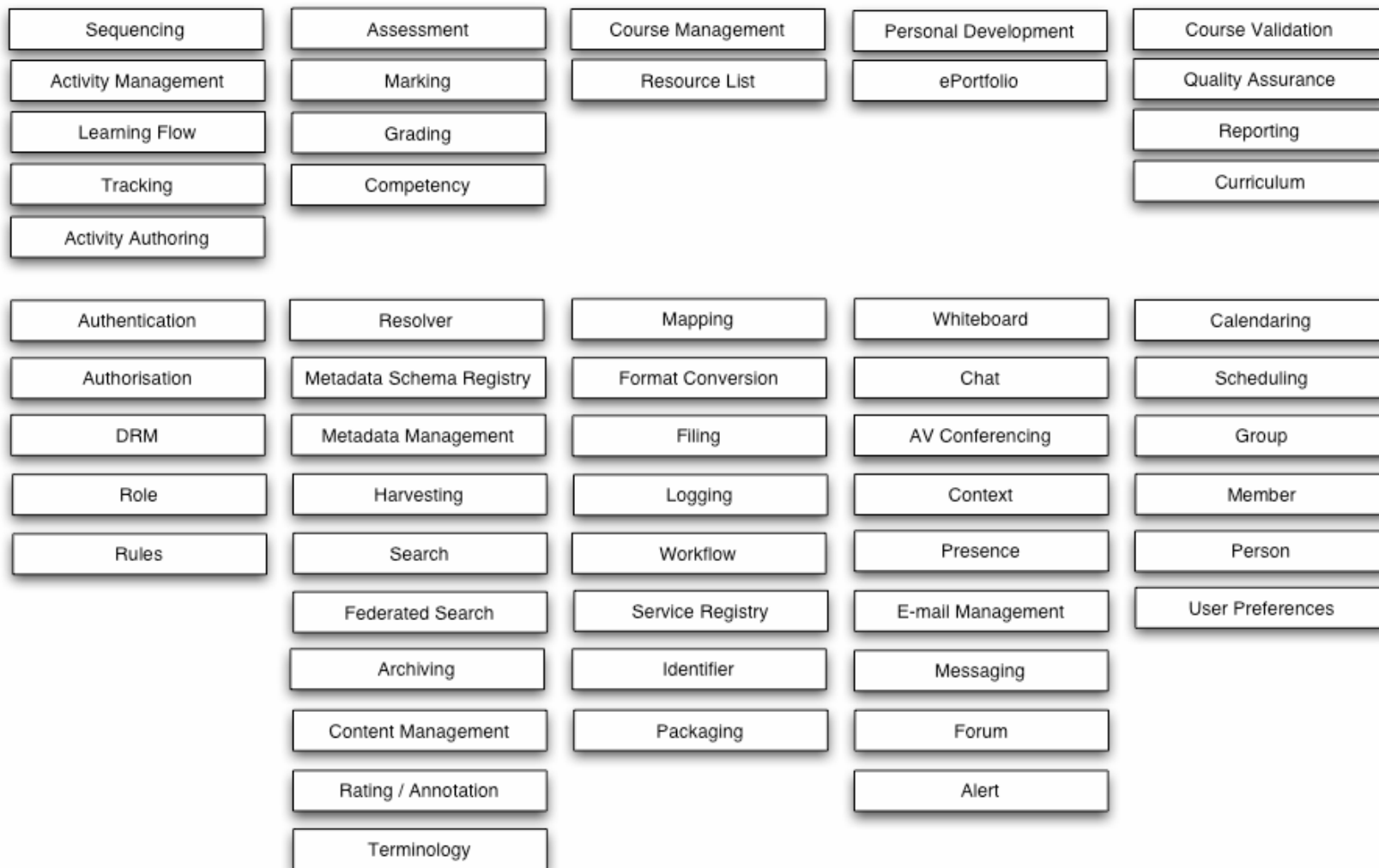


Figure 1 - e-Learning Framework - Services

3 Service Descriptions

Below are brief descriptions of the services shown in the diagram²:

3.1 Application Services

Activity Author

Supports the process of creating learning activities.

Activity Management

Supports the management of learning activities.

Assessment

Supports the delivery and scoring of assessments.

Competency

Supports the management of competency frameworks, and the mapping of units of learning, assessments, and activities against specific competencies and competency definitions.

Course Management

Supports management of courses, modules and other units of learning.

Course Validation

Supports the lifecycle of course proposal, approval, certification and validation.

Curriculum

Supports curriculum development and access to curriculum structures and properties.

ePortfolio

Supports the management of artefacts created by learners, such as essays and projects, and evidence records such as formal transcripts of achievements.

Grading

Supports the submission of grades against courses, modules, and other units of learning.

Learning Flow

Supports the management and use of complex learning scenarios.

Marking

Provides automated marking (assessment) services. It could also support a drop-box method for traditional artefact-based assessment.

Personal Development

Supports the management of a learner's personal development plans and personal development records.

Quality Assurance

Supports the recording and retrieval of quality assurance statements, such as second marking of assessments and approval of content for use in courses.

² Although some of these services have names in common with existing specifications, these service descriptions may have significantly larger scope.

Reporting

Provides standardised institutional (performance) data to outside agencies.

Resource List

Supports the creation, access to, and management of reading lists and other lists of resources.

Sequencing

A sequencing service provides support for the use of sequenced learning objects, primarily of use within LMS/VLEs and similar environments for the delivery of complex learning experiences.

Tracking

Supports recording and retrieval of performance information; typically this is as a result of students undertaking learning activities or interacting with materials.

3.2 Common Services**Alert**

Allows dissemination of news, updates, and announcements.

Archiving

Supports the long-term preservation (and managed destruction, if appropriate) of materials.

Authentication

Allows the identity of agents to be established.

Authorisation

Allows the rights and permissions of agents to be established and supports the management of access to resources

AV conferencing

One of the collaborative services; includes functions like audio and videoconferencing.

Calendaring

Supports the sharing of calendars, such as personal calendars and course timetables.

Chat

Manages one on one messaging as well as multi-user chat.

Content Management

Supports the storage, publishing, retrieval, description, and organisation of information resources, including their lifecycle management.

Context

Supports accessing information about the nature of the activity a user is currently engaging in, such as the module or activity that a student is accessing within a learning system, in relation to information about the user such as role, subject expertise etc. Also supports registering and deregistering of context by applications.

Digital Rights Management (DRM)

Supports the allocation and application of rights policies against resources, consuming data in a digital rights expression language (DREL) to determine access. Typically, DRM works in conjunction with Authorization services, and is generally intended to be called by Authorization implementations as the result of a request to use a resource.

E-mail management

Supports email management.

Federated Search

Supports the processing of searches that target multiple types of repository, such as a combined search using SRW, XQuery and Z39.50 protocols against repositories supporting a range of different metadata formats the results from which are then aggregated for presentation to the consumer. Contrast with Search service, which is aimed at supporting searches using an agreed Query Grammar over a single repository.

Filing

Supports access to remote storage facilities, such as a SAN or central RAID, for storage and retrieval of arbitrary data sets. For long-term preservation of materials, an Archiving service should be used instead.

Format Conversion

Supports transformation of information from one format to another, for example, from IMS Content Packaging to METS.

Forum

Supports the use of asynchronous collaborative messaging, as offered by Web forums and message boards.

Group

Supports access to information about groups, including courses, modules, activities, seminar groups, teams, and departments.

Harvesting

Supports harvesting copies of some or all metadata and/or resources.

Identifier

Supports the creation, registering and deregistering of identifiers for objects.

Logging

Supports generic logging service for applications.

Mapping

Supports cross-mapping of values in different namespaces, such as crosswalks between metadata schema.

Member

Supports the management of membership of persons in groups, such as student enrolment on modules.

Messaging

Allows broadcast of messages to users and groups using appropriate communication technology.

Metadata Management

Supports the management of metadata for objects, including creation, validation and retrieval.

Metadata Schema Registry

Supports the registration of metadata schemas, including obtaining definitions of elements.

Packaging

Supports the assembly of packages of information resources by aggregation and disaggregation, their preparation for transport and delivery, and the ingestion and disassembly of those packages.

Person

Provides a means to manage basic information about people, such as names, contact information, and perhaps some types of demographic and system management information, such as would typically be stored in a directory.

Presence

Provides information about a user's on-line status, much like a chat application.

Rating / Annotation

Provides support for the creation, management and use of secondary metadata (user ratings and text annotations).

Resolver

Provides services based on the use of identifiers or other metadata and knowledge of the current locations for items including redirection to digital repositories, document delivery services, redirection to online bookshops, to local library services, and other discovery activities

Role

Supports the management of role types, whether for access management (security roles) or organisational management (job roles) purposes.

Rules

Supports access to, creation, and management of rules and policies, such as may be used within access management or workflow processing. Rules may be machine readable or human readable.

Scheduling

Supports the management of allocation of resources against time, such as rooms, people and equipment.

Search

Supports the finding of information resources including learning objects, assets, e-reserves, learning opportunities, funding sources and so on. Search will typically target a single query grammar (such as SRW for library resources) although a Search service can support multiple search types that can be selected from by consumers. For searches that aggregate results from across multiple types of search, a Federated Search service should be used instead.

Service Registry

Supports discovery of available services.

Terminology

Provides automated, machine-readable mappings between terms, either within a particular thesaurus or across multiple thesauri or classification schemes.

User Preferences

Provides machine-readable information about users' personal preferences.

Whiteboard

Supports the use of collaborative tools that focus on shared editing and idea sharing, such as electronic whiteboards.

Workflow

Supports generic workflow management.

3.3 Definitions of individual services

Each service in this Framework consists of:

- A simple description of the functions the service supports
- A scope and definition statement which provides more detailed requirements
- A specification matrix, which addresses:
 - o Data Representation
 - o Interface
 - o Service Definition
- Files, such as guides on best practice and patterns for implementation
- Links to projects that investigate use of this service
- A discussion forum

3.3.1 Example: Group service

The key functions for a Group management service are:

- Support creating, reading, updating and deleting one or more group
- Support querying for groups of a certain type or criteria

Additionally such a service should also support queries as to the types of Group it supports.

The Group service may be implemented using the Enterprise Services specification, specifically:

- **Data Representation** the Group and Groups UML static structure models from the IMS Enterprise Services specification Group Information Model document should be used to represent Group instances, and Groups as collections, respectively. Where such data is exchanged using XML, the XML schema binding for these classes defined by IMS should be used.
- **Interface** The Group Management and Groups Management UML Interface models from the IMS Enterprise Services specification Group Information Model document should be used for defining any APIs to support a Group service.
- **Service** The IMS Enterprise Services Web Service bindings for Group Management and Groups Management should be used to implement a Group service as a Web Service using WSDL and SOAP.

4 Gap Analysis

Looking over the set of services, it is possible to identify where there are open standards that can support service implementation. The accompanying paper "Service-Oriented Frameworks: Modelling the infrastructure for the next generation of e-Learning" discusses in more detail the set of standards components required for complete service definitions.

However, for the most part the specifications available only cover part of the solution, e.g., while there is a Sequencing data specification, there is no specification for a sequencing service; or the specification does not yet cover the full functionality required, e.g., the Resource List Interoperability specification only covers the exchange of a self contained resource list.

Where services have some form of open standard, these are highlighted in light grey in the diagram on the next page. Where a complete set of open standards – including both data models and service definitions – is available, the service is highlighted in dark grey with white text.

Note that some services that do not yet have any standards indicated by light grey shading may have definitions defined by a community of practice. However, we have not shaded these services in this analysis as the definitions have not yet been submitted to an open standards process.

The framework will be living document, requiring ongoing updates and validation to identify issues and gaps in service factoring and incorporate progress in standardisation.

5 Current work

JISC is currently funding a range of projects aimed at exploring areas of functionality defined in the framework, specifically by developing toolkits and libraries, and exploring the use of open standards. The diagram on the following page highlights the areas covered by the current set of active projects, which will be completed in October. There will be at least two subsequent waves of development projects building on this initial work and expanding the range of services addressed.

Services addressed by current projects have black backgrounds, white italicized text, and a dashed border.

It is the intention of the collaboration partners to use the Framework as a strategic tool e.g., to identify potential areas for collaboration, prioritise investment in standardisation efforts; and provide a vehicle for developing services and tools based upon open standards that support the core functions of education.

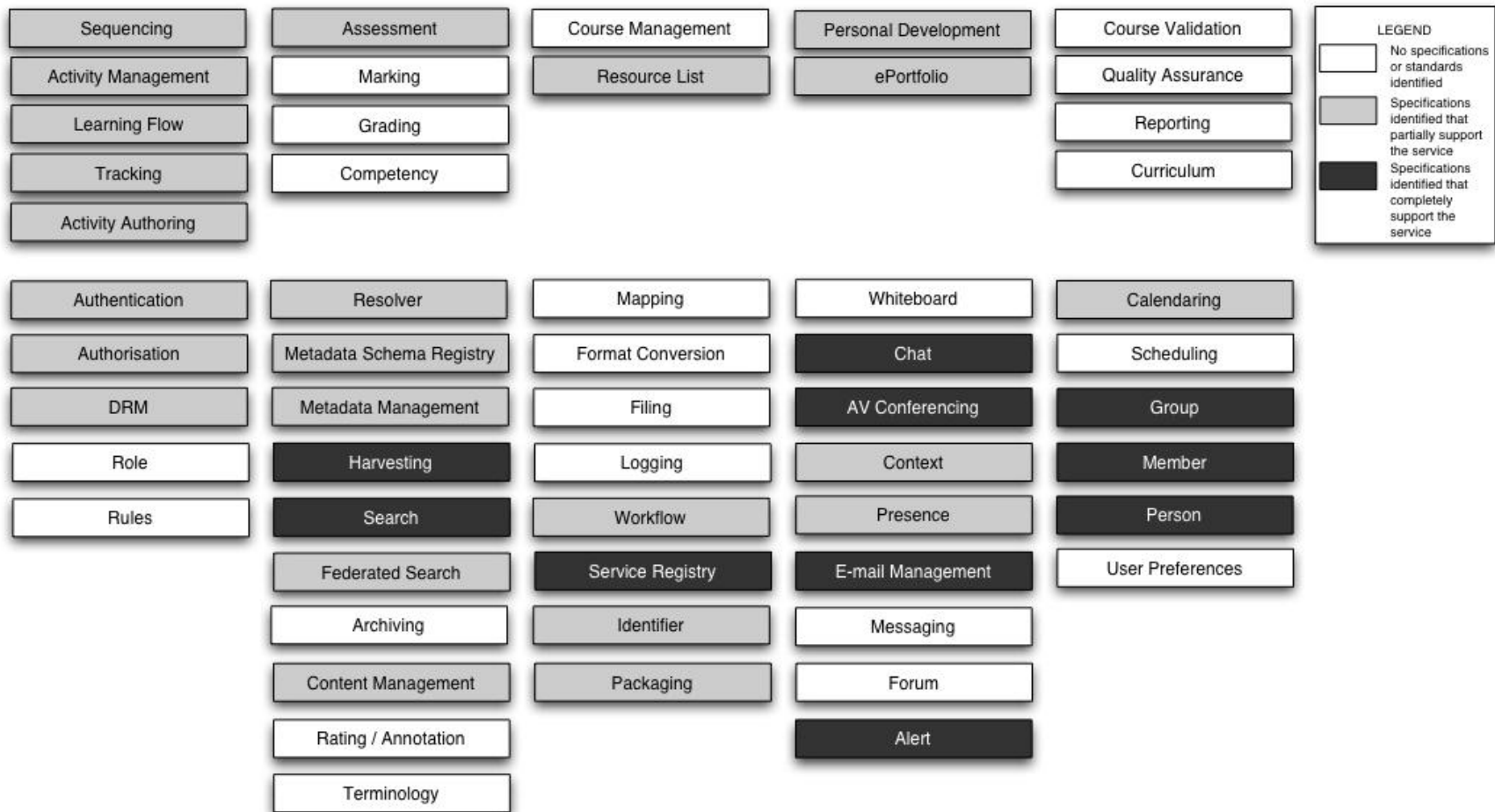


Figure 2 - Gap Analysis

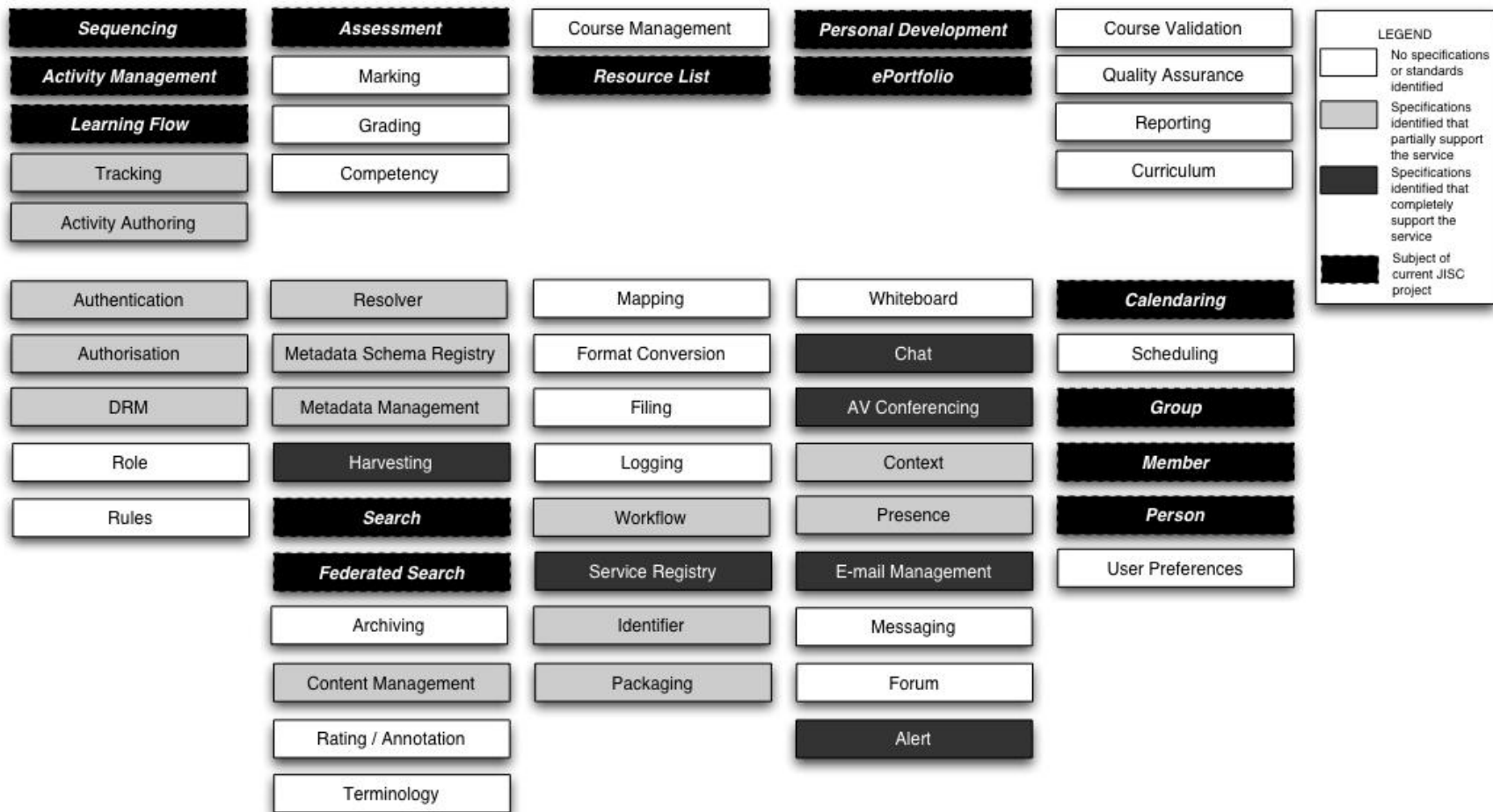


Figure 3 - Current JISC Projects