

Service Usage Model: ADL Environment

Intellectual Property Rights Statement: This Service Usage Model is a derivative work. This work was created by the Learning Systems Architecture Lab.

The Service Usage Model is derived from work created as part of the Evolving the JADL Integrated Prototype Architecture: Alignment with the e-Framework project within the Workforce ADL Co-Lab. The JADL IPA project was funded in part by the Joint ADL Co-Lab under contract N61339-06-C-0082. Any opinions, findings, conclusions or recommendations expressed herein are those of the author(s) and do not reflect the views of the U.S. Government, the University of Memphis or other project sponsors.

The template structure and format of this document are based on the Service Usage Model Description document from the Evolving the JADL Integrated Prototype Architecture: Alignment with the e-Framework Technical Report. This work was funded in part by the Joint ADL Co-Lab under contract N61339-06-C-0082.

The template structure and format of this document are based on e-Framework documentation templates and guidelines, which are governed by the e-Framework *Intellectual Property Rights Statement* [<http://www.e-framework.org/Default.aspx?tabid=738>].

The template structure and format of this document are also based on Federated Repositories for Education (FRED) project documentation templates and guidelines, which were created as part of the FRED Project within the Australian ADL Partnership Laboratory. The FRED project is sponsored by the Australian Commonwealth Department of Education, Science and Training under the Framework for Open Learning Programme.

e-Framework work © Copyright 2007, e-Framework Partners. e-Framework work licensed under the *Creative Commons Attribution-ShareAlike 2.5 Australia License* [<http://creativecommons.org/licenses/by-sa/2.5/au/>].

FRED project work © Copyright 2007, University of Southern Queensland and University of Memphis. FRED project work licensed under the *Creative Commons Attribution-ShareAlike 2.5 Australia License* [<http://creativecommons.org/licenses/by-sa/2.5/au/>].

JADL IPA project work © Copyright 2007, Workforce ADL Co-Lab.

Template structure and format © Copyright 2008, Learning Systems Architecture Lab. The template structure and format may be used under the *Creative Commons Attribution-ShareAlike 2.5 Australia License* [<http://creativecommons.org/licenses/by-sa/2.5/au/>].

Service Usage Model © Copyright 2008, Learning Systems Architecture Lab. All Rights Reserved.

The appropriate attribution for a derivative of this work is: "This document is derived from work created by the Learning Systems Architecture Lab. © Copyright 2008, Learning Systems Architecture Lab." and should be followed by all of the attributions for this Service Usage Model as documented herein.



Introduction

The Introduction provides a brief, standalone overview of the Service Usage Model. It is for a non technical reader. It may duplicate other material in the Service Usage Model Description.

The Advanced Distributed Learning (ADL) Environment service usage model is an abstract model to describe learning and training systems and their integration with other computing and support systems. The ADL environment does not define a single application or a single ADL system. It defines how to model and describe a set of components (both ADL components and overall infrastructure components), applications and services and their interfaces in the support of learning and training. Thus, the ADL Environment service usage model is an overall architecture or framework for describing an ADL environment.

The ADL Environment service usage model is derived in part from the Joint ADL (JADL) Integrated Prototype Architecture (IPA). The JADL IPA provides an architectural framework to describe how to combine a collection of systems, components and services in support of a life-cycle training process in an ADL environment. The ADL Environment service usage model is an e-Framework representation of the core of the JADL IPA.

The ADL environment provides core capabilities for:

- Delivery of content (courseware, simulations, games, ...) to learners in a web-accessible delivery environment.
- Content development and authoring (including creating formal courseware and simulation/training scenarios).
- Management of content in repositories.
- Discovery of content from the ADL Registry (ADL-R).
- External interfaces to human resources and personnel systems.
- Integration of an LMS and delivery environment with other components.

The ADL environment supports:

- Learners and trainees.
- Content developers and designers.
- Instructors.
- Training managers.
- Program managers and policy makers.

The ADL Environment service usage model provides a service-oriented description of such an environment. The ADL Environment service usage model is presented as a collection of interrelated component service usage models and the resources they manage. The ADL Environment service usage model does not model a single application or ADL system, or a single instance of the JADL IPA, but it does provide the description of the service components necessary to build the different parts of an ADL environment and to deploy a service-based ADL ICT computing fabric.

Thus the ADL Environment service usage model could be used to describe a service-oriented collection of ADL systems and applications, including:

- A service-oriented SCORM-based LMS/LCMS.
- The service interfaces to the ADL SCORM Simple Run-Time Environment (SRTE), a simulation environment or a performance support system.
- The ADL-R as a repository federation.
- The ADL-R portal.



Service Usage Model Description

The Service Usage Model Description is the complete, formal documentation of the Service Usage Model.

The ADL Environment service usage model is an e-Framework representation of an ADL environment. The ADL Environment service usage model is described through a collection of interrelated component service usage models and the resources they manage.

Rationale

The Rationale element presents the justification for the Service Usage Model and explains the use intended by its authors.

The ADL Environment service usage model is a formal description of an ADL environment using the e-Framework modeling methodology. The ADL Environment service usage model may be used to:

- Develop a consistent set of open, standards-based service components for an ADL environment to provide well-defined functionality that may be used by others.
- Design, implement and deploy different applications and client systems using the exposed services.
- Document the range of services, components and standards that are needed to support applications, and to create an overall ADL software environment.
- Define interfaces between an ADL environment and other infrastructure systems.
- Develop a straw man for a comprehensive ADL service-based model, building from the capabilities in the JADL IPA.
- Inform ADL planning and development.

The ADL Environment service usage model is also intended as an exemplar of a complex service usage model.

Service Usage Model Metadata

The Service Usage Model Metadata contains basic labeling, classification and a version history for the Service Usage Model.

Name

- Service Usage Model Name: ADL Environment
- LSAL ID: hdl:1870/F231D5A451D3412A9464CF4F9CAE7523
- JADL IPA Service Usage Model Name: JADL IPA
- JADL IPA ID: hdl:JADL-IPA-NA/AA4FE5711B6B4E128125ABF866BC3442 (source for derivative)

Classification

Classification Facets:

- Service Usage Model Type: Domain
- Service Usage Model Status: Unapproved
- Domains: Repository, Training, Games and Simulation, Performance Support, Training Management, Competencies, Personnel, Content Authoring, Infrastructure (all ADL domains)
- Domain Coverage: Multiple
- Deployment Status: Proposed
- Deployment Scale: Isolated
- Maturity: Immature
- Composition: Composite
- Purpose: Exemplar, Application, Planning
- Genre or Expression: SUM (genre based)



Technical Facets:

- Batch Behavior: N/A (defined by the component service usage models)
- Time Constraint Behavior: N/A (defined by the component service usage models)
- Service End Point: Transcoder
- Authentication / Authorization: N/A (defined by the component service usage models)

Version

- LSAL Version: 1.0.0 [hdl:1870/F231D5A451D3412A9464CF4F9CAE7523]
- JADL IPA Version: 1.0.0 [hdl:JADL-IPA-NA/AA4FE5711B6B4E128125ABF866BC3442]

Version History			
Version	Date	Author	Description
0.50	2007-08-02	DR	Full draft JADL IPA version from prior material. hdl:JADL-IPA-NA/AA4FE5711B6B4E128125ABF866BC3442
0.51	2007-08-03	DR	Editorial review, consistency.
0.52	2007-08-03	DR	Word recovery.
0.70	2007-08-03	DR	Draft for review.
0.90	2007-08-18	DR	Final editorial.
1.0.0	2007-08-31	DR	Final JADL IPA V1.0.0.
1.0.0	2008-06-18	DR	LSAL V1.0.0. Derivative from JADL IPA version.

Notation

The Notation element includes conventions used to describe the Service Usage Model.

The words MUST, MUST NOT, REQUIRED, SHALL, SHALL NOT, SHOULD, SHOULD NOT, RECOMMENDED, MAY, and OPTIONAL in this document are to be interpreted as described in [RFC 2119].

Notational conventions follow those given in the LSAL *Service Notation and Document Conventions*.

The identification and versioning scheme follows those given in the LSAL *Service Component Identification Scheme*.

The service classification scheme follows those given in the LSAL *Service Classification Scheme*.

The Service Usage Model Description follows those given in the LSAL *Service Usage Model Description Guidelines*.

Description

The Description element is an informal, standalone, non technical narrative description of the Service Usage Model (problem, process, business-level capabilities and workflow).

The ADL Environment service usage model describes the structure of a collection of collaborating service usage models (along with their associated managed resources) used to provide the functionality needed to implement the variety of capabilities and features of an ADL environment, based in part on the structure of the JADL IPA (see Figure 1).

An ADL environment is a collection of tools, applications, systems, services, and interfaces to infrastructure systems that support training (e.g., formal training (both online and face-to-face), performance support) and training management. The component service usage models within the ADL Environment service usage model describe a service-oriented view of interacting ADL systems, and provide the functionality to manage and deliver training and to manage the resources that support the capabilities of an ADL environment. This service-oriented view of the ADL environment is illustrated in the *Structure & Organization* element of the service usage model (Figure 3).



The ADL Environment service usage model provides capabilities to:

- Train and deliver content (courseware, simulations, games, ...) to learners in a web-accessible delivery environment.
- Manage training and training management systems.
- Design, develop and author content and content resources (including creating formal courseware, performance support materials and simulation/training scenarios).
- Manage content and knowledge in repositories.
- Discover content from the ADL Registry (ADL-R).
- Interface to infrastructure systems and other components and services within an ADL environment.
- Manage personnel and users within the ADL environment.
- Manage ADL systems and infrastructure.



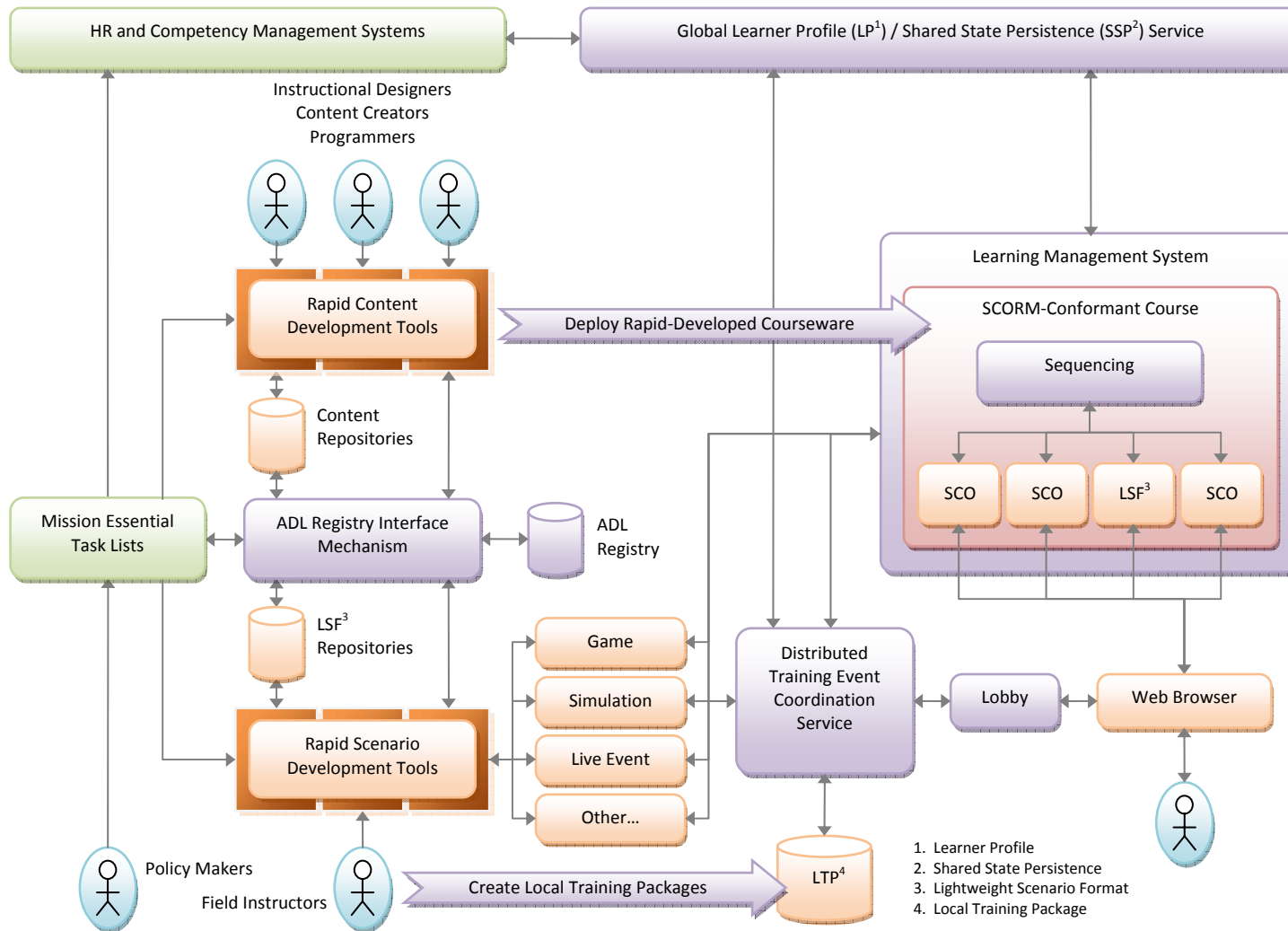


Figure 1: Joint ADL 2012 Integrated Prototype Architecture (IPA) [Public Domain 2006, US Government, Joint ADL Co-Lab.]



Business Process Modeling

The Business Process Modeling element lists the business functions to be supported by the Service Usage Model. Business process modeling provides necessary context to understand the description of the Service Usage Model. The business analysis motivating the Service Usage Model should be summarized within the Service Usage Model (to make it readable as a self-contained object), with fuller discussion possibly outside the Service Usage Model. Functions should be listed as groups, in business terms. The description should not be encumbered with either technical services or detailed workflows.

A complete, formal business process analysis of the ADL environment has not been performed. The following higher-level business functions have been identified and are supported by services in the ADL Environment service usage model.

NB: The ADL Environment service usage model may also be used to support additional high-level business functions that are outside of the scope of this analysis.

Training Business Processes

- Deliver content to trainee (course, SCO, simulation, ...)
- Adapt content to trainee based on trainee profile (personalize, customize)
- Adapt content to trainee based on trainee knowledge (competencies, objectives)
- Assess trainee
- Sequence training/performance support steps
- Initiate/terminate training session
- Suspend/resume training session
- Trainee interaction with trainee (multi-user interactions)
- Trainee interaction with instructor
- Track trainee during training
- Save results of training
- Discover knowledge, content, support materials

Content Development Business Processes

- Design content
- Design content structure/pattern
- Design training program
- Author new content
- Distribute content (to repository, LMS)
- Discover content for use/reuse
- Repurpose content
- Tag content for discovery (metadata, classifications, ...)
- Develop training objectives
- Match content to training objectives

Content and Knowledge Management Business Processes

- Obtain content
- Obtain content descriptions (metadata)
- Discover content
- Tag content (metadata, classifications, ...)
- Manage rights
- Manage content copies (and lifecycle)
- Expose content to discovery
- Identify content (assign identifier)
- Resolve identifiers
- Disseminate content



- Convert to dissemination format

Training Program Management Business Processes

- Add course/training program to course catalog
- Add course/training program to content delivery environment (LMS/LCMS)
- Enroll trainee in course/training program
- Monitor trainee
- Schedule training

Personnel Management Business Processes

- Maintain individual personnel profiles
- Maintain individual competency profile (qualifications)
- Maintain job profiles
- Define competencies (individual, map)
- Match competencies to job role
- Create training plan
- Perform gap analysis
- Add training results to personnel records

User Management Business Processes

- Administer users (create, ...)
- Administer roles
- Assign users to roles (and rights)

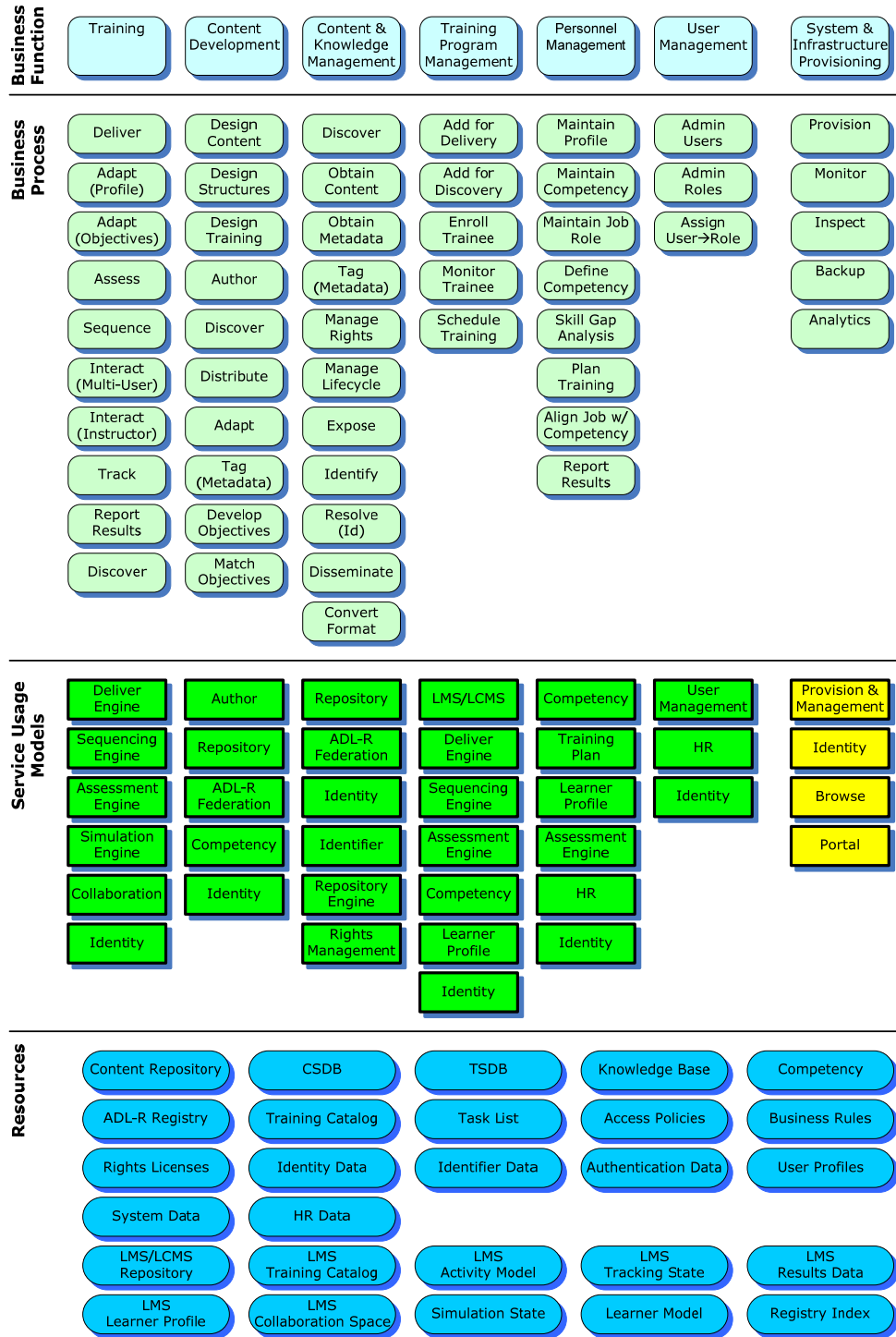
Systems and Infrastructure Management Business Processes

- Provision systems
- Monitor
- Inspect
- Back up
- Gather analytics

Service Usage Model Diagram

Service Usage Model diagram showing the business functions, business processes, component service usage models and resources are shown in Figure 2.





© Copyright 2007, Learning Systems Architecture Lab. All Rights Reserved.

Figure 2: Service Usage Model Diagram: ADL Environment
 [© Copyright 2007, Learning Systems Architecture Lab. All Rights Reserved.]



Usage Scenarios

The Usage Scenarios element is an informal, non technical description of how the Service Usage Model is used in support of business processes. An illustration of business workflows, expressed using services, is included. An illustration of an application using the components of the Service Usage Model may be included (but not a description of the design of the application). Full business process modeling and detailed diagrams are excluded. No critical or essential information required to understand the Service Usage Model should be included.

Available usage scenarios are documented separately in the JADL IPA *Requirements and Usage Scenarios*.

Other service usage models, e.g., those for applications and systems based on this service usage model and those that detail the component service usage models of the ADL Environment service usage model, SHOULD develop their own list of usage scenarios.

Applicability

The Applicability element details when the Service Usage Model can be used or when its use would be inappropriate. It represents specific constraints and assumptions on the use of the Service Usage Model. It is more specific and normative than the informal Usage Scenarios. No critical or essential information required to understand the Service Usage Model should be included.

The ADL Environment service usage model is applicable as an overall architecture for describing an ADL environment. The ADL Environment service usage model does not define any particular or any single ADL application, system or component.

The ADL Environment service usage model does not specify functional requirements for any ADL application, system or component derived and built from the service usage model.

The ADL Environment service usage model is applicable to defining specific applications, services or systems that make up an ADL environment. Each of these would be documented with its own service usage model derived from, in part, the ADL Environment service usage model.

The ADL Environment service usage model is applicable both for creating end-user applications and imbedding services in other applications and tools, or accessing resources (via their service interfaces) from other applications and tools.

Descriptions of ADL system and application defined in terms of service usage models SHALL use the same set of resources, service usage models, service genres and service expressions defined in the ADL Environment service usage model and its component ADL Environment service usage models (see the LSAL *Service Directory* for the list of resources, service usage models, service genres and service expressions). Additional resources, service usage models and service genres may be defined, and additional specializations of service genres to new service expressions may be specified as needed to describe and create the ADL ICT computing fabric.

The ADL Environment service usage model assumes a common collection of domain resources that are managed by different component service usage models. The service end points provided by these component service usage models are integration points used to build applications and systems on top of the resources. These service end points define the interoperability interfaces between the parts of an ADL ICT computing fabric. The component service usage models SHALL expose all service end points required for interoperability.

The ADL Environment service usage model does not define the internal structure of individual component tools, systems or applications. External interfaces not exposed nor available to others SHALL NOT be included in the overall e-Framework model of the ADL environment.

The ADL Environment service usage model assumes that some of the domain resources are a part of and are managed by other infrastructure systems. The service end points of these resources (also captured in component



service usage models) define the interoperability interfaces between the ADL environment and other infrastructure systems. The component service usage models SHALL expose all service end points required for interoperability.

While authentication and authorization are core concepts and features throughout the ADL Environment service usage model, the component service usage models will establish their own authentication and authorization requirements. There is not a central requirement that all systems support the same (or any) AAAI (authentication, authorization, accounting, identity) model. The ADL Environment service usage model does provide the way to document, in a service-oriented approach, the AAAI model used in any part of the ADL environment.

The ADL Environment service usage model assumes common core features, such as identifiers, that are used through the component service usage models. The ADL Environment service usage model does provide the way to document, in a service-oriented approach, the common features and services used in any part of the ADL environment.

The ADL Environment service usage model assumes there are appropriate mechanisms to provision, manage, operate and administer the various physical infrastructure components (e.g., servers, network), systems and services needed by the ADL ICT computing fabric. Such details are defined external to the ADL Environment service usage model and its component service usage models.

How the components defined through the ADL Environment service usage model participate in an ADL ICT computing fabric (e.g., via service-level agreements) is not specified. Such details are defined external to the ADL Environment service usage model and its component service usage models.

Functionality

The Functionality element details and illustrates the behaviors provided by the Service Usage Model in terms of services, workflows, messages, resources and data objects. It is not a technical description of the Service Usage Model, but it must provide sufficient information to develop the Structure & Organization of the Service Usage Model and to evaluate conformance of the Service Usage Model to the stated behaviors. It should not include implementation-specific information.

The functionality required in ADL Environment service usage model can be split into major groups derived from the business processes:

- *Training Functions:* Training and training system-to-trainee interactions.
- *Content Development Functions:* Design, development and authoring of training content and training programs.
- *Content and Knowledge Management Functions:* Management of different types of content and knowledge resources, including training, performance support, competencies, KSA objects.
- *Training Program Management Functions:* Operating and managing training and trainees.
- *Personnel Management Functions:* Personnel management in support of ADL activities.
- *User Management Functions:* User identity management in support of ADL activities.
- *System and Infrastructure Management Functions:* Provision and operate ADL systems and components.

These functions are further classified as:

- **BASE** (essential capabilities) or **VALUE ADDED** (desirable but not essential ADL services). The distinction is based both on technical requirements and community requirements.

The functionality descriptions summarize the service usage models and resources used by function point, along with an alignment of function and business process. Neither the description nor the alignment is complete: a function may require more service usage models and resources, and it may support additional business processes. Refer to the full details of the component service usage models for complete descriptions of all functionality, including workflows.

NB: The functionality described does not imply a particular implementation strategy.



Training Functions

Training functions apply to all types of training content (e.g., online, games, simulations, intelligent tutoring systems). The functions are not specialized by type of content.

Deliver Content Object: [BASE]

Primary Service Usage Model: content delivery engine

End Point: deliver {content object}

Supporting Service Usage Model(s): identity

Primary Resource: content repository, LMS/LCMS repository

Secondary Resource(s):

Object(s): content object

Business Process: *Deliver content object*

Sequence Content: [BASE]

Primary Service Usage Model: content delivery engine

End Point: sequence {activity model}

Supporting Service Usage Model(s): identity

Primary Resource: LMS activity model data, LMS tracking state data

Secondary Resource(s): content repository

Object(s): content object, activity model

Business Process: *Sequence content, Track trainee during training*

Report Results: [BASE]

Primary Service Usage Model: content delivery engine

End Point: report {results object}

Supporting Service Usage Model(s): identity

Primary Resource: LMS results data

Secondary Resource(s): competency data, HR data, LMS learner profile data, LMS tracking state data

Object(s): results object

Business Process: *Save results of training*

Control Content Delivery: [BASE]

Primary Service Usage Model: content delivery engine

End Point: multiple

Supporting Service Usage Model(s): identity

Primary Resource: LMS tracking state data

Secondary Resource(s):

Object(s):

Business Process: *Initiate/terminate training session, Suspend/resume training session, Suspend/resume content object/simulations*

Adapt Content: [VALUE ADDED]

Primary Service Usage Model: content delivery engine

End Point: adapt {training event object, content object}

Supporting Service Usage Model(s): identity

Primary Resource: content repository, LMS/LCMS repository

Secondary Resource(s): competency data, HR data, LMS learner profile data, LMS activity model data, learner model

Object(s): training event object, content object

Business Process: *Adapt content to trainee based on trainee profile (personalize, customize), Adapt content to trainee based on trainee knowledge (competencies, objectives)*



Assess Training: [BASE]

Primary Service Usage Model: assessment

End Point: assess {assessment object}

Supporting Service Usage Model(s): content delivery engine, identity

Primary Resource: content repository, LMS results data

Secondary Resource(s):

Object(s): assessment object, results object

Business Process: *Assess trainee**Training Collaboration:* [BASE]

Primary Service Usage Model: content delivery engine

End Point: multiple

Supporting Service Usage Model(s): LMS/LCMS, identity

Primary Resource: LMS collaboration space

Secondary Resource(s): LMS tracking state data, LMS results data, LMS learner profile data

Object(s): content object

Business Process: *Trainee interaction with trainee (multi-user interactions), Trainee interaction with instructor***Content Development Functions**

Content development functions apply to all types of training content (e.g., training content, performance support content). The functions are not specialized by type of content.

Design Training Program and Content: [BASE]

Primary Service Usage Model: author

End Point: design {training object}

Supporting Service Usage Model(s): repository, competency, identity, identifier

Primary Resource: training catalog data

Secondary Resource(s): competency data, task lists data

Object(s): training object

Business Process: *Design training program, Develop training objectives, Match content to training objectives**Develop Content:* [BASE]

Primary Service Usage Model: author

End Point: develop {content object}

Supporting Service Usage Model(s): repository, ADL-R repository federation, competency, identity, identifier

Primary Resource: content repository, TSDB, CSDB

Secondary Resource(s): ADL-R repository federation registry

Object(s): content object, metadata object

Business Process: *Design content, Design content structure/pattern, Author new content, Distribute content (to repository, LMS), Repurpose content***Content and Knowledge Management Functions**

Content and knowledge management functions apply to all types of content (e.g., training, performance support, competencies, KSA objects) and repositories.

Expose Content: [BASE]

Primary Service Usage Model: repository

End Point: expose {content object}

Supporting Service Usage Model(s): repository storage manager, ADL-R repository federation, identity, identifier

Primary Resource: content repository, TSDB, CSDB

Secondary Resource(s): ADL-R repository federation registry

Object(s): content object, metadata object

Business Process: *Expose content to discovery, Store content in repository, Identify content (assign identifier)*

Discover Content: [BASE]

Primary Service Usage Model: ADL-R repository federation registry, repository
 End Point: discover {content object}
 Supporting Service Usage Model(s): repository storage manager, identity, identifier
 Primary Resource: content repository, TSDB, CSDB, ADL-R repository federation
 Secondary Resource(s):
 Object(s): content object, metadata object
 Business Process: *Discover content, knowledge for use, reuse*

Obtain Content: [BASE]

Primary Service Usage Model: repository
 End Point: obtain {content object}, obtain {metadata object}
 Supporting Service Usage Model(s): repository storage manager, ADL-R repository federation registry, identity, identifier
 Primary Resource: content repository, TSDB, CSDB
 Secondary Resource(s): ADL-R repository federation
 Object(s): content object, metadata object
 Business Process: *Obtain content, Obtain content descriptions (metadata), Disseminate content, Resolve identifiers, Convert to dissemination format*

Manage Content: [BASE]

Primary Service Usage Model: ADL-R repository federation registry, repository
 End Point: manage {content object}
 Supporting Service Usage Model(s): repository storage manager, identity, identifier
 Primary Resource: content repository, TSDB, CSDB, ADL-R repository federation
 Secondary Resource(s):
 Object(s): content object, metadata object
 Business Process: *Tag content (metadata, classifications, ...), Manage rights, Manage content copies (and lifecycle), Identify content (assign identifier)*

Training Program Management Functions*Manage Training Environment:* [BASE]

Primary Service Usage Model: LMS/LCMS
 End Point: multiple
 Supporting Service Usage Model(s): content delivery engine, assessment
 Primary Resource: LMS/LCMS repository, LMS training catalog data
 Secondary Resource(s): content repository
 Object(s):
 Business Process: *Add course/training program to content delivery environment (LMS/LCMS)*

Enroll Trainee: [BASE]

Primary Service Usage Model: LMS/LCMS
 End Point: enroll {trainee}
 Supporting Service Usage Model(s): competency, learner profile, identity
 Primary Resource: LMS tracking state data, LMS results data
 Secondary Resource(s): LMS learner profile data, LMS training catalog data, competency data, HR data
 Object(s):
 Business Process: *Enroll trainee in course/training program*



Schedule Training: [VALUE ADDED]
 Primary Service Usage Model: LMS/LCMS
 End Point: schedule {trainee, course}
 Supporting Service Usage Model(s): identity
 Primary Resource: LMS tracking state data, LMS results data
 Secondary Resource(s): LMS learner profile data, LMS training catalog data
 Object(s):
 Business Process: *Schedule training*

Report Training Results: [BASE]
 Primary Service Usage Model: LMS/LCMS
 End Point: report {results object}
 Supporting Service Usage Model(s): identity
 Primary Resource: HR data
 Secondary Resource(s): LMS results data, LMS learner profile data, LMS tracking state data
 Object(s): results object
 Business Process: *Save results of training*

Monitor Training: [BASE]
 Primary Service Usage Model: LMS/LCMS
 End Point: multiple
 Supporting Service Usage Model(s): identity
 Primary Resource: LMS results data, LMS learner profile data, LMS tracking state data
 Secondary Resource(s):
 Object(s):
 Business Process: *Monitor training*

Personnel Management Functions

Manage Learner Profile: [BASE]
 Primary Service Usage Model: learner profile
 End Point: manage {learner profile}
 Supporting Service Usage Model(s): competency, identity
 Primary Resource: user profile data
 Secondary Resource(s): competency data, HR data
 Object(s): learner profile
 Business Process: *Maintain individual personnel profiles, Maintain individual competency profiles (qualifications), Maintain job profiles, Add training results to personnel records*

Training Planning: [BASE]
 Primary Service Usage Model: training plan
 End Point: training plan {training plan}
 Supporting Service Usage Model(s): competency, learner profile, identity, HR, assessment
 Primary Resource: user profile data
 Secondary Resource(s): user profile data, tasks list data, training catalog data, competency data, HR data
 Object(s): training plan
 Business Process: *Create training plan, Match competencies to job role, Perform gap analysis*



Competency Management: [BASE]

Primary Service Usage Model: competency

End Point: multiple {competency object}

Supporting Service Usage Model(s):

Primary Resource: competency data

Secondary Resource(s):

Object(s): competency object

Business Process: *Define competencies (individual, map)*

Note: Competency management functions are like other content management functions (obtain, discover).

User Management Functions

Manage Users: [BASE]

Primary Service Usage Model: identity

End Point: user management {user}

Supporting Service Usage Model(s): HR

Primary Resource: identity data, authentication data

Secondary Resource(s): HR data

Object(s): user

Business Process: *Administer users (create, ...), Administer roles, Assign users to roles (and rights)*

Systems and Infrastructure Management Functions

Establishing the operations of the resources and managing their systems-level operations. Provisioning functions apply to all types of ADL resources.

Provision: [BASE]

Primary Service Usage Model: provisioning and management*

End Point: provision {resource*}

Supporting Service Usage Model(s): identity

Primary Resource: resource*

Secondary Resource(s):

Object(s):

Business Process: *Provision systems*

Notes: The functionality applies equally to all resource provisioning. Service Usage Models include: LMS/LCMS provisioning and management, ADL-R federated metadata registry provisioning and management, repository provisioning and management, competency provisioning and management, identifier provisioning and management, identity provisioning and management.

Inspect: [BASE]

Primary Service Usage Model: provisioning and management*

End Point: provision {resource*}

Supporting Service Usage Model(s): identity

Primary Resource: resource*

Secondary Resource(s):

Object(s):

Business Process: *Monitor, Inspect, Gather and Report analytics*

Notes: The functionality applies equally to all resource provisioning. Service Usage Models include: LMS/LCMS provisioning and management, ADL-R federated metadata registry provisioning and management, repository provisioning and management, competency provisioning and management, identifier provisioning and management, identity provisioning and management.



Backup: [BASE]

Primary Service Usage Model: provisioning and management*

End Point: provision {resource*}

Supporting Service Usage Model(s): identity

Primary Resource: resource*

Secondary Resource(s):

Object(s):

Business Process: *Backup*

Notes: The functionality applies equally to all resource provisioning. Service Usage Models include: LMS/LCMS provisioning and management, ADL-R federated metadata registry provisioning and management, repository provisioning and management, competency provisioning and management, identifier provisioning and management, identity provisioning and management.

Other Functions

The functionality that is defined MAY be extended..

Structure & Organization

The Structure & Organization element is a normative, technical description of the Service Usage Model that documents and illustrates the service-oriented operational view of the Service Usage Model as a whole, in terms of services, resources and their messaging interactions. The Structure & Organization element is required to implement applications that use the Service Usage Model, but the Service Usage Model must be understandable without reference to the contents of the element.

NB: The Structure & Organization element does not describe how to implement applications that use the Service Usage Model, but provides information needed to implement elements of the Service Usage Model itself.

A schematic view of the ADL Environment service usage model is illustrated in Figure 3. The ADL Environment service usage model consists of a set of component service usage models and a set of ADL and infrastructure domain resources. The ADL Environment service usage model is not defined in terms of services (service genres or service expressions); see the *Design Decisions & Tradeoffs* element for a discussion of this topic. The complete list of component service usage models in the ADL Environment service usage model is presented in the *Related Service Usage Models* element.

The diagram shows key domain resources in an ADL ICT environment and a set of service usage models that manage these resources. The service usage models expose a set of service end points that can be used by applications, systems and services that implement or use the functionality of an ADL environment. The complete list of resources in the ADL Environment service usage model is presented in the *Resources Used* element.

The diagram also illustrates a set of resources internal to the ADL Environment service usage model. These resources are part of and are defined in the component service usage models of the ADL Environment service usage model.

The diagram does not illustrate all provisioning and management service usage models.

While the diagram illustrates selected service genres within the component service usage models, the actual services and service end points are defined in the individual service usage models. Each function of the ADL environment SHOULD be mapped to a service end point, but the structure of each service usage model is defined independently as required to meet the service usage model's functionality. The service usage models SHOULD be properly factored to expose all required service end points to support all defined ADL functionality.

Other than working on a shared domain resource set, the service usage models are not interdependent.

Integration across service usage models (e.g., common identity management) is not defined in the ADL Environment service usage model. While a common service infrastructure is assumed, the details of such integration are defined in the component service usage models of the ADL Environment service usage model.

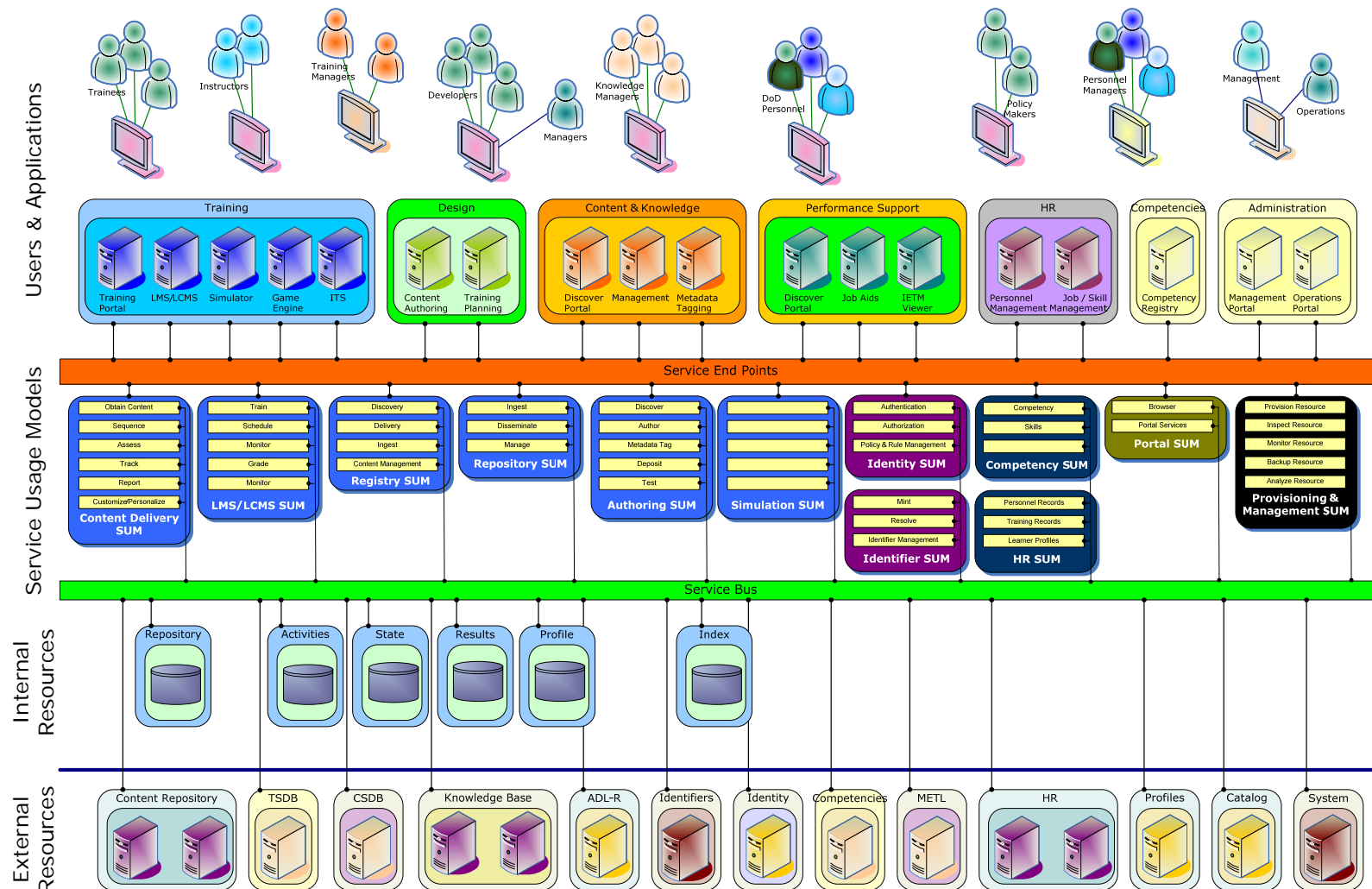


Internal details (workflows, trust environments, component resources) are defined in the component service usage models of the ADL Environment service usage model.

There is no defined overall application or overall ADL environment or ADL ICT computing fabric.

The ADL Environment service usage model is the basis for defining a set of applications and describing an overall ADL environment.





© Copyright 2007, Learning Systems Architecture Lab, All Rights Reserved.

Figure 3: ADL Environment Service Usage Model Schematic [© Copyright 2007, Learning Systems Architecture Lab, All Rights Reserved.]



Design Decisions & Tradeoffs

The Design Decisions & Tradeoffs element documents overall choices, tradeoffs and their implications on the design of the Service Usage Model. It does not address the design of applications or the internal implementation of the elements of the Service Usage Model. No critical or essential information required to understand the Service Usage Model should be included.

The ADL environment is an “architecture”, i.e., a set of components and a vocabulary used to define systems, applications and services built using these pieces, described using the vocabulary. The ADL environment provides the basis for building ADL systems and integrating them with other infrastructure systems. In itself, there is no single ADL environment application or system; different components are designed and implemented to build parts of this environment.

Within the e-Framework, a service usage model is typically used to describe a particular application or to describe a model for a collection of similar systems (different applications built from the service usage model). Applications are not designed or implemented directly from the service usage model; the service usage model is first refined into the design of an application or set of services. These design specifications are used for implementation.

Since the scope of the ADL environment is broad and diverse, there cannot be a single ADL application. The ADL Environment service usage model thus cannot model a single application or system (contrast this with the (ADL-R) repository federation service usage model, which models the ADL-R).

The ADL Environment service usage model serves as an architecture to aid in defining the collection of systems, components, applications and services that would make up the ADL ICT computing fabric. The ADL Environment service usage model is defined in broad terms, and in terms of a set of other service usage models. Each of these service usage models exposes a set of key service end points that are used to integrate system and components. The set of service usage models makes up the ADL environment view of an ADL ICT computing fabric.

The description of the individual service usage models and their service end points are documented separately. Attempting to define all of the ADL services and their end points in a single service usage model would produce a large, unwieldy service usage model, and violates the key concept of modularity and interoperability, allowing different parts of the ADL environment to be described, documented and implemented separately.

The design of the ADL Environment service usage model is meant to be independent of any implementation concerns.

The ADL Environment service usage model captures key features and capabilities. Additional service usage models and resources can be added without breaking the overall ADL Environment service usage model. Issues such as interoperability and dependencies between the component service usage models and their services must be addressed in the service usage models and their corresponding service genres and service expressions. Consistency and a common approach across all of the components of the e-Framework model of the ADL environment must be maintained.

Implementation Guide & Dependencies

The Implementation Guide & Dependencies element describes issues of concern in implementing applications that use the Service Usage Model, including organization, performance, behaviors, representations and policies. Resolution of issues discussed is deferred to the actual application design. No critical or essential information required to understand the Service Usage Model should be included.

The ADL Environment service usage model does not specify the design or details of the implementation a complete ADL environment or any of its components. The component service usage models of the ADL Environment service usage model SHOULD each provide implementation guidance. All of the aspects listed in the *Aspects of Service Design* SHOULD be considered for inclusion.



Components, capabilities and services within the ADL environment may be built by direct implementation of a capability or service, or by service composition of other services. Direct implementation versus service composition has implications such as complexity, reuse and performance.

The ADL Environment service usage model assumes integration with other existing infrastructure ICT systems (e.g., HR). Specific service end points and interfaces to these systems needed to develop an overall ADL environment SHALL be documented in their respective service usage models. These service usage models need to focus on the interfaces that these infrastructure ICT systems provide to support the functions of the ADL environment. The technical and operational characteristics of these existing (legacy) systems need to be considered when defining service end points to access their functionality.

The ADL Environment service usage model assumes an identity management system. Identity management is described in the identity service usage model and identity provisioning and management service usage model.

The ADL Environment service usage model assumes an identifier system. Identifiers and identifier management are described in the identifier service usage model and identifier provisioning and management service usage model.

The ADL Environment service usage model does not specify details of the infrastructure or components required to implement any application or ADL environment. An implementation or component service instance may require distributed or replicated servers and multiple service instances and resource sets for load balancing and performance.

Applicable Standards

The Applicable Standards element lists domain-specific standards required to implement the functionality of the Service Usage Model as a whole. Standards are described in terms of name, version and citation link. Conformance requirements and extensions should be noted. Standards used to implement applications are excluded. No critical or essential information required to understand the Service Usage Model should be included.

None. No standards are directly applicable to the ADL Environment service usage model as a whole.

The component service usage models of the ADL Environment service usage model SHALL document their applicable standards and specifications.

The list of standards used in the ADL environment aggregated from the standards used in the component service usage models of the ADL Environment service usage model are documented in the LSAL *Service Directory*.

Known Uses

The Known Uses element documents actual uses of the Service Usage Model in applications and systems, including how used, extensions, and limits.

None as described. ADL Environment service usage model is a model of ADL systems and an ADL environment, not the description of a single operational system, application or component.

Potential Service Usage Models:

This general ADL Environment service usage model could be used to describe a collection of ADL systems and applications, including:

- A SCORM-based LMS/LCMS.
- The ADL SCORM Simple run-time environment.
- The ADL-R as a repository federation.
- The ADL-R portal.
- Any of the JADL prototype projects (specifically those that incorporate the Distributed Training Event Coordination Service).
- Applications and systems based on the component service usage models of the ADL Environment service usage model.



Resources Used

The Resources Used element documents all Resources used in the Service Usage Model. Resources are identified by name and version.

The service usage models within the ADL Environment service usage model manage domain resources. The resources needed to provide essential functionality are labeled [BASE] while others are labeled [VALUE ADDED]. Resources common and shared across multiple applications and an overall ADL environment are labeled [PUBLIC]. Resources internal to a component service usage model in the ADL Environment service usage model are labeled [PRIVATE].

The list of resources aggregated from the resources used in the component service usage models of the ADL Environment service usage model are documented in the LSAL *Service Directory*.

Domain Resources

Key domain resources include:

content repository: [BASE] [PUBLIC]

Managed storage for learning objects, learning content and related information used in training and performance support. Content objects conform to learning content standards.

TSDB: [VALUE ADDED] [PUBLIC]

Trusted source database (TSDB). Managed storage for objects used as source material for training and performance support.

CSDB: [BASE] [PUBLIC]

Common source database (CSDB). Managed storage for performance support content and materials. Content objects conform to performance support content standards, e.g., S1000D.

knowledge base repository: [VALUE ADDED] [PUBLIC]

General repository of knowledge objects used in training, performance support and supporting other functions in an ADL environment.

ADL-R repository federation registry: [BASE] [PUBLIC]

Managed storage for metadata used in discovery (metadata objects, collection objects, repository objects), i.e., content exposed and discoverable from the ADL-R repository federation. The repository federation registry resource incorporates other registry resources.

competency data: [VALUE ADDED] [PUBLIC]

Managed storage for competency data used in managing skills (e.g., competency objects, competency maps, job skills, job roles). Competency data may be managed via a single registry, a federation registry, or a collection of different competency data repositories. Competency data objects conform to competency description standards.

training catalog data: [VALUE ADDED] [PUBLIC]

Managed storage for descriptions of training events (e.g., course descriptions, training events, schedules). Catalog data may be managed via a single registry, a federation registry, or a collection of different repositories.

task lists data: [VALUE ADDED] [PUBLIC]

Managed storage for descriptions of tasks lists (e.g., job skills, mission task lists). Task list data may be managed external to the ADL environment, e.g., part of a supporting infrastructure.

access control policy/authorization data: [BASE] [PUBLIC]

Managed storage for access control policies used to control access to objects managed by the resources in the ADL environment. Access control policies conform to access control description standards.



business rule/policy data: [BASE] [PUBLIC]

Managed storage for policy and business rules used to control operations of the resources in the ADL environment. Business rules conform to business rule description standards.

rights licenses: [VALUE ADDED] [PUBLIC]

Managed storage for digital rights management (DRM) licenses used to control content access. Rights descriptions conform to rights license standards.

identifier resolution data: [BASE] [PUBLIC]

Identifier attributes used in identifier resolution and object access. Identifier data conforms to identifier standards. The ADL environment assumes a single, shared common identifier infrastructure.

identity data: [BASE] [PUBLIC]

Information about user identities for those who access components and service in the ADL environment. Identity data may be managed via a single registry, a federation registry, or a collection of different identity repositories. The ADL environment assumes federated identity management that is provided through the identity service usage model. Identity data may be managed external to the ADL environment, e.g., part of a supporting infrastructure.

authentication data: [BASE] [PUBLIC]

Information about authentication of users for those who access the registry.

user profile data: [BASE] [PUBLIC]

Managed storage for user profile data. User profile data may be managed via a single registry, a federation registry, or a collection of different user profile repositories. Federated identity management is provided through the identity service usage model. Identity data may be managed within the ADL environment or external to the ADL environment, e.g., part of a supporting infrastructure. ADL accessible data conforms to user profile data standards.

system data: [BASE] [PUBLIC]

Managed storage for system-level objects used to describe, manage and control the components of the ADL environment (vocabularies, schemata, registry descriptions).

HR data: [BASE] [PUBLIC]

Managed data for human resources (HR) (personnel records, training records, user descriptions). HR data is managed external to the ADL environment as part of a supporting infrastructure.

Component Resources

Resources internal to component service usage models include (ADL environment component service usage models will identify additional resources):

LMS/LCMS repository: [BASE] [PRIVATE]

Managed storage for training content within an LMS/LCMS or training delivery system.

LMS training catalog data: [BASE] [PRIVATE]

Managed storage for a training catalog within an LMS/LCMS or training delivery system (course descriptions, schedule).

LMS activity model data: [BASE] [PRIVATE]

Managed storage for content trees and activity structures used to sequence and deliver training content within an LMS/LCMS or training delivery system.

LMS tracking state data: [BASE] [PRIVATE]

Managed storage for tracking data used to sequence and deliver training content within an LMS/LCMS or training delivery system.



LMS results data: [BASE] [PRIVATE]

Managed storage for learner results used to sequence and deliver training content systems within an LMS/LCMS or training delivery system and used to roll up results to external systems.

LMS learner profile data: [BASE] [PRIVATE]

Managed storage for learner profiles used to customize or personalize training content within an LMS/LCMS or training delivery system.

LMS collaboration space: [BASE] [PRIVATE]

Managed storage for trainee-to-trainee and trainee-to-instructor collaboration data in an LMS/LCMS or training delivery system.

simulation state data: [BASE] [PRIVATE]

Managed storage for simulation data used to control simulator behavior within a simulator.

learner model: [VALUE ADDED] [PRIVATE]

Managed storage for a learner model used to create an adaptive learning experience in an adaptive training delivery system or intelligent tutoring system.

registry index data: [BASE] [PRIVATE]

Indexing information in the ADL-R repository federation registry used in search and discovery.

Services Used

The Services Used element documents all Services used in the Service Usage Model. Services are identified by name and version.

A list of services is not provided. The ADL Environment service usage model is defined only in terms of other service usage models. The ADL Environment service usage model does not explicitly define a set of services. The component service usage models of the ADL Environment service usage model SHALL document the services within the service usage models.

The list of the services (service genres and service expressions) aggregated from the component service usage models of the ADL Environment service usage model are documented in the LSAL *Service Directory*.

Related Service Usage Models

The Related Service Usage Models element documents and illustrates how the Service Usage Model is related to other Service Usage Models required to provide its stated behaviors. Related Service Usage Models are identified by name and version. No critical or essential information required to understand the Service Usage Model should be included.

The ADL Environment service usage model is defined in terms of a set of component service usage models. The key components are listed below. The set is grouped into two categories: those used in normal operations (i.e., targeted at end users), and those used to manage and provision the ADL environment (i.e., targeted at systems administrators and operations personnel).

The list of service usage models aggregated from the component service usage models of the ADL Environment service usage model are documented in the LSAL *Service Directory*.



ADL Environment Operational Service Usage Models

Key operational service usage models include:

content delivery engine: [BASE] Vx.xx.

[\[link to service usage model\]](#)

The content delivery engine service usage model integrates a set of service genres to provide delivery of electronic training content (including performance support content) to a trainee or set of trainees. Functionality includes selecting, sequencing, tracking, delivery of content to the end user and reporting of user progress and results.

assessment: [BASE] Vx.xx.

[\[link to service usage model\]](#)

The assessment service usage model integrates a set of service genres to provide delivery of assessment content to a trainee or set of trainees. Functionality includes generation, delivery, results capture, grading, and reporting.

LMS/LCMS: [BASE] Vx.xx.

[\[link to service usage model\]](#)

The LMS/LCMS service usage model integrates a set of service genres to provide learning/training management and content management in support of learning and training. Functionality includes scheduling, enrollment, content delivery (using the content delivery engine service usage model), monitoring users, grading, collaboration and loading courses and content.

(ADL-R) repository federation: V1.0.0

[\[ADL-R repository-federation-sum-v100 / hdl:1870/E2FE4AD428A1468FA284E270245F72D7\]](#)

The (ADL-R) repository federation service usage model provides an integrated set of service genres used to populate and use the metadata registry that supports a repository federation. Functionality includes content management (creation and management of metadata objects within a repository federation), content discovery (discovery of content objects from a repository federation) and content delivery (retrieval of and access to content objects discovered through a repository federation).

repository: [BASE] Vx.xx.

[\[link to service usage model\]](#)

The repository service usage model integrates a set of service genres to support the operations of an individual repository, e.g., a training content repository, a competency repository, a knowledge repository. Functionality includes content ingest, discovery, dissemination, delivery and tagging. The repository service usage model provides a common service usage model that may be further specialized to handle specific types of content. When designing applications based on the repository service usage model, these specializations are applied to selecting appropriate service expressions bound to specific standards for the type of content in the repository. Resource-specific variants of the repository service usage model SHOULD NOT be required.

repository storage manager: [BASE] Vx.xx.

[\[link to service usage model\]](#)

The repository storage manager service usage model is an integrated set of service genres that provides basic access operators (CRUD, versioning, audit, ACID transactions) for a stored data collection.

authoring: [BASE] Vx.xx.

[\[link to service usage model\]](#)

The authoring service usage model integrates a set of service genres to support the development of training content (including simulations, performance support, etc.). Functionality includes discovery (from registries or repositories), assembly, dissemination (to registries and repositories), tagging and validation.



simulation engine: [BASE] Vx.xx.

[\[link to service usage model\]](#)

The simulation engine service usage model integrates a set of service genres to provide delivery and running of simulations for a trainee or set of trainees. Functionality includes delivery, tracking and reporting of user progress and results.

training plan: [BASE] Vx.xx.

[\[link to service usage model\]](#)

The training plan service usage model integrates a set of service genres to support the development of personnel training and assessment plans. Functionality includes assembly, alignment of skills and roles, skill gap analysis.

competency: [BASE] Vx.xx.

[\[link to service usage model\]](#)

The competency service usage model integrates a set of service genres to support the operations on competency data, e.g., competencies, competency maps, job skills. Functionality includes ingest, discovery, delivery and tagging. Management of trainee competency data is excluded.

HR: [BASE] Vx.xx.

[\[link to service usage model\]](#)

The HR service usage model is an integrated set of service genres that enables integration with ADL ICT infrastructure HR systems. Functionality includes access to learner data and learner profiles, and recording of trainee results and competencies. The HR service usage model provides only the functionality needed in an ADL environment; it is not a service usage model for a complete HR system.

learner profile: [BASE] Vx.xx.

[\[link to service usage model\]](#)

The learner profile service usage model is an integrated set of service genres that provides access operators (CRUD) for learner profile data. Functionality includes accessing and maintaining the profile, and synchronizing the profile with an HR resource.

identifier: [BASE] Vx.xx.

[\[link to service usage model\]](#)

The identifier service usage model is an integrated set of service genres that provides the operational identifier infrastructure used by all component service usage models of the ADL Environment service usage model. Functionality includes the creation, registering, publishing, managing and resolving of identifiers.

NB: The ADL environment assumes a single, shared common identifier infrastructure.

identity: [BASE] Vx.xx.

[\[link to service usage model\]](#)

The identity service usage model is an integrated set of service genres that provides the operational user identity infrastructure used by all component service usage models of the ADL Environment service usage model.

Functionality includes the creation of user rights and roles, user authentication and user authorization.

NB: Authentication and authorization functions are combined within a single service usage model.

NB: The ADL environment assumes federated identity management.

browse: [VALUE ADDED] Vx.xx.

[\[link to service usage model\]](#)

The browse service usage model provides an integrated set of service genres used to develop browsing-based interfaces for ADL applications and systems.

portal: [VALUE ADDED] Vx.xx.

[\[link to service usage model\]](#)

The portal service usage model provides an integrated set of service genres used to develop web portals for ADL applications and systems.



rights management: [VALUE ADDED] Vx.xx.

[\[link to service usage model\]](#)

The rights management service usage model is an integrated set of service genres that provides rights management for content (including metadata) in the repositories and registries. Functionality includes creation and management of rights expressions.

ADL Environment Provisioning and Management Service Usage Models

Key provisioning and management service usage models include:

LMS/LCMS provisioning and management: [BASE] Vx.xx.

[\[link to service usage model\]](#)

The LMS/LCMS provisioning and management service usage model provides an integrated set of service genres used to create, provision and manage an LMS or LCMS. Functionality includes provisioning of users, courses and content, data management (backup), and monitoring and reporting.

(ADL-R) federated metadata registry provisioning and management: [BASE] V1.0.0

[\[ADL-R registry-provision-v100 / hdl:1870/84E0738844B54A1DB69C649E85B1EE6\]](#)

The federated metadata registry provisioning and management service usage model provides an integrated set of service genres used to create, provision and manage the metadata registry that supports a repository federation. Functionality includes provisioning of rules (authorization and business), data management (backup), analytics and computing registry state and maintaining registry internal structures used for discovery and operations.

repository provisioning and management: [BASE] Vx.xx.

[\[link to service usage model\]](#)

The repository provisioning and management service usage model provides an integrated set of service genres used to create, provision and manage an individual repository, e.g., a training content repository, a competency repository, a knowledge repository. Functionality includes configuration, provisioning users, data management (backup) and analytics.

competency provisioning and management: [BASE] Vx.xx.

[\[link to service usage model\]](#)

The competency provisioning and management service usage model provides an integrated set of service genres used to create, provision and manage competency resources. Functionality includes configuration, provisioning users, data management (backup) and analytics.

identifier provisioning and management: [BASE] Vx.xx.

[\[link to service usage model\]](#)

The identifier provisioning and management service usage model is an integrated set of service genres that manages the identifier infrastructure. Functionality includes provisioning and management of the identifier system (establishing namespaces, operations).

identity provisioning and management: [BASE] Vx.xx.

[\[link to service usage model\]](#)

The identity provisioning and management service usage model is an integrated set of service genres that manages the user identity infrastructure. Functionality includes provisioning and management of the identity system (users, roles, rights).

NB: Authentication and authorization functions are combined within a single service usage model.

Service Patterns Used

The Service Patterns Used element documents all Service Patterns used in the Service Usage Model. Service Patterns are identified by name and version.

None.



References

The References element includes references and bibliographic citations to works needed to understand the Service Usage Model.

None. The component service usage models of the ADL Environment service usage model SHOULD document their cited works.

Glossary & Terminology

The Glossary & Terminology element defines domain-specific terms used in documenting the Service Usage Model.

Terms in the LSAL *Service Glossary* are applicable to this Service Usage Model.

The component service usage models of the ADL service usage model SHOULD document their domain-specific terms.

Working Notes / Things To Do

The Working Notes element documents open issues in the development of the Service Usage Model and is for internal project use only. It should be deleted before the Service Usage Model is submitted for publication.

None.

