Australian *Flexible* Learning Framework

supporting e-learning opportunities

VET Learning Object Repository Network

Business and functional requirements

Version 1.2

ISBN: 1 921045 22 1

Part of the Australian Flexible Learning Framework

Managed by the Flexible Learning Advisory Group on behalf of the Commonwealth, all States and Territories in conjunction with ANTA

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Document control

Version	Date	Who	Description
Draft 0.1	17 September 2004	David Drinkwater, Richard Arkell	Initial draft
Draft 0.2	6 October 2004	David Drinkwater	Changes based on feedback from Ref Group
Draft 0.3	7 October 2004	Richard Arkell	Changes based on discussion with ***education.au*** limited
Draft 0.4	20 October 2004	Richard Arkell	Changes based on feedback from Executive Project Management Group
Draft 0.5	20 October 2004	Richard Arkell, David Drinkwater	Changes based on feedback from Reference Group and network members meeting, Melbourne 29/10/04
Draft 0.6	19 November 2004	Richard Arkell	Editorial changes taken in
Draft 0.7	21 November 2004	Richard Arkell	Editorial changes completed
1.0	28 November 2004	Richard Arkell	Version 1.0 release. Changes based on consultation with Project Reference Group prior to release.
1.1	21 January 2005	Richard Arkell	Version 1.1 release. Changes based on feedback from Program Steering Group.
1.2	16 February 2005	Richard Arkell	Version 1.2 release. Final formatting prior to public release.

About this document

This document describes requirements identified by the Learning Object Repository (LOR) Implementation Project (2004). It proposes a staged approach to establishing a network – implementing further functionality in 2005 and beyond. It is a consolidation of both original material and information from other documents.

Related documents

The following documents should be read in conjunction with this document.

- VET Learning Object Repository Network Interoperability Specification
  http://www.flexiblelearning.net.au/vlorn/
- VET Learning Object Repository Network Implementation Guidelines
  http://www.flexiblelearning.net.au/vlorn/
- VET Interoperability Framework website
  http://www.flexiblelearning.net.au/interop/
- VET Metadata Application Profile (VETADATA)
  http://www.flexiblelearning.net.au/interop/topics/vocab.htm

List of acronyms, terminology and definitions

AEShareNet	**AEShareNet** is a collaborative system to streamline the licensing of intellectual property so that Australian learning materials are developed, shared and adapted efficiently. See *www.aesharenet.com.au* for more information.
AEShareNet-FfE	Material with the **AEShareNet Free for Education** mark may be freely used and copied for educational purposes as defined on the AEShareNet website but the owner retains full control of its use for any other purposes. A user may make very limited modifications to the material for their own educational purposes. The mark is not intended only for education and training resources. The FfE mark can be applied to any material, this could include government information, company fact sheets, checklists, technical specifications and content on a publicly accessible website. See *www.aesharenet.com.au/coreBusiness/* for more information.

AEShareNet-U	Material with the **AEShareNet Unrestricted** mark may be freely copied, adapted and used by anyone. Exact copies must retain the owner's copyright statement and the AEShareNet-U mark. Enhancements must not contain the owner's copyright statement and may have a new copyright statement by the Licensee. Intended for situations where the owner does not require acknowledgement as the original source of the content and there is no requirement to maintain a consolidated version. Examples might include checklists and guidelines which can be freely adapted for an organisation's own circumstances; or professional development materials. See *www.aesharenet.com.au/coreBusiness/* for more information.
AFLF	**Australian Flexible Learning Framework** – a five year national program to create and share knowledge about flexible learning and to support its take-up in vocational education and training, managed by the Flexible Learning Advisory Group on behalf of the Commonwealth, all States and Territories in conjunction with Australian National Training Authority
API	**Application programming interface** – the interface or calling conventions application programs use for accessing services provided by another module or system
Authentication	Authentication is any process to verify that someone is who they claim they are. This usually involves a username and a password, but can include any other method of demonstrating identity, such as a smart card, retina scan, voice recognition, or fingerprints. Authentication is equivalent to showing a drivers license at the ticket counter at the airport. Logically authentication precedes authorisation.
Authorisation	Authorisation is finding out if a person, once identified, is permitted to have a resource. This is usually determined by finding out if that person is a part of a particular group, if that person has paid fee, or has a particular level of security clearance. Authorisation is equivalent to checking the guest list at an exclusive party, or checking for your ticket when you go to the opera.
CAP	**Consumer access provider** – a search facility provided for consumers (such as a search engine on the internet or a search engine provided by a VET institution on an intranet) that has implemented the search API so it can send a search to the federated search provider (FSP) and receive the combined results provided by the FSP in return.
Consumer	People with access to the federated search facility via a consumer access provider (CAP). Consumers are typically teachers and students. Consumers may or may not be associated with participating network members.

DREL	**Digital rights expression languages** – a formal language for expressing conditions and permissions for the use of digital resources.
EdNA Online	**EdNA Online** is an information service (*www.edna.edu.au*) that aims to support and promote the benefits of the Internet for learning, education and training in Australia. It is organised around Australian curriculum, its tools are free to Australian educators, and it is funded by the bodies responsible for education provision in Australia – all Australian governments.
FLAG	**Flexible Learning Advisory Group** – the management committee of the Australian Flexible Learning Framework.
FSP	**Federated search provider** – a distributed search manager that enables a single LO discovery experience by distributing a learning object search request out to multiple resource service providers (RSPs) and presenting the combined results to the consumer via a consumer access provider (CAP).
HTML	**HyperText Markup Language**
IMS	The IMS Global Learning Consortium develops and promotes the adoption of open technical specifications for interoperable learning technology. IMS is a worldwide non-profit organisation that includes more than 50 contributing members and affiliates. These members come from every sector of the global e-learning community. They include hardware and software vendors, educational institutions, publishers, government agencies, systems integrators, multimedia content providers and other consortia. The Consortium provides a neutral forum in which members with competing business interests and different decision-making criteria collaborate to satisfy real-world requirements for interoperability and re-use. The scope for IMS specifications, broadly defined as 'distributed learning', includes both online and off-line settings, taking place synchronously (real-time) or asynchronously.
IMS Content Packaging Specification	The IMS Content Packaging Specification defines how content should be packaged digitally to facilitate the sharing of learning resources. This enables all systems that use the IMS content packaging specification to share learning resources. In practice, the content is represented as an XML manifest file, with the predefined name *imsmanifest.xml*. Content that is packaged in XML format in accordance with the IMS content packaging specification can be distributed on a range of compliant learning management systems. [Source – *Learning Objects Quick Guide: Developing concepts and technologies in the VET sector*] The IMS content packaging specification is available at *www.imsglobal.org/content/packaging/index.cfm*

IMS DRI	**IMS Distributed Repository Interoperability**
Interoperable	Interoperability involves standardising technical services, information formats and business processes.
LMS	**Learning management system**
Learning object	A resource in digital format that provides a learning experience of some kind. Learning objects can be compared to the resources housed in a physical library. [Source – *Learning Objects Quick Guide: Developing concepts and technologies in the VET sector*]
LOR	**Learning object repository**
OAI-PMH	Open Archives Initiative Protocol for Metadata Harvesting
Open Archives Initiative	The Open Archives Initiative develops and promotes interoperability standards that aim to facilitate the efficient dissemination of content. See *www.openarchives.org* for more information.
Producer	An organisation that publishes learning objects in a learning object repository (LOR) meeting agreed standards.
RSP	**Repository service provider** – a learning object repository (LOR) that enables consumers to discover, sample, view and download learning objects via agreed interoperability protocols.
RSS	'**Rich site summary'** or more colloquially as '**really simple syndication**'. RSS is a shared or common XML markup that simplifies the delivery of text content (commonly news information). It is delivered as an automatically updating feed where the provider changes the content and the content updates in the reader. The reader can be a stand alone piece of software, an RSS enabled browser or an RSS reader enabled website. [Source: VET Interoperability Framework website *www.flexiblelearning.net.au/interop/index.htm*]
RTLA	**Resources for Teaching Learning and Assessment** – a program of the Australian Flexible Learning Framework.
Service consumers	Those who use a consumer access provider (CAP).
Service providers	Repository service provider (RSP) and federated search provider (FSP)
'Trusted organisations'	Organisations that participate in initial implementations of VLORN where the initial security mechanism supports very simple, low security authentication between systems at the organisation level.
VET sector	Vocational Education and Training sector
VETADATA	**VET Metadata Application Profile**

VLORN	**VET Learning Object Repository Network** – a network of organisations that contribute via agreed standards to enable the discovery and use of learning objects.
VLORN Management	Management is the role played by the body that sets the overall VLORN policy for parties to operate within thenetwork.
W3C Web Content Accessibility Guidelines	The World Wide Web Consortium (W3C) manages a Web Accessibility Initiative (WAI) to promote a high degree of usability for people with disabilities. WAI, in coordination with organisations around the world, pursues accessibility of the web through five primary areas of work: technology, guidelines, tools, education and outreach, and research and development. The WAI homepage is http://www.w3.org/WAI/
XML	**eXtensible Markup Language**

Executive summary

This document describes the business model and functional requirements adopted for the Learning Object Repository (LOR) Implementation Project (2004).

The purpose of the LOR Implementation Project (2004) is to build the capacity of the Australian VET sector to share teaching and learning resources that support flexible delivery through the establishment and embedding of interoperable principles in the design and development of resource repositories.

The project:

- consolidates and implements research undertaken in 2003, progressing the work of the VET Learning Object Repository (VLOR) Project (2003) in practical implementation situations, on a national basis
- focuses on establishing a network of federated repositories in terms of searching, viewing, downloading and transfer of reusable learning components and other interoperability issues
- **is not** a 'demonstrator' project – the expected outcome is 'sustainable infrastructure' that can be built on, extended and adapted in the future.

The interoperability model

The interoperability model comprises a network of 'trusted organisations' that cooperate via agreed standards to enable the discovery and use of learning objects.

The interoperability model is based on four guiding principles:

1. **Open standards**, based on national and international standards, eschewing closed networks and proprietary standards that are not in the spirit of the open standards approach promoted by the IMS.
2. **Common services infrastructure** to aid discovery, viewing and delivery of teaching and learning resources.

3. **Distributed and democratic modelling** to build on existing organisation technologies and collaborative frameworks
4. **Long term requirements specification** for future services associated with learning object publishing.

In the network, interoperability is developed at three levels:

1. business policy – agreement to a broad set of business policies
2. technical standards – interoperability of hardware, software and information systems
3. implementation – alignment of practical considerations when implementing the technical standards.

Interoperability is provided by service providers and consumed by service consumers as shown in Figure 1:

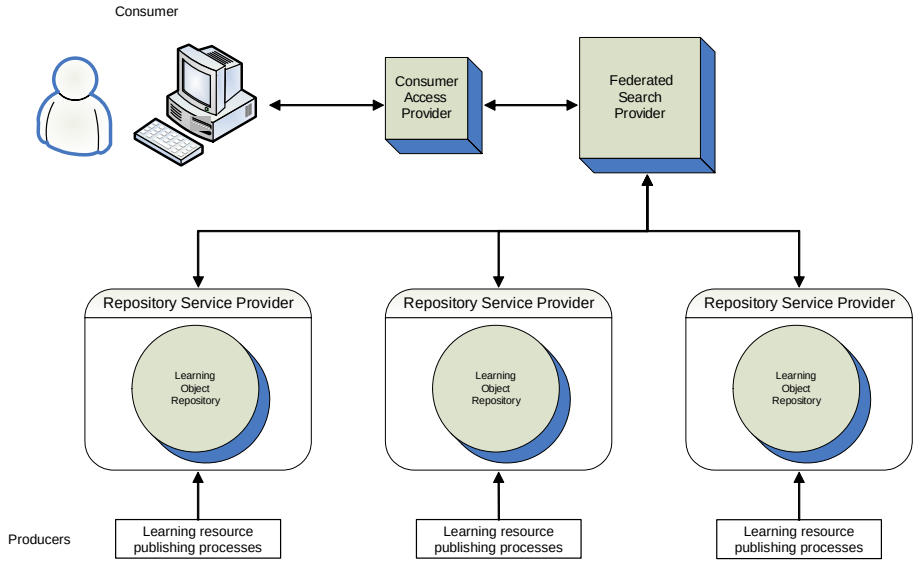

Figure 1: diagrammatic representation of the interoperability model.

Figure 1 illustrates:

- Consumers initiating a search via a consumer access provider (CAP) that sends a search request.
- Federated search provider, (FSP) which receives the request and enables a single learning object discovery experience by distributing a learning object search request to multiple repositories and presenting the combined results to the consumer.
- Repository service providers, (RSPs) which enable consumers to discover, sample, view and download learning objects, stored in resource repositories, via agreed interoperability protocols.
- Producers, which manage processes for publishing learning resources and storing them in an LOR.

The repositories contain learning resources that are described by metadata and comprise a properly formed IMS content package.

The establishment of the interoperable network aligns with the Australian Flexible Learning Framework (AFLF) priorities for 2004 for the exchange of e-learning resources between states and territories.

Background

Overview of the situation in January 2004

The situation at the start of 2004 for sharing and reuse of digital content in the Australian VET sector can be summarised as in need of a common model for interoperability across business and technical domains.

It was found that a common business or technical model for design, production, storage and distribution across the nation did not exist. Instead, VET organisations were producing large volumes of digital content using divergent technologies and business models.

The development and management of teaching and learning resources was found to be devolved and complex, comprising:

- some national level development, such as Flexible Learning Toolboxes
- some state/territory level development
- much provider level development and adaptation of resources.

Free text searching was the norm for online resource acquisition. This is characterised by inaccurate searches, no assurance of quality, uncertainties regarding copyright, no support and no associated community of learners.

Repositories were found to utilise a range of systems architectures and applications at a technical level, and different rules to govern contribution and acquisition at a business level. Additionally, there was little or no visibility of these repositories beyond the respective organisations and no national metadata standard for describing content therein.

(For a fuller description see the Work and Finance Plan for this project.)

Overview of the current situation

By the end of 2004 the project had addressed the following areas:

- description of a business/interoperability model for a network of learning object repositories (LORs)
- support of a number of flexible learning publishers for the ongoing development of IMS content packaged learning resources designed and published so they are available to others
- provision for identification of users in the network (at an organisational level) and associated access to learning resources
- establishment of infrastructure to support searching of metadata records across multiple LORs
- agreement to strategies for continuing development of service provision and new functionality within the network beyond 2004.

Business requirements

Overview

The purpose of the Learning Object Repository (LOR) Implementation Project (2004) is to build the capacity of the Australian VET sector to share teaching and learning resources that support flexible delivery through the establishment and embedding of interoperable principles in the design and development of learning object repositories (LORs).

The LOR Implementation Project (2004) establishes a sustainable infrastructure which provides access to content in a distributed network of existing repositories, with the potential for new repositories to be developed in the future.

The LORs contain learning objects that are described by metadata and packaged in conformance with IMS content packaging specifications. The establishment of this network aligns with the Australian Flexible Learning Framework (AFLF) priorities for 2004 for the exchange of e-learning resources between states and territories.

This interoperability model, known as the VET Learning Object Repository Network or VLORN:

- defines a minimal set of responsibilities for consumer access, the search provider, the repository provider and the governing body
- provides a framework for the understanding and increasing awareness of LOR concepts required to enable national sharing and access
- enunciates the concepts required for organisations to be effective participants in the network
- provides a framework, including terminology and concepts, for describing and analysing interoperability at business policy, technical standards and implementation levels
- provides a foundation for future expansion to cover long term requirements.

Membership of the network

The model described in this document comprises a network (or federated system) of producers, linked to consumers by a common services search provider**.**

Network members

Members of VLORN and their roles are:

- **Repository service provider (RSP)** – manages a repository of learning objects and provides services to enable discovery, sample, view and download of these.

  Currently, RSPs comprise the Flexible Learning Toolboxes and three other VET sector Registered Training Organisations (RTOs). These RTOs successfully met the requirements of the Expression of Interest (EOI ETG076/2004) for Learning Object Repository Adaptation and Development released by WestOne Services in 2004.
- **Consumer access provider (CAP)** – provides access to search/discovery services.
- **Federated search provider (FSP)** – provides a federated search that allows a search to be distributed across a number of RSPs and return results to a CAP.

Joining the network

The process to join VLORN (either as a CAP or a RSP) is based on implementing a set of interoperability specifications and application programming interfaces (APIs) whilst agreeing to work – in a sprit of cooperation – to advance the interests of the sector, especially in relation to gaining efficiencies from sharing teaching and learning resources.

Network members must meet the following principles of cooperation:

- Commitment to working with other members – in a spirit of cooperation – to advance the interests of the whole sector especially in relation to gaining efficiencies from sharing teaching and learning resources.
- Commitment to exposing a reasonable amount of content so that using the federated search is a rewarding experience for the consumer.
- Agreement to adhere to a minimum set of business and technical specifications.

- Agreement to licence learning objects to users to be reusable within the terms of the associated digital rights (during 2004, learning objects in the repositories should correspond with the AEShareNet-U (unrestricted) and AEShareNet-FfE (free for education purposes) licences).

Governance of the network

VLORN Management is the overall responsibility of the Flexible Learning Advisory Group (FLAG). FLAG is not involved in day-to-day operations, but devolves responsibility for VLORN Management to the Resources for Teaching Learning and Assessment (RTLA) Program Steering Committee in 2004 and to the Resources and Innovation Program Steering Committee in 2005.

The governance role performed by VLORN Management includes:

- system establishment
- policy and rules for access
- management of changes to the interoperability model (review and version control of business and functional requirements, interoperability specifications and implementation guides)
- consultation with stakeholders prior to adoption of changes to requirements, specifications and guides
- management of service level agreements (see Note below)
- resolution of issues
- system reporting.

In practical terms, VLORN responsibilities are concerned with day-to-day management of the interactions and relationship between the consumer access providers, federated service providers and repository service providers as described in this document.

> Note: As an interim arrangement, Memorandums of Understanding with a maximum duration of 12 months will be implemented between the FSP and RSPs to ensure that the necessary actions are taken to enable the systems to interoperate. More formal arrangements, such as service level agreements, are proposed for implementation in 2005.

Business transaction model

Search transaction

The federated search provider (FSP) manages the initial transaction between a consumer and a producer. The FSP facilitates initial contact between consumers and producers. Beyond the initial inquiry, transactions between a producer and a consumer are the responsibility of the producer. VLORN does not restrict additional transactions between the producer and consumer.

Figure 2 illustrates the extent of relations in this transaction.

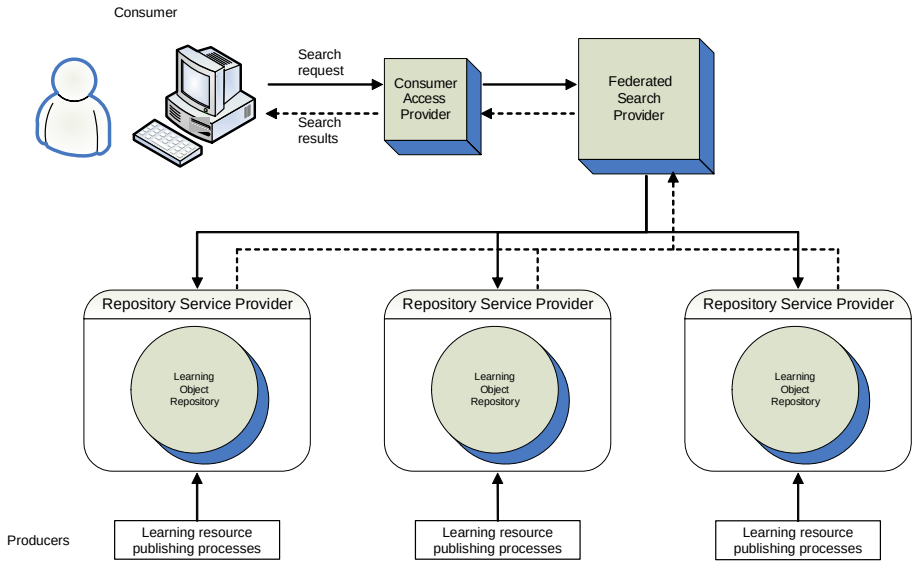

Figure 2: Illustration of a search transaction in VLORN.

In the search transaction illustrated in Figure 2:

- 'Producer' is the role played by organisations that publish learning objects.
- 'Repository service provider' (RSP) is the role played by organisations that manage repositories that provide the learning objects.
- 'Consumer' is the role played by those persons, or consumer systems, that interact with a consumer access provider (CAP) to find and acquire learning objects.
- 'Search provider' is the role played by the FSP in brokering contact between consumers and producers.

Figure 3 illustrates the search transaction in more detail, showing the VLORN model in an international context. Scenarios are shown where searches are initiated by three consumers:

- **Consumer A** is from a sector other than the VET sector and is searching via a public internet search portal (such as EdNA Online) that has implemented the federated search API.
- **Consumer B** is from the VET sector and is searching via a public internet search portal (such as EdNA Online) that has implemented the federated search API.
- **Consumer C** is from the VET sector and is searching from within a VET organisation (via an intranet search portal) that has implemented the federated search API.

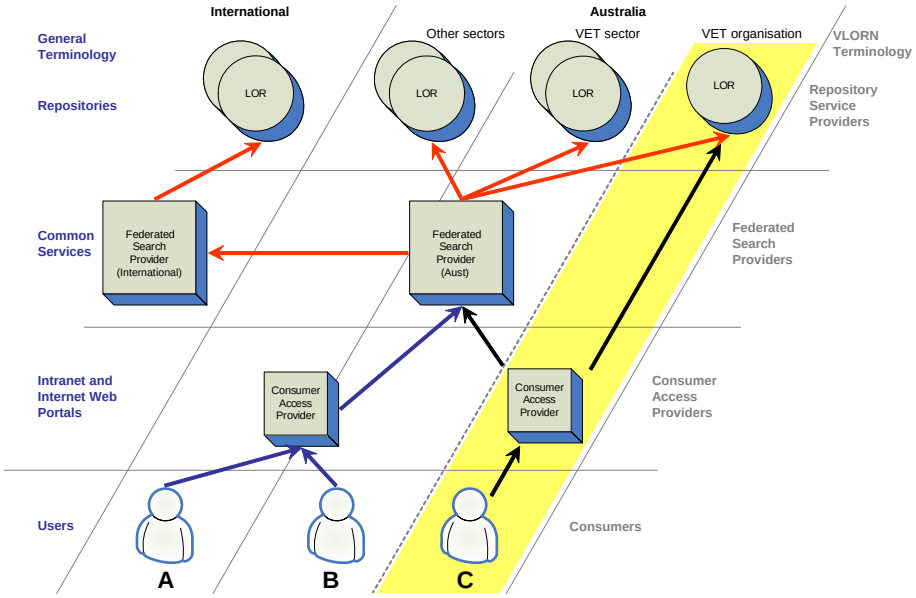

Figure 3: The VLORN model in an international context – showing searches initiated by consumers from different educational sectors in Australia.

In each scenario, using the VLORN model:

- the intranet and internet web portal search facilities are CAPs which have implemented the Search API
- the CAP sends a search request to the FSP which distributes the search request to a number of repositories in Australia and possibly other international federated search engines
- responses are returned to the FSP where they are combined and returned to the CAP for display to the consumer
- the CAP displays the search results in a way that is consistent with their own interface design and business needs.

Security authentication

The notion of 'trusted organisation' in VLORN is supported by security authentication between the CAPs and the FSP. Further transactions between a CAP and a RSP (described below) must also be supported by security authentication.

An authorisation mechanism allows CAPs to identify themselves (at the organisational level) to RSPs. The RSP can use this identification to apply local security policies (authentication and authorisation) to each service request. The RSP can implement a range of differing options for each learning object in its repository. The approach adopted by VLORN provides the greatest flexibility for RSPs in agreeing to expose learning objects for searching, while controlling the options for 'sample', 'view' and 'download'.

Example of using authentication to service a request

In the search scenarios shown in Figure 3

- Consumers A and B are searching from an internet search portal, meaning that the consumer is essentially unknown to the RSP. The RSP may choose to limit access to their learning objects, based on their own business policies and allow the consumer to –say – discover and sample a learning object but not to view or download it.
- Consumer C, searching from an intranet based search engine, will be identified at an organisation level and the RSP may apply different access rules to the service request compared to Consumers A and B. The RSP may have a bilateral arrangement with the organisation from where the search originated and provide access to the consumer to search, sample, view and download learning objects (as per Access Level 1 in Table 1).

Function	Access Level				
	1	2	3	4	5
Search	Yes	Yes	Yes	Yes	No
Sample	Yes	Yes	Yes	No	No
View	Yes	Yes	No	No	No
Download	Yes	No	No	No	No

Table 1: Example of different options for access that RSPs may implement.

Further transactions

If a consumer chooses further transactions with the RSP after a search transaction, the FSP does not manage or participate in those further transactions.

Transactions other than search transactions are conducted between the consumer and the RSP and this relationship is the responsibility of the RSP to define and implement. No restrictions are placed on the business relationship between the consumer and the RSP.

Figure 4 illustrates the extent of relations in VLORN transactions other than search.

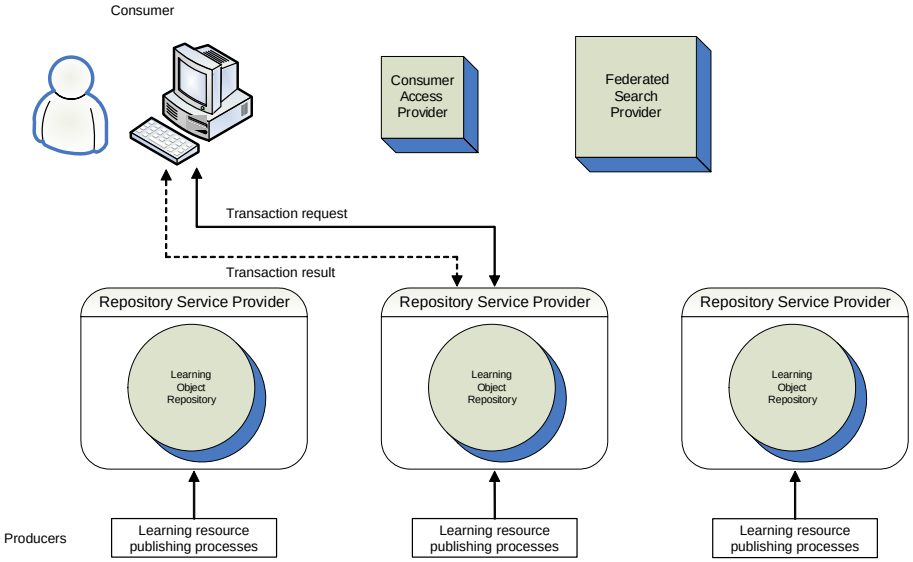

Figure 4: Transactions in VLORN, other than search, are conducted directly between the consumer and the repository service provider.

Content requirements

The VLORN model accommodates information that is inherently digital. The digital information is stored as a ‘learning object’ – that is, a resource in digital format that provides a learning experience of some kind.

The educational definition of a learning object is not material (beyond the requirements described in ‘Repository specification’ at p xvii), as long as it can be discovered, sampled, viewed and downloaded by the consumer.

Conformance

A conforming VLORN implementation shall support the *VET Learning Object Repository Network Interoperability Specification*.

A conformant repository may provide additional services to users that are beyond those required of VLORN.

Functional requirements

Overview

The guiding principals that underpin the VLORN interoperability model are:

- **Open standards**: build architectures based on national and international standards, eschewing proprietary based application sets that are not in the spirit of an open standards approach as promoted by the IMS. The approach recognises and supports the diversity across states, territories and training providers with regard to existing and future learning object repository strategies.

  The approach also aims to maximise flexibility for repository owners to implement business policies that suit their operational context. The 'hurdle' to enter the network is set deliberately low.

  No restrictions are placed on the business relationship between the consumer and the producer.
- **Common services infrastructure**: focus on common services to aid discovery, viewing and delivery of teaching and learning resources.
- **Distributed and democratic modelling**: recognise a number of pre-existing environmental factors, building on existing technologies and collaborative frameworks with the dual advantages of leveraging national/international best practice and reducing the risks associated with 'starting from scratch'.
- **Long term requirements specification**: develop specifications that account for possible future services associated with a learning object publishing approach, to ensure developments in this project are inclusive and compatible with future requirements. A range of common services will be considered for future adoption as part of the common services infrastructure beyond the timeframe of this project.

Interoperability model

Roles

The VLORN model is a network of 'trusted organisations' that cooperate via agreed standards to enable the discovery and use of learning objects. This interoperability is modelled as a set of services that are provided by service providers and consumed by service consumers.

Functionality

The VLORN model supports functionality to deliver the following scenario:

- A number of repository service providers (RSPs) expose the information in their learning object repositories (LORs) as a set of web services:
  - Search: a simple keyword search that returns information about learning objects in the repository
  - Sample: a service that resolves to a URL of an HTML page that allows a consumer to preview part of the learning object
  - View: a service that resolves to a URL of an HTML page that allows a consumer to view the complete learning object
  - Download: a service that returns an IMS content-packaged (zip) learning object to the consumer for download
  - News: an RSS feed of news that relates to the LOR.
- A federated search provider (FSP) acts as an intermediary service to simplify the process of searching across a set of LORs and may interact with other federated search engines. The search returns information about learning objects from the selected repository set.
- A number of websites acting as consumer access providers (CAPs) (i.e. web portals or intranet based search centres which have implemented the federated search API) use these federated search services to deliver learning object discovery services to consumers.

Standards and specifications

Where practical, the VLORN interoperability model is based on agreed international standards and specifications.

The specification of this model (as described in *VET Learning Object Repository Network Interoperability Specification*) is based on

- a pragmatic assessment of current international standards
- the need for the initial implementation to be simple, easy and fast.

The priority in the development of the interoperability specification has been to develop a solution that meets the minimum required functionality with maximum simplicity and ease of implementation.

It is expected that the *VET Learning Object Repository Network Interoperability Specification* will be enhanced over time to support more functionality and to align more closely with international specifications. This enhancement will continue in 2005 beyond the life of the current project.

Methodology

The methodology used to produce the interoperability specification involved looking for solutions at each interoperability point according to the following priorities:

- formal international standards or specifications
- existing Australian specifications in common use
- adaptations of the above
- develop a new specification.

Reference

The major reference informing the interoperability specifications is the IMS Distributed Repository Interoperability (IMS DRI) framework. The 2004 implementation of VLORN supports the following three IMS DRI (version 1.1.2) functions:

1. Search/Expose: A search intermediary provides a search service across a number of LORs. Each LOR provides an 'expose' service to enable information about the learning objects to be obtained.
2. Request/Deliver: Each LOR provides a 'request/deliver' service to enable learning objects to be downloaded.
3. Alert/Expose: Each LOR can alert users to changes in the state of the LOR information content. A simple implementation is based on a 'really simple syndication' (RSS) news feed.

A fourth IMS DRI function, Gather/Expose, may be included in a future implementation beyond 2004. It is expected that this will be achieved via the Open Archives Initiative Protocol for Metadata

Harvesting (OAI-PMH) and an intermediary metadata repository (such as EdNA Online – see *http://www.edna.edu.au/edna/page384.html* for more information).

The analysis of candidate specifications and implementation rationale for VLORN is described in the *VET Learning Object Repository Network Interoperability Specification*.

Security model

The VLORN interoperability model comprises a group of systems that authenticate to each other and in doing so participate in a trusted federation of peers.

The initial security mechanism supports security authentication between systems at the organisation level.

The initial implementation, described in the *VET Learning Object Repository Network Interoperability Specification*, supports the concept of a simple user 'key' that can be sent with each request to identify the requesting organisation.

Federated search

The role of the federated search provider (FSP) is to provide search facilities into a range of repositories and other federated search engines. This service is the first element of the common services layer – see Figure 3. Further common services will be developed beyond this project in 2005.

education.au limited is the FSP. The ***education.au limited*** search engine interfaces with consumer access providers and repository search providers as described in the *VET Learning Object Repository Network Interoperability Specification*.

Consumer access

Consumer access can be provided by any internet or intranet search engine that implements the search API to interface with the federated search provider. A consumer access provider (CAP) must register in VLORN prior to implementing the API. The purpose of registration is not to provide a mechanism to limit who can join the network, but to ensure that changes and revisions of specifications can be communicated and managed properly. The register is maintained by the federated service provider.

The registration process will be managed by the 'community website' (described in 'Administration requirements' on page xix below). This enables the network and governing body to monitor and track usage and establish lines of communication with a community of users.

In 2004 ***education.au limited*** modifications to EdNA Online has provided the first CAP internet portal for federated searching.

Repository specification

This project has defined the following specifications for learning object repositories (LORs). See the *VET Learning Object Repository Network Interoperability Specification* for detailed information on the implementation of interoperability specifications.

Core functionality

Repositories should, at a minimum, support the following areas of core functionality as outlined by the VLOR Project (2003):

- Search/Expose
- Request/Deliver
- Submit/Store.

These functions are described in detail in the *IMS Digital Repository Specification* available from *www.imsglobal.org*.

IMS compliance

Repositories should support IMS compliant learning objects. To facilitate this, learning objects must:

- include adequate metadata descriptions for discovery within a learning object repository (see 'Metadata' below)
- comprise, or be part of a properly formed IMS content package.

Metadata

All learning objects must include appropriate metadata that:

- conforms to the VET Metadata Application Profile (VETADATA)
- reflects the appropriate usage restrictions in relation to digital rights through the use of an agreed Digital Rights Expression Languages (DREL).

The VETADATA profile has been developed by the Interoperability Project (2004) and is available at *http://www.flexiblelearning.net.au/interop/*.

Interoperability

Interoperability is essential to the success of this project, and all repositories must meet the following interoperability requirements:

- support communications between repositories across firewalls
- support the adaptation of the federated search provider (FSP) API and repository service provider (RSP) APIsto provide a suitable search service
- successfully interface with and implement the FSP and RSP API.

Learning object content specification

Participating repositories support a number of learning objects that are able to meet the following criteria.

Learning objects:

- conform to IMS content packaging compliance
- are a completely self-contained piece of learning and ready for publishing
- comply with W3C Web Content Accessibility Guidelines – see *http://www.w3.org/WAI/*
- should be designed to be discoverable, interoperable, context-able, editable and re-usable as described in the VLOR Project (2003) recommendations and findings
- during 2004, should correspond with the AEShareNet-U (unrestricted) and AEShareNet-FfE (free for education purposes) licences. See *www.aesharenet.com.au/coreBusiness/* for more information.

Additionally, the rights associated with each learning object should be exposed to the consumer during the search process as described in the ‘Copyright requirements’ below.

IMS content packaging

Content packaging addresses the description, structure, and location of online learning materials and the definition of some particular content types.

Repository service providers (RSPs) are required to provide content to meet the Final Version 1.1.2 of the *IMS Content Packaging Specification* released to the public in August 2001.

The *IMS Content Packaging Specification* provides the functionality to describe and package learning materials, such as an individual course or a collection of courses, into interoperable, distributable packages.

Copyright requirements

Copyright and licensing is the responsibility of the RSPs. However, as part of operating within VLORN, RSPs warrant that they own the copyright to the material in terms of publication and that such rights are expressed to the consumer as part of exposure in the search result.

Learning object identifiers

RSPs implement a unique learning object identification system. This system is enunciated by the *VET Learning Object Repository Network Interoperability Specification*. The system is based on a recognised standard of the Open Archives Initiative.

Administration requirements

A ‘community website’ is required to enable administration of the federated search services (and potentially other central services as they are developed from time to time). This site will be branded as an Australian Flexible Learning Framework website and will contain:

- a registration form to create or modify details of a repository service provider (RSP)
- a registration form to create or modify details of a consumer access provider (CAP)
- documentation (specifications, implementation guides etc)
- links to conformance test suite
- a list of registered RSPs
- a list of registered CAPs
- management reports (web logs).

The site will be implemented at flexiblelearning.net.au/vlorn

Development of interoperability functionality

The following VLORN functionality has been identified, with the proposed target date for implementation beyond 2004 contingent on future project approvals via Framework programs.

The shaded area indicates the scope of the current project.

Functionality	Comment	Role	Difficulty	Value	Target Date
Federated search and discovery		FSP	Low	High	2004
Learning object previewing		RSP	Low	High	2004
Learning object viewing		RSP	Medium	High	2004
Learning object delivery		RSP	Low	High	2004
Standards based networked system		FSP/RSP	Low	High	2004
Minimal licence implementation (U and FfE)		RSP	Low	High	2004
Alert service	Mechanism for alerting users about change in status of learning objects	RSP	Medium	High	2004
Extension of keyword searching	Extend search capability beyond keyword search developed in 2004	RSP	Medium	High	2005

Functionality	Comment	Role	Difficulty	Value	Target Date
Secure authorisation for individuals	2004 system only allows for authentication on an organisation basis	RSP	Medium	High	2005
Gather/expose	Harvesting of learning objects metadata between repositories or via an intermediary	FSP/RSP	Medium	Medium	2005
Intellectual property/DRM	Research initial IP/DRM model within the federation by reviewing current developments in other sectors	RSP	High	High	2005
Extend range of licenses	Agree additional licence templates for adoption by RSPs	RSP	Medium	High	2005
Learning object preview services	Web services to enable view and run of learning objects without requiring an LMS	FSP/RSP	High	Medium	2005
Governance arrangements	Establish Service Level Agreements between parties in the federation	FSP/RSP	Low	High	2005
Licensing transactions	Establish mechanisms for licensing learning objects via a web service	Web service	Medium	High	2006 +

Functionality	Comment	Role	Difficulty	Value	Target Date
Learning object authoring tools		RSP	Low	Low	2006 +
Single sign on and identity management		RSP	Medium	Unknown	2006 +
DRM	Implement a staged approach to DRM with an initial DRM model	Web service/RSP	High	Unknown	2006+

Appendix – Use Cases

This Appendix describes a series of Use Cases that have been used to define the Business and Functional Requirements described in this document.

Roles

The following roles are described:

- End user: trainer, public, trainer external from their institution
- Federated search provider (FSP)
- Repository service provider (RSP)
- Consumer access provider (CAP)
- Repository administrator
- Contributors (authors)
- Governance.

Use Case: End user (trainer)

Description

A trainer is a person who finds, previews and downloads learning objects for the purpose of selection in a course.

Context

A trainer has access to (is logged into) the institution's internal search portal (where the search portal has implemented the federated search API and is a consumer access provider).

Trigger

A trainer wishes to find and use learning objects for a course. The trainer wishes to access a wider range of learning objects than are held within the institution's local LOR.

Flow

The trainer performs a search from the local consumer access provider (CAP) node e.g. intranet search portal for learning objects or internet search portal for learning objects, based on some search query. The search function sends the query to a federated search provider (FSP) node which distributes the query to all LOR Service Provider (RSP) nodes in the federation.

Each RSP returns a set of metadata associated with each learning object that meets the query request.

The FSP combines all search results and returns the federated results back to the trainer.

The trainer is able to browse the results and see things such as:

- title, description, owner
- conditions of use
- permission to preview
- permission to retrieve.

If permitted the trainer can preview the learning object.

If permitted the trainer can then retrieve the learning object(s) into a bundle for use in the course. The learning object will be downloaded as an IMS Manifest which will be unpacked and stored in the local LMS.

Required functionality

The FSP supports an API (federated search API) that allows a search to be distributed across a number of RSPs.

The RSP supports an API that allows a search into the LOR.

The RSP supports an API that allows one or more learning objects to be retrieved from the LOR for HTML preview.

The RSP supports an API that allows one or more learning objects to be retrieved from the LOR as an IMS manifest for full function access.

The CAP supports access to the FSP and RSP.

The CAP is registered and sends the issued user key with the search request.

Learning object metadata returned as a result of a search on the RSP includes condition of use.

Use Case: End user (public)

Description

A public end user is a person who finds, previews and downloads learning objects from an internet based consumer access provider (CAP).

Notes

- A member of the public should be able to discover and preview learning objects using an internet based CAP (eg EdNA Online). Retrieval will be subject to the RSP's policy.
- Public portals should provide access to this functionality for the public.
- Details for this Use Case are the same as for a trainer (see above).

Use Case: End user (trainer external to their institution)

Description

A trainer wishes to find, preview and download/retrieve learning objects for the purpose of selection in a course.

Context

A trainer is operating externally from their institution eg from home or on the road.

Notes

- The trainer's institution must provide access to the institution's intranet search for the trainer to search the federated network with an authenticated organisational user key
- Alternatively, the trainer can use a public internet portal and be unidentified in terms of the organisation to whom he/she belongs.

Use Case: Federated search provider (FSP)

Description

A federated search provider (FSP) supports a single discovery experience across multiple RSPs. It implements the IMS DRI Search Intermediary role and supports the IMS DRI Search Use Case.

At the front end, the FSP provides an XML API to allow a search client node (CAP) such as a portal or LMS to send a federated search query request.

At the back end the FSP acts as a search client to multiple RSPs. Each RSP provides an XML Search API into the LOR.

Context

An FSP is authenticated to access and search multiple RSPs in the federated network.

Multiple CAPs are authenticated to access and search the FSP.

Trigger

An end user wishes to find and use a wider range of learning objects than are held within the institution's local LOR.

Flow

The user performs a search from the local consumer access provider (CAP) node e.g. intranet search portal for learning objects or internet search portal for learning objects, based on some search query. The search function sends the query to a federated search provider (FSP) node which distributes the query to all repository service provider (RSP) nodes in the federation.

Each RSP returns a set of metadata associated with each learning object that meets the query request.

The FSP combines all search results and returns the federated results back to the trainer.

The trainer is able to browse the results and see things such as

- title, description, owner
- conditions of use
- permission to preview
- permission to retrieve

Required functionality

The FSP supports an API (federated search API) that allows a search to be distributed across a number of RSPs.

The RSP supports an API that allows a search into the LOR.

The CAP supports access to the FSP and RSP.

The CAP is registered and sends the issued user key with the search request.

Learning object metadata returned as a result of a search on the RSP includes conditions of use.

A method to authenticate between CAPs, FSPs and RSPs will be required.

Use Case: Repository service provider (RSP)

Description

An RSP is a VET Sector organisation that provides:

- LOR search
- IMS content packages for download.

Context

The RSP is a member of the federated network.

Trigger

The RSP acquires and publishes learning objects for distribution on an internal network/intranet and nationally through the federation.

Flow

The RSP:

- Acquires raw and packaged content. Raw content is aggregated into ims content packages.
- Manages metadata: addition and attachment of metadata.
- Manages compliance checking: content and technical QA
- Defines/maintains/distributes development and delivery guidelines and standards.
- Search and discovery and/or preview and/or download.
- Provides content change/maintenance trigger information.
- Collects and manages usage data: who, what, where.

Use Case: Consumer access provider (CAP)

Description

The CAP is either a public internet portal or an intranet search interface of a VET organisation.

Context

The CAP is registered as part of the federation and has implemented the search API.

The CAP has been issued with a user key that is passed with each search query. The user key allows RSPs to identify the source of the search query.

RSPs may implement business rules to provide more or less access to learning objects depending on the source of the query.

Trigger

An end user wishes to find a wider range of learning objects than he/she has access to in his/her own institution.

Flow

The user performs a search from the local consumer access provider (CAP) node e.g. intranet search portal for learning objects or internet search portal for learning objects, based on some search query. The search function sends the query to a federated search provider (FSP) node with the CAP's user key. The FSP distributes the query to all repository service provider (RSP) nodes in the federation.

Each RSP returns a set of metadata associated with each learning object that meets the query request.

The FSP combines all search results and returns the federated results back to the trainer.

Required functionality

The FSP supports an API (federated search API) that allows a search to be distributed across a number of RSPs.

The RSP supports an API that allows a search into the LOR.

The CAP supports access to the FSP and RSP.

The CAP is registered and sends the issued user key with the search request.

Learning object metadata returned as a results of a search on the RSP includes conditions of use.

A method to authenticate between CAPs, FSPs and RSPs will be required.

Use Case: Repository administrator

The repository administrator performs a technical role maintaining internal and external repository systems and services.

Backend administration covers databases, programs, interfaces, monitoring, user accounts and support.

National administration activities include web services management, LOR availability and performance.

Use Case: Contributors (authors)

Since RSPs are responsible for acquisition, QA and publishing of learning objects, this Use Case is outside of scope.

Description

Contributors create learning objects. Three types of contributor were identified:

- commissioned
- third-party licensing
- voluntary
  - practioner
  - student
  - other.

Context

Contributors work in, or are contracted by, the RSP.

Trigger

Project initiation and budget allocation.

Flow

The flow for contribution to a repository is dependent on the acquisition methodology of the RSP. There needs to be a balance between demands placed on the contributor and publishing requirements of the RSP.

Issues

The question of voluntary submission of learning objects raised the issue of two tiers of LOR. While not within scope for this project, the idea may be worth mentioning as a possible future implementation:

- Tier one – the standards based quality assured model.
- Tier two – the open access minimum requirements model.

Both models are owned and managed by a member of the federated search Consortium. The federated search differentiates between the two tiers for the user. The second option is only a consideration for inclusion in requirements in terms of specification of relationship

between the models and between each model and the federated search.

Use Case: Governance

The type of governance performed:

- system management
- policy
- rules for access
- manage agreements/membership issues
- system admin/reporting.