

Sustaining the Momentum - Directions for Interoperability in the VET Sector

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Executive summary

This report was commissioned by the 2005 Australian Flexible Learning Framework (2005 Framework) through its Research and Policy Advice Project, working in conjunction with the Resources and Innovation Program.

The 2005 Framework is a national strategy that works to provide the vocational education and training (VET) sector with e-learning skills, professional development opportunities, resources and support networks to meet today's increasingly technology-driven learning environment. It builds on the work carried out by the 2000-2004 Australian Flexible Learning Framework (Framework).

Interoperability activities undertaken to date within the 2005 Framework are reviewed in the context of other national and international interoperability developments and emerging trends in information and communications technology (ICT). In particular, the strategic approach outlined in the VET Interoperability Framework is assessed for its currency and relevance. So far, the approach adopted has been to focus on five key areas of technical interoperability, while at the same time, endeavouring to provide overall direction and coherence to activities conducted under the auspices of the 2005 Framework. There is a strong consensus among stakeholders that, to this point, this strategic approach has been effective.

However, the Australian VET sector is influenced by an increasingly interconnected ICT environment. Access and delivery devices have proliferated, as have high-bandwidth network connectivity options. In responding to this, the VET Interoperability Framework will need to broaden its scope to accommodate new requirements and diverse stakeholder interests.

Maintaining an interoperability focus also requires consideration of a range of influences beyond the ICT environment itself. These influences include the business drivers and the political environment at various levels (national, jurisdictional and organisational). Importantly, maintaining the focus requires stakeholders to clearly understand and articulate their business requirements. Ongoing identification of ICT standards and specifications appropriate to stakeholder requirements is critical if an informed strategy is to be continued.

Currently, there is a high degree of awareness in the VET sector of IMS, SCORM, and W3C standards, an awareness that has largely been facilitated by the evolution in the development of the Framework's Flexible Learning Toolboxes (Toolboxes) and high-profile projects such as VLORN and VETADATA. Having achieved this, however, there is a need to consider the broader range of standards that impact upon the delivery of and access to e-learning. The first generation of content-based e-learning standards (LOM, SCORM, IMS Content Packaging) represents just one aspect of the interoperability required in the developing e-infrastructure. Other standards and specifications now receiving significant attention globally include those focused on authentication and identity management, e-portfolio design and portability, repository federation and interoperability, learning design, performance support, intellectual property rights management, and search services. Consideration of the impact of web services technologies and service-oriented architectures is also critical in maintaining a *framework* approach.

The following is a summary of recommendations based on the review of relevant documentation, analysis of trends and developments, and consultations with leading practitioners.

A glossary explaining abbreviations can be found on p.52 of the report.

Recommendations

Recommendation 1: Continuity of the interoperability focus

- 1.1 It would be strategic to continue the interoperability focus within the broader Framework, to provide ongoing leadership to the sector, and build upon the foundations already established.
- 1.2 There is a requirement for an ongoing consultative mechanism within the VET sector for collaborative participation of stakeholders in interoperability issues and planning. The VET Interoperability Expert Group (VET IEG) provides a point of focus for this.
- 1.3 An updated strategy that addresses the growing interest in open source software would be beneficial, given that open source implementation does not guarantee interoperability.
- 1.4 It is recommended that a strategy for considering and possibly adopting interoperability specifications and standards associated with e-portfolios be given a high priority.
- 1.5 It is recommended that a strategy be developed for considering and possibly adopting a range of IMS interoperability specifications.
- 1.6 It is recommended that the VET IEG consider developing a conceptual model for future interoperability activities informed by relevant key initiatives, such as the AGIMO TIF and the e-framework being jointly developed by DEST and JISC.
- 1.7 It is recommended that planning for extensions to VLORN functionality identified in the Report on usability testing of VLORN (for example, searches that handle access rights, competency names and codes, and further granular descriptions of learning objects) be undertaken.
- 1.8 It is recommended that a review be undertaken by the VET IEG and Flexible Learning Advisory Group (FLAG) of vocabularies used by key services, including EdNA Online, ATP, AESL, NTIS, flexiblelearning.net.au, and training.com, with a view to identifying interoperable pathways.
- 1.9 It is recommended that the Framework consider its position on participation in the IMS Compliance Program, given that conformance with specifications is a useful strategy for ensuring interoperability.
- 1.10 It is recommended that the VET sector support and engage in activities within Standards Australia IT-19-1, the formal mechanism for Australian standards development.

Recommendation 2: Update, maintenance and communication of the VET Interoperability Framework

- 2.1 It is recommended that the VET Interoperability Framework website continue its advocacy and dissemination functions.
- 2.2 It is recommended that the VET Interoperability Framework website build an online capability that supports collaborative and consultative processes.
- 2.3 It is recommended that ongoing development of the VET Interoperability Framework website include links (and possibly RSS feeds) to key interoperability websites (such as CETIS, WS-I, W3C, IMS, and ADL).

- 2.4 It is recommended that information about the IMS Compliance Program be posted on the VET Interoperability Framework website.
- 2.5 It is recommended that ongoing development of the website include links (and possibly RSS feeds) to whole-of-government initiatives, such as the AGIMO and GovDex Interoperability Framework.
- 2.6 It is recommended that the six strategic areas identified (content formats, content packaging, metadata and vocabularies, intellectual property rights, repositories, and web services) be expanded to include e-portfolios.
- 2.7 It is recommended that the VET IEG update information and guidelines on the VET Interoperability Framework website associated with SCORM to reflect more recent developments.
- 2.8 Current listings of standards and specifications on the website reference would be enhanced if each entry had some visible metadata attached in the way of 'current as of date ...' or 'last updated'.
- 2.9 In providing easy access to the bigger picture of implementing interoperability specifications and standards, it is recommended that a link be provided to the e-framework being developed collaboratively by DEST and JISC, United Kingdom (UK).
- 2.10 It is recommended that reference to the IMS accessibility specifications and guidelines be considered for inclusion into the VET Interoperability Framework website.
- 2.11 Given that a large range of learning management systems are deployed within the VET sector, it is recommended that the VET Interoperability Framework consider including reference to the IMS Tools Interoperability Framework.

Recommendation 3: Monitoring new technologies

- 3.1 There is a proliferation of new digital devices that can be used to access online training materials, including personal digital entertainment (PDE) devices such as iPods, personal digital assistants (PDAs), PocketPCs, tablet computers, and even some mobile phones. Many of these technologies can be utilised in mobile learning environments and interoperability issues are inherent to these and related innovations.
- 3.2 The rapid growth in broadband and wireless connectivity (including protocols such as WiMax and BlueTooth) brings with it many opportunities for the delivery of flexible learning. It will be important for the VET IEG to monitor these developments.
- 3.3 Radio Frequency Identification (RFID) is set to revolutionise many workplace and learning environments. While this technology can potentially streamline processes such as library check-out and supply-chain inventory management, it could also be developed for learning technology applications (for example, RFID tags could easily include LOM metadata).
- 3.4 The popular adoption of blogging software by individuals brings with it a number of issues that may impact on the delivery of flexible learning, including assessment and the use of content syndication protocols such as RSS, Atom and iCalendar. It is recommended that such technologies be referenced within the VET Interoperability Framework.

- 3.5 The proliferation of domain-specific vocabularies, taxonomies and ontologies brings with it the need for interoperability solutions that could utilise W3C technologies such as RDF and OWL, as well as other technologies such as Topic Maps. It is recommended that Topic Map technology be considered as a vocabulary management tool.

Recommendation 4: Appraisal of new specifications and standards

- 4.1 It is recommended that outputs in the form of web services specifications from the WS-I Consortium be monitored and appraised routinely.
- 4.2 It is recommended that the Framework develop an interoperability standards policy concerned with authentication, authorisation, and identity management. In particular, Shibboleth should be appraised for its suitability for the sector.
- 4.3 It is recommended that the Framework consider the possible adoption of the IMS Learning Design specifications, given that the Quality e-learning Resources Project has had the foresight to define Toolbox collections in terms of *learning activities* as well as *learning resources*.
- 4.4 It is recommended that the VET sector monitor international developments in the area of content packaging with a view to developing a VET sector policy on imminent updates to the IMS and SCORM specifications.
- 4.5 It is recommended that the VET sector note ADL activities associated with CORDRA. It is likely that CORDRA specifications have longer-term implications for the VLORN project.
- 4.6 It is recommended that a VET sector-wide approach to object identifiers be developed (in consultation with stakeholders from the schools and higher education sectors along with representatives from IMS Australia and the Australian ADL Partnership Lab).
- 4.7 It is recommended that the VET IEG note the Australian ADL activities associated with SCORM and S1000D.
- 4.8 It is recommended that the VET Interoperability Framework develop a broad view of interoperability that explicitly acknowledges the important standards development emerging from a wide range of organisations apart from IMS and ADL (for example, OASIS, WS-I, IETF, W3C, HR-XML, ITU, ISO, and others). This could be done while also emphasising agreed priority interoperability areas.
- 4.9 It is recommended that the VET sector investigate the usefulness of the IMS specification for e-portfolios.
- 4.10 It is recommended that the VET sector investigate the usefulness of the IMS RDCEO specification for the purposes of building systems enabling efficient recognition of prior learning.
- 4.11 It is recommended that the VET sector note the formation of the 'Common Cartridge' working group within IMS, which is focused on developing specifications for a 'course or major course component level collection of content' and the rules for interacting with it.
- 4.12 It is recommended that the VET IEG continue to monitor developments relating to digital rights management.

- 4.13 It is recommended that the VET IEG note the MAMS activity and consult with appropriate personnel prior to advising on any authentication-related interoperability specifications for the VET sector.
- 4.14 It is recommended that the VET IEG review the specifications for content interoperability in order to ensure currency.

Recommendation 5: Whole-of-government coordination

- 5.1 It is recommended that whole-of-government initiatives focused on achieving interoperability (such as the AGIMO and GovDex Interoperability Framework) inform future work within the VET sector.
- 5.2 It is recommended that the VET sector consider adopting the Web Publishing and Good Practice Guidelines developed by AGIMO.
- 5.3 It is recommended that the VET sector consider a mechanism for providing input to AGIMO and GovDex with a view to ensuring that the requirements of VET stakeholders are accommodated.

Purpose

The purpose of this report is to review the approach and outcomes of the Framework's interoperability activities to date, and the progress towards achieving a considered strategy adequately informed by other national and international interoperability developments.

Scope

This report provides:

- A literature review of relevant documents, websites, standards and specifications associated with the Framework's interoperability initiatives.
- A status report of current VET projects associated with interoperability (Toolboxes, the VET Learning Object Repositories Network [VLORN], and VETADATA).
- Results, in the form of case studies, of consultations with stakeholders identified by the VET Interoperability Expert Group.
- Analysis of the interoperability specifications used by Framework Projects and the efforts made to pursue an integrated approach between the projects.
- Commentary on national and international ICT interoperability standards relevant to VET sector activities.
- Practical recommendations associated with moving the 'interoperability agenda' forward within the Australian VET sector.

Methodology

This report is the result of research into key information resources on VET sector activities related to interoperability, and consultation with stakeholders directly involved in 2005 Framework Projects. The methodology comprised:

- local stakeholder consultation
- literature research
- workshop
- international consultation.

A full list of resources is provided at the end of the document.

Context

The ongoing development and support of flexible learning requires an infrastructure that is not only flexible, but also affordable, sustainable, and responsive to stakeholder requirements. While the Internet provides a basic platform for resource sharing and communication, finding targeted training resources can sometimes be very difficult. Since 2000 the Australian National Training Authority has funded a major initiative known as the Australian Flexible Learning Framework (Framework). It was clearly identified within the Framework (2000–2004) that an appropriate flexible learning infrastructure would necessitate the adoption of common technical standards and systems. This approach

would support the development of national repositories of training materials, enabling resource sharing and re-use.

Substantial effort has already been invested in establishing a foundation for a collaborative approach to this work, and there is reasonable consensus that significant 'baseline interoperability' has been achieved.

Beginning with the VET Preferred Standards projects (1998 and 2001) a range of projects have since been funded that have addressed the issues associated with interoperability. A key activity amongst these projects has been the development of the VET Interoperability Framework (2003), an outcome of the Collaborative Interoperability Project which produced a set of recommendations for further activity by the Framework in interoperability.¹

Based on the work of these projects, a number of organisations and institutions have either already implemented, or are in the process of implementing some of the recommendations.

This current research report has been commissioned to review the approach and outcomes of the Framework's interoperability activities to date and to provide comment on progress. This will facilitate the development of a well-considered strategy which has been adequately informed by both national and international developments.

Defining interoperability

For many people, the term 'interoperability' is not only awkward to say, but it also suggests technological complexity. Moreover, most definitions have a technical focus. Examples include:

The ability of systems and data to work seamlessly together.

<<http://www.cetis.ac.uk/encyclopedia/entries/20011126153126>>

Interoperability is defined by the IEEE Standard Computing Dictionary (IEEE, 1990) as 'the ability of two or more systems or components to exchange information and to use the information that has been exchanged'. From the user perspective, interoperability is the ability of systems to work together, to 'plug and play' without any hassles. The interoperability of a digital learning resource is the degree to which it can run properly on multiple systems and can successfully be used in its potential audience's computing and learning environments. It also refers to the ease with which an author or developer can modify a resource for adaptation.

<<http://www.reusablelearning.org/index.asp?id=29>>

The ability of a system or a product to work with other systems or products without special effort on the part of the customer.

<<http://www.education.tas.gov.au/wiseweb/appendices/glossary.htm>>

The ability of software and hardware on multiple machines from multiple vendors to communicate meaningfully.

<<http://www.netdictionary.com/i.html>>

The capability of two or more components or component implementations to interact.

<<http://www.sei.cmu.edu/opensystems/glossary.html>>

However, other commentators have attempted to further explain the meaning of interoperability by presenting it in contextual terms (political, business, semantic, syntactic, jurisdictional, cultural, technical). Even where interoperability is defined in terms of *systems* exchanging information and/or data, this can also refer to *organisational*

¹ Australian Flexible Learning Framework, *Findings and recommendations of the Collaborative Interoperability Project*, 2003, <http://www.flexiblelearning.net.au/projects/resources/ci_findings_2003.doc>

systems. This interpretation can be inferred from the current definition on the VET Interoperability Framework website:

Interoperability involves standardising technical services, information formats and business processes to enable them to work together effectively.

[<http://www.flexiblelearning.net.au/interop/>](http://www.flexiblelearning.net.au/interop/)

... to be interoperable, one should actively be engaged in the ongoing process of ensuring that the *systems, procedures and culture of an organisation* are managed in such a way as to maximise opportunities for exchange and re-use of information, whether internally or externally.

[<http://www.ariadne.ac.uk/issue24/interoperability/>](http://www.ariadne.ac.uk/issue24/interoperability/)

... the ability for *organisations* to share information and data.

[http://webdomino1.oecd.org/COMNET/PUM/egovproweb.nsf/viewHtml/index/\\$FILE/glossary.htm](http://webdomino1.oecd.org/COMNET/PUM/egovproweb.nsf/viewHtml/index/$FILE/glossary.htm)

For the [COLIS] Project to deliver benefits to particular institutions the need for political, cultural and technical interoperability to be aligned must be acknowledged. Cultural interoperability needs to become ingrained and systems must be corporately owned, and perceived as used by all, rather than as owned by different sections of the institution.

<http://www.colis.mq.edu.au/projects/wkshp/interopera.htm>

An [interoperability binding is a] binding that supports interoperability between two systems, with no ambiguity. Interoperability can occur at several levels within the layered abstract framework and so the content must be clearly defined.

<http://www.imsglobal.org/af/afv1p0/imsafglossaryv1p0.html>

For the purposes of this report – which is largely intended to inform policy development – we have drawn from these broader definitions. Often, achieving technical interoperability is not just a technical problem: it can be hindered by marketplace practices (as is the case of so-called ‘territorial lockout’ in the entertainment device industry, where media compatibility is deliberately designed for proprietary platforms), or political and cultural factors.²

VET sector achievements in interoperability

Ever since the web began making an impact on education and training in Australia, the VET sector has had a documented commitment to standards and interoperability. This began with input into the EdNA Metadata Standard and was soon followed by development of the specifications for AShareNet and a number of iterations of the VET Preferred Standards. In more recent years this has translated into a considered strategy articulated by the VET Interoperability Framework and highlighted in a range of Project outputs described in the 2005 Framework business plan.³

Other achievements include:

- creation of the VET Interoperability Framework and supporting website
- development of quality e-learning resources (Toolboxes)
- migration to the ‘learning object’ approach and to the Sharable Content Object Reference Model 1.2 (SCORM) conformance (beginning with the series-7 Toolboxes) in order to achieve interoperability, modularity and reusability of content

² B Ip & G Jacobs ‘Territorial lockout – an international issue in the videogames industry’, *European Business Review*, vol.16, no.5, 2004, pp.511–21, <http://images.emeraldinsight.com/emerald/pdfs/200575.pdf>

³ Australian Flexible Learning Framework, *2005 Australian Flexible Learning Framework for the national vocational education and training system – 2005 framework business plan*, http://www.flexiblelearning.net.au/aboutus/resources/Business_Plan_2005_final_website_050210.pdf.

- ensuring interoperability as a key focus of the Resources for Teaching Learning and Assessment (RTLTA) 2004 Framework Program
- a commitment to practical and demonstrable implementations of interoperability (for example, the phase 2 Learning Object Exchange of the Rights Enabled Framework and VLORN)
- establishment of a network of repositories (VLORN) searchable by a federated search function
- the Quality e-learning Resources Project which broadened the scope of Toolboxes by defining them as 'collections of learning activities and resources'
- development of VETADATA metadata application profile
- collaboration with the multimedia industry, and the schools and higher education sectors over interoperability issues
- increased access to both the directory and collections of resources of the EdNA VET project through RSS feeds and portlet technology
- participation and input into the IDEA SCORM workshop
- development of a management framework combining national, State and Territory responsibilities to facilitate federated access to online teaching and learning resources.

Business drivers for interoperability

The pursuit of interoperability is fundamental, if the overarching goal of the 2005 Framework of 'creating a world-class, flexible, education and training system, focused on students and clients', is to be realised:

With VET providers and clients in different States and Territories using different delivery platforms, improved information management and greater adoption of consistent technical standards can ensure that these technologies can work together seamlessly, free the VET sector from constraints imposed by proprietary and competing technological platforms and enable ready access to online VET services within Australia and internationally. The sector needs a coherent interoperability framework as a vehicle for seeking recognition of VET standards in wider education and government arenas and a reference point for VET personnel on interoperability issues.⁴

Achieving interoperability requires agreement concerning common goals, business practices, conventions, standards and protocols. And whether technically focused, a business process, or a common vocabulary, it is *standards* that represent consensus and best practice within a community of practice.

Standards generally provide an environment that is more predictable, safer, efficient, and dependable than one assembled in an ad hoc manner. Standards stimulate innovation and development of products and services, while reducing the duplication of effort, unnecessary costs, and complexity.

While standards and specifications are often considered to be the same, this is not necessarily true. Most formally specified standards can take anywhere from three to five years to develop and they typically reflect a certain maturity in collective thinking and implementation. In the case of IMS, specifications are developed over a much shorter timeframe to assist the marketplace to accept and understand technology as quickly as

⁴ Australian Flexible Learning Framework, *Evaluation of the Australian Flexible Learning Framework 2000–2004: Phase two evaluation – summary*, 2004, <<http://flexiblelearning.net.au/aboutus/keydocuments.htm#evaluation>>

possible. IMS does this by developing a rough consensus among stakeholders concerning a particular technology requirement or innovation that is not yet interoperable, and developing specifications that can lead to rapid prototyping.

However, while this difference between the two is sometimes important to highlight, standards and specifications are both focused on the goal of achieving interoperability. In the case of SCORM, while it is formally an implementation profile of both standards and specifications, it has achieved *de facto* status as a standard for online content for single-learner, self-paced, online instruction.

One of the key challenges for stakeholders involved in developing ICT infrastructure to support learning, education, and training is that a rich diversity in technology enablers and innovations is available. Moreover, in many ways e-learning is still an emerging field. Thus, it makes a great deal of sense to develop considered strategic plans based upon informed input from key stakeholders.

Interoperability can be seen to deliver value by facilitating:

- resource sharing
- cost reduction through common infrastructure development
- administrative efficiency gains
- opportunities for shared procurement
- seamless integration with a diversity of services and applications
- development of strategic approaches to service development
- the means to deliver integrated applications and services in an increasingly interconnected environment that embraces more than just the web
- seamless connectivity between services from disparate, but related organisations, reducing costs of delivery and access
- data exchange between e-commerce ICT systems, applications and business processes
- the interfacing of systems that deliver learning and training with registries of competencies and qualifications (for example, Australian Qualifications Framework [AQF] and National Training Information Service [NTIS])
- a reliable and trusted platform for the delivery of online training
- consistent quality of training resources relevant to the needs of a highly skilled workforce in a rapidly changing environment
- flexibility for both employers and employees in engaging in training programs.

One prominent business driver in 2005 not previously obvious arises from the signing of the Free Trade Agreement (FTA) between Australia and the United States. SCORM is now mandated across United States government agencies wishing to procure products to be used for online training. In order for Australian stakeholders to compete in this marketplace, their products and services will likewise need to conform with SCORM. Similarly, in our own Asian region, the fact that SCORM has gained significant inroads in recent years signals that Australian online training products need to conform to be competitive.

Given that SCORM originated from a defence sector organisation in the United States, a similar importance will be attached to SCORM specifications for the Australian defence industry following the FTA. Of particular interest is the establishment of the Centre of Excellence for Defence Industry Systems Capability (CEDISC) in South Australia. CEDISC represents a key component of the South Australian Government's strategy to

improve workforce skills, and it will form a hub for collaboration between local industry supplying training materials to the defence sector, international agencies, and national research and training centres, such as the Defence Science and Technology Organisation (DSTO). Other Australian States and Territories have defence force capability and will have similar requirements.

There is a need for greater coordination and networking, and state involvement with interoperability and standards forums. This can help reduce duplication of effort and allow states with limited resources to benefit from the experience of those that have been able to address some of the issues.⁵

There are also consequences of *not* pursuing the interoperability agenda. Without interoperability:

- The development of a sustainable, national, technical infrastructure for the Australian VET sector would not be possible.
- A whole-of-government approach to reliable online services delivery *cannot* be implemented or sustained.
- The deployment of trusted systems cannot be achieved.
- Equitable access to online content within the VET sector would not be possible.
- Building capability would be more localised and would be likely to result in technology and business silos.
- The marketplace would be more fragmented and hence the capacity to innovate would be compromised.
- The ability to integrate or leverage outputs from all Framework Projects would be limited.

Auditing the broader environment

In order to assess the progress of the interoperability agenda within the VET sector, it is necessary to consider perspectives and environmental factors from within, as well as external to the VET sector.

Relevant national activities

Within the broader national context a number of relevant activities and projects are underway which are focused on promoting interoperability and standards for e-learning. Of particular interest are:

- changes in the political environment
- IMS Australia (including the Australian ADL Partnership Lab)
- Standards Australia (code of practice for metadata usage)
- e-Government activities
- The Learning Federation
- Higher Education Systemic Infrastructure Initiative.

⁵ Australian Flexible Learning Framework, *Management of teaching and learning assets (MTLA): Research report*, Australian Flexible Learning Framework 2005, p.22, <http://flexiblelearning.net.au/projects/resources/mtla_research_report%201.01.pdf>.

Political environment

There are three key political influences to consider:

- the abolition of ANTA
- the consolidation of government agencies
- skills shortages.

In the VET sector, the abolition of ANTA is a key change to the political environment. Such a change necessarily brings with it new opportunities, and some of the changes are already underway; for example, a commitment by the Australian Government to develop a series of vocational secondary technical colleges across Australia. The government has also committed over AUD\$100M to a network of 'industry career advisers'. Such initiatives illustrate the intention to address the skills needs identified by industry. Meeting these needs will require training resources and a delivery infrastructure.

The outcomes of the national consultation on the new national VET arrangements indicate strong support for a national, consistent, industry-developed, competency-based set of training packages. Stakeholders also indicated their support for a one-stop-shop approach to the national distribution of training products and support materials.

A number of other important changes will also have implications for the interoperability agenda. The proposed formation of a new ministerial company from a merged AShareNet (AESL) and Australian Training Products (ATP) is likely to streamline current practices and consolidate the management of infrastructure that delivers access to high-quality training resources while fulfilling licensing requirements. Furthermore:

The new company could potentially take on a broader role than those of ATP and AESL. Its role could encompass the provision of advice to the Ministerial Council on strategies to develop data and *interoperability standards* in the sector to improve on-line access to training materials held in separate repositories across Australia.⁶

Already, in collaboration with the Framework, *education.au limited* plays a lead role in the area of interoperability standards advocacy and development within the VET sector (particularly through projects such as VLORN and VETADATA). In framing a strategy for the future, the proposed new ministerial company would need to collaborate with *education.au limited* in order to ensure continuity and consistency.

In June 2005 the Council of Australian Governments (COAG) issued a communiqué that summarised outcomes of its annual meeting. It is worthwhile noting that the first listed agreed outcome is focused on 'addressing skills shortages through a national approach to apprenticeships, training and skill recognition'. From an interoperability perspective, the key elements of such a national approach would include:

- flexibility in the delivery of training
- systems that enable national recognition of skills and prior learning.

IMS Australia

The 2005 workplan for IMS Australia is focused on the following:

- participation in IMS Global Learning Consortium activities
- pursuit of activities listed under Department of Education, Science and Training– Joint Information Systems Committee (DEST–JISC [UK]) Cooperation Framework (development of the e-Framework for Education and Research Innovation,

⁶ Department of Education, Science and Training, *Skilling Australia: New directions for vocational education and training*, DEST, Canberra, 2005, p.21.

projects relating to the management and interoperability of repository services and identification of common projects in developing middleware infrastructure within and across service domains)

<<http://www.e-framework.org>>

- establishment of an ADL partnership Co-Lab in Australia. Among other things this is intended to further the interests of the VET sector SCORM community together with e-learning industry partners who have a vested interest in SCORM
<<http://www.adlaustralia.org>>
- involvement in other national and international standards organisations and infrastructure, including SC36, IEEE LTSC, and DCMI.

→ Recommendation:

In providing easy access to the bigger picture of implementing interoperability specifications and standards, it is recommended that a link be provided to the e-framework being developed collaboratively by DEST and JISC (UK).

Standards Australia

Through one of its sub-committees (IT-19-1) Standards Australia has agreed to proceed with the development of a code of practice for the use of metadata in education and training in Australia and New Zealand. Standards Australia is the formal standardisation body in Australia and interfaces with formal standards bodies such as ISO and SC36. As such, it is a key channel for ensuring that Australian stakeholder requirements are considered in international standards development.

The work associated with the code of practice is also being informed by a similar effort in the United Kingdom: the British Standards Institute has developed a code of practice to support interoperability between metadata systems used for education and training. It was published in February 2005.⁷

There is currently no mechanism for formal engagement in Standards Australia committees by State, Territory or National education and training systems within the committee structures of the education and training sector. This is because no funding had been made available for the AICTEC Standards Sub-Committee which had previously been responsible for this work. Standards Australia is prepared to take this forward with its own consultation mechanisms.

Engagement in the formal processes of standardisation is the primary means for ensuring that stakeholder needs can be accommodated.

→ Recommendation:

It is recommended that the VET sector support and engage in activities within Standards Australia IT-19-1, the formal mechanism for Australian standards development.

e-Government activities

Interoperability is fundamental to the development of e-Government services and is attracting worldwide interest. The Australian Government Information Management Office (AGIMO) has further developed the interoperability specifications established by its predecessor, the National Office for the Information Economy (NOIE). AGIMO's position is that: 'The development of an interoperability framework will underpin the provision of

⁷ British Standards Institute, *BS 8419-1:2005, Interoperability between metadata systems used of learning, education, and training – Part 1: Code of practice for the development of application profiles*, British Standards Institute, February, 2005.

integrated services by articulating a set of agreed policies and standards to allow electronic information and transactions to operate seamlessly across agencies and jurisdictions'.⁸

The AGIMO conceptual model identifies three key domains: technical, informational, and business process, and has classified the technology interoperability framework standards requirements according to the following headings:

- security
- discovery
- interconnection
- data exchange
- presentation and encoding formats
- metadata for process and description
- naming.

More recently the AGIMO GovDex initiative has taken forward this agenda and established a comprehensive website (<http://www.govdex.gov.au/default_whatmsgdx.aspx>).

→ Recommendation:

It is recommended that ongoing development of the website include links (and possibly RSS feeds) to whole-of-government initiatives, such as the AGIMO and GovDex Interoperability Framework.

→ Recommendation:

It is recommended that the VET IEG consider developing a conceptual model for future interoperability activities informed by relevant key initiatives, such as the AGIMO TIF and the e-framework being jointly developed by DEST and JISC.

→ Recommendation:

It is recommended that whole-of-government initiatives focused on achieving interoperability (such as the AGIMO and GovDex Interoperability Framework) inform future work within the VET sector.

→ Recommendation:

It is recommended that the VET sector consider a mechanism for providing input to AGIMO and GovDex with a view to ensuring that the requirements of VET stakeholders are accommodated.

→ Recommendation:

It is recommended that the VET sector consider adopting the Web Publishing and Good Practice Guidelines developed by AGIMO.

The Learning Federation (TLF)

In developing content for the schools sector in Australia and New Zealand, TLF established consultative committees to collaborate with jurisdictions on specifications, delivery, content development and trialling. The specifications adapt, interpret and extend

⁸ Australian Government Information Management Office, *Interoperability Framework*, <<http://www.agimo.gov.au/practice/framework>>, <<http://www.agimo.gov.au/publications/2005/04/agtifv2#Australian20Technical20Framework>>.

international and national standards to meet local requirements of the schools sector in Australia and New Zealand.

TLF monitors technologies and standards to assist decisions about updating jurisdiction infrastructure. To this end discussion papers have been released about new technologies, new content requirements and possible specification updates.

TLF has published specifications⁹ on:

- content development
- education soundness
- rights management
- accessibility
- metadata (an application profile)
- exchange web service.

Metadata

The Learning Federation's metadata application profile is a hybrid schema, adopting elements from other organisations (for example, IEEE LOM v1.0, Dublin Core Metadata Element Set (DCMES), Qualified Dublin Core (DCQ)) and elements developed by The Learning Federation to accommodate local requirements. The TLF metadata profile identifies 29 elements as mandatory for learning objects. However, this set does not include all the mandatory elements required for SCORM compliance.

SCORM advocates a very structured approach to organising content and is more appropriate for prescriptive training. TLF content is not developed to be SCORM-compliant because it does not require a highly structured form of content and prefers the selection and sequencing of content to be left to the individual teacher. (It has been noted during the consultation process that Toolboxes require more flexibility than is currently provided by the structured SCORM approach.)

IMS packaging

TLF content currently conforms to IMS content packaging specifications. IMS content packaging has wide support within the e-learning community as the preferred mechanism for packaging learning content when it is transferred between e-learning systems.

Higher Education Systemic Infrastructure Initiative

Originally announced by the Australian Government in January 2001 as part of Backing Australia's Ability – An Innovation Action Plan for the Future (BAA), the Systemic Infrastructure Initiative provides annual funding to a range of projects that are primarily focused on developing national infrastructure to support research activities. However, a number of projects, including IMS Australia, have been funded under this initiative. Submissions for the next round of funding were called in April 2005 and are likely to be announced in the next few months. Projects already funded during 2006 that are highly dependent upon ICT standards and interoperability include:

- IMS Australia (discussed above)
- Meta Access Management Systems (MAMS) project
- Australian Research Repositories Online to the World (ARROW)

⁹ Australian Flexible Learning Framework, *Interoperability: Relationship between TLF and VET interoperability specifications*, 2005.

- Australian Partnership for Sustainable Repositories (APSR).

ARROW

The ARROW project has developed a metadata infrastructure designed to facilitate the development and harvesting of institutional repositories of research output. While this project is focused on higher education research results, the metadata infrastructure has some relevance for VET projects.

Initially the project was expected to create a single metadata schema to support the description of research outputs. However, after reviewing various metadata schemas and the various kinds of research likely to be included, it was determined that no one schema would have the capacity to fulfil the diversity of requirements.

Consequently, the ARROW project has tested the OCLC¹⁰ interoperability core which enables crosswalking between schema, and the generation of Dublin Core metadata for resource discovery once that crosswalk has been defined. The ARROW solution will enable crosswalks between DC, LOM, GEM, ONIX, MARC, and EAD).

More information is available at <<http://www.arrow.edu.au/>>.

MAMS

The MAMS project is concerned with the integration of multiple solutions to identity management, authentication, and authorisation issues. It is also involved in developing common services for digital rights management, search services and metadata management. The project aims to provide an essential 'middleware' component to increase the efficiency and effectiveness of Australia's higher education research infrastructure. While higher education stakeholders are the primary beneficiaries of this project, the range of technologies associated with middleware and the notion of common services are also important for the VET sector.

Among the interoperability standards being adopted by the MAMS project is the Shibboleth specification developed by the Internet2 Middleware Architecture Committee for Education. Shibboleth provides a secure mechanism for both authentication and authorisation for a range of user types and enables inter-institutional resource sharing by establishing 'clubs' or federations of trusted services.

More information is available at <<http://www.melcoe.mq.edu.au/projects/MAMS/>>.

→ Recommendation:

It is recommended that the Framework develop an interoperability standards policy concerned with authentication, authorisation, and identity management. In particular, Shibboleth should be appraised for its suitability for the sector.

APSR

The APSR project aims to establish a centre of excellence for the management of 'scholarly assets' in digital format. Its participants include the Australian Partnership in Advanced Computing, the National Library of Australia, and three universities.

Its primary focus is on access continuity and sustainability of digital collections and will build on a base of demonstrators.

More information is available at <<http://www.apsr.edu.au>>.

¹⁰ OCLC is the Online Computer Library Centre, <<http://www.oclc.org/>>.

Trends in technology

The Australian VET sector operates in an increasingly interconnected technology environment. Consequently interoperability requirements will also broaden in scope. Some of the key technologies to watch include:

Web services

A range of new web services specifications and standards are continually being developed by various bodies, among the more influential groups of which is the Web Services Interoperability consortium (WS-I). Gartner recommends 'vigilance' when adopting web services standards:

The evolution of specifications and standards is often complex and confusing. More than half of the current Web services protocols will be consolidated within the next three years.¹¹

→ Recommendation:

It is recommended that outputs in the form of web services specifications from the WS-I Consortium be monitored and appraised routinely.

e-portfolios

Worldwide interest in e-portfolio development as a service for lifelong learners has gained considerable momentum in the last year or so – particularly throughout Europe and in higher education in the United States. With a few exceptions (such as the *myfuture Employability Skills Portfolio*), interest in Australia in this area has not yet gathered sufficient support or been adequately scoped.

Some useful websites in this area include:

<<http://www.eportconsortium.org>>

<<http://www.eife-l.org/portfolio/ep2005>>

<<http://www.qwiki.info/projects/Europortfolio/epicc>>

<<http://www.theospi.org>>.

Although e-portfolios can be used for a number of purposes, common features include user control of resources relating directly to that user. Such information would include learner information, transcripts and qualifications, and other relevant information.

→ Recommendation:

It is recommended that a strategy for considering and possibly adopting interoperability specifications and standards associated with e-portfolios be given a high priority.

→ Recommendation:

It is recommended that the VET sector investigates the usefulness of the IMS RDCEO specification for the purposes of building systems enabling efficient recognition of prior learning.

Peer-to-peer

Ever since Napster became prominent, peer-to-peer (P2P) applications have gained in popularity: they allow users to share large amounts of files while bypassing centralised services. P2P technology has the potential to increase productivity and save money, but

¹¹ Gartner, *Be vigilant when adopting web services standards*, 2004, <<http://www.ws-i.org/Docs/Press/20041123gartner.pdf>>.

from an interoperability perspective, it has a number of disadvantages. P2P applications introduce a whole new class of security issues that need to be dealt with by network and security managers, since members of a P2P network typically duplicate files, thus causing new challenges for information management.

Some useful websites utilising P2P applications in e-learning include:

<<http://lionshare.its.psu.edu/main>>

<<http://edutella.jxta.org>>

Identity management

The proliferation of services whereby end-users participate in transactions requiring authentication and authorisation has meant that streamlined and secure approaches to identity management are desirable. Among the more important initiatives in this area is the Shibboleth specification developed by the Internet2 Middleware Architecture Committee for Education. This technology is being adopted by the MAMS project, already discussed, within the higher education sector and also involves Single Sign On (SSO) (see below). The development of a national approach to delivering a system for the administration of authentication of users to enable a seamless access to a range of information offers an opportunity for the VET sector.

→ Recommendation:

It is recommended that the VET IEG note the MAMS activity and consult with appropriate personnel prior to advising on any authentication-related interoperability specifications for the VET sector.

Security

Related to identity management is the broader area of security (which also encompasses security of data). Almost all vendors have indicated improvements in the security of their products. Microsoft, having recently and very publicly increased its commitment to security, has highlighted what the organisation considers to be one of the primary weaknesses in IT security – the user. A number of important standards are being developed, and nationally, Australian Government agencies are now being required to adopt ACSI-33, a policy document focused on data security.

Closely related to managing security is the whole area of smart card technology. Whether a smart card or biometric device, physical security strategies may begin to enhance username and password-based security.

Digital rights management

The area of digital rights management remains highly contentious even though mainstream office applications (such as Microsoft Office and Adobe Acrobat) provide some lightweight digital rights management (DRM) solutions. While standardised rights expression languages are now available, standards-based solutions directly relevant to the education and training sector have not yet emerged.

→ Recommendation:

It is recommended that the VET IEG continue to monitor developments relating to digital rights management.

Connectivity

Through a range of state-based and national initiatives, access to broadband technology is now becoming widely available. A recent study conducted by Nielsen NetRatings has

revealed that the number of Australians using broadband connections for Internet access has increased to around 3.3 million. This represents 41% of all home Internet users.

Interestingly, a number of ISPs are suggesting recent peaks in broadband demand may be driven by the games market. With the release of the new X-Box game Halo2, the online gaming network X-Box live has experienced a significant increase in traffic. Sony has recently released a network-ready play station gaming console and this is also likely to increase traffic generated as a result of online gaming. This increasing access to higher-bandwidth connections is likely to bring with it the requirement for the interoperability of multimedia-rich content.

Open source

With the success of open source implementations in the government sector, other sectors can feel more confident about doing likewise. In the broader environment there is a trend towards deriving the dual benefits of open source and open standards. The release of *Sun Solaris 10* as open source is very significant and *Sun* is now publicly advocating the importance of open source, open standards, and interoperability. One area where interoperability is an issue, but has not yet seriously been addressed by the VET sector, is the wide diversity of learning management systems, whether they are proprietary (for example, WebCT, Blackboard, and InterWoven) or open source (Moodle). However, the key point is that open source by itself is no guarantee for interoperability.

Given these developments, the VET Interoperability Framework would benefit from consideration given to *open source* solutions in terms of compatibility with *open standards* (developed collaboratively through due process, platform-independent, vendor-neutral extensible, reusable, and not encumbered by royalties).

→ Recommendation:

An updated strategy that addresses the growing interest in open source software would be beneficial, given that open source implementation does not guarantee interoperability.

Wireless

New technologies such as IPV6, Radio Frequency Identification (RFID) and wireless technologies are likely to have profound implications for the way technology can be applied in training environments. Anything (physical or digital) can have a unique ID, can be tagged, and no wires are needed for communication.

→ Recommendation:

Radio Frequency Identification (RFID) is set to revolutionise many workplace and learning environments. While this technology can potentially streamline processes such as library check-out and supply-chain inventory management, it could also be developed for learning technology applications (for example, RFID tags could easily include LOM metadata).

→ Recommendation:

The rapid growth in broadband and wireless connectivity (including protocols such as WiMax and BlueTooth) brings with it many opportunities for the delivery of flexible learning. It will be important for the VET IEG to monitor these developments.

Mobile technologies

Mobile and wireless technologies offer further flexibility in the delivery of training to remote and regional communities, as well as to industry stakeholders such as the transport industry. This could open up a whole new arena of resource and knowledge discovery.

A project being investigated as part of the *New Practices in Flexible Learning 2005* Project is one which situates the IMS Question and Test Interoperability (QTI) specifications within a mobile learning environment. The primary method of delivery of this project will be a QTI player for mobile devices.

The whole area of mobile learning has been actively researched for a number of years, particularly in Europe. The MOBIlearn project, specifically, has undertaken extensive research on the potential in this area and has documented interoperability and standards issues as a deliverable of the project.

More information is available at <<http://www.mobilelearn.org>>.

→ **Recommendation:**

There is a proliferation of new digital devices that can be used to access online training materials, including personal digital entertainment (PDE) devices such as iPods, personal digital assistants (PDAs), PocketPCs, tablet computers, and even some mobile phones. Many of these technologies can be utilised in mobile learning environments and interoperability issues are inherent to these and related innovations.

Accessibility

Accessibility is key to developing and delivering quality resources across the sector. This has been particularly demonstrated in the evolution of the Toolboxes series. Greater emphasis was placed on accessibility and aligning the development of Series 4 Toolboxes with the VET-preferred technical standards, and incorporating W3C Web accessibility features. The W3C Web Content Accessibility Guidelines were used to assist developers to create web pages accessible to a diversity of users, particularly those with disabilities.¹² Accessibility became a mandatory requirement in the development of Toolboxes from series 5 onwards. Strategies employed to assist developers to meet accessibility requirements included commissioned accessibility testing, forum discussions, focused email discussions and access to accessibility experts.

In terms of accessibility and metadata, a number of organisations are working towards producing accessibility guidelines. These include:

- **IMS AccessForAll Meta-data Specification:** this is a collaborative project between IMS, W3C, IEEE, CEN/ISSS, Dublin Core and a number of other groups. The AccessForAll Meta-data specification proposes to describe and record user preferences for content display with an emphasis on access for all users. <<http://www.imsproject.org/accessibility>>
- **IMS Learner Information Package Accessibility for LIP:** this defines two new sub-schemas for the IMS Learning Information Package. These provide support for disabled people and also include accessibility needs, such as mobile computing and amelioration of noisy environments. The Accessibility for Learner Information Package v1 Final Specification was approved in July 2003.

¹² Australian Flexible Learning Framework, *Developing quality online materials: The flexible learning Toolbox experience*, 2004.

- **IMS Guidelines for Developing Accessible Learning Applications:** developed by the IMS Working Group, the guidelines consist of a set of recommendations for ensuring that resources are accessible to people with disabilities. <<http://www.imsproject.org/accessibility/accessiblevers/index.html>>
- **DCMI Accessibility Working Group:** the working group has produced a set of documents to be considered by the Usage Board for the creation of a new DC element to be called 'DC:Accessibility'. The proposed term aims to match designed resources and services to people's needs and preferences for display, control and content. <<http://dublincore.org/groups/access>>

→ Recommendation:

It is recommended that reference to the IMS accessibility specifications and guidelines be considered for inclusion into the VET Interoperability Framework website.

Overview of international activities

IMS Global Learning Consortium (IMS) – alt-i-lab 2005

The annual IMS *alt-i-lab* (Achieving Learning Technology Interoperability Lab) provides an important indicator of the state of play vis-a-vis interoperability in learning, education and training settings. During the *alt-i-lab 2005* meetings held in June 2005 in Sheffield in the UK, IMS showcased a number of interoperability demonstrations. These included Tools, Applications for Distributed Content, and Learning Design. In addition, keynote presentations and workshops highlighted important developments and helped to provide a broader context for activity.

Strategic context

The keynote presentation for *alt-i-lab* was presented by Diana Laurillard from the UK Department for Education and Skills and was titled the 'Strategic context for interoperability'. The author outlined key government policies associated with harnessing technology for education and training. Key priorities included:

- integrated online information services for all citizens
- integrated online learning and personal support
- fostering collaborative approaches where possible
- ensuring a common digital infrastructure.

A strong message from the presentation was the move by UK authorities to encourage all organisations to support 'personal learning spaces' for all learners; in other words, the development of services to support e-portfolio applications. A range of drivers for this move has been identified. However, the UK has developed a uniform approach to learner transcripts based upon the IMS Learner Information Package (LIP) called UKLeap (UK Lifelong Learner Profile), now published as a formal British Standard (BS8788).¹³

The requirement for a common infrastructure can also be seen as fitting into the overall interoperability roadmap specified by the UK e-Envoy in its routine updating of a 'Standards Catalogue'. More Information is available at <http://www.govtalk.gov.uk/documents/TSCv6.2_2005_4_29.rtf>

¹³ British Standards Institute, *BS 8788:2004, The United Kingdom learner profile – UKLeap*, British Standards Institute, 2005.

→ Recommendation:

It is recommended that a strategy be developed for considering and possibly adopting a range of IMS interoperability specifications.

Tools interoperability

Pilot implementations of the IMS Tools Interoperability Framework (TIF) were unveiled and involved demonstrations of Blackboard, Sakai, WebCT and Moodle Learning Management Systems (LMS), each interconnecting with two assessment tools (Perception from Questionmark and SAMigo from Sakai) and ConceptTutor from University of Wisconsin-Madison. The TIF has been developed by IMS as an efficient, reusable mechanism for integrating LMS platforms with third-party tools, thus allowing institutions to extend the functionality they can offer learners.

→ Recommendation:

Given that a large range of learning management systems are deployed within the VET sector, it is recommended that the VET Interoperability Framework consider including reference to the IMS Tools Interoperability Framework.

Distributed content

The demonstration session built upon work initiated during the previous year's *alt-i-lab* which was focused on repository interoperability. A number of GLOBE members (education.au, MERLOT, ARIADNE, and European SchoolNet) participated, along with the Open Knowledge Initiative (OKI). A range of educational software tools for authoring, search, aggregation, and delivery were demonstrated, highlighting interoperability with OKI Open Service Interface Definitions, SCORM, METS, IMS Content Packages and IEEE LOM.

e-Portfolios

In early July, after two years in development, IMS announced the final version 1.0 specification for e-portfolios. Based upon a profile of content packaging and LIP, the specification is positioned to be the first in a series designed to satisfy the portability requirements of user-controlled digital resources, including personal information such as official transcripts. Parallel to this development, the Open Source Portfolio Initiative (US-based) has also recently released an update to its open source software.

The specification aims to facilitate:

- evidence-based learning, while also enabling portability of portfolios from schooling to workplace institutions to better track learner competencies
- the use of e-portfolios for career development
- easy application of personal preferences for online interaction.

Note: Locally, e-portfolio projects are beginning to appear in Australian universities (for example, Queensland University of Technology and the University of Sydney), while *myfuture* has now completed its prototype of an Employability Skills e-portfolio service.

More information is available at <<http://www.imsglobal.org/ep/index.html>>
<<http://www.theopspi.org>>.

→ Recommendation:

It is recommended that the VET sector investigate the usefulness of the IMS specification for e-portfolios.

Learning design

While many people would argue that the IMS learning design specification is still largely an R&D exercise, proponents view it as broadening the scope of e-learning specifications by supporting *learning activities* as distinct from *learning content*. In Europe, in particular, there are now a growing number of applications based upon the specification. Furthermore, the *alt-i-lab* demonstration showed successful interoperation between the ASK-LDT Editor, the CopperCore Learning Design Engine, and the RELOAD Learning Design Editor.

Note: Locally, the Learning Activities Management System (LAMS) can be seen as inspired by the IMS Learning Design specification, although it does not interface with it. LAMS was released as open source software in early 2005.

→ Recommendation:

It is recommended that the Framework consider the possible adoption of the IMS Learning Design specifications, given that the Quality e-learning Resources Project has had the foresight to define Toolbox collections in terms of *learning activities* as well as *learning resources*.

Common cartridge

The need to develop specifications for a 'course or major course component level collection of content' and the rules for interacting with it was articulated by a group of high-profile publishers, including representatives from Pearson Education, McGraw Hill, Wolters-Kluwer Education, Elsevier Health Science and Education, as well as LMS vendors WebCT and Blackboard. These stakeholders indicated the requirement for interoperability between a range of content formats and delivery systems and a need for stronger digital rights management.

→ Recommendation:

It is recommended that the VET sector note the formation of the IMS 'Common Cartridge' working group, which is focused on developing specifications for a 'course or major course component level collection of content' and the rules for interacting with it.

Compliance program

IMS also officially launched its Compliance Program during *alt-i-lab 2005*. This should be of interest to companies and organisations which have developed products that support IMS specifications.

The IMS Compliance Program improves interoperability in the worldwide implementation of IMS specifications by establishing realistic measures of interoperability and increasing those measures over time as best practice and more rigorous testing capabilities become available. Product developers will provide evidence to support conformance claims based on self-testing. IMS may from time to time add reference implementations as mandatory requirements for self-testing and reporting.

Vendors and organisations with conformant products and services will receive the right to use the IMS-conformant logo and will be included in a public list of conformant products.

Further information is available at <<http://www.imsglobal.org/conformance/index.html>>.

→ Recommendation:

It is recommended that the Framework consider its position on participation in the IMS Compliance Program, given that conformance with specifications is a useful strategy for ensuring interoperability.

→ Recommendation:

It is recommended that information about the IMS Compliance Program be posted on the VET Interoperability Framework website.

IMS Global Learning Consortium Specifications Update

IMS has now developed a total of 16 specifications. Recent specifications include:

- Enterprise Services version 1.0
- Reusable Definitions of Competency or Educational Objective (RDCEO) 1.0
- Resource List Interoperability version 1.0
- Access-for-All Meta-Data version 1.0
- Question and Test Interoperability (QTI) version 2.0
- e-portfolios version 1.0.

The following specifications are part of its work plan:

- General Web Services
- Common Cartridges (initiated by publishers)
- Content Packaging 1.2
- Tools Interoperability
- Query Services
- Assessment Services.

IEEE LTSC Standards Development

The IEEE LTSC LOM Working Group has recently (May 2005) reconvened with a view to assembling requirements for revisions and/or updates to its LOM standard. Moreover, on 10 May 2005, the XSDL (XML Schema Definition Language) Binding of the LOM (1484.12.3) officially became the latest IEEE LTSC standard.

Other work currently underway within the IEEE LTSC includes:

- standardisation of the IMS RDCEO (Reusable Definitions of Competency or Educational Objective) specification
- final stages of the development of *Recommended practice for digital rights expression languages suitable for e-learning technologies*
- XML bindings for the CMI (a key component of SCORM)
- development of a resource aggregation model for learning, education, and training (aimed at defining a nomenclature and a conceptual model for digital aggregates of resources for learning, education, and training applications). This work has been influenced by the need for convergence between various content packaging standards (IMS Content Packaging, METS, and MPEG-DIDL).

In addition, a study group focusing on simulation interface standards has been established.

On 8 July 2005 the IMS Global Learning Consortium, the Advanced Distributed Learning (ADL) initiative and the IEEE LTSC announced a joint collaboration to update the IMS Content Packaging specification and adopt it as an IEEE standard. The updated specification will be accredited as an IEEE standard and the profile of the content packaging specification included as a key component of SCORM 2004. The updated IMS specification is scheduled for completion by December 2005, with IEEE balloting

expected to be completed within four to six months after that date. Once the standard has been formally released, then SCORM 2004 will be updated accordingly.

SCORM and ADL

Initially released in early 2000 the Sharable Courseware Object Reference Model (SCORM) specifications have clearly gained market acceptance and adoption worldwide, particularly in the training sector, where single-learner, online, self-paced training materials are utilised. The updated specifications are now published as SCORM 2004. As indicated within these specifications, updates to referenced standards will be updated as these standards themselves are updated.

Looking more broadly at the scope of the Advanced Distributed Learning (ADL) initiative, it is clear that SCORM 2004 represents just one aspect of 'advanced distributed learning' (single-learner, online, self-paced training). The Content Object Repository Discovery and Registration/Resolution Architecture (CORDRA) is a new project of the ADL initiative and can be viewed as its next strategic step. The primary aim of CORDRA is to enable a highly scalable means for learning content exchange across diverse and distributed repositories. In achieving this, CORDRA aims to rely upon a range of already available technical standards and specifications, such as those providing persistent, resolvable, and actionable identifiers. The initiative is not aiming to develop new standards as such; it is primarily focused on specifying the components that will enable inter-repository interoperability.

ADL is also currently pursuing research and development in the areas of:

- incorporating electronic performance support objects
- repository interoperability (CORDRA)
- designing new run-time and content data model architectures
- incorporating simulation aspects
- implementing SCORM-based intelligent tutoring capabilities
- designing a new content model
- incorporating gaming technologies.

With the establishment of an ADL partnership Co-Lab in Australia, there will be new opportunities for the collaborative activities for stakeholders within the VET sector. It is significant that ADL is also pursuing interoperability agenda beyond the SCORM specifications. In particular, the CORDRA and the S1000D standard for the production of training manuals in the aviation and defence industries are current priority work items.

→ Recommendation:

It is recommended that the VET sector note ADL activities associated with CORDRA. It is likely that CORDRA specifications have longer-term implications for the VLORN project.

→ Recommendation:

It is recommended that the VET IEG update information and guidelines on the VET Interoperability Framework website associated with SCORM to reflect more recent developments.

Standards and interoperability in New Zealand

With the support of its National Library, the Ministry of Education in New Zealand is currently pursuing development of a whole-of-(education)-sector metadata schema (ESMS). This development is largely influenced by the National Library's broad metadata framework for New Zealand in which the various types of metadata are clearly described in terms of their purpose (resource discovery, structural binding, rights management, access control, and technical management). These are summed up as metadata for finding, using, and administering.

See <<http://www.govis.org.nz/conference2005/presentations/jonathan-shennan.ppt>>.

It is also useful to note here that key New Zealand personnel involved in these developments are keen to provide input into the Standards Australia project focused on delivering a code of practice for metadata usage within education and training in Australia and New Zealand.

Key developments in vendor activity

For those stakeholders who take a keen interest in developments within the vendor community it will be of interest to note the ongoing development and status of the Sun-Microsoft Interoperability Initiative.

Since mid-2004 Sun and Microsoft have indicated a certain degree of cooperation in relation to interoperability activities that the two companies have been working on. A number of press releases since that time have focused on delivering interoperability in the web services, directory services, digital rights management, and single-sign-on technology areas.¹⁴ While some commentators view the announcements 'as primarily public-relations-oriented'¹⁵, others have identified more promising signals.¹⁶

Overview of VET sector interoperability activities

In the mid- to late-1990s ANTA embraced flexible teaching and learning as a viable mode for the delivery of training courses to the VET sector. In line with this objective, particular attention was focused on emerging web technologies and standards, and the key role they could play in flexible delivery in the sector.

Early activities which provided the drive for interoperability included the Toolbox¹⁷ initiatives and the NET*Working Conferences. The NET*Working Conferences have been used to inform the sector of emerging technologies, of issues arising with implementation, and to showcase innovative development within the sector.

More recent activities have built on this foundation and include VETADATA, the VET Learning Object Repositories Network (VLORN), and the VET Interoperability Framework.

¹⁴ *NET Journal*, 2004 <<http://dotnet.sys-con.com/read/46370.htm>>.

¹⁵ Gartner, May 2005 <http://www.gartner.com/DisplayDocument?doc_cd=127974>.

¹⁶ *The Register*, April 2005, <http://www.theregister.co.uk/2005/04/21/ballmer_virtualserver>
The Register, June 2005, <http://www.theregister.com/2005/06/14/sun_microsoft_management>.

¹⁷ Australian Flexible Learning Framework, *Developing quality online materials*, 2004.

Flexible Learning Toolboxes

The Flexible Learning Toolboxes (Toolboxes) initiative commenced in 1998 and since then has provided the sector with a nationally coordinated approach to the development of quality e-learning resources. The key developments and issues include:

- Beginning with series 1, the initiative produced 12 Toolboxes and offered national encouragement for the development of training products that would in turn assist VET providers to develop online resources.
- Toolbox development work has taken place with two considerations in mind: educational design to facilitate a high-quality learning experiences; and technical design which allows for portability, flexibility and the potential for customisation.
- Series 2 saw the refinement of Toolbox material and the requirement that such content be developed for online and stand-alone usage.
- Later series of the Toolboxes introduced additional features with greater emphasis on customisation, disaggregation, alignment with the VET Preferred Technical Standards and incorporation of W3C Web Accessibility features.
- The concept of 'learning objects' and compliance with SCORM were key in the development of Toolboxes from Series 7 onwards.
- The decision to adopt SCORM was influenced by a number of factors including:
 - the experience of the first Toolbox repository which showed the difficulty of using individual pages of material which had not been packaged as discrete objects
 - growing demand for modular and reusable chunks of learning material
 - increasing expectation from the commercial sector that training materials would standardise through use of SCORM
 - the 2003 VET Learning Object Repository (VLOR) research project of identification by international specifications and standards relating to learning objects and repositories and recommendation that IMS Content Packaging be adopted for learning objects and repositories participating in the national system
 - the additional indication by the VLOR research project that a move to SCORM may be appropriate based on the outcomes of trials undertaken by the Framework.
- In 2004 the Quality e-learning Resources Project developed Toolboxes which are SCORM-compliant and searchable via federated search application.
- Key issues faced by Toolbox national project managers included the time lag between release of different SCORM versions and the availability of tools to support development, and the delay in adoption of the new SCORM version by the main learning management systems.
- Accessibility issues, relating to learners with disabilities, Indigenous learners, and learners requiring literacy and numeracy support have been addressed by the Toolbox initiatives.
- Through testing the application of emerging standards and specifications, the Toolbox initiative has continued to keep pace with developments in e-learning.

- The Quality e-learning Resources Project broadened the scope of Toolboxes beyond the production of learning resources by defining them as 'collections of learning activities and resources'.
- The practical experience of Toolbox projects over the years has provided a sound basis from which to validate ongoing recommendations on standards for content formats, content packaging and learning design.

VETADATA

Under the initial VET Interoperability Framework, 'metadata and vocabularies' was identified as one of five priority areas (the others being content formats, content packaging, web services, and intellectual property rights).

Metadata and vocabularies are essential tools for describing and managing learning objects as well as a range of other information resources. The use of common metadata and shared vocabularies enables interoperability in the sharing or discovery of these resources.

As new distributed online content was being developed, the development of a VET metadata application profile became a pressing need for the sector. In other words, there needed to be a consistent approach to the description, management, and discovery of online teaching and learning resources. VETADATA v1.0 was endorsed by the FLAG in May 2005 as the recommended metadata application profile for VET educational resources.

Prior to the development of VETADATA, many metadata application profiles developed by organisations in Australia had been based upon Dublin Core (for example, include the EdNA Metadata Standard and Australian Government Metadata Standard [AGLS]) and included additional elements and vocabularies to accommodate local needs. Government departments and agencies have also been required to comply with the government's information management standards and apply AGLS metadata to describe government information and services.

The complete VETADATA profile consists of 37 elements, with 26 of these requiring data to be entered. The remaining 11 are aggregate or container elements which are effectively structuring devices for grouping the elements logically. Essentially, VETADATA is very similar to the SCORM profile and represents a sub-set of LOM v1.0, but has been simplified.

The mandatory minimum set of five entry elements for all types of resources is identified to enable basic level of interoperability across the sector and with other communities. However, projects developing learning objects have been advised to use a set of 20 elements identified as mandatory for the creation of this content. It is expected that adoption of this number of specific elements will provide the VET sector with a rich source of interoperable learning objects, described in a consistent manner using the same elements and accompanying vocabularies.¹⁸

A number of organisations and projects have already implemented the profile in describing their resources. Learning objects being developed by VLOR projects are described using VETADATA and a number of mandatory elements have been defined to enable a high degree of interoperability across these repositories.

Other organisations/agencies such as the Department of Education and Training in New South Wales have adopted VETADATA as the interoperable profile and added elements to accommodate local and cross-sector needs.

¹⁸ VET Metadata Application Profile, <<http://www.flexiblelearning.net.au/interop/topics/vocab.htm>>.

A number of vocabularies, thesauri and classification schemes have been developed and recommended to accompany VETADATA in the description of learning resources. Using consistent terminology to describe similar resources enhances their capacity to be located and, in the description of such resources, also provides interoperability across the sector. The following have been recommended to describe VET resources:

- The VETADATA Educational Use vocabulary
- *myfuture* industry classification scheme
- VOCED thesaurus
- Australian Qualifications Framework
- National Training Information Service.

The recommendations on vocabularies were based on the usage of thesauri/classification schemes by key organisations and national projects such as training.com, EdNA Online, *myfuture*, NTIS, AEShareNet and the National Centre for Vocational Education Research (NCVER).

There are a range of benefits that flow from this approach. The use of metadata and accompanying vocabularies:

- provides consistency in the description of resources thus improving search results
- enables the development of consistent browsing and navigational structures
- enables links and mappings to be established
- enables single entry of data into multiple systems
- provides consistency for user experience.

VET Interoperability Framework

The VET Interoperability Framework (2004) has its roots in a number of earlier Framework Projects, beginning with the Preferred Standards Project (2000–2002) followed by the Collaborative Interoperability Project of 2003.

The primary aim of the Project has been to create a coherent interoperability framework for development projects within the VET sector.

The first iteration of the VET Interoperability Framework identified five priority areas of focus (content formats, content packaging, metadata and vocabularies, web services, and intellectual property rights). In early July 2005, this was extended to include a sixth priority: repositories.

An important feature of this Project has been the collaborative and consultative processes adopted. Each of the interoperability Projects has been well supported by external and expert reference and working groups.

Reflecting the goals of this project has been the VET Interoperability Framework website which has served an important role in the dissemination of relevant and current information relating to ICT specifications and standards, while also ensuring that ongoing activities within the sector in relation to implementing interoperable systems are transparent.

In doing so, the website has provided a reference point for VET personnel on interoperability standards issues, and has extended access for practitioners to resources through improved information management and adoption of technical standards.

→ Recommendation:

It would be strategic to continue the interoperability focus within the broader Framework, to provide ongoing leadership to the sector, and build upon the foundations already established.

→ Recommendation:

It is recommended that the VET Interoperability Framework website continue its advocacy and dissemination functions.

→ Recommendation:

It is recommended that the VET Interoperability Framework website build an online capability that supports the collaborative and consultative processes.

→ Recommendation:

It is recommended that ongoing development of the VET Interoperability Framework website include links (and possibly RSS feeds) to key interoperability websites (such as CETIS, WS-I, W3C, IMS, and ADL).

→ Recommendation:

The popular adoption of blogging software by individuals brings with it a number of issues that may impact on the delivery of flexible learning, including assessment and the use of content syndication protocols such as RSS, Atom, and iCalendar. It is recommended that such technologies be referenced within the VET Interoperability Framework.

→ Recommendation:

Current listings of standards and specifications on the website reference would be enhanced if each entry had some visible metadata attached in the way of 'current as of date ...' or 'last updated'.

VET Interoperability Expert Group

In June 2005 the VET Interoperability Expert Group (VET IEG) was established as part of the Resources and Innovation Program of the 2005 Framework. Its primary aim is to provide a strategic advisory role in the area of interoperability issues. Its initial activities have included:

- provision of advice to the commissioned research report (this report)
- preparation of briefing materials on interoperability directions for FLAG meetings
- review of the VET Interoperability Framework website and its provision of advice on priorities and currency
- provision of input into the promotional strategy for VETADATA and other interoperability initiatives.

The IEG also provides:

- a platform for the sharing of information across jurisdictions concerning interoperability and ICT standards
- opportunities for State and Territory input to the national interoperability agendas.

→ Recommendation:

There is a requirement for an ongoing consultative mechanism within the VET sector for collaborative participation of stakeholders in interoperability issues and planning. The VET IEG provides a point of focus for this.

→ **Recommendation:**

It is recommended that the VET Interoperability Framework develop a broad view of interoperability that explicitly acknowledges the important standards development emerging from a wide range of organisations apart from IMS and ADL (for example, OASIS, WS-I, IETF, W3C, HR-XML, ITU, ISO, and others). This could be done while also emphasising agreed priority interoperability areas.

VET Learning Object Repository Network (VLORN)

Repositories of learning resources are currently being developed worldwide in three main 'architectures': centralised, distributed, and peer-to-peer. The primary motivation for these repositories is to enable resource sharing, and in all cases certain interoperability issues arise. In the case of the VET Learning Object Repository Network (VLORN) the emphasis is upon learning object discovery within a distributed network.

Interoperability has played a big part in the VLORN project, and we've used standards and specs to get the four repositories working together, such that we can perform the distributed search etc. (stakeholder comment)

The purpose of the project is to build 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.¹⁹

- This project focused on establishing a network of interoperable repositories with the purpose of searching, viewing, downloading and transferring reusable learning resources.
- The interoperability model is based on national and international open standards and a common services infrastructure to aid discovery, viewing and delivery of teaching and learning resources.²⁰
- VLORN contains learning objects that are described using metadata (VETADATA) and packaged to conform with IMS content packaging specifications.

The methodology used to produce the VLORN interoperability specifications has been to look for solutions at each interoperability point according to the following priorities:

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

However, to date, a need to 'adapt' specifications or 'invent' new specifications has not arisen. At this stage further development of the VLORN specifications is likely to be

¹⁹ Australian Flexible Learning Framework, *VET Learning Object Repository Network*, 2005.

²⁰ VET Learning Object Repository Network, *Interoperability Specifications v.1.2*, <http://www.flexiblelearning.net.au/projects/resources/2005/vlorn/VLORN_InteroperabilitySpecification_vesion1.2.pdf>.

triggered by the broader international context through developments such as CORDRA. In particular, object identifiers are a key consideration within the CORDRA approach.

→ Recommendation:

It is recommended that a VET sector-wide approach to object identifiers be developed (in consultation with stakeholders from the schools and higher education sectors along with representatives from IMS Australia and the Australian ADL Partnership Lab).

→ Recommendation:

It is recommended that the VET IEG note the Australian ADL activities associated with SCORM and S1000D.

Case studies

While investigating the progress of the interoperability agenda within the VET sector a number of case studies were gathered (see Appendix 2) which illustrate the adoption of ICT technologies and standards. These case studies, from education departments/agencies as well as institutions, provide a snapshot of current activities and issues in the implementation of interoperable e-learning systems. The following are highlights of some of the issues and challenges being addressed by organisations:

- streamlining operations across departments and divisions of large organisations to enhance interoperability
- establishing learning technology teams to address issues of interoperability and facilitate the adoption of appropriate standards by stakeholders
- addressing data exchange and re-use issues relating to the implementation and usage of a range of learning management systems
- addressing conformance relating to uploading and running SCORM objects on a variety of learning management systems
- handling content which conforms to various versions of SCORM
- balancing local metadata requirements and usage, while also achieving broad interoperability with systems managing a diverse range of learning resources.

Current priorities

Within the current VET Interoperability Framework six key priority areas for pursuing interoperability are identified. They are:

- content formats
- metadata and vocabularies
- web services
- intellectual property
- content packaging
- repositories.

→ **Recommendation:**

It is recommended that the six strategic areas identified (content formats, content packaging, metadata and vocabularies, intellectual property rights, repositories, and web services) be expanded to include e-portfolios.

Content formats

It is now recognised that content needs to be developed to standards to make it portable between different web browsers and reusable by different applications such as learning management systems.

Work undertaken by the VET Interoperability Project in this area over the years, primarily identifies W3C specifications.

Learning content in the VET sector is increasingly presented in the form of 'learning objects' or 'sharable content objects'. Standards associated with such content are key to Projects such as Toolboxes and VLORN.

→ **Recommendation:**

It is recommended that the VET IEG review the specifications for content interoperability in order to ensure currency.

Metadata and vocabularies

Metadata and controlled vocabularies play a pivotal role in delivering interoperability between information systems and e-learning applications. Together, they are essential tools for describing and managing learning objects as well as a range of other information types. The use of common metadata and shared vocabularies provides interoperability in the sharing or discovery of these resources.

The endorsement of VETADATA as the recommended metadata application profile for the sector represents a major milestone in terms of achieving interoperability.

→ **Recommendation:**

It is recommended that a review be undertaken by the VET IEG and FLAG of vocabularies used by key services, including EdNA Online, ATP, AESL, NTIS, flexiblelearning.net, and training.com, with a view to identifying interoperable pathways.

→ **Recommendation:**

The proliferation of domain-specific vocabularies, taxonomies and ontologies brings with it the need for interoperability solutions that could utilise W3C technologies such as RDF and OWL, as well as other technologies such as Topic Maps. It is recommended that Topic Map technology be considered as a vocabulary management tool.

Web services

Web services can be defined as self-contained business functions operating over the Internet and which enable the exchange of data between applications. They are important because they allow systems in different companies or organisations to interoperate with each other more easily. Web services provide a high degree of versatility in customised service delivery. They also highlight an alternative approach to the 'learning object' paradigm of sharing and reusing content by utilising technologies such as Really Simple

Syndication (RSS), content can be easily syndicated. Possible web services for VET include:

- news feeds using RSS to allow syndicated content, such as automated exchange of news and changes to resource collections
- access to key coding systems (for example, NTIS codes as they are updated automatically transferred to other sites such as Resource Generator, AShareNet Central System)
- automated licence transactions (for example, a request for an object from a learning object repository automatically transacts an AShareNet licence to cover use of material).²¹

A number of organisations and projects are currently delivering web services. They include:

- The VET portal, training.com.au (all services)
- EdNA Online (search, RSS headlines, latest resources).

Intellectual property

Stakeholders commonly believe that solving the problems associated with the management of intellectual property and copyright (IP&C) is essential in building a sustainable infrastructure that will in turn support widespread implementation of e-learning. Moreover, as one of the reports from 2003 in *New Practices in Flexible Learning* concludes, there is an important interoperability issue at its heart:

Issues of Intellectual Property and Copyright (IP&C), flexible learning and publishing systems show a convergence of concerns – to date they have evolved as independent entities, but now are requiring a ‘road map’ in terms of Digital Rights Management (DRM).²²

AShareNet has developed a collaborative system for easy licensing of intellectual property to enable Australian training materials to be shared and adapted efficiently. The AShareNet website offers services to the public and members, including a searchable database of training materials. It also has the capacity for members to transact standard licences for using and adapting materials and for negotiating individual licences based on a common framework. The interoperability solution at work within AShareNet is clearly a step forward for managing IP&C, but at this stage the licensing regime is limited to Australian stakeholders.

In 2003–2004 the project concerned with rights enabled learning object exchange developed a phased trial that proposed a framework which included descriptions for digital rights management (DRM) of learning objects. This framework was tested within a learning object exchange designed following an analysis and customisation of licensing agreements from both overseas and in Australia to ensure that the business objectives of participating institutions were clearly met.

²¹ Interoperability website, <<http://www.flexiblelearning.net.au/interop/topics/webservices.htm>>.

²² Hand, T et al., *Framework for rights enabled learning object trial: New practices in flexible learning (final report)*, ANTA, Canberra, 2003, <http://www.flexiblelearning.net.au/projects/resources/rightsenabled_report.pdf>.

Key findings from the project included:

- Digital media transacted online create a range of IP&C issues not previously recognised, particularly where digital content is recombined and changed.
- DRM must be understood in the online environment as being concerned with all stakeholder rights – not just those of the rights holders, but also those of the end-users.
- DRM requires systemised processes that recognise rights expression languages (REs) capable of communicating agreements and licence offers between all parties involved.
- REs need to accommodate a range of workflow functions, such as acquisition, creation, distribution, as well as factors arising from business models, constraints and jurisdictions.
- Training organisations, and the education sector more widely, have articulated requirements that DRM systems must embrace technologies free of proprietary obligations.
- Interoperability has a strong e-commerce driver: in order to remain competitive, the VET sector needs to increase its exposure to external markets, and engage in the trade or sharing of content across other education sectors and commercial providers.
- Interoperability in a DRM context needs to accommodate licensing models ranging from provision of fair use to monitor-and-charge schemes and restricted access. However, there is an urgent need for dialogue between business, legal, learning and technical communities of practice to ensure reference to relevant vocabularies.
- Interoperability in a DRM context also points to the need in the VET sector for networks of trusted systems which seamlessly interconnect using agreed terminology, accommodate differing business models, and are supportive and secure.

In the broader international environment considerable work has already been undertaken in the area of digital rights expression (DRM) and management. Of particular interest is work undertaken in Europe and North America. A draft paper on DRM for the VLORN project suggests that VLORN repositories should consider an extensible solution similar to that identified by EduSource Canada. The paper indicates that an extensible solution is crucial to educational institutions as they move forward in this area and that this solution will ensure that content is managed irrespective of the content standard being used to manage data. Some key websites identified include:

- DRM in Education
<<http://www.drmcentre.org.in/pages/drm8.htm>>
- Edusource
<<http://www.edusource.ca>>
- BELLE (Broadband Enabled Lifelong Learning Environment)
<<http://belle.netera.ca>>
- The Netera Alliance
<<http://www.netera.ca>>
- Rights Market Inc.
<<http://www.rightsmarket.com>>

- CanCore
<<http://www.cancore.ca>>
- In the UK CETIS²³, JISC²⁴ and Intrallect have made recommendations to UK education and research communities to adopt various aspects of DRM. This recommendation has also been made in Europe, with JISC being a contributor to European research.²⁵
- CEN-ISSS²⁶ DRM Report (Europe)
<http://www.cenorm.be/cenorm/businessdomains/businessdomains/iss/activity/drm_fg.asp>
- In the US the American Library Association is promoting the need for a DRM regime.

Content packaging

Content packaging is a key requirement for successful and efficient transfer of self-contained learning materials from repositories to online learning or training environments. Content packaging has been a core specification of IMS and SCORM for some years and has been widely adopted throughout both the e-learning vendor and end-user community. IMS content packaging specifications have been a key component of the VLORN interoperability specifications.

Given that work has been already underway within IMS and the IEEE LTSC, it is likely that, within the next 12 months, an update to the IMS and SCORM specifications concerning content packaging will occur.

→ Recommendation:

It is recommended that the VET sector monitor international developments in the area of content packaging with a view to developing a VET sector policy on imminent updates to the IMS and SCORM specifications.

Repositories

While projects such as VLORN have provided the impetus for closer examination of repository interoperability, it was not until June 2005 that 'repositories' were listed as a priority area.

The VLORN Project has developed a set of specifications, and in the process has identified the IMS Distributed Repository Interoperability (IMS DRI) specification as a key document for describing the required functions. VLORN has used this specification as the basis for implementation of distributed repositories linked by a federated search capability.

→ Recommendation:

It is recommended that planning for extensions to VLORN functionality identified in the Report on usability testing of VLORN (for example, searches that handle access rights, competency names and codes, and further granular descriptions of learning objects) be undertaken.

²³ <<http://www.cetis.ac.uk>>

²⁴ <<http://www.jisc.ac.uk>>

²⁵ <<http://www.intrallect.com/drm-study>>

²⁶ <http://www.cenorm.be/cenorm/businessdomains/businessdomains/iss/activity/drm_fg.asp>

Overview of key initiatives

AEShareNet

AEShareNet Limited (AESL), a non-profit company (established by Australian ministers of education and training) operates the AEShareNet system, a collaborative system designed to streamline the licensing of intellectual property to enable Australian learning materials to be developed, shared and adapted efficiently.²⁷

In early 2005, AEShareNet released four separate trademarks for free usage. These trademarks define the conditions of terms of use for content. These are suitable for digital repositories and website content while still applying to all forms of media.

The four trademarks are:

- AEShareNet-FfE – Free for Education
- AEShareNet-U – Unlocked Content
- AEShareNet-S – Share and Return
- AEShareNet-P – Preserve Integrity

Discovery of materials through metadata searches

With the introduction of the Free for Education trademark, and subsequent release of three additional AEShareNet 'instant licences', it became apparent that there was a need to develop a mechanism to assist users to find materials containing these trademarks. AEShareNet is currently conducting research to meet this challenge, and will be shortly seeking expert advice on search capabilities. A report on this project is due to DEST in October 2005.

Cross-sectoral issues

There is a need to address interoperability issues where some organisations (for example, New South Wales Department of Education and Training) work across both the VET and schools sectors, while others (RMIT and Charles Darwin universities) work across VET and higher education. In these situations there are likely to be different vocabularies, learning management systems, independent policies and varying pricing models for managing learning materials within and across organisations.

Inhibitors to interoperability

All States/Territories currently have different jurisdictional purchasing, procurement and/or commercialisation guidelines, whereby many are required to levy a charge for the distribution or supply of a resource. These charges vary between jurisdictions, and situations can arise where one policy applies within one State/Territory and another applies for other jurisdictions and overseas clients. Where the AEShareNet instant licences are applied, there are no costs for the copyright licence itself. In other words, the existence of a system that is widely embraced eliminates these issues.

Apart from the major public provider repositories, there are a significant number of other organisations developing and supplying products to the sector (for example, enterprises, corporations, the adult and community education sector, educational publishers, individual authors and private providers). It would clearly be beneficial for all these organisations to have the capacity for interoperability.

²⁷ AEShareNet website, <<http://www.aesharenet.com.au>>.

Training.com.au

The VET portal (also known as training.com.au), was developed by the State and Territory training authorities in collaboration with ANTA. It is a business response to the need for a single point of access for accurate, current and consistent information about the VET sector, while also providing a future e-commerce platform for clients to transact their VET business. The VET portal provides access to information about the training system, courses and qualifications, information about training organisations, apprenticeship information, VET-related publications, networking information and VET news.

In delivering its products and services, a number of ICT standards are used:

- Dublin Core/EdNA metadata for description of web pages
- Department of Employment and Workplace Relations (DEWR) terms for descriptions of occupations
- the *myfuture* scheme for descriptions of industry classifications
- web services are used for news and events items.

A custom-built schema based on Dublin Core was developed to describe and manage the news and events information on the site. In collaboration with NCVER, work is being undertaken to enhance the VOCED thesaurus by incorporating *myfuture*'s industry terms.

Australian Training Products (ATP) Limited

Australian Training Products (ATP) is the national not-for-profit publisher and distributor of endorsed training packages and VET support materials, including Toolboxes. ATP supplies registered training organisations (RTOs) in Australia, as well as international customers, with training materials. Along with its repository functions, ATP also undertakes marketing, runs workshops, reproduces Toolboxes in CD-ROM format, is the custodian of the master copies and administers the sale of Toolboxes.

ATP utilises metadata to index product files and in the deployment of its web catalogues. A number of catalogues are available for browsing by users to locate resources. These enable clients to browse by a number of vocabularies, such as the Australian Vocational Education and Training Management Information and Statistical Standard (AVETMISS) (for VET) or the Australian and New Zealand Standard Industry Codes (ANZSIC) (for industry).

The TAFE VC (Virtual Campus) catalogue within the ATP browse function offers Victorian flexible learning materials. Materials are organised under the following top-level categories:

- Administration, Business, Economics, Law
- Agriculture, Renewable Resources
- Built Environment
- Education
- Engineering, Processing
- Health Sciences
- Hospitality, Tourism & Personal Services
- Humanities

- Mathematics, Computing
- Sciences
- Social Studies
- Social, Educational & Employment Skills
- Visual/Performing Arts.

The *VET Discipline catalogue* enables the discovery of products using AVETMISS. AVETMISS applies to VET programs delivered by RTOs, except those programs that fall in the higher education and school sectors.

The *Occupation catalogue* enables the discovery of products according to the occupation they relate to, as defined by the Australian Standard Classification of Occupations (ASCO), a hierarchical classification developed and maintained by the Australian Bureau of Statistics.

The *Education Field catalogue* is based on the Australian Standard Classification of Education (ASCED). ASCED is a national standard classification which spans all sectors of the formal Australian education system including school, vocational education and training and higher education.

The *Industry catalogue* provides access to products according to the industry they relate to, as defined in ANZSIC, a system for classifying industries developed by the Australian Bureau of Statistics.

The *Toolbox catalogue* shows all Toolboxes by series. A Toolbox is a collection of flexible learning resources to assist delivery of training package qualifications. To find out more about Toolboxes see <<http://www.flexiblelearning.net.au/toolbox>>.

ATP uses a number of thesauri and classification schemes in providing access to resources from its website. The user is directed to search in a number of places to find relevant material. An interface providing an integrated approach to resource discovery may better serve its clientele.

National Training Information Service (NTIS)

The National Training Information Service has been developed to provide access to current and emerging training market information and products in vocational education and training. Currently, NTIS comprises a database of VET accredited courses, competency standards, training packages and training providers, and text information on a range of complementary issues. A complete rebuild of the NTIS commenced in August 2002 in response to increased user expectations, new technologies and business requirements. The rebuild, based on consultations with a range of stakeholders, including State and Territory training authorities, will ensure that NTIS meets user expectations. The rebuild includes:

- improved search facilities
- improved access to detailed training package information, and the capacity to publish training packages
- packages and their components via the web
- archival capacity and recording of the scope of RTOs, accredited courses and training packages
- capacity to download customised reports and electronic files and version control for files.

Key vocabularies and classification schemes used include the Australian Qualifications Framework and the NTIS codes.

VETADATA has mandated the use of the NTIS competency codes in the description of learning objects and in particular, Toolboxes.

EdNA Online and EdNA VET Project

The EdNA VET Online service (as part of the 2005 Framework's Knowledge Sharing Services Project) aims to maintain and develop the VET components of the EdNA Online service by providing access to a wide range of VET and ACE resources accessible from EdNA Online. The Project also collaborates with other VET projects to support documentation and dissemination of interoperability solutions.

The EdNA VET Online project team manages development of information services for the VET and ACE sectors within the EdNA Online Portal.

Metadata is used to manage and describe information and Internet resources for teaching and learning, current issues, educational research, and providers. The EdNA Metadata Standard, along with a number of purpose-built vocabularies, is used to describe VET resources. A browse structure has been developed to provide access to related resources. This 'browse' structure or hierarchical category structure is not modelled on any particular classification scheme; it has been developed to reflect the organisation of the VET sector. As such, there is limited interoperability with other key projects in terms of classifying resources. Interoperability is provided in terms of shared metadata elements.

EdNA Groups

EdNA Groups has only been operational for a few months and in that time has grown to provide a web presence to over 200 online communities. The original purpose for Groups was to provide a collaborative platform to host forums, chat, blogs, file sharing etc. The software selected to perform this was Moodle, an open source LMS. In addition to providing basic LMS functionality, Moodle also has a good selection of collaborative tools.

The Groups functionality is an ideal area for communities of interest (which do not have their own IT infrastructure) to establish online communities. In the VET sector, a growing number of independent groups/RTOs are seeing the value of EdNA Groups not just for its collaborative tools, but also for the LMS functionality, and have developed learning environments for their constituents. Some of these groups have been so successful that the group owners have been able to justify the investment for establishing their own infrastructure and deploying Moodle on it.

Interoperability plays a key part in the success of EdNA Groups. Since Moodle supports SCORM, users are able to import content packages into their learning environments. If they then decide to deploy their own LMS, their content packages can be exported to any other LMS that supports SCORM.

RSS feeds are also used to make the content in these groups more dynamic and relevant to their audiences.

From an *education.au limited* perspective, EdNA Groups has been very successful, as can be demonstrated in the growth rate of the online communities established, as well as the types of usage that the Groups are being put to. There has been a noticeable demand for lightweight learning environments that support standards to enable content to be shared/imported/exported. These environments are affordable alternatives to the enterprise-level learning management systems.

While Moodle can support SCORM, novice users may still have trouble importing content packages that would seem to be supported. Further work needs to be done on supporting standards and making it easy for non-technical users to work with content packages.

EdNA RSS feeds

EdNA Online provides a number of RSS feeds that owners of websites and Internet users can subscribe to. The capacity for having content available to users when and where they want it, along with the ability for them to decide how they want it to look is very attractive for users. They do not need to navigate outside their portal/webtop to gain access to EdNA's content. Using a well-supported format (RSS) enables many users in different types of environments to receive these news feeds. Since RSS is so well supported, the EdNA developer team is saved the overhead of having to support and maintain non-standard/proprietary interfaces into portals/websites.

Issues

Whole-of-government initiatives – coordination

Many States/Territories are currently reviewing or developing whole-of-government approaches to IP policy; commercialisation guidelines; technology platforms, open source approaches/products and even metadata schemas. As the ACT identified, these areas have the potential to cause implementation issues with specific VET interoperability standards and may require individual exemptions.

Vocabularies

There are a number of different vocabularies in use across the sector/s which make discovery of learning materials difficult. There would be value in mapping areas of similarity and difference and encouraging consistency.

Inconsistency of cataloguing

A review of metadata records by AEShareNet has indicated a widespread misuse of metadata. Findings indicate that even expert users are not applying metadata consistently. The result of this is poor discovery for end-users.

Systems interoperability

A key issue identified by a number of stakeholders is that student management and enrolment systems are not interoperable with State/Territory-wide learning management systems.

Communities of practice

A key consideration in achieving interoperability is the fostering of communities of practice whereby technologists, teachers, and instructional designers can come together to share information, learn from each other, and combine expertise to achieve a better overall result.

Tools

There is a requirement for tools that can assist non-expert practitioners in their everyday workflow in creating and managing standards-conformant content.

Learning management systems

There are many ways in which to achieve interoperability between learning management systems. Some States/Territories are finding the solution lies in prescribing a particular platform, while others are recognising the importance of purchasing standards-ready systems. In the last 12 months IMS has established a working group to develop specifications to assist in this area (Tools Interoperability). Given the significant investment in LMS, this issue requires careful consideration.

Intellectual property rights and copyright

The issues surrounding IP&C are complex and have been discussed earlier. However, it is also worth noting that government funds are often invested in the development of learning resources. Restricted access to these resources creates an inequitable situation. Resources are stored behind institutional firewalls and in some cases the clearance of third-party copyright further compounds access issues.

Future considerations

The issues worthy of future consideration and research are summarised in the points below.

- Apart from the *myfuture Employability Skills Portfolio*, development of e-portfolio services in Australia has yet to gain momentum and the benefits of supporting the concept of e-portfolios are yet to be realised. E-portfolios bring together the idea of a user-controlled repository of resources (such as a meaningful collection of learner achievements and official transcript information) with network portability. In order to achieve this, a number of interoperability issues need to be addressed (such as content formats, the secure exchange of identity information, verified transcript information, and evidence of competencies achieved etc.). While there has been significant attention given to institutional repository development and interoperability, these requirements are largely conceptualised from the institutional delivery perspective.
- Given that the Quality e-learning Resources Project has defined Toolbox collections in terms of *learning activities* as well as *learning resources*, an opportunity exists for projects such as VLORN to consider prototype extensions based upon the IMS Learning Design specifications. Throughout Europe there are now growing numbers of applications and tools which conform to the IMS specification for learning design.
- The development of question-and-test repositories conformant with the IMS QTI specification may provide a useful service, if scoped nationally.
- Mobile and wireless technologies have the potential to open up a whole new arena of resource and knowledge discovery, offering further flexibility in the delivery of training to specific audiences such as remote and regional communities.
- Under the 2005 Framework's E-learning for Target Learner Groups Project there appears to be scope for investigation of gaming technologies for use in education and training.
- The discussion paper, *Extension of interoperability specifications for VLORN*, recommends global identifiers for all learning objects shared in the VLORN Network, and specifically in regard to the need to implement DOI. However, this is an area requiring careful consideration given the recommendations for the use of the Handle system from the CORDRA specifications.

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Appendix 1: Key questions asked during consultations

1. Can you please identify any key documents you're aware of that need to inform the research?

- policy documents
- documentation concerning implementations based upon the Framework's interoperability standards

2. What policies and strategies re interoperability are in place in your jurisdiction?

- Do you have a State/Territory-based approach? If so, how does it fit with the Australian Flexible Learning Framework?
- Are TAFEs working together?
- What evidence do you have that interoperability projects have been successful? (case studies?)

3. To what extent has the interoperability agenda promoted resource sharing across the sector? (case studies?)

4. Can you list any known issues or problems relating to current interoperability projects/services?

5. How do you manage your own (organisational) information resources? Is metadata used?

6. Can you provide in summarised form, use-cases that:

- describe interoperability *enablers* in your projects and/or jurisdictions and any relevant achievements?
- describe interoperability *inhibitors* in your projects and/or jurisdictions and any particular issues?

7. Can you please provide any details of the range of Learning Management Systems in use within your jurisdiction?

8. Do you have a sense of 'what's next' for enhancing the delivery of flexible learning services and programs? What are your stakeholders saying?

Appendix 2: Case studies

The following information was submitted by leading practitioners engaged in designing and managing ICT systems and implementing interoperability specifications and standards.

Canberra Institute of Technology, ACT

Interoperability enablers

A senior operations group at the Canberra Institute of Technology (CIT) initially identified a need for an automated system for online course creation as early as mid-2003. A business case based upon sound research was commissioned for the implementation of an automated system linking CIT's Student Information Management System (SIMS) – an implementation of Sungard SCT Banner – and CIT's online course delivery platform, WebCT. As part of the evaluation process, all of the institute's requirements for such a system were documented. An evaluation followed, which included a number of likely solutions for the issues of automation and integration.

Based on this business case, and after negotiation with Sungard SCT, CIT purchased the Sungard SCT Luminis product in December 2004. Luminis acts as a 'message broker' between Banner and WebCT; when certain events occur in Banner, such as the creation of a new course, or the addition of a new student, Banner event handlers trigger a 'message' to be passed to the Luminis server, which forms an XML request file. This file is subsequently passed to WebCT's IMS Enterprise API, which populates the WebCT system with the necessary information.

Because WebCT has an IMS Enterprise API, the Banner system could be customised with additional forms and processes, which made the system far more acceptable to its users. Initial evaluations of the system demonstrated that most teachers understood and were excited about the possibilities.

Interoperability inhibitors

The initial test system did not completely meet all of CIT's business requirements; for example, the way in which teachers used Banner to record how much they should be paid by CIT conflicted with the way in which Luminis calculated what materials teachers should have access to in an online course; and the method by which courses were 'cross-listed' to allow multiple (administratively separated) courses to access a single online course was cumbersome and too complex.

Centre for Learning Innovation, Department of Education and Training, NSW

In New South Wales where the school and VET sectors are beginning to merge their operations and develop streamlined systems, the need for interoperability of learning resources is significant. TaLE (the Teaching and Learning Exchange) will provide a single entry point to a vast range of learning and teaching resources and professional learning to 2200 government schools and 130 TAFE colleges. To this end a range of technical interoperability standards have been addressed.

Implementation of interoperable standards

In 2004, a Learning Technology Standards (LTS) team was set up in the Centre for Learning Innovation (CLI) to coordinate the development and implementation of interoperability standards across the Department of Education and Training.

The main role of the team is to:

- assist with the development and implementation of learning technology standards
- develop user guidelines²⁸
- monitor the development of standards and specifications
- recommend and plan the implementation of relevant standards
- document relevant standards for use within DET
- developing a metadata application profile.

Metadata

The Department of Education and Training (DET) has also recently developed a new metadata application profile for learning resources being used within TaLE, the common web gateway for the schools and VET sectors in New South Wales.

Previously, DET supported a metadata application profile consisting of EdNA, LOM, and custom DET elements. This was used for both learning resources and corporate resources and became the *de facto* standard for the department. However, there were a number of issues related to this; in particular, trying to describe corporate resources (based upon AGLS) and learning resources using the same profile.

- The profile had limited capacity to capture contextual educational metadata.
- It was VET-centric with limited school-relevant elements.
- This profile caused problems in meeting VETADATA/SCORM requirements.
- It was not applied consistently across the department.
- Metadata capture was labour-intensive.

The solution was to develop a standard DET-wide metadata approach that solved these problems and met the needs of the new TaLE portal. A project was established to create the new DET Learning Resource Metadata (DET LRM) which involved the development of:

- the application profile, vocabulary, binding and guidelines
- metadata business processes and system
- training strategy.

The expected completion date is September 2005.

The new profile will be interoperable with VETADATA, SCORM and TLF, and consultation occurred with the VET and school sectors. There are crosswalks to the TAFE-NSW profile (and thus to EdNA), to VETADATA and TLF.

²⁸ Option Keys developing accessible websites, <<http://www.cli.nsw.edu.au/optionkeys>>.

TAFE Virtual Campus, Victoria

- The Victorian statewide learning platform, TAFE Virtual Campus (TAFE VC) <<http://www.tafevc.com.au>> provides a range of e-learning tools, materials and resources to support teachers, learners and organisations to achieve their business goals.
- The learning management system (LMS) used is WebCT. In addition, the learning content management system (LCMS), The Learning Edge (TLE), is used as a resource centre, lightweight LMS and an activity assemble which allows teachers to edit content and deliver in the WebCT LMS.
- TLE is capable of IMS and SCORM packaging.
- IMS packaging was adopted to ensure compliance with the VET Learning Object Repository Network and WebCT 4.1.
- The main purpose of moving to IMS/SCORM packaging was to ensure interoperability between the learning management system, the learning content management system, the e-portfolio and the VET Learning Object Repository Network.
- Victoria has 100 IMS content packages. It is reviewing its state content for suitability for conversion to IMS /SCORM packages.
- The Reload editor is used for packaging content and the Advanced Distributed Learning (ADL) test suite for testing compliance.
- The VETADATA metadata profile is used to describe content in standardised vocabularies, including ASCO and ASCED fields of education, which aid power searching on the TAFE VC.
- In 2005 an additional application will be installed onto the TAFE VC which provides alignment between job types and VET qualifications. Additional standards and vocabularies used include the ANZSIC, the Occupational Information Network <<http://www.onetcenter.org>> and the Holland Personality Types <<http://www.careerkey.org>>.
- The TAFE VC e-portfolio application conforms to the W3C AA Accessibility Guidelines. It is accessible through any browser through valid XHTML and CSS.
- One key issue identified by the TAFE VC team is that student management and enrolment systems are not interoperable with the statewide LMS. This means that there is a manual process for transferring students from one system to the other.
- However, adoption of the statewide LMS is not universal. It has been noted by leading practitioners that a very strong culture of interinstitutional ('proudly independent') competition exists. Several providers, especially the larger players, have implemented their own LMSs including WebCT CE6 and Moodle.
- A small number of providers have developed and implemented their own proprietary LMS. For example, South West TAFE has developed 'OnCourse', which provides basic LMS functionality and is closely integrated with their student management system, QLS. This institute is currently investigating the issues of content packaging and management, with a view to achieving interoperability with the statewide system.

Department of Employment and Training, Queensland

Interoperability enablers

- The Department of Employment and Training in Queensland has a high level of understanding in relation to interoperability, and relevant 'experts' are often being seconded to work on different initiatives to ensure the interoperability requirements are included.
- Presentations are made to various business units on the importance of standards. While the VET Interoperability Framework's initial focus was on e-learning resources, staff are well aware of the implications for the much wider field of information systems in general.
- The newly formed Office of the Chief Information Officer includes interoperability as a key part of its ICT strategic plan, and encourages further work in this field.
- The department will comply with VLORN recommended specifications and standards.
- The department is considering adopting a statewide LMS, rather than continuing to use the current six. (Note: this is just one way to achieve interoperability.)
- VETADATA is the metadata schema being implemented with inclusion of additional government requirements. All recommended VETADATA vocabularies will be used where appropriate.

Interoperability inhibitors

- One issue that has inhibited the uptake of the VET Interoperability Framework is its focus on IT systems for e-learning resources, rather than product.
- The Department of Employment and Training currently uses a database system and it is widely acknowledged that some effort would be required to bring this system up to date to meet Framework standards.

Department of Education, Tasmania

- Learning Media Services develops content for professional development purposes across the sector.
- Learning management systems used in the past include; WebCT and CBTS. Recently purchased was a learning content management system, 'The Learning Edge' (TLE). It is used as a repository and a lesson assembler and allows teachers to upload to WebCT or other learning management systems. Learning Media Services plays a role in professional development activities and is a publishing unit for resources in any media.
- TLE is capable of IMS packaging and the Learning Media Services unit is working with the company to include packaging requirements of SCORM.
- Research undertaken by Learning Media Services indicates that SCORM packages run well in TLE. Assembled lessons, including SCORM LOs, are now being used in online delivery. However, most packaging is being done by Learning Media Services.

- The main purpose of moving to SCORM compliance is to achieve the organisational goals for exchange and re-use of learning materials, and more importantly to deliver a 'quality learning experience' for students, which is a key 'strategic direction' of TAFE Tasmania.
- The main reason for moving to SCORM is to overcome problems caused by different software delivery and re-use platforms. It is hoped and expected that the 'learning object' model will further enhance re-use of materials within different training contexts.
- Tasmania has in excess of 250 SCORM-compliant learning objects in TLE, and plans are in place to continue developing SCORM-compliant materials and also upgrade existing materials to SCORM specifications.
- SCORM is also considered for procuring third-party content as a requirement for end-user systems, for tracking user progress through content, and for dynamically sequencing content.
- Tasmania's content conforms to SCORM 1.3. Currently consideration is being given to SCORM 2004, if applicable, when software support is available.
- Reload editor is used for packaging content.
- VETADATA is used to describe content along with local vocabularies to describe learning outcomes.
- TAFE Tasmania, in partnership with The Learning Edge (VLORN repository) has implemented elementary DRM functionality which is working for that repository.

WestOne, Western Australia

Interoperability enablers

- Learning resource materials are currently created to meet current standards.
- Advice on interoperability is provided to TAFEWA clients.
- Learning materials are developed in collaboration with TAFEWA colleges (for example, for Toolboxes)
- Toolboxes are uploaded into WebCT on request from TAFEWA. Lecturers find the familiar environment of WebCT, the ability to customise content more easily, and the addition of features, such as collaboration tools, make it a better delivery option than CD/web.
- Learning content is now also being developed to be 'LMS free' so that it is not dependent upon a single system (WebCT).

Interoperability inhibitors

- Many practitioners are not fully aware of the need for interoperable standards and do not have the development skills to ensure their e-learning materials meet these requirements.
- The majority of TAFEWA practitioners develop learning resources within WebCT which is the LMS supplied to them from WestOne. While a single platform has benefits, there are issues involved in ensuring that learning content is interoperable with other systems.

Appendix 3: Acronyms and abbreviations

ACE – Adult and Community Education

ACSI-33 – Australian Government Information and Communications Technology Security Manual

ADL – Advanced Distributed Learning

AESL – AShareNet Limited

AGIMO – Australian Government Information Management Office

AGLS – Australian Government Metadata Standard

AICTEC – Australian Information and Communications Technology in Education Committee

ANTA – Australian National Training Authority

ANZSIC – Australian New Zealand Standard Industry Classification

APSR – Australian Partnership for Sustainable Repositories

AQF – Australian Qualifications Framework

ARROW – Australian Research Repositories Online to the World

ASCED – Australian Standard Classification of Education

ASCO – Australian Standard Classification of Occupations

ATP – Australian Training Products

AVETMISS – Australian Vocational Education and Training Management Information Statistical Standard

BELLE – Broadband Enabled Lifelong Learning Environment

CEDISC – Centre of Excellence for Defence Industry Systems Capability

CEN/ISSS – European Committee for Standardization/Information Society Standardization System

CETIS – Centre for Educational Technology Interoperability Standards

CLI – Centre for Learning Innovation

CMI – Computer-managed Instruction

CORDRA – Content Object Repository Discovery Registration/Resolution Architecture

DC – Dublin Core

DCMES – Dublin Core Metadata Element Set

DCMI – Dublin Core Metadata initiative

DCQ – Dublin Core Qualified

DEST – Department of Education, Science and Training

DET – Department of Education and Training

DETLRM – Department of Education and Training Learning Resource Metadata
DEWR – Department of Employment and Workplace Relations
DOI – Digital Object Identifier
DRM – Digital Rights Management
DSTO – Defence Science and Technology Organisation
EAD – Encoded Archival Description
EdNA – Education Network Australia
ESMS – Education Sector Metadata Schema (NZ)
FLAG – Flexible Learning Advisory Group
FTA – Free Trade Agreement
GLOBE – Global Learning Objects Brokered Exchange
GEM – Gateway to Educational Materials
HTML – HyperText Mark up Language
IEEE – Institute of Electrical and Electronics Engineers
IEEE LTSC – Institute of Electrical and Electronics Engineers, Learning Technology Standards Committee
IEG – Interoperability Expert Group
IETF – Internet Engineering Task Force
IMS – IMS Global Learning Consortium
ITU – International Telecommunication Union
ISO – International Standards Organisation
IT-19-1 – Standards Australia Sub-Committee 19-1, IT for Learning, Education, and Training
JISC – Joint Information Systems Council
LAMS – Learning Activities Management System
LCMS – Learning Content Management System
LIP – Learner Information Package
LMS – Learning Management System
LOM – Learning Object Metadata
LTS – Learning Technology Standards
MAMS – Meta Access Management Systems
MARC – Machine-Readable Cataloguing
METS – Metadata Encoding and Transmission Standard
NCVER – National Centre for Vocational Education Research
NOIE – National Office for the Information Economy

NTIS – National Training Information Service

OAI-PMH – Open Archives Initiative Protocol for Metadata Harvesting
OASIS – Organization for the Advancement of Structured Information Standards
OCLC – Online Computer Library Centre
OKI – Open Knowledge Initiative
ONIX – Online Information eXchange
P2P – Peer-to-peer
QTI – Question and Test Interoperability
RDCEO – Reusable Definitions of Competency or Educational Objective
RDF – Resource Description Framework
REL – Rights Expression Languages
RFID – Radio Frequency Identification
RSS – RDF Site Summary (also: Really Simple Syndication)
RTL – Resources for Teaching, Learning and Assessment
SC36 – Sub-Committee 36, ISO/IEC Joint Technical Committee 1
SCO – Sharable Content Object
SCORM – Sharable Content Object Reference Model
SSO – Single Sign On
TaLE – Teaching and Learning Exchange
TIF – Tools Interoperability Framework
TLE – The Learning Edge
TLF – The Le@rning Federation
URI – Universal Resource Identifier
VET – Vocational Education and Training
VETADATA – VET Metadata Application Profile based on LOM
VLORN – VET Learning Objects Repository Network
VOCED Thesaurus – Vocational Education Thesaurus
W3C – World Wide Web Consortium
WS-I – Web Services Interoperability consortium
XML – Extensible Markup Language
XSDL – XML Schema Definition Language

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