

AUSTRALIAN *FLEXIBLE LEARNING*

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

**Preferred Standards to Support
National Cooperation in Applying
Technology to Vocational Education
and Training**

Strategy 2000

This document forms part of a series of reports on
Preferred Standards to Support National Cooperation in Applying Technology to
Vocational Education and Training

An initiative within the
Framework for National Collaboration in Flexible Learning in
Vocational Education and Training

2000 – 2004

All reports and consolidated recommendations are available at

<http://www.flexiblelearning.net.au>

Copyright Australian National Training Authority

2000

Acknowledgements

The Project was overseen by a Steering Committee. All States and Territories and the Commonwealth were represented on the Steering Committee. The Steering Committee was appointed by members of the EdNA VET Advisory Group.

The Steering Committee was comprised of the following members:

Dr Charles Henderson (Chair, Queensland)

Mr Mark Bevelander (Vic)

Ms Jean Hollis (Tas) for Mr Graeme Walsh

Mr Ian Hutton (NSW)

Ms Gabrielle Onitiri (Commonwealth) for Ms Janette Lenz

Mr Tony Richards (NT)

Mr Paul Rixonn (SA)

Mr Harry Yaldren (ACT)

The contribution made by the Steering Committee is gratefully acknowledged.

Project Team

The consultants were DSTC Pty Ltd, University of Queensland, Brisbane. The consultancy team was led by

Margaret Turner, and

Frank Eilert.

Individual researchers with responsibility for the *Workshop Papers* were

Wasim Sadiq, *Management Systems*

Tim Mansfield, *Groupware*

Michael Gray, *Web Protocols*

Andrew Loch, *Multimedia*

Nigel Wood, Margaret Turner and Jon Henry, *Resource Locator Technologies*

Keenyn Williams, *Hardware (for client computers)*

The Project was managed by the Project Manager, Mr Jon Henry, Department of Employment, Training and Industrial Relations, Queensland.

Contact details for the authors of all discussion papers are available in the relevant *Workshop Papers* on the Project Web Site.

TABLE OF CONTENTS

INTRODUCTION	1
PURPOSE OF THE PROJECT	3
OUTPUTS	4
SCOPE OF RECOMMENDATIONS	6
FUNDING	8
METHODOLOGY	9
Working Groups	9
Consultant	9
Process	10
PROJECT OUTCOMES	11
Preferred Standards	11
Management Systems	11
Groupware	11
Web Protocols	14
Multimedia	15
Resource Locator Technologies	18
Hardware for client computers	19
Emerging Standards	22
Operational Guidelines	24
CONTINUING WORK	29
COMMUNICATION PLAN	31
SURVEY OF THE USE OF PREFERRED STANDARDS	33
PROPOSED PROJECTS	35

1. Introduction

Background

The then EdNA VET Advisory Group (EVAG) commissioned a project “National Cooperation in Applying Technology to VET” in 1997. In the Project Report a National Technology Standards Policy and a Maintenance and Further Development Process were proposed.

Subsequently, in 1998, EVAG commissioned the project “Preferred Standards to Support National Cooperation in Applying Technology to VET”. Published in 1999, the Report identified preferred standards for seven technologies and these were endorsed by ANTA CEOs.

The current project was part of the EdNA VET Advisory Group’s *Strategy 2000*, which commenced the implementation of the Australian National Training Authority’s national project *Framework for National Collaboration in Flexible Learning in Vocational Education and Training 2000 – 2004*, which, in turn, supports the broader scope of the *National Strategy for Vocational Education and Training*.

The National Strategy is available at <http://anta.gov.au> and has five components

- equipping Australians for the world of work,
- enhancing mobility in the labour market,
- achieving equitable outcomes in Vocational Education and Training,
- increasing investment in training, and
- maximising the value of public Vocational Education and Training.

The Project supports all five of these components.

The *Framework for National Collaboration in Flexible Learning in Vocational Education and Training 2000 – 2004* is available at <http://www.flexiblelearning.net.au>. It lists the guiding principles as

shared benefits for all States and Territories,

strategic use of new technologies,

accelerated take up of flexible learning methodologies,

strategic partnerships among training organizations and between training organizations and other service providers,

use of public training funds to leverage other investments in the Vocational Education and Training system,

employee involvement in, and ownership of, projects, and

projects driven by client demand.

The *Framework for National Collaboration in Flexible Learning in Vocational Education and Training 2000 – 2004* lists five areas in which projects were run

staff skills,

infrastructure,

content,

policies, and

regulation

Strategy 2000 involved twenty-six projects in the five areas listed in the *Framework* document. The Preferred Standards Project was one of five Projects in the infrastructure area.

The Project has important relationships with a number of the other projects outlined in Strategy 2000. Of particular interest is the Technology Infrastructure Investment Fund Project. The Preferred Standards will be a technical guide to the use of the Technology Infrastructure Investment Fund.

The EdNA Reference Committee has set up a Standards Sub Committee. The Sub Committee will advise on standards matters of relevance to all three educational sectors. The Project will take a lead role in gaining national agreement on standards. It is expected that some of the recommendations from the Project will be adopted by the Sub-Committee for all three sectors while others will form the basis of further work commissioned by the Sub-Committee. The Sub-Committee has expressed particular interest in results from the Project related to multimedia streaming technologies.

2. Purpose of the Project

The aim of the Project was a nationally agreed, standards-based environment for the use of online training experiences in which

provision of flexible training in a manner that best suits requirements can be accomplished with an eclectic mix of products from competing manufacturers,

a complete range of training experiences is available online (including text-based information, whiteboard, live and recorded video and audio presentations, chat sessions, email, visualisation, and collaboration on projects),

both competition and cooperation between training organizations is possible on an agreed technological basis to the best advantage of the Australian Vocational Education and Training system as a whole, access to online training is available to all Australians on a generic client platform of choice,

transfer of clients among training organizations is facilitated by standards for the transfer of records concerning progress and results,

training needs of clients can be met in a manner consistent with the requirements of place, time, working arrangements, and particular equity group,

students can interact with instructors and other students in both a synchronous and asynchronous manner,

seamless interaction of products from different manufacturers is made possible by agreed operational guidelines, and

the Australian Vocational Education and Training system is a highly competitive player on the international stage.

Implementation of the Project Recommendations will enable this vision to be realised.

3. Outputs

The project considered six areas of standards relevant to the online delivery of training.

The six standards areas were

management systems (including data storage and transmission, training delivery platforms, and training management platforms) – AVETMISS, IMS, AICC, etc,

groupware (document management, workflow management, scheduling, calendar, chat, application sharing, whiteboard, forums, email) – ODMA, ODMA workflow extensions, Workflow Coalition distributed workflow architecture, iCalendar, vCalendar, T120, vCard, SMTP, IMAP4, MIME, etc,

web protocols – XML, HTML, HTTP, Java, Javascript, etc,

multimedia – delivery standards: SDP, RTSP, H320, H323, gateways for H320 and H323, RTCP, RTP, HTTP; coordination standards: SMIL; encoding standards: hinted quicktime, ASF; compression schemes: H261, Sorenson, etc; data types: MPEG, AVI, AU, GIF, JPEG, PDF, etc,

resource locator technologies (meta data, search engines, and directory services) – LDAP, X400, X500, Dublin Core, EdNA metadata, IMS metadata, etc, and

hardware (for client computers) – processor power, main memory, disk storage, monitor resolution, graphics memory, modem speeds, etc.

For each of these standards areas, the Project produced recommendations on

preferred standards,

emerging standards requiring further attention,

operational guidelines, and

continuing work.

A Communication Plan has also been prepared. The Communication Plan includes recommendations on target audience, web site development, road shows, online shows, bake offs, showcases, appellation scheme, development system, permanent contact point, email announcements, newsletter articles, flyers, conference presentations, and public relations. An indicative budget is provided.

A Project website, available at <http://flexiblelearning.net.au>, has been set up.

A survey was conducted to gather information on the implementation of preferred standards produced by the 1998 project. A report on the survey is available and it includes recommendations to address perceived problems in the implementation of Preferred Standards. Example problems are confusion between standards and brands, lack of communication of Preferred Standards to practitioners, currency of Preferred Standards, and difficulty in supporting open standards.

A number of needs for further work beyond the scope of this Preferred Standards Project were identified during the course of the Project. These are the subject of recommendations in a separate report on *Proposed Projects*.

The results of the Project are described in nine reports.

Summary and Recommendations, (this document)

Management Systems,

Groupware,

Multimedia,

Resource Locator Technologies,

Hardware,

Communication Plan,

Survey Report, and

Proposed Projects.

All reports are available at the Project Web Site.

4. Scope of Recommendations

The recommendations from the Year 2000 Preferred Standards Project are intended to support the realisation of the vision of national cooperation in applying technology to Vocational Education and Training. This vision is outlined in the section titled *Purpose of the Project* above.

The Preferred Standards are relevant to circumstances where national cooperation is agreed to be desirable. Such circumstances could include

- development of reusable training materials for national use (e.g. Toolboxes),

- joint delivery of courses and training programs,

- national purchasing arrangements, and

- installation of national infrastructure.

The Preferred Standards are relevant to individual training organizations in circumstances where they wish to

- improve services to students by using an optimal mix of products from different manufacturers,

- reduce development and deliver costs by using the most cost effective mix of products from different manufacturers,

- make their systems scalable,

- future-proof their systems by enabling substitution of individual components as required,

- hire staff with appropriate knowledge to contribute to the planning, development and operation of online training systems,

- compete in the international arena on a basis at least equal to the overseas competition, and

attract students by offering online learning that can be accessed using hardware and software readily available to students.

The recommendations are not intended to replace State and Territory whole of government arrangements that have been established for other purposes.

The recommendations are particularly aimed at online learning. They are intended to indicate the standards required in client hardware and software used by students. They are not intended to influence Standard Operating Environments (SOEs) used by staff for administrative purposes.

The Project was concerned with standards applicable to the delivery of online training to students. The Project did not consider standards for the administration of students or finances.

5. Funding

The Project was sponsored by the EdNA VET Advisory Group using funding provided by the Australian National Training Authority.

A total of \$200,000 was available.

A further \$80,000 was available in the year 2001 for continuing work.

6. Methodology

The core part of the Project process was the conduct of a series of workshops involving representatives from each State and Territory.

Working Groups

Six Working Groups were established to investigate the six standards areas. The Working Groups represented the States and Territories and were comprised of nominees of the Steering Committee.

The Working Groups participated in discussions on email lists and met in a series of workshops.

Most States and Territories were represented on each Working Group. All states and Territories were represented on at least two Working Groups. Industry representatives participated in three Working Groups. Individuals comprising the Working Groups are acknowledged in the *Workshop Papers* on the Project Web Site.

Consultant

The Project Manager and the Working Groups were assisted by DSTC Pty Ltd acting as consultant. The consultant prepared background papers, arranged the workshops, made presentations at the Workshops, conducted a survey on the use of Standards in Vocational Education and Training, developed a Communication Plan, and produced draft final reports.

Process

The Consultant was appointed after consideration of tenders by a Sub-Committee of the Project Steering Committee. Work on the Project commenced in July 2000.

Initially, Consultant research staff authored *Discussion Papers* on the six standards areas assigned to the Working Groups. For each of the standards

areas, an email list was used for discussion by members of the relevant Working Group. Documents were placed on the Project Web Site.

The Project Manager proposed candidate recommendations to be discussed on the email list. Consultant staff extended the *Discussion Papers* to cover the technologies in the candidate recommendations and produced the *Workshop Papers*. Consultant staff worked with the Project Manager in further developing the candidate recommendations for discussion at the workshops. Comments from the email lists were also incorporated into the *Workshop Papers*.

Workshops involving the Working Groups for the selected standards areas were held in October with attendance from all jurisdictions. The Workshops were extremely productive. Participants brought to the Workshops a variety of backgrounds, expertise, experience, and current interests. The Working Group memberships were complemented by observers from the Schools sector. All attendees participated actively. The results of the Workshops were incorporated into the *Workshop Papers* and feedback obtained from the Project Steering Committee.

A *Communication Plan* was developed to disseminate and encourage the uptake of the Preferred Standards.

As part of the project, the Consultant developed proof-of-concept demonstrations. The aim of the demonstrations was to introduce possibilities for the technology to the project stakeholders. The demonstrations included the transfer of a student record between two registered training providers using an WML scheme consistent with AVETMISS. The Consultant also demonstrated the use of SMIL language for choreographing multimedia presentations.

A survey was conducted to gather information about the use of the 1998 Preferred Standards, specifically

the relevance of the standards within projects,

initiatives and projects that have used the standards,

opportunities for improving the preferred standards, and

constraints and barriers to the use of preferred standards.

The survey was distributed to all jurisdictions and the results and consequent recommendations are included in the report titled *Survey Report*.

The Steering Committee considered all results from the Project. All recommendations were accepted subject to minor changes in wording that were subsequently made by the Project Manager and Consultant.

7. Project Outcomes

This section outlines the recommendations for the three components of the *Preferred Standards to Support National Cooperation in Applying Technology to Vocational Education and Training*: Preferred Standards, Emerging Standards and Operational Guidelines.

A. Preferred Standards

Management Systems

- Training statistics, recording and exchange: AVETMISS. Reference:
<http://www.ncver.edu.au/statistics/avetmiss30/>
- Student records, exchange: XML – extensible Markup Language: W3C. Reference:
<http://www.w3c.org/XML/>
- Student records, record definition: XML – extensible Markup Language: W3C. Reference:
<http://www.w3c.org/XML/>
- Student records, distributed processing: ODBC – Open Data Base Connectivity: Microsoft Corporation. Reference:
<http://ourworld.compuserve.com/homepages/Vbrandt/stds.htm>
- Student records, interfacing between testing and recording modules: XML – extensible Markup Language: W3C. Reference:
<http://www.w3c.org/XML/>
- Online training materials, packaging components for reuse: XML – extensible Markup Language: W3C. Reference:
<http://www.w3c.org/XML/>

Groupware

- Email, sending from client to server: SMTP – Simple Mail Transfer Protocol: IETF. Reference:
<http://www.ietf.org/rfc/rfc0821.txt>
<http://www.ietf.org/rfc/rfc0822.txt>
<http://www.ietf.org/rfc/rfc1869.txt>
- Email, receiving mail from server to client: IMAP – Internet Message Access Protocol: IETF. Reference
<http://www.ietf.org/rfc/rfc2060.txt>
- Email, receiving mail from server to client: POP – Post Office Protocol: IETF. Reference
<http://www.ietf.org/rfc/rfc1725.txt>
- Email, format of messages: MIME – Multipurpose Internet Mail Extensions: IETF. Reference
<http://www.ietf.org/rfc/rfc1521.txt>
- File transfer, transfer of files: FTP – File Transfer Protocol: IETF. Reference
<http://www.ietf.org/rfc/rfc0959.txt>
- Directory services for email, scheduling, conferencing, etc, interface between client and server for lookup: LDAP – Lightweight Directory Access Protocol: IETF. Reference
<http://www.ietf.org/rfc/rfc2252.txt>
<http://www.ietf.org/rfc/rfc2253.txt>
<http://www.ietf.org/rfc/rfc2254.txt>
<http://www.ietf.org/rfc/rfc2255.txt>
<http://www.ietf.org/rfc/rfc2256.txt>
- Directory services for email, scheduling, conferencing, etc, format for storage of contact information: LDAP – Lightweight Directory Access Protocol: IETF. Reference
<http://www.ietf.org/rfc/rfc2256.txt>

- Directory services for email, scheduling, conferencing, etc, format for storage of contact information: vCard: IETF. Reference
<http://www.ietf.org/rfc/rfc2425.txt>
<http://www.ietf.org/rfc/rfc2426.txt>
- Directory services for email, scheduling, conferencing, etc, ad hoc exchanging of contact information: LDAP URL - Lightweight Directory Access Protocol Universal Resource Locator. Reference
<http://www.ietf.org/rfc/rfc2255.txt>
- Directory services for email, scheduling, conferencing, etc, ad hoc exchanging of contact information: vCard: IETF. Reference
<http://www.ietf.org/rfc/rfc2425.txt>
<http://www.ietf.org/rfc/rfc2426.txt>
- Directory services for email, scheduling, conferencing, etc, updating of contact information: vCard: IETF. Reference
<http://www.ietf.org/rfc/rfc2425.txt>
<http://www.ietf.org/rfc/rfc2426.txt>
- Appointment scheduling, format for exchanging address book information: vCard: IETF. Reference
<http://www.ietf.org/rfc/rfc2425.txt>
<http://www.ietf.org/rfc/rfc2426.txt>
- Appointment scheduling, format for exchanging appointment information: iCalendar: IETF. Reference
<http://www.ietf.org/rfc/rfc2445.txt>
- News services, distributing news: NNTP – Network News Transfer Protocol: IETF. Reference
<http://www.ietf.org/rfc/rfc0977.txt>
- Asynchronous text-based conferencing, message distribution: UseNet: IETF. Reference
<http://www.ietf.org/rfc/rfc1036.txt>

- Synchronous text-based conferencing (chat), interfacing clients: IRC – Internet Relay Char Protocol: IETF. Reference
<http://www.ietf.org/rfc/rfc1459.txt>
<http://www.ietf.org/rfc/rfc2810.txt>
<http://www.ietf.org/rfc/rfc2811.txt>
<http://www.ietf.org/rfc/rfc2812.txt>
<http://www.ietf.org/rfc/rfc2813.txt>
- Video and audio conferencing, transport over internet: H.323: ITU. Reference
http://www.itu.int/itudoc/itu-t/rec/h/s_h323.htm
- Whiteboard sharing, transport over internet: T.120-T.128: ITU. Reference
<http://www.itu.int/itudoc/itu-t/rec/h/index.html>
- Application sharing (more than one user operating the one program simultaneously), transport over internet: T.120-T.128: ITU. Reference
<http://www.itu.int/itudoc/itu-t/rec/h/index.html>
- Joint authoring, storing structured data for manipulation by several applications: XML – extensible Markup Language: W3C. Reference
<http://www.w3c.org/XML/>
- Joint authoring, versioning and locking on web server: WebDAV – Web Document Authoring and Versioning Standard: IETF. Reference
<http://www.ietf.org/rfc/rfc2518.txt>
- Joint authoring, interfacing document creation clients to web servers: WebDAV – Web Document Authoring and Versioning Standard: IETF. Reference
<http://www.ietf.org/rfc/rfc2518.txt>
- Joint authoring, interfacing document creation clients to file servers: ODMA – Open Document Management API 1.0: AIIM. Reference
<http://www.infonuovo.com/odma>
- Joint authoring, interfacing document creation clients to file servers: DMA – Document Management Alliance Standard 1.0: AIIM. Reference
<http://www.infonuovo.com/dma>

- Workflow, sequencing contributions from authors: ODMA Workflow Extensions: AIIM. Reference
<http://www.infonuovo.com/odma>

Web Protocols

- Documents, storing structured data for display (e.g. spreadsheets): XML – eXtensible Markup Language 1.0: W3C. Reference.
<http://www.w3c.org/XML/>
- Documents, storing formatted data for display on multiple platforms (e.g. mobile phone, handheld PC, desktop PC): XHTML – eXtensible Hypertext Markup Language 1.0: W3C. Reference.
<http://www.w3c.org/TR/2000/REC-xhtml-basic-20001219/>
- Documents, storing structured data for display on conventional browser: HTML – Hypertext Markup Language 4.1: W3C. Reference.
<http://www.w3c.org/TR/html4/>
- Documents, storing formatted data for display in exactly the original form: PDF – Portable Document (an alternative format for persons with reading difficulties should be offered): Adobe. Reference.
<http://www.adobe.com>
- Documents, storing structured data for manipulation by user at client station: RTF – Rich Text Format (should be offered wherever PDF is offered): Microsoft Corporation. Reference.
http://www.msdn.microsoft.com/library/specs/rtf/spec_2.htm
- Programs, structured programs for download and efficient execution on client machine (applets): Java 1.1: Sun Microsystems. Reference
<http://java.sun.com/>
- Programs, structured programs for download and efficient execution on server (servlets): Java 1.1: Sun Microsystems. Reference
<http://java.sun.com/>

- Programs, free form programs imbedded in web pages for execution on client machine: Javascript 1.2: Netscape, ISO. Reference
<http://developer.netscape.com/tech/javascript/index.html>
- Programs, free form programs for execution on server: Javascript 1.2: Netscape, ISO. Reference
<http://developer.netscape.com/tech/javascript/index.html>
- Communication, transmission of data between server and client: HTTP – Hypertext Transmission Protocol 1.1: W3C. Reference
<http://www.w3.org/Protocols/>
- Accessibility, making web information available to persons with special needs (e.g. persons with seeing, reading, hearing difficulties): World Wide Web Consortium Web Accessibility Guidelines: W3C. Reference
<http://www.w3c.org/TR/WAI-WEBCONTENT>

Multimedia

- Streaming delivery, advertising sessions available from server: SAP – Session Announcement Protocol: IETF. Reference
<http://www.ietf.org/rfc/rfc2974.txt>
- Streaming delivery, describing stream content: SDP – Session Description Protocol: IETF. Reference
<http://www.ietf.org/rfc/rfc2327.txt>
- Streaming delivery, delivery control for one way delivery (stop, start, etc): RTSP – Real Time Streaming Protocol: IETF. Reference
<http://www.ietf.org/rfc/rfc2326.txt>
- Streaming delivery, delivery control for peer to peer delivery (video and audio conferencing) over ISDN: H.320: ITU. Reference
<http://www.itu.int/itudoc/itu-t/rec/h/h320.htm>

- Streaming delivery, delivery control for peer to peer delivery (video and audio conferencing) over IP: H.323: ITU. Reference
http://www.itu.int/itudoc/itu-t/rec/h/s_h323.htm
- Streaming delivery, delivery control for peer to peer delivery (video and audio conferencing) over PSTN: H.324: ITU. Reference
http://www.itu.int/itudoc/itu-t/rec/h/s_h324.htm
- Streaming delivery, delivery control for peer to peer delivery (data sharing): T.120-T.128: ITU. Reference
<http://www.itu.int/itudoc/itu-t/rec/h/index.html>
- Streaming delivery, Monitoring and low level control: RTCP – Real Time Control Protocol: IETF. Reference
<http://www.ietf.org/rfc/rfc1889.txt>
<http://www.ietf.org/rfc/rfc1890.txt>
- Streaming delivery, transport: RTP – Real Time Transport Protocol: IETF. Reference
<http://www.ietf.org/rfc/rfc1890.txt>
- Streaming delivery, transport: HTTP – Hypertext Transmission Protocol 1.1: W3C. Reference
<http://www.w3.org/Protocols>
- Compression for streaming, compression of video data where high compression and quality are required: Sorenson codec: Sorenson Media. Reference
<http://www.sorenson.com>
- Compression for streaming, compression of video data where high compression and quality are required: H.263: ITU. Reference
<http://www.itu.int/itudocs/itu-t/rec/h/h263.html>
- Compression for streaming, compression of video data where high compression and quality are required: MPEG-4: ISO (MPEG). Reference
<http://www.cselt.it/mpeg/standards/mpeg-4/mpeg-4.htm>

- Compression for streaming, compression of video data where compatibility with older systems is required or hardware speed is limited: H.261: ITU. Reference
<http://www.itu.int/itudocs/itu-t/rec/h/h261.html>
- Compression for streaming, compression of video data where compatibility with older systems is required or hardware speed is limited: Cinepak: Supremac Technology. Reference
<http://www.cinepak.com>
- Compression for streaming, compression of audio data: G.711 (ulaw): ITU. Reference
<http://www.itu.int/itudocs/itu-t/rec/g/g700-799/g711.html>
- Compression for streaming, compression of audio data: G.724 : ITU. Reference
<http://www.itu.int/itudocs/itu-t/rec/g/g700-799/g724.html>
- Compression for streaming, compression of audio data: G.728 : ITU. Reference
<http://www.itu.int/itudocs/itu-t/rec/g/g700-799/g728.html>
- Compression for streaming, compression of audio data: MPEG-1 audio layer 111 : ISO (MPEG). Reference
<http://www.mpeg.org/MPEG/mp3.html>
- Compression for streaming, compression of audio data: MPEG-4 and MPEG-2 AAC (Advanced Audio Coding: ISO (MPEG). Reference
<http://www.mp3-tech.org/index.html>
- Compression for streaming, compression of audio data: MPEG-4 and MPEG-2 Twin VQ (Transform-domain Weighted Interleave Vector Quantisation): ISO (MPEG). Reference
<http://www.mp3-tech.org/index.html>
- File formats for use by servers to deliver material by RTSP streaming protocols, packaging different media types into one file for streaming with RTSP: Hinted Quicktime: Apple Computer. Reference
<http://www.apple.com/quicktime/products/tutorials/hintracks.html>

- File formats for recording, manipulation, storage and delivery of material, audio: AU-audio: Sun Microsystems. Reference
<http://www.opengroup.org/public/pubs/external/auformat.html>
- File formats for recording, manipulation, storage and delivery of material, audio: MP3 – MPEG-1 audio layer 111: ISO (MPEG). Reference
<http://www.mpeg.org/MPEG/mp3.html>
- File formats for recording, manipulation, storage and delivery of material, video and audio: AVI – Audio/Video Interleave: Microsoft Corporation. Reference
<http://www.daubnet.com/formats/AVI.html>
- File formats for recording, manipulation, storage and delivery of material, video and audio: MOV – Quicktime movie: Apple Computer. Reference
<http://www.apple.com/quicktime/products/tutorials/tracks.html>
- File formats for recording, manipulation, storage and delivery of material, virtual reality: VRML – Virtual Reality Modelling Language: Web3D Consortium. Reference
<http://www.web3d.org/vrml/spv.htm>
- File formats for recording, manipulation, storage and delivery of material, animated graphics: Shockwave (Flash, Director, and Authorware): Macromedia. Reference
<http://www.macromedia.com/software/flash/open/licensing/fileformat/>
- File formats for recording, manipulation, storage and delivery of material, still graphics: PNG – Portable Network Graphics: PNG Development Group, IETF, W3C. Reference
<http://www.libpng.org/pub/png/spec>
<http://www.ietf.org/rfc/rfc2083.txt>
<http://www.w3c.org/TR/REC-png.html>
- File formats for recording, manipulation, storage and delivery of material, still graphics: JPEG: ISO/ITU (JPEG). Reference
http://www.itu.int/itudoc/itu-t/rec/t/s_t86.html

- File formats for recording, manipulation, storage and delivery of material, text and still graphics: PDF – Portable Document Format (an alternative format for persons with reading difficulties should be offered): Adobe. Reference
<http://www.adobe.com>

Resource Locator Technologies

- Metadata, recording descriptive information about stored data (e.g. files on web servers): EdNA metadata standard: EdNA. Reference
<http://www.edna.au/EDNA/genericpage.html?file=/edna/aboutedna/metadata/index.html>
- Metadata, recording descriptive information about stored data (e.g. files on web servers): IMS metadata standard: IMS. Reference
<http://www.imsproject.org/metadata/index.html>
- Metadata, recording descriptive information about stored data (e.g. files on web servers): Dublin Core metadata standard: DCMI. Reference
<http://purl.org/dc/documents/dcmes-qualifiers>
- Metadata, recording descriptive information about stored data (e.g. files on web servers): AGLS – Australian Government Locator Service: Commonwealth Government. Reference
http://www.naa.gov.au/recordkeeping/gov_online/agls/summary.html
- Metadata, making metadata available in a form that can be processed electronically: RDF – Resource Description Format: W3C. Reference
<http://www.w3.org/TR/REC-rdf-syntax/>

- Directory services for looking up information, interface between client and server for lookup: LDAP – Lightweight Directory Access Protocol: IETF. Reference
<http://www.ietf.org/rfc/rfc2252.txt>
<http://www.ietf.org/rfc/rfc2253.txt>
<http://www.ietf.org/rfc/rfc2254.txt>
<http://www.ietf.org/rfc/rfc2255.txt>
<http://www.ietf.org/rfc/rfc2256.txt>
- Directory services for looking up information, interface between client and server for lookup: X.500: ITU. Reference
<http://www.itu.int/itudoc/itu-t/rec/x/x500up/index.html>
- Directory services for looking up information, interface between client and server for lookup: Z39.50: Reference
<http://www.ukoln.ac.uk/interop-focus/bath>
- Directory services for looking up information, format for storing information about people: organisationalPerson object class from X.521:ITU. Reference
<http://www.itu.int/itudoc/itu-t/rec/x/x500up/index.html>
- Directory services for looking up information, format for storing information about people: LDAP – Lightweight Directory Access Protocol: IETF. Reference
<http://www.ietf.org/rfc/rfc2256.txt>
- Directory services for looking up information, format for storing information about books: Z39.50: Reference
<http://www.ukoln.ac.uk/interop-focus/bath/>

Hardware for Client Computers

- IBM style hardware, highest speed required by students to receive online training.

	Highest required specification
CPU	Intel Pentium II/Celeron or AMD K6-2 at 300 MHz
Bus	PCI + ISA + USB + EIDE
Ports	Serial + parallel
RAM	64 Mb
Hard Disk	4 Gb
Floppy Disk	1.44 Mb
Display Adapter	2 Mb ram + 800x600 resolution + 64k colours + hardware MPEG-1 video decoding.
Sound Card	16bit 44.1kHz stereo input and output + simple MIDI synthesiser
CD-ROM drive	
Speakers, Monitor, Keyboard, Mouse	

- IBM style hardware, lowest specification for new purchases.

	Standard PC	Advanced PC
Motherboard	Intel/VIA Chipset	Intel/VIA Chipset
CPU Speed	>= 600 MHz	>= 800 MHz
Memory SDRAM	>= 128 Mbyte (PC-133)	>= 256 Mbyte (PC – 133) ECC RAM recommended for >256 Mb
Hard disk	10 Gbyte, ATA/33	20 Gbyte. ASTA/66
Floppy disk	1.44 Mbyte	1.44 Mbyte
CD ROM	Yes, access to a CD-W	CD-W, DVD
Video display	>=17", 1024x768 @ 80Hz, 0.27 micron pixel'	>= 19", 1600x1200 @70Hz, 0.26 pixel'
Graphics card	>= 8 MB, 64 bit, AGP	>=32 MB, 256 bit, AGP
Network card	10 Mb/s combo ISA or 10/100 Mb/s UTP PCI	10 Mb/s combo ISA or 10/100 Mb/s UTP PCI Std
Sound card	>= 16 bit, 128 voice, 44.1 KHz, PCI, Full Duplex	>= 16 bit, 128 voice, 44.1 KHz, PCI, Full Duplex
Video capture	-	MPEG-2 hardware and software
Printer	Access to B/W Laser Printer	Access to Colour Laser Printer
Optional extras	DVD B/W Laser Printer	LS 120 FDD B/W Laser Printer Colour Laser Printer Scanner Digitiser

- Macintosh style hardware, highest specification required by students to receive online training: Any hardware capable of running OS8.5

- Macintosh style hardware, lowest specification for new purchases

Component	Standard Macintosh	Advanced Macintosh
Operating system	System 8.5.3 or above	System 9.0.2 or above
CPU speed	G3 processor at 300 MHz or above	G4 system. Dual or single processor
Memory SDRAM	>= 64 Mbyte	>= 256 Mbyte
Hard disk	4Gbyte, ATA/33	20 Gbyte
CD ROM	Yes, access to a CD-W	CD-W, DVD
Video display	>= 15"	>= 19"
Network card	10/100 Mb/s Ethernet	10/100 Mb/s Ethernet, Gigabit Ethernet
Multimedia support	Yes	Yes
Video capture	-	Fire Wire (IEEE1394)
Printer	Access to B/W Laser Printer	Access to Colour Laser Printer
Optional extras	DVD B/W Laser Printer	100/250 Mbyte Zip drive B/W Laser Printer Colour Laser Printer Scanner Digitiser

B. Emerging Standards

Management Systems

- Online testing of students, interface between testing and recording modules: IMS -Learning Test Interoperability Specification: IMS. Reference <http://imsproject.org/question/index.html>
- Online training materials, packaging components for reuse: IMS - Content Packaging Specification: IMS. Reference <http://imsproject.org/content/index.html>
- Online training materials, packaging components for reuse: SCORM – Sharable Courseware Object Reference Model (XML-based representation of course structures): ADLNet. Reference http://www.adlnet.org/Scorm/scorm_index.cfm

Groupware

- Appointment scheduling, interface between clients for scheduling appointments: iTIP – iCalendar Transport – Independent Interoperability Protocol: IETF. Reference <http://www.ietf.org/rfc/rfc2446.txt>
- Appointment scheduling, interface between clients for scheduling appointments: iMIP – iCalendar Message – Independent Interoperability Protocol: IETF. Reference <http://www.ietf.org/rfc/rfc2447.txt>
- Appointment scheduling, interface between client and server for scheduling appointments: CAP – Calendar Access Protocol: IETF. Reference <http://www.ietf.org/html.charters/calsch-charter.htm>

Multimedia

- Coordination of components for delivery by streaming, web, chat, whiteboard, etc protocols, choreographing presentations by combining components of different media that are delivered from different sources: SMIL – Synchronised Multimedia Interaction Language: W3C. Reference
<http://www.w3.org/TR/1998/REC-smil>
- Coordination of components for delivery by streaming, web, chat, whiteboard, etc protocols, choreographing graphics for streaming with special effects such as fade: Real Pix (only to be used when no industry standard is suitable): Real Networks. Reference
<http://service.real.com/help/library/guides/realpix/realpix.htm>
- Coordination of components for delivery by streaming, web, chat, whiteboard, etc protocols, choreographing text for streaming with special effects such as scrolling and ticker taping: Real Text (only to be used when no industry standard is suitable): Real Networks. Reference
<http://service.real.com/help/library/guides/realtext/realtext.htm>
- Compression for streaming, compression of audio data: MPEG-4 CELP (Code Excited Linear Prediction): ISO (MPEG). Reference
<http://www.cselt.it/mpeg/standards/mpeg-4/mpeg-4.htm>
- Compression for streaming, compression of audio data: MPEG-4 BSAC (Bit Sliced Arithmetic Coding): ISO (MPEG). Reference
<http://www.cselt.it/mpeg/standards/mpeg-4/mpeg-4.htm>
- Compression for streaming, compression of audio data: MPEG-4 HILN (Harmonic Individual Line and Noise): ISO (MPEG). Reference
<http://www.cselt.it/mpeg/standards/mpeg-4/mpeg-4.htm>
- File formats for use by servers to deliver material by RTSP streaming protocols, packaging different media types into one file for streaming with RTSP: MPEG-4: ISO (MPEG). Reference
<http://www.cselt.it/mpeg/standards/mpeg-4/mpeg-4.htm>

C. Operational Guidelines

The Operational Guidelines agreed by the Working Groups are listed below. They are referenced by number in the Preferred Standards and Emerging Standards.

1. Student access to learning management and delivery systems is to be via a web interface.
2. Learning management by both traditional (classroom) and flexible (individual, self paced, and collaborative) to be supported.
3. Terminology from the National Training Framework to be used in learning management systems.
4. Official contact lists for Training Organizations to be maintained by the individual organizations on LDAP-compliant directory servers.
5. Official contact list information to conform to both LDAP and xCard schemata.
6. Official contact list server addresses to be published adequately by the owner organizations.
7. Official contact list users to be provided with support by owner organizations.
8. Official contact list contents (stored on LDAP servers) to be shared using LDAP URLs.
9. Private contact list contents to be shared using vCard messages.
10. Updates to LDAP directories to be achieved by submission to the administrator as vCard messages for automatic conversion to LDIF and submission to the LDAP server.
11. Email to be available to users via IMAP.

12. Email to be stored in a server-based home directory for each user. This is to allow the user's email to that user from any work station.

13. Facilities, other than email, for moving large files across networks to be provided by administrators for users. These could include ftp, web servers, and document management systems.

14. Email contents to be prepared so that

Line lengths are limited to 70 characters,

The body of the message is in plain ASCII text (word processor documents containing only text can be saved as plain text and included in the body of the message),

Other media types are included by placing them in MIME attachments,

Total lengths of messages, including attachments, are limited (long files should be made available to intended recipients via another means, e.g. an ftp server, a web server, or a document management system), and

Senders take responsibility for ensuring that receivers can open attachments.

15. Where administrators enforce rejection of email messages longer than a set limit,

The message header (and body without attachments if possible) is to be passed through to the intended recipients, and

Sender and recipients are to be advised of other means of transmitting information.

16. For online, text-based discussions where all participants are known, messages to be

Distributed via a mailing list server, and

Archived on a web-based archive system

17. For online, text-based discussions where many participants may not be known, messages to be made available via a web-based discussion system
18. For very large (greater than 100 participants) online, text-based discussions, messages to be made available via a Usenet news server.
19. Usenet news servers for Training Organizations to be arranged in a national network to enable efficient distribution of messages.
20. Training in message distribution techniques to be provided for local experts and users.
21. User's calendar information (free time, busy time, and optionally appointments) to be accessible via ftp or CAP.
22. Documents likely to be shared among several users, or likely to go through several revisions, to be stored in some kind of repository. The repository may be a shared file system, a web server, or a document management system.
23. Document formats to be selected by users to maximise opportunities for information exchange, e.g.

Plain ASCII if only the text is important,

PDF or HTML if formatting is to be preserved,

HTML or RTF if formatting is to be modified,
Standard, rather than proprietary, formats in all circumstances, and

More than one format where members of the target audience may have differing needs (e.g. some persons require machine readable formats).

24. Style sheets to be used to separate content from form in web pages.

25. Web pages to display to the authors' satisfaction in

Netscape Navigator 4.6 or later

Microsoft Internet Explorer 4.01 SP2 for PCs and 5.0 for Macs or later,
and

Opera 4.x or later.

26. The following published guidelines to be followed

W3C Web Accessibility Guidelines,

W3C Guidelines for Maintaining Backward Compatibility of XHTML with
HTML,

Guidelines for Commonwealth Information Published in Electronic
Formats, and

Australian National Training Authority Toolbox Web Publishing
Guidelines.

27. Material for online use over the internet to be capable of intelligible display
when received via a 28 kbs modem.

28. Multimedia material to be offered in a choice of compression rates to suit
different available line speeds and display engines.

29. Client hardware to be powerful enough to decompress material
compressed with the Sorenson codec.

30. Video conferencing systems to have

Stations equipped as recommended by the 1998 Preferred Standards Project, i.e. H.320 operating at 128 Kb/s, H.323 on campus including gateways to H.320 systems, and T.120.

Transmission possible at 128 kbps, and

Gateways capable of using and transcoding G.728.

31. Multimedia material to be distributed in a mix of ways chosen to balance effective presentation against the need for up-to-date content, e.g.

DVD for material not requiring frequent revision,

Overnight download for material requiring frequent revision, and
Streaming for live material.

32. Material to be tested with a suitable testing product with the functions of Media Cleaner Pro.

33. Metadata to be associated with all important electronic learning resources and web pages.

34. Metadata may be stored separately from the subject source.

35. Metadata elements to comply with

EdNA Metadata Standard,

AGLS,

Relevant State/Territory requirements,

IMS Metadata, and

Additional metadata invented to suit a particular requirement.

36. Values for metadata attributes to be chosen from thesauri recommended by the EdNA Metadata Standard.
37. Metadata to be created with EdNA metadata tools.
38. Z39.50 servers for metadata to conform to the Bath profile.
39. Client PCs to have network cards.
40. PC laboratories to have wireless network base stations and wireless network cards to enable private laptops to connect to the network.
41. CD writer access to be provided for students.

8. Continuing Work

Recommendations listed in this section are those requiring additional work that could reasonably be accomplished as a continuation of the current arrangements for the Preferred Standards Project, i.e. they are focussed directly on standards or would require minimal labour. Projects of a more diverse or substantial nature are listed in the section on Proposed Projects.

Mapping between AVETMISS and IMS terminology.

Monitoring of web site usage statistics to determine when to change the versions of popular web browsers that should be supported and listed as Preferred Standards.

Evaluation of available methods for online delivery (satellite, television, frame relay, ISDN, ADSL) to determine relevant standards and requirements for data compression.

Establishment of Standing Committee for continuing review of standards and developments.

Investigation of remote sensing image format standards and methods for automatic conversion of Virtual Reality tours.

Monitoring of product support for SMIL (SMIL is currently implemented by Netscape Communicator 6, Internet Explorer 5.5, Quicktime Player, and Real Player.)

Communication of bandwidth requirements for training to decision makers in relevant areas.

Examination of methods for providing the functionality of the PDF format in a way that is accessible to visually impaired persons.

Documentation of standards and development of guidelines for the use of Codecs.

Recommendations to the EdNA Metadata Project Group on thesauri commonly used by Vocational Education and Training but not included in the current EdNA Metadata Standard. These are, in order of preference – AVETMISS, VOCED, Ozjac, AShareNet, and ASCED.

Evaluation of RDF and RDF compliant metadata tools to determine utility within Vocational Education and Training.

Encouragement of all training organizations to conform to the EdNA Memorandum of Agreement for harvesting of links to web sites.

Maintenance of a list of software that conforms to the Preferred Standards.

Monitoring of developments in the following hardware areas

 Infra red and cableless connection between desktop PCs and handhelds, palmtops, and laptops to support synchronisation,

 Smart card readers,

 Thin and flat screen monitors,

 Headset microphones for dictation, navigation, commands, etc, and

 Other devices for web access, e.g. mobile phones, kiosks, palmtops, etc.

Consideration of the firewire standard and its acceptance as a Preferred Standard.

Investigation of ecommerce standards such as smart cards for their relevance to Vocational Education and Training.

Documentation of standards and investigation of development methods specifically for DVD.

Documentation of relevant security standards including those for secure delivery of information, server authentication, student authentication, and copyright.

Documentation of relevant standards for wireless and mobile access by students to online training.

This continuing work to be managed by the Project Manager of the 2001 Preferred Standards Project using the \$80,000 available for the purpose in the year 2001.

9. Communication Plan

The Communication Plan is published separately and is available at the web site www.flexiblelearning.net.au. The following represents a summary of the Plan's key strategies. Implementation of the Communications Plan will be the responsibility of the Project Manager, 2001 Preferred Standards Project. Implementation of the Communications and will include those strategies that can be funded from within the 2001 project budget.

Permanent Preferred Standards Web Site to be established based on material in the year 2000 Project Web Site.

Preferred Standards Road Shows to be staged on a continuing basis to provide tangible proof of the benefits of using the Preferred Standards.

Preferred Standards Online Shows to be set up and made available to provide focussed demonstrations on demand.

Preferred Standards Bake Offs to be initiated to bring competing manufacturers together with training practitioners in order to demonstrate interoperability of technologies for the online delivery of training.

Project Manager of the 2001 Preferred Standards Project to approach relevant manufacturers to arrange an initial Preferred Standards Bake Off on topics of mutual interest to the manufacturers and Training Organizations.

Appropriate training products to be selected as Preferred Standards Showcases, commencing with Toolbox products.

Project Managers of the 2001 Preferred Standards and Toolbox Projects and the Manager of Australian Training Products to liaise further in relation to Preferred Standards documentation specifically targeted at the needs of Toolbox developers and in relation to publicity of mutual benefit.

Preferred Standards Appellation Scheme to be commenced in order to promote the use of the Preferred Standards by allowing conforming training products to display an appropriate brand.

Permanent contact point, in the form of an email address and/or a telephone number to be established for questions related to the Preferred standards.

All communications to refer to the permanent Preferred Standards Web Site and contact points.

Public relations consultant to be appointed to assist with the preparation of written materials, and graphics for the permanent Preferred Standards Web Site.

Email to be used to notify Training Organizations of the web site and the benefits of using the Preferred Standards. Emails to be sent using the resources of the organizations who participated in the Preferred Standards Project.

Articles to be prepared for regular newsletters for Training Organizations. Articles initially to be prepared by the Project Manager of the 2001 Preferred Standards Project, the public relations consultant, and the editors of the respective newsletters.

An expert from the Preferred Standards 2000 Project to give presentations at relevant conferences.

Implementation of the Communication Plan to be commenced at the first opportunity within the \$80,000 made available for the 2001 Preferred Standards Project.

10. Survey of the Use of 1998 Preferred Standards

The Survey of the Use of 1998 Preferred Standards is published separately and is available at the web site www.flexiblelearning.net.au. The following represents a summary of the main recommendations arising from the survey findings.

Lack of awareness of Preferred Standards to be addressed with Communication Plan.

Misunderstanding about the difference between products and standards to be addressed by using the Communication Plan to highlight the benefits of open standards.

Lack of understanding of the Preferred Standards to be addressed through staff training.

Possible conflict between the Preferred Standards and local arrangements to be resolved by explanation of the scope of the Preferred Standards (as in *Scope of Recommendations* earlier in this report) and further collaboration among the relevant jurisdictions.

Currency of Preferred Standards to be addressed by continual maintenance.

Difficulty in supporting open standards to be mitigated by permanent advisory service under a Standing Committee.

Requirements for further information to be addressed through extending the scope of the Preferred Standards to include the following suggestions

IMS (Integration of training delivery and training management systems, enhancement of interoperability, reduction in costs of implementation and future proofing of procurement decisions),

Effective ICT infrastructure, platforms, and tools for online delivery of training,

Convergent technologies, particularly video, television and the Internet,

Multimedia streaming (SMIL, SDP, RTSP, RTP, and RTCP),

Multimedia compression,

Multimedia data types,

XML,

DHTML,

CSS,

Cataloguing,

Metadata,

Workflow,

Electronic white board sharing,

Meeting scheduling (iCalendar, vCalendar),

Java and Javascript,

DVD,

Thin clients,

Firewalls (while maintaining security and removing barriers to connectivity of interoperating systems and functions), and

Smart cards.

(Many of the suggested extensions to the Preferred Standards were addressed in the Year 2000 Preferred Standards Project.)

11. Proposed Projects

Development of XML schemata required by the Vocational Education and Training sector for the transfer of information between systems.

Development of a framework for considering online delivery of training. The framework would take a broad view of delivery technologies. It would provide an agreed terminology and set of options.

Rationalisation of the terminology used in the National Training Framework to resolve inconsistencies with international standards. This could be done by adopting international terminology where appropriate and by providing precise definitions of Australian terms and mapping to international ones.

Development of an LDAP directory of practitioners in the Australian Vocational Education and Training sector.

Examination of technology and standards for the use of Virtual Reality in training delivery. The project would develop guidelines for equipment, software, and resource sharing and would implement pilot modules.

Examination of technology, standards, and value of thin client architectures in training delivery.

Investigation of possible interconnectivity of Vocational Education and Training management systems with banking systems and the relevant banking standards for financial management.

Investigation of use of interactive television for training delivery.

Establishment of a Vocational Education and Training Metadata Working Group to complement the EdNA Metadata Project Group.

Further development of Vocational Education and Training use of the EdNA Online web portal. This could include a dedicated search engine for Vocational Education and Training materials.

Investigation, in collaboration with EdNA Online, of unified search engines that can interrogate data made available via Z39.50, X.500, and LDAP.