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1.0 Introduction

Education Services Australia (ESA) has developed the Technical specification guide for online resources to provide guidelines for system administrators, content developers, commercial publishers, schools and teachers to enable the use of their resources on the National Digital Learning Resources Network and repositories managed by the Australian education jurisdictions.

ESA manages the National Digital Learning Resources Network to provide a sharing and distribution infrastructure available to all jurisdictions. ESA also manages the Scootle website, which provides a search and access tool for the resources. The use of the network by the jurisdictions is shown below.

National Digital Learning Resources Network

Two distribution models are provided for education jurisdictions:

- supply of the digital curriculum resource and its metadata
- delivery of the metadata only, so that users are directed to the website of a partner institution to access the digital curriculum resource.

There are three core systems that make up this infrastructure:

- the Learning Exchange (LEX), a framework for creating, distributing and managing digital curriculum resources and intellectual property rights
- the Sharing Exchange (SHEX), a repository for the Australian school sector that enables digital curriculum resources to be shared
• the Metadata Exchange (MEX), a system that harvests the metadata records of digital curriculum resources suitable for schools in Australia from a range of cultural institutions (eg museums, non-government organisations), eliminating the need for users to identify and search individual repositories of cultural institutions.

1.1 Purpose

The Technical specification guide for online resources lists the technical standards and specifications to be used when developing digital curriculum resources and online content for use in the repositories connected to the National Digital Learning Resources Network. It provides information to assist resource developers in identifying suitable internationally accepted specifications and tools that will enable them to develop resources that are viable, robust and interoperable.

Education Services Australia is working with the National Schools Interoperability Program to ensure that technical and metadata standards continue to be aligned with education jurisdictions' requirements.

1.2 Obligations of Education Services Australia

Education Services Australia will fulfil the following obligations in managing these standards:

• consult with relevant education jurisdictions, organisations, user groups and digital resources developers in establishing, implementing and reviewing this specification

• proactively review and, as appropriate, update this specification to reflect knowledge and practice derived from the development, deployment and use of resources

• proactively review and, as appropriate, update this specification to meet emerging standards and specifications affecting educational digital resources

• contribute to national and international standards development in the area of digital resources procurement through the evolving body of knowledge and practice.

1.3 Development, monitoring and usage

The Technical specification guide for online resources has evolved from specifications developed for resources produced by The Learning Federation (TLF) project from 2003 to 2009.

The National Digital Learning Resources Network (NDLRN) now manages the learning objects and digital resources created by TLF. This specification reflects the changes in requirements as the number of learning objects created is reduced and resource development shifts to a wider range of web-based digital curriculum resources and tools delivered on a wider range of devices. Education Services Australia will monitor technologies and standards adopted by the educational jurisdictions and those deployed in classrooms to ensure that these standards remain effective and relevant.

Mobile devices such as smart phones and digital pads are becoming significant in the education market. Education Services Australia is monitoring the adoption and use of these technologies and where appropriate will be updating standards to include these devices.

The Technical specification guide for online resources will be updated regularly and published on the National Digital Learning Resources Network website.
1.4 Associated standards

This standard should be read with the following Education Services Australia standards documents:

- Educational value standard for digital resources
- Accessibility specification for content development
- Learning object repository access and exchange (LORAX).

1.5 Conformance

Resources conforming to this specification must adhere to the principles described below, the information model at section 3.0 and the resource requirements listed from section 4.0 of this document.

1.6 Language used in this document to indicate requirement levels

Within this specification document, the following words are to be interpreted as described in RFC-2119: ‘must’, ‘must not’, ‘required’, ‘shall’, ‘shall not’, ‘should’, ‘should not’, ‘recommended’, ‘may’ and ‘optional’.
2.0 Principles

Use of the Technical specification guide for online resources assists developers to conform to the following four principles for resources used across education jurisdictions:

- interoperability
- flexibility
- durability
- scalability.

Using the Technical specification guide for online resources with the Accessibility specification for content development will also ensure that resources conform to the requirements for:

- accessibility
- usability.

2.1 Interoperability

The aim of this principle is to ensure that resources can be used on and shared between a wide range of software and hardware platforms and mobile devices. It assumes that the resources will be used within operating environments that support internationally adopted standards and specifications.

2.2 Flexibility

This principle relates to mixing and reusing digital curriculum resources from a range of sources, enabling them to fit into multiple applications and environments. Flexibility is realised by ensuring that digital curriculum resources and their constituent components are adequately described and packaged so that they can be found and recontextualised.

2.3 Durability

This principle aims to ensure that online resources can withstand technology changes without requiring redesign or recoding. The principle is often realised by encoding resources in formats that can be easily interpreted and translated into future technologies. For example, images may need to be provided in both low- and high-resolution formats. The low-resolution format is for inclusion in the resources, and the high-resolution format would be used for possible future translations.
2.4 Scalability
This principle relates to using technologies that allow educational resource providers to benefit from both a growth in demand for services and an increase in new inputs. Using technologies that may enhance the reuse of the resources collected is an example of scalability.

2.5 Accessibility
The W3C Web Content Accessibility Guidelines (WCAG 2.0) assist developers to create resources that enable people with disabilities to access products and information as easily as possible. Compliance with the WCAG 2.0 Guidelines will ensure that resources conform to Commonwealth laws concerning accessibility, and to state and territory policies regarding inclusive education provision. This accessibility principle informs Education Services Australia’s specifications on technical resources, accessibility and educational value standards.

All new Education Services Australia resources must conform to the WCAG 2.0 Level AA specification. All existing material is required to be Level A compliant by 31 December 2012 and Level AA compliant by 31 December 2014.

2.6 Usability
Resources must be useable by teachers and students on a range of devices. The resources interface must be able to be learnt, efficient, memorable, consistent and pleasant to use.

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1 This definition of usability is derived from Usability Engineering by Jakob Nielsen, published by Academic Press, USA, 1993.
3.0 Information model

Education Services Australia develops digital curriculum resources in a range of formats. Resources that contain a number of components grouped into a package for upload and delivery from a repository must conform to the information model described.

3.1 Learning content model

The information model for digital curriculum resource content (both interactive and non-interactive) is illustrated in Figure 1 below. Digital curriculum resources contain resources, organisation information and metadata.

- **Resources** are files and subordinate learning content that are used to facilitate the learning experiences. Resources may be any of the file types described in the ‘Content requirements’ section of the document including for example XHTML files, CSS style sheets, MP3 audio files and JPEG images.

- The **organisation** information describes one or more structures or ‘organisations’ for a package and is provided as an XML file which defines the pathway or pathways through the learning resource. For example, a digital curriculum resource may have two educationally equivalent organisations: one optimised for visual learners and one optimised for use by visually impaired learners.

- Within learning content, **metadata** is structured information about the learning content and its resources. For example, metadata may include the learning content’s title, description and educational purpose. The metadata required is described in the ANZ-LOM 1.02 (Mar 2011) metadata application profile.

![Content Package Diagram]

Figure 1: Example Digital curriculum resource Learning Content Information Model
3.2 Packaging digital curriculum resources

The National Digital Learning Resources Network delivers digital curriculum resources to stakeholders as either IMS Content Packages (see Content Packaging Specification on the IMS Global Learning Consortium website) or SCORM 2004 2nd edition version 1.3 Content Packages (see the Advanced Distributed Learning website).

Resources can be uploaded to digital repositories operated by the National Digital Learning Resources Network to enable discoverability and distribution to the education jurisdictions. Content is stored on the Sharing Exchange (SHEX) and metadata on the Metadata Exchange (MEX).

3.3 Separating structure, presentation and functionality

As much as possible, National Digital Learning Resources Network resources must be constructed using technologies that separate the resources’ structure, presentation and functionality.

The structure of a resource refers to how it is organised. In print media, information in a document may be organised by chapters, and usually includes an introduction and a table of contents. In web media, information in a document may be organised within elements and nodes in an XML file.

The presentation of a resource refers to how the resource is rendered. For example, a document may be represented in print, as a web page or as an audio file (for instance as synthesised speech). The presentation of a resource may also be affected by the application of another resource. For example, a CSS or XSLT may alter the presentation of an XML file.

The functionality of a resource refers to how the resource interacts with a user. For example, a web page may contain links that open other web pages in separate windows, and a programmed simulation of a calculator may perform calculations in response to user interaction.

Where possible, the resource structure, presentation and functionality should be separated.

Separating structure, presentation and functionality enhances the stated principles of accessibility, usability, flexibility and durability. It allows graceful transformation of content into different renderings for different devices and easy repurposing of content for different users. Digital curriculum resource structure, presentation and functionality should facilitate the development, maintenance and repurposing of content.

The externalisation of data, including audio, should be maximised, as it decreases costs of production, including development time, and increases the capacity to reuse resources.
4.0 **Summary of content requirements**

Digital resources (including learning objects) and websites must only include resources conforming to the following specifications. In all cases the current effective version of a specification is listed. The version listed may not be the latest release. See the Appendix for more detailed information on these specifications, and for further guidance on such things as client software and hardware requirements.

<table>
<thead>
<tr>
<th>Area</th>
<th>Specifications</th>
</tr>
</thead>
</table>
| Tested browsers       | Internet Explorer 7 and 8, Firefox 5 on Microsoft Windows XP  
                      | Internet Explorer 7, 8 and 9 on Microsoft Windows Vista  
                      | Internet Explorer 8 and 9, Firefox 5 on Microsoft Windows 7  
                      | Safari 5.1 and Firefox 3.6 on Apple OS X version 5 (Leopard)  
                      | Firefox 4 on Apple OS X version 6 (Snow Leopard)             |
| HTML markup           | HTML 4.01                                                                                                                                   |
| Characters            | UTF-8                                                                                                                                       |
| XML markup            | XML 1.0  
                      | DOM Level 3 Core Specification  
                      | XHTML 1.1  
                      | SVG 1.1  
                      | SVG 1.2 Tiny  
                      | SMIL 3.0  
                      | MathML 3.0  
<pre><code>                  | QTI 2.0                                                                 |
</code></pre>
<p>| Style sheets          | CSS 2.1                                                                                                                                    |
|                       | XSLT 2.0                                                                                                                                   |
|                       | XPath 2.0                                                                                                                                   |
| Images and graphics   | PNG 1.0                                                                                                                                     |
|                       | JPEG                                                                                                                                       |
|                       | SVG 1.1                                                                                                                                     |
| Audio                 | MPEG-1 Audio Layer 3 (MP3)                                                                                                                 |
|                       | MPEG-4 AAC                                                                                                                                  |
|                       | Ogg Vorbis 1.0                                                                                                                               |
| Video                 | QuickTime video, playable in QuickTime Player v7.6.0                                                                                       |
|                       | H.264/MPEG-4 AVC                                                                                                                             |
|                       | swf/flv, playable in Flash Player 10                                                                                                        |
| Document formats      | Text files for simple data (.txt)                                                                                                          |
|                       | PDF                                                                                                                                         |
|                       | RTF                                                                                                                                         |
|                       | Acceptable alternatives subject to approval: MS Word, MS Excel, MS PowerPoint                                                            |
| Client-side scripting | JavaScript 1.8 (ECMAScript Edition 5)                                                                                                      |
|                       | ActionScript 3                                                                                                                              |
|                       | Ajax and jQuery                                                                                                                             |
| Web applications      | XHTML, DOM, XML, XSLT, XMLHttpRequest and JavaScript                                                                                         |
|                       | Flash, playable in Flash Player 10                                                                                                          |
|                       | AIR, playable in AIR 1.5.3                                                                                                                 |</p>
<table>
<thead>
<tr>
<th>Area</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Java applets</td>
<td>Java SE applets to run in Java Runtime Environment (JRE) 6.0</td>
</tr>
<tr>
<td></td>
<td>QuickTime VR, playable in QuickTime Player v7.6.0</td>
</tr>
<tr>
<td>Persistence</td>
<td>Digital curriculum resources may remember a state accumulated during an interaction with a user. This information can be made available to a learning management system. State should not be maintained across digital curriculum resources or browser sessions.</td>
</tr>
<tr>
<td>Screen layout</td>
<td>Scalable objects, optimised for screen resolution of 1024 x 768 pixels</td>
</tr>
<tr>
<td>Start file</td>
<td>index.html or index.xml as starting point</td>
</tr>
<tr>
<td>File and directory names</td>
<td>RFC 3986–acceptable characters</td>
</tr>
<tr>
<td>Device independence</td>
<td>Support both keyboard and mouse access. Allow 200% zoom without content loss.</td>
</tr>
<tr>
<td>Accessibility</td>
<td>All pages should conform to WCAG 2.0 level 2 (AA) requirements.</td>
</tr>
<tr>
<td>Fonts</td>
<td>Windows XP and Windows 7: default installation fonts plus East Asian fonts</td>
</tr>
<tr>
<td></td>
<td>OS X: default installation fonts</td>
</tr>
</tbody>
</table>
5.0 **Appendix: descriptions of content requirements**

This section describes the standards listed in Section 4.0 in more detail, the wider issues surrounding the standards and, where possible, the choices that have been made in adopting the standard. This section also includes information on the versions of each standard available and of any new standards that are expected to be introduced and could soon be introduced to the specification.

### 5.1 Tested browsers

The table below lists the earliest tested web browser versions supported under each of the commonly used operating systems. The browsers listed are used to test content developed for the sharing and distribution network managed by Education Services Australia.

As new operating systems and web browsers become available it is important to make sure that there are suitable transition paths for new technologies and that developers and jurisdictions are able to create and maintain resources efficiently. This will mean that older browsers and operating systems will be removed from testing when it is no longer practical to support their use. The browser versions tested are chosen for their level of use and stability. Other browsers are available for use but are not used for testing. The full list of current browsers used is shown below.

<table>
<thead>
<tr>
<th>Browser</th>
<th>Windows XP</th>
<th>Windows Vista</th>
<th>Windows 7</th>
<th>OS X v5</th>
<th>OSX v6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet Explorer 7</td>
<td>Tested</td>
<td>Tested</td>
<td>Available</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Internet Explorer 8</td>
<td>Tested</td>
<td>Tested</td>
<td>Tested</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Internet Explorer 9</td>
<td>NA</td>
<td>NA</td>
<td>Tested</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Firefox 3.6</td>
<td>Available</td>
<td>Available</td>
<td>Available</td>
<td>Tested</td>
<td>Available</td>
</tr>
<tr>
<td>Firefox 4</td>
<td>Available</td>
<td>Available</td>
<td>Available</td>
<td>Available</td>
<td>Tested</td>
</tr>
<tr>
<td>Firefox 5</td>
<td>Tested</td>
<td>Available</td>
<td>Available</td>
<td>Available</td>
<td>Available</td>
</tr>
<tr>
<td>Chrome</td>
<td>Available</td>
<td>Available</td>
<td>Available</td>
<td>Available</td>
<td>Available</td>
</tr>
<tr>
<td>Safari 5.1</td>
<td>Available</td>
<td>Available</td>
<td>Available</td>
<td>Tested</td>
<td>Available</td>
</tr>
<tr>
<td>Opera</td>
<td>Available</td>
<td>Available</td>
<td>Available</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

Internet Explorer 6 is no longer tested or supported on the sharing and distribution network. The use of all of the browsers listed will be reviewed at the completion of each school year and decisions made on adding or deleting them from the testing list.

### 5.2 HTML markup

The HTML 4.01 standard is recommended for use in web content markup. It has been a W3C recommendation since December 1999 and is now being replaced by HTML 5. The specification is managed by [W3C](http://www.w3.org).
5.2.1 HTML 5

This is a major revision of the HTML standard. It is currently at working draft stage with the latest draft released in November 2011. It is expected that a ‘candidate recommendation’ version will be available in 2012 but sections of the standard are now stable and have been implemented in web browsers. It will be some time before HTML 5 content can be interpreted by the majority of browsers used in schools, so HTML 4.01 remains the recommended standard.

HTML 5 combines the HTML 4.01 and XHTML 1.1 specifications and adds features such as video playback and drag-and-drop that have previously been dependent on third-party browser plug-ins.

The standard is being released in parts by W3C and has already been implemented within some web browsers. The specification is managed by W3C, which will continue to release the standard in parts. It is not expected that the full specification will be approved until 2022.

5.3 Characters

The UTF-8 character set is currently specified as it is a mature standard and includes the Unicode 6.0.0 character set and is compatible with the ASCII character set. XML and HTML 5 both use the UTF-8 character set. The specification is managed by The Unicode Consortium.

5.4 XML markup

XML is a key technology for separating structure and presentation. XML should be used to represent structured information. Technologies such as style sheets should be used to present that information.

XML that conforms to a published schema enhances the stated principle of interoperability by allowing automated validation of information structure. It also enhances the stated principle of durability by conveying some of the information’s purpose within the XML elements and schemas used to represent the structure.

Using externalised XML is especially important, as it allows for quick and easy editing of onscreen text within digital curriculum resources.

5.4.1 XML 1.0

XML 1.0 describes a type of data structure and computer applications that enable interpretation to ensure that data is presented logically and consistently. Structured information should be represented using XML 1.0.

XML element and attribute names should represent the semantics of the data that they describe. The XML standard is managed by W3C.

5.4.2 Document Object Model Level 3 Core Specification

The Document Object Model (DOM) is a basic scripting interface developed by W3C to allow programs and scripts to dynamically access and update web page content, structure and style. More advanced scripting interfaces are becoming available (eg XMLHttpRequest and Geolocation) to enable more functionality (see 5.10).

The DOM Level 3 Core Specification is the current recommended version. The full specification is available on the W3C website.

5.4.3 XHTML 1.1

Web page markup must conform to the XHTML 1.1 specification. The XHTML standard is being incorporated into the HTML 5 specification and will not be updated. The specification is managed by W3C and the full specification is available on the W3C website.
is available on their website.

5.4.4 SVG 1.1
SVG is a language for describing two-dimensional graphics in XML. Where appropriate, graphics should be represented in Scalable Vector Graphics (SVG) version 1.1 format. The standard is managed by W3C and they have decided that the specification will be developed as ‘focused’ modules rather than one large specification. The SVG 1.1 (Second Edition) specification is now well advanced and two Mobile SVG specifications (Tiny and Basic) have been released to cover specific markets.

SVG objects will be able to be placed within HTML 5 documents.

The full specification is available on W3C website.

5.4.5 SVG 1.2 Tiny
SVG 1.2 Tiny is a language for describing two-dimensional vector graphics combined with raster graphics and multimedia. Its goal is to provide the ability to create a whole range of graphical content, from static images to animations to interactive web applications.

SVG 1.2 Tiny has been added to the specification as it is focused on interactive web applications on mobile phones and extends the web capability of the SVG 1.1 specification.

The specification is managed by W3C.

5.4.6 SMIL 3.0
SMIL is used for synchronising simple multimedia presentations that integrate streaming audio and video with images, text or any other media type.

Where appropriate, the structure of simple audiovisual presentations should be represented using Synchronised Multimedia Integration Language (SMIL) version 3.0. Refer to the W3C recommendation for full details.

5.4.7 MathML 3.0
MathML facilitates creation of mathematical expressions within web pages and the use of these expressions by other applications such as voice synthesis. Where appropriate, mathematics should be represented in Mathematical Markup Language (MathML) version 3.0.

The Math ML 3.0 specification is managed by W3C. Refer to the full W3C recommendation for details.

5.4.8 QTI 2.0
The QTI specification describes an XML structure for the representation of basic question (item) and test (assessment) data, and their corresponding result reports.

Activities for evaluating and supporting student understanding may be represented using the IMS Question & Test Interoperability Specification (QTI) version 2.0. The full specification is available on the IMS Global Learning Consortium website.

5.5 Style sheets
5.5.1 CSS
Document presentation must be defined using Cascading Style Sheets CSS 1 and/or CSS 2.1. Refer to the Cascading Style Sheets section of the W3C website.

5.5.2 XSLT 2.0
Where appropriate, XSLT 2.0 should be used to facilitate the transformation of information stored in XML documents into a format for presentation on a web page. The complete XSLT specification is available on the W3C website.

5.5.3 XPath 2.0
Where appropriate, XPath 2.0 should be used in conjunction with XSLT to access or refer to content within an XML document. The complete XPath specification is available on the W3C website.

XPath is an expression language used in unison with XSLT to traverse the content within an XML document.

5.5.4 Linking style sheets
Styles should be contained in an external linked .css file, using the <link> element in XHTML or the <?xml-stylesheet?> processing instruction in XML.

XHTML example:

```html
<link rel="stylesheet" type="text/css" href="style.css" />
```

XML example:

```xml
<?xml-stylesheet type="text/css" href="./stylesheet/style.css"?>
<?xml-stylesheet type="text/xsl" href="./stylesheet/xslstyle.xsl"?>
```

5.6 Images and graphics
To support the stated principle of durability, Education Services Australia may require supply of nominated images in high-resolution formats and supply of graphics in SVG format.

5.6.1 Raster graphics
Raster graphics must be specified in one of the following formats:

- PNG version 1.0 format – refer to PNG on the W3C website
- JPEG format – refer to the JPEG website

Images must not be supplied in GIF format.

5.6.1.1 PNG 1 (second edition)
The PNG specification is managed by the W3C (also published as ISO/IEC 15948:2003) and is used for single images only and was developed to replace the GIF image format. The current specification is version 1 (second edition).
5.6.1.2 JPEG
The JPEG specification is used for single images only and is managed by the Joint Photographic Experts Group. It is also published as ISO/IEC IS 10918-1.

5.6.2 Vector graphics
Externalised vector graphics must be represented in the following formats:

- Scalable Vector Graphics (SVG) version 1.1 format
- SVG 1.2 Tiny.

For more information refer to Scalable Vector Graphics (SVG), XML graphics for the web on the W3C website or section 5.4.4 of this document.

5.7 Audio
Until HTML 5 becomes more widely used we will need to have different audio format files available for use in web browsers. Ogg Vorbis files will play in Firefox and Chrome while MP3 and AAC files will play in Internet Explorer, Safari and Chrome.

The audio files must be available in MPEG-1 Audio Layer 3 (MP3), MPEG-4 AAC or Ogg Vorbis 1.0 format. Refer to ‘Coding of moving pictures and audio’, on the International Organization for Standardization website for the MP3 and AAC specifications and the Ogg Vorbis website for their standard.

5.7.1 MPEG-1 Audio Layer 3 (MP3)
MP3 is a patented digital audio encoding format using lossy data compression. Used for the transfer and playback of music on digital audio players. The file format is supported in the Firefox, Chrome and Opera browsers.

The specification is managed by the Moving Photographic Experts Group.

5.7.2 MPEG-4 AAC
AAC is a part of the MPEG-4 specification and provides a standardised, lossy compression and encoding scheme for digital audio. It is designed to be the successor of the MP3 format. Players for AAC are available within the Safari, Chrome and Internet Explorer web browsers.

The specification is managed by the Moving Photographic Experts Group.

5.7.3 Ogg Vorbis 1.0
Vorbis is an open source audio codec for lossy audio compression used with the Ogg container. It was developed to compete with the patented MP3 format. The file format is supported in the Firefox, Chrome and Opera browsers.

The specification is managed by the Xiph.Org Foundation.
5.8 Video

Web browsers currently don’t support all of the video formats specified below so multiple formats need to be available to ensure that the video will play. Microsoft and Apple currently support the H.264 format while Google, Firefox and Opera are supporting Flash and the evolving WebM format.

Video must be supplied in one of the following formats:

- QuickTime (v7.6.0) format – refer to the [QuickTime](http://quicktime.apple.com) information on the Apple website
- SWF (compiled in Flash version 10) and FLV video format for viewing in Flash Player 10.

5.8.1 QuickTime video, playable in QuickTime Player v7.6.0

QuickTime 7.6 was released in January 2009. QuickTime X was released in August 2009 but is a very different product to 7.6. We recommend use of video that will play in QuickTime 7.6.

QuickTime is a proprietary application owned by [Apple Computers](http://www.apple.com).

5.8.2 H.264/MPEG-4 AVC

H.264 is a codec standard developed to improve video quality at lower bit rates. It is included in the MPEG-4 standard. MPEG-4 is an evolving standard that covers video requirements from low bit rate web to Blu-ray Discs and 3D television. Different video products address required parts of the standard, making it very flexible.

The current MPEG-4 release is version 13 (released March 2010). The Education Services Australia–recommended version is version 8, which was released in November 2007 and is now supported within a number of video applications.

The specification is managed through a series of agreements. H.264 is managed by the ITU-T Video Coding Experts Group (VCEG). MPEG-4 is managed by the ISO/IEC Moving Picture Experts Group (MPEG). H.264/MPEG-4 AVC is the combined standard, produced in a partnership between these organisations called the Joint Video Team (JVT).

5.8.3 SWF/FLV

Flash format files will play in all browsers. Video content supplied in this format must be configured to play in Flash version 10.

5.8.4 WebM

WebM is being supported by most of the major browser developers (not supported by Microsoft and Apple) as a new standard for video presentation. It is intended for integration into HTML 5 pages and is not a format currently supported by Education Services Australia.

WebM is an open, royalty-free, media file format designed for the web. It defines the file container structure, video and audio formats. WebM files consist of video streams compressed with the VP8 video codec (owned by Google) and audio streams compressed with the Vorbis audio codec (owned by Xiph Foundation). The WebM file structure is based on the Matroska container.

The specification is managed by the [webM Project](http://www.webmproject.org).
5.9 Document formats

It is important to ensure that information stored as text within documents is accessible. For more information on accessibility and the legal requirements visit the [accessibility section](#) of the Australian Government Information Management Office website.

5.9.1 Text documents (.txt)

Text files may be used to store simple data, such as the value of a configuration variable. When more than a few bytes of information are stored in a text file, or when the information contains detailed structure, consideration should be given to storing the information as XML.

5.9.2 PDF (.pdf)

Documents used in offline activities, such as activity sheets or templates, may be represented in PDF format. The PDF format generally has poor accessibility unless it is prepared using very controlled styles and formatting.

If a PDF is to be used we recommend saving it in PDF/A format in version 1.6 which will display in Acrobat Reader version 7 and above. All fonts should be embedded. This format does not support the inclusion of audio or video content and the use of JavaScript or executable file launches.

Originally a proprietary format, PDF was officially released as an open standard on July 1, 2008, and published by the International Organization for Standardization as ISO/IEC 32000-1:2008. The specification is now managed by [ISO/IEC](#).

Consideration should be given to storing the information in either XML or XHTML format.

5.9.3 RTF (.rtf)

If more complex text documents are required, they should be provided in RTF format. RTF files are intended to be opened in any word processing application or text reader application. The [RTF specification](#) is owned by Microsoft and available on its website. Version 1.9.1 (developed for use with Word 2007) is the last supported version of the standard. It is not being developed beyond this version and has been replaced by the Open Document Format (ODF) as a file interchange format.

If viable, consideration should be given to storing the information in either XML or XHTML format.

If the RTF files are to be used in a text reader it is recommended that all images and diagrams be removed and replaced with descriptive text and the text formatting simplified to include headings and a single column of text. Files for transfer of content to another word processing application can retain images and diagrams but text formatting should be simplified where possible.

Some features of Microsoft Word documents later than 2007 will not be included in any RTF file created from them (such as linking and embedding of images) so it is best to check documents to ensure all content has been retained.

5.9.4 OpenDocument Format (ODF)

ODF is an OASIS developed standard for document exchange that has become an International Standards Organization standard as ISO/IEC 26300:2006. It is now used in most word processing applications for both importing and exporting files.

It is recommended that we move to replace RTF format files with ODF files.
5.9.5 Other document formats

Education Services Australia will consider the following alternatives to PDF. Approval of these formats will be considered on a case-by-case basis:

- Microsoft Word
- Microsoft Excel
- Microsoft PowerPoint.

To support the stated principle of durability, Education Services Australia may require supply of nominated documents in an accompanying RTF or ODF format version.

As mentioned above, strong consideration should be given to storing the information in either XML or XHTML format.

5.10 Client-side scripting

5.10.1 JavaScript

JavaScript is a scripting language used for programming. JavaScript is an extension of the ECMA-262 standard. It should be used to add functionality to web pages, SVG and SMIL resources.


Client-side JavaScript must be contained in an external linked .js file, using the XHTML <script> element.

Example:

```html
<script type="text/javascript" src="js/script.js"></script>
```

5.10.2 ActionScript

ActionScript 3 should be used to add functionality to Flash and AIR objects.

5.10.3 Ajax and jQuery

Ajax can be used to provide web browser and server communications to enable dynamic loading of page content. The Ajax deployed must use standard XMLHttpRequest to manage communications and JavaScript as the scripting language.

jQuery can be used as an additional client-side scripting language. The features offered within jQuery are updated regularly and care must be taken to ensure that all scripts are tested for functionality and compatibility with the web browsers specified.

5.11 Web applications

5.11.1 Server independence

All web applications must operate as standalone objects that do not require interaction with a server.
5.11.2 Allowed application formats

Web applications must be supplied in one of the following formats:

- XHTML, DOM, XML, XSLT, XMLHttpRequest and JavaScript
- Flash, using ActionScript 3.0, playable in Flash Player 10
- Java applets that run with version 1.5.0 (and higher) of the Java Virtual Machine
- QuickTime VR, playable in QuickTime Player v7.6.0.

5.11.2.1 XHTML, DOM, XML, XSLT, XMLHttpRequest and JavaScript

A combination of these web applications can be used to communicate with a server in the background without disrupting the display of the current page. The processes and structures to manage the use of the technologies have been combined into defined applications such as Ajax.

The specification lists the core applications used rather than the combined name as the functionality available will change as new functions are added and new combinations become available.

5.11.2.2 Flash, playable in Flash Player 10

Flash is still used to deliver interactive and multimedia content but its use needs to be considered against the restrictions imposed by the lack of support on Apple devices and the hardware performance levels required to process it efficiently. It is still an approved product.

Proprietary application owned by Adobe.

5.11.2.3 AIR, playable in AIR 1.5

Adobe Integrated Runtime (AIR) is an approved application for the development of Flash-based internet applications that can be deployed as desktop applications. Version 1.5.3 was a minor release in December 2009. The current release version is 2.5.1.

Proprietary application owned by Adobe.

5.11.2.4 Java applets (Java SE applets to run in Java Runtime Environment (JRE) 6.0)

Java applets can be created to run within the web browser using the Java Runtime Environment (sometimes referred to as the Java Virtual Machine). Users need to have the latest version installed or the application will install an upgrade.

Proprietary application owned by Oracle.

5.11.2.5 QuickTime VR, playable in QuickTime Player v7.6.0

QuickTime Virtual Reality videos can be loaded to conform to the requirements of QuickTime Player version 7.6. QuickTime Player version X has been released but the functionality to enable QuickTime VR to play has not yet been approved for a suitable number of products.

Proprietary application owned by Apple.
5.12 Digital curriculum resources

The following requirements relate to the production of digital learning resources for use on desktop, laptop and NetBook computers.

5.12.1 Performance

5.12.1.1 Interaction time

Interaction time is defined as the time between a user’s first point of interaction with a digital curriculum resource and subsequent events.

Digital curriculum resources will frequently be used over limited bandwidth connections. As a baseline, all digital curriculum resources developed for Education Services Australia will have an interaction time of less than 10 seconds over a dedicated 64 kbit/s connection. In circumstances where restricting the bandwidth to 64 kbit/s limits the educational integrity of the resource and decreases the capacity of the resource to meet educational soundness requirements, Education Services Australia may agree to an exception to this requirement and test to an interaction time of less than 10 seconds over a dedicated 256 kbit/s connection. Where an exception is agreed, it will be recorded in the relevant metadata element in SHEX and that information will be available in the content package.

5.12.1.2 Overall size

Digital curriculum resources will be downloaded and replicated over limited bandwidth connections. For this reason, the overall size of each content item should be minimised where possible.

5.12.1.3 Ordering interactivity

Components of a learning task must load in the correct sequence for the user to accomplish the task.

Example:

If an introduction to an activity includes text instructions, an image and an enter button, then the enter button should not be available before the text and image appear onscreen. If they do, there is a risk that the student may progress without sufficient information.

If a task includes text instructions, a video and a quiz dependent upon the user viewing the video, then the video should fully load before the user is required to complete the quiz.

Interactivity order must be maintained over varying bandwidth connections. That is, components of the task must load in the same order over both low bandwidth and high bandwidth connections.

5.12.2 Persistence

Digital curriculum resources may remember a state accumulated during an interaction with the user. For example, a user may be required to log in with their name, so that the resource can remember the user’s name and display it onscreen at other points in the resource or on an associated printable output.

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2 Where ‘dedicated’ means only one user is using the connection.
User and session information can be made available to a learning management system.

For privacy reasons, state should expire when the user has completed the digital curriculum resource or at the end of the browser session. State should not be maintained across a digital curriculum resource or browser sessions.

5.12.3 Screen layout

5.12.3.1 Dimensions

Digital curriculum resources should be optimised to display on a screen resolution of 1024 x 768 pixels.

Many factors ultimately determine the final dimensions of the available area, so the following should be used as a guide.

Where a web page contains standalone embedded objects, each object should be completely visible and operate successfully when it is displayed on an 800 x 600 pixel monitor (SVGA) with the browser navigation on. This leaves an effective display area of 760 x 570 pixels to the object.

5.12.3.2 Scaling

Resources should scale to fill available space gracefully when a browser is resized. Techniques for graceful scaling include using relative rather than absolute size definitions within XHTML and the use of scalable vector graphics within Flash objects.

When a standalone digital curriculum resource does not have the ability to scale, the recommended maximum fixed size of the object is 760 x 570 pixels. A digital curriculum resource developed to a fixed size must not exceed 760 x 570 pixels (to fit on an 800 x 600 pixel monitor – SVGA – with the browser navigation displayed).

For netbooks with resolutions lower than 1024 x 768 pixels, and where the resource does not have the ability to scale, the content should be presented in a way that allows the user to scroll with the browser.

Using a zoom function within a browser should allow users to view content up to a zoom level of 200% without overlap or loss of content.

5.12.3.3 Centre standalone resources

Where a web page has a standalone digital curriculum resource embedded, such as SVG, Flash or a Shockwave resource, it should be centred vertically and horizontally in the page.

5.12.4 Directory structure

Digital curriculum resources must be delivered to Education Services Australia as a directory structure containing resources.

5.12.4.1 Start file

The top level of the directory structure must contain either an XHTML file named index.html or an XML file named index.xml, which represents a common starting point for interacting with the digital curriculum resource.
5.12.4.2 Flash and Director files

Flash and Shockwave applications must have a Flash or Director file named index.swf or index.dcr in the top level of the directory structure.

These files are crucial because Flash and Director applications cannot resolve relative paths on some platforms. The top level of the directory structure for Flash and Director digital curriculum resources must also contain a container named /loader.swf to combat a known interoperability issue related to streaming and the <object> element with certain browsers.3

Shockwave applications must have all '.dcr' files located within the top level of the directory structure of the digital curriculum resource and external assets located within a subdirectory under a dswmedia directory. This is required for Shockwave to load external assets from local disks.

All objects will contain a shared_assets directory on publication. This directory will contain a standard set of files, any logo files, plus any applicable system images and icons.

If not affected by the requirements outlined above, all other files must be stored in directories named by file extension or mime type. For example, JPEG image files might be stored in a directory named jpg, jpeg or image. MP3 audio files might be stored in a directory named mp3, mpeg, mpeg3 or audio.

5.12.4.3 File and directory names

File and directory names must use the following:

- lower-case alphanumeric characters (a–z, 0–9)
- the characters - (dash) and _ (underscore)
- the slash character '/' to separate hierarchical parts of a file path.

File and directory names must not use the space character.

These requirements ensure that file and directory names can be easily referenced in URLs and are portable between operating systems.

5.12.5 Device independence

All content should be designed to be device independent. In other words, a user should be able to interact with the content with their preferred input (or output) device and switch between devices should they wish to do so.

Generally, interactive content that allows keyboard interaction is also accessible through speech input or a command line interface. If interactive digital curriculum resources include sophisticated interactivity such as a timed game, keyboard access and tab order may not be appropriate.

3 For more information, see ‘Streaming and the object element’ at http://jira.thelearningfederation.edu.au/confluence/x/0wM.
This section uses the following definitions of user interface events⁴:

- **Gain focus** - An interactive element gains focus when a pointing device is moved onto the element or tabbing navigation moves onto the element.

- **Lose focus** - An interactive element loses focus when a pointing device is moved off the element or when tabbing navigation moves out/off of the element.

- **Activated** - An interactive element is activated when it has focus and a mouse is clicked or a key is pressed.

### 5.12.5.1 Keyboard and pointing device access

Every interactive element, script and applet should be able to **gain focus**, **lose focus** and be **activated** with both a keyboard and a mouse.

Available interactive elements must show a clear change of state when they gain focus, lose focus and are activated. There must be a discernable difference between the unfocused, focused, and activated states.

Disabled or unavailable interactive elements must be clearly unavailable, for example masked but visible, and should not show any change of state.

Focus areas must be clearly defined and must not obscure other elements.

### 5.12.5.2 Default keyboard interaction

Keyboard navigation should consist of logical keyboard interaction with all interactive elements. The tab order should facilitate the user's navigation through the object in the order required to complete the learning task.

Depending on the technology used, the keys used to navigate through interactive elements may vary. Please note: the SPACE BAR must not be used as the only mechanism to activate interactive elements. It may be used to provide an alternative to the ENTER key, but the ENTER key must always operate.

### 5.12.5.3 Grouping interactive elements

Where appropriate, related interactive elements should be grouped and identified. In these cases, a way to bypass interaction with the group of elements must be provided. The keyboard interaction outlined for grouping should be applied to drop-down menus or pick lists.

When element grouping is supported, depending on the technology used, the keys to navigate may vary.

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⁴ User interface event definitions are based on the definitions in the W3C Document Object Model (DOM) Level 2 Events Specification at [http://www.w3.org/TR/DOM-Level-2-Events](http://www.w3.org/TR/DOM-Level-2-Events)
5.12.5.4 **Pop-up windows**

Users must be informed before a child browser window (HTML pop-up) is opened over the top of the parent window. This is not necessary for Flash/Shockwave pop-up windows.

HTML and Flash/Shockwave pop-up windows must include a mechanism (such as a button) to close the child window and return to the parent window. On launch of the pop-up, focus must be given to the child window and no elements of the parent window should be accessible until such time as the child window is closed. Focus must return to the parent window after a child window has been closed.

5.12.5.5 **Data input**

Data input fields (such as textboxes) must be accessible with both a keyboard and a pointing device.

Content must, where possible, indicate when invalid data has been entered into a data input field.

5.12.5.6 **Data output**

Where a print function is included in digital curriculum resources, the output must be printer independent and legible.

5.12.6 **Content delivery considerations**

All presentation formats must be able to be retrieved via a standard http connection, using a standard HTTP/1.1 server.

Resources must *not* rely on client- or server-side caching.

5.13 **Fonts**

In order for a font to display correctly on a user’s computer, the computer must have access to that font. Fonts may be accessed by one of the following methods:

- accessing a font outline embedded within the resource
- referencing the font from within the resource and assuming that the font has been installed on the user’s computer
- Use of Web Open Font Face (WOFF) technology to access fonts when agreed with Education Services Australia.

For reasons related to guaranteed presentation and layout, developers should use embedded font outlines in technologies that permit this, rather than device fonts (referenced fonts).
If, with agreement of Education Services Australia, fonts are referenced, developers must assume that only the following fonts are available on the user's computer:

<table>
<thead>
<tr>
<th>Operating system</th>
<th>Font</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows 2000</td>
<td>Fonts available with the default installation, plus fonts installed with the 'Japanese, Simple Chinese, Traditional Chinese font' installation option.</td>
</tr>
<tr>
<td>Windows XP</td>
<td>Fonts available with the default installation, plus fonts installed with the 'Install East Asian characters' installation option.</td>
</tr>
<tr>
<td>Windows 7 Chinese (PRC)</td>
<td>Chinese (Taiwan)</td>
</tr>
<tr>
<td></td>
<td>Japanese (Japan)</td>
</tr>
<tr>
<td>OS X</td>
<td>Fonts available with the default installation. Asian language fonts are available by default.</td>
</tr>
</tbody>
</table>

The development of the WOFF standard allows web fonts to be loaded on servers for access by web browsers. It is not yet implemented within all web browsers and should only be used after discussions with Education Services Australia. Consideration will be given to the user profile expected for the website, the web technologies used on the site, the extent to which the WOFF fonts are used and the costs associated with the licensing and storage of the fonts.

5.14 **Client software requirements**

The Education Services Australia content is viewed within Learning Management Systems (LMS) and web browsers. At the time of publication, no LMS or web browser supported all the content model requirements described in this document.

5.14.1 **Minimum browser and operating system requirements**

Education Services Australia tests all content in the following environments:

- Internet Explorer 7.0 and 8.0, Firefox 3.0 on Microsoft Windows XP
- Internet Explorer 7.0 and 8.0, Firefox 3.0 and Google Chrome on Windows 7
- Safari 5.1 on Apple OS X, V5 (Leopard)

- Until software supports the standards and specifications defined in this document, content metadata should include information about the environments in which the content has been successfully tested. The metadata must also include information about any extensions to these environments needed to operate the content.

5.14.2 **Latest browsers**

Content must operate and should be tested in the latest versions of Mozilla Firefox, Google Chrome and Microsoft Internet Explorer on Microsoft Windows XP and Windows 7, and Safari on Apple OS X.
5.14.3 Browser plug-ins

The browser plug-ins listed in the table below are commonly used to render education resources. Content containing resources with these formats must operate with the plug-ins listed in this table.

<table>
<thead>
<tr>
<th>Format</th>
<th>Plug-in</th>
</tr>
</thead>
<tbody>
<tr>
<td>SVG</td>
<td>Adobe SVG Viewer Plug-in</td>
</tr>
<tr>
<td></td>
<td>[<a href="http://www.adobe.com/svg/">http://www.adobe.com/svg/</a>]</td>
</tr>
<tr>
<td>QuickTime</td>
<td>QuickTime 7.6.9 Player</td>
</tr>
<tr>
<td>PDF</td>
<td>Adobe Acrobat Reader 7 or above</td>
</tr>
<tr>
<td></td>
<td>[<a href="http://www.adobe.com/products/acrobat/readstep.html">http://www.adobe.com/products/acrobat/readstep.html</a>]</td>
</tr>
<tr>
<td>Flash MX</td>
<td>Adobe Flash Player 10</td>
</tr>
<tr>
<td>Shockwave</td>
<td>Macromedia Shockwave Player 11 (full installer)</td>
</tr>
<tr>
<td></td>
<td>[<a href="http://www.macromedia.com/shockwave/download/alternates/">http://www.macromedia.com/shockwave/download/alternates/</a>]</td>
</tr>
<tr>
<td>Java applets</td>
<td>Java Runtime Environment (JRE) 6.0</td>
</tr>
<tr>
<td>Wolfram CDF</td>
<td>Wolfram CDF player runs demonstrations in your browser</td>
</tr>
<tr>
<td></td>
<td>[<a href="http://demonstrations.wolfram.com/index.html">http://demonstrations.wolfram.com/index.html</a>]</td>
</tr>
</tbody>
</table>

5.15 Client hardware requirements

Resources must at least operate on systems configured according to the minimum hardware requirements as specified by the nominated browser and plug-in manufacturers:

- Internet Explorer

- Safari
  [http://support.apple.com/kb/DL1070]

- Flash (select Flash Player system requirements link under the Resources menu)
  [http://get.adobe.com/flashplayer/]

- Shockwave
  [http://www.macromedia.com/software/shockwaveplayer/productinfo/systemrqs/]

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