



THE
le@rning
FEDERATION

schools online curriculum content initiative

TECHNICAL SPECIFICATION FOR CONTENT SHARING, HARVESTING AND PROCUREMENT

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Disclaimer

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1 Introduction

The Le@rning Federation's *Technical Specification for Content Sharing, Harvesting and Procurement* documents the standards and specifications that should be satisfied when providing content to, and accessing content via, The Le@rning Federation (TLF) project.

1.1 Purpose

The *Technical Specification for Content Sharing, Harvesting and Procurement* defines the use of technical standards and specifications for digital curriculum resources that are procured by Curriculum Corporation through The Le@rning Federation project, shared between jurisdictions and made available via metadata harvesting as part of the project.

It also aims to ensure that content follows internationally accepted specifications and recommendations. This specification provides The Le@rning Federation with content acquisition and quality assurance guidelines that will maximise the viability, integrity and portability of the content over the life of the project and beyond.

1.2 Obligations of The Le@rning Federation

Curriculum Corporation will fulfil the following obligations in undertaking and delivering The Le@rning Federation outcomes:

- consult with relevant education jurisdictions, provider organisations, user groups and digital content developers in establishing, implementing and reviewing this specification
- proactively review and, as appropriate, evolve this specification to reflect knowledge and practice derived from development, deployment and use of content for the project
- proactively review and, as appropriate, evolve this specification to meet emerging standards and specifications affecting educational digital content
- contribute to national and international standards development in the area of digital content procurement through the evolving body of knowledge and practice generated under the auspices of the project.

1.3 Monitoring and usage

The *Technical Specification for Content Sharing, Harvesting and Procurement* applies to all content procured as part of The Le@rning Federation project.

It is expected that technologies will evolve over the course of the project. For that reason, The Le@rning Federation will monitor technologies and standards likely to be deployed in classrooms over the course of the project and beyond.

The *Technical Specification Content Sharing, Harvesting and Procurement* will be updated and enhanced during procurement, deployment and use of content. Updated specifications and related guidelines will be documented and published on The Le@rning Federation website at <http://www.thelearningfederation.edu.au> and in The Le@rning Federation knowledge base at <http://jira.thelearningfederation.edu.au/confluence/x/IAE>.

1.4 Conformance

Content conforming to this specification should adhere to the principles described in Section 2, the information model in Section 3 and the requirements defined in Section 4 of this document.

1.5 Conventions used in this document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY" and "OPTIONAL" in this document are to be interpreted as described in RFC-2119 at <http://www.ietf.org/rfc/rfc2119.txt>.

2 Principles

The *Technical Specification for Content Sharing, Harvesting and Procurement* is used to assess whether content procured by The Le@rning Federation conforms to the following six principles:

- accessibility
- useability
- interoperability
- flexibility
- durability and sustainability
- scalability.

2.1 Accessibility

The first principle aims to ensure that content acquired as part of The Le@rning Federation's online content and services is inclusive of a range of teaching and learning capacities, contexts and environments. It aims to ensure that, where possible, third-party content conforms to Commonwealth laws concerning accessibility, and state and territory policies regarding inclusive education provision. This accessibility principle informs The Le@rning Federation specifications on technical content, accessibility and educational soundness. Where conformance to accessibility guidelines and requirements cannot be met due to the nature of learning activity design or technical limitations, then content will be made available and tagged with appropriate metadata to indicate this limitation.

2.2 Useability

Content procured through The Le@rning Federation project should be useable by a range of teachers and students. That is, the content's interface must be learnable, efficient, memorable, have a low error rate and be pleasant to use¹.

2.3 Interoperability

The aim of this principle is to ensure that content accessed through The Le@rning Federation project can be used on and shared between a wide range of software and hardware platforms. It assumes that the content will be used within operating environments that support internationally adopted standards and specifications.

2.4 Flexibility

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

This will be informed by the nature of the content licence required to bring content into The Le@rning Federation project.

2.5 Durability and sustainability

This principle aims to ensure that content acquired, shared, and linked as part of The

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

Le@rning Federation project can withstand technology changes without requiring redesign or recoding, and be available to users on a sustained and robust basis. The principle includes storing source media in manner that allows interpretation and translation into new formats so that improvements in bandwidth and technologies can be easily incorporated to maximise quality. For example, images may need to be provided or maintained in both low- and high-resolution formats. The low-resolution format is for inclusion in the content, and the high-resolution format would be used for possible future translations.

2.6 Scalability

This principle relates to choosing content that allows The Le@rning Federation to benefit from both growth in demand for its services and an increase in new inputs. For example, choosing content that uses technologies that may enhance the reuse of the resources collected.

3 Information model

The Le@rning Federation is procuring a range of digital curriculum resources in various content formats.

3.1 Learning content model

The information model for digital curriculum resource content is illustrated in Figure 3–1: Example Digital Curriculum Resource Learning Content Information Model. Digital curriculum resources contain resources, organisations 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 Section 4 ‘Content model requirements’, for example XHTML files, CSS style sheets, Flash files, MP3 audio files and JPEG images.
- An **organisation** specifies a navigation path through the learning content. A piece of learning content may have many organisations, and hence many possible navigation paths. For example, a digital curriculum resource may have two educationally equivalent levels of organisation: 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. Metadata is described in The Le@rning Federation’s *Metadata Application Profile*. It supports the digital curriculum resource and resource management, description of educational purpose, technical interoperability, digital rights management and accessibility.

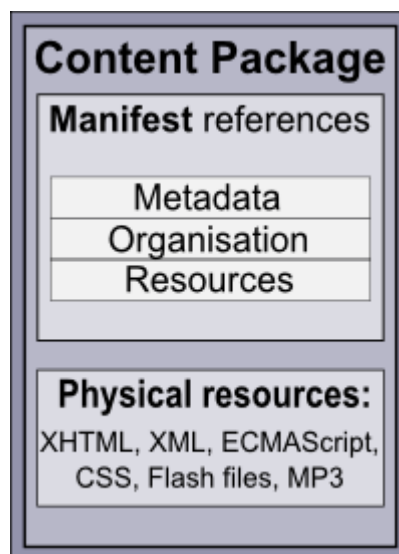


FIGURE 3–1: EXAMPLE DIGITAL CURRICULUM RESOURCE INFORMATION MODEL

3.2 Packaging digital curriculum resources

The Le@rning Federation delivers digital curriculum resources to stakeholders as either IMS Content Packages (see 'Content Packaging Specification' on the IMS Global Learning Consortium, Inc. website at <http://www.imsproject.org/content/packaging/>) or SCORM 2004 2nd edition version 1.3 Content Packages (see the Advanced Distributed Learning (ADL) website at <http://adlnet.gov>).

The Le@rning Federation uses the ANZ-LOM metadata application profile. Information on the ANZ-LOM is available at http://www.thelearningfederation.edu.au/for_developers/learn_about_our_technology/standards_and_specifications/metadata_guidelines.html

Developers can upload resources to The Le@rning Federation's sharing services systems, namely The Learning Exchange, The Sharing Exchange and via harvesting to the Metadata Exchange. The digital curriculum resources are then exported from these systems as either IMS or SCORM 1.3 Content Packages.

For metadata harvesting, records will be provided to portals in the form of either IMS packages with references to external content or via the OpenSearch data-harvesting method.

3.3 Separating structure, presentation and functionality

As much as possible, content procured by The Le@rning Federation should be constructed using technologies that separate the content's 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, which includes an introduction and a table of contents. In web media, information in a document may be organised within elements and nodes within 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 such 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 Flash 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, useability, 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 should be maximised as it decreases costs of production, including development time, and increases the capacity to reuse content.

4 Content model requirements

Digital curriculum resources procured by The Le@rning Federation should only contain resource types listed in this section of the *Technical Specification for Content Sharing, Harvesting and Procurement*.

4.1 Summary

Area	Specifications
HTML markup	HTML 4.01
XML markup	UTF-8 character set

	<p>DOM Levels 1 and 2 (where possible)</p> <p>XHTML 1.0 and 1.1</p> <p>SVG 1.0</p> <p>SMIL 2.0</p> <p>MathML 2.0</p> <p>QTI 1.2</p>
Style sheets	<p>CSS 1</p> <p>CSS 2.1</p> <p>XSLT 1.0</p> <p>XPath 1.0</p>
Images and graphics	<p>PNG / MNG 1.0</p> <p>JPEG</p> <p>SVG 1.0</p> <p>GIF89a</p>
Audio and video	<p>MPEG-1 Audio Layer 3 (MP3)</p> <p>Ogg Vorbis 1.0</p> <p>QuickTime video, playable in QuickTime Player v7.6.0</p> <p>MPEG-4 Video</p> <p>WMV</p>
Colours	<p>Do not rely on colour alone to convey information</p> <p>Provide sufficient contrast between foreground and background colours</p>
Device independence	<p>Support both keyboard and mouse access</p>
Document formats	<p>Text files for simple data (.txt)</p> <p>PDF</p> <p>RTF</p> <p>MS Word</p> <p>MS Excel</p> <p>MS PowerPoint</p>
Client-side scripting	<p>ECMAScript Revision 3 (JavaScript)</p> <p>ActionScript</p> <p>Lingo</p>

Web applications	XHTML and SVG with ECMAScript Flash, playable in Flash Player 10 AIR, playable in AIR 1.1 Shockwave, playable in Shockwave Player v11 (full installer) Java applets (J2SE Runtime Environment (JRE) 6.0) QuickTime VR, playable in QuickTime Player v7.6.0
Bandwidth	Interaction time of less than 10 seconds over dedicated 256 kbit/s connection Maximum size guideline: 5 MB
Persistence	State should not be maintained across digital curriculum resources or browser sessions, unless this limits the educational integrity of the content and decreases the capacity of the content to meet educational soundness requirements. Where content is linked via metadata harvesting and is hosted centrally, state may be maintained if the implementation is browser independent and the content allows the user to access it from a different location.
Screen layout	Scalable objects, optimised for screen resolution of 1024 x 768 pixels
Recommended start file	<code>index.html</code> or <code>index.xml</code> recommended as starting point
File and directory names	RFC 2396 acceptable characters
Client software requirements	Internet Explorer 7.0 and 8.0, Firefox 3.0 on Microsoft Windows XP Internet Explorer 7.0 and 8.0, Firefox 3.0 on Microsoft Windows Vista Internet Explorer 6.0 and Firefox 3.0 on Microsoft Windows 2000 Safari 3.0 on Apple OS X

4.2 HTML

HTML is a key web technology used to present information to users with the intent of the maximum amount of interoperability available. It is widely supported and viewable on a number of different platforms and devices.

4.2.1 HTML 4.01

HTML 4.01 must conform to the HTML 4.01 specification. This is the most recent version of the HTML specification and it has an almost universal uptake. While XHTML is preferred over HTML, many older resources will have been developed in HTML 4.01.

No foreseeable implications

4.3 XML

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.

XML 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 on-screen text within digital curriculum resources.

4.3.1 Structured information as XML

Structured information should be represented using XML.

XML element and attribute names should represent the semantics of the data that they describe.

Implications and/or considerations:

XML should be used to store variable information for technologies that are XML-aware.

4.3.2 UTF-8

XML documents, including XHTML documents, must be encoded using the UTF-8 character set.

Implications and/or considerations:

The default character set for XML is ISO/IEC-10646, of which UTF-8 is a transformation format. This should be kept in mind when copying text from a Microsoft Office application. Microsoft Office may default to Windows-1252, which is (mostly) incompatible with ISO/IEC-10626.

4.3.3 Document Object Model

Document Object Model (DOM) Levels 1 and 2 should be used where possible.

Implications and/or considerations:

This affects how events on elements should be treated. Any manipulations to the XML structure must occur through the DOM.

Example:

HTML method -

```
element.onclick(doThis);
```

XHTML/XML method -

```
element.addEventListener('click', doThis, false);
```

4.3.4 XHTML

XHTML markup must conform to the XHTML 1.0 or XHTML 1.1 specifications. Refer respectively to the W3C websites at <http://www.w3.org/TR/xhtml1/> and <http://www.w3.org/TR/xhtml11/>.

Implications and/or considerations:

XHTML 1.1 is missing several attributes and elements that are commonly used by web developers, most notably `target`. All XHTML content must also be treated as XML rather than regular HTML.

4.3.5 SVG

Where appropriate, graphics should be represented in Scalable Vector Graphics (SVG) version 1.0 format. Refer to the W3C recommendation at <http://www.w3.org/TR/SVG/>. SVG is a language for describing two-dimensional graphics in XML.

Implications and/or considerations:

IE does not support SVG as is. Must use a SVG plug-in.

4.3.6 SMIL

Where appropriate, the structure of simple audiovisual presentations should be represented using Synchronised Multimedia Integration Language (SMIL) version 2.0. Refer to the W3C

recommendation at <http://www.w3.org/TR/smil20/>. SMIL is used for synchronising simple multimedia presentations that integrate streaming audio and video with images, text or any other media type.

No foreseeable implications

4.3.7 MathML

Where appropriate, mathematics should be represented in Mathematical Markup Language (MathML) version 2.0. Refer to the W3C recommendation at <http://www.w3.org/TR/MathML2/>. It facilitates creation of mathematical expressions within web pages and the use of these expressions by other applications such as voice synthesis.

Implications and/or considerations:

IE does not support MathML as is. Must use a MathML plug-in.

4.3.8 QTI

Activities for evaluating and supporting student understanding may be represented using the IMS Question & Test Interoperability (QTI) specification XML binding, version 1.2. Refer to the IMS Global Learning Consortium, Inc. website at <http://www.imsglobal.org/question/>. QTI describes an XML structure for the representation of basic question (item) and test (assessment) data and their corresponding result reports.

No foreseeable implications

4.4 Style sheets

4.4.1 CSS

Document presentation should be defined using Cascading Style Sheets CSS1 and/or CSS2.1. Refer to 'Cascading Style Sheets', W3C website at <http://www.w3.org/Style/CSS/>.

Implications and/or considerations:

CSS 2.1 contains a number of changes from CSS 2, not all of which are compatible. For additional information, see <http://www.w3.org/TR/CSS21/changes.html#new>.

4.4.2 XSLT

Where appropriate, XSLT 1.0 should be used to facilitate the transformation of XML into a more user-accessible format. Refer to the W3C recommendation at <http://www.w3.org/TR/xslt>. XSLT is a stylesheet language for XML. It is designed to transform XML content into a visual representation of the XML data.

Implications and/or considerations:

There may be idiosyncrasies in the implementation of XSLT and XPath, depending on the XML parser.

4.4.3 XPath

Where appropriate, XPath 1.0 should be used in conjunction with XSLT to access or refer to content within an XML document. Refer to the W3C recommendation at <http://www.w3.org/TR/xpath>. XPath is an expression language used in unison with XSLT to traverse the content within an XML document.

Implications and/or considerations:

There may be idiosyncrasies in the implementation of XSLT and XPath, depending on the XML parser.

4.4.4 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:

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

XML example:

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

4.5 Images and graphics

To support the stated principle of durability, The Le@rning Federation may require:

- supply or maintenance of nominated images in high-resolution formats
- supply or maintenance of graphics in SVG format.

4.5.1 Raster graphics

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

- PNG / MNG version 1.0 format – refer to ‘PNG’, on the W3C website at <http://www.w3.org/Graphics/PNG/>
- JPEG format – refer to the JPEG website at <http://www.jpeg.org/>
- GIF89a format – refer to the W3C website at <http://www.w3.org/Graphics/GIF/spec-gif89a.txt>

4.5.2 Vector graphics

Externalised vector graphics must be represented in the following format:

- Scalable Vector Graphics (SVG) version 1.0 format – refer to ‘Scalable Vector Graphics (SVG), XML graphics for the web’, W3C website at <http://www.w3.org/Graphics/SVG/>

4.6 Audio

Audio must be supplied in MPEG-1 Audio Layer 3 (MP3) or Ogg Vorbis format. Refer to ‘Coding of moving pictures and audio’, on the International Organisation for Standardisation website at <http://www.chiariglione.org/mpeg/standards/mpeg-1/mpeg-1.htm> for the MP3 standard, and the Ogg Vorbis website at website at <http://xiph.org/vorbis/doc/> for the Ogg Vorbis standard.

To support the stated principle of durability, The Le@rning Federation may require supply or maintenance of nominated audio in a high-quality, lossless format.

These formats include:

- Waveform Audio Format – <http://www.microsoft.com/whdc/device/audio/multichaud.msp>
- AIFF – <http://www.cnpbagwell.com/aiff-c.txt>
- FLAC – <http://flac.sourceforge.net/>

4.7 Video

Video must be supplied in one of the following formats:

- QuickTime (v7.6.0) format – refer to <http://www.apple.com/quicktime/>
- MPEG-4 video format (ISO/IEC 13818) – refer to ‘MPEG standards’, on the International Organisation for Standardisation website at <http://www.chiariglione.org/mpeg/standards.htm>

- Microsoft WMV format² – refer to <http://www.microsoft.com/windows/windowsmedia/default.mspx>

4.8 Colour independence

Do not rely on colour alone to convey information.

If colour alone is used to convey information, the following people will not receive the information:

- users who cannot differentiate between certain colours
- users with devices that have non-colour or non-visual displays.

Examples:

- An instruction on a screen that states: 'Select the blue button for yes' may not be perceived by a user without a colour display. In this case, the button should also contain the word 'yes' so that the instruction is clear and understandable.
- If a button changes from red to green when it is activated, a colour-blind user may not be able to perceive that it has been activated. In this case, activation should also be indicated by one of the following: a button offset, resizing the button or movement surrounding the button.
- A graph or chart that uses colour alone to indicate the results of a test may mean that a user with colour discrimination issues may not be able to complete the activity or may misinterpret the data. In this case, add texture, shading or labels on the data to ensure that the user can differentiate the different data.

4.8.1 Contrast

Foreground and background colour combinations must provide sufficient contrast when viewed by someone with colour deficits, when viewed on a black-and-white screen or when printed.

4.9 Device independence

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

This section uses the following definitions of user interface events³:

- 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.

² WMV *must not* contain DRM.

³ 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>.

- Activated

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

4.9.1 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 should 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.

4.9.2 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.

4.9.3 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 should 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.

4.9.4 Pop-up windows

Users should 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 should 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.

4.9.5 Data input

Data input fields (such as text boxes) should be accessible with both a keyboard and a pointing device.

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

4.9.6 Data output

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

4.10 Content delivery considerations

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

Content to be distributed in packages must *not* rely on:

- a streaming server
- client or server-side caching.
- ports other than 80 for HTTP and 443 for HTTPS.
- Where links to external content are made available, streaming servers may be employed to deliver video and audio files to user agents. The lowest recommended data rate that the stream should degrade to is 64 kbit/s.

4.11 Document formats

4.11.1 Text documents

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.

4.11.2 PDF

Documents used in offline activities, such as activity sheets or templates, may be represented in PDF format.

However, owing to the accessibility implications of using PDF, strong consideration should be given to storing the information in either XML or XHTML format.

4.11.3 RTF

If more complex text documents are required, they should be provided in RTF format. The RTF specification is located at [http://msdn2.microsoft.com/en-us/library/aa140277\(office.10\).aspx](http://msdn2.microsoft.com/en-us/library/aa140277(office.10).aspx).

If viable, owing to the accessibility implications of using RTF, strong consideration should be given to storing the information in either XML or XHTML format.

4.11.4 Other document formats

The Le@rning Federation 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, The Le@rning Federation may require supply of nominated documents in an accompanying RTF format version.

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

4.12 Scripts

4.12.1 ECMAScript (JavaScript)

ECMAScript is a scripting programming language, 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 ECMAScript must conform to ECMA Standard-262, ECMAScript Language Specification, Revision 3 – refer to Ecma International website at <http://www.ecma-international.org/publications/standards/Ecma-262.htm>.

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

Example:

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

4.12.2 ActionScript

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

4.12.3 Lingo

Lingo should be used to add functionality to Shockwave objects.

4.13 Web applications

4.13.1 Server independence

All web applications must operate as standalone objects that do not require interaction with a server, except where the content is to be accessed via a link.

4.13.2 Allowed application formats

Client-side web applications must be supplied in one of the following formats:

- Scalable Vector Graphics (SVG) version 1.0 format, using ECMAScript to implement interactive functionality
- Flash, using ActionScript, playable in Flash Player 10
- Shockwave, using Lingo, playable in Shockwave Player v11 (full installer)
- 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.

4.14 Performance

4.14.1 Interaction time

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

Digital curriculum resources will frequently be used over limited bandwidth connections. As a baseline, all digital curriculum resources shared and procured for The Learning Federation will ideally have an interaction time of less than 10 seconds over a dedicated 64 kbit/s connection⁴. However, in circumstances where restricting the bandwidth to 64 kbit/s limits the educational integrity of the content and decreases the capacity of the content to meet educational soundness requirements, The Learning Federation may agree to an exception to the requirements and test to an interaction time of less than 10 seconds over a dedicated 256 kbit/s connection. Where an exception is agreed, the exception will be recorded in the relevant metadata element and that information will be available in the content package.

4.14.2 Overall size

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

Where content will be downloaded by the user agent before executing, as a guide, the

⁴ Where 'dedicated' means only one user is using the connection.

maximum size of the content item should be 5 MB. Where this is not possible, it will be noted in the metadata.

Where content will be streamed either in a streaming server or via pseudo streaming at 128 kbs in an approved the plug-in, the total file size shall not exceed 70 MB.

4.14.3 Ordering interactivity

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

Example:

- a) 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.
- b) If a task includes text instructions, a video and an interactive 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 should be maintained over varying bandwidth connections. That is, components of the task should load in the same order over both low bandwidth and high bandwidth connections.

4.15 Persistence

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

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.

4.16 Screen layout

4.16.1 Dimensions

Digital curriculum resources should be optimised to display on a screen resolution of 1024 x 768 pixels and scale gracefully in higher resolutions.

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 in an area of 760 x 570 pixels. This represents a 4:3 aspect ratio on a monitor with a screen resolution of 1024 x 768 pixels (less the header and navigation areas).

4.16.2 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 fixed size of the object is 760 x 570 pixels. The fixed size of a digital curriculum resource may be no larger than 760 x 570 pixels.

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.

4.16.3 Centre standalone resources

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

4.17 Directory structure

If digital curriculum resources will be distributed by The Le@rning Federation, the content should be provided to The Le@rning Federation as a directory structure containing resources.

4.17.1 Start file

The top level of the directory structure should 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. Where an entry point in to content does not rely on an HTML/XHTML page, this does not apply.

4.17.2 Flash and Director files

Flash and Shockwave applications should 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 Le@rning Federation's recommended embed syntax should be used where possible to allow the maximum amount of interoperability and standards-compliance possible⁵.

If this approach is taken, 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.

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 subfolder 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 should 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`.

4.17.3 File and directory names

File and directory names should use the following:

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

File and directory names *should not* use the space character.

⁵ For more information, see 'Streaming and the object element' at <http://jira.thelearningfederation.edu.au/confluence/x/0wM>

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

4.18 Rights information

4.18.1 Copyright statement

If the content has been developed for The Le@rning Federation, the standard copyright statement must be placed in the start file of each digital curriculum resource. Where content is licensed to The Learning Federation and intellectual property ownership is owned by the provider, this statement may also incorporate rights information for partner institutions:

The standard statement should read: © Curriculum Corporation, 2009, except where indicated under Acknowledgements

- The year date refers to the year in which the content is published or republished.
- The copyright statement must be coded in the XHTML start file and styled using CSS stylesheet as follows:
 - 1 Arial 8 point font.
 - 2 High contrast should be provided between foreground and background colours.
 - 3 The statement footer should be centred.

The statement may be varied to include partner institutions:

© Curriculum Corporation and Partner institution, 2009, except where indicated under Acknowledgements

For content shared via the sharing services systems, a copyright statement that reflects the licence terms under which the content is provided should be clearly be visible within the content at all times. A link to the Conditions of use statement should be made available to the user when the content is accessed.

4.18.2 Printable outputs

Where content is commissioned directly by The Le@rning Federation, the printable output footer should be placed on all printable outputs.

Usually the footer will read: Printable worksheet made available by The Le@rning Federation: © Curriculum Corporation, 2009, except where indicated under Acknowledgements

- The year date refers to the year in which the content is published or republished.
- The printable output footer should be styled as follows:
 - 1 Onscreen appearance of Arial 8 point font.
 - 2 High contrast should be provided between foreground and background colours.
 - 3 The statement footer should be left aligned.
- Where content is either shared or linked via harvested metadata, printable outputs should include a copyright statement that reflects the licence and intellectual property rights of the content owner.

4.19 Fonts

In order for a font to display correctly on a user's computer, the computer should have access to that font. The content gains access to specific fonts by one of the following methods:

- accessing a font outline embedded within the content
- referencing the font from within the content and assuming that the font has been installed on the user's computer.

For reasons related to guaranteed presentation and layout, developers should use embedded font outlines in technologies that permit this, rather than using device fonts (referencing fonts).

If, with agreement of The Learning Federation, fonts are referenced, developers must assume that only the following fonts are available on the user's computer:

Operating system	Font
Windows 2000	Fonts available with the default installation plus fonts installed with the 'Japanese, Simple Chinese, Traditional Chinese font' installation option.
Windows XP	Fonts available with the default installation plus fonts installed with the 'Install East Asian characters' installation option.
Windows Vista	Chinese (PRC) Chinese (Taiwan) Japanese (Japan)
OS X	Fonts available with the default installation. Asian language fonts are available by default.

4.20 Client software requirements

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

4.20.1 Minimum browser and operating system requirements

The Learning Federation tests all content in the following environments:

- Internet Explorer 6.0 and Firefox 3.0 on Microsoft Windows 2000
- Internet Explorer 7.0 and 8.0, Firefox 3.0 on Microsoft Windows XP
- Internet Explorer 7.0 and 8.0, Firefox 3.0 on Microsoft Windows Vista
- Safari 3.0 on Apple OS X

The fonts described in Section 4.19 should also be installed.

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

4.20.2 Latest browsers

Content should also be tested and operate in the latest versions of Mozilla Firefox and Microsoft Internet Explorer on Microsoft Windows 2000, Windows XP and Vista, and Safari on Apple OS X.

4.20.3 Browser plug-ins

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

Format	Plug-in
SVG	Adobe SVG Viewer Plug-in http://www.adobe.com/svg/
QuickTime	QuickTime 7.6.0 Player http://www.apple.com/quicktime/download/
PDF	Adobe Acrobat Reader 5 http://www.adobe.com/products/acrobat/readstep.html

Flash MX	Adobe Flash Player 10 http://www.adobe.com/shockwave/download/download.cgi?P1_Prod_Version=ShockwaveFlash
Shockwave	Macromedia Shockwave Player 11 (full installer) http://www.macromedia.com/shockwave/download/alternates/
Java applets	J2SE Runtime Environment (JRE) 6.0 http://www.java.com/en/download/manual.jsp

4.21 Client hardware requirements

Content 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
<http://www.microsoft.com/windows/products/winfamily/ie/ie7/sysreq.mspx>
- Mozilla Firefox
<http://www.mozilla.org/products/firefox/>
- Safari
http://support.apple.com/downloads/Safari_3_1_1
- Flash
http://www.macromedia.com/support/flash/releasenotes/mx/rn_mx.html#systemrequirements
- Shockwave
<http://www.macromedia.com/software/shockwaveplayer/productinfo/systemreqs/>