Testing IMS in Real Contexts

Implementing IMS Specifications
Implications and Best Practice

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Executive Summary

Since the IMS consortium began developing specifications for distributed learning systems there has been confusion over how these developments will impact the academic community in HE and FE in the UK. This report aims to provide a straightforward report for this community.

IMS are developing a number of specifications covering different aspects of distributed learning systems. This report attempts to take a holistic approach and uncover the impact and implications of the IMS specifications as a whole.

Although the development of the IMS specifications is being driven by businesses, this report does not review why IMS specifications are the way they are or the impact they will have on the business community.

Key concerns were identified through extensive literature review (mainly online documents) and interviews with practitioners with expertise in the field of IMS and its implementation. Two key concerns for the HE and FE academic community were clearly identified. The first was the creation of metadata to describe learning resources and the subsequent retrieval of that content. The second was the interoperability of learning resources. These two areas of concern were investigated further through two case studies.

The report begins with an overview of IMS and a look at how IMS may impact HE and FE institutions within the UK. Issues for individual course developers and delivers are then outlined before the two case studies are described. The report concludes with a glossary of terms. So if you are not sure what metadata and interoperability are then the glossary might be a good place to start.
Global Overview

Position of IMS in mid 2001

The IMS consortium aim to provide a framework for the effective development and management of distributed learning resources. IMS state their two key goals as being:

1. Defining the technical specifications for interoperability of applications and services in distributed learning, and
2. Supporting the incorporation of the IMS specifications into products and services worldwide. IMS endeavours to promote the widespread adoption of specifications that will allow distributed learning environments and content from multiple authors to work together (in technical parlance, “interoperate”).

Their main areas of interest currently include:

- locating and using educational content,
- tracking learner progress,
- reporting learner performance,
- exchanging student records between administrative systems.

The consortium has been broken up into a number of individual working groups, each with a particular area of interest. These are:

- Question & Test
- Content Management
- Competency
- Profiles
- Metadata
- Learning Design
- Accessibility
- Digital Repositories

There are 6 specifications, which are currently within the scope of IMS and at various stages of development. These are:

- IMS Learning Resource Metadata Specification
- IMS Enterprise Specification
- IMS Content Packaging Specification
- IMS Question and Test Interoperability Specification
- IMS Learner Information Package Specification
- IMS Reusable Competencies Definition Information Model Specification

The delivery of education within a global marketplace has led to the strategic development of collaborative learning initiatives, which allow the learner to receive their education in a flexible and
transferable manner. The introduction of IMS should allow educational material and student records to pass from institution to the learner as well as between institutions in a manner, which is seamless, consistent and transparent.

**Future Expectations**

"No matter how many search engines or information retrieval systems we use today finding a needle in the data-haystack can be a fruitless effort. This enormous problem will not be solved overnight, but LOM (Learning Object Metadata) and DCMI (Dublin Core Metadata Initiative) are building the path that will make information retrieval and exchange a much more rewarding process," (Stu Weibel, Director of DCMI, *E-Learning Takes Important Step Forward*, Dublin Core Metadata Initiative Press Release, 6/12/2000, http://dublincore.org/news/pr-20001206.shtml).

Whilst the full impact and ultimate success of IMS and its specifications may still be difficult to fully define, the international endorsement of them may lead to their adoption as standards within the next few years. There is still scope for caution however regarding the future direction of IMS, with some scepticism apparent within the educational sector.

"...the standards issue has raised concerns among some e-learning developers, technology buyers, and industry consultants. Questions of how smoothly industry standards would replace current proprietary e-learning architectures, of whether such standards would raise or lower the quality of e-learning, and of using standards compliance claims to market e-learning are being voiced from many quarters." (Barron, T, *Standards - The Vision and the Hype*, Learning Circuits, Nov. 2000, p.1, http://www.learningcircuits.org/nov2000/standards.html).

The outcomes being addressed within the IMS initiative will, of course, be determined through proprietary vendor uptake and universal compliance as well as common interpretation of the specifications in their final format. This may prove problematic as vendors who claim universal compliance take development paths, which are dictated by the need for market advantage over competitors as against universal compliance.
Institutional Overview

The main implications of IMS at institutional level will be in terms of policy development. The need for sustainability within the global learning market has necessitated the development of rigorous strategies which are designed to optimise on-campus and in particular, off-campus learning. To this end, the institutionalisation of delivery platform may well become more prevalent in the near future due to the standardisation benefits it offers.

Choice of Platform

The availability of a wide range of Virtual Learning Environments (VLEs) and the current development of Managed Learning Environments (MLEs) gives academic institutions the opportunity to deliver and monitor learning with an efficiency which has not previously been available.

Many individual departments and faculties within the FE / HE sectors in the UK already use VLEs in their course delivery such as Blackboard and WebCT. The decision to opt for a particular platform at institutional level however raises a number of questions:

- Is the proposed system IMS-enabled?
- Which platforms are currently in use within the institution?
- How long-term are the present options?
- Will one platform interact effectively with others?

A lack of clarity and confusion in understanding the highly technical language and claims being made of these learning environments have been criticised as undermining the effectiveness and perception of initiatives such as IMS.

"People charged with investigating standards as part of their purchasing efforts often voice frustration about the seemingly duplicative standards groups and highly technical specifications they produce. Some also contend that such words as compliant and conformant are used by some vendors inappropriately, a problem standards developers acknowledge." (Barron, T, Standards - The Vision and the Hype, Learning Circuits, Nov. 2000, p.1, http://www.learningcircuits.org/nov2000/standards.html).

It is therefore important to carry out a rigorous needs assessment before selecting an MLE/VLE in order to ensure that the platform purchased meets your teaching and administrative needs as well as being able to transfer information with similar learning environments used within partner institutions. In this sense, adherence to the IMS specifications is an important factor to consider in the selection process as this may have an impact on longevity and effective communication with other learning environments.

Further information on MLEs can be found at: http://www.jisc.ac.uk/mle/
**Institutional Costs**

Although there are few if any direct costs to the institution, which are associated with the implementation of the IMS specifications, there may be considerable indirect cost implications.

These costs may include the following:

- Generation of metadata for new and existing learning materials
- Maintenance of metadata
- Modification of existing learning materials from IMS non-compliance to compliance
- Modification of existing materials to achieve high granularity

**Staff Development**

There is a need for considerable staff awareness and development, which relates to the design and implementation of IMS conformant educational materials, if a successful uptake is to take place within the academic community. From the generation of metadata to packaging and transference of learning materials from one system to another, a high degree of support will be required to service the IMS initiative.

Whilst there are a number of interested parties and funding bodies nationally and internationally engaged in the development and dissemination of IMS awareness and effectiveness programmes, there is a need for this to filter down to institutional initiatives for the promotion of awareness and effective use.

**Administration and Support**

The time and costs associated with the generation and maintenance of metadata, particularly in the case of existing learning materials, which requires updating to conform to IMS requirements could be considerable. There may be a need therefore to provide administrative support to the academic in this sense, in order to remove much of the burden of metadata creation.

The obvious solution would be to use librarian skills to create and maintain metadata information. This however poses a serious problem, since metadata is intended to accurately describe learning objects, which in many cases can only be adequately described by the creators themselves.
Issues for the Course Developer

Much of the development of Web-based course materials in recent years has been carried out by individually enthusiastic academics, who wish to explore this field. Recent progress towards fully integrated learning environments, which include provision for recording and assessment as well as course delivery has necessitated a more rigorous approach to course development.

There are a number of areas, which the developer should consider as good practice in course design, if it is to conform to IMS specifications.

Appropriate course and learning object descriptors

In order for learning materials to reach the appropriate end-user audience, great care is required in describing individual learning objects within a course as well as the course itself. This requires a considered approach to the generation of metadata, which will ultimately direct the end-user to the course material. The use of language for example should be remembered in describing learning materials within an international context. The use of terms such as 'evaluation' and 'assessment' can have slightly different meanings within the UK educational sector, as compared to that of North America, which may lead to confusion. The use of generic terms, which adequately describe learning objects, whilst desirable, may of course prove inappropriate for specific descriptions, however the developer should consider language and interpretation, where possible.

There are a number of taxonomies available, which may assist in the creation of uniformity. The Scottish electronic Staff Development Library (SeSDL) has done work in this area (see http://www.sesdl.scotcit.ac.uk/).

Content packaging

File types and sizes should be considered for their conformance with other systems. Packets of materials which constitute a course or part of one should be suitable for collation and packaging in a format such as a zip file, in order to allow material to transfer from one learning environment to another.

Granularity of individual learning objects

The effective development of courseware should consider the granularity of resources, which make up the course itself. SeSDL describes granules as being, “...the smallest possible 'free-standing' educationally viable elements.” (User Guidelines - http://www.sesdl.scotcit.ac.uk/). Large volumes of work, which are packaged as a single piece of course material, can be difficult to breakdown into individual learning units suitable for editing or re-use in another course structure.

The ability for learning materials to be searched and edited for re-use is known as granularity and can be described thus:
1. Low granularity - a large resource which is difficult to re-use in a different context.
2. High granularity - a resource which is easy to re-use or edit for use in another context.

An example of this would be a course, which is developed as one large Adobe Acrobat file. The opportunity to take individual elements of the course can be difficult since most users access Acrobat files through Acrobat Reader which does not have full editing capability. For further explanation of granularity and its implications for the course developer see:

http://www.met.ed.ac.uk/pac-man/tutorial.html

http://www.aln.org/alnweb/magazine/Vol3_issue2/wiley.htm

The spin-off in striving for high granularity is versatility in the user's ability to edit and re-use material. However this comes at the cost of the time required in generating metadata for multiple elements which make up a single teaching resource.

**IMS Specifications**

The implementation of IMS specifications within the scope of course development highlights a number of issues, which are important for consideration. Most important of these is the need for course development to incorporate IMS throughout its design phase.

**Use of Metadata**

It is important that the development of new course material for on-line delivery considers the IMS specifications at the design stage, if they are to be effectively integrated. The evidence of this research has shown that adherence to the specifications have been considered a 'bolt-on' to the content development. This can create problems and add considerably to development time if the implementation is not viewed as a fundamental component of the design, particularly where IMS conformance is specified within the scope of the brief.

Appropriate Interpretation and implementation of relevant IMS specifications is important for course materials, which are intended to interface or operate within virtual learning environments.
Issues for the Course Deliverer

Since the delivery of courses may take many different forms and encompass a number of individual roles, it may be appropriate to define the course deliverer as a lecturer or a teacher. In many cases, the course deliverer will also be the course developer, although not necessarily in the sense of developing associated with computer programming.

Course Materials

In light of the fact that the course deliverer can often be viewed as the person who is closest in a pedagogical sense to any learning materials, so it could be said, are the potential implications of IMS. It is therefore important that the course deliverer has access to materials that are versatile enough to operate in a generic manner across learning environments.

Existing Course Materials

There is a huge variety and volume of learning materials, which are at present being delivered online. The implementation of the IMS specifications will not have any impact on the operability of existing course materials within present systems. In order to make existing materials IMS-enabled however, a number of steps must be taken. These include:

- Generation or modification of metadata to describe materials as IMS-enabled learning objects.
- Repackaging of learning materials in a manner, which will allow their transfer to any IMS-enabled MLE/VLE.

New Course Materials

The implication for new learning materials is that the overhead is reduced compared to existing materials so long as these new materials adhere to the requirements and recommendations of the specifications at the design stage.

Just as in the case for the content developer, the academic who wishes to produce new course materials within the scope of the IMS specifications, should endeavour to design with adherence to the specifications from conceptual to final stages of the design. Treating IMS compliance as a bolt on to the development of the resource may well prove costly and time-consuming towards the end of the design phase if compliance necessitates major redesign.
Issues for the End-User

A successful transition to IMS conformance with regards to learning materials should result in a seamless interface for the end-user, which is no different from on-line learning resources currently in use. There are a number of implications however, when we consider the need to effectively target appropriate learning resources at the learner.

The future ability to transfer learner information from VLE to VLE or institution to institution should enable a seamless transition for the learner in whichever educational direction they choose to take, for example, see the JISC funded “Joined up System for Learners” projects at http://www.jisc.ac.uk/mle/7-99/
Case Study One - The Use of Metadata

The following case studies investigate some of the key elements of IMS, which are currently testable, and their implications for the academic community.

This first case study investigates the generation and entry of learning object metadata and the subsequent use of this metadata in retrieving relevant course materials. The case study makes use of the Scottish electronic Staff Development Library (SeSDL) metadata interface - http://www.sesdl.scotcit.ac.uk/

Entering Metadata

A number of experts and non-experts were asked to input data which described a particular learning object into the metadata interface in order to investigate the following:

- Time taken to describe a learning object
- Appropriateness of descriptors
- Understanding of descriptors
- Resource retrieval

SeSDL have developed a taxonomy of descriptors, which are suitable for the input of metadata into their database. This is intended to create a degree of uniformity in the generation of metadata, which is crucial to the effective retrieval of information by the end-user.

Whilst IMS have currently opted to make none of their metadata descriptors mandatory, SeSDL have concluded that there is a need for a number of mandatory metadata descriptors in order to adequately describe learning objects with some consistency.
Time Taken to Describe A Learning Object

In order to gain an insight into the time required to input metadata to a resource database, metadata for two image files was generated. The image files were specifically chosen on the basis that one would be generic in nature and one would be specific to the subject's expertise. The subject was asked to describe each of the image files using the SeSDL interface for metadata generation in order to create a searchable granule or learning object for each image. In each case the subject chose one image which was compatible with their own specialist field and therefore suitable for detailed description as well as being given a more generic image which required an interpretative approach to description. Examples are shown below in figures 1 and 2.

Through observation and use of a 'think aloud' approach, subjects entered data, which they felt best described the image. Although many input fields gave the user pre-determined selection options, some did not. Open fields tended to cause most difficulty amongst subjects as to choice of language and description content. These fields contributed greatly to the overall time taken to complete the description of the learning object.

The time taken to describe each of the learning objects under test was generally between 10 and 15 minutes. Whilst it was felt that this was not a considerable length of time on its own, in terms of generating metadata to support an entire course, consisting of many individual learning objects, this time could become significant.

Appropriateness of Descriptors

The appropriateness of learning object descriptors and their interpretation were considered in terms of each subject's confidence and ability to describe the two learning objects under test. The choice and intended content of descriptors was highlighted as key to the effective description of learning objects. Highly subjective descriptors such as 'level of difficulty' and 'time required' to complete a learning object were mostly regarded as being to subjective and context-related and were therefore often left blank.
Subjects felt fairly comfortable in describing the specialist images given to them and tended to describe them in some detail. There were however some issues raised as to the retrieval of learning objects, which require quite specific technical language in their description. This, it was felt could lead to end-user difficulty in retrieving learning objects without an extensive specialist vocabulary.

In describing the generic image, subjects varied more in their approach to describing the learning object. Since the image could be used in a wide variety of learning contexts, this influenced the language used for description. Some of the descriptions generated by subjects included:

"A photograph taken of a village set on a mountainside, with clouds and snow also visible. Whitewashed houses in village. Bare trees in foreground."

"Picture of a small mountain village."

"Image of mountain village, possibly in southern Europe. Shows topography, vegetation and buildings. Date unknown."

The descriptions above highlight the part that language and vocabulary play in the effective description of resources as learning objects. This has obvious implications for the future retrieval of the learning object and its relevance to the end-user.

It was also noted that some subjects tended to leave descriptive elements that were non-compulsory. This led to final metadata descriptions of the same learning object being quite different in terms of detail. In terms of IMS which presently designated all metadata elements as optional, this could lead to a disparity in the description of learning objects through differing interpretation and implementation of the Metadata specification.

**Resource Retrieval**

Since the intention of metadata is to describe learning resources in an appropriate manner for end-user retrieval, a test of resource retrieval was carried out in order to ensure that learning resources were reaching their target audience. In order to achieve this, a number of specific learning objects were described by a non-expert academic for later retrieval.

It was decided that the learning object metadata should be generated by a person who was isolated from the development of each resource in order to test the validity and appropriateness of the metadata generated.

Since this process relies heavily on the identification of key words for effective retrieval, testing was carried on a 'simple search' basis.
Case Study Two - Resource Interoperability

This case study considered an example of the transfer of course material from one learning platform to another within the scope of the IMS Question and Testing Interoperability specification. Course material for transfer consisted of a number of student assessment questions in a variety of formats which were generated using Clyde Virtual University's assessment generator tool, *Miranda* and transferred into *QuestionMark Perception*.

Since the IMS specifications are still very much in the development stage, the opportunities for testing the question and test interoperability specification are limited and convoluted. This is highlighted within the help documentation of the SCAAN IMS Assessment Creation Tool, which states:

"A word of warning: IMS is currently very new and changeable. It is not guaranteed currently that other IMS systems will implement it in exactly the same way as Miranda does. This will settle down eventually, but it is important to note that currently there may be discrepancies between differing tools. Please let us know if you find any discrepancies." (http://www.scaan.ac.uk/ims.html, Help Menu, Contents, June 2001).

At the time of carrying out the case study, it was only possible to transfer assessment data in one direction, from Miranda to QuestionMark Perception and not the other way round. A number of tools were required to allow transfer of questions from one system to the other. These were:

- IMS Assessment Creation Tool (Miranda)
- QuestionMark QTI XML Viewer
- QuestionMark Perception Authoring Software

The choice of question type was dictated entirely by the options available within the Miranda environment. This demonstrated an immediate limitation, since a number of question types, which are available through QuestionMark Perception were unavailable to Miranda, therefore limiting the functionality, which was available to the user. A number of academics were involved in the case study, ranging from expert to non-expert.

<table>
<thead>
<tr>
<th>Miranda Question Options</th>
<th>QuestionMark Perception Question Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple Choice</td>
<td>Essay</td>
</tr>
<tr>
<td>Multiple Response</td>
<td>Explanation</td>
</tr>
<tr>
<td>Fill in Blanks</td>
<td>Fill in Blanks</td>
</tr>
<tr>
<td>True / False</td>
<td>Hotspot</td>
</tr>
<tr>
<td>Yes / No</td>
<td>Matrix</td>
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<td></td>
<td>Multiple Choice</td>
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<td>Multiple Response</td>
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<td></td>
<td>Selection</td>
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<tr>
<td></td>
<td>Text Match</td>
</tr>
</tbody>
</table>
A number of common issues were raised by participants:

- Question types which were able to transfer from one platform to the other was limited to those which Miranda offered.
- The transfer process at present is crude and requires a large degree of expert knowledge and intuition to succeed.
- Understanding of language proved difficult for non-experts. Terms that proved difficult included: compliant, xml, interoperability etc.

The present situation regarding the transfer of assessment material from one assessment tool to another is a difficult one. The interfaces, which are currently available, such as SCAAN’s IMS Assessment Creation Tool (http://www.scaan.ac.uk/ims.html) and QuestionMark Perception, presently require intermediary software (QuestionMark QTI XML Viewer) to facilitate the transfer.

Proprietary vendors such as QuestionMark are currently in the process of IMS-enabling their product range, which will remove the need for the QTI viewer and should allow import and export facilities to and from one assessment tool and another.
Best Practice Guidelines

The following guidelines are intended to assist the non-expert user within the academic community in finding their way around the principles of IMS and how to tailor on-line educational resources so as to IMS-enable them.

Design of IMS-Enabled Content

When designing a course, which is intended for on-line delivery, it is important to plan and develop a structure which enables individual course elements to be edited for re-use where applicable.

The following issues should be considered at the planning and design stages if course content is to be optimised:

- Use readily available file formats where possible (html, pdf, jpeg, gif, etc.), so that they are easy to access and edit where necessary.
- Try to enable content editing where possible. Figure 3 shows an image, which has course-specific textual information embedded, which would be difficult to edit for re-use in another context.

Avoid the use of corporate or institutional logos within individual course documents, as these may be difficult to edit.
- Try to design for high granularity, as this will allow your material to be utilised in a variety of learning contexts. This may require great attention to the pedagogical relevance of a particular learning object and its ability to be broken down into discreet learning objects or granules.
Describing Learning Objects

There are a number of areas that should be considered in generating metadata to describing a learning object:

- Use language that is suited to the target audience.
- Try to identify keywords within the description of a learning object, which will make it easier to retrieve through a keyword search.
- Remember that a particular resource may have a number of potential learning applications within different contexts when describing a learning object.
Support Available in the UK

Current provision for the support of stakeholders is limited mainly to literature, which is available through the IMS web-site (IMS Global Learning Consortium, http://www.imsproject.org/). The Centre for Educational Technology Interoperability Standards (CETIS), based at Bangor University is largely responsible for the dissemination of IMS material for the UK academic community.

The following Web sites provide great starting points for further exploration.

CETIS - http://www.cetis.ac.uk/

JISC Managed Learning Environments - http://www.jisc.ac.uk/mle/

JISC Committee for Integrated Environments for Learners - http://www.jisc.ac.uk/jciel/


Glossary

This glossary is intended to identify and explain specialist terms which appear within this and related literature. Other glossaries are being prepared as this document was being written. See the JISC Technology Watch A to Z at http://www.jisc.ac.uk/techwatch/resources/specific.html and the CETIS Learning Content SIG’s Terms and Definitions MS Word file that is linked at the bottom of http://www.cetis.ac.uk/learning-content/

CAB file (Cabinet file)
A compressed file which is suitable for the transfer of large amounts of information in a single file.

Content management
The development and management of learning content in a manner that is suitable for packaging and transfer within IMS compliant learning environments.

Content package
A collection of learning materials which may include text and images, animations, simulations etc. (learning objects) that are assembled as a package, suitable for transfer to any other IMS compliant learning environment. This would commonly be done through the creation of a zip file or a CAB file.

Content producer
A description of anyone who develops learning content. This can vary from an individual teacher producing on-line content for a particular course to commercially developed learning materials, which are intended for on-line delivery.

DTD - Document Type Definition.
This is the formal specification of a markup language, written using SGML

Element
A descriptor for the input of metadata which describes a learning object - e.g. name, date, level of difficulty etc.

Enterprise
Specification aimed at the standardisation of learning resources and student information across multiple systems. Particularly focussed on corporations, schools, government agencies and software vendors for training administration, human resource management, student administration, financial management, library management and other functions which support learning.

Granule
A single piece of media which combines with other granules to constitute a learning resource. E.g. a single text document, jpeg image, movie file etc.

Granularity
The degree to which a resource can be broken down to its constituent elements or granules.
HTML - HyperText Markup Language
HTML is a collection of platform-independent styles (indicated by markup tags) that define the various components of a World Wide Web document. HTML was invented by Tim Berners-Lee while at CERN, the European Laboratory for Particle Physics in Geneva.

IMS - Instructional Management Systems
Formally known as IMS Global Learning Consortium Inc, now known simply as IMS.

Interoperability
The ability for one virtual learning environment to share or transfer information with another (i.e. being able to talk to each other).

Learner profile
Learner information, such as assessment details, attendance detail, special needs etc. which combine to form a profile for each individual learner. Learner profiles can transfer with the learner to different IMS compliant content providers.

Learning object
A learning object is any item of information, which is intended to aid learning. This could be a picture, animation, spreadsheet, simulation etc. The learning object is described using metadata.

Learning provider
An institution, commercial provider or individual who provides learning content

LIP - Learner Information Package
A means by which learner information can be packaged so that the resultant data can be transferred between different MLEs.

LMS - Learning Management System
A system which enables organisations or institutions to deliver, track and manage multiple forms of learning from one central point. Often used synonymously for MLE.

LOM - Learning Object Metadata
Term used within the Institute of Electrical and Electronics Engineering (IEEE) for the description of learning material, through the generation of metadata.

Manifest
A special piece of code, which describes all the individual pieces of content within a content package.

Metadata
Metadata is actually data about data. It is descriptive information about documents which allow for easy categorisation and retrieval. Examples include:
- A library catalogue
- Descriptors for learning resources intended for delivery over the WWW.
MLE - Managed Learning Environment
An integrated environment for course delivery combined with learner administration such as assessment and enrolment records. An MLE would normally connect a number of administrative systems with a VLE.

Plug-in
A small software application, which can be installed on your computer to extend the functionality of an existing application or Web browser. Examples include Macromedia’s Shockwave, Flash and Authorware plug-ins.

Schema
Structural elements within the specifications, showing for example the XML coding structure of a standard on-line assessment.

SCORM - Shareable Courseware Object Reference Model Initiative

SGML - Standard Generalised Markup Language.
A standard for describing markup languages such as HTML, XML, VRML etc.

Stakeholder
Any individual or group for whom IMS will have an impact. The key stakeholders for the benefit of this document are: academic institutions, academics, administrators, developers, learners.

VLE - Virtual Learning Environment
A learning environment which allows all the functions of a traditional learning environment to be carried out on-line.

VRML - Virtual Reality Modelling Language
A mark-up language which is used to develop 3-dimensional information for the Web. Could be thought of as HTML in 3 dimensions. Web browsers generally need a plug-in to run VRML applications.

XML - Extensible Markup Language
A more intelligent programming language for the Web that offers more flexibility and complexity than HTML.

ZIP File
A compressed file which is suitable for the transfer of large amounts of information in a single file. Easier to generate than CAB files using software such as Winzip which is freely available.