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IPeMS
A Digital Rights Management framework for learning objects

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Abstract

The Internet is long-acclaimed to provide a medium for easy sharing of ideas and collaboration, and has huge potential for academic and training organisations to share learning resources. However, there are no formal mechanisms for managing intellectual property (IP) and there remain today tensions between freedom to share and ownership of creativity.

Theories around land property rights have contributed to the rights of IP as we know them today. Creating digital IP, however, is not a physical labour like toiling the land. It does not preclude the owner from retaining a copy and copying the IP does not make the IP more scarce, or competitive to possess.

Management of IP rights is about finding a balance between over zealous enforcement and 'free' use of IP. Protection of IP can be achieved by law and technology, and a mechanism for managing the use of digital learning objects would require a digital rights management (DRM) framework.

Architecture of XML (eXtended Markup Language) Web Services is emerging as a standardised approach to dynamic component connectivity and interoperability that relies on self-describing components and open connectivity standards and emerging standards, including IP (Internet Protocol), SOAP (Simple Object Access Protocol), WSDL (Web Services Description Language) and UDDI (Universal Description, Discovery and Integration).

XML Web Services technologies have great potential as the underlying technology for the establishment of a DRM framework for learning objects (LOs) on the Internet.

An initial survey, with endorsement of findings by experts in Information and Communication Technologies (ICT) in education, identifies the components of an online contract that would license an educator to use LOs. A framework is proposed and a prototype of an intellectual property electronic management system (IPeMS) is designed and developed. Web Services operations authenticate teachers and enable the teachers to search for LOs. The teachers can view permissions and constraints of use of the LOs, and can create a contract, with or without payment as the conditions dictate, that, on agreeing to, will license the teachers to use one or more learning objects. Another evaluation survey completes the research study, giving feedback about IPeMS, with respect to its application to an educational environment, to license an educator to use digital LOs.

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1 Introduction

The Internet is long-acclaimed to assist similar thinking people to collaborate and share ideas, and provides huge opportunities for academic and training institutions to share their learning resources. However, there are no formal mechanisms available for academic and training organisations to manage the intellectual property (IP) rights of these resources.

This research involves the development of a digital rights management (DRM) framework that enables educators to carry out agreements over the Internet, with or without payment, to license the use of learning resources.

1.1 Research Background

This research extends previous work of the author (Hill, 2004), who was fascinated by code segments called Web Services. She claimed that the architecture of XML (eXtended Markup Language) Web Services was emerging as a standardised approach to dynamic component connectivity and interoperability that relied on self-describing components and open connectivity standards and emerging standards, including Internet Protocol, SOAP (Simple Object Access Protocol), WSDL (Web Services Description Language) and UDDI (Universal Description, Discovery and Integration).

The researcher recognised that XML Web Services technologies could have great potential as the underlying technologies for the establishment of a DRM framework for managing learning objects (LOs) on the Internet. The motivation for this research was to show this potential by designing a framework and building a DRM prototype that enabled educators to carry out agreements over the Internet, with or without payment, to license the use of LOs.

1.2 Importance of the research

A prototype of the DRM framework, using XML Web Services technology, is developed and demonstrated. Such a system could make sharing of digital learning resources on the Internet easy, without losing the IP rights of the creator. The findings of this research about the DRM prototype could initiate dialogue between developers and clients in a commercial environment to build such a system that will manage IP rights in education on the Internet.

1.3 Research questions arising from the research topic

From an initial investigation, the following research questions were identified:

- What DRM policies currently exist in organisations (educational and business) in New Zealand (NZ)?
- What are the components of a contract for DRM in organisations who share resources with external users?
- What would be the design of an appropriate Web Services-enabled DRM framework to respond to a teacher's request for license to use LOs?
- Can a prototype of a DRM framework, using XML Web Services technology, be developed?

- How will we know if the prototype can be effectively applied to an educational environment, to license a teacher to use one or more LOs?

The findings to these research questions provide the substance of content for this thesis. The journey of research endeavours to answer these questions.

1.3.1 Scope of research

The focus of this research is on developing a framework to manage the IP of learning resources in an educational environment only. As part of this research, the prototype addresses some issues of user interface design of a DRM system. The research does not provide conclusive attributes, but identifies some essential attributes of a DRM system that need to be considered in building a commercial product. This research could provide a point of dialogue between a developer and a client.

1.4 Research design

The research design follows a conventional structure where purpose, methodology, findings, discussion and conclusion are presented (Emerson, 2000; Booth, Coulomb and Williams, 1995).

1.4.1 Purpose

The purpose of any research is to find answers to research questions. The activities of research are iterative and generally can be identified as:

- A literature review to determine the extent of the field and define components of objects in the research study.
- Development of a model that creates the research questions, and considers the design of approach to the study, that is, the methodology.
- Implementation of the research design to collect and process data.
- Evaluation of research outcomes and analysis of research findings. A conclusion presents recommendations and reflections of the research process.

The objective of this research is to investigate the development of a DRM framework using XML Web Services technologies. It is intended that the Web Services will create the contract for the teacher that, on agreeing to, will license the teacher to use selected LOs.

Specifically, this research seeks to:

- Identify the DRM policies that currently exist in organisations (educational and business) in NZ.
- Determine the components of a contract for digital rights management in organisations who share resources with external users.
- Design an appropriate Web Services-enabled DRM framework to respond to a teacher's request for license to use LOs.
- Develop a prototype of the DRM framework.
- Evaluate the prototype with respect to its application in an educational environment to license a teacher to use one or more LOs.

The next section looks at the types of methodology used in this research to find the answers to the research questions.

1.4.2 Methodology

There are a number of methodology tools available to a researcher, for the purpose of finding answers to research questions. This research study used literature review, surveys, and personal communication, as follows:

- A literature review provided understanding of the theories behind IP and online trading, the concept of DRM, LOs, and the technology and application of XML Web Services. The review helped to define the sort of questions that should be asked in the initial survey.
- An initial investigation using a survey determined the components of an online contract to manage IP rights and to license educators online to use LOs.
- An evaluation survey of the prototype DRM framework gave an insight into who would use such a system, and how a full implementation might look like.

Results from different types of methods used were collected and collated as explained in the next section.

1.4.3 Results

The literature review helped to determine the questions of the initial survey. The results from the initial survey questions and the endorsements of ICT educational experts identified the components of an online contract to license educators to use LOs. A DRM framework was designed on these findings and a prototype of the DRM framework showed to a sample population what such a system could look like in terms of its services, functions and interfaces. An evaluation was carried out to test the appropriateness and usefulness of such a DRM system in an educational context.

1.4.4 Limitations of the research

This research study was limited by time (as defined by the requirements of a Master's student timeframe) and cost.

Opportunities of further research are identified by the researcher in section 7.2 "Limitations and opportunities of the research".

1.4.5 Thesis structure

The thesis structure reflects the research design. Each section of this research is summarised:

Literature review

The literature review explored and assisted the understanding of IP management of learning objects, using XML Web services technologies. The review begins by looking at the theories that underpin IP. The theories have their beginnings in property rights that were first applied to land. However, there are some obvious differences around attributes of digital IP being non-exclusionary (where the creator still retains the creative work) and non-rivalrous (where by copying you are

proliferating the creative work and not making it scarce and competitive). There still exist tensions today around 'fair use' and first sales rights of IP. The intent of the medium of Internet is discussed and a call for a balance is made between free use by the user, and protection of IP rights of the creator. Maintaining this balance requires a management system using both law and technologies of DRM.

Digital LOs are held in repositories and their attributes lend themselves to being managed digitally for trade. XML Web Services technologies have great potential as the underlying technology for the establishment of a DRM framework for trading LOs on the Internet.

What is required for online contracts?

An initial survey determined the components that are required for an online contract. The results showed that organisations had varying protection of their IP, but had a clear idea of the essential requirements of a contract that would manage digital IP rights.

A framework to manage IP of digital LOs

The findings of the initial survey contributed to the design of a framework. An algorithm describes a framework that will authenticate the user, provide a global search for LOs and a contract to manage IP rights. Scenarios are given to put the framework in a real-time context.

The prototype – IPeMS

A prototype of the framework to manage digital IP rights was designed and built, using Web Services technologies. The name DRM was dropped in favour of IPeMS (or Intellectual Property electronic Management System). The system was developed using Visual Basic .NET, and client user interfaces were designed appropriately for their purpose.

Evaluation of IPeMS

An evaluation survey acquired feedback from the participants about IPeMS, with respect to its application in an educational environment, to license an educator to use digital LOs.

Conclusion

The conclusion summarises the journey of the research that involved the development of a DRM framework, using XML Web Services technologies that enabled educators to carry out agreements over the Internet, with or without payment, to license the use of learning resources.

2 Literature review

2.1 Introduction

The purpose of the literature review was to explore and understand IP management of electronic learning objects, using XML Web services technologies. The findings of the review provided the background material to help 'shape' the initial survey and assisted the author to design and implement a prototype of an IP management system that will license an educator to use digital LOs.

We begin the literature review with an understanding of the theories that underpin IP. These theories have their beginnings in land property rights. However, attributes of digital IP, such as, non-exclusionary (where the creator still retains the creative work) and non-rivalrous (where copying proliferates the creative work and does not make it scarce and competitive) are clearly different from that of land property rights. Tensions around reward of effort, especially 'fair use' and first sales rights of IP are still debated to this day.

The Internet has enabled collaboration and sharing of information between similar thinking people. However, a call for balance is made between free use by the user and protection of IP rights of the creator. Maintaining this balance requires a management system, and application of law and technologies of DRM are seen as a solution to protect and manage digital IP rights in the future.

Digital LOs are digital files or group of files that can be reused and redistributed for enhancing learning. They are generally held in repositories and their attributes lend themselves to being discovered and managed for trade.

XML Web Services technologies have great potential as the underlying technologies of a DRM framework that will license an educator to use digital LOs.

2.2 Theories underpinning intellectual property

Theories around property rights that were first applied to land have shaped the property rights applied to intellectual objects or non-tangible goods. Theories about what defines property were postulated by two influential philosophers, John Locke of 17th century, and G.W.F Hegel of 19th Century. It is their theories around the rights of land property that have contributed to theories that underpin the rights of IP today (Spinello & Tavani, 2005).

2.2.1 Land property and intellectual property

Philosopher John Locke of the 17th century was the first person to seriously theorise that people had a natural right or entitlement to their fruits of labour, provided there was no harm or spoil. In other words, that their labour efforts did not damage future opportunities of labour by others (Spinello & Tavani, 2005). This law applied to common land. Common land was land that was not owned by anyone, and entitled people to reap the benefits of their labour if they improved this land. Advocates of intellectual rights have applied Lockes' theory to intellectual objects, believing that an author or creator should benefit from their labours when creating an object.

However, there are conflicts that have not been resolved when applying Locke's theory to rights of IP (Spinello & Tavani, 2005; Ghosh, 2005). Some of the conflicts include:

- In creating and benefiting, you are indeed interfering with the commons or public good for future creators. However, the application of 'fair use' to an intellectual object may be enough to provide benefits for the creator, and still allow its augmentation in the public domain.
- The making of an intellectual object is not a physical labour like the toiling of land.
- Unlike tangible objects, creating intellectual works are:
 - non-exclusionary (that is, copying does not preclude the owner from having it); and
 - non-rivalrous (that is, copying indeed proliferates the object and therefore does not make the object scarce and competitive to possess). Once the object is made digital, reproduction can be done infinitely with no inherent marginal cost of reproduction. If there are any costs, they are solely related to the medium of reproduction.

Another influential philosopher, a German, by the name of G.W.F Hegel of the 19th Century, argued that land ownership was determined by first occupancy, and therefore became property that must be protected (Spinello & Tavani, 2005). For the first occupiers, he theorised that the land in time became a necessary component in the development of the people and their personality. Similarly, in his *Philosophy of Right* Hegel made claims that IP was an expression of one's personality and gave meaning to one's very existence or life (Redding, 2002). Hegel insisted that IP, too, needed to be protected. However, what he failed to explain is work that had been influenced by other factors, such as, by other people or inspiration from an everyday scene. Also, the application of Hegel's theory to IP rights was marred by our society's inability to define and quantify self-expression.

In contrast to Locke's and Hegel's theories, where property was considered a natural right, the Utilitarianism theory, created by 17th and 18th Century philosophers Bentham and Mill, reasoned that it was desirable to protect 'the greatest good of the greatest number', where property rights could be justified on the basis of their contribution to social utility (Spinello & Tavani, 2005). If we apply this to intellectual works, this means that reward of its creation is measured by the degree of 'good' affecting the greatest number of people, or what achieves the most desirable economic ends. Utilitarianists believed that it was this reward that would stimulate and provide incentives for production and further creativity of intellectual works. However, the IP debate has not proven that IP has any economic basis (Ghosh, 2005).

These first IP theories were complementary and their intent was to protect the public domain and the common good. Discussion by Redding (2002), Ghosh (2005) and Spinello & Tavani (2005) suggest that each of the first IP theories, however, have contributed to the rights of IP in some way, as we know them today. Spinello & Tavani (2005) are convinced that, if there is no reward there would be no incentive to continue to produce new and innovative work.

2.3 Debate about reward of effort

Debate about IP continues today around the reward of effort, or more explicitly around fair use and 'first sales' rights of intellectual objects. Fair use enables use of IP for 'common' purposes such as criticism, comment, news reporting, teaching and research. 'First-sale' refers to the sale by the author/creator to sell an original work for the first time, and defines whether the original owner will also lose rights over the work (NZ Copyright Act 1994; section 2.5.1 Protection of IP by law).

One side of the debate argues that if there is no copyright protection, authors would lack incentive to create more works (Spinello & Tavani, 2005). However, on the other side of the debate, theories against any rights of IP claim that intellectual objects are unowned and therefore reward of effort can not be assigned to a creator. For example, a Marxist approach would oppose any copyright theory (Soderberg, 2002; Spinello & Tavani, 2005), claiming that there must be information socialism, where:

- no one should own property; and
- there would not be approval of corporate producers sovereignty over intellectual objects, and harmful consequences of exploitation of developing countries. Marxists argued that developing countries often were at the mercy of companies holding patents for pharmaceutical products (for example, commercialising traditional knowledge about medicinal plants) or copyrights for important software technologies.

Ghosh (2005) reminded us that humans have collaboratively created and owned knowledge since as long as we have communicated. State protection of IP rights (such as, trademark, copyright, and patent) were initially developed with the primary justification of increasing human creativity, increasing public's access to the creativity, and increasing collaborative creativity. However, in his writing, Ghosh (2005) had observed that IP policies around the world over time had strengthened IP rights of the creator to such a point that they actually threatened to decrease creativity, decrease the public access to creativity and decrease collaborative creativity. 'Inherently human' collaboration had become a novelty! But, Ghosh also pointed out that more recently there has been renewed public interest of collaborative creativity that can only be attributed to the open source and free software movements.

IP and open source and free software

In 1985, Richard Stallman established the Free Software Foundation (FSF) (<http://www.fsf.org>). FSF is a non-profit organisation that continues to advocate users' rights to use, study, copy, modify and redistribute software, and support the development of free and open software. The view of the organisation is that software is different from material goods in a fundamental way in that one is not deprived of one's software in copying to others (known as non-exclusionary). They believe that once software is sold, the rights to its use is also part of that sale, and the buyer should be entitled to use it as they wish.

O'Reilly (n.d), with some exasperation, describes a "battle of ideological control" between two factions in software development. Both factions claim that distributing computer program's source code provides opportunities to change and extend software, with "a positive, reinvigorating effect on software development at large", but they each reach this with very different ends in mind. One faction, FSF, fervently

believes that this is achieved by doing away with IP altogether, and will as a result prevent competition, greed and secrets. FSF's GNU project has made possible the free operating system program Linux. The other faction, postulated by Eric Raymond, presents the Open Source Initiative (OSI), a utilitarian approach, where users of any sort can contribute to the ongoing process of improving existing software, and ultimately increasing the collective intellectual quotient (or IQ) of its software development community. OSI success stories include Netscape, Perl and Apache.

Another similar effort, Creative Commons (<http://creativecommons.org/>) is a non-profit organisation that promotes the creative re-use of intellectual and artistic works and is devoted to expanding the range of creative work available for others to build upon and share (Hill, 2004). However, while Creative Commons provides flexible copyright protection for works by authors, artists and educators, they must be managed through their own IP licences.

Much of the debate for or against any copyright protection leads us to have an understanding of the nature of the media, the Internet, and the ease at which sharing and collaboration of IP can and has occurred. The next section explores the purpose of the Internet and the ongoing tensions that exist between freedom to share and IP.

2.4 Internet and IP

The intended purpose of the Internet was to enable collaboration and sharing of information, firstly, in the 1950s for the US Defence force, and then by 1969 for researchers of universities, before commercial use in the early 1990s.

Today tensions exist between freedom to share and ownership of creativity and the rights to be rewarded. With the rapid developments in digital technology, the digital movie and music industries struggle with the implications of piracy and peer-to-peer networks, such as Gnutella and Kazaa. These tensions are demonstrated in the following court cases (Spinello & Tavani, 2005):

- *A & M Records, Inc versus Napster (2000)*. Napster's free file-sharing software meant that users could locate and download digital music from someone else's hardware without caching or copying music files to Napster's servers.
- Microsoft antitrust lawsuit (*US versus Microsoft*). Microsoft leveraged its dominance in the web software development industry by launching its Windows operating system platform with a proprietary built-in browser, Internet Explorer. Microsoft had hoped to squeeze out Netscape's Navigator browser. The argument was that the single access or gateway to the 'intellectual' commons of the Internet was stifling innovation.
- *e-Bay versus Bidders' Edge (BE) (2000)*, (Bell, 2000). This case was about the use of an automated querying program, robot, web crawlers or similar devices trawling through other sites for information. e-Bay objected to trespass by spiders, automated queries, crawlers and bots. In court, BE's claim was that there was no harm and the intent was for the common good of user doing searches for information. Co-operation was called for and it was agreed that Internet users should make sacrifices to maintain the Internet's

intended purpose. It was noted that e-Bay thrived on the Web's openness and free flow of information and benefited hugely from the economical opportunities of the Internet. Therefore, in return, it was felt that e-Bay had some obligation to contribute to that openness and not enclose publicly available information to suit its own competitive interests. A moral obligation to allow for such searches was called for.

Spinello & Tavani (2005) recommended that a balance was required between no copyright protection of digital IP and recognition and reward of digital IP. Such a balance, however, would require some sort of management of IP rights, as investigated in the next section.

2.5 Management of IP rights

A balance is required between the removal of all rights at one extreme and a protection that is over zealous enforcement where the use of restrictive controls will not allow 'fair use'. Crewes & Thierer (2001) were right in that there were "no clean-cut, easy answers in this [IP rights] debate", and in fact both extremes can deter the creation and use of intellectual objects. They claimed that IP disputes always involved trade-off between the legal protection for IP works and free expression and exchange of ideas.

Hill (2004) identified a number of ways in which IP rights could be managed. The principles that they relied on were as follows:

- Digital Rights Management (DRM) that involves a range of technologies and standards to protect digital works. DRM systems are the subject of the section 2.6 "Digital Rights Management (DRM)".
- Trusted partnerships where effective frameworks can be built to manage IP between specific individuals and/or organisations. For example, Sanchez, Parra, Sanjuan and Sicilia (2004) proposed a "LO design by contract" architecture, where interaction between Web Services (that enabled access to public LO repositories) and agent technologies ensured that a dynamic course composition met their user requirements, and usage fees, usage statistics and access was managed.
- Open share of IP, like CreativeCommons (<http://creativecommons.org/>), where a framework managed a range of licences that allowed the re-use of original works and registered users.
- Deconstruction of LOs where Wiley (2003) believed that if you deconstruct an LO down to its smallest components, there would be no IP. Wiley, described a focus to being on how to use "a library of free, non-rivalrous educational resources" to reconstruct components for entirely different contexts. He claimed then that management of IP of the smallest component, was not required at all!

Protection of IP is achieved by law and technology, and is rarely in isolation of each other. The next two sections look at protection of IP rights, firstly, by law and then by technology.

2.5.1 Protection of IP by law

Many nations have put in place copyright laws for protection of IP that address the principles of fair use and first-sale.

NZ IP law

In NZ, copyright protection laws, in relation to original work, are defined in the Copyright Act 1994. They allow "copyright owners to control certain activities relating to the use and dissemination of copyright works" (Ministry of Economic Development, 2005). Registration of copyright is not required in NZ; copyright exists automatically. However, while not necessary, acknowledgement that the work is protected by copyright is recommended and is represented by three attributes: © symbol, the name of the copyright owner and the year the copyright work was first published. For example: © IPeMS, 2005.

Since 2001, a review of the implications of digital technology for the NZ Copyright Act 1994 has resulted in the drafting of legislation to amend the Act. The legislation is planned to be fully released to the public once the Copyright (New Technologies and Performers' Rights) Amendment Bill is introduced to Parliament. The review assesses the "applicability, adequacy and operation of the Act in the context of the development and adoption of digital technologies, including the Internet" (Ministry of Economic Development, 2005).

The NZ review is also looking at the implication of digital technology amendments in NZ law to two international Internet treaties negotiated by the World Intellectual Property Organisation ("WIPO" <http://www.wipo.org/>) of the United Nations:

- WIPO Copyright Treaty ("WCT" <http://www.wipo.org/treaties/ip/wct/>) and
- WIPO Performers and Phonograms Treaty ("WPPT" <http://www.wipo.org/treaties/ip/wppt/>).

Together, these two Internet treaties are known as the WIPO Internet Treaties.

The NZ government has recognised that digital technology facilitates the ease of copying, manipulation and dissemination, at minimal effort and cost, at an identical quality to the original. As a result, discussion has also included looking at implications of any changes to the Act on the ability of the public to access works. The NZ government has recognised that access issues will also need to be addressed by technology protection measures.

The approach that the NZ government has taken to review the Copyright Law 1994 is underpinned by the following principle:

The key principle that guides the development of copyright policy is the enhancement of the public interest - copyright laws must benefit New Zealand as a whole. While the term "balance" is frequently used when discussing copyright policy, this balance is about the wider public interest, rather than simply achieving a middle ground between the competing aims of creators, owners and users of copyright works. The Ministry prefers a more principled approach to law reform, based on broad principles, not narrowly defined and negotiated rights and exceptions. (Ministry of Economic Development, 2002)

Under the NZ Copyright 1994 Act, as it stands now, the author of a piece of work has "exclusive right" to do certain "restricted acts" in relation to the work. These include:

- copying the work;
- publishing, issuing or selling copies of the work to the public;
- the right to perform the work in public;
- playing the work in public;
- showing the work in public;
- broadcasting the work or including the work in a cable programme service;
- making an adaptation of the work or doing any of the above activities in relation to an adaptation; and
- authorising any other person to do any of the restricted activities listed above.

This means that individuals/organisations can determine, within the law, what exclusive rights and restrictive acts they will 'give away' when publishing their works. Authors of original works can attribute permissions and constraints to their work for the use by others, as long as the restrictions are within the law. This is observed around legal contracts between individuals/organisations, both private and public. For instance, a standard clause about IP rights for work done in contractual services for the NZ Ministry of Education (MoE) is typically seen in their contracts as follows:

Intellectual Property Rights (including copyright)

- All intellectual property rights in all works and material produced under this Agreement ("new works") shall remain the property of the Ministry.
- Both parties shall continue to own all intellectual property rights that they held prior to the commencement of this Agreement.
- The Contractor agrees that it will not itself, or through any agent or third party, copy, decompile, sell, lease, licence, sub-licence, or otherwise deal with the Ministry's intellectual property rights or any adaptations, variations, modifications, copies, release, or versions or have any other programme written or developed for itself on any other work undertaken under this Agreement without the Ministry's prior written consent or licence.
- The Contractor will not infringe any third party intellectual property rights in developing any work under this Agreement, and indemnifies the Ministry against any third party claim against the Ministry for breach of the third party's intellectual property rights, as a result of the source materials used by the Contractor in delivery of the services under this Agreement.
- Unless otherwise agreed in writing, the Contractor will grant or gain all consents as may be necessary to enable the Ministry to use the works developed under this Agreement at no additional charge (NZ MoE. Retrieved sample hard copy 10 April 2006).

A huge industry has been built around protecting IP rights, both locally, in NZ, and internationally. There are many roles that contribute in some way to maintaining copyright laws in our commercial world. For instance:

- The role for legal editors/writers of contracts is required to ensure that documents are robust and legally bound.
- The role of compliance and enforcement agencies of copyright is an expensive business. There are agencies, for example, whose sole purpose is

to police copyright in NZ - two major copyright watchdog companies - Copyright Licensing Limited - CLL (representing Book Publishers Association of NZ and the NZ Society of Authors) and Print Media Copyright Agency (a division of NZ Press Association Ltd representing some newspapers and magazines). In June 2005, a report (Fogarty, 2005) was published on AJ Park's IP lawyers and consultants web site, that an-out-of-court settlement between CLL and Waiariki Institute of Technology (Waiariki) had ended. This case highlighted the potential danger faced by educational establishments when dealing with copyright material. To settle the dispute, Waiariki paid \$48,000 to CLL and agreed to take a copyright licence. CLL's action in this case made it clear that it would actively pursue infringers of copyright and would sue educational establishments if necessary.

While technology may be used to 'control' IP, it is usually the law that will resolve an IP dispute. For example, a non-profit international organisation, Electronic Frontier Foundation (EFF, <http://www.eff.org/about/>), founded in 1990, exists for the sole purpose of defending in the courts, free speech, privacy, innovation, and consumer rights today, in the digital world. They blend expertise of lawyers, policy analysts, activists, and technologists to achieve significant victories on behalf of consumers and the general public, such as the following two examples:

- *Sony BMG (Sony BMG Litigation Info, n.d.)*
EFF held Sony BMG accountable for infecting its customers' computers with software that, as part of a misguided attempt to restrict consumer usage, created grave security vulnerabilities and let the company spy on listening behavior. The settled lawsuit required Sony to take CDs off the market and repair any damage done, and fix the security flaws.
- *MGM versus Grokster and the INDUCE Act (MGM v Grokster, n.d.)*
EFF defended the right of innovators to build new technologies without begging Hollywood's permission first. Hollywood has hoped to control innovation by overturning the "Betamax doctrine" - the bedrock principle that the developer of a technology with substantial legal uses cannot be held liable for users' copyright violations. In the Grokster case, 28 of the world's largest entertainment companies sued the distributors of peer-to-peer (P2P) file-sharing software. EFF defended one of the software companies all the way to the U.S. Supreme Court, which refused to overturn the Betamax doctrine or to force technology companies to redesign multipurpose technologies. Meanwhile, EFF helped block the INDUCE Act, a bill that would have severely undermined the Betamax doctrine.

While protection of IP has been achieved by law for centuries, it is the digital technology that has offered new opportunities to enhance protection of IP in an automated way. The "new way" is to use both types of protection of IP together. The next section introduces technology that can provide protection of IP.

2.5.2 Protection of IP by technology

There are number of ways in which IP can be protected by using technology. In the first instance, a piece of work can be uniquely identified by using, for example, a licence number, tagging, watermark, or fingerprinting techniques. Code certification and authentication, encryption, locked files controls, rights messaging languages,

and rights messaging protocols are some of the technologies that can be used individually or be integrated into a single system to manage IP rights.

A system that manages digital rights is called a DRM system integrating at least some, if not all, of these technologies. In the next section we will take a closer look at DRM and the technologies they use to protect IP.

2.6 Digital Rights Management (DRM)

The IMS Global Learning Consortium (<http://www.imsglobal.org>) describes DRM as a group of technologies and standards that provide a systematic approach to support the management of IP of digital works. Fausett (2001) claimed that the ultimate aim of DRM systems was to solve problems for the creator.

For example, a DRM system could manage the collection and audit of revenue and royalty rates of an author's works from different distributors delivering to different markets across the world. A unique identifier could assist counting as well as playing a role in controlled delivery of media-rich IP over broadband. Another DRM could use a property of the IP to specify the type of data, for example, voice or streaming movie, and could create priority when routing the IP, as well as tracking its distribution and destination on the Internet.

Fausett (2001) claimed that DRM would ensure that online site operators dealing with 3rd party IP would stay within their licence, for example, by limiting downloads to only those countries that are covered within the licence agreement.

The following sections look at DRM technology a little closer. DRM systems are generally not simple, but are complex and are still evolving.

2.6.1 DRM technology

Coyle (2003) called DRM the "technology of rights" for the content writer or creator of works. While copyright law cannot stop the user from copying, the technologies of DRM can be "potentially a nearly absolute protection of works". She described a trend whereby authors will increasingly control more of their works and publications, using the following technologies for controls:

- Constraints on the use of a digital file can provide control to the way a user can use the works. Constraints, for example, could include printing one page at a time, or disable print function entirely, or copy selected information only, or disable the text-to-voice functionality.
- Encryption is a control only on access. An encrypted file can still be copied or moved, even though it may not be able to be read! If the key is given with a licence to decrypt, there is no control on copying of the IP material. DRM has the potential to use a technique to tie the encrypted digital file to a particular hardware. Ideally, the best solution would be to tie the file to a person to use on any hardware. Sophisticated solutions using 'trusted systems' are emerging as new DRM technology that can do just that.
- The emergence of rights expression languages (REL) provides a vocabulary and syntax that allows a publisher to designate a complex set of usage controls. For example, a publisher may want to:

- control the number of times a particular information can be read (or accessed), or
- set time controls allowing the user to limit the time and date range that the file can be accessed, or
- manage distribution, sale and lending of the digital file.

RELs work with quantitative measures that exist within the computing environment. For example, such measures could include time and units that can be counted (such as, a page or a paragraph of an e-book, or a track of a DVD, or an hour of music), and value exchange (such as, a price of music could be associated with an hour of music, made by a payment of money or by using a non-monetary exchange like frequent flyer miles). Examples of generalised REL include:

- Open Digital Rights Language (ODRL), an XML-based rights expression language, developed by Ianella (2001), who recognised that ODRL could provide the semantics for DRM expressions. Such rights expressions include user permissions, constraints of time, units or territory and payments or exchange of value requirements (Coyle, 2003).
- eXtensible rights Markup Language (XrML), a product of ContentGuard (<http://www.contentguard.com/xrml.asp>), adopted as the rights language standard for the Moving Picture Experts Group (MPEG), the group developing standards for digital audio and video.

The system of Creative Commons (<http://www.creativecommons.org>) could be considered to use a simple REL, allowing creators to select the licence that best described the permissions and constraints they want.

Examples of REL that are specific to a particular task could include e-book reader software packages that allow you to read a book online, such as Acrobat Adobe e-Book or Microsoft Reader. Microsoft Reader has 3 levels of protection to a digital file. Each level represents increasing controls, and hence an increased degree of protection and associated cost. The least protection will not allow any modification to content. A middle level protection will retain names of the creator and publisher on a first page, and the highest protection will use encryption. On purchase of a licence, a key can activate the computer to decrypt and allow the file to be read. Activation in Microsoft Reader is achieved by associating the user's Microsoft Passport account with the specific copy of Reader on the user's computer. A unique identification software module is downloaded to the computer's memory, which prevents the e-book from being opened on any other device (Coyle, 2003; Ghosh. ed., 2005).

Another specific REL is Publishing Requirements for Industry Standard Metadata (PRISM), which is an industry standard for syndicated magazine and newspaper articles, and includes copyright statements and expiration dates on files that have been established in business' contracts. PRISM does not use automated enforcement (Coyle, 2003).

However, RELs are only standardised languages of rights; they do not enforce IP rights. Enforcement of IP rights can come about if integrated in a trusted system.

A *trusted system* is described by John Erickson of Hewlett-Packard Laboratories as a system that allows digital content to be sold or distributed within a secure end-to-end system (Vora, Reynolds, Dickinson, Erickson & Banks, 2001; Erickson, 2002).

Ianella (2001) described DRM systems as complex and evolving to enable digital works to be shared in safe, open, and *trusted* environments. The next section looks at the complexity of DRM systems.

2.6.2 DRM is complex

As well as managing and controlling the use of digital content using technology, DRM is also involved in documentation of the rights, permissions and policies of the digital objects. DRM *is* complex.

Standards and trusted systems

A demand for interoperability has seen the emergence and maintenance of standards of DRM systems in open organisations, such as observed in International Digital Publishing Forum (<http://www.idpf.org/>), Moving Pictures Experts Group (MPEG) for ebook and multimedia sectors, and in industry from the Internet Engineering Task Force (<http://www.ietf.org/>) and World Wide Web Consortium (<http://www.w3.org/>).

A trusted system uses a DRM architecture that assumes standardised structures for identification, code certification and authentication, metadata, cryptography, controls using a rights expression language, and rights messaging protocols. The rights of works are distributed securely between one party and another, and an agreed value exchange of payment or lending is established (Erickson, 2002). One such system, for example, The Le@rning Federation (2002) documents its most recent version of a Rights Management Specifications online.

It is the use of standards that have allowed DRMs to evolve. AEShareNet (<http://www.aesharenet.com.au>) is another example of a complex DRM, using trusted systems that manage digital IP in an educational environment. The purpose of their business is to connect people who want learning material with those who own them, and automate the negotiation and licensing processes.

Trusted systems, however, have not always been accepted in a positive way. In 2002 Microsoft released information that they were developing an operating system called "Palladium" that they called a '*trusted*' computing platform. Microsoft claimed to provide a secure environment for other applications, by using technology to embed "unique machine identifiers". For example, if an online music store downloaded a song that had associated rights instructions to play just once, "Palladium" had the ability to put restrictions in place to allow the song to be played only once from that machine (Costello & Sayer, 2002). The news caused a lot of controversy. Stallman of FSF claimed that Microsoft would have more control over your own machine than yourself, and that IP about you and your machine would be collected. The debate of security issues around DRM and open-source software such as the "rival operating system Linux" became more complex. Microsoft turned to partners such as IBM and Intel to eventually launch the software architecture as Next-Generation Secure Computing Base (NGSB) to implement controversial parts of "Trustworthy Computing" concept in future Microsoft Windows operating systems.

Because of the potential ability of DRM to be exact and uncompromising, the debate about open source software versus private proprietary content, and the abandonment of private ownership versus managed trusted systems continues. Resolving the debate is not easy. The next section returns us to the principles of Spinello & Tavani (2005) who made “a call for balance” in “fair use” of IP.

2.6.3 Resolving the ‘fair use’ debate

Spinello & Tavani (2005) emphasised strongly that a balance is required between over- and under- protection of IP of digital objects. They suggested that understanding the principle that information should be free and shared could help us to frame copyright policies that:

- encourage flow of information and its sharing; and
- reward fairly the authors and creators of literary and artistic works and software manufacturers.

DRM manage licences through software controls that are implemented by quantitative measures of computer devices. A DRM is not an implementation of copyright law but a management system for protection of digital works. Debate around fair use and first sales rights will continue and the law will continue to recognise users’ rights of fair use. However, in the end, a DRM system, can only implement those rights that have been defined within the rules and standards of the DRM. For instance, a creator may constrain the number of pages to be printed to six pages, and yet it still may be fair use to print seven pages.

Distrust in DRM could potentially stall innovation (Coyle, 2003). There exists a perception that DRM technology threatens the intellectual freedom through loss of “information commons”, by excessive and automated constraints and restrictions, and that these will go beyond the ‘fair use’ copyright laws. Also, distrust exists where users may be unable to experiment on a trusted platform. For example, a click–once licence means that user must first agree to the level of rights before proceeding to use a digital object.

Coyle (2003) claimed that developers building DRM systems had the following challenges.

- To find the balance to regulate and only embed ‘fair use’ rules in DRM.
- Archiving and future use of works have implications whereby the system controlling the rights no longer exists, but the digital files still do. The question must be asked how will the future exercise the use of *these* files.
- Trusted DRM systems require strong security, end-to-end from creator of digital file to the end user.
- While there are generic rights for IP of hard copy objects, DRM with REL language could have a different set of rights for each publication, and this would demand a complex database of rights and users information.

This research aims to build a prototype framework that manages IP rights that are determined by the creator and that uses ‘trusted partners’ to allow trade, with or without payment, to use the IP. The next section of this report focuses on one type of IP, the digital learning objects.

2.7 Digital learning objects

For the purpose of this research, a learning object (LO) is a digital file or group of files that can be reused and redistributed, and that can be used to generate e-learning activities or experiences (Richards, McGreal, Hatala and Friesen, 2002; <http://ltsc.ieee.org/>). These files may contain reusable content that may range from simple static Microsoft Word document to a dynamic interactive multimedia file, like Moviemaker (Hill, 2004). These files may be used with or without modification, to enhance teaching/learning. LOs also have the potential to be repurposed, whereby the same content could be used very differently than what it was originally intended for when created (Duval and Hodgins, 2003).

LOs are generally organised into repositories, making up a set of distributed resources, and are stored on provider web servers and distributed using many of the same mechanisms as web pages. LO repositories have the following attributes (Richards, McGreal, Hatala and Friesen, 2002):

- They are based on database technology.
- They may contain LOs that are of specialist focus, for example, AVIRE, which specialises in architectural learning objects.
- They have effective and efficient mechanisms to encourage discovery (such as metadata-enabled search mechanisms) to identify the storage location of the LO, their exchange and reuse.
- They can be scalable to a national level.
- They use distribution technology of the Internet to deliver objects in a repository to the user. For example, repositories can be networked together to form a collection of repositories, often with a single gateway.

Examples of large LO repositories include:

- POOL (Portal for Online Objects in Learning) project, EduSourceCanada
- Careo - <http://www.careo.org/> (Alberta)
- MERLOT – <http://www.merlot.org> (USA)
- ARIADNE Foundation - <http://www.ariadne-eu.org/> (Europe)
- EdNA – <http://www.edna.edu.au> (Australia)
- Te Kete Ipurangi – <http://www.tki.org.nz> (NZ)
- The Learning Federation – <http://www.thelearningfederation.edu.au> (Australia)
- NIME - <http://www.nime.ac.jp/index-e.html> (Japan)

While some of these repositories are standalone, an example of the next generation LO repositories is Global Learning Objects Brokered Exchange (GLOBE). GLOBE facilitates a federated search using “trusted repositories”. In 2004, organisations from Australia, Canada, Europe, Japan and the US announced this global alliance. This international consortium provides a distributed network of shared online quality learning resources or LOs, to educators and students around the world. GLOBE (<http://globe.edna.edu.au/globe/go>) “aims to connect the world and unlock the ‘deep web’ of quality online educational resources through brokering relationships with content providers”.

The next section investigates research of models that are involved in trade of digital LOs.

2.7.1 Trading in Learning objects

DRM is emerging as the solution to manage trading of LOs on the web (Barron, 2002; AShareNet - <http://www.aesharenet.com.au/>).

Researchers Santos & Ramos (2003) described a conceptual model that applies to eLearning to promote protection and Internet-based licensing of learning objects in a trusted system.

Downes (2002), in blog discussions about a digital rights model that ensured fair compensation for use of LOs, identified some issues to consider:

- How do you ask for payment (and specify conditions)?
He suggested that the use of standardised files such as XML files would specify a set of rights and conditions, and cost. Downes identified a variety of schemata that already existed for creation of such metadata files to describe digital rights, for example, XrML (by Oasis - <http://www.xrml.org>), and ODRL (an open digital rights markup language - <http://odrl.net>). Organisations like IEEE-LTSC are dedicated to developing technical standards, recommended practices, and guides for learning technology (<http://ieeeltsc.org/>). He claimed that Creative Commons project (<http://www.creativecommons.org>) has template licences that have embedded rules to facilitate sharing of IP on Internet.
- How does the list of learning resources get presented?
Downes suggested that there could be a mechanism that profiles the user at work and at home. If set up on the employer's servers, a profile metadata schema could be developed (such as the XML schema code viewed at <http://cml.sourceforge.net/schema/STMMML/EXAMPLES/PERSONAL.XSD>), and restrictions to particular resources could then be controlled. Consideration should be given to using a third party personal profile service, such as Microsoft Passport.
- How do you make the payment?
After a list of resources was presented, a user would select a resource and retrieve its digital rights information. Downes identified that a request for the LO, and a response granting the request for the LO had to be generated. Downes claimed that the approach must satisfy the users, content providers and other stakeholders, such as ministries of education and school boards. For instance, he identified that the users must retain control over presentation, trust in the payment mechanism, and the procedure for payment must be easy. The content provider would require to provide actual receipt of payment in real time, and trust that the copyright conditions would be observed. Other stakeholders might want mechanisms that included some influence on the selection of resources for use (for example, by cost range or media of LO or age of learning group). Other stakeholders might want a mechanism for payment of resources on behalf of users via licenses or subscriptions, and/or the ability to track use of LOs. While Downes identified a number of third parties, for example CardService, PSIGate, who could be contracted to manage payment, he recognised that their options are often limited. He believed that a service that will represent the purchaser as well as the IP creator is needed.
- How do you make delivery of the Learning object on payment?

Downes described a model of a content distribution network where resource metadata would have to be available to be discovered. Once in place, Downes claimed that the layer of DRM is "almost trivial". He described a service (by a provider broker) that would manage the request to use an LO between the resource provider and the user. While there are payment services and provider brokers, he concluded that he had been unable to find examples of composite tools that are available to anyone who wish to provide or to purchase LOs.

Ianella (2003) reviewed existing DRM systems that enabled trading of LOs. He claimed that the most appropriate mechanism for eLearning community is the "rights-enabled LO" (RELO). Such an LO has "active" metadata attached to it that describes both the contents of the LO and its behaviour (or the way it is controlled during use). This metadata extends the IMS Learning Resource Metadata (LRM), or formally known as IEEE LO Metadata (LOM), which focuses on describing only the content for discovery purposes.

The issues that Downes presented and the description of RELOs became important background for designing a framework for trading LO online. In the next section, we take a look at the architecture used to design a framework for an IP management system.

2.8 Web Services technology

XML Web Services architecture is proposed as a suitable framework for IP management system. This section presents the knowledge behind the Web Services architecture and justifies its use in designing a framework that creates an online contract to manage IP.

2.8.1 Web Services architecture overview

Web Services architecture is described by three fundamental roles - service provider or publisher which makes the Web service available on the Web, a service requestor (usually a client application) that will find and consume the Web service, and the service registry or broker which provides a logical centralised directory of services (IBM web services architecture team, 2000; Cerami, 2002; Hill, 2004).

The W3C Web Services Working group (2004) defined a Web Service as:

A software system designed to support interoperable machine-to-machine interaction over a network. It has an interface described in a machine-processable format (specifically WSDL). Other systems interact with the Web Service in a manner prescribed by its description using SOAP messages, typically conveyed using HTTP with an XML serialization in conjunction with other Web-related standards.

Web Services are small segments of code, that usually perform some common function, such as looking up a database to authenticate a user or carrying out a calculation for a larger Web application. They are modular, self-describing, self-contained applications that are accessible over the Internet. Because they are based on standardized XML messaging system, applications using any platform,

object model and programming language can communicate with them to exchange information (Barefoot, 2002; Jacobsen, 2002).

Quality attributes, such as, availability, performance, compliance, security, inexpensiveness and reliability must be taken into consideration when building Web Services architecture. XML Web Services are technologies that follow industry standards for networks, application interfaces and protocols. They can be discovered by a URL address, and reused again and again by other client Web applications. Chatterjee & Webber (2004) claimed that ultimately, Web Services in a 'trusted' system or an enterprise (that are made up of an aggregation of Web Services) can provide an environment that is totally reliable, absolutely secure and extremely functional for specific groups of people like customers and partners, where interconnection between legacy systems are generally incompatible.

Web Services are based on XML and use platform-independent messaging protocols such as SOAP. XML schemata are powerful and complex tools for creating structure and validating that structure in compliant XML documents. The XML Schema language is also referred to as XML Schema Definition, and hence an XML schema file has typically an ".xsd" file name extension. An XML schema describes the structure of an XML document (W3C Architecture Domain: XML Schema, n.d.)

An organization and its "trusted" partners can benefit by using the same XML schemata to exchange data. Schemata are also useful for keeping XML documents consistent throughout a single organization.

The next section looks at a few examples where Web Services architecture has been used in NZ.

2.8.2 Application of Web Services in NZ

Examples of XML Web Services in NZ have not been easy to find. An information system manager (anonymous) explained that in NZ as a result of multiple bandwidths between locations, performance of NZ networks are affected by bandwidth and latency (that generally cause delays in processing network data). Because XML Web Service applications usually involved requests from multiple locations, bandwidth and latency could be limiting factors on Web Service performance. He also felt that another limitation of SOAP was that SOAP used tools that often carried unnecessary 'extra baggage' for their task and hence required increased bandwidth. By having pre-made 'wizard' tools on the development platform, Web Services tended to also distance the developer from the code and that a developer required specialist training. These may well explain what Hill (2004) discovered in her assembly of examples of Web Services in business and education from around the world. Out of 24 applications of Web Service architecture in business/education, only one was from NZ. USA does not suffer from multiple bandwidths and therefore less latency, and enthusiasm for Web Service technologies in USA in business and education was definitely more pronounced.

However, the following NZ examples of Web Service applications were found:

- SchoolSMART is a Web Service deployed within the School's Monitoring and Analysis Group of NZ Ministry of Education to capture, integrate and deliver information, collected from schools and the education sector. It applies a set of predictive risk indicators to establish a profile of each school (Hill, 2004).

- ERLAWS (Eastern Ruapehu Lahar Warning System) was commissioned by the NZ Government in July 2002 for Department of Conservation (Department of Conservation, NZ, n.d.) to develop an alarm/response system to monitor Ruapehu crater lake levels and provide early warning of an imminent lahar. Web Service technologies were used initially to return sensor data from the database to an ASP.NET web page to alert police, Department of Conservation, local authorities and other agencies (Waldeck, D., personal communication, 06 September 2005).
- Catalyst IT Limited (<http://catalyst.net.nz/>), a NZ software development company, used XML Web Services for application communication at a client's request especially for modules of the open-source software Moodle. A 3-year contract to design, develop, host and maintain the NZ Electoral Enrolment Centre (EEC)'s core electoral roll management system was awarded to them in 2005. This multi-tiered architecture system maintains voter registration details, electoral boundaries and related data for both national and local body elections. XML Web Services have been used to handle requests from the user interface for functions relating to, for example, the presentation of the EEC's web page. However, generally Catalyst used the protocol XML RPC (Remote Procedure Call) in preference to SOAP for messaging between two applications (McMillan, personal communication, 16 June 2006).
- Te Ara, the online Encyclopedia of NZ, (<http://www.optimation.co.nz/customers/case-study-te-ara.html>) developed by Optimation NZ Ltd demonstrates integration skills with content and document management technology, and with the Microsoft .NET environment. Custom-developed .NET Web Services handle specialised tasks such as automated content upload.

2.9 Summary and conclusion

A literature research was the beginning of a journey to answer the initial questions of this research. It provided the background material to understand the theory around IP, and its application to license use of digital objects on Internet, using XML Web services technologies. The review also assisted in the design of the initial survey to answer the question "what is required for an online contract to license the user to use LOs?" and the design of the prototype.

It was found that theories underpinning IP have their beginnings in rights of land property as far back as 17th century. However, it is clear that there are some obvious differences around attributes of digital IP being non-exclusionary (where the creator still retains the creative work) and non-rivalrous (where copying proliferates the creative work and does not make it scarce and competitive). As a result there continues to be unresolved tensions today around IP especially reward of effort, 'fair use' and first sales rights of IP.

The advent of the Internet enabled collaboration and sharing of information between similar thinking people, however, a call for balance is made between free use by the user and protection of IP rights of the creator. Protection of IP can be achieved by application of laws and use of technology. The technologies of DRM, for example, constraints on use of object, encryption, REL, standards and trusted systems, are seen as the solution that could maintain a balance between over- and under-

protection of IP of digital objects. DRM are complex and use a range of technologies to protect and manage digital IP rights. However, it is only those rights that are defined in rules and standards of a DRM that can be implemented. There are challenges to developers of DRM systems to:

- identify the balance and only embed 'fair use' rules in the system.
- consider the implications of IP constraints of use in the future after the 'life' of the DRM system.
- develop trusted systems with strong security.
- consider limitations of a complex database of rights and users information.

For the purpose of this research digital LOs are defined as digital objects (or files) that can be reused and redistributed for the purpose of enhancing learning. We generally find LOs in repositories and they have attributes that allow them to be discovered and used for trade. Some existing large LO repositories include POOL, MERLOT, ADRIANE, EdNA, The Learning Federation, and the composite federated repositories called GLOBE.

A number of issues need to be considered when trading LOs, such as, presentation of LOs information and specify conditions of use, the process of payment, and delivery of the LO on payment. XML Web Services architecture has great potential as the underlying technologies for the design and development of a DRM framework for trading LOs on the Internet. Examples of application of Web service technology in NZ include SchoolSMART, ERLAWS, NZ Electoral Enrolment Centre and Te Ara. A possible explanation for the lack of use of Web service technology by NZ software development companies maybe attributed to limiting factors in performance of SOAP, such as multiple locations, bandwidths and latency.

The next stage of this journey is to answer the first research question "What is required for an online contract to license the user to use LOs?"

3 What is required for online contracts?

3.1 Introduction

In order to answer the research question "What is required for an online contract to license the user to use LOs", an initial survey was designed and implemented. The literature review contributed the background material to assist design of the initial survey. This section describes the design of the survey, the questions, the sample collection, findings and analysis.

Analysis of the responses of the survey showed that organisations (educational and business) have varying protection for their IP, but had a clear idea what the essential requirements of a contract should be to manage digital rights.

3.2 Objectives of initial data collection

The objectives of an initial data collection, early in the research, were to:

- identify the existence of policies managing IP of digital objects that currently exist in organisations (education and business) in NZ; and
- determine the requirements of a contract for DRM in organisations that share their resources with external users.

3.3 Data collection

The method of data collection in the initial research was by a survey questionnaire, targeting a sample of individuals in organisations (business or educational) who were seen as potentially having an understanding of IP in their organisation. Endorsement of research findings from the results of the initial survey questionnaire was then sought from a group of experts of ICT in education. The information contained in the initial survey questionnaire is presented in Appendix A.

In the design of the questions, consideration was given to the following:

- The identification of the target audience: The audience targeted for the survey questionnaire was people working in commercial business and education.
- The question types: Some questions were closed questions requiring a yes/no answer, whereas other questions were open questions requiring ideas, views and suggestions, both facts and opinions.
- The length of each question and of the entire survey questionnaire: The survey questions had to be easy to understand and answer, and not take too long to respond. For the study, the researcher required completed surveys with focused answers. To ensure this, questions were short and clear. The survey had 16 questions in total, of which five related to background information about the participant, such as name, business, contact information and so on.
- Context of survey questions: The survey included a clear introduction to put the questions in context for the participants and to explain the motivation for the survey.
- Easy process to answer each question: The survey document was created using Microsoft Word interactive forms, which allowed participants to enter each answer digitally and enabled tabbing from one question to the next.

- Management of responses: A workflow process was administered that thanked the participants, collated the results, and analysed the findings.

3.4 Sampling

Before the data collection began, it was essential to establish an element of trust with the participants. The research procedure therefore involved contacting, by telephone, 30 NZ organisations from a wide range of businesses – school and tertiary education, internet and web service providers, computer consultancies, statutory authorities, research, food manufacturers, and electricity generation and suppliers. From the 30 organisations approached, 24 organisations agreed to participate in the research and became the sample for the initial research.

Consideration was also made to ethics. This research did not collect data that could be harmful or sensitive to the individuals or businesses. However, some thought was given to the way in which private data about the respondent would be stored. Consequently, the information was stored in a database on the local hard drive of the researcher's laptop, and would be destroyed on completion of this research. Assurance to the respondents of a code of practice about non-disclosure or association of data/information with the respondent was given at the end of the survey document (Appendix A: Table 1). A low risk notification was also filed with Human Ethics Committee of Massey University.

The survey questionnaire was produced as a Microsoft Word document, and a copy was sent to each participant as an attachment to an email. Questions were answered by the participants either in the document itself and sent back to the researcher, or they printed the survey out, completed and sent by post to the researcher.

3.5 Avoiding bias

Sample bias may result if the numbers of the sample of the target population are small, or if the sample is limited to a particular demographic group when information is being gathered from the general public. This survey targeted the opinions of people in a wide range of organisations who had some knowledge of the IP in their company. While 24 people initially agreed to participate in the survey, in the end only 15 people actually responded. While the numbers are small, the sampling served the purpose of providing information to 'shape' the components of a prototype of an online contract. The survey was not intended to provide conclusive answers to what an online contract would look like. The findings from the survey were then submitted to five ICT experts in education as a point for discussion and further endorsement (or not). It was the combined responses from the participants of the survey and the ICT experts that contributed to the design of an online contract.

In an attempt to avoid response bias, the following criteria were applied to question design:

- Questions were clear, precise and relatively short.
- Questions were relevant, and matched the research objectives.
- Questions were not "loaded" or "leading" to suggest to the respondent that the researcher expected a particular way to answer.

- One question focused on a single issue.
- Double negative questions were avoided.
- Questions were written in a familiar language with the target audience in mind.

3.6 The questions and results

The questions of the initial survey questionnaire were grouped into 4 sections.

The first section included three questions requesting background information about the participants: the name of their organisation, description of the core business of their organisation, and an email contact address.

The questions of the second section, Section A, identified the existence of policy(s) related to the organization's sharing of resources with external users.

Section B asked questions around the requirements of a contract, and management of sharing of intellectual property with external users.

Questions in Section C concluded the survey, asking if participants wanted more involvement, by offering results of the findings and requesting acceptance of further contact, if necessary, for clarity or more information.

The essential findings of this research came from the background information and Sections A and B. It is the results of these sections that will be described in the following paragraphs. Appendix B: Tables 2 and 3 present the results of Sections A and B respectively. In addition, the purpose of each group of questions is stated, and the type of question is noted.

3.6.1 Questions requesting background information

Fifteen (out of 24) organisations, from a wide range of businesses responded to the initial survey. There were 9 respondents from educational institutions and 6 respondents from business organisations.

3.6.2 Questions and results of Section A

The purpose of the questions in this section was to identify the existence of policy(s) in organisations related to sharing of resources with external users, to satisfy objective one of the initial data collection. The findings (Appendix B: Table 2) were as follows:

- 15 organisations claimed to share their resources with users outside their organisation, but only 6 actually charged for the use of these resources.
- 13 organisations had policies relating to protecting their IP, and 11 claimed that these policies were organisation-wide.
- Not all organisations (8 out of 15) were confident that their IP policies could be legally binding. 4 organisations were sure they would not, and 2 organisations did not give a response.
- 12 people (out of 15) felt that the existing policies in their organisation would enable an agreement between themselves and an external user, to use an

organisation's resources. Two people answered that the existing policies would not, and one person did not respond.

3.6.3 Questions and results of Section B

The purpose of the questions in this section was to provide information about a contract that licenses the use of a resource, and the management of digital rights, in the organisation. The first 6 questions satisfied objective two of the initial data collection. A definition of DRM was provided to assist the respondents to answer the last 3 questions, and their answers reflected both objectives. The findings (Appendix B: Table 3) were as follows:

- At least 10 respondents felt that the components of an online contract to license the use of a resource should include:
 - Name of resource
 - Description of resource
 - Permissions e.g. display, print, modify
 - Constraints e.g. restrictions of its use
 - Terms and conditions of use
 - Acceptance of terms and conditions
- Additional components included acknowledgement of the creator, remuneration of the creator, an exit clause that described permissions and constraints after the winding down of a business partner, and first right to purchase IP on sale of a business.
- The permissions applied to a resource should include display (8 responses), print (8), play (6), execute (5), modify (5) and copy (5). There was a general comment that there needs to be an agreement for permission to use the resource for a specific business reason, and will depend on the resource.
- The constraints applied to a resource should include count (4 responses), place (4), date restriction (4), purpose (7) and who can use it (6). Again, it was important that the constraints were agreed upon before use, and will depend on the resource.
- 10 people claimed that their organisations managed the application and confirmation of a contract manually, and only one digitally, using an automated online computer system. Four people did not respond to this question.
- Only 7 participants claimed to enforce the contract or license to use resource, 4 claimed that they did not, and 4 did not respond.
- Enforcement of a contract included control of time of use of resource, using legal obligations to protect IP, or ensuring that a confidential agreement was signed before release of the resource.
- After reading the definition of DRM, only one person felt that their organisation had such a system, but this response seemed incongruous with their response to saying they had a manual system to manage their IP. Three people did not answer.
- Two comments suggested that their organisations had a crude management rights system and used passwords.

Responses from the open and last question calling for general comments were used in the analysis as appropriate.

3.7 Post survey procedure

On receipt of completed surveys, the researcher acknowledged the respondents, thanking them for their time and participation. At a predetermined time of 3 weeks, 15 out of 24 questionnaires were returned. The results were collated and recorded in a database.

3.8 Seeking endorsement

Endorsement of research findings from the results of the initial survey questionnaire was sought from a group of experts of ICT in education. Seven experts were approached, of which five expressed willingness to comment on the findings of the initial survey questionnaire about the essential components of an online contract. The expert questionnaire can be viewed in Appendix C.

A rich response of views, suggestions and comments was returned. This response served to endorse or disapprove the generic components of an online contract from the findings of the results of the initial survey questionnaire. New ideas and views enhanced the study and were considered in the analysis.

3.9 Analysis

An initial survey questionnaire sampling 15 people from various organisations was carried out to identify if policies for DRM existed in NZ organisations. The survey also determined the requirements of an online contract managing digital rights in organisations who shared IP with external users. Further endorsement was sought from five ICT educational experts. The information that was given to the ICT educational experts can be viewed in Appendix C. The analysis of the findings was conducted by sorting and categorising similar findings into logical chunks of information. The analysis and the literature research helped to shape the framework of an online management system for IP. The following section represents a summary of the findings regarding online management of IP in NZ.

3.9.1 Existence of policies for DRM in NZ organisations

Policy(s) related to an organization sharing resources with external users do exist, however, most participants felt that their organisation was managing their IP manually, with only one organisation claiming that they manage IP digitally using an automated computer system. One organisation participating in the survey felt that their organization was using a DRM system, however, this could not be endorsed, and on the basis of some incongruity with other responses by them, could be dismissed.

3.9.2 Observations of current management to share IP with external users

- Statutory authorities are bound to conduct business publicly by Local Government Official Information and Meetings Act. Information was already being shared freely between similar authorities.
- In education, issues around ownership of IP could become very complex where there are publicly funded projects. For example, NZ's Copyright Act stipulates that everything created under a "contract for service" to the MoE is Crown copyright, unless the contract states otherwise. However, some

organisations commented that IP is sometimes not clear; that organisations also needed to protect their 'patch'.

- Private business' claimed to require robust structures and that investment of software to assist management of IP internally and externally had to be pursued.
- One private business expressed concern that the commercial protection of IP is not always taken seriously by academic institutions.

3.9.3 Components of an online contract to manage IP

- A contract will require at least the following:
 - Title of a resource
 - Author who created the resource
 - Description of resource
 - Permissions, depending on the type and purpose of the resource, could include publish/display, print, play/execute, modify/adapt, copy, or distribute.
 - Constraints will include count (for example, how many), place (for example, available for use in NZ only), duration of use (for example, available for 30 days), purpose (for example, for educational use or editorial use only), who can use it (for example, individual or group).
 - Terms and conditions of use.
 - An opportunity to accept the terms and conditions.
- and depending on the type of resource and its purpose, a contract may also include:
 - Acknowledgment of the creator
 - Remuneration for creator
 - An exit clause that, in winding down a business partnership, should include statements around non-disclosure of trade secrets, non-competition, copyrights and patents, and division of future profits.
 - First right to purchase the business, should the company decide to sell. A food manufacturer felt that where a licence to use recipes was purchased, and the original company (who was the creator of shared recipes) was for sale, that the licensee would like to be assured of the destination of the recipes (the IP). First right to purchase the company was also suggested.

3.9.4 Further comment on permissions

- The meaning of the word "copy" in the context of digital technology referred to make a duplication, and therefore included processes to "forward", or "reformat". For example, converting content of a 'pdf' file to a word processed document like MS Word, or "downloading" or "storing" a digital LO, on a personal computer or a school server.
- The license to "repurpose" should be considered. This is the situation where an 'atomic' object may be used for a different purpose than what the author intended it to be used for (Duval and Hodgins, 2003). For instance, the easy opportunities of media shifting allows, for example, a single music MIDI file to be viewed as a score, to be heard in various skins (or designs) or viewed on screen as abstract shapes. XML files can similarly be published or repurposed in various transformations.

- It was felt that components of DRM should not be viewed in isolation, but must always be related to its context. For example, for public domain government information, any DRM restrictions should be minimal, if any at all. A greater emphasis should be placed on meta-tag descriptors that will ensure that the information was discoverable. For copyright material, the simple protocol that applied to the print world should also apply in digital technology, and that is "ask the permission [at the source] of the author". It was felt that the Internet provided an unparalleled opportunity for two way communications, where users consult with and gain the permission of digital authors. This would also mean that at the time of publication, authors would not be required to think about all the combinations of situations in which their LO should or should not be used.

3.9.5 Further comment on constraints

- Monitoring a release of an LO for use in cyberspace was seen as difficult. The constraint "count" was easier to manage in print publishing than in digital technology. For instance, the following questions were asked: Is it possible that a DRM could manage the use of an LO on a network of a 1000 users, that is constrained for use by 5 users accessing the object at any one time; or that only 10% of the IP document could be copied? And how would a DRM manage a commercial issue where an LO was resold for profit?
- It was felt that there was a need to distinguish between use by a non-profit and a profit organisation. One institution included a constraint on use of their resources, for instance, to allow use "for promotion". They felt that an item that was not strictly for "instruction" should be separate from an item used in a course guide or advertisement to promote the resource.

3.9.6 Legislation in NZ

- One expert pointed out that existing requirements were explicit in the current NZ Copyright Act 1994, and that as a result of recent reviews on the implications of digital technology for the Copyright Act 1994, the amended legislation was in its final stages of drafting.
- One respondent claimed that most academic institutions had issues with NZ's IP and Copyright Act, and their associated links with employment contracts. Many institutions utilised a copyright broker, such as Copyright Licensing Limited (CLL) in NZ, and there was concern with copyright management and other countries. The NZ MoE had identified that this is one of the critical areas that must be addressed by tertiary institutions (and other educational institutions) when developing an e-Learning capability. However, it had been observed that few tertiary applicants bidding for the e-Learning Capability Development Fund in 2005 attempted to address this area.

3.9.7 Regulation - Monitoring and compliance

- Some organisations felt that there was a reliance on copyright notices and that compliance was not yet very well developed in NZ.
- There are examples of efforts to manage IP with 'cunning' technology solutions which have often been thwarted by discoveries of more cunning ways to circumvent the restrictions. As a result DRM is not necessarily the best way to manage IP commercially. In one attempt to combat piracy, the global DVD marketplace was divided into 6 regions. The intention was that

all DVD movies are marked with a regional code. At any one time, a DVD movie released in one region could only be accessed/viewed from a disk in that region, and would not play on another DVD player in any other region. We were reminded that it did not take long before the DVD player electronics industry produced multi-region players that allows a DVD disk from any region to be played.

3.9.8 Other opportunities to manage IP

- Some organisations felt that DRM might be overkill and that it was easier to consider free share from the public domain. Managing IP was seen as difficult. There was evidence of growing interest in the use of open source software, and collaboration by means of 'wikis' and Creative Commons licensing.
- It was suggested that file exchange opportunities could exist, for instance, for objects such as photographs on a brokering site, such as TradeMe. Such a proposal could allow:
 - Single one off payments or micro-payments could be per download, starting at \$1 for a low-resolution image, increasing to about \$10 for mid-resolution (212 dpi). Micro-payments could accrue until they trigger an automatic email for response, then direct credit to the supplier's bank account.
 - Bulk purchase or macro-payment could be negotiated by government agencies, for example, MoE to purchase objects from suppliers for permission to use (free or cheaper) nationally. Examples of this exist in education with the Australian government, and NZ MoE has similarly made available software to the school sector.
- DRM could use a parameter that reports usage. Commercial users of the web (e.g. Amazon, eBay) encouraged feedback from users; and this affirmative (or otherwise) information provided a very effective internal mechanism for maintaining quality and building confidence. Educators could use this as a measure of confidence of quality assurance in assessing and using digital LOs.
- Payment was expected as a right to the creator. One organisation felt that if NZ's education increasingly followed a business-client model, that rights and permissions to use objects should follow a similar model. In other words, if the creation is private, then educators should not deny income to a creator. Consequently the creator would be encouraged to create again.

3.9.9 Satisfying the IP rights of others

- A lot of time can be consumed by an organisation to satisfy IP rights of others. For example, in one organisation, to satisfy the IP of a front cover of a document for an Art History course, 14 permissions had to be gained from the artist and from the collector of each of the 7 embedded art works, while the overall collage was owned by the educational institution.
- Another organisation commented that rights to the use of music, pictures, and artwork could prove to be difficult, for example, for recordings with Australasian Performing Rights Association (APRA) (<http://www.apra.co.nz/welcome.htm>).

3.9.10 Need to follow standards for schemata, protocol and metadata

- The system needs to be easy! Discussion focused on attributes that a system would have to be 'largely' automatic and seamless.
- A claim that schemata of LO repositories should follow international standards, such as, International Organisation of Standardisation (ISO), Dublin Core etc.
- Interoperability required standards of protocol in communication for request and responses, across different operating platforms.

3.9.11 Philosophical debates – more research questions posed

- How far do we need to regulate? For instance, do we want more constraints on access to and use of digital information than analogue information to protect the rights of the producer? Or are there other mechanisms to remunerate authors and creators (that is, pay authors adequately in the first place, and have equity value with other jobs), promote open access to digital information, and thus reduce rules and regulations around the use of a learning object?
- Should information be free? If we acknowledge that the original purpose of the Internet was for accessing information easily and collaborating/sharing with others, then, publishing to the Internet should be shareware, and users of this information should be free to use, develop, build on, reformat etc.
- Who will gain the most from regulation of IP? One of the biggest concerns is while DRM issues are driven by players who seek to commercialise the Internet and profit from it, the increased regulation may mean that the people most profiting from regulation and compliance will be lawyers.

3.10 Conclusion

The information gathered from the initial survey questionnaire and the endorsement by the ICT educational experts contributed to the understanding and shaping of an online application that would manage IP.

The research began with a focus on management of IP rights using DRM systems. From the literature and from respondents of the initial data collection, the researcher identified that there was a perception that such systems had excessive constraints and restrictions on use, and there was an assumed understanding that DRM *always* involved payment to license for use of resources.

From this point in the research, a shift was deliberately made by the researcher to focus on a framework that would manage IP of digital LOs online without reference to DRM.

4 A framework to manage Intellectual Property of digital learning objects

4.1 Introduction

A framework to manage IP of digital LOs using XML Web Services technology could provide remote access to, and manage reuse of, digital LOs for users on different operating systems (Hill, 2004).

The framework represents a 3rd party application and offers an online service to check authentication of the user, provide a global search for LOs, and a contract to manage IP rights. Such a framework is named Intellectual Property electronic Management System or IPeMS.

An algorithm describes, in ordered steps, the generalised framework to manage IP of digital LOs. Two different scenarios demonstrate the application of a proposed framework.

4.2 The algorithm

A generalised conceptual framework using Web Services technology to manage IP of digital LOs is represented in Figure 1.

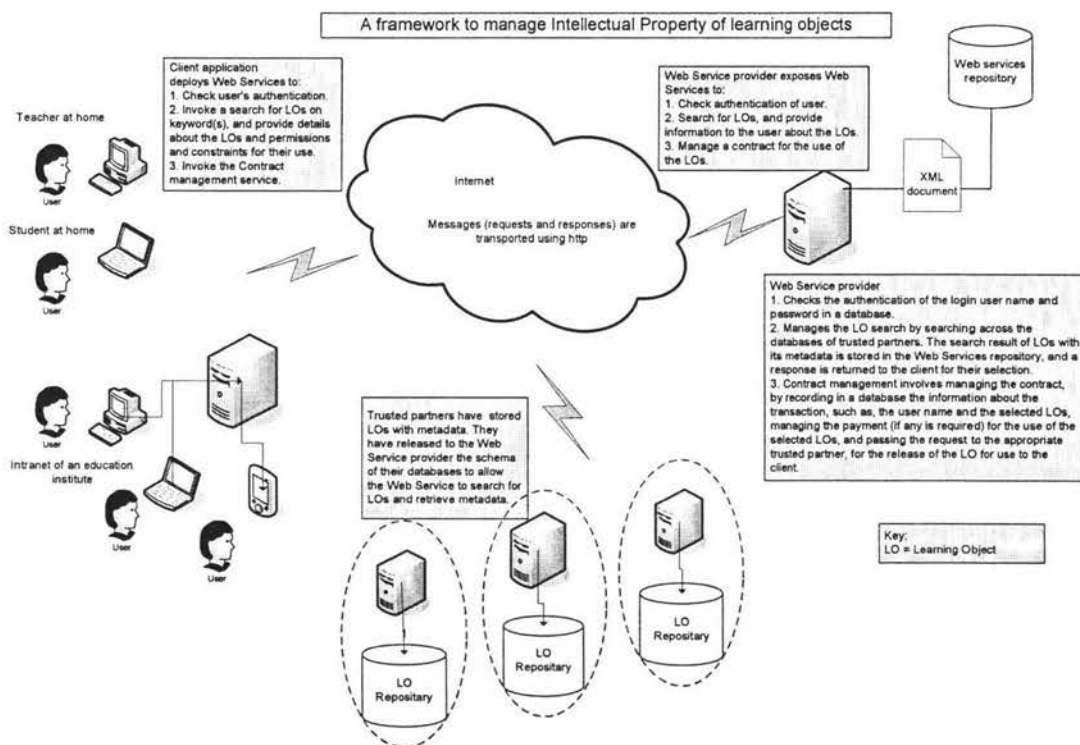


Figure 1: A framework to manage Intellectual Property of Learning Objects

The framework focuses on the activity of an educator (a teacher or a lecturer) who wishes to find or create educational material, such as, study course documents, a lesson plan or an interactive simulation that will enhance an existing digital educational resource. The educator is at home or on the intranet of the educator's educational institution and using a web browser executes an application that

invokes operations of Web Services that will authenticate the user, help find digital LOs, and manage licence requirements to use the LOs.

Other users and other activities are outside the scope of this research. Within the framework, a contract is created for the educator that, upon agreeing to, will allow the educator to use the selected digital LO(s) within the permissions and constraints of the objects' licences.

The steps of the algorithm are as follows:

1. A registered educator decides to search for digital LOs.
2. The educator clicks on a button or control that invokes the Search Web Service
 - a. If the educator has not logged in already (say, through an intranet portal)
 - i. Educator logs in with a user name and password
 - ii. On pressing the Login button, a Web Service is invoked that will authenticate the username and password.
3. If the user is not validated, error messages are presented on the screen for the educator to try again or abandon the login.
4. If the user is validated, the user gets a session ID for the time the user is logged on.
5. The educator is presented with a search form.
6. The educator enters keyword(s) about the topic of the digital LOs.
7. In the event of clicking the Search button, a Web Service is invoked that requests a search for LO(s) using the keywords.
8. Using Web Service technologies a federated search is made in the local LO repository and across a number of external repositories of digital LOs of trusted partners.
9. A response to the resultant search of LOs is presented as a datagrid on the web page to the educator, and includes LO metadata that describes attributes, such as, name, cost, and media type of each LO.
10. The educator can also view the permissions and constraints of each LO by clicking on View option of any LO.
11. The educator may also view a sample of the LO, by selecting the Sample button.
12. The educator selects LOs that are wanted in this session.
13. In the event that the educator clicks on the Submit button a contract for the selected LO(s) is rendered as a new web page.
14. In the event that the educator agrees to the contract to be licensed to use the LO(s), the educator must complete secure payment for the LO(s) online by giving information including type of credit card, expiry date on card, and the credit card number
 - a. If the information given by the user is incorrectly entered, error messages prompt the user to try again.
15. At any stage the educator may return to select or unselect LO(s), or view or sample any LO.
16. In the event that a transaction is submitted, a Web Service is invoked that enters the following data into the database:
 - a. Transaction details, for example, payment details, time and date of transaction, total cost of licences.
 - b. Identification of the educator.

c. Selected LO(s)

17. Once a transaction is made, the 'time/date is frozen', and the educator cannot return to reenter data on the same contract.
18. The Web Service passes the request to the 'trusted partner' to release the LO(s) to the educator, and responds to the educator by confirming the transaction and providing access to the LO(s).
19. At any stage the educator may exit from the session.

4.3 Scenarios

Two scenarios represent real time examples of use of the framework to manage the IP of LO(s), as outlined by the above algorithm.

Scenario One:

Educator Jane is preparing the course guidelines for a second semester's online study course for the undergraduate training teachers in early childhood education in her university. Part of the study course includes an investigation and application of the principles of the NZ Early Childhood curriculum, *Te Whāriki*. Jane knows that number of digital resources about the curriculum have been developed for existing courses, since its inception in 1996.

She turns on her computer at home and executes the application that allows her to search for digital LOs. Jane logs in the application with her username and password.

At the search page she enters the words *Te Whāriki*, and clicks the Search Button. A datagrid returns with a list of 5 LOs. She looks at samples of the first 4 LOs. The 5th LO is clearly not suitable as the media of the LO is Windows Media, and she knows that half of her students have Apple Macs and would not be able to view this LO. She likes the sample displays of two of the LOs and checks the permissions and constraints around the use of these LOs. Both of the LOs are able to be shared across an intranet network. Jane only wants one LO, and selects the free LO.

She proceeds to make a contract. The contract indicates that there is no payment involved, so Jane agrees to the contract. The contract is confirmed, access to the LO is provided, and Jane knows that a formal copy of the contract will be sent to her. She will file this with her network manager Mary. Mary will know that while this LO is available to all students and staff without cost, the LO has constraints to be used only on the organisation's intranet and the file name must acknowledge the te reo Māori authors.

Jane evaluates the LO and feels that the content is appropriate and adequate for the undergraduate study course. However, she decides that to enhance the learning and provide informative assessment, she will facilitate an online discussion around the fundamental principles during August. Jane incorporates access to the LO in the course guide and sets some dates in August for the online discussion.

Scenario two:

Physics teacher Brian is sitting in his office preparing a lesson plan on vectors. However, from past experience he knows that some students will like to have additional educational material that will add value to his face-to-face lesson tomorrow.

He logs in to the school's portal. He knows that his username and password will be checked against his profile data stored in the school's local database on the intranet. John is rendered a personalised digital dashboard interface. He selects the button that allows a federated search for digital learning objects. He enters the keyword *vectors* and then presses the return button to begin the search.

A page is rendered that states that he has found more than 300 digital LOs, of which only 10 can be viewed at any one time on the page. He realises that he has a class in 5 minutes, so he decides to add more keywords to refine the search. He adds the words "*adding vectors*" and *animation* to the Keyword box and presses the Search button. The resultant list is now only 6 LOs. Brian looks at the description of each LO, the size of each of the files and their display media. He finds a simple demonstration that adds 2 vectors graphically and also demonstrates that vector addition is commutative. This animation is only 7Kb in size and requires only Flash 5. Brian knows that this will meet the specifications of the school's network.

He views the permissions and the constraints, and notes that this is one of an entire series of physics digital LOs. The first one is free, but he notes that a whole series can be purchased for \$50.00. He copies the information from the screen to revisit at a later time to purchase the entire series. There are no special permissions or constraints on a single LO.

He selects the "Adding 2 Vectors" animation and proceeds to make a contract. There is no payment for this one, but Brian notes the payment process for next time. On agreeing to the contract, a confirmation of the licence is rendered. He notes that the contract details will be sent to him by ordinary mail. Access to the learning object is provided within 5 seconds. Brian 'drops' the animation file into an online lesson plan. The lesson plan is now complete. He places the lesson plan in the physics class' learning management system, and logs out of his laptop.

At the end of the day on his way home by train, Brian decides to evaluate the series of learning objects about physics. He is keen to check if anyone else has made online comments about the use of these. The students had given him positive feedback about the vector animation. He turns on his laptop, connects to the internet with wireless, and logs into the school portal. He selects the search application and is immediately taken to the Search page. He selects History from the menu, and is given a list of his previous searches. Brian selects the resultant search on vectors. For each learning object there is a link to a page that provides feedback from other users.

Brian carefully reads the comments, decides to select the entire series and proceeds to being licensed. He has the department's credit card information which he enters. The total cost is \$50.00 for use of 10 digital animations of a wide range of physics concepts for his Year 12 and 13 classes. In confirming the transaction, Brian is reminded that if the school chooses to modify any of the animations that the original author must be acknowledged and that the school is now licensed to receive any upgrades for the next 2 years. Brian saves the LOs with the access details into his Physics folder in the learning management system. He sends the access information to the school's network manager with a request to place the LOs into the Physics library of files. He logs out and closes the wireless connection.

4.4 Conclusion

Hill (2004) claimed that a framework, using XML Web Services technology, could provide remote access to, and manage reuse of, digital LOs for users on different operating systems. The framework proposed in this report builds on this concept and represents a 3rd party application that offers an online service to check authentication of the user, provide a global search for LOs, and a contract to manage IP rights. Such a framework is named Intellectual Property electronic Management System or IPeMS.

An algorithm describes a generalised framework to manage IP of digital LOs. Two different scenarios of the algorithm demonstrate specific applications of this proposed framework.

A university lecturer of early childhood education (ECE) is working from home and executes an application to search for a resource for a course guide. She logs in and is rendered the search page, and enters the keywords *Te Whāriki* to search for resource material around the ECE curriculum. After evaluating the sample and checking the permissions and constraints of a number of digital LOs, she chooses an LO that can be licensed to be used on a network. She agrees to the contract and when the hard copy arrives by ordinary mail, she will file it with the network manager, who will note the constraints to use the LO only on the organisation's intranet, and that the file name must acknowledge the te reo Māori authors.

A school teacher searches for supporting material about vectors. From the resultant dataset he selects an animation file that is one of a series of digital LO devoted to physics. He proceeds to create a contract which has no restrictions for use as a single LO but he is determined to return to purchase a licence at \$50 for the series at a later date. The animation file is 'dropped' into a lesson plan for students to access the next day in class.

The next chapter focuses on the design and development of a prototype that demonstrates the framework to manage IP of digital LOs.

5 The prototype - IPeMS

5.1 Introduction

A prototype was designed to demonstrate the framework to manage IP of digital LOs. Because of pre-existing perceptions that DRM involved excessive constraints and permissions on the use of LOs, the prototype is named as Intellectual property electronic Management System or IPeMS. The prototype used XML Web Services and the software development platform chosen was Microsoft Studio .NET: Visual Basic.NET.

Criteria to evaluate IPeMS were considered before embarking on the design of the application, for the purpose of evaluating its success or quality. The design followed the requirements identified from the findings of the Initial survey. IPeMS is made up of three ASP.NET pages, a database and an XML Web Service file containing three Web methods. IPeMS was implemented on a Windows IIS server.

5.2 The prototype

A prototype is a working model that looks, feels and functions similar to the finished product. In software development, creating a prototype is a way of resembling the product that the customer wants. It provides a means of getting feedback from potential customers early in the software development of a product (*SearchSMB.com Definitions: Prototype. Whatis.com, 2005*).

5.2.1 What's in a name?

The researcher recognised that there exist perceptions in literature and from respondents of the initial data collection that DRM has connotations of excessive constraints and restrictions on use, and always involved in payment to license the use of LOs. The research deliberately shifted to focus on a framework that would manage IP of digital LOs. DRM as a name was therefore discarded.

The name of the prototype of the framework that was developed to manage the IP of digital LOs online is Intellectual Property electronic Management System or IPeMS.

5.3 Choice of development platform

One of the challenges of this research was to select a development platform where a prototype was built to demonstrate that Web Services technologies and their deployment could be used in the proposed framework. The decision of the development platform was also made on its familiarity and access to the researcher, cost, technical and programming support, compatibility with the development and Web servers, and database.

XML Web Services' platforms provide functionality that facilitates the building of XML Web Services and the interaction with distributed applications using XML messages. In the software industry, the development and deployment communities revolve mostly around two preferred environments: Microsoft and Java, and both environments provide support for the development and deployment of Web Services (Newcomber, 2002). Microsoft has focused its implementation of Web Services within the .NET

Framework, while Sun Microsystems and other Java vendors are focused on Java 2 Platform, Enterprise Edition (J2EE), now known as Java EE.

5.3.1 Making the choice of development platform

The specifications of the development server where development occurred were as follows:

Toshiba, Satellite laptop

Intel Celeron processor

1.1 GHz

240 MB RAM

Operating system: Windows XP Professional Version 2002.

Database: Microsoft Office Access 2003

A number of Web servers, both Windows- and Java-compatible, were available to the researcher by the university for publishing the prototype.

The researcher was familiar with a number of procedural programming languages, such as COBOL, Pascal, QBasic, and Web scripting languages, such as HTML, Java script, ASP, PHP, JSP and Java servlets, and had had a short encounter with Java and object oriented programming language, Delphi 6.

The development process had to be easy. The researcher looked for a platform where XML Web Services were an important part of the environment, where programming tools also supported Web and Windows-based application development and that employed a debugger. The platform was also required to utilise existing features and functions of the operating system.

Open source software was considered. However, the decision of the development platform also depended on the available time for this research. Consequently, familiarity of the software and ease of setting up became an important part of the decision.

In the end, the decision was made to use a Microsoft environment. Microsoft Visual Studio .NET: Visual Basic.NET: Standard Version 2003 was purchased. This development package provides tools to design, develop, debug, and deploy Web applications, XML Web Services, and traditional client applications. Installation was easy. Online tutorials and development communities were easily accessible during the time of the development of the prototype.

5.4 Consideration of evaluation criteria

Before a project starts, project personnel must develop an evaluation plan that identifies attributes that will measure quality and success of a project (Jukes, 2004). Quality is measured by whether the project output is useful, meets the user needs, and performs well. Evaluation of JISC projects involving software development specifically focuses on whether the application is effective, whether it achieves the objectives and whether the outcomes have impact.

So what attributes of a prototype that manages IP online, are indicators of quality or success?

The evaluation criteria of a prototype can be categorised into 2 groups (Dybkjær, Bernsen, Blasig, Buisine, Fredriksson, Gustafson, Martin, & Wirén, 2003). A usability evaluation evaluates the design of the user interface, and suitability of the application for the intended user. A technical evaluation identifies the intended tasks of the user and consequently functions of the prototype and system. The JISC Project Management guidelines suggest that focus should be on a few important factors and to create questions that can be answered unambiguously.

5.4.1 Evaluation criteria

The method of the evaluation involves asking a set of questions that would be aimed at the target audience, who were in this case the educators. The questions had to gather opinions from a sample group in a systematic way using closed and open-ended questions.

The questions to ask for a usability evaluation revolved around the use by an educator and included:

Will you use this service?

Will you make an online payment?

Is the application easy to use?

Is the design appropriate?

Are the functions appropriate and complete?

The questions for a technical evaluation would give the project information about attributes that related to the Web Services, such as:

Are the services interoperable?

Are the services able to be used remotely?

Are the services reusable?

5.5 Design of the prototype

Results from the initial survey were analysed and contributed to 'shaping' the design and hence the development of the prototype.

5.5.1 Requirements of the prototype

The prototype needed to demonstrate:

- A secure login.
- A search function that would allow a federated search across a number of LO repositories.
- A display of information about the LO.
- The ability to view the permissions and constraints around the use of the LO.
- Opportunity to select LOs.
- Management of a contract to license the use of LOs, that will record details about the transaction, including secure payment, if any.
- Release of the LOs appropriately to the educator.
- Connectivity to MS Access database where information would be held about the educator, LO, and contract.

The prototype is made up of a client web application developed using ASP.NET, that invokes a number of XML Web Services, using SOAP technology.

5.5.2 IPeMS – the client web application

IPeMS is made up of three ASP.NET pages.

The login page (Figure 2) presents a login function for the educator to enter a username and password. On pressing the Login button, the application invokes a Web Service to authenticate the username and password.



Figure 2: IPeMS – Login page

If authenticated, the educator will go on to next page. However, if not authenticated the educator is given an explicit error message below the Login button, such as:

- A user name is required.
- Please enter a password

The educator is assigned a session ID for the time they are logged on. At any stage during the application the educator can exit by selecting Logout from the bottom navigation bar.

At the search page (Figure 3), the educator enters keywords to search for LOs. For the purpose of the demonstration the search is simple and is restricted to one word. In the event of clicking on Search, a Web Service is invoked that will carry out a federated query search across a number of LO repositories of 'trusted' partners.

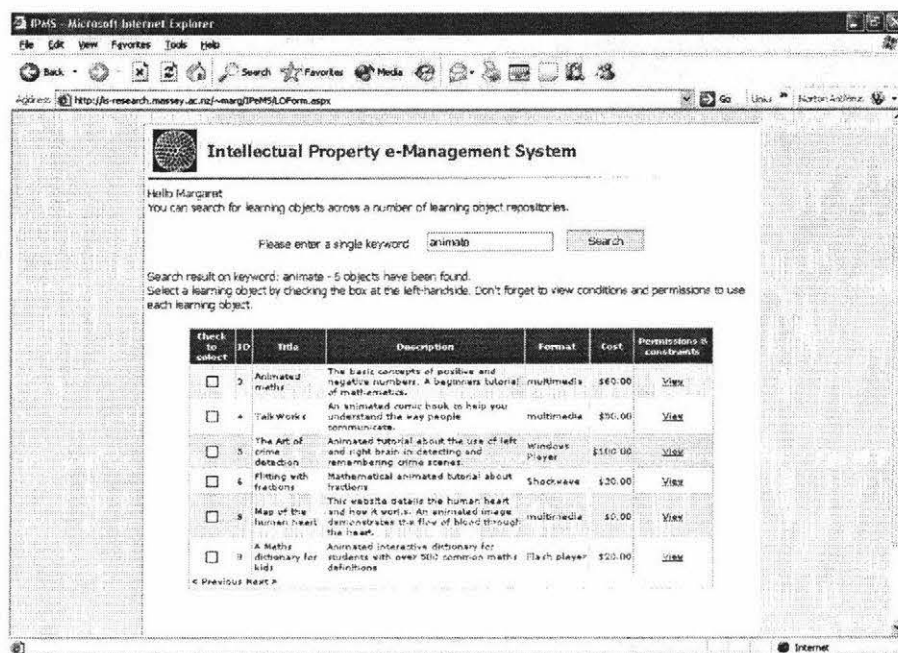


Figure 3: IPeMS - Search page showing search result

A dataset is filled and returns the results of the search for LOs. To reduce connectivity activity with the database, the dataset contains all the information relating to the LOs of the search. In the client application, a datagrid control is bound to the dataset and renders a resultant list of LOs (Figure 3) with some of their details displayed.

For the purpose of this prototype, the dataset only contains some of the attributes that describe the IP of an LO. The 1st column has a check box for each LO that can be selected to include in a contract for licensing the use of an LO. On selecting an LO, a running total is calculated to let the educator know the cost (if any) involved. The datagrid shows the unique identification number of the LO, the title, description, format and cost of the LO. The educator can also view the permissions and constraints of any LO by clicking on View button. The information appears on the page below the datagrid (Figure 4). For the purpose of this demonstration, only some permissions and constraints are rendered.

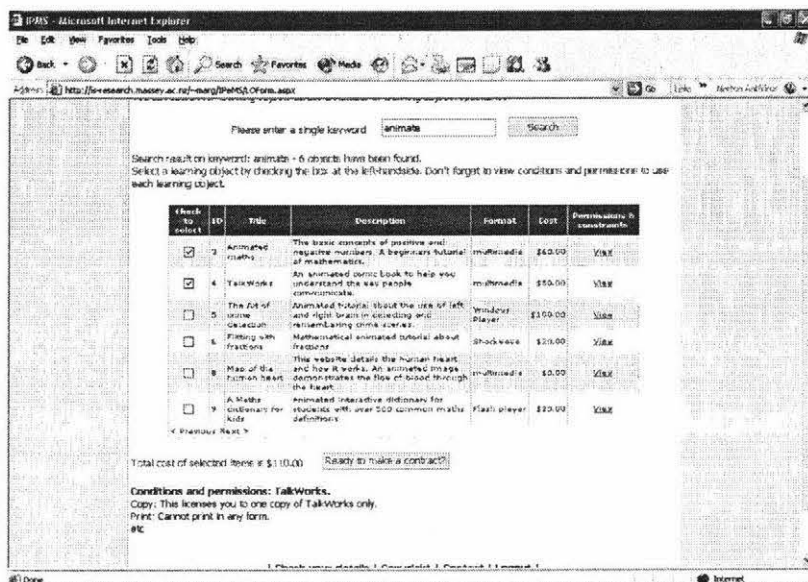


Figure 4: IPeMS - Search page showing permissions and constraints of LO

When ready, the educator submits the page to make a contract. The contract page (Figure 5) is rendered. Session retains the identification of the user. Information about the transaction is given, including the total payment of selected LO(s), if any. Payment details are requested, such as, payment method, expiry date, and card number.

Button options on the right-hand-side of the screen allow the educator to review details about the selected learning objects again, or start a new search from the beginning.

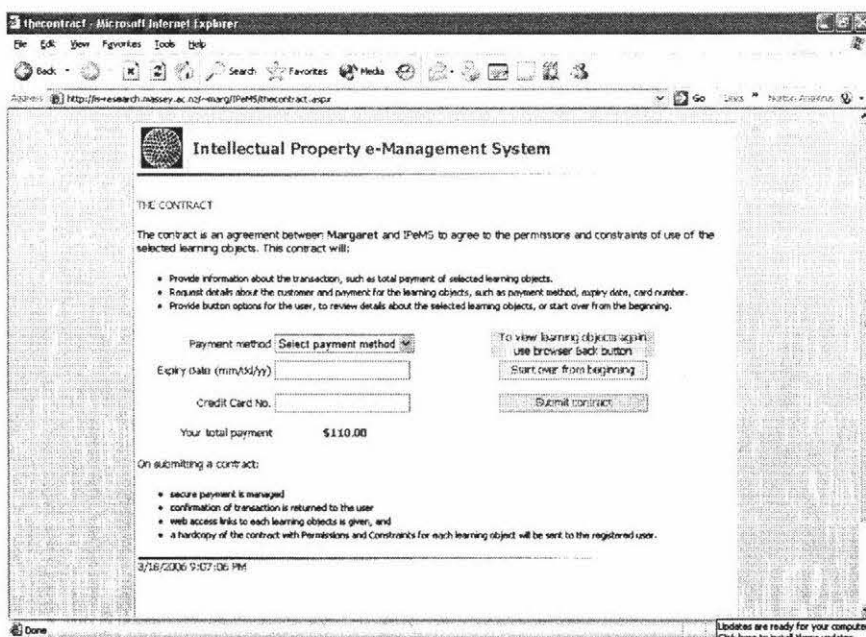


Figure 5: IPeMS -Contract page

In the event of submitting the contract, a Microsoft message (Figure 6) requests confirmation that the permissions and constraints of the selected LOs have been viewed and checked.

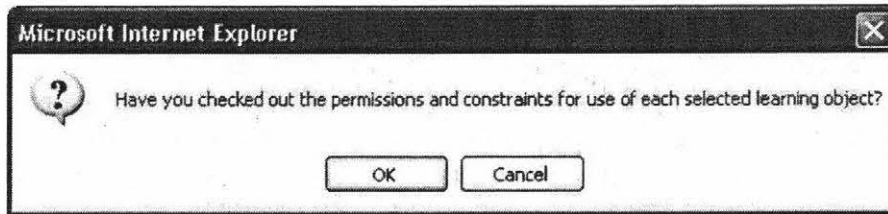


Figure 6: IPeMS - Microsoft message

On agreeing that the user has checked the information, a Web Service is invoked that manages the contract as follows:

- Information about the transaction is recorded.
- Payment, if any, is managed.
- Time is 'frozen' at the time of the transaction. User is prevented going back to add more information to the same contract. Once submitted, the transaction is given a unique identifier.

Confirmation of the transaction (Figure 7) is returned to the user.

In the prototype, time is 'frozen' and recorded below the contract in the confirmation. Also, the confirmation returns links to web sites, simulating the web access links to render the LOs in the 'real' developed application.

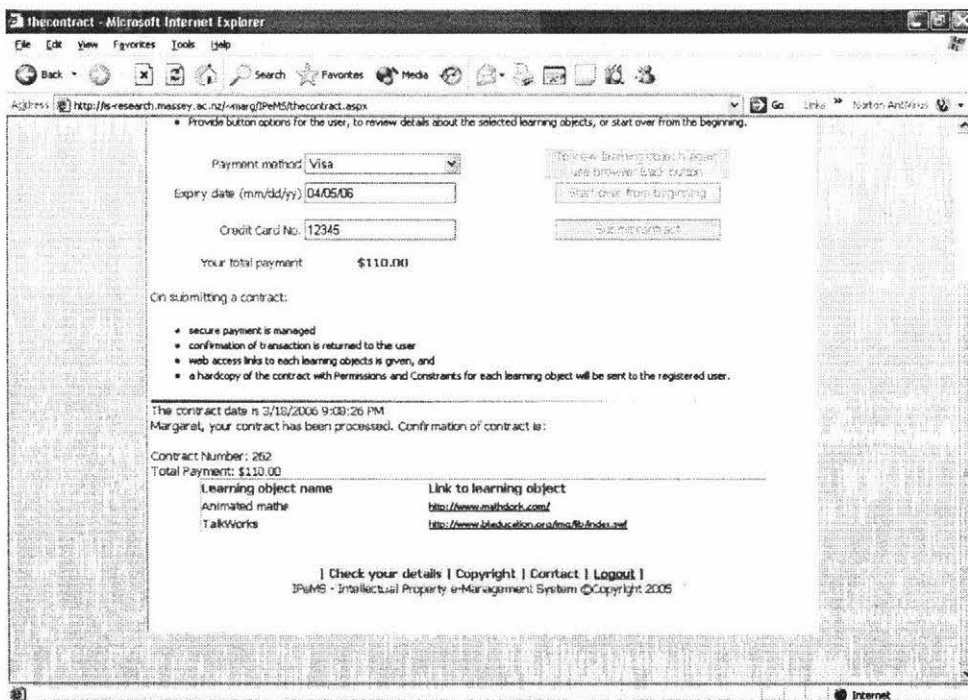


Figure 7: IPeMS - Contract page showing confirmation of the contract

In a finished application the security of the transaction would be paramount, and the Web Service would manage the legal online contract between the educator and 'trusted' partner to release the LO(s) to the educator. A hardcopy of the contract with Permissions and Constraints for each LO is sent to the registered user.

5.5.3 Database

The model for the information of the prototype stored in the MS Access database is shown in Figure 8.

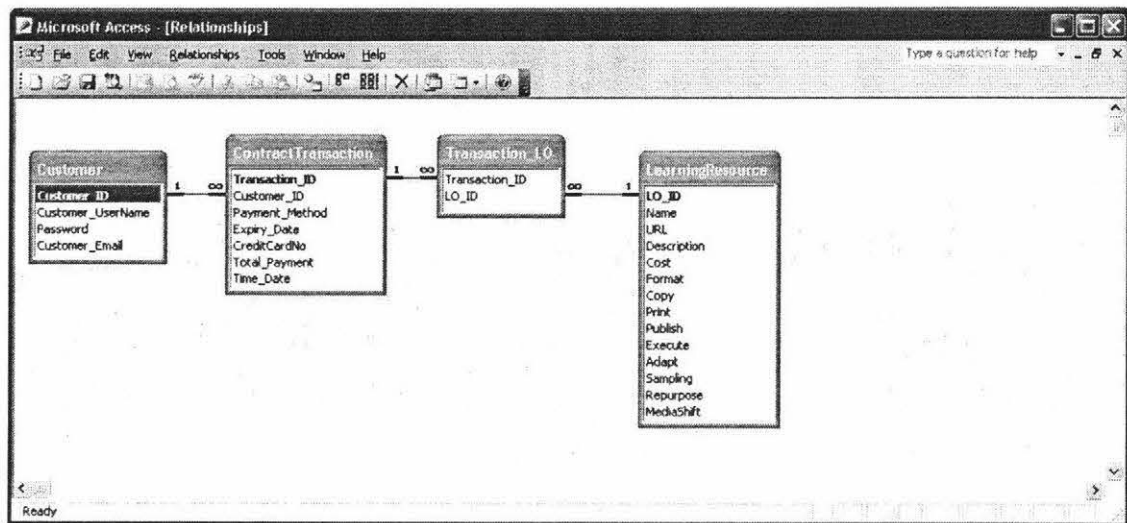


Figure 8: IPeMS - Relationship Diagram.

The model is made up of 4 tables.

- The Customer table holds information about the educator. The Customer_ID attribute identifies each educator uniquely.
- The Contract_Transaction table holds information about the transaction, and each contract created will have a unique identifier, the Transaction_ID. Each customer (educator) may create one or more contracts, and each transaction must be created by only one customer.
- The Learning_Resource table holds information about each LO, and each is uniquely identified by the LO_ID. A many-to-many relationship exists between Contract_Transaction and Learning_Resource, where each contract must be created for licensing the use of one or more LOs, and where each LO is licensed for use by one or more contracts. However, this is resolved by the linking 4th table, Transaction_LO.
- Transaction_LO table has two attributes as the primary key, Transaction_ID and LO_ID, to uniquely identify the link.

5.5.4 XML Web Services

The prototype application invokes a Web Service file, with .asmx file name extension (Appendix F), with the following Web methods to:

- check authentication of the login user name and password;

- carry out a search on a keyword across the Learning_Resource table in a MS Access database; and
- manage the contract - to record, gain payment (if any) for use of, and provide access to learning objects.

The complete list of operations carried out by the Web Service is viewed by executing the .asmx file. Figure 9 shows the Web page that is rendered by the .NET Framework, and is generated automatically by the system.

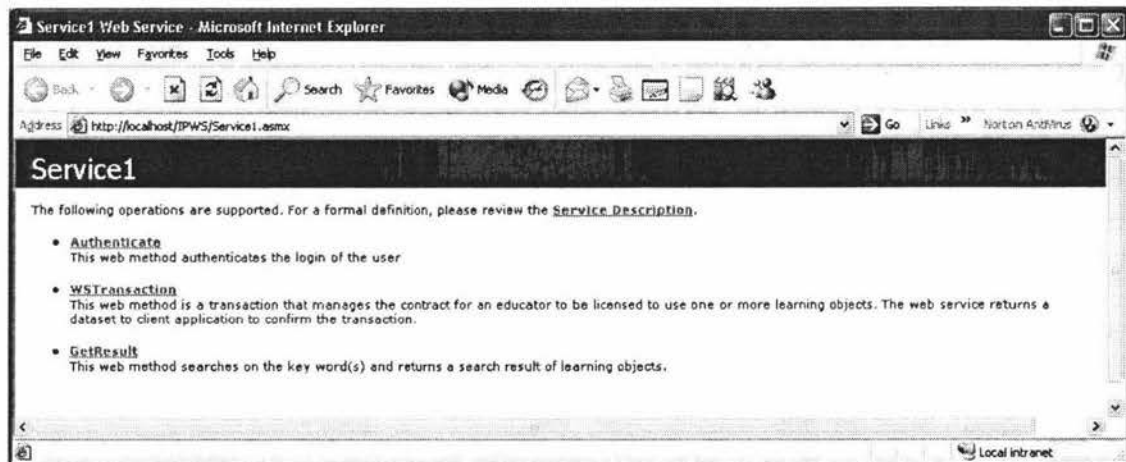


Figure 9: IPeMS - Web Services page showing list of operations

It provides the opportunity to test a simple Web Service, where a single test form is generated for methods with primitive types or arrays of primitive types as parameters, such as found in 'Authenticate' and 'GetResult' Web methods. The multiple requests of WSTransaction, however, mean that this Web Method cannot be tested. For example, selecting *Authenticate* will allow you to test the Web Method operation. Figure 10 shows the test form that requests values for the parameters of the User name (txtLogin) and Password (txtPassword).

Authenticate

This web method authenticates the login of the user

Test

To test the operation using the HTTP POST protocol, click the 'Invoke' button.

Parameter	Value
txtLogin:	<input type="text"/>
txtpassword:	<input type="text"/>

Invoke

Figure 10: IPeMS - Single test form to test the Web Method Authenticate

The parameters are the variables named in the Web Service code for the Web Method *Authenticate*. In the event of clicking the Invoke button, the Web Service function is tested by using HTTP POST messaging. In the case above the Web Method *Authenticate* uses the values of the parameters, txtLogin and txtpassword, and will authenticate these values against the values that are in the Customer_Username and Password fields in the Customer table. The unique Customer ID, Customer username and Customer e-mail is returned and used in the client application for session control, for a 'friendly' user name greeting throughout the application, and to facilitate the sending of confirmation, respectively.

Creating the Web Service file in Visual Studio automates a number of XML files. The Web Service description language file (WSDL), or schema is viewed as an XML file, with an .xsd file name extension (Appendix G). XML schemas are powerful tools that describe the contents of XML documents using valid XML elements and attributes, and the structure or order of these elements. Validation of XML documents verifies that all of the elements (individual pieces) of data exist, are in the expected sequence, and are all of the correct data type.

5.6 Development of IPeMS

IPeMS was developed using Microsoft Visual Studio .NET: Visual Basic.NET: Standard Version 2003, on personal Web Server, Toshiba Satellite laptop with XP Professional operating system.

It was recognised that the application IPeMS was a prototype that represented 'proof of concept', that is, it provides evidence that demonstrated that a business model or idea was feasible. However, the researcher wished to demonstrate that the use of Web Services using SOAP was an appropriate technology for this idea. Consequently the Web Service was developed outside the client application to simulate a 'real' model. The two components could have actually existed on two very different and geographically separate Web servers. Also, some thought was given to design of the user interface of the client web pages.

5.7 Migration to Server

The Web server administrator was required to create a virtual directory for the files on the Windows IIS server, set an alias for the folder, and set the physical folder as an application for each of the ClientWebApplicationII and the Web service IPWS.

The version of .NET framework was checked to ensure that it matched the .NET version 2 of the development personal Web server, where the original project files were compiled.

The minimum files needed to run the application were copied to the Windows IIS server.

Figure 11 represents a dual view of the researcher's file structure on the local host machine and the files in the public_html folder on the Windows IIS server.

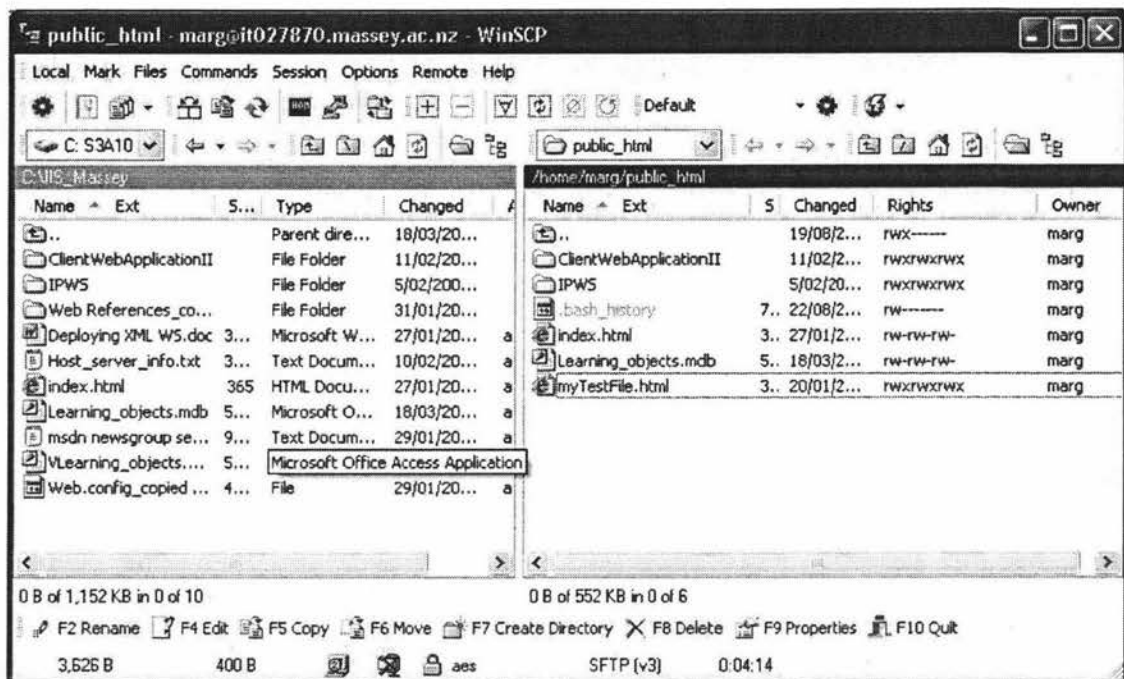


Figure 11: Dual view of files on the local host machine and Windows IIS server

The exact folder structure was recreated on the target server. The client application files were placed in the ClientWebApplicationII folder, alias IPeMS, in the researcher's public_html folder, and included:

- 3 ASP.NET web page files with .aspx extensions;
- Global.asax file
- Web.config file;
- image files;
- footer and header .ascx files;
- style .css file; and
- ClientWebApplicationII.dll file in the bin folder.

The Web service files were placed in the Web Service folder IPWS and included:

- IPWS service file with extension .asmx;
- Web.config file;
- Global.asax file; and
- IPWS.dll file in bin folder.

The Microsoft Access database file, Learning_objects.mdb that holds the data was copied to the public_html folder.

Final testing was carried out on the remote Windows IIS server. The researcher tested the application on computers that was not the location of the original compiled Visual Studio project files.

Users accessed the client application using a Web browser. The client application deployed Web Services in the event of the user making requests to authenticate

their login, to search for a keyword and view details of LOs, and to manage the intellectual property of selected LOs.

5.8 Conclusion

Intellectual property electronic Management System or IPeMS represents a prototype demonstrating a framework to manage IP of digital LOs. It was decided to not refer to the prototype as DRM, because of pre-existing perceptions that DRM systems involved excessive constraints and permissions on the use of LOs. IPeMS was developed using the software development platform, Microsoft Studio .NET: Visual Basic.NET and implemented on a Windows IIS server.

Consideration to key indicators of success and quality helped 'shape' the design of the application, along with the components and concepts expressed in the initial survey. IPeMS is made up of three ASP.NET pages, a database and an XML Web service file containing three Web methods. The key indicators were used to determine the questions to ask in the evaluation survey, as described in the next section.

6 Evaluation of IPeMS

6.1 Introduction

Prototype, IPeMS, was developed to demonstrate proof of concept of a system that managed IP rights online. The evaluation involved designing a survey of questions that measured the success and quality of the concept using the application. The findings of the evaluation survey confirmed that an online IP management system has opportunities for the educators wanting to use LOs and the creators wanting to protect the IP rights of their work.

6.2 Purpose of evaluation

The purpose of the evaluation of the prototype IPeMS was to seek feedback from participants about IPeMS, with respect to its application to an educational environment to license an educator to use one or more LOs online. Answers to questions from the evaluation survey provided a description of the computer environment of each participant, determined the potential use of an application like IPeMS, and provided feedback on the application's design as an online management system of IP. An analysis of the findings of the evaluation contributed to the final stages of this research.

6.3 Methodology

6.3.1 Data collection

Data collection involved a second survey questionnaire, targeting a sample of individuals in various organisations (business and education). The design of the data collection followed similar activities as outlined in sections 3.3, 3.4, and 3.5.

A copy of the findings from the initial survey was also included with the emails to help frame the context of the research for the participants.

6.3.2 Sampling

31 people were approached and agreement was sought to participate in the survey to evaluate IPeMS from the following people.

- 14 (out of the 15) participants from the initial survey who had expressed agreement to be further contacted about the research. The fifteenth person had explicitly requested that she did not wish to be contacted further.
- 2 expert ICT educators and one Copyright Advisor involved in distributed education, who commented on the findings of the initial survey.
- 15 additional people from a wide range of businesses, including a commercial database administrator, Microsoft training provider, Web and document editors, environmental consultant, industrial researcher, tertiary students, and early childhood, primary, secondary and tertiary educators.

Each of the 31 people agreed to participate in the evaluation, and the evaluation survey was sent by email to them. After 2 weeks, if there was no response, a reminder was sent. Eventually, 21 people out of 31 responded to the evaluation survey and formed the sample of this evaluation of IPeMS.

Their responses represented the opinions and knowledge of a focus group of informed people with respect to an online management system of IP.

6.4 The evaluation survey questionnaire

The information contained in the evaluation survey questionnaire is presented in Appendix C. The survey document was organised into four main parts:

- An introduction provided background information about the research.
- A brief description described the prototype in terms of the client Web application pages and the functions of the XML Web Services that were invoked.
- Instructions provided guidelines for participants to use the survey.
- The evaluation survey consisted of 3 initial questions requesting background information about the respondent, such as, the name of their organization, description of the core business of their organisation and the name of an email contact. 11 questions were directly related to IPeMS and were grouped into sections A and B.
 - Section A requested information about the participant's computer environment.
 - Section B asked questions that evaluated the use of IPeMS with respect to its purpose and interface design.

Section C completed the survey with 2 questions, asking if participants wanted the results of the survey, and requesting acceptance of further contact, if necessary, to clarify their answers or to request for more information.

The essential findings for the evaluation came from the background information and Sections A and B. It is the results of these sections that are described in the following sections.

Appendix E: Tables 5 and 6 present the results of Sections A and B, and in addition, the purpose of each group of questions is stated, and the type of question is noted.

6.4.1 Questions requesting background information

The range of business types involved in the evaluation survey increased from that of the initial survey. 21 (out of 31) organisations from early childhood, primary and secondary school, and tertiary education, Internet and Web Services provider, statutory authority, industrial research, commercial database administration, Microsoft training provider, Web and document editing, environmental consulting, computer training provider/consultancy, as well as tertiary students responded to the evaluation survey. The sample consisted of 14 respondents from educational organisations and 7 respondents from business organisations.

6.4.2 Questions and results of Sections A and B

The purpose of the questions in Section A was to provide information about the computer environment of the participants. These questions confirmed the attributes of use of Web Services technology. The findings can be viewed in Appendix E: Table 5.

Section B questions requested information about the Web application IPeMS. Answers to the first 3 questions evaluated the usefulness of the application to an educator who wished to use LOs. Responses to Question 5 reflected the confidence that the educator had in making an online payment. Questions 7 and 8 evaluated usefulness of IPeMS to a developer or creator of LOs. Question 7 asked whether the developers would 'trust' such a system to manage their creations. The findings can be viewed in Appendix E: Table 6.

An acknowledgment of receipt, including a thank-you for participating was sent to participants on receiving their response. Further clarification of responses from two people were sought.

The results provided a rich mix of facts and opinions. The answers were organised into themes/groups of similar findings before carrying out the analysis on the findings.

6.5 Analysis

Analysis of the results of the evaluation survey has provided evidence for the following:

- attributes of Web Services, such as interoperability, remote access, and reusability;
- potential usefulness of IPeMS as an online DRM system for an educator and for a creator;
- required and preferred functions of the application (are they appropriate and complete?); and
- design interface preferences.

6.5.1 Attributes of Web Services

The client Web application IPeMS invoked a Web Service to authenticate user, to search for learning objects and to secure payment to license the use of selected learning objects (the contract). Access of the application was made from a wide range of geographic locations in NZ, using a wide range of computers of different brands and models, operating systems, processor speeds, RAM size, and Internet connections. Access could be made at anytime and by multiple users at any one time.

While some technical issues were identified, none of the issues related to accessibility of the application. The issues related to the way the Web pages were presented to the user, and the request for more sophistication of application functions. These issues are discussed in section 6.5.5.

It was noted that performance was seen as an essential attribute of a Web Service, where the Web Service must respond efficiently and ensure that Web pages downloaded quickly. Menasce & Almeida (2002) similarly believed that a Web Service would be judged (and used) by its capacity, that is, its measured performance and capability.

6.5.2 Usefulness of IPeMS to an educator

Most educators felt that they would use an online IP rights management system, such as IPeMS, to search for LOs, and pay online for a license to use selected LOs. Two people hoped that their organisation would pay and that use of IPeMS would have cost-saving benefits to their organisation by accessing existing LOs and not having to always create their own LOs.

From the findings it was recognised that an IP rights management system for an educator would have the following functional attributes:

- A quality assurance system for LOs that ensured consistent and reliable standards.
- Ability to search repositories containing a wide range of LOs that would continually be updated with new and/or modified LOs. Repositories would have compatible metadata schemas for LOs to facilitate federated search.
- There would be an easy-to-use precision search to find useful, relevant, appropriate and quality LOs in a time-efficient way. It was suggested that the search should not just be on keywords. The search could be extended to use other attributes of an LO, such as its format, cost and subject area. The users were not adverse to using an existing commercial product that already demonstrated an excellent search algorithm, for example, Google.
- A preview of LOs before contracting.
- Explicit and complete information about Permissions and Constraints of IP rights to use the LO, easily accessible throughout the contract 'shaping'.
- A secure credible payment method. It was recognised that credible commercial products already exist that could manage such a transaction.

6.5.3 Cautious creators

Creators or developers of IP expressed caution in using an online IP rights management, such as IPeMS, to protect the IP rights of their LOs. Only about half (52%) of the participants felt that, as a creator, they could trust the system. Creators wanted a simple system that would register and manage any media.

The creators would expect the following components of an IP rights management system:

- Clear and explicit information about the costing structure rationale of LOs and be assured that they would be rewarded on the basis of the complexity of the LO development.
- Information about the management and control processes that would identify a breach of use, and the consequent enforcement and litigation process.
- An acknowledgement of risk of the sharing of LOs and IPeMS's obligation to minimise risk to the creator.
- Functionality that allowed the creator to attribute permissions and constraints to their own LOs, for use by others.
- Access to information about the use of their own LOs, such as frequency of use and any feedback from users.
- A list of all LOs (by name and type) in the LO repositories, for viewing to identify gaps in LO content, and recognise potential opportunities to develop new LOs.
- A robust legal agreement for management and compliance of IP of LO between the service and creator.

- An assurance that legal obligations of the online contract between the service and educator were robust. In the situation of a dispute between buyer and developer, clear policy and procedures would need to provide the vehicle for resolution between parties.
- An assurance that IP is managed securely. This would mean that:
 - The system would control and release safely the creators' products, and that no access would be given unless contract with or without payment was complete.
 - Information about the payer and payee was confidential.
 - Secure monetary transactions were carried out.
 - The creator could view their own account online, with respect to transactions.
 - The creator would receive feedback about any transaction of their LO.
 - The creator could view a list of authorised users.
 - The creator could restrict/refuse any user when, for example, payments are dishonoured, or if an organisation was known to steal IP.

One comment "*there is a huge element of trust here*" summed up the caution expressed by creators. Creators would need to be confident that licensed users would, in fact, only use the IP rights as stated in the contract. They want to be sure that the user would not further share or publish the works in any way that will give others an opportunity to use the works without payment. There would need to be trust between the person/company/authority of the system that managed the search for the creator. Authenticity and credibility of the owner of the IP management system was seen as very important. One response stated, for example, that they would happily submit to a system run by a known and credible organisation like the Ministry of Education, but would be very cautious about submitting to a single unknown individual. Another preferred to use a recognised world-wide "standard" application like Microsoft [Passport] rather than a custom-made application.

Comments such as "*it is hard to constrain copying of LOs*", and "*unsure about protection of IP, once out in the big wide world*" showed that creators were unsure how IP rights would actually be managed. They hoped that payment to the creator or developer was managed according to a set of business rules and ethics, but unsure of the legal compliance of these.

6.5.4 Opportunities of IPeMS

IPeMS could be a one-stop-shop for both educator and developer, where educators could also register LOs that they have created. The system should not exclude other searches, and even encourage other search engines that might complement or partner the targeted search that IPeMS offered. One response was:

[IPeMS] also has application for managing access to IP for which a developer/owner wishes to charge, whether or not the object is a learning one. Even in the public sector, there is information that both ought to be publicly available, and ought to be accessible, subject to payment, in order to cover development costs. IPeMS offers a good prospect here.

It was suggested that such a management system could also extend to searches on other data, such as, weather data, Science/Research libraries and Patent searches.

6.5.5 Design interface preferences

Most people found that the application was easy to follow and use. User preference insisted on a *“clearly set out”* interface that was *“attractive looking”*, *“professional, crisp and classy”*, and *“clear and simple”*. Content should have *“good clear information”* with useful explanations, and that instructions should be easy to follow but could be more direct. It was important that *“the text flows well”*. While the colours of the application were commented favourably, improvements to accessibility could be made by darkening the green/blue font type.

Good design of user interfaces of a management rights system should include the following:

LO Search page

- Explicit information about the media format of the LO.
- Clear instruction with no ambiguity about the process to make a contract. For example, the button “Ready to make a contract” was only visible once the user viewed the Permissions and Constraints of at least one LO.
- Explicit view of Permissions and Constraints of an LO. Permissions and Constraints could be viewed when selecting an LO and/or clicking on View, and be refreshed when Web page is refreshed, or when returning to the LO search page from the Contract page to select more LOs or to begin search again.

Contract page

- User should see the entire contract, and be able to view explicit licensed conditions for each selected LO during the entire life cycle of the contract-making.
- Date format should follow the format most familiar to NZers, that is, day/month/year. The expiry date of credit cards should follow the format month/year.
- An input mask for the entry of a credit card number would assist the user. This means that each digit inputted would enter a pre-formatted number pattern.
- If licensing for use of LOs without payment, there was no need to request details of payment method.
- A credible secure payment would need to be explicitly advertised on the Web page, for example, BPAY®.
- A button should return the educator to the Search page to begin a new search before the contract was complete or on completion of one contract.
- The Windows pop-up message represented a digital acceptance of the contract, and therefore legal advice should be sought on the wording of this message. An article on website of a NZ lawyers endorses this statement (James & Wells, 2002).

The application should be easy to use and navigate. Some good design features are as follows:

- Submit buttons should respond to the event of pressing the keyboard key 'Enter'. For example, this function should have existed for submit buttons for the login username and password, and search keywords.
- Exception errors should be user-friendly responses. For example, when clicking on 'Ready to Make a Contract' without having selected an LO, or when an error was made in entering expiry date.
- Refreshing Web pages should appear seamless to the user. For example, when selecting an LO by clicking in the check box, the screen of IPeMS would go blank for 2-3 seconds, before refreshing the Web page with additional information about the LO. The user wants a smooth transition from selection of LO to the refreshed and updated Web page.
- In the event of selecting or clicking a button, information to view should not be placed at the bottom of the refreshed page so that the user is required to scroll down to view. Either the information should be bookmarked appropriately in the refreshed page or positioned in the top half of the page to avoid scrolling, or opened in a new window.
- The copyright year of the application should be current.

6.5.6 Further comments relating to sharing of IP included:

- *"We take this issue [of IP rights] very seriously and build protection into our products".*
- Issues around IP should be addressed during planning of infrastructure installations or upgrades, and not after.
- There did exist evidence of sharing of IP in industry, often with expectations of business ethics and quid pro quo. This legal term refers to transactions of valued items or favours, in return for giving something of value. However, reporting and documenting these expectations of business ethics were not generally planned or managed.
- It was suggested that in organisations a central IP management team could be formed. Their role would be to evaluate IP management systems for departmental groups to assist budgeting of licensing of LOs for use. The team should also check quality of LOs that were being developed within their institution for release and use by others.
- IP policies and procedures should reflect the way organisations value IP created in their company and by other organisations.
- TradeMe is not an agent, but a means of linking buyer and seller and enabling transfer of messages and funds. One respondent thought that TradeMe represented a good model to follow. He felt that IPeMS should NOT be responsible for transactions. He suggested that IPeMS could offer simplified options for people to agree, in the same way CreativeCommons offered various options.
- One respondent distributed IP through a Web site or through media such as DVD to clients directly. Most of the IP was done as bespoke (or custom-designed) work and had little application to other users.

While IPeMS provides one online opportunity to manage IP rights for the educators and potentially the creators, there are others. In addition to IP management systems described in Section 2, one respondent identified other IP management systems. HarvestRoad Hive® (<http://www.harvestroad.com/>) was a web site that offered a federated digital repository system that managed sharing and reuse of any form of content in any online learning environment across any number of locations

or countries, and integrated with any Learning Management or Enterprise Resource Planning (ERP) system. Similarly, a web based library management system, Softlink Liberty 3 (www.softlinkpacific.co.nz) was suggested as having a federated search system. Further investigation showed that the software had extensive search and retrieval function capability and was made up of modules for acquisition, cataloguing, circulation, and serials and interloan management.

The journey of this research is almost complete. The evaluation of the prototype IPeMS has provided us with a rich picture of what an online IP management system could look like in an educational environment. The next section concludes the analysis.

6.6 Summary and conclusion of evaluation

By using Web Service technologies to build IPeMS, attributes of interoperability, remote access and reusability were demonstrated. The application invoked a Web Service to authenticate the user, to search for LOs and to manage a contract with or without payment to license the use of LOs.

Most educators were encouraged to use an online IP rights management system and were very clear in the functional attributes that were required. They liked the idea of precision and seamless searches across a number of LO repositories, but wanted checks and assurances that the LOs were of high quality and appropriate. The system had to be secure for payment and be capable of performing efficiently.

However, creators were more cautious in submitting LOs to such a system. They wanted flexible licensing permissions and constraints, and needed to know the statistics of use of their LOs. Creators wanted to be rewarded fairly for their efforts and be very confident of security, and of legal compliance and enforcement that proper use of their creations occurred.

Most participants recognised the potential of IPeMS for both the educators and creators and felt that the concept could be extended to manage other sorts of IP, such as weather data, library resources and patents.

Good design of user interfaces was a requirement. Users were clear that the system had to be easy to use and navigate, efficient in page refreshing and loading, explicit in the attributes of LOs and permissions and constraints of the use of individual LOs, and secure in the contractual agreement to release LOs.

From this evaluation, a commercial build of an online IP rights management system would have an extensive list of user preferences to follow. This evaluation could provide a starting point to dialogue between a developer and client wishing to build such a system.

In the next and final section we conclude the research journey and reflect on limitations and opportunities that could further enhance this research.

7 Conclusion

7.1 Conclusion of Research

The journey began in February 2005 to extend the research of Hill (2004) to develop a framework to manage IP rights online using Web Service technologies.

The research involved the development of a digital rights management (DRM) framework that enabled educators to carry out agreements over the Internet, with or without payment, to licence the use of learning resources.

The research design involved an initial literature review that investigated the theories behind IP and digital IP management. An understanding of the range of technologies used by DRM, a definition of LOs and LO repositories, and Web Services architecture were presented.

An initial survey identified the components required for an online contract. A conceptual framework was designed and a prototype called IPeMS was built using XML Web Services technologies.

An evaluation gave a rich picture of educators' and creators' expectations of an online IP rights management system.

7.2 Limitations and opportunities of the research

One limitation of this research includes the motivation behind the research. The research completes a thesis requirement of an Information Science Master's degree and hence places time constraints to complete, as well as scope limitation of the design and development of IPeMS. The prototype was only required to represent a model of what it could be if commercially built. However, these limitations of the research offer opportunities for further research.

While the numbers are small, the sampling in the initial survey served the purpose of providing information to 'shape' the components of a prototype of an online contract. The survey was not intended to provide conclusive answers to what an online contract would look like. Similarly the small number of participants decreases the importance of the evaluation survey results. However, the findings of this research about a DRM prototype could provide the basis of the initial discussion between client and developer, in a commercial environment, to build an information management system to manage IP rights in education on the Internet.

The architecture of this project demonstrated deployment of XML Web Services from within a single application design. There still, however, needs to be a demonstration to deploy the same Web Services from more than one application design. Any variation to the architecture like this would still require a federated search across LO repositories of 'trusted partners', and consequently an agreement of the schema (or WSDL file) to exchange the same parameter data types (Barefoot, 2002; Jacobson, 2002).

There could also be variations of the way the Web service Methods were deployed. For instance, each Web Method could have been a separate (or stand-alone) Web Service, each invoked in turn by the same client application. Each Web Service

would have to be discovered and have its own WSDL file that would describe the interface available to the client application and to any other Web application, Web Service or software system. For example, three separate Web Services (authentication, federated search, and contract payment) could be created by three different developers and be deployed by an application whose architecture would be built to manage the workflow of these Web Services. The services could be seen as just another tool or component that can be invoked from within an institution's application. One survey participant likened this opportunity to the concept used by Microsoft DRM, where a licence to consume an instance of a medium is delivered, on demand, within their application.

While this research focused on desktop computers deploying Web Services, there are opportunities that the service could be extended to other ICT devices, such as, a web-enabled mobile phone or a Personal Digital Assistant (PDA), such as a Palm Pilot.

As this research concluded, an interview with an IS manager revealed limitations of XML Web Services using SOAP that was never discovered in the literature or the surveys. These limitations related particularly to NZ's digital infrastructure, where between geographic locations, users experienced limitations with bandwidth size and latency. Such limitations would affect the performance of XML Web Services. Further research could include an investigation measuring performance of Web Services in our NZ digital environment. One software development company expressed a preference to use XML RPC instead of XML SOAP.

This research has come to an end. Its purpose was to design and develop a DRM framework that would enable educators to carry out agreements over the Internet, with or without payment, to license the use of LOs. Limitations of the research mean that there are opportunities for further research in the future.

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Appendix A: Initial survey questionnaire

Table 1 shows the initial survey questionnaire that was sent to each individual of the sample.

Table 1: Initial survey questionnaire

Survey to investigate how organizations in New Zealand manage intellectual property for their digital resources.

Background:
I am a post-graduate student in a Masters of Information Science program at Massey University. The research of my thesis aims to investigate the development of a digital rights management framework that will enable educators to carry out agreements over the Internet, with or without payment, to license the use of learning resources. The digital rights management framework will use Web Services technology as the underlying technology to create the contract for an educator that, on agreeing to, will license the educator to use the selected resources.

This survey will identify the existence of policies managing intellectual properties for digital resources currently in organizations (business or educational) in New Zealand, and will determine the requirements of a contract for digital rights management in organizations who share their resources with external users.

- Instructions:
- Tab through the questions and answers.
 - Enter text in the normal manner where you are asked to write a text response.
 - Click the mouse to check a box (Yes or No).

Please complete the following about the details of your organization. The information that you give me will be confidential and used only for the purpose of this research.	
Name of your organization:	
Description of your core business:	
Name of email contact:	
Please answer the following questions with respect to your organization:	
Section A	
Sharing of organization's resources:	
1. Do you share resources that you have created, with users outside your organization?	<input type="checkbox"/> Yes <input type="checkbox"/> No
2. Do you charge these users for the use of the resources?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Policy:	
3. Do you have policy(s) that aims to protect intellectual property in your organization?	<input type="checkbox"/> Yes <input type="checkbox"/> No
4. Does the policy(s) apply across the entire organization?	<input type="checkbox"/> Yes <input type="checkbox"/> No
5. In the event of a breach of copyright, are you confident, that the policy(s) is legally binding?	<input type="checkbox"/> Yes <input type="checkbox"/> No
6. Does policy(s) enable a contract or an agreement between your organization and an external user, to use your resources?	<input type="checkbox"/> Yes <input type="checkbox"/> No

If you have answered yes to policy(s) enabling a contract for the use of your resources, please continue answering the questions in Section B. OR go to Section C.

Section B

The following questions in Section B relate to information that is presented in a contract for the purpose of licensing the use of your resources by external users.


Information in a contract to share your resources:	
7. Please tick the boxes of the components that are in a contract that licenses the use of your resources.	<input type="checkbox"/> Name of resource <input type="checkbox"/> Description of resource <input type="checkbox"/> Permissions e.g. display, print, modify <input type="checkbox"/> Constraints e.g. restriction of its use <input type="checkbox"/> Terms and conditions of use <input type="checkbox"/> Acceptance of terms and conditions <input type="checkbox"/> Other. Please name.
8. What permissions are applied to your resources. Tick the appropriate boxes.	<input type="checkbox"/> Display <input type="checkbox"/> Print <input type="checkbox"/> Play <input type="checkbox"/> Execute <input type="checkbox"/> Modify <input type="checkbox"/> Copy <input type="checkbox"/> Other. Please name.
9. What constraints are applied to your resources. Tick the appropriate boxes.	<input type="checkbox"/> Count e.g. how many <input type="checkbox"/> Place e.g. available for use in NZ only <input type="checkbox"/> Date restriction e.g. available for 30 days <input type="checkbox"/> Purpose e.g. for educational use only <input type="checkbox"/> Who can use it e.g. individual or group <input type="checkbox"/> Other. Please name.
Management of sharing resources:	
10. Does your organization manage the application and confirmation of a contract ..	<input type="checkbox"/> manually or <input type="checkbox"/> digitally, using an automated computer system e.g. online system
11. Do you enforce the contract or license for use of your resources?	<input type="checkbox"/> Yes <input type="checkbox"/> No
12. If yes, how do you enforce the protection of the intellectual property of your organization's resources?	

Digital Rights Management (DRM) is emerging as the solution to manage trading of objects on the web. The IMS Global Learning Consortium (www.imsglobal.org/) defines DRM as a group of technologies that provide a systematic approach to support the management of intellectual property for digital resources. DRM products were developed in response to the rapid increase in online piracy of commercially marketed material, which proliferated through the widespread use of Napster and other peer-to-peer file exchange programs (www.whatis.com). DRM includes functions for the description, identification, trading, protection, monitoring and tracking of digital content. DRM systems also support the expression of rights offers and agreements (e.g. licenses) for content and all the

parties involved (including rights holders). ¹	
13. Do you have anything similar to a digital rights management system?	<input type="checkbox"/> Yes <input type="checkbox"/> No
14. If yes, please tell me about it (e.g. name of DRM, off-the-shelf or customized product, date of installation, technologies used, pros and cons).	
Do you have any other comments you would like to contribute about managing the sharing of your organization's intellectual property?	
15. Your comments:	
Section C	
Thank you for completing this survey. I appreciate the time that you have given.	
16. Would you like to have the results of the findings of this survey?	<input type="checkbox"/> Yes <input type="checkbox"/> No
17. Would you agree to me contacting you, in the future, about this topic?	<input type="checkbox"/> Yes <input type="checkbox"/> No

Regards
Margaret Hill

Please email me your completed survey or
Post to:

Margaret Hill
PO 

Statement of ethics:

This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher named above is responsible for the ethical conduct of this research. If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher, please contact Professor Sylvia Rumball, Assistant to the Vice-Chancellor (Ethics & Equity), telephone 06 350 5249, email humanethicspn@massey.ac.nz.

¹ Iannella, R. (2003). Trading learning objects. Educause Australasia conference 2003. Retrieved August 2004 from <http://www.iprsystems.com/assets/lo-trade-educause-2003.pdf>

Appendix B: Results from Section A and B of Initial survey questionnaire

Tables 2 and 3 present the results of Sections A and B respectively from the Initial survey questionnaire. In addition, the purpose of each group of questions is stated, and the type of question is noted.

Table 2 : Results from Section A of Initial survey questionnaire

Section A
Sharing of your organization's resources
Purpose: To identify whether the organisation shares resources, and whether for free or fee.
Question 1: Do you share resources that you have created, with users outside your organization?
Type of question: Closed question
Result: 15 Yes 0 No
Question 2: Do you charge these users for the use of the resources?
Type of question: Closed question
Result: 6 Yes 9 No
Policy
Purpose: To identify the existence of policy(s) about protection of intellectual property, and the functions and extent of the policy(s).
Question 3: Do you have policy(s) that aim to protect intellectual property in your organization?
Type of question: Closed question
Result: 13 Yes 2 No
Question 4: Does the policy(s) apply across the entire organization?
Type of question: Closed question
Result: 11 Yes 3 No and 1 answering both yes and no
Question 5: In the event of a breach of copyright, are you confident, that the policy(s) is legally binding?
Type of question: Closed question
Result: 8 Yes 4 No
Question 6: Does policy(s) enable a contract or an agreement between your organization and an external user, to use your resources?
Type of question: Closed question
Result: 12 Yes 2 No

Table 3: Results from Section B of Initial survey questionnaire

Section B
Information in a contract to share your resources
Purpose: To identify the components of a contract for digital rights management
Question 7: Please tick the boxes of the components that are in a contract that licenses the use of your resources.
Type of question: Multiple closed question, and an open question for Other:
Result:
11 Name of resource
11 Description of resource

<p>10 Permissions e.g. display, print, modify</p> <p>11 Constraints e.g. restriction of its use</p> <p>10 Terms and conditions of use</p> <p>10 Acceptance of terms and conditions</p> <p>Other</p> <p>Result:</p> <p>Acknowledgements, remuneration, exit clause, and 1st right of purchase on sale of business</p>
<p>Question 8: What permissions are applied to your resources? Tick the appropriate boxes.</p> <p>Purpose: To identify the components of a contract for digital rights management</p> <p>Type of question: Multiple Closed question, and an open question for Other.</p> <p>Result:</p> <p>8 Display</p> <p>8 Print</p> <p>6 Play</p> <p>5 Execute</p> <p>5 Modify</p> <p>5 Copy</p> <p>Other:</p> <p>Result: Must use for agreed business reason only.</p>
<p>Question 9: What constraints are applied to your resources? Tick the appropriate boxes.</p> <p>Type of question: Multiple Closed question, and an open question for Other:</p> <p>Result:</p> <p>4 Count e.g. how many</p> <p>4 Place e.g. available for use in NZ only</p> <p>4 Date restriction e.g. available for 30 days</p> <p>7 Purpose e.g. for educational use only</p> <p>6 Who can use it e.g. individual or group</p> <p>Other:</p> <p>Result: Must use for agreed business reason only</p>
<p>Management of sharing resources:</p> <p>Purpose: To provide information about the process to contract, and the management of digital rights in an organisation.</p>
<p>Question 10: Does your organization manage the application and confirmation of a contract... manually/digitally?</p> <p>Type of question: Closed question</p> <p>Result: 10 manually or 1 digitally, using an automated computer system e.g. online system</p>
<p>Question 11: Do you enforce the contract or license for use?</p> <p>Type of question: Closed question</p> <p>Result: 7 Yes 4 No</p>
<p>Question 12: If yes, how do you enforce the protection of the intellectual property of your organization's resources?</p> <p>Type of question: Open question</p> <p>Result:</p>

- By controlling the time of use, legal obligations to protect IP, or by signing confidentiality agreement with a person or organisation before releasing any information

Digital Rights Management (DRM)

Purpose: Presents a definition of DRM and identifies whether the organisation's system is a DRM.

Definition

DRM is emerging as the solution to manage trading of objects on the web. The IMS Global Learning Consortium (<http://www.imsglobal.org/>) defines DRM as a group of technologies that provide a systematic approach to support the management of intellectual property for digital resources. DRM products were developed in response to the rapid increase in online piracy of commercially marketed material, which proliferated through the widespread use of Napster and other peer-to-peer file exchange programs (<http://www.whatis.com>). DRM includes functions for the description, identification, trading, protection, monitoring and tracking of digital content. DRM systems also support the expression of rights offers and agreements (e.g. licenses) for content and all the parties involved (including rights holders).²

Question 13: Do you have anything similar to a digital rights management system?

Type of question: Closed question

Result: 1 Yes 11 No

Question 14: If yes, please tell me about it (e.g. name of DRM, off-the-shelf or customized product, date of installation, pros and cons)

Type of question: Open question

Result:

- Crude management rights are used.
- By using password access.

Question 15: Do you have any other comments you would like to contribute about managing the sharing of your organization's intellectual property?

Type of question: Open question

Result:

- Statutory authorities are bound by Local Government Official Information and Meetings Act to conduct business publicly. Between similar authorities, information is shared freely.
- In education, issues around ownership of IP can become complex where there are publicly funded projects, for example by the Ministry of Education.
- DRM may be overkill and that it is easier to consider free share from public domain.
- Feel there is a reliance on copyright notices and that compliance was not very well developed yet.
- Private business' require a robust structure and investment in software to protect management of information internally and externally existed or is being pursued.
- One private business expressed concern that the commercial protection of IP was not always taken seriously in academic institutions.

² Iannella, R. (2003). Trading learning objects. Educause Australasia conference 2003. Retrieved August 2004 from <http://www.iprsystems.com/assets/lo-trade-educause-2003.pdf>

Appendix C: Expert questionnaire

Below is the information that was given to ICT educational experts, to respond to the findings of the initial survey questionnaire.

Research: Digital Rights Management Framework for learning objects

Background

I am a post-graduate student of Dr Kinshuk studying for a Masters of Information Science at Massey University. The research of my thesis aims to investigate the development of a digital rights management framework that will enable educators to carry out agreements over the Internet, with or without payment, to license the use of learning resources. The digital rights management framework will use Web Services technology as the underlying technology to create the contract for an educator that, on agreeing to, will license the educator to use the selected resources.

Research survey

Twenty four people with a wide range of business focus – school and tertiary education, internet and web services provider, computer consultancy, statutory authority, research, food manufacture, electricity generation and supplier - were invited to participate in a survey. The purpose of the survey was to identify the digital rights management policies that currently exist in organizations (education and business) in New Zealand and to determine the components of a contract for digital rights management in organizations who share resources with external users. Fifteen organisations responded and took part in the survey. The following information represent some results of the survey.

I invite you to comment about anything that you may think should be included in an online contract. I will use your comments to confirm the response from the survey.

Information in a contract to share resources:

1. It was generally felt that the components of a contract that licenses the use of their organisation's resources must include the following:
 - Name of resource
 - Description of resource
 - Permissions e.g. display, print, modify
 - Constraints e.g. restriction of its use
 - Terms and conditions of use
 - Acceptance of terms and conditionsand depending on the type of resource and its purpose may also include:
 - Acknowledgment of the creator
 - Remuneration
 - An exit clause
 - First right of purchase on sale of business.

Your comment:

2. The permissions that can be applied to a resource were clearly dependent on the type and purpose of the resource and could be explicitly stated in an agreement. The range of permissions may include:
 - Display
 - Print
 - Play
 - Execute
 - Modify
 - Copy.

Your comment:

3. The constraints applied to the resource were dependent on the type and purpose of the resource and could be explicitly stated in an agreement. The range of constraints may include:
- Count e.g. how many
 - Place e.g. available for use in NZ only
 - Date restriction e.g. available for 30 days
 - Purpose e.g. for educational use only
 - Who can use it e.g. individual or group.

Your comment:

Management of sharing resources:

4. A definition of **Digital Rights Management system (DRM)** was given in the survey to participants as an emerging solution to manage trading of objects on the web, thus:

The IMS Global Learning Consortium (www.imsglobal.org/) defines DRM as a group of technologies that provide a systematic approach to support the management of IP for digital resources. DRM products were developed in response to the rapid increase in online piracy of commercially marketed material, which proliferated through the widespread use of Napster and other peer-to-peer file exchange programs (www.whatis.com). DRM includes functions for the description, identification, trading, protection, monitoring and tracking of digital content. DRM systems also support the expression of rights offers and agreements (e.g. licenses) for content and all the parties involved (including rights holders).³

However, no organisation participating in the survey felt that they were using a DRM system. Most felt they were managing their intellectual property manually, with only one organisation claiming that they were managing IP digitally using an automated computer system.

Some final comments about the management of sharing organization's IP included:

- Statutory authorities are bound by Local Government Official Information and Meetings Act to conduct business publicly. Between similar authorities, information is shared freely;
- In education, issues around ownership of IP can become complex where there are publicly funded projects, for example by the Ministry of Education.
- Some felt that DRM may be overkill and that it was easier to consider free share from the public domain;
- Some felt that there was a reliance on copyright notices and that compliance was not very well developed yet;
- Private business' require robust structures and that investment of software to assist management of IP internally and externally was being pursued.
- One private business expressed concern that the commercial protection of IP was not always taken seriously in academic institutions.

In conclusion, **your comments** about the management of sharing resources and the use of a DRM system:

Thank you for contributing to my research. I appreciate the time that you have given.
Would you agree to me contacting you, in the future, about this topic? ☐ Yes ☐ No

Please return this document with your comments by 10 June 2005 to [REDACTED]

³ Iannella, R. (2003). Trading learning objects. Educause Australasia conference 2003. Retrieved August 2004 from <http://www.iprsystems.com/assets/lo-trade-educause-2003.pdf>

or post to Margaret Hill, [REDACTED] [REDACTED]

Statement of ethics:

This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher named above is responsible for the ethical conduct of this research. If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher, please contact Professor Sylvia Rumball, Assistant to the Vice-Chancellor (Ethics & Equity), telephone 06 350 5249, email humanethicspn@massey.ac.nz.

Appendix D: Evaluation questionnaire

Table 4 is the information contained in the evaluation survey questionnaire that is sent to each individual of the sample.

Table 4: Evaluation survey to assess a prototype - IPeMS

CONTENT

A. Introduction:	Background information about the research
B. About the prototype:	Information providing a brief description of the structure of the web application and the functions of the Web Services that are invoked.
C. Instructions:	Guidelines for participants to use the survey.
D. Evaluation survey:	A short survey consisting of 13 questions that participants are requested to complete and return to the researcher.

A. Introduction

This survey is the second survey within a post-graduate research that aims to investigate the development of a digital rights management (DRM) framework using Web Services. It is intended that the Web Services will create a contract for the teacher that, on agreeing to, will license the teacher to use selected learning objects. The post-graduate research seeks to:

1. Identify if DRM policies currently exist in organizations (education and business) in New Zealand.
2. Determine the requirements of a contract for DRM in organizations who share resources with external users.
3. Design an appropriate Web Services-enabled DRM framework to respond to a teacher's request for license to use learning object(s).
4. Develop a prototype of the DRM framework.
5. Evaluate the prototype with respect to its application in an educational environment, to license a teacher to use one or more learning resources/objects.

In early 2005, fifteen (out of 24) organisations, from a wide range of business' – school and tertiary education, internet and web services provider, computer consultancy, statutory authority, research, food manufacture, and electricity generation and supplier, responded to an initial survey. The purpose of the initial survey was to find answers to objectives 1 and 2 above, and the findings from this initial survey were further endorsed by 5 ICT educational experts (Attached file: *Summary of initial survey results.doc*)

The results of the initial survey contributed to the design and development of a prototype of a DRM framework, called Intellectual Property electronic Management System (IPeMS).

A second survey now requests feedback from participants about the prototype, for the purpose of meeting objective 5 above. Answers to questions will provide for the researcher a description of the user computer environment, will determine the potential use of IPeMS, and will provide feedback on the application's design, as an online digital rights management system. An analysis of your evaluation will contribute to the final stages of this research and thesis.

B. About the prototype

The web application prototype is built using VB.NET. It is made up of three ASP.NET client pages:

- A login page
- A search page which returns details, such as a description, media, permissions and constraints, for the use of learning objects.
- A contract page

The application invokes Web Services with the following Web methods to:

- check authentication of the login user name and password.
- carry out a global search on a keyword across a number of learning object repositories.
- manage the contract - to record, gain payment (if any) for use of, and provide access to learning objects

The application (IPeMS) can be accessed in your browser at <http://is-research.massey.ac.nz/~marg/IPeMS/>

C. Instructions for the survey

- On the next page, tab through the questions.
- Enter text in the normal manner where you are asked to write a text response.
- Click the mouse to check a box (Yes or No).

D. Evaluation survey

Please complete the following about the details of your organization. The information that you give me will be confidential and used only for the purpose of this research.

Name of your organization:	
Description of your core business:	
Name of email contact:	

If you haven't already, execute the web application IPeMS in your browser.
Please answer the following questions with respect to your use of the application

Section A: Your computer environment

1. Where is the locality of the computer that you are using to run the application. eg home in Foxton, office in Wellington etc	
2. To access this application, please give the specifications of your computer environment. <ul style="list-style-type: none"> • computer brand • computer operating system • processing speed of computer • other 	
3. Did you experience any technical difficulties when accessing/running the application? Explain.	

Section B: Comments about web application IPeMS

Usefulness to an educator to use learning objects

4. If you were an educator, would you use an online system like this to search for learning objects?	<input type="checkbox"/> Yes <input type="checkbox"/> No
5. Would you be willing to pay online for use of learning objects?	<input type="checkbox"/> Yes <input type="checkbox"/> No
6. Please write further comments about the use of IPeMS as an online digital rights management system.	

Usefulness to a developer of learning objects

7. If you were a developer would you trust a system like this to protect the intellectual property of learning objects that you may develop in the course of your work?	<input type="checkbox"/> Yes <input type="checkbox"/> No
8. What expectations would you have of the third party with respect to the contract and payment in managing your intellectual property? Please explain.	

Application design

9. Is the application easy to follow and use?	<input type="checkbox"/> Yes <input type="checkbox"/> No
10. Comment on any aspect of design of the interface – both good and opportunities to improve.	

General comments

11. Please make any other comments about managing the sharing of your organization's intellectual property.	
Section C	
Thank you for completing this survey. I appreciate the time that you have given.	
Would you like to have the results of the findings of this survey?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Would you agree to me contacting you, in the future, about this topic?	<input type="checkbox"/> Yes <input type="checkbox"/> No

Please return this document with your comments by 28 February 2006 to marg.pete@xtra.co.nz or post to Margaret Hill, PO Box 4, Foxton

Statement of ethics:

This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher named above is responsible for the ethical conduct of this research. If you have any concerns about the conduct of this research that you wish to raise with someone other than the researcher, please contact Professor Sylvia Rumball, Assistant to the Vice-Chancellor (Ethics & Equity), telephone 06 350 5249, email humanethicspn@massey.ac.nz.

Appendix E: Results from Section A and B of Evaluation questionnaire

Tables 5 and 6 present the results of Sections A and B respectively of the Evaluation questionnaire. In addition, the purpose of each group of questions is stated, and the type of question is noted.

Table 5: Results from Section A of Evaluation questionnaire

Section A:					
Your computer environment					
Purpose: To provide information about the participant's computer environment					
1. Where is locality of the computer that you are using to run the application. eg home in Foxton, office in Wellington etc					
Purpose: Geographic locality determines remote access from anywhere.					
Type of question: Open question					
Result:					
Wide geographic locations					
Home locations in Pukerua Bay; Palmerston North x 2; Bulls; Levin; Wadestown in Wgtn; North Shore, Auckland; Foxton;					
Office locations in Wellington x 9; Auckland; Napier; Auckland					
2. To access this application, please give the specifications of your computer environment.					
<ul style="list-style-type: none">• computer brand• computer operating system• processing speed of computer• other					
Purpose: Determines types of computer platforms accessing the IPeMS.					
Type of question: Open question					
Result:					
A wide range of computers of different brands and models, operating systems, processor speeds, RAM size, and Internet connection accessed IPeMS.					
Brand/Model	Operating system	Processor	RAM	Internet connection	Other information
Advantage	Microsoft (MS)	AMD Duron CPU	256 MB	56 kbs dialup	Hard drive: 80GB
ASUS laptop	Windows 98	650 MHz	512 MB DDR SDRAM	ASDL modem 320 mbs	Internet Explorer: 6.0.2800
Compaq	MS Windows 2000	Intel Pentium processor	1.49GB		
Compaq Presario 2100	XP Professional	900MHz	2GB		
Dell Dimension	V2000 Service Pack 1	Pentium 1.6 GHz			
Hewlett Packard (HP) 7540	MS Windows XP Service Pack 2	1.79GHz CPU			
HP nx9110	MS Windows XP Home edition	1.83 GHz Dual Core			
HP Compaq					
IBM Laptop (T42)		Pentium R 2.8GHz			

MAC G4 Powerbook		Intel Pentium III			
Toshiba laptop Toshiba Tecra A7		Intel Prescott Pentium 4 3.0 GHz			
Quay computers		Pentium 4 3.2GHz			
		Intel Pentium M processor 740			
<p>3. Did you experience any technical difficulties when accessing/running the application? Explain.</p> <p>Purpose: Determines any technical problems with accessing/running the system.</p> <p>Type of question: Open question</p> <p>Result:</p> <p>14 users did not experience any technical problems.</p> <p>Technical problems experienced when accessing/running the application included:</p> <p>Search and LO page:</p> <ul style="list-style-type: none"> To submit the search keyword, pressing 'Enter' does not work. the search is only executed in the event of clicking the Search button. When clicking button "Ready to make a Contract", without selecting any LO, a server error rendered. When selecting an LO by clicking in the check box, the screen goes blank for 2-3 seconds, and the Permissions and Constraints do not change until the 'View' is clicked. Returning to this page from the Contract page to search again, the Permissions and Constraints for the first search were still on the page below the datagrid. <p>Contract page:</p> <ul style="list-style-type: none"> After entering a fictitious VISA number and expiry date, got a Server Error in "~marg/lpeMS" application ("Unable to process request"), when trying make a contract for selected "Free Crossword" LO. Credit card expiry date mm/dd/yy would only work if numbers of day and month were less than 2 digit numbers. A false date entered 'bounced' user back to Search page. 					

Table 6: Results from Section B of Evaluation questionnaire

Section B: Comments about web application IPeMS	
Purpose: To determine the use of IPeMS and comment on its design, as an online digital rights management system.	
Usefulness to an educator to use learning objects	
4. If you were an educator, would you use an online system like this to search for learning objects?	
Type of question: Closed question	
Result:	
19 Yes 1 No	
5. Would you be willing to pay online for use of learning objects?	
Type of question: Closed question, but 2 respondents said yes, but with condition	

Result:

17 Yes 4 No

Conditions:

- Depends on the content of the site.
- "Actually depends", and only if education institution pays.

6. Please write further comments about the use of IPeMS as an online digital rights management system.

Type of question: Open question

Comments about use of IPeMS by an educator as an online system that manages IP of LO:
Quality assurance of Learning objects

- As an educator in a school, with a budget, a planned approach to build a bank of LOs that focus and enhance student achievement according to the school's strategic plan is required. To justify licensing LOs that are found using IPeMS, school will need to be assured that LOs have already been quality assured and/or screened.
- Search engine will need to assist an educator to locate quality and appropriate LOs in a time-efficient way, or else the educator will choose to use an 'open' search. x2
- Institution policy will have to support the use of LOs in external repositories, and that cost is justified by, for example, time saving, to search to use someone else's work, instead of creating own material.

Learning Objects

- There needs to be a wide range of quality and appropriate LOs. x3
- Explicit information about permissions and constraints to avoid infringement is useful

Characteristics of a digital rights management system needs to be:

- Easy to use and navigate x 4.
- Easy search to find relevant and appropriate LO.
- LOs choice is continually being increased with new and/or updated LOs.
- Secure, to protect the information being shared, and use of a secure and credible payment method (for example, for a secure credit card transaction use of the credit card identifier number on the back of the card could be used as further authentication of user).
- A one-stop-shop for educator and developer.

Functions of a DRM system need to include

- Uploading of a new LO by developer

Educator's preference

- The educator can not be excluded to search outside the federated search accessed from this DRM. Experience has been with The Le@rning Federation that a single search is not enough, and that a search across the Internet is preferred.

Opportunities

- Similar management systems access other data, for example, weather data.
- Use of this type of system could extend to Science/Research library and Patent searches.
- Improvement on search function: The prototype search facility is fairly crude. A commercial product of this type will require a much better search algorithm. In order to fully evaluate such a system one must also evaluate the metadata schema for the the database holding the profile on the learning material.

Usefulness to a developer of learning objects

7. If you were a developer would you trust a system like this to protect the intellectual property of learning objects that you may develop in the course of your work?

Type of question: Closed question but 4 also gave a conditional answer

Result:

11 Yes 5 No 5 Did not answer

Conditions:

- The system should include the following for the developer:
 - Rationale of the costing structure for LOs, relating to complexity of their development.
 - Frequency of access to each LO.
 - Documentation around the management of the IP, before submitting work, with an opportunity to state the permissions and constraints for the use of the LO by others.
 - An online legal contract for management of IP of LO for the developer.
- Trust will have to be earned between the person/company/authority of the system that manages the search and the developer. Authenticity and credibility of the owner is seen as important. For example, the developer would submit to a system run by the Ministry of Education, but would be cautious about a single unknown individual.
- Would only use the system if endorsed in institution IP policies.

8. What expectations would you have of the third party with respect to the contract and payment in managing your intellectual property? Please explain.

Type of question: Open question

Result:

Developer would have the following expectations:

Legal process

- Assurance that all legal aspects of contract with the 3rd party are robust and stand up in court.
- Good contractual obligations are required.
- Legal aspects of security and value for money are required.

Security

- Assurance that IP is managed securely.
- Acknowledgment of risk is explicit.
- Confidentiality of information about the payer and payee.
- Secure monetary transactions are carried out.
- No access unless licence with or without payment is complete.

Management of developers' IP

- Ability to view all LOs (by name and type) in the LO repositories, to carry out a gap analysis of content, in order to focus on development of LOs that are not yet developed.
- The right to define the permissions and constraints for each LO they submit.
- Any change in payment is signalled in advance
- Confidence that system will control and release safely the developer's product.
- Understand the process and controls that will identify a breach of use of an LO, and enforcement of the breach.
- Payment to the developer is managed according to a business rule and ethics.
- Ability to check own account online, with respect to transactions.
- Ability to receive feedback about any transaction.
- The right to view a list of authorised users.
- The option to restrict/refuse some users, for example, when payments are dishonoured, or if organisations are known to steal IP.
- Regular updates and communication.

Other comments

- "There is a huge element of trust here." System must develop trust between developer and the purchaser. There needs to be confidence that licensed users will in fact only use the IP as stated in the contract, and not further share or publish it in any way that will give others opportunity to use it with out payment. Unsurety in how you mange this. Comments included "It is hard to constrain copying of LOs",

- “unsure about protection of IP, once out in the big wide world”
- System is ‘the middle man’ managing the selling and buying of information only.
- “As a third-party provider I would want a process that was simplicity itself for registration and management of any media I promoted through such a site. The legalities are something I would look at on a case-by-case basis”

Application design

9. Is the application easy to follow and use?

Type of question: Closed question

Result:

18 Yes 1 No 2 Did not answer

10. Comment on any aspect of design of the interface – both good and opportunities to improve.

Type of question: Open question

Comments:

Components

- Selection of LO did not give a view of LO. Information of Permissions and Constraints is only viewed in the event of clicking View.
- Good to see format of an LO.
- The button “Ready to make a contract” is not available until you view Permissions and Constraints for at least one LO. Need to instruct the user that a contract is only possible once the user has viewed the Permissions and Constraints.
- Details of Permissions and Constraints of previous search are retained, even after changing the search, and only change in the event of clicking View from the new search.
- Submit buttons, for example, to view Permissions and Constraints of LO or to submit payment of LO, rendered the page again at the top of the page. This meant that it was not clear where the information was and there was a need to scroll down to view the conditions or the completed contract respectively. A suggestion to was to either put the views at the top of the page, or write something appropriate to tell me to look for information at the bottom of the page, for example, “scroll down to view your completed contract” or “congratulations on your purchase”. The user even “wondered if my contract had been accepted.”
- Credit card date should be in order of dd/mm/yy, since that is the order most New Zealanders are used to.
- Expiry date of AMEX or credit cards only use month and year.
- Credit card number is often restricted by length. Could provide an input mask for this entry.
- If the payment is zero dollars, one person suggested that there is no need to request details of payment method.
- Once a contract is completed, there needs to be a button that will return the educator to the Search page to begin a new search.
- Links need to work, for example, there is a broken link for <http://is-research.massey.ac.nz/~marg/IPeMS/www.pasifikalegends.co.nz>
- Copyright year must be current.

Design, content and layout

- Interface design is “clearly set out”.x2; “easy to follow”; “fine”; “fairly clean”; “very straight forward and neat”; “attractive looking”; “professional, crisp and classy”; “clear and simple”
- Content is easy to follow; “good clear information although use of some words a bit obscure, for example ‘learning object repositories’ but may be educator jargon”; “explanations and instructions are easy to follow. The text flows well”;
- Useful explanation on the Contract page tells the user what was needed and what

to expect next.

- The word "You" is used in the Permissions and Constraints information. It was felt by one respondent that you is "insufficient as it treats all users the same. It needs to specify educational/editorial use".
- Prompt in windows pop-up message was seen as 'good'
- One person gave advice on wording instructions, suggesting they need to be more direct, for example:
 - "Don't forget to view conditions and permissions to use each learning object." could be more direct.
 - "Select a learning object by checking the box at the left-handside" needs to be more direct too, especially where "check to select" actually means "tick the box".
 - Windows pop-up message, "Have you checked out the permissions and constraints..." meaning have you looked at, read, and understood.
 - "Try a valid date, for example, 12/25/06" isn't quite right. Should be "Use a valid date".
- The Windows pop-up message could represent the digital acceptance of the contract, and if so legal advice should be sought on the wording.
- "I like the colours"; colours "are easy on the eyes"; "shaded grey differentiates the different objects well";
- Two people commented on colours to improve accessibility, especially the 2 grey and green print on grey/white. One suggestion was to darken the green type 'considerably' or change to black.
- The view of Permissions and Constraints appeared on screen at the bottom of the datagrid, and sometimes only noticed if scrolled down.
- Permissions and Constraints are an integral part of the Search result, and would be better to appear alongside or in a new window, without having to scroll down below a long listing.
- Two people would like to see the entire contract online, explicit license conditions for each LO, as well as the hard copy that is sent to the educator.

New components, functions and ideas

- A preview of the LO would be helpful for educator to know what they are purchasing. Suggestion that in the description field, a link to detailed description, including screen-shots/demonstrations of the LO would be useful.
- Require a function to submit new LOs.
- Search could be extended to types of format.
- Advertise secure payment, for example, BPAY®
- To better simulate the LO purchase rather than linking to a web site, it may be better to link to a package file, for example, Zip file or provide a digital certificate to authenticate the actual contract.

General comments

11. Please make any other comments about managing the sharing of your organization's intellectual property.

Type of question: Open question

Comments:

- "We take this issue very seriously and build protection into our products".
- Issues around IP are not often addressed by some business' until after infrastructure installations or upgrades are made, and consequently required hardware and software are not all purchased.
- There is evidence of some sharing of IP in industry. There is often expectations of business ethics and Quid pro quo (which is a legal term for the transaction of valued items or favours, in return for giving something of value). However, use of reporting and IP are not generally planned and managed.

- In one large tertiary institution, there will be difficulties in using such a system because of the requirement of a budget to purchase the licence to use LOs, and the requirement of a central IP management team to scrutinise and check quality of LOs that are developed within their institution, before allowing upload.
- The opportunity for maintaining quality work in a restricted or passworded online environment means that there needs to be quality assurance processes in place.
- "This also has application for managing access to IP for which a developer/owner wishes to charge, whether or not the object is a learning one. Even in the public sector, there is information that both ought to be publicly available, and ought to be accessible, subject to payment, in order to cover development costs. IPeMS offers a good prospect here".
- Organisations can manage the sharing of their IP through IP policy.
- One person investigated existing federated search engines and found:
 - for a learning object repository - HarvestRoad Hive - <http://www.harvestroad.com/> ; and
 - for a library - Softlink Oliver (aka Liberty) – <http://www.softlinkpacific.co.nz>
- The same person states that:
 - a DRM should not be integrated into an application for the purpose of power use;
 - installing a custom-made application does not appeal, but would be prefer a world-wide "standard" application such as one owned by Microsoft or by an international group.
 - Title and Author are the minimum for attributes, under the NZ Copyright Act 1994.
 - While Creative Commons licensing is a great idea, people overlook the fact that their own creative work must also be licensed under Creative Commons??
 - .APRA / AMCOS are specifically for published recordings and not text or images.
 - TradeMe is not an agent, but a means of linking buyer and seller and enabling transfer of messages and funds. He sees that IPeMS should NOT to be responsible for transactions. He suggests that IPeMS could offer simplified options for people to agree (in the same way Creative Commons offers various options).
- In the situation of a dispute, between buyer and developer, clear policy and procedures need provide an avenue for resolution between the parties.
- One respondent distributes IP through a web site or through media such as DVD to clients directly. Most of the IP is done as bespoke (or custom-designed) work and has little application to other users.

Appendix F: Web service code

The Web service code making up the .asmx file is written in Visual Basic and is created in Visual Studio.NET. The Web Methods or operations of the service can be seen as the functions GetResult, Authenticate, and WSTransaction.

```
Imports System.Web.Services
Imports System.Data
Imports System.Configuration
```

```
<System.Web.Services.WebService(Namespace := "http://tempuri.org/IPWS/Service1")> _
Public Class Service1
    Inherits System.Web.Services.WebService
```

'Web Services Designer Generated Code not shown'

```
    <WebMethod(Description:="This web method searches on the key word(s) and returns a
search result of learning objects.")> _
    Public Function GetResult(ByVal txtKeyword As String) As System.Data.DataSet
        Dim myConn As New OleDb.OleDbConnection(ConfigurationSettings.AppSettings("strConn"))
        Try
            Dim Adapter As New OleDb.OleDbDataAdapter("SELECT LO_ID, Name, Description,
Format, Cost, Copy, Print FROM LearningResource WHERE LearningResource.Name LIKE '%" &
txtKeyword & "%' OR LearningResource.Description LIKE '%" & txtKeyword & "%'", myConn)
            Dim DS As New DataSet
            Adapter.Fill(DS, "LearningResource")
            Return DS
        Finally
            myConn.Close()
        End Try
    End Function
```

```
    <WebMethod(Description:="This web method authenticates the login of the user")> _
    Public Function Authenticate(ByVal txtLogin As String, ByVal txtpassword As String) As DataSet
        Dim myConn As New OleDb.OleDbConnection(ConfigurationSettings.AppSettings("strConn"))
        Try
            Dim Adapter As New OleDb.OleDbDataAdapter("SELECT Customer_ID,
Customer_Username, Customer_Email FROM Customer WHERE Customer_UserName = '" &
txtLogin & "' AND Password = '" & txtpassword & "'", myConn)
            Dim DSid As New DataSet
            Adapter.Fill(DSid, "Customer")
            Return DSid
        Finally
            myConn.Close()
        End Try
    End Function
```

```
    <WebMethod(Description:="This web method is a transaction that manages the contract for an
educator to be licensed to use one or more learning objects. The web service returns a dataset to
client application to confirm the transaction.")> _
    Public Function WSTransaction(ByVal intCustomer_ID As Integer, ByVal txtPayment_Method As
String, ByVal dateExpiry_Date As Date, ByVal txtCardNo As String, ByVal TPayment As Decimal,
ByVal strLOList As String()) As System.Data.DataSet
        Dim myConn As New OleDb.OleDbConnection(ConfigurationSettings.AppSettings("strConn"))
        myConn.Open()
        Try
            Dim strSQL As String = "INSERT INTO ContractTransaction(Customer_ID,
Payment_Method, Expiry_Date, CreditCardNo, Total_Payment) VALUES ('" & intCustomer_ID & "', '" &
txtPayment_Method & "', '" & dateExpiry_Date & "', '" & txtCardNo & "', '" & TPayment & "')"
            Dim objCmd As New OleDb.OleDbCommand(strSQL, myConn)
            objCmd.ExecuteNonQuery()
            Dim strSQL2 As String = "SELECT @@IDENTITY"
```

```

Dim objCmd2 As New OleDb.OleDbCommand(strSQL2, myConn)
Dim transID As Integer = Nothing
transID = objCmd2.ExecuteScalar()
Dim i As Integer
Dim currTotal As Decimal
For i = 0 To strLOList.GetUpperBound(0)
    Dim strSQL4 As String = "INSERT INTO Transaction_LO(Transaction_ID, LO_ID)
VALUES (" & transID & ", " & Convert.ToInt64(strLOList(i)) & ")"
    Dim obj4Cmd As New OleDb.OleDbCommand(strSQL4, myConn)
    obj4Cmd.ExecuteNonQuery()

    Dim strSQL5 As String = "SELECT Cost FROM LearningResource WHERE LO_ID = " &
Convert.ToInt64(strLOList(i)) & ""
    Dim obj5Cmd As New OleDb.OleDbCommand(strSQL5, myConn)
    Dim LOCost As Decimal = obj5Cmd.ExecuteScalar()
    currTotal = currTotal + LOCost
Next
Dim strSQL6 As String = "SELECT Total_Payment FROM ContractTransaction WHERE
Transaction_ID = " & transID & ""
Dim obj6Cmd As New OleDb.OleDbCommand(strSQL6, myConn)
Dim TotalCost As Decimal = obj6Cmd.ExecuteScalar()

If currTotal = TotalCost Then
    Dim Adapter As New OleDb.OleDbDataAdapter("SELECT
ContractTransaction.Transaction_ID, Customer.Customer_UserName, LearningResource.Name,
LearningResource.URL, LearningResource.LO_ID, ContractTransaction.Total_Payment " & _
" FROM (Customer INNER JOIN [ContractTransaction] ON Customer.Customer_ID =
ContractTransaction.Customer_ID) INNER JOIN (LearningResource INNER JOIN Transaction_LO
ON LearningResource.LO_ID = Transaction_LO.LO_ID)" & _
" ON ContractTransaction.Transaction_ID = Transaction_LO.Transaction_ID " & _
" WHERE (((ContractTransaction.Transaction_ID)=" & transID & " ))", myConn)

    Dim DS As New DataSet
    Adapter.Fill(DS, "Confirming")
    Return DS
End If
Finally
    myConn.Close()
End Try
End Function
End Class

```

Appendix G: Web service XML schema

The XML code of the WSDL file is auto-generated code when creating a Web service in Visual Studio.NET. The schema describes the structure and the order of the elements, and attributes of associated XML documents.

```
<?xml version="1.0" encoding="utf-8" ?>
- <definitions xmlns:http="http://schemas.xmlsoap.org/wsdl/http/"
  xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
  xmlns:s="http://www.w3.org/2001/XMLSchema" xmlns:s0="http://tempuri.org/IPWS/Service1"
  xmlns:soapenc="http://schemas.xmlsoap.org/soap/encoding/"
  xmlns:tm="http://microsoft.com/wsdl/mime/textMatching/"
  xmlns:mime="http://schemas.xmlsoap.org/wsdl/mime/"
  targetNamespace="http://tempuri.org/IPWS/Service1"
  xmlns="http://schemas.xmlsoap.org/wsdl/">
- <types>
- <s:schema elementFormDefault="qualified" targetNamespace="http://tempuri.org/IPWS/Service1">
  <s:import namespace="http://www.w3.org/2001/XMLSchema" />
- <s:element name="GetResult">
- <s:complexType>
- <s:sequence>
  <s:element minOccurs="0" maxOccurs="1" name="txtKeyword" type="s:string" />
  </s:sequence>
  </s:complexType>
  </s:element>
- <s:element name="GetResultResponse">
- <s:complexType>
- <s:sequence>
- <s:element minOccurs="0" maxOccurs="1" name="GetResultResult">
- <s:complexType>
- <s:sequence>
  <s:element ref="s:schema" />
  <s:any />
  </s:sequence>
  </s:complexType>
  </s:element>
  </s:sequence>
  </s:complexType>
  </s:element>
- <s:element name="Authenticate">
- <s:complexType>
- <s:sequence>
  <s:element minOccurs="0" maxOccurs="1" name="txtLogin" type="s:string" />
  <s:element minOccurs="0" maxOccurs="1" name="txtpassword" type="s:string" />
  </s:sequence>
  </s:complexType>
  </s:element>
- <s:element name="AuthenticateResponse">
- <s:complexType>
- <s:sequence>
- <s:element minOccurs="0" maxOccurs="1" name="AuthenticateResult">
- <s:complexType>
- <s:sequence>
  <s:element ref="s:schema" />
  <s:any />
  </s:sequence>
  </s:complexType>
  </s:element>
  </s:sequence>
  </s:complexType>
  </s:element>
- <s:element name="WSTransaction">
```

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- <s:complexType>
- <s:sequence>
  <s:element minOccurs="1" maxOccurs="1" name="intCustomer_ID" type="s:int" />
  <s:element minOccurs="0" maxOccurs="1" name="txtPayment_Method" type="s:string" />
  <s:element minOccurs="1" maxOccurs="1" name="dateExpiry_Date" type="s:dateTime" />
  <s:element minOccurs="0" maxOccurs="1" name="txtCardNo" type="s:string" />
  <s:element minOccurs="1" maxOccurs="1" name="TPayment" type="s:decimal" />
  <s:element minOccurs="0" maxOccurs="1" name="strLOList" type="s0:ArrayOfString" />
</s:sequence>
</s:complexType>
</s:element>
- <s:complexType name="ArrayOfString">
- <s:sequence>
  <s:element minOccurs="0" maxOccurs="unbounded" name="string" nillable="true" type="s:string" />
</s:sequence>
</s:complexType>
- <s:element name="WSTransactionResponse">
- <s:complexType>
- <s:sequence>
- <s:element minOccurs="0" maxOccurs="1" name="WSTransactionResult">
- <s:complexType>
- <s:sequence>
  <s:element ref="s:schema" />
<s:any />
  </s:sequence>
</s:complexType>
</s:element>
</s:sequence>
</s:complexType>
</s:element>
</s:schema>
</types>
- <message name="GetResultSoapIn">
  <part name="parameters" element="s0:GetResult" />
</message>
- <message name="GetResultSoapOut">
  <part name="parameters" element="s0:GetResultResponse" />
</message>
- <message name="AuthenticateSoapIn">
  <part name="parameters" element="s0:Authenticate" />
</message>
- <message name="AuthenticateSoapOut">
  <part name="parameters" element="s0:AuthenticateResponse" />
</message>
- <message name="WSTransactionSoapIn">
  <part name="parameters" element="s0:WSTransaction" />
</message>
- <message name="WSTransactionSoapOut">
  <part name="parameters" element="s0:WSTransactionResponse" />
</message>
- <portType name="Service1Soap">
- <operation name="GetResult">
  <documentation>This web method searches on the key word(s) and returns a search result of
    learning objects.</documentation>
  <input message="s0:GetResultSoapIn" />
  <output message="s0:GetResultSoapOut" />
</operation>
- <operation name="Authenticate">
  <documentation>This web method authenticates the login of the user</documentation>
  <input message="s0:AuthenticateSoapIn" />
  <output message="s0:AuthenticateSoapOut" />
</operation>

```



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- <operation name="WSTransaction">
  <documentation>This web method is a transaction that manages the contract for an educator to
    be licensed to use one or more learning objects. The web service returns a dataset to client
    application to confirm the transaction.</documentation>
  <input message="s0:WSTransactionSoapIn" />
  <output message="s0:WSTransactionSoapOut" />
  </operation>
</portType>
- <binding name="Service1Soap" type="s0:Service1Soap">
  <soap:binding transport="http://schemas.xmlsoap.org/soap/http" style="document" />
- <operation name="GetResult">
  <soap:operation soapAction="http://tempuri.org/IPWS/Service1/GetResult" style="document" />
- <input>
  <soap:body use="literal" />
  </input>
- <output>
  <soap:body use="literal" />
  </output>
</operation>
- <operation name="Authenticate">
  <soap:operation soapAction="http://tempuri.org/IPWS/Service1/Authenticate" style="document" />
- <input>
  <soap:body use="literal" />
  </input>
- <output>
  <soap:body use="literal" />
  </output>
</operation>
- <operation name="WSTransaction">
  <soap:operation soapAction="http://tempuri.org/IPWS/Service1/WSTransaction" style="document" />
- <input>
  <soap:body use="literal" />
  </input>
- <output>
  <soap:body use="literal" />
  </output>
</operation>
</binding>
- <service name="Service1">
- <port name="Service1Soap" binding="s0:Service1Soap">
  <soap:address location="http://localhost/IPWS/Service1.asmx" />
  </port>
</service>
</definitions>

```