# Content ecosystem implementation roadmap

# Table of contents

# 1 Introduction

Becta published the strategy document Promoting an ecosystem that enables the discovery, delivery and sharing of digital learning resources[1], created collaboratively with National Education Network (NEN) partners, on 5 June 2009.

The strategy document sets out a vision for content discovery, delivery and sharing advocated by those active in the NEN, describing high level end-user functionality and a set of technical architecture recommendations to support it. It promotes a sustainable model that prioritises the support of a coherent integration of existing and developing services above the creation of new, centrally managed services.

The ecosystem strategy is designed to improve efficiency for users by:

- reducing the time taken for users to find resources that are appropriate for educational use and meet specific requirements, including quality
- reducing the incidence of users investing time and money in resources that are either inadequate or not appropriate to their needs
- improving sharing and reuse of resources and reducing the inappropriate use of rights protected resources.

It will also provide efficiencies for resource and service providers by providing a level playing field for bringing products to market and by:

- allowing the user to exercise greater informed choice and so focus investment in the development of services and resources that meet the needs of the end user
- reducing supplier overheads including marketing costs and costs associated with support for multiple technical standards
- removing the need for providers having to play multiple roles in the delivery chain, ie content providers will not need to create search portals or delivery platforms themselves.

This is the first supplementary document to be published in relation to the ecosystem strategy. Its core purpose is to expand upon, contextualise and prioritise the components that are currently recognised as having strong potential for inclusion within the ecosystem. The document is intended to provide a flexible pathway to enable the realisation of the content ecosystem vision through a collaboration of partners and providers making up the NEN. To address the key principle of sustainability of services the roadmap will be further shaped by the community that evolves to deliver and support the content ecosystem.

The implementation roadmap has been divided into four phases. This document focuses on the first phase and provides initial planning for the second, third and fourth phases.

[1] [http://industry.becta.org.uk/display.cfm?resID=40418]

## 2 Executive summary

The ecosystem implementation roadmap defines a set of aims that will be achieved during the first phase of the project. It also defines a less detailed scope for activities that will be prioritised in phases two, three and four.

The phase one aims are listed below, in no particular order of priority.

**Aim 1**

We will actively engage with stakeholders who have already expressed support or interest in the ecosystem strategy, facilitate potential business relationships and approach new stakeholders to encourage support and participation.

**Aim 2**

We will work with stakeholders to identify and establish communities of practitioners to support a wider understanding and uptake of digital content and tools to support the ecosystem.

**Aim 3**

We will work with a group of stakeholders to select or, where appropriate, define education application profiles of the Learning Object Metadata (LOM), Dublin Core (DC) and Machine-Readable Cataloguing (MARC 21) schemas for describing digital learning resources.

**Aim 4**

We will work with a group of stakeholders to select or, where appropriate, define standards, specifications and education application profiles for digital learning resources.

**Aim 5**

We will work with a group of stakeholders to define the elements that should be stored within a central index and how the relevant metadata/packaging standards map to this information.

**Aim 6**

We will work with a group of content providers to ingest metadata into a pilot central index through harvesting, feeds or deposit methods.

**Aim 7**

We will lead work to identify the issues that make intellectual property rights (IPR) and copyright problematic and identify approaches to solving each. This work will also identify a set of licences that encompass the broad requirements and their interrelation.

**Aim 8**

We will lead work to provide guidance on the real web issues surrounding mismanagement of digital learning resource identity and resolution and how to overcome this. Considered recommendations will be made for suitable technologies that could be used, by setting, to manage persistent identity and resolution.

**Aim 9**

We will work with stakeholders to define appropriate standards and specifications for use by the pilot central index. We will also work with partners to design and configure a working prototype that enables both the ingestion of information about digital learning resources and the searching of the resulting index through machine to machine interfaces.

**Aim 10**

We will work with a group of stakeholders to define the policy and management aspects that a central index service should include. This will also include discussion of possible sustainable business models for the service.

**Aim 11**

We will work with the UK Access Management Federation (UK federation) to establish how federated access management can be more seamlessly integrated by service providers, tackling misconceptions, implementation problems and concerns that stakeholders have raised to date. JANET(UK) will produce refreshed guidance, while a series of case studies will be presented and discussed at the UK federation in practice event[2] in October 2009.

**Aim 12**

We will produce and publish an ecosystem standards catalogue through consultation with stakeholders.

[2] [http://www.ja.net/services/events/2009/federationinpractice_london/index.html]

In conjunction with these aims we will be encouraging interested parties to submit proposals that offer prototype added value services that exemplify the ecosystem vision. Details of these procurements will be published on our Industry and developers website[3] once available.

The implementation of the ecosystem will involve a series of separate procurement exercises and a single multi-lot procurement. It's not anticipated that all procurement activity will involve a direct cost to government. There is a realisation that augmentation and reuse of existing technology and effort can deliver a proportion of the aims with no cash cost implications at all.

[3] [http://www.becta.org.uk/industry/procurement]

# 3 The ecosystem jigsaw

The ecosystem is analogous to a jigsaw. Without any single piece the ecosystem would not be complete. It also takes time to put together in the correct way. The ecosystem can be divided into ten 'pieces' or elements that comprise the complete jigsaw. The diagram below illustrates the components.

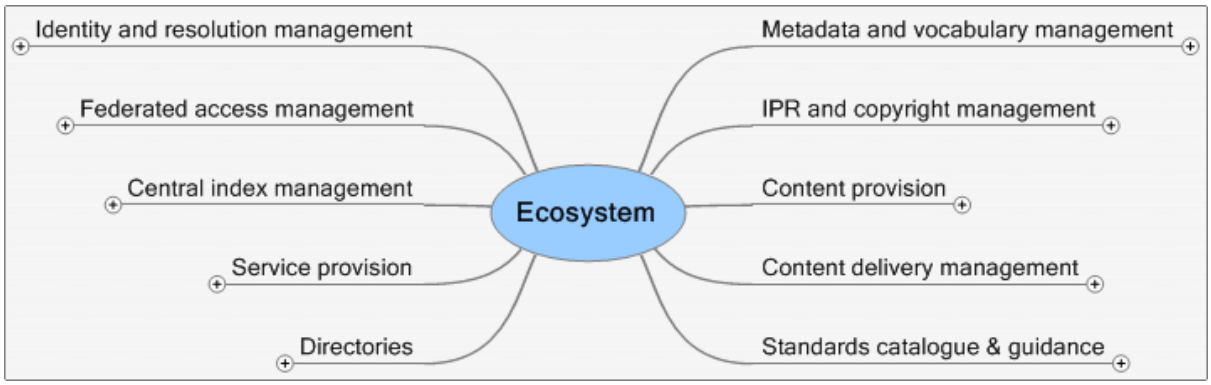


*Figure 1- Ecosystem components*

Each element is described at a high level below.

## 3.1 Content provision

Digital learning resources (DLRs) are the 'currency' of the ecosystem. They can be any of the following sources:

- Public funded – from local authorities, government departments and agencies and the cultural sector, amongst others
- Commercial – predominantly from commercial publishers
- User generated – created by teacher and learner communities
- Remixed – the mashup[4] of any type of existing digital content.

The ecosystem is reliant on there being a diverse and comprehensive set of DLRs provided by these different sources, so that service providers can develop rich applications that deliver compelling outcomes for the user.

[4] Mashup – the blending of two or more existing digital content resources to create a new derivative work.

## 3.2 Content delivery management

DLRs can come in various file formats of varying size. The ecosystem needs to meet the personalised approach as described in the government's e-strategy – Harnessing Technology: Transforming Learning and Children's Services[5] and should support learning opportunities at anytime and anyplace, especially in light of the government's Home Access[6] programme delivery.

While technologies are advancing rapidly, bandwidth is likely to remain a potential constraint for the foreseeable future, for homes, schools and other places of learning. The ecosystem strategy must take this into account and encourage the best possible use of available bandwidth, to ensure that applications and services fully exploit what is available. Underlying delivery infrastructure must also be optimised to ensure a consistent user experience as far as possible, regardless of location. There are a range of techniques to consider here, such as the provision of low- and high-resolution video streams, for example, as well as peering, hosting/collocation, caching architectures and other Wide Area Network (WAN) optimisation/acceleration tools and technologies. It is also important to recognise the need for diversity of approach, as different applications and services require different techniques to ensure delivery.

## 3.3 Metadata and vocabulary management

Metadata and vocabularies are fundamental components not only in the authoritative descriptions of digital learning resources themselves, but also expert created information concerning their practical application within specific contexts of use and other predominantly user generated added value information.

Different metadata schemas are used by different sectors of digital learning resource origin, such as the cultural sector, health and commercial. However, it is crucially important to know how the elements within each metadata record relate to the information stored by the central index. Defining profiles of all relevant schemas and managing their relationship to the central index is of key importance.

Vocabularies and folksonomies are increasingly important, whether defined by user communities or central agencies and bodies. Common vocabularies need to be established and their relationships well defined, so that a more co-ordinated approach to tagging is achievable.

[5][http://publications.dcsf.gov.uk/default.aspx?PageFunction=productdetails&PageMode=publications&ProductId=DFES-1296-2005]

[6] [http://www.becta.org.uk/homeaccess]

## 3.4 IPR and copyright management

There is a compelling case for all stakeholders within the ecosystem to ensure a safe, successful and legal navigation through what is currently an IPR and copyright minefield. This area is not only very confusing to interpret but incredibly complex to understand and even more so to apply in practice.

There is a case for the number of independently constructed licences applied to digital learning resource usage to be reduced in favour of a set of licences that encompass the broad requirements. The broad set needs to be supported through application by industry whilst being easily discernable by teachers, learners, parents and others.

## 3.5 Identity and resolution management

Unique and persistent identification of digital learning resources will provide the glue to link added value information with a specific piece of content. Efficient and standardised referencing of digital content becomes impossible without being confident that both the identity and location are persistent over time. Serious issues in the orphaning of information, thus breaking the whole referencing model, would become common place in an ecosystem that doesn't support good practice in this field.

Although perhaps many organisations are identifying their content it is arguable that this isn't managed in such as way for both the identity and resolution to persist over time – for example a URL might change for a resource when a newly revamped website is launched, thus making the previous URL broken if the website's assets aren't well managed.

Various technical solutions are available to try and solve this issue, while practical persistent identity and resolution good practice guidance is needed.

## 3.6 Central index management

The central index is the lynchpin of the whole ecosystem. It will enable many service providers to develop their offerings without the burden of having to locate and broker specific relationships with content providers. Likewise it will enable many content providers to expose their content offerings to a wide range of different service providers without the need for specific relationships to be negotiated.

Various metadata ingestion options and search interfaces (specifically **not** a website) will be created and all information will be filtered through the application of a number of search indices.

The management of the index in an impartial manner, usage policies and technical requirements need to be defined so that all stakeholders are able to fully engage with the ecosystem.

## 3.7 Federated access management

Federated access management is a fundamental component for the ecosystem to improve the user experience from the point of discovery to the point of use.

The current education environment characterises that digital learning resources can either be freely accessible, free but requiring registration or subscription based.

Access to freely accessible resources normally poses little issue and is seamless in process in the eyes of the user. However, the user is faced with increased complexity when trying to access digital learning resources from either free registration or subscription based service providers. It is generally accepted practice, as it currently stands, that each service provider provides username and password combinations to their registered or subscribed users.

It is also acknowledged that users find remembering various usernames and passwords difficult. Sometimes they use measures to help them remember – such as using the same combination repeatedly or simply writing each down and keeping the information in a 'safe' place. This poses greater risk to both the user, having their accounts used by other people who have acquired their access credentials, and to the service provider, who is not necessarily aware of multiple users accessing through a single shared account. This is also a particularly topical issue in light of the increased attention now being paid to information security, as access to an account will most likely allow access to the personal details held within it.

In an ideal system a user shouldn't need to remember multiple usernames and passwords to access services they already have a subscription to, provided by their school, local authority (LA), Regional Broadband Consortia (RBC) or personally. Access should be as straightforward and efficient as if the resources were freely accessible.

Federated access management contains measures within its architecture that remove the requirement for multiple usernames and passwords. It enables trusted relationships to be built between users/establishments and services, which enables the ideal vision. Federated access management within the UK education system is becoming more established.

## 3.8 Service provision

The ecosystem is built upon a sustainable implementation model where a minority of funding is provided by government and the majority by industry partners. Industry is encouraged to provide innovative services, which have sustainable business models that are interoperable with other ecosystem services and components.

The central index will provide the foundations for the development of compelling discovery based services by third parties, delivering targeted or specialist functionality to their audience. This will also open doors for added value service providers to complement these implementations, which in turn will increase the value of the user's experience. It will also act as an enabler for the user to make a more discernable choice in selecting digital learning resources that meet their needs.

There is scope for providers to offer many different kinds of services, some of which were specifically identified within the strategy document, including expert reviews, user recommendations, social bookmarking, social tagging, collaboration and various others. There is no 'limit' on the scope of services, rather the encouragement to develop innovative, effective, interoperable and user focussed solutions.

## 3.9 Directories

As the ecosystem matures there will be a growing need for some of the standards, specifications and services to be easily located. The natural solution for this is to use the concept of directory or registry technologies, so that they can seamlessly be integrated within service offerings.

Specifically, there should be a growing need, as the ecosystem matures, to have metadata schema/profiles, vocabularies, licences and services catalogued and referenced from definitive authorities, through registry systems yet to be defined.

## 3.10 Standards catalogue

There will be a standards catalogue underpinning the ecosystem. This catalogue will list all the standards, profiles and specifications employed within the ecosystem, where they are used and include guidance for implementers. It will be the definitive reference guide for participation by stakeholders, embracing interoperability and co-operative working.

# 4 Implementation roadmap

The ecosystem strategy's vision is clear but it will be complex to implement due to the number of elements comprising the solution and the integral relationships that are required between them. As this is the case the implementation needs to be completed over a number of phases that gradually build upon the capacity, capability of the providers of system components.

A four phase implementation approach has been chosen to deliver the ecosystem strategy. Each phase will require commitment from a range of organisations to work together on the deliverables required to move the project forward.

Figure 2 shows each of the ecosystem components defined as smaller constituent parts, with annotations depicting the phase in which implementation will be focussed. This is given in order to shape priority but does not exclude participation by interested stakeholders at an earlier point in time.

This document focuses on the detail of the first phase of implementation, while phases two, three and four are described at a high level. Further detail of phase two will be produced towards the end of phase one, taking into account accomplishments of the phase and progressive market activity.

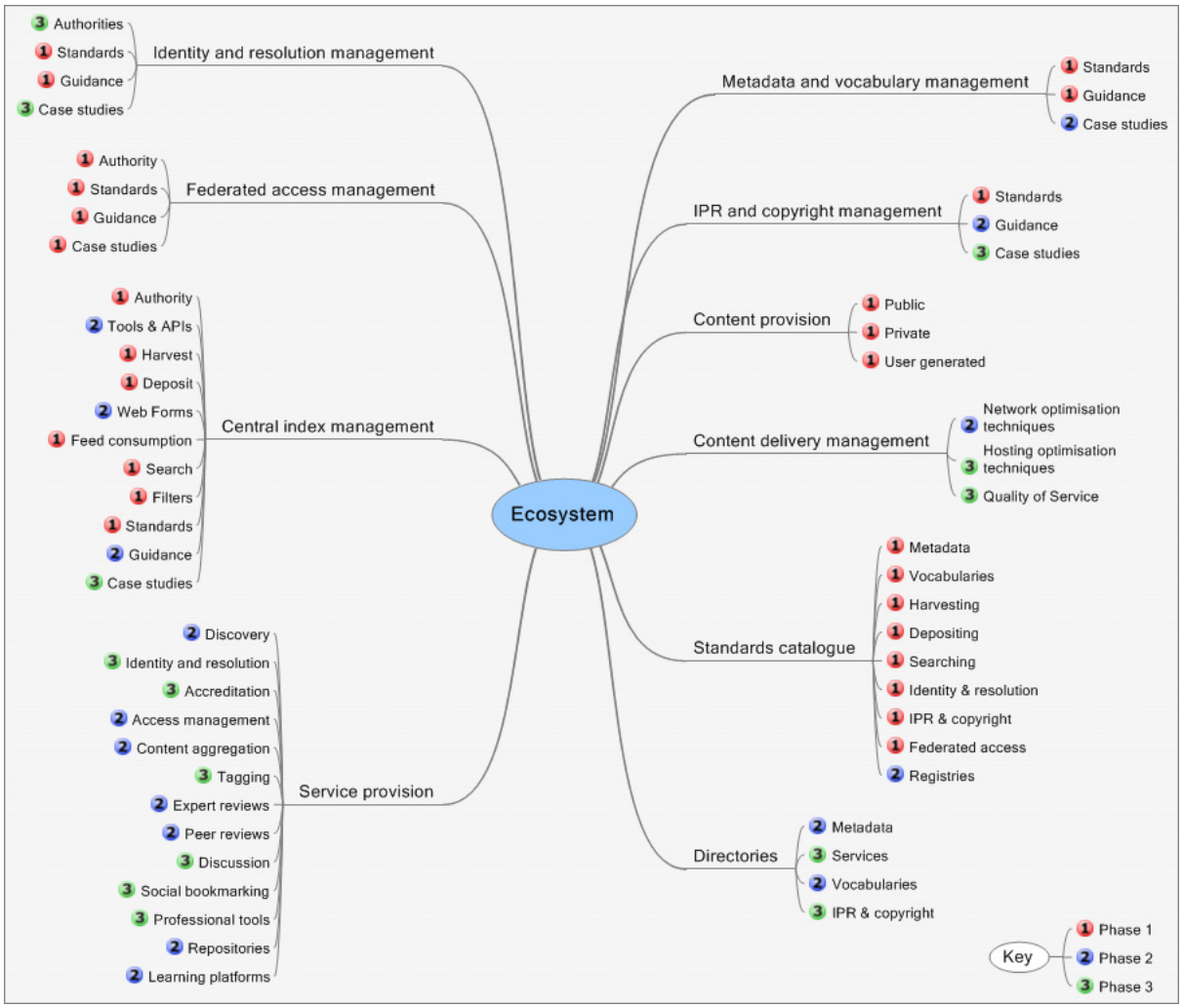


*Figure 2- Ecosystem phased implementation plan*

## 4.1 Phase 1 – Foundation

The first phase will see the implementation of some of the core components that underpin the ecosystem with the option of other complementary non-core innovation activity occurring. Piloting and refinement will be the main thrust of activity during this period.

### 4.1.1 Core activity

#### 4.1.1.1 Industry engagement, facilitation and leadership

Throughout the first phase we will continue to actively engage with stakeholders who have already expressed their will to participate, support or be kept up-to-date with progress in implementation of the ecosystem.

Added to this further engagement will take place to introduce the ecosystem strategy to new organisations and encourage their support and participation. This will be a consistent theme throughout all the phases of the ecosystem realisation strategy.

A key role played by Becta will be to facilitate potential business relationships and partnerships to help deliver the ecosystem vision through introductions and a focus on delivering the ecosystem vision for education.

It is acutely recognised that this strategy has to be implemented as a community effort and that Becta is uniquely placed to facilitate and lead this community activity.

**Aim 1: We will actively engage with stakeholders who have already expressed support or interest in the ecosystem strategy, facilitate potential business relationships and approach new stakeholders to encourage support and participation.**

#### 4.1.1.2 User engagement and communities of practice

The ecosystem needs to not only be supported through implementing partners but also through active use by teachers, learners and parents. Without the user knowledge of user facing delivery services the ecosystem will be ineffective and ultimately unsuccessful in its primary aim.

In order to push this interaction forward Becta will work with stakeholders to identify and establish communities of practitioners to support a wider understanding and uptake of digital content and tools that support improved educational experience and outcomes.

The communities will identify effective use of digital content and tools and identify content and tools that excel in supporting effective use. They will promote and stimulate wider practitioner awareness of high quality products and services.

**Aim 2: We will work with stakeholders to identify and establish communities of practitioners to support a wider understanding and uptake of digital content and tools to support the ecosystem.**

#### 4.1.1.3 Provision of digital learning resources

Currently there are two accepted base schemas used to describe digital learning resources – Dublin Core (DC)[7] and Learning Object Metadata (LOM)[8], while Machine-Readable Cataloguing (MARC 21)[9] metadata is used in other sectors to describe assets that could be utilised within an education setting. Each of these schemas is known to have multiple application profiles that have been created for use in specific settings.

Education based controlled vocabularies will be an important step towards enhancing interoperability and DLR discovery. Appropriate existing and/or new vocabularies, where appropriate, should be incorporated into the definition process of metadata schema application profiles.

Conformity and interoperability is just as important in the production of the physical digital learning resource as well as when providing information about it. While many file formats are either agreed industry standards or have become de facto through active practice, there are some areas that require attention.

Various content packaging standards exist, such as Sharable Content Object Reference Model (SCORM)[10], Common Cartridge (CC)[11] and Content Packaging (CP)[12]. It is clear that there is confusion over which to choose and how to apply it. Work is required here to provide a clear direction for education and Becta is working in collaboration with the Information Standards Board (ISB) to deliver this through the creation of an educational application profile for content packaging[13], in consultation with industry.

[7] [http://dublincore.org]

[8] [http://en.wikipedia.org/wiki/Learning_object_metadata] The IEEE standards body restricts access to the LOM standard definition as it is a paid for resource. This Wikipedia entry is a good primer.

[9] [http://www.loc.gov/marc/bibliographic/]

[10] [http://www.adlnet.gov/technologies/scorm/default.aspx]

[11] [http://www.imsglobal.org/cc/]

[12] [http://www.imsglobal.org/content/packaging/]

[13] [http://industry.becta.org.uk/display.cfm?resID=40523]

In the case of interactive whiteboards there have been prolonged interoperability issues between the proprietary file formats deployed by each software provider. This has posed problems for schools that have multiple vendor installations and where a teacher wishes to share their work with a colleague who has a different vendor's software. Becta has been working with industry to define an interactive whiteboard common file format [14] to help alleviate these interoperability issues.

Becta will provide leadership in this area, with partners, to move the agenda forward and to enable an increased level of metadata/packaging interoperability.

**Aim 3: We will work with a group of stakeholders to select or, where appropriate, define education application profiles of LOM, DC and MARC21 for describing digital learning resources.**

**Aim 4: We will work with a group of stakeholders to select or, where appropriate, define standards, specifications and education application profiles for digital learning resources.**

The central index needs to hold the information that will enable the searcher to have the best chance of making an efficient and considered selection of digital learning resources. Recent research has suggested a core set of key information requirements for this process to be more successful and there is a clear need to map these elements with those found in the metadata/packaging application profiles detailed above.

**Aim 5: We will work with a group of stakeholders to define the elements that should be stored within a central index and how the relevant metadata/packaging standards map to this information.**

Information about digital learning resources, taken in the majority from conformant metadata/packaging, will be required from the range of different content providers that exist within the education system. This will of course include public funded, commercial and user generated content. This information will be essential to the population of a pilot central index. Various mechanisms should be encouraged – through harvesting, feeding and depositing – to obtain this information.

**Aim 6: We will work with a group of content providers to ingest metadata into a pilot central index through harvesting, feeds or deposit methods.**

[14] [http://industry.becta.org.uk/display.cfm?resID=39694]

#### 4.1.1.4 Intellectual Property Rights (IPR) and copyright for digital learning resources

This phase will see leadership in this area to help identify and alleviate the issues experienced both from the perspective of industry and of the end user. The core aim of this work will be to be able to establish what problems can be solved through co-operative measures and those that may require group lobbying for legislative or policy change. It will also look to recommend the use of an agreed set of licences for digital learning resources and define their inter-relation for remixing for educational use.

Various licensing schemes exist that may be appropriate to base an educational set of licences upon. Schemes such as Creative Commons (CC)[15], Educational Recording Agency's 'plus' (ERA+)[16] and other popular licence types exist along with numerous 'publisher unique' licences. Analysis of these schemes and licences will be essential.

**Aim 7: We will lead work to identify the issues that make IPR and copyright problematic and identify approaches to solving each. This work will also identify a set of licences that encompass the broad requirements and their interrelation.**

#### 4.1.1.5 Persistent identity and resolution for digital learning resources

The persistent identity and resolution of a digital learning resource is another cornerstone of the ecosystem. This activity will focus upon noting the problems that can occur by mismanagement of digital learning resource identity and resolution and will provide recommendations for effective management, through the use of best practice and viable technical solutions, according to the setting. It is readily accepted that best practice principles will remain the same no matter what the setting but the technical solution employed may significantly differ in scale, flexibility and cost. Decisions will take into account the range of approaches and levels of success experienced in global education settings.

Guidance on the appropriateness of Handle[17], Digital Object Identifier (DOI)[18] and Persistent Uniform Resource Locator (PURL)[19] amongst others, as opposed to the

[15] [http://creativecommons.org]

[16] [http://www.era.org.uk/ERA_plus.html]

[17] [http://www.handle.net]

[18] [http://www.doi.org]

[19] [http://purl.oclc.org/docs/index.html]

close management of a Uniform Resource Identifier (URI)[20] will help digital learning resource providers discern their approach.

**Aim 8: We will lead work to provide guidance on the real web issues surrounding mismanagement of digital learning resource identity and resolution and how to overcome this. Considered recommendations will be made for suitable technologies that could be used, by setting, to manage persistent identity and resolution.**

#### 4.1.1.6 A pilot central index of digital learning resource information

A pilot central index will give the opportunity for testing, refinement and issue resolution to occur on the core set of functions required and for lessons to be learnt for implementation of a live system. This will allow for discussion and formulation of non-technical policy requirements for a release implementation.

The central index needs to adopt a flexible approach to ingesting information about digital learning resources in order to enfranchise organisations of any size to take part at the level they are comfortable with. In tune with this, the pilot approach should test a range of well respected standards, which offer differing levels of complexity.

Standards and specifications already exist in this space that are becoming adopted to differing extents around the world, some being more mature than others.

Core to the pilot will be standards for getting information about digital learning resources into the index itself. This will cover feed syndication, harvesting and depositing. It is anticipated that Really Simple Syndication (RSS)[21], ATOM Syndication format[22], Open Archives Initiative – Protocol for Metadata Harvesting (OAI-PMH)[23] and ATOM Publishing Protocol (APP)[24] will be the major standards and specifications to be assessed during the central index pilot and application profiles used or defined, where appropriate.

The pilot will also provide standards based machine to machine interfaces to the central index to search for content and apply filters across various elements of controlled data. These machine interfaces will allow third party organisations to integrate the search within their own service provision. It is anticipated that Search/Retrieve via URL (SRU)[25] and OpenSearch[26] will be key standards to

[20] [http://www.ietf.org/rfc/rfc2396.txt]

[21] [http://www.rssboard.org/rss-specification]

[22] [http://tools.ietf.org/rfc/rfc4287.txt]

[23] [http://www.openarchives.org/OAI/openarchivesprotocol.html]

[24] [http://www.ietf.org/rfc/rfc5023.txt]

[25] [http://www.loc.gov/standards/sru/]

[26] [http://www.opensearch.org]

assess for this, whilst other methods of delivering specialist feeds may also be prevalent. It is also expected that further measures can be deployed to allow index replication and harvesting of index data by third party organisations.

**Aim 9: We will work with stakeholders to define appropriate standards and specifications for use by the pilot central index. We will also work with partners to design and configure a working prototype that enables both the ingestion of information about digital learning resources and the searching of the resulting index through machine to machine interfaces.**

#### 4.1.1.7 Central index policy and management

A full release central index will require polices for dealing with various aspects of use. Our initial engagement process highlighted aspects of non-bias and reliability as being of great importance to contributors of DLRs. One resulting aspect may then be that a requirement exists for those integrating the central index search facility within their own service to abide by a terms of usage agreement. There will clearly be other considerations such as how to manage contributions of DLR information. Phase one will need to gain an understanding of what requirements are present from the non-technical standpoint and how the service can be sustainable in the longer term, through consultation with stakeholders.

**Aim 10: We will work with a group of stakeholders to define the policy and management aspects that a central index service should include. This will also include discussion of possible sustainable business models for the service.**

#### 4.1.1.8 Federated access management

The role of federated access management within the ecosystem is well understood in principle but perhaps not ubiquitously in terms of implementation and application. The UK Access Management Federation (UK federation)[27] came into existence at the end of 2006 and has seen a strong growth in organisations joining. Initially uptake in physical implementation of the technology that delivers the functionality required was slow in the school sector but this has increased over the past year. By comparison, implementations in FE and HE organisations are almost universal.

A gap in the market has existed for a while for service providers to remove some of the complexity of implementation and overhead through the provision of paid for 'plug-in' Service Oriented Architecture (SOA) based solutions for identity provision (Identity Provider – IdP). It is recognised that more progress must be stimulated in this area.

[27] [http://www.ukfederation.org.uk]

It is clear that effort needs to be made to more clearly demonstrate implementation paths and options; also to dispel many of the myths that surround the UK federation concerning cost and complexity. Consultation evidence has shown that there are organisations that do not see the business case for implementation, predominantly due to the perceived barriers and perceived lack of local authority and school take-up. However, there are growing numbers of good implementation examples in existence, which can be turned into focussed case studies that can be targeted to specific audiences. Likewise many of the organisations who have implemented the UK federation infrastructure into their service offering can provide a wealth of knowledge to those who are not sure where to start or have reservations. A combination of SOA based service provision, increased support and guidance material and proactive engagement will go a long way towards increasing the pace of federated access management adoption and active implementation.

**Aim 11: We will work with the UK federation to establish how federated access management can be more seamlessly integrated by service providers, tackling misconceptions, implementation problems and concerns that stakeholders have raised to date. JANET(UK) will produce refreshed guidance, whilst a series of case studies will be presented and discussed at the UK federation in practice event[28] in October 2009.**

#### 4.1.1.9 An ecosystem standards catalogue

Open standards are the backbone to the success of an interoperable and efficient ecosystem. A standards catalogue will be created that covers the core set of data, process and reference based standards and specifications, which will become the definitive guide for stakeholders implementing ecosystem compliant services. This will be created in consultation with stakeholders.

Becta will continue working with the Information Standards Board (ISB) and other authorities, such as the Strategic Content Alliance (SCA), towards the uniform agreement of standards that support the ecosystem becoming officially recognised and incorporated into these wider activities.

**Aim 12: We will produce and publish an ecosystem standards catalogue through consultation with stakeholders.**

[28] [http://www.ja.net/services/events/2009/federationinpractice_london/index.html]

### 4.1.2 Non-core innovation activity

The first phase of implementation will concentrate on producing a strong foundation for future development and to pilot the conceptual design, population and searching of the central index. This is more of a consolidation approach in terms of bringing information about digital learning resources together and is not necessarily focused on innovation.

To complement this consolidation and give early indications of what could be possible, we will be encouraging organisations/consortia to submit proposals to deliver innovative prototype services that utilise the central index or other ecosystem services/components and provide either the user or third-party service provider with added value. These prototype services will provide demonstrable examples that will enable a physical experience of the ecosystem vision.

### 4.1.3 Implementation through procurement

Phase one will involve collaboration from many different stakeholders. Becta will encourage organisations/consortia to present their bids for delivering the aims of the ecosystem, as detailed previously in the document, through a series of separate procurements and a multi-lot procurement. It is anticipated that some procurement contracts will have no underlying cost to government, rather a realisation that augmentation and reuse of already existing technology and effort can deliver the requirement.

Details of the procurement activity will be published shortly after the release of this implementation plan.

### 4.1.4 What does it mean for my organisation in this first phase?

Taking part in the first phase of the ecosystem implementation will give organisations the unique opportunity to help influence and shape the future of digital learning resource discovery, delivery and sharing for education. Your involvement in bringing industry knowledge, experience and practical application to the table will be invaluable and crucial to the project's success.

Becta is keen for stakeholders to engage with the aims planned for this phase where they feel appropriately qualified and available to contribute. The kind of activities you could become involved with are given some context in the following sub-sections, split by role.

#### 4.1.4.1 Advocates

The ecosystem needs advocates. Without industry advocacy the implementation will suffer. Being an advocate could involve various contributions including:

- promoting the principles and vision of the ecosystem
- providing contextual interpretation of what the ecosystem enables
- encouraging and supporting participation
- influencing policy for real world application
- engaging with communities of practitioners in the effective use of digital content and tools.

#### 4.1.4.2 Content providers

There are many areas where content providers can become involved with the implementation of the ecosystem. This can include the following:

- identifying and defining metadata application profiles and controlled vocabularies for describing digital learning resources and what fields should be stored within the central index
- IPR and copyright policy definition
- influence in defining central index technical standards for ingesting information about digital learning resources
- providing information about digital learning resources to the central index
- central index non-technical policy definition
- engaging with the work of the UK federation.

#### 4.1.4.3 Service providers

Service providers have an equal opportunity to become involved in the evolution of the ecosystem. The key thrust of service provider interest should be upon the provision of services that add value to the process of searching the central index, filtering the information and delivering results to the end user. These services could be user facing or part of the mechanics behind the scenes. Activities that may be of interest to service providers may be:

- influence in defining central index technical standards for searching and filtering of information about digital learning resources

- exemplifying the ecosystem concept through the delivery of added value services for the discovery, delivery and sharing of DLRs
- central index non-technical policy definition
- engaging with the work of the  UK federation.

## 4.2 Phase 2 – Consolidation and extension

The second phase of ecosystem implementation will concentrate upon consolidating the lessons and experiences gained through the phase one pilot central index and to extend both its operation and integration flexibility. There will be a strong theme of producing appropriate guidance for different industry audiences, which details practical implementation of the standards, specifications and services that constitute the ecosystem. This phase will also concentrate heavily on the evolution of added value services.

The first phase of implementation will have dealt with the identification and uptake of core metadata application profiles, vocabularies and guidance for implementing within a supplier's system. This phase will focus on case studies that exemplify this implementation. Further work will be undertaken to standardise interoperability between services suppliers whose services utilise different kinds of added value information, such as describing educational use of DLRs within specific settings.

While IPR and copyright issues and appropriate educational licence schemes will have been identified in phase one, the guidance for their application will still be required. This will be completed in phase two.

Delivery of high bandwidth content is likely to become even more prevalent by the time phase one has completed, in the context of Next Generation Broadband Networks[29], through increased digitisation of national archives and modern rich media development. It will be important to implement measures to manage the deliver of this content to the education sector in the most effective manner, perhaps using network peering and associated approaches. The continuing development of regional and local authority networks, in partnership with the national JANET network, puts the sector in a strong position to optimise delivery of and access to a wide range of applications, services and resources. More information about the JANET network is available in the publication 'Using the Power of JANET', from the JANET (UK) publications website[30].

Access and utilisation of the pilot central index will need to be as flexible as possible. Tools and Application Programming Interfaces (APIs) will be developed in this phase for all the leading web oriented programming languages, such as Java, .NET, PHP and Ruby, in order to deliver this flexibility.

Comprehensive guidance for interacting with the pilot central index for both syndicating information about DLRs and searching the index for relevant DLRs will be an essential product of this phase.

[29] [http://www.itif.org/index.php?id=231]

[30] [http://www.ja.net/services/publications/]

It is anticipated that the appetite and requirement for directory services will develop over the first two phases of implementation to the extent where providers will need directories of ecosystem ‘approved’ metadata profiles and vocabularies. This is something that should be provided within this phase.

Uptake and implementation of the UK federation is expected to grow more rapidly in this phase of the ecosystem as a greater awareness and understanding of its function and benefits become more widely appreciated. Further support will be given to support these activities.

The second phase will see the wide development of various kinds of innovative ‘added value’ services by industry partners and the more wide integration within current product lines. It is anticipated that the core set of services will revolve around the areas of discovery, federated access management, sector specific content aggregation, peer and expert reviews, while these services should see integration within repositories and learning platforms.

User communities established in phase one will start to use metrics to discern the most effective and fulfilling services for their setting. This in turn will help develop and focus the market on producing services that meet their changing needs in supporting learning.

## 4.3 Phase 3 – Expansion

The third phase of ecosystem implementation will focus on expanding the breadth of added value services offered by suppliers, while providing further directory services, enhanced delivery management and more ecosystem case studies for implementers.

The second phase of implementation will have looked at a wide range of techniques and technologies to manage the delivery of high bandwidth content to all education based facilities. It is predicted that this phase could see further work in this area looking at whether centralised, cached or mirrored hosting of this type of content would be beneficial and technologies like Quality of Service (QoS) and multicast for effective network management.

Growing appetite for directory services could point to a requirement for further directories for IPR and copyright licences and 'ecosystem ready' services. These directories could complement those already established in phase two.

It is expected that one of more authorities for managing persistent identity and resolution of DLRs may emerge during this phase.

The third phase should see the pilot central index become stable and ready for moving towards release as a sustainable service. It is anticipated that a suitable business model and policy management will be incorporated for the move to a production system. This will most likely involve either a sustainable proposal being submitted by the community or a competitive process to decide how the production system enters service.

Case studies of actual service implementations for further components of the ecosystem will be produced, specifically in persistent identity and resolution, use of the central index and IPR and copyright management.

It is anticipated that further added value services will come online during this phase, specifically complementing those already featured by contributing tagging and categorisation, social bookmarking, accreditation, identity and resolution and professional tools. This phase should see increased levels of innovation as a competitive marketplace for ecosystem services begins to become established.

Ecosystem services should become readily used within school learning platforms during this period, further inspired through the championing achieved through the user communities.

## 4.4 Phase 4 – Business as usual

The final phase, termed business as usual, will see the ecosystem enter the early stages of maturity. The central index, infrastructure and added value services will all be at a production state and a competitive marketplace for interoperable SOA based services will be very apparent.

The key activity during this final phase shall be the ongoing support, encouragement and inspirations for further innovation in this area to meet and challenge modern teaching and learning requirements.