Metadata Interoperability Project

Ensuring Interoperable Digital Object Management Metadata in Scotland

Report of the SLIC-funded CMS Metadata Interoperability Project.

Findings, Conclusions, and Guidelines for Best Practice

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OSIAF, CISAG, and CTG

The acronyms OSIAF[2], CISAG, and CTG are referred to at various points in this report. CTG is the Cultural Technical Group, chaired by Elaine Fulton of SLIC. It is a sub-group of the Common Information Standards Advisory Group[3] (CISAG) which, in turn, reports to, and co-ordinates standards on behalf of, the Openscotland Information Age Framework (OSIAF). OSIAF leads interoperability work in Scotland on behalf of the Scottish Executive. Between them, OSIAF, CISAG, and CTG provide the overarching infrastructure within which the work proposed in this report would take place, should its findings be accepted.

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[1] CMS Metadata Guidelines Support website: http://cms.cdlr.strath.ac.uk/guidelines/
[2] Openscotland Information Age Framework (OSIAF): http://www.scotland.gov.uk/Topics/Government/Open-scotland/19913/21663
[3] http://www.scotland.gov.uk/Topics/Government/Open-scotland/19913/CISAG

Ensuring Interoperable Digital Object Management Metadata in Scotland

Executive Summary

Introduction and Aims

As in other parts of the developed world, digital resources are being created in ever increasing numbers by a growing range of archives, libraries, museums, and other organisations in the Scottish Common Information Environment (SCIE).

Interoperability in respect of the often complex metadata required to manage digital materials is a prerequisite of providing seamless and long-term access to distributed resources for users, optimising resource re-usability, and maximising value from scarce funding and staffing resources. Recognising this, SLIC[4] funded the CMS Metadata Interoperability Project[5] to survey the Scottish scene, research and analyse the issues, identify a 'safe path' towards ensuring interoperability in the area, and formulate guidelines for best practice as a basis for implementing it.

Main Project Outputs

This report summarises the results of the study under four headings:

1. Study Findings and Conclusions.
2. Guidelines for Best Practice: National SCIE-wide Actions.
3. Guidelines for Best Practice: Institution or Sub-SCIE Group Actions.
4. Appendices (including lists of participants and references, and a glossary).

The associated (but embryonic) CMS Metadata Guidelines Support website set up at http://cms.cdlr.strath.ac.uk/guidelines/ provides a range of supporting material on metadata standards, a practical approach to dealing with a range of representative 'use scenarios', content standards, and a range of other things. It provides vital background and context for those aiming to use this report – and its guidelines – to address interoperability issues in practice.

Conclusions

The study concludes that a prescriptive approach to ensuring interoperability of digital object metadata in the SCIE is both difficult and inadvisable and proposes instead:

1. The development of an informed 'interoperability consciousness' in key staff as the best route forward, with the guidelines provided in the body of the report, the associated support website, the OSIAF[6] infrastructure, and relevant training programmes, as key mechanisms.

2. Strengthening this through the publication and dissemination of a series of advisory notes on a range of key interoperability issues. These would be indicative rather than prescriptive, but would have the authority of the OSIAF-backed Cultural Technical Group (CTG)[7] behind them.

It also proposes the creation of a Scottish Metadata Registry as a tool to encourage, enhance, and support interoperability in this important area.

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[4] Scottish Library & Information Council (SLIC): http://www.slainte.org.uk/slic/
[5] http://cms.cdlr.strath.ac.uk/
[6] Openscotland Information Age Framework (OSIAF): http://www.scotland.gov.uk/Topics/Government/Open-scotland/19913/21663
[7] The Cultural Technical Group is a sub-group of Common Infrastructure Standards Advisory Group which report to, and co-ordinates standards on behalf of, OSIAF

Ensuring Interoperable Digital Object Management Metadata in Scotland

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Ensuring Interoperable Digital Object Management Metadata in Scotland

1. Findings and Conclusions

Introduction

Digital repositories – encompassing everything from hardcopy materials digitised to improve access, through electronic learning materials, to born-digital materials such as academic papers[8] and PDA-based guides to parks and museums – are being created and made available by museums, archives, electronic services of various kinds, public, university, college and other libraries, and a range of other organisations across Scotland.

At present, little or no effort is being put into coordinating approaches to the provision of the often complex metadata required to manage these repositories and the digital materials they contain. As a result, we are in danger of repeating the mistakes of the past[9] and creating an 'interoperability deficit' that will diminish the extent to which organisations serving Scottish users can offer them seamless, flexible, long-term access to the distributed digital collection as it develops, act as a barrier to the re-use of valuable digital resources for new purposes in new contexts, and undermine the efforts of collaborating institutions to optimise the digital impact of scarce financial and staff resources.

The CMS Project

The aim of the SLIC[10]-funded CMS Metadata Interoperability Project[11] was to examine the situation in Scotland as regards the use of metadata to manage digital objects, research the issues raised by the situation as discovered, analyse the results, and utilise the outcomes to provide guidelines for best practice in this area with a view to providing a safe path towards interoperability in digital object management and access in the developing Scottish Common Information Environment (SCIE)[12].

The work undertaken included: a survey of Scottish institutions active in the area; an identification of the kinds of problems being tackled[13]; follow-up consultation and discussion with survey respondents and partners[14]; an examination of the literature on digital object management metadata and of web-based national and global initiatives in the area[15]; and an overlapping analysis of the issues raised by 'use scenarios' representative of the kinds of problems encountered in the Scottish digital object management scene.

Digital Object Management in Scotland

A range of organisations are managing digital content in Scotland at the present time. Some are doing so without metadata or content management systems, but these appear to be in the minority. A full – but probably not comprehensive – list of those managing digital objects using metadata can be found in Appendix A of this report. Metadata schema in use include DC[16], e-GMS[17], UK LOM[18], EAD[19], METS[20], and MARC[21], with

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[8] A JISC-funded project, IRI-Scotland is co-ordinating activity on this front – see http://www.iriscotland.lib.ed.ac.uk/
[9] Scotland has a service, the 'Cooperative Information Retrieval Network for Scotland' (CAIRNS - http://cairns.lib.strath.ac.uk/), which cross-searches library online catalogues across the country. The constituent catalogues were set up long before CAIRNS as stand-alone services and interoperability between them was not considered an issue at the time. As a result, although CAIRNS is able to provide a reasonable service, it has to cope with a range of interoperability problems whose source is the fact that the original approaches to metadata were (understandably in that instance) not coordinated.
[10] Scottish Library & Information Council (SLIC): http://www.slainte.org.uk/slic/
[11] CMS Metadata Interoperability Project: http://cms.cdlr.strath.ac.uk/
[12] Taken to mean a publicly accessible online information environment in which the various participating domains (any domain, in theory, but taken to include at least libraries, museums, archives, government information services and learning object repositories) aim to provide as far as possible seamless cross-domain services to users. Dunsire, 2005 gives a good basic introduction to the concept.
[13] See CMS Study Survey Report at http://cms.cdlr.strath.ac.uk/guidelines/CMSmetadatasurveyreport.pdf
[14] See Appendix A
[15] See Appendix B
[16] Dublin Core Metadata Element Set (DC): http://dublincore.org/documents/dces/
[17] e-Government Metadata Standard (e-GMS): http://www.govtalk.gov.uk/schemasstandards/metadata.asp
[18] UK Learning Object Metadata Core (UKLOM): http://www.cetis.ac.uk/profiles/uklomcore (application profile of IEEE LOM: http://ltsc.ieee.org/wg12/)
[19] Encoded Archival Description (EAD): http://www.loc.gov/ead/
[20] Metadata Encoding Transmission Standard (METS): http://www.loc.gov/standards/mets/
[21] Machine Readable Cataloguing Record (MARC): http://www.loc.gov/marc/

DC currently the most common by far. Emerging standards likely to impact on the development of the Scottish scene include METS[22], IMS-CP[23], MODS[24], MIX[25], and a range of others. A more comprehensive and detailed report is available on the support web-site[26]. Further details on usage breakdown across institutions in Scotland, together with associated information such as the content management systems in use, can be found in the survey report, also available on the web-site[27].

The types of digital objects being held range from the simple (single images, or sound files, or similar), to the complex (a website, or a 'digital essay', or an 'interpretive journey'). Their intended functions range from simple illustration or information provision, through learning and teaching, to long-term preservation for research. This range of types and functions inevitably impacts on the types and complexity of metadata and metadata standards needed for management. In one set of circumstances, a simple and minimal implementation of DC might be sufficient. In another, a public sector body managing complex digital objects with complex needs in areas such IPR and digital preservation, and a requirement to record both the structure of the complex composite, and appropriate metadata on a range of component objects of different types (video, audio, still images, text, and so on) might require to use not only e-GMS (obligatory in the public sector) and METS (an over-arching standard designed specifically for the management of complex digital objects), but a range of other standards also (e.g. METS extension schemas such MIX for still images, LC-AV Audio[28], and LC-AV Video[29]). Appendix C – an outline of the e-GMS, METS, and MIX standards – gives an indication of the wide range of metadata that can be required for managing digital objects.

Interoperability Issues Imperfectly Understood

It is reasonable to assume that the interoperability issues raised by digital resource usage in a common information environment are imperfectly understood at present. The authors of this report do not feel able to claim they have identified all of them, and see ongoing review of these guidelines as essential for many years to come. What is clear is that the digital environment throws up new interoperability issues not encountered with physical resources. Cross-service retrieval remains a key issue, of course, with the range of formats and the associated need for software environments that can handle them adding at least one additional dimension. In addition, there are new areas of concern. These include the need to consider standardisation in areas such as (1) expressing the relationship of digital materials to the physical resources that, in some cases, were their original source, (2) packaging digital objects, their metadata, and associated 'players' for long-term access via digital preservation (e.g. for the proposed NLS 'Trusted Digital Repository' (TDR)[30]) (3) packaging for re-use in new contexts (e.g. re-use in another repository for a different function) (4) seamless integration of complex digital objects across services and domains (e.g. integration of separate learning packages). (5) the need for standardised approaches to expressing rights metadata. In many cases, issues can extend beyond the post-creation use of metadata to describe and manage objects. There may, for example, be a need – at the creation or pre-creation stage - to consider designing complex digital objects in a way that ensures that their component objects can be readily re-used. The use of content standards[31] to ensure interoperability of field content across different metadata schemas is a given, but there is a requirement to extend their application to some areas of non-descriptive metadata.

A Layered, Non-prescriptive Approach, but with Authoritative Advice at a National Level

If every digital resource management issue could be addressed using one metadata schema, one set of content standards, one access protocol, and one data format, interoperability would probably not be a major issue. In reality, a range of options exists under each of these headings and there are often good reasons in terms of local flexibility, economy, independence, interoperability within a domain, and so on, for individual organisations and groups making the differing choices that make interoperability an issue. In addition, interoperability issues and scenarios themselves range from the simple to the complex. In consequence, it is

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[22] Metadata Encoding & Transmission Standard (METS): http://www.loc.gov/standards/mets/
[23] Instructional Management Software Content Packaging (IMS-CP): http://www.imsglobal.org/content/packaging/
[24] Metadata Object Description Schema (MODS): http://www.loc.gov/standards/mods//
[25] Metadata for Images in XML (MIX): http://www.loc.gov/standards/mix/
[26] SCIE: Principal Metadata Standards: http://cms.cdlr.strath.ac.uk/guidelines/metadatastandards.html
[27] CMS Study Survey Report at http://cms.cdlr.strath.ac.uk/guidelines/CMSmetadatasurveyreport.pdf
[28] Library of Congress -Audio/Visual - AMD: Audio Technical Metadata Extension Schema: http://lcweb2.loc.gov/mets/Schemas/AMD.xsd
[29] Library of Congress –Audio/Visual – VMD: Video Technical Metadata Extension Schema http://lcweb2.loc.gov/mets/Schemas/VMD.xsd
[30] National Library of Scotland (NLS) Trusted Digital Repository (TDR): http://www.nls.uk/professional/digitalprojects/index.html
[31] AACR2, IPSV, the various 'encoding schemes' specified by e-GMS, and so forth.

both difficult and undesirable for the authors of a report such as this to be prescriptive – to recommend one schema, one set of content standards, one basic approach to interoperability, and so on, either to individual institutions or groups, or as the basis of a strategy for co-ordinating interoperability in the SCIE on a top down basis via the Cultural Technical Group (CTG)[32] and the OSIAF[33] infrastructure. The preferred approach has therefore been to provide stand-alone, but relatively general, advice on how best to tackle interoperability issues through the *Guidelines for Best Practice* presented below, but to supplement this with an embryonic *CMS Metadata Guideline Support Website*[34] providing, amongst other things, access to the range of information and materials likely to be needed as context and background when making actual interoperability-related decisions in particular circumstances. The underlying assumption – and the key message of this report - is that the best basis for both institutional and SCIE-wide strategy as regards digital interoperability is the development of an informed 'interoperability consciousness' in those involved in interoperability decisions related to digital resource planning and management[35]. It is recommended that SLIC, via CTG and the OSIAF infrastructure, make this the basis of their 'safe path' and utilise the guidelines below and the support website as key mechanisms in the management and development of the approach.

Aside from the guidelines themselves, and the associated report on the result of the survey of organisations involved in digital object management in Scotland, the website offers access to information on principal metadata standards, illustrations of how some organisations have implemented these in practice, access to information on content standards, a 'key' metadata issues section providing vital background guidance for SCIE interoperability, and a set of 'use scenarios' intended to coincide roughly with the circumstances of organisations operating at particular levels of digital resource management. Together with the guidelines below, these provide a relatively[36] easy route into the issues for given organisations in given circumstances, including those co-ordinating SCIE-wide activity (who will have an interest in all of them).

Ensuring appropriate levels of interoperability both across the SCIE generally, and within particular sub-SCIE groupings of institutions, requires action at various levels, and the guidelines presented below reflect this. The first of the two sets of guidelines deals with national SCIE-wide actions, and is addressed primarily to organisations with a role at that level. The second deals with actions likely to be required of individual participant institutions and sub-SCIE groups – that is, groups concerned with interoperability in particular regions or domains, with sectors within domains, and so on.

Although a prescriptive approach to interoperability in the SCIE is not recommended, it is nevertheless felt that the provision of informed, regularly-updated, community-mediated, and authoritative and indicative, advice by CTG can only be an aid to interoperability, and an action on the provision of such authoritative advice is therefore a primary focus of the national SCIE-wide guidelines presented below. It may also be worthwhile to consider utilising the OSIAF-supported and government-backed e-GIF[37] standard as the core basis for all types of interoperability relevant to the SCIE (note that these extend beyond e-GMS and metadata – Appendix D gives a selective overview relevant to digital object management web-sites) and building on it in the various areas where this will be necessary (e.g. by having having digital object packaging standards such as METS and IMS-CP adopted).

2. Guidelines for Best Practice: National SCIE-wide Actions

[1]*Ensure continuous review by the appropriate element of the OSIAF infrastructure:* These guidelines, and the content of the associated website[38], should be viewed as a 'best first pass' at covering the interoperability issues raised by digital resource management in the SCIE. Continuous review is important, not only because the interoperability issues raised are imperfectly understood at present, but also because the area is one of constant (and often rapid) change, and will continue to be so for the forseeable future. Accordingly, this report should be reviewed annually, if not more regularly, either by the CTG itself, or by a sub-group set up to handle this and related issues on an ongoing basis [see 2 [2] below]. This review process

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[32] The Cultural Technical Group (CTG) is a sub-group of Common Infrastructure Standards Advisory Group which report to, and co-ordinates standards on behalf of, OSIAF.
[33] Openscotland Information Age Framework (OSIAF): http://www.scotland.gov.uk/Topics/Government/Open-scotland/19913/21663
[34] CMS Metadata Guideline Support Website: http://cms.cdlr.strath.ac.uk/guidelines/
[35] In other words, the central requirement is for well-informed staff who understand the issues…
[36] This is a complex area.
[37] e-Government Interoperability Framework (e-GIF): http://www.govtalk.gov.uk/schemasstandards/egif.asp
[38] CMS Metadata Guideline Support website: http://cms.cdlr.strath.ac.uk/guidelines/

should start as soon as possible and this document and the associated website should be regarded as advisory drafts until the first review is complete. An essential part of the review process should be to ensure that issues that might be more appropriately considered by other elements of the OSIAF infrastructure (other technical sub-groups of CISAG, for example) are forwarded via the proper channels, together with any input from the CTG deemed necessary to the decision-making process.

[2] ***Consider creating a digital professionals group (DIG):*** In comparison to the situation with (for example) library OPACs, where the 'interoperability deficit' was significant many years before interoperability was even recognised as an issue, the situation in respect of the digital environment has been addressed in a timely fashion. However, it will deteriorate rapidly unless these guidelines are implemented 'in the field'. The organisations addressed in this section – particularly CTG (who represent the other main organisations and report to OSIAF) and COSMIC[39] – should take responsibility for ensuring that the guidelines are implemented in practice.

As part of this effort, the CTG should consider setting up a representative group of professionals working in this field – a Digital Interoperability Group (DIG). This group would take responsibility for encouraging implementation of the guidelines, and might also organise the continuous review process noted under 2 [1] above. In addition, the CTG should write to individual organisations encouraging them to follow these guidelines and participate in associated activities, and should work with regional organisations to determine how they might best contribute to – and, where appropriate, manage – the processes described in these guidelines [see section 3 below].

[3] ***Adopt an advisory, but authoritative and indicative approach:*** A prescriptive approach to managing interoperability is probably unworkable and unwise. However, an advisory, but *authoritative and indicative* approach is likely to aid interoperability and should be considered by the CTG. A prescriptive requirement to use METS rather than IMS-CP or MPEG21 DIDL[40] as an overarching standard for managing complex digital objects may be unsafe; but an indication that organisations should use one or the other if in doubt is less so and should enhance interoperability overall. Even if it turns out to be wrong in individual cases, it will address management and interoperability issues at the appropriate level and make mapping to the alternative overarching standards more likely to succeed. Accordingly, either CTG itself, or the DIG sub-group of professionals as proposed above should consider, make recommendations on, and seek official OSIAF approval and support for the creation and issue of a set of advisory sheets on key issues. This would include, but would not necessarily limited to, the following:

Advice Topic and Associated Notes
General advice note on interoperability in the SCIE – might cover the institution-specific guidelines set out below, together with 'lowest common denominator' interoperability advice, perhaps based on minimal permited e-GMS compliance or compliance with DC equivalent of this.
Overarching standards and when to use them, perhaps with advice to use a particular one (METS, say) if in doubt.
The role of e-GMS and e-GIF – mandatory for public sector bodies, safe path for others with similar needs, possible basis as the core of SCIE interoperability.
Content standards - AACR2[41]; RDA[42] for future; IPSV[43], LCSH, DDC, e-GMS and other encoding schemes.
Standards for specific materials types, e.g. METS extension schemas (video; audio; text files; MIX for still *images*).
Domain-specific guidelines: SPECTRUM[44]; MARC; e-GMS; EAD; UK LOM, etc.
IPR Metadata and content standards.
Digital Preservation Metadata and interoperability (PREMIS[45], OAIS[46], etc), including advice on preservation file type and (if applicable and possible) metadata and other requirements of the proposed NLS TDR.
Browser, player and file types access support provided in the SCIE.

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[39] Confederation of Scottish Mini Cooperatives (COSMIC): http://cosmic.cdlr.strath.ac.uk/
[40] Moving Pictures Expert Group Multimedia Framework (21) (MPEG21) – Digital Item Declaration (DIDL): http://www.chiariglione.org/mpeg/standards/mpeg-21/mpeg-21.htm
[41] Anglo-American Cataloguing Rules Second Ed. (AACR2): http://www.collectionscanada.ca/jsc/
[42] Resource Description and Access (RDA): http://www.collectionscanada.ca/jsc/rda.html. RDA is the 'digital successor' to AACR2 which, when officially released, will provide a useful overarching content standard for all types of resources (both digital and analogue), will ensure that metadata content is readily adaptable to new and emerging database structures and applications, and will constitute a domain independent approach that recognizes the value of separating content standards from schemas. The aim is that it should be suitable for all types of metadata community and format, and should reflect international developments such as FRBR and Virtual International Authority File. It will also provide content standards for authorities (http://www.oclc.org/research/projects/viaf/) .
[43] Integrated Public Sector Vocabulary (IPSV): http://www.govtalk.gov.uk/schemasstandards/gcl.asp
[44] SPECTRUM (UK standard for documentation in museums): http://www.mda.org.uk/spectrum.htm
[45] Preservation Metadata Maintenance Activity (Library of Congress) (PREMIS): http://www.loc.gov/standards/premis/
[46] Consultative Committee for Space Data Systems (2002) ***Reference Model for an Open Archival Information System (OAIS)*** ***CCSDS 650.0-B-1 – Blue Book***, NASA, Washington, USA. Available: http://www.ccsds.org/documents/650x0b1.pdf

Cross-walks and application profiles.

The listing is presented in suggested order of priority, but a consideration of priorities should be an early focus of the proposed work and may result in an adjustment of the order and content of the above. This report and the associated website will provide useful and informative background material to support the work, which should, above all, take a pragmatic approach to interoperability guidance issues. Funding may be necessary to support this work.

[4]Actively Propose SCIE Standards to CISAG and OSIAF: As the work on review of this document and on the proposed advisory notes outlined under 2 [3] proceeds, there should be active consideration of whether to propose to CISAG and OSIAF that recognised standards such as METS should be adopted as standards to be recommended for use in particular circumstances and particular organisational contexts. It is understood that OSIAF welcomes proposals of this nature and there is an established procedure to accommodate them. It is also understood that backing from a group such as the CTG would be a key consideration in the determination of whether or not such a proposal would be accepted.

[5]Scope Out and Meet Training requirements: Training and awareness are key issues in this area, especially in the next few years. Either the CTG or the DIG proposed in 2 [2] should draw up and aim to implement a three-year training plan for this. The plan should include training and awareness on choosing and, perhaps more important, implementing Content Management Systems, but its main focus should be metadata for managing digital objects, with a particular focus on SCIE interoperability issues. Ideally, additional resources would be found to support the programme. Failing that, it is suggested that the programme be rolled out through co-operation with the special interest groups and training groups already in place in Scotland.

[6]Set Up and Maintain a Scottish metadata registry: Consideration should be given to funding the creation of a Scottish metadata registry[47] as an extension to the website set up under this study. This would list metadata standards implemented in Scotland, including those in use for digital resource management. It would enhance interoperability by showing which organisations were implementing what standards in what ways and for what purposes. In time, it would probably play a vital role in the shared services infrastructure that supports CAIRNS[48] and SCONE[49]. Since mapping out the detail of this is beyond the remit of this report, a scoping study to draw up the design requirements of a Scottish metadata registry should be considered. Ideally, examples of how standards have been implemented would also be included and kept up to date, perhaps via a link to the websites of the institutions concerned. This would also help institutions with addressing issues beyond interoperability – that is, with digital object management metadata generally.

[7]Consider Being an RDA Early Implementer: Content standards are vital to interoperability in the SCIE[50]. In addition to considering content standards generally and producing an advisory note on the topic, the CTG should consider whether RDA could usefully be adopted as the core standard in this area for the SCIE. Note that supplementary standards will be required to provide content standards for all digital resource interoperability issues, which extend beyond the scope of RDA.

[8]Ensure Scottish participation in international interoperability and standards work: Scottish participation in this work is one essential thread in ensuring that the SCIE is interoperable in appropriate and necessary ways with the global environment[51]. The CTG should actively aim to identify any potential areas of concern and work within OSIAF to find the best way of addressing them.

[9]Work via COSMIC to encourage topic-based, regional, and domain or sector level, organisations to help disseminate and promote these guidelines, together with associated SCIE standards and initiatives: To paraphrase earlier COSMIC literature on interoperability, 'people and organisation level interoperability is a pre-requisite of metadata-level interoperability'. Communication with

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[47] The International Organization for Standardization (ISO) has published standards for a metadata registry (ISO/IEC 11179). See: http://metadata-standards.org/11179/. There is also an HE and FE registry at http://www.ukoln.ac.uk/projects/iemsr.
[48] Cooperative Information Retrieval Network for Scotland (CAIRNS): http://cairns.lib.strath.ac.uk/
[49] Scottish Collections Network (SCONE): http://scone.strath.ac.uk/service/
[50] See content standards on the CMS Metadata Guideline Support website: http://cms.cdlr.strath.ac.uk/guidelines/contentstandards.html
[51] In this context, it is worth noting that there is semi-official Scottish representation on the CILIP/BL committee on AACR (RDA) and CILIP DDC committee (Gordon Dunsire of CDLR and Ann Mellors of Bibliographic Data Services, Dumfries).

and through the wide range of 'sub-SCIE organisations' is an essential part of efforts to ensure appropriate levels of interoperability in the SCIE.

3. Guidelines for Best Practice: Institution or Sub-SCIE Group Actions

[1]*Assign a Digital Resources Senior Manager:* Where an organisation manages digital resources, or plans to do so in the near future, it should consider allocating responsibility for policy-making, implementation, and review at a senior level. This Digital Resources Senior Manager or DRSM[52] should be given responsibility for reading this document and investigating the associated support website, setting out organisational aims and objectives as regards interoperability, and writing a short 'interoperability audit report' on implications for the local organisation. This might include any changes needed in policy, procedures (check on interoperability when new object types added, for example), resources, training, allocation of responsibilities, and so on. The DRSM should also be given responsibility for implementing the results of the audit. In considering organisational aims and objectives in respect of digital object management and interoperability, questions that should be considered include (but are not necessarily limited to) the following:

- At what level(s) is interoperability an issue for the organisation? Within the whole SCIE? Within a particular library, museum, or archives sector (e.g. University archives)? Within a region? Trans-nationally? More than one of these?
- Do local users, or the users of other organisations, need to be able to seamlessly cross-search the local catalogue of digital resources and those belonging to other institutions with overlapping interests and resource collections?
- Are formats for individual resource types (e.g. images, sound files) an interoperability issue for the groups the organisation aims to interoperate with? What about software packages needed to 'play' these formats? Note that, these questions can have a digital preservation context as well as an access context.
- Is it important to express rights metadata in a standard way that can be clearly understood, or reliably machine-processed, across a range of interoperating organisations?
- Is packaging for re-use in new contexts (e.g. re-use in another repository for a different function) an interoperability issue for the organisation and the groups it aims to interoperate with?
- Is seamless integration of complex digital objects across services and domains (e.g. integration of separate learning packages) an interoperability issue for the organisation and the groups it aims to interoperate with?
- Is digital preservation an issue and is interoperability an issue here (e.g. to meet any NLS standards that may emerge in relation to the proposed TDR)?
- Is expressing the relationship of digital materials to the physical resources that were their original source an interoperability issue for the organisation and the groups it aims to interoperate with?

[2]*Make Informed Metadata Choices Based on Your Aims and Objectives*: Every institution or group faces different interoperability issues, either because of internal considerations, or because of the groups it requires to interoperate with for the benefit of its users, or both. These should be made explicit in the aims and objectives set out as proposed above. It should then be possible to make sound informed metadata choices based on these aims and objectives by applying the following guidelines and using the support website[53] to provide vital background and context[54]:

a. Strike a sustainable balance between resources allocated and agreed and stated policy and practice, whether this means adjusting staffing or funding to match policies and practices or vice versa.
b. Aim, as far as possible, to future-proof choices relating to metadata interoperability. If there is a strong likelihood that future digitisation will encompass formats not currently encompassed, make sure that the metadata choices made now are flexible enough to cope with future needs.
c. Avoid, if at all possible, creating an 'in-house' metadata schema or an 'in-house' taxonomy. There are well-maintained schemas and terminology schemes available for a wide range of purposes. Choose one of these instead. Failing that, develop a cross-walk between the in-house schema and any standard used

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[52] Sub-SCIE groups may find it more appropriate to set up a small advisory sub-group of suitably knowledgeable individuals.
[53] CMS Metadata Guideline Support website: http://cms.cdlr.strath.ac.uk/guidelines/
[54] In particular, the analyses provided at http://cms.cdlr.strath.ac.uk/guidelines/metadatapreguidance.html, http://cms.cdlr.strath.ac.uk/guidelines/metadataselection.html, http://cms.cdlr.strath.ac.uk/guidelines/metadatacontentstandards.html and http://cms.cdlr.strath.ac.uk/guidelines/otherconsiderations.html should be considered when implementing guidelines [2] a to [2] m.

by partner institutions and make both the in-house schema and the cross-walks available on an easy-to-find and well-publicised web page. At minimum, provide such mappings to e-GMS and DC.

d. Choose a metadata standard or standards appropriate to organisational requirements and responsibilities in respect of interoperability. Membership of a particular organisation or group may require adherence to a particular standard or standards. The requirement on government-funded organisations to use e-GMS or e-GIF is an obvious example. A requirement on an organisation to take responsibility for digital preservation of certain classes of material is another and may entail a need to adopt standards such as OAIS or emerging standards such as PREMIS. Similarly, organisational requirements in respect of interoperability in CMS metadata may entail anything from minimal level interoperability with e-GMS or the DC equivalent, to a need to encompass an overarching standard such as METS and extension standards such as those for video or audio files.

e. All other things being equal, choose a standard or standards appropriate (and in prominent use) in the domain or sector or other grouping the organisation aims to interoperate with - for example (and where appropriate) MARCXML[55] or MODS in the libraries domain, EAD in archives, UK LOM in the learning community, or, at another level, METS in the library, archives, and museums communities, IMS-CP in the learning community, and so on. Consider adopting an application profile to ensure that members of a group or domain apply their chosen standard in an agreed way.

f. Where more than one standard is required to meet responsibilities and requirements, consider the potential interoperability value of using groups of standards designed to work together. Obvious examples here include METS and METS extension schemas and UK LOM and IMS-CP.

g. Choose appropriate, widely-used, content standards for every metadata attribute used where interoperability with others is important (Examples include e-GMS encoding standards and AACR2.

h. All other things being equal, choose a standard developed for the purpose (e.g. RightsDeclarationMD[56], the METS extension schema for rights), rather than inventing one, or extending a schema intended for a different purpose (e.g. extending MARC21 to cope with IPR).

i. Where possible, choose a metadata standard that can be expressed and stored in XML format with a view to future-proofing processability, software compatability, and data-sharing.

j. If in doubt about an appropriate standard, choose a 'safe path'. For example, a schema like e-GMS with e-Government Unit[57] authority behind it might provide a safe path even for some non-government organisations. Equally, METS might be a safe path where there is no obvious choice of an overarching schema, simply because it is, relatively speaking, a more widely implemented and better supported standard than IMS-CP or MPEG 21.

k. Do not follow these guidelines blindly. Establishing all-encompassing rules that apply to every organisation and every circumstance is probably impossible.

l. Make any and all decisions taken on metadata readily available on an easy-to-find and well-publicised web page using a standard URL[58], including information on content standards, controlled vocabularies, and application profiles in use. The same page might also provide information on other relevant local circumstances (e.g. the nature and detail of any Z39.50[59] or SRW[60] target provided).

m. Aim to stay current. Developments in metadata for digital object management is fast-moving and ongoing, with new versions of metadata standards, new application profiles, and even new standards appearing constantly. Make decisions on the basis of up-to-date knowledge. Be aware, in particular, of RDA and FRBR[61] developments, and of new services appearing that may be enhancing interoperability (terminology mapping services, for example, or cross-walk and schema transformation services).

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[55] XML framework for MARC (MARCXML): http://www.loc.gov/standards/marcxml///
[56] RightsDeclarationMD METS Extension Schema: http://cosimo.stanford.edu/sdr/metsrights.xsd
[57] e-Government Unit: http://www.cabinetoffice.gov.uk/e-government/
[58] A suggestion is that the form baseURL/standards/metadata be used. For example, SMC might put their data at.
http://www.scottishmuseums.org.uk/standards/metadata /
[59] Z39.50 International Standard Maintenance Agency: http://www.loc.gov/z3950/agency/
[60] Search / Retrieve Web Service (SRW): http://www.loc.gov/standards/sru/srw/
[61] Functional Requirements for Bibliographic Records (FRBR): http://www.ifla.org/VII/s13/frbr/frbr.htm

Appendix A: Participants and their Digital Object Management Activities

Appreciation is extended to survey participants, those institutions that participated in detailed one to one discussions or email exchanges with the authors, and all those that have commented on preliminary drafts of this document. Gratitude is extended to the Scottish Library & Information Council, the National Library of Scotland, the Scottish Museums Council and the Confederation of Scottish Mini-Cooperatives for strategic input.

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Dumfries and Galloway Archives;
East Lothian Libraries;
East Renfrewshire Council;
Falkirk Council Archives;
Fife Council Libraries;
Glasgow City Council - Libraries, Information and Learning;
Helensburgh Heritage Trust;
Historic Scotland;
Historylinks Museum;
Hunterian Museum and Art Gallery, University of Glasgow;
John Wheatley College;
Learning and Teaching Scotland;
McManus Galleries;
MoPark;
Moray Council Museums Service;
Napier University;
National Library of Scotland;
Orkney Library and Archive;
Perth College;
Queen Margaret University College;
Royal Scottish Academy;
Scottish Agricultural College;
Scottish Agricultural Science Agency;
Scottish Enterprise;
Scottish Library & Information Council;
Scottish Mining Museum;
Scottish Museums Council;
Scottish Screen Archive;
Shetland Museum;
South Lanarkshire Council;
South Lanarkshire Libraries;
University of Aberdeen;
University of Aberdeen Historic Collections;
University of Abertay Dundee;
University of Edinburgh;
University of Glasgow;
Victorian Times.

The following are some **representative** examples of the kind of work to be found in the area of digital object management in Scotland:

- The most common pursuit of museums is to manage digital images of museum exhibits. Moray Council Museums Service[62], McManus Galleries[63] and Aberdeenshire Heritage[64] are three such institutions. Several libraries (large and small) and archives are also engaged in digitisation programmes designed to increase access to special collections and for the purposes of collection management. For example, Falkirk Council Archives[65] creates digital versions of existing items in their collection. These tend to be scanned photographs, digital photos of objects, scanned archives, all for the purposes of increased user access and collection management. Similarly, Ayrshire Archives Centre[66] provides digitised manuscripts and photographs original archival materials, managed using DC.

- The NLS has intensive digitisation programmes that include images, but also sound files. The NLS also receives materials in a variety of e-formats and creates electronic materials principally through digitisation. Voluntary deposit of electronic information also has to be managed and the NLS is currently considering the use of MODS and PREMIS Data Dictionary within METS for the TDR.

- Learning and Teaching Scotland[67] (LT Scotland) creates and manages digital materials for the LT Scotland website and the coming Scottish Schools Digital Network[68] (SSDN). Their collection of resources covers all sectors of Scottish education from ages 0-18, including 5-14, National Qualifications, Community Learning, Inclusion, Curriculum Flexibility, etc. They employ teams of developers, graphic designers and cataloguers in the development of ICT resources and manage their resources using UKLOM within a Tridion CMS.

- The Scottish Screen Archive[69] creates digitised video clips and other digital moving image content in partnership with the BBC[70] or others in the HE sector. They also create still images. This is all managed using a combination of International Federation of Film Archives[71] (FIAF) guidelines with ISAD(G)[72] and EAD, using a bespoke management system.

- South Lanarkshire Council[73] (as distinct from South Lanarkshire Council Libraries) focuses on the use of metadata for web and intranet pages, as well as content and documents loaded into their web/Intranet sites. They anticipate that once metadata has been properly established in these areas, they will be rolled out to other council information (e.g. Information Asset Register, Local intelligence system, Customer Tracking systems, Geographical Information Systems (GIS), Electronic Records management systems, Audio/Video archives etc.)

- Libraries, Information and Learning[74] (LIL) at Glasgow City Council[75] are involved in the development of the Glasgow City Council web site, including the application of the e-GMS and a modified version of IPSV within a .NET CMS. LIL also manages the Virtual Mitchell[76] - a web based database of images of historic Glasgow - via iBase and individual digital objects within the Virtual Mitchell are currently being rendered e-GMS complaint. LIL plan to expand and diversify their digital collection through the Virtual Mitchell in the immediate future[77].

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[62] Moray Council Museums Service: http://www.moray.gov.uk/moray_standard/page_572.html
[63] McManus Galleries: http://www.mcmanus.co.uk/
[64] Aberdeen Heritage: http://www.aberdeenshire.gov.uk/museums/index.asp
[65] Falkirk Council Archives: http://www.falkirk.gov.uk/cultural/museums/archives.htm
[66] Ayrshire Archives Centre: http://www.ayrshirearchives.org.uk/archivescentre.htm
[67] Learning and Teaching Scotland: http://www.ltscotland.org.uk/
[68] Scottish School Digital Network (SSDN): http://www.ltscotland.org.uk/ssdn/
[69] Scottish Screen Archive: http://data.scottishscreen.com/home/
[70] British Broadcasting Corporation (BBC): http://www.bbc.co.uk/
[71] International Federation of Film Archives (FIAF): http://www.fiafnet.org/uk/
[72] General International Standard Archival Description (ISAD(G)): http://www.mclink.it/personal/MD1431/sito/isaargrp/isad(g)e.html
[73] South Lanarkshire Council: http://www.southlanarkshire.gov.uk/
[74] Libraries, Information & Learning (LIL), Glasgow City Council: http://www.glasgow.gov.uk/en/Residents/Leisure_Culture/Libraries/
[75] Glasgow City Council: http://www.glasgow.gov.uk/
[76] Virtual Mitchell: http://www.mitchelllibrary.org/vm/
[77] Libraries, Information & Learning, Glasgow City Council, Digitised Collections:
http://www.glasgow.gov.uk/en/Residents/Leisure_Culture/Libraries/Collections/Digitisedcollections/

- The MoPark Project[78] aims to encourage green tourism within the Loch Lomond and the Trossachs National Park[79] through the creation and population of a digital multimedia repository and management system. This entails the management of complex digital composites called 'Interpretive Journeys', plus a range of other simpler materials, including the component objects of the Interpretive Journeys. A bespoke CMS has been designed to assist in digital management and has been designed specifically for the use of the METS schema, but requires further development beyond its current baseline functionality. The Park is looking at using e-GMS within METS to manage their complex digital objects.

- Am Baile[80] digitises material of cultural and historical significance to the Scottish Highlands and Islands (mostly paper-based but also audio, video etc). This is managed using DC and iBase[81] DAMS.

- Edinburgh University Library[82] are managing digital images, E-prints, Archival Finding Aids, E-theses, Exam papers, Streaming video. They are using a variety of standards, such as Qualified DC, DC-Lib[83], VRA Core 3[84] (Visual Resources Association Data Standards Committee Core Categories), EAD, ISAD(G), UKLOM, TEI. METS is also being explored by the metadata team at Edinburgh for the purposes of long-term management, particularly within respect to digital preservation, as is the use of MIX (Metadata for Images in XML - NISO Technical Metadata for Still Images)[85].

- John Wheatley College[86] are in the process of managing a plethora of learning materials and administrative documents (including minutes and agendas etc) via the Mandate Project[87].

- University of Aberdeen[88] are currently developing AURA (Aberdeen University Research Archive), based on the DSpace[89] software as an institutional repository for e-prints and other research output within the university. They create and manage digital learning objects and are currently piloting the packaging of pre-existing and newly created materials as IMS-CP for storage and re-use.

- Citizens Advice Scotland maintains an online information system that is used for the provision of advice in bureaux containing thousands of digital resources.

- Aberdeen Art Gallery and Museums (AAGM)[90] manage numerous digitised museum objects via the Explorer initiative and promotes exploration by allowing users to search the entire collection catalogue on-line. The key audience for Explorer are those people who are unfamiliar with the services of the AAGM. AAGM are using DC to manage the digital objects. This metadata is being used in conjunction with a CMS provided by Gallery Systems' 'The Museum System'[91] (with eMuseum).

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[78] MoPark: http://www.mopark.net/
[79] Loch Lomond & The Trossachs National Park: http://www.lochlomond-trossachs.org/
[80] Am Baile: http://www.ambaile.org.uk/
[81] iBase: http://www.ibase.com/
[82] University of Edinburgh Library: http://www.lib.ed.ac.uk/
[83] Dublin Core Library Application Profile (DC-Lib): http://dublincore.org/documents/2004/09/10/library-application-profile/
[84] Visual Resources Association Data Standards Committee Core Categories, Version 3.0: http://www.vraweb.org/vracore3.htm
[85] Metadata for Images in XML (MIX): http://www.loc.gov/standards/mix/
[86] John Wheatley College: http://www.jwheatley.ac.uk/
[87] Mandate Project: http://www.jwheatley.ac.uk/mandate/
[88] University of Aberdeen: http://www.abdn.ac.uk/
[89] DSpace: http://www.dspace.org/
[90] Aberdeen Art Gallery and Museums (AAGM): http://www.aagm.co.uk/
[91] Gallery Systems: http://www.gallerysystems.com/

Appendix B: Useful References

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Appendix C: Examples: e-GMS, METS, and LC-AV: Video Technical Metadata Extension Schema (VMD)

The outlines of the e-GMS, METS, and LC-AV: Video Technical Metadata Extension Schema (VMD) standards presented below give an indication of the wide range of metadata that can be required for managing digital objects.

e-GMS: Overview

The UK e-Government Metadata Standard (e-GMS) is a component of the wider e-Government Interoperability Framework (e-GIF)[92] as proposed by the government's e-Government Unit (eGU)[93] (formerly known as the Office of the e-Envoy) and adopted by the Open Scotland Information Age Framework (OSIAF)[94]. e-GMS[95] is based on DC to ensure wide interoperability, but has been significantly extended with administrative elements to cater for the requirements of government. This includes a further ten elements and ninety domain specific element refinements. e-GMS also supports the use of a variety of encoding schemes to improve semantic interoperability, such as the Integrated Public Sector Vocabulary (IPSV)[96] for populating the e-GMS Subject element and the e-GMS Audience Encoding Scheme (e-GMSAES)[97] for populating the Audience element. To ensure the e-GMS is user-friendly for all government employees, the elements are ordered alphabetically.

Element Name	Definition
Accessiblity	Indicates the resource's availability and usability to specific groups.
Addressee	The person (or persons) to whom the resource was addressed.
Aggregation	The resource's level or position in a hierarchy.
Audience	A category of user for whom the resource is intended.
Contributor	An entity responsible for making contributions to the content of the resource.
Coverage	The extent or scope of the content of the resource.
Creator	An entity primarily responsible for making the content of the resource.
Date	A date associated with an event in the life cycle of the resource.
Description	An account of the content of the resource.
Digital Signature	To be decided
Disposal	The retention and disposal instructions for the resource.
Format	The physical or digital manifestation of the resource.
Identifier	An unambiguous reference to the resource within a given context.
Language	A language of the intellectual content of the resource.
Location	The physical location of the resource.
Mandate	Legislative or other mandate under which the resource was produced.
Preservation	Information to support the long-term preservation of a resource.
Publisher	An entity responsible for making the resource available.
Relation	A reference to a related resource.
Rights	Information about rights held in and over the resource.
Source	A reference to a resource from which the present resource is derived.
Status	The position or state of the resource.
Subject	A topic of the content of the resource.
Title	A name given to the resource.
Type	The nature or genre of the content of the resource.

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[92] e-Government Unit. (2005) *e-Government Interoperability Framework Version 6.1, e-Government Unit*, London. Available: http://www.govtalk.gov.uk/documents/e-GIF%20v6_1(1).pdf
[93] eGovernment Unit (eGU): http://www.cabinetoffice.gov.uk/e-government/
[94] Openscotland Information Age Framework (OSIAF): http://www.scotland.gov.uk/Topics/Government/Open-scotland/19913/21663
[95] eGovernment Metadata Standard (e-GMS), Version 3: http://www.govtalk.gov.uk/interoperability/metadata_document.asp?docnum=872
[96] Integrated Public Sector Vocabulary (IPSV): http://www.esd.org.uk/standards/ipsv/
[97] e-GMS Audience Encoding Scheme (e-GMSAES): http://www.govtalk.gov.uk/documents/Encoding_scheme_audience_draft_2002.pdf

METS: Overview

Metadata Encoding & Transmission Standards (METS)[98] is a relatively new standard that has been developed specifically to provide an overall framework within which metadata for all types of digital materials - digitised video, sound files still images, electronic texts, and others – can be integrated. To this end, METS provides an XML document format for encoding metadata necessary for both management of digital library objects within a repository and exchange of such objects between repositories (or between repositories and their users). The following is an overview of the kinds of metadata encompassed within the METS standard. Given the relative size and breadth of the METS specification, and the reliance METS has on extension schemas, the overview below summarises the purpose of the METS 'sections' only:

- **Descriptive Metadata:** The Descriptive Metadata section might point to externally held descriptive metadata (e.g. a MARC record held in an WebPAC), or it might contain the relevant metadata internally by embedding it (e.g. a DC or MODS record). Alternatively, it might be that both approaches that have to be accommodated by the document.
- **Administrative Metadata:** The Administrative Metadata provides information pertaining to 'Technical Metadata': Info on files' creation, format and use characteristics; IPR Metadata: Copyright and license information; Analog Source Metadata: Descriptive and administrative metadata regarding the analogue source from which the digital library object derives, and; Digital Provenance Metadata: Information on source/destination relationships between files, including master/derivative relationships and migration/transformation employed between original digitisation and current incarnation.
- **File Section Metadata:** The File Section lists all the files containing content which encompass the electronic versions of the digital object. These lists can be grouped with group elements so as to facilitate the subdivision of files by object version.
- **Structural Map Metadata:** The Structural Map metadata is particularly important for complex digital objects. It documents the hierarchical structure of the object and links the elements of the structure to content files and metadata relating to each element.
- **Structural Links Metadata:** The Structural Links metadata allows the metadata creator to record the use of hyperlinks between items in the hierarchy recorded in the Structural Map. Such a facility is of particular value for archiving websites for example, where there exist links between items in often complex hierarchies.
- **Behaviour Metadata:** The Behaviour Metadata is used to express associated executable behaviours with particular content recorded within the metadata document.
- METS also includes the **METS Header**, containing metadata describing the METS document itself; information such as the creator, editor and so forth.

It is helpful to segment metadata into the above categories in order to appreciate the wide range of information that often has to be captured when managing digital objects. However, it should be remembered that such segmentation is rarely absolute and distinctions between particular metadata types can be fuzzy[99]. For example, descriptive metadata can often be spread across multiple metadata types, such as administrative and behavioural metadata types. Instances of such fuzziness will be apparent in the use scenarios provided at the CMS Metadata Guidelines Support website[100]. It is worth noting that although preservation is often subsumed within the administrative metadata type, sufficient descriptive metadata and – for complex digital objects – structural metadata will also be required if digital preservation is to be successful.

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[98] Metadata Encoding & Transmission Standard (METS): http://www.loc.gov/standards/mets/
[99] Lavoie, B. & Gartner, R. (2005) **Technology Watch Report – Preservation Metadata**, OCLC Online Computer Library Center Inc. / Oxford University Library Services / Digital Preservation Coalition, York. Available: http://www.dpconline.org/docs/reports/dpctw05-01.pdf
[100] CMS Metadata Guideline Support website: http://cms.cdlr.strath.ac.uk/guidelines/

LC-AV: Video Technical Metadata Extension Schema (VMD): Overview

As noted above, METS relies on the use of extension schemas. The LC-AV Video Metadata Extension Schema (VMD)[101] is one such XML schema which has been proposed by the AV Project for capturing specific technical metadata for digital video objects. An overview of the fields and field definitions is provided:

Field Name	Definition
analog_digi_flag	Indicator of the how this entity is describe in the METS document instance.
aspect_ratio	The desired aspect ratio of the image on screen, e.g., 4:3, etc. Some files produced for display on non-square-pixel monitors have a desired aspect ratio that differs from the ratio of horizontal to vertical pixels.
bits_per_sample	The number of bits of sample depth, e.g., 8, 24, etc.
calibration_ext_int	Indicator that the calibration information is contained within the file or externally.
calibration_location	Temporary location of the calibration file if it is external e.g. URL
calibration_type	Type of calibration used.
closed_captioning_note	Information about closed captioning in this source item.
closed_captioning_type	Type of closed captioning.
codec_creator_app	The name of the application used to apply the codec, e.g., LEADTOOLS MCMP/MJPEG codec.
codec_creator_app_version	The version of the application used to apply the codec, e.g., 1.2.
codec_name	The name and version (or subtype) of the compression algorithm used, e.g., Frauenhofer xyz ["xyz"] is a placeholder for versioning information].
codec_quality	Indication whether the codec is lossy or lossless.
color_burst	Indicates presence or absence of colour burst signal.
condition	Narrative description of the physical condition of the item, e.g., sticky shed tape, deformed by slots in reel, etc.
data_rate	Data rate of the audio in an MPEG or other compressed file expressed in mbps, e.g., 8, 12, 15, etc.
data_rate_mode	Indicator that the data rate of the video is fixed or variable.
dimensions_depth	Depth of the object expressed in the unit of measure indicated in dimensions_unit, e.g., 12.
dimensions_diameter	Diameter of any circular object expressed in the unit of measure indicated in dimensions_unit, e.g., 3.5, 5, 7.
dimensions_height	Height of the object expressed in the unit of measure indicated in dimensions_unit, e.g., 23.
dimensions_note	Desciption of odd-shaped objects that cannot be described using the standard dimensions fields.
dimensions_unit	Unit of measurement of the source object, e.g., inches.
dimensions_width	Width of any non-circular object expressed in the unit of measure indicated in dimensions_unit, e.g., 3.5, 5, 7.
disposition	What became of the source item, e.g., reshelved on shelf number 1234, discarded, loaned to XYZ organization, destroyed, etc.
dtv_note	Note about digital video source item.
dtv_resolution	Resolution of digital video source item expressed as horizontal lines.
dtv_scan	Indication whether digital video source item is scanned in an interlaced or progressive mode.
duration	Elapsed time of the entire file, expressed using ISO 8601 syntax; see http://www.w3.org/TR/NOTE-datetime
frame_rate	The number of frames per second at which the video source item was captured.

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[101] LC-AV Video Metadata Extension Schema (VMD): http://lcweb2.loc.gov/mets/Schemas/VMD.xsd

gauge	Gauge or width of source tape, including indication of unit of measure, e.g., 8 mm, 0.5 inch, 0.25 inch, etc.
generation	Generation of physical source item which was digitized, e.g., studio master, preservation tape copy, photostat copy, etc.
interlacing	Draws either the even or the odd horizontal lines of the image, then returns to the top and draw the remaining lines.
length	Length of source open-reel tape recording, including indication of unit of measure, e.g., 700 feet, 1200 feet, etc.
note	Additional information about the video source item.
num_sample_frames	The number of frames within a video file.
number_carriers	The number of carriers (reels, cassettes) needed to house the video source item.
phys_format	Name for the physical format of the source e.g., Videotape, Film Reel etc.
pixels_horizontal	The horizontal size of a frame in picture elements.
pixels_vertical	The vertical size of a frame in picture elements.
reflective_layer	The substrate of an optical disk.
sampling	The video sampling format (in terms of luminance and chrominance), e.g., 4:2:0, 4:2:2, 2:4:4, etc.
signal_format	Signal format of the video source item. Analog-source examples include composite monochrome, NTSC (composite colour), PAL, SECAM, and analog component. Digital-source examples include digital component and others.
sound	Indicator of the presence of sound in the video file.
stock_brand	Manufacturer and stock number for source recording, e.g., Scotch XYZ, Ampex ABC, etc.
tape_thickness	The thickness of a tape.
time_stamp	Exact location of calibration tones within a file.
timecode_record_method	Method for recording timecode on the video source item, e.g., longitudinal, vertical interval, etc.
timecode_type	Type of timecode recorded on video source item, e.g., SMPTE dropframe, SMPTE nondropframe, etc.
tracking_type	The type of tracking code, e.g., MAVIS number, actual shelf numbers, bar-code, etc.
tracking_value	Shelf number or other identifier for source, e.g., MAVIS number, actual shelf numbers, etc.
videodisc_type	Identification of whether this videodisc recording is constant linear velocity (CLV) or constant angular velocity (CAV).
videotape_type	General type of videotape format, e.g., 2-inch quadraplex, 1-inch type C, VHS, Betacam SP, etc. Complementary to stock_brand.

Appendix D: E-GIF: Selective Overview for Digital Object Management Websites

The e-GIF guidelines cover a wide variety of stipulations pertaining to virtually all facets of the electronic environment in which government departments are likely to operate, from WI-FI networks to SmartCards to Information Kiosks[102]. The list below covers those e-GIF stipulations that pertain to the provision of websites or web-based information services ONLY. Note: there is an un-stated assumption that websites will conform to W3C guidelines on accessibility and XHTML transitional mark-up.

Before outlining specific areas where e-GIF conformance is paramount, it is worthwhile noting the key threads influencing e-GIF guidelines:

- e-GIF seeks wider alignment with the Internet; the universal adoption of common specifications used on the Internet and World Wide Web for all public sector information systems;
- Adoption of XML as the primary standard for data integration and data management for all public sector systems;
- Adoption of the browser as the **key** interface for all public sector information systems; all systems are to be accessible through browser-based technology. e-GIF permit other interfaces but only in addition to browser-based ones;
- The use of metadata for government information resources; Specifically, the development and adoption of the e-GMS, based on the Dublin Core Metadata Element Set;
- The use, development and maintenance of the Integrated Public Sector Vocabulary (IPSV) (formerly known as the Government Categories List (GCL));

Specific implications for website or web-based services are as follows:

INTERCONNECTION

- **DNS** is to be used for Internet/intranet domain name to IP address resolution;
- **FTP** should be used where file transfer is necessary within government intranets; Restart and recovery facilities of **FTP** are to be used when transferring very large files;
- Services and projects have to follow the UK Government **domain naming policy**. (i.e. http://www.YourGovermentAgency.gov.uk/).   See   the   following   URL   for   details: http://www.cabinetoffice.gov.uk/e-government/domain;
- When Web services are used, they shall be based on **SOAP** and **WSDL** specifications; The e-GIF policy for the interface between intermediaries and government systems is to conform to the Web service interface standards being developed by the **WS-I initiative** and the **Organisation for the Advancement of Structured Information Standards** (OASIS);
- The e-GIF policy is for a gradual migration to **IPv6**, maintaining coexistence with **IPv4**. e-GIF advice for new procurements is to support coexistence of IPv4 and IPv6 networks and to procure dual IPv4 and IPv6-enabled products when it is cost effective to do so.

DATA INTEGRATION

- The technical policies for systems data integration and transformation cover:
    - **XML** and **XML schemas** for data integration
    - **UML, RDF and XML** for data modelling and description language
    - **XSL** for data transformation.

   The **W3C's XML schema** recommendation is the main schema language used for **XML-based** products and services. ISO/IEC are currently defining standards for **XML schema languages** (ISO/IEC 19757 Document Schema Definition Languages (**DSDL**), see http://www.dsdl.org/), and future versions of e-GIF will mandate these and provide guidance for their use. In the meantime, Schematron (see http://www.ascc.net/xml/resource/schematron/schematron.html) may be used to

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[102] For further details see: e-Government Unit. (2005) **e-Government Interoperability Framework Version 6.1**, e-Government Unit, London. Available: http://www.govtalk.gov.uk/documents/e-GIF%20v6_1(1).pdf

supplement the **W3C XML schema**, for example when adding local or application-specific constraints to existing schemas.

- Centrally agreed **XML schemas** are to be approved through the **GovTalk** processes. To view these, go to http://www.govtalk.gov.uk/schemasstandards/xmlschema.asp

FORMS

- An **XML** output should be provided for forms data entry.

  Future versions of e-GIF will mandate standards for **XML-based** forms with best-practice guidance on their use: current guidance is to require forms data to be exchanged using **XML**.

CONTENT MANAGEMENT METADATA

- The technical policies for content management metadata cover:

  o The adoption and development of the **e-GMS**, based on the international **Dublin Core** model, to meet the government's information management and retrieval needs.

  o The **e-GMS** is a 'superset' of metadata elements and refinements, and it is unlikely that any single system will require all of them.

  o Organisations are therefore encouraged by e-GIF to develop sector and system-specific standards, removing elements that are not required and adding local constraints.

  o The use, development and maintenance of the **IPSV**.

Relevant specifications for content management: http://www.govtalk.gov.uk/egif/contentmment.asp#table4

IDENTIFIERS

- **Identifiers** should be used that are appropriate to the business needs.

- **Persistent identifiers** shall conform to the **ANSI/NISO Z39.84** standard http://www.niso.org/

- Relevant specifications for identifiers: http://www.govtalk.gov.uk/egif/contentmment.asp#table5

E-SERVICES AND CHANNELS

- Government information systems should be designed to meet UK legislation and to support channels that provide **accessibility for disabled people, members of ethnic minorities and those at risk of social/digital exclusion.**

- When using the Internet as a delivery channel, additional middleware or plugins can be used when necessary, **provided these can be easily downloaded via a browser and without incurring a licensing fee**.

- Government information systems will be designed to provide protection against the security risks of connection to the Internet, including the ability to protect against the vulnerability of downloading executable content code that is not authenticated.

DELIVERY CHANNELS

- The full range of services to be delivered to the citizen will dictate the specifications required. Content management techniques and personalisation technologies can be used to support service delivery, e.g. low-function Web browsers, public kiosks, digital TV, Wi-Fi devices, smart phones as defined in the TSC: specifications for other channels http://www.govtalk.gov.uk/egif/infoaccess.asp#table7

- Transcoding services, as an example of a personalisation technology, can deliver Web content to a variety of destination environments within greatly reduced timescales and at significantly reduced cost. The principle is that transcoding can be used to dynamically filter, convert and reformat Web content to match the requirements and display capabilities of the destination device. Transcoding technology is server-side software that modifies Web page content based on data protocols, mark-up languages, device and network parameters and user preferences.

- Personalisation technologies may also be used to support groups such as ethnic minorities and visually impaired or blind people (e.g. by using text translation, larger fonts and graphics, audio, etc., via a transcoder). Such aspects are covered by the 'Guidelines for UK government websites', see www.cabinetoffice.gov.uk/e-government/webguidelines

Appendix E: Glossary

AACR2	Anglo-American Cataloguing Rules
Application Profile	A set of metadata elements, policies, and guidelines defined for a particular application or purpose.
CAIRNS	Cooperative Academic Information Retrieval Network
CDLR	Centre for Digital Library Research
CISAG	OSIAF Common Information Standards Advisory Group
CMS	Content Management System
COSMIC	Confederation of Scottish Mini-Cooperatives
CTG	OSIAF Cultural Technical Group
DC	Dublin Core Metadata Element Set
DDC	Dewey Decimal Classification
DIG	Digital Interoperability Group
e-GIF	e-Government Interoperability Framework
e-GMS	e-Government Metadata Standard
EAD	Encoded Archival Description
FRBR	Functional Requirement for Bibliographic Records
IMS-CP	Instructional Management Software Content Packaging
Interpretive Journey	Planned PDA-base interactive guide to guided walks and cruises in the Loch Lomond and Trossachs National Park
IPR	Intellectual Property Rights
IPSV	Integrated Public Sector Vocabulary
JISC	Joint Information Systems Committee
LC-AV	Library of Congress Audio-Visual Metadata
LCSH	Library of Congress Subject Headings
MARC	Machine Readable Cataloguing Record
MARCXML	XML framework for MARC
METS	Metadata Encoding Transmission Standard
MIX	Metadata for Images in XML Schema
MODS	Metadata Object Description Schema

MPEG-21	Moving Pictures Expert Group Multimedia Framework (21)
MPEG-21 DIDL	MPEG-21 Digital Item Declaration Language
NGfL	National Grid for Learning
NLS	National Library of Scotland
OAIS	Open Archival Information System
OSIAF	Openscotland Information Age Framework
PDA	Personal Digital Assistant
PREMIS	PREservation Metadata: Implementation Strategies (Schemas)
RDA	Resource, Description & Access
SCIE	Scottish Common Information Environment
SCONE	Scottish Collections Network
SLIC	Scottish Library and Information Council
SMC	Scottish Museums Council
SPECTRUM	UK Documentation Standard for Museums
SRW	Search / Retrieve Webservice (ZING – Z39.50 International: Next Generation)
TDR	Trusted Digital Repository
UK LOM Core	UK Learning Object Metadata Core (application profile of IEEE LOM)
XML	Extensible Markup Language
XSLT	Extensible Stylesheet Language Transformation
Z39.50	'Z39.50' refers to ISO 23950: 'Information Retrieval (Z39.50): Application Service Definition and Protocol Specification' and to ANSI/NISO Z39.50. The standard specifies a client/server-based protocol for searching and retrieving information from remote databases.