

## **ISSUES IN ONLINE HERITAGE MANAGEMENT: TOWARDS A SOLUTION WITH A SERVER-BASED HERITAGE MANAGEMENT SYSTEM (TOADHMS).**

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### **Introduction**

The requirement for every country to produce a published inventory of monuments and sites, together with photographs and explanatory notes, has long been encouraged by the international heritage community. For instance the compilation of such inventories was a requirement in 1931 of Article VII c) 1 of the Athens Charter for the Restoration of Historic Monuments<sup>1</sup>. This theme was expanded in 1964 in the Venice Charter, adopted by ICOMOS in 1965, which emphasised the importance of the documentation of monuments in the form of analytical reports, illustrated with drawings and photographs with the report published and the full records made available in the archives of a public institution<sup>2</sup>. By 1990 it was recognised that published inventories and their supporting archives could no longer be regarded as static entities. The Charter for the Protection and Management of the Archaeological Heritage, approved by the 9<sup>th</sup> General Assembly of ICOMOS, recognised that inventories had to be dynamic, if they were to be effective as essential working tools in protection and understanding<sup>3</sup>. Five year's later the Principles for the Recording of Monuments, Groups of Buildings and Sites, ratified by the 11<sup>th</sup> ICOMOS General Assembly, drawing largely on the experience of the United Kingdom, detailed the content of records, explained the role of international standards and encouraged the ability to retrieve information at a local, national and international level<sup>4</sup>. These Principles recognised that the effective compilation, management and distribution of recorded information requires, where possible, the understanding and the appropriate application of up to date information technology.

The RecorDIM Roundtable-1 Report<sup>5</sup>, recognised that there is a global need for access to state-of-the-art software solutions at low cost but at the same time such solutions must meet with developing frameworks of standards and agreements within both the heritage and ICT worlds. This paper offers a pragmatic solution to many heritage management needs based around the development by an Oxford University based spin-out company, Oxford ArchDigital, of a server-based Heritage Management System (ToadHMS) a process that has highlighted many of the central issues concerning modern networked information

sharing. It is useful to be able to use the development of ToadHMS as a vehicle for this wider discussion concerning heritage management software, for while it will not solve all problems in all situations, we claim that it is certainly an important step in the right direction by offering a powerful, network-based solution for the management, distribution and presentation of heritage data. A major advantage is access entirely through a web browser enabling the management and editing of heritage information over any internet or intranet, and also the facilitation of controlled public access to monuments records, museum or heritage databases.

As shown in the RecorDIM Roundtable-1 report, there is a need for flexible systems to manage complex data obtained from archaeological fieldwork and research. This need, compounded by the clear requirement for a new generation of network-based heritage solutions, led to the development of a system that incorporates all aspects of heritage management, accommodating textual, spatial and graphical data. ToadHMS incorporates the functionality of an image engine which allows heritage managers to attach an unlimited number of images to every database object. Its underlying spatial engine allows the plotting of sites on a map and the creation of clickable distribution maps without the need for a server-side GIS, and the integral basic database functionality incorporates features such as advanced and quick search functionality, and XML and CSV export. It is essential that these separate core functions should be combined in a single application that provides a complete content management solution for heritage data.

To meet the needs of the RecorDIM Roundtable-1 recommendations for low-cost state-of-the-art software solutions it is necessary to recognise that the needs and resources of each monuments record, museum or archaeological/heritage project are, at the same time, both similar and different. While individual applications will require personalised front-ends, individual identities and need to incorporate specific data, it is possible to identify the core functionality required by these projects, rather than attempting to create a rigid 'one-size-fits-all' solution. It is also crucial to recognise that most organisations will already have their own IT infrastructure in place: rather than requiring an organisation to use a specific database on a specific

platform, any solution aiming for wide appeal must run on a wide variety of operating systems including Windows, Linux and Unix, and, we would suggest, be accessed through any JavaScript compliant web browser. Furthermore, to meet the low-cost criteria software products should ideally be virtually database independent, being able to use most open source or proprietary database backends including ORACLE, Microsoft SQL Server, and MySQL. It is only with such an accessible, flexible and open approach, that the creation a powerful, scalable and efficient solution to satisfy the complex and increasing needs of data management projects within the archaeology and heritage sector can be achieved.

## Security

While security of data and systems is obviously a central issue it should not inhibit access to information, both by data-users and data-suppliers and managers. Our suggested solution is for access and management entirely through any JavaScript compliant web browser: the ability to add, edit and delete records, upload and alter images, run queries and print reports should be possible without requiring any additional software. The same system can be used by internal staff for data management, and by the public for controlled browsing of the database content. If required, the data can be linked by the administrator to a separate, and possibly already existing, GIS (MapInfo, ESRI products or any other mainstream GIS) or external database such as Microsoft Access or ORACLE.

To maintain data integrity and ensure easy data management the system must be able to allow the system administrator full control over who can access each and every database record. Core functionality must include the ability to apply read and/or write permissions for each database record/user combination so that, for example, sensitive information can be hidden from public users while at the same time allowing read-only access to development colleagues and full read and edit control to project managers. Using this technology and philosophy, a further benefit is that it is no longer necessary to maintain two versions of the database: one for private management, and one for public access. A further step towards low-cost is that the administrator should not need any special training, and be able to manage system security through user and group level access control. In organisations with budget pressures this will obviate the IT officer as an intermediary between the system and its content.

## The importance of images

Photographic and image data are an essential and integral part of any heritage dataset and any software solution must be able to offer the full range of image handling capabilities to enable efficient management and access. At a minimum this should include the ability to associate multiple images with each monument, small find, artefact, event or archive; to be able to have thumbnails of multiple photographs, drawings and x-rays displayed with each object record, or

scan an unpublished manuscript or early plate and associate it with the document entry within the system. The interface should be customisable, be able to establish a number of 'thumbnail' images to display with the option to view all associated images in a light table format; clicking on each thumbnail should bring up a full-sized image, incorporating a watermark or copyright stamp if requested by the administrator.

Security and management requirements suggest that it is beneficial to store each image in the server's file system to allow access (if required) to images outside the system's interface. Storing the images independently of the textual data will also allow backup of the visual and textual resources separately when required, and thus facilitate synchronisation.

Because images come in a wide variety of sizes and digital formats it is essential that any heritage management system is flexible enough to handle the full range and so prevent important data from being excluded. As a minimum the following image formats should be handled: jpeg (JPEG bitmap); gif (Compuserve bitmap); png (Portable Network Graphics); tiff (Tagged Image File Format); svg (Scaleable Vector Graphics); psd (Adobe Photoshop®); bmp (Windows® and OS2® bitmap); tga (Targa file format); miff (Image Magick® file format); pict (Macintosh PICT); pcx (Paintbrush); pcd (Kodak Photo-CD). All image formats should be handled natively: there is no need for image conversion, although web-compatible images (*jpeg*, *gif*, *png*) usually provide added functionality.

Another big advantage is the use of a server-side graphics engine to process images on the server before they are delivered to the client. This means that administrators need only manage one version of their image (not up to four as in some on-line image databases), and bandwidth is maximised because images are delivered at screen-optimised resolutions. Perhaps the most important aspect of this server-side manipulation is that it is possible to deliver to the public versions of an image that differ from the original stored version. There is now no need to resample and edit images for web delivery, instead they can be resized, altered and watermarked dynamically before delivery.

One of the primary concerns when making image data available on the web is the protection of intellectual property and copyright once images have been made available to the public. It should now be standard procedure for a heritage management system to use several methods, including a tiled watermark to alter the image dynamically before it is sent to the client (server-based image processing as described above). The creation of individual and corporate watermarks, a logo or copyright stamp, and their application to all images when they are being viewed by members of the public should be standard so that the original images remain unchanged. A watermark can be tiled over the entire image to prevent it being cropped, with alteration of the hue and saturation of the watermark. Another option should be the ability to 'stamp' the image with text from a database field, such as image copyright, or use the same text for all images in the collection.

## Searching

Rapid navigation and retrieval of data, both for management and usage purposes, is another fundamental requirement of any online heritage system. Form-based search interfaces should generate optimised SQL queries to find matching database objects quickly and precisely. A useful facility is a 'quicksearch' to obtain quick but general results, as well as the advanced search to generate detailed results from very specific queries. Our research has shown that the following should be a minimum specification for any search engine:

- 'Quicksearch' from any page on the site
- Keyword searching with wildcard character support
- Unlimited number of Boolean search combinations
- Search on fields that 'contain', 'start with' or 'are exactly' your search term
- Search with drop-down 'pick lists' of values and fields
- Sort results by any number of fields, ascending or descending
- Optimised queries produce very fast results: a typical search through 3,000 records on six fields and three words using wildcards usually takes well under 0.2 seconds to complete with a typical MySQL installation
- Search on related and synonymous terms with the integrated thesaurus. Perform searches through cascading hierarchies: for example, using the English Heritage monument thesaurus a search for all 'funerary sites' will search on over 100 different terms within the funerary site hierarchy
- SQL: administrators should be able to run textual SQL queries
- Export search results as XML or CSV
- Show the results of any search on a map

Any search engine must be designed to be powerful enough to satisfy professional researchers yet simple enough to be used by interested members of the public and schoolchildren. The ability to create additional search interfaces offers useful flexibility.

## Geographic Information

As with image data, spatial data is often a fundamental component of heritage data that needs to be stored, managed and retrieved. Fully functional server-side Geographic Information System (GIS) software is still expensive and complex to manage although if spatial data is stored in an ANSI compliant database it can easily be tied to nearly any server- and client-side GIS including MapXtreme, MapInfo, ArcView, ArcGIS and ArcIMS. A simpler solution should also be offered though, and for those who are not prepared to invest in an expensive server-side GIS solution, simple web-based mapping functionality should be an option. Our

suggested solution is a system that uses the Easting and Northing, or Longitude and Latitude, generated automatically from the grid reference (or other projected grid) to create clickable distribution maps on georeferenced raster maps.

This integrated mapping facilities should allow users to:

- Validate grid and coordinate input
- Save input time and reduce error through derivative data: Easting, Northing, Longitude, Latitude, coordinate accuracy and the relevant map tiles can all be generated from a grid reference
- See the monument or find location on a site, region or countrywide map
- View the results of any search as a clickable distribution map: for example, search the database for a specific type of site and click on the point to bring up the site record
- Perform simple buffering: find neighbouring sites that fall within a specified distance

This integrated mapping facility is not intended to replace a GIS, but rather to compliment an existing one or to provide a quick and easy solution for presenting simple geographic data over the web without complicated server side GIS or heavy Java-based map browser applets. RecorDIM Roundtable-1 calls for state-of-the-art solutions at low-cost and we propose that offering this flexibility is the solution for geographical data.

## Thesauri and Data Dictionaries

It is essential that any heritage management system is flexible enough to incorporate existing and developing standards, whether national or international. Standards compliancy should enable configuration to accommodate any data standard, the use of any number of standardised or custom data dictionaries, and automatic data dictionary update and synchronisation. Because our system has been developed in the UK it comes with integrated thesauri and data dictionaries from English Heritage and the mda (Museum Documentation Association). To satisfy the wider international market any others can be added. The importance of thesauri and data dictionaries is two-fold:

For data control:

- Drop-down lists: the use of standardised dictionaries for controlled lookup tables, or for a self-referring drop-down list
- Data validation: to validate entries against data dictionaries or thesauri. If data is invalid, alternatives should be offered based on sound and spelling
- Preferred term validation: to flag the use of non-preferred terms during data entry, and suggest preferred terms or submit candidate terms.

For search enhancement:

- To use the thesaurus structures to automatically search on synonymous terms and related terms

- To perform searches through cascading hierarchies: for example, using the English Heritage monument thesaurus retrieving 'funerary sites' will search for over 100 different terms within the funerary site hierarchy

It should also be possible to use data dictionaries that are stored within the management system or, if preferred, data dictionaries located on other servers throughout the internet: this enables the centralisation of all system installations on the same data resource.

### Synchronisation and Export

Another important feature that should be available is in-built record synchronisation. If each record within the system has its own unique ID, records can be shared between datasets while still maintaining the ability to be updated at a later date. More importantly this enables the downloading of record sets on a portable computer, to be taken into the field to be updated and amended, and then synchronised with the main dataset when the fieldwork is complete. Any system should also be able to share data so that information can be exported into other applications, using either CSV or preferably XML export for which custom and standardised tag sets can be created.

### The way forward

By combining a core solution that is flexible, state-of-the-art and low-cost, this paper has described an online heritage management system that goes a long way towards meeting the requirements of the RecordIM Roundtable-1 needs. As well as the core technology described above it offers a look and feel that is easily customised to suit any project, web site, or corporate layout through the choice of colours, logos, look and layout. By using open technology the cost is minimised and accessibility is increased, this uses only HTML and JavaScript through any JavaScript compliant browser, it does not use Java applets. On the server side it can use a variety of database platforms, again maintaining maximum flexibility.

Application areas for this technology will be any that require the management and use of text, image and spatial data. These could include:

- Museums and Heritage Services to catalogue object collections and accession registers, to manage collections and create 'virtual tours' of specific parts of a collection or else make the entire collection accessible to a visitor anywhere in the world. Not only does this raise the profile of the museum and its collection, it also offers unparalleled opportunities for e-commerce based on images from the collection.

- Archaeological Organisations and Research Projects to manage data for all of their survey and field projects: the same system can be used to manage multiple excavations and all of the associated data including that gained from desk-based assessments and survey. The system can also be configured to accommodate specialist databases such as environmental datasets, pottery and small finds collections. These specialist configurations can run alongside or be totally integrated with the primary excavation or site dataset.
- Monuments Records, regional or national, can use the system as a total solution to heritage management: present data to the public, restrict access to sensitive records, manage aerial photographic and image collections, and add, edit and modify data based around the event/monument/archive model. Thematic site tours on the web can be created, and to manage archaeological sites and monitor their status the system will even send e-mail notifications of overdue site visits if requested.

This technology is available now and through sensitive and informed application it can be used to the benefit of heritage management and access.

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