



## SWORD2 Project Final Report

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The project partners involved were:

- Centre for Advanced Software and Intelligent Systems (CASIS), Department of Computer Science, Aberystwyth University.
- University of Southampton, Eprints
- Intrallect Ltd.
- Jim Downing, University of Cambridge

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## Executive Summary

The SWORD vision is about 'lowering the barriers to deposit', primarily for depositing content into repositories, and additionally, for depositing into any system which may wish to receive content from remote sources. The SWORD protocol defines a standard mechanism for depositing into repositories and other systems. The project and protocol were developed because there was previously no standardised way of doing this. A standard deposit interface allows repository services to be built that can offer functionality such as deposit from multiple locations, e.g. disparate repositories, desktop drag'n'drop tools, or from within standard office applications. SWORD can also facilitate deposit to multiple repositories, increasingly important for depositors who wish to deposit to funder, institutional or subject repositories. There are many other possibilities, including migration of content between repositories and transfer to preservation services. In addition to refining the existing SWORD application profile, the SWORD2 project has developed a number of tools and services to demonstrate these possibilities. It has also been pro-active in promoting SWORD and encouraging its uptake within other repositories, services and tools, notably with its adoption into the Microsoft Article Authoring Add-in for Word 2007 [1] and with the new Microsoft Zentivity repository system [2].

The core aims of the project were to update the SWORD Protocol, the SWORD repository code libraries in the DSpace, Fedora, EPrints and Intralect repositories, and the existing reference demonstrators. A Facebook application and validator have also been developed. Advocacy efforts include an e-learning case study, a briefing paper, a new SWORD website [3], and a range of additional dissemination activities, including conference papers, presentations, demonstrations and workshops at a number of national and international conferences and meetings.

The project was structured into six work packages, with testing phases employed to iteratively guide development. Project management was intentionally lightweight and agile given the short duration of the project and the geographical spread of the project team.

All of the project work has now been successfully completed. The SWORD2 outputs have been extremely well received by the repository community, and the SWORD profile has been widely accepted as the de-facto standard for deposit by the repository and wider development community. The project and its outputs continue to gain acceptance and adoption within a growing number of real world implementations [4].

## Background

Three years ago, JISC provided a small amount of funding to start a working group to scope the requirements for defining a deposit standard. The work arose from discussions at the JISC CETIS conference in 2005 and resulted in a set of requirements for repository deposit, a list of potential candidate standards, and draft XML serialisations demonstrating how a deposit standard might be realised in practice. A paper presented at Open Repositories 2007 brought the deposit API idea to a wider audience where concerns were expressed about developing a new standard where existing ones might be leveraged. In early 2007, a proposal for a lightweight project was funded. Its aims were to:

- Define a protocol or specification
- Produce evaluation reports on relevant standards
- Implement web services in EPrints, Fedora, IntraLibrary and DSpace
- Produce a deposit client implementation
- Create a service expression for the E-Framework
- Commission implementation case studies from implementers outside the core project team

The original project focussed specifically on three elements: service discovery, the point of deposit, and a receipt or response. For these, it drew on the Atom Publishing Protocol [4a], extending it to support identified requirements. A number of requirements were considered out of scope for the initial

SWORD project. These, and some additional requirements, were discussed in detail at a SWORD2 kick-off project meeting, and formed the basis of the SWORD2 project plan.

## Aims and Objectives

The project aims and objectives broadly cover three areas: the revision of the application profile, the technical development work, and the advocacy efforts.

### Aims

- To revise and update the original SWORD application profile (version 1.2)
- To diversify and expedite the options for both the population and the use and reuse of repository content
- To improve the uptake of SWORD through increased advocacy efforts
- To improve repository interoperability as outlined in the Information Environment
- To take a service-oriented approach to development as outlined by the E-Framework

### Objectives

- To revise, test and refine the existing SWORD Application Profile according to requirements identified
- To implement the newly specified SWORD functionality in EPrints, DSpace, Fedora and IntraLibrary, updating the implementations from the SWORD first phase
- To enhance the existing prototype tools
- To disseminate the resulting work and encourage community uptake
- To ensure that the approach developed by this project is cognisant of UK requirements (as defined by the JISC Common Repository Interfaces Group – CRIG) and International work in this area (including the OAI-ORE activity)

## Methodology

The project drew on discussions and ideas arising from a project meeting held on July 1st 2008 at Birkbeck College in London to identify requirements and work packages. The project was structured into six work packages, running concurrently, with scope for considerable cross-fertilisation between each. Testing phases were used to iteratively guide development. The management of the project was intentionally lightweight and agile given the short duration and geographical spread of the team.

The chief aim for this project was achieving interoperability between repositories, allowing material to be deposited in a standard way. The scope of the project was primarily the revision and implementation of the SWORD application profile, and the technical development involved in implementing revisions and necessary refinements to the existing repository implementations in DSpace, Fedora, Eprints and IntraLibrary. Renewed and extended advocacy efforts to improve the global uptake of SWORD were also seen as major priority for this second phase of the SWORD project.

Critical success factors included the successful implementation of the revised application profile for each software platform and the demonstration that a SWORD client can continue to deposit content into each repository, fulfilling a range of identified use cases and scenarios. Community acceptance and implementation of the SWORD web services by repositories and other agents were seen as essential, as was ensuring the project remained cognisant of other work around repository functions.

## Implementation

The project began with a set of possible requirements carried over from SWORD phase 1 that were added to a discussion document along with some additional requirements identified from subsequent email discussions and ad hoc discussions at various conferences and meetings. The discussion

document formed the basis of an agenda for the project kick-off meeting where the SWORD project partners discussed possible work to carry over from SWORD phase 1, along with requirements identified since. Priorities were allocated and, as before, a significant number of requirements were immediately ruled as out of scope. The notes from the meeting were written up and a selection of specific requirements extracted.

Given the chosen requirements and the success of the first phase of SWORD, the existing project partners were engaged in the work, with Jim Downing additionally contracted to update the application profile. All the while, management and reporting was kept lightweight, as the time available was too short to employ more rigorous methodologies or analysis. The requirements gathering process has been ongoing via the sword partner internal email list, the sword-app-tech sourceforge list, twitter discussions and feedback from presentations at conferences. These requirements have been incrementally added to the project wiki for a possible SWORD project phase 3.

The application profile refinement, maintenance and development work was largely undertaken by Jim Downing, with input from the partners. There were discussions on the sword partners' list that fed into the profile development around the areas of file upload size and package types that SWORD supports [5].

The technical development work consisted mainly of updates to the SWORD repository code libraries. SWORD profile version 1.3 compliance for the DSpace and Fedora repositories was undertaken by CASIS at the University of Aberystwyth, and by EPrints and Intrallect for their respective repositories. CASIS also developed a Facebook deposit client and SWORD validator. All partners have been involved in testing and providing feedback into the iterative development process.

Advocacy and dissemination efforts were undertaken by all partners to some degree. CASIS have provided hosting for reference implementations and a new plone based SWORD project website that all partners are able to contribute to. Julie Allinson undertook the bulk of the migration from the original SWORD wiki, which is now primarily being used for internal project documentation.

Adrian Stevenson and Julie Allinson provided the overall project management. Deliverables were developed for the project plan and the partners implemented these over the six months, from June 2008 to December 2008. An extension was required to the end of February 2009 for some of the technical development work due to staffing changes and contractual delays. A lightweight informal management approach was adopted, consisting predominantly of communication by email and phone calls, with some occasional face-to-face meetings made possible by informal meet-ups at various conference and meetings.

## Outputs and Results

The project has provided a number of tangible outputs, mainly in the form of software and support materials:

- Updated SWORD AtomPub application profile version 1.3 [6]
- Updated SWORD repository code libraries for DSpace, Fedora, EPrints and Intrallect repositories [7]
- Updated SWORD deposit demonstrators – web based and desktop [8]
- A SWORD Facebook deposit client [9]
- A SWORD validator [7]
- An eLearning case study [10]
- A new SWORD website [3]
- Other dissemination activities and related work [11]

The broader intangible outputs include gaining a better understanding of the scenarios, context and requirements for deposit, and a greater awareness of issues or further work required. We also have a better understanding of the wider context in which repository development sits, and how it relates to other providers and services, such as publisher systems and VLEs.

## Outcomes

The project has been successful in delivering all of its specified outputs. The technical developments were clearly defined and have all been fully implemented. These are now available from the new SWORD website.

### Aims

*To revise and update the original SWORD application profile.*

Version 1.3 of the SWORD profile was successfully completed by Jim Downing, and has now been implemented in all repositories and demonstrators.

*To diversify and expedite the options for both the population and the use and reuse of repository content*

The increasingly wide-ranging availability of SWORD enabled applications such as Microsoft Office and Facebook achieve this aim.

*To improve the uptake of SWORD through increased advocacy efforts*

Although uptake of SWORD has been impressive, this is only partly due to our advocacy efforts, despite our intentions for SWORD2. This is something we feel should be addressed more vigorously in the future. Nevertheless, presentations and demonstrations from Adrian Stevenson, Julie Allinson and Sarah Currier have been well received, as have contributions from SWORD partners in the form of blog posts about technical developments and discussions at events. The case study from Sarah Currier in particular was very well received. The swordapp twitter feed [12] has also been very successful and has proved to be a useful tool for developing a user community around SWORD, providing news and a means of interacting with the community to aid the requirements gathering purposes.

*To improve repository interoperability as outlined in the Information Environment*

The SWORD project work has been consistent with this aim.

*To take a service-oriented approach to development as outlined by the E-Framework*

The SWORD project work has been consistent with this aim. The project has liaised with Phil Nichols regarding SWORD and E-Framework.

### Objectives

*To revise, test and refine the existing SWORD Application Profile according to requirements identified*  
Jim Downing has successfully completed version 1.3 of the profile and it has now been implemented in all partner repositories and demonstrators. Informal testing has been ongoing. Interest in the new profile continues to grow, a recent example being a Japanese translation of the profile.

*To implement the newly specified SWORD functionality in EPrints, DSpace, Fedora and IntraLibrary*

All the newly updated implementations are now complete and accessible from the SWORD website. We have already had a significant number of queries from projects looking to implement the new version of the profile. It is highly likely that SWORD 1.3 will be rolled into the next releases of all four repository software products.

*To enhance the existing prototype tools*

The existing reference demonstrator tools have all been updated to meet version 1.3 profile compliance. In addition, new tools continue to be developed using the SWORD protocol, including the OfficeSWORD tool [13] and the Microsoft Article Authoring Add-in [1], which allow direct deposit from the suite of Microsoft Office applications. There is an open source SWORD Widget [14], enabling deposit from popular web tools such as Netvibes, iGoogle or web pages. The FeedForward project [15] has implemented a SWORD deposit service plug-in allowing repository deposit by means of a simple drag and drop mechanism. The fact that a number of tools exist that are not funded through SWORD2 demonstrates that the project has achieved a high level of successful community engagement.

*To disseminate the resulting work and encourage community uptake*

Uptake of SWORD has been significant. Despite this, as noted above, the renewed and extended advocacy efforts promised as part of SWORD2 did not happen to the extent we would have liked. We do not feel that this has hindered the project in any significant way, but that more effort would have resulted in even greater impact.

*To ensure that the approach developed by this project is cognisant of UK requirements (as defined by the JISC Common Repository Interfaces Group) and International work in this area (including the OAI-ORE activity)*

We are happy that this objective has been met. We have maintained close contact with the CRIG project and we are content that our efforts have been in line with the overall efforts of CRIG. Implementing ORE resource map deposit was not one of the in-scope objectives of SWORD2, but we have maintained contact with OAI-ORE activities, Adrian Stevenson being the OAI-ORE technical representative at UKOLN. The ForeSite project demonstrated a relationship between ORE and SWORD by passing ORE resource maps via SWORD. Richard Jones, one of the lead developers on that project, and member of the ORE Technical Committee, was a partner in SWORD.

SWORD has had an impressive impact on the repository community. A non-exhaustive list of real world SWORD implementations [4] include the following:

- APSR SWORD compatible OJS Plugin.
- arXiv 1.3 SWORD compliant endpoint.
- Feedforward - personal information environment, with a SWORD interface, among other features.
- SWORD Widget - For Netvibes, IGoogle and embedding in web pages.
- The Depot - SWORD-compliant.
- Foresite - using SWORD to deposit ORE resource maps describing journals within JSTOR into a DSpace repository.
- Biomedcentral's Open Repository - implementing a SWORD interface.
- Intrallect - desktop drag and drop tool based on SWORD.
- Microsoft Article Authoring Add-in for Word 2007 - allows repository deposit direct from Word.
- Microsoft Zentity Research Output Repository platform supports SWORD deposit.
- Microsoft Client code - Microsoft Office SWORD deposit plug-in  
<http://www.codeplex.com/OfficeSWORD>.
- Microsoft eJournal Service (Alpha) and Research Output Repository Platform (Beta) -  
[http://www.microsoft.com/mscorp/tc/scholarly\\_communication.mspx](http://www.microsoft.com/mscorp/tc/scholarly_communication.mspx)
- SOURCE project.
- BibApp - SWORD Ruby Client <http://code.google.com/p/bibapp/>
- ICE-TheOREM - has demonstrated 'ORE-over-SWORD'
- TARDIS, the Australian Repository for Diffraction Images is implementing a SWORD interface: <http://tardis.edu.au/wiki/index.php/TARDIS2>
- PublicationsList.org is using SWORD for deposit into EPrints <http://publicationslist.org/>
- EU PEER Project will be implementing SWORD for deposit <http://www.peerproject.eu/>
- EM-Loader project has used SWORD for batch deposit <http://publicationslist.org/em-loader/emloader-report-sword-experiences.html>
- The CLASM project will be developing a SWORD plugin for Moodle  
<http://dablog.ulcc.ac.uk/category/projects/clasm/>
- Max Planck Digital Library's eSciDoc solution, 'PubMan' has implemented SWORD  
[http://colab.mpdl.mpg.de/mediawiki/PubMan\\_Sword](http://colab.mpdl.mpg.de/mediawiki/PubMan_Sword)
- The YODL-ING project at York is developing a SWORD-based 'one-stop' deposit client
- CUNY, The City University of New York Libraries are using SWORD for deposit into DSpace
- SWORD interfaces in various installations of DSpace, EPrints, Fedora and IntraLibrary

## Conclusions

All of the project work has now been successfully completed. The SWORD2 outputs have been extremely well received, both by the repository community and wider technical communities, and there is currently a great deal of interest and activity around SWORD, much of this detailed on the SWORD implementations web page [4]. A number of new JISC projects, including YODLING and CLASM, as well as some EU projects such as PEER, are in the process of implementing SWORD in their repositories and building SWORD based deposit mechanisms into their deposit workflows. New tools continue to be developed using the SWORD protocol, including the Microsoft Article Authoring Add-in and OfficeSWORD tools, which allow direct deposit from Microsoft Office applications. There is an open source SWORD Widget, enabling deposit from popular web tools such as Netvibes and IGoogle. Establishing the SWORD profile and achieving a critical mass of uptake is notoriously difficult, but we believe SWORD has made considerable progress towards the goal of making interoperability of deposit a reality.

## Implications

As part of the requirements gathering and scoping process for SWORD and SWORD2, we had a considerable amount of outstanding possible future work that would be very worthwhile to undertake but that was ruled out of scope. These requirements have continued to be captured on the SWORD project wiki to feed into any further SWORD activities. We are also continuing to get a considerable amount of interest from the repository and wider communities, with additional ongoing requirements and support requests. We feel that SWORD is now established and embedded to a degree that support for the foreseeable future should be considered to be a priority.

## Recommendations

The value of SWORD has been wide reaching, from enabling multiple deposit, to supporting the creation of new deposit tools, to supporting easy transfer between different repository software platforms. In order to continue to capitalise on the success of SWORD, it needs continued general support. In addition, there are a range of options and issues for taking forward the SWORD work into a more fully developed standard. Without further discussion and development, there is a danger that the full potential of SWORD may not be realised.

Renewed and extended advocacy efforts to increase the global uptake of SWORD were seen as a major priority for the second phase of the project. Despite the success of the project, it was generally felt that this goal was not addressed adequately, and should be pursued in any further phase. It should be noted that these activities take significant amounts of time and effort and should not be underestimated in relation to resourcing and funding.

Also, new activities and requirements have emerged in the interim. There is a pressing need to address and support the considerable amount of interest in and activities around SWORD in an appropriate way. There is also a need for a managed SWORD package types registry, as well as the possible need for a registry of SWORD enabled repositories. SWORD is reaching a level of maturity where its future as a standard needs to be considered. Options for future development, including the possibility of undertaking a process leading to formal standardisation, should be assessed, and recommendations made.

## References

- [1] Microsoft Article Authoring Add-in for Word 2007  
<http://research.microsoft.com/en-us/projects/authoring/>
- [2] Microsoft Zentity 1.0 Research-Output Repository Platform  
<http://research.microsoft.com/en-us/downloads/48e60ac1-a95a-4163-a23d-28a914007743/>
- [3] SWORD Website  
<http://www.swordapp.org/>
- [4] SWORD AtomPub Profile implementations  
<http://www.swordapp.org/sword/implementations>

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Date: 30<sup>th</sup> June 2009

- [4a] The Atom Publishing Protocol  
<http://bitworking.org/projects/atom/rfc5023.html>
- [5] SWORD Content Package Types version 1.0 (draft)  
<http://purl.org/NET/sword-types>
- [6] SWORD AtomPub Profile version 1.3  
<http://purl.org/net/sword/>
- [7] SWORD downloads  
<http://www.swordapp.org/sword/software>
- [8] SWORD client and demonstrators  
<http://www.swordapp.org/sword/demonstrators>
- [9] SWORD Facebook client  
<http://fb.swordapp.org/>
- [10] E-learning case study  
<http://www.elearning.ac.uk/features/sword>
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<http://www.swordapp.org/advocacy>
- [12] SWORD Project twitter feed  
<http://www.twitter.com/swordapp>
- [13] OfficeSWORD tool  
<http://www.codeplex.com/OfficeSWORD>
- [14] SWORD widget  
<http://rwidgets.co.uk/wiki/doku.php?id=wiki:sword>
- [15] FeedForward Project  
<http://legolas.cetis.ac.uk/>