

Subject Portals Project

Continuation Project Plan

Document Notes

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Date	17 April 2007
Version	1.2
Revision	258
Document Name	spp_continuation_plan
Notes	Revised to reflect change of collaborators. Confidential budgetary information not included.

Summary

This document contains the full project work plan for the Subject Portals Project (SPP) underspend continuation funding. This work is planned to support the continued maintenance and development of the SPP software. Its broad aims are to increase the ease of adoption by improvement of standards support and of component separation, to address maintenance issues raised by software users, to build on developments in recent related projects, and to establish the project outputs in an open source context for potential future use and development by the community. In addition, it seeks to disseminate outputs throughout the appropriate communities.

Project start: 1st May 2006

Project end: 30th April 2007

Duration: 12 months

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1 Project Description

The Subject Portals Project (SPP) [SPP] was originally funded under the 5/99 Programme to improve the functionality of the Resource Discovery Network (RDN) [RDN] subject hub sites. It built and packaged portal-based software using open source Java-based portal technologies. However, when the RDN recently reviewed its technical infrastructure in light of a changed funding environment it made the decision not to pursue the use of portal technologies as the platform of delivery for their subject hubs.

However, it is clear that the software outputs of SPP could be of value to the wider community and that they offer potential for many other services and organisations wishing to develop portals themselves. The development strategy adopted by the project aimed to create portable components, which could then be embedded into a variety of other environments. This has been achieved by the creation of a series of portlets, exhibiting a variety of functionality (e.g. cross-searching, alerting), and designed to sit within a portal framework. The use of standards and open source licensing aids their potential for external adoption and re-use.

This plan details how the project will use the final SPP budget underspend to meet these broad aims:

- To contribute standards-compliant portlets to the HE and FE community (and beyond) and to establish the framework for their support within the open source community. It is envisaged that the portlets will be deposited in appropriate repositories (e.g. the JA-SIG [JASIG] Clearinghouse [JASIGCH]) while the source code will reside in an open source development repository (e.g. sourceforge.net [SFORGE]).
- To respond to maintenance and development requests from key software users. In particular, the RDN service EEVL Xtra [XTRA] and the PerX [PERX] project both make use of SPP software. As part of this work plan they have provided us with a list of suggested SPP maintenance and enhancement tasks. (See appendix A).¹
- To review and build upon relevant research done elsewhere, for instance the recently completed Contextual Resource Evaluation Environment (CREE) [CREE] project.
- To explore routes towards interoperability with frameworks other than portals. Of particular interest in this area is the SAKAI framework [SAKAI].
- To explore and demonstrate potential routes for portlet deployment in production settings by developing case studies involving real-world institutional portal platforms.
- To disseminate project outcomes via appropriate community channels.

2 Work Packages and Deliverables

2.1 WP1: Project Management

Duration: 12 months

This effort would be spread across the lifetime of the extension project and would involve overall coordination of the work packages and the deliverables, as well as being the external contact point for JISC and being responsible for the timely production of the required project reports.

Deliverables:

- P1: Interim project report

¹ *Incompatibilities in project timetables eventually prevented our project and the PerX project from being able to collaborate. In mitigation, a working relationship was formed with both the IBVRE project (regarding the Alerting Portlet), and the CREE2 project (regarding the Cross-searching Portlet). This plan has been updated in places to reflect this change.*

- P2: Final project report

2.2 WP2: Framework Review

Duration: 2 months

Whilst support for the JSR 168 and WSRP standards (see WP3) is seen as the key way to ensure maximum interoperability of our components, the project also plans to review the interoperability potentials of alternate platforms. Particular attention will be paid to the SAKAI framework, but in addition various virtual learning environment (VLE) implementations will be considered. It is to be understood from the CREE outcomes that current support for portlet standards within these applications is incomplete. The decision whether to undertake technical development work within the project with regards any of these platforms will be taken after the review. These decisions will be based on a variety of weighted factors, including, for example, the complexity of development, the scale of the platform's adoption and its potential for future portlet standards support. The survey will also include a discussion of the already available literature in this area, including the outcomes of other related JISC projects (e.g. CREE).

Deliverable:

- F1: Framework review report

2.3 WP3: Technical Development

Duration: 10 months

The project's aim is ensure that the portlets and associated code that is made available to the community adheres to the appropriate standards. In this regard, some technical development work relating to the two key portlet standards would be undertaken.

2.3.1 Standards Compliance

- JSR 168. This portlet standard [JSR168] emerged during the lifetime of the original SPP as a key standard. It aims to ensure interoperability between Java portals and Java portlets, allowing compliant Java portlets to be deployed in any compliant Java-based portal. Support for the standard within the SPP outputs was adopted as an important part of the exit strategy and this support was largely achieved in the latter stages of the project. SPP JSR 168 compliant portlets have been demonstrated working in uPortal [UPORTAL], a portal platform other than the project's chosen platform (apache's jetspeed [JETSPEED]). However, it is necessary to re-factor this work in order to increase the modularity of the portlets made available via this standard, not least by loosening their coupling to backend services such as user profiling and account management. Improving this modularity would help increase the portlets' flexibility and potential for re-use. This work also needs to be informed by the current development of the next version of the portlet specification, JSR 286 [JSR286]. This specification is planned for development during 2006 with a final release scheduled for the end of the year. It is likely that there will be no reference implementation of this specification during the lifetime of this project, but it will be important to be aware of the features it is likely to include when re-factoring to improve support for JSR 168.

Deliverables:

- T1: Enhanced JSR 168 portlets
 - T1a: Cross-searching portlet
 - T1b: Alerting portlet
 - T1c: Newsfeed portlet²
- T2: JSR 286 impact report (see also T4 below)

² At the project review (December 2006) it was agreed to suspend work on the Newsfeed portlet and divert effort to the other two portlets. It was felt that there was already a reasonable availability of RSS-capable portlets, as opposed to alerting and cross-searching portlets.

- WSRP (Web Services for Remote Portlets) is the other important standard [WSRP10]. Using the Simple Object Access Protocol (SOAP), it defines a layer of interoperability between portals and portlets hosted in separate locations, and thus allows more scalable service architectures to be implemented than by achievable using the JSR 168 standard alone. It is not a competitor for JSR 168; in fact the two standards were designed with reference to one another. It will be important to ensure that portlets produced by SPP work successfully via the current version of this specification, WSRP 1.0. This aim was identified within the latter part of the project but effort was concentrated on JSR 168 as support for this standard is a stepping stone to WSRP 1.0 compliance. CREE has demonstrated this in practice, using apache's wsrp4j [WSRP4J] to bring WSRP producer support to JSR 168 portlets. This work package would seek to ensure that all portlets released from WP3 would achieve WSRP 1.0 compliance. It would also include work to demonstrate this compliance using an appropriate portal framework, in all likelihood an appropriate release of uPortal, an example of a portal framework that can act as a WSRP consumer. In addition a demonstrator WSRP 1.0 producer service based on SPP outputs will be delivered. While implementing WSRP 1.0 support, the project would monitor the development of WSRP 2.0 [WSRP20]. This next version of the specification is due for release to public review in 2006. The project will maintain a watching brief and react appropriately should implementation code become available during the project's lifetime. At the very least, the project will report on the likely impact of WSRP 2.0 on the future development of its outputs.

Deliverables:

- T3: WSRP 1.0 portlet compliance
- T4: WSRP 2.0 impact report (see also T2 above)
- T5: Demonstrator WSRP 1.0 service.

2.3.2 Additional Functionality

Several areas of additional functionality development are planned.

- Shibboleth [SHIB] is the next-generation authentication and authorisation framework adopted by JISC to provide access control within HE. Work has been done elsewhere [SPIE] looking at the issues around securely delegating access rights across application tiers, as found in a portal architecture. The next release of Shibboleth (2.0) plans to address this area, and the project will maintain awareness of its development. If appropriate implementation code becomes available within the project's lifetime, the project will seek to support it within the portlets it distributes. In support of this goal, the SPP account management module will be re-factored to provide portlets with lightweight user management.

Deliverable:

- T6: Account management re-factoring and Shibboleth review.
- The work of the CREE project suggested several areas that merited further technical exploration. Of these, the project plans to investigate a subset:
 - The ability for portlets to communicate with each other. This is not covered in the WSRP 1.0 specification. The utility of this functionality (and an example implementation of it) was demonstrated by HIERPORT within the CREE project. Portlet inter-communication was used in that case to allow search results obtained by one portlet to be utilized in another. WSRP 2.0 is due to be released for public review in 2006. This version of the specification will, among other things, deal with the issue of portlet inter-communication.

Deliverable:

- T7: Report on potential portlet inter-communication use cases and implementation routes.
- Further development of the cross-search portlet. This will include development of support for the search and retrieve protocols SRW [SRW] and SRU [SRU], and of the harvesting protocol OAI-PMH [OAI]. Work in both these areas would build on the functionality already present in the SPP cross-searching portlet. This work will also be undertaken with reference to the JAFER [JAFER] Z39.50 library and portlet. This work will also include further development of the ability

to manage search result sets, including their exporting, as well as the addition of administrative portlet interfaces.

Deliverable:

- T8: Cross-search portlet development³
- In line with the Information Environment architecture, work was done during the original project on interoperability with other JISC services, in particular IESR [IESR] and Xgrain (now GetRef [GETREF]), and other appropriate technologies, for example OpenURLs [OPENURL]. The project would continue development in some of these areas.
- The IESR provides machine-readable metadata about JISC services. Currently the SPP software interoperates with the IESR to present the end-user with collection level metadata, such as collection title and description. This devolves the maintenance of this data away from each portal administrator to the central IESR service. However the IESR holds further data related to each collection that is currently duplicated at the portal. For instance, each searchable collection included in the search portlet requires maintenance of its connection details and record formats. This data could instead be retrieved behind the scenes from the IESR, for example in the form of ZeeRex records, machine-readable metadata records that describe Z39.50 services. In addition to this the IESR could be used as a service discovery tool. In this scenario the portal could not only discover collections newly added to the IESR, but also automatically configure the search interface to include them, utilising the connection details metadata mentioned above. This work supports the JISC IE architecture and moves the collection metadata maintenance responsibility away from each portal administrator and on to the IESR. The IESR also now provides a OAI-PMH interface, which the project will include support for.

Deliverables:

- T9: Deeper use of IESR metadata, including the investigation of automatic search interface configuration and service discovery.
- T10: Support for the IESR OAI-PMH interface
- Currently the SPP cross-searching tool has support for JISC's OpenURL Router [OPENROUT] built in. The project would seek to introduce more flexibility into the internal OpenURL support by increasing its robustness and configurability, and by providing administrative interfaces.

Deliverable:

- T11: OpenURL support development.
- The SPP alerting portlet provides the basis for a useful subject based personalised notification service. It allows registered users to specify their subject interests and the set of information sources to be monitored (chosen from a list defined by the administrator). The user will then be notified of any new information from those sources that is deemed to match their subject interests. The portlet and accompanying backend service currently perform this task successfully, however the range of sources and the matching algorithms are limited. The project will seek to address this, and, in addition, the creation of appropriate administrative interfaces.

Deliverable:

- T12: Alerting portlet development.
- The SPP newsfeed portlet currently provides a simple one-newsfeed per-portlet display. Newsfeed searching is provided by a plug-in for the cross-search portlet. While this is effective to some degree, this project intends to investigate improvements. These include newsfeed subscription administrative interfaces, an improved newsfeed selection interface, aggregated newsfeed item display and an integrated search.

Deliverable:

³ After discussions with CREE2 and JAFER it was agreed to incorporate SPP developments into the JAFER portlet code base. The resulting portlet will be used in the CREE2 project.

- T13: Newsfeed portlet development.⁴

2.4 WP4: Support and Maintenance

Duration: 12 months

The project plans to devote effort to software support and maintenance.

- Software development repository. The project plans to move the GPL licensed source code to an established third-party open source development repository, such as sourceforge.net. Housing the software in an environment more likely to be familiar to open source collaborators would increase the visibility and potential use and future maintenance of the software.

Deliverable:

- S1: House SPP project at an open source development repository
- Maintenance. This work package would provide effort to offer a level of support to those within the JISC community using SPP outputs. From the outset, this would include a consideration of the work already suggested by the PerX project (see appendix A). This effort would also include working on, and issuing, appropriate software releases and software patches. Multiple releases will be scheduled during the lifetime of the project.

Deliverable:

- S2: PerX maintenance issues⁵
 - S2a: WSRP compliance
 - S2b: SRW/SRU support
 - S2c: OAI issue resolution
 - S2d: Display issue resolution
 - S2e: Software dependencies maintenance
 - S2f: Memory issue resolution
 - S2g: JSR 168 cross-search compliance
 - S2h: Open source release
- S3: Software releases
- Documentation. Each portlet will be accompanied by supporting documentation. Installation and administrative guidelines will be provided, and user guidance will be supplemented via text supplied via portlet help.

Deliverable:

- S4: Portlet documentation

2.5 WP5: Dissemination

Duration: 10 months

Dissemination of the project's outputs would be conducted by a variety of means.

⁴ See footnote 2, page 4

⁵ See footnote 1, page 3

- The project website would continue to provide a central point for dissemination of project activities. The project would undertake an overhaul of the website at an early stage, including the addition of a wiki to ease further website development and management.
- Liaison with appropriate institutions and projects will continue throughout the project. The project will set-up relationships with two institutions who are working with portal platforms, with the aim of demonstrating the use of the project deliverables within a production environment. This will facilitate the testing of the portlets' installation and use in real-world settings. This work will feed back into the development and the documentation, and will form the basis of case studies. These case studies will not only discuss the technical steps and issues involved in the institutions' portlet adoption, but also the any arising procedural and policy issues. The project will also have an ongoing relationship with the EEVL Xtra and PerX projects. The latter of these, because of project time constraints, has currently implemented an alternate framework, but plans to adopt the deliverables from this project in due course.⁶
- The portlet outputs will be deposited in appropriate portlet repositories (e.g. the JA-SIG Clearinghouse).
- The project team will seek to take advantage of relevant dissemination opportunities, including presenting at appropriate conferences or workshops, writing articles for on-line and print publication, and mailing list contributions.

Deliverables:

- D1: Overhaul and maintenance of the project's website.
- D2: Portlets deposited in portlet repositories.
- D3: Portlets in production environments case studies.
- D4: Dissemination activities (articles, presentations, etc.)

2.6 WP6: Evaluation

Duration: 4 months

- The WP5 case studies will provide a good opportunity to evaluate the project and its outputs in a setting external to the project itself. These scenarios will offer system and portlet administrator-level feedback on the project outputs, as well as information regarding the procedural and policy changes necessary when utilising the project's portlets in an institutional production setting. Work will be undertaken with reference to the case studies work to gauge the success of the project and its portlet deliverables in a production-level context.
- The project will attempt to monitor and gauge the level of use of its software within the community. As well as logging simple download statistics, the project would also conduct the monitoring of the trial WSRP service use. Where possible, end-user opinions and feedback will also be sought and summarised in the evaluation report.
- The project will conduct internal evaluation of its progress against its stated objectives and timescales.

Deliverables:

- E1: Evaluation report

2.7 Deliverables Index

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P2: Final project report.....	4
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⁶ See footnote 1, page 3

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3 Timetable

Project start: 1st May 2006

Project end: 30th April 2007

Duration: 12 months

3.1 Summary

Table 1: Timetable summary

	1	2	3	4	5	6	7	8	9	10	11	12
WP1: Project Management									P1			P2
WP2: Framework Review								F1				
WP3: Technical Development									T12 T13	T1 T11	T3 T6 T7 T8 T9 T10	T2 T4 T5
WP4: Support and Maintenance										S1 S2	S4	S3
WP5: Dissemination										D1	D3	D2 D4
WP6: Evaluation												E1

3.2 Work Plan

Table 2: Detailed work plan

Note: Greyed-out items are original plan items that have now been removed.

Work Package and Tasks	Start Date	Completion Date	Outputs
WP1: Project Management	01-05-2006	30-04-2006	
1 Interim report	18-12-2006	15-01-2007	P1
2 Final report	01-04-2006	30-04-2007	P2
WP2: Framework Review			

Work Package and Tasks	Start Date	Completion Date	Outputs
3 Framework review	01-09-2006	15-12-2006	F1
WP3: Technical Development			
4 Increase de-coupling of backend services	01-09-2006	01-10-2006	Loosely coupled cross-cutting services. <i>The design decision was taken to further separate the portlets, such that each can stand independently. This removes the requirement of cross-cutting services.</i>
5 Inter-portlet communication	01-03-2007	31-03-2007	T7
6 AM re-factoring	01-12-2006	31-03-2007	T6
7 Cross-search migration to JAFER	01-12-2006	01-02-2007	JzKit replaced with JAFER
8 Cross-search SRW/SRU development	01-10-2006	01-11-2006	T8, S2b <i>This task has been depreciated after discussion with the JAFER team. See footnote 3.</i>
9 Cross-search OAI development	01-03-2007	31-03-2007	T8 <i>This task has been depreciated after discussion with the JAFER team. See footnote 3.</i>
<i>JAFER related tasks</i>	<i>01-01-2007</i>	<i>30-04-2007</i>	<i>T8</i> <i>Added task: Incorporation of SPP functionality into JAFER portlet code base.</i>
10 JSR 168 & cross-search portlet	01-12-2006	01-02-2007	T1a, S2g
11 JSR 168 & alerting portlet	01-11-2006	01-02-2007	T1b
12 JSR 168 & newsfeed portlet	01-09-2006	01-11-2006	T1c <i>The decision was taken not to develop the newsfeed portlet any further. Effort freed has been directed towards the other portlets. See footnote 2.</i>
13 WSRP compliance	01-11-2006	31-03-2007	T3, S2a
14 Demonstrator WSRP 1.0	01-02-2007	30-04-2007	T5

Work Package and Tasks	Start Date	Completion Date	Outputs
service			
15 JSR 286 report	01-03-2007	30-04-2007	T2
16 WSRP 2.0 report	01-03-2007	30-04-2007	T4
17 IESR metadata usage development	01-03-2007	31-03-2007	T9
18 IESR OAI support	01-03-2007	31-03-2007	T10
19 OpenURL support	01-02-2006	28-02-2007	T11
20 Alerting portlet	01-11-2006	01-03-2007	T12
<i>IBVRE related tasks</i>	<i>01-01-2007</i>	<i>30-04-2007</i>	<i>Added task: Collaboration regarding the Alerting portlet</i>
21 Newsfeed portlet	01-11-2006	01-01-2007	T13 <i>This portlet being developed no further. See footnote 2.</i>
WP4: Support and Maintenance			
22 PerX: OAI issues resolution	01-04-2006	01-05-2006	S2c <i>PerX requirements no longer apply. See footnote 1.</i>
23 PerX: Display issue	01-05-2006	01-06-2006	S2d <i>PerX requirements no longer apply.</i>
24 PerX: Memory issues	01-05-2006	01-06-2006	S2f <i>PerX requirements no longer apply.</i>
25 Software repository migration	01-02-2007	28-02-2007	S1, S2h
26 Software release	01-10-2006	30-04-2007	S3
27 Documentation	01-02-2007	30-04-2007	S4
<i>CREE2 related tasks</i>	<i>01-02-2007</i>	<i>30-04-2007</i>	<i>Added task: Collaboration regarding the Cross-search portlet</i>

Work Package and Tasks	Start Date	Completion Date	Outputs
WP5: Dissemination			
28 Overhaul website	01-12-2006	01-02-2007	D1
29 Deposit portlets	01-02-2007	30-04-2007	D2
30 Case studies	01-02-2007	31-03-2007	D3
31 Dissemination activities	01-01-2007	30-04-2007	D4
WP6: Evaluation			
32 Report	01-03-2007	30-04-2007	E1

4 Budget

5 Appendices

A. Suggestions for SPP Maintenance/Enhancement Tasks that are of Relevance to the PerX project

Removed - no longer relevant. See footnote 1.

B. Brief CVs

Mike Jones is a Senior Technical Researcher in ILRT, University of Bristol, and is currently working on the JISC IUGO conference data organisation project (<http://iugo.ilrt.bris.ac.uk/>). Prior to March 2006, Mike was a Senior Web Developer in the Web and Portal Team of Cardiff University where he acted as a lead developer and technical architect. He has been developing Web applications in Perl or Java in a Higher Education context for over six years.

Nikki Rogers is a Senior Technical Researcher at the ILRT, University of Bristol. She has several years' experience in developing Web applications in a Higher Education context including previous technical work on the JISC Subject Portals Project (<http://www.portals.ac.uk/spp/>), the JISC IE Metadata Schema Registry (<http://www.ukoln.ac.uk/projects/iemsr/>) and the JISC Shibboleth-aware Portals and Information Environments Project (<http://www.oucs.ox.ac.uk/rtspie/>). She is currently working on the JISC IUGO conference data organisation project (<http://iugo.ilrt.bris.ac.uk/>).

Jasper Tredgold is a Senior Technical Researcher at ILRT, at the University of Bristol. He has many years experience of working on the technical aspects of HE-based software, notably with the Social Science Information Gateway (<http://www.sosig.ac.uk/>) and more recently as technical coordinator for the Subject Portals Project (<http://www.portals.ac.uk/spp/>). Jasper has recently been involved with the JISC Shibboleth-aware Portals and Information Environments Project (SPIE) (<http://www.oucs.ox.ac.uk/rtspie/>) and is currently working on the JISC IUGO conference data organisation project (<http://iugo.ilrt.bris.ac.uk/>).

C. Organisation Expertise

ILRT - The Institute for Learning and Teaching Research Technology (ILRT) is an internationally recognised centre of excellence in the development, use and application of learning and research technologies. The ILRT has a successful track record of innovation in the use and evaluation of Information and Communications Technologies and in developing, leading and successfully delivering a range of projects and services for education and commercial clients, research councils and national and international research funding bodies. Currently the Institute is involved in over 40 externally funded projects in ICT development, applications and training, and employs 70 full and part-time staff with a range of expertise and skills across the technical and educational domains. The annual turnover for the Institute in the last financial year was around £2.8 million.

The Institute's considerable success in attracting new projects and continuing funding for existing ones is a measure of the dedication, skills and commitment of staff. There is a strong emphasis on quality and professionalism in a leading-edge research and development and service environment; this is reflected in the Institute's commitment internally to training and staff development and to its quality assurance procedures. This has been recognised externally as the Institute was awarded the Investors in People standard in March 1999 and successfully reassessed in April 2001.

Institute projects have national and international impact and value, attracting funding from, for example, the UK Higher Education Funding Councils, the Economic and Social Research Council and the European Commission, as well as professional associations and support from local schools and businesses. The Institute's Internet Developments team also works with commercial and not-for-profit organisations. Recent clients include the Joint Information Systems Committee, the ESRC, the University of Bristol and other leading tertiary education institutions. Other non-governmental and public clients include the National Maritime Museum, Association of British Insurers, International Network for the Availability of Scientific Publications, Teachers Assurance Group and the Open University. In addition, the Institute has been granted qualified status as both a provider and developer of materials for the University for Industry.

D. References

[CREE]

Contextual Resource Evaluation Environment project
<http://www.hull.ac.uk/esig/cree/index.html>

[GETREF]

EDINA GetRef Service
<http://edina.ac.uk/getref/>

[IESR]

Information Environment Service Registry
<http://iesr.ac.uk/>

[JAFER]

Java Access For Electronic Resources Project
<http://www.jafer.org/>

[JASIG]

Java Architectures Special Interest Group
<http://www.ja-sig.org/>

[JASIGCH]

JA-SIG Clearinghouse
<http://clearinghouse.ja-sig.org/>

[JETSPEED]

Apache Jetspeed 1
<http://portals.apache.org/jetspeed-1/>

[JSR168]

JSR 168: Portlet Specification
<http://www.jcp.org/en/jsr/detail?id=168>

[JSR286]

JSR 286: Portlet Specification 2.0
<http://www.jcp.org/en/jsr/detail?id=286>

[OAI]

Open Archives Initiative
<http://www.openarchives.org/>

[OPENROUT]

JISC OpenURL Router
<http://openurl.ac.uk/doc/>

[OPENURL]

Development of an OpenURL Standard
<http://library.caltech.edu/openurl/>

[PERX]

Pilot Engineering Repository Xsearch
<http://www.icbl.hw.ac.uk/perx/>

[RDN]

Resource Discovery Network
<http://www.rdn.ac.uk/>

[SAKAI]

SAKAI: Collaboration and Learning Environment for Education
<http://sakaiproject.org/>

[SFORGE]

SourceForge.net
<http://sourceforge.net/>

[SHIB]

Shibboleth
<http://shibboleth.internet2.edu/>

[SPIE]

Shibboleth-aware Portals and Information Environments
<http://spie.oucs.ox.ac.uk/>

[SPP]

Subject Portals Project
<http://www.spp.opensource.ac.uk/>

[SRU]

Search/Retrieve via URL
<http://www.loc.gov/standards/sru/>

[SRW]

Search/Retrieve Web Service
<http://www.loc.gov/standards/sru/srw/>

[UPORTAL]

uPortal portal software
<http://www.uportal.org/>

[WSRP10]

Web Services for Remote Portlets 1.0
<http://www.oasis-open.org/committees/download.php/3343/oasis-200304-wsrp-specification-1.0.pdf>

[WSRP20]

Web Services for Remote Portlets 2.0

[WSRP4J]

Apache WSRP for Java
<http://portals.apache.org/wsrp4j/>

[XTRA]

TechXtra Service
<http://www.techxtra.ac.uk/>