

# The British Library Research Information Centre (RIC)

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## Abstract

In this paper we present the Research Information Centre (RIC), a *virtual research environment* being jointly developed by the Technical Computing Group at Microsoft and The British Library. We view researchers as *extreme information workers* and the purpose of the RIC is to support researchers in managing the increasingly complex range of tasks involved in carrying out research. Our first implementation of the RIC is focused on the biomedical researcher, leveraging commercial off-the-shelf software to the extent possible. However, the base architecture of RIC is designed so that it can be re-used for research in other domains.

## 1. Introduction

In this paper we present the Research Information Centre (RIC), a *virtual research environment* [1, 2, 3, 4] being jointly developed by the [Technical Computing Group at Microsoft](#) [5] and The British Library. The purpose of the RIC is to support researchers in managing the increasingly complex range of tasks involved in carrying out research. Specifically, to provide structure to the research process, easy access to resources, guidance and tools to manage information assets, along with integrated collaboration services. Research builds on previous research. RIC is being designed to encompass all aspects of this research lifecycle. A high-level view of the cyclic nature of research is illustrated in Figure 1.

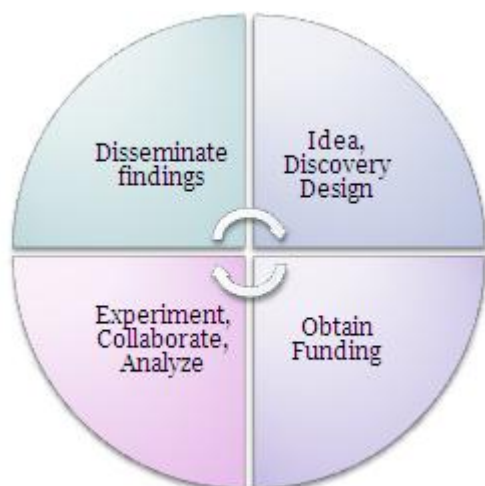


Figure 1 – A model of the research lifecycle.

As we describe in this paper, the RIC is a response to known researcher needs and we believe it has the potential to make the research

process more efficient, enabling the researcher to focus on the primary activity – the research itself. We model the research process as a series of phases or steps, where each project can be individually identified and configured. A researcher is assumed to be working on a number of research projects simultaneously with other members of the team distributed around the world but connected to the Internet. In order to participate in a research project employing RIC, a researcher merely needs access through any web browser. Membership of the project is administered by the ‘owner’ with the RIC managing access to shared documents, tools, applications, data sets, etc.

The implementation of RIC is based on an architecture that is extensible and supports, but does not restrict, the resources needed by individual research teams. In addition, we build and deploy RIC on currently available tools and software, including commercial off-the-shelf software (COTS) such as SharePoint Server [6] and Office 2007 with custom ribbon extensions [7] for research, an *Office Ribbon for Research*.

In the remainder of this paper we identify key capabilities and describe the design and implementation of the RIC. In Section 2 we identify current design goals. In Section 3 we outline functionality provided to support select aspects of the research lifecycle illustrated in Figure 1. In Section 4 we describe ongoing implementation and the role of COTS, and finally we summarize the paper in Section 5.

## 2. RIC Design Goals and Features

We view researchers as *extreme information workers*, who in order to carry out a project must search and navigate a range of web services, access remote data and compute resources, share and manage document collections, and collaborate in virtual teams to

produce results, such as research proposals, project reports and publications; often each researcher participates in several such research projects. To support the researcher, as an *extreme information worker*, we targeted the following design goals for our initial implementation of the RIC:

**Enable Collaboration.** The RIC is designed to make it easy to create a research project, identify collaborators, and share the results of their analysis with other researchers, program sponsors, etc. In light of the increasingly interdisciplinary and collaborative nature of research, both national and international, it is vital that the core services on which the RIC is built to operate across organizations. This suggests that shared resources are centrally managed, but accessible via the Internet through a web browser.

It is envisaged that collaboration will take many forms. This includes real-time collaboration (e.g. instant messaging), shared calendars, e-mail and longer term support tools such as shared documents. An important aspect of collaborative research is file versioning. Research outputs often undergo a number of iterations and ideally this process needs to be as transparent and efficient as possible.

**Access to Rich Content.** RIC will provide means to gain access to and leverage content. The underlying content sources are defined as British Library-owned or third party and are expected to consist of document repositories, catalogues, datasets and tools. It is unlikely that all members of a research team would have subscriptions to all commercial resources likely to be available. In this scenario, the RIC will provide access to the content on a 'pay as you go' basis or in the worst case, provide a link to the supplier's site for purchase. In the case of raw scientific datasets, specific tools and applications will be provided for viewing and manipulating the data, particularly for so-called 'in silico' experiments. Where possible these will be accessible directly from the RIC. For the purposes of the initial prototype, the content to be provided will focus on the bioscience domain, which offers a range of potential resources for the RIC prototype and a highly information-literate community.

**Search.** The RIC will provide researchers with a better query tool that is more conducive to how they actually **search** for information on a day-to-day basis. The search operation will execute across all resources selected by the user. The user will not have to go into each individual

search interface, though if the content has been configured by the user and therefore not in the content list then there might be no choice.

**Continual Queries.** RIC will offer an enhanced query tool to allow the researcher to save searches so they can be rerun on an ad hoc or regular basis. The user can also receive updates from specific resources sites, e.g. e-mail and RSS feeds. At a minimum, RIC will provide the means to store search results and allow them to be searched, retrieved and manipulated at a later date. These results are likely to cover a range of data types, including datasets, documents, people and organization profiles. There will be an option to store in personal bibliographic tools such as Reference Manager, EndNote, or OneNote

**Support Publication Life-Cycle.** The RIC will provide a collection of tools to support the publication life-cycle, from literature search and retrieval, a project library where researchers can rate and annotate papers, tools to manage a bibliography, support for authoring, obtain peer reviews, e-prints/self-archiving;

**Personalization.** RIC will provide a range of content resources, from The British Library and third parties, which the user can choose from and store in a personal preference list. The content list can accommodate the fact that the resources will change/expand over time. As there are likely to be resources to which the researcher has access, but are not included in the Library's list of options, the user can configure their own content into their preferences. Longer term, RIC will identify resources to which the user has institutional access, perhaps using openURL resolution.

**Architect for Participation.** The tools, features and resources of RIC will, by design, be an evolving story. The intention of our prototype effort is not to produce a complete virtual research environment, but rather to design the architecture and develop a common software framework with associated protocols that will encourage others to work within this framework to develop and populate RIC with their own tools, services and resources appropriate to their needs. That is, architect for community participation and enhancements.

### 3. Supporting the Research Lifecycle

As previously discussed, the RIC is intended to provide overall structure to the research lifecycle, illustrated in Figure 1, to guide the project, along with easy access to resources and

tools to manage information assets and integrated collaboration services.

Our first implementation of RIC is focused on the biomedical researcher, as this builds on The British Library's existing strength in this domain. However, the base architecture of RIC is designed so that it can be re-used for research in other domains. In this section we will highlight selected features of RIC that are intended to support the research lifecycle.

British Library, third party or local databases. In Section 3.3 we discuss content sources included in the initial version of our prototype.

A tools area is provided where the user can access identified tools applicable to the project. These may be online tools, installed local tools or links to resources where additional application/tools can be acquired, for example the BLAST protein sequencing tool.

The screenshot displays the 'RESEARCHERS DESKTOP' interface. At the top, there is a navigation bar with 'Home', 'Site Actions', 'My Site', and 'My Links'. Below this, a 'Welcome Jill' message is shown next to a profile picture of a woman. A central horizontal flow diagram illustrates the project lifecycle with four stages: 'IDEA DISCOVERY & DESIGN', 'OBTAIN FUNDING', 'EXPERIMENT, COLLABORATE & ANALYSE', and 'DISSEMINATE FINDINGS'. Below the flow, several panels are visible: 'SEARCH' with a search bar and 'Advanced Search | Saved Searches'; 'MY PROJECTS' listing 'Gene Splicing', 'Geneology', and 'Genomics'; 'MY TEAM MEMBERS' with 'Contacts' and 'Wiki'; 'BLAST TOOL' with a text input field and a 'Begin Search' button; 'IDEA CREATION' with links to 'Definition of the original idea', 'Idea definition template with examples', 'Inspirational ideas web links', and 'Discuss with inner circle of experts'; 'REVIEW LITERATURE/ PRIOR ART' with links to 'Search content sources', 'Keep track of papers, articles, abstracts which have been viewed/accessed', 'Setup alerts for the availability of the content source', 'Find applications and tools to manipulate datasets/ simulations', and 'Find datasets'; 'DESIGN STUDY/ EXPERIMENT' with links to 'Range of templates for designing expr.', 'Choose collaborators', 'Choose research methodology', 'Identify IP issues/ requirements', and 'Estimate project size/equipment/cost'; 'My Documents' table with columns 'Type', 'Name', and 'Modified By', showing a document 'Genomics Analysis' by 'System Account'; 'My References' table with columns 'Type', 'Name', and 'Modified By', showing references to 'Genomics Analysis', 'Institut Pasteur', and 'Molecular Biology Resources'; 'My Proposals' table with columns 'Type', 'Name', and 'Modified By', showing a proposal 'Recommendation for Gene Splicing Alternatives'; 'Funding Alerts' with links to 'Antarctic Research', 'Broadening Participation in Computing Science', 'Science of Science and Innovation Policy', 'Physical and Structural Systems', and 'Neutral Systems'; and 'Hot Topics' with the same set of links.

### 3.1 The RIC at First Glance

After logging in to the Research Information Centre (RIC), the researcher is presented with a workspace where most of the tasks in a specific project are to be conducted. A view of the various phases of the project is provided to allow the user to navigate through the project, carry out specific tasks, access tools, invoke help for particular areas and mark off progress against the plan. When accessing a task a window is displayed containing specific information/links/functionality pertaining to that task such as template documents, predefined searches, alert notification and configuration.

An idea creation area is provided for the researcher to evaluate a topic, identify possible collaborators and search for funding opportunities. A content area is provided where a user can access identified content sources applicable to their project. These may be

### 3.2 Supporting Collaboration in Context

Once the researcher has identified a topic for research, they may wish to find potential collaborators to support the proposal and to work on the project. The user can use the RIC to find potential collaborators in their institution or organization by entering a set of keywords (expanded to cover synonyms) and find a list of names, their research interests, skills and links to any personal website. The user then checks boxes that expand the search to cover external collaborators within the UK and overseas countries. The information is persisted in the project store. Potential collaborators are checked off and e-mailed about the project.

Having found potential sources of funding, the user wishes to submit a proposal to one or more funding bodies. The user wants to see what proposals have succeeded previously and

enters keywords into a search box to find proposals that resulted in grants from selected funding bodies. This search is confined to proposals from within the user's organisation for confidentiality.

Once a user has identified collaborators they can use RIC to put together a research team. Contact and skill details retrieved previously are stored in a profile database and moved into a team folder, which can be used to create user accounts on RIC. The team folder can be updated as new members of the team are added or when staff members leave.

There are a series of new information models which promote a level of social interaction that can be consumed on a contextual basis where one opts in to contribute or consume content. The information models are primarily focused around Blogs, Wikis and social networks. This content is typically exposed through a basic web application and distributed as a service, such as RSS. These models have worked well for rapid distribution and syndication of information on the web and are now being harnessed within science projects. RIC can be used to automatically prepare a Wiki or Blog for the project.

### 3.3 Providing Access to Rich Content

A number of resources have been identified as being relevant for the initial phases of the research lifecycle (Idea, Discovery, and Design) as exemplified by the Research Information Centre. These have been sourced from interviews, focus groups and general discussions with researchers undertaken as part of projects and studies with which The British Library has been involved. The resources selected for the prototype are those that are deemed to be of importance to biomedical researchers; biomedicine being the primary focus of the RIC prototype. A number of the resources scheduled for the initial releases of the prototype are freely available on the Web. They have been selected, not only because they are highly used, but also because open access resources tend to have interoperable interfaces that enable them to be seamlessly plugged into the RIC environment. Fortunately, many key resources are available through the Library's partners such as Manchester Information and Associated Services (MIMAS) based at the University of Manchester and the European Bioinformatics Institute. This will make the integration of content and services available from these institutions easier to implement.

The first point of call for the majority of researchers in terms of sourcing information for

a particular project, is the research literature - and in particular, journals. The British Library's Electronic Table of Contents database covers around 20,000 current journal titles and 100,000 conference proceedings; over 26 million articles (including 5 million conference papers). The database contains article information from 1993 to date, and is updated on a daily basis (two million new records added each year; 8,000 new article title level records are added every day). For the purposes of our first prototype, the version specifically tailored towards the UK higher education research community, [ZETOC](#) (Z39.50 Electronic Table of Contents) hosted by MIMAS at the University of Manchester, will be used.

As far as biomedical research literature is concerned, the dominant database is the National Library of Medicine's [PubMed](#). PubMed provides access to bibliographic information that includes MEDLINE, the National Library of Medicine's premier bibliographic database. MEDLINE contains article information and author abstracts from more than 5,000 biomedical journals from around the world and over 15 million records dating back to the mid-1950's. The British Library subject indexes the UK input for this database using the National Library of Medicine's controlled vocabulary, which is also used to generate data for the Library's own AMED database covering literature on alternative/complementary medicine and allied health services such as physiotherapy. RIC will also include the European Bioinformatics Institute's version of PubMed, [CiteXplore](#). CiteXplore has a unique feature that provides linkages from keywords in the article title and abstract to the molecular biology datasets hosted at the Institute using text mining technologies. CiteXplore also provides the option to search for other material such as European patents and Chinese Biological Abstracts.

[Windows Live Academic](#) extends the range of research literature available on RIC still further by providing a wide range of scholarly journal articles, conference proceedings, dissertations and academic books from major publishers and professional societies. Although the peer-reviewed, published article is still deemed to be the definitive version of research by many, there is nevertheless a need to provide access to other material of value to researchers, such as that currently held in repositories. Services such as Google Scholar and Elsevier's Scirus portal attempt to address this by incorporating other types of document. [Google Scholar](#) not only covers published peer-

reviewed papers, but also includes theses, books and articles from academic publishers, professional societies, preprint repositories and universities. Its linking service enables the user to source the full-text from their local holdings, if appropriate, and The British Library's document supply service. [Scirus](#) is a free web portal provided by Elsevier focusing on scientific content. It boasts more than 300 million science-related Web pages from both subject and institutional repositories, digital archives, patents and journal databases. Sites covered include PubMed and PubMed Central, the physics e-print archive [ArXiv](#) (that contains papers on quantitative biology and therefore of particular interest to system biologists), the cognitive sciences e-print repository [CogPrints](#), journals from the open access publisher [BioMed Central](#), e-prints and theses from the Indian Institute of Science and Elsevier's own full-text online store of over seven-and a half million articles covering 2000 journals and reference works, [ScienceDirect](#). It is not only the broad range of document types that is important here; the comprehensive subject coverage helps support the increasingly interdisciplinary nature of research.

The resources described above tend to focus on the metadata associated with the documents, albeit with links to the full-text where permitted. The ultimate goal for the researcher is to obtain guaranteed access to the actual content, preferably electronically. For the Research Information Centre prototype, the principal full-text repository will be [UK PubMed Central](#) (UKPMC). UKPMC is based on the [PubMed Central](#) open access repository of biomedical literature hosted by the US National Library of Medicine. UKPMC is managed by the British Library and hosted by the University of Manchester as part of a network of [PMC International \(PMCI\)](#) repositories. The intention is to provide a permanent, free-to-access online digital archive of full-text, peer-reviewed research publications for UK biomedical research. The service includes a manuscript submission system ([UKMSS](#)) to enable researchers, funded by the [UKPMC Funders Group](#), to deposit articles that have been accepted for publication in a peer-reviewed journal. The aim is to develop a seamless link from within the RIC environment to UKMSS to enable researchers to deposit articles at the mere 'click of a button'. UKPMC will be developed over time. In the first wave of developments, it is planned to implement context-sensitive links to other online resources, such as gene and chemical compound databases and eventually to

provide additional links to resources hosted in the UK and Europe which are of interest to the UK biomedical research community.

Increasingly the demand from biomedical researchers is for the actual data resulting from research. This may range from raw experimental data (that can be reused) to standardised, curated reference data (for visualisation and modelling). It may not necessarily be supplied as supplementary material with the document that describes the research or indeed be related to a specific formal text-based output. Systems biology in particular, with its emphasis on in silico based research and complex mathematical modelling, is dependent on data. Any tool purporting to support research needs to take this into account. The two main repositories of curated datasets of "omic" bioscience data (e.g. genome, proteome) are the [National Center for Biotechnology Information \(NCBI\)](#) and the [European Bioinformatics Institute \(EBI\)](#). The European Bioinformatics Institute hosts a range of scientific datasets, including genomes, gene expression, nucleotide sequences, protein sequences, macromolecular structures and reaction pathway models. Some of the data is the same at both NCBI and EBI, a result of international collaboration and data sharing policies, while other datasets are unique. Both sites provide text-based search and retrieval systems that enable the databases to be cross-searched. Even with similar underlying data, the different tools provided for analysing the data, the connections between the various elements of data and the way in which the data is displayed, mean that RIC will be required to offer both sites as options within its interface.

#### 3.4 Providing Rich Search and Alerts

The British Library's discussions with researchers have shown that they make extensive use of general internet search engines to find relevant material. The key one, not surprisingly, is [Google](#). Its dominance and the vast number of web pages available mean that it is often the initial entry point to find papers, general information on a topic, personal websites and subject-specific gateways/portals. A more selective approach for the discovery of specialist websites is Intute. This is a free online service hosted by the University of Manchester providing access to Web resources for education and research. The service is created by a network of UK universities and partners. Subject specialists select and evaluate websites and write a description for each resource. The most relevant subject domain as

far as RIC is concerned is the [Health and Life Sciences](#) interface.

Alerting is a fundamental requirement to keeping up to date, whether it be articles from recently published journals or the latest 'hot' topic. In addition to the current awareness mechanisms offered by ZETOC, PubMed and other bibliographic databases, the RIC plans to include feeds from more specialist sources such as those offered by the [Nature Publishing Group](#) (NPG). NPG has collaborated with a number of organisations to deliver a set of [gateways](#) that provide information on a variety of topics, e.g. neuroscience, signalling, cell migration. These are in addition to their more general community-based products such as Connotea and Nature Networks, which also generate information outside of their traditional journals and to which researchers would expect to have access via their virtual research environments. [Thomson Scientific](#) offers a suite of alerting services on emerging research trends – a valuable source of information on [key papers](#), ['hot' topics](#) and [highly-cited scientists](#). The [National Library of Health](#) is the National Health Service's portal for medical information. It provides access to resources of interest to those in the UK health service, including evidence-based research from organisations such as the Cochrane Library, the Centre for Reviews and Dissemination and the National Institute for Health and Clinical Excellence as well as feeds on specific topics drawn from across its specialist domains. One resource available through the National Library of Health for which direct access as well as feeds will be considered for RIC will be the [Research Findings Register](#). This register provides access to the outputs of research studies sponsored by the UK Department of Health. It fills in the gap between the completion of the research and publication by publishing the findings of many projects listed in the [National Research Register](#) (a list of ongoing research projects funded by, or of interest to, the National Health Service). These findings are sometimes disseminated before the research is formally published.

The RIC's sophisticated functionality makes maximum use of standards and protocols that enable machine-to-machine interoperability. One of the objectives of the RIC prototype will be to test its ability to query service registries. The [Information Environment Service Registry](#) hosted by the University of Manchester. The IESR provides a registry of information about electronic resources for teachers, researchers and learners and is a core component of the JISC e-Framework. The aim is to create a

source of information that other applications, such as portals and virtual research environments, can freely access through machine-to-machine protocols. The IESR contains information about the resources themselves, technical details on they can be accessed and details of the resource providers. The RIC project will include an investigation of the US National Science Digital Library's Ockham initiative, which is planning to use similar registry technologies.

### 3.5 Access to Subscription Based Resources

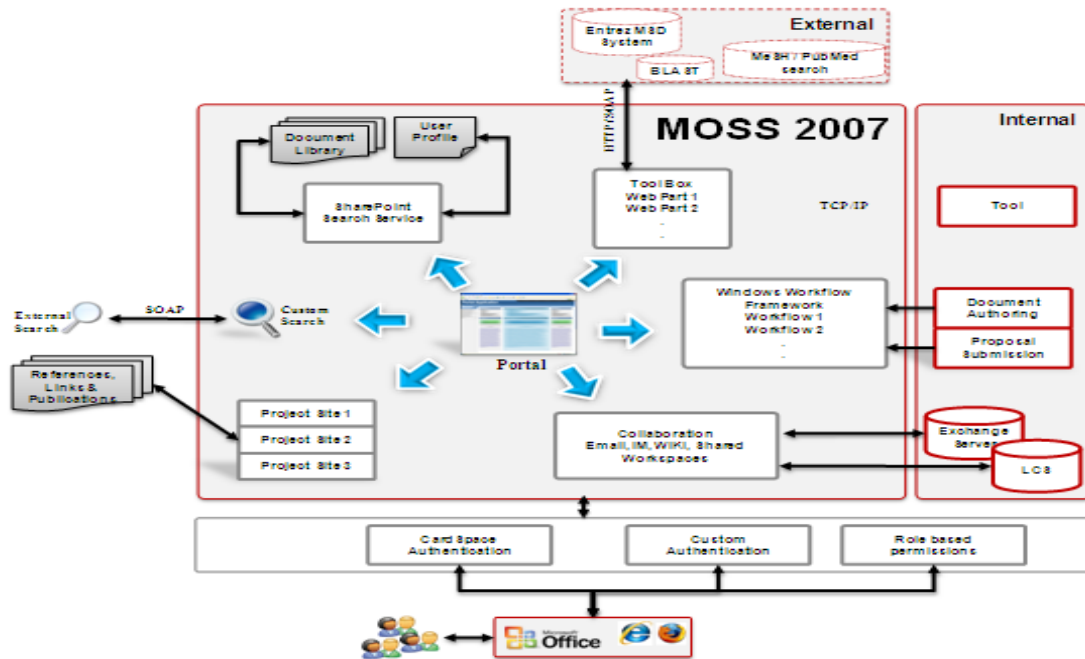
There are of course, a number of other important scientific subscription-based resources provided by various publishers and aggregators that researchers use on a regular basis. Examples are [Scopus](#) from Elsevier and [Web of Science](#) from Thomson Scientific. Scopus is a large abstract and citation database of scientific, medical, technical and social science literature covering 15,000 journal titles from 4,000 publishers. Eighty percent of the titles are subject indexed with controlled vocabularies. It also provides access to a range of web resources through integration of Scirus. Web of Science covers article information across all scientific disciplines from around 8,700 high impact research journals. It provides a unique search mechanism based on cited references within the article. This enables users to navigate forwards and backwards through the literature, following lines of research amongst a network of citations. Access to electronic full-text journal articles is also provided. The incorporation of subscription resources within the RIC will depend on negotiations with the service provider.

## 4. Current Implementation Effort

Our prototype of the RIC is being implemented using Microsoft Office SharePoint Server (MOSS) 2007 and integrated with Microsoft Office 2007. Our objective is to build and deploy RIC based on currently available tools and software, including commercial off-the-shelf software (COTS).

### 4.1 MOSS 2007 Implementation

We use Microsoft Office Share Point Server 2007 (MOSS'07) as the primary interface to the RIC. Research groups may be geographically separated, so the MOSS'07 web-based interface ensures RIC is available to all users. In addition, we can leverage out-of-the-box features MOSS'07 provides, including



collaboration, document management and enterprise search service.

- Search Service:** RIC leverages the enterprise search service provided by MOSS'07. This allows all project documents stored in the SharePoint document library to be indexed and searched from SharePoint portal. Further, it provides search for user profile and expertise. Using this feature, the researcher can search for people with similar interests or search for similar expertise levels. The out-of-the-box search feature can be extended using the SharePoint object model, to add comments to the search results and to save the search result URLs. The RIC can also be connected to an external search engine like Windows Live by consuming the exposed web service.

- Collaboration:** Researchers using RIC can collaborate using some of the out-of-the-box features provided by MOSS. MOSS'07 provides integration with Microsoft Outlook and Live Communication Server, which provides functionality like presence detection, ability to send emails, ability to schedule a meeting or initiate an IM conversation through the portal. Additionally, MOSS provides community features like Wiki, Blog, RSS reader and Shared workspace.

- SharePoint Templates:** MOSS'07 offers templates for creating specific sites. The sites for researchers, projects and the home page are described in the sections below.

**A. Researchers Site:** Each researcher's MySite created out from the template will have provisions to collate personal details such as skills, interests, past projects and contact details along with interesting links, notes on colleagues, project memberships, etc. SharePoint features like the document library and lists will be from MOSS'07 and other required functionality will be plugged in to the RIC using custom web parts.

**B. Projects Site:** Each project site from the SharePoint template will have provisions for announcements, event management, task lists, sharing documents/templates and holding discussion forums. It will also maintain project tasks and workflows.

**C. Home Page:** The home site hosts the welcome page for the research project and all project sites as sub sites.

- Workflow:** Some of the out-of-the-box MOSS'07 workflows can be used for document review and approval process. Custom workflows can be created using Windows Workflow for addressing any project needs.

- Tools:** Tools required by the researcher can be plugged into SharePoint portal using Custom Web parts. Web parts can be developed to query external database like MSD or BLAST.

- Web Parts:** Web parts will be plugged in to create custom functionality into SharePoint sites. SharePoint's web part will be used for receiving RSS feeds for receiving alerts on

funds. Following are some of custom web parts RIC builds on MOSS'07:

**A. Search web part:** It allows searching for related words and synonyms and the ability to select sources. This webpart will connect to following sources:

- a) External resources (articles, documents)
- b) Funding Sources;
- c) Conferences;
- d) Tools/Software;

This web part will make use of MOSS'07 data store for storing search related metadata and will be integrated with Office 2007 applications as required. For instance an interesting search result can be moved to the user's Office OneNote application.

**B. Publishing web part:** This web part assists researchers in making submissions for publishing their findings. By knowing the requirement of submission sites, this web part can ease the submission process by collating the requirements for submission.

#### 4.2 Integration with MS Office 2007

The application layer of the RIC is made up of enhanced Microsoft Office 2007 applications, such as Excel, Word, OneNote and InfoPath. Integration with Microsoft Office 2007 provides core features like ability to submit data through Office InfoPath forms and ability to use OneNote as a journal for tracking purposes. These applications are customizable containers that can now more easily surface information and new functionality from custom extensions through customized task panes, ribbons, and actions that present users with data and actions in the context of their current activity.

One MS Word extension we are currently implementing presents a draw down list of journal templates, from which the researcher can select and open a template that contains the basic structure for an article in the selected bioscience journal; a user with sufficient privileges can add or delete templates. Other extensions include integrated search, allowing a researcher to search for references from within the document they are authoring, and self publishing that allows the user to select a target journal and the extension will review the document, highlighting possible problem areas and extract the necessary tags for submission.

#### 4.3 Implementation Approach

We intend to produce a series of prototypes, which will be used to gather feedback from the community, especially biomedical researchers

and others involved in developing virtual research environments. We recognize the RIC will only be successful if it addresses the needs of the community of researchers for which it was designed and it is easy to use. Hence, we hope to foster an active Beta community, with an email alias for feedback and discussions. Feedback from our beta community will be incorporated into the next release to keep our community actively engaged. Also, gaining and maintaining the trust of users will be important, so security reviews will be part of the development process from the beginning (for example – users need to know that ideas and draft papers added to the project library, will not be visible outside the project itself).

### 5. Discussion

In this paper we introduced the Research Information Centre (RIC), a virtual research environment being jointly developed by the Technical Computing Group at Microsoft and The British Library. The purpose of the RIC is to support researchers, as *extreme information workers*, in managing the increasingly complex range of tasks involved in carrying out research. Our first implementation of the RIC is focused on the biomedical researcher, leveraging currently available tools and commercial off-the-shelf software to the extent possible. However, the base architecture of RIC is designed so that it can be easily re-used for research in other domains.

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