Advancing the Usability of VREs by Promoting Loose Coupling

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Abstract

This paper will identify issues in existing monolithic Virtual Research Environment (VRE) implementations and discuss the subsequent consequences for researchers. It will discuss the implications of a loosely coupled VRE with a particular emphasis on the associated usability issues. It will also review the standards and technologies that make interoperability with loosely coupled web applications possible. Finally, the paper will review how the OJAX++ project aims to blend the advantages of traditional 'everything in one place' VREs while leveraging the power of collaborative web 2.0 tools. OJAX++ enhances the usability of a loosely coupled VRE by augmenting research activity conducted on third party tools.

1. Introduction

This paper discusses the implications of a loosely coupled Virtual Research Environment (VRE) with an emphasis on the associated usability issues. The recent ongoing move towards standards-based approaches has made interoperability between loosely coupled web applications possible. The OJAX++[1] project aims to blend the advantages of traditional 'everything in one place' VREs while leveraging the power of the latest collaborative web 2.0 tools. OJAX++ enhances the usability of a loosely coupled VRE by adding management and overview functions, which augment research activity conducted on third party tools.

'Loosely coupled Virtual Research Environment (VRE)' is a term used to describe the concept of a research environment that is interoperable with a number of tools but does not explicitly rely on any one of these tools. The use of such a VRE enables a research practitioner to choose their preferred tools. In a world where cutting-edge advances are being made to web tools daily, the advantages this brings are manifold. Advances such as open access to user data and the prevalence of service APIs (Application Programming Interface) have laid the foundation for systems capable of managing content that is created using loosely coupled environments.

2. The VRE

"Virtual research environments (VREs), as one hopes the name suggests, comprise digital infrastructure and services which enable research to take place" [1].

Existing VREs have tended towards being integrated, single service solutions; which have tended to be developed as an all-encompassing portal or e-framework. The word 'monolithic' may be used to describe these types of software. The tools within a monolithic VRE are either created as components of the VRE or the VRE is developed around a single existing piece of (usually institutional) software where research can take place. A VRE may be designed to support research in a specific discipline (for example archaeology) or it may be general-purpose and support research across a number of different disciplines. In the latter case, customisation is generally required to facilitate some discipline-specific research activities.

3. Loosely Coupled

The term 'loosely coupled', as it relates to a VRE, stems from a movement instigated by educators referred to as 'loosely coupled teaching [2]. This, in turn, is based on the concept of creating a personal learning environment [4] Loosely coupled teaching is a teaching practice where educators choose not to use the course management tools that are provided by their respective institutions. Instead, they choose a number of highly focused and publically available tools. These tools can be commercial or non-commercial and tend to be classified as 'Web 2.0', although this is not requirement of loosely coupled teaching.

I propose that a 'loosely coupled VRE' allows the researcher to create a tailored suite of applications. They are encouraged to choose from the many freely available web tools that aid the research process.

A typical loosely coupled VRE may consist of tools for:

- Citation (e.g. CiteULike[2])
- Bookmarking (e.g. Delicious[3])
- Blogging (e.g. Wordpress[4])
- Micro-blogging (e.g. Twitter[5])
- Documents (e.g. Google Docs[6])
- Online file storage (e.g. Dropbox[7])
- Collaborative Mind Mapping (e.g. MindMeister[8])

[1] http://www.ucd.ie/ojax/

[2] http://www.citeulike.com/

[3] http://www.delicious.com/

[4] http://www.wordpress.com/

[5] http://twitter.com/

[6] http://docs.google.com /

[7] http://www.getdropbox.com/

[8] http://www.mindmeister.com/

- To-Do Manager (e.g. Remember The Milk[9])
- Research Planner (e.g. Google Calendar[10])
- Research Outliner/Jotter (e.g. Loose Stitch[11])
- Academic Repositories (e.g. PubMed[12])
- Real-time communication (e.g. Skype[13])

These tools can be substituted for similar tools: the researcher may wish to use Diigo[14] instead of Delicious or perhaps Zoho's[15] suite of applications is preferred by the researcher over Google Docs.

4. Usability Implications

Why might a researcher want to construct their own set of loosely coupled tools instead of using the monolithic tools provided by their institutions? The usability benefits of building a tailored suite of applications have been identified and are outlined below:

1. **Better quality tools** — Each of the third-party tools are highly focused. It is unlikely that a VRE, which aims to include a broad set of built-in tools for bookmarking etc, will have the quality, attention to detail and rich user experience of a dedicated third-party tool.
2. **Convenience** — The chosen tools are tools that the individual researcher deems to be most appropriate. The researcher can decide later to switch to another tool if they desire to do so.
3. **No tech lag** — Web applications are constantly evolving. It is difficult for a tightly coupled VRE to remain current with the latest technologies. There is a lot of competition in the web 2.0 space and commercial web applications tend to be closer to the cutting edge.
4. **Reduced Duplication** — When working with a monolithic VRE, researchers may find the need to duplicate content that they have created in third-party tools in order to make the content available to the VRE.
5. **Gentler learning curve** — There is no need for a user to reinvent their research workflow to accommodate the VRE; a user may simply use their existing tools.
6. **Well-tested** — Many of the publically available tools already enjoy widespread use. Well-tested applications will be less likely to suffer from bugs and usability issues.
7. **Auxiliary benefits of using a popular tool** — Many popular third-party tools themselves have third-party tools that plug into their API. Bookmarking services like Delicious and Diigo have plugins for Firefox and Internet Explorer. The micro-blogging service twitter has a number of applications available that allow posting from the desktop or from a mobile device. Developers create third-party applications because they are widely used. Components of a VRE will tend to not be as widely used by the general public and are therefore unlikely to attract third-party developers.
8. **Motivation enhancer** — The researcher has an enhanced stake in the VRE because they are responsible for choosing the tools. This can act as a motivator during the research process.

Each of these benefits can significantly enhance the usability of a VRE. However, managing the data from a number of chosen third-party research tools can be difficult and may negatively impact usability because there is not the same level of tight integration between components that may be found in a monolithic VRE. OJAX++ (discussed in section 6) tackles this issue.

5. The Open Web

The Open Web is an ongoing recent effort to decentralize and liberate a user's data; it does not refer to any one technology or concept, it is a combination of:

- Proliferation of public APIs.
- Continued adoption of standards-based approaches. This encourages interoperability between applications and lessens the workload for a developer wishing to support different applications, which adopt the same standards.
- Data portability.

Public APIs are becoming almost ubiquitous among web 2.0 tools that deal with a user's data; this is in direct contrast with earlier web tools, which were analogous to silos because it was very difficult to get data out from one application and into another. This advance, coupled with the growing establishment of standards (both de facto and formal/de jure) around the issue of data portability, has made The Open Web a reality. Particularly relevant standards include:

- **OpenID**[16] — An open single sign-on and authentication solution that has seen significant uptake recently. OpenID has significant usability issues, which yahoo have identified in their published user experience tests[17]. An OpenID implementation with support for email addresses such as the proposal by Michael Atkins[18] may allay a lot of the usability concerns expressed by Messina [5].
- **OpenSocial**[19] — A common set of API specifications for social applications. OpenSocial is

[9] http://www.rememberthemilk.com/

[10] http://calendar.google.com/

[11] http://loosestitch.com/

[12] http://www.pubmed.gov/

[13] http://www.skype.com/

[14] http://www.diigo.com/

[15] http://www.zoho.com/

[16] http://www.openid.net/

[17] http://developer.yahoo.com/openid/bestpractices.html

[18] http://www.apparently.me.uk/18285.html

[19] http://code.google.com/apis/opensocial/

heavily backed by Google and is adopted by the majority of popular social networking sites with the one exception being Facebook.

- **OAuth**[20] — An open protocol that allows secure API authorisation. OAuth is the recommended authorization mechanism for use in OpenSocial and is the de facto standard for authorization among public APIs that require authorization.
- **XFN (XHTML Friends Network)**[21] — A lightweight way to represent human relationships in XHTML webpages.
- **Microformats**[22] — a set of simple, open data formats that allow you to markup items like events or contact details in a syntax that makes them machine-readable.
- **FOAF (Friend Of A Friend)**[23] — Similar to XFN in utility but takes a more full featured yet complex approach to describing human relationships. Also, unlike XFN FOAF is published externally to XHTML in a FOAF file. The combination of XFN and FOAF are credited with making the Google Social Graph API[24] possible.

The growth of a more open web where users have control over their own content and data is a central enabler for a VRE that promotes the use of loosely coupled research tools. Using Open Web technologies, it is possible to create a central hub for managing research activity regardless of the researcher's chosen tools. OJAX++ is an example of such a tool.

6. OJAX++

OJAX++[25] is an 'in progress' VRE focusing on the usability of online collaborative research. The project is funded by the SFI (Science Foundation Ireland) and is a collaboration between the UCD School of Information & Library Studies (SILS) and the UCD School of Computer Science & Informatics (CSI). OJAX++ aims to manage disparate knowledge from a wide variety of third-party tools. The concept of a loosely coupled environment is promoted in OJAX++.

The organisation of research and associated content in an integrated fashion across third-party tools is an ongoing research issue in the field of VREs. OJAX++ tackles this issue. It aims to act as a single cohesive entity that provides the management and overview functions that would normally be associated with a monolithic, 'everything in one place' VRE.

The key features of OJAX++ centre around its ability to act as (1) a hub and central point for the aggregation of data from third party applications and (2) a communication and collaborative system for researchers wishing to collaborate using OJAX++.

[20] http://oauth.net/

[21] http://www.gmpg.org/xfn/

[22] http://microformats.org/wiki/hcard

[23] http://www.foaf-project.org/

[24] http://code.google.com/apis/socialgraph/

[25] http://www.ucd.ie/ojax/

6.1 The Hub

Open Web technologies allow OJAX++ to access content from other web tools and draw commonalities between the data; this data can then be organized into more useful classifications such as projects and research themes. A dashboard view presents researchers with an 'at a glance' view of all of their research activity across multiple third-party applications and sorted chronologically into an activity stream.

The OJAX++ plug-in architecture allows easy addition and removal of supported third party applications. Items retrieved from third-party applications are stored as generic and source agnostic content-types, for example a webpage URL will be saved as a bookmark regardless of whether it was saved from Delicious, Diigo or entered manually on OJAX++.

6.2 Communication and Collaborative System

Collaboration and communication between researchers is a stated goal of OJAX++. A hub for third-party applications (as discussed in the previous section) does not necessarily help to facilitate collaboration. OJAX++'s social and collaborative features add a social networking substrate to the concept of a hub for loosely coupled applications. The features of modern web 2.0 social networking platforms can be thought of as being complimentary to the feature requirements of a collaborative VRE. OJAX++ employs collaborative and communicative functionality that will be familiar to those who use social networking websites.

Modern VREs are often designed as social networks with research specific features. This can be seen with VREs such as MyExperiment[26] and SciSpace.net[27]. MyExperiment focuses heavily on social aspects such as finding people; commenting and rating items; building a profile; creating and joining groups; and sending messages. SciSpace.net has the stated goal of placing "people at the centre of their digital world"; this is a goal that could be shared with a general-purpose social network. It's also noteworthy that SciSpace.net was built using Elgg[28], which is a platform for developing social networking sites.

To compile a list of social/collaborative features for OJAX++ it is useful to examine features from a popular social networking site such as Facebook[29] and identify which features could have value for researchers or those conducting research. The following is a list of candidate social/collaborative features for OJAX++:

- Private Messaging
- Profile Page
- Social Graph (add or remove contacts and specify relationship with contact e.g. 'Colleague')
- Affiliation to college/institution
- Networks/Groups
- Status Updates (e.g. what are you working on now)
- Fine-grained Privacy Controls
- Activity Feed

[26] http://www.myexperiment.org/

[27] http://www.scispace.net/

[28] http://elgg.org/

[29] http://www.facebook.com/

Social networking features not only aid collaboration inside OJAX++, they also provide a level of 'stickiness' for users who want to remain up-to-date with the research activities of their colleagues. Stickiness is a term used to refer to how much time a user spends on a website and the likelihood that a user will use a website regularly.

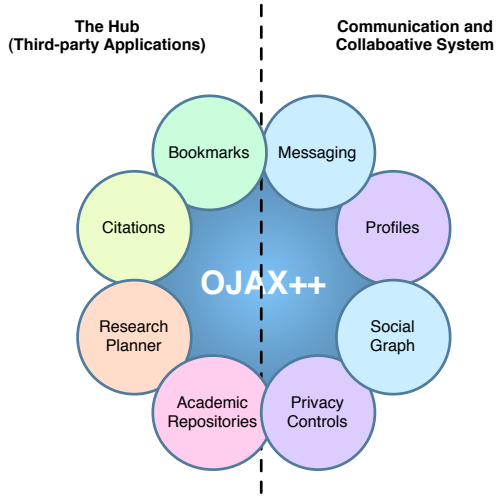

Figure 1: Illustration of the division between 'The Hub' and 'Communication and Collaborative System' in OJAX++.

6.3 Choosing a Suite of Third-Party Applications

Supporting all possible third-party applications that researchers may use is not possible; the quantity of supported applications is limited by resources and available development time. OJAX++ uses the following criteria for choosing which applications are included in a loosely coupled VRE:

1. **Research Value** — Is the application valuable to researchers? Does the application contribute significantly to the research process?
2. **Access to Application Data** — Does the application provide access to its data, either through a data API or through an RSS/Atom feed? Data APIs are preferred; data APIs based on open standards are yet more preferrable. If an application does not provide access to its data in a machine-readable format then it cannot be aggregated and therefore cannot be considered for inclusion.
3. **Popularity** — In the case of an application satisfying criteria 1 and 2. The popularity of an application will be used to measure whether a tool will be included or not, preference is given to the most popular tool.

7. Discussion

This paper has introduced the topics of VREs and loosely coupled applications. I have outlined a typical set of components in a VRE and given examples of possible third-party applications that could be used as substitutes to the corresponding tools of a VRE.

I have made the case for loosely coupled applications in the research process and identified the usability benefits that a loosely coupled VRE can have over a monolithic VRE. I have established that the characteristics of 'The Open Web' allow a level of interoperability and data portability that previously weren't available.

These factors have culminated in the design of OJAX++; a hub and social collaborative environment for researchers based on integration with third-party applications.

The features that define OJAX++ as a VRE are simply the third-party applications that are chosen for inclusion. The core concepts behind a hub for loosely coupled applications and indeed the concepts behind OJAX++ are not specific to the research domain. The focus of OJAX++ could be altered to a Virtual Learning Environment (VLE) or the focus could also be expanded to a more general-purpose project management system simply by supporting a different/wider set of applications.

Essentially, the core concept of OJAX++ is a hub that aggregates data from third-party applications and a set of features that aid collaboration. The pluggable architecture of OJAX++ allows expansion of the concept into other domains.

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