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Using Web 2.0 Tools to Create Customized Research Portals

Andy Tattersall

Claire Beecroft

Anna Cantrell

ABSTRACT. The Information Resources team within the School of Health and Related Research (ScHARR) at the University of Sheffield has a long-standing interest in the application of new and emerging Web 2.0 technologies for research, learning and teaching. In early 2008, members of the group began to discuss the development of customized web portals, also referred to as personal start pages, to aggregate various streams of specialist information relevant to researchers within the School and in the wider National Health Service (NHS) research community. This paper documents the background to the portals, their development, and reflects on the challenges and issues the team encountered.

KEYWORDS. aggregators, portals, start page, RSS, Web 2.0

AUTHORS. Andy Tattersall, BA (Hons), MSc (a.tattersall@sheffield.ac.uk) is Information Specialist (Electronic Networks), Information Resources Group, HEDS, ScHARR, The University of Sheffield, Regent Court, 30 Regent Street, Sheffield, South Yorkshire, S1 4DA.

Claire Beecroft, BA (Hons), DPS, MA, MCLIP (c.beecroft@sheffield.ac.uk) is University Teacher and Information Specialist, Information Resources Group, HEDS, ScHARR, The University of Sheffield, Regent Court, 30 Regent Street, Sheffield, South Yorkshire, S1 4DA.

Anna Cantrell, BA, MA, MCLIP (a.j.cantrell@sheffield.ac.uk) is Information Specialist,
Information Resources Group, HEDS, ScHARR, The University of Sheffield, Regent Court, 30
Regent Street, Sheffield, South Yorkshire, S1 4DA.

INTRODUCTION

Web 2.0 Overview

Web 2.0 is the label given to the growing number of second generation websites that is characterized by allowing users to edit, comment on, communicate, collaborate, share information, and design content. It is the democratization of the Internet in so much that it has enabled and empowered everyone to become editors, authors, filmmakers, diarists, artists, librarians, and journalists without the need for specialist web editing skills and knowledge of traditional web development tools such as HTML. By democratizing the web, it has opened the doors for users to control large areas of content such as Wikipedia, Facebook, MySpace, and blogs, and in turn revolutionized how such sites interact with the growing number of other, newer Web 2.0 sites that have emerged.

The Need for Customized Content

In early 2008, members of the Information Resources group based at ScHARR Library began to discuss and investigate the potential of customized web portals, also referred to as personal start pages, to aggregate various streams of specialist information relevant to researchers within the School and in the wider National Health Service (NHS) research community. This paper documents the background to the portals, their development, and reflects on the challenges and issues the team encountered.

Information professionals not only face an increasing problem of information overload but also a

demand by clients to tailor services and products to their exact needs. This issue of information overload can be curtailed to some extent with the aid of web portals. Reid² reminds us of what Web 2.0 innovator Tim O'Reilly so aptly pointed out that we don't try to drink the river.

The Information Resources (IR) team based at The School of Health and Related Research (ScHARR) at The University of Sheffield has seen first hand the change in demand for information and library service provision. ScHARR has an extensive research portfolio working with the Department of Health, the National Institute for Clinical Excellence (NICE), and the National Institute for Health Research (NIHR) in addition to providing teaching to post-graduate and PhD students. All have different needs in terms of support and resources, and all are capable of draining valuable resources from the IR team.

The need to tailor so many resources to such a disparate group of clients has led the team to reassess how best to offer additional research support services without compromising the traditional information services such as the physical library, literature searching, and reference management. One innovation has been using web portals as a means of providing additional information to supplement existing services such as the in-house current-awareness e-mail and research funding bulletins.

Another need for such a tailored service was for the provision of information services to National Health Service (NHS) health professionals in the Yorkshire and the Humber region to support their NHS research through the National Institute for Health Research (NIHR). As a result, it was decided that several specialist health topic portals would be set up to support neurologists, nephrology specialists, and dentists, with other portals to follow. The need for these resources is perhaps somewhat overdue as back in 2006 Giustini talked about the ways that Web 2.0 would change medicine as doctors seek new methods of information discovery due to the

limitations of search engines.³

A good reason for creating such portals is to offer services that many official websites do not. Firstly, there is the formative content, the association websites, such as charity based websites that conduct research and that issue calls for funding, such as Cancer Research UK and the biomedical journals. One health topic can have several useful, informative, and authoritative web presences, and the problem for the modern information professional or clinician is accessing these sources of information from multiple websites; it can be a hard task remembering where to look. Most journals and many official websites (such as those of the British Medical Association and the British Broadcasting Corporation) now provide RSS feeds, all of which can be fed into a single online location. Secondly, there is a growing source of informal multimedia content, such as YouTube and Vimeo videos, audio podcasts, blogs, and wikis, which are often overlooked and under-valued, perhaps due to them being in the public domain and sometimes collaboratively produced/authored.

By employing a web portal, it is possible to pull in several streams of information using RSS from multiple websites and cement it in one place using widgets; all of which are updated with fresh content automatically. Once the portal is created, there is little work to do, apart from searching for fresh content streams and ensuring the existing ones still work. By using a web portal, information professionals are able to pool video, audio, pictorial, and textual content in one place without the need for specialist web design skills.

PORTALS OVERVIEW

Web portals, also known as a customized or personalized home page, allow users to collate

content from various other websites into one single presence. The most famous of these tools being iGoogle, which is in essence the Google search page with customized widgets that range from weather and news updates to Google Maps and YouTube videos. There are several lesser known web portals freely available, with Pageflakes and Netvibes being two of the better quality ones. All three have been in operation since 2005. Web portals, such as those offered freely by iGoogle, allow the collation of several forms of information into one functional web space via the use of “widgets” – small applications which have been created using JavaScript, DHTML, or Adobe Flash – to give web users the ability to create and mash up resources without the aid of HTML. These resources not only include text but combine audio and visual content. The use of widgets makes building portals a much easier task than that of traditional websites such as those that employ HTML or specialist software such as Dreamweaver. In essence, anyone can make a web resource with no previous knowledge of web coding. Web portals, as with most new technologies that fall under the Web 2.0 banner, are invariably free to use. In addition, they are quite often intuitive to learn and allow flexibility for users to create their own mash-ups and additions that were never envisioned by the technology creators. The potential of such Web 2.0 technologies is endless as users devise new ways and methods to use them. Leading personal web portal and start page providers include Netvibes, Pageflakes, iGoogle, and Yahoo Pipes. These sites all allow users to create a web portal very simply by using various widgets to import content from other sites and then arrange this content on a page or series of “tabs” (a collection of pages that can all be accessed from a single home page by clicking on named tabs at the top of the screen). They use asynchronous Javascript (otherwise referred to as Ajax), which is a web development technique for creating interactive web applications. Standard components of these start pages and web portals include RSS feed readers, podcasts, HTML pasting and editing,

calendars, video embedding, notepads, discussion forums and e-mail interaction, to-do lists, and bookmarks.

Of the various leading start-page providers and personal web portals, ScHARR employs Netvibes and Pageflakes due to their adaptability and reputation. Although they differ in their overall appearance, both applications offer very much the same in terms of tools and widgets and allow much freedom in their appearance. They also offer a tab system that allows users to create multiple pages of content. In the case of Pageflakes, each tab is called a flake. The tabs are able to store either a combination of multi-contextual information or focus on just one type of content, whether it is textual, visual, or audio. Where they differ is in how the user embeds their content, as each widget has its own way of working. The number of widgets available has continued to grow, with many created not by Netvibes or Pageflakes, but by subscribers to these tools. This can be problematic for any one wishing to create a web portal as it can be very difficult to choose which of the staggering number of widgets is right for your task. Even in 2008, the iGoogle content directory stored an impressive array of some 25,000 content modules or “gadgets” as these mini web applications are called.¹ Netvibes has expanded its widget portfolio more recently than the stalling Pageflakes, which after a successful initial period has seen troubled times.

EXAMPLES OF GOOD PRACTICE

Development of the research portals involved searching for other similar portals. Identification of similar portals provided ideas for the various ScHARR research portals. The search revealed a number of portals that the team agreed demonstrated good practice. The majority of the portals discussed below use the provider Netvibes. A number did originally use Pageflakes, moving over

to Netvibes when the site became regularly unavailable due to maintenance. The following discussion considers some examples of portals, organized by the type of service that the portal is representing.

Public Library Portals

A number of public libraries have utilized portals as the access point to their online services. Dublin City Public Library <<http://www.netvibes.com/dublincitypubliclibraries#Home>> is an excellent example of a portal for a public library developed on Netvibes. The Dublin City Public Library makes excellent use of the widgets to bring together the different services and resources they provide. The portal home page appearance is interesting and draws together a variety of different applications including Flickr, and Twitter, as well as their own library catalogue, and access to databases and resources such as Britannica Online. In addition, there are clear contact details and links to reading lists. A novice portal user might find the home page a little intimidating, and the home page tab could be less cluttered with some of the content moved to other pages, known as tabs, or flakes in the case of Pageflakes. Additionally, the information on the home page of the portal could be reorganized to give prominence to certain information, for example, the contact details for the library appear at the bottom of the home page only after scrolling down. The portal also has tabs for the more specific resources you might expect to find at a public library (such as resources for job seekers and genealogists) and much more.

Another public library that has developed a good portal is the East Lothian Libraries <<http://www.netvibes.com/east-lothian-libraries#>>. The portal was first developed on Pageflakes before migrating across to Netvibes due to the previously mentioned instability of the website.

The library intuitively used links from their Pageflakes portal through to their new Netvibes portal to ensure that users of the Pageflakes version were able to easily find and access the new Netvibes portal. The links from the Pageflakes take you through to the travel and weather page of the portal, even though it does have a specific home page, which could be confusing to its users. Each of the portal pages are less cluttered than the Dublin City Public Library portal, which might make it easier for users to find what they are looking for.

Health Library Portals

Health libraries have also utilized portals to provide their online services to their users. Two examples of good portals developed by health libraries are the Central Medical Library, University Medical Centre Groningen <http://www.netvibes.com/cmb#CMB_Toolbox> and the Shrewsbury and Telford Health Libraries Team Knowledge Updates <<http://www.netvibes.com/sathlibraries#Welcome>>. Both of these sites bring together their library resources. The Central Medical Library portal brings together access to PubMed, Embase, LibraryThing, new books, and Scopus. The site also has tabs for specific conditions including epidemiology, dermatology, and neurology, where more detailed information is provided about these areas. The portal provides information about citation management, health news, and RSS feeds. This site splits content by type, for example, books, e-books, and searching, which ensures that there is not too much information on each page. Additionally, there is a “more widgets” tab where extra useful widgets can be found, stopping other pages from been too cluttered; but, there is a possibility that users might not understand what this tab is for.

The Shrewsbury and Telford Health Libraries: Team Knowledge Updates portal brings

together the resources of the Shrewsbury and Telford Health Libraries. The portal home page provides general information, and the site has an extensive number of tabs covering different topic areas. Within the different topic areas there is access to relevant journals, RSS feeds, and other useful resources. Some of the pages appear very full, and it might be hard for users to find exactly what they are looking for. Additionally, a new portal user might find the vast amount of information too much to handle. NHS staff are being encouraged to follow evidence-based practice and be research active, but may not have the skills for this role. Staff without these skills could find the portal hard to use or be unable to benefit fully from the amount of information available. Access to some of the useful content could also be restricted by prohibitive firewalls within certain NHS trusts. It is important when developing portals to consider whether the defined user base will be able to fully access the portal content.

Research Portals

Portals have also been used to provide access to research information. One useful example is the Tropical Diseases Research (TDR) to Foster Innovation & Knowledge Application portal <<http://www.tropika.net/>>. This portal provides access to research in the area of tropical diseases to foster innovation and knowledge application and is provided by TDR to enable and encourage research on diseases linked to poverty. This is an extensive resource bringing together research articles, reports, strategy, review articles, and many more resources. This portal is an exceedingly useful resource for researchers in this area. The different sections within the portal have clear names that would be self-explanatory to a researcher. The portal does not make use of many of the widgets found on the other sites, perhaps to ensure that the content is available to the

majority of their users. The site does helpfully provide a number of RSS feeds that other sites can subscribe to.

The search for similar portals found public library, health library and research portals relevant to the portals being developed. Good practice included an interesting home page to draw the user in, use of a variety of applications, and clear self-explanatory information.

TECHNICAL, PRACTICAL AND PROMOTIONAL ISSUES - CONTENT CHALLENGES

One of the major issues in getting a new piece of technology implemented in an organization is finding the right platform to work from. It has to be one which does what is required of it, is fairly easy to master, and above all must be stable. A key challenge for the project was to decide which of the Web 2.0 portal tools currently available could achieve this. Initial Internet scoping searches and research identified several paid-for or freely available portals that allowed various degrees of flexibility.

The second major issue in adopting new technologies, and especially in the case of Web 2.0, is finding technology that is easily and rapidly learned – something referred to as “a quick win,” as well as being either free or at the very least low in cost. Because of the growing number of tools available on the web, it is increasingly difficult for the user to sort “the wheat from the chaff”; a lot of time can be spent researching new technologies with poor results and no return. The only way to limit or even avoid this is to conduct thorough research with a keen critical eye of the existing evidence.

The third major issue surrounding use of new Web 2.0 technologies is the inevitable uncertainty and impermanence that surrounds them; the question “will it be there tomorrow?” is

an important one. For a library professional to implement a new tool or way of working requires an element of risk – there is always the chance that the wrong tool may be chosen. In a service setting, this can be as important as a dead URL or inaccurate information and can create a poor first impression of a resource which can be detrimental to the functionality of a website, quite often ensuring that some visitors do not return. Demonstrating a new Web 2.0 application to a prospective group of users falls flat if the resource provider behind it (such as a portal hosting site) has gone out of business the previous day or the resource is temporarily and unexpectedly unavailable. In short, choosing and using Web 2.0 tools is fraught with risk, but with good research these risks can be minimized.

After deciding that web portals would be a useful complement to the existing service portfolio, the project team carried out an extensive evaluation of the leading portal providers. The initial evaluation included Pageflakes, Netvibes, and iGoogle in addition to other websites such as Zimbio and Yahoo Pipes, which could be considered as personal home pages and portals.

Eventually the project team decided that Pageflakes, which is an Ajax-based personal web portal very much like Netvibes, would be the one best suited to ScHARR. Pageflakes works by utilizing widgets called “flakes,” which can be slotted in and moved anywhere on the portal web page. Additional content can be spread out over several “tabs,” which enable flakes to be organized by categories such as content type or subject area. There are hundreds of pre-designed “flakes,” which vary in content from RSS/Atom feeds, calendars, search engine boxes, notes, and bookmarks to widgets for sites such as Flickr, Facebook, YouTube, Twitter, plus e-mail and user-created “flakes.” The decision to use Pageflakes was influenced by the quality and diversity of the widgets available as well as the adaptability of the flakes. At the time, it appeared that Pageflakes was the leader in Web 2.0 personal homepages with the likes of The Dublin Public

Library and independent information consultant Phil Bradley being keen advocates of the tool. Netvibes on the other hand appeared to only offer limited capabilities compared to Pageflakes.

THE ScHARR PORTALS

Three initial web portals were created and a fourth one was created later on. First, the team created the ScHARR portal,⁵ which served staff and students based at the school. This has now been superseded by a Netvibes version of the portal.⁶ The content of this portal was built around the research topics and areas of interest for ScHARR. This included bringing in the RSS feeds of the journals the library subscribes to. Each department in ScHARR was given its own tab where content was hosted – this is their own personalized web page. Externally hosted ScHARR content was also pulled into the portal, this included The ScHARR Library Blog, Delicious bookmarks, videos, Library Thing catalogue, and the library’s Google Calendar of events. Informal content relating to ScHARR’s research areas, such as YouTube videos, podcasts, and blogs, were also fed into the portal.

The second portal was a neurology portal⁷ for neurology researchers based at The Royal Hallamshire Hospital in Sheffield. The content for this portal is sourced from neurology-based journals, organizations, blogs, podcasts, and videos. The third Pageflakes portal⁸ was designed for dental researchers based in the Yorkshire and The Humber region. Again, like the previous web portal, content was sourced from formal and informal websites and included podcasts and videos. As with the neurology portal, it was created to aid health professionals to undertake their own research through the National Institute for Health Research Research Design Service (NIHR RDS). After moving away from Pageflakes and rebuilding the ScHARR Library portal⁶ in

Netvibes, a fourth new portal was built for renal specialists based at the Northern General Hospital in Sheffield.

EMPLOYMENT OF A REPLACEMENT WEB PORTAL TOOL

The decision to move to Netvibes as the primary source for these portals was prompted by three events at Pageflakes which in turn led to much criticism on their forums and in the general Internet community. First, without warning, Pageflakes started to embed sponsored advertisement into users' portals.^{4, 10, 11} For many users, that may not have been a problem, but for an academic institution with strong ties to the NHS and others in government or non-profit organizations, it meant potentially conflicting and embarrassing content being hosted on their public pages.

Second, there was a distinct lack of news updates and information coming from Pageflakes shortly after the first event. This was highlighted by the posts to the Pageflakes forum by frustrated users who felt they should have been consulted first. An example of how the advertising had affected some users was highlighted by a member of the NHS who had used the portal as part of his training resources, only to find that there was an advertisement from the private health care company BUPA on his home page. The growing discontent, stemming from Pageflakes' lack of communication, was summed up by Phil Bradley posting the critical article, "Pageflakes: 10 Fatal Mistakes" on his blog.¹⁰

The third reason that triggered the move to Netvibes was the growing instability of SCHARR's Pageflakes portals. There were several occasions when the portals were not visible or when RSS feeds did not work. Prolonged lack of communication by Pageflakes again left their

users frustrated.¹² The only information to emerge was that they were in the process of moving servers; hence, the pages not working, but this was regarded with suspicion and many users believed the service was about to cease.^{12, 13}

After these events, it was agreed that Netvibes would be employed to create any future portals, although there was still concern as to whether it could meet the previously high standards of Pageflakes. This initial concern did not come to fruition as Netvibes has developed into an adaptable, comprehensive, and versatile tool. Singer Gordon argued that using Netvibes could be a beneficial way to improve communication among a team.¹⁴ It appears that having seen its main competitor Pageflakes stumble, Netvibes has taken up the mantle as the personalized web portal of choice for many information professionals in the online community. In any case, for users who require a free and ad-free service, Pageflakes is no longer a viable option as their free version now has a fixed advertising widget that cannot be modified, moved, or edited in any way. Web 2.0 applications, like any other business, need to raise revenue, and advertising is one way of doing this.

Since moving to Netvibes, the team has created two more portals – a new ScHARR portal, which caters to each separate section in the school, and a renal portal for NHS Staff in The Yorkshire and The Humber Region of the NIHR RDS. It is worth noting that the three existing portals created in Pageflakes are still working despite the fact that no more work has been done on them; they are effectively self-maintaining.

SELECTING CONTENT FOR THE PAGEFLAKES AND NETVIBES PORTALS

The selection of web-based content in the area of health information requires sensitive treatment.

It is important to point out that some organizational IT systems, such as those within the NHS, limit the types of websites and web-based content that their staff can view. This has significant implications for portal design as users within these organizations will be disappointed if they find that they are unable to access some content within the portal due to restrictions in using plug-ins such as Adobe Flash to view a video.

As well as deciding whether the content is appropriate for the portal, it also needs to be up-to-date, function properly within the portal, and remain stable. It is important when trying to establish a portal to have a clear understanding of the intended audience and what their interests and needs are. If the content is too basic or already easily available elsewhere, users will not feel there is any added value to the resource, and if the level of the content is too complex or technical, it could scare them away. Initially, the content was decided through consultation within the team and by conducting scoping searches to discover what was available that might be of interest to the target audience. Once a demonstration portal had been developed, the project team presented it to relevant groups of clinicians, who offered comments on what they felt was useful and what needed to be added.

However, as the team's ultimate aim was to be able to hand over the portals to an editorial group who had subject expertise, the main focus was less on content, and more on the structure and usability of the portals. The team's aim was to populate the portals with a sufficient range of content to demonstrate their immediacy, diversity, and flexibility and hopefully to engage the audience and encourage them to take over the ownership of the portal. By providing the log-in details of a portal to a specialist group, the editorial control of the portal can be handed over to them to allow them to create, update, and edit their own content.

FUTURE CHALLENGES AND DEVELOPMENTS

Using Web 2.0 tools, especially those that are hosted purely online in the Cloud, is not without its challenges. The tools have great potential, but also provide many challenges for organizations wishing to employ them. As with the web it is impossible to say what it will look like and how it will be used in the future. The evidence shows that with regard to the web, nothing can be taken for granted. It is not only small web start-ups that can disappear overnight, but larger, more established ones.

The popular search engine Infoseek is a good example of a website being bought out by a larger corporation, The Walt Disney Company, before being merged into their own web portal, Go.Com, and effectively disappearing. In recent years, popular tools such as Pageflakes and Screentoaster have had several problems by going offline with little or no warning. For some time, the free screencasting website, Screentoaster, had warned of its impending demise, while as detailed earlier, the customizable Web 2.0 portal creation site Pageflakes has been unreliable for long periods since 2009. Another popular Web 2.0 tool, the Social Bookmarking website, Delicious, owned by Yahoo!, also looked like it could disappear after stories were leaked on the web that Yahoo! planned to cull this site amongst others as a cost-cutting exercise. These stories were denied on their blog <<http://blog.delicious.com/>>, with Yahoo! claiming that their intention was to relocate the website outside of the Yahoo! domain. Pageflakes' instability and rumors of Delicious' demise led many of its users to reconsider their options, and several online articles were written as a result, offering alternatives to the popular tools. In the case of Delicious, which has been in existence since 2003, it blogged in 2008 that it had 5.3 million users and 180 million URLs bookmarked by users. In 2011, it was bought by Avos Systems, and users were

encouraged to migrate their bookmarks to the new site, identical in appearance to old one. Pageflakes' failings were documented by Bradley.¹¹ The main reason for Pageflakes' collapse was due to a takeover and as a result of a lack of investment in the website. As a result, many users and organizations moved to other similar tools, most notably Pageflakes' main competitor Netvibes.

ISSUES IN CREATING ScHARR PORTALS

The key questions that arose from the creation of the ScHARR portals were:

- 1) Will the portal provider still be around in years to come?
- 2) Is it secure?
- 3) What control do I have over it?
- 4) Can my organisation access it?

1) Will the portal provider still be around in years to come?

The answer to that depends on how popular the tool is, how well it is run, and who is behind it. Even so, as documented previously, a popular website like Infoseek and a quality tool such as Screentoaster can be annexed within a larger site/resource. With these scenarios in mind, it is important to have a back-up plan. Many tools these days have export functions that allow the user to take their content elsewhere. In the case of the Delicious rumors, users were able to export their bookmarks to other tools such as the social bookmarking website Diigo, to be sure that their bookmarks were protected should the Delicious site disappear suddenly. Even the biggest and most successful web company in the world can close down large scale projects with little notice. Google released their social platform Google Wave in 2009, and by 2010, the tool

had been shelved until it was picked up by the Apache Software Foundation for further development. As for Pageflakes users, their problem was that there was no direct way of exporting the content from one portal to another such as Netvibes. Pageflakes and Netvibes both use widgets that are individual chunks of HTML code, so each piece of the portal's content had to be migrated to the new portal. Despite this, a portal that had about 50 widgets would only take a couple of hours to copy over. Because portals and start pages pull their content from RSS feeds, you can easily recreate a new tool with old content. The important thing to remember is where the original content is kept.

2) Is it secure?

Again, that depends on the tool and who is behind it. iGoogle is potentially the most secure tool to use to create a start page. Not only does it have the backing of a large and powerful web organisation, but it has been in existence for over five years, making it quite established. iGoogle also allows users to easily incorporate their e-mail, documents, and RSS subscriptions via a single log in. iGoogle and Netvibes have remained consistent in their web presence and have never been offline for any noticeable period of time.

3) What control do I have over it?

With these tools, you have 100 percent control over the content you put in it. Nevertheless, when building a shared resource, particularly in the public sector, it is important to remember that the owner of the tool can change the terms and conditions relating to its usage. It is also important to remember that these tools are quite often free, so the host has absolute say in how it is run. In the case of Pageflakes, third-party advertising was added without first informing its customers.

Obviously these web companies need to raise revenue, and they do that in a variety of ways, creating premium models, selling their idea and website to a larger company, and through advertising. Shortly after the appearance of advertisements on Pageflakes and the instability of the tool, complaints were documented on their website and the advertisements were soon removed for a period of time. Even so, it is still possible that any of the portal and start page websites could change their terms and conditions without notice. Again, it is important to have a back-up plan, so that if a portal service employs changes in a way that makes it no longer suitable, the content can be quickly moved to an alternative service.

4) Can my organization access it?

This depends on an organization's firewall policy. If web access is mediated by a firewall such as those employed in areas of the NHS, the chances are that users will not be able to access some parts of a portal, if not the whole portal itself, as audio-visual content from sites such as YouTube may be inaccessible. The worst-case scenario would be that the whole portal could be blocked due to the tool employed to create it being on a blacklist of websites the organization does not wish its staff to access.

Speed is also an issue, as these portals require a good quality Internet connection to pull in the various RSS feeds from across the web into one location. A slow connection or poor connectivity within an organization can restrict the portal and its usability. In order to make a good first impression on potential users, a portal needs to load its various content streams within a few seconds; if not, the user could quickly form the impression that the portal is poor and inefficient.

CONCLUSION

Portal tools such as Pageflakes and Netvibes can and should be embraced by both the information and research communities as a major tool to manage diverse information streams, keep up-to-date with current developments, and avoid information overload. When developing portals it is important to consider the skills set of your target audience. A number of the portals brought together large ranges of resources on their home page which, while useful to an experienced user, could be intimidating for novice users. It is also important when developing portals to consider whether your defined user base will actually be able access all the resources on the portal.

The development of research portals may present a steep learning curve for library and information professionals, but can ultimately lead them into the world of other Web 2.0 tools and enable them to develop skills and knowledge that can be applied to many other aspects of their work. As Web 2.0 tools become ubiquitous in our daily lives, library and information professionals need to be aware of the multifarious benefits and pitfalls of Web 2.0 and Cloud Computing and how they can use these tools to develop closer, collaborative links with the research community. Developing portals is not without risks, but the experience has highlighted how to minimize these risks, and hopefully, demonstrated that they are risks worth taking in order to develop relevant library services for the digital age and to improve researcher's engagement with the ever-expanding range of multi-media information that can support them.

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