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Personal Learning Environments : challenging the dominant design of educational systems.

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Personal Learning Environments: Challenging the dominant design of educational systems

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Abstract

Current systems used in education follow a consistent design pattern, one that is not supportive of lifelong learning or personalization, is asymmetric in terms of user capability, and which is disconnected from the global ecology of Internet services. In this paper we propose an alternative design pattern for educational systems that emphasizes symmetric connections with a range of services both in formal and informal learning, work, and leisure, and identify strategies for implementation and experimentation.

1 Introduction

Abernathy and Utterback introduced the concept of dominant design in 1978 (Abernathy and Utterback, 1978) to describe the emergence of a broadly accepted core design principle from a number of competing incompatible alternatives.

Common examples are the QWERTY keyboard, the VHS video standard and the IBM PC. The primary characteristic of a dominant design is that, once it emerges, innovative activity is directed to improving the process by which the dominant design is delivered rather than exploring alternatives.

A dominant design may persist for a considerable period of time, even though it might not represent the best technical solution (e.g. VHS v Betamax).

Within the field of education technology, the focus in recent years has been on the improvement of the technology of the virtual learning environment (VLE, also known as a Learning Management System, or LMS) with software and techniques that do not fit the general pattern of capabilities of a VLE being largely marginalized.

We have seen the emergence in recent years of substantial product improvement, of mergers and consolidation (e.g., the merger of WebCT and Blackboard), standardization and conformance regimes (e.g., IMS[1], SCORM[2], and major investments made in open-source versions of VLEs (Moodle[3], Sakai[4]).

However, in this same time period several other innovative technologies – peer to peer systems, weblogs, wikis, and social software – have at the same time been both widely adopted and used by a varied and diverse number of people, yet until very recently been marginalized, unsupported and even in some cases banned (Parry, 2005) within educational institutions, despite increasing conviction amongst some education technologists (e.g., Downes (2004)) that they represent something closer to the generally lauded ideals of lifelong and personalized learning.

If we accept the notion that the VLE represents a dominant design, then perhaps we can also consider the possibility that there lies within the alternatives the possibility of a new design which represents not just a refinement of the design but an entirely new design pattern which could offer a very different set of possibilities, better reflecting the needs of lifelong learners.

Current systems used in education follow a consistent pattern, one that is typically referred to as a Virtual Learning Environment (VLE, fig 1.) within

1 IMS Global Learning Consortium, http://www.imsglobal.org

2 Advanced Distributed Learning Network, http://www.adlnet.org

3 Moodle, http://www.moodle.org

4 Sakai, http://www.sakaiproject.org

the context of UK education (and termed a Learning Management System (LMS) elsewhere).

This pattern describes a particular category of software that has reached near saturation within the UK educational system (Farmer and Tilton, 2006), from which we might justify describing the VLE pattern as the dominant design of educational systems.

2 Characteristics of the dominant design

2.1 Focus on integration of tools and data within a course context

The general design of a VLE follows a consistent model of integrating a set of tools (forums, quizzes) and data (students, content) within a context of a course or module. This pattern follows the general educational organizational pattern of modularization of courses and the isolation of learning into discrete units. This design pattern is very prevalent; in some VLE products it isn't even possible to share content between course spaces within the same system.

2.2 Asymmetric relationships

Within current learning systems there is often a very clear distinction between the capabilities of learners and of teachers. In particular, the tools to organize and create are richer for the teacher than for the learner. This asymmetry sends a conflicting message to users; on the one hand they are exhorted to be creative, participate, and to take control of their learning, and on the other they are restricted to a primarily passive role, where what contributions are possible are located first within the small slice of their overall learning represented within the VLE, and then further by the slots within the existing structure of information organization presented within the VLE.

2.3 Homogenous experience of context

The course-centric organizational model and the limits on learner's ability to organize the space combine to create a context which is greatly homogenous; all learners have the same experience of the system, see the same content, organized in the same fashion, with the same tools. This replicates the general pattern of education that places emphasis on the common experience of learners within a context. This contradicts the desire often expressed under the general heading of lifelong learning for an individualized experience tailored to personal needs and priorities.

2.4 Use of open e-learning standards

Alongside the VLE a parallel development process has taken place, creating a set of standards and specifications to assist in the integration of VLE products into management systems (e.g., the IMS Enterprise and Enterprise Services specifications), for incorporating packaged learning materials (e.g. SCORM, IMS Content Packaging), and for incorporating automated assessments (e.g. IMS QTI). These have been adopted by VLE vendors and requested by customers and industry groups, and have further stabilized the design of systems around compliance with these core platform standards.

However, other specifications, such as RSS[5], that have achieved widespread adoption outside education have not directly impacted the VLE; this is at least partially a side effect of the closed nature of the products, which discourage open sharing of content.

2.5 Access control and rights management

The VLE typically restricts access to content and conversations to the cohort engaging in a unit, and through arrangements with publishers acts to safeguard licensed content from external view. This restriction acts against the drivers of lifelong and lifewide learning, which seeks to unite the experiences of learning in the workplace and home, and of cross-organizational learning. Most content within a VLE is not available to the outside world; it is also often unavailable to learners after they leave a course.

2.6 Organizational scope

The scope of operation of a VLE is typically the organization that installs and manages the software; a service-based model is supplementing this where systems are hosted for organizations by vendors on their behalf. However, the scope of operation is still organizational in that the scope of information managed by the system is the management information of the organization. Typically a VLE makes it difficult to engage external organizations, and learners who are not registered in some fashion with the organization. Again, this is in opposition to the lifelong and lifewide learning model where there is an important role for cross-organizational learning and informal learning.

More interesting are hybrid models emerging such as the Blackboard model of creating a network of systems enabling better coordination amongst organizations using Blackboard. However, the scope of operation is still limited to organizations using the same platform, and so the problem of isolation remains.

5 RSS (file format) http://en.wikipedia.org/wiki/RSS_(protocol)

3 Characteristics of an alternative design

The critical design flaws inherent in today's learning systems can be addressed through adopting a new design pattern that shifts emphasis away from the isolated experience of the modular VLE. We characterize this new pattern a Personal Learning Environment, although unlike the VLE this is primarily a pattern concerned with the practices of users in learning with diverse technologies, rather than a category of software.

The discourse of PLE began to emerge from conversations amongst a diverse group of educational technologists in early 2005, and in particular momentum began to build when Wilson published a conceptual model for a new type of system, termed at the time as the "VLE of the future" (Wilson, 2005). An updated version of the diagram is presented here to illustrate the possibilities of a PLE (See Fig 1.)

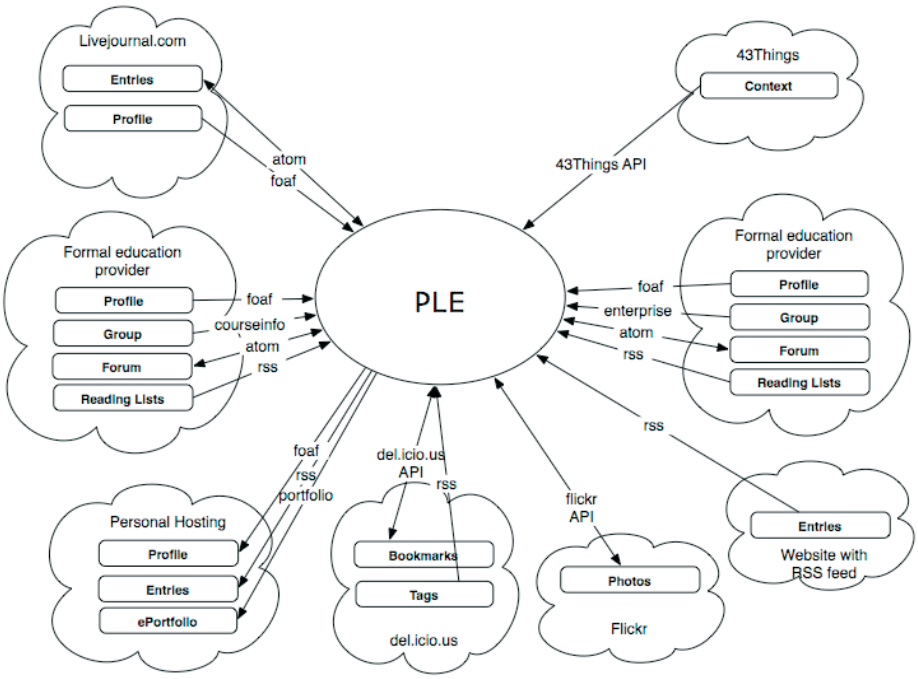

Fig. 1. Conceptual model of a personal learning environment, a development of the model by Wilson (2005)

3.1 Focus on coordinating connections between the user and services

Rather than integrate tools within a single context, the system should focus instead on coordinating connections between the user and a wide range of servi-

ces offered by organizations and other individuals. Rather than interacting with the tools offered within the contexts supplied by a single provider, the PLE is concerned with enabling a wide range of contexts to be coordinated to support the goals of the user. This is more consistent with a competence-oriented approach to learning, and explicitly recognizes the need to integrate experiences in a range of environments, including education, work, and leisure activity.

3.2 Symmetric relationships

The system should be rebalanced in favour of symmetric relationships; any user should be able to both consume and publish resources using a service, and users should be able to organize their resources, manage contexts, and adopt tools to suit their needs.

3.3 Individualized context

Given the focus and nature of the relationship with the system, it will no longer be possible to provide a homogenous experience of a context outside the scope of closed systems, as users can re-organize the information within the context as they see it in any fashion and choose the information and tools to situate within it.

3.4 Open Internet standards and lightweight proprietary APIs

Because the scope of the system has expanded beyond the services offered by institutions, the range of standards and protocols used to interact with services increases, and it is no longer possible to focus solely on standards developed to suit the needs of the education sector. Instead, systems will need to interact with services offering their own proprietary APIs (for example, Google Maps[6]) and with services offering interfaces that support more general web standards (for example, IETF Atom[7]).

From the perspective of the PLE, connection is far more critical than compliance, and it is far better to offer a wide range of services, requiring support for a range of standardization from formal standards through to fully proprietary (yet publicly available) APIs, than to restrict the connections possible to users.

3.5 Open content and remix culture

Unlike the VLE, the PLE is concerned with sharing resources, not protecting

6 Google Maps API, http://www.google.com/apis/maps/

7 The Atom Syndication Format, RFC4287, Internet Engineering Task Force, http://www.ietf.org/rfc/rfc4287.txt?number=4287

them, and emphasizes the use of creative commons licenses[8] enabling editing, modification, and republishing of resources. Rather than pre-packaged learning objects, the resources collected and accessed using the PLE are more typically weblog postings, reviews, comments, and other communication artefacts.

The PLE encourages users to make "playlists" of resources and to share them with others for collaborative knowledge construction, using online services such as del.icio.us[9] and connotea[10].

3.6 Personal and global scope

Whereas the VLE operates within an organizational scope, the PLE operates at a personal level in that it coordinates services and information that is related directly to its user and owner. However, the PLE can also be considered global in scope, as the range of services it can potentially coordinate is not bounded within any particular organization. The user can connect their PLE with social networks, knowledge bases, work contexts, and learning contexts of any size to which they can obtain access.

4 Implementation strategies

Implementing the pattern is not straightforward, as the pattern suggests several very different strategies may be feasible. For example, a single PLE application may be possible, or on the other hand, the coordinated use of a range of specialized tools may achieve a satisfactory result. However, there are some general strategies that will be useful in many cases.

4.1 Plug-in connectors for services

One of the characteristics of the PLE pattern is the use of a range of services within the environment. While it may be possible to connect these services in a very minimal fashion (e.g. by screen-scraping techniques, or by just linking to them), far more interesting results are possible by utilizing a range of machine-readable services.

Primarily this can be accomplished through the use of feeds to exchange metadata; however, there are also a wide range of web APIs available from services that enable a much more interactive range of services. Crucially, these support the creation of new information and not just the aggregation of existing content, one of the major requirements of the PLE pattern.

While it is perfectly possible to implement web APIs in a piecemeal, one-off

8 Creative Commons, http://www.creativecommons.org

9 Del.icio.us, http://del.icio.us

10 Connotea, http://www.connotea.org/

fashion, it may be more effective to elaborate a general pattern of connectors for services that can be managed dynamically and share core techniques. We term this type of reusable connector a conduit, and its main characteristics are that it provides an encapsulated service usage capability, including all the format conversion and protocol management needed to support the API, can be dynamically associated with an application, and can also encapsulate any provisioning or access control information needed to access a particular service.

An example of a conduit is the service management within the Flock[11] social browser application. Flock enables connection to a range of services including social bookmarks, blogging, and notification. The set of connections is managed using a categorized set of preferences; each individual conduit contains both the protocol information and also any required credentials.

This is especially useful in development as many web APIs, even if they begin in a totally proprietary fashion, are increasingly likely to be adopted by similar services. For example, the adoption of the Blogger API by rival services.

This implementation pattern is not just a feature of Flock. Quite independently, the PLE project at the University of Bolton (Wilson, et. al., 2006) consciously developed a conduit pattern for their prototype service-oriented personal system, Plex[12]. Plex, like Flock, has a management interface for adding new services and dialogs for entering credentials and options[13].

Online, there are also examples of this pattern in a range of web applications, such as NetVibes (which offers its conduit API to other developers to assist them in developing new conduits[14]) and SuprGlu[15].

4.2 Tags, lists and smart groups

To support effective organization of information, mechanisms of flexible tagging should be combined with list creation and sharing facilities. Wherever possible the acts of tagging and listing should by default be shared with a wider community through social bookmarking services. Also, rather than supporting hierarchical folder structures, the use of flexible playlist-style groups and smart groups should be considered. Smart groups are used extensively in products such as iTunes[16] and enables organisation to structure itself based on simple user-provided rules.

11 Flock, http://www.flock.org

12 Plex, http://www.reload.ac.uk/plex/

13 A set of screenshots from Plex and Flock comparing the configuration of service can be found online at http://www.flickr.com/photos/vanishing/sets/72157594167600345/

14 Netvibes mini API specification, http://eco.netvibes.com/developers/mini-api-specification

15 Suprglu, http://www.suprglu.com

16 iTunes, http://www.apple.com/itunes/

5 Challenges

5.1 Lowest common factors

A PLE combines information from a heterogeneous set of services within the purview of the user; while this can be done in a fairly isolated fashion (such as an information portal) more value can be obtained by the user when the information of services is combined to enable sorting, filtering and searching.

However, given the scope of operation of the PLE, the implication is that the structure of the information operated upon will be highly diverse. This means that, rather than relying on services to offer a very detailed set of metadata using a common profile, systems will instead need to offer greater capability for managing either heterogeneous information or operate on a very limited set of information which can be commonly assumed, such as titles, summaries, and tags.

To counter the potential reduction in capability the PLE can take advantage of collaborative filtering techniques through the use of sharing "playlists", and the use of rating services, reviews, and comments. The PLE needs to contribute to this process by enabling the automatic sharing of ratings and comments made by the user on resources with the wider network.

5.2 Soft boundaries

While the contexts of formal education systems can be characterized as having bounded variety (e.g., a course typically has around 20-2000 members) and possessing rigid boundaries, general social systems used in informal learning can possess more diverse levels of variety (e.g., Goal groups in the online service 43Things[17] vary in size from 1 to hundreds of thousands of members) and have soft boundaries. For example, social contexts possess 'lurkers', transient members, and members with varying levels of commitment and visibility that makes establishing the actual boundary of a context more difficult.

Connecting with very large contexts using a PLE poses both a technical and a usability challenge, as it will not be possible to absorb all the information within the context into an environment to be operated upon locally, nor is it feasible to present users with flat representations of contexts when they contain thousands of resources.

One solution is to accept soft boundaries as being an inherent aspect of context, and to design the PLE to provide locally meaningful context boundaries for the user. One approach to supporting this is to filter the context to reduce the amount of visible users and resources based on the declared interest of the user.

17 43Things, http://www.43things.com

To cope with large contexts, the PLE may opt to reduce the scope of representation (for example, just provide the context name and an indication of member numbers with some search tools), and encourage interaction with the context through leaving the PLE system and engaging directly with the service.

Clearly, however, the approach used in the dominant design of presenting the entire contents of a context in a fairly flat way does not scale well to handling more diverse contexts.

5.3 Effective coordination of groups and teams

While social software in general has seen widespread popularity, and general social mechanisms operating across very diverse groups has been demonstrated in these open public systems, it remains unclear what mechanisms can underpin the coordination of collective actions by groups and teams within a PLE. The PLE project at the University of Bolton has investigated some mechanisms using services for coordination, and this is being further explored within the TenCompetence project[18].

5.4 Inappropriate reification of the design

While we have discussed the PLE design as if it were a category of technology in the same sense as the VLE design, in fact we envisage situations where the PLE is not a single piece of software, but instead the collection of tools used by a user to meet their needs as part of their personal working and learning routine. So, the characteristics of the PLE design may be achieved using a combination of existing devices (laptops, mobile phones, portable media devices), applications (newsreaders, instant messaging clients, browsers, calendars) and services (social bookmark services, weblogs, wikis) within what may be thought of as the practice of personal learning using technology.

However, for the design to reach equivalent or superior levels of efficiency to the VLE, as well as broader applicability, requires the further development of technologies and techniques to support improved coordination. Some initial investigations include the work of projects such as TenCompetence and the Personal Learning Environments work at the University of Bolton cited previously.

5.5 Living with existing systems

It is one of the invariant laws of technology that any new system must co-exist with previous systems, while that in the case of education the VLE

18 TenCompetence project website, http://www.tencompetence.org

pattern should lose, eventually, its status as the dominant design, the technology will be around us for a long time to come. So how will the PLE and the VLE design co-exist? This can simply be a case of parallel lives, with the PLE becoming a dominant design in the space of informal learning and some types of competence-based learning, with the VLE remaining the key technology of formal educational systems. Alternatively, we may see a period of connection, whereby VLE products start to open their services for use within the PLE. However, we may also see a pattern of co-opting, whereby the characteristics of the PLE are incorporated into the VLE, yet along the way robbing them of some of their transformative power.

We are seeing some evidence of all three strategies. We have an emerging discourse of "e-learning 2.0" (Downes, 2005), new tools for competence-based learning in projects such as TenCompetence, and also of existing VLEs adding features such as weblogs and Wikis.

6 Conclusions

The VLE is clearly the dominant design in educational technology today, and is nearly ubiquitous in higher education institutions. However, its hegemony is being challenged, partly from within education by the desire to bridge the worlds of formal and informal learning and to realize the goals of lifelong learning, and partly from outside education by the increasingly prevalent forms of social software and the new paradigms of the web as technology platform.

The VLE is by no means dead, and those with investments in this technology will attempt to co-opt new developments into the design in order to prolong its usefulness. It is however the view of the author that the key distinctions between the VLE and the PLE are of a more conceptual nature than one purely of features, and that ultimately alternatives such as the PLE model will develop in sophistication, making the VLE a less attractive option, particularly as we move into a world of lifelong, lifewide, informal and work-based learning.

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