How Mobile Computing and the Semantic Web Will Change Learning Forever (Aug 11)

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The Internet has forever changed our world and our relationships to people and organizations within it. It continues to evolve, with many varied applications and technologies emerging. Although we can't say for sure what the Internet will look like in the future, thought leaders all agree that some Internet trends are here to stay. One such trend, and perhaps the most comprehensive, is the evolution towards a mobile workforce, a Mobile Web, and a Semantic Web.

In this article, I will look at the significance of mobile computing navigating through the Semantic Web – specifically at how these technologies will impact learning and the learning industry. For those still trying to resolve Web 2.0, and how to integrate it into learning, hold on tight because the ride is going to speed up faster than you can catch up.

Some background

We're all familiar with mobile computing since most of us, if not all, carry the Web with us on our mobile phones. However, not everyone is familiar with the Semantic Web.

> "*The Semantic Web approach … develops languages for expressing information in a machine processable form." This is perhaps the best way of summing up the Semantic Web – technologies for enabling machines to make more sense of the Web, with the result of making the Web more useful for humans*. (Edd Dumbill, "The Semantic Web: A Primer," 2000)

Learning professionals may be interested in that phrase, "…enabling machines to make more sense of the Web." Some people may be thinking that machines already make sense of the Web by providing us tools like search engines, blogs, wikis, etc. Allow one more definition:

> *Web 3.0, a phrase coined by John Markoff of the New York Times in 2006, refers to a supposed third generation of Internet-based services that collectively comprise what might be called 'the intelligent Web' – such as those using Semantic Web, microformats, natural language search, data-mining, machine learning, recommendation agents, and artificial intelligence technologies – which emphasize machine-facilitated understanding of information in order to provide a more productive and intuitive user experience.* (*Communities Dominate Brands* Weblog entry, February 8, 2007)

Isn't "Semantic Web" just … semantics?

In the first definition, our interest was in the term "making sense of." In the second one, we are interested in the phrase "…machine-facilitated understanding." Although a search engine can direct us to a Website or answer our questions, does it understand?

What makes the Semantic Web different from what we now experience is the presence of *context,* which allows a machine to *understand* the information it's reading, not just point to it based on tags. To be more specific, a machine that "understands" can draw relationships between things without having to have that relationship explicitly stated.

An example would be the names of cities on a Web page. Currently, the Web can find the occurrence of the city name "Toronto" on a Web page. A machine that understands "Toronto" will know that Toronto is a city located in the province of Ontario, which is a province inside Canada, which is part of North America.

What exists as links to pages now will be links to the things themselves insomuch as those things can be represented in digital form. Now this may seem somewhat foreign and obtuse, so let's pause for a moment to make sure we understand.

Comparing the Semantic Web to Google

Suspend for the moment the significance of "tags" and "tag clouds" to our interaction with the Web. As consumers of the Internet we are always introducing and re-introducing ourselves to it each and every time we use it.

Think about using Google®. Every time you search for something on Google, it does not remember who you are or what you looked for last time (although it may remember your computer). Google is more interested in linking you to the right Web page than in understanding your context. The future evolution of the Web is the Web making sense of itself. That translates to a Web that understands our real life connections, our work environment, our homes, and our travel destinations. This understanding persists with us in the Internet and provides context for who we are and where we may want to go.

The Semantic Web as Operating System

The other aspect to the Semantic Web is the Web as an operating system from which everybody can work. Once the Web can read itself and understand context, the revolutionary use of the Web as a personal operating system holds many possibilities. (This is said without factoring in privacy, which is a major hurdle the Semantic Web will have to overcome.)

Right now we are seeing the growth of SaaS (Software as a Service), which allows users to do their desktop computing online through hosted software applications. The benefit is a model where you only pay for what you use. Along with SaaS comes the notion of "cloudbooks," "netbooks," and most importantly, "Mobile Computing." Cloudbooks or netbooks are essentially storage-diluted compact machines loaded with Internet apps designed to work on and from the Internet. Mobile computers, I would argue, include not only netbooks, but also smartphones and tablets.

Mobile makes a difference

The advent of mobile computing is significant as it supports the notion of using the Internet as a background operating system. Mobile computing reaffirms that the evolution of the Web is to create more transparency, to allow content and content objects to be transparent to "readers," so that they can create context and meaning. While many may know this already, some users of mobile phones, PDAs, etc., may not. Think of mobile devices, which all use the Web to deliver content in a context-sensitive way.

How does this change learning?

Although predicting the future of the Internet is out of the scope of this article, I do want to capture some key trends that the advent of mobile computers epitomizes, to see how "learning" will fundamentally change. As a quick review, those trends include:

- Allowing machines to derive context
- Allowing machines to draw meaning from context
- Allowing content to be transparent to machines
- Creating hardware that uses the Internet as its OS

Learning has already changed

Before moving on to how learning will change, allow me to take a brief moment to capture how it has already changed.

For clarity, when I talk about "learning," my opinion is that our physiological processes for learning have fundamentally remained the same, but the ways in which we package learning to appeal to those physiological processes has changed. Therefore, I'm really concerned with how training professionals have repackaged learning content over the years, rather than with "learning" itself.

The real growth and evolution in learning, it seems to me, has been the ability to distribute learning to greater numbers of learners and yet allow it to be even more targeted to the learners to whom it has been distributed. This is accomplished through modularization of content and packaging formats like SCORM that allow us to describe who the content is for. We've changed distribution models from pushing content through a central brain to facilitating pulling content through a distributed network of brains (similar to the evolution of robotics).

Access and context

If access to content is a growing trend, then, as learning practitioners, we should really focus our attention on how to facilitate access. Sugata Mitra, a researcher who began a project called the "Hole in the Wall," shows us clear evidence that even in an unstructured environment, a Web-enabled computer left unsupervised can have a huge impact on learning for children.

To some degree the SCORM standard has identified that content needs some context through its inclusion of LOM (Learning Object Metadata) as part of the standard. Metadata allows content creators to package content with an assortment of information about the content so that people who may want access to that content can have some information to help them decide if the content is appropriate or not.

SCORM itself was meant to deal with interoperability issues. However, it was always conscious of the "what if" factor when content repositories grew to extremely large scales. How would consumers of content find what they were looking for in large libraries? How could learning content repositories avoid having large quantities of information returned from content searches that were irrelevant and inappropriate?

This is the role of metadata. SCORM itself is a wrapper for content that allows it to be ingested and digested in a variety of environments in the same way each time. Metadata is part of that wrapper and provides some transparency to the content itself (which for the most part is a black box without the metadata).

So now we are at a point where learners (in theory) can access large libraries of content, search for relevant content objects, find what they are looking for, and make their way through that content at their own pace and at their own discretion. They can also find relevant networks of people with expertise or interests similar to their own, and pull content from those networks.

This happens both in controlled environments such as learning management systems and in uncontrolled environments such as Google or Weblogs and other Web 2.0 applications. Learners are also increasingly using mobile technology to find content and to access their pre-packaged learning events. What was once the anthem for e-Learning (Anytime, Anywhere) has, for all the right reasons, been assumed by mLearning and mobile learning.

Who – or what – makes the connections?

Regardless of the new-found mobility in learning, the link between learner and content is still manual. Somebody, some person, must create the link. There are instances in controlled environments where learning paths are pre-programmed based on learner criteria and thus provide a pre-programmed link between learner and content. However this link is native to the system in which the learner operates and is not persistent outside of that environment.

So how will advances in Web technology combined with mobile computing change this scenario? First and foremost, "the cloud," more than being just a new Web buzzword, will be an intelligent, networked operating system from which our mobile computing platforms can pull and negotiate context while processing information in real time based on that context. (Think of your cell phone knowing when you are in the U.S. versus Canada versus Europe.) In other words, there are no predetermined links to pages, but rather networked context which a mobile platform will read, understand, and process in real time to deliver to its user the information the user needs.

The next steps

The future of the Web is to provide a learning environment where learners and content are linked through context, which is persistent regardless of where the learner is operating. This is due in part to the notion of the Internet as an operating system, but is also a result of semantic technologies.

There are several hurdles we must overcome to make the semantic Web a reality, not the least of which is agreement on the language to use for creating context.

Think Dewey Decimal System here. What makes the Dewey Decimal System so potent is not the technology used in conjunction with it, but the adoption of it as the standard for cataloguing literary references by libraries across the globe. Once that has been set in place, we can create better and faster tools that facilitate its use, but the system had to be put in place first. The creation of a Dewey Decimal System for the semantic Web will be a long and arduous process, more so because the initial step is the deconstruction of all information on the Web.

Learning on the Semantic Web will also require the creation of semantics so that its context can be properly negotiated. Standards have already emerged, such as the Learning Object Context Ontology (LOCO), based on the Resource Description Framework (RDF), and Web Ontology Language (OWL) technologies. Standards such as Darwin Information Typing Architecture (DITA) accomplish the same end goal (although DITA does not make use of RDF and OWL). If the learning community can come together and create a globally accepted semantic structure, then both software and hardware can adopt the standard and make use of it.

If mobile platforms reaffirm that hardware adaptations are made based on the implementation of standards or software, then those platforms will be able to provide us with the Holy Grail of learning, which is true just-in-time training.

As learning professionals, we need to understand and embrace this evolution. Nothing has ever come as close to delivering just-in-time training as the Semantic Web accessed through mobile platforms promises to do. If learning professionals can rally behind the concept, then the work of creating our "Dewey Decimal System" for learning content can be achieved.