Harnessing Collective Intelligence for the Learning Communities; a Review of Web 2.0 and Social Computing Technologies

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Abstract

Web 2.0 and Social Computing is based upon the knowledge of connecting people globally using adequate technologies to increase people interaction. Technology has always played a key role for innovation in education, and with the advent of Web 2.0 and social computing, educators have been quick in recognizing the great potential that this represents. There has been a dramatic shift of information power and everything is decentralized, participatory and collaborative. Properly filtering and harnessing 'user-generated content' in web 2.0 and social computing can represent a valuable repository of knowledge for the learning communities. Nowadays, the number of people accessing social websites is rising exponentially and educators are seriously contemplating the option of using these social websites to reach the learners, especially youngsters. The Facebook phenomenon is particularly true in this situation where we find many learners sharing notes, uploading learning materials, discussing on a particular topic related to learning and education. So in a way, we find that these social websites are no longer being used only for entertainment but also for learning purposes. This is limited not only to Facebook. So many social websites together with the accompanying web 2.0 tools and features if properly used, can represent an interesting repository of knowledge. This paper outlines some key features of web 2.0 and social computing.

Characteristics of Web 2.0

Web 2.0 and Social Computing is based upon the knowledge of connecting people globally using adequate technologies to increase people interaction. Nowadays, people are more into interaction than before. Web 2.0 mainly consists of collective intelligence which relies upon managing, understanding, and responding to large volumes of data generated by the user in real time.

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The "subsystems" of the rising of internet operating system are a rising data subsystem that is place, people, products and the complexity of meanings that tie them together which results to new levels of competitive benefits consisting of data being the core of the next generation of computer applications [1]. Web 1.0 was released in the early 1993 to 2001. The term www occurred due to the boom in 2001 of the DOT-com bubble. Web 2.0 was used for current designing of the web, business models and methods for branding of sites on the World Wide Web, since 2004. Web 2.0 as a web application facilitates sharing of information interactively, interoperability, user-centered design and collaboration [2]. Tim O'Reilly defined it as being a gravitational core rather than a hard boundary. It can be seen as a group of principles and practices attached to each other as a veritable solar system of sites that show some or all of those principles, at a varying distance from that core [3].

Web 2.0 websites allow users to do more than just retrieve information. By increasing what was already possible in "Web 1.0", they provide the user with more user-interface, software and storage facilities, all through their browser. This has been called "Network as platform" computing. Users can provide the data that is on a Web 2.0 site and exercise some control over that data

Some of the most important characteristics of Web 2.0 are discussed below [4].

- User-centered Design.

A web design is created to fulfill every possible need of the end user, empowering the user when doing certain customizations within the design. Designs which are user-centered are cleaner, usually based on Ajax and navigation is easier. Special preference is given to the design during its creation. One example is iGoogle, a customizable Google.

- Crowd-sourcing.

Web 2.0 major contribution is that each small unit leads to the website state of relevance. For example, Blogger and WordPress are beating up any conventional Media company by making millions of users the core contributor thereby building up a huge resource within a little amount of time.

- Web as Platform.

    Web 2.0 nowadays is not dependant on the OS and does not require a client download condition for accessing various web applications.

- Collaboration.

    Wikipedia is the best example of collaboration in terms of content quantity.

- Power Decentralization.

    Web 2.0 is not more administrator dependent but rather follows a self service model. For example, Google Adsense provides a platform whereby users get to deployAds on their site/blog without the administrator allowing or rejecting them. Same goes for social bookmarking services such as Digg, Reddit, Stumbleupon etc.

- Dynamic Content.

    Web 2.0 services need to be highly dynamic and proactive where the blogosphere has overpowered the conventional mainstream media. If crowd sourcing is there then dynamicity follows by default.

- SaaS.

    SasS (Software as a service) is whereby web service are not platform dependant with the intrusion of cloud computing.

- Rich User Experience.

    Use of XHTML, CSS 2.0, Ajax, flex, HTML5 and similar other technologies for producing rich media have helped making web services lighter, faster, less cluttered and more interesting to the end user. Nowadays a better experience with the system leads to the user coming back again to the webs service.

Social Computing form parts of Web 2.0 era. It is a combination of both social behavior and computational systems. It became the key concept of business nowadays. In simpler term, it uses social conventions to make people interact with each other across the world using software and technology. For better interaction we make use of blogs, email, instant messaging, social network services, wikis, social bookmarking and other instances. In a broader term, it includes collaborative filtering, online auctions, prediction markets, reputation systems, computational social choice, tagging and verification games [5].
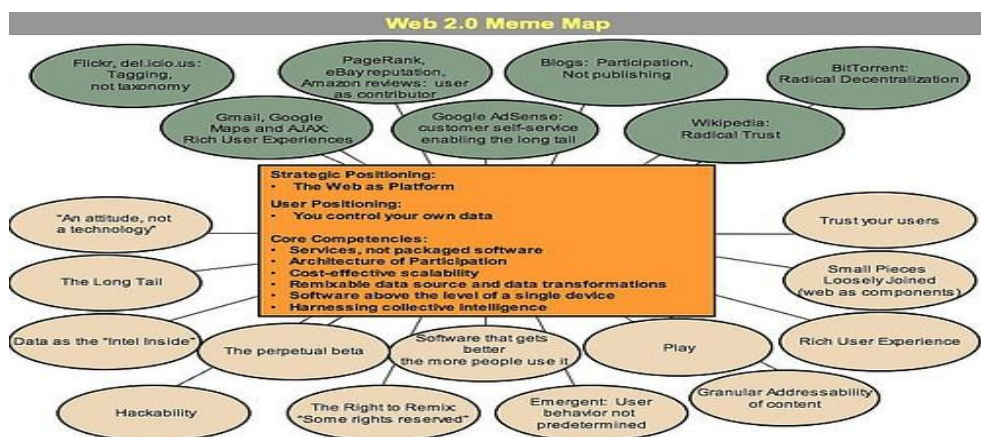

Figure1: Web 2.0 Meme Map [3]

Social Computing Architecture

Social computing architectures have five basic concepts [6]:

• User Profile

Mostly ever companies have a LDAP that stores basic information of all users while for social sites this problem has been gone with the profile storing of users in Microsoft® SharePoint™.

Active Directory is already integrated with this profile thereby providing the possibility of populating other system using the Business Data Catalogue. Data has been separated into two categories: basic user data and data that relates to the other key social computing concepts.

- User Connections.

There are two types of user connections: one-to-one connections or to express that users are related to each other in some way. The main function of social computing is to specify these connections.

A Community concept has been developed to allow users to create and join groups. It consist of a Microsoft® SharePoint™ team site which make use of a standard but extensible interface and various key additional features. Storing of membership by Social Sites in public communities is performed on separated servers. SharePoint™ does not originally have this concept of joining an open team site, so it was added on a separate platform. Since Social Sites create Communities, users get easy discovery and recommendation of appropriate Communities to join. Similarly, activities within Communities are automatically tracked and presented to users who join them.

- Content

Companies nowadays are trying to increase content creation capabilities for the right user to have the right information based upon social computing goals but in the long run content creation tools will have to be "socially aware" that is understanding the social graph and emit and consume events.

- Events

An events store was included in the design when the architectural approach was taken into consideration for Social Sites. The Microsoft® SharePoint™ Colleague Tracker API was extended for capturing of more colleague events. Events are generated from our communities, and events are captured from (foreign) content updates by users. Events are pulled into the repository to have the possibility of distributing them back to appropriate places.

- Security and Privacy.

Security context is already established for content repositories and creation environment in nearly all enterprises.

So the creation of content in any new social computing platform which will be implemented will follow the same path. Likewise, the same security context should be applied for any technologies which is distributing that content (like RSS). The risk of security issues increases with every new authentication or authorization system added to the enterprise architecture.

Usage of Web 2.0 and Social Computing

Social Information Processing is the process of collecting human actions to manage knowledge. Analysis of the information processing power of social systems is performed [7]. Some computer tools examples are:

- Authoring tools: e.g., blogs
- Collaboration tools: e.g., wikis, in particular, e.g., Wikipedia
- Tagging systems(social bookmarking):e.g., del.icio.us, Flickr, CiteULike
- Social networking: e.g., Facebook, MySpace, Essembly, LinkedIn
- Collaborative filtering: e.g., Digg, the Amazon Mechanical Turk, Yahoo answers, Urtak
- Social Information Aggregation: e.g., scratchmysoul.com
- Microblogging: e.g. Twitter, Yammer
- Photo Sharing:e.g. Picasa, Flickr
- Video Sharing:e.g: Youtube, Google Video
- Live broadcasting: e.g. uStream, Mogulus
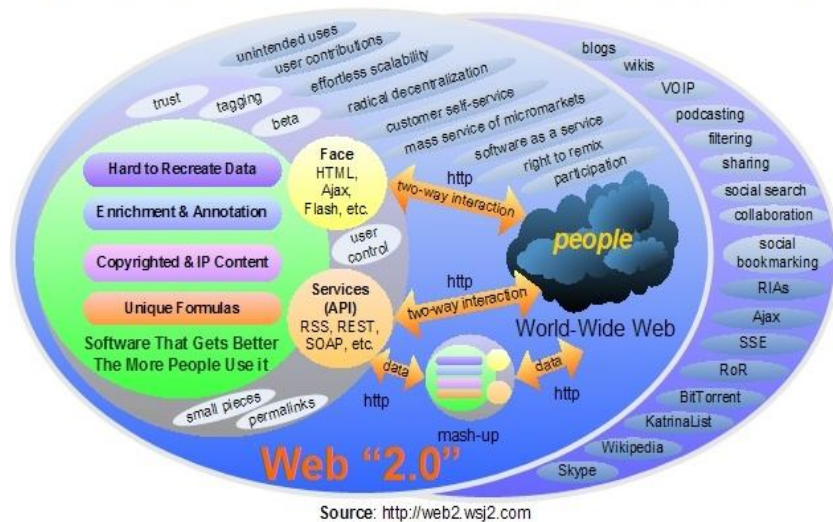
Elements of the Web's Next Generation

Source: http://web2.wsj2.com

Figure 2: Elements of the Web's Next Generation

Web 2.0 brings together the capabilities of client- and server-side software, content syndication and the usage of network protocols. Thereby making use of plug-ins by standards-oriented web browsers and software extensions to handle the content and the user interactions. Web 2.0 sites allow users to store information, create, and the capability to disseminate that was not possible in the environment now known as "Web 1.0".

Web 2.0 websites usually contain some of the following features and techniques. Andrew McAfee used the acronym SLATES to refer to them [8]:

- Search: To find information through keyword search.
- Links: It provides low barrier social tools and connects information together into a meaningful information ecosystem using the model of the Web.
- Authoring: The possibility of creating and updating content leads to the collaborative work of many rather than just a few web authors. In wikis, users may extend, undo and redo others works too. In blogs, posts and the comments of individuals increase over time.

- Tags: Categorization of content by users adding tags to facilitate searching, without reliance on pre-made categories. Collections of tags within a single system which are created by users may be referred to as "folksonomies" (folk taxonomies).
- Extensions: The software which makes the Web an application platform and a document server.
- Signals: Usage of syndication technology such as RSS to notify users of changed in the content.

Transition of Web 1.0 to Web 2.0

Web 2.0 started with the conference session between O'Reilly and MediaLive International. The web pioneer, Dale Dougherty and O'Reilly VP, make notice of the fact that far from having being crashed, the web with its new applications and sites popping up was more important than ever. The dot-com collapse could have marked the turning point of the web to the Web 2.0 era. The conference was held from the 5th -7th of October in 2004 in the Hotel Nikki in San Francisco, California.

Table 1: Web 2.0 Transitions Examples

Web 1.0	Web 2.0
DoubleClick	Google AdSense
Ofoto	Flickr
Akamai	BitTorrent
mp3.com	Napster
Britannica Online	Wikipedia
personal websites	blogging
Evite	Upcoming.org and EVDB
Domain name specification	Search engine optimization
Page views	Cost per click
Screen scraping	Web services
Publishing	Participation
Content management system	Wikis
Directories(taxonomy)	Tagging(folksonomy)
Stickiness	Syndication

Web 2.0 Network Map

More than any time in the history of the Web, holders in the network economy are reinforcing their power and staking new claims to key points of control.

At the same time, those who are against both large and small are hoping to gain footholds or take ground in new territories. This is a Points of Control related to the map below.

Figure 3: Web 2.0 World Map

According to the map, web 2.0 can be categorized in terms of enterprise, gaming, ecommerce, payment, social commerce, tablets and PCs, infrastructure, OS and UI, platform plateau, search, content, media access, advertising, data, identity, social networks, activity, location based service and handset.

Table 2: Types of Sites

Type	Site
Enterprise	Adope, Novell, Oracle, SAP, CISCO, Salesforce, IBM, Microsoft, HP
Gaming	Google, AOL, Microsoft, Apiple, Facebook, Nintendo, Playstation, Zynga, iWon, Plyadom
Ecommerce	Paypal, ebay, Zappos, Amazon, GSI Commerce, Alibaba, Walmart, Revolution Money
Payment	Square, Verizon/AT&T, Visa, American Express, MasterCard, ebay, Paypal, Apple, Google
Social Commerce	Rue la la , Groupon, Gilt
Tablets and PCs	Blackberry, LG, Cisco, Microsoft, Augen, Lenovo, HP, Dell, Asus, Apple
Infrastructure	Microsoft, Salesforce, Oracle, Vmware, Apple, Rackspace, Cloudera, Eucalyptus, Liveops, Google, Amazone
OS and UI	Windows Phone, Android, RIM, Linux, Chromium OS, IOS, J2ME, Samsung Bada, Nokia Symbian, OS X, Web OS, Adope, Windows, Mozilla
Platform Plateau	Apple, Blackberry, Microsoft, Google
Search	Google, Yahoo, Bing, Blekko, Quora, Baidu, Ask
Content	Viacom, Bertelsmann, Disney, Newscorp, AOL, Conde Nast, Hearst, Meredith, Time Warner, Yahoo, Wordpress, Youtube, Demand Media, Tumblr, Federated Media, Six Apart
Media Access	Apple, Google, Amazone, Hulu, Sony, Netfix, Microsoft, B&N
Advertising	Microsoft, AOL, Google, Apple, Yahoo, WPP, Glam, Federated Media, Facebook
Data	Bluekai, Cadreon, Vivaki, Tynt
Identity	Google, Facebook, Microsoft Identity Management, Twitter, ClaimID, Wordpress, Resilient Networks
Social Networks	Facebook, Google, Twitter, mySpace, LinkeIn, Foursquare, Microsoft, hi5, Ning, Bebo, DailyBooth
Activity	Tumblr, LinkedIn, TenCent, Wordpress, Twitter, Facebook, mySpace, Google
Location based service	Google, Facebook, Nokia, Foursquare, Twitter, Simple Geo, Gowalla, Yelp, Loopt, Apple
Handset	Samsung, Sony Ericsson, Google, Microsoft, Motorola, HTC, LG Electronics, Nokia, Palm

While Web 2.0 network can globally be sum up in this table social computing on the other hand is a more detailed behavior of these websites. Social computing is a multi-disciplinary research program which focuses on human, cultural, and behavioral aspects.

Bringing together experts from various disciplines like: anthropology, cognitive science, computer science, economics, linguistics, mathematics, neuroscience, political science, psychology, sociology, statistics, and theology. Social computing is where there is the intersection of social behavior and computational systems. It is also referred to as modeling complex human interactions that are expressed on a variety of social media. Social media, or mostly known as the Social Web, consists of an ant-colony of services including blogs, media sharing, micro blogging, social bookmarking, social news, social friendship networking websites, and wikis. Different social media sites could be similar or different in terms of functionality. We briefly describe each category and the functionalities [9]:

- Blogs or web logs, is a collection of articles arranged in reverse chronological order. These articles are known as blog posts. Blogosphere is the referred to the collection of all blogs. Blogs allow sharing of views, expressing of opinions, interaction and discussion through the linking to other blogs or posting comments. A blog can be maintained by an individual known as an individual blog or by a group of people known as a community blog. The authors of blogs are known as bloggers. Some blogs such as BlogCatalog (http://www.blogcatalog.com/) also allow users to create their friendship networks.
- Media Sharing sites allow the uploading and sharing of multimedia content on the web, including, images, videos, audio, etc. with other people. People can watch the content shared by others, enrich them with tags, and share their thoughts through comments. Some media sharing sites allow users to create friendship networks.
- Micro Blogging sites are similar to blogs except that the articles can only be of certain length. In case of Twitter (http://www.twitter.com/), the articles can be 140 characters in length. As they are of short length, the articles are called messages. Besides posting messages people can also create friendship networks. They can follow or become followers of other users.
- Social Bookmarking sites allow tagging ofr favorite webpages or websites and sharing it with the other users. This generates a good amount of metadata for the webpages. People can search through this metadata to find relevant or most favorite webpages/websites. People can also see the most popular tags or the most freshly used tags and freshly favored website/webpage. Some social bookmarking sites like StumbleUpon (http://www.stumbleupon.com/) allow people to create friendship networks.

- Social Friendship Networks allow people to interact with their friends and having new friends. Individuals hereby create their profile on these sites based on their interests, location, education, work, etc. Usually there are non-directional ties, which means that between two nodes there is a need to reciprocate the friendship.
- Social News sites allow the sharing of news among people and provide voting possibility of these stories. Most voted news emerges as the most popular news stories. Tagging of various news stories is possible.
- Wikis are publicly edited encyclopedias. However, there moderation of the wikis to avoid vandalism. Wikis provide a great technology for content management, where people with a very basic knowledge of formatting contribute and produce rich sources of information. Wikis also maintain changes of the history and have the possibility to go back to any previous version. Popular wiki likeWikipedia (http://www.wikipedia.org/) also allow people to classify the articles under one of the following categories: Featured, Good, Cleanup, and Stub.

Table3: Categories of Social Sites

Category	Social Sites
Blogs	Wordpress, Blogger, Blogcatalog, MyBlogLog
Media Sharing	Flickr, Photobucket, YouTube, Multiply, Justin.tv, Ustream
Micro Blogging	Twitter, SixApart
Social Bookmarking	Del.icio.us, StumbleUpon
Social Network	MySpace, Facebook, Friendfeed, Bebo, Orkut, LinkedIn, PatientsLikeMe, DailyStrength
Social News	Digg, Reddit
Wikis	Wikipedia, Wikiversity, Scholarpedia, Ganfyd, AskDrWiki

Web 2.0 Tools

In this section, we are going to discuss various technologies in detail and mention the reasons why they played such an integral role in the evolution of the World Wide Web. We categorize them according to the OSI 7-layer model: AJAX, SOAP and REST, Adobe Flash, Flex and AIR, Open APIs and Mashups, RSS Feeds, Microformats and Semantics [10].

- AJAX

AJAX is probably the one that revolutionized the way web applications and services are delivered, a term which is accredited to Jesse James Garrett and stands for Asynchronous JavaScript + XML. It is not a new web-based programming language, but it's a group of technologies combined together, having as a base the Ajax engine, creating a new experience for users and their interaction with web applications. The technologies that it incorporates are already mature, stable, and popular web-based programming languages and script languages and include (X) HTML, CSS, XML, XSLT, JSON, DOM, XMLHttpRequest, Javascript, VBScript, Adobe's Flash, Flex and AIR and Microsoft's Silverlight.

- SOAP & REST Architectures.

SOAP is the traditional, standards-based approach; it was developed by Microsoft in 1998 and since then has become the most popular standard in exchanging XMLbased messages between applications. It has become so popular, because it was the first architecture that enabled the usage of new technologies like AJAX and being introduced by a major corporation as Microsoft is, it was bound to become a success.

From a technical point of view, SOAP is a protocol architecture for delivering the necessary interoperability between message-based middleware tools across the entire industry.

REST was developed by Roy Fielding and simply provides communications interface using XML and HTTP, using commands, such as POST, GET and PUT. It relies on simplicity, ubiquity and scalability, since it can support small, simple services and complex services, offered by large service providers, such as Amazon and Google.

- Adobe Flash - Adobe Flex - AIR & Microsoft Silverlight.

Adobe Flash is a multimedia platform, which is used to create Rich Internet Applications (RIA), whereby developers has the ability to include animation, interactive graphics and other options to webpages, without considerably slowing down the loading of webpages.

Adobe Flex is package for the development of such applications and offers a separate IDE for developers to create their RIAs based on the Flash platform. AIR is another development of Adobe, which is a cross-operating system runtime that enables you to use your existing HTML/Ajax, Flex, or Flash web development skills and tools to build and deploy rich Internet applications to the desktop.

Silverlight is an alternative way to create multimedia applications for the web. Cross-browser, cross-platform and cross-device browser plug-in which helps companies in designing, developing and delivering applications and experiences on the Web.

• Open APIs & Mashups.

Application Programming Interface (API) mechanism provides the usage of functionality of a set of modules without having access to the source code. Open APIs are free and open for all programmers to make use of and taking advantage of certain features in their own projects.

Mostly major web service providers giving out APIs for developers, most notably Facebook and the Facebook Apps API, Flickr and Google with various APIs, with the likes of the Google Maps API being rather popular.

In Web 2.0 era this has become really popular, which has been triggered with the rise in the number of mashups. Mashups are application that can be customized taking disparate data sets which can be both static and real time.

The usage of Open APIs has become a must amongst developers and this has lead to the creation of the alliances such is the "Open MashUp" alliance (www.openmashup.org), having support of major companies such as HP, Intel, Cap Gemini and the –under development– project lead by Google, called "Open Social" (www.opensocial.org), in cooperation with social service providers such as MySpace, Hi5, XING and others.

- RSS feed, Microformats & Semantics.

Since the social aspect of Web 2.0 is rather crucial, we have seen many technologies that give users the opportunity to have personalized information right on their desktop or mobile phone (RSS), personalize their accounts at websites (Microformats) and even to be able to get information specifically for them, based on their interests or previous browsing (Semantics).

According to specifications of RSS 2.0, it is a syndication of web content format. It is a dialect of XML. As mentioned what RSS does, is give users the opportunity to receive information they have selected as interesting and to be instantly notified about new updates on their favorite subjects, from their preferred blogs or websites.

Microformats could be placed one step above RSS, since technologically it provides developers with a way of adding simple markup to human-readable data items such as events, contact details or locations, on web pages, so that the information in them can be extracted by software and indexed, searched for, saved, cross-referenced or combined.

Social Computing Tools both Technologically and   Socially Oriented.

Technologically Oriented

- Open Platform

This principle dictates that Web 2.0 services provide users the possibility to access information they desire with their browser and puts an emphasis on synergy between different devices and applications that are connected to the Internet. At the same time it does not imply the replacement of desktop computers and classic operating systems but promotes compatibility and collaboration, towards a more social web [10].

- Lightweight Models

When talking about lightweight models, flexibility and agility ways of developing a product, thus being able to update, change and reuse much faster than the classic development methods. This is common for a web based service, "…it requires an agile business model, which can handle such a fast update rate…" and it also helps to reduce the costs in organizational change, a process that is expensive in terms of energy usage as well as investments.

- Enabling Services

Differentiation of online services that follow the model of SaaS - Software as a Service, a model used extensively, by services such as the applications by Google e.g. Gmail and Google Docs. Characteristics of these services are flexibility, openness, scalability and re-usability. These characteristics enable the creation of mashups, faster updating, online management of data and lower transaction costs.

- Intuitive Usability

Usability is key when it comes to interfaces, which is a main element of all web services. Consequently, interfaces must be easy and simple for all types of users, according to the walk up 'n' use mentality, but at the same time to offer expert users more options to personalize their side of the service according to their liking.

For example, with introduction of the term of Rich Internet Applications in Macromedia as described in the previous section, but things became even more usable when AJAX was introduced, exploiting the graphic environment offered by JavaScript.

Socially Oriented

- Long Tail

80 - 20 Pareto distribution is the basis of this principle, meaning that services should aim at both sides of the market; the 20% of customers that   generate   large profit, as well as the 80% of customers that generate small profit, but are by far larger in number.

To achieve this, services must attract users of all orientations, having Amazon as an example which manages to gain a lot of profit from this group of customers, by offering niche products, exclusively from their online store.

- Unbounded Collaboration

Social computing is all about collaboration and communication, between users and between services. This can be achieved, by giving developers the ability to create mashups, through the Open Platform principle, for example by using Open APIs (as described in Web 2.0 Technologies). Additionally, users are meeting, are interacting and communicating in online communities [11]. Within these communities there is user contributions which add value to these services or to the organizations that have created the service.

- Collective Intelligence

When talking about Social Computing and Unbounded Collaboration of users, then we also have to take into consideration the knowledge, which is created by these communities, whether they work in groups or individually.

Trust amongst users is the major issues of this principle, since this decentralization of the web suffers from lack of control. Web services that want to harness the vast amounts of information generated by all these users, it is important attract as many as possible to contribute, since the 1% rule applies in these communities.

- Network Effects

This principle describes the interaction between users and services, but this relation works both ways; users contribute to make services richer in content, by sharing their knowledge and services attract users, by offering more options and by adjusting their content to every user's preferences and history.

Due to the limited number of users spending time and effort contributing to an application, attracting users is an ongoing race, where the rule of first-mover-wins does not apply, since we constantly encounter new services that make competition harder.

- User Generated Content

Social Computing contains all of the previously mentioned principles and technologies, but in its core, data is the main driver of social computing and the owner of the data is key. Managing all this data is a difficult task, since there are many issues regarding this matter; authorship, privacy and security. The usage of content and protection by service providers is a major issue thereby influencing how popular a service is.

Mapping of both Web 2.0 and Social Computing Technologies

Platform									
Technologically Oriented	Socially Oriented								
Technologies	Open Platform	Lightweight Models	Enabling Services	Intuitive Usability	Long Tail	Unbounded Collaboration	Collective Intelligence	Network Effects	User Generated Content
AJAX	■	■	■	■					
SOAP & REST	■	■		■					
Open API & Mashups	■		■		■	■			■
Flash, AIR, Sliverlight				■		■		■	
RSS, Micromats				■				■	■

Figure 4: Mapping of Technologies

Conclusion

The role that web2.0 and social computing plays in the learning communities is enormous and this is expected to rise exponentially. The rise is even more felt in developing countries where access to the internet represents easy access to a large repository of information and knowledge.

Learning becomes more interesting and efficient with web 2.0 features and tools. The use of social computing for learning purpose will continue to increase, especially when we know how 'connected' our youngsters are. Another major topic of discussion is Semantics, since many analysts and scientists mention another web (web 3.0), called the Semantic Web. This would represent some virtual blending of online and offline worlds. It might be that your computer remembers your tastes, interests and styles, so that your browser becomes like a personal assistant when you look or search for learning materials. This whole notion of personalization that web 3.0 will bring arouses tremendous excitement in the learning communities.

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