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| **WEB 2.0: AN INTRODUCTION**  "Web 2.0" refers to the use of the Internet for interpersonal content sharing and online service delivery. Whereas the unnamed "Web 1.0" that came before it was largely concerned with creating and viewing online content (reflected in the browser wars and in a proliferation of websites that few people ever visited), the Web 2.0 concept highlights services that allow people to find and manipulate content, coupled with those that enable all types of media and services to be published and inter-linked (or "mashed") in places that lots of people actually know about. Key players in the emerging Web 2.0 marketplace therefore include [Google](http://www.google.com/), [YouTube](http://www.youtube.com/), [MySpace](http://www.myspace.com/) and [Wikipedia](http://en.wikipedia.org/).  The following provides a fairly comprehensive and integrated overview of the rapidly evolving and largely borderless Web 2.0 concept, as well as the new and broader idea of [Web Squared](http://explainingcomputers.com/web2.html#squared).  **THE KEY ASPECTS OF WEB 2.0**  Some people dismiss "Web 2.0" as a piece of marketing hype intended to try and stoke a second Dot Com boom. However, the more you think about and investigate the involved ideas -- and in particular the more leading Web 2.0 pioneers launch new web-based services that fit under the Web 2.0 banner -- the more convincing the argument for taking Web 2.0 very seriously becomes. Indeed, what has to be appreciated from the start is that Web 2.0 involves the acceptance of a paradigm shift.  At a conceptual level, Web 2.0 is concerned with establishing and maintaining more fluid, more flexible and richer online connections between people, services and/or information. Specifically, such improved connections may be created and maintained between two or more people, between two or more computers and organizations that provide online services, or between individuals and the digital content they create, manipulate and store. Isolating these three possible categories of Web 2.0 connection quickly enables us to define the three key aspects of Web 2.0 as comprising:   * **Interpersonal computing** -- involving person-to-person interactions facilitated via websites that enable collaborative content creation, sharing and manipulation. * **Web services** -- involving application-to-application (and hence organization-to-organization) data and service exchanges facilitated by automated connections between web servers and other Internet technology. * **Software as a service (SaaS)** -- involving human interactions with digital content facilitated by applications delivered over the web and that free the user from locally installed software.   The following sections explain these three key aspects of Web 2.0 in more detail.  **WEB 2.0 AND INTERPERSONAL COMPUTING**  The personal computing revolution of the early 1980s and onwards primarily involved individuals working in isolation on their own PC. Key personal computing applications were hence activities such as word processing, creating spreadsheets or graphics, and playing stand-alone games. In contrast, "interpersonal computing”- focuses on the use of computers to link people to each other and hence to facilitate richer forms of digital human interaction. Interpersonal computing has existed ever since computer networking was developed. However, it is only with the fairly recent developments of Web 2.0 that interpersonal computing has really come of age.  The easiest way to start to understand both interpersonal computing and hence the first key aspect of Web 2.0 is to gain some knowledge of those specific online developments that most commentators accept as characteristic of these phenomenon.  The interpersonal computing aspects of Web 2.0 are most commonly associated with the development of wikis, blogs, social networking sites, and viral video sites. **Wikis** are websites that allow visitors to easily add, remove and edit content, hence enabling the collaborative authorship of comprehensive documents (as opposed to single-authored information resources that usually languish all alone on the web). The best example of a wiki is the multi-lingual, web-based encyclopedia [Wikipedia](http://en.wikipedia.org/), and which currently includes over two million articles.  A **blog** -- or "web log" -- is a chronological, journal-style website which its author (or "blogger") maintains like an online diary. There are now a whole host of websites that enable anybody to start their own blog, such as [Blogger](http://www.blogger.com/) Interest is now also growing in "microblogging", as available on [Twitter](http://twitter.com/), and which is based on blog entries no more than 140 characters in length, and which can be access from both the web and a mobile phone. There is even a special blog search engine called [Technorati](http://www.technorati.com/), and which currently tracks over 100 million blogs.  **Social networking sites** (SNS) enable people to build social networks online. Groups established within such communities are usually fostered around existing friendships, interests, teams and activities, and facilitated by online tools for sending individual messages, file sharing (particularly photo sharing), discussion forums, and online chat. The most popular social networking sites are [MySpace](http://www.myspace.com/), [Facebook](http://www.facebook.com/) and [Bebo](http://www.bebo.com/).  Related to social networking is **social bookmarking**. This is offered by sites including [del.icio.us](http://del.icio.us/), [Reddit](http://reddit.com/), [Digg](http://digg.com/), [Facebook](http://www.facebook.com/), [StumbleUpon](http://www.stumbleupon.com/) and [Kaboodle](http://www.kaboodle.com/), and allows people to save links to web pages that they want to remember and to share, and with tags and a variety of other tools being available for bookmark organization.  Social networking sites are the successful offspring of earlier attempts by many companies in the 1990s to create online virtual communities (VCs) -- a concept first coined and popularized by legendary cyber pioneer [Howard Rheingold](http://www.rheingold.com/) in his now freely available book [The Virtual Community](http://www.rheingold.com/vc/book/).  Finally, **viral video sites** are websites that allow anybody to post videos online. While it is now not difficult to put a video on any website, the significance of viral video sites is that they provide somewhere to put videos where it is likely that at least some other people will actually find them. In a sense, viral video sites hence act as "everybody's broadcaster" or "everybody's distributor" in a world in which everybody is already a potential film maker and publisher. The giant of viral video sites is [YouTube](http://www.youtube.com/), although there are now some very interesting competitor sites, such as [Kaltura](http://www.kaltura.com/), where users can "create together" video and other online media projects.  What all true interpersonal computing websites have in common is that they involve all visitors in actually or potentially transforming the experience of many or all other visitors. This concept is often greatly misunderstood in that it does not imply that all or even the majority of visitors will explicitly author new "top level" content -- such as writing a blog or uploading a photo or video -- and which remains an online activity still only undertaken by a minority. However, successful Web 2.0 sites nevertheless turn as many visitors as possible into valuable **content shapers**.  To illustrate this concept, every visitor to [YouTube](http://www.youtube.com/) shapes the site's content each time they watch a video. This is because by watching a video they increase its number of recorded "views". Even more importantly, once they watch more than one video each visitor also contributes to the web of connections that builds up between videos, and which in turn helps to generate each video's "related videos" list, not to mention the lists of the most popular videos. On [YouTube](http://www.youtube.com/) everybody is therefore almost inevitably a content shaper, and this is before we even start to consider the actions of those visitors who actually log-in and rate videos, comment on them, or save "favorites" to their own channel -- let alone those proactive individuals who actually upload new video content.  **THE RISE OF WEB SERVICES**  The public face of Web 2.0 may very much be focused on those websites like [MySpace](http://www.myspace.com/) and [YouTube](http://www.youtube.com/) that facilitate free interpersonal content sharing. However, at least as important in terms of the business implications of Web 2.0 is the second key aspect of web services. In essence, whilst interpersonal computing is concerned with improving the scope and quality of the interconnections that may exist between two or more people, web services enable improvements in the scope and quality of interconnections that may exist between two or more different web resources, and hence between those organizations that deliver them.  Web services can most simply be thought of as components of online functionality that can be plugged together -- or "mashed" -- like a kind of digital Lego. So, to take a practical example, if an organization needs to take credit card payments online, it can either set up its own merchant bank account, or -- more sensibly -- integrate the web service of a payment service provider (PSP) like [Worldpay](http://www.worldpay.com/), [Netbanx](http://www.netbanx.com/) or [Paypal](http://www.paypal.com/) into its site. Visitors will make their purchase from the company's own website, but will then be transported to the PSP's website to where they will enter their credit card details and payment will be arranged. All of this will happen automatically, with two organizations having their offering electronically integrated online.  As another example, and like many property websites [HousingMaps](http://www.housingmaps.com) integrates a web service into its online offering to provide a map and local information for every property for sale or rent. It uses GoogleMaps to provide the mapping information. Most visitors to [HousingMaps](http://www.housingmaps.com) may be oblivious to the fact that the information they view is sourced from multiple services. However, this absolutely transparent integration of computer-to-computer and hence organization-to-organization interactions online is what web services are all about.  Other examples of web services include [Google Analytics](http://www.google.com/analytics/) -- which can be easily be "plugged" into any website to enable traffic analysis -- as well as [Google Checkout](http://checkout.google.com/). The latter not only handles online payments, but also provides shopping cart facilities for larger retailers, as well as simple "Buy Now buttons" that can be used by smaller websites wanting to offer a few items for sale without the hassle of setting up their own e-commerce facility.  To make use of the above and other web services, so called **mashups** are created by embedding a piece of code from a web service provider into the page of the website accessing the service. Such code may be as simple as, say, a [YouTube](http://www.youtube.com/) video embed link, through to a more complex piece of code written in the application programming interface (API) of the web service provider. A list of over 500 websites with publically available web service APIs can be found at [programmableweb.com/apis](http://www.programmableweb.com/apis). While creating mashups is potentially complex, there are already an increasing range of free tools available to assist with the process. These include [Yahoo! Pipes](http://pipes.yahoo.com/) and Intel's [Mash Maker](http://mashmaker.intel.com/). There are also now sites that bring together a great many web services "gadgets" in one place, such as the excellent [Google Gadgets](http://www.google.com/webmasters/gadgets/) where any web developed can showcase and sell their mashable wares. Indeed, build a site (for free) with [Google Sites](http://sites.google.com/) and incorporating most [Google Gadgets](http://www.google.com/webmasters/gadgets/) fairly easy.  In a business context, web services are frequently linked to the broader concept of developing a **service-orientated architecture** (SOA) whereby business activities are broken down into distinct processes that can then be delivered via a mashup of web services purchased from several organizations and subsequently inter-linked online. The business activity of selling something to a customer, for example, can be broken down into the processes of taking their order, taking their money, and providing them with the goods concerned. As already discussed, a company's own website could be used to take customer order details, with the services of a payment service provider inter-linked to process credit card payments, and a shipping company (such as [Federal Express](http://www.fedex.com/)) also inter-linked via web services to facilitate both the delivery of goods and online delivery tracking.  A business selling goods to a customer via the above online arrangement (which offers the customer a seamless service from three distinct companies inter-linked via web services) is often described as **loosely coupled**. This is because the specific services used within their overall business process could easily be removed and replaced with those offered by other providers. The company could, for example, relatively easily switch from one payment service provider or shipping company to another due the flexibility inherent in coupling computer systems and hence organizations together via Internet technology.  **SOFTWARE AS A SERVICE (SaaS)**  The final key aspect of web 2.0 is software as a service or "SaaS". This broadly encompasses the delivery of software application functionality directly via the web. Some commentators choose to classify SaaS as one element of web services, which to an extent is reasonable given that both web services and SaaS involve online service delivery. However, in all but the most basic analysis of Web 2.0 it is more sensible to separate SaaS from web services. This is because SaaS involves services that provide new means for human beings to create, access and manipulate digital content, in contrast to web services, which facilitate automated data exchanges between organizations and their online systems. Thus, SaaS offers online services to people, whereas web services offer online functionality to computers and organizations.  The mainstream adoption of SaaS will potentially offer a great many benefits, not least including being able to access both our software and our data from any web-enabled computing device. What Bill Gates has termed the coming online software "services wave" will also significantly impact on the computer software industry.  For over 25 years, personal computer users have had no option but to purchase software functionality in discrete and often expensive applications packages that have taken little or no account of their individual requirements. A home user wanting to write a few letters, for example, has had to purchase the same office software as a large multinational. SaaS changes this in that users will increasingly only have to access (rather than purchase and install) the specific software functionality they require. The pricing model will as a result fundamentally change, with many users likely to obtain basic services for free, while larger concerns will pay for more advanced SaaS applications, as well as application customization, integration and support.  Conceptually, SaaS development may also lead to a blurring in the divide between software and the data that software is used to manipulate. Before Web 2.0, common practice was to exchange data -- such as photographs or Word documents -- by e-mail attachment, with an assumption being made that the recipient would have purchased and installed appropriate software to access such attachments on whatever computing device they happened to be using. When it comes to exchanging photos and video, already this has largely changed, with the norm having become the exchange of a link to a website where the file can be viewed. As SaaS office and business applications become more commonplace, so many people will similarly cease to exchange office document attachments in favor of exchanging links to data that can be both viewed and manipulated in a SaaS application (such as [Google Docs](http://docs.google.com/)). Software will thereby become "transparent". Indeed, in three-to-five years, to send somebody a file that they require appropriate software to open will for the most part be unthinkable.  SaaS offerings are frequently associated with another Web 2.0 term known as **Rich Internet Applications** (RIAs). RIAs are defined as offering far more functionality than traditional web pages, with all of the SaaS examples listed above also being classifiable as RIAs.  SaaS/RIA developments depend on the use of new and more complex Internet programming technologies than the hypertext mark-up language (HTML) in which web pages have traditionally been written. At present, Adobe's **Flash** technology has become pretty much a standard, and hence the basis for many Web 2.0 offerings. However, Microsoft is keen to promote its own competitor to Flash known as **Sliverlight**, and which at present has not been installed as a browser plug-in by many Internet users. A standards war is therefore now starting to be played out between Adobe with its established Flash technology and an associated set of RIA development tools called Flex and Adobe Integrated Runtime (AIR) on the one side, and Microsoft with Silverlight and an associated RIA development platform called Windows Presentation Foundation (WPF) on the other.  **CORE WEB 2.0 PRINCIPLES**  As the above discussion of interpersonal computing, web services and SaaS hopefully highlights, Web 2.0 developments present both individuals and organizations with many new business and computing paradigms that challenge current norms. [Tim O'Reilly](http://www.oreillynet.com/pub/au/27) first coined the term "Web 2.0" in 2004.  O'Reilly suggests that the "gravitational core" of Web 2.0 is encapsulated via the following seven principles:   * **The web as a platform** (which not least highlights the move away from a Microsoft dominated desktop to a new world of web-based online application functionality and integrated web services). * **Harnessing collective intelligence** (which signals an embracing of user input to aggregate more and better content via social networking sites, wikis, blogs and viral video, and crowdsourcing. * **Data as the next Intel inside** (which suggests that value will increasingly become associated with data and its management, as opposed to software development and dedicated infrastructure provision). * **The end of the software release cycle** (which will be as a consequence of continually updated SaaS applications accessed online as the new software industry model). * **Lightweight programming models** (which relates to the increased use of more open and more flexible online programming tools and languages in systems development). * **Software above the level of a single device** (which refers to a world in which all data, web services and SaaS applications will become accessible from any desktop or mobile computing device that has wired or wireless Internet access). * **Rich user experiences** (which reflect the increasing trend for audio, video and interactive online content).   Perhaps the most significant concept to note is the emergence of the web as the world's dominant computing platform. Whereas in the Web 1.0 era, companies (such as [Netscape](http://www.netscape.com/) and even [Microsoft](http://www.microsoft.com/)) competed to get people to download and install their software, so key Web 2.0 players (like [Google](http://www.google.com/)) simply want users to access their services. Indeed, the range of new web services and SaaS applications that [Google](http://www.google.com/) has on offer -- ranging from [maps](http://maps.google.co.uk/maps) to [Google Earth](http://earth.google.com) satellite imagery, to [Google Docs](http://docs.google.com/), to [Google Analytics](http://www.google.com/analytics), to [Google Checkout](http://checkout.google.com/), to [language translation](http://www.google.com/translate_t), to [e-mail alerts](http://www.google.co.uk/alerts) is quite simply staggering.  Today users of Web 2.0 services are being invited to run [software](http://explainingcomputers.com/software.html) on the [hardware](http://explainingcomputers.com/hardware.html) of the [Internet](http://explainingcomputers.com/internet.html), not to install and run it on the [hardware](http://explainingcomputers.com/hardware.html) of their individual desktop or [mobile device](http://explainingcomputers.com/mobile.html). Users access just the functionality they require when they require it, rather than purchasing and installing applications overloaded with costly functionality that most will never actually use.  O'Reilly's second principle of "harnessing of collective intelligence" is also highly of note. It refers to Web 2.0 developments that enable everybody both to find and to publish content in a public space, and which through such interactive activity embed knowledge of value to others. One key way in which such a "wisdom of crowds" develops is via the use of **collaborative tagging** (also known as folksonomy) to categorize content -- and where tags are user selected keywords applied to files that then enable both the user and others to locate content of relevance to them. **Crowdsourcin**g is also another means by which the wisdom of crowds is captured and spread..  With Web 2.0 there is an evolution away from personal and organizational computing, and towards interpersonal and interorganizational computing and a future computing industry in which neither [hardware](http://explainingcomputers.com/hardware.html) or [software](http://explainingcomputers.com/software.html) companies have the market power they once did (and arguably just about still have). Web 2.0 in this context is just another development in the ever-increasing transparency of computing as both a business and a human activity.  **FROM WEB 2.0 TO WEB SQUARED**  The term "Web 2.0" was first used five years ago. That's simply an age in computing, and hence it's not unreasonable to ask "so what comes next?" For some time there has been discussion of "Web 3.0" to signify the emergence of an artificially intelligent "semantic web", or perhaps a 3D web accessed in virtual reality. However, in June 2009 Tim O'Reilly and John Battelle went far further by [introducing the concept of "Web Squared"](http://www.web2summit.com/web2009). This is described in their excellent white paper [Web Squared: Web 2.0 Five Years On](http://assets.en.oreilly.com/1/event/28/web2009_websquared-whitepaper.pdf).  In essence, Web Squared links the collaborative power of social networking to the "Internet of Things", as well as applying Web 2.0 thinking beyond the computer industry. While Web 2.0 is solely about using the [Internet](http://explainingcomputers.com/internet.html) as a platform for establishing new types of connection and facilitating collective intelligence, Web Squared builds on this foundation in two important respects.  First, the "squared" part of Web Squared signals the way web activity will grow exponentially as more and more objects get online. This will result in Web 2.0 applications being fed data not just by human beings typing on keyboards, but also by cameras and other types of sensor.  Some objects will get online directly via embedded technology such as RFID tags or Bluetooth or WiFi network links. However, the growth of the Internet of Things will also be driven by technologies that will recognize objects and link data to them. As vision and voice recognition technologies improve, in time this means that almost every camera, microphone, scanner, GPS locator and other form of sensor may potentially start to directly feed the web with data on the objects within its range. If the resultant "data shadows" are then collaboratively and openly shared a whole host of new opportunities will emerge. For example, Sat Nav systems will be able to direct us not just using an internal map, but also data on the location and predicted intent of every other vehicle on the road.  A collaborative Internet of Things is already starting to happen. For example first-generation augmented reality browsers such as [Layar](http://www.layar.com/) and [Wikitude](http://www.wikitude.org/) are already overlaying information about the places or objects viewed on the video feed from a mobile phone camera. Google has also just heralded the new era of [voice and sight search](http://googlemobile.blogspot.com/2009/12/mobile-search-for-new-era-voice.html) with its beta release of [Google Goggles](http://www.google.com/mobile/goggles/) for android mobile phones.  The second and even more fundamental aspect of Web Squared signals the application of Internet thinking beyond computing. The idea is that the openness, transparency and many-to-many collaboration of Web 2.0 will have a powerful role to play in addressing global problems such as [Peak Oil](http://www.explainingthefuture.com/challenges.html#peakoil) and [climate change](http://www.explainingthefuture.com/challenges.html#climate).  In this broader context, the Web Squared trend highlights how the world and the world-wide web are converging, with our conceptual focus shifting from the new forms of connection facilitated by Web 2.0, to the single entity created as all Internet users and computers become the interconnected cells of a global, cybernetic creature.  **WEB 2.0: SUMMARY**  Any reasonable understanding of where computing is today, let alone where computing is going in the near future, has to involve a solid appreciation of Web 2.0 and the emerging concept of [Web Squared](http://explainingcomputers.com/web2.html#squared). For example, the rise of [SaaS](http://explainingcomputers.com/web2.html#saas) may significantly diminish the purchase of packaged [software](http://explainingcomputers.com/software.html) and the need for individual [storage](http://explainingcomputers.com/storage.html), as well as driving the wider adoption of desktop and [mobile](http://explainingcomputers.com/mobile.html) thin-client [hardware](http://explainingcomputers.com/hardware.html) (hence increasing further the significance of computer [networking](http://explainingcomputers.com/networking.html) and our reliance on the [Internet](http://explainingcomputers.com/internet.html)), and resulting in more power-friendly, [greener computing](http://explainingcomputers.com/green.html).  Because Web 2.0 is making it more obvious that all that really matters are the services and information that computer technology now near-effortlessly facilitates access to, both individuals and companies will increasingly not be paying for complex devices and applications that they don't understand and really don't need to understand. Web 2.0 matters increasingly to business because where the value is created is starting to be challenged and changed. It is therefore perhaps not surprising that *Business Week* has claimed that [Web 2.0 Has Corporate America Spinning](http://www.businessweek.com/technology/content/jun2006/tc20060605_424102.htm). |