Term Paper

Implementations of the Web 2.0 phenomenon and its technologies for science outreach and communication in the research network

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1. Abstract:

A collection of methods and application design ideas for customizing the web are part of the Web 2.0 movement. Because it refers to a group of web-based apps that have been found to have specific design patterns, it differs from traditional web technologies. The phrase is now used to refer to a variety of web-based applications, including mashups, blogs, wikis, feeds, tagging systems, user created publication systems, and social networking tools. In order to cater to various user groups, the study briefly highlights some applications of these emerging developments in science outreach and information sectors. Such apps' web-based design places some restrictions on the underlying network architecture and inexorably raises security issues.

2. Introduction:

Web 2.0 is a word that is frequently used nowadays to describe a user-centric, participatory, read/write web. Both content creators and users increasingly see the web in a more dynamic way. As the popularity of Web 2.0-based social programs like MySpace and YouTube have amply proved, the emphasis is on promoting social interaction amongst peers and engaging users more effectively.

However, Web 2.0 is a use approach as well as a technological paradigm that suggests societal and commercial tendencies. It consists of a variety of web technologies, interactive web application methodologies, and services that when used to enhance websites. The information, education, and outreach team of the Italian National Institute of Astrophysics (INAF, http://www.inaf.it) has adopted the new approach to the web that this vision delivers.

The goal of this group's use of online technology has always been to reach as many individuals as possible while promoting astrophysical sciences. The group's target audience is diverse, but we may classify it into three groups: institute researchers, students of various ages, and the general public. Each category has unique requirements, which may call for a distinct strategy while using Web 2.0 technologies. For instance, researchers must be informed about significant news about both the Institute and astrophysics. Students might be encouraged to pursue this subject using cutting-edge methods that closely match their customary attitudes and behaviors. Others need a professional perspective and a more straightforward language to comprehend the significance of this knowledge.

The report quickly explains three potential approaches—strongly based on the Web 2.0 vision of a participatory web—and how the group implemented them considering these different user types. The effectiveness of these solutions significantly depends on the underlying network, which should offer great reliability, capacity, and performance given the trend towards online apps rather than

desktop applications. On the other hand, frequent usage of the internet and these similar participatory characteristics results in significant security issues that must be taken into consideration while creating and utilizing programs.

3. Web 2.0 technology and its methods:

We concentrate on specific applications of phenomena like web syndication using feeds and podcasting among the several online technologies referred to as "Web 2.0." Web 2.0 is primarily employed in social apps, although its ideas and technology can also be applied to enhance web applications' responsiveness. Podcasting and similar syndication formats, as well as RSS, are effective means of delivering content to users. Additionally, we talk about our experience with mobile technology, which is directly associated with the Web 2.0 movement.

A logical extension of participation, mobile devices and wireless networks enable people to use the tools and keep informed wherever they are. The solutions put in place are specifically designed for the three user types we typically work with: researchers, students, and the general public.

3.1 Syndication and Web feeds:

Web feeds are frequently utilized as a convenient method of disseminating information online and providing viewers with real-time news. In this example, we use syndication tools to update academics on significant news involving the Institute and the astronomy community. The INAF Institute is made up of a number of distinct organizations, each with its own website, including observatories, research institutes, and facilities. In order to serve as an aggregation point, a new Institute website has been created using a content management system. It offers a number of feeds for news, press releases, and the most recent updates, but researchers rarely use it. Many of them don't regularly visit the Institute website, and neither do they use aggregators or feed readers via client software or online resources.

Therefore, the challenge was to devise a practical method of automatically providing researchers with information. The use of syndication technique has been put into practice by information providers who create feeds by compiling content from many sources, and by information consumers who see the feeds on the regional home pages of each institution's websites.

The approach involved gathering content from the Institute website and other sources, structuring it into an aggregate feed using the standard feed representation format, and producing a "package" that could be integrated into each local website to display the feed (Figure 1).

Figure 1. RSS/Atom feed renders on a web page

There are various definitions and standards that describe the collection of news items into a distinct feed file, necessitating the need for various feed formats. All of them are XML-based, but only the Atom IETF syndication standard (http://tools.ietf.org/html/rfc4287) and the RSS specifications in their two distinct and non-compliant versions (RDF Site Summary 1.0, http://web.resource.org/rss/1.0/, and Really Simple Syndication 2.0, http://www.rssboard.org/rss-specification) use their own set of tags to describe.

However, many applications use a third format (like JavaScript object notation, or JSON, http://www.json.org) to represent feed content in order to provide a better process for visualizing it. Aggregators, i.e., client software like Feedreader, http://www.feedreader.com/ or browser plug-in, can typically deal with both formats. To provide greater usability by all programs, we decided to create feeds in both the RSS and Atom formats.

Feed visualization has been accomplished using either client-side or server-side technology. In the first method, the server parses the feed using a particular PHP application before presenting it using Ajax technologies. In the second method, the Google Ajax feed API (http://code.google.com/apis/ajaxfeeds/), which is accessible from Google, has been used only for parsing and rendering the feed. Feeds are displayed in this fashion on each home page, even though the final presentation could be customized by modifying style sheets included in the scripts package supplied to each webmaster. The compatibility with web standards like XHTML, CSS, JavaScript, and the DOM model is the foundation of Ajax technologies' strength.

3.2 Podcasting for Urania:

Beginning in 2002, the Urania project (http://www.cieloblu.it) published a weekly astronomy and astrophysics web news bulletin in HTML and streaming (using Real/Helix technology) (Figure 2). It was necessary to gradually switch to other formats, such mp3, in order to solve network issues brought on by streaming and constrained bandwidth as well as to create an audio version that was simpler to distribute and administer. The streaming version has been neglected as a result of the initiative's success and the potential of an "anyway" hearing being more popular with consumers.

Additionally, the availability of podcasts has made it possible for a variety of traditional and online radio stations to broadcast news on a weekly basis, reaching a large audience and enabling widespread distribution of such products. Currently, there are more than 80 radio networks broadcasting Urania. The story is chosen not just for "popularity," but also for its scientific importance. We also created a richer audio/video bulletin in the last year using Adobe Flash technology.

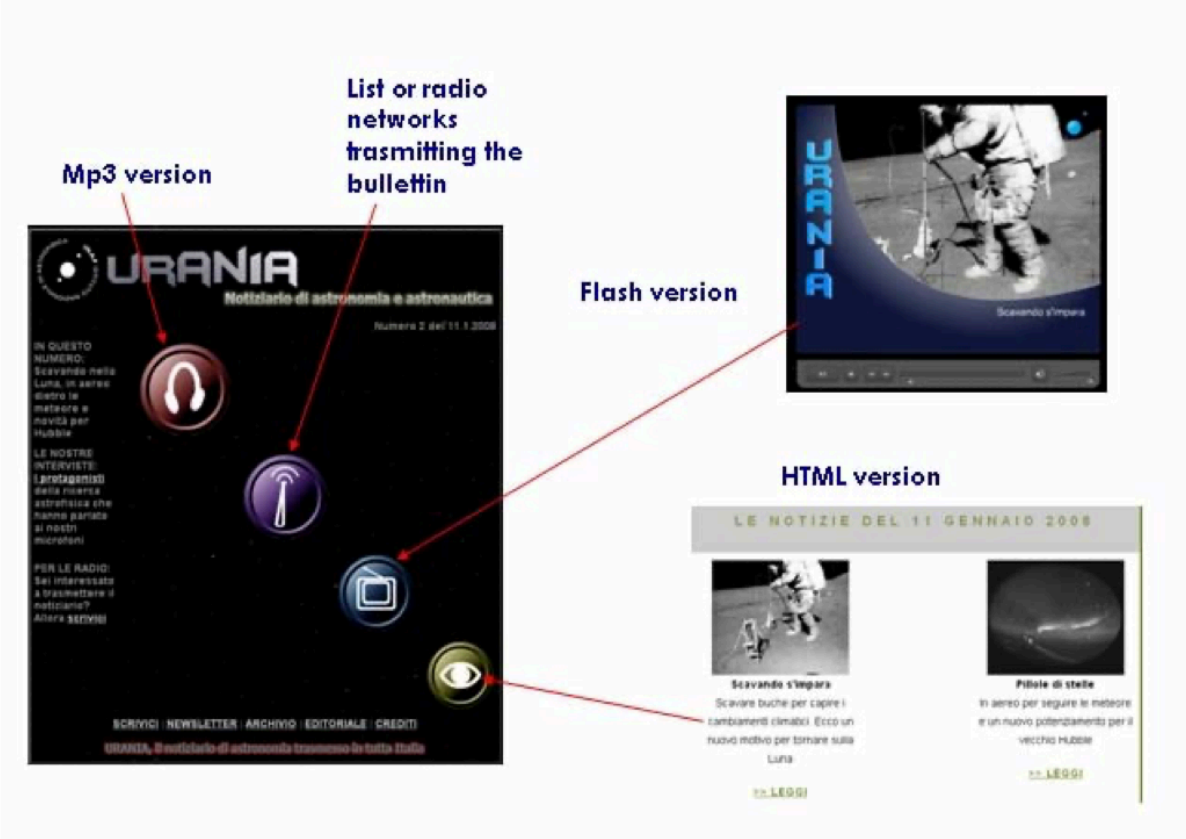

Figure 2. Urania website and the several formats of the bulletin

The fact that it is available in a variety of media has ensured both its success and a wider distribution. Podcasting and video formats are excellent for introducing young people to science and fostering their interest in the subject. For instance, specialist social networking specialized video sites like YouTube regularly upload content in the Flash format. This facilitates communication with many users who provide comments on the news you just heard.

3.3 Web 2.0 and mobile: the Virtual Planetarium on mobile phones:

Mobility and mobile technologies may be thought of as ways to enhance involvement. Many people own a cell phone, particularly in Italy. In addition to their core function of phone communication, these devices now contain other features including an Internet connection. Cameras, wireless networking (Bluetooth or Wi-Fi), text and video messaging, and other functions are increasingly becoming standard on new gadgets [11]. Since web connectivity is on the rise, most of them have a browser. Therefore, while creating material that should be accessible to a wide audience, this type of device, which differs greatly from a desktop computer in terms of hardware and software limits, must be considered.

Our mobile strategy was developed in response to the success of the "Learning from Starlight" project, which won the HP Philanthropy and Education grant in 2004. Through this project, students of various ages were able to experience what it's like to take an astrophysics class online while using mobile devices and wireless network connections. The results of this project experience have demonstrated how mobility and the mobile world may enable students to approach science wherever they are and whenever they choose, using tools that are suitable for their lifestyle.

In that project, we primarily employed an iPAQ PDA and an HP tablet PC, both of which have Bluetooth and Wi-Fi connectivity. However, we observed that the use of PDAs, which are like cell phones, was quite successful and that students utilized these tools to follow classes and instructional content. From this angle, the research of adapting educational initiatives and tools for a mobile environment is once again in the spotlight. Due to the limitations imposed by varied processing and memory capacity, a restricted battery, screen size, and resolution, this entails the production of customized content for mobile use and thus incorporates two factors.

The mobile Internet, which entails using a mobile device and a mobile connection to browse the Internet, allows access to content. To meet the limited features of the gadgets, educational content must be adjusted accordingly. This, for instance, entails using web mobile standards for both the structuring and presentation of HTML pages that offer content. The Worldwide Online Consortium, W3C (http://www.w3.org), has a special group, the Mobile Web Initiative (MWI), to investigate ways to make web browsing from mobile devices a reality. The Open Mobile Alliance, OMA provides technical specifications and standards for the mobile world. It considers, among other things, the development of a language for building web pages that is independent of any device.

However, now, even with standards, it is quite challenging to obtain the same results on all devices, as each vendor's devices have very diverse hardware and software functionalities. However, material could be created as a mobile web application utilizing a particular framework, such as the Java Mobile Edition (J2ME) language. This firstly means that the Java language's underlying

operating system must be supported. Even if the application doesn't require an Internet connection to use, it should nonetheless be locally downloadable and require enough memory. In actuality, the biggest barrier to the broad usage of the mobile world up until now has been the Internet connection.

As a result of the high cost of alternative connections, only students with Bluetooth or Wi-Fi access are now able to utilize such programs. Even though 3G devices are widely available, the use of mobile phones is restricted to chatting and music downloads due to the high cost of the connection. Additionally, only a small number of cell phones—usually the priciest ones, such smartphones—have built-in Wi-Fi connectivity. The Virtual Planetarium, an interactive online astronomy course that is available in both Italian and English, is being ported to a mobile platform as part of a pilot project since that is our goal—using mobile devices for educational and outreach purposes.

The original version of this course was created in 1998 using CGI server-side technologies and C language applications. Then it was rewritten utilizing JavaScript technology and a client-side approach. Now, similar materials could be applied to create a more recent application designed especially for mobile devices. A version of the course that could be delivered through a mobile web browser by complying with the XHTML-MP standard and a version that could be deployed as a mobile web application by using a J2ME midlet to be locally executed are the two formats that will result from the new design, reflecting the two perspectives on mobile web development. Figure 3 displays a preliminary illustration of the XHTML-MP-based web mobile version.

Figure 3. The XHTML-MP version of the Virtual Planetarium, as seen in a browser device (through an emulator)

The entire application needs to be rewritten to ensure standards compliance, adhering for instance to the ECMAScript specification (http://www.ecmascript.org) of the JavaScript language and to the fundamental web languages such as XHTM, CSS, and XML, as well as to enable processing of multiple questions. The design stage is now underway for the second strategy, in which the course will be created as a J2ME application.

4. Implications of the Web 2.0 approach and further development:

In order to enable genuine participation, Web 2.0 sites heavily rely on a network infrastructure that must be effective and function efficiently.

Apps are moving from the desktop to the web even if they still have the interactive characteristics of desktop applications because the web is where a lot of work is done. These network activities as a whole demand even more bandwidth.

It is necessary to consider online internet infrastructure, protocol standards, and software engineering techniques while creating web applications based on browser technology. Additionally, in the world of mobile devices, connectivity bandwidth and speed are crucial in relation to features like memory and computing power. Another problem is the connection's price.

Additionally, frequent web usage poses security risks. Because they are more participatory than standard websites, web 2.0 sites naturally include higher risks. Malicious or undesirable code may be uploaded by users, downloaded by clients, and then uploaded to the server. For instance, syndication systems deliver the code right to the browser, putting the client at risk of receiving harmful content.

However, the majority of interaction is implemented using the JavaScript programming language, which is restricted in many browsers since it is thought to be inherently harmful. Security is a hot topic right now, especially as it relates to Ajax-based apps. Thus, even though user participation in science education, outreach, and information is a successful strategy for educating a broad audience and advancing scientific literacy, its successful implementation presents challenges for developers as well as system and network administrators who must take security risks into account. Following the broad adoption of Web 2.0 tools and services, these technologies should be used in both educational and commercial settings in order to reach and engage the largest possible audience.