

Internet Application Technologies in Web 2.0 Era

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Abstract:

The Internet has stepped into Web 2.0 era. Web 2.0 application technologies and services are rapidly developing, accompanied by the innovation and revolution of business models. This article analyzes the development of Web 2.0 technologies and their promotion role in the development of Internet services, discusses the implementation of Web 2.0 core concepts (including user participation, resource sharing and platform) by the multiple Internet application technologies, and gives the development trends of Internet application technologies.

The development of Internet application technologies has promoted Internet's capability of service implementation, expanded service provisioning modes, and enriched service forms and types. It has been one of the important driving forces for the abundance and development of Internet applications and for the popularity of Internet services. In the era of Web 2.0, Internet technologies can be classified into resource sharing and multiplexing technology, user participation and collaboration technology, and user experience improvement technology. These three types of technology have not only inherited the Web 1.0 technologies, such as Extensible Markup Language (XML), but also achieved outstanding innovation and development in the past few years, with a large amount of new emerging technologies like Widget and Mashup.

These new technologies give the Internet multiple capabilities of reuse, multiplexing, once refresh, application and data sharing, and syndication, forming a technical implementation platform for Web 2.0 applications. With them, the Internet services and applications are entering into the Web 2.0 era with wide user participation,

good user experience and syndication of information and applications.

1 Architecture for Web 2.0 Application Technologies

The concept of Web 2.0 was first proposed with a conference brainstorming session between O'Reilly and MediaLive International. Since then the term "Web 2.0" has been used extensively. It can say that the concept proposal has initiated a new Internet era, which is involved with Web 2.0 application technologies, Web 2.0 service applications and Web 2.0 application models. With the development of Web 2.0 application technologies, the Internet has improved its service provisioning capability to some extent, and more diversified Internet applications are emerging.

The Web 2.0 application technology architecture, an organic set of various application technologies, is the fundament for Internet service implementation. It fulfills the core philosophy of Web 2.0. Centralized on resource sharing, syndication and multiplexing, the system has continuous innovation and development, pays special attention to user participation and collaboration and good user experience,

and promotes the extensive use of Internet applications. The system embraces the openness of the Internet, gradually forming an open Internet technology platform.

According to service provisioning capability of the Internet, Web 2.0 application technologies can be divided into three types, as shown in Figure 1.

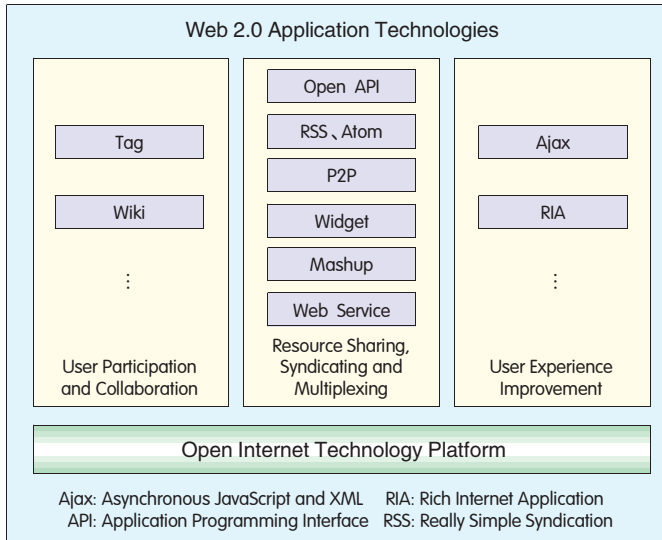
(1) Technologies for Resource Sharing, Syndicating and Multiplexing

Focusing on technology multiplexing and openness, this technology type plays a key role in the Web 2.0 application technology architecture. Plenty of technologies based on the openness and sharing concept of Web 2.0 have been emerging, including such multiplexing technologies as Open Application Programming Interface (API), Mashup and Web Service, such syndication technologies as Really Simple Syndication (RSS) and Atom, and such sharing technologies as Widget and Peer-to-Peer (P2P).

(2) Technologies for User Participation and Collaboration

These technologies, such as Tag and Wiki, aim to improve user participation, and facilitate users' content creation and collaboration between users.

(3) Technologies for User Experience Improvement



◀ Figure 1.
Web 2.0 application
technology system.

This type focuses on interaction, and has a goal of improving all-around experience at the Web client end. The typical technologies include Asynchronous JavaScript and XML (Ajax) and Rich Internet Application (RIA).

Being a new development stage of the Internet, Web 2.0 technologies not only inherit Web 1.0 technologies, such as XML, but also bring great technical innovation.

2 Web 2.0 Application Technologies

2.1 Resource Sharing and Multiplexing Technologies

The resource sharing and multiplexing technologies in the Web 2.0 era have most innovation, together with extensive inheriting Web 1.0 technologies. They fulfill multiplexing and syndication, the core idea of Web 2.0.

2.1.1 Reuse Technology: XML

As the core technology for Web services, XML is a general-purpose specification for data exchange in the Internet. Data in the Internet, including public service data like weather data, enterprise private data, and even interface data of software developed by users themselves, can be exchanged in XML. With XML, the data become sharable, readable and reusable, and the Internet becomes an open platform for data sharing.

XML is a simplified subset of the

Standard Generalized Markup Language (SGML), used for creating custom markup languages. It is simple, independent of platforms, and extensively used. Compared to Hypertext Markup Language (HTML), XML is excellent in its separation of user interfaces from structured data. The separation makes it possible to integrate data from different sources.

With the richness of Internet applications, the single file format of HTML fails to adapt to kaleidoscopic documents and data, seriously influencing network data transport and sharing. XML simplifies the procedures for file type definition and for programming and SGML document processing, therefore, it simplifies Web transport and sharing.

XML makes Internet data sharable, readable and reusable. Using XML as the data standard, Web 2.0 can fulfill RSS/ATOM/RDF/FOAF-based data synchronization, syndication and immigration^[1]. Moreover, XML makes the Internet an open platform for data usage. After the XML data processing, these data can be randomly combined, and be presented and processed through various application programs, no matter Web programs or desktop programs. XML is also used by Web service technologies to transport and exchange data, which greatly promotes data openness and sharing.

2.1.2 Openness Technologies: Widget
Widgets are on-screen plug-ins with

different functions and ability of accessing contents of other websites. Web Widget, a mini program, can be used for decorating web pages, blogs and social network websites, and can also provide new functions. Widget tools can be either created by online businesses and then selected by users, or developed directly by users with simple corresponding technical skills according to their own demands and interests.

Widget makes Internet information and applications more open in the Web 2.0 era, which contributes to new service creation. Widget can offer diversified modules (Widget tools) to enrich and personalize users' desktops and web pages such as personal spaces and blogs. The contents of Widget can be anything, such as games, music, stock, video, slides, and system applications. Widget can implement any functions users can imagine.

Future Widget has two important development trends: integrating with mobile system, and integrating with operating systems. With the development of Widget technologies and applications, plenty of Widget products have been applied into handset media, for example, Nokia has launched its S60 Widget while Apple iPhone also has Widget. On the other hand, the development of Widget has generated a large amount of plug-in programs, some of which have been put in the same position with Windows and Linux by analyzers. Therefore, it can be seen that Widget is moving into mobile terminals and integrating with operating systems to provide platform functions.

As a technical mechanism for the creating, launching and sharing of small web application programs, web Widgets help various applications spread quickly by plugging in web pages like social networks, personal web pages and blogs and spreading. It fully presents the participation of users in the Web 2.0 era in content creation, syndication and spread, and at the same time meets users' diversified and personalized demands.

Widgets bring the following two innovations for Web 2.0:

(1) Desktop Widgets integrate desktop applications and network services, which enables users to enjoy

online services without accessing websites through browsers.

(2) Web Widgets fulfill information collection, releasing and sharing in the Internet. It provides a platform for users to quickly and conveniently create, release, share, trace and manage various Widget applications.

2.1.3 Syndication Technology: Mashup

Mashups are a new development mode of software and applications, involved with the convergence of multiple technologies and applications, such as Web 2.0 applications, SaaS service, SOA development mode, Web services technology and Wiki services. This mode retrieves contents searched by external data sources through various channels, and uses them to create innovative services for unified Internet application experience.

Mashup^[2] is Internet-based content and application syndication. Mashup can easily establish a new application through API, which is its most attractive feature.

Mashup is an innovative mode for Internet data syndication and reuse. Mashup finally uses syndicated data to provide users with data and application solutions according to users' input customized information (including the data combination mode, data selection and filtering, and data updating). Accordingly, Mashup basically changes users' data retrieving methods, and forms new application service.

Mashup is popular in the Internet, with the following typical applications:

- Maps, such as Google's map service;
- Video and Images, such as Flickr, that, through an analysis of the characteristics of information, such as music or news, mashups the user information and photos together to provide a new type of service;
- Searches and Shopping;
- News.

Mashup technologies syndicate various applications and contents to create new applications, and push more people to participate in service innovation and prompt service provisioning. Therefore, they greatly promote the innovation of Internet service applications. Moreover, Mashup enables



▲ Figure 2. A Mashup application case (the combination of map and picture services).

more elaborate service provisioning procedures. With it, Internet application provisioning is going from a closed application development field to a service integrated platform; based on the huge Internet platform, everybody can just do what he is good at, and contents and applications are syndicated to work out more elaborate service provisioning procedures and to greatly improve the efficiency of the industrial chain in the end.

Figure 2 shows a Mashup application case: City8.com. City8.com combines map and picture services, where clicking any place on the map will call out the instant street view of that place. The pictures and maps come from different websites, and are used by Mashup through its API to create such new inquiry service.

2.2 User Participation and Collaboration Technology

One of the core concepts of Web 2.0 is extensive user participation. It is implemented by multiple application technologies and innovative service modes, for instance, tag technology.

Tag technology fulfills fuzzy, intelligent and more flexible classification. Socialized tag is a new way for online information organization and management. It greatly promotes users' participation.

Generally speaking, Internet information retrieving has gone through three development phases:

- (1) Local Area Network/Wide Area

Network (LAN/WAN) Period

In this period, users mainly used such services as File Transport Protocol (FTP) to retrieve Internet data based on point-to-point transport.

- (2) Web 1.0 Era

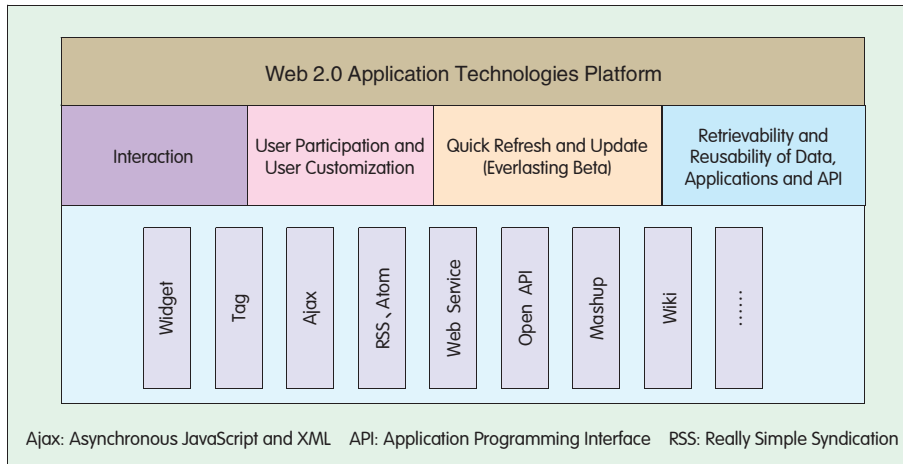
Information retrieving in this phase was mainly implemented through content searching, which was less efficient. Users made object searches on search engine websites like Google, Baidu and Yahoo!, and retrieved corresponding web pages and information.

- (3) Web 2.0 Era

Tag is the typical technology for information retrieving in this phase. It goes beyond search, and fulfills intelligent syndication and User-Created Content (UCC), and provides active search tags for other users to quickly and effectively retrieve information.

All the multimedia digital files, such as pictures and video, can be managed based on tag technology. Users can look over contents with the same tag, and have more connections with others; information does not exist isolatedly anymore. Tag has become the functional module with most usage on Web 2.0 websites, which offers a development solution for traditional classification technologies. Tag respects users' individual values, and uses highly effective methods to implement intelligent content presence. That is why it becomes a key technology for Web 2.0.

With good interaction, tag technology represents the socialization concept of Web 2.0. It fulfills the socialization of



▲ Figure 3. Application technologies supporting Web 2.0 platform.

services, and shows the power of groups, greatly enhancing content correlation and user interaction.

Tag improves the inquiry function. It is more directional than classification. Most available tag systems can simultaneously support data from two or more tags, which makes the matched data more accurate. Accordingly, users get a more smooth experience and search results are better matched.

Tag also represents the common use of Web 2.0. It is not limited by classification, but ubiquitous and easy for use at user's will. Setting one or more tags for contents helps users to read more related articles, which makes information more knowledgeable.

Tag-created information sections embody the decentralization concept of Web 2.0. Using tag technology, an information section can be quickly set up in a public information space for intelligent information syndication. Although seen as simple, the technology has a powerful information penetrating capability, elaborately presenting valuable information.

In a word, tag helps users create contents, and brings improved capability of content piloting and organization.

2.3 User Experience Improvement Technology

Ajax is XML-based asynchronous JavaScript. It is not a brand-new technology, but a combination of several technologies.

As an asynchronous interaction technology, Ajax improves user

experience of services^[3]. It is the solution to heavy pressure on both network transport bandwidth and servers caused by slow response of web pages to initiated user requests in the traditional Client/Server (C/S) mode. Ajax uses XMLHttpRequest object to send requests and gets response from the server, and finally updates web pages by using JavaScript to operate the Document Object Model (DOM) with no need of reloading the entire pages.

Ajax has the following innovative features:

- Asynchronous Response Mode
- Update Without Page Refresh
- Data Retrieving on Demand

Decreasing information traffic for interaction, the Ajax asynchronous response mode speeds the response of web pages, shortens much waiting time for interaction, and greatly enhances user experience.

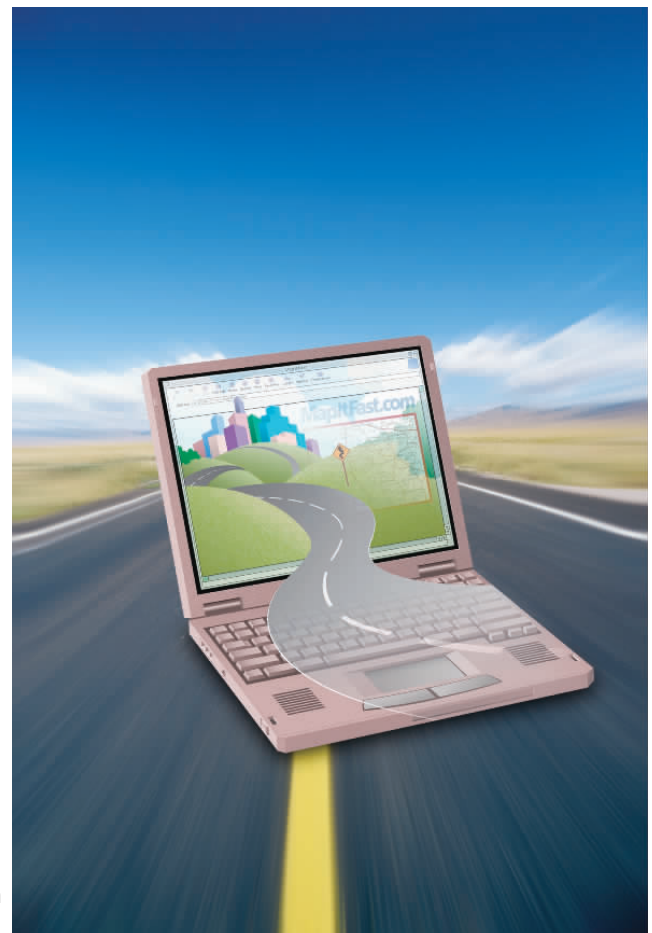
Moreover, Ajax is applied into the Mashup framework system for improving user experience at the client end. Ajax, combined with Service-Oriented

Architecture (SOA), can directly connect to background services through user interfaces. This enables service multiplexing on the client layer, facilitating enterprises to make use of basic services to create diversified Internet applications.

3 Application Technologies Supporting Web 2.0 Platform Concept Implementation

The Internet in Web 2.0 era is presenting an obvious feature of the platform. The creation and breakthroughs of its application technologies support the implementation of the platform concept, as shown in Figure 3. The platform features include as follows:

- Good Interaction
- User Participation and User Customization
- Quick Refresh and Update of Technology Development
- Retrievalability and Reusability of



Data, Applications and API

Various innovative Web 2.0 technologies improve the capabilities of the Internet, and offer a basic Web 2.0 application technology platform for Internet service development. They finally create the Web 2.0 era, making the Internet an open and sharable platform with innovation and extensive user participation.

4 Development Trends of Internet Application Technologies

Internet application technologies have the following development trends:

(1) The technical development will help the Internet improve its capability of organizing and integrating data and applications.

The development of Internet application technologies will make information fragmentation and reforming granularities more elaborate, and data integration will be micronized. The development will guarantee the formatting of data organization, and make data retrieving methods more diversified.

(2) The technical development will pay close attention to the intelligence of Internet services.

The artificial intelligence technologies, represented by semantic interpretation, especially macro semantic interpretation, will integrate with Web 2.0 applications more to promote service intelligence. Moreover, being more intelligent, the searching technologies will provide users with personalized search results according to users' attributes and network behavior.

(3) The technical development will continuously improve interaction capabilities and enhance user experience.

The continuous enriching and improving of client-end technologies will increasingly improve the interaction experience between users and web. The further development of blog, Wiki and Social Network Service (SNS) technologies will continuously enhance inter-user interaction and collaboration. Moreover, the interaction capability of websites will be improved.

5 Conclusion

The Internet application technologies are the basis for Internet service development and mode innovation, so their development brings the improvement of both service provisioning and network capabilities. With the development of the application technologies, the Internet has been moving into Web 2.0 era, and Internet services have been presenting more syndication and intelligent features. It can be expected that more and more intelligent Internet services on demands will emerge.

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Wang Lin graduated from Computer Department of Sichuan University. She is a senior engineer and senior technical supervisor with the Planning and Designing Research Institute, China Academy of Telecommunication Research, Ministry of Industry and Information Technology (MIIT) of China. Her research

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