chapter

1 What Is WAP?

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The influence of wireless technology is seen everywhere these days. Whether it is sending text messages, making wireless telephone calls, accessing remote information, or connecting to the Internet, wireless technology is having a major impact on people's lives all across the globe. Early on the framers of wireless technology realized that defining a common set of wireless protocols would help put wireless technology development on the fast track, and help prevent the proprietary bottlenecks often faced in other areas of development.

In 1997, Omnipoint, a U.S.-based network operator, issued a tender for the definition of a common standard for the supply of mobile information services. Nokia, Motorola, Ericsson, and Phone.com joined forces to answer this problem. From this beginning, the now famous WAP Forum was born.

The Forum, now consisting of over 450 members representing a wide range of wireless network operators, manufacturers of handheld devices and software companies, set out to develop an open standard that would enable wireless devices, such as wireless phones and personal digital assistants (PDAs), to easily access advanced telephony services and, more importantly, the content and applications available on the World Wide Web. The evolving standard that has emerged from the efforts of the Forum is known as the Wireless Application Protocol (WAP).

The protocol was developed, and continues to be developed, based on several goals that the WAP Forum established for itself:

- *It should leverage existing Internet standards and technology wherever possible.*
- *Where needed, it should promote new and open standards.*

- *It should work across all wireless network technologies.*
- *It should enable the creation of content and applications across a wide range of device types.*

Before jumping into the framework of the WAP protocol suite, it is important to have a broad overview of both the business and technological necessities as well as the benefits of the WAP, including a high-level discussion of the architecture.

◆ The Need for WAP

According to studies conducted by market research firms like the Strategis Group and Cahners In-Stat Group, the number of wireless services subscribers across the globe will reach anywhere from 1 to 1.3 billion by the year 2004. An even larger number of wireless communication–enabled phones, handheld computers, and other devices will be in use, and they will require access to the content and services expected by today's Internet user. The studies also predict that most of those phones and wireless devices will have multimedia capabilities, mandating access to an even richer source of content and applications.

These studies, combined with the expected improvements in the wireless infrastructure and technology, and the need of consumers to access information anytime and anywhere, caught the attention of many companies, including a U.S.-based named Openwave (at the time known as Unwired Planet and later called Phone.com) and a Japanese service operator named NTT DoCoMo. Both of these companies decided to leverage the World Wide Web infrastructure to provide users of mobile phones and other wireless devices access to the content available on the Internet.

Openwave came up with the Hand-held Device Markup Language (HDML), which was essentially a scaled-down version of HyperText Markup Language (HTML). It was optimized for effective transfer of Internet content to a mobile device over wireless networks using Phone.com's Hand-held Device Transport Protocol (HDTP). A minibrowser, much like a scaled-down version of Netscape Navigator or Internet Explorer, was used to render the HDML content. A gateway server, called the UP.Link Server, was used to convert HDTP into HTTP and vice versa.

Similarly, NTT DoCoMo started marketing a service called I-mode in Japan that offers its subscribers access to games, elec-

tronic postcards, and hit lists services. The service gained a lot of acceptance in Japan and the number of subscribers increased at a rate of over a quarter of a million per week.

The success of these and many similar ventures sparked the interest of several large companies in the wireless market. These companies decided to develop an open standard to replace HDML and I-mode.

Interoperability

Looking back at the success of the Web, the single most important reason the Internet became so popular so fast was its dedication to open standards and architecture. This openness encouraged many companies to work together to develop Web specifications, and be sure about their investment.

The same is true in the wireless universe as well. Any given solution is based on products and services provided by a diverse range of companies. In order to publish a company's roster on a mobile device, there might be a need for an Apache Web server, an Openwave gateway, network services from Sprint, a mobile device from Nokia, and a minibrowser from Openwave. Imagine requiring all of these vendors to support many different proprietary protocols from each vendor involved in delivering a complete wireless solution.

There was obviously a need for an open standard, formed by a consortium of industry experts representing a wide range of vendors. A device manufacturer needs to know that its mobile phone will work on any kind of air interface and will let the user access information from any kind of content source. The same is true for service providers, who need to be sure that their investments in network infrastructure can be capitalized in the future. They need to ensure that software vendors and device manufacturers are developing products that will interoperate within their networks.

The WAP specification guarantees that any WAP-compliant element of a wireless solution will work with any other WAP-compliant component, just as the Internet specifications guarantee that any browser from any software vendor can render and present content accessed from any kind of Web server.

Growth of the Wireless Market

A great benefit of developing the WAP specification was the encouragement of major industry players to communicate and facilitate technical exchanges between the best minds in the

industry. This interchange allowed the WAP Forum to become very successful in drawing attention to the wireless market. Scattered efforts by individual vendors to market their proprietary protocols and products would not have caused this much industry commotion. A single, concentrated effort was needed to get everyone's attention away from the Internet and focus it toward a powerful new mode of reaching millions of users.

Today many organizations are talking about WAP-enabling their Internet operations, and there is already a wireless or WAP division in most large organizations that have an Internet presence. Access to the WAP specification is open, and there are hundreds of companies implementing products and services based on WAP to help bring the power of the Internet to the mobile devices of today. If it were not for WAP, this revolution might not have started.

New Needs of a New Market

The wireless market is vastly different from the Internet market, which is dominated by relatively sophisticated users accessing content and services from a desktop browser. The needs and expectations of consumers in the wireless world are drastically different, and had to be addressed by a standard other than the World Wide Web.

SIZE OF THE MARKET

The number of users who need access to content and services through their mobile devices is predicted to grow at a phenomenal rate. Soon the market will become so large that new, optimized means of fulfilling wireless needs will have to be developed. The Internet standards of today have evolved out of the desire of a few physicists wanting to exchange static documents across simple networks in the 1970s. Even the growth of the Internet market itself is pushing the limits of what HyperText Transfer Protocol (HTTP) and a simple markup language like HTML can accomplish.

There was a need for development of a new standard based on a more efficient protocol optimized to address the needs of a rapidly growing market. At the same time, it needed to be simple enough to gain rapid acceptance in the developer community so that application development could keep pace with the growing needs of consumers.

SIMPLICITY

The most important feature that all consumers of wireless services will desire in their applications is simplicity. Operating a wireless

device, a mobile phone, for example, is more cumbersome than moving a mouse and navigating through a hypertext document. As devices evolve and become more sophisticated, users will also desire more feature-rich applications, but the environments in which these applications will be utilized—while driving to work on a busy highway, waiting for food in a restaurant, or sitting in a boring meeting—will still require that they be simple and easy to use.

There was a need to develop a new framework for developing applications that discouraged complexity. WAP fulfills that need superbly, by basing the markup language used to develop WAP applications on the Extensible Markup Language (XML). XML needs only a small number of tags to develop simple yet feature-rich applications.

SUPPORT FOR NEW FEATURES

The consumers in the new wireless market need access to new and different services, and developers need a way to easily develop and incorporate these advanced features into their wireless applications. The mobility of a wireless subscriber and capabilities of the device, including access to telephony features and services of the operator, all lend themselves to the development of more feature-rich applications that are not yet possible on the Internet.

The WAP protocol will continue to evolve to provide application developers a means to access more advanced capabilities of mobile devices. There will also be provisions to access the advanced services of wireless network operators through a consistent interface.

DIFFERENT USAGE PATTERNS

The average Internet user is familiar with accessing the Web from the comfort of his or her home by dialing out through a modem to access a service provider. In contrast, the mobile user will want wireless applications to work just like mobile phones work, like placing a telephone call, which means instant and reliable access to very specific content or services, based on the current needs of the user. Additionally, these connections will usually be brief. This usage pattern will repeat over a period of time. Also, unlike the traditional Internet user, who is often able to talk on the phone or sip a cup of coffee at a study table while waiting for a page to download, wireless customers will interact with the services in short but very concentrated and exclusive sessions.

The current Internet standards fall short when compared to the usage patterns of a wireless network. In addition, wireless

devices have many limitations in their capabilities. Both of these constraints drive the need for new specifications to deliver applications and content for a new set of usage patterns and device limitations.

Constraints of the Wireless Network

The network infrastructure carrying today's wireless communication is constrained in many ways. First and foremost is limited bandwidth due to the scarcity of an available frequency spectrum for radio wave transmission. To make the problem worse, the higher the bandwidth of the network, the more work has to be performed by the wireless device, which results in a more rapid drain of the device's battery.

A consequence of this constraint is a much higher latency in wireless networks as compared to their wired counterparts. Long delays are common in wireless transmission, and coupled with connection instability and less predictable network availability, they mandate a new set of protocols.

Internet standards like HTTP and Secure Socket Layer (SSL) become extremely inefficient over these mobile networks. They require a lot of handshaking between the two communicating network nodes, and messages are mostly sent in text format without any compression. If used unaltered for mobile communications, they would result in a very unpalatable user experience.

On the other hand, WAP uses the limited bandwidth of wireless networks much more effectively by encoding the messages in compressed binary format before transmission. WAP sessions are designed to handle connection instability and can operate over a wide range of wireless transport mechanisms. As new, higher-speed networks become available, WAP will only help increase data throughput to create a much more pleasant experience for the mobile user.

Limitations of Wireless Devices

New models of desktop computers hit the market every few months, rendering relatively recent models obsolete. Central Processing Units (CPUs) and clock speeds are getting faster every year, with current versions already breaking the 1 gigahertz (GHz) barrier. Physical memory keeps getting cheaper and more compact, with the average desktop computer of today equipped with at least 64 megabytes (MB) of random-access memory (RAM). New generations of video graphics cards and monitors present users with an unprecedented quality of onscreen pictures and

graphics. Additionally, more ergonomic keyboards and a more evolved and capable species of mouse make users' interaction with their PCs more pleasant.

It is not exactly the same with a small mobile phone that can fit in a front pocket. Just the mere restriction in the size of the device imposes practical limitations on the bells and whistles that can be incorporated into these wireless devices. The more minuscule the phone is, the more it appeals to the public. Additionally there is a mobility factor. Since mobile phones are supposed to be exactly what their name suggests—mobile—the limited life of a small, inconspicuous battery has to be utilized efficiently. All this means a lower-power, smaller, and slower CPU and much less physical memory. The display size and quality are also no match for a desktop monitor. The display has to be small and less demanding of the limited power of the device, which means less saucy graphics and a constrained text display. The input device generally consists of a few additional buttons on a normal phone dial pad. There is definitely no room for a mouse.

Again, HTML, the de facto authoring language of the Internet, would not work here. It is written for content display in browsers running on user PCs with a larger display area. HTML also assumes that the user has access to a keyboard or a mouse. Even though the capabilities of the wireless devices will keep evolving over time, consumer demand for lightweight gadgets and longer battery life will limit the power consumption of the CPU, memory, and display, as will the scarcity of bandwidth.

The Wireless Markup Language (WML), which is a part of the WAP specifications, is optimized for small screen displays and navigation. It is also optimized for devices of limited capability that are most often designed to be operated by a single hand. It can also be used just as effectively for feature-rich content display and navigation on devices with bigger displays, including PDAs and smart phones.

◆ Benefits of WAP

Developing applications using WAP, as opposed to proprietary frameworks and languages like HDML and I-mode, has several benefits for application developers. In addition, WAP development benefits the companies that manufacture handheld wireless devices, network operators or service providers, and the users of the mobile devices themselves.

Benefits to Developers

Since WAP is a widely supported wireless application development specification, developers can be sure that their applications will work across a large number of devices, browsers, gateways, and networks. This is a significant advantage over the older wireless model, in which developers had to account for all these variables in the application code itself. That requirement limited the reach of the applications, made the code more complex, and increased the cost of development significantly.

WAP developers also have the advantage of leveraging their technical skills gained while riding the Internet bandwagon, since WAP relies on the Web technology infrastructure. The incorporation of network- and device-specific telephony features into WAP allows developers an easy means of creating more feature-rich applications and increases the value proposition to the end user.

The Wireless Transport Layer Security (WTLS) specification of WAP allows developers to easily incorporate security features into their applications, hence extending the type of applications and content that could be developed or served to their users.

Benefits to Device Manufacturers

Just by adding a WAP-compliant minibrowser with very low memory and CPU requirements, device manufacturers can significantly enhance the perceived value of handheld devices for their customers. Just like they can with a Web browser, users can access numerous applications and services developed by a large community of developers. At the same time, the manufacturers are assured that the browser will work across a wide range of gateways and networks without the incorporation of specific logic on their part. The end result is a larger market share of wireless applications and hence increased revenues.

Benefits to Service Providers

Like manufacturers of wireless devices, service providers benefit from the prospect of offering a better value proposition to their customers. By encouraging their customer base to use WAP-compliant devices and adding support for WAP-compliant gateways themselves, they can offer their customers access to a huge number of applications and content available on the Internet.

Since service providers control the gateway, they can control the home page of the user also. Working in conjunction with providers

of wireless content and applications like Yahoo and Amazon, they can generate significant revenue by placing access to these sites as hot links from the home page of a wireless session. Large wireless content providers are known to pay tens of millions of dollars to get a spot on the home pages of the service providers just so their subscribers have an easy means of accessing their wireless site.

Service providers also don't have to worry about the device type their subscribers are using in order to offer them access to the services. The same situation applies to the type of bearer that the service providers support, since WAP applications are independent of the air interface. (See Section 2.1.2.6 on bearers.)

Since WAP specifies a standard for accessing network telephony services, it can easily support application developers trying to incorporate those services into their applications, once again increasing the value proposition for their customer base.

Benefits to End-Users

Subscribers probably benefit the most among the four different classes of WAP users. Theoretically speaking, they can reach any content on the Web through means of HTML-to-WML formatting services; how the content developed for a browser running on a 17-inch monitor is rendered on a three-line display of a mobile phone is another story. A large number of application developers are developing content and services specifically for wireless devices using WML, which users with WAP-compliant devices can interact with in addition to the applications or services offered by their network operator.

Just like HTML rendering on a browser, WML allows developers to provide a consistent user interface for their application on a wide range of devices and browsers. This is a significant value proposition for the subscribers since they don't have to learn to interact with numerous interfaces. There are, however, some minor differences in how different browsers render the same WML, but they don't call for a significant change in human-application interaction experience.

The end-users will have the choice of numerous handheld devices as long as they are WAP-compliant, and users will still be able to access the content and services regardless of the service provider or the network. Additionally, the security features of WAP allow customers to be comfortable transacting with secure wireless applications and exchanging sensitive information like credit card numbers and passwords.

◆ Recap

The WAP Forum has introduced an excellent new technology that has developed and evolved over its brief lifespan. WAP fills in the gaps of the wireless applications space, driving it to be quickly accepted by the industry.

The potential and promise of WAP has benefits for end users, network operators, wireless device manufacturers, and wireless application developers. The is the reason most companies with an Internet presence have a current WAP initiative in their information systems departments.

The WAP architecture is discussed in more detail in Chapter 2, with a thorough look under the hood of the technology that makes up WAP. All the components that make up the WAP specifications are reviewed in much greater detail, along with a discussion of some of the WAP application development frameworks from different vendors in the market.