

## DATA COMMUNICATIONS MANAGEMENT

# WIRELESS APPLICATION PROTOCOL (WAP) AND MOBILE WIRELESS ACCESS

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## INTRODUCTION

It is projected that by year 2002 we will have 400 million Internet subscribers and 600 million mobile phone users. As a result of this expansion, there will be a growing demand for wireless data services with a corresponding demand for quick access to information from any location — hence the watchword of “any place, any where, any time.” While WAP does provide access to the Internet, a “killer” application has not yet made an appearance.

Behind this rapid growth in the Wireless Application Protocol (WAP) has been The WAP Forum. The WAP Forum began in December 1997 as an industry association to develop, support, and promote a world standard for wireless information and services accessed via a digital mobile telephone or similar wireless device. The WAP Forum’s charter is to bring together service providers, handset manufacturers, Internet content providers, application developers, and infrastructure manufacturers to ensure interoperability between devices

### PAYOFF IDEA

While the present adoption of WAP technology is still evolving, future WAP telephone designs will provide the required WAP improvements. There are a lot of novelty Web-based services that have made their appearance; however, as more WAP-based systems become available that empower the user to better navigate the business world, there will then be an expanded use of WAP-based services. Further, as these services along with Bluetooth base services become more affordable and prove to increase personal productivity, there will be an observable increase in wireless access services of all types.

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and promote the growth of wireless Internet-based service (see [Exhibit 1](#)). The WAP Forum has over 300 regular members plus associate

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**EXHIBIT 1 — Get Rid of the Phones**

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WAP-enabled pagers are fast becoming a way to send messages back and forth over the Internet. Today, there are many regional and national pager carriers that offer short message services using a Palm Pilot or one of the popular Motorola devices such as the Talkbout or Timeport. These must be a viable service because they have been very popular with the teenagers since they found that they can send messages back and forth to their friends. Teachers have now banned them from class because they can obviously be used to cheat on tests.

The costs vary from service carrier to service carrier. Generally, the devices range between \$399.95 and \$149.00, plus an access fee of about \$17.90 per month for up to 25,000 characters; extra messages above this cost \$0.01 per 100 characters. The subscriber is given an 800 number that can be accessed by other similar devices to send messages to the subscriber. For those who do not have such a device, an operator can be accessed through an 800 number who will manually key in any desired messages. The subscriber pays about \$10.00 per month for this service for up to 30 such messages and \$0.65 for additional messages above the 30 message rate.

Generally speaking, these services have become quite popular because the per-call costs are very low and the subscriber can be reached anywhere in the United States. There are also carriers overseas that can be used to extend services. The bottom line is that short message services are more cost-effective than WAP-enabled telephones.

members, including handset manufacturers representing over 95% of the market, carriers with over 150 million customers, infrastructure providers, software developers, and other related industries.

The WAP Forum maintains liaison with other industry organizations to include the European Telecommunications Standards Institute, Cellular Telecommunications Industry Association, The Worldwide Web Consortium, and the Internet Engineering Task Force. All are actively working with the Forum to evolve the next-generation HTML (HTML-NG).

The WAP is also being enhanced to address the next-generation 3G wireless networks that will support fully packetized information transmission.

### **THE WIRELESS APPLICATION PROTOCOL**

The Wireless Application Protocol (WAP) is the *de facto* standard for providing Internet communications and advanced telephony-based services over digital mobile telephones, pagers, personal digital assistants, and other wireless terminals. The WAP is an open, global standard that empowers users of mobile telephones and wireless devices to securely access and instantly react with Internet information and services.

This single-industry, agreed-upon standard for wireless application interoperability uses an XML-compliant markup language called WML

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(Wireless Markup Language). The advantage of WML is that it provides a path for application developers as well as content providers to develop and deliver Web-based services. The WML user interface is a WAP micro-browser that maps into mobile phones and other wireless devices. Devices using WAP-based microbrowsers can access an array of innovative value-added services.

The basic concept of the WAP is to specify the network server, the mobile telephone software, and the communications between them. Communication is established between the mobile handset (client) and a gateway that serves as the gateway to the Internet. The gateway supports protocol and format conversion between a network application server, enabling communication with WAP-enabled handset or client.

The WAP is designed to function over any wireless network, including CDPD, CDMA, GSM, PDC, Mobitex, and others. An application server on the Internet provides the information or data desired by the client while the network serves as the bearer for the data.

Microbrowser firmware is embedded into the mobile phone and the developer must be able to support that version of the microbrowser. However, because each manufacturer is different, there are subtleties that the developer must be able to support for each handset. Further, the programming language used to develop applications (WML or HDML) may have variants when deployed in the Asian market where slightly different versions of these programming languages are used. This forces developers to be conversant in four versions of the markup language and design their applications to interface with each of these language variants.

Design differences in the handset create additional problems for the developer because screen space varies, forcing the application designer to work toward the lowest common denominator. Because present-day WAP telephones are slow and do not always respond as expected, software applications may not perform as designed. This creates additional design problems affecting security and user privacy issues.

### **WAP Specification**

The WAP specification is unique because it defines an open standard architecture and set of protocols intended to facilitate wireless Internet access. It also provides solutions for problems not solved by other standards bodies (e.g., W3C, ETSI, TIS, IETF, etc.) and serves as a catalyst for wireless development and standardization. The specification key elements include a definition of the WAP programming model, which is based on the existing WWW programming model. This serves to benefit the developer community because it provides a familiar programming model, an established architecture, and the ability to leverage existing tools (i.e., Web servers, XML tools, etc.). A markup language adhering to XML standards is designed to enable powerful applications within the constraints and limitations of handheld devices. The Wireless Markup

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Language (WML) and WML script do not assume the availability of a QWERTY keyboard or mouse for user input. Unlike the flat structure of HTML documents, WML documents are divided into a set of well-defined units of user interaction.

Another key element is the specification for a microwrowser in the wireless terminal that controls the user interface and is analogous to a standard Web browser. This specification defines how WML and WML script should be interpreted in the handset and presented to the user.

In addition to the above, there is a lightweight protocol stack to minimize bandwidth requirements, guaranteeing that a variety of wireless networks can run WAP applications — a framework for Wireless Telephony Applications (WTA) that allows access to telephony functionality such as call control, phone book access, and messaging within WML script applets. This allows the operator to develop secure telephony applications integrated into WML/WML scripts.

## **WIRELESS APPLICATION PROTOCOL SOLUTION BENEFITS**

### **Benefits to the Service Provider**

It should not be a secret that service providers can add significant value to their service offerings by adding WAP-based services to their wireless networks. At present, many of the mobile handset and PDA manufacturers are starting to sell WAP-enabled devices. The only thing for the service providers to do is to package a product. By developing a WAP-based product line, the service providers will be able to market new services to the subscribers, which greatly increase network usage. By controlling the data connection through a WAP gateway, service providers can maintain strong customer relationships with their subscribers, forestalling customer churn. Many WAP developers are beginning to offer new content systems that provide the service provider with new easy to access subscriber services. This is much the same as with a new public page on the Internet that can be accessed globally by any Internet user. Because of the WAP open standard, many more options are available to the service providers for WAP gateways, WAP-enabled handsets, or Web-enabled content services. This flexibility of choice makes it possible for the service provider to choose from a wide array of vendor products, all at competitive price levels.

### **Benefits to the Manufacturer**

Handset manufacturers are now beginning to see the advantage of integrating a microbrowser into their handsets that is low in cost and provides additional capability beyond just voice access. Some vendors are also including Bluetooth chips as well, which will enhance the value of their handsets over that of competitors. These microbrowser-enabled handsets will allow their handsets to work on all WAP servers and all net-

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works that offer WAP-based services. These new enhancements increase their value to the network service provider who is now in a position to package these new handsets into a variety of new service offerings.

### **Developer Benefits**

Application developers are now in a position to reach a much larger audience of end users who carry Web-enabled mobile handsets. Phone.com, a wireless Internet service provider, reported that its registered developers who create Web sites and applications grew from 62,000 to over 110,000. Another element that has encouraged developers is the fact that WML is based on XML and is an easy markup language for the developers to learn. Because WML has its basis in XML, it sets the stage for automatic content transformation. Information written in XML can be automatically translated into content for HTML or WML. As the technology for universal content continues to evolve, application developers can feel secure in using present-day WML because there will always be a migration path upward from WML. WML also serves as the common denominator for all developers, with no one having a unique advantage over their competitors. WML provides a common thread among developers because any application written in WML will run on any network. WML allows developers to integrate their applications with any device or telephony functions.

## **SOME CONSTRAINTS OF A WAP-ENABLED WIRELESS NETWORK**

### **Security Issues**

Many of the applications destined for the Web require a secure connection between the client (mobile handset) and the application server. The WAP specification ensures that there is a secure protocol to support transactions between a wireless handset and the application server. This secure protocol is known as the Wireless Transport Layer Security (WTLS) Protocol and is based on the industry standard Transport Layer Security (TLS) Protocol, also known as Secure Sockets Layer (SSL). WTLS is designed to be used with the WAP transport protocols and has been optimized for use over narrow-band communications channels. WTLS is designed to ensure data integrity, privacy, authentication, and denial-of-service protection. Where Web applications employ standard Internet security techniques using TLS, the WAP gateway automatically and transparently manages the wireless security.

In the WAP environment, the WAP gateway serves to translate WAP to Web protocols, thereby enabling the WAP devices to access the Web. The WTLS Protocol encrypts transmission from the mobile handset to the gateway. However, before the gateway can encrypt the transmission into the TLS/SSL, it must first decrypt the WTLS packets. In this situation, all of the data is briefly in the clear before being encrypted for its journey to

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the application server. Herein lies a weak link in the WAP transmission process. To correct this problem, the WAP Forum is working on a fix that may well appear in the WAP Version 1.2 or 1.X in the near future.

There have been some half-way solutions proposed to combat this situation, such as securing one's own gateway in a locked facility. There are a number of software vendors (e.g., Entrust Technologies) that offer software suites that will provide end-to-end security. Utilizing PKI software modules, such systems can issue WAP server certificates as well as client certificates for complete user-to-server authentication.

Baltimore Telepathy offers a security gateway that supports end-to-end security from the mobile user to the WAP/Web server. This is a stand-alone solution for content service providers that requires digital signatures for authentication.

Hardware manufacturers are also starting to announce secure WAP servers that can be placed online and provide immediate security. HP has recently announced its HP Praesidium Virtual Vault, which is aimed at the financial arena. This trusted WAP solution sits at the edge of the network between the outside world and the enterprise to connect mobile users to the corporate applications and database.

#### **Secure Application Development**

To date, there have been a number of products that support securing WAP-based operations. Many of these developments have been in the software arena.

Certicom and 724 Solutions have joined forces to develop a wireless Public Key Infrastructure solution for the financial industry. This will be an open standards-based security solution that enables secure communications and digital signatures via a variety of Internet-enabled devices such as PDAs, mobile telephones, and pagers. This system will serve to support the new legislation that went into effect October 1, 2000, which allows businesses and consumers the ability to close contracts with digital signatures. The new wireless PKI solution will provide financial institutions with the ability to offer consumers the confidence and convenience of performing secure "any time, any where" high-value transactions.

#### **PREPARING FOR THE MOVE FORWARD**

High-speed Internet access over circuit-switched wireless networks is not a very viable means for providing a base for data services that expect access to screens of information. Fortunately, circuit-switched wireless networks are undergoing change, from their present form to one where all information will travel in the form of packets of information. At present, there are any number of GPRS tests underway in various GSM networks in Europe and Asia. In like manner in the United States, Sprint and Bell Atlantic (now Verizon) have moved to convert their wireless networks from circuit-switched to 2G IP packet-based networks. The impact of

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these migrations will serve to enhance WAP-based applications because the higher speed IP packet networks will support greater throughput for all services.

Operators see the introduction of data as a way of addressing declining voice revenues. These operators will only be too glad to accommodate the WAP-enabled user who wishes access to the Internet for a variety of services. If nothing else, WAP-enabled handsets will more than ensure the operator of much higher revenues over voice because data access will ensure long call hold times and therefore much greater network occupancy.

Integrated access of both voice and enhanced WAP data services will ensure that the network operators will have more services to sell under a variety of pricing plans. Network operators will be more than a data delivery pipe; they will be purveyors of a range of upscale consumer services. These services will serve the needs of the subscriber in ways not thought of before.

#### **RECENT WAP DEVELOPMENTS AND APPLICATIONS**

Numerous announcements were made during the course of the year 2000, many of these coming during that year's PCIA 2000 conference. There are starting to emerge many content and value services that until now have been well-developed for those who access the Web through a wired connection. In addition, another new application that will be coming along with WAP-based applications will be location services utilizing GPS (Global Positioning Satellite). While GPS services have been around for some time, they will now be embedded in a mobile phone. These new services will allow the end user to access a Web site that will provide the end user with directions to a specific location or service. This is very similar to the very same services that are available on the Web for a wired user accessing the Web with a browser. For example, GeePS announced that it has agreed with Advanced Internet, a creator of community-based Web sites to provide a wireless version of its product. This new product will merge WAP and GPS technologies and will allow consumers to surf the Web to locate their local merchants.

Visa and BT Cellnet, a U.K. service provider have announced a new WAP location service for Visa card holders who have WAP-enabled handsets. This new location service will allow Visa card holders to use their WAP telephones to locate the nearest Visa ATM by entering the postal code for the area where they are located. BT Cellnet will extend this service to locate over 531,000 Visa ATMs located throughout the world. Future versions of this service will support mobile handsets equipped with GPS so that the service can locate the nearest ATM automatically without regard to a postal code.

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### **Information Search and Retrieval**

There have been a number of WAP utility packages developed to search the Web for a specific information stream. MobileWAP.com is a good example of a search engine dedicated to finding WAP content on the Internet. A built-in electronic agent continuously searches the World Wide Web, seeking and indexing relevant Internet pages written for WAP-enabled devices using the wireless markup language (WML) and adding these to its range of listings. MobileWAP.com can be accessed wirelessly with any WAP-enabled device or through the Internet using wired access.

### **E-mail and More**

Sheffield Dialogue Communications recently demonstrated in Europe a Windows e-mail attachment to a WAP-enabled device. Using the latest version of their Dialogue Expressway 2000 E-Mailconnector, users can read any document from a Microsoft Office Suite of software using their WAP-enabled telephone. In this system, documents using MS Word or Power Point are translated into simplified text that can be read on a mobile handset screen. This connector allows the user to read, reply, forward, or delete messages, as well as view attachments and have access to address books.

The Expressway 2000 acts as a broker for WAP-enabled devices providing a fully functional e-mail client on a phone. Access to personal or global address books is provided through LDAP support. Expressway 2000 also employs advanced session handling and e-mail session spoofing to ensure that the user's e-mail remains intact even if the WAP device drops the connection to the network.

### **BANKING AND E-COMMERCE**

There are a number of initiatives undertaken in the banking industry. This effort has been reinforced with the introduction PKI systems to ensure customer security. In Germany, Savings Bank Dortman has introduced WAP-based services using MATERNA Information & Communication's WAP-based software and their Anny Way WAP gateway. This system allows any user with a WAP-enabled mobile telephone to request account balances as well as view the financial status of all their accounts and deposits. End users can also make transfers and payments through their WAP brokerage service. Customers can also request stock exchange indices, stock values, as well as buy and sell securities. All of these services are available through any WAP-enabled telephone.

### **Management Applications**

Memorex Telex Ireland's field salesforce is using WAP technology to update its customer management database using WAP-enabled handsets.

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The system uses the Esat Digifone network and software designed by eWARE Limited. This system allows the user to access content and then update relevant information to their Customer Relationship Management (CRM) system. The Memorex system is isolated from the rest of the Memorex network and users must sign on through a separate firewall. The eWARE has its own separate application-level security that serves to secure the entire application.

The Memorex sales staff are now able to dial up current customer histories, pricing, or any other information that they may have had access to back at the home office that is necessary to service their customers. This new WAP-based CRM system allows the Memorex salespeople to concentrate on selling without the burden of administrative details because all of the information needed is available to them via their WAP-enabled telephone.

Phone.com, a developer of WAP-based software, has announced a software package for service providers — Mobile Management Server (MMS) version 1.0. This WAP-based system will enable service operators to provision their WAP gateways, applications, and handsets “over the air.” MMS uses WAP’s WTLS secure protocol to communicate with a handset; it also uses a trusted provisioning domain mechanism to authenticate MMS to a handset. This version of MMS allows the service operator to remotely alter specific software settings and configurations of handsets once they have been placed in service.

#### **GPS Positioning-based Location Services**

Landstar Systems (a transportation services company) and PhoneOnline.com (a wireless software development company) have launched a WAP-based vehicle location and intermodal transportation services for over 8000 independent trucking operators. Three applications were put online via a WAP-based solution using a WAP-enabled handset (Nokia 7190). The first application was the Balance Inquiry application. This application allows a driver to access his account to determine the balance in his debit account. The amount can be read on the screen on his handset. The next application is the Check Call application, in which a driver can call the Landstar system to update his arrival at a customer location. The driver can enter arrival information, tractor number, trailer number, freight bill, current date, time, and location using his Nokia 7190 WAP mobile telephone. The third application is the Available Load application. This allows the driver to access the Landstar system to identify available loads that the driver can elect to pick up for his return trip back to his point of origin. This is a very valuable service because it allows the driver to gain revenue from a return trip rather than driving back home “empty,” or “dead heading” as it is known in the industry.

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## **WAP MOBILE WIRELESS MOVES AHEAD**

While some observers have felt that the mobile handset manufacturers would continue to produce voice-only handsets, particularly for Third World users, this has not been the case. The recent PCIA 2000 show seemed to indicate that manufacturers are moving ahead with WAP-enabled phones, some equipped with Bluetooth chip sets. For some manufacturers, China has proven to be their best customer with major purchases of WAP-enabled phones. Perhaps the feeling among some developing nations is that while every village cannot be equipped with PCs, at least one mobile handset might be available for Internet access.

Some observers estimate that there are over four million WAP-enabled phones in the United States alone, and 12 million in Japan. Japan's NTT's DoCoMo i-mode service has proven to be a very successful WAP-based service. This due to the fact that i-mode uses a cut-down version of HTML (compact "cHTML") and employs an "always on" link to the Internet.

To keep pace with this rapidly evolving future, mobile service providers are rapidly upgrading their networks to support future foolproof methods for delivering wireless data services while overcoming bandwidth and ergonomic obstacles associated with mobile communications.

### **SUMMARY**

#### **The Future Expansion of Technology**

While the present adoption of WAP technology is still evolving, future WAP telephone designs will provide the required WAP improvements. However, there is a lot of hype going full throttle that would have one believe that nearly everyone will be WAP-enabled next week. For example, the Strategis Group in Washington D.C. predicts that the sales of handsets with microbrowsers will grow by more than 900 percent to 7.8 billion by the year 2005. They also predict that by 2005, more than 9.6 million people will have subscribed to third-generation networks (3G) or 2.5-G mobile high-speed data services. While all of this is encouraging, we still must wait and see what WAP-based applications come to the top that will encourage the widespread use of the Internet for purely data-based applications.

There is no doubt that some forms of short message service will continue to prevail. At present, many vendors have reported utter amazement at the sale of PDAs and other short message devices. For example, short message devices are being sold to a very large subscriber base in the teenage and young-adult market, both in the United States and in Europe. These devices have quickly replaced pagers because now they provide two-way capability.

In other information areas such as stockmarket quotes, weather, location services, etc., it remains to be seen how quickly these services will

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expand into convenience services such as banking, which is already taking hold as a Web-based service via wired access.

Another area that shows promise for the future is in vehicle systems such as wireless enhanced “smart vehicles.” Such systems are already making their appearance in GPS/cellular location systems such as ON STAR, which provides location and direction services as well as basic vehicle security support.

There are a lot of novelty Web-based services that have made their appearance; however, as more WAP-based systems become available that empower the user to better navigate the business world, there will be an expanded use of WAP-based services. Further, as these services along with Bluetooth base services become more affordable and prove to increase personal productivity, there will be an observable increase in wireless access services of all types.

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