

NOKIA

Wireless Application Protocol – The Corporate Perspective

White Paper

March 1999

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1. Introduction: Demand for Mobility

In the present dynamic business environment, companies are forced to become more competitive in order to survive. Tightening competition, globalization and changes in customer behavior present formidable new challenges to the companies. They have to adapt to the changes in the business environment quickly enough and invest more in know-how and skilled employees to be able to increase their competitiveness.

One the most recent and significant changes in the business environment has been the growing demand for mobility. This means that customers, partners and employees should be able to access the information resources and services of a company wherever they are and whenever they want.

In 1998, 73% of European corporations were using some kind of mobile data solution and 91% of those who were not said, that they would within 1999.¹ In addition, 60% of the mobile data users in the United States said they wanted to use a mobile phone for the mobile data instead of a computer or some other device.² These results clearly show that there is a true demand for access to more information and services on mobile phones.

However, most of the mobile data users currently use only SMS applications, which can provide only limited functionality compared to, for example, Internet services. This is now changing. It is estimated that in 2005 there will be about one billion mobile phone subscribers, and that a substantial portion of the phones sold that year will have multimedia capabilities.³

This means that there will be an explosion in the number of services that can be provided to a mobile phone. As a result, markets, brands and customer loyalties are on the move. Constant availability is the key concept for future competitiveness.

This will provide a huge market potential for corporations. Besides offering their existing services via a new mobile channel, they have unlimited possibilities to create new services and products for their customers. Users of mobile phones can now be offered relevant personal services that suit their needs. Today people must carry with them at least a wallet, a calendar and a phone. Soon it will be only a phone - a media phone, which enables you to make calls, pay bills, buy tickets, check e-mail and manage your agenda.

¹ The Yankee Group Report. The Mobile Corporation: An Update. Vol. 2, No.9 November 1998

² The Yankee Group Report. Wireless Intelligent Terminals: Smarter Than Your Average Phone. Vol.2, No.10 November 1998

³ Nokia Press Release December 15, 1998

1.1 WAP: Platform for the media phones

The Wireless Application Protocol (WAP) is the platform for media phones. It provides an open universal standard for bringing Internet content and advanced value added services to mobile phones and other wireless devices. WAP enables corporations to be part of the wireless future.

While developing WAP technology, products and services, the leading telecommunications companies have built on the experience of the Web era. At the same time, however, they have designed WAP tools that take into account the critical constraints of the wireless world, namely: limited bandwidth, challenging conditions of use, and the specific user interface and processing characteristics of mobile phones.

As a result, WAP enables a wide range of wireless services that are independent of the underlying digital wireless network technology. WAP based services are global, easy to use and offer improved security. In addition, because WAP and Web tools are similar, it is relatively straightforward to adapt existing applications and IT systems to the mobile environment. As of now, the mobile web means business.

Nokia is one of the four founding members of the WAP Forum. The WAP Forum is the industry association that has developed the WAP standard. The primary goal of the WAP Forum is to bring together companies from all segments of the wireless industry value chain to ensure product interoperability and growth of the wireless market. Today the WAP Forum members represent over 90% of the global handset market, carriers with more than 100 million subscribers, leading infrastructure providers, software companies and other organizations providing solutions to the wireless industry.

1.2 Mobile phone usage: Breaking the records

In order to understand the business potential of WAP, let's take a closer look at the characteristics of a mobile phone. A mobile phone as an access device has four important attributes (Figure 1).

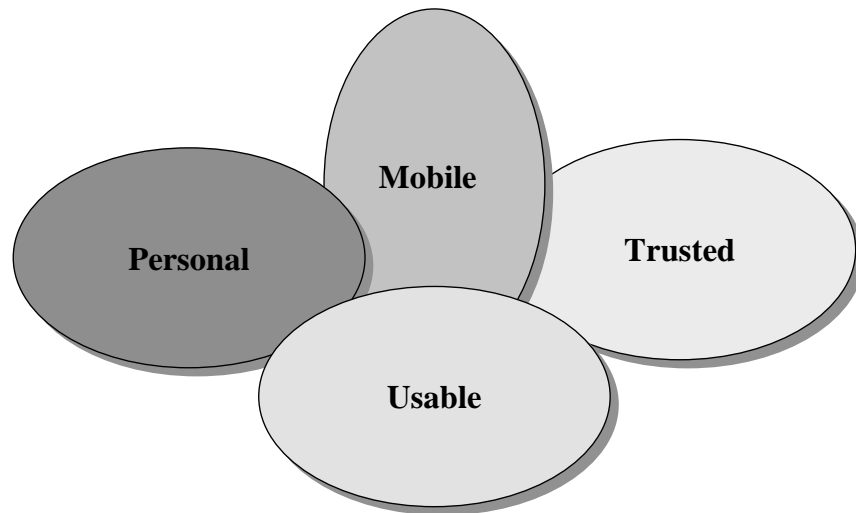


Figure 1. Mobile phone attributes

As with a watch or a high-quality pen, a mobile phone says something about its owner. The phone has become a very personal device. It is also a device over which the user has full control. The user is able to choose where, when, and how he or she uses the device. A mobile phone plays a key role when offering truly personalized services.

Second, a mobile phone is by definition mobile. It enables the user to communicate at anytime regardless of location. Literally, the mobile phone is within the immediate vicinity of its owner 24 hours a day. A mobile phone is also a trusted device and a natural platform for secure applications.

The mobile phone is a highly usable device. It is always at hand, immediately ready to use without time-consuming boot sequences, and readily connected – no hassle with those modem configurations and messy wires! The usability is clearly illustrated by the rapid penetration of mobile phones in all age, social and professional segments. For example, recent research shows that the total number of mobile phone users worldwide is over 300 million, double the number of Internet users. (See Figure 2) In addition, it is estimated that in 2005 there will be about 1 billion mobile phone subscribers.

In conclusion, a mobile phone in every pocket is a near-future prospect. It is fast becoming the preferred method of communication: an essential connection to everyday reality.

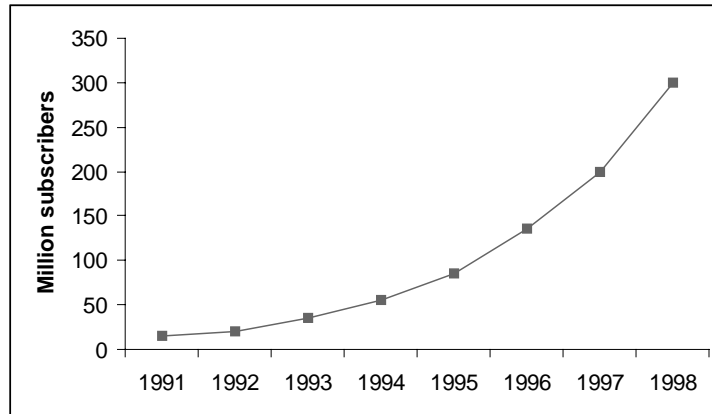


Figure 2. World-wide mobile phone subscribers

2. Business applications: WAP means money

WAP represents significant business potential for corporations across multiple industries. This potential is twofold.

First, WAP provides an open technology platform for offering new and innovative services to the consumer market and a wireless channel for existing services.

Second, it increases employee productivity and improves business performance through continuous mobile access to corporate Intra- and Extranets.

2.1 Consumer applications: Services while on the move

The division between work and free time is blurring. Moreover, the time spent away from work and from home is increasing. This implies that there is a growing number of time periods when an individual is neither working nor at home; one such example is waiting for a plane. Many of us would like to use these moments as effectively and enjoyably as possible.

The mobile phone is a bi-directional channel enabling development of services that allow users to react *only* when notified by the mobile phone. For instance, a mobile phone can alert a user when the threshold limit of a stock rate is passed. Investors thus do not have to constantly watch the stock rates on their own. In addition, they can react immediately wherever they are.

WAP applications help the consumer to reduce the hassle related to many routine activities, freeing up time for more meaningful activities. Banking is probably the one most often cited application area that will benefit from WAP. Being able to check your bank account and carry out transactions with a mobile phone is a very lucrative offering. On-line ticketing is another domain where

mobility opens up interesting opportunities. For example, a business traveler who realizes that an important meeting will extend over its planned duration can use his mobile terminal to change his flight to the next available connection. This offers real value.

The whole area of "*infotainment*" presents an important business potential. Being able to receive simple, but in many cases vital, pieces of information such as weather, news and sports, traffic information, white and yellow pages, as well as public transportation schedules on a mobile terminal will make life easier for most of us. WAP is an entertainment medium as well. For example, it makes it possible to connect to a network of chess enthusiasts and play a game or two over your mobile phone.

Recent developments in the retail industry clearly underline the opportunities of Internet-based retailing. Mobility increases the business potential even further. It is important to note that it may be that only one part of the purchasing cycle is completed via a mobile terminal. For example, it is likely that one would not define or configure a weekly shopping list with the limited user interface and a small keyboard of a mobile phone. However, it is easy to envisage modifying the list, glancing through available delivery times, and triggering the delivery through a WAP-enabled phone.

2.2 Corporate Intra- and Extranets: Towards real time operations

In most companies there is a daily need to access corporate information. Sales representatives are meeting potential customers all over the globe. Customer service representatives are working at customer sites. Management has to be able to track the development of business operations. Remote customers and suppliers want to know the status of their particular order. Mobile access to corporate Intra- and Extranets enables employees and business partners to access data in a cost and time efficient manner while on the move. This is true both in terms of generic applications, such as email, calendar and directories, as well as access to tailored industry-specific applications. More specifically, the following applications lend themselves especially well to being WAP-enabled.

- Sales force and field service automation: A WAP-application for sales force and field service automation includes mobile access to contact management, order entry, product and spare parts availability and deal tracking. Advanced push-notifications can bring additional benefits through distributing business-critical data when the timing of the information delivery is crucial.
- Operations and maintenance: Industrial machinery or even individual components can be equipped with "*GSM chips*." This then makes it possible to provide the operating and maintenance personnel with access to information about the component's performance and need for maintenance. This mission-critical information can be aggregated into a few high-level indicators, which can then be further investigated by "*drilling down*" into the specific data elements.
- Management information: In practically all companies there exists a vast amount of information that has significant managerial value. This information resides in various corporate databases, enterprise applications, and numerous

departmental systems. It is essential for effective managerial decision making. Moreover, in most cases this information is simple textual information with low bandwidth requirements, thus ideal for WAP.

In conclusion, mobile access to corporate Intra- and Extranets will enable companies to move one step closer to real time operations. In today's fast-paced competitive environment this translates to operational excellence, faster and better decision making, and ultimately to superior business performance.

3. Technological base: Elements of a global standard

WAP enables Internet access to mobile devices. The fact that the access will be over a mobile network has some important implications.

First, saving bandwidth will always be relevant. The coming broadband networks, such as HSCSD, GPRS and UMTS, will indeed offer increased bandwidth. However, their coverage will be, at least in the initial phases, limited to major metropolitan areas. In addition, even the peak bandwidth, that is 2 Mbps for stationery terminals and some 384 Kbps for mobile terminals, will be significantly less than wireline networks today. Moreover, the massive use of WAP devices will constrain the use of bandwidth. Hence, the bandwidth in the mobile network will be a scarce resource for the foreseeable future. Considering all this, it is important that WAP is designed with this limitation in mind.

Mobile access means that the access device will have to be small enough to comfortably fit in a pocket. From the technical aspect, this implies that the device will have a limited display and restricted man-machine interface capabilities. Looking at the issue of usability, WAP applications and utilization environments will be fundamentally different from that in the wireline Internet. People on the move typically use mobile phones with one hand. In such environment, the time for "*surfing*" and "*browsing*" is very limited. Quick access to the information is the mode of use. The Wireless Markup Language (WML), which is part of WAP, is specifically designed for this kind of use.

Security is especially important in many corporate solutions. WAP includes a specification which implements options for authentication and encryption and is optimized for use in the mobile environment. It provides end-to-end security for messages. Corporations can be sure that the information travels securely all the way to the end-user.

Voice will remain an important application in the wireless world for the coming years. This is demonstrated by the success of already existing applications, such as phone banking. WAP is an application protocol for devices inherently geared towards voice communication and it accommodates for the integration between voice and data applications.

3.1 The WAP Standard: Application environment and protocol

Roughly speaking, the WAP standard defines two things: an application environment and an application protocol.

The application environment consists of two things: a markup language, WML, that allows programmers to define the application's user interface in a device-independent way, and a programming language, WMLScript, that allows programmers to embed executable logic in their applications. In practice, these are realized in the microbrowser environment in a mobile terminal. Conceptually, the microbrowser is very similar to a Web browser. Because the WAP applications can be downloaded on demand and discarded when no longer needed, the application environment also allows for dynamic extension of the terminal's user interface.

The actual application protocol is a layered communication stack that consists of a session protocol, a transaction protocol, a security protocol, and a datagram protocol. The protocol stack isolates the applications from the bearer so that one application can be run regardless of the actual transport service being used. Naturally the amount of data being transferred and the nature of user interaction affect the selection of the optimal bearer. For example, one would probably not implement an image database or a multi-user reaction time competition over SMS.

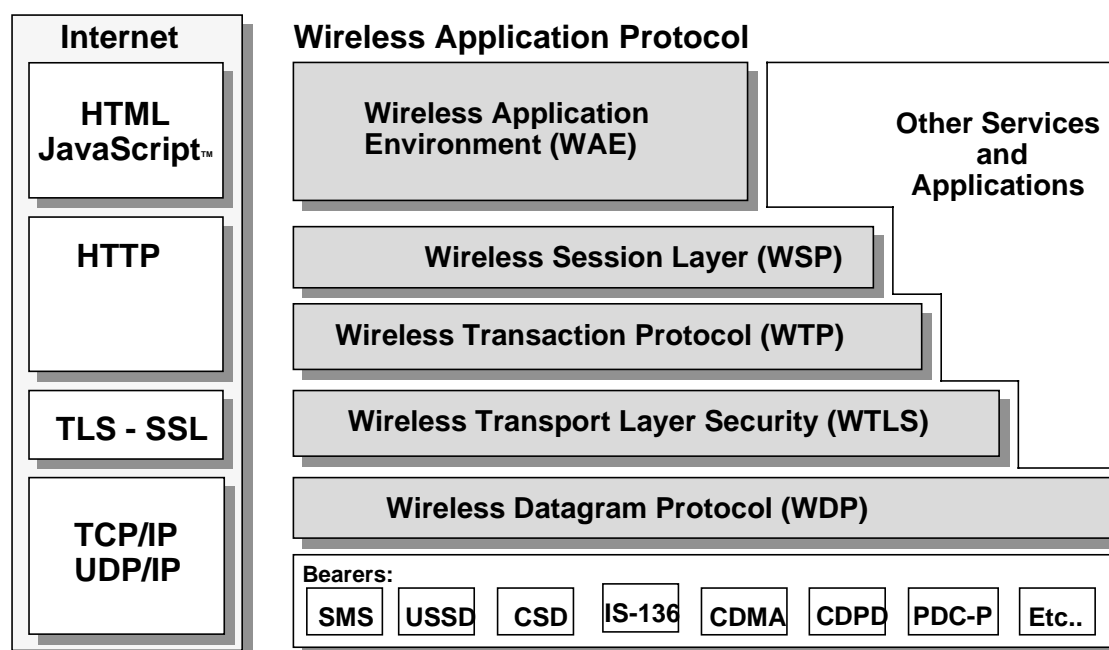


Figure 3. WAP protocol architecture and comparison to Internet protocols

In addition to the application environment and the application protocol, the WAP standard also defines a technology known as WTA. It is a telecom-oriented technology that allows WAP to be integrated with the advanced services in the telecom network, such as Intelligent Networks. Combined with the browser-based user interface of WAP, the WTA would allow, for instance, new Intelligent Networks based services to be introduced to users without modifying the terminals in any way.

The Wireless Application Protocol has all the elements of a successful global platform standard. It defines the key ingredients of interoperability at an appropriate level of abstraction. Interoperability is fundamentally defined by protocols, programming interfaces and content formats. Moreover, recent years have brought to the attention of the public a new kind of content format: mobile code. It is an executable content format that can be dynamically downloaded and extended, as well as safely executed in its target environment. Java is the most famous example of mobile code technologies. The trend of utilizing mobile code in application development will strengthen continuously in the near future. WAP will provide the content developers with a mobile code technology that is especially designed keeping the limitations of mobile terminals in mind.

4. Summary

*One of the changes in the business environment has been the growing demand for mobility. This means that customers, partners and employees should be able to access the information resources and services of a company wherever they are and whenever they want. Millions of cellular phone users know what they want, and they expect to get it now. The market is on the verge of gathering momentum, and the first WAP based products have already been launched.

*According to recent studies, the total number of mobile phone users worldwide is over 300 million, double the number of Internet users. It is estimated that in 2005 there will be about one billion mobile phone subscribers, and that a substantial portion of the phones sold that year will have multimedia capabilities.

*Wireless Application Protocol (WAP) provides a universal standard for bringing Internet content and advanced value added services to mobile phones and other wireless devices. In addition, WAP supports all major standards like GSM, TDMA, CDMA, etc, and it will also play an important role in the future when emerging broadband standards and technologies like GPRS and UMTS become available. WAP enables the corporation to be part of the wireless future.

*WAP provides an open technology platform to offer new innovative services to the consumer market and a wireless channel for the existing services. Furthermore, WAP increases employee productivity and improves business performance through continuous mobile access to the corporate Intra and Extranets.

*Consumers, corporations, application developers and service providers will all benefit from the new WAP standard. Mobile Web business is an opportunity in your hands: corporate directories, stock prices, news, flight schedules, hotel bookings, buying tickets and wireless banking, and much, much more. As a business decision-maker, you may be interested in taking the opportunity now, as early adopters will ensure competitive advantages.

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For further information see www.wapforum.org

Abbreviations

WAP	Wireless Application Protocol
WAE	Wireless Application Environment
WML	Wireless Markup Language
WTA	Wireless Telephony Application
WTAI	Wireless Telephony Application Interface
WSP	Wireless Session Protocol
WTP	Wireless Transaction Protocol
WTLS	Wireless Transport Layer Security
WDP	Wireless Datagram Protocol
URL	Universal Resource Locator
SIM ATK	SIM Application Toolkit