Wireless Application Protocol (WAP)

Definition

Wireless application protocol (WAP) is an application environment and set of communication protocols for wireless devices designed to enable manufacturer-, vendor-, and technology-independent access to the Internet and advanced telephony services.

Overview

Positioned at a high level, this tutorial serves as an introduction to WAP, explaining its basic concept, benefits, architecture, and future.

Topics

1. Introduction
2. Benefits
3. Why Choose WAP?
4. Mobile-Originated Example of WAP Architecture
5. The Future of WAP
6. Summary
7. The Way Forward for WAP

   Self-Test

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1. Introduction

WAP bridges the gap between the mobile world and the Internet as well as corporate intranets and offers the ability to deliver an unlimited range of mobile value-added services to subscribers—independent of their network, bearer, and terminal. Mobile subscribers can access the same wealth of information from a pocket-sized device as they can from the desktop.

WAP is a global standard and is not controlled by any single company. Ericsson, Nokia, Motorola, and Unwired Planet founded the WAP Forum in the summer of 1997 with the initial purpose of defining an industry-wide specification for developing applications over wireless communications networks. The WAP specifications define a set of protocols in application, session, transaction, security, and transport layers, which enable operators, manufacturers, and applications providers to meet the challenges in advanced wireless service differentiation and fast/flexible service creation. There are now over one hundred members representing terminal and infrastructure manufacturers, operators, carriers, service providers, software houses, content providers, and companies developing services and applications for mobile devices.For more information, visit the WAP Forum at http://www.wapforum.org.

WAP also defines an application environment (WAE) aimed at enabling operators, manufacturers, and content developers to develop advanced differentiating services and applications including a microbrowser, scripting facilities, e-mail, World Wide Web (WWW)–to–mobile-handset messaging, and mobile to telefax access.

The WAP specifications continue to be developed by contributing members, who, through interoperability testing, have brought WAP into the limelight of the mobile data marketplace with fully functional WAP–enabled devices (see *Figure 1*).

Figure 1. WAP–Enabled Devices
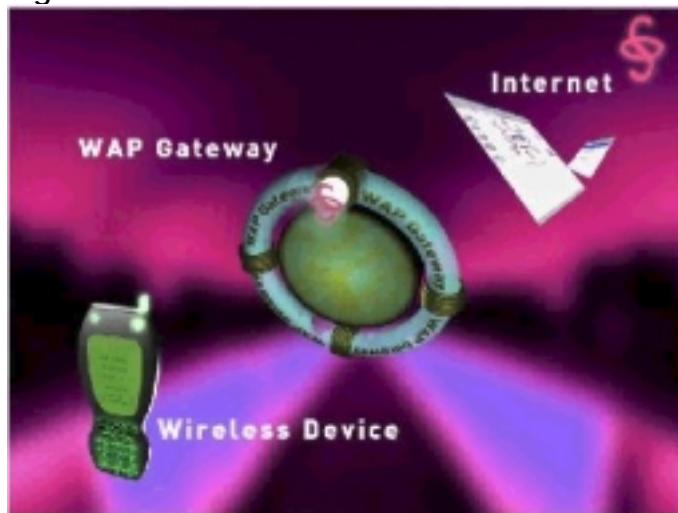
Based on the Internet model, the wireless device contains a microbrowser, while content and applications are hosted on Web servers.

2. Benefits

Operators

For wireless network operators, WAP promises to decrease churn, cut costs, and increase the subscriber base both by improving existing services, such as interfaces to voice mail and prepaid systems, and facilitating an unlimited range of new value-added services and applications, such as account management and billing inquiries. New applications can be introduced quickly and easily without the need for additional infrastructure or modifications to the phone. This will allow operators to differentiate themselves from their competitors with new, customized information services. WAP is an interoperable framework, enabling the provision of end to end turnkey solutions that will create a lasting competitive advantage, build consumer loyalty, and increase revenues.

Content Providers

Applications will be written in wireless markup language (WML), which is a subset of extensible markup language (XML). Using the same model as the Internet, WAP will enable content and application developers to grasp the tag-based WML that will pave the way for services to be written and deployed within an operator's network quickly and easily. As WAP is a global and interoperable open standard, content providers have immediate access to a wealth of potential customers who will seek such applications to enhance the service offerings given to their own existing and potential subscriber base. Mobile consumers are becoming more hungry to receive increased functionality and value-add from their mobile devices, and WAP opens the door to this untapped market that is expected to reach 100 million WAP–enabled devices by the end of the year 2000. This presents developers with significant revenue opportunities.

End Users

End users of WAP will benefit from easy, secure access to relevant Internet information and services such as unified messaging, banking, and entertainment through their mobile devices. Intranet information such as corporate databases can also be accessed via WAP technology. Because a wide range of handset manufacturers already supports the WAP initiative, users will have significant freedom of choice when selecting mobile terminals and the applications they support. Users will be able to receive and request information in a controlled, fast, and low-cost environment, a fact that renders WAP services more attractive to consumers who demand more value and functionality from their mobile terminals.

As the initial focus of WAP, the Internet will set many of the trends in advance of WAP implementation. It is expected that the ISPs will exploit the true potential of WAP. Web content developers will have great knowledge and direct access to the people they attempt to reach. In addition, these developers will likely acknowledge the huge potential of the operators' customer bases; thus, they will be willing and able to offer competitive prices for their content. WAP's push capability will enable weather and travel information providers to use WAP. This push mechanism affords a distinct advantage over the WWW and represents tremendous potential for both information providers and mobile operators.

3. Why Choose WAP?

In the past, wireless Internet access has been limited by the capabilities of handheld devices and wireless networks.

WAP utilizes Internet standards such as XML, user datagram protocol (UDP), and IP. Many of the protocols are based on Internet standards such as hypertext transfer protocol (HTTP) and TLS but have been optimized for the unique constraints of the wireless environment: low bandwidth, high latency, and less connection stability.

Internet standards such as hypertext markup language (HTML), HTTP, TLS and transmission control protocol (TCP) are inefficient over mobile networks, requiring large amounts of mainly text-based data to be sent. Standard HTML content cannot be effectively displayed on the small-size screens of pocket-sized mobile phones and pagers.

WAP utilizes binary transmission for greater compression of data and is optimized for long latency and low bandwidth. WAP sessions cope with intermittent coverage and can operate over a wide variety of wireless transports.

WML and wireless markup language script (WMLScript) are used to produce WAP content. They make optimum use of small displays, and navigation may be performed with one hand. WAP content is scalable from a two-line text display on a basic device to a full graphic screen on the latest smart phones and communicators.

The lightweight WAP protocol stack is designed to minimize the required bandwidth and maximize the number of wireless network types that can deliver WAP content. Multiple networks will be targeted, with the additional aim of targeting multiple networks. These include global system for mobile communications (GSM) 900, 1,800, and 1,900 MHz; interim standard (IS)–136; digital European cordless communication (DECT); time-division multiple access (TDMA), personal communications service (PCS), FLEX, and code division multiple access (CDMA). All network technologies and bearers will also be

supported, including short message service (SMS), USSD, circuit-switched cellular data (CSD), cellular digital packet data (CDPD), and GPRS.

As WAP is based on a scalable layered architecture, each layer can develop independently of the others. This makes it possible to introduce new bearers or to use new transport protocols without major changes in the other layers.

# 4. Mobile-Originated Example of WAP Architecture

WAP will provide multiple applications, for business and customer markets such as banking, corporate database access, and a messaging interface (see *Figure 2*).

Figure 2. Messaging Interface

The request from the mobile device is sent as a URL through the operator's network to the WAP gateway, which is the interface between the operator's network and the Internet (see *Figure 3*).

Figure 3. WAP Gateway
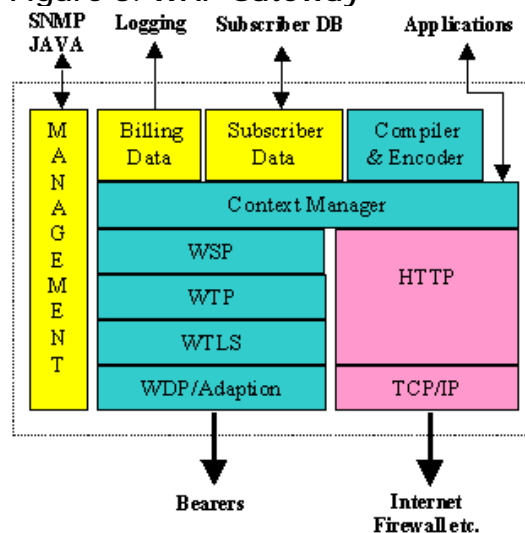
Architecture of the WAP Gateway

WDP

The WAP datagram protocol (WDP) is the transport layer that sends and receives messages via any available bearer network, including SMS, USSD, CSD, CDPD, IS–136 packet data, and GPRS.

WTLS

Wireless transport layer security (WTLS), an optional security layer, has encryption facilities that provide the secure transport service required by many applications, such as e-commerce.

The WAP transaction protocol (WTP) layer provides transaction support, adding reliability to the datagram service provided by WDP.

## WSP

The WAP session protocol (WSP) layer provides a lightweight session layer to allow efficient exchange of data between applications.

HTTP Interface

The HTTP interface serves to retrieve WAP content from the Internet requested by the mobile device.

WAP content (WML and WMLScript) is converted into a compact binary form for transmission over the air (see *Figure 4*).

Figure 4. WAP Content in Compact Binary Form
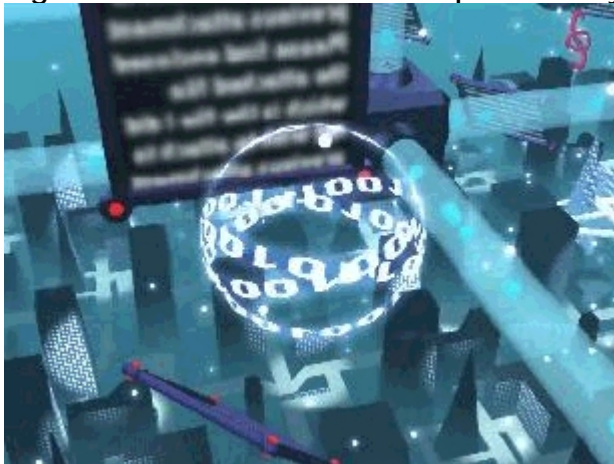
The WAP microbrowser software within the mobile device interprets the byte code and displays the interactive WAP content (see *Figure 5*).

Figure 5. Mobile Device Display
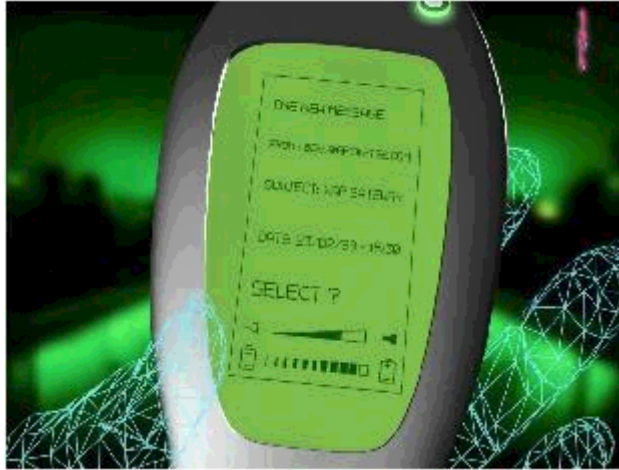
5. The Future of WAP

The tremendous surge of interest and development in the area of wireless data in recent times has caused worldwide operators, infrastructure and terminal manufacturers, and content developers to collaborate on an unprecedented scale, in an area notorious for the diversity of standards and protocols. The collaborative efforts of the WAP Forum have devised and continue to develop a set of protocols that provide a common environment for the development of advanced telephony services and Internet access for the wireless market. If the WAP protocols were to be as successful as transmission control protocol-(TCP)/Internet protocol (IP), the boom in mobile communications would be phenomenal. Indeed, the WAP browser should do for mobile Internet what Netscape did for the Internet.

As mentioned earlier, industry players from content developers to operators can explore the vast opportunity that WAP presents. As a fixed-line technology, the Internet has proved highly successful in reaching the homes of millions worldwide. However, mobile users until now have been forced to accept relatively basic levels of functionality, over and above voice communications and are beginning to demand the industry to move from a fixed to a mobile environment, carrying the functionality of a fixed environment with it.

Initially, services are expected to run over the well-established SMS bearer, which will dictate the nature and speed of early applications. Indeed, GSM currently does not offer the data rates that would allow mobile multimedia and Web browsing. With the advent of general packet radio services (GPRS), which aimed at increasing the data rate to 115 kbps, as well as other emerging high-bandwidth

bearers, the reality of access speeds equivalent or higher to that of a fixed-line scenario become evermore believable. GPRS is seen by many as the perfect partner for WAP, with its distinct time slots serving to manage data packets in a way that prevents users from being penalized for holding standard circuit-switched connections.

Handset Manaufacturers and WAP Services

It is expected that mobile terminal manufacturers will experience significant change as a result of WAP technology—a chance that will impact the look and feel of the hardware they produce. The main issues faced by this arm of the industry concern the size of mobile phones, power supplies display size, usability, processing power, and the role of personal digital assistants (PDAs) and other mobile terminals.

With over 75 percent of the world's key handset manaufacturers already involved in the WAP Forum and announcing the impending release of WAP–compatible handsets, the drive toward new and innovative devices is quickly gathering pace. The handsets themselves will contain a microbroswer that will serve to interpret the byte code (generated from the WML/WMLS content) and display interactive content to the user.

The services available to users will be wide-ranging in nature, as a result of the open specifications of WAP, their similarity to the established and accepted Internet model, and the simplicity of the WML/WMLS langauges with which the applications will be written. Information will be available in push and pull functionality, with the ability for users to interact with services via both voice and data interfaces. Web browsing as experienced by the desktop user, however, is not expected to be the main driver behind WAP as a result of time and processing restraints.

Real-time applications and services demand small and key pieces of information that will fuel the success of WAP in the mobile marketplace. Stock prices, news, weather, and travel are only some of the areas in which WAP will provide services for mobile users. Essentially, the WAP application strategy involves taking existing services that are common within a fixed-line environment and tailoring them to be purposeful and user-friendly in a wireless environment.

Empowering the user with the ability to access a wealth of information and services from a mobile device will create a new battleground. Mobile industry players will fight to provide their customers with sophisticated, value-added services. As mobile commerce becomes a more secure and trusted channel by which consumers may conduct their financial affairs, the market for WAP will become even more lucrative.

WAP in the Competitive Environment

Competition for WAP protocols could come from a number of sources:

- **subscriber identity module (SIM) toolkit**—The use of SIMs or smart cards in wireless devices is already widespread and used in some of the service sectors.

- **Windows CE**—This is a multitasking, multithreaded operating system from Microsoft designed for including or embedding mobile and other space-constrained devices.

- **JavaPhone™**—Sun Microsystems is developing PersonalJava™ and a JavaPhone™ API, which is embedded in a Java™ virtual machine on the handset. NEPs will be able to build cellular phones that can download extra features and functions over the Internet; thus, customers will no longer be required to buy a new phone to take advantage of improved features.

The advantages that WAP can offer over these other methods are the following:

- open standard, vendor independent

- network-standard independent

- transport mechanism–optimised for wireless data bearers

- application downloaded from the server, enabling fast service creation and introduction, as opposed to embedded software

6. Summary

WAP provides a markup language and a transport protocol that open the possibilities of the wireless environment and give players from all levels of the industry the opportunity to access an untapped market that is still in its infancy.

The bearer-independent nature of WAP has proved to be a long-awaited breath of fresh air for an industry riddled with multiple proprietary standards that have suffocated the advent of a new wave of mobile-Internet communications. WAP is an enabling technology that, through gateway infrastructure deployed in mobile operator's network, will bridge the gap between the mobile world and the Internet, bringing sophisticated solutions to mobile users, independent of the bearer and network.

Backed by 75 percent of the companies behind the world's mobile telephone market and the huge development potential of WAP, the future for WAP looks bright.

Self-Test

1. WAP enables mobile phone users to retrieve information from the Internet.

    a. true

    b. false

2. WAP only utilizes SMS to send and receive information.

    a. true

    b. false

3. WAP uses binary compression to improve performance and reliability over wireless networks.

    a. true

    b. false

4. Current wireless devices could access WAP content.

    a. true

    b. false

5. WAP content can include graphics.

    a. true

    b. false

6. WML and WMLScript are based on HTML and Javascript.

    a. true

    b. false

7. Which of the following is not a layer in the WAP gateway stack?

    a. WDP

b. context manager

c. TCP

d. WSP

8. WAP devices will view WAP content using microbrowser software.

    a. true

    b. false

9. WAP will provide an interface to voice mail and prepaid systems. The range of applications is unlimited.

    a. true

    b. false

10. The WAP Forum is controlled by the founding companies.

    a. true

    b. false

Correct Answers

1. WAP enables mobile phone users to retrieve information from the Internet.

    a. true

    b. false

    See Topic 2.

2. WAP only utilizes SMS to send and receive information.

    a. true

    b. false

    See Topic 5.

3. WAP uses binary compression to improve performance and reliability over wireless networks.

    a. true

b. false

See Topics 2 and 5.

4. Current wireless devices could access WAP content.

    a. true

    b. false

    See Topic 5.

5. WAP content can include graphics.

    a. true

    b. false

    See Topic 5.

6. WML and WMLScript are based on HTML and Javascript.

    a. true

    b. false

    See Topic 3.

7. Which of the following is not a layer in the WAP gateway stack?

    a. WDP

    b. context manager

    c. TCP

    d. WSP

    See Topic 4.

8. WAP devices will view WAP content using microbrowser software.

    a. true

    b. false

    See Topic 1.

9. WAP will provide an interface to voice mail and prepaid systems. The range of applications is unlimited.

   a. true

   b. false

   See Topic 2.

10. The WAP Forum is controlled by the founding companies.

    a. true

    b. false

    See Topic 1.

Acronym Guide

HTML
hypertext markup language

HTTP
hypertext transfer protocol

WAP
wireless application protocol

WML
wireless markup language

WMLScript
wireless markup language script

WTA
wireless telephony application