LOVELY PROFESSIONAL UNIVERSITY

WAP & WML

Edited By

Kumar Vishal

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SYLLABUS

WAP & WML

Objectives: To Impart the skills needed to implement wireless applications. Student will learn wireless application protocols using WAP, Wireless Markup Language WML to work with devices that support WAP. Student can work with images and manage input and outputs. Student will also learn WML Scripts and security issues related to wireless applications.

Sr. No.	Description
1.	***Understanding WAP, Introducing WML:*** What is WML, Getting started with WML? Understanding WML usage
2.	***Writing for WAP in WML:*** Creating first card, Building decks of cards, Using basic navigation
3.	***Card Navigation:*** Using URLs, Tags used in Navigation, Using phone buttons and Function keys, Navigation History.
4.	***Managing Output:*** Basic Card output, Layout, Rendering
5.	***Using Images:*** Using images and icons, Image restrictions, Using localscr Images, Using images efficiently
6.	***Working with user input:*** Using variables, Free form input with <input>, restricted input with <select>, under implemented input behavior, delivering data to applications
7.	***Email Integration:*** Email and WAP, integrating Email into your applications
8.	***Using WMLScript:*** WMLScript vs Javascript, Using WMLScript Functions, Using WMLScript Libraries, Sample Application
9.	***Securing Applications:*** Security basics, WAP security architechture, Session management, WML for secure applications
10.	***Writing for HTML and WML:*** Why two languages, How to write for both languages, database driven applications, other languages

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Unit 1: Understanding WAP (Wireless Application Protocol)

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Objectives

After studying this unit, you will be able to:

- Scan what is WAP
- Describe WAP Services
- Demonstrate WAP Application

Introduction

This unit will familiarize you with WAP or Wireless Application Protocol which is one of the pervasive computing tools which helps to manage information easily. You will get to know how this protocol originated and its present status and what are its future potentials. You will learn what is the importance and benefits of WAP to various users such as operators, content providers and end-users. Also WAP offers various advantages over other technologies which make it ideal for wireless applications and in this regard you will study its architecture and compare it with other Internet Protocol layers. Also you will learn what are the various WAP services and applications available.

Pervasive Computing: Tools to Manage Information Easily

Pervasive computing is the new currency of the global economy. We increasingly rely on the electronic creation, storage, and transmittal of personal, financial, and other confidential information, and demand the highest security for all these transactions. We require complete access to time-sensitive data, regardless of physical location. We expect devices, as listed below to access that information and work together in one seamless, integrated system.

Notes

- Personal digital assistants
- Mobile phones
- Office PCs
- Home entertainment systems

Pervasive computing can help us control information quickly, efficiently, and effortlessly. Pervasive Computing is about making our lives simpler.

Pervasive computing aims to activate people to accomplish a growing number of personal and professional transactions using a new class of smart and portable devices. It provides people easy access to corresponding information placed on powerful networks, permitting them to simply take action anywhere, round the clock.

These new clever appliances or "smart devices" are embedded with microprocessors that permit users to plug into intelligent networks and gain direct, simple, and secure access to both corresponding information and services. These devices are as simple to utilize as calculators, telephones or kitchen toasters.

Pervasive computing eases life by uniting open standards-based applications with day-to-day activities. It eliminates the complexity of new technologies, helps us to be more efficient in our work and gives us more free time. Pervasive computing drives out the notion of working as an isolated activity, which is bound to desktop, and instead makes it an integral part of day-to-day life.

Did u know? **What is the aim of Pervasive Computing?**

Pervasive computing aims to speed up progress in every field of computing, by uniting together researchers, educators and practitioners from discrete disciplines. The aim is to attain a world saturated with computing and communication, yet gracefully linked with human users.

1.1 What is WAP?

An important landmark in the world of communications came with the introduction of WAP for accessing the universal Internet-based information by means of wireless devices.

Wireless Application Protocol (WAP) is an application environment and group of communication protocols for wireless devices modeled to activate manufacturer-vendor and technology-independent access to the Internet and advanced telephony services.

Notes The Wireless Application Protocol (WAP) is an open, global specification that empowers mobile users with wireless devices to easily access and interact with information and services instantly.

1.1.1 Importance and Benefits of WAP

WAP fills the void between the mobile world and the Internet as well as corporate intranets and provide the ability to present a wide range of mobile value-added services to subscriber-independent of their network, bearer and terminal. Mobile subscribers can access the same information from a pocketsize device as they can use with the desktop.

Notes

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.

1.1.2 History of WAP

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.

Did u know? **What is the purpose of WAP?**

To enable easy fast delivery of relevant information and services to mobile users.

Present Day Scenario

All players in the vertical benefit form the common development format:

- Handset manufacturers
- Access providers
- Network infrastructure
- Content providers
- Mobile consumers

Carriers will be able to develop gateways that work with a variety of phones and all applications and content. Handset manufacturers can develop high volume, low cost handsets for all carriers.

The WAP specifications formulate a group of protocols in application, session, transaction, security, and transport layers, which aid operators, manufacturers, and application providers to cope with the challenges in advanced wireless service differentiation and fast/flexible service creation.

There are now over one hundred members representing terminal manufacturers, infrastructure providers, operator carriers, service providers, software houses, content providers and companies developing services and applications for mobile devices.

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

- Micro browser
- Scripting facilities
- E-mail

Notes

- WWW-to-mobile
- Handset messaging
- Mobile to Telefax access

The WAP specifications remain 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. The WAP is an open, worldwide specification that empowers mobile users with wireless devices to easily access and interact with information and services instantly.

Task Analyze what type of devices will use WAP? Explain with examples.

The core purpose of WAP is to enable easy fast delivery of relevant information and services to mobile users. Handheld digital wireless devices such as mobile phones, pagers, two-way radios, smart phones, and communicators can use WAP.

WAP was created after largely unsuccessful efforts of several companies to arrive separately at a viable technology delivery format. These companies included Nokia, Motorola, and Phone.com. The problem for network operators was the selection of a wireless data infrastructure supported by the many different mobile handset makers. No such infrastructure existed at the time.

The wireless industry came up with the idea of WAP. The point of this standard was to show internet contents on wireless clients, like mobile phones.

- WAP stands for Wireless Application Protocol
- WAP is an application communication protocol
- WAP is used to access services and information
- WAP is inherited from Internet standards
- WAP is for handheld devices such as mobile phones
- WAP is a protocol designed for micro browsers
- WAP enables the creating of web applications for mobile devices.
- WAP uses the mark-up language WML (not HTML)
- WML is defined as an XML 1.0 application

Did u know? **Which wireless networks does WAP work with?**

WAP is designed to work with most wireless networks, such as CDPD, CDMA, GSM, PDC, PHS, TDMA, FLEX, ReFLEX, iDEN, TETRA, DECT, DataTAC, Mobitex and GPRS.

The Wireless Application Protocol is targeted to offer the following:

- A global wireless service specification to be adopted by appropriate standards bodies which would be independent of the network infrastructure system in place.
- An advanced service and Internet content to digital cellular phones and terminals.
- A common standard means with the potential for realizing economies of scale, encouraging cellular phone manufacturers to invest in developing compatible products, and cellular network carriers to develop new differentiated service offerings as a way of attracting new subscribers.

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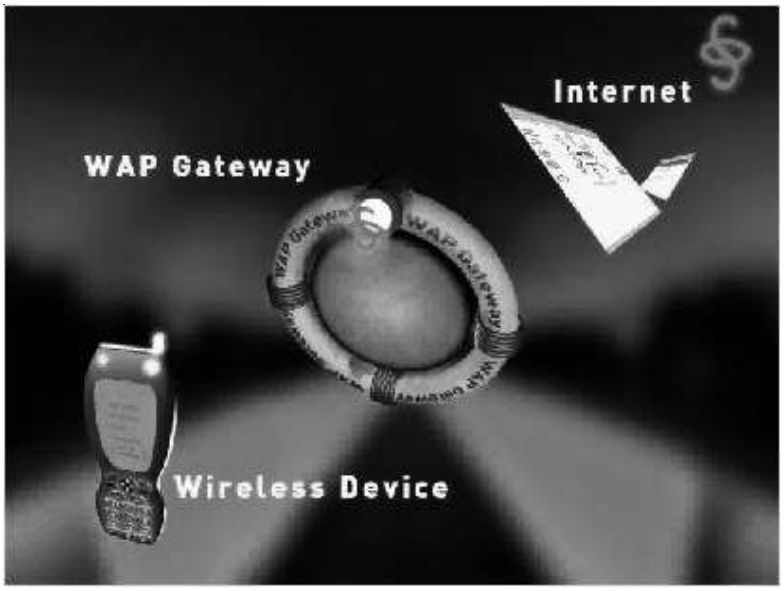
- A varied choice for consumers in advanced mobile communication applications and services.
- An advanced services and Internet content to digital cellular phones and terminals. Consumer benefit through more and varied choice in advanced mobile communication applications and services.
- Offer operators, infrastructure and terminal manufacturers, and content developers a common environment that will enable development of value-added service for mobile phones.

All the applications of the protocol will be scalable with a variety of bearer transport. The WAP protocol is the leading standard for information services on wireless terminals like digital mobile phones. The WAP standard is based on Internet standards (HTML, XML and TCP/IP). It consists of a WML language specification, a WML Script specification, and a Wireless Telephony Application Interface (WTAI) specification. WAP is published by the WAP Forum, founded in 1997 by Ericsson, Motorola, Nokia, and Unwired Planet. Forum members now represent over 90% of the global handset market, as well as leading infrastructure providers, software developers and other organizations.

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 1.1).

Figure 1.1: WAP–Enabled Devices



Based on the Internet model, the wireless device contains a micro browser, while content and applications are hosted on Web servers.

1.1.3 Objectives of WAP

WAP considers the consumer viewpoint: of not only they enjoy the benefits of the Web but also using it to pass time during, say, commuting. The concept is very lucid: someone with a cell phone, pager, or PDA should be able to do limited Web surfing.

Notes

Example: One should be able to check stock quotes, get restaurant information, or access bank accounts.

WAP's goal can be listed as following:

- Allow a wide variety of wireless devices and compensate for the restraints and applications.
- Utilize as few resources as possible on the handheld device and compensate for the constraints of the device by enriching the functionality of the network.
- Enable a variety of devices, from the very basic handset to a fully featured PDA or laptop PC, to access the same information and content.

The features supported by WAP software are the following:

- Multiple devices like Standard phones, enhanced phones, smart phones, palmtops, laptops.
- Multiple displays like Text only, Bitmapped.
- Multiple input devices-numeric keypads, touch screen, stylus.
- Multiple transports like 1-way SMS, 2-way SMS, Circuit Switched data, Packet data.
- Scalable applications like Applications are written once and run on all devices.

For available devices, the Wireless Application Protocol will be applicable, but not limited to the following:

- GSM 900, GSM 1800, GSM 1900
- CDMA IS-95
- TDMA IS-136
- 3G systems – IMT-2000, W-CDMA, Wideband IS-95.

Task Analyze the present day scenario of WAP.

1.1.4 Benefit to Operators, Content Providers and End-Users

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

Notes

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 2005. This presents developers with significant revenue opportunities.

Example:

1. Using WAP we can get information of train timetable.
2. Using WAP can purchase tickets. Like: movie, journey ticket, etc.

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 Internet Service Providers (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.

Caution This push mechanism affords a distinct advantage over the WWW and represents tremendous potential for both information providers and mobile operators.

1.1.5 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 Internet Protocol (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.

Notes

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 (WML Script) 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 General Packet Radio Service (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.

Task What is WAE? What facilities does it micro browser support?

Self Assessment

Fill in the blanks:

1. …… computing can help us control information quickly, efficiently, and effortlessly.
2. Pervasive computing eases life by uniting open …… applications with day-to-day activities.
3. The WAP specifications define a set of protocols in application, session, transaction, security, and …… layers.
4. Carriers will be able to develop …… that work with a variety of phones and all applications and content.
5. …… was created after largely unsuccessful efforts of several companies to arrive separately at a viable technology delivery format.
6. New applications can be introduced quickly and easily without the need for additional …… or modifications to the phone.
7. Applications will be written in Wireless Markup Language (WML), which is a subset of ……
8. WAP utilizes binary transmission for greater compression of data and is optimized for long latency and low ……
9. WAP content is scalable from a two-line text display on a basic device to a full …… on the latest smart phones and communicators.
10. The lightweight WAP protocol stack is designed to …… the required bandwidth and maximize the number of wireless network types.

Notes

1.2 WAP Services and Applications

The WAP layered architecture enables other services and applications to utilize the features of the stack through a set of well-defined interfaces.

External applications may access the session, transaction, and security and transport layers directly. This permits the WAP stack to be utilized for applications and services not currently specified by WAP, but deemed to be valuable for the wireless market.

Example: Applications such as electronic mail, calendar, phone book, notepad and electronic commerce, or services, such as white and yellow pages, may be developed to use the WAP protocols.

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 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.

Task

1. Contrast the WAP protocol layers with Internet protocol layers.
2. What are some of the services and applications that may be developed to use the WAP protocol?

Self Assessment

Fill in the blanks:

11. …… applications may access the session, transaction, and security and transport layers directly.

Notes

12. WAP is not actually a …… at all, in the sense that HTTP and IP are protocols.
13. WAP defines a communications protocol as well as an …… environment.
14. Wireless Application Protocol (WAP) is an enabling technology based on the …… client server architecture model.
15. As a …… technology, the Internet has proved highly successful in reaching the homes of millions worldwide.

Caselet

Gartner sees Global Mobile Payment Volume to Touch $86 b in 2011

Worldwide mobile payment volume is expected to nearly double to $86.1 billion in 2011 from $48.9 billion in 2010, says market research firm Gartner.

The number of mobile payment users worldwide will surpass 141.1 million in 2011 against 102.1 million in 2010, it said.

Gartner analysts, however, forecast a slower-than-expected growth for mobile payment market in spite of strong growth projections.

"While developing markets have favourable conditions for mobile payments, such as high penetration of mobile devices and low banking penetration, this is no guarantee of success, unless service providers adapt their strategies to local market requirements," the Gartner research director, Mr Sandy Shen, said in a statement today.

Mr Shen added that in developed markets, companies are trumpeting the prospects of Near Field Communication (NFC) without realising the complexity of the service model.

"We believe mass market adoption of NFC payments is at least four years away," he said.

Gartner identified effort to change user behaviour as one of the biggest challenges in mobile payment business.

The firm found that SMS and Unstructured Supplementary Service Data (USSD) are likely to remain the dominant access technologies in developing markets due to the constraints of mobile phones.

USSD is used by telecom operators to send alert to mobile phone users at the end of each calls or SMS.

The research found that Wireless Application Protocol (WAP) will remain the preferred mobile access technology in developed markets, where the mobile Internet is commonly available and activated on the phone.

Money transfers and prepaid top-ups will drive transaction volumes in developing markets, the report said.

"We predict that in 2011, merchandise purchases will account for 90 per cent and 77 per cent of all transactions in North America and Western Europe, respectively," Mr Shen said.

Notes

1.3 Summary

- Pervasive computing is aimed at providing people easy access to information and to help us control information quickly, efficiently and effortlessly making lives easier for us.
- Smart devices are embedded with microprocessors that permit users to plug into intelligent networks and gain direct, simple, and secure access to both corresponding information and services.
- Wireless Application Protocol (WAP) is an application environment and group of communication protocols for wireless devices modeled to activate manufacturer-vendor and technology-independent access to the Internet and advanced telephony services.
- WAP provide the ability to present a wide range of mobile value-added services to subscriber-independent of their network, bearer and terminal. Mobile subscribers can access the same information from a pocketsize device as they can use with the desktop.
- 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 standard is based on Internet standards (HTML, XML and TCP/IP). It consists of a WML language specification, a WML Script specification, and a Wireless Telephony Application Interface (WTAI) specification.
- WAP's goal is to allow a wide variety of wireless devices and compensate for the restraints and applications, to utilize as few resources as possible on the handheld device and compensate for the constraints of the device by enriching the functionality of the network.
- For wireless network operators, WAP promises to decrease churn, cut costs, and increase the subscriber base both by improving existing services and facilitating an unlimited range of new value-added services and applications.
- 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.
- End users of WAP will benefit from easy, secure access to Internet information and services through their mobile devices as well as access to Intranet information such as corporate databases.
- WAP utilizes Internet standards such as XML, UDP, and IP which have been optimized for the unique constraints of the wireless environment: low bandwidth, high latency, and less connection stability.
- 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.
- 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.
- WAP is based on a scalable layered architecture making it possible to introduce new bearers or to use new transport protocols without major changes in the other layers.
- WAP defines a set of standard components that enable communication between mobile terminals and network servers which are standard naming model, content typing, standard content formats, and standard communication protocols.

Notes

- The WAP proxy typically is comprised of the following functionality: protocol gateway, content encoders and decoders.
- Wireless Application Environment is a general-purpose application environment based on a mixture of the World Wide Web (WWW) and Mobile Telephony technologies.
- WAE includes a micro-browser environment containing the following functionality: wireless markup language, WML script and content formats.
- WAP Datagram Protocol (WDP) is the transport layer that sends and receives messages via any available bearer network, Wireless Transport Layer Security (WTLS), an optional security layer, has encryption facilities that provide the secure transport service, WAP Transaction Protocol (WTP) layer provides transaction support, adding reliability to the datagram service provided by WDP, WAP Session Protocol (WSP) layer provides a lightweight session layer to allow efficient exchange of data between applications.
- The WAP Gateway translates WSP requests from the mobile device and sends them to a Web Server. The data returned from the Web Server is translated by the WAP gateway into WSP format before sending it forward to the mobile device.
- The layered architecture of the WAP is very similar to the Internet Protocol Stack.
- The WAP protocols are modeled to operate over a variety of bearer services, including short message, circuit-switching data and packet data.
- The WAP layered architecture enables other services and applications to utilize the features of the stack through a set of well-defined interfaces. External applications may access the session, transaction, and security and transport layers directly.
- Initially, services are expected to run over the well-established SMS bearer. 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.

1.4 Keywords

Authentication: The authenticity of the terminal and application is ensured server.

Content Formats: It is set of well-defined data formats, including images, phone book records and calendar information. The application environment is modeled for use with mobile devices that have limited input keys.

Content Providers: An organization or individual that creates information, educational or entertainment content for the Internet, CD-ROMs or other software-based products. A content provider may or may not provide the software used to access the material.

Data Integrity: WTLS ensures that data sent between the terminal and an application server is unchanged and uncorrupted.

Denial-of-Service: Detecting and rejecting data that is replayed or not successfully verified.

Denial-of-Service Protection: To provide protection ensuring that typical denial of service attacks are harder to accomplish and protects the upper protocol layers.

Operators: It is an organization which provides carrier services in the wired or wireless arena. One example is ISPs.

Pervasive Computing: It is aimed at providing people easy access to information and to help us control information quickly, efficiently and effortlessly making lives easier for us.

Notes

Privacy: It means ensuring that eavesdropping of information by unauthorized persons is prevented.

Wireless Application Protocol (WAP): It is an application environment and group of communication protocols for wireless devices modeled to activate manufacturer-vendor and technology-independent access to the Internet and advanced telephony services.

Wireless Markup Language (WML): It is a lightweight markup language, analogous to HTML, but optimized for use in hand-held mobile terminals.

WML Script: It is a lightweight scripting language, analogous to JavaScript.

1.5 Review Questions

1. Substantiate what is WAP? Explain the significance of WAP.
2. How WAP was developed? Explain the salient features of WAP.
3. In your point of view what is the future of WAP? What are some of the features supported by the WAP software?
4. What are the benefits to be offered to content providers? How will the WAP benefit the end-users?
5. Pervasive Computing is about making our lives simpler. Explain.
6. WAP bridges the gap between the mobile world and the Internet. Do you agree with this statement? Explain with reasons to support your answer.
7. Handset manufacturers can develop high volume, low cost handsets for all carriers. Explain.
8. WAP sessions cope with intermittent coverage and can operate over a wide variety of wireless transports. Discuss.
9. As WAP is based on a scalable layered architecture, each layer can develop independently of the others. Explain.
10. The data returned from the Web Server is translated by the WAP gateway. What have you understood from this statement? Explain in detail.

Answers: Self Assessment

1.	Pervasive	2.	standards-based
3.	transport	4.	gateways
5.	WAP	6.	infrastructure
7.	Extensible Markup Language (XML)	8.	bandwidth
9.	graphic screen	10.	minimize
11.	External	12.	Protocol
13.	Application	14.	Internet
15.	fixed-line		

Notes

1.6 Further Readings

Books

Demon Hougland, *Essential WAP for Professional*, 2001, Prentice Hall PTR.

Dieter Fensel, *Spinning the Semantic Web: Bringing the World Wide Web to its full Potential*, 2003 MIT Press.

Paul Wallace Andrea Hoffmann, *Mika Tuppola, I – Mode Developer Guide,* 2002.

Online links

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Unit 2: Basic of a Good WAP Application

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2.4 Common Design Mistakes

2.5 Summary

2.6 Keywords

2.7 Review Questions

2.8 Further Readings

Objectives

After studying this unit, you will be able to:

- Scan WAP Micro Browsers
- Discuss Generic WML Interface
- Describe Application Design Process
- Explain Common Design Mistakes
- Describe Example of WAP Network
- Describe Examples of WAP Use

Introduction

This unit gives you an idea about what micro browsers are and why are they important for WAP applications. In this unit you will learn some tips about how one can go about designing a simple and well-structured design of WAP applications and what the common pitfalls are one should avoid while designing. Lastly with an example of a WAP network you will see how communication takes places and what are some of the uses WAP has enabled on mobile devices.

2.1 WAP Micro Browsers

To fit into a small wireless terminal, WAP uses a Micro Browser. A Micro Browser is a small piece of software that makes minimal demands on hardware, memory and CPU. It can display information written in a restricted mark-up language called WML.

Mobile devices use special browsing software, sometimes referred to as "microbrowsers" due to their size and capacity, to request and display information from a network. As on the Web, not all WAP browsers are created equal. Older devices with outdated browsers are still in circulation, and what works on one device may not work on another at all.

Notes

Add to that the fact that the WML specification allows for a range of interpretations of elements and functions, so even browsers that are 100% WML-compliant may have significant differences in their implementation of the standard.

Most WAP-enabled devices use the recently renamed Openwave Mobile Browser (formerly called UP.Browser) developed by Openwave (at one time called Unwired Planet, thus "UP").

Notes Not surprisingly, Microsoft has thrown its hat into the wireless ring with its browser, Microsoft Mobile Explorer for cell phones. MME is a dual-mode browser, supporting both WML and HTML content.

WAP micro browsers are small software that displays information written in a special mark-up language called wireless markup language (WML) on the internet. WAP micro browsers is a kind of web browsers, which is also known as mini browsers and mobile browsers. This designed for handled devices such as PDAs and cellular phones. WAP micro browsers are optimized to display internet content most effectively on small display screen with the help of low speed processor. Micro browsers contains small first their require low memory space on wireless handled devices. The earlier versions of WAP micro browsers were having only essential and minimal features of web browsers but now some WAP micro browsers are developed that can handle latest technologies such as CSS 2.1 .

2.1.1 WAP Micro Browsers Technologies

The WAP micro browsers set up the cellular networks and gets content that are written in XHTML language, also known as WAP 2.0 and WML also known as WAP 1.3, which was based on HDML. WML and HDML are suitable formats for transmission of data across wireless connection with low bandwidth. WAP 2.0 specifies XHTML language and WAP CSS, which are the subsets of the World Wide Web consortium standard. The W3C standard is the forum for information, commerce, communication and collective understanding. W3C developer's technology method standards and guidelines for developing software and tools that run on any operating system.

2.1.2 Types of WAP Micro Browsers

After the establishment of WAP standards, development of different supporting software for WAP devices such as WAP operating system and WAP micro browsers took place. Following are the different types of WAP micro browsers:

Hitchhiker

Hitchhiker was developed to present the entire device use interface (UI). STNC Ltd. Hitchhiker is believed to be first WAP micro browser that deals with HTML and WAP along with WML script, Post Office Protocol (POP3). POP3 protocol is used to retrieve e-mail from a mail server, Internet Message Access Protocol (IMAP) mail and EcmaScript from a single client.

Microsoft Mobile Explorer

Now Hitchhiker became Microsoft Mobile Explorer 2.0. Mobile Explorer 2.0 was available on the Sony CMD-Z5, CMD-J5 etc. Mobile Explorer 3.0, the advanced version of Microsoft Mobile Explorer 2.0 was released that includes iMode compatibility and several schemes.

Notes

Palmscape

Palmscape was a freeware browser for the PalmOS ,written in Japan, and still in limited use.

Opera Browser

Opera Browser emerged with its Small Screen Rendering technology. Opera Browser is able to relay out regular Web pages that can fit on small screens and medium-sized (PDA) screens. It was able the first widely available mobile browser to support Ajax.

Some other Micro Browsers

Some of the more popular default browsers WAP micro browsers are:

- Blazer by Palm
- Embider by Infraware
- Nokia Series 40 browsers by Nokia
- Nokia Web browsers by Nokia
- Opera Mobile by Opera Software ASA: capable for reading HTML and reformat for small screens
- Picsel browser by Picsel Technologies
- Play station portable web browser by Microsoft Inc.
- Wapaka Browser java micro-browser by Digital Airways
- Web browser for S60 by Nokia.

User installable WAP browsers are the browsers that are not provided with the WAP operating system. You need to install them before developing a WAP application. Following are the certain user-instable WAP Browsers available:

- Bluelark bought Anygraaf Oy
- Minimo by Mozilla Foundation
- MobileLeap
- Novarran web
- Opera browser
- Opera mini
- Web viewer by Reqwireless.

Did u know? **What is Mobile Browsers?**

WAP micro browsers are a kind of web browsers, which is also known as mini browsers and mobile browsers.

2.2 Generic WML Interface

WML stands for Wireless Markup Language. It is a mark-up language inherited from HTML, but WML is based on XML, so it is much stricter than HTML.

Notes

WML is used to create pages that can be displayed in a WAP browser. Pages in WML are called DECKS. Decks are constructed as a set of CARDS.

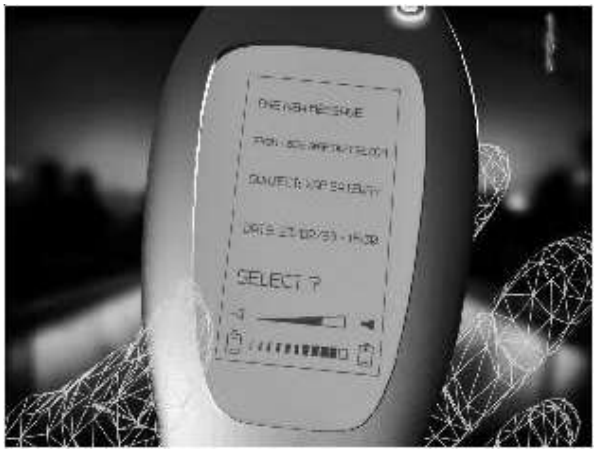
HTTP Interface

The HTTP interface serves to retrieve WAP content from the Internet requested by the mobile device. WAP content (WML and WML Script) is converted into a compact binary form for transmission over the air. The WAP micro browser software within the mobile device interprets the byte code and displays the interactive WAP content. WAP content (WML and WMLScript) is converted into a compact binary form for transmission over the air (see Figure 2.1).

Figure 2.1: WAP Content in Compact Binary Form

The WAP micro browser software within the mobile device interprets the byte code and displays the interactive WAP content (see Figure 2.2).

Figure 2.2: Mobile Device Display



Caution WAP content (WML and WML Script) is converted into a compact binary form for transmission over the air.

Self Assessment

Notes

Fill in the blanks:

1. ……. is believed to be first WAP micro browser that deals with HTML and WAP along with WML script, Post Office Protocol (POP3).
2. WAP micro browsers are small software that displays information written in a special mark-up language called ……. on the internet.
3. The WAP micro browsers set up the ……. networks and gets content that are written in XHTML language.
4. WAP content (WML and WML Script) is converted into a ……. binary form for transmission over the air.
5. ……. Browser emerged with its Small Screen Rendering technology.
6. WML is used to create ……. that can be displayed in a WAP browser.
7. User installable WAP browsers are the browsers that are not provided with the ……. operating system.
8. WAP micro browsers are optimized to display internet content most effectively on small display screen with the help of low speed …….

2.3 Application Design Process

Device Dependency

Today all statements toward designing WAP applications are extremely device dependent, e.g. different display sizes and availability of softkeys. Therefore, a simple and well-structured design is the best strategy for minimizing the problem of supporting different browsers as well as phones and other WAP devices.

Simplicity

When it comes to designing any kind of electronic service, simplicity is the key to gaining acceptance and appreciation from the users. Simplicity is especially important in the context of use in a mobile environment since the user often needs to concentrate on other things besides using the terminal. Two examples for this are:

- Fully mobile, such as walking through the streets
- Semi mobile, such as sitting in a train

Thus restrictions apply due to the factors device, application and context. Some implications of this are the following:

- It should be unnecessary to remember codes, numbers, or other information from one part of the application to another.
- In situations of choice the users should be asked to make simple decisions rather than complex ones. Divide the problem if possible.

Good utilization of the extremely limited display space is important. Therefore avoid unnecessary blank space.

The user interface should be as simple as possible, but not simpler. Unnecessary information and functionality should be removed. In conventional office applications one rule of thumb says that 20% of the functionality is used 80% of the time. To simplify, we could say that in mobile applications it is often advisable to cut out this 80% in order to reduce complexity and increase usability.

Notes

Context of Use

The situation or context of use is more demanding than under the usual circumstances when designing "stationary" software for office use. When using a mobile device, the users will probably experience a larger number of interfering factors, which will distract their attention.

It is recommended that user testing on all services are done in a live environment.

To assure that the application is usable, the design process should be user centered, rather than technology driven. If you start to think about WAP applications consider your:

- Primary user group
- Context of use
- Primary user tasks.

Task Analyse what is a microbrowser? Name some of mobile browsers used by WAP-enabled devices.

Information Access

Motto: Keep the Focus on the Task and the most Relevant Information, Functions / Links, ...

The tasks conducted on a WAP terminal can be divided into two major task types:

1. Information retrieval, e.g. getting the latest news:
   i. Usually the users will prefer to use a normal PC based Internet connection to browse for information.
2. Problem solving, e.g. getting information about and book the next connection flight:
   i. This makes it important to make sure that the users are able to work on their tasks by allowing quick access to brief information.
   ii. Focus on the most needed functions in relation to most important information regarding the focused task.
   iii. Keep an acceptable and understandable ratio between information value and interaction effort.

Task In a group of four analyze what are the issues involved in designing WAP applications?

Self Assessment

Fill in the blanks:

9. ……. is especially important in the context of use in a mobile environment.
10. Good utilization of the extremely ……. display space is important.
11. To assure that the application is usable, the design process should be user centered, rather than ……. driven.
12. Focus on the most needed ……. in relation to most important information regarding the focused task.

2.4 Common Design Mistakes

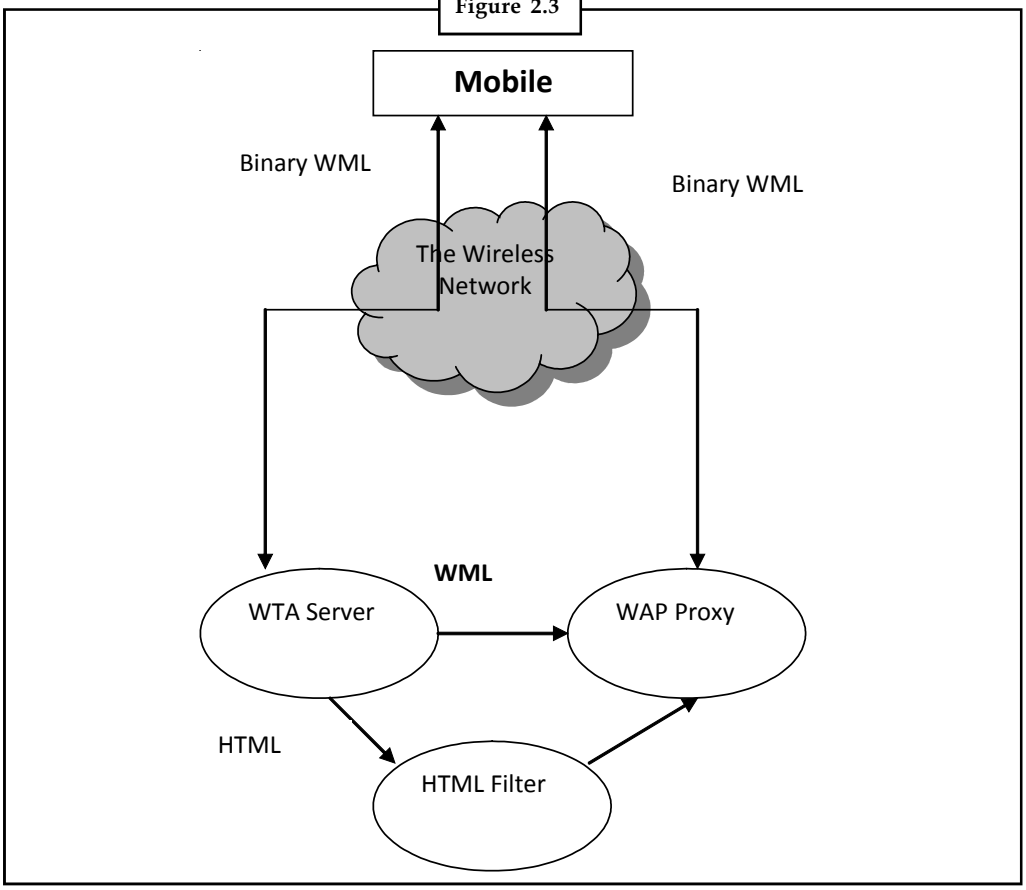
Notes

1. Sloppy WAP Site Copy
2. Bad Color Coordination
3. Pages Load Too Slowly
4. Poor Navigation
5. Orphan Pages
6. Long Scrolling
7. Meta Tags Missing
8. Lack of Marketing Strategy
9. Poor Layout and Design
10. Avoid Using Frames
11. No Cross Browser Compatibility
12. Outdated Information

Example: of WAP Network

An illustrative example is shown in the Figure 2.3.

Figure 2.3



Notes

In the example,

- The WAP client interacts with two servers in the wireless network.
- The WAP proxy translates WAP requests to WWW requests thereby permitting the WAP client to submit requests to the web server.
- The proxy also ciphers the responses from the web server into the compact binary format understood by the client.
- If the web server offers WAP content, the WAP proxy retrieves it directly from the web server.
- However, if the web server provides WWW content (such as HTML), a filter is used to translate the WWW content into the WAP content. For example, the HTML filter would translate HTML into WML.
- The Wireless Telephony Application (WTA) server is an example origin or gateway server that responds to requests from the WAP client directly. The WTA server is used to provide WAP access to features of the wireless network provider's telecommunications infrastructure.

Examples of WAP use

- Checking train table information
- Ticket purchase
- Flight check in
- Viewing traffic information
- Checking weather conditions
- Looking up stock values
- Looking up phone numbers
- Looking up addresses
- Looking up sport results

Task What is the WTA server? What is it used for?

Self Assessment

Fill in the blanks:

13. A filter is used to translate the …….. content into the WAP content.
14. The WTA server is used to provide WAP access to features of the wireless network provider's …….. infrastructure.
15. If the web server offers WAP content, the WAP proxy retrieves it directly from the ……..

Notes

Caselet

Customizing e-commerce

An increase in smartphone penetration leading to a subsequent increase in mobile internet users have encouraged e-commerce sites in developing their own applications and payment gateways accessible across different operating systems (OS) like BlackBerry, iOS (Apple), Android and others.

The basic idea is to integrate the services — including payment options — available on the web into the handheld devices.

Trying to take the first mover advantage, some of the e-commerce sites like Naaptol, OLX or Snapdeal are moving away from the traditional WAP sites (mobile compatible sites) into the realm of developing their own applications.

Traditionally, e-commerce sites have preferred using the web and after popularity of the mobile web, developed WAP – Wireless Application Protocol – enabled sites for easy viewing on the mobile. However, with increasing popularity of applications, thanks mainly to smartphones, e-commerce sites are now exploring newer avenues for better reach.

Says Mr Amarjit Batra, country head, OLX.in, "The penetration of smartphones will boost hyper-localisation of products and help users. We found users more comfortable in having a mobile application than opting for mobile web search or using WAP sites."

OLX.in with presence across 96 countries has nearly 15 crore users globally and its application is available across seven different mobile platforms that include Android, iOS (Apple), Ovistore (Nokia), Windows and Blackberry.

Snapdeal too is planning to widen their reach through applications. Snapdeal already has an application in the Android market and is planning to bring out similar applications on other OS.

While Naaptol's application is currently available on the Android platform only, it plans to introduce similar application across iOS and Blackberry platforms by January 2012.

Global telecom analyst Gartner, has pointed out that mobile device sales in India is expected to reach 231 million units in 2012, an increase of 8.5 percent over 2011 sales of 213 million units.

The mobile handset market is expected to show steady growth through 2015 when end user sales will surpass 322 million units.

Interestingly, companies like Tradusads.in which still has a WAP site confirmed that it was looking at possibilities of developing applications across different platforms (OS). However, Mr Saurabh Pandey, Vice President, Error**! Hyperlink reference not valid.**, maintains that with feature phones still dominating the Indian market, having a WAP site was had its benefits compared to an application.

"Many feature phones still do not have an option for application download. However, developing an application is the next step" he adds.

Payment Options

According to industry sources, integrating web services into handheld devices would mean adding payment options to these applications. Currently, mobile applications

Contd...

Notes

contribute "not more than" one per cent of the total business of e-commerce sites. For the share to pick up, the availability of payment option or the integration of m-commerce is required in these applications.

Current mobile applications developed by these e-commerce sites generally have a search option for users and advertise options for merchants.

Admitting the importance of such integration, Mr Sachin Singhal, Head, e-commerce, Naaptol, adds: "A mobile app is more user-friendly than having a WAP site. However, integrating the payment window with it makes the application complete."

According to Mr Sandeep Komarvelley, Head, Marketing and Alliances, Snapdeal, a payment gate option would make mobile apps "more meaningful" in providing end to end solution for users.

While Naaptol is developing a payment gateway that will allow users to use their credit cards to buy products, it also plans to set up a new server to cater to mobile app user requirements of faster browsing.

Snapdeal too is exploring options of integrating a payment gate along with its applications, Mr Komarvelley said.

2.5 Summary

- A Micro Browser is a small piece of software that makes minimal demands on hardware, memory and CPU. It can display information written in a restricted mark-up language called WML.
- Most WAP-enabled devices use the recently renamed Openwave Mobile Browser developed by Openwave.
- MME stands for Microsoft Mobile Explorer which is a dual-mode browser, supporting both WML and HTML content.
- WML stands for Wireless Markup Language which is a mark-up language inherited from HTML, but WML is based on XML, so it is much stricter than HTML.
- WML is used to create pages that can be displayed in a WAP browser. Pages in WML are called DECKS. Decks are constructed as a set of CARDS.
- The HTTP interface serves to retrieve WAP content from the Internet requested by the mobile device. WAP content is converted into a compact binary form for transmission over the air. The WAP micro browser software within the mobile device interprets the byte code and displays the interactive WAP content.
- While designing WAP applications there are various issues involved. Important ones included are device dependency in which designing WAP applications are extremely device dependent, e.g. different display sizes and availability of softkeys, simplicity, context of use and information access.
- Therefore a simple and well-structured design is the best strategy for minimizing the problem of supporting different browsers as well as phones and other WAP devices.
- The user interface should be as simple as possible, but not simpler. Unnecessary information and functionality should be removed.
- When using a mobile device, the users will probably experience a larger number of interfering factors, which will distract their attention so the design should be user centered

Notes

- Regarding information access there should be focus on the task and the most relevant, functions, links, etc.
- Common design mistakes include among others sloppy WAP site copy, poor navigation, bad color coordination, pages loading too slowly, long scrolling, meta tags missing, outdated information, no cross browser compatibility, etc.
- The Wireless Telephony Application (WTA) server is an example origin or gateway server that responds to requests from the WAP client directly. The WTA server is used to provide WAP access to features of the wireless network provider's telecommunications infrastructure.
- Examples of WAP uses include checking train table information ,ticket purchase ,flight check in ,viewing traffic information ,looking up phone numbers and addresses and sports results, etc.

2.6 Keywords

Decks: Pages in WML are called DECKS. Decks are constructed as a set of CARDS.

Micro Browser: It is a small piece of software that makes minimal demands on hardware, memory and CPU. It can display information written in a restricted mark-up language called WML.

MME: It means Microsoft Mobile Explorer developed by Microsoft which is a dual-mode browser, supporting both WML and HTML content.

Openwave Mobile Browser: It is a micro browser developed by Openwave which most WAP-enabled device are using

The HTTP Interface: It serves to retrieve WAP content from the Internet requested by the mobile device.

WML: It stands for Wireless Markup Language. It is a mark-up language inherited from HTML, but WML is based on XML, so it is much stricter than HTML

WTA server: It stands for Wireless Telephony Application (WTA) server used to provide WAP access to features of the wireless network provider's telecommunications infrastructure.

2.7 Review Questions

1. Explain why a Micro Browser is used for WAP? Examine what are the WAP application design processes?
2. Substantiate the common design mistakes in WAP. How do you avoid them? Explain WAP network with an example.
3. Highlight the usage of WAP. What is MME? What are the names of some of the devices which uses MME?
4. What are DECKS and how are they constructed?
5. Explain the process from the moment a mobile user request WAP contents till the display of the WAP contents on the mobile device.
6. Why is it especially important that the design process should be user centered rather than technology driven? Explain.
7. What are some of the constraints faced by the designers while designing WAP applications?

Notes

8. Micro browsers contains small first they require low memory space on wireless handled devices. Discuss.
9. Hitchhiker was developed to present the entire device use interface (UI). Analyze.
10. Opera Browser is able to relay out regular Web pages that can fit on small screens and medium-sized (PDA) screens. Comment.

Answers: Self Assessment

1.	Hitchhiker	2.	Wireless Markup Language (WML)
3.	cellular	4.	compact
5.	Opera	6.	pages
7.	WAP	8.	processor
9.	Simplicity	10.	Limited
11.	Technology	12.	Functions
13.	WWW	14.	Telecommunications
15.	web server		

2.8 Further Readings

Books

Demon Hougland, *Essential WAP for Professional*, 2001, Prentice Hall PTR.

Dieter Fensel, *Spinning the Semantic Web: Bringing the World Wide Web to its full Potential*, 2003 MIT Press.

Paul Wallace Andrea Hoffmann, *Mika Tuppola, I – Mode Developer Guide*, 2002.

Jennifer Niederst Robbins, 2006, O'Reilly.

Online links

http://en.wikipedia.org/wiki/Mobile_browser

http://www.scribd.com/doc/36908778/19/WAP-Microbrowser

Notes

Unit 3: WAP Development Tools and Software

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3.1.1 Software Development Kits and Integrated Development Environments
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3.2.1 WML versus Other Languages
3.2.2 File Extensions
3.3 Converting Images/Graphics
3.3.1 WAP Software
3.3.2 WAP Company
3.4 MobileDev – Wireless Application Development
3.5 Summary
3.6 Keywords
3.7 Review Questions
3.8 Further Readings

Objectives

After studying this unit, you will be able to:

- Discuss WAP Editors and Emulators
- Explain the need of WAP Homepages
- Discuss File Extensions
- Convert Images/Graphics
- Understand the specification of Well defined WBMP Type
- Discuss WAP Software, WAP Company and WAP Forum

Introduction

In order to make their task of testing their documents easier WAP developers use emulators. This unit will familiarize you what an emulator is and what are various emulators which WAP developers use. There are various WAP software developer kits available and you will be introduced to them. Even though WAP applications are mostly text-based one can add images to the WML documents. You will get a basic idea of how images or graphics are added to the WML documents and lastly you will be introduced to the tools available for creating WMBP files.

3.1 WAP Editors and Emulators

WAP application developers generally use WAP emulators to test their documents. An emulator (or "simulator") is a program that runs on your computer that shows you how your document will appear and function on a wireless device. It alleviates the need to buy a half-dozen cell phones to test your designs.

Notes

One of the nifty things about emulators is that they look just like the real thing (see Figure 3.1) – you can even use the buttons to navigate the way you would on a real phone. Unfortunately, emulators do not always *behave* exactly like the real thing.

Caution Expect some discrepancies in text layout and even basic functionality, so be sure to test on real devices before going live to avoid surprises.

Figure 3.1: The Openwave Simulator WAP Emulator Program

The following are some popular WML emulators and their respective sites for downloading. The Openwave Simulator is the most popular due to the widespread use of the Openwave Mobile Browser and its predecessor, the UP.Browser. All of these programs are Windows-only, so Mac and Unix users are out of luck.

Openwave Simulator (previously UP.Simulator)

http://developer.phone.com/download/

Microsoft Mobile Explorer Emulator

http://www.microsoft.com/mobile/phones/mme/default.asp

Nokia Toolkit

http://forum.nokia.com

Ericsson WapIDE SDK

http://www.ericsson.com/developerszone/

Motorola Mobile ADK

http://developers.motorola.com/developers/wap/index.html

Notes

Notes The Opera browser Version 5 features experimental support for WAP and WML. While it is not a substitute for a full emulator, it may be useful for testing your WML code or just viewing other WAP applications. As alternative to a full emulation program, you can view WML pages using one of the web-based emulators at Wapemulator.com (http://www.wapemulator.com) or Gelon.net (http://www.gelon.net). These emulators are limited in their functionality and accuracy, but they give you a good general idea and allow you to view WAP applications from the comfort of your desktop computer.

3.1.1 Software Development Kits and Integrated Development Environments

ALT Consulting

The <alt> Web SDK: WAP 1.2 Edition is a complete Java-WAP SDK that provides a visual composition editor and a Java API for WML and Phone.com's WML extensions, a Java API for WTA telephony, and Notifications including both WAP 1.2 Push and Phone.com alerts. The Web SDK: WAP 1.2 Edition generates WML, WMLC, Push, Java Servlets, Java Brazil Handlers, JSP, ASP, ColdFusion, Perl, and PHP.

Business SMS

ActiveXMS Mobile Messaging SDK suite

Take control of your mobile messaging applications and save weeks of development time. Run-time royalty free components include:

- WAP Push - Service Indication Messages
- WAP Push - Service Loading Messages
- Smart Messaging
- Enhanced Messaging Services (EMS)
- Over The Air Provisioning (GPRS/MMS/CSD/USSD)
- Service Messages
- WAP Bookmarks
- SyncML OTA Configuration

Dynamic WAP Developer Kit

Comprehensive tools for developing WAP applications including the WAR (Wireless Application Reader) browser and a set of WML and WMLScript source code examples.

Ericsson WAP IDE SDK

The WapIDE SDK 2.0 is an Integrated Development Environment for developing WAP Services. It consists of three main components: WAP Browser, Application Designer and Server Toolset.

Notes

Did u know? **What are the Ericsson WISETM Solutions?**

WISE Time to WAP, WISE Services Unlimited, WISE Internet Direct Access, WISE High Speed Internet.

Mobile Internet Exchange TM (MIX) Platform

This enables mobile individuals to receive necessary information through the communications device or user interface of their choice. The MIX platform comprises servers, gateways, software applications and content. Plus, the Mobile Application Development Kit (Mobile ADK) enables third-party developers to create their own add-on voice and data solutions.

The Mobile ADK brings together development tools for both WAP and VoxML applications and unites them in a single toolkit. The current version of the VoxML simulator, in conjunction with various WAP-compliant modules, synthesizes the source code and builds onto existing components to create a single tool that is capable of testing both WML and VoxML applications. The VoxML application enables the user to query web servers anywhere in the world and gain access to critical information by merely utilizing a telephone and a voice.

Nokia WAP Toolkit

The Nokia WAP Toolkit is a generic software tool that makes it easy for you to compose and test your application software that will run on a Nokia WAP Server. The toolkit can also be used in promotions to demonstrate WAP applications. It provides an easy environment for developers to write, test and debug applications on a PC-based simulator.

Nokia Mobile Internet Toolkit

This provides developers with a realistic, PC-based testing and simulation environment in which they can create WAP and other mobile Internet applications, including those based on the eXtensible Hypertext Markup Language (XHTML) and Cascading Style Sheets (CSS).

Mobile Internet Toolkit 3.1

This supports Multimedia Messaging Services (MMS) Application Development. The Toolkit comes with the Nokia Mobile Browser 3.0.1 simulator, which supports WAP 2.0 technologies including Extensible Hypertext Markup Language (xHTML) and Cascading Style Sheets (CSS).

Openwave Mobile SDK

This allows you to develop world-class mobile applications and services quickly and easily. With technologies based on open standards, you'll be able to take advantage of the latest browsing technology and build compelling XHTML, MMS, location and push-based applications that work across a wide range of phones and networks.

Xmenu – Free J2ME Software

XMenu is a J2ME software that can let you build a simple wireless portal in 15 minutes without programming knowledge. No WML (Wireless Markup Language in WAP) or cHTML (compact HTML in i-mode) is needed.

Notes

WAP Objects Framework

The tight integration of the WAP objects framework into the Web objects development environment enables rapid development of complex database driven custom applications using pre-build WML components. The award-winning Web objects application server delivers high scalability, availability and performance for your upcoming WAP services.

Task Analyze what is an emulator? What are some of the latest WAP emulators presently available in the market?

Self Assessment

Fill in the blanks:

1. An emulator (or "simulator") is a program that runs on your computer that shows you how your document will appear and function on a ……. device.
2. The ……. application enables the user to query web servers anywhere in the world and gain access to critical information by merely utilizing a telephone and a voice.
3. The ……. Web SDK: WAP 1.2 Edition is a complete Java-WAP SDK that provides a visual composition editor.
4. The ……. Simulator is the most popular due to the widespread use of the Openwave Mobile Browser.
5. The tight integration of the WAPobjects framework into the WebObjects development environment enables rapid development of ……. database.
6. The toolkit can also be used in promotions to demonstrate ……. applications.
7. The ……. platform comprises servers, gateways, software applications and content.

3.2 WAP Homepages

WAP homepages are not very different from HTML homepages. The markup language used for WAP is WML (Wireless Markup Language). WML uses tags - just like HTML - but the syntax is stricter and conforms to the XML 1.0 standard.

WML pages have the extension *.WML, just like HTML pages have the extension *.HTML.

Tools for Development

- Software Development Kit (SDKs). These are present for most devices and browsers.
- Device emulators
- Gateway/Server emulators
- Actual networks and devices
- Web servers
- Databases

Authoring Tools

- WML documents are plain-text files. They can even be developed and edited with a simple text editor such as Notepad.

Notes

- The value of high-end development environments is in the programming aids such as color coding and debugging references.
- Software Development Kits (SDKs) are available for most WAP device browsers and are the recommended development tools.
- WYSIWYG tools are expected.

Task Software Development Kits (SDKs) are available for most WAP device browsers. Analyze

3.2.1 WML versus Other Languages

HTML

- Modeled for the World Wide Web.

HDML

- Modeled for handheld devices
- Utilizes more memory than Smart Phones carry.

XML

- This is a meta-language, not a complete language by itself.
- WML is an application of XML for use on wireless devices.

HDML is a subset of SGML (Standard Generalized Markup Language). SGML was modeled particularly for use on the World Wide Web. As such, it comprises many elements and tags that are of little use to the wireless world and would serve only to cut down wireless applications.

HDML was modeled for use with handheld devices (HHDs) in particular, not all wireless devices. While it does a neat job in this field, the aim of WML is to offer a single language that can be used with both phones and HHDs.

XML is the core language or rule-set for WML.

3.2.2 File Extensions

Table 3.1

Extensions	Media Type	Content Type
Wml	Text	WML in source form
Wmlc	Application	WML "compiled" to binary
Wmls	Text	WML scripts
Wmlsc	Application	Compiled WML Script
Wbmp	Image	Wireless bitmap
Dtd	Text	XML Doc Type Definition

Notes

Table 3.1 lists the file extensions. The majority of our files will be .wml followed by WMLs. The wireless bitmaps (.wbmp) act just as any other bitmaps but are geared for the low bandwidth, low resolution environment of the wireless community. The XML DTDs are used as reference at the top of any WML file.

Task Contrast WML with other languages.

Self Assessment

Fill in the blanks:

8. WML pages have the extension …….. , just like HTML pages have the extension *.HTML.
9. HDML is a subset of ……..
10. SGML was modeled particularly for use on the ……..
11. The wireless …….. act just as any other bitmaps but are geared for the low bandwidth, low resolution environment of the wireless community.

3.3 Converting Images/Graphics

Although WAP<> applications are primarily text, it is possible to add simple images to a card (see Figure 3.2). In order for an image to be displayed in a WAP application, it must be in the specially optimized Wireless Bitmap (WBMP) format. WBMP files are 1-bit graphics capable of displaying only black and white pixels. It is recommended that you keep any graphic image as small as possible. No graphic should exceed 150 pixels square. Be aware that some micro browsers do not support graphics at all, so always provide alternative text.

Figure 3.2: Examples of WBMP Graphics in a WAP Application

Images are added to the document with the <img/> element. Make sure that it is placed within <p> tags, as shown in this example:

Example:

```
<card>
<p><img src="logo.wbmp" alt="Cookbook Logo"></p>
</card>
```

Some mobile devices have stored in their memory a library of small images that can be placed in the WML document using the localsrc attribute in the image tag. The advantage of local images is that they reduce the amount of data that needs to be transferred from the server, so

Notes

they display more quickly than external WBMP files. It is a good idea also to provide a pointer to an external graphic in case local images are not supported. The following example requests a generic credit card icon from the local image library and specifies an alternative .wbmp file. The alt text will display on devices that do not support graphics at all.

<img localsrc="creditcard" src="card.wbmp" alt="credit card symbol">

Specification of Well defined WBMP Type

There are few tools available that can create WBMP files at this time. However, you can download the free UnWired plug-in from RCP Distributed Systems that enables you to create WBMP files in Adobe Photoshop 5 and higher and JASC Paint Shop Pro (or any graphics package that supports plug-ins.

3.3.1 WAP Software

Online WAP Browser

Gelon.net

Gelon.net fetches WML pages, and converts them to HTML (WEB pages) with their "Wapalizer". An excellent tool if you want to see how your WML pages look like in a WAP browser.

Online WBMP Converter

Teraflops

An online WBMP converter by Teraflops Ltd., that takes graphics files of format GIF, JPEG and BMP as input and outputs optimized WBMP.

3.3.2 WAP Company

Symbian

Symbian was established as a private independent company in June 1998 and is owned by Ericsson, Nokia, Matsushita (Panasonic), Motorola, Psion, Siemens and Sony Ericsson. Symbian supplies the advanced, open, standard operating system - Symbian OS - for data-enabled mobile phones.

Self Assessment

Fill in the blanks:

12. The advantage of local images is that they reduce the amount of data that needs to be transferred from the server, so they display more quickly than external …… files.
13. …… fetches WML pages, and converts them to HTML (WEB pages) with their "Wapalizer".

3.4 MobileDev — Wireless Application Development

MobileDev is the first Wireless Development Environment (WDE) specifically for WAP Internet applications. Its innovative open-ended development model integrates a graphical application mapper with a wizard interface and a rich tool set. MobileDev supports WAP technologies like WML, HDML, Microsoft Active Server Pages (ASP), Perl and Java Server Pages (JSP).

Notes

Using the GUI application mapper to show the relationships between objects, developers can quickly outline the components of a WAP application. Then they can take advantage of wizards that generate Decks and Cards in both WML and HDML, and use MobileDev's code builder to write WML/HDML syntax that complements the wizard-generated code. The integration of the application mapper with wizards and the code builder provides a seamless WDE that delivers results fast.

MobileDev comes complete with its own powerful integrated runtime engine, MobileDev Server Script. Server Script can quickly create prototypes or build full-blown business WAP applications that can be natively connected to an RDBMS. MobileDev WDE is also designed to support development in ASP, JSP, Perl or other template-based server technologies.

Task What is WMBP format? Name some of the tools that can create WMBP files.

WAP Forum

The Wireless Application Protocol (WAP) Forum developed the de-facto world standard for wireless information and telephony services on digital mobile phones and other wireless terminals. It has published an open, global wireless protocol specification based on existing Internet standards, such as XML and IP, for all wireless networks.

WAP Forum members now represent over 90% of the global handset market, as well as leading infrastructure providers, software developers and other organizations providing solutions to the wireless industry.

WAP Forum Members

The WAP Forum was founded in 1997 by Ericsson, Motorola, Nokia, and Unwired Planet (now Phone.com). Their WAP pages can be found at:

Ericsson Mobility World

At Ericsson Mobility World you get the latest product information and software on WAP and many more technologies. By sharing our technology and expertise with developers worldwide, Ericsson Mobility World help turn your great ideas into real-world applications.

Nokia WAP Developer Forum

The Nokia WAP Developer Forum is targeted at developers who are interested in using the Nokia WAP products to create services on the Wireless Application Protocol (WAP) platform.

Phone.com WAP Overview

Self Assessment

Fill in the blanks:

14. The Wireless Application Protocol (WAP) Forum developed the …… world standard for wireless information and telephony services on digital mobile phones and other wireless terminals.

15. …… supports WAP technologies like WML, HDML, Microsoft Active Server Pages (ASP), Perl and Java Server Pages (JSP).

Notes

Caselet

Linkedwith Launches WAP Solutions

LINKEDWITH India, a subsidiary of Linkwith GmbH, Germany, has announced the launch of Tamino Mobile Office, its Wireless Application Protocol (WAP) based solution aimed at Indian corporates.

"Linkedwith has been developing turnkey solutions in India for the past two years. Now we have decided to market our XML-based WAP server technologies, products and services in India," Dr Sushil Agarwal, CEO (Asia), Linkedwith, said.

The Tamino WAP server uses eXtensible Markup Language (XML) to connect existing data to WAP applications enabling corporates to build intranets that can be accessed by employees through cellular phones.

"The Mobile Office has been localised to suit the needs of Indian corporates and offers features such as address book, email, calender, document manager and bookmarks," Dr Agarwal said.

"The solution can run across platforms including WindowsNT, Linux, Solaris, Unix and AS400. It can also be upgraded to technologies like General Packet Radio Switch (GPRS) and Universal Mobile Telephone System (UMTS)," Mr Kim Onneken, Chief Technology Officer, Linkwith GmbH, said.

The company intends to distribute the solution through marketing alliances and hopes to acquire 10 per cent market share within the next five years, Dr Agarwal said.

3.5 Summary

- An emulator is a program that runs on your computer that shows you how your document will appear and function on a wireless device. It alleviates the need to buy half-dozen cell phones to test your designs.
- Some popular WML emulators are Openwave Simulator (previously UP. Simulator) ,Microsoft Mobile Explorer Emulator, Nokia Toolkit, Ericsson WapIDE SDK, Motorola Mobile ADK.
- Software developers kit include the <alt> Web SDK: WAP 1.2 Edition, ActiveXMS Mobile Messaging SDK suite, WAR (Wireless Application Reader) browser and a set of WML and WMLScript source code examples.
- The WapIDE SDK 2.0 is an Integrated Development Environment for developing WAP Services. It consists of three main components: WAP Browser, Application Designer and Server Toolset.
- Mobile Internet eXchange™ (MIX) platform enables mobile individuals to receive necessary information through the communications device or user interface of their choice. The MIX platform comprises servers, gateways, software applications and content. Plus, the Mobile Application Development Kit (Mobile ADK) enables third-party developers to create their own add-on voice and data solutions.
- The Nokia WAP Toolkit is a generic software tool that makes it easy for you to compose and test your application software that will run on a Nokia WAP Server.
- Nokia Mobile Internet Toolkit provides developers with a realistic, PC-based testing and simulation environment in which they can create WAP and other mobile Internet

Notes

applications, including those based on the eXtensible Hypertext Markup Language (XHTML) and Cascading Style Sheets (CSS).

- Mobile Internet Toolkit 3.1 supports Multimedia Messaging Services (MMS) Application Development. The Toolkit comes with the Nokia Mobile Browser 3.0.1 simulator, which supports WAP 2.0 technologies including Extensible Hypertext Markup Language (xHTML) and Cascading Style Sheets (CSS).
- Openwave Mobile SDK allows you to develop world-class mobile applications and services quickly and easily.
- XMenu - Free J2ME software is J2ME software that can let you build a simple wireless portal in 15 minutes without programming knowledge. No WML or cHTML is needed.
- WAP homepages are not very different from HTML homepages. WML uses tags but the syntax is stricter and conforms to the XML 1.0 standard. WML pages have the extension *.WML.
- Tools for development of WAP homepages are Software Development Kit (SDKs), Device emulators, Gateway/Server emulators, Actual networks and devices, Web servers, databases.
- WML documents are plain-text files and can be developed and edited with a simple text editor such as Notepad, the value of high-end development environments is in the programming aids such as color coding and debugging references, Software Development Kits (SDKs) are available as well as WYSIWYG tools are expected.
- HTML was developed for use with World Wide Web. SGML, modeled particularly for use on the World Wide Web, comprises many elements and tags that are of little use to the wireless world and would serve only to cut down wireless applications.
- XML is the core language or rule-set for WML.
- In order for an image to be displayed in a WAP application, it must be in the specially optimized Wireless Bitmap (WBMP) format. WBMP files are 1-bit graphics capable of displaying only black and white pixels. Images are added to the document with the <img/ > element
- UnWired plug-in from RCP Distributed Systems enables creation of WBMP files in Adobe Photoshop 5 and higher and JASC Paint Shop. A Java utility called *pic_2_wbmp* converts existing BMP files to WBMP format.
- Some of the WAP software are Gelon.net, an online WAP browser, Teraflops an online WBMP converter.
- MobileDev is the first Wireless Development Environment (WDE) specifically for WAP Internet applications. It supports WAP technologies like WML, HDML, Microsoft Active Server Pages (ASP), Perl and Java Server Pages (JSP).

3.6 Keywords

Emulator: It is a program that runs on the computer that shows how documents will appear and function on a wireless device.

HDML: It is a subset of SGML. HDML was modeled for use with handheld devices (HHDs) in particular, not all wireless devices.

HTML: Hyper Text Markup Language.

Notes

SGML: Standard Generalized Markup Language was modeled particularly for use on the World Wide Web.

WBMP: Wireless Bitmap files are 1-bit graphics capable of displaying only black and white pixels.

XML: It is the core language or rule-set for WML.

3.7 Review Questions

1. What are different editors and emulators available for WAP? Discuss their pros and cons.
2. What do you mean by Software Development Kit (SDK) in terms of WAP? What are different SDKs available for WAP?
3. How do you convert images in WAP? Explain briefly.
4. Why do WAP application develops require emulators?
5. Explain what are some of the WAP software development kits?
6. Substantiate what is the mobile ADK? What are some of the authoring tools available for WAP homepages?
7. The Nokia WAP Toolkit is a generic software tool that makes it easy for you to compose and test your application software that will run on a Nokia WAP Server. Comment.
8. WAP application developers generally use WAP emulators to test their documents. Explain.
9. MobileDev is the first Wireless Development Environment (WDE) specifically for WAP Internet applications. Discuss.
10. How are images added to documents in WAP? Explain with the proper example.
11. What are the WAP technologies which MobileDev supports? Explain briefly with example

Answers: Self Assessment

1.	wireless	2.	VoxML
3.	<alt>	4.	Openwave
5.	complex	6.	WAP
7.	MIX	8.	*.WML
9.	SGML	10.	World Wide Web
11.	bitmaps (.wbmp)	12.	WBMP
13.	Gelon.net	14.	de-facto
15.	MobileDev		

3.8 Further Readings

Books

Demon Hougland, *Essential WAP for Professional*, 2001, Prentice Hall PTR.

Jennifer Niederst Robbins, *Web Design in a Nutshell*, 2006, O'Reilly.

McGraw Hill Professional, *Wireless Messaging Demystified*

Notes

Michael Juntao, Yuan, *Nokia Smartphone Hacks*, 2005, O' Reilly.

Paul Wallace Andrea Hoffmann, *Mika Tuppola, I – Mode Developer Guide*, 2002.

Viadimir Geroimenko, *Dictionary of XML Technologies and the Semantic Web*, 2004 Springer.

Online links

http://en.wikipedia.org/wiki/WAP

http://wapindia.wen9.net/

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Unit 4: Introduction to WML

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4.1 What is WML?

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Objectives

After studying this unit, you will be able to:

- Scan WML (Wireless Markup Language)
- Describe Uses of WML

Introduction

The Wireless Markup Language (WML) is a simple markup language that was designed exclusively for the purpose of creating applications to be sent over wireless networks to WAP - enabled mobile devices. WML is an open standard and was developed by the WAP forum and the WML specification forms a part of the broader WAP specification. WML is an application of XML. WML has some distinct differences from other markup languages, for instance HTML.

WML looks quite like HTML, but there is a significant difference between them. HTML is mainly used for creating documents, which in turn are being designed to display information. But WML is being used for creating applications, which are designed for user interaction.

There is one more important difference. Basically Web contents are being accessed from powerful desktop computing systems that have bigger displays and fast, cheap, reliable wired network connections. The web browser is a sophisticated software package that offers a number of flexible and convenient features for the viewers. But wireless network connections are unreliable, slow and expensive and the micro browsers that are fitted in WAP-enabled mobile devices have very small displays, which in a way makes receiving and sending information inconvenient.

Considering the limitations of mobile devices and the wireless networks, WML has to be designed in such a way that it offsets many of those limitations.

Notes Also mobile communication, being expensive, the mobile users would visit sites seeking specific pieces of information and like to get them very quickly. WML meets these requirements quite successfully and brings a high degree of interaction with users.

Notes

4.1 What is WML?

WML is an acronym for Wireless Markup Language. While the HTML language creates web pages for the PCs, the WML creates web pages for the handheld devices. WML's similarity to HTML was not random. The structure, formatting, and syntax are immediately recognizable to those familiar with HTML and XML. WML is a direct descendent of Handheld Device Markup Language (HDML). WML, however, has been optimized for the constraint wireless device. As a result, there is a prominent difference between HTML and WML.

Wireless Markup Language (WML), based on XML, is a markup language intended for devices that implement the Wireless Application Protocol (WAP) specification, such as mobile phones. It provides navigational support, data input, hyperlinks, text and image presentation, and forms, much like HTML (HyperText Markup Language). It preceded the use of other markup languages now used with WAP, such as HTML itself, and XHTML (which are gaining in popularity as processing power in mobile devices increases).

WML is a markup language designed especially for specifying and displaying content on WAP (Wireless Application Protocol) devices. WML is part of the WAP application environment, which requires the use of WML.

WML is the wireless equivalent of HTML for the Web. WML is based on XML and derived from xHTML (the XML version of HTML). There are many differences between WML and HTML. For example, WML has a different mechanism for linking between its pages called "cards" as compared to linking between HTML pages. WML browsers are stricter than HTML browsers by not being tolerant of errors. WML browsers enforce the WML requirement of matching closing "tags", an XML characteristic.

Did u know? **What are the limited capabilities of WAP devices?**

WML works with the WAP micro browsers found on WAP devices. This browser is cognizant of the limited capabilities of WAP devices such as

- small displays,
- limited processing power,
- limited memory,
- narrow bandwidth connection, and
- limited battery use without recharging.

To address the limitations of WAP devices, WML uses the metaphor of card decks, and each page is referred to as a card. The card is the basic unit of navigation and user interface. The user can view only card at a time. WML browsers read the whole deck (complete document) from the server to minimize interaction with the server. Consequently, when flipping (navigating) between the cards in a deck, the browser does not contact the server. This eliminates delays (because each card contains very little text and users are likely to move quickly from one card to another).

A WAP deck is the equivalent of a Web page, the card being the portion of the Web page that can be seen on the screen. Navigation within the cards of a deck is done within the WAP device just as scrolling a Web page is done within the Web device. (Without contacting servers in both cases).

An HTML writer does not worry about screen or display boundaries. Instead, the Web browser manages issues relating to the screen boundaries. But a WML writer must be aware of screen boundaries of WAP devices when writing code for cards.

Notes

Web server requests are routed through WAP gateways (proxies). A Web server may generate WML content for WAP devices or it may simply dish out HTML (XML). In case the Web server generates HTML (XML), the WAP gateways must convert the HTML (XML) to WML. Before sending the WML to the WAP device, the gateway compresses it to WMLC (the C in WMLC is for compressed). If the WML generated by the Web sever is WMLC, then the compression step is skipped.

Incidentally, converting HTML automatically to WML typically does not produce good or even usable results. For best results, Web servers should generate WML for WAP devices.

Self Assessment

Fill in the blanks:

1. The Wireless Markup Language (WML) is a simple markup language that was designed exclusively for the purpose of creating applications to be sent over wireless networks to …….. mobile devices.
2. The web browser is a sophisticated …….. that offers a number of flexible and convenient features for the viewers.
3. …….. within the cards of a deck is done within the WAP device just as scrolling a Web page is done within the Web device.
4. Web server requests are routed through WAP ……..
5. In case the Web server generates HTML (XML), the WAP gateways must convert the …… to WML.
6. WML is an open standard and was developed by the WAP forum and the WML specification forms a part of the broader …….. specification.
7. The Web browser manages issues relating to the …….. boundaries.

4.2 Getting Started with WML

WML requires a micro browser to interpret the various commands necessary to render a document, or "deck" as WML documents are called. These browsers are usually embedded in the mobile device.

Cards and Decks are the two main parts in an WML application. WML applications are composed of one or more decks, which are containers of collections of cards. Each card typically contains some content, such as text and images that are displayed to the user, and some other content that is used by the micro browser to control how the user moves from one card to the next. Also a card may contain input fields for the user to enter data as we have the form functionality using HTML in web browsers.

WAP-enabled devices will display a single card at a time. If a card is too large to fit the display all at once, the device may split the card and show it as a sequence of screens or use some mechanism such as scroll bars.

Normally, a WML card is similar to an HTML page, but there is no way in HTML for bundling a collection of pages together. This distinct facility being offered by WML decks is more important for wireless Internet applications. That is, by combining related cards, several cards can be sent to microbrowsers at the same time. This has the potential of saving a great deal of time and by designing applications intelligently, it is feasible to reduce the number of decks to be passed to devices. If deck is too large, the wireless application developer has to split it up in the most logical way.

Notes

Caution One has to play off the benefits of having many cards on the WAP-enabled device at once against the time for a very large deck to travel from content server to mobile devices.

Since WML is an application of XML, it has to start with a document prolog. The prolog states that the particular WML belongs to which version of XML and the gives the location of the document type definition against which this document will be validated. The document type declaration tells that the root element in a WML document will be . There will be only one deck per document. The element defines a WML deck and there will be beginning and ending tags for each deck. There should be at least one card per deck. A deck also can contain elements and elements. The paragraph element <p> is being used to mark data in WML for output.

As it is a wireless network, the data transfer size has to be very minimum. Towards this, WML documents from the content server have to be compiled into smaller binary file. This process of compilation is being accomplished by the intermediate WAP Gateway. The compiled binary file is called WAP binary XML (WBXML). The compilation of WML files is mostly a process of tokenization, in which the names of the tags and elements in the WML files are replaced by predefined, single-character codes. This technique drastically reduces the size of each WML document. When the compiled deck reaches the microbrowser, the reverse process has to be done by the microbrowser to bring the original document in the content server.

White Space is a generic term for characters in a WML code that serve to break it up visually, but has no meaning as far as WML is concerned. White space represents spaces, tabs, line breaks, and so on. WML follows the XML rules as far as white space is concerned. The rule recommends to ignore it before and after an element and to compress all other sequences of white spaces into a single space between two words. This process reduces the total number bytes of a WML application. Thus compilation process actually means applying this rule about white space as it proceeds. The other important feature is that WML supports inserting comments in the code. They start with the sequence. The comments will not be displayed in the microbrowsers.

Did u know? **What is HDML?**

WML (Wireless Markup Language), formerly called HDML (Handheld Devices Markup Languages), is a language that allows the text portions of Web pages to be presented on cellular telephones and personal digital assistants (PDAs) via wireless access.

There are two more possibilities to extend a WML file. They are adding more elements to the existing deck or adding attributes to the elements that already exist. In WML, there are three attributes that can be used with almost all elements: xml:lang, class and id. The first one is xml:lang and this attribute is optional. Its value defines the human language of any data that may be presented to the user, so that user agent can modify its behavior if there is a need for the displaying purpose.

By specifying a class attribute with the same value in several different elements, these elements can be made part of the same class. This feature does not make any impact on the microbrowser or to the users of that WML application. But this feature can be used by some external program that was asked to process the decks present in the WML application.

The id attribute is used to provide an element with a unique name within a single deck. The id attribute specifies a name for a card. This feature is necessary if there is more than one card in the

Notes

deck. When users want to navigate from one card in the deck to another, there should be a mechanism to differentiate the cards.

Below we are see some of the elements that a card may contain.

Paragraphs - To have a formatted text in the user screen, a text can be broken into paragraphs. The paragraph element has align attribute, whose value may be center, right or left. Also the paragraph element has mode attribute, whose value may be wrap and nowrap.

Character Encoding

All the text in the cards of an WML application has appeared faithfully in the microbrowser to be viewed by the users. But there are some characters that are intended to convey very specific information to the microbrowser and not for users consumption. For instance '<' in a code like x < y + z. Here microbrowsers on encountering the < character will look for a closing tag. But there is no closing tag and this will result in error as WML is very strict about the tag rules as WML is an application of XML. Actually '<' is a reserved character in WML. There are two kinds of ways for outputting such kinds of reserved characters. They are numeric character entities and named character entities.

Numeric Character Entities are actually an alternative means of expressing any character, not just reserved ones. Every character that may be displayed has a number associated with it and by referring to that number in a WML code, one can make the corresponding character to be displayed.

Task Analyze how the numbers which WML uses to represent characters are borrowed from Unicode?

Named Character Entities work in broadly the same way as numeric ones. They are not defined for all characters and serve as an easy way to remember the representations of some of the reserved characters the developers have to display often. This representation makes the WML code easier to read. The above code can be displayed using x < y + z.

Line Breaks - Different WAP-enabled devices have different screen sizes and even if they use the same microbrowser, there is no guarantee that the applications will look the same. This is because of the fact that number of characters per line is varying according to the screen size. This makes the sentences and paragraphs to wrap in a different manner. Also there may be occasions, such as forcing a line break between two words, preventing line break from occurring between two words or enforcing a word to be split across two lines. The <br> element is used to force a line break between two words in a paragraph.
 element has no content and it is always empty.

The non-breaking space character entity ; is used to prevent a line break between two words. The last layout control is - character entity, which is used to add a discretionary hyphen. This means that the microbrowser may add a line break at its location and if it does, it should also add a hyphen.

There are controlling elements in WML for manipulating the appearance of content. The <b> element is used to make text use a bold font, while the <i> element is used to italicize text. The element makes the text emphasized. There are some other controls such as <small>, , <big> to facilitate distinguishing text contents. Thus adding and formatting text-based content can be accomplished through the use of paragraphs, elements and entities.

Notes

WML Tags

WML is mostly about text. Tags that would slow down the communication with handheld devices are not a part of the WML standard. The use of tables and images is strongly restricted.

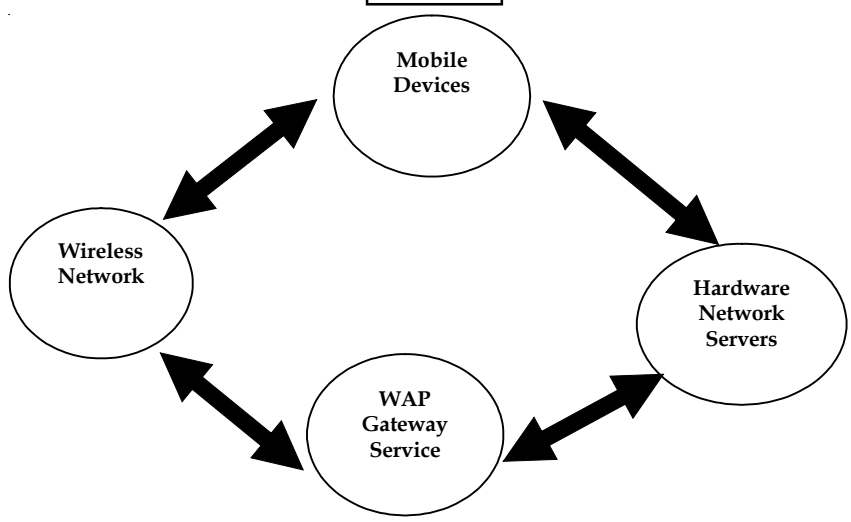
Notes Since WML is an XML application, all tags are case sensitive (<wml> is not the same as <WML>), and all tags must be properly closed.

4.2.1 WAP and WEB

Generic Mobile Network

A generic mobile network is shown in the Figure 4.1.

Figure 4.1



- It is generic representation of a wireless WAN.
- It is a simple overview of a mobile network design.
- Infrastructure is obviously more complex.
- WAP Gateway Server performs the critical bridge functions of communicating with the mobiles device and translating sent-received data to and from Web Servers.

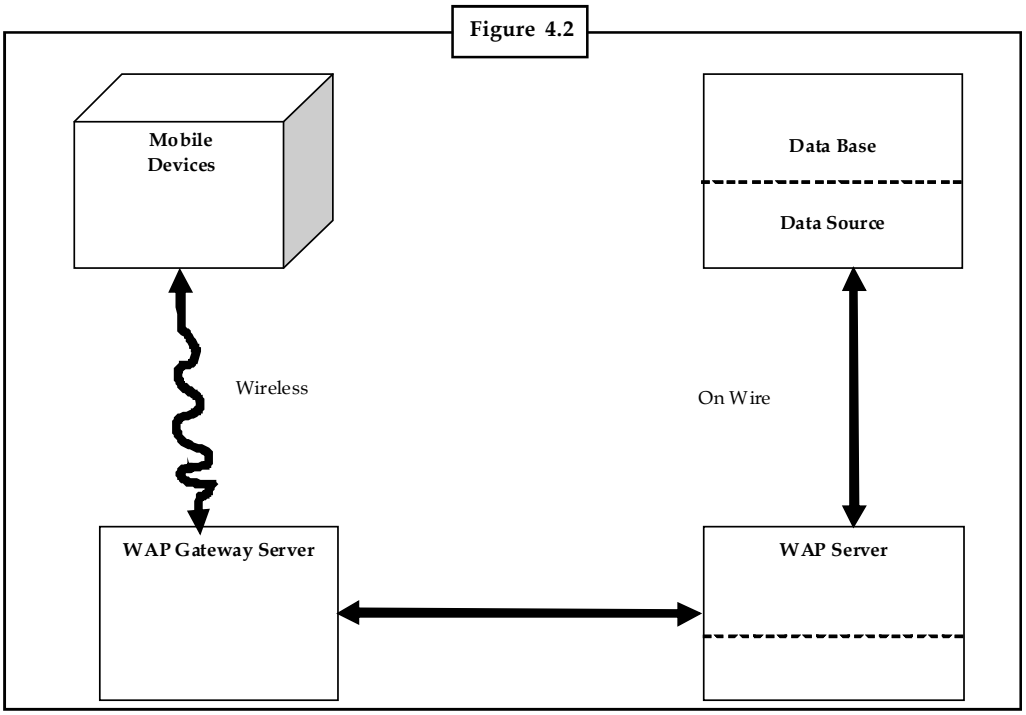
System Components

Notes Note the elements of a wireless network structure in Figure 4.2. This figure has been simplified for clarity.

Notes

The bridge between the wired world and wireless domain is the WAP Gateway Server.

Figure 4.2



- ***WAP Client:*** End user for wireless services. The user platform includes all necessary applications.
- ***WAP Gateway:*** Manages two-way communication between a mobile device and the wired Internet. Translates Web Server output (HTTP) to wireless application protocols (WAP) to send to mobile service and vice versa.
- ***Web Server:*** Standard web server, including Web Proxy. An example of this is IBM's Websphere Application Server.
- ***Data Source:*** This is the data repository, which could flow through other servers and reside within one or more databases.

Mobile Device Hardware Considerations

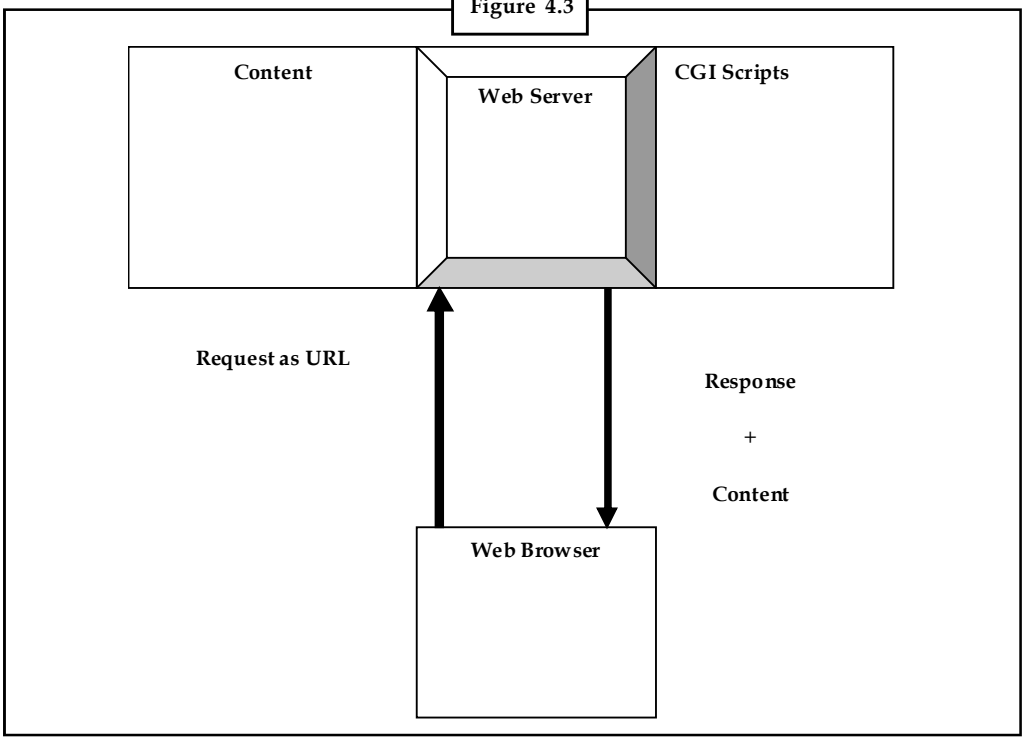
WAP enabled devices are presently quite limited. They typically have very small screens, little memory, limited battery power, slow rates, and awkward input keys. Two-way voice communication is available, only the simplest of graphics input keys. Also, a programmer cannot assume that his or her users have the most capable devices.

The World-Wide Web Model

The Internet World-Wide Web (WWW) architecture as depicted in Figure 4.3 offers a very adaptable and efficient programming model. Applications and content are presented in standard data formats, and are browsed by applications known as web browser. The web browser is a network application, i.e., it sends requests for named data objects to a network server and the server in turn responds with the data encoded using the standard formats.

Notes

Figure 4.3



- ***Standard Naming Model:*** All servers and content on the WWW are named with an Internet-standard Uniform Resource Locator (URL).
- ***Content Typing:*** All content on the WWW is given a specific type thereby permitting web browsers to correctly process the content based on its type.
- ***Standard Content Formats:*** All web browsers support a set of standard content formats. These include the Hypertext Markup Language (HTML), the JavaScript scripting language, and a large number of other formats.
- ***Standard Protocols:*** Standard networking protocols permit any web browser to interact with any web server. The most commonly used protocol on the WWW is the Hypertext Transport Protocol (HTTP).

This infrastructure permits user to easily reach a enormous of third party applications services. It also permit developers to simplify create applications and content services for a large community of clients.

The WWW protocols define three classes of servers:

- ***Origin Server:*** The server on which a given resource (content) resides or is to be created.
- ***Proxy:*** An intermediary program that acts as both a server and a client for the purpose of making requests on behalf of other clients. The proxy typically resides between clients and servers that have no means of direct communication, e.g., across a firewall. Requests are either serviced by the proxy program or passed on, with possible translation, to other servers. A proxy must implement both the client and server requirements of the WWW specifications.
- ***Gateway:*** A server, which behaves as an intermediary for some other server. Unlike a proxy, a gateway receives requests as if it were the origin server for the server resource. The requesting client may not be aware that it is communicating with a gateway.

Notes

Task Analyze the difference between WML and HTML.

Self Assessment

Fill in the blanks:

8. WAP-enabled devices will display a …… card at a time.
9. WML documents from the content server have to be compiled into smaller …… file.
10. WML card is similar to an HTML page, but there is no way in HTML for bundling a collection of …… together.
11. The paragraph element has …… attribute, whose value may be center, right or left.
12. The <a> element's title attribute is used to provide a brief description of the ……
13. The …… is the simplest way in WML of creating an anchor that links one document to another.

4.3 Understanding WML Uses

Short for Wireless Markup Language, an XML language used to specify content and user interface for WAP (Wireless Application Protocol) devices; the WAP forum provides a DTD (Short for document type definition. A DTD states what tags and attributes are used to describe content in an SGML document, where each tag is allowed, and which tags can appear within other tags. For example, in a DTD one could say that LIST tags can for WML.

WML is supported by almost every mobile phone browser around the world.

WML pages are requested and served in the same way as HDML (Handheld Device Markup Language is used to format content for Web-enabled mobile phones. HDML is Openwave's (formerly known as phone.com) proprietary language, which can only be viewed on mobile phones that use Openwave browsers.

For Web servers to serve WML pages, they must contain the text/vnd.wap.wml mime type MIME (Short for Multipurpose Internet Mail Extensions, a specification for formatting non-ASCII messages so that they can be sent over the Internet. Many e-mail clients now support MIME, which enables them to send and receive graphics, audio, and video files via the Internet mail system. In addition, MIME supports messages in character sets other than ASCII).

Like HTML, WML is easy to use. However, compared to HTML, WML has the following advantages in the context of wireless:

- WML is part of the WAP standard and its use is required.
- Transmission of WML (WMLC) documents requires less bandwidth compared to HTML documents because WML documents are simpler and WML is compressed before it is sent to the WAP device.
- Compared to HTML documents, displaying WML documents requires less processing power and memory. Consequently, a WAP device can work with a less powerful (cheaper) CPU and the use of less power means that the battery can operate longer without recharging.
- WML provides support for limited graphics with a limited gray scale.

Self Assessment

Notes

Fill in the blanks:

14. A …… states what tags and attributes are used to describe content in an SGML document.

15. HDML is Openwave's (formerly known as phone.com) proprietary language, which can only be viewed on mobile phones that use …… browsers.

Caselet

Virus Threat to Cell-phones

I Have a Samsung C100 model cell-phone onto which I often download pictures and ring tones. I would like to know if there is any virus threat to the phone because of this. If so please tell me how to avoid it. — D.S. Nanda

The possibility of your mobile getting virus-infected through downloaded pictures and contents depends on how you download them.

If it is through a WAP browser, then the chances of your mobile phone getting infected with a virus are more.

On the other hand, if it is through a communication cable or infrared or an MMS forward, then the chances are a lot less Viruses use scripting language to do their job and WAP supports WML Scripts, which are as strong as Java Scripts on which virus codes can be run and can even go to the extent of corrupting your address store and other contents.

But there is nothing much to worry about for now as most of the WAP providers have anti-virus software installed on their gateway, which scans the contents before you download them.

However, it will not be long before WAP and WML Scripting become more complex, eventually causing more problems and giving more room for virus writers.

4.4 Summary

- The Wireless Markup Language (WML) is a simple markup language that was designed exclusively for the purpose of creating applications to be sent over wireless networks to WAP - enabled mobile devices.
- WML is an open standard and was developed by the WAP forum and the WML specification forms a part of the broader WAP specification.
- WML is an application of XML. WML has some distinct differences from other markup languages, for instance HTML.
- WML is an acronym for Wireless Markup Language.
- While the HTML language creates web pages for the PCs, the WML creates web pages for the handheld devices. WML's similarity to HTML was not random.
- Cards and Decks are the two main parts in an WML application. WML applications are composed of one or more decks, which are containers of collections of cards.
- Each card typically contains some content, such as text and images that are displayed to the user, and some other content that is used by the micro browser to control how the user moves from one card to the next.

Notes

- Also a card may contain input fields for the user to enter data as we have the form functionality using HTML in web browsers.
- WML pages are requested and served in the same way as HDML (Handheld Device Markup Language is used to format content for Web-enabled mobile phones. HDML is Openwave's (formerly known as phone.com) proprietary language, which can only be viewed on mobile phones that use Openwave browsers.

4.5 Keyword

HDML: Handheld Device Markup Language

HTML: Hypertext Markup Language

WML: Wireless Markup Language

XML: Extensible Markup Language

4.6 Review Questions

1. WML's similarity to HTML was not random. Comment.
2. A WAP deck is the equivalent of a Web page, the card being the portion of the Web page that can be seen on the screen. Explain.
3. A Web server may generate WML content for WAP devices or it may simply dish out HTML (XML). Discuss.
4. Converting HTML automatically to WML typically does not produce good or even usable results. Explain with examples.
5. The id attribute is used to provide an element with a unique name within a single deck. Discuss.
6. State some of the differences between WML tags and HTML tags.
7. How are the wired world and the wireless domain bridged?
8. Each card typically contains some content, such as text and images that are displayed to the user. Explain with examples.
9. A proxy must implement both the client and server requirements of the WWW specifications. Comment.
10. All web browsers support a set of standard content formats. Is it true? Why?

Answers: Self Assessment

1.	WAP - enabled	2.	software package
3.	Navigation	4.	gateways (proxies)
5.	HTML (XML)	6.	WAP
7.	Screen	8.	Single
9.	Binary	10.	Pages
11.	Align	12.	Hyperlink

13. Element
14. DTD
15. Openwave

Notes

4.7 Further Readings

Books

Demon Hougland, *Essential WAP for Professional*, 2001, Prentice Hall PTR.

Jennifer Niederst Robbins, *Web Design in a Nutshell*, 2006, O'Reilly.

Jon Orwant, *Web Graphics & Perl/TK: Best of the Perl Journal 2003 O' Reilly.*

Paul Wallace Andrea Hoffmann, *Mika Tuppola, I – Mode Developer Guide*, 2002.

Online links

http://www.tutorialspoint.com/wml/wml_environment.htm

http://www.developershome.com/wap/wml/wmlIntro.asp

Notes

Unit 5: Understanding WAP in WML

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Objectives

After studying this unit, you will be able to:

- Scan how to create first card
- Describe building deck of cards
- Demonstrate using basic navigation
- Recognize WML tasks

Introduction

WML (Wireless Markup Language) is the new web language for making sites on mobile phones. Over the past few months new WAP (Wireless Applications Protocol) phones have become extremely popular and many large websites have created special 'mobile' versions of their site. Many people predict that, over the next few years, WAP sites will become even more popular and e-commerce over mobile phones will be widely available.

The roots of WAP are rather interesting, as they are built on the premise of industry cooperation. This is rather ironic, since the first official release of the protocol took place at the height of the ill-remembered 'Browser Wars'. It is undoubtedly this cooperation that was one of the major propellants for the widespread acceptance of WAP, allowing the standard to be quickly developed and integrated into the existing products of the many corporations responsible for its' development. This open standard also led to the rise of many new start-ups focused upon developing and marketing their own niche applications. Let's turn towards a brief discussion of this history, and how it ultimately led to the popularity seen today.

Way back when, in 1995, Ericcson spearheaded an effort to develop a general protocol that would offer a variety of value added services to wireless networks.

Notes

Notes Several other companies were soon on Ericcson's heels, developing various other technologies to compete in this soon-to-explode market, two major players including Nokia (http://www.nokia.com) and Phone.com, formally known as Unwired Planet (http://www.phone.com).

5.1 WML Decks and Cards

WML pages are called DECKS. They are constructed as a set of CARDS, related to each other with links. When a WML page is accessed from a mobile phone, all the cards in the page are downloaded from the WAP server. Navigation between the cards is done by the phone computer - inside the phone - without any extra access trips to the server.

WML Programming Model

The WML programming model offers for

- Application navigation (cards and decks)
- User interaction, events
- Definition of tasks, work to be performed

Writing WML Code and Data Formatting

<?xml version="1.0"?><!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN""http://www.wapforum.org/DTD/wml_1.1.xml"><wml><card id="HTML" title="HTML Tutorial"> Our HTML Tutorial is an award winning tutorial from W3Schools. </card><card id="XML" title="XML Tutorial"> Our XML Tutorial is an award winning tutorial from W3Schools. </card></wml>

As it can be seen from the example, the WML document is an XML document. The DOCTYPE is defined to be wml, and the DTD is accessed at www.wapforum.org/DTD/wml_1.1.xml.

The document content is inside the <wml>...</wml> tags. Each card in the document is inside <card>...</card> tags, and actual paragraphs are inside ... tags. Each card element has an id and a title.

Task Try to explain the code which is written above for data formatting.

Self Assessment

Fill in the blanks:

1. WML pages are called …….....
2. ……..... between the cards is done by the phone computer — inside the phone — without any extra access trips to the server.
3. The document content is inside the ……..... tags.

5.2 Creating First Card

The whole WML-page is called a Deck and it consists of one or more cards. Each card contains the information that is displayed on the cellular devices in one screen. So in one Deck you can define

Notes

one more screens. Cellular device displays first card when it receives a Deck. And in first card using elements and attributes we can define our navigational structure between different cards.

Let's create our first application. So, here is the code of our application.

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card id="Card1" title="Learning WML ">
<p>
Welcome to Unwired World!
</p>
</card>
</wml>
```

In any WML application first three line is must and it contains the XML and document type declaration.

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
```

Task According to you what is the procedure of making the first card in WML?

After XML and document type declaration WML deck start with <wml> and ends with </wml> tags. Each deck may contain one or more cards. First card of WML page is displayed by the cellular device and this card provides the links to the other cards of the deck.

```
<wml>
<card id="Card1" title="Learning WML ">
<p>
Welcome to Unwired World!
</p>
</card>
</wml>
```

WML card starts with <card>and ends with </card> tag. Attribute "id" of card element gives the identity to the card and using this id we can refer any card in the WML page. Next is <p> tag which we are using to display the paragraph. We can use <p>, <b>, <i>, <br>, <a> in our programming and these tags are identical to the HTML tags.

Tags	Functionality
<p>	Writing paragraph
<b>	Writing bold text

Notes

<i> Writing italic text

 Inserts a line break

<a> Creates a link

By the end of this unit you are very much familiar with the WML language. Now try the following WML script which uses the different formatting tags. You can test your script by copying and pasting the code in above text area and pressing the test button.

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card id="Card1" title="Learning WML ">
<p>
Welcome to Unwired World! <br/> Line break<br/>
<b>This is bold.</b><br/>
<i>This is italic.</i><br/>
<b>This is bold.</b><br/>
<u>This is underline.</u><br/>
<small>This is small.</small><br/>
<strong>This is strong.</strong><br/>
</p>
</card>
</wml>
```

Did u know? **What is the history of WML 2.0?**

WAP site developers need not to care about WML 2.0. WML 2.0 is created for backward compatibility purposes and it is not for use by WAP site developers. To develop a WAP site with the WAP 2.0 standard, use XHTML Mobile Profile.

Self Assessment

Fill in the blanks:

4. The whole WML-page is called a Deck and it consists of ……. cards.
5. Cellular device displays ……. card when it receives a Deck.
6. WML card starts with ……. and ends with </card> tag.
7. Attribute ……. of card element gives the identity to the card and using this id we can refer any card in the WML page.
8. First card of WML page is displayed by the cellular device and this card provides the ……. to the other cards of the deck.

Notes

5.3 Building Decks of Cards

WML pages are often called "decks". A deck contains a set of cards. A card element can contain text, markup, links, input-fields, tasks, images and more. Cards can be related to each other with links.

When a WML page is accessed from a mobile phone, all the cards in the page are downloaded from the WAP server. Navigation between the cards is done by the phone computer - inside the phone - without any extra access trips to the server:

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card id="no1" title="Card 1">
<p>Hello World!</p>
</card>
<card id="no2" title="Card 2">
<p>Welcome to our WAP Tutorial!</p>
</card>
</wml>
```

The result MIGHT look like this in your mobile phone display (note that only one card is displayed at a time):

——— Card 1 ———

Hello World!

Card

It is a single unit of WML navigation, which often directs to one screen of viewed content but could work on a step that is not displayed.

Deck

Some important points about a deck are highlighted below.

- It is analogous to an HTML page in that it is the unit of content transmission.
- Decks are to WML identical as documents are to HTML.
- WML decks are XML documents.
- Decks send requests for services and/or to be carried out on servers.
- Decks comprises of component known as "cards".
- Each deck must have at least one card.

The device browser accesses and open a deck and reads the cards within the deck. Navigation traverses from card within a deck. Once loaded, the deck resides in device's memory.

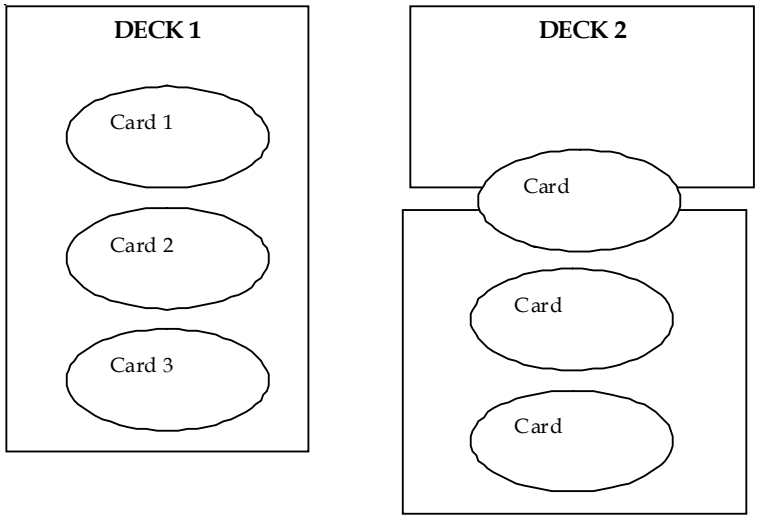
Each deck starts with the <wml> tag and ends with the </wml> tag. Within these decks, every card starts with the <card> tag and ends with the </card> tag.

Notes

Task Analyze the importance of deck in WML.

Figure 5.1 is a pictorial representation of decks and cards.

Figure 5.1



Deck syntax

```
<wml>
        <card id="1">
                ********************
                ********************
        </card>
                (More cards as required)
</wml>
```

Once the deck is loaded, there is no requirement to load additional data. A deck is a self-contained set of elements or user functions. The user function presumes that the cards, which are read, are related to the deck in memory. This is beneficial where there are suspend and resume modes.

WML decks are helpful in the following ways.

- Showing content
- Providing selections
- Local area checking
- Easy scripting tasks
- Routing to other decks and Servlets

Task How are WML decks helpful?

Notes

Self Assessment

Fill in the blanks:

9. When a WML page is accessed from a mobile phone, all the cards in the page are downloaded from the …….. server.
10. The device …….. accesses and opens a deck and reads the cards within the deck.
11. Once the deck is loaded, there is no requirement to load additional ……..
12. Decks are to WML identical as documents are to ……..

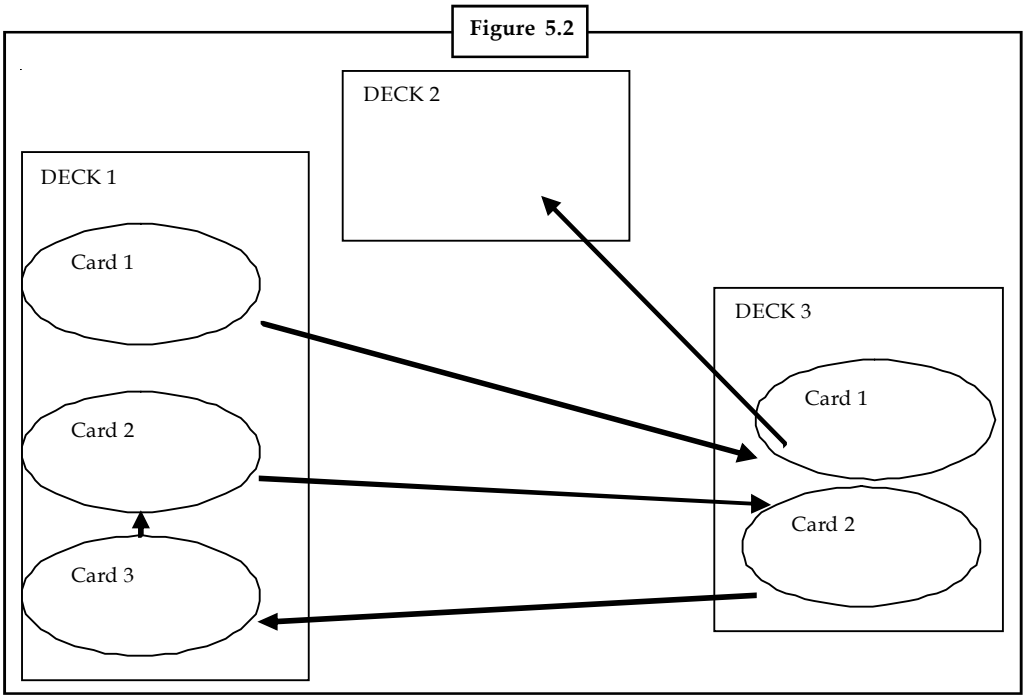
5.4 Using Basic Navigation

Navigation instructions shifts from the current card to the next active card. Navigation can happen in the following ways:

- Between cards in the same deck
- Moving from deck to deck
- Between applications
- Between sites.

Refer Figure 5.2 for a better understanding.

Figure 5.2



Events Overview

The browser recognizes an event and reports it to the application. WML has constructs to tie a task to an event.

Notes

Types of events are:

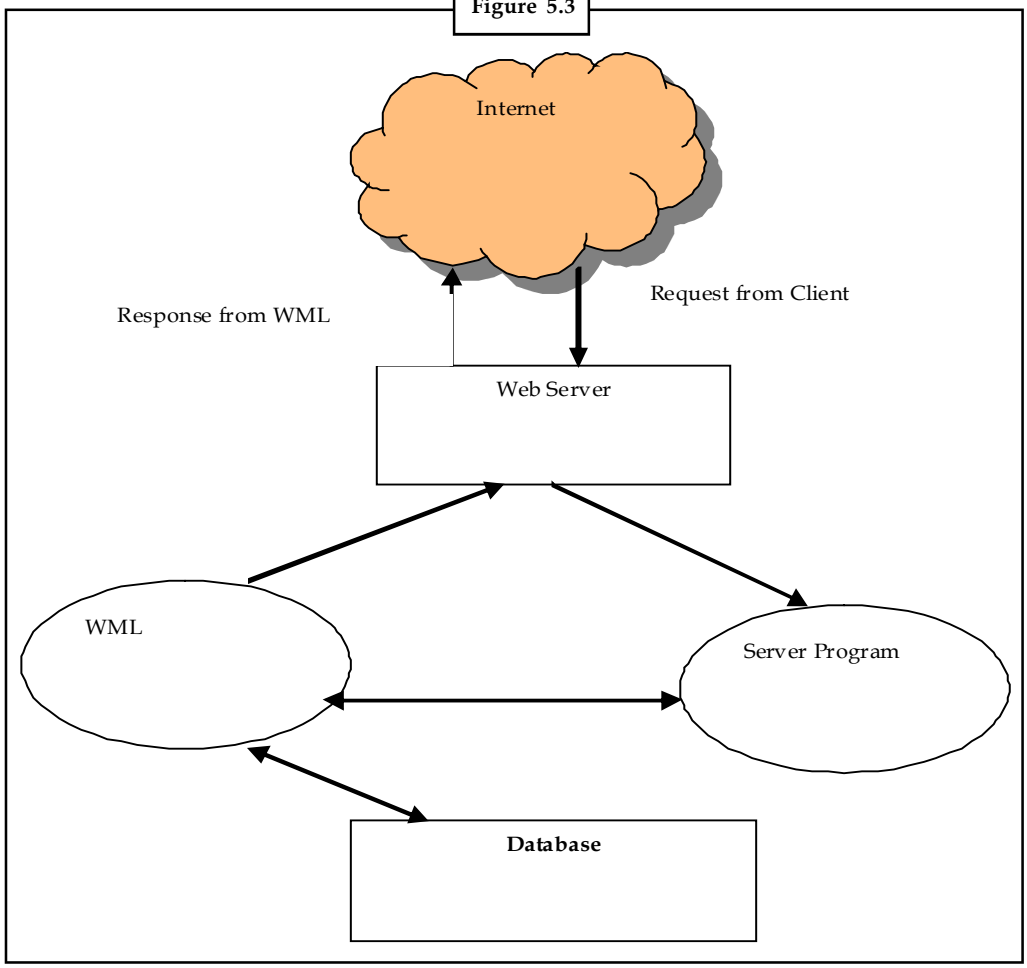
- Intrinsic events (e.g., a card has loaded)
- Extrinsic event-user initiated event (e.g., a button is pressed)

Tasks Overview

- Variable manipulation
- Navigation
- Scripted tasks: For instance,
  - Input validation
  - Calculation
  - Navigation
  - Server interaction
  - Server Interaction

Figure 5.3 is a pictorial representation of server interaction.

Figure 5.3



Notes

Server-Side Programming

- JavaScript
- Visual Basic
- Perl
- CGI
- ASP
- Java

Server-side programs or scripts will support most advanced wireless applications.

- Dynamic content generation
- CGI programs or Servlets
- ASP, JavaScript, Perl subroutines.

The bulk development will be on the server side.

> *Notes* The art of programming for WML depends on how finely data is extracted and served to the mobile device.

5.5 WML Tasks

A task specifies what action to perform when an event, like entering a card or selecting a link, occurs.

Go Task

The <go> task represents the action of switching to a new card.

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card>
<p>
 <anchor>
  Go To Test
  <go href="test.wml"/>
 </anchor>
</p>
</card>
</wml>
```

Prev Task

Notes

The <prev> task represents the action of going back to the previous card.

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card>
<p>
 <anchor>
  Previous Page
  <prev/>
 </anchor>
</p>
</card>
</wml>
```

Did u know? **What is the Markup Basics?**

Markup rules closely follow the same rules of any markup language.

- Should use start and end tags.
- Utilize attributes within tags to control their effect.
- Additional white space is ignored.

There are some variations.

- WML tags and attributes are case-sensitive and MUST be lowercase.
- Syntax must be followed.

Refresh Task

The <refresh> task refreshes some specified card variables. If any of the variables are shown on the screen, this task also refreshes the screen.

Example: The example below uses an <anchor> tag to add a "Refresh this page" link to the card. When the user clicks on the link, he or she refreshes the page and the value of the variable x will be set to 30:

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card>
<p>
 <anchor>
```

Notes

```
 Refresh this page
 <go href="thispage.wml"/>
 <refresh>
  <setvar name="x" value="30"/>
 </refresh>
</anchor>
</p>
</card>
</wml>
```

Noop Task

The <noop> task says that nothing should be done (noop stands for "no operation"). This tag is used to override deck-level elements.

The <do> tag can be used to activate a task when the user clicks on a word/phrase on the screen.

Example: The example below uses a <do> tag to add a "Back" link to the card. When the user clicks on the "Back" link, he or she should be taken back to the previous card. But the <noop> tag prevents this operation; when the user clicks on the "Back" link nothing will happen:

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card>
<p>
 <do name="back" type="prev" label="Back">
  <noop/>
 </do>
</p>
</card>
</wml>
```

5.5.1 Task Elements

Start tag	Purpose	WML
<go>	Represents the action of switching to a new card	1.1
<noop>	Says that nothing should be done (noop stands for "no operation"). Used to override deck-level elements	1.1
<prev>	Represents the action of going back to the previous card	1.1
<refresh>	Refreshes some specified card variables. If any of the variables are shown on the screen, this task also refreshes the screen	1.1

Notes

Example: Sample WML Code

```
<?xml version =”1.0">
<! DOCTYPE wml PUBLIC “-// WAPFORUM//DTD WML 1.1// EN” “
http://www.wapforum.org/DTD/wml_1.1.dtd”>
<wml>
        <head>
                <access domain = www.ibm.com/>
                </head>
        <template>
                . . .
        </template>
        <card>
                <p> Welcome to code wml site </p>
        </card>
</wml>
```

Self Assessment:

Fill in the blanks:

13. The browser recognizes an event and reports it to the ……...
14. The <refresh> task refreshes some …….. card variables.
15. The …….. task says that nothing should be done (noop stands for “no operation”).

Caselet

WorldSpace Inks Pact with Webel Mediatronics

WEBEL Mediatronics Ltd (WML) today signed a memorandum of understanding (MoU) with WorldSpace India Pvt Ltd, a wholly owned subsidiary of WorldSpace Inc of the US, to collaborate in the arena of satellite radio technology development. WML is a subsidiary of West Bengal Electronics Industry Development Corporation

The MoU envisages transfer of technology from WorldSpace to WML for assembly, installation, and commissioning of broadcasting infrastructure, including gap fillers that work in conjunction with WorldSpace Satellite Radio service offerings.

According to Mr Noah A. Samara, Chairman & CEO of WorldSpace Inc, WorldSpace and WML will co-operate in manufacturing, deployment and maintenance of modern broadcasting equipment including gap fillers, receivers, and related accessories in India.

Contd....

Notes

The companies would also explore markets both in India and neighbouring countries.

WorldSpace already provides satellite radio offerings in select cities in the country.

WorldSpace India has a range of 40 radio stations across genres - from jazz to classical, and old Hindi film music to rock.

Its Indian programming includes two Indian classical stations as well as regional stations.

Over the next two years, WorldSpace will invest about $150 million in technology development and marketing in the Indian market, Mr Samara said.

The company has already invested around $200 million in and for the development of the Indian market.

On its part, WML has been serving the electronic media for the last 25 years.

Over the years, it has supplied products to Doordarshan kendras and All India Radio stations. It has also pioneered the manufacture of studio equipment and community radio systems in the country.

According to a senior official of WML, the MoU with WorldSpace is the first of its kind in India. It envisages the development of hybrid technology-based digital audio broadcasting systems.

The scope of such digital audio broadcasting systems based on the coded orthogonal frequency division multiplexing technology is huge not just in India but in developed, mature markets, he added.

5.6 Summary

- WML is Wireless Markup Language which creates web pages for the handheld devices. The structure, formatting, and syntax of WML are familiar with HTML and XML.
- WML is a direct descendent of Handheld Device Markup Language (HDML). WML, however, has been optimized for the constraint wireless device. As a result, there is a prominent difference between HTML and WML.
- WML requires a micro browser to interpret the various commands necessary to render a document, or "deck". These browsers are usually embedded in the mobile device.
- WML is mostly about text. Tags that would slow down the communication with handheld devices are not a part of the WML standard. The use of tables and images is strongly restricted. Since WML is an XML application, all tags are case sensitive, and all tags must be properly closed.
- WAP Gateway Server performs the critical bridge functions of communicating with the mobiles device and translating sent-received data to and from Web Servers.
- WAP Client means the end user for wireless services. The user platform includes all necessary applications.
- WAP Gateway manages two-way communication between a mobile device and the wired Internet. Translates Web Server output (HTTP) to wireless application protocols (WAP) to send to mobile service and vice versa.
- Web Server means standard web server, including Web Proxy.

Notes

- Data Source is the data repository, which could flow through other servers and reside within one or more databases.
- The WML document is an XML document. The DOCTYPE is defined to be wml, and the DTD is accessed at www.wapforum.org/DTD/wml_1.1.xml.The document content is inside the <wml>...</wml> tags. Each card in the document is inside <card>...</card> tags, and actual paragraphs are inside ... tags. Each card element has an id and a title.
- WML pages are often called "decks". A deck contains a set of cards. A card element can contain text, markup, links, input-fields, tasks, images and more. Cards can be related to each other with links.
- Card is a single unit of WML navigation, which often directs to one screen of viewed content but could work on a step that is not displayed.
- Deck is analogous to an HTML page in that it is the unit of content transmission, Decks are to WML identical as documents are to HTML, WML decks are XML documents, Decks send requests for services and/or to be carried out on servers, Decks comprises of component known as "cards", Each deck must have at least one card.
- The device browser accesses and open a deck and reads the cards within the deck. Navigation traverses from card within a deck. Once loaded, the deck resides in device's memory.
- Each deck starts with the <wml> tag and ends with the </wml> tag. Within these decks, every card starts with the <card> tag and ends with the </card> tag.
- Once the deck is loaded, there is no requirement to load additional data. A deck is a self-contained set of elements or user functions. The user function presumes that the cards, which are read, are related to the deck in memory. This is beneficial where there are suspend and resume modes.
- WML decks are helpful in showing content, providing selections, local area checking, easy scripting tasks and routing to other decks and Servlets.

5.7 Keywords

Card: It is a single unit of WML navigation, which often directs to one screen of viewed content but could work on a step that is not displayed. A card element can contain text, markup, links, input-fields, tasks, images and more. Cards can be related to each other with links.

Data Source: This is the data repository, which could flow through other servers and reside within one or more databases.

Decks: WML pages are often called "decks". A deck contains a set of cards.

WAP Client: End user for wireless services. The user platform includes all necessary applications.

WAP Gateway Server: It performs the critical bridge functions of communicating with the mobiles device and translating sent-received data to and from Web Servers.

WAP Gateway: Manages two-way communication between a mobile device and the wired Internet. Translates Web Server output (HTTP) to wireless application protocols (WAP) to send to mobile service and vice versa.

Web Server: Standard web server, including Web Proxy. An example of this is IBM's Websphere Application Server.

WML: WML is Wireless Markup Language which creates web pages for the handheld devices.

Notes

5.8 Review Questions

1. Explain how the role of WML in mobile Internet applications is the same as that of HTML in web applications?
2. Write a simple WML code and explain all the elements in it.
3. Decks send requests for services and/or to be carried out on servers. Explain.
4. "WML (Wireless Markup Language) is the new web language for making sites on mobile phones". Comment.
5. The roots of WAP are rather interesting, as they are built on the premise of industry cooperation. Discuss.
6. When a WML page is accessed from a mobile phone, all the cards in the page are downloaded from the WAP server. Explain.
7. What are cards? What should be the minimum number of cards in a deck?
8. A WML file can contain multiple cards and they form a deck. Explain with proper examples.
9. A card element can contain text, markup, links, input-fields, tasks, images and more. Explain with proper examples.
10. Navigation traverses from card within a deck. Once loaded, the deck resides in device's memory. Discuss.

Answers: Self Assessment

1.	DECKS	2.	Navigation
3.	<wml>...</wml>	4.	one or more
5.	first	6.	<card>
7.	"id"	8.	Links
9.	WAP	10.	Browser
11.	Data	12.	HTML
13.	Application	14.	Specified
15.	<noop>		

5.9 Further Readings

Books

Demon Hougland, *Essential WAP for Professional*, 2001, Prentice Hall PTR.

Jennifer Niederst Robbins, *Web Design in a Nutshell*, 2006, O'Reilly.

Jon Orwant, *Web Graphics & Perl/TK: Best of the Perl Journal* 2003 O' Reilly.

Paul Wallace Andrea Hoffmann, *Mika Tuppola, I – Mode Developer Guide*, 2002.

Notes

Online links

http://www.developershome.com/wap/wml/helloWorldWmlEg.asp

http://www.wirelessdevnet.com/channels/wap/training/wml.html

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Unit 6: Card Navigation

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Objectives

After studying this unit, you will be able to:

- Scan URL's
- Describe Tags used in Navigation
- Demonstrate using phone buttons and function keys
- Recognize navigation history

Introduction

Uniform Resource Locators (URLs) are being used to name resources in WML. There are two different types of URLs: absolute and relative URLs. A WML fragment anchor is specified by suffixing the URL for a deck with a # symbol and the destination element's id attribute is added as follows:

deck-url#card-id

Example: If we want to refer to the "menu" card in mydeck, we have to use an absolute URL such as http://www.peterindia.net/mydeck.wml#menu.

In this unit we will discuss about the card navigation.

Notes

6.1 Card Navigation

The element is the simplest way in WML of creating an anchor that links one document to another. Elements have a number of attributes that can be used to configure and customize their behavior. Apart from the common attributes xml:lang, id and class, the <a> element supports attributes called href, title and access key. href is used to specify the destination of a hyperlink. The destination may be within a deck, or a card in another deck that is also on the same site or the card may be in a deck which is on another site. For the first case, it is simply a matter of specifying the id of the destination card as the value of href. For the second one, we have to specify the URL for the deck and the id attribute of the desired card element within that deck. For the last case, the destination has to be specified fully with a full URL, the server name, the deck to load and the card within the deck.

The <a> element's title attribute is used to provide a brief description of the hyperlink. The accesskey attribute allows the user to select an anchor by pressing a key on the keypad of the WAP-enabled device. The accesskey attribute's values are the numbers, which appear on the left side of the hyperlinks. Pressing those keys will result immediate navigation.

The <anchor> element supports the same attributes with the same semantics as, with the exception of href. It performs straightforward navigation. This element can be used together with elements called <go> and <prev> to specify a destination for the hyperlink.

The <go> element is used to specify a navigation action that occurs as a result of an event. The <go> supports a number of attributes. When used with the <anchor> element to perform simple navigation, the <go> element has the following general form:

<anchor>

content

<go href="destination" />

</anchor>

The <anchor> element offers the ability to navigate to the previous card. This is being achieved by the <prev> element.

The <card> element encloses a WML card within a deck. In addition, text and graphics enclosed within <p> elements, it may also contain a number of event bindings

Attributes:

The <card> element supports the following attributes:

Attribute	Value	Description
title	cdata	Gives a title to this card. This title is displayed in some way by the browser when the card is visible.
newcontext	true false	Specifies that when this card is entered, the browser context should be cleared.
ordered	true false	Provides a hint to the browser about how the card is organized. Set it to true if the card consists of a number of separate fields that should be dealt with in the order they appear in the card. Set it to false if the card contains optional fields or may be filled in out of order.
onenterforward	URL	Occurs when the user navigates into a card using a "go" task
onenterbackward	URL	Occurs when the user navigates into a card using a "prev" task
ontimer	URL	Occurs when a "timer" expires
xml:lang	language_code	Sets the language used in the element.
class	cdata	Sets a class name for the element.
id	element_ID	A unique ID for the element.

Notes

Example: Following is the example showing usage of this element:

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.2//EN"
"http://www.wapforum.org/DTD/wml12.dtd">
<wml>
<card id="one" title="First Card">
<p>
This is the first card in the deck
</p>
</card>
<card id="two" title="Second Card">
<p>
This is the second card in the deck
</p>
</card>
</wml>
```

6.2 Using URLs

Links may be given in two ways, but the <a> tag is preferred.

```
<anchor>Go to URL<go href="url.wml"/></anchor>
<anchor>Go to URL<go href="http://wml.org.de/url.wml"/></anchor>
<a accesskey="1" href="#card">Go to card</a>
<a href="http://wml.org/deck.wml/#card">Go to card</a>
```

href: Target; either a deck or a card; a card is prefixed by #, the target can either be given relative or absolute. If no card is given, the first card of a deck is linked. This address is called URL (Uniform Resource Locator).

Self Assessment

Fill in the blanks:

1. The element is the simplest way in WML of creating an …….. that links one document to another.
2. The …….. element encloses a WML card within a deck.
3. The …….. element is used to specify a navigation action that occurs as a result of an event.
4. …….. is used to specify the destination of a hyperlink.

Notes

6.3 Tags Used in Navigation

Links use the familiar <a> tag or the <anchor> tag with a ”go” task. (The anchor tag may also have the tasks ”prev” and ”refresh.”) Here’s an example of both types of links. To link to another card in the same deck, the # is used.

Notes Note that the new card is created within the same file as the first card in the deck.

Example:

```
<?xml version=”1.0"?>
<!DOCTYPE wml PUBLIC “-//WAPFORUM//DTD WML 1.1//EN”
“http://www.wapforum.org/DTD/wml_1.1.xml”>
<wml>
<card id=”card1" title=”My First Ever WML Card”>
<p>I made a WML card! Woo Hoo!</p>
<p><a href=”somewhere.wml”>Get Somewhere</a></p>
<p>
<anchor>New page
<go href=”new.wml”></anchor>
```

Notes

```
</p>
</card>
<card id=”card2" title=”My Second Card”>
<p><a href=”#card1">Back to Card One</a>
</p>
</card>
</wml>
```

Anchor links enable the navigation between different WML cards. If you select an anchor link, you will be brought to another WML card in the current deck or in another deck.

The <anchor></anchor> tag pair is used to create an anchor link. It is used together with tags such as <go/> and <prev/>, which tell WAP browsers what to do when a user selects the anchor link. <go/> and <prev/> should be enclosed within the <anchor></anchor> tags, like this:

```
<anchor>
  <go href=”...” ... />
</anchor>
<anchor>
  <prev/>
</anchor>
```

Like HTML, WML uses a URL (Uniform Resource Locator) to refer to the location of a WML file or a card in a deck. The href attribute of the <go/> tag is used to specify the URL. Both absolute and relative URLs are accepted. URLs in WML have the same form as those in HTML. Here is the general form of an absolute URL in WML:

http://host_name/path/file_name#offset?parameter1=value1&parameter2=value2...

The protocol used in WML URLs is HTTP. The reason is that WAP gateways request WML files from ordinary web servers using the HTTP protocol, although wireless devices communicate with WAP gateways using WAP protocols.

Task Analyze what are the basic and important tags used in WML for navigation?

6.3.1 WML Links

- Links are user-selectable hotspots.
- Links offer navigation capabilities.
- WML links are equivalent to HTML hyperlinks.
- Links are deployed in WML as either the <anchor> tag or the <a> tag.

Link-Anchor Elements

- ***The <a> element***
  - simple hot spot

Notes

```
<a href =" #anothercard">
        Moves to that card
</a>
```

- ***The <anchor> element***
  - used with <go>, <prev>, or <refresh>
  - can be used with parameters

```
<anchor><prev/>
        Moves back one card
</anchor>
```

- ***URLs***
  - Fully Qualified URLs

```
<a href =http://www.hotbar.com/test1.wml>
```

  - Relative URLs

```
<a href ="#card2">
```

Task Analyze the difference between the <a> and <anchor> element.

6.3.2 Creating Links

Linking with Hot Spots

- A hot spot is a "clickable" area on screen that directs navigation or other actions.
- Link code connects a hot spot to a task. A task may be
  - Navigation task
  - Previous navigation task
  - Refresh page task
- Hot spot links defined with anchor tags, either <a> or <anchor>

Link to Files

We can use hotspots to connect users to any file on the web.

```
<a href ="www. Microsoft.com/hi.wav">
        This is how we link to files
</a>
```

Links can comprise of one and only task.

- The <a> element us used in combination with the href attributes just as in HTML
- The <anchor> element can be utilized more broadly to contain other elements such as <go>, <prev>, and <refresh>

Notes

A word of caution: it is best to link files via cards rather than directly. If the device fails to handle the particular file or if there is an error, it is often simpler for a user to come back out of card than from a "random" file.

Links to Decks

We can utilize to point users to other decks and applications. Two examples are given below.

```
<a href ="deck2.wml">
        Go to deck two
</a>
<a>
        Go to deck two
            <go href="deck2.wml">
                <setvar name ="id" value="a1" />
            </go>
</a>
```

Link to Cards

Hotspots are mainly used to navigate users from one card to another. Two examples are given below.

```
< a href ="#card3">
        Go to card 3.
</a>
<a href=" ">
        Return to previous card
</a>
```

The navigation history is shown in Figure 6.1

Navigation History

Figure 6.1: Current Card

€	
7th	
6th	
5th	
4th	
3rd	http://www.card.com/deck3.wml
2nd	Deck1.wml#card6
1st	#card1

Task Examine what is a hot spot and how they are defined?

Notes

User Interface Variations

The function of our application should be mainly the same across various devices.

- The user interfaces can vary considerably from one device to another.
- The implementation and user interaction can fluctuate and we must plan for this

Example: A WML deck with two cards - one for user input and one for displaying the result - can be set up, as demonstrated in this example:

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card id="card1" title="Tutorial">
<do type="accept" label="Answer">
 <go href="#card2"/>
</do>
<p>
<select name="name">
  <option value="HTML">HTML Tutorial</option>
  <option value="XML">XML Tutorial</option>
  <option value="WAP">WAP Tutorial</option>
</select>
</p>
</card>
<card id="card2" title="Answer">
<p>
You selected: $(name)
</p>
</card>
</wml>
```

Example Explained

The Document Prolog and the First Tag

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
```

The first lines in the WML document are called the prolog. The prolog defines that this is an XML document, it then defines the XML version, and the DTD to be referenced.

Notes

The Deck Header and Deck Footer

<wml> ..... </wml>

The deck is the WML document itself. It is embedded within <wml> tags

The Cards

<card> ..... </card>

Cards are always displayed one at the time. This WML deck contains two cards - one for user input and one for displaying the result.

The <do> element

<do> ... </do>

The first card has a <do> element that defines an event to be triggered. The type="accept" attribute of the <do> element causes the label="Answer" to be displayed in the lower left corner of the display.

The Event

The <go> element triggers when the user clicks the <do> label. The href="#card2" attribute of the <go> element causes card2 to be displayed on the screen.

The Variable

Card2 displays the $(name) variable from card1, because variables are valid across cards.

Deck/Card Elements

Start tag	Purpose	WML
<access>	Defines information about the access control of a deck	1.1
<card>	Defines a card in a deck	1.1
<head>	Contains information about the document	1.1
<meta>	Defines meta information about the document	1.1
<template>	Defines a code template for all the cards in a deck	1.1
<wml>	Defines a WML deck (WML root)	1.1
<!-->	Defines a comment	1.1

Text Elements

Start tag	Purpose	WML
 	Defines a line break	1.1
<p>	Defines a paragraph	1.1
<table>	Defines a table	1.1
<td>	Defines a table cell (table data)	1.1
<tr>	Defines a table row	1.1

Notes

Text Formatting Tags

Start tag	Purpose	WML
<b>	Defines bold text	1.1
<big>	Defines big text	1.1
	Defines emphasized text	1.1
<i>	Defines italic text	1.1
<small>	Defines small text	1.1
	Defines strong text	1.1
<u>	Defines underlined text	1.1

Anchor Elements

Start tag	Purpose	WML
<a>	Defines an anchor (a link)	1.1
<anchor>	Defines an anchor (a link)	1.1

Self Assessment

Fill in the blanks:

5. A hot spot is a …….. area on screen that directs navigation or other actions.
6. To link to another card in the same deck, the …….. is used.
7. The first card has a …….. element that defines an event to be triggered.
8. The …….. can vary considerably from one device to another.

6.4 Using Phone Buttons and Functions Keys

Now let us introduce to you another useful element in WML — the <do> element. The <do> element is used to associate a task to a certain user interface element of a wireless device. The task will be done if the user activates the user interface element. The mapping between a <do> element and a user interface element depends on the actual wireless device. The WAP specification states that the user interface element may be a softkey, a function key, a voice-activated command, etc. In mobile phones, <do> elements are very often associated to softkeys or items in the options menu that is brought up by pressing a softkey. To program softkeys of mobile phones, we need to know how to use the <do> element.

The <do> element is not difficult to use. Tasks such as <go>, <prev> and <refresh> are enclosed in the <do></do> tags. The name attribute of <do> specifies a unique name to a <do> element.

Did u know? **What does the label attribute specifies?**

The label attribute specifies the label to be displayed on the wireless device's screen (if applicable).

The number of characters in a label should be equal to or smaller than six if you want it to be displayed nicely on different types of wireless device. If a label is too long, it may be truncated on some wireless devices.

Notes

The type attribute of the <do> element is mandatory. It specifies which type of user interface element should be associated to a <do> element. Some commonly used attribute values are accept, options and prev.

If the type attribute value is accept, the <do> element is associated to a user interface element that can provide a way for the user to accept some kind of action. The ACCEPT element is usually the left softkey in mobile phone browsers, since the left softkey is used as the "Yes" or "OK" softkey typically. The table below gives some descriptions of how ACCEPT elements are presented on some mobile phone emulators:

Mobile phone emulators	Descriptions of the ACCEPT element
Nokia Mobile Browser 4.0	If you press the Options softkey on the left, you will see all the ACCEPT elements.
Openwave Mobile Browser 6.2.2	The first ACCEPT element becomes the left softkey. If there are two ACCEPT elements, the second one becomes the right softkey. If there are more than two ACCEPT elements, the right softkey will be labeled as Menu. You can see the second to the nth ACCEPT elements if you press the Menu softkey, where n is the total number of ACCEPT elements.
Sony Ericsson T610 mobile phone	If you press the More softkey on the right, the options menu is opened and you can see all the ACCEPT elements there.
Sony Ericsson T68i mobile phone	If you press the "Options menu" button (located between the Yes button and the 1 button), the options menu is opened and you can see all the ACCEPT elements there.

If the type attribute value is options, the <do> element is associated to a user interface element that can provide users further options or operations to choose from. Very often WAP browsers place the OPTIONS elements in an options list and they provide a certain way for you to bring up the options list, such as pressing a softkey or a physical button. The table below gives some descriptions of how OPTIONS elements are presented on some mobile phone emulators:

Mobile phone emulators	Descriptions of the OPTIONS element
Nokia Mobile Browser 4.0	If you press the Options softkey on the left, you will see all the OPTIONS elements. (Presented in the same way as the ACCEPT element)
Openwave Mobile Browser 6.2.2	The first OPTIONS element becomes the right softkey. If there are two or more than two OPTIONS elements, the right softkey will be labeled asMenu. You can see the second to the nth OPTIONS elements if you press the Menusoftkey, where n is the total number of OPTIONS elements.
Sony Ericsson T610 mobile phone	If you press the More softkey on the right, the options menu is opened and you can see all the OPTIONS elements there. (Presented in the same way as the ACCEPT element)
Sony Ericsson T68i mobile phone	If you press the "Options menu" button (located between the Yes button and the 1 button), the options menu is opened and you can see all the OPTIONS elements there. (Presented in the same way as the ACCEPT element)

Notes

If the type attribute value is prev, the <do> element is associated to a user interface element that enables users to navigate backwards. The PREV element is usually the "Back" softkey or physical button of a wireless device. The table below gives some descriptions of how PREV elements are presented on some mobile phone emulators:

Mobile phone emulators	Descriptions of the PREV element
Nokia Mobile Browser 4.0	The first PREV element becomes the right softkey. If there are two or more than two PREV elements, you can see the second to the nth PREV elements if you press the Options softkey on the left, where n is the total number of PREV elements.
Openwave Mobile Browser 6.2.2	The first PREV element becomes the Back button. If there are two PREV elements, the second one becomes the right softkey. If there are more than two PREV elements, the right softkey will be labeled as Menu. You can see the second to the nth PREV elements if you press the Menu softkey, where n is the total number of PREV elements.
Sony Ericsson T610 mobile phone	If you press the More softkey on the right, the options menu is opened and you can see all the PREV elements there.
Sony Ericsson T68i mobile phone	If you press the "Options menu" button (located between the Yes button and the 1 button), the options menu is opened and you can see all the PREV elements there.

Task The PREV element is usually the "Back" softkey or physical button of a wireless device. Analyze.

6.4.1 Back Button

Backward Navigation

The right softkey of the 7110 can only be used as a back button, and is labeled as such. By default, it has no action at all. Some sub-versions of the 7110 allow reprogramming of the back key with <do type="prev">. Unfortunately, this is not the case with all phones. The way to get the phone to do what you want is:

```
<card id="mycard" onenterforward="#nextcard"
onenterbackward="http://logical_back">
```

Unfortunately, this has the side effect of spoiling the history stack.

Never provide a label for the <do type="prev"> element. The 7110 will remove the Back label from the right softkey, and instead create a new entry in the menu accessed through the left softkey. This confuses users who expect to find the back key in a well-known position.

Guidelines for UP.Browser

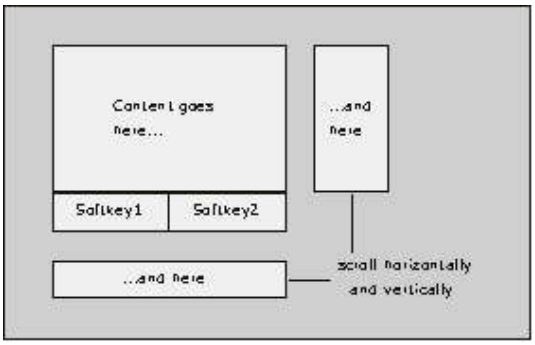
The Phone.com browser has a different interface from the Nokia 7110. The general idea behind the UP.Browser is that a <do> element is mapped directly to a softkey whenever possible.

Notes

Notes Users will only ever be one click away from performing a main-path activity. Other activities will also be reachable in a simple way. This is in sharp contrast with the Nokia 7110.

<do type="accept"> elements are normally used to support main-path activities. They are also called ACCEPT buttons. Other activities are supported through <do type="options"> elements (OPTION elements).

Figure 6.2: OPTION Element Example



If you have a single main-path activity, for example, the best you can do is to associate it with an ACCEPT button, which is always bound to a softkey (usually mapped to Softkey1). This way, your users are only one click away from the activity they are most likely to perform.

If you have a single <do type="option"> element (or OPTION button), this will be mapped to Softkey2. In the case of multiple OPTION buttons, Softkey2 will display the label menu, which leads to a pseudo-card that allows you to select the option from a simple list (similarly to Softkey1 on the 7110).

Some UP.Browser phones support three softkeys. In that case, you can afford an ACCEPT task and two OPTION tasks without the need to go through an extra menu.

In the diagram, you can see softkey1 on the left and softkey2 on the right, but this is not always the case. Softkeys occupy different positions in different implementations of the UP.Browser.

6.4.2 Why HTML is not used in WAP?

HTML was modeled for high bandwidth; it delivers large data files on dedicated connections. WML is compact for lower bandwidth pipeline; and therefore sends binary encoded content in small packets.

Compatibility of WAP with others

In the past, wireless Internet access has been restricted by the capabilities of handheld devices and wireless networks. WAP utilizes standards such as XML, user datagram protocol (UDP), and Internet Protocol (IP).

Many of the protocols are based on the Internet standards such as hypertext transfer protocol (HTTP) and TLS but have been optimized for the unique constraints of the wireless environment like the following:

- Low bandwidth
- High latency
- Less connection stability

Notes

Internet standards such as hypertext markup language (HTML), HTTP, TLS and transmission control protocol (TCP) are efficient 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 (WML Script) are used to produce WAP content. They make optimum use of small displays, and navigation may be performed with one hand.

Caution WAP content is scalable from a two-line display on a base device to a full graphic screen on the latest 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. The aim is to support WAP on multiple networks. These include:

- Global System for Mobile communications (GSM) 900, 1800, 1900 MHz
- Digital European Cordless Communication (DECT)
- Time Division Multiple Access (TDMA)
- Personal Communication Service (PCS)
- FLEX
- Code Division Multiple Access (CDMA)

All network technologies and bearers will also be supported, including short message service (SMS), USSD, circuit-switched data (CSD), cellular digital packet data (CDPD), and general packet radio service (GPRS). As WAP is based on a scalable-layered architecture, each layer can develop independently of the others keeping WDP constant. This makes it possible to introduce new bearers or to use new transport protocols without major changes in the other layers.

Self Assessment

Fill in the blanks:

9. The <do> element is used to associate a task to a certain user interface element of a ……
10. Tasks such as <go>, …… and <refresh> are enclosed in the <do></do> tags.
11. The …… element is usually the left softkey in mobile phone browsers, since the left softkey is used as the "Yes" or "OK" softkey typically.
12. WAP utilizes …… for greater compression of data and is optimized for long latency and low bandwidth.

6.5 Types of WML Cards

WML pages are structured within "decks," allowing several pages ("cards") to be defined in each WML file. This deck analogy allows multiple pages to be delivered to the mobile client at the same time, minimizing the loading time between related pages. However, the limited memory on most devices constrains the deck size, usually to less than 1024 bytes. Therefore,

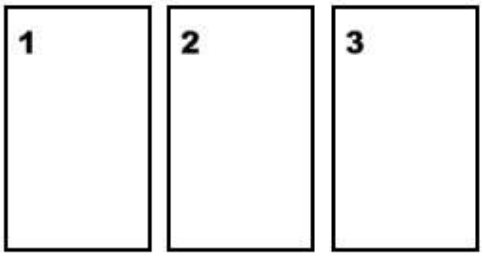
Notes

careful consideration and planning should go into any WAP application; don't start coding without investing time in planning.

Notes Remember your audience. Mobile users generally scroll through cards rapidly and will be reading on a display that's a mere handful of characters wide (usually less than 20 characters) and usually less than 10 lines high. Keep your content to a minimum, provide an intuitive navigation structure, and optimize your decks to maximize links within the deck and minimize links outside of the deck.

Visualizing a physical "deck of cards" structure can help in understanding the principles of WML. For example, suppose we have three simple cards (pages) as shown in Figure 6.3.

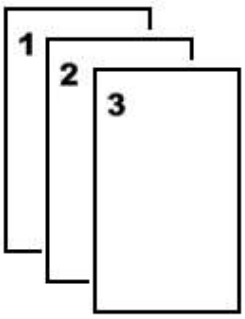
Figure 6.3: The Physical Card Analogy to WML Decks Helps Visualize How they Work



The Second Card and Subsequent Cards

These cards together form a deck and are delivered to the mobile device in one file. Now suppose that each card links to the next (card one links to card two, which links to card three, and so on), and that each card also has a "back" link to take the user back to the previous card. As the user navigates the deck, the cards stack in memory as shown in Figure 6.4.

Figure 6.4: As the user follows the Links through the Deck, the Cards Stack up in Memory



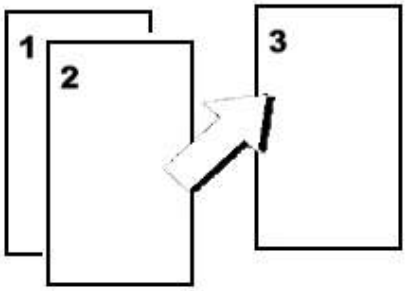
Using Multiple Cards

A developer accustomed to HTML might be tempted to implement the "back" feature by providing a link to the deck, specifying the previous card. However, this would cause the mobile device to re-request the whole deck before redisplaying the card-a card it already had in memory.

Notes

Instead, you should use the tag, which tells the browser to remove the current page and display the previous page in the history list (like using the Back button on a PC browser). Of course, the content of the previous page might need to be refreshed each time it's accessed; in that case, valid techniques could include recalling the whole deck or specifying that the page not be cached. Proper navigation will be covered in future articles.

Figure 6.5: The <prev> tag "pops" the top Card off the Stack (out of the history list), Redisplaying the Previous Card in the History



6.6 Core Elements of a WML Deck

Table 6.1 lists out the core elements of a WML Deck.

Table 6.1

Element	Purpose
<wml>	Defines the deck and covers all information and cards.
<head>	Comprises information relating to the entire deck.
<card>	A deck is comprised of one or more cards. Each card contains text and input.
<template>	Declares properties to apply to all cards in the deck. Many be overridden.

Text Formatting Tags

The Text Formatting Tags are listed in Table 6.2.

Table 6.2

Tag	Purpose
<p>	New paragraph. Can comprise of other attributes.
 	Starts a new line within a paragraph.
	Emphasis
	Strong emphasis
<b>	Bold font
<i>	Italic font
<u>	Underline font
<big>	Large font
<small>	Small font

We can add comments any where in our WML documents, when they are never used by the browser or seen by the user. They can also provide useful information for developers.

Notes

Elements Attributes

- Attributes provide additional information about an element.
- A certain group of attributes will apply to a certain set of elements.

<card id = “code”>

<do type=”accept” label=”exit”>

<option value=”d”>

<p align=”center”>

Paragraphs and Line Breaks

A WML card can be set up to display the paragraph and line break functions of WML:

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card title="Paragraphs">
<p>
This is a paragraph
</p>
<p>
This is another<br/>with a line break
</p>
</card>
</wml>
```

The result MIGHT look like this in your mobile phone display:

— — — Paragraphs — — —

This is a paragraph This is another with a line break

Paragraph Attributes

Table 6.3 gives the list of Paragraph Attributes.

Table 6.3

Attribute	Purpose
align=”left”	Aligns text to the left. This is the default.
align=”center”	Aligns text to the center
align=”right”	Aligns text to the right
mode=”wrap”	Lets the browser break long lines and “wrap” to display remainder on next line. This is the default.
mode=”nowrap”	Forces the browser to not break a long line of text

Notes

The default paragraph alignment is left and is utilized in most classes. Modes can be set in addition to alignments.

The mode "nowrap" must be used sparingly since various devices handle it differently and often not well. To aid with paragraph layout, we can also use the non-breaking space   and soft hyphen &syt; for better control of when and where words are across lines of text.

Did u know? **What is non-breaking space requirements?**

The non-breaking space requires two words be kept together on the same line. One use would be for software names and their version number.

The soft hyphen can be added within a word to suggest the best possible place to break the word with a hyphen. This is particularly useful with longer words (for example, anti dis establish & shy;ment- arian & shy;ism).

6.6.1 Card Attributes

- Attributes offer further descriptions of elements.
- Cards can contain the following attributes.
  - title
  - newcontext
  - ordered
  - onenterforward
  - onenterbackward
  - ontimer
  - id
  - class

The id Attribute

The id attribute

- uniquely identifies the card in the deck
- is typically used in navigation
- can be used in transformation

The is attribute assigns a name for a card. Each name must be unique within a deck. They are used as anchors for linking.

The Title Attribute

The title attribute

- is optional
- can be rendered differently by each user agent.

<card title ="Employee">

Various browsers interpret this attributes in various ways. Some use it as "title bar" text while others will use it as the default bookmark name.

Notes

Notes HTML browsers use it as both. Other wireless browsers ignore the attribute completely.

The Newcontext Attribute

The newcontext attribute

- is optional
- stays "false" (default) if not changed
- causes the browser to reformat; clears all variables from the previous cards
- clears browser history

The default is "false".

When "true" is specified, a new browser context is created which clears the navigation history and any defined variables. This allows us to start with a known state where only the current card appears in the history stack.

Task What are the various ways in which navigation can happen?

6.6.2 Text Formatting

A WML card can be set up to display the text formatting functions of WML:

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card title="Formatting">
<p>
normal<br/>
<em>emphasized</em><br/>
<strong>strong</strong><br/>
<b>bold</b><br/>
<i>italic</i><br/>
<u>underline</u><br/>
<big>big</big><br/>
<small>small</small>
</p>
</card>
</wml>
```

Notes

The result MIGHT look like this in your mobile phone display (don't take it for granted that all formatting tags will render as expected):

— — Formatting — —-

normal

emphasized

strong

bold

italic

underline

big

small

Self Assessment

Fill in the blanks:

13. The soft hyphen can be added within a word to suggest the best possible place to break the word with a ……..
14. The mode …….. must be used sparingly since various devices handle it differently and often not well.
15. The …….. attribute assigns a name for a card.

Caselet

Saying it Right

WIRELESS communications are increasingly binding us, like the invisible strands of a giant spider. S. Ruseyev puts together the technique in action in WAP Technology and Applications, a book from Eswar Press (www.eswarbooks.com).

A myth about wireless application protocol (WAP) is that it provides delivery of the entire content of the Internet to wireless terminals. Also, all the media hype about these wireless wonders glosses over the limitations of wireless networks. "The wireless channels' capacities are less, their inactive period is longer, their connection is less stable, and service accessibility is not as predictable." Plus, wireless terminals have a host of problems such as smaller screens, processing power, RAM, battery power, and keyboards. "Hence, there will always be a wide gap between the best PC and the best wireless pocket device." Yet, one should understand that the requirements of a wireless terminal owner are different from those of PC user. "Wireless terminals are useful companions when you need prompt information or want to get access to corporate data while on the move."

For language buffs, WML — the markup lingo for wireless applications — can be interesting. It has the same syntax as XML, and is very similar to HTML. "Therefore, all Web developers who studied these languages over the last 10 years may promptly apply their knowledge to using WML."

Contd...

Notes

If wireless became the standard, as it threatens to evolve into, all that is wired may seem too weird to accommodate.

Etiquette for the e-men

An anecdote: "A young married woman sent her husband an e-mail, recounting the pleasures of their preceding night in some detail. It was an innocent and romantic gesture.

Unfortunately for her, he wasn't the only one to read it.

The e-mail went public somehow — the 'how' doesn't matter — and before she knew it, 15 million around the world knew the full story of her romp with her husband, all because she broke the cardinal rule of e-correspondence: e-mails are public documents."

This is from Peter Post's Essential Manners for Men, a book from HarperCollins (www.harpercollins.com) . This is no IT book, one might say, but, like it or not, tech stuff has gone into lingo and communication.

Speed kills is a traffic warning that could apply to electronic missives. The speed we love about e-mail is also an insidious danger, Post warns. "The problem with any immediate response is that it invariably will be much more about your anger than about solving the problem at hand. When penning any sort of message, take your time." Remember, you are what you write, warts and all. "Typos, misspellings, malaproprisms, grammatical errors — they all stand out. These mistakes reflect on you, so make a point of carefully reviewing everything you write, even informal notes." How about quick despatches to the boss? Won't he look at the ideas you present rather than frown at the undotted i's and uncrossed t's? Wishful thinking, according to the author. "If you send your boss an e-mail containing misspelled words, your boss is likely to focus on and remember those misspellings — and the content you worked so hard on will be compromised as a result."

Elsewhere in the book, Post lays down e-mail rules that include the suggestion to use the 'draft' or 'send later' facility so that you can proofread and reread your cyber-communication before sending. Use fonts that have serifs, is another advice. "They help the reader to scan the line. Also, avoid using all capitals in your e-mails. They indicate yelling and are also difficult to read."

Another child of technology, the cell-phone can do with a good measure of lessons in etiquette. "Commuters are starting to rebel against cell-phone users who insist on talking on a railway car or bus," states the book. "If someone's cell-phone use on a public conveyance is disturbing you, make your complaint to management. Never try to approach the offender directly."

Good read for women too, if only to see what they can expect of well-mannered men.

Route to recovery

Whether there is life after death is not so important a question for computer users. They would be keener to know if there is recovery after a crash. Data loss and disk crash are accidents to live with if you dabble with bytes and files, PCs and other comps. To reduce the trauma, here is Do-it-yourself Data Recovery in easy steps by Saurabh Gupta, and brought out by Ranee Publications (raneepublications@vsnl.com). It is "intended to help you recognise, react appropriately to and resolve a data emergency," and has inputs on data storage technology, types of file systems, data loss situations, and loss prevention techniques.

Two don'ts that the book begins with are: "Do not write anything onto the drive containing the important data that you just deleted accidentally. Do not try to write data that you

Contd...

Notes

found and are trying to recover back onto the same drive." More tips are sprinkled all through the book, such as: "Do not power up a device that has obvious physical damage. Activate the write-protect switch or tab on any problem removable media such as tape cartridges and floppies; many good backups are overwritten during a crisis."

There are also dos: "When facing data loss, stop and review the situation. The process of reviewing and writing down a synopsis of the situation has the dual purpose of preparing for a recovery and inducing a calm." Also, "Do no harm." A lesson from the medical profession.

Contrary to popular belief, CD audio is "remarkably resilient to data loss," informs the author. "Bits of dust or dirt on the surface of the disk, or even small scratches, will often not impede the performance of the CD player or the CD-ROM."

One of the techniques that makes this possible is ECC (error-correcting code), "a special data encoding protocol that uses a combination of redundant information and special data positioning, to make it possible to detect and recover from missing bits of data."

6.7 Summary

- Apart from the common attributes xml:lang, id and class, the <a> element supports attributes called href, title and access key. href is used to specify the destination of a hyperlink.
- The destination may be within a deck, or a card in another deck that is also on the same site or the card may be in a deck which is on another site.
- Anchor links enable the navigation between different WML cards.
- If you select an anchor link, you will be brought to another WML card in the current deck or in another deck.
- The <do> element is used to associate a task to a certain user interface element of a wireless device.
- The task will be done if the user activates the user interface element.
- The mapping between a <do> element and a user interface element depends on the actual wireless device.
- Navigation instructions shift from the current card to the next active card. Navigation can happen between cards in the same deck, moving from deck to deck, between applications and between sites.
- The core elements of a WML Deck are wml, head, card and template.
- A hot spot is a "clickable" area on screen that directs navigation or other actions. Link code connects a hot spot to a task. Hot spot links are defined with anchor tags, either <a> or <anchor>. We can use hotspots to connect users to any file on the web. We can utilize to point users to other decks and applications. Hotspots are mainly used to navigate users from one card to another.

6.8 Keywords

CDMA: Code Division Multiple Access

CDPD: Cellular Digital Packet Data CDPD

CSD: Circuit-Switched Data

Notes

DECT: Digital European Cordless Communication

ECC: error-correcting code

GSM: Global System for Mobile communications

Hot Spot: A hot spot is a "clickable" area on screen that directs navigation or other actions

PCS: Personal Communication Service

SMS: Short Message Service

TDMA: Time Division Multiple Access

6.9 Review Questions

1. How do you create links in WML? Explain different varieties of links.
2. Examine what are templates? How do you use them explain with appropriate example?
3. Explain how hot spots can be used to link users to files on the web?
4. Explain how hot spots can be used to link one card to the other?
5. Anchor links enable the navigation between different WML cards. Comment.
6. The protocol used in WML URLs is HTTP. Explain.
7. The WAP specification states that the user interface element may be a softkey, a function key, a voice-activated command, etc. Discuss.
8. WAP is based on a scalable-layered architecture, each layer can develop independently of the others keeping WDP constant. Explain with a example.
9. If a label is too long, it may be truncated on some wireless devices. Do you agree with this statement? Why or why not?
10. Substantiate the core elements of a WML deck? Explain each element with its purpose.
11. The limited memory on most devices constrains the deck size, usually to less than 1024 bytes. Comment.

Answers: Self Assessment

1.	anchor	2.	<card>
3.	<go>	4.	Href
5.	"clickable"	6.	#
7.	<do>	8.	user interfaces
9.	wireless device.	10.	<prev>
11.	ACCEPT	12.	binary transmission
13.	hyphen	14.	"nowrap"
15.	is		

6.10 Further Readings

Notes

Books

Demon Hougland, *Essential WAP for Professional*, 2001, Prentice Hall PTR.

Jennifer Niederst Robbins, *Web Design in a Nutshell*, 2006, O'Reilly.

Jon Orwant, *Web Graphics & Perl/TK: Best of the Perl Journal* 2003 O' Reilly.

Paul Wallace Andrea Hoffmann, *Mika Tuppola, I – Mode Developer Guide*, 2002.

Online links

http://www.tutorialspoint.com/wml/wml_anchor_tag.htm

http://www.tutorialspoint.com/wml/wml_links.htm

Notes

Unit 7: Managing Outputs

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Objectives

After studying this unit, you will be able to:

- Scan basic card output
- Describe layout and rendering

Introduction

Wireless Markup Language (WML) is a markup language based on Extensible Markup Language (XML) and was developed specifically for content and user interface for mobile device. WML is a tag-based markup language designed after the model of HTML for Web content. The designers of WML (and its companion scripting language, WMLScript) created an environment that demands less memory and processing power from browsers than HTML and JavaScript.

Caution WML also includes features that tailor it for the relatively small display sizes of today's wireless devices .WML and HTML differ in significant ways.

Although WML strips some features from HTML and co-opts others, WML also incorporates some powerful programming constructs not found in HTML like variables, tasks, and events. WML implements a stricter tag syntax than HTML and includes a DTD for use with XML parsers. The markup language of the WAP protocol for wireless Internet access. Pages written in WML can be read and displayed properly by cell phones with a small screen where standard HTML pages (the markup language used on most regular wide web pages) would produce an bad output and might even be unviewable.

7.1 Basic Card Output

Notes

7.1.1 Card Setup

A WML card can be set up to let a user enter information, as demonstrated in this example:

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card title="Input">
<p>
Name: <input name="Name" size="15"/><br/>
Age: <input name="Age" size="15" format="*N"/><br/>
Sex:  <input name="Sex" size="15"/></p>
</card>
</wml>
```

The result MIGHT look like this in your mobile phone display:

Top of Form
----- Input ---------- Name: Age : Sex :
Bottom of Form

Select and Option

A WML card, can be set up to display the select and option functions of WML:

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card title="Selectable List 1">
<p>
<select>
<option value="htm">HTML Tutorial</option>
<option value="xml">XML Tutorial</option>
```

Notes

```
<option value="wap">WAP Tutorial</option>
</select>
</p>
</card>
</wml>
```

The result MIGHT look like this in your mobile phone display:

Top of Form

--- Selectable List 1---

- HTML Tutorial
- XML Tutorial
- WAP Tutorial

Bottom of Form

Example: In the example below, the result is a selectable list where the user can select more than one item:

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card title="Selectable List 2">
<p>
<select multiple="true">
<option value="htm">HTML Tutorial</option>
<option value="xml">XML Tutorial</option>
<option value="wap">WAP Tutorial</option>
</select>
</p>
</card>
</wml>
```

The result MIGHT look like this in your mobile phone display:

Top of Form

--- Selectable List 2---

- HTML Tutorial
- XML Tutorial
- WAP Tutorial

Bottom of Form

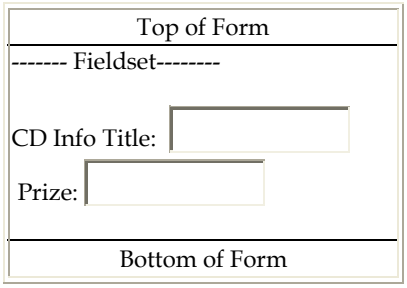
Notes

Fieldset

A WML card, can be set up to display the fieldset function of WML:

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card title="Fieldset">
<p><fieldset title="CD Info">
Title: <input name="title" type="text"/><br/>
Prize: <input name="prize" type="text"/>
</fieldset>
</p>
</card>
</wml>
```

The result MIGHT look like this in your mobile phone display:



Decks and Cards

WML pages are often called "decks". A deck contains a set of cards. A card element can contain text, markup, links, input-fields, tasks, images and more. Cards can be related to each other with links.

When a WML page is accessed from a mobile phone, all the cards in the page are downloaded from the WAP server. Navigation between the cards is done by the phone computer - inside the phone - without any extra access trips to the server:

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card id="no1" title="Card 1">
<p>Hello World!</p>
</card><card id="no2" title="Card 2">
<p>Welcome to our WAP Tutorial!</p>
```

Notes

```
</card>
</wml>
```

The result MIGHT look like this in your mobile phone display (note that only one card is displayed at a time):

```
------ Card 1 ------

Hello World!
```

Task Cards can be related to each other with links. Explain and analyze with a proper example

7.1.2 Paragraph of Text Formatting Option

Text Formatting

A WML card can be set up to display the text formatting functions of WML:

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card title="Formatting">
<p>
normal<br/>
<em>emphasized</em><br/>
<strong>strong</strong><br/>
<b>bold</b><br/>
<i>italic</i><br/>
<u>underline</u><br/>
<big>big</big>
<br/><small>small</small>
</p>
</card>
</wml>
```

Did u know? **What is the definition of <p> element?**

The <p> element defines a paragraph of text and WAP browsers always render a paragraph in a new line. A <p> element is required to define any text , image or a table in WML.

Notes

The result MIGHT look like this in your mobile phone display (don't take it for granted that all formatting tags will render as expected):

```
----- Formatting -----
normal
emphasized
strong
bold
italic
underline
big
small
```

Paragraphs and Line Breaks

A WML card can be set up to display the paragraph and line break functions of WML:

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card title="Paragraphs">
<p>
This is a paragraph
</p>
<p>
This is another<br/>with a line break
</p>
</card>
</wml>
```

The result MIGHT look like this in your mobile phone display:

```
------ Paragraphs ------

This is a paragraph

This is another
with a line break
```

Self Assessment

Fill in the blanks:

1. A ……..... element can contain text, markup, links, input-fields, tasks, images and more.

Notes

2. WML is a tag-based markup language designed after the model of HTML for …….....
3. When a WML page is accessed from a mobile phone, all the cards in the page are downloaded from the …….....
4. WML implements a stricter tag syntax than HTML and includes a ……..... for use with XML parsers.
5. The designers of WML (and its companion scripting language, WMLScript) created an environment that demands ……..... and processing power from browsers than HTML and JavaScript.
6. The ……..... language of the WAP protocol for wireless Internet access.

7.2 Layout

7.2.1 Text Wrapping and Alignment

To start a new line in display text, simply insert a <br/> tag where you want to start the line.

Notes Adding a carriage return or line feed has no effect: the WML compiler treats it as a single space.

The p element establishes both the line wrap and alignment parameters for a paragraph. WML has two line-wrapping modes for visual user agents: breaking (or wrapping) and non-breaking (or non-wrapping). The current line wrap mode controls how lines too long to fit on the screen are treated.

- If mode="wrap" is specified, the line is word-wrapped onto multiple lines. In this breaking mode, line breaks should be inserted into a text flow as appropriate for presentation on an individual device, and any space between words is a legal line breaking point.
- If mode="nowrap" is specified, the line is not automatically wrapped. In this non-breaking mode, the user agent must provide a mechanism to view entire non-wrapped lines (horizontal scrolling, for example, or some other user-agent-specific mechanism).

Any space between words is a legal line break point. The non-breaking space entity (or   ) indicates that the user agent must not treat the space as a space between words. It is recommended that you use   to prevent unwanted line breaks. The soft-hyphen character entity (& shy; or &#173) indicates a location that may be used by the user agent for a line break. If a line break occurs at a soft-hyphen, the user agent inserts a hyphen character (-) at the end of the line. In all other operations, the soft-hyphen entity is ignored. Note also that a user agent may ignore soft-hyphens when formatting text lines. The p tag establishes both the new wrap and alignment parameters for a paragraph. If the wrap mode is not specified, it is identical to the line–wrap mode of the previous paragraph in the current card. If the text alignment is not specified, it defaults to left. Empty paragraphs, such as an empty element or an element with only insignificant white space, should be considered as insignificant and ignored by visual user agents. Insignificant paragraphs do not impact line-wrap mode. If the p element in a card does not specify a line-wrap or alignment mode, that mode defaults to the initial mode for the card.

Notes

Notes The user agent must insert a line break into the text flow between significant p elements.

7.2.2 Line Break

 is the line breaking tag in WML, which is the same as that in HTML. The following WML example demonstrates the usage of line breaks:

(lineBrEg1.wml)

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.3//EN" "http://www.wapforum.org/DTD/wml13.dtd">
<wml>
 <card id="card1" title="Line Break">
  <p>
   Before br<br/>After br
  </p>
 </card>
</wml>
```

The screenshots below show the result of the above WML example in some mobile phone browsers. As you can see, the text after the <br/> tag starts on a new line.

Sony Ericsson T610 Sony Ericsson T68i Nokia Mobile Browser 4.0

7.2.3 Tables

A WML card can be set up to display the table functions of WML:

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
```

Notes

```
<wml>
<card title="Table">
<p>
<table columns="3">
<tr>
<td>Cell 1</td>
<td>Cell 2</td>
<td>Cell 3</td>
</tr></table>
</p>
</card>
</wml>
```

The result MIGHT look like this in your mobile phone display:

```
------ Table ------
Cell 1   Cell 2   Cell 3
```

Self Assessment

Fill in the blanks:

7. The p element establishes both the …… and alignment parameters for a paragraph.
8.
 is the line breaking tag in WML, which is the same as that in ……
9. If a line break occurs at a ……, the user agent inserts a hyphen character (-) at the end of the line.
10. The …… establishes both the new wrap and alignment parameters for a paragraph.

7.3 Rendering

7.3.1 Special Characters

WML supports both named and numeric character entities. All numeric character entities are referenced with respect to the document character set (Unicode) and not to the current document encoding (charset). This means that the notation { always refers to the same logical character, independent of the current character encoding. WML supports the following character entity formats:

1. Named character entities, such as & and <
2. Decimal numeric character entities, such as {
3. Hexadecimal numeric character entities, such as &#x12;

Notes

The following table illustrates the seven named character entities that are particularly important in the processing of WML

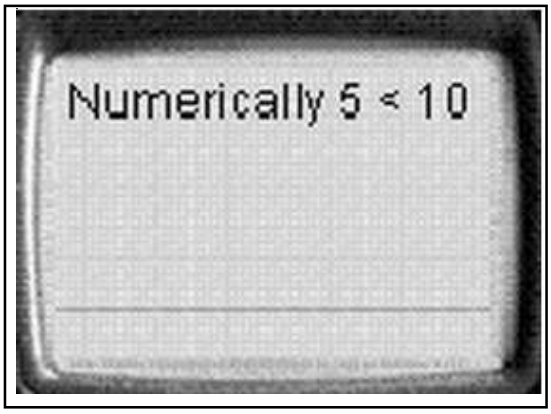
Entity	Notation	Explanation
quot	"	quotation mark
amp	&	ampersand
apos	'	apostrophe
lt	<	less than
gt	>	greater than
nbsp		non-breaking space
shy		soft hyphen (discretionary hyphen)

Notes The semicolon (;) is part of the escape sequence for a special character.

To include a special character, simply use the escaped notation described in the table above. For example, the following code includes a less than character (<) in the escaped form &#60.

```
<wml><card id="Card_1"><p>Numerically 5 &#60; 10</p></card></wml>
```

This would generate the following screen display:



Self Assessment Questions

Fill in the blanks:

11. All …… character entities are referenced with respect to the document character set (Unicode) and not to the current document encoding (charset).

12. To include a special character, simply use the …….. notation.

Caselet

Ecom City Portals to Support Shopping

ECOM Concepts India Pvt Ltd, the company behind city-specific portals, Mumbai123.com and Delhi123.com, will set up e-commerce shop fronts for the two portals by October this year.

Contd...

Notes

"The software, which allows small and medium enterprises to set up a store front on the Web sites, is at testing stage right now and should be functional by the third week of October," Mr. Yateesh Srivastava, Chief Operating Officer, Ecom, told Business Line.

"Talks are on with Citibank and HDFC bank for a payment gateway. We will also tie up with two courier service providers, one in town and another in the suburbs, for logistics."

The company plans to start with low-value items such as books, cassettes, CDs, flowers and home furnishings in a co-branding exercise with 10-15 stores at a non-competitive level.

"Eventually, we plan to set up a cyber mall and apart from a revenue sharing model, we will charge for the application service," Mr. Srivastava said.

With listings on the Web site expected to contribute 50 per cent of total revenue, advertising 20-25 per cent and the rest from e-commerce, the company expects to break even on an investment of Rs. 3.5 crores by 2003.

Ecom will also venture into the wireless market in Delhi and Mumbai next month through a tie-up with a leading cellular operator for its WAP (wireless application protocol) offering, Mr. Srivastava said.

"Our USP will be a large database of localised content which is a strong strategy for pulling in more customers. For instance, we have a list of 1,500 restaurants around town and 15,000 local stores that our customers can chose from."

He added: "Another unique feature will be our GPS mapping product which provides driving directions for the two cities.

"The textual driving instructions are being transferred to WML (Wireless Markup Language) for WAP content and will be available to customers in Delhi in the next 45 days, followed by Mumbai."

Apart from its foray into e-commerce and wireless, the company also plans to launch city-specific portals in six other cities including Pune, Chennai, Bangalore, Hyderabad, Calcutta and Chandigarh this year.

7.4 Summary

- WML pages are often called "decks". A deck contains a set of cards.
- Wireless Markup Language (WML) is a markup language based on Extensible Markup Language (XML) and was developed specifically for content and user interface for mobile device.
- WML is a tag-based markup language designed after the model of HTML for Web content.
- The current line wrap mode controls how lines too long to fit on the screen are treated.

7.5 Keywords

HTML: Hypertext Markup Language

WML: Wireless Markup Language

XML: Extensible Markup Language

Notes

7.6 Review Questions

1. Navigation between the cards is done by the phone computer - inside the phone - without any extra access trips to the server. Explain.
2. WML has two line-wrapping modes for visual user agents: breaking (or wrapping) and non-breaking (or non-wrapping). Discuss.
3. Empty paragraphs, such as an empty element or an element with only insignificant white space, should be considered as insignificant and ignored by visual user agents. Analyze.
4. If the p element in a card does not specify a line-wrap or alignment mode, that mode defaults to the initial mode for the card. Explain with an example.
5. Discuss how WML supports both named and numeric character entities?
6. Explain which character entity formats WML supports?

Answers: Self Assessment

1.	card	2.	Web content
3.	WAP server	4.	DTD
5.	less memory	6.	markup
7.	line wrap	8.	HTML
9.	soft-hyphen	10.	p tag
11.	numeric	12.	escaped

7.7 Further Readings

Books

Demon Hougland, *Essential WAP for Professional*, 2001, Prentice Hall PTR.

Jennifer Niederst Robbins, *Web Design in a Nutshell*, 2006, O'Reilly.

Jon Orwant, *Web Graphics & Perl/TK: Best of the Perl Journal* 2003 O' Reilly.

Paul Wallace Andrea Hoffmann, *Mika Tuppola, I – Mode Developer Guide*, 2002.

Online links

http://www.developershome.com/wap/wml/wmlSendingData.asp

http://www.xml.com/pub/rg/WML_Tutorials

Notes

Unit 8: Using Images

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Objectives

After studying this unit, you will be able to:

- Describe the use of images and icons
- Demonstrate image restriction
- Recognize using localscr images
- Explain using images efficiently

Introduction

In this unit we will write application of images in WML. We can use the tag to display the image in our document. The image appears wherever tag is placed within the text.

8.1 Using Image and Icons

In this unit we will write application that images. We can use the <img> tag to display the image in our document. The image appears wherever <img> tag is placed within the text. Some cellular does not support image, in that case we can use the alt property of <img> to display the text.

Syntax:

Attribute	Functionality
alt	Text to be displayed when cellular device does not support image or the image was not available.
src	URL of the image.
localsrc	The name of a known icon.

Notes

Did u know? **How to create an image link?**

Creating an image link is simple. You just need to place an <img/> tag within an <anchor></anchor> tag pair or an <a> tag pair.

Now here is the code of the program.

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card id="C1" title="Learning WML!">
  <p mode="nowrap">
   Select:<br/>
   <a href="#jokes">Jokes</a><br/>
   <a href="#star">Star</a><br/>
   <a href="#target">Target</a><br/>
  </p>
</card>
<card id="jokes" title="Learning WML">
<do type="accept">
<prev/>
</do>
<p>Jokes:
<img localsrc="hound" alt="prev" src="joke.gif"/>
</p>
</card>
<card id="star" title="Learning WML">
<do type="accept">
<prev/>
</do>
<p>Star:
<img localsrc="star2" alt="prev" src="star.gif"/>
</p>
</card>
<card id="target" title="Learning WML">
<do type="accept">
```

Notes

```
<prev/>
</do>
<p>Target:
<img localsrc="circleslash" alt="prev" src="target.gif"/>
</p>
</card>
</wml>
```

The <img> tag is used to add an image to a WML card. This is the same as in HTML. WAP browsers will display the text assigned to the alt attribute of the <img> tag if it cannot display the image for reasons such as file not found or image format not supported. The URL of the image file is specified with the src attribute.

The height and width attributes of the <img> tag, as their names suggested, are used to specify the height and width of an image's display area. WAP browsers may reserve some space on the screen according to the values of these two attributes when the image is still downloading, so that users can know the layout of the card.

Notes Also, WAP browsers may scale up or down the size of an image if the height and width attribute values are not the same as the image's real size.

8.1.1 Image Restrictions

Older WAP-enabled wireless devices can only display WBMP images. Newer ones support image formats commonly used on the web such as GIF, JPG and PNG.

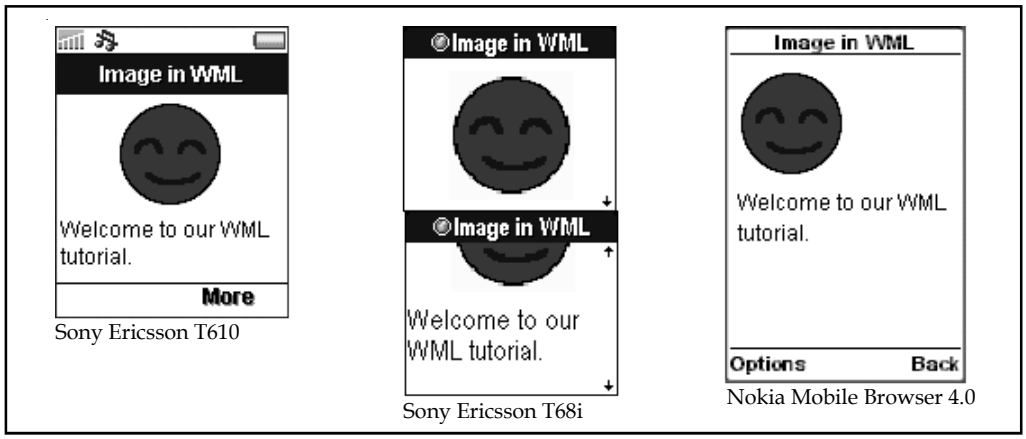
Example: This example demonstrates how to display an image in WML using the <img> tag:

(imageEg1.wml)

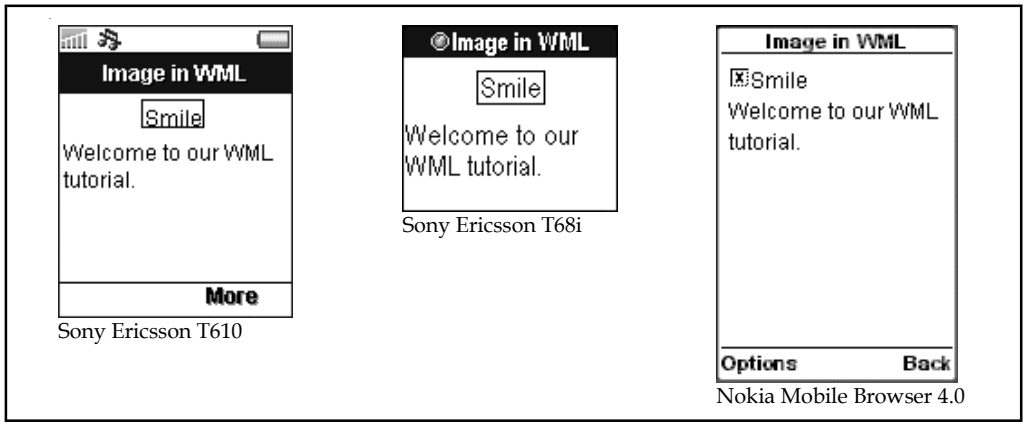
```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.3//EN" "http://www.wapforum.org/DTD/wml13.dtd">
<wml>
 <card id="card1" title="Image in WML">
  <p>
   <img src="smile.gif" alt="Smile" height="62" width="60" /><br/>
   Welcome to our WML tutorial.
  </p>
 </card>
</wml>
```

Notes

The result of the above WML markup code in WAP browsers is shown below:



If the image file does not exist, the result will become:



Self Assessment

Fill in the blanks:

1. The image appears wherever …….. tag is placed within the text.
2. Some cellular does not support …….., in that case we can use the alt property of <img> to display the text.
3. The URL of the image file is specified with the …….. attribute.
4. Newer ones support image formats commonly used on the web such as …….. and PNG.
5. WAP browsers may reserve some space on the screen according to the values of the two ……..

8.2 Using Localscr

Although WAP<> applications are primarily text, it is possible to add simple images to a card (see Figure 8.1). In order for an image to be displayed in a WAP application, it must be in the specially optimized Wireless Bitmap (WBMP) format. WBMP files are 1-bit graphics capable of displaying only black and white pixels. It is recommended that you keep any graphic image as small as possible. No graphic should exceed 150 pixels square. Be aware that some microbrowsers do not support graphics at all, so always provide alternative text.

Notes

Figure 8.1

Example: Examples of WMBP graphics in a WAP application

Images are added to the document with the <img/> element. Make sure that it is placed within tags, as shown in this example:

<card>

<img src="logo.wbmp" alt="Cookbook Logo">

</card>

Some mobile devices have stored in their memory a library of small images that can be placed in the WML document using the localsrc attribute in the image tag. The advantage of local images is that they reduce the amount of data that needs to be transferred from the server, so they display more quickly than external WBMP files. It is a good idea also to provide a pointer to an external graphic in case local images are not supported. The following example requests a generic credit card icon from the local image library and specifies an alternative .wbmp file. The alt text will display on devices that do not support graphics at all.

<img localsrc="creditcard" src="card.wbmp" alt="credit card symbol">

A complete list of library images and their names is available athttp://developer.phone.com/htmldoc/41/wmlref/taglist.html#575099.

Task Analyze the advantages of localscr images in WML with example.

Creating WBMP Graphics: There are few tools available that can create WBMP files at this time. However, you can download the free UnWired plug-in from RCP Distributed Systems that enables you to create WBMP files in Adobe Photoshop 5 and higher and JASC Paint Shop Pro (or any graphics package that supports plug-ins). It is available at http://www.rcp.co.uk/distributed/downloads/.There is also a Java utility called pic_2_wbmp that converts existing BMP files to WBMP format. It is available at http://www.gingco.de/wap/.

Self Assessment

Fill in the blanks:

6. No graphic should exceed …….. pixels square.
7. WBMP files are …….. graphics capable of displaying only black and white pixels.
8. You can download the free …….. plug-in from RCP Distributed Systems that enables you to create WBMP files in Adobe Photoshop 5.
9. The advantage of local images is that they …….. the amount of data that needs to be transferred from the server, so they display more quickly than external WBMP files.

Notes

8.3 Using Images Efficiently

WAP - Wireless bitmap (level 0) image format. The Wireless Application Protocol Bitmap Format (WBMP) is designed for use with applications that operate over wireless communication networks. The WBMP format is commonly used in mobile phones (WAP phones) and enables graphical information to be sent to the handset.

Ivan Image Converter is a powerful image editing and conversion tool supporting over 170 input image formats (WAP, GIF, JPG, JPEG, PNG, TIF, TIFF, TGA, PSD, RAW, etc.) and conversion into 44 formats (TIFF, JPEG, JPG, BMP, PNG, EPS, PDF, TIF, etc.), which gives you virtually limitless capabilities in terms of cross-format image conversion.

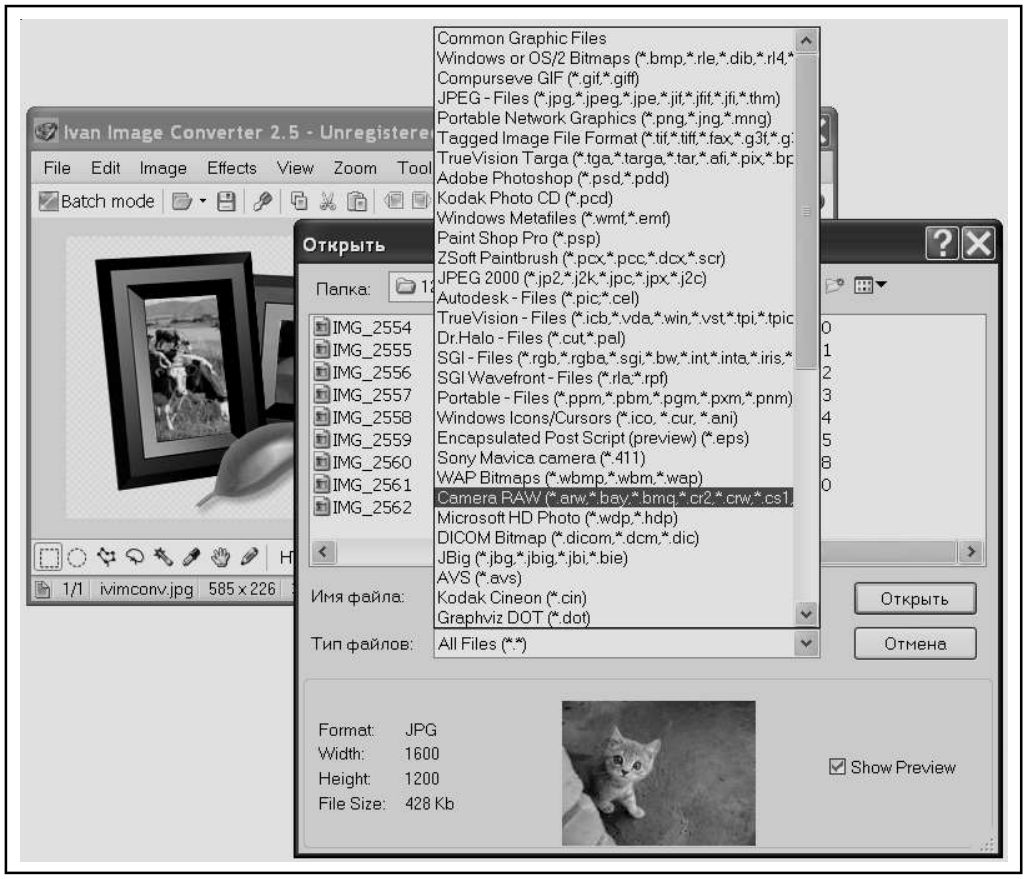
Caution Despite its power and impressive functionality, Ivan Image Converter is a breeze to use, so you can convert your images to other formats with just a few mouse clicks.

Below is a quick guide that will help you do that with a minimum of efforts and confusion. In fact, you can convert any image in just three simple steps described below.

Step 1 – Starting the Program

First, you need to start the program. To do that, locate the program in the Programs menu or double-click a corresponding desktop shortcut (if any).

Step 2 – Opening a file (.WAP)

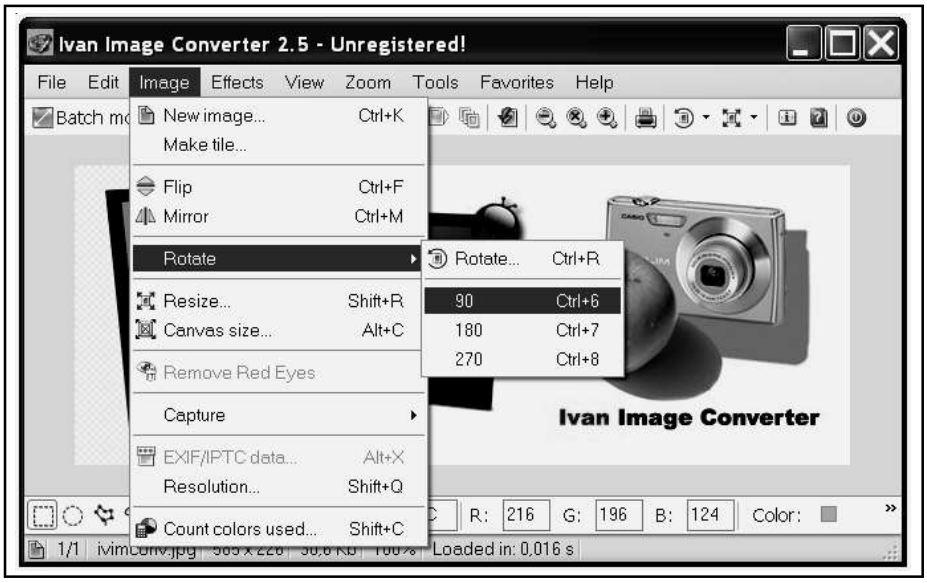


Notes

You can open a WAP file either by pressing Insert or selecting File – Open from the main program menu. An open file dialog will open. The dialog enables you to preview images in the currently selected folder and displays the size and resolution of the selected file. Use the format filter to select the WAP file type. Once the necessary WAP file is selected, click Open.

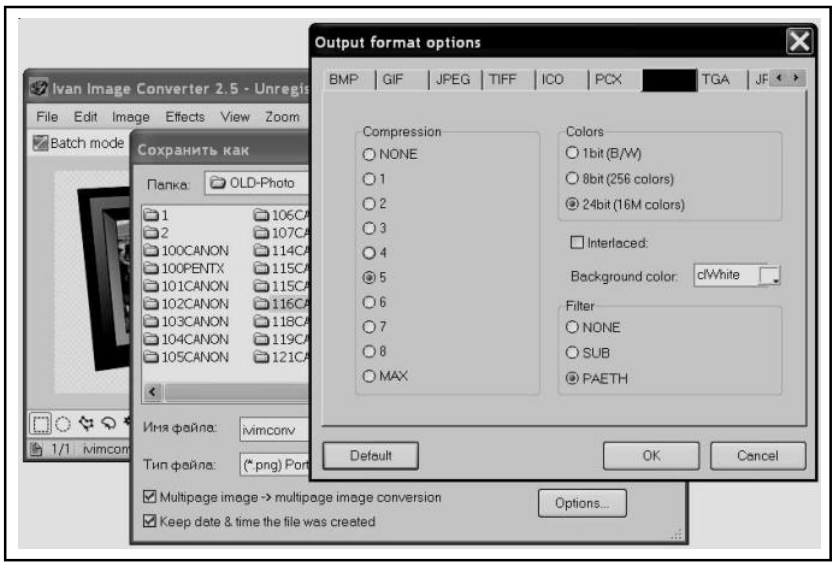
Step 3 – Image Editing (Optional)

Besides being a powerful image converter, this software has plenty of image editing functions. You can flip, rotate, resize images, set them as the desktop wallpaper, apply various effects and even add text to images. Once you have finished editing an image, you can proceed to the next step and convert it into another format.



Step 4 – Converting an Image (.WAP)

Once the WAP file is loaded into the program window, you are ready for image conversion. Use the Ctrl + S combination or choose the File – Convert command to open the image conversion dialog. Choose the necessary output format and rename the image, if necessary. Once ready to convert, press the Convert button.



Notes

Notes Your WAP file will be saved in the selected format under the name you provided in the image conversion dialog.

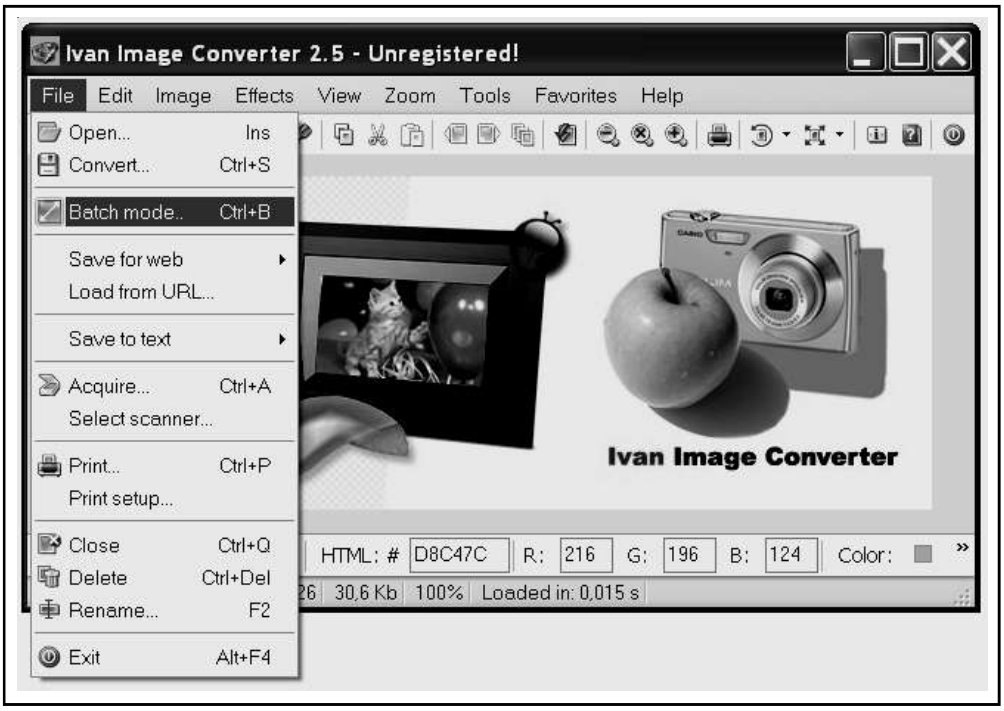
8.3.1 How to Batch Edit, Resize and Convert WAP Images

Batch conversion of WAP images and the use of the command line in Ivan Image Converter.

Besides being a powerful image converter, image resizer and image editor, Ivan Image Converter offers some advanced features (such as those of a batch image converter, batch photo resizer, batch image editor, etc.) that can make routine image processing operations manifold easier and save you a lot of time. The software features advanced batch conversion functions and has a command line operation mode. Below is a short guide to the use of the command line and the program's batch processing functions.

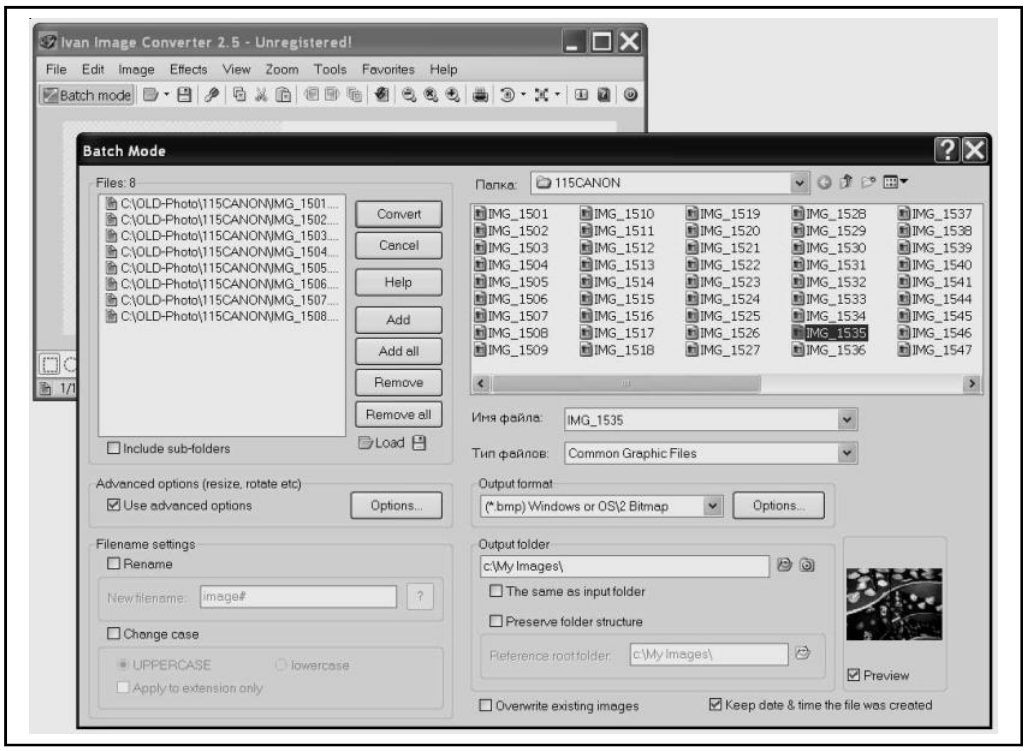
Task If you have several dozen or hundred WAP images that you want to process at once, Ivan Image Converter will make it a real snap. Analyze

Just select the "Batch mode" command from the main menu to open the batch conversion dialog (alternatively, you can click the "Batch mode" button on the toolbar or press the Ctrl+B key combination).



The dialog enables you to select the WAP files to be processed, specify the batch processing parameters (resizing, cropping, flipping, watermarking, color effects, morphing and more), the output location and the destination format (TIFF, JPEG, JPG, BMP, PNG, EPS, PDF, TIF, etc.). That's it - once you are good to go, click "Convert" and the batch image editor will take care of the rest! Apparently, you can select a number of options that will affect the work of this feature-packed batch image converter – from the case of output file names and file name renaming patterns to advanced batch processing options and target location.

Notes



For your convenience, we also added command line support to this batch image converter. This feature can be used for creating *.BAT files, scheduling batch conversion tasks or executing calls from other applications. The executable file of the program can be started with various parameters defining the conversion result. Virtually every aspect of the process can be controlled from the command line – just refer to the help section of the program for details. Here is a short example of a typical command:

ivimconv.exe "c:\bitmaps\old1.wap" /flip /negative /rotate=(90,1) /convert="c:\bitmaps\new1.tiff"

This command will read old1.wap, flip it vertically, invert its colors, rotate it by 90%, apply fast anti-aliasing and save it as new1.tiff.

Notes As you see, using the command line in Ivan Image Converter in really easy – it will take you minutes to start using its batch conversion capabilities efficiently for large arrays of images!

Self Assessment

Fill in the blanks:

10. …… files, scheduling batch conversion tasks or executing calls from other applications.
11. The dialog enables you to select the …… files to be processed.
12. Just select the …… command from the main menu to open the batch conversion dialog.

Notes

13. The software features advanced batch conversion functions and has a …… operation mode.
14. Once the WAP file is loaded into the …… window, you are ready for image conversion.
15. Use the …… combination or choose the File – Convert command to open the image conversion dialog.

Caselet

BIS Maintains Stance Against Open XML

In a disappointment for Microsoft, the Bureau of Indian Standards (BIS) on Thursday decided to stick to its earlier stance of 'disapprove vote' on Microsoft-backed Open XML becoming an ISO standard for electronic document creation and storage.

"While we are disappointed with the decision of the BIS committee, we are very encouraged by the support of IT industry players such as Nasscom, TCS, Wipro and Infosys Technologies who voted in favour of Open XML becoming an ISO standard. We will continue to work with the government to address any concerns they may have; and to achieve its stated goal of technology neutrality," Microsoft said in a statement here.

BIS is the nodal agency representing India at the International Organisation for Standardisation (ISO). Standards are technical specifications that allow developers of software and services to make and distribute products that interoperate with each other. The debate between standards for electronic documents – Open XML and Open Document Format - has been building-up over the past few months. The ODF standard is being supported by companies like IBM, Sun, Red Hat and others. The issue assumes significance as once a standard gets adopted as an ISO standard, it could have a bearing on procurement of software by Government.

Open XML was approved by Ecma International in December 2006, and then submitted by them for standardisation at the ISO. At the conclusion of the Ballot process, the BIS voted a 'disapprove with 82 comments' in September 2007 for Open XML. Between September 2007 and January 2008, Ecma International worked on and submitted proposed dispositions to all the comments, all of which were discussed during the Ballot Resolution Meeting last month; and 1011 of them adopted by consensus.

"The concerns raised by a BIS committee have been addressed by the ISO and Ecma International with a majority of the comments getting addressed at the recently concluded Ballot Resolution Meeting (BRM) at Geneva. We hoped that 98.73 per cent of the total 1027 comments from all national bodies stood resolved at the BRM would be welcomed by the BIS, as it has been by the national bodies of numerous countries," Microsoft said today. The ISO would take a decision after March 29, the last date for receiving votes from all member nations.

8.4 Summary

- We can use the <img> tag to display the image in our document.
- The image appears wherever <img> tag is placed within the text. Some cellular does not support image, in that case we can use the alt property of <img> to display the text.

Notes

- In order for an image to be displayed in a WAP application, it must be in the specially optimized Wireless Bitmap (WBMP) format. WBMP files are 1-bit graphics capable of displaying only black and white pixels.
- It is recommended that you keep any graphic image as small as possible.
- No graphic should exceed 150 pixels square.
- WAP - Wireless bitmap (level 0) image format.
- The Wireless Application Protocol Bitmap Format (WBMP) is designed for use with applications that operate over wireless communication networks.
- The WBMP format is commonly used in mobile phones (WAP phones) and enables graphical information to be sent to the handset.

8.5 Keywords

<img> tag : The <img> tag is used to add an image to a WML card.

WBMP: Wireless Application Protocol Bitmap Format

8.6 Review Questions

1. The <img> tag is used to add an image to a WML card. Explain with a suitable example.
2. The height and width attributes of the <img> tag, as their names suggested, are used to specify the height and width of an image's display area. Discuss.
3. Some mobile devices have stored in their memory a library of small images that can be placed in the WML document using the localsrc attribute in the image tag. Comment.
4. It is a good idea also to provide a pointer to an external graphic in case local images are not supported. Comment.
5. The executable file of the program can be started with various parameters defining the conversion result. Do you agree with this statement? Why or why not?
6. You can select a number of options that will affect the work of this feature-packed batch image converter. Explain.
7. Batch conversion of WAP images and the use of the command line in Ivan Image Converter. Discuss.
8. Your WAP file will be saved in the selected format under the name you provided in the image conversion dialog. Analyze.
9. Besides being a powerful image converter, which software has plenty of image editing functions? Explain.
10. Explain how you can open a WAP file?

Answers: Self Assessment

1.	<img>	2.	image
3.	src	4.	GIF, JPG
5.	Attributes	6.	150
7.	1-bit	8.	UnWired

Notes

9. Reduce
10. BAT
11. WAP
12. "Batch mode"
13. command line
14. program
15. Ctrl + S

8.7 Further Readings

Books

Demon Hougland, *Essential WAP for Professional*, 2001, Prentice Hall PTR.

Jennifer Niederst Robbins, *Web Design in a Nutshell*, 2006, O'Reilly.

Jon Orwant, *Web Graphics & Perl/TK: Best of the Perl Journal* 2003 O' Reilly.

Paul Wallace Andrea Hoffmann, *Mika Tuppola, I – Mode Developer Guide*, 2002.

Online links

http://www.developershome.com/wap/wml/wml_tutorial.asp?page=wmlLinks7

http://www.tutorialspoint.com/wml/wml_images.htm

Notes

Unit 9: Working with user Input

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Objectives

After studying this unit, you will be able to:

- Describe variables
- Demonstrate free form input with <input>
- Recognize restricted input with <select>
- Explain delivering data to applications

Introduction

This unit will familiarize you with what option menus are, how selections are done on the Nokia WAP toolkit 1.2 and on Phone.com UP SDK. You will learn what events are and how they are bound to tasks. Also it will familiarize you with the various WML tags such as the input tag which enables information to be collected from users in the form of text fields, the select element which gives a range of choices to the users to select from and the option group contains a list of options that relate to the group, etc.

9.1 Using Variables

- A variable is a named location in memory where data can be stored.
- A variable consists of a name-value pair.

Notes

Table 9.1: Example Name Value Pair

Variable Name	Variable Value
MyAge	31

A sample variable table is shown in Table 9.1. If variable data is not drawn from an earlier card or a database, the initial value must be set. This can be done within a card using either onenterforward or ontimer.

As we may recall, onenterforward effectively creates a card that is never seen by the user but can be used by the browser. The ontimer binding sets the variable after a (very) brief pause.

Variable escaping is typically used within URLs (also called URL escaping) to replace particular characters with ones that have a lower chance of misinterpretation or incorrect translation.

Caution Typically "safe" characters are ASCII letters, digits, and some punctuation (%) marks.

Variables

- It can be used in content.
- It can be used in some attribute values.
- It cannot be used for element or attribute names.
- It can be used to store captured user inputs.
- Variable value is set using <setvar> or control name attribute.

  <setvar name ="first name" value="Adam"/>

  <input name ="firstname"/>

Anytime a single dollar sign is used in our text, it is seen as a variable reference. In order to avoid this usage, we use two-dollar signs ($$) when referring to the currency. We can also use the character reference form (&36), but again, it must be added.

Parentheses can be omitted if there is white space (<space> or <enter>) following a variable. Thus, $time does not need them, but $date does. For consistency, it may be best to always use them.

Notes When a user switches from card to card in a deck, we need to store data in variables. WML variables are case sensitive.

Specify a Variable with the Setvar Command

When someone executes a task (like go, prev, and refresh), the setvar element can be used to set a variable with a specified value.

The following example will create a variable named i with a value of 500:

<setvar name="i" value="500"/>

The name and value attributes are required.

Notes

Examples:

```
<do type =”accept” label=”Initialize”>
        <refresh>
                <setvar name =”name” value=”John” />
        </refresh>
</do>
<p>
        Our name
        <input title= “name” name =”name1" />
</p>
```

Specify a Variable through an Input Element

Variables can also be set through an input element (like input, select, option, etc.).

The following example will create a variable named schoolname:

```
<card id="card1">
<select name="schoolname">
<option value="HTML">HTML Tutorial</option>
<option value="XML">XML Tutorial</option>
</select>
</card>
```

To use the variable we created in the example above:

```
<card id="card2">
<p>You selected: $(schoolname)</p>
</card>
```

Variables in Content

```
<wml>
        <card id =”card1">
                <p>
                        No variables set. <br/>
                        <anchor>
                                <go href =”#card2">
                                <setvar name =”var1" value=”Scrumpy”/>
                                </go>
                                Set var1
                        </anchor>
                </p>
```

Notes

```
        </card>
        <card id ="card2">
            <p>
                var1 set
            </p>
        </card>
    </wml>
```

Getting User Input

- Entry fields <input> are used to collect information from the user in the form of text fields.

Selection lists <select> are used to give users a choice of several predetermined answers in the form of radio buttons or check boxes.

Task Analyze what is the Input tag used for? What are its attributes?

Self Assessment

Fill in the blanks:

1. If variable data is not drawn from an earlier card or a ……., the initial value must be set.
2. ……. effectively creates a card that is never seen by the user but can be used by the browser.
3. Variable escaping is typically used within …….
4. ……. can also be set through an input element.
5. Entry fields ……. are used to collect information from the user in the form of text fields.

9.2 Free form Input with <input>

The <input> entry fields collect information from the user in the form of text fields. Attributes are listed in Table 9.2.

Table 9.2

Name	Identifies the name of the variable in which the user input is to be used
Value	Supplies the default value
Format	Specifies an input mask for the input
Size	Sets the desired display width
Maxlength	Sets the maximum number of chars. allowed
Type	Default is “text” but can be “password”
EmptyOK	Indicates whether or not an empty string is valid, the default is “false” or no.

Notes

The <input> element defines an entry field. Information entered here can be referenced within our WML decks or can be passed to our application server.

The browser stores this in a named variable <input name="variable">.

<input> Example Code

```
<wml>
<card title="Input">
<p>
EmployeeName: <input name="EmployeeName"
size="25"/> <br/>
Age: <input age="Age" size="4" format="*N"/><br/>
Gender: <input gender="Gender" size="10"/>
</p>
</card>
</wml>
```

Self Assessment

Fill in the blanks:

6. The <input> element defines an …….. field.
7. …….. indicates whether or not an empty string is valid, the default is "false" or no.

9.3 Select and Option

A WML card, can be set up to display the select and option functions of WML:

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card title="Selectable List 1">
<p>
<select>
<option value="htm">HTML Tutorial</option>
<option value="xml">XML Tutorial</option>
<option value="wap">WAP Tutorial</option>
</select>
</p>
</card>
</wml>
```

Notes

Example: In the example below, the result is a selectable list where the user can select more than one item:

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card title="Selectable List 2">
<p>
<select multiple="true">
<option value="htm">HTML Tutorial</option>
<option value="xml">XML Tutorial</option>
<option value="wap">WAP Tutorial</option>
</select>
</p>
</card>
</wml>
```

9.3.1 Restricted Input with Select

The <select> selection lists gives users a choice of several predetermined answers in the forms of radio buttons or check boxes. Attributes are presented in Table 9.3.

Table 9.3

Attribute	Purpose
Multiple	True or False, default is "false"
Name	Variable name
Value	The initial value, if any
Iname and ivalue	The 'iname' is similar to the 'name' attribute. However, the variable defined stores the index value(s) associated with the option(s) by the user. The index value is derived from the position of the <option> element list, starting from 1. If no option is selected, the value is 0.
Tabindex	This is used for putting the selection into a table order.

9.3.2 The <option> Element

The <option> attributes are presented in Table 9.4.

Table 9.4

Attributes	Purpose
Value	Sets the value of variable once chosen.
Onpick	Designates a URL to go to, if chosen

Notes

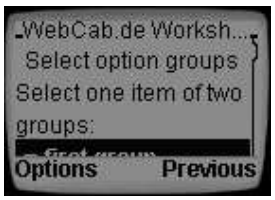
```
<card id="c1">
        <p> Flavor:
            <select name ="flavor">
            <option value ="mo"> Mocha </option>
            <option value ="va"> Vanilla (/option>
            <option value ="mt"> Mint </option>
            </select>
        </p>
</card>
<a href ="#c2">Next </a>
```

Task

1. What is the Input tag for? What are its attributes?
2. What is the Select element for? What are its attributes?
3. What is the Option element for? What are its attributes?

9.3.3 Option Groups

The option groups are shown. The label of the first group is highlighted.



Push the "Options" key.

Push the "Select" key.

Notes

The second item is selected because the variable var is still set to "item2" from the previous deck. Push the Up button to select the first item. Push the "Select" key. The variable var is set to "item1". Push the "OK" key.

The card is displayed again. Push the "Options" key.

Push the Down button and then the "Select" key.

Did u know? **In how many ways you can set the value of a variable?**

You can set the value of a variable in the following ways:

- Using the <setvar/> tag
- Using data collection tags <select> and <input/>
- Using the setVar() function of WMLScript's WMLBrowser standard library

Self Assessment

Fill in the blanks:

8. The …….. selection lists gives users a choice of several predetermined answers in the forms of radio buttons or check boxes.
9. The …….. is similar to the 'name' attribute.
10. Push the Up button to select the …….. item. Push the "Select" key.

9.4 Selection on the Nokia

The WAP Toolkit 1.2 product from Nokia is similar in some respects to Ericsson's WapIDE. Both products contain graphical development environments (though neither one supports any type

Notes

of drag-and-drop UI creation), browsers, and WML/WMLScript compilers. The Nokia toolkit currently runs only on Windows NT 4.0 but note that the Nokia WAP Toolkit also requires a Java 2 runtime. You will want to make a visit to Sun's Java Web site to download either the Java 2 SDK or the Java 2 Runtime Environment (JRE) before evaluating the WAP Toolkit product.

After installation, the WAP Toolkit Program Group (under Windows) will contain shortcuts to the toolkit Integrated Development Environment (IDE) as well as excellent documentation on WAP, WML, WMLScript, and the toolkit itself. The toolkit application itself supports the creation, modification, and testing of WML/WMLScript code within one application.

The user can toggle between loading the WAP applications through HTTP or via a WAP gateway. Nokia also sells a separate Java Servlet-based WAP Server product. This Server incorporates the application server and WAP gateway functionality into one product. In all, the Nokia WAP products appear to be well-thought out and functional and is superior, from a user interface standpoint, to the Ericsson WapIDE product.

9.4.1 Selection on the Phone.com

The Phone.com UP.SDK product (available for Windows 95/98/NT and Solaris) differs a bit from the Nokia and Ericsson product in that no graphical IDE is provided with the product. Instead of focusing on providing an integrated environment for editing and testing WML/WMLScript code, UP.SDK focuses much more heavily on providing a set of reusable code libraries for use with languages such as WML, Perl, C, C++, and Visual Basic.

Notes As Phone.com is the manufacturer of the leading WAP microbrowser, naturally the UP.SDK comes with a WAP browser known as the UP.Simulator. Note that the Simulator is currently only available for the Windows platform.

You will need a live Internet connection because the simulator actually dynamically connects to the Phone.com developer Web site. It does this in order to download samples and access live WAP applications on the Web. We definitely recommend checking this product out because it will give you a good feel for how WAP can be used (I was able to check my local weather and favorite stock quotes in a manner of seconds using the Up.Simulator). The UP.SDK also includes Perl and C library functions for generating WML and handling HTTP requests as well as C++ (Solaris) and COM (Windows) objects for notification, digest, and fax handling. The UP.SDK also includes tools for requesting and installing SSL certificates for security purposes. Besides providing the standard WAP functionality, Phone.com extends WAP's capabilities through fax and notification support. The UP.LINK server includes a Fax Manager product which allows handheld users to fax information directly from their WAP browser! Postscript, ASCII text, Microsoft Word, RTF, and Adobe Acrobat document types are accepted as fax or fax response formats. Asynchronous notifications can also be pushed to handheld clients via the Phone.com Notification API. This API allows the control of alerts, document cache, and decks on the client.

Fieldset

A WML card, can be set up to display the fieldset function of WML:

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
```

Notes

```
<wml>
<card title="Fieldset">
<p>
<fieldset title="CD Info">
Title: <input name="title" type="text"/><br/>
Prize: <input name="prize" type="text"/>
</fieldset>
</p>
</card>
</wml>
```

Input Fields

A WML card can be set up to let a user enter information, as demonstrated in this example:

Example:

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card title="Input">
<p>
Name: <input name="Name" size="15"/><br/>
Age:  <input name="Age" size="15" format="*N"/><br/>
Sex:  <input name="Sex" size="15"/>
</p>
</card>
</wml>
```

Tables

A WML card can be set up to display the table functions of WML:

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card title="Table">
<p>
<table columns="3">
```

Notes

```
<tr>
<td>Cell 1</td>
<td>Cell 2</td>
<td>Cell 3</td>
</tr>
</table>
</p>
</card>
</wml>
```

The result MIGHT look like this in your mobile phone display:

— — — Table — — —

Cell 1 Cell 2 Cell 3

Timer

A WML card can be set up to use the timer function of WML. The time unit of the timer is 1/10 of a second.

The example below will display a message for 3 seconds, and then take you to the file "test.wml":

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card ontimer="test.wml">
<timer value="30"/>
<p>Some Message</p>
</card>
</wml>
```

Self Assessment

Fill in the blanks:

11. The time unit of the timer is …….. of a second.
12. …….. notifications can also be pushed to handheld clients via the Phone.com Notification API.
13. The …….. application itself supports the creation, modification, and testing of WML/WMLScript code within one application.

9.5 Delivering Data to Applications

In the earlier sections of this WML tutorial, we have mentioned about how to use input fields and selection lists to create forms and obtain data from a user. In many situations, you need to

Notes

submit the form data to the server for further processing. To submit data to the server in WML, you need the <go></go> and <postfield/> tags. The <postfield/> tag should be enclosed in the <go></go> tag pair.

Let's first have a look at the following WML example before we go into the details:

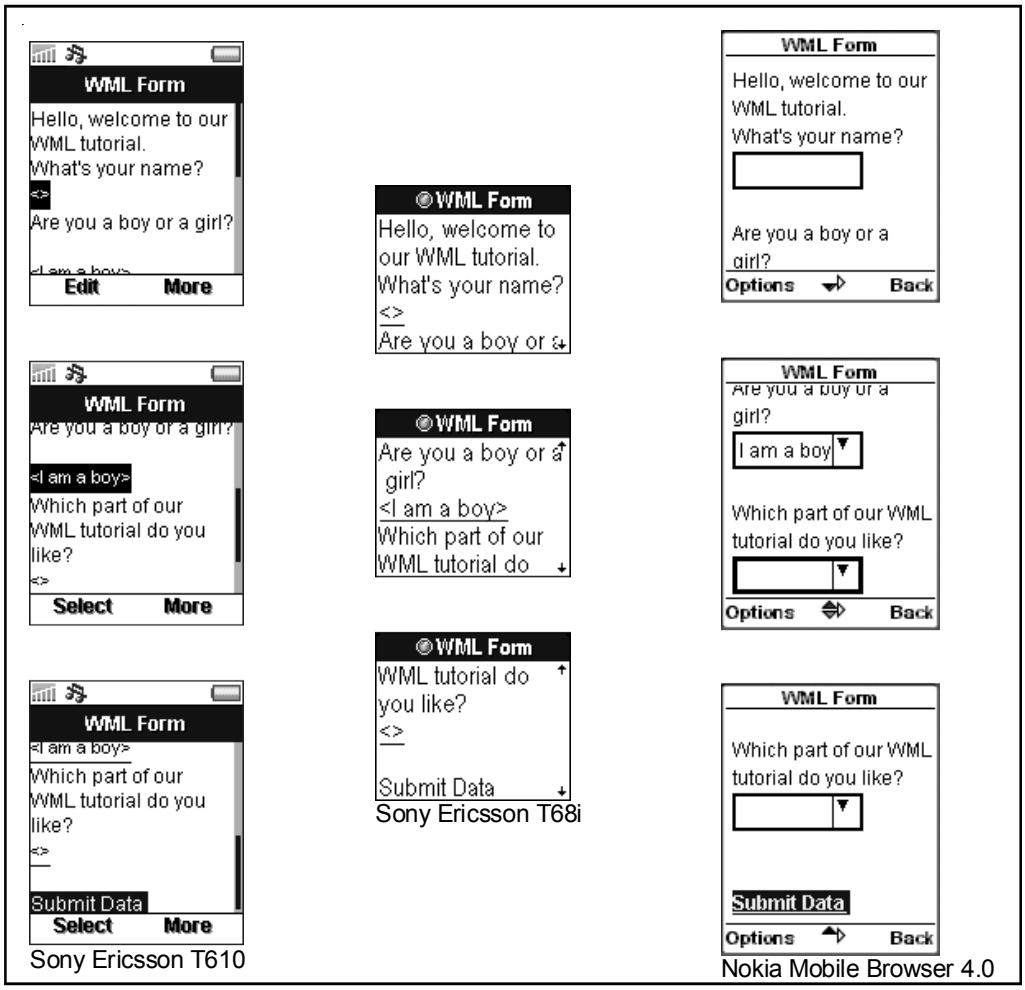
Example: (sendDataEg1.wml)

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.3//EN" "http://
www.wapforum.org/DTD/wml13.dtd">
<wml>
 <card id="card1" title="WML Form">
  <onevent type="onenterforward">
   <refresh>
    <setvar name="my_temp_id" value="123456"/>
   </refresh>
  </onevent>
  <p>
   Hello, welcome to our WML tutorial.<br/>
   What's your name?<br/>
   <input name="myName"/><br/>
   Are you a boy or a girl?<br/>
   <select name="myGender">
    <option value="Boy">I am a boy</option>
    <option value="Girl">I am a girl</option>
   </select><br/>
   Which part of our WML tutorial do you like?<br/>
   <select name="favorite_tutorial_part" multiple="true">
    <option value="Part 1">Part 1</option>
    <option value="Part 2">Part 2</option>
    <option value="Part 3">Part 3</option>
    <option value="Part 4">Part 4</option>
   </select><br/><br/>
   <anchor>
    <go method="get" href="processing.asp">
     <postfield name="name" value="$(myName)"/>
     <postfield name="gender" value="$(myGender)"/>
      <postfield name="tutorial_part" value="$(favorite_tutorial_part)"/>
     <postfield name="temp_id" value="$(my_temp_id)"/>
```

Notes

```
      </go>
      Submit Data
    </anchor>
  </p>
 </card>
</wml>
```

The following screenshots show what you will see if you open the above WML document in some mobile phone browsers:



In the above WML example, one input field and two selection lists are created to obtain user data. If a user clicks the "Submit Data" anchor link, the form data will be submitted to the server. Unlike HTML, WML does not support the creation of submit buttons.

The method attribute of the <go> tag specifies which HTTP method should be used to send the form data. We use the HTTP GET method in the above WML example. If you want to use the HTTP POST method, you should assign the value post to the method attribute, like this:

<go method="post" ...>

If the HTTP POST method is used, the form data to be sent will be placed in the message body of the request. If the HTTP GET method is used, the form data to be sent will be appended to the

Notes

URL. Since a URL can only contain a limited number of characters, the GET method has the disadvantage that there is a size limit for the data to be sent. If the user data contains non-ASCII characters, you should make use of the POST method to avoid encoding problems.

The href attribute of the <go> tag specifies the URL to submit the form data to. In the above WML example, we instruct the WAP browser to submit the form data to "processing.asp" for processing when the "Submit Data" anchor link is selected.

Four <postfield/> tags has been enclosed in the <go></go> tags in the above WML example. The <postfield/> tag is used to specify the name-value pairs to be submitted to the server.

The <postfield/> tag has two attributes, name and value. As their names suggest, the name attribute specifies the name of the parameter to be sent and the value attribute specifies the value of the parameter.

Notes Notice the difference between HTML and WML here. In HTML, the name attribute of the <input> and <select> tags is used to specify the name of the parameter to be sent, while in WML the name attribute of the <postfield> tag is used to do the same thing. In WML, the name attribute of <input> and <select> is used to specify the name of the variable for storing the form data.

At the beginning of the above WML document, a value is assigned to the my_temp_id variable. When the "Submit Data" anchor link is clicked, it is sent to the server as part of the form. We use it to simulate the function of a hidden field in HTML.

Self Assessment

Fill in the blanks:

14. To submit data to the server in WML, you need the ……. and <postfield/> tags.
15. The <postfield/> tag is used to specify the ……. pairs to be submitted to the server.

Caselet

WAP Still Finding its Feet in India

WIRELESS application protocol (WAP), the new age technology that provides instant connectivity, anytime, anywhere, may not take off in India for at least another year, according to experts.

"WAP in India is still at a nascent stage and it will take at least a year or two for the technology to become effectively operational here," Mr. R. Trivedi, Partner, Ernst and Young, said.

There are various constraints that will hamper widespread use of this service, the first being the cost of WAP-enabled handsets.

Most WAP-enabled mobile phones cost more than ₹ 20,000. A Nokia 7110, for instance, costs ₹ 23,299 and an Ericsson R320 is priced at ₹ 31,995. According to analysts, unless prices come down to around ₹ 10,000, WAP will be an expensive proposition.

Contd...

Notes

"On the technological front, there is a limited amount of information that can be transmitted and downloaded on a mobile phone. Moreover, you cannot store information on handsets," Mr. Trivedi said.

There are also issues of security protocols that need to be dealt with to transfer information and carry out transactions, he added.

The speed at which data is transmitted is another problem, as the service is being provided using GSM technology with a speed of 9.6 kbps. This not only slows down data transfer but makes it an expensive proposition, even with users only paying for the airtime (Rs. 4 per minute).

"What is required is the General Packet Radio Service (GPRS) technology, which has the potential of enabling data transmission at the rate of 140 kbps but is currently used at 40 to 50 kbps," said Mr. Paresh Vora, General Manager, Internet Gateways Solutions, Silicon Automation Systems, Bangalore.

Content, which will be the driving force behind WAP, is yet another issue. "There are a lot of operators providing the service, but content providers are lagging behind," Mr. Trivedi said.

While there are an estimated 600 WAP-enabled Web sites across the world, India has just a handful. Web sites are made WAP-compatible by using Wireless Markup Language (WML)-enabled content.

"Apart from the technological hiccups, there is also the fact that WAP will have limited appeal for people who may use it to check e-mail or get updates on news flashes and stock quotes at the most," Mr. Trivedi said.

Why then is there a mad rush to provide the service, with everyone from Orange, BPL, Tata Cellular, Bharti and Spice joining the race?

"It could be competitive pressure, fear of losing customers to competition," said Mr. Vikas Aggarwal, IT analyst, ICRA. "Information flow has become important, accessibility and connectivity have currency value and this is definitely a value-added service.''

Mr. K.V. Seshasayee, President, Cellular Operators Association of India, said: "There will not be immediate revenues for operators, but it is a definite service enhancement that helps in building a larger consumer base. In fact, if WAP content is provided in local scripts such as Gujarati, Punjabi and Tamil, it would really take off."

Mobile phone penetration, which is currently only 50 per cent, is estimated to increase to 90 per cent by 2001. "Operators will use this service to induce increased use, which in turn will lead to lower airtime charge and a further increase in user base ," Mr. Vora said.

Mr. Aggarwal, however, said: ''There will not be a large market for WAP. It will be a niche market mostly consisting of the business community."

Most analysts are looking at a market of 5-10 per cent, with only around 100 to 200 WAP users at present. The figure may be even smaller if users have to pay for the service, which is now being provided free for the first two months of its launch.

"WAP is being provided free of cost to fill up free airtime slots. Once it becomes popular, it may come as a bundled cost, like the rates you pay for an Internet connection," Mr. Aggarwal said.

Mr. Trivedi, however, said that for WAP to take off, it has to be provided free of cost because that is the whole idea behind the Internet.

Notes

9.6 Summary

- A variable is a named location in memory where data can be stored. A variable consists of a name-value pair. If variable data is not drawn from an earlier card or a database, the initial value must be set. This can be done within a card using either *onenterforward* or *ontimer*.
- Variables can be used in content, in some attribute values, cannot be used for element or attribute names, It can be used to store captured user inputs.
- Variable value is set using <setvar> or control name attribute. When a user switches from card to card in a deck, we need to store data in variables. WML variables are case sensitive.
- When someone executes a task (like go, prev, and refresh), the setvar element can be used to set a variable with a specified value. Variables can also be set through an input element (like input, select, option, etc.).
- Entry fields <*input*> are used to collect information from the user in the form of text fields. The <*input*> element defines an entry field. Information entered here can be referenced within our WML decks or can be passed to our application server.
- A WML card can be set up to display the select and option functions of WML. The <select> selection lists gives users a choice of several predetermined answers in the forms of radio buttons or check boxes.
- The option element is used with the select element to define the choices available. The <option> attributes are onpick, value and title. Onpick is used to specify a URL to open if this option is chosen. Title is used to specify a title for the option. Value specifies the value for this option, If this option is selected, the value is assigned to the name attribute of the select element.
- The optgroup element allows you to group options so they are more manageable. The option group contains a list of options that relate to the group. The optgroup element has a single attribute called title that determines what is displayed on the device to represent the group.
- The fieldset element allows you to group select or input elements within a card to make navigation simpler. The fieldset has a title attribute.
- The WAP Toolkit 1.2 product from Nokia contains graphical development environment, browsers, and WML/WMLScript compilers. The Nokia toolkit currently runs only on Windows NT 4.0 but the Nokia WAP Toolkit also requires a Java 2 runtime.
- The toolkit application itself supports the creation, modification, and testing of WML/ WMLScript code within one application. The user can toggle between loading the WAP applications through HTTP or via a WAP gateway.
- The Phone.com UP.SDK product has no graphical IDE provided with the product. UP.SDK focuses much more heavily on providing a set of reusable code libraries for use with languages such as WML, Perl, C, C++, and Visual Basic.
- The UP.SDK comes with a WAP browser known as the UP. Simulator. Through Internet connection the simulator can dynamically connect to the Phone.com developer Web site in order to download samples and access live WAP applications on the Web.
- The UP.SDK also includes Perl and C library functions for generating WML and handling HTTP requests as well as C++ (Solaris) and COM (Windows) objects for notification, digest, and fax handling.

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- The UP.SDK also includes tools for requesting and installing SSL certificates for security purposes. Phone.com extends WAP's capabilities through fax and notification support.
- WML card can be set up to display the table functions of WML. A WML card can be set up to use the timer function of WML. The time unit of the timer is 1/10 of a second.

9.7 Keywords

Do element: It is used to bind events to tasks.

Events: Tasks are typically linked to events. Events can be either user initiated or intrinsic

Fieldset Element: It allows you to group select or input elements within a card to make navigation simpler.

Input Element: The <input> element defines an entry field. Information entered here can be referenced within our WML decks or can be passed to our application server.

Optgroup Element: It allows you to group options so they are more manageable.

Option Element: It is used with the select element to define the choices available.

Option Group: It contains a list of options that relate to the group.

Phone.com UP.SDK.: UP.SDK provides a set of reusable code libraries for use with languages such as WML, Perl, C, C++, and Visual Basic.

Select> selection lists: It gives users a choice of several predetermined answers in the forms of radio buttons or check boxes.

Template: It applies to all the cards in deck.

The WAP Toolkit 1.2: It offers developers an environment for creating and testing and demonstrating WAP applications and allows service providers to evaluate the usability of wireless applications and services with their end user organizations.

Variable: It is a named location in memory where data can be stored. A variable consists of a name-value pair.

WML Links: They are user-selectable hotspots, offer navigation capabilities, are equivalent to HTML hyperlinks and links are deployed in WML as either the <anchor> tag or the <a> tag.

9.8 Review Questions

1. When someone executes a task, the setvar element can be used to set a variable with a specified value. Explain with the proper example.
2. The <input> entry fields collect information from the user in the form of text fields. Explain.
3. The Nokia toolkit currently runs only on Windows NT 4.0 but note that the Nokia WAP Toolkit also requires a Java 2 runtime. Comment.
4. Scrutinize 'Options' in terms of WML? How do you do the selection in Nokia and Phone.com?
5. Substantiate what are Events? How do they help you in WML programming?
6. The <option> attributes are onpick, value and title. Explain.
7. The optgroup element allows you to group options so they are more manageable. Discuss.

Notes

8. What is the Select element for? What are its attributes?
9. Explain how entry fields <input> are used to collect information from the user in the form of text fields.
10. A WML card can be set up to display the select and option functions of WML. Discuss.

Answers: Self Assessment

1.	database	2.	onenterforward
3.	URLs	4.	Variables
5.	<input>	6.	Entry
7.	EmptyOK	8.	<select>
9.	'iname'	10.	First
11.	1/10	12.	Asynchronous
13.	Toolkit	14.	<go></go>
15.	name-value		

9.9 Further Readings

Books

Demon Hougland, *Essential WAP for Professional*, 2001, Prentice Hall PTR.

McGraw Hill Professional, *Wireless Messaging Demystified*

Michael Juntao, Yuan, *Nokia Smartphone Hacks*, 2005, O' Reilly.

Paul Wallace Andrea Hoffmann, *Mika Tuppola, I – Mode Developer Guide* 2002, Addison- Wesley Professional.

Online links

http://www.developershome.com/wap/wml/wmlVariables.asp

http://www.tutorialspoint.com/wml/wml_variables.htm

Notes

Unit 10: Email Integration

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Objectives

After studying this unit, you will be able to:

- Describe Email and WAP
- Demonstrate integrating Email into your application

Introduction

The wireless telecommunication and the Internet are rapidly growing industries that are gaining more and more customers every day. The WAP intention is to combine these two markets and answer the new demands in this field. These reasons and more driven some of the largest vendors to unite and create the WAP Forum, the standardizing organization of the WAP.

WAP specifies an application framework and network protocols for wireless devices such as mobile phones, pagers and personal digital assistants. WAP specifications extend existing mobile networking technologies such as wireless networking standards and extend some Internet technologies such as XML, scripting and content formats.

Wireless hand-held devices preset a more constrained computing environment and platforms, compared to desktop computers which most of the Internet technology was developed for. The hand-held devices tend to have less powerful CPU, less memory, very restricted power consumption and problematic MMI (smaller and variant displays, phone keypads, etc.). Furthermore the wireless networks present greater problems as communication infrastructures they have less bandwidth, more latency and less connection stability and unpredictable availability. WAP intends to overcome these difficulties by being interoperable, have scalable quality of service, efficient in the mobile network resources, reliable and secure.

Technical Concept Introduction

The WAP programming model is similar to the WWW programming model. This provides several benefits to the application developer community, including a familiar programming model, a proven architecture, and the ability to leverage existing tools (e.g., Web servers, XML tools, etc.). Optimizations and extensions have been made in order to match the characteristics of the wireless environment. Wherever possible, existing standards have been adopted or have been used as the starting point for the WAP technology.

Notes

WAP content and applications are specified in a set of well-known content formats based on the familiar WWW content formats. Content is transported using a set of standard communication protocols based on the WWW communication protocols.

Caution A micro browser in the wireless terminal co-ordinates the users interface and are analogous to a standard web browser.

10.1 Email and WAP

10.1.1 WAP Development Issues

Following are several issues that are related to WAP development which are not standardized yet and the WAP developers should be aware of.

- ***Push Not Supported:*** The WAP Wireless Session Layer (WSP) specification defines the WSP push operation and a WSP push PDU (Protocol Data Unit). A push operation is not specified for the HTTP protocol, used by the WAP Gateway server to communicate with content hosts. To support pushes, the server has to provide an application interface to allow server based applications to generate a push to a mobile client. The support of pushes on the client side depends on the capabilities of the handsets to handle pushed content. The Nokia over-the-air (OTA) configuration proposal to the WAP Forum describes the use of a connectionless push over the SMS bearer, to transfer the configuration data to the handset.
- ***Lack of Cookies for Session Management:*** There are no "cookies" for session management, i.e. to hold the session together. Cookies are used on the fixed Internet to identify the web browser and thereby assist in providing customized and streamlined services. Instead, some WAP applications use indexes in the URL as an alternative. The cookie information is transmitted via HTTP headers. Because WAP Wireless Session Layer (WSP) is based on HTTP headers, it should be possible to transmit cookie information to the clients. The problem may be the clients themselves, which may currently not support the handling of cookie HTTP header information or the ability to save this information to a persistent storage in the mobile phone. Some third parties have now announced support for cookies.
- ***Fear of Viruses being transmitted via WAP:*** The mobile phone will follow a similar development path to PCs- with good ideas like screensavers and bad ideas like computer viruses appearing on mobile phones such as they do on PCs today.

Task Analyze how solutions are being developed by various private companies?

- ***Premature Encryption Endpoint:*** The Wireless Transport Layer Security (WSLS) defines encryption between the Mobile Station and the WAP Gateway. The "endpoint" of the encrypted WTLS data is the WAP Gateway proxy server. To have a secure connection to a content host (e.g. banking server) the Gateway proxy server has to establish secure (https) connections to this hosts. In this case the proxy server has access to the decrypted data received via WTLS from the mobile station or from the content host via https.
- ***Small Downloadable Unit Size:*** WAP incorporates no compression techniques for the textual content, although the WML markup commands are compressed. Additionally, the "deck"- the smallest unit of downloadable information in Wireless Markup Language- is

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limited to a maximum of 1400 bytes. This means that applications need to be specifically designed to be very code efficient by using templates and variables and keeping information on the server and using the cache on the phone. WML byte code converting (WMLC) defines a (maybe inefficient) compression technique by string tables. With this technique duplicate strings in the WMLC bytecode are avoided. This reduces the size of the data to transfer to the mobile client. The WSP SDU size of 1400 bytes is a default value. An increased size may be negotiated by a mobile client within the WSP capabilities.

Notes The WAP transport layer (WTP) is able to handle greater SDU sizes than 1400 too, by using SAR (Segmentation and Reassembly).

10.1.2 Applications for WAP

The Wireless Application Protocol (WAP) is being used to develop enhanced forms of existing applications and new versions of today's applications.

The WAP will allow customers to easily reply to incoming information on the phone by allowing new menus to access mobile services.

Early applications are modification of existing applications such as information, along with applications such as mobile commerce, mobile banking and mobile games.

Mobile Commerce

Mobile commerce applications involve using a mobile phone to carry out financial transactions. This usually means making a payment for goods or transferring funds electronically. Transferring money between accounts and paying for purchases are electronic commerce applications.

There are several issues relating to the development of mobile commerce applications, such as security, integration with the retail and banking hardware and systems, non-standardized mobile infrastructure and competing e-commerce standards. Additionally, there is a lack of standards relating to the mobile phone to network interface, the interfaces between host and mobile platforms and between different mobile platforms. As such, the scalability of mobile commerce is questionable. There are also questions about the appropriateness of using a mobile phone as the interface to e-commerce applications. The MMI (Man Machine Interface) on mobile phones is currently sub-optimal and difficult for mass-market users to manipulate. However, this area of electronic commerce applications is expected to contribute to grow significantly in the future, as mobile phone penetration delivers a critical mass of potential customers for such services.

It is expected that the mobile commerce will become just an extension of electronic commerce on the Internet. There will not need to be any special applications developed for the mobile to take into account screen, bandwidth and security limitations of the mobile device.

Did u know? **What is Electronic Commerce?**

E-commerce is a selling and transfer process requiring several institutes. It is systematic and organized network for the exchange of goods between produces and consumers. The Net aims to establish the interconnections between producers and consumers directly and in this, the Internet embraces all those related activities which are indispensable for maintaining a continuous, free and uninterrupted distribution and transfer of goods. The Website or portals may be categorized into commercial and noncommercial.

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The value chain for mobile commerce took a step further in April 2000 with the announcement that Motorola, Ericsson and Nokia had partnered to see mobile commerce standards. The possibility to handle trusted electronic transactions from a personal mobile device is regarded as one of the most important areas of the mobile Internet. As such, the aim of these companies is to offer solutions where security and payment services will be integrated as a standard into the mobile devices in years to come. Some of the key technology cornerstones will be WAP security functions, such as WTLS (Wireless Transport Layer Security), WIM (Wireless Identification Module), wireless public key technologies and others.

Mobile Banking

The successful implementation of mobile banking programs incorporates several different elements such as private information services, WAP and security. There are a few technology limits affecting how the mobile banking service is designed:

- Any information that is useful to bank customers can be provided such as last 4 transactions, account balances, overdraft limits and so on.
- Information can be provided in a number of different ways. It can be pull based and requested on an ad hoc basis via a telephone call to an electronic voice menu to initiate the information. Alternatively, the user could send an information request in and get an information message back, or the service can be push based such that information is automatically generated at set intervals or on the basis of events.
- The mobile banking service can run on all existing mobile phones or to be tailored for a particular branded phone or protocol-compliant phone, e.g. WAP.
- Protocols such as WAP allow not just information provision, but also secure mobile transactions and electronic commerce.
- Mobile banking suppliers using WAP include Materna (www.materna.com). Banks offering services over WAP include Deutsche Bank and Visa International.

Banking services using WAP from around the world include:

In the UK, Woolwich company offered 100 of its customers interactive banking over a WAP enabled mobile phone. Using a Nokia 7110 handset, customers will be able to view balances and transactions, pay bills, and transfer money on current, savings and borrowing accounts.

Example: In Belgium, CCB (the Belgian bank) officially launched its mobile banking venture. This will allow customers to check balances, carry out payments and transfers, and - in the future - buy shares from a WAP mobile phone.

Games

Games are a huge service that many people see as being a key application for future mobile devices. In the same way as music distribution will increasingly take place electronically, so too will games. Instead of having to go to the video store to rent a game or video, we can download this from an Internet site and charge this transaction to our mobile phone bill.

Mobile games suppliers using WAP include:

www.digitalbridges.com , http://www.wapholesun.com, www.k-mobile.com and others.

Ringtones

Another emerging service is downloading ringtones. Ringtones are the tunes that the phone plays when someone calls it. With the same phone often sold with the same default tune, it is

Notes

important for phone users to be able to change their ringtone to distinguish it from others. Phones often come with a range of different ringtones built into the phones memory that the users can choose from. However, it has become popular to download new ringtones from an Internet site to the phones. These tunes tend to be popular television of film theme tunes. Ringtones composers are also popular because they allow mobile phone users to compose their own unique ringtones. Expect to see this application grow in availability and popularity over time!

Unified Messaging

Unified messaging is an emerging value-added network service that is particularly compelling because it elevates communication above the technology used to communicate the message takes precedence over the media. Currently, it is difficult to manage all the different kinds of messages that people get - they have to dial in and pick up emails, pick up their faxes from a fax machine, call in and listen to voice mail, and so on. Unified messaging involves providing a single interface for people to access the various kinds of messaging they use. Be the messages of any kind, they can be conveniently accessed from a single point in the most actionable form.

The user typically receives a short message notifying them that they have a new message in their unified messaging box. The short message often includes an indication of the type of the new message. With WAP, users have a menu on the phone from which they can access and mange their unified messaging box.

Task Scrutinize how unified messing plays an important role in WAP? Give examples

Internet Email

Upon receiving a new email in their mailboxes, most Internet email users do not get notified of this fact. They have to dial in speculatively and periodically to check their mailbox contents. However, by linking Internet email with WAP Push, users can be notified whenever a new email is received.

The Internet email alert is provided in the form of a short message that details the sender, the subject field and first few words of the email message. Most of the mobile Internet email solutions incorporate filtering, such that users are only notified of certain messages with user-defined keywords in the subject field, or from certain senders.

Because of the high and increasing usage of Internet email to communicate globally, and the benefit from using WAP Push to notify mobile users about important new email messages, this is likely to be a fast growing and popular application for WAP.

Affinity Programs

Affinity programs are the result of collaboration between mobile carriers and other companies in different industries with large customer groups. Affinity partners include television companies, sports clubs, supermarkets, hotels, airlines, banks and other retailers. WAP can be used to provide customers with all kinds of remainders and information such as frequent flyer miles status, overdue videotape rentals, appointment remainders and other notifications.

Example: Some examples of partners between companies in different areas of the mobile value chain to develop WAP services include:

Notes

- Hong Kong network operator Hutchison Telecom has joined with Health Care International Holdings to launch an online medical service portal, Healthcare2U.com. Subscribers to Hutchison network can access the medical portal via WAP phones.
- Finnair will enable passengers to make, alter and cancel reservations using WAP-enabled mobile phones. The service operates in English, but currently is only available to customers with Finnish phone service providers.
- Ericsson announced a deal to make the guide Michelin travel publications available on WAP mobile telephones. The new service will give the customers instant access to a database of some 60,000 hotels and restaurants across Europe via WAP.

Customer Service

By providing mobile phone customers with information about their account, the WAP can help to avoid the need for expensive person to person voice calls to customer service centers.

Customer service suppliers using WAP include Phone.com (www.phone.com) and Categoric (www.categoric.com). Categoric specializes in event alerts. Every time an event of interest to the customer happens, SMS or WAP are used to let them know.

Positioning

Positioning in mobile context can mean several things: location of vehicles or people or phones. Vehicle positioning application integrates satellite positioning systems that tell people where they are with WAP which lets people tell others where they are. The Global Positioning System (GPS) is a free-to-use global network of 24 satellites run by the US Department of Defense. Anyone with a GPS receiver can receive their satellite position and thereby find out where they are.

The SMS is ideal for sending GPS information such as longitude, latitude, bearing and altitude. GPS information is typically about 60-character length, leaving room for other vehicle-specific information.

Notes Vehicle Positioning suppliers using WAP include www.wapolution.com.

Instant Messaging

Instant messaging is a cross between chat and email that allows people to view a listing of people they frequently communicate with, determine if these people are currently available for communication (i.e. online), and send and receive messages instantaneously. The tendency is to send instant messages to people rather than emails if you find that they are online.

Instant messaging was launched in early 1997 and continues to grow in popularity with over 100 million total users.

Wireless Instant Messaging is another example of the extension of the same services that people can access on the Internet becoming increasingly available on mobile phones. This is initially done through gateways that perform protocol conversion and reduce the size of the communication down to that which can be handled by low bandwidth wireless services. Over time, the gateways will not be needed, as seamless access to unmodified services becomes more widespread.

Instant Messaging suppliers using WAP include AOL Tegich (www.tegic.com).

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Task Analyze the distinction between unified messaging and instant messaging.

Chat

Chat can be distinguished from general information services by the information source: In chats, the source of information is a person, whereas in general information services the source is usually in Internet site. The amount of information transferred per message tends to be lower with chat, where people are more likely to state opinions rather than factual data. In the same way as Internet chat groups have proven a very popular application for the Internet, groups of like-minded people called communities of interest have begun to use non-voice mobile services as a means to chat, communicate and discuss.

Because of its association with the Internet, the General Packet Radio Service (GPRS) would allow mobile users to participate fully in existing Internet chat groups rather than setting up their own groups that are dedicated to mobile users.

Qualitative Information

A wide range of content can be delivered to mobile phone users ranging from share prices, sports scores, weather, flight information, news headlines, lottery results, jokes and so on. This information need not necessary be textual, it may be maps or graphs or other types of visual information.

The length of a short message of 160 characters suffices for delivering information when it is quantitative such as a share price or a sports score or temperature. However, when the information is of qualitative nature, such as a horoscope or news story, this 160-character length is too short. Therefore, GPRS will likely be used for qualitative information services, but SMS will continue to be used for delivering most quantitative information services.

Information services suppliers using WAP include Infospace.com, I3 Mobile and others.

Self Assessment

Fill in the blanks:

1. WAP specifies an application framework and …… for wireless devices such as mobile phones, pagers and personal digital assistants.
2. The hand-held devices tend to have less powerful CPU, ……, very restricted power consumption.
3. WAP content and applications are specified in a set of well-known content formats based on the familiar …… content formats.
4. A …… is not specified for the HTTP protocol, used by the WAP Gateway server to communicate with content hosts.
5. The …… of the encrypted WTLS data is the WAP Gateway proxy server.
6. The …… on mobile phones is currently sub-optimal and difficult for mass-market users to manipulate.
7. The successful implementation of …… programs incorporates several different elements such as private information services, WAP and security.

Notes

8. …… elevates communication above the technology used to communicate the message takes precedence over the media.
9. …… programs are the result of collaboration between mobile carriers and other companies in different industries with large customer groups.
10. The amount of information transferred per message tends to be lower with chat, where people are more likely to state opinions rather than …… data.

10.2 Integrating Email into your Application

It is a Java servlet allows you to send email from WAP phone or any another PDA supports WML. With this servlet you may simulate for example HTML's tag mailto:

How does it work? You have to create a text template for your mail and pass this file as a parameter for servlet. You may have more than one template of course. Servlet will read mail settings from such template and detect what kind of parameters do we need to ask from the user in the dialogue.

Example: For example you may decide to use some static subject for the letter or servlet will ask user to type this information, etc.

The typical scenario for your WML portal is: suppose you need to give your users the ability to send some file (e.g. price list, contact agreement etc.) from WML page. Just create a text file describes mail host, port, subject, source (from) address and the path to attached file. Destination address will be asked in the dialogue. Add to your WML page the following link:

```
<a href="http://your_host/servlet/WmlMailServlet?your_template_file">Send price list</a>
```

and your users will be able to activate this mail right from the phone.

How to use it:

(a) copy wmlMailPackage.jar into WEB-INF/lib directory

(b) describe servlet in your web.xml file:

```
<servlet>
 <servlet-name>WmlMailServlet</servlet-name>
 <servlet-class>com.jsos.wmlmail.WmlMailServlet</servlet-class>
 </servlet>
```

You can pass template file as a parameter to this servlet and use it in this form:

```
http://your_host/servlet/WmlMailServlet?template_file
```

or you may describe template file as an initial parameter (parameter name is config):

```
<servlet>
 <servlet-name>WmlMailServlet</servlet-name>
 <servlet-class>com.jsos.wmlmail.WmlMailServlet</servlet-class>
 <init-param>
  <param-name>config</param-name>
  <param-value>path_to_your_template_file</param-value>
 </init-param>
</servlet>
```

Notes

and use servlet in this form:

http://your_host/servlet/WmlMailServlet

Template file is a text describes mail settings and template for mail. In this file you can set address of your SMTP relay, smtp port, domain and describe contents for your letter. Appropriate WML form will be composed dynamically according to settings in the template file.

When you describe your letter you can use meta-variables: $from, $to, $subject, $body. These variables will be replaced by the appropriate field value from the submitted form. Letter will be also composed dynamically, when you submit form in WML. You can also attach some files saved on your server (e.g. price list from your company, your resume etc.)

Notes Template file has got free format, but description of any parameter must starts with the appropriate reserved word on the new line.

Current version supports the following list of parameters:

- Mailhost: describes your smtp host. This parameter is mandatory
- Port: describes smtp port. By default it is 25.
- Domain: describes your domain. This parameter is mandatory
- From: describes source address.
- To: describes destination address.
- Subject: set letter's subject
- Body: set letters body
- Attach: you can set here a list of files you want to be attached to the composed letter.
- After: you can set here an URL for some WML page user will jump to after mail sending.
- Encoding: character encoding for input parameters. Default value is ISO-8859-1
- Html: describes format. Possible values are true or false. If this value if true servlet will send letter in HTML format. Default value is false.

Example: E.g. the simplest configuration file is:

Mailhost:smtp.your_company.com

Domain:your_company.com

Port:25

From:$from

To:$to

Subject:$subject

Body:$body

After:/index.wml

Another example: for some Short Message service you can describe field To as

To:$to@acme.com

Notes

and type only the first part of address ($to) (e.g. phone number) in the generated mail form. You can set also constant value for any field:

To:support@your_company.com

In this case that field will be omitted in the generated WML form.

When you describe body field you can use also construction like:

$file=path_to_some_text_file

Content of this file will be added to the body of composed letter.

When you set attachments you can use list of files. Files should be separated by commas.

Notes

Configuration file can be saved anywhere on your server. In case of usage WmlMail?file_name we assume that this file is saved under the root (docBase) directory of your servletrunner. But you can always use the full path for setting file's location. E.g. you can type some like:

http://your_host/servlet/WmlMailServlet?c:\myfiles\myconfig.txt

or

http://your_host/servlet/WmlMailServlet?/home/users/me/myconfig.txt

WAP to E-Mail Gateways

- gmail-mobile is a PHP application that will give you access to your GMail account with any WAP phone (WML format). It is built on top of libgmailer. You will be able to read your mail, compose message, reply, access to your labels, etc.
- WapReader provides a WAP-based interface for reading and writing email from mobile devices that support WAP 1.1 protocol. The program is used as a gateway between a WAP-enabled mobile device and a plain POP3/IMAP mail server. With WapReader, a user can read mail, compose new messages, and delete mail. It uses the IMAP or POP3 protocols for getting mail and the SMTP protocol for sending mail. WapReader does not require any SQL server, and is very easy to set up and configure even for an inexperienced webmaster. WapReader supports base64 and quoted-printable mail encodings and all charsets supported by iconv().
- WAPPop allows mobile phone users access to their mail by interfacing with a POP server, giving access to read, reply, forward, delete, and compose messages.
- PhonEMail enables you to read your email from a handheld Web-browser, like a cell phone. More technically, phonemail.pl provides a Web-based gateway to your IMAP account for HDML browsers/devices.
- SB Timmy is an IMAP client for WAP/WML devices. It fully supports MIME, including allowing the user to download attachments to their mobile device, and supports sending mail via SMTP.
- WmlPOP is a Java servlet to read your POP mailbox through WAP/WML devices.
- Wapymail is a WAP/WML email client. It allows you to check your IMAP email from any WAP/WML-enabled device, like most mobile phones.

Notes

Self Assessment Questions

Fill in the blanks:

11. gmail-mobile is a …… that will give you access to your GMail account with any WAP phone (WML format).
12. …… is an IMAP client for WAP/WML devices.
13. …… does not require any SQL server, and is very easy to set up and configure even for an inexperienced webmaster..
14. phonemail.pl provides a …….. to your IMAP account for HDMLbrowsers/devices.
15. WapReader provides a WAP-based interface for reading and writing email from mobile devices that support ……

Caselet

BSNL 'boots' in Private Sector for Rural Wireless Network

IN a first of its kind project, Bharat Sanchar Nigam Ltd has invited bids from private players to roll out wireless rural telecom network on a Build, Own, Operate and Transfer (BOOT) model.

The successful bidder will function as a BSNL franchisee on a revenue share basis. BSNL has, however, ruled out partnering any company that has a licence to offer telecom services.

Initially, the project will be implemented in Tamil Nadu Circle and depending on its success, BSNL may consider implementing the new model in other parts of the country. This is the first time any telecom operator has considered the BOOT model, which is quite common in other infrastructure projects such as roads and ports.

The franchisee company will bring the technology, provide the capital expenditure for the equipment, install and commission them and provide direct support for operations, maintenance and customer care. The franchisee would also assume the role of content aggregator and arrange for the content for the set of broadcast TV signals and Video on Demand. BSNL will be to provide the necessary wireless spectrum, co-location space for the equipment, power and air conditioning, bandwidth and bill collection.

The agreement is fixed at 10 years. At the end of 10 years, the franchisee shall not be entitled to any revenue share and all assets in the infrastructure segment shall be transferred to BSNL at zero cost.

The assets that have not completed the 10-year life and associated resources shall be valuated through a third party valuator. The content- related businesses would, however, continue with the franchisee under a revised agreement, which will be drawn up in advance before the exit time. BSNL will provide high-speed Internet access, ISP-related services such as VoIP services, broadcast TV, video on demand and interactive gaming

The franchisee will also be given a roll-out obligation. For instance, in Tamil Nadu, the franchisee will have to cover at least ten districts in the first year and the remaining allotted districts within two years of signing of the agreement.

Notes

10.3 Summary

- The wireless telecommunication and the Internet are rapidly growing industries that are gaining more and more customers everyday.
- The WAP intention is to combine these two markets and answer the new demands in this field.
- These reasons and more driven some of the largest vendors to unite and create the WAP Forum, the standardizing organization of the WAP.
- The Nokia over-the-air (OTA) configuration proposal to the WAP Forum describes the use of a connectionless push over the SMS bearer, to transfer the configuration data to the handset.
- WAP incorporates no compression techniques for the textual content, although the WML markup commands are compressed.
- Unified messaging involves providing a single interface for people to access the various kinds of messaging they use.
- Instant messaging is a cross between chat and email that allows people to view a listing of people they frequently communicate with, determine if these people are currently available for communication (i.e. online), and send and receive messages instantaneously.
- A wide range of content can be delivered to mobile phone users ranging from share prices, sports scores, weather, flight information, news headlines, lottery results, jokes and so on.
- This information need not necessary be textual, it may be maps or graphs or other types of visual information.

10.4 Keywords

GPRS: General Packet Radio Service

MMI: Man Machine Interface

OTA: Over The Air

PDU: Protocol Data Unit

WIM: Wireless Identification Module

WSP: Wireless Session Layer

WSLS: Wireless Transport Layer Security

10.5 Review Questions

1. WAP specifications extend existing mobile networking technologies. Explain.
2. Wireless hand-held devices preset a more constrained computing environment and platforms. Discuss.
3. The wireless networks present greater problems as communication infrastructures they have less bandwidth. Comment.
4. The WAP programming model is similar to the WWW programming model. Do you agree with this statement? Why or why not?

Notes

5. Explain why the support of pushes on the client side depends on the capabilities of the handsets to handle pushed content.
6. The WAP will allow customers to easily reply to incoming information on the phone by allowing new menus to access mobile services. Discuss.
7. Banks offering services over WAP include Deutsche Bank and Visa International. Explain.
8. The SMS is ideal for sending GPS information such as longitude, latitude, bearing and altitude. Give reasons.
9. PhonEMail enables you to read your email from a handheld Web-browser, like a cell phone. Explain.
10. WapReader supports base64 and quoted-printable mail encodings and all charsets supported by iconv(). Explain with reasons.

Answers: Self Assessment

1. network protocols
2. less memory
3. WWW
4. push operation
5. "endpoint"
6. MMI (Man Machine Interface)
7. mobile banking
8. Unified messaging
9. Affinity
10. Factual
11. PHP application
12. SB Timmy
13. WapReader
14. Web-based gateway
15. WAP 1.1 protocol

10.6 Further Readings

Books

Demon Hougland, *Essential WAP for Professional, 2001*, Prentice Hall PTR.

Jennifer Niederst Robbins, *Web Design in a Nutshell*, 2006, O'Reilly.

Jon Orwant, *Web Graphics & Perl/TK: Best of the Perl Journal* 2003 O' Reilly.

Paul Wallace Andrea Hoffmann, *Mika Tuppola, I – Mode Developer Guide*, 2002.

Books

http://en.wikipedia.org/wiki/Wireless_Application_Protocol

http://www.sitepoint.com/markup-language-introduction/

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Unit 11: Using WML Script

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Objectives

After studying this unit, you will be able to:

- Scan WMLScript Vs Javascript
- Describe WMLScript functions
- Demonstrate WMLScript Libraries

Introduction

To enhance application performance and user experience scripting is done. WML uses WMLScript which is a lightweight JavaScript language to run simple code on the client. This unit with give you a basic idea of WMLScript, the rules of WMLScript, variables, operators, control constructs, reserved words, functions, its standard libraries, arrays and pragmas. Lastly you will be introduced to some general coding principles which will be useful if you are planning to develop a WAP site as well some technical tips for the experienced WAP developers.

11.1 WMLScript

WML uses WMLScript to run simple code on the client. WMLScript is a light JavaScript language. However, WML scripts are not embedded in the WML pages. WML pages only contains references to script URLs. WML scripts need to be compiled into byte code on a server before they can run in a WAP browser.

Notes

WML Script resides within the high-level applications layer of the WAP structure and adds capabilities for swifter, more advanced and interactive logical operations between the mobile device and server.

Caution WML Script code can be written in normal text files.

11.1.1 The Rules of WML Scripts

What is Scripting?

Scripting adds "behavioral" capabilities to the device to enhance application performances and the user experience.

Scripting adds capabilities like the following:

- Validating user input
- Accessing device capabilities and processing alerts
- Enabling device extensions.

Scripting enables local processing on the device and eliminates needless "roundtrip" messages over the air link to the server, and thus

- Speeds up the user experience
- Reduces connection time costs
- Enables faster information input and display

WMLScript Basics

WML Script is

- Inherited from JavaScript 1.1 and ECMA Script
- Modeled for limited capacity devices
- Procedural rather than object oriented
- Uses 32 bit integer
- Is referenced from WML, not contained within it
- Is compiled to binary to run on WAP devices (compiling is handled by the gateway server)

Script Syntax Rules

WML Script follows these syntax rules.

- Script is case sensitive
- White space is ignored
- Blocks are enclosed in brackets "{}".

Notes

- Semicolons mark the ends of statements.
- Comments are marked with "//".

Task In a group of four analyze why do WML scripts need to be compiled into byte code before they can be run on a WAP browser?

11.1.2 What are the WML Script Syntax Rules?

WML Script Functions

- An "executable" file in WML Script is called a function
- A function is
  - An ordered set of language statements
  - Modeled to perform a task
  - Selected with the wmls filename extension
  - Stored on the application server
  - Executed on the device
  - Referenced from WML, not contained in it
  - Accessed by URL, like a deck or card

Notes A WMLScript function is a named part of the WMLScript compilation unit that you can call to perform a specific set of statements and to return a value.

The following section describe how you can declare and use WMLScript functions.

Declaration

You can use the function declaration to declare a WMLScript function name (Identifier) with the optional parameters (FormalParameterList) and a block statement that is executed when the function is called. All functions have the following characteristics:

- Function declaration cannot be nested.
- Function names must be unique within one compilation unit.
- All parameters to functions are passed by value.
- Function calls must pass exactly the same number of arguments to the called function as specified in the function declaration.
- Function parameters behave like local variables that have been initialized before the function body (block of statement) is executed.
- A function always returns a value. By default, it is an empty string (" "). However, you can use a return statement to specify other return values.

Notes

Self Assessment

Fill in the blanks:

1. WML scripts are not embedded in the …….
2. WML Script resides within the high-level applications layer of the …….
3. Function names must be ……. within one compilation unit.
4. Function calls must pass exactly the same number of ……. to the called function as specified in the function declaration.
5. All ……. to functions are passed by value.

11.2 WML vs Java Script

WML Script (Wireless Markup Language Script) is the client-side scripting language of WML (Wireless Markup Language). A scripting language is similar to a programming language, but is of lighter weight. With WML Script, the wireless device can do some of the processing and computation. This reduces the number of requests and responses to/from the server. In the old days, fewer round-trips can improve the performance of your WAP site significantly since data transmission over wireless networks is slow. Today, the performance gained may not be so significant any more as data transmission speed has improved a lot. However, you may still find WML Script useful since putting some operations at the client-side can reduce the load of your servers.

WML Script is based on ECMA Script (European Computer Manufacturers Association Script), which is JavaScript's standardized version. So, the syntax of WML Script is very similar to JavaScript.

Did u know? **The Javascript.**

Java Script is a scripting language commonly used on the web.

If you have some programming experience with Java Script, you should be able to learn WMLScript quickly. You may glance through or even skip some parts of this WMLScript tutorial.

A major difference between JavaScript and WMLScript is that JavaScript code can be embedded in the HTML markup, whereas WMLScript code is always placed in a file separated from the WML markup.

WMLScript has a number of standard libraries. They contain a lot of useful functions that you should get familiar with. We will talk about them in later parts of this unit.

One common use of WMLScript is to validate form data. Another common use is to display message boxes to give alerts and error messages or to ask for confirmation of actions (no round-trip is needed for showing message boxes, which helps save bandwidth and improve the WAP application's response time).

WMLScript is the dialect of JavaScript used for WML pages and is part of the Wireless Application Protocol (WAP).

WMLScript is a client-side scripting language and is very similar to JavaScript. Just like JavaScript WMLScript is used for tasks such as user input validation, generation of error message and other Dialog boxes etc.

Notes

Table 11.1

Feature	WMLScript	JavaScript
Semicolons	Mandatory	Optional
Supports HTML Comments	No	Yes
Non-escape characters preceded by a backslash	No	Yes
Names may include $ characters	No	Yes
Supports global variables	Yes	Yes
Supports automatic declarations	Yes	Yes
Supports the generic term number	Yes	No
Specifies maximum and minimum values for integers	Yes	No
Supports double-precision floating-point values	No	Yes
Supports objects	No	Yes
Supports arrays	No	Yes
typeof returns	an integer	a string
Supports for..in	No	Yes
Supports with	No	Yes
Supports Libraries	Yes	No
Supports invalid	Yes	No
Supports isvalid	Yes	No
>Supports delete	No	yes
Supports void	No	Yes
Supports div	Yes	No
Supports extern	Yes	No
Supports pragmas	Yes	No

Notes URLs are used to refer to the actual WMLScript code in the WML document.

WMLScript is based on ECMAScript (European Computer Manufacturers Association Script), which is JavaScript's standardized version. Thus the syntax of WMLScript is very similar to JavaScript but not fully compatible.

A major difference between JavaScript and WMLScript is that JavaScript code can be embedded in the HTML markup, whereas WMLScript code is always placed in a file separate from the WML markup. URLs are used to refer to the actual WMLScript code in the WML document.

Notes

Self Assessment

Fill in the blanks:

6. With ……., the wireless device can do some of the processing and computation.
7. WMLScript is a ……. language and is very similar to JavaScript.
8. WMLScript code is always placed in a file separate from the …….
9. One common use of WMLScript is to ……. form data.

11.3 Using WML Script Functions

FunctionDeclaration:

externopt function Identifier (FormalParameterListopt) Block ;opt

FormalParameterList:

Identifier

FormalParameterList, Identifier

You can use the optional extern keyword to specify that a function is to be externally accessible. External functions can be called from outside the compilation unit in which they are defined.

Identifier is the name specified for the function.

The optional FormalParameterList is a list of argument names separated by commas.

Block is the body of the function that is executed when the function is called and the parameters have been initialized by the passed arguments.

Function Example

```
<wml>
        <card> title=" Do Square">
                <p>
                        <do type ="accept" label ="SquareIt">
                 <go href ="squareit.wml#doSquare('8')" />
                        </do>
                        $test
                </p>
        </card>
        <card title="Results">
                <p>
                        The result is "$test"
                </p>
        </card>
</wml>
```

Notes

More about Functions

- Can be predefined by the system
- Can be created by the developer
- Are typically grouped into libraries
- Accept input parameters, then return values based on the input

Compilation Units

- This is an example of a single wmls file
- Scope is defined by the presence of extern

```
extern function f1() {
        …
}
extern function f2() {
        …
}
extern function f3() {
        …
}
```

Example: Another example is given below.

```
extern function openDialog() {
var doContinue =Dialogs.confirm("Continue?", "Yes ", "No");
        // yes is ok
        // no is cancel
        if (doContinue) {
                WMLBrowser.setVar ("test", "we continued");
        }
        else {
                WMLBrowser.setVar ("test", "we stop continue");
        }
        WMLBrowser.refresh();
}
```

Return Values

These accomplish the same thing.

```
        extern function MyFunct() {
```

Notes

```
        WMLBrowser setVar ("answer", " Yes");
}
extern function MyFunct() {
        return "Yes";
}
```

11.3.1 Working with Variables

Variables for WML Script functions are:

- weakly typed
- must be declared
- have a local scope
- must be one of these data types
  - Boolean
  - Integer
  - Invalid
  - Float
  - String

Data Types

Table 11.2 represents the data types and their description.

Table 11.2

Data Type	Description
Boolean	Must be either True or False
Integer	Integer from 2,147,483,648 to 2,147,483,647. Precede hex literals with "ox" or "oX". Precede octal literals with"0"
Invalid	Literal variable. Indicates invalid values that may result from a floating-point overflow
Float	Floating point decimal numbers from +/- 1.17549435E-38 to +/-3.02823476E+38. Specify literal exponents with "e" or "E".
String	Character string. Enclosed by single quotes or double quotes.

Variable: Declaring and Setting

```
var MyVar;
Setting a variable's value
MyVar="Welcome";
MyVar="6.5"
```

Other possibilities

- pre-increment

Notes

- pre-decrement
- post-increment
- post-decrement

Reserved Words

The following words are reserved words and cannot be used for other naming purposes in WML Script.

- Access
- Agent
- Break
- Continue
- Div
- Domain
- Else
- Equiv
- Extern
- For function
- Header
- http
- if
- Isvalid
- Meta
- Name
- Path
- Return
- Typeof
- url
- Use
- User
- Var
- While

Task Examine the working of WMLScript function. Analyze the characteristics of a function.

Notes

11.3.2 Operators

Table 11.3 shows the four categories of operators used in WML Script.

Table 11.3

Category	Operators
Assignment	=
Arithmetic	+, -, /, *, div, %
Comparison	==, !=, <, >, <=, >=
Logical	&&, ||, !

Arrays

WMLScript does not support arrays as such. However, the standard String library supports functions by which array-like behavior can be implemented using strings. A string can contain elements separated by a specified separator. For this purpose, the String library contains functions which allow you to create and manage string arrays. The following is an example of an array operator:

```
function dummy() {
        var str = "Mary had a little lamb";
        var word = String.elementAt(str,4,"");
};
```

Pragmas

WMLScript supports the use of pragmas that specify compilation unit level information. Pragmas are specified at the beginning of the compilation unit before any function declaration.

Notes Note that all pragmas start with the keyword use and are followed by pragma-specific attributes.

Syntax

```
CompilationUnit:
        Pragmasopt FunctionDeclarations
Pragmas
        Pragma
        Pragmas Pragma
Pragma:
        Use PragmaDeclaration;
PragmaDeclaration:
        ExternalCompilationUnitPragma
        AccessControlPragma
        MetaPragma
```

Notes

Self Assessment

Fill in the blanks:

10. ……. is the name specified for the function.
11. You can use the optional ……. keyword to specify that a function is to be externally accessible.
12. WMLScript supports the use of ……. that specify compilation unit level information.
13. The standard String library supports functions by which array-like behavior can be implemented using …….

11.4 Using WMLScript Libraries

11.4.1 Script Libraries

Table 11.4

Library	Description
Lang	Constants, math functions, etc.
Float	Floating point math functions
String	String processing functions
URL	URL processing
WML Browser	Browser interface, links to WML Script
Dialogs	Basic user interactions

Dialog Library

Table 11.5

alert()	Displays a message, waits for a confirmation, and then returns an empty string
confirm()	Displays a message, waits for an answer, and returns a Boolean value depending on the selected answer
prompt()	Displays a question, waits for an input, and then returns the user's answer

Float Library

Table 11.6

sqrt()	Returns the square root of a specified number
floor()	Returns the nearest integer that is not larger than a specified number
int()	Returns the integer part of a specified number
ceil()	Returns the nearest integer that is not smaller than a specified number
maxFloat()	Returns the largest possible floating point number
minFloat()	Returns the smallest possible floating point number
pow()	Raises a number to the power of a second number and returns the result
Round()	Returns the nearest integer to a specified number

Notes

String Library

Table 11.7

charAt()	Returns a character that is placed in a specified position of a string
Compare()	Compare two strings, and returns an integer that tells if the one string identical, smaller or larger than other
Elements()	Separates a string into elements, and then returns a specified element
find()	Returns the position of a sub-string in a string
format()	Formats a value, and returns the result
insertAt()	Separates a string into elements, inserts a sub-string, and then returns the result
squeeze()	Reduces all white spaces to single spaces, and returns the result
trim()	Returns a string without leading and trailing spaces
Substring()	Returns a string that is a specified part of another string
toString()	Creates a string from a number, and returns the result
replace()	Replaces a part of the string with a new string, and return the result
replaceAt()	Separates a string into elements, replaces an element, and then returns the result
length()	Returns the length of a string
removeAt()	Separates a string into elements, removes an element, and then returns the result

Task Analyze what are the various standard libraries available for WMLScript?

WML Browser Library

Table 11.8

getCurrentCard()	Returns the (relative) URL of the current card
getVar()	Returns the value of a variable
go()	Goes to a new card, specified by the new URL, and returns an empty string
newContext()	Clears all variables, and returns an empty string
prev()	The browser goes back to the previous card, and returns an empty string
refresh()	Refreshes the current card, and returns an empty string
setVar()	Sets the value of a variable, and returns true if the new value was implemented successfully, and false if not

Lang Library

Table 11.9

abort()	Aborts a WML Script and returns a message to the caller of the script
abs()	Returns the absolute value of a number
characterSet()	Returns the character set supported by the WML Script interpreter
exit()	Exits a WML Script and returns a message to the caller of the script
float()	Returns true if floating-point numbers are supported, and false if not

Contd...

Notes

isFloat()	Returns true if a specified value can be converted into a float-point number by the parseFloat() function, false if not
isInt()	This validates whether the given parameter value can be converted to an integer or not. A Boolean value is returned if the given value can be converted to an integer number using parseInt(value), else false is returned
max()	Returns the largest value of two number
maxInt()	Returns the maximum possible integer value
min()	Returns the smallest value of two numbers
minInt()	Returns the minimum possible integer value
parseInt()	Returns an integer defined by a string
random()	Returns a random integer between 0 and a specified number
seed()	Initializes the random number generator with a number, and returns an empty string
parseFloat()	Returns a floating point value defined by a string

URL Library

Table 11.10

escapeString()	Replaces special characters in a URL with an escape sequence, and returns the result
getFragment()	Returns the fragment in a URL
getHost()	Returns the host specified in a URL
getParameters()	Returns the parameters in the last path segment of a URL
getPath()	Returns the path specified in a URL
getPort()	Returns the port number specified in a URL
getQuery()	Returns the query part in a URL
getScheme()	Returns the schema in a URL
isValid()	Returns true if a URL has the right syntax, and false if not
loadString()	Returns the content and the content type of a specified URL
resolve()	Returns an absolute URL from a base URL and a relative URL
unescapeString()	Replaces the escape sequence in a URL with characters and return the result

Task Does WMLScript support arrays? If not then what do you mean by arrays in WMLScript?

11.5 Sample Application

WMLScript's Dialogs standard library contains three functions — alert(), confirm() and prompt(). They are used to display alert messages, confirmation messages and input boxes to users. They

Notes

can help reduce the number of trips to the WAP server. For example, let's say we have a WMLScript function that is used to check whether a certain variable's value is in the range 1 to 100. If it is outside the range, we will give the user a message to ask him/her to enter again. The message is stored in a WML document.

```
function checkRange(number)
{
  if (number < 1)
    WMLBrowser.go("alertTooSmall.wml");
  else if (number > 100)
    WMLBrowser.go("alertTooLarge.wml");
  else
   WMLBrowser.go("success.wml");
}
```

In the above script, if number is not in the range 1 to 100, the WML browser has to download the WML file alertTooSmall.wml or alertTooLarge.wml from the WAP server, which involves a round-trip.

Now we rewrite the above script using the alert() function of the Dialogs standard library, like this:

```
function checkRange(number)
{
  if (number < 1)
    Dialogs.alert("Number too small. Please enter again.");
  else if (number > 100)
    Dialogs.alert("Number too large. Please enter again.");
  else
   WMLBrowser.go("success.wml");
}
```

The script instructs the WML browser to generate an alert message if number is out of range, which means the WML browser does not need to download the WML file alertTooSmall.wml or alertTooLarge.wml from the WAP server any more. Hence, a round-trip to the WAP server is saved and the WML browser will give a quicker response.

Self Assessment

Fill in the blanks:

14. …… displays a message, waits for an answer, and returns a Boolean value depending on the selected answer.
15. …… separates a string into elements, and then returns a specified element.

Notes

Caselet

Rural Broadband: BSNL Pushes for Common Wireless Network

Bharat Sanchar Nigam Ltd has proposed setting up a common wireless network for reaching broadband services in rural areas.

The public sector company has suggested that instead of multiple operators setting up a parallel network, a single network should be set up with support from the Universal Services Obligation funds.

BSNL's proposal comes at a time when the Department of Telecom is all set to launch a scheme to support operators for setting up broadband infrastructure through subsidy from the USO fund. Under this scheme, two operators will be selected in each circle through a bidding process.

"The cost of setting up parallel infrastructure by two operators in rural areas shall be wastage of national resources. It would be better that only one operator is allowed to roll out the network in rural areas and other operators may use the same network for providing services in these areas through the Mobile Virtual Network Operator (MVNO) model," BSNL has told DoT.

BSNL's suggestion is similar to the National Optic Fibre Network (NOFN) project being undertaken by the Government to create a pan-India wired broadband infrastructure. The Rs 20,000-crore NOFN will be laid by BSNL and the management will be entrusted to a Special Purpose Vehicle. All the other operators will be able to use this wired network to reach broadband services to rural areas.

Meanwhile, the Minister for Communications and Information Technology, Mr Kapil Sibal, on Monday said the proposed national optic-fibre cable network should not be used by private operators to push their own services but to offer products that benefit the society at large.

Rural Teledensity

Addressing the curtain raiser conference of 'India Telecom 2011: m-Powering India', Mr Sibal said, "The fact that rural teledensity stands at 36 per cent against the urban teledensity of 163 per cent shows that the telecom revolution has not reached the people who really need to be benefited. It should be our endeavour to ensure that this revolution is completed in an equitable manner."

11.6 Summary

- WML uses WMLScript to run simple code on the client. WMLScript is a light JavaScript language.
- WML scripts are not embedded in the WML pages and they need to be compiled into byte code on a server before they can run in a WAP browser. WML Script is inherited from JavaScript 1.1 and ECMA Script, Modeled for limited capacity devices, Procedural rather than object oriented, Uses 32 bit integer.
- WML Script resides within the high-level applications layer of the WAP structure and adds capabilities for swifter, more advanced and interactive logical operations between the mobile device and server.

Notes

- WML Script follows syntax rules which are script is case sensitive, white space is ignored, blocks are enclosed in brackets "{}", semicolons mark the ends of statements, comments are marked with "//".
- An "executable" file in WML Script is called a function. A WMLScript function is a named part of the WMLScript compilation unit that you can call to perform a specific set of statements and to return a value.
- You can use the function declaration to declare a WMLScript function name (*Identifier*) with the optional parameters (*FormalParameterList*) and a block statement that is executed when the function is called.
- In the syntax of function the optional *extern* keyword is used to specify that a function is to be externally accessible. External functions can be called from outside the compilation unit in which they are defined. *Identifier* is the name specified for the function. The optional *FormalParameterList* is a list of argument names separated by commas.
- *Block* is the body of the function that is executed when the function is called and the parameters have been initialized by the passed arguments.
- Variables for WML Script functions are weakly typed, must be declared, have a local scope, must be one of these data types which are Boolean, Integer, Invalid, Float.
- The following words are reserved words and cannot be used for other naming purposes in WML Script. They are Access, Agent, Break, Continue, Div, Domain, Else, Equiv, Extern, Forfunction, Header, http, if, Isvalid, Meta, Name, Path, Return, Typeof, url, Use, User, Var, While, String.
- The four categories of operators used in WML Script are assignment, arithmetic, comparison and logical.
- WMLScript does not support arrays as such. However, the standard String library supports functions by which array-like behavior can be implemented using strings.
- WMLScript supports the use of *pragmas* that specify compilation unit level information. Pragmas are specified at the beginning of the compilation unit before any function declaration. All pragmas start with the keyword *use* and are followed by pragma-specific attributes.
- The standard libraries include script libraries, dialog libraries, float libraries, string libraries, WML browser library, lang library, url library.

11.7 Keywords

ECMAScript: European Computer Manufacturers Association Script

Pragmas: WMLScript supports the use of pragmas that specify compilation unit level information.

Scripting: Scripting adds "behavioral" capabilities to the device to enhance application performances and the user experience

WML Script: WML Script is a light JavaScript language.

WML: Wireless Markup Language

WMLScript Arrays: The standard String library supports functions by which array-like behavior can be implemented using strings.

WMLScript Function: An "executable" file in WML Script is called a function

Notes

WMLScript Operators: The four categories of operators used in WML Script which are assignment, arithmetic, comparison and logical.

WMLScript Reserved Words: They are words reserved and which cannot be used for other naming purposes in WML Script.

WMLScript Standard Libraries: The standard libraries include script libraries, dialog libraries, float libraries, string libraries, WML browser library, lang library, url library.

WMLScript Variables: They are variables for WML Script functions which are weakly typed, must be declared, have a local scope, must be one of these data types which are Boolean, Integer, Invalid, Float.

WMLScript: WML uses WMLScript to run simple code on the client.

11.8 Review Questions

1. Scripting adds "behavioral" capabilities to the device to enhance application performances and the user experience. Discuss.
2. WML uses WMLScript which is a lightweight JavaScript language to run simple code on the client. Explain.
3. Explain how a scripting language is similar to a programming language, but is of lighter weight?
4. Explain the syntax of function using an example of a function.
5. Substantiate what are variables for WMLScript function? What data types can the variables be?
6. Explain what is Reserved words? Name the reserved words in WMPScript with examples.
7. A string can contain elements separated by a specified separator. Discuss.
8. Pragmas are specified at the beginning of the compilation unit before any function declaration. Comment.
9. Block is the body of the function that is executed when the function is called, Explain with the suitable examples.
10. External functions can be called from outside the compilation unit in which they are defined. Explain.

Answers: Self Assessment

1. WML pages
2. WAP structure
3. unique
4. arguments
5. parameters
6. WMLScript
7. client-side scripting
8. validate
9. WML markup
10. Identifier
11. Extern
12. Pragmas
13. Strings
14. confirm()
15. Elements()

Notes

11.9 Further Readings

Books

Demon Hougland, *Essential WAP for Professional*, 2001, Prentice Hall PTR.

Paul Wallace Andrea Hoffmann, *Mika Tuppola, I – Mode Developer Guide*, 2002, Addison- Wesley Professional.

Online links

http://en.wikipedia.org/wiki/WMLScript

http://www.developershome.com/wap/wmlscript/

Notes

Unit 12: Secure Application

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Objectives

After studying this unit, you will be able to:

- Scan security basics
- Describe WAP security architecture
- Demonstrate session management
- Recognize WML for secure applications

Introduction

The WAP platform has leveraged the lessons from the development of other platforms, such as the HTML browser, and it has built-in facilities to address security. The WAP platform provides you with facilities at the transport level to ensure confidentiality and message integrity. The Wireless Transport Layer Security (WTLS) provides security for the data exchanged directly between the wireless device and the WAP gateway. In this unit we will WAP security basics and architecture.

12.1 Security Basics

This intro to wireless networking setup and security is written with the assumption that the reader has a basic understanding of wired networks, because in terms of protocol, wireless works almost the same way. The difference is in the wireless component and associated hardware configuration.

Notes

Equipment

To create a home network, you need a single access point (WAP). You'll also need a wireless adapter for every PC you want to participate on the wireless network. The PC adapters will connect to the WAP, and the WAP will connect to the Internet. We personally prefer Linksys products, and these can be found in your local computer store or online. Because technology is always changing, we don't want to recommend a specific model, but here are links to wireless access points and wireless adapters.

Protocol

Wireless hardware comes in different "languages". Stick to 802.11g, also called "Wireless G".

Notes Note that this might interfere with cordless phones in the 2.4GHz band.

The easy way to identify this problem is that your PC's Internet connection will die every time someone makes a phone call. If you have a cordless phone at home and are experiencing connection drops with your wireless equipment, try changing the wireless "channel" on your WAP. Hopefully you can find a channel for your computers that your phone isn't using.

Notes If you can't, and your computer drops connections no matter what channel your WAP uses, then there are two other solutions:

1. Purchase a new phone, one that doesn't use the 2.4GHz band.
2. Instead of 802.11g equipment, use 802.11a equipment. 802.11a uses a 5GHz band.)

12.1.1 Wireless Security Setup

After you install your hardware and have all PCs operating happily on the network (the hardware manuals provide good instructions for doing this, though most equipment will work with no configuration – just plug everything in and things will hopefully work immediately), secure it by making these changes.

1. ***Change your WAP password:*** By default, all WAPs or the same model have the same password, and these passwords are widely known. Change your default password to prevent unauthorized people from changing your WAP configuration.
2. ***Enable WPA2 encryption (also called 802.11i):*** Available in the WAP, you can turn on WPA2 "Pre-Shared Key" encryption. Create a long, difficult (thus secure) password within the WAP. For each PC that wants to connect to the WAP, they will have to enter that password once to be authorized on the network. Use WPA2 for the authentication type and AES for the encryption method. (The WPA2 and AES combo will give you the best protection.)

Caution If you have problems setting up WPA2, be aware that older hardware and operating systems require updates before they'll work.

Notes

If WPA2 is giving you problems or isn't available in Windows XP, try this before you set up WPA and WPA2:

(a) Install the latest Windows Service Pack. WPA encryption functionality is included as of Windows XP Service Pack 2. In addition, if setting up WPA2, your Windows PCs may need the patch at this link. It enables the WPA2 standard on Windows.

(b) Apply the latest firmware drivers for your WAP.

(c) Apply the latest drivers for your wireless adapters. If you have older adapters, they may not even support WAP. If this is the case (the website support section of the adapter's manufacturer should state this), upgrade to a model that does.

Yes, there have been times where I needed to do all three of these things in order to get WPA working properly. If you still have no luck, verify your hardware (wireless access point and PC wireless adapter) supports WPA. Some older hardware does not. The hardware manufacturer's website should clarify this.

3. ***Change SSID:*** Your WAP has a identifier name called the SSID, and is set to a default name by the hardware manufacturer. Change this name to something else. This will lot actually improve security. Do this is to indicate to others that your network was set up by someone who knows more than to take the defaults, and therefore may not be worth attempting to hack.

Task Your WAP has a identifier name called the SSID. Do you agree with this statement? Explain.

4. ***Firewall:*** If your WAP also routes your Internet traffic, and has a built-in firewall, make sure it's turned on. If you have an option for "Block anonymous internet requests", enable it.

5. ***Appliance timers:*** If you're really paranoid, get an appliance timer and hook it up to your WAP. Set it to turn the device off when you know you're not using it (like overnight, while you're at work, etc.) Sometimes the most effective security is to use the OFF switch!

You may have heard other recommendations for setting up security on a wireless network, things like disabling SSID broadcasting, using WEP encryption, turning off DHCP, MAC address filtering, restricting the transmitter power or placing the WAP in certain locations in the house. Do not do any of these. Here's why:

(a) *Don't disable SSID broadcast:* This attempts to hide the existence of your network. It doesn't. If a computer is talking to an access point, that traffic is visible, regardless of SSID settings.

(b) *Don't use WEP encryption:* It was nice while it lasted, but WEP encryption has been broken. With the proper (free) tools, your WEP-protected network can be hacked in minutes.

(c) *Don't disable DHCP:* All computers on a network must have a unique address. DHCP allocates this address automatically. Turing off DHCP will do nothing to stop anyone slightly familiar with networking, since the address can also be created manually.

(d) *Don't use MAC address filtering:* Like a computer's fingerprint, all networked computers have a unique identifier called a MAC address. But unlike fingerprints, a MAC address can be manually changed. It's not difficult for someone using sniffer software to (1) figure out what MACs are allowed on your network and (2) change their PC's MAC address to an allowed value.

Notes

Don't try to restrict the wireless signal: Radio waves travel farther than you might realize, and are almost impossible to limit or restrict. Don't restrict the signal – it's more effective and easier to have the signal be as powerful as possible, but encrypt the data on it. If we can walk outside your house and detect your wireless signal, no big deal: I'm still prevented from using it if you've enabled the encryption methods specified above.

After you think you've gotten all PCs connected, reboot them and make sure they reconnect automatically. Verify you can still connect to the network and/or Internet. This will ensure that all changes are applied correctly and that those security changes will "stick".

Self Assessment Questions

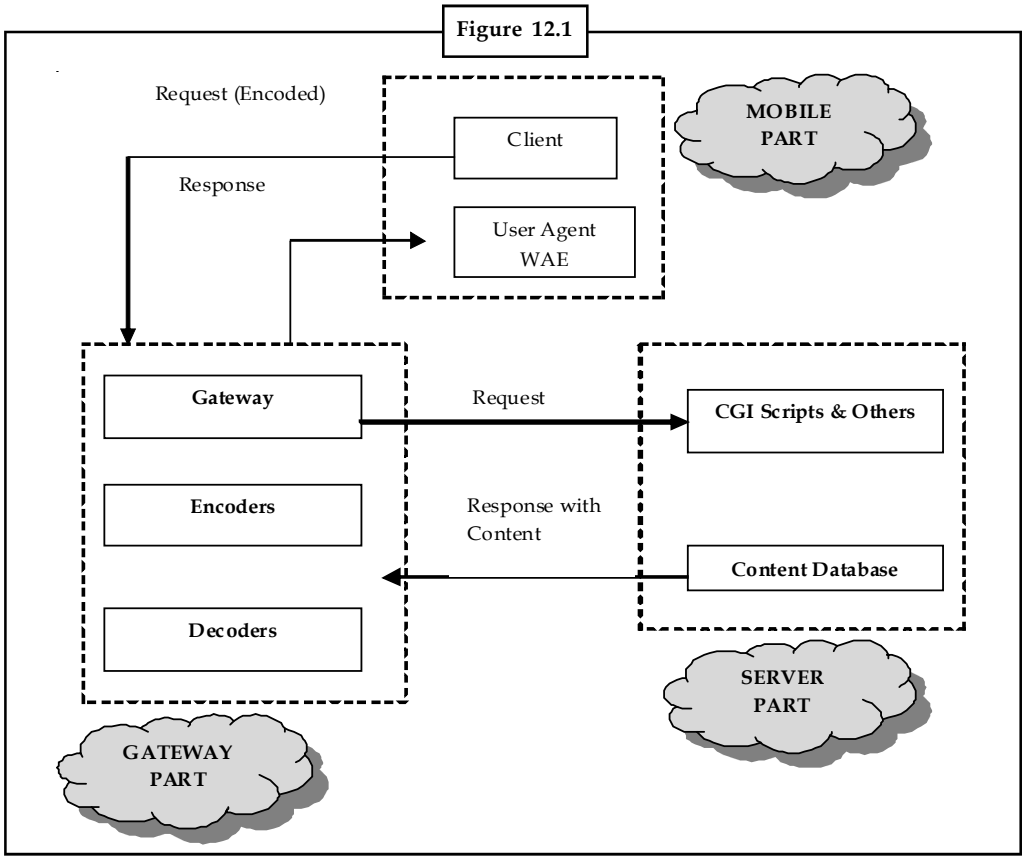
Fill in the blanks:

1. The ……. provides security for the data exchanged directly between the wireless device and the WAP gateway.
2. All computers on a network must have a ……. address.
3. Use ……. for the authentication type and AES for the encryption method.
4. Like a computer's fingerprint, all networked computers have a unique identifier called a …….

12.2 WAP Security Architecture

The WAP programming model shown in Figure 12.1 is analogous to the WWW programming model.

Figure 12.1



Notes

This offers several benefits to the application developer community, including a familiar programming model, a proven architecture and the ability to leverage existing tools.

Optimization and extensions have been made in order to match the characteristics of the wireless environment. Wherever possible, existing standards have been adopted or have been used as the entry point for the WAP technology.

WAP content and applications are specified in a set of well-known content formats based on the familiar WWW content formats. Content is transported using a set of standard communications protocols based on the WWW communications protocols.

Did u know? **What is the use of Micro Browser?**

A micro browser in the wireless terminal co-ordinates the user interfaces and is analogous to a standard web browser.

WAP defines a set of standard components that enable communication between mobile terminals and network servers. These include the following:

- ***Standard Naming Model:*** WWW standard URLs are used to identify WAP content on origin servers. WWW standard URLs are used to identify local resources in a device, e.g., call control functions.
- ***Content Typing:*** All WAP content is given a specific type consistent with WWW typing. This allows WAP user agents to correctly process the content based on its type.
- ***Standard Content Formats:*** WAP content formats are based on WWW technology and include display markup, calendar information, electronic business card objects, images and scripting language.
- ***Standard Communication Protocols:*** WAP communication protocols enable the communication of browser requests from the mobile terminal to the network web server.

The WAP content types and protocols have been optimized for mass market, hand-held wireless devices. WAP utilizes proxy technology between the wireless domain and the WWW. The WAP proxy typically is comprised of the following functionality:

- ***Protocol Gateway:*** The protocol gateway translates requests from the WAP protocol stack (WSP, WTP, WTLS, and WDP) to the WWW protocol stack (HTTP and TCP/IP).
- ***Content Encoders and Decoders:*** The content encoders translate WAP content into compact encoded formats to limit the size of data over the network.

This infrastructure ensures that mobile terminal users can browse a wide range of WAP content and applications and that the application author is able to build content services and applications that run on a large base of mobile terminals. The WAP proxy permits content and applications to be hosted on standard WWW servers that include the WAP proxy functionality.

Notes Such a server can be utilized to ease end-to-end security solutions, or applications that need better access control or a guarantee of responsiveness.

12.2.1 Sample Configurations of WAP Technology

WAP technology is expected to be beneficial for applications and services beyond those specified by the WAP forum.

Notes

Figure 12.2

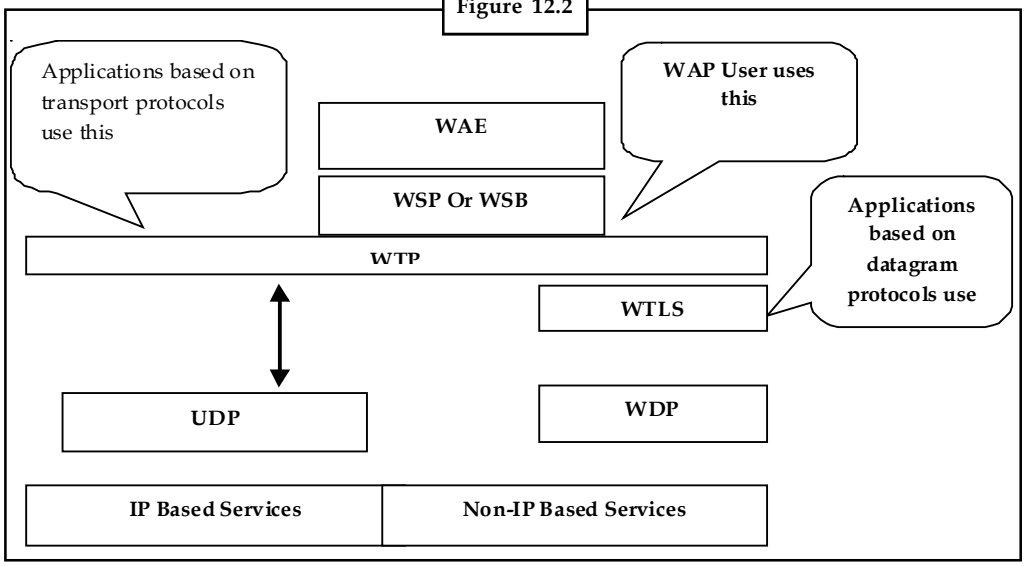


Figure 12.2 depicts several possible protocol stacks using WAP technology. These are for illustrative purposes only and do not constitute a statement of conformance or interoperability.

- The leftmost stack represents a typical example of a WAP application, i.e., WAE user agent, running over the complete portfolio of WAP technology.
- The middle stack is intended for applications and services that require transaction services with or without security.
- The rightmost stack is intended for applications and services that only require datagram transport with or without security.

Task WAP utilizes proxy technology between the wireless domain and the WWW. Analyze

WAP Structure

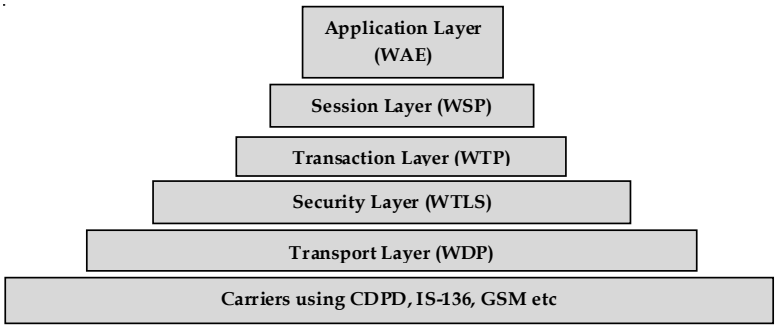
The WAP specification standardizes a set of protocols intended to send content to mobile devices like cellular phones, pagers and Personal Digital Assistants (PDAs). It defines application environment and transport protocols. It utilizes present Internet technologies and many of its components. The WAP application is developed taking into account the limitations of the handheld devices.

- Less powerful CPUs
- Less memory
- Smaller display
- Several input devices
- Less bandwidth network connectivity.

WAP is a communication protocol and also application environment. It can be constructed on any operating system including PalmOS, EPOC, Windows CE, FLEXOS, OS/9, and JavaOS. It provides service interoperability even between different device families.

Notes

Figure 12.3: Wireless Application Environment (WAE)



The Wireless Application Environment (WAE) is a general-purpose application environment based on a mixture of the World Wide Web (WWW) and Mobile Telephony technologies. The primary objective of the WAE effort is to establish an interoperable environment that will allow operators and service providers to build applications and services that can catch a wide variety of different wireless platforms in an efficient and useful manner. WAE includes a microbrowser environment containing the following functionality:

- ***Wireless Markup Language (WML):*** It is a lightweight markup language, analogous to HTML, but optimized for use in hand-held mobile terminals.
- ***WML Script:*** It is a lightweight scripting language, analogous to JavaScript.
- ***Content Formats:*** It is set of well-defined data formats, including images, phone book records and calendar information. The application environment is modeled for use with mobile devices that have limited input keys. The WAE plays the role of host for the WAP browser. WAE functions include Wireless Markup Language (WML), WML Script Language, and Telephony Applications. This layer manages the data formats and communication between received content and other device functions. The other WAP layers deal with communications between the mobile device and the WAP Gateway Server.

Task Why cannot Internet Standards such as HTML, HTTP and TCP be used over the mobile network?

Mobile-Originated Example of WAP Architecture

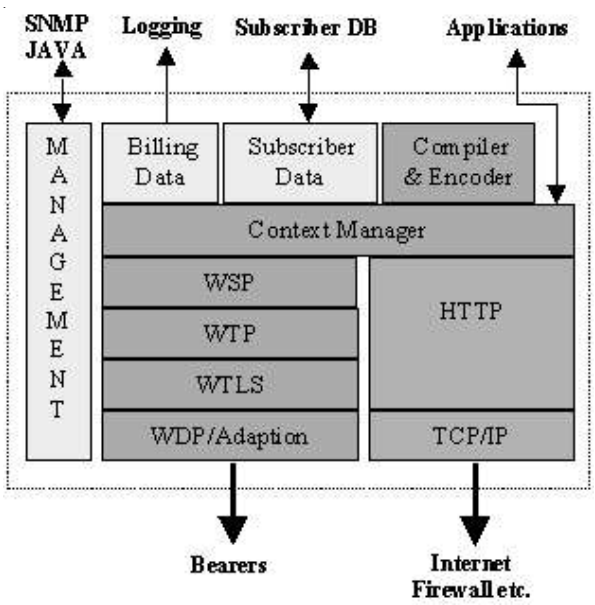
WAP will provide multiple applications, for business and customer markets such as banking, corporate database access, and a messaging interface (see Figure 12.4).

Figure 12.4: Messaging Interface

Notes

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 12.5).

Figure 12.5: 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.

The Transport layer protocol in the WAP architecture is the Wireless Datagram Protocol

(WDP). The WDP layer operates above the data capable bearer services aided by various network types.

As a general transport service, WDP offers a consistent service to the upper layer protocols of WAP and interact transparently over one of the available bearer services.

Since the WDP protocols offer a common interface to the upper layer protocols the Security, Session and Application layers area able to function independently of the underlying wireless network. This is achieved by adapting the transport layer to specific features of the underlying bearer.

By keeping the transport layer interface and the fundamental consistent, global interoperability can be achieved using mediating gateways. 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.

The Wireless Datagram Layer (WDL) is the lowest layer of the WAP protocol stack. This layer controls the flow of data from various bearer networks to the upper levels of the WAP protocol stack in the mobile device/WAP Gateway.

WDP contains various protocols for each bearer network supported. Use of mobile devices may entail transmission of data over various bearer networks during the same session. WDP is the single interface supporting data recognition for the upper layer protocols.

Notes

Notes WDP enables mobile devices to operate independently of the design of the bearer network sending the data.

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.

WTLS is a security protocol based upon the industry standard Transport Layer Security (TLS) protocol, formerly known as Secure Sockets Layer (SSL). WTLS is intended for use with the WAP transport protocol and has been optimized for use over narrow-band communications channels. WTLS provides the following features:

- ***Data integrity:*** WTLS ensures that data sent between the terminal and an application server is unchanged and uncorrupted
- ***Privacy:*** WTLS ensures that eavesdropping of information by unauthorized persons is prevented.
- ***Authentication:*** WTLS ensures the authenticity of the terminal and application server.
- ***Denial-of-service protection:*** WTLS contains facilities for detecting and rejecting data that is replayed or not successfully verified. WTLS makes typical denial of service attacks harder to accomplish and protects the upper protocol layers.

WTLS may also be utilized for secure communication between terminals, e.g., for authentication of electronic business card exchange.

Applications are able to selectively activate or disable WTLS features based on their security needs and the characteristics of the underlying network. Wireless transport layer security (WTLS), an optional security layer, has encryption facilities that offer the secure transport service by many applications, such as e-commerce.

Similar to WTP, WLTS is enabled for suspend and resume mobile sessions. WTLS uses certificates, data encryption and regular renewal of encryption keys.

Notes Interestingly, this protocol is optional. Some providers may choose to sacrifice security for bandwidth.

WTP

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

The Wireless Transaction Protocol (WTP) runs on top of a datagram service and provides a lightweight transaction-oriented protocol that is suitable for implementation in "thin" clients (mobile stations). WTP operates efficiently over secure or non-secure wireless datagram networks and provides the following features:

- Three classes of transaction service
- Unreliable one-way requests
- Reliable one-way request

Notes

- Reliable two-way request-reply transactions
- Optional user-to-user reliability: WTP user triggers the confirmation of each received message
- Optional out-of-bound data on acknowledgements
- PDU concatenation and delayed acknowledgements to reduce the number of message sent
- Asynchronous transactions

Did u know? **What are the functions of Wireless Transmission Protocol?**

The Wireless Transmission Protocol (WTP) aids reliable transaction management and data exchange with the upper layers of the WAP layers. The "transaction" in this context is the unique pairing of device client requests with content server response.

This protocol monitors message status and resends messages as necessary. This reliable message exchange is accomplished by sending acknowledgement messages for data. If the message is not acknowledged within "x" period, the message is resent until acknowledged. WTP also prompts the mobile user to confirm receipt of data.

WSP

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

The Wireless Session Protocol (WSP) offers the application layer of WAP with a consistent interface for two session services.

- The first is a connection oriented service that operates above the transaction layer protocol WTP
- The second is a connectionless service that operates above a secure or non-secure datagram service (WDP)

The Wireless Session Protocol currently consists of services suited for browsing applications (WSP/B). WSP/B provides the following functionality:

- HTTP/1.1 functionality and semantics in a compact over-the-air encoding
- Long-lived session state
- Session suspend and resume with session migration
- A facility for reliable and unreliable data push
- Protocol feature negotiation

The protocol in the WSP family is optimized for low-bandwidth with relatively long latency. WSP/B is modeled to permit a WAP proxy to connect a WSP/B client to standard HTTP server. The Wireless Session Protocol (WSP) manages the exchange of interaction between the mobile devices and the WAP Gateway, as well as the sessions between the two devices. WSP supports the operation of the micro browser on the mobile device.

WSP includes HTTP 1.1 semantics. This eases the two-way transaction between the WAP Gateway and Web Server.

The WAP Gateway translates WSP requests from the mobile device and sends them to a Web Server. In the return of data from the Web Server, the WAP gateway translates the Web Server's HTTP data into WSP format before sending it forward to the mobile device. The WAP session

Notes

protocol (WSP) layer offers a lightweight session layer to permit efficient exchange of data across applications.

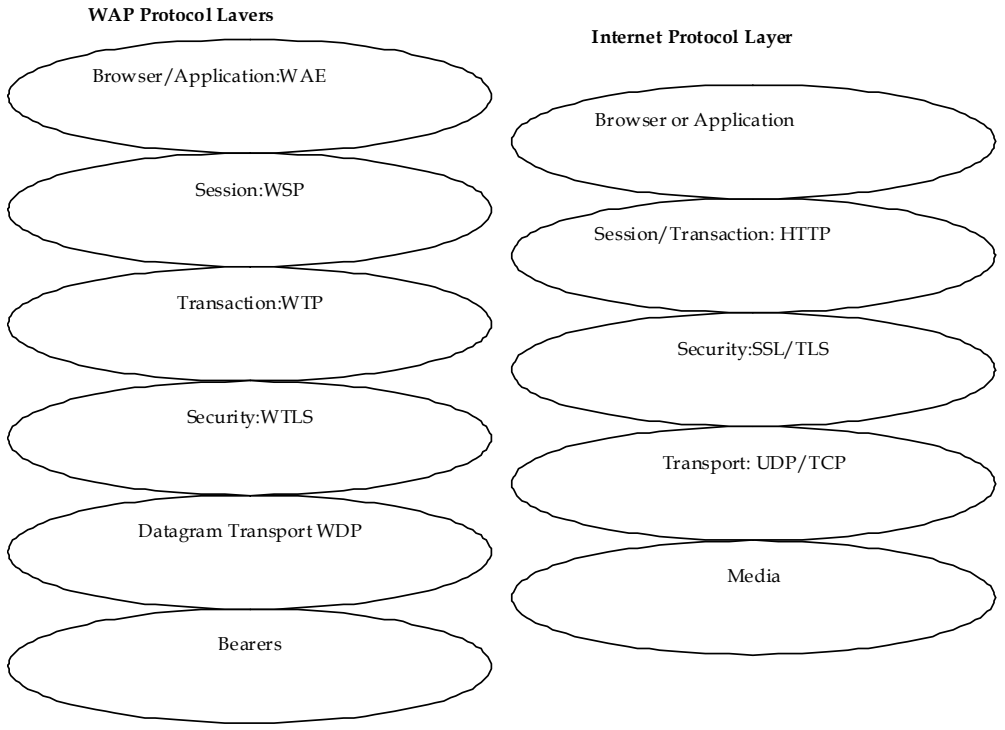
Task What does denial of service protection mean? How is it accomplished in the WAP architecture?

12.2.2 Comparison between WAP and Internet Protocol Layers

WAP architecture offers scalable and extensible environment for application development for mobile communication devices. This is achieved through the layered design of the entire protocol stack. Each of the layers of the architecture is accessible by the layers above, as well as by other services and applications.

A pictorial comparison between WAP and the Internet Protocol Layers is given in Figure 12.6.

Figure 12.6



The WAP layered architecture enables other services and applications to utilize the features of the WAP stack through a set of well-defined interfaces. External applications may access the session, transaction, and security and transport layers directly. The following sections provide a description of the various elements of the protocol stack architecture. These layered applications are symmetric; they reside both on the client device and the WAP Gateway. This layered structure is very similar to the Internet Protocol Stack.

Bearers

The WAP protocols are modeled to operate over a variety of bearer services, including short message, circuit-switching data and packet data. The bearers offer differing levels of quality of

Notes

service with respect to throughput, error rate and delays. The WAP protocols are modeled to substitute for or tolerate these varying levels of service.

Since the WDP layer offers the convergence between the bearer service and the rest of the WDP stack, the WDP specification lists the bearers that are aided and the techniques used to permit WAP protocols to run over each bearer. The list of aided bearers will change over time new bearers being added as the wireless market evolves.

Self Assessment

Fill in the blanks:

5. WAP defines a set of standard components that enable communication between mobile terminals and ……
6. WAP communication protocols enable the communication of …… requests from the mobile terminal to the network web server.
7. The WAP content types and …… have been optimized for mass market, hand-held wireless devices.
8. The protocol gateway translates …… from the WAP protocol stack (WSP, WTP, WTLS, and WDP) to the WWW protocol stack (HTTP and TCP/IP).
9. The …… is a general-purpose application environment based on a mixture of the World Wide Web (WWW) and Mobile Telephony technologies.
10. The Transport layer protocol in the WAP architecture is the ……
11. WTLS is a security protocol based upon the industry standard Transport Layer Security (TLS) protocol, formerly known as ……
12. …… contains facilities for detecting and rejecting data that is replayed or not successfully verified.
13. The WAP Transaction Protocol (WTP) layer provides transaction support, adding …… to the datagram service provided by WDP.

12.3 Session Management

In order to tailor your WAP application to a user, you will need to create a software session in which you can store context information. This session may contain the name of the user and any data that he generates during his visit, such as items in a shopping cart.

WAP has no support for application sessions built in to its definition. You will have to manually create them by authenticating the user and tracking his progress. The next few sections will address how to do this, but it should be remembered that the WML applications should be as simple as possible to use – you should minimize the information burden you place on the user.

12.3.1 Client Authentication

There are two main ways to authenticate a user for your application: manually in a deck or with built-in Web server basic authentication. The former requires that you create a user database with login names and passwords, while the latter requires that you use a user database that your Web server can access. To create a manual authentication deck, you simply need to ask the user for his name and password and then pass him on to the deck he wanted originally. This is a very simple process in most cases. An alternative approach to creating your own authentication mechanism is the built-in facility in the Web server. This built-in facility is Basic Authentication – HTTP supplies it in IETF RPC 2617.

Notes

The Web browser and server implement the Basic Authentication scheme below the application layer. To understand how this works, let's look at the communication pattern between the browser and sever. The Web server generates a response code for each HTTP request that it sees. Often this response code is "OK", however, when the request is for a page that is protected, the response code tells the browser to challenge the user for his identity.

This identity challenge tells the browser, HTML or WML, to prompt the user for his username and password. The browser then sends this information back to the Web server immediately and the server attempts to verify the information. When the user supplies authentic information to the challenge, the Web server responds with the "OK" and the originally requested page. When the user fails to supply a valid combination of username and password, the Web server responds with the response code "Forbidden" and does not send the page.

In order to implement the Basic Authentication facility, the Web server requires a user directory. This user directory might be unique to your Web application or a shared corporate directory. Directory services vary widely between Web servers; Microsoft IIS integrates natively with the Microsoft Active Directory, while Netscape Enterprise Server uses Netscape Directory Server.

Once authentication is successful, each subsequent request from the browser to the Web server includes the username and password of the user. The Web server then creates an application variable for the Web application called REMOTE_USER containing the name of the user.

In addition to using a manual authentication structure or Basic Authentication, you may be able to take advantage of platform-specific identification information.

Example: The WAP gateway that Phone.com delivers sends an HTTP variable that is unique to the wireless device making the request. This variable is named HTTP_X_UP_SUBNO and is tied directly to the device; the gateway constructs it from the wireless connection. You may be able to take advantage of this server variable in your application.

12.3.2 WML for Secure Applications

When creating WML decks, you have a few techniques available to ensure that sensitive information does not leave the secure communication channel between the user and your application. You can protect your decks from attacking applications using the access element and the sendreferer attribute of the goelement.

WML allows you to tell the browser to keep other applications from linking into decks within your application. That is, WML provides you the access element in which you specify where the linking deck must live in order to reference your deck successfully.

You can add the access element to the <head> tag of any deck. The absence of the <access> tag allows any deck to reference that deck. When configuring the element, you should specify the path and domain attributes. The domain attribute controls the set of Web servers that can link into your application.

The path attribute restricts access within a domain in order to thwart cross- application linking. It permits any decks in a more specific path access.

The sendreferer attribute of the go element is quite simple to use – it can only be set to true or false. This attribute instructs the browser to send along the HTTP variable describing the deck that makes a request, when it is set to true. You can then decide, in you application logic, whether to permit the linking deck access by checking this variable. Unfortunately, the sendreferer attribute defaults to the false value, suppressing this valuable information.

Notes

Notes You should get into the habit of specifying this attribute as true each time you create a go element, even if you don't need access control immediately.

12.3.3 Cleaning Up

There is one last thing that you must take care of when you create an application that handles sensitive information: you must clean out your variables. This is critically important when you create decks that retrieve passwords, and social security numbers, for example. You cannot leave the data that the user enters into the browser in memory since the next deck may be able to access it and deliver it to another application against the user's wishes.

In order to clear out the variables before using them, you should use the on enter forward event, refresh, and setvar elements. You should make sure that each time you retrieve data from the user and leave the deck; you also clear out the in-memory data. You can simply do this with the setvar element at the exit point of the program setting all variables back to null. This is a good habit to get into, not only for sensitive data, for all data your deck uses.

Self Assessment

Fill in the blanks:

14. The ……. attribute of the go element is quite simple to use – it can only be set to true or false.
15. The ……. attribute restricts access within a domain in order to thwart cross-application linking.

Caselet

Tikona Rolls out Wireless Broadband in 50 Cities on Unlicensed Spectrum

At a time when most telecom operators are awaiting auctions for 3G and broadband spectrum, Mumbai-based Tikona Digital Networks has launched wireless broadband services across 10 cities utilising unlicensed air waves.

The company, which has an Internet Service Providers' licence, plans to expand its presence to 50 cities by the end of this year with an investment of ₹ 500 crore.

Tikona is deploying the wireless broadband services on the Multiple-Input and Multiple-Output (MIMO) platform using about 110 Mhz of free spectrum in 2.4 Ghz and 5.8 Ghz frequency bands. Though there are multiple users on this band, Tikona claims that it has taken care of interference issues through a unique network architecture.

The company has partnered with global equipment vendors including Cisco and Ruckus Wireless to offer the service. Tikona is the first player to use MIMO platform in India.

Subscribers can get up to 2Mbps speeds, which is the fastest wireless broadband services in the current market. Monthly charges vary between ₹ 299 and ₹ 1,249 depending on the free download allowed. Customers will also have to pay ₹ 500 as installation charges. Tikona

Contd...

Notes

offers a Circuit Breaker feature which enables subscribers to set a maximum amount they want to spend in a month for the service.

With WPA 2 and 802.1X provisions it offers the high level of security available on wireless network. Mr Prakash Bajpai, Founder, Managing Director and CEO, Tikona Digital Networks, said, "The current broadband internet scenario is similar to what the mobile scenario was 10 years ago. India has just a little under 10 million broadband while China has more than 120 million broadband. Wireless broadband is the only option for India to increase its broadband base to levels that are similar to China's."

12.4 Summary

- This intro to wireless networking setup and security is written with the assumption that the reader has a basic understanding of wired networks, because in terms of protocol, wireless works almost the same way.
- The difference is in the wireless component and associated hardware configuration.
- The WAP specification standardizes a set of protocols intended to send content to mobile devices like cellular phones, pagers and personal digital assistants (PDAs).
- It defines application environment and transport protocols. It utilizes present Internet technologies and many of its components.
- The WAP application is developed taking into account the limitations of the handheld devices.
- WAP has no support for application sessions built in to its definition.
- You will have to manually create them by authenticating the user and tracking his progress.
- The next few sections will address how to do this, but it should be remembered that the WML applications should be as simple as possible to use – you should minimize the information burden you place on the user.

12.5 Keywords

PDAs: personal digital assistants

SSL: Secure Sockets Layer

TLS: Transport Layer Security

WAE: Wireless Application Environment

WDL: Wireless Datagram Layer

WDP: WAP Datagram Protocol

WTLS: Wireless Transport Layer Security

12.6 Review Questions

1. How does communication between the mobile terminals and network servers take place?
2. What is WML? How does it differ from HTML?
3. What are the functionalities of the WAP proxy? What does the WAP gateway do?

Notes

4. WAP content and applications are specified in a set of well-known content formats based on the familiar WWW content formats. Explain.
5. WAP is a communication protocol and also application environment. Discuss.
6. WAP utilizes proxy technology between the wireless domain and the WWW. Comment.
7. The content encoders translate WAP content into compact encoded formats to limit the size of data over the network. Give reasons.
8. The WAE plays the role of host for the WAP browser. Give reasons to support your answer.
9. WAP will provide multiple applications, for business and customer markets. Comment.
10. WML allows you to tell the browser to keep other applications from linking into decks within your application. Explain.

Answers: Self Assessment

1.	Wireless Transport Layer Security (WTLS)	2.	unique
3.	WPA2	4.	MAC address
5.	network servers	6.	browser
7.	protocols	8.	requests
9.	Wireless Application Environment (WAE)	10.	Wireless Datagram Protocol (WDP)
11.	Secure Sockets Layer (SSL)	12.	WTLS
13.	Reliability	14.	Sendreferer
15.	path		

12.7 Further Readings

Books

Demon Hougland, *Essential WAP for Professional*, 2001, Prentice Hall PTR.

Paul Wallace Andrea Hoffmann, *Mika Tuppola, I – Mode Developer Guide*, 2002, Addison- Wesley Professional.

Online links

http://www.informit.com/articles/article.aspx?p=30938&seqNum=2

http://www.yellowtom.co.uk/159856

Notes

Unit 13: Writing for HTML and WML

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13.1 Why two Languages?

13.2 Difference between HTML and WML

13.3 How to Write for both Languages

13.4 Database Driven Application

13.5 Other Languages

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13.7 Keywords

13.8 Review Questions

13.9 Further Readings

Objectives

After studying this unit, you will be able to:

- Scan HTML and WML
- Describe how to write for both languages
- Demonstrate database driven application
- Recognize other markup languages

Introduction

WML is the wireless equivalent of HTML for the Web. WML is based on XML and derived from xHTML (the XML version of HTML). There are many differences between WML and HTML.

Example, WML has a different mechanism for linking between its pages called "cards" as compared to linking between HTML pages.

WML browsers are stricter than HTML browsers by not being tolerant of errors. WML browsers enforce the WML requirement of matching closing "tags", an XML characteristic.

13.1 Why two Languages?

The single most popular component of WAP is undoubtedly Wireless Markup Language (WML). WML allows developers to specify how content will be presented to a WAP browser. WML can be compared to HTML in terms of its syntax and functionality, but many differences between the two exist.

In general, HTML (especially in combination with JavaScript) requires more memory and processing power to support a browser than is desirable for a wireless device like a cell phone or PDA. WML strives to be a more viable alternative by stripping out the unneeded features of HTML and enforcing conventions that make pages easier to parse.

Notes

Notes An HTML writer does not worry about screen or display boundaries. Instead, the Web browser manages issues relating to the screen boundaries. But a WML writer must be aware of screen boundaries of WAP devices when writing code for cards.

WML Syntax

WML supports a tag-based syntax just like HTML. Many tags with the same name can be found in both languages, although the behavior of these tags may differ:

<a>

<input>

<select>

WML attempts to improve on the inconsistent syntax seen in much of today's HTML. WML generally requires stricter conformance to standards — specifically the inclusion of end-tags or closed empty-element tags. For example, the tag must always be followed by a matching tag (or else the page will not display). Tags without a matching end tag, such as br, must incorporate the ending slash as follows:

Because WML is a subset of XML designed for XML parsers, the top of every WML page includes the following header information to specify the Document Type Description (DTD):

<?xml version="1.0">

<!DOCTYPE wml PUBLIC

"-//WAPFORUM//DTD WML 1.1//EN"

"http://www.wapforum.org/DTD/wml_1.1.xml">

WML Cards and Decks

The most apparent difference between WML and HTML source files is the concept of WML cards and the <card> tag. Cards effectively implement multiple WML screens within a single page. WAP browsers display only one card at a time, but they load a page file (called a deck) that contains multiple cards in one transaction.

Loading multiple cards at once caches potential screen views locally on the WAP browser to reduce the need for network requests. In addition, one network request to fetch a file the size of a typical HTML page will generally execute faster than a series of requests for much smaller pieces of the file. In these ways, WAP's implementation of cards and desks is a clever optimization of the limited bandwidth on today's wireless networks.

Did u know? **What are the Advantages of WML?**

Like HTML, WML is easy to use. However, compared to HTML, WML has the following advantages in the context of wireless:

Notes

- WML is part of the WAP standard and its use is required.
- Transmission of WML (WMLC) documents requires less bandwidth compared to HTML documents because WML documents are simpler and WML is compressed before it is sent to the WAP device.
- Compared to HTML documents, displaying WML documents requires less processing power and memory. Consequently, a WAP device can work with a less powerful (cheaper) CPU and the use of less power means that the battery can operate longer without recharging.
- WML provides support for limited graphics with a limited gray scale.

Is WML A Programming Language?

Most software developers agree that HTML (by itself, without JavaScript) is only a markup language and not a true programming language. HTML lacks variable assignments, control flow statements, and conditionals. WML, however, is much closer to a programming language if not squarely in that camp.

WML supports variables. The <setvar> tag assigns a value to an alphanumeric name as follows:

```
<setvar name="index" value="1">
```

Accessing a variable in WML is similar to Perl:

```
<a href="page_$(index).wml">Next page</a>
```

WML supports control flow through tasks. It also supports events including timer events with the <timer> tag. These features make things like form validation in the browser easier for developers to implement in WML than HTML. Validating form data in the browser saves bandwidth over the alternative of sending data to the server for validation.

13.2 Difference between HTML and WML

WML (Wireless Markup Language) and HTML (Hypertext Markup Language) are markup languages, the main function of which is to serve content from web sites. The main difference between WML and HTML is the target devices that they aim to serve. HTML was created to serve content to desktop computers, which have a lot of processing power to spare in parsing and rendering the content. When the internet began to expand to mobile phones, it became very apparent that mobile phones do not have the processing power, screen size, and color range to actually work with HTML. Thus, WML was created as an alternative to HTML in serving web content to mobile phones.

Task Like HTML, WML does specify how the content is to be displayed. Analyze

WML is very limited with the things that it can do. This is necessary in order to simplify the flow of the page and to minimize the amount of processing needed in rendering the page. It is also not beneficial to include many or large images into a WML page as it would probably not be discernable on the very small screens of mobile phones. On the other hand, HTML is quite full featured, even in its earlier versions. Coders can place multiple images, animations, frames, tables, and a whole lot more to their pages. Compared to other tasks done with computers, rendering web pages is relatively very simple and would not load the processor too much.

As technology evolves, computers and mobile phones are also getting better and better. Color and high resolution screens become more and more common in mobile phones; especially with smartphones. This improvement means that more phones are able to process HTML pages. The

Notes

problem with small screens is partially solved by providing the user with the ability to zoom in and out of pages. This led to the gradual shift from WML to HTML.

Today WML is rarely used and often just as an alternative to a main page. Smartphones, and even ordinary feature phones, now have the ability to view websites just like as you would on a computer; albeit, on a much smaller screen.

Notes WML is used on phones while HTML is used for desktop clients. HTML requires a lot more processing power than WML. WML is no longer used as much as HTML

WAP/WML	HTML
Markup language for wireless communication	Markup language for wired communication
Makes use of variables	Does not use variables
WML script stored in a separate file	Javascript is embeded in the same HTML file
Images stored as WBMP	Images are stored as GIF, JPEG or PNG
WBMP is a 2 bit image	Size of the images are much larger in HTML
Case sensitive	Not case sensitive
WML has fewer tags than HTML	HTML has more tags than WML
A set of 'WML Cards' make a 'DECK'	A set of 'HTML pages' make a 'SITE'

Self Assessment

Fill in the blanks:

1. WML is the wireless equivalent of HTML for the ……...
2. A Web server may generate WML content for ……... devices or it may simply dish out HTML (XML).
3. WML browsers are stricter than HTML browsers by not being tolerant of …….
4. WML strives to be a more viable ……... by stripping out the unneeded features of HTML.
5. The most apparent difference between WML and HTML source files is the concept of WML cards and the ……... tag.
6. ……... lacks variable assignments, control flow statements, and conditionals.
7. Validating form data in the browser saves ……... over the alternative of sending data to the server for validation.
8. WML is rarely used and often just as an alternative to a ……...

13.3 How to Write for both Languages

The goal of markup languages is to present information across many different systems. Most Web development languages today use markup languages in some fashion. With markup languages, text, tables, images, and user navigation display in a consistent manner. The type of platform that receives the information does not matter.

WML is a markup language and, like other markup languages, it works on several platforms. WML is also compact, working quickly and efficiently. These attributes make WML a perfect language for WAP development.

Notes

If you're familiar with other areas of Web development, you might find several similarities between HTML (the markup language used through Web development) and WML (the markup language used throughout WAP development). Table 13.1 details some of the similarities and differences between HTML and WML.

Did u know? **What are Some Limitations of WML?**

- Like HTML, WML does specify how the content is to be displayed. Thus micro browsers on different WAP devices are likely to display the WML content differently.
- WAP devices such as WAP phones will not accept large decks (1.4K for some WAP phones).

If you've never looked at HTML or WML before, don't worry about this table. By the time you're finished with this book, you'll have a thorough understanding of the information in Table 13.1.

Table 13.1: Similarities between HTML and WML

Feature	HTML	WML	Example
Opening and closing tags	?	?	<wml>...</wml>
Self-closing tags	?	?	
Attributes	?	?	<card id="Card1">
Nesting elements	?	?	<wml> <card> </card> </wml>
White space	?	?	-<wml> <card>
Images	?	? (WBMP format only)	<wml> <card> <img> </img> </card> </wml>
Nested tables	?		<table> <tr> <td> <table> <tr> <td> </td> </tr> </table> </td> </tr> </table>
Heading levels	?		<html> <body> Heading 1 </body> </html>
Nested scripting languages	?		<html> <body> <language = "vbscript"> </body> </html>

Notes

Self Assessment

Fill in the blanks:

9. The goal of markup languages is to present …… across many different systems.

10. In HTML, only the …… reads and deciphers the meanings of certain codes.

13.4 Database Driven Application

- ***AVIDWireless:*** AVIDRapidTools (ART) is a Java component that allows development of WAP/WML, i-Mode/MS Mobile Explorer/CHTML, Palm VII/PQA and HTML wireless applications. It works with Java Servlets, JDBC and J2EE. ART allows IT developers to rapidly develop wireless applications connecting to legacy database systems. ART handles all of the wireless networking protocols allowing developers to focus on their application. This allows projects to be completed in days rather than weeks.
- ***Coldjava:*** Java Servlets Office Suite (JSOS). This product is a collection of Java servlets and JSP "out of the box" ready for building web-pages. JSOS plays the same role as a set of CGI scripts and can be used by webmasters for adding dynamic capabilities to their sites. JSOS has a rich set of servlets such as Message Board, Chat, Calendar etc. And now WAP/WML is also supported.
- ***Columbitech WAP Connector:*** Columbitech offers a WAP server solution for true end-to-end security. The product is designed for maximum security, ease of use, and flexibility. Columbitech WAP Connector is used as a plug-in to an existing Windows based web server, turning it into a WAP server. A Non-Secure Edition of Columbitech WAP Connector as well as a WAP Mail application for Microsoft Exchange is available for free download from Columbitech's web site.
- ***Dejima, Inc.:*** Dejima provides a powerful agent-oriented software architecture and a visual SDK for the creation of natural language front ends for wireless and wireline apps. It is grammar independent and therefore the non-linguist developer can quickly develop NLIs in any language very quickly.

Did u know? **What is White Space?**

White Space is a generic term for characters in a WML code that serve to break it up visually, but has no meaning as far as WML is concerned. White space represents spaces, tabs, line breaks, and so on. WML follows the XML rules as far as white space is concerned.

- ***EZOS MoByKit WAP Engine:*** WAP engine for manufacturers of electronic appliances who want to quickly integrate WAP technology into their platform. The WAP engine is platform-independent (Written in C).
- ***Electronic Workforce:*** Edify's award winning development and run time tool, Electronic Workforce, allows rapid development of applications. Content can be rendered into WAP, iMode, SMS or any other major wireless channel, as well as Web, Email, Fax and Voice channels, all on the same platform
- ***Enlightment Entertainment Ltd:*** Enlightment Entertainment is a developer of WAP games. We have our own WAP game development platform and WAP adventure creation kit.
- ***Ericsson WAP IDE:*** The WapIDE SDK is an Integrated Development Environment for developing WAP Services. It consists of three main components: WAP Browser, Application

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Designer and Server Toolset. The WapIDE SDK 2.1 release supports WML 1.1 and WML Script 1.1 as proposed in the specifications from Wap Forum, dated June 16, 1999.

- ***JAWAP:*** JAWAP (Java Application Framework) contains a framework of Java code that facilitates the task of designing dynamic WAP Applications as Java servlets. This enables deployment of WAP applications in Java server environments and supports distribution of application logic using Java RMI.
- ***Nokia WAP Toolkit:*** To assist developers in producing WAP applications and WAP services Nokia has developed a toolkit. The Nokia WAP Toolkit provides a development environment for people who want to provide Internet services and content for mobile terminals. It will allow developers to write, test, debug, and run applications on PC-based simulations of both the Nokia 7100 series phone as well as a Nokia concept phone prototype.
- ***Orsus iGlue:*** Orsus provides a graphical integrated development environment that can extend any function on content on the we today to wireless devices extremely quickly by capturing business process.
- ***SmartWAP:*** SmartWAP is a WAP Development Library written in Java. It was designed by WAP veterans with a simple idea of making development fast, easy, bug-proof and keeping you away as much as possible from dealing with diversity of mobile phones and WAP browsers.
- ***SmartWAP Benefits include:*** SmartWAP provides solution for multiple mobile phones/ browsers support – no more replication of code. - SmartWAP dramatically reduces amount of code to be written by using library building blocks. - SmartWAP reduces time spent debugging WML – WML is produced by library components pre-tested against WML DTD. - SmartWAP is run-time optimized – correctness of produced code is ensured by object hierarchy rather than run-time verification. - SmartWAP provides comprehensive extensible programming model – new browsers can be plugged in seamlessly. - SmartWAP takes care of WML versions for you. - Provides Pure Java access to Phone.com push service

Task SmartWAP provides comprehensive extensible programming model. Analyze

- ***Syclo:*** Agentry connects the components of a successful mobile strategy: enterprise applications, internet content, wireless networks, and mobile devices.
- ***WAPobjects:*** The WAPobjects framework links application logic and WAP devices. WAPobjects integrates into the WebObjects development environment and allows rapid development of complex database driven applications with its ready-to-use components. Performance, scalability and availability are guaranteed by the WebObjects Application Server, which has been awarded "Software Product of The Year 1999" by Network Computing.
- ***WAPtelnet:*** WAPtelnet is a Telnet client for WAP mobiles. One can use WAPtelnet to connect via WAP enabled devices to UNIX boxes, routers and all the other machines that understand the Telnet protocol. WAPtelnet allows remote administration for sysadmins from every place where a WAP phone works - football stadiums, opera houses, conference meetings, tramways, whatever places you can imagine.
- ***WaveDev.com:*** WAP integration and development. Wireless consulting and system design. Free WML creation tool.
- ***bSmart.to Master Browser:*** A key element of the patented* bSmart.to Smartphone browser is that it enables specific screens tailored to the specific requirements of the customer, to

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be created for each category of information, and for changes only to be updated on the relevant screens, as well as enabling the user to request additional, or new, information by pushing simple function keys. The browser operates through SMS or datacall channels depending on which is most cost effective, and the browser is not limited by the standard size of SMS messages.

Self Assessment

Fill in the blanks:

11. …… allows IT developers to rapidly develop wireless applications connecting to legacy database systems.
12. …… contains a framework of Java code that facilitates the task of designing dynamic WAP Applications as Java servlets.
13. The WAPobjects framework links application logic and ……
14. …… connects the components of a successful mobile strategy.
15. HTML documents need to be well-formed, they can be parsed using standard …….

13.5 Other Languages

HDML

HDML (Handheld Device Markup Language) - often compared to Wireless Markup Language (WML) - is a language that allows the text portions of Web pages to be presented on cellular telephones and personal digital assistants (PDA) via wireless access. Developed by Unwired Planet, HDML is an open language offered royalty-free. According to UP's president Chuck Parrish, any programmer with working knowledge of HTML, CGI, and SQL should be able to write a presentation layer using HDML. One major difference between HDML and WML is that WML is XML-based, while HDML is not. Another difference between HDML and WML is that HDML does not allow scripting, while WML allows it's own version of JavaScript, called WMLScript. Although Unwired Planet has changed their name to Phone.com, specifications for HDML are still available on their Web site in pdf format.

SAML

SAML stands for Security Assertions Mark-up Language. The charter of the group is to define a data format for authentication and authorization assertions, including descriptions of authentication events. The authorization includes group and role membership, profile information et al.

One feature of SAML which could be very valuable for web services is the fact that SAML will allow assertions to be made about anonymous principals, where "anonymous" means that an assertion about a principal does not include an attribute uniquely identifying the principal (ex: user name, distinguished name, etc.).

The SAML messaging protocol allows push and pull model. It also has the notion of security zones, which is good for the syndicated/aggregated services. We could have one zone for syndication and another for external interaction thru the XML bus.

Notes

Caution SAML will define bindings for browser, HTTP, MIME, XMLP and ebXML.

XHTML

XHTML (eXtensible HyperText Markup Language) is a family of XML markup languages that mirror or extend versions of the widely-used Hypertext Markup Language (HTML), the language in which web pages are written.

While HTML (prior to HTML5) was defined as an application of Standard Generalized Markup Language (SGML), a very flexible markup language framework, XHTML is an application of XML, a more restrictive subset of SGML. Because XHTML documents need to be well-formed, they can be parsed using standard XML parsers—unlike HTML, which requires a lenient HTML-specific parser.

XHTML 1.0 became a World Wide Web Consortium (W3C) Recommendation on January 26, 2000. XHTML 1.1 became a W3C Recommendation on May 31, 2001. XHTML5 is undergoing development as of September 2009, as part of the HTML5 specification.

Caselet

PDF, HTML Files

What do terms such as pdf file, html, etc., mean? How does one convert these into text files? Please explain.

S. Krishnamoorthy

A PDF file is a Portable Document Format file. It can be viewed from any PDF reader application such as Adobe Acrobat Reader.

Any document that has to be distributed across multiple platforms will be made a PDF file and distributed. The advantage of this is that any PDF reader is sufficient to view and print the document and it is freely available.

If the document is sent in any other format other than the relevant application, you should have the fonts installed. Most manuals are sent as PDF files.

An HTML file is a Hyper Text Markup Language file. It can be viewed from any Web browser such as Internet Explorer, Netscape, etc. HTML document is used in the Internet.

You can open the HTML file in a browser and from the browser it can be saved as Text file.

For some pages, the file of text format is not the same as it appears in the browser. Similarly a PDF file can be saved as Text Format from a PDF application such as Adobe Acrobat. Acrobat Reader 7.0.7 full version can be downloaded from this URL: http://www.softwarepatch.com /graphics/acrobatreader7.html

Only a PDF reader is freely available on the Internet.

If you want to create a PDF document, you will need to buy a licensed application such as Adobe Acrobat or any third party applications.

Notes

13.6 Summary

- The Wireless Markup Language is a simple markup language that was designed exclusively for the purpose of creating applications to be sent over wireless networks to WAP - enabled mobile devices.
- WML is an open standard and was developed by the WAP forum and the WML specification forms a part of the broader WAP specification.
- WML is an application of XML. WML has some distinct differences from other markup languages, for instance HTML.
- HTML was created to serve content to desktop computers, which have a lot of processing power to spare in parsing and rendering the content.
- When the internet began to expand to mobile phones, it became very apparent that mobile phones do not have the processing power, screen size, and color range to actually work with HTML.
- Thus, WML was created as an alternative to HTML in serving web content to mobile phones.
- WML looks quite like HTML, but there is a significant difference between them.
- HTML is mainly used for creating documents, which in turn are being designed to display information.
- But WML is being used for creating applications, which are designed for user interaction.
- HDML (Handheld Device Markup Language) – often compared to Wireless Markup Language (WML) – is a language that allows the text portions of Web pages to be presented on cellular telephones and Personal Digital Assistants (PDA) via wireless access.
- The SAML messaging protocol allows push and pull model. It also has the notion of security zones, which is good for the syndicated/aggregated services.
- While HTML (prior to HTML5) was defined as an application of Standard Generalized Markup Language (SGML), a very flexible markup language framework, XHTML is an application of XML, a more restrictive subset of SGML.

13.7 Keywords

ART: AVIDRapidTools

HDML: Handheld Device Markup Language

JAWAP: Java Application Framework

JSOS: Java Servlets Office Suite

PDA: Personal Digital Assistants

SAML: Security Assertions Mark-up Language

XHTML: eXtensible HyperText Markup Language

13.8 Review Questions

1. The main difference between WML and HTML is the target devices that they aim to serve. Explain.

Notes

2. WML allows developers to specify how content will be presented to a WAP browser. Discuss.
3. WML can be compared to HTML in terms of its syntax and functionality, but many differences between the two exist. Comment.
4. Explain how loading multiple cards at once caches potential screen views locally on the WAP browser to reduce the need for network requests?
5. WML attempts to improve on the inconsistent syntax seen in much of today's HTML. Discuss.
6. Examine why cards effectively implement multiple WML screens within a single page?
7. WML is a markup language and, like other markup languages, it works on several platforms. Explain.
8. WML is also compact, working quickly and efficiently. Do you agree with this statement? Why or why not? Give reasons to support your answer.
9. The Nokia WAP Toolkit provides a development environment for people who want to provide Internet services and content for mobile terminals. Explain briefly.
10. The SAML messaging protocol allows push and pull model. Comment.

Answers: Self Assessment

1.	Web	2.	WAP
3.	errors	4.	alternative
5.	<card>	6.	HTML
7.	bandwidth	8.	main page
9.	information	10.	web browser
11.	ART		
12.	JAWAP (Java Application Framework)	13.	WAP devices
14.	Agentry	15.	XML parsers

13.9 Further Readings

Books

Demon Hougland, *Essential WAP for Professional*, 2001, Prentice Hall PTR.

Paul Wallace Andrea Hoffmann, *Mika Tuppola, I – Mode Developer Guide*, 2002, Addison- Wesley Professional.

Online links

http://www.peterindia.net/WMLOverview.html

http://www.vijaymukhi.com/documents/books/wap/sec2/chap1/chap1.htm

Notes

Unit 14: Problems for Practice

1. Program to Accept Two numbers and print Sum

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card id="abc">
<p>
Enter the first number:
<input type="text" name="nam"/><br>
Enter the second number:
<input type="text" name="nam1"/><br>
Result:<input type="text" name="message"/><br>
<do type="Calculate">
<go href="two_num.wmls#root()"/>
</do>
</p>
</card>
</wml>
```

2. Program to Accept a numbers and calculate Square

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card id="abc">
<p>
Enter the number:<input type="text" name="nam"/>
<do type="square">
<go href="sq_root.wmls#root($(nam))"/>
</do>
$(message)
</p>
</card>
</wml>
```

3. Example of Simple WML Script

Coding of WML FIle

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card id="abc">
```

Notes

```
<p>
<a href="script.wmls#hello()">Click Here</a>
$(message)
</p>
</card>
</wml>
```

Coding of WMLS (script.wmls)

```
extern function hello()
{
WMLBrowser.setVar("message","How are you!");
WMLBrowser.refresh();
}
```

4. Example of Using DO type Tag In WML

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card title="First Page" id="first">
<do type="Next">
<go href="#second"/>
</do>
<p>
This is first page
</p>
</card>
<card id="second">
<do type="Back">
<go href="#first"/>
</do>
<p>
Hello
</p>
</card>
</wml>
```

5. Example of Using <P> Tag In WML

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card id="HTML" title="HTML Tutorial">
  <p>Our HTML Tutorial is an award winning
tutorial from W3Schools.</p>
</card>
```

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```
<card id="XML" title="XML Tutorial">
  <p>Our XML Tutorial is an award winning
tutorial from W3Schools.</p>
</card>
</wml>
```

6. Example of My First Card In WML

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card title="First Page">
<p>
Hello Everybody
</p>
</card>
</wml>
```

7. Example of Using OPTGROUP Tag In WML

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card id="one">
<p>
<select name="choice">
<optgroup title="food">
<option>Chinease</option>
<option>Indian</option>
</optgroup>
<optgroup title="Cold Drink">
<option>Coke</option>
<option>Pepsi</option>
<option>Fanta</option>
</optgroup>
<optgroup title="Ice Cream">
<option>Strawberry</option>
<option>Venilla</option>
</optgroup>
</select>
</p>
```

8. Example of DECK (Multiple Cards) In WML

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
```

Notes

```
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card id="one" title="course">
<do type="bba">
<go href="#two"/>
</do>
<p> <br/> </p>
<do type="bca">
<go href="#three"/>
</do>
</card>
<card id="two" title="detail">
<p>
this is bba
</p>
</card>
```

9. Example of using Input Tag In WML

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
  <card title="Resume">
     <p>
<b> Name: </b> <input name="s" size="15"/>
<b>  Age:  </b> <input name="a" size="4"/>
      </p>
  </card>
</wml>
```

10. Example of using Hyperlink Tag In WML

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card id="First" title="Information">
<do type="clickhere">
<go href="#second"/>
</do>
</card>
<card id="second" title="hello">
<p>
hello this is my pc
</p>
```

Notes

```
</card>
</wml>
```

11. Example of Anchor Tag In WML

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card title="Messages">
<p>
<anchor>Inbox<br/>
<go href="table.wml"/>
</anchor>
<anchor>Sent
<go href="table.wml"/>
</anchor>
</p>
</card>
</wml>
```

12. Example of ONPICK Event In WML

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card id="one" title="Make ur choice">
<p>
<select name="choice">
<option onpick="#p1" value="BBA">BBA</option>
<option onpick="#p2" value="BCA">BCA</option>
<option onpick="#p3" value="Msc">Msc</option>
</select>
</p>
</card>
<card id="p1" title="Ur choice">
<p>
Your choice is BBA
</p>
</card>
<card id="p2" title="Ur choice">
<p>
Your choice is BCA
</p>
</card>
```

Notes

```
<card id="p3" title="Ur choice">
<p>
Your choice is Msc
</p>
</card>
</wml>
```

13. Example of Using Option Tag In WML

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
 <card id="card1" title="Tutorial">
   <do type="accept" label="Answer">
    <go href="#card2"/>
   </do>
<p><select name="name">
     <option value="HTML">HTML Tutorial</option>
<option value="XML">XML Tutorial</option>
<option value="WAP">WAP Tutorial</option>
   </select></p>
 </card>
<card id="card2" title="Answer">
   <p>You selected: $(name)</p>
 </card>
</wml>
```

14. Example of Using Image Tag In WML

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card title="Picture">
<p>
This is an ".wbmp" image
<img src="bb.wbmp" alt="WML Pic|"/>
</p>
</card>
</wml>
```

15. Example of Table In WML

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
```

Notes

```
<card title="Table">
<p>
<table columns="2">
<tr>
<td>Rollno:</td>
<td>Name:</td>
</tr>
<tr>
<td>001</td>
<td>ABC</td>
</tr>
<tr>
<td>002</td>
<td>PQR</td>
</tr>
</table>
</p>
</card>
</wml>
```

16. Example of Login Form In WML

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
"http://www.wapforum.org/DTD/wml_1.1.xml">
<wml>
<card id="one" >
<p>
Username:<input type="text" name="use"/>
Password:<input type="password" name="pwd"/>
</p>
<do type="login">
<go href="#two"/>
</do>
</card>
<card id="two" >
<p>
hello $(use)
Your password is $(pwd)
</p>
<do type="back">
<go href="#one"/>
</do>
</card>
</wml>
```