CMER

Centre for Mobile Education and Research

Mobile Web Services

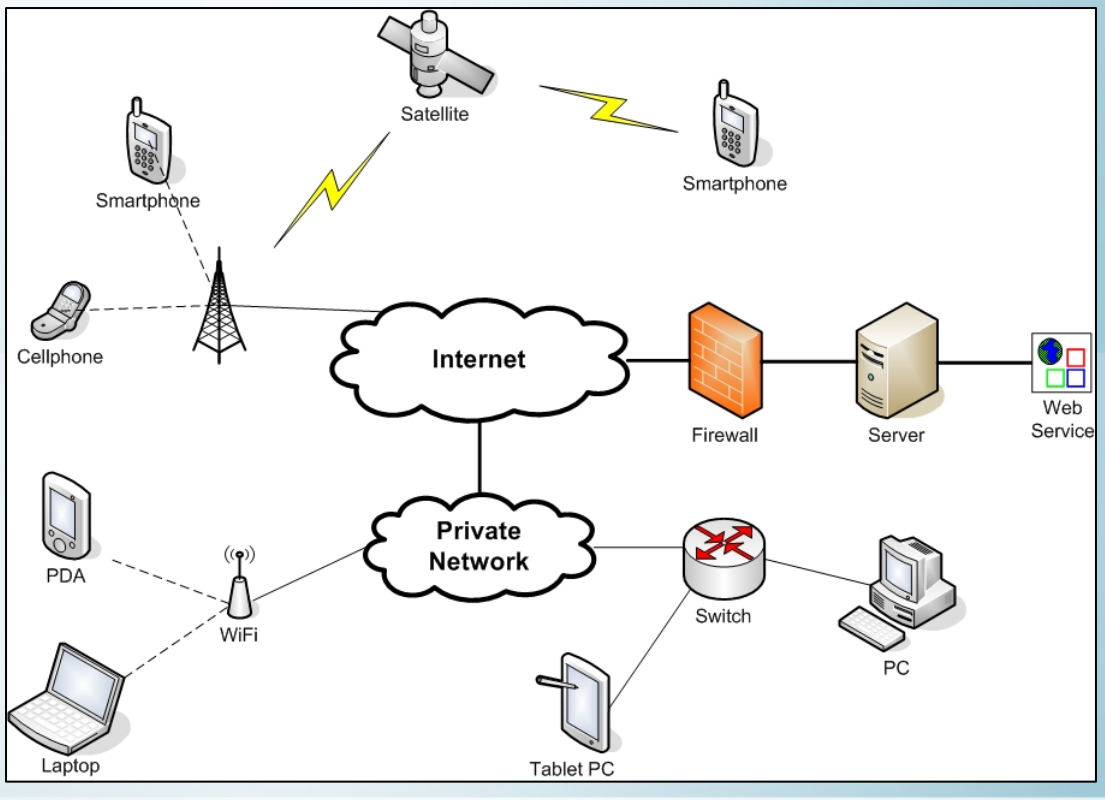
Week II

Overview

- Introduction
- Mobile Limitations
- Mobile Communication Types
- Device Platforms
- Design Considerations

Introduction

- **Web services on mobile devices hold many opportunities and challenges**



Introduction (Cont.)

- The sale of mobile devices has grown rapidly over recent years:
  - **Laptops, notebooks, tablets, PDAs, Smart Phones, Cell Phones**
- Over 3.3 billion mobile subscribers as of November, 2007
- People are becoming mobile offices

Introduction (Cont.)

- Combining mobile devices and web services to offer wireless access to web services
- Provides new services to consumers and enables employees to access Web service-based enterprise applications and data wherever and whenever

Mobile Device Limitations

- **Mobile devices have different properties than PC's, Laptops that need to be taken into account when implementing Web services:**
  - **Processing power**
  - **Memory**
  - **Screen size**
  - **Bandwidth**
  - **Connectivity**
  - **Security**

Processing Power

- XML Parsing requires respectable processing power
- Device Specifications:
  - PC's/Laptops → ~ 2.0GHz
  - PDA's → ~ 400MHz
  - Cell Phones → ~ 200MHz

Memory

- Parsing large amounts of XML can be memory intensive
- Device Specifications:
  - Desktops/Laptops → ~ 2GB
  - PDA's → ~ 128MB
  - Cell Phones → ~ 32MB

Screen Size

- Device Specifications:
  - Desktops/Laptops → ~ 19”
  - PDA’s → ~ 2”
- WAP made it possible to view the Web from a mobile device
  - Mostly strictly text
- New methods for device interaction are making possible for full-on mobile Web browsing
  - Touch screens, advanced keypads

Bandwidth

- Internet-based applications require large amounts of bandwidth
- XML traffic can be heavy and inefficient

- Bandwidth Specifications:
  - **DSL → ~ 256 Kbps to 24,000 Kbps**
  - **WiFi → ~ 54 Mbps**
  - **GPRS → ~ 170 Kbps**
  - **EDGE → ~ 384 Kbps**
  - **EVDO → ~ 2.4 Mbps**
  - **Bluetooth → ~ 2.1Mbps**

Connectivity

- Mobile devices typically rely on wireless mediums for connectivity
  - Cellular Network
  - WiFi
  - Bluetooth
- Mobile devices move in and out of coverage areas
  - Synchronous connections are difficult
  - Moving towards a reliable “Always-on” network

Security

- **Web service security is difficult to implement although specifications are in motion**
  - **WS-Security**
  - **WS-Encryption**
- **Wireless connections are vulnerable to attacks**

Mobile Communication Types

1. Voice
2. Text Messaging
   - SMS
   - EMS
   - MMS
3. Data
   - WAP
   - XHTML
   - SOAP

Voice

- Digital cellular networks use various modulation schemes to encode voice data on to a carrier frequency
  - TDMA
  - FDMA
  - CDMA

Text Messaging

- **There are multiple forms of text messaging:**
  - **SMS (Short Messaging Service)**
    - **“texting”**
    - **160 characters (140 bytes of 7 bit set)**
  - **EMS (Enhanced Messaging Service)**
    - **Standard text combined with:**
    - **Text, pictures, sounds**
  - **MMS (Multimedia Messaging Service)**
    - **a standard which is associated with 3G**
    - **text, pictures, sounds, video**

Data

- There are various language protocols that can be used to send/receive information to/from mobile devices:
  - **WML**
  - **HTML**
  - **SOAP**

WML

- Wireless Markup Language
- A markup language intended for devices that implement the WAP specification
- Necessary for devices with little processing power (Micro Browsers)
- WAP Forum created the WML 1.1 standard in 1998

HTML

- Hyper Text Markup Language
- Gives structure to information
- The predominant markup language of the Web
- Standard HTML/XHTML pages can be accessed via PDA's and Smart Phones
- Not viably viewable from most cell phones due to screen size and processing power

SOAP

- XML-based messaging protocol
- Used by Web services
- Commonly operates over HTTP
- Separates the presentation from the content
- Like HTML, can be cumbersome on mobile devices

Device Platforms

- **Many familiar application platforms have mobile variations that support Web services.**
  - **Symbian**
  - **Java ME**
  - **.NET Compact Framework**
  - **Flash Lite**
  - **BlackBerry**
  - **Linux**
  - **Palm OS**
  - **iPhone OS (no WS support)**

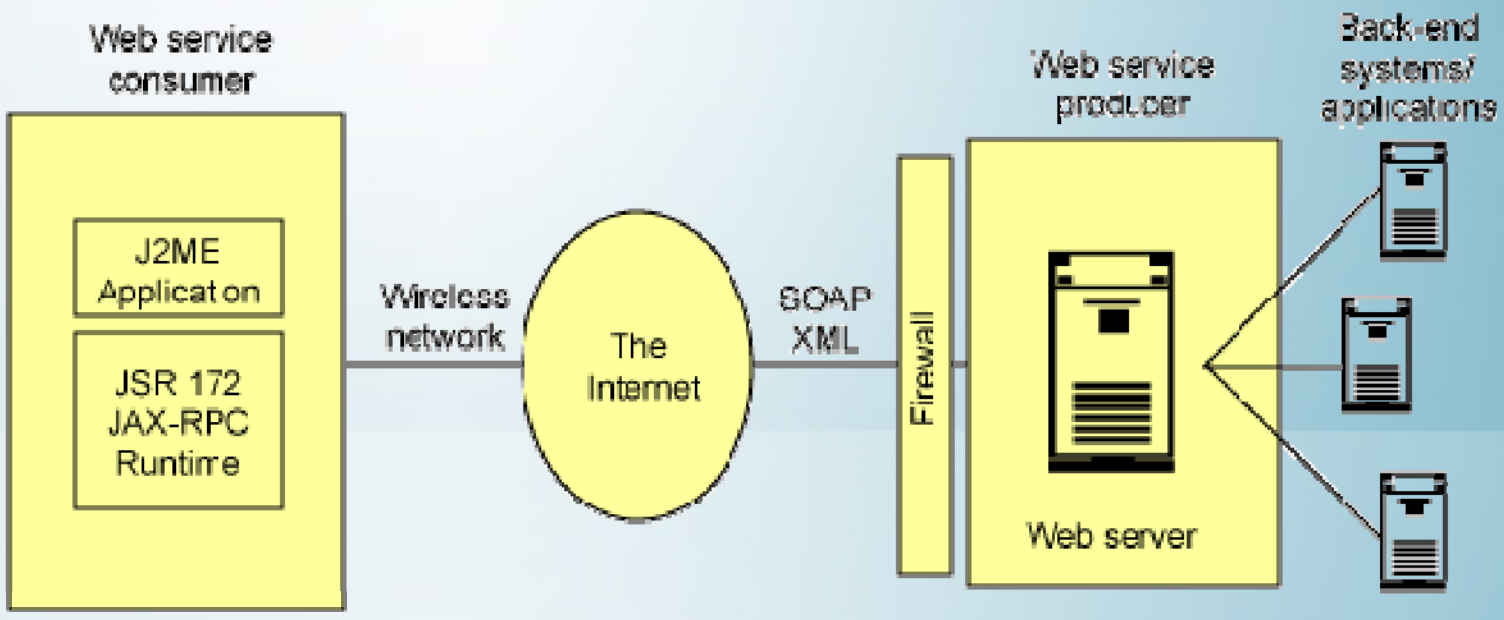
Symbian

- A proprietary OS
- Owned by Nokia, Ericsson, Sony Ericsson, Panasonic, Siemens AG, and Samsung
- Only runs on ARM processors
- Can build Symbian C++ applications through favourite C++ IDE
- Decent support of Web services
  - **Various tools and SDKs**

Java ME

- Widely adopted and embedded into mobile devices
- Development and tools are (for the most part) straight-forward and easy to use
- Much Web service support from development community and third party

Java ME WS Architecture



Java ME WSA

- Web Services APIs
- Optional package that extends the Java Web services platform to include Java ME
- Enable Java ME devices to be Web services clients
- Provides a programming model that is consistent with the standard Web services platform

Java ME WTK

- Wireless Toolkit
- Renamed to Sun Java Wireless Toolkit
- Supports WSA 1.0
- Allows application developers to easily emulate client Web services for MIDP, CDC, and CDLC devices
- Includes emulation environments, performance optimization and tuning features, documentation, and examples

BlackBerry

- Built on Java ME framework
- Provides additional BlackBerry specific tools and API's
- Many available IDE's
  - MDS Studio, JDE, Visual Studio
- Web service support for both standard and enterprise environments
  - BlackBerry proprietary protocol for bandwidth efficiency on enterprise Web services

Linux

- An open source kernel
- Many successful distributions in the PC market
  - Fedora, SUSE, Ubuntu
- Making headway in mobile OS market
  - Android by Open Handset Alliance
- Huge developer community
- Third party APIs

Palm OS

- Provides SDK and simulation tools for Palm OS applications
- Not a large market share
- Third party tools for Web services
  - **WebServices Toolkit for Palm OS (CodeWarrior Platform) 1.51**

.NET Compact Framework

- Robust environment for mobile applications
  - **Visual Studio**
- Has no major share of the mobile phone market but…
- Widely supported on many smart phones and PDAs
  - **Windows Mobile**
- Support for Web services

Flash Lite

- Is becoming broadly accepted by mobile device manufacturers
- Extremely bandwidth efficient
  - Suitable for cellular networks
- Highly interactive
- Support for Web services

iPhone OS

- A proprietary OS
- Designed by Apple for iPhone and iPod Touch
- Derived from Mac OS X
- No support for Web services as of yet

Design Considerations

- Proxies & Gateways
- Device-Based vs. Web-Based
- Mobile Web service support
- Deep nested XML
- Service Granularity

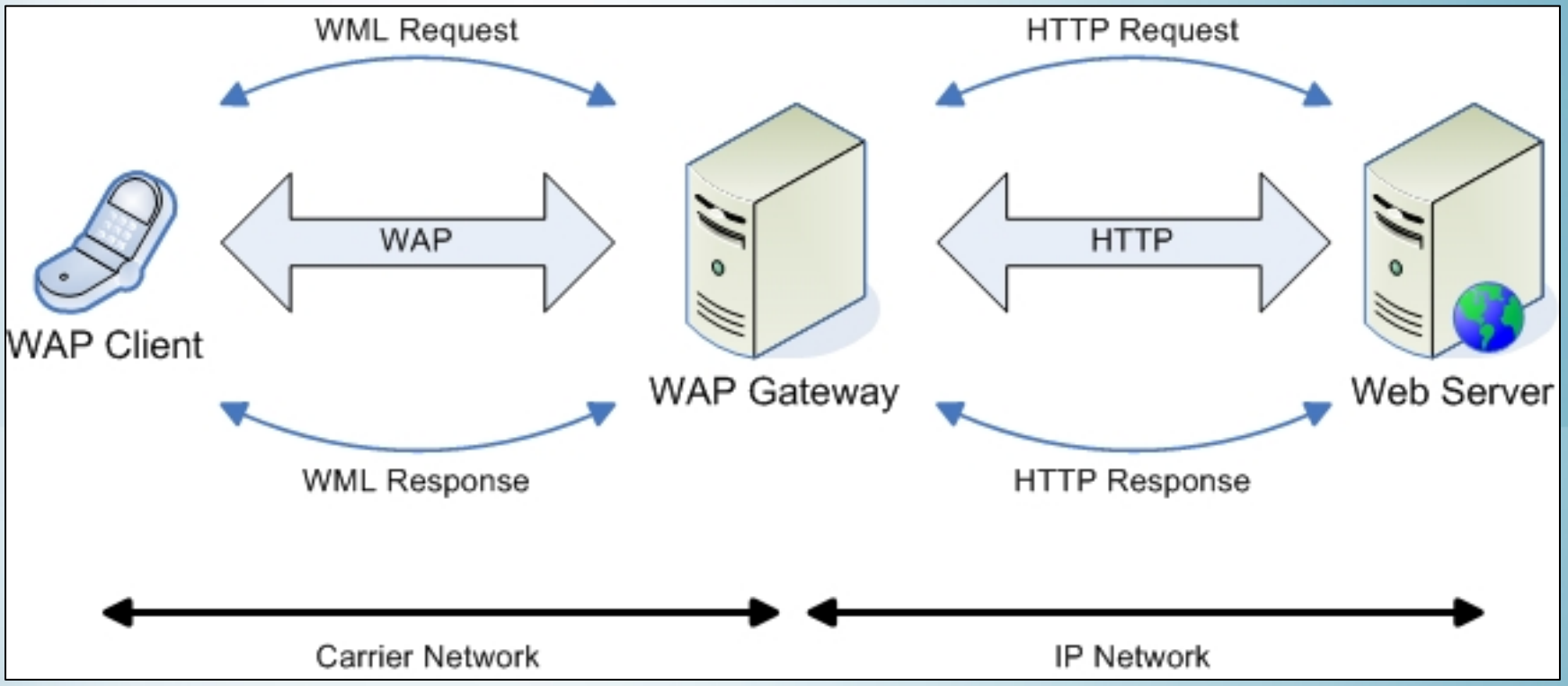
Proxies

- Cache server information
- Can speed up requests by accessing cache instead of re-invoking Web service
- If a device is out of service area the cache can complete request/response when service returns.

Gateways

- WAP Gateway
- Mediates between the cell phone and a Web service.
- Reformats Web service information to WML so that it is more mobile friendly (compact)
- Does the reverse from cell phone to Web service

Gateways


WML Request
HTTP Request
WAP
HTTP
WAP Client
WAP Gateway
Web Server
WML Response
HTTP Response
Carrier Network
IP Network

Device-Based vs. Web-Based

- **Device Application**
  - **Put as little as possible of the client on the mobile unit to serve as a user interface and have all the functionality reside on a server**
  - **Improves performance**
  - **Java ME, .NET Compact, Flash Lite**
- **Web Application**
  - **More accessible but may be bandwidth intensive**
  - **HTML, WML, SOAP**

Mobile Web Service Support

- Older mobile devices likely will not have support for Web services
- Older phones may not be Web enabled
- Many phones may not have access to 3G services

Deep Nested XML

- Avoid deeply nested XML elements that may prolong:
  - Parsing
  - Marshalling
  - Unmarshalling
- A universal design consideration for Web services; more so for mobile Web services because of performance limitations

Service Granularity

- Granularity → Level of detail at which information is viewed or described
- Coarse-grained vs. fine-grained
  - **Course-grained**
  - **Fine-grained**

Fine-Grained

- Fine-grained Web services will break operations down to their most basic components
- Not effective in this case because of the overhead of XML on invocations

Course-Grained

- Course-grained Web services will combine the atomicity of the operations to reduce network latency
- Could save up to 30% processing time

Conclusion

- Mobile access to data is becoming more widespread as an essential service
- Web services seem like a natural solution to Web integration
- Web services have no guaranteed support from Web technologies

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- http://www.ibm.com/developerworks/wireless/library/wi-websvc/