

Advanced Programming Language (630501)
Fall 2011/2012 – Lecture Notes # 3

Wireless Gateway

Outline of the Lecture

- Functionality of a WAP Gateway
- Web Model vs. WAP Model
- Positioning of a WAP gateway in the network
- Gateway examples

Functionality of a WAP Gateway

1. Implementation of "WAP protocol stack" layers.
2. Protocol conversion: WSP \leftrightarrow HTTP.
3. Domain Name resolution.
4. HTML to WML conversion.
5. Encoding of WML Content.
6. WMLScript compilation.
7. Security.
8. Caching for frequently accessed content.

1. Implementation of WAP protocol stack layers :-

Depending on whether the type of service is connection –oriented or connectionless, secure or not secure, the following layers need to be implemented:

a) *Secure connection –oriented :*

WAE-WSP-WTP-WTLS-WDP

b) *Secure connectionless :*

WAE-WSP-WTLS-WDP

c) *Non secure connection –oriented :*

WAE-WSP-WTP-WDP

d) *Non Secure connectionless :*

WAE-WSP-WDP

2. Protocol conversion : WSP \leftrightarrow HTTP :

WSP supports complete **HTTP 1.1**, this include

- a) *request-reply methods : Get, post, ... etc*
- b) *request*
- c) *response*

- d) *Entity headers* like "**Accept: application/vnd.wap.wmlc**"- request header that specifies the **MIME** types that a client can handle.
- e) *Content negotiation* –is the process of selecting the best representation for a client for a given response when there are multiple representations for the same content available from the server.

Entity headers

- **Request header:**
Is a meta information that is sent along with HTTP request.
- **Response Header :**
Is a meta information in a HTTP response that is sent by the server as a response to a previous HTTP request.

WSP Headers

WSP headers are in a compact binary **tokenized form**, as defined in the WAP specification.

Token is a group of characters that has a specific meaning when used together as a string.

Example :

- *In Accept header* →

```
Accept: text/plain,
text/vnd.wap.wml,
text/vnd.wap.wmlscript,
Application /vnd.wap.wmlc,
Application /vnd.wap.wmlscriptc
```

- "Accept:" "plain/text", "text/vnd.wap.wml", etc. are string tokens.
- This header indicates to the server that the client can accept content in any of the above formats, plain text, WML in both compact and text form, WMLScript as text and in its compact form.
 - **WSP representation** (WSP header) for this example will be the following binary token : 6 octets (*6 octets representation*):


```
0x80    0x83    0x88    0x89    0x94    0x95
```
- For MIME type not defined in the WAP specifications, encoding is not done and the textual headers are sending as is.

3. Domain name resolution.

- Resolution of domain names, used in URLs, to IP address is done by domain name server (**DNS**) this is optional if the Gateway uses an HTTP proxy to retrieve the content, in the case of public internet HTTP proxy has the responsibility of resolving internet domain names instead of WAP Gateway in this case .

4. HTML to WML conversion

- a) It is optional feature, this conversion can **never be perfect**, and it will not be rendered probably on a wireless device.
- b) Content providers actually provide WML content **separately**.
- c) Content providers provide **WML & HTML** contents in the same server, and the server looks at the **"user-Agent"** and /or **"Accept:"** HTTP request header to decide which one to send.
- d) Provide content in **XML** and convert this to HTML or WML using **XSLT** for the transformation.

5. Encoding of WML content :-

- This process is known as **tokenization**, during this process, the Gateway checks to verify that the WML content has no errors and is well formatted (*because WML is XML language*)

6. WMLScript Compilation :-

- The compilation of WMLScript on the Gateway involves syntax and semantic checks, and the generation of byte code according to the WMLScript instruction set, it is not entirely analogous to WML encoding, the differences are summarized in the table below

WML Encoding	WMLScript Compilation
<ol style="list-style-type: none"> 1. the structure and content of the WML documents are encoded into standard binary values that have been defined in the specification (octet representation) 2. Encoded WML can be directly used to be reader the content on the device because a one-to-one mapping exists. 	<ol style="list-style-type: none"> 1. WMLScript is compiled in a manner to compilation of programs in other programming languages (all compiler phases present here). 2. the code is similar to Java bytecode (non-existing architecture) The client need to use interpreter to interpret the instruction and execute on the client device

7. security:

- This involves providing WTLS, between the Gateway and the device, and SSL between the gateway and HTTP server.

- It is necessary to use WTLS between the gateway and the device for secure applications, the use for SSL may not be necessary even for secure application; this depends on the position of WAP gateway in the network.

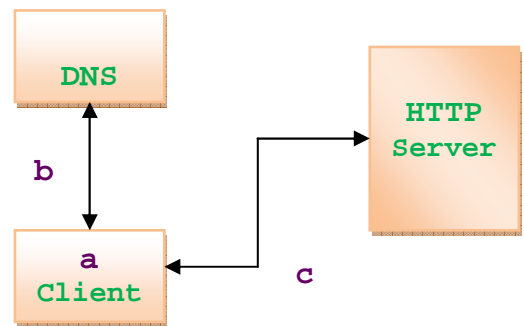
8.provide caching for frequently accessed content

- This functionality is very similar to that of proxy servers, that cache internet content regularly accessed.

Web Model vs. WAP Model

Web Model

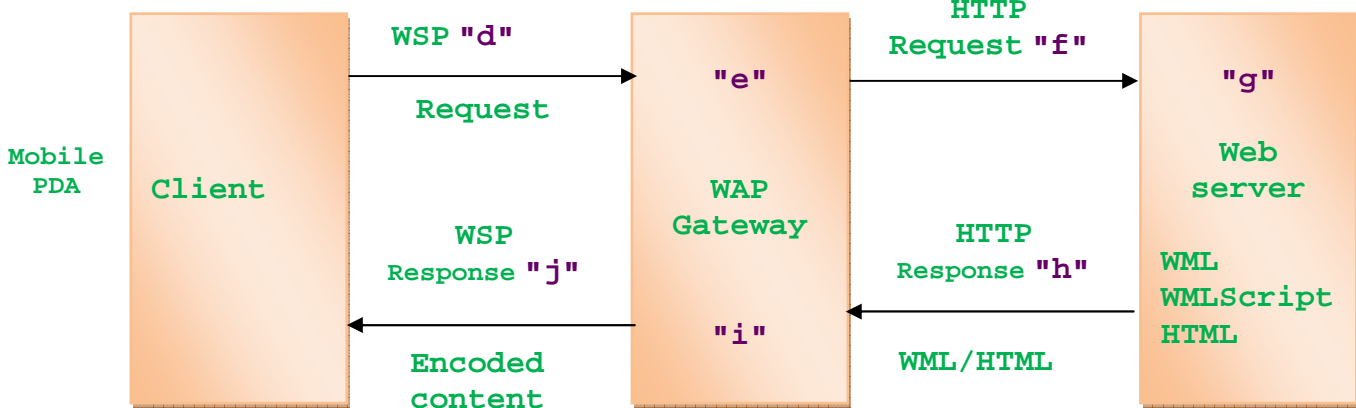
- a) URL Selection.
- b) URL parsing.
- c) TCP connection: request and response.



- if we have HTTP proxy(to increase security and reduce traffic by caching) then the proxy defines from where the response will be rendered (from cache or from server)

WAP Model

"WAP Model"



- d) WSP request is sent to WAP gateway in the encoded format.
- e) The WAP gateway transforms the encoded WSP request into an HTTP request: the gateway decides whether the content is already present in its cache or the HTTP request needs to be sent to the origin server.
- f) An Http or an Https (secure Http) request is then sent to the server.

- g) Server returns static content (HTML, WML, Graphics files) and executes CGI/ ASP/JSP Script if any.
- h) HTTP or HTTPS response is sent back to the WAP gateway.
- i) WAP gateway performs: HTTP to WSP conversion, WML encoding, WMLScript compilation if required, and HTML to WML conversion followed by WML encoding.
- j) WSP response with the encoded content is sent to the mobile.

Differences between the two models

Web Model	WAP Model
1. TCP/IP Protocol is used	1. WAP stack protocol is used between device and gateway , TCP/IP is used between gateway and server
2. HTTP request and response are human readable	2. WSP request and response are encoded into a compact binary form.
3. HTTP proxy can be used	3. WAP gateway is always used.
4. Client- side scripting (java script and VBScript) embedded in the HTML code before being interpreted by the browser	4. client –side scripting (WMLScript only)is in a separate file, the user – Agent must have an interpreter for byte code.
5. Browser support a large number of images formats	5. Mobile user agent support a smaller number of multimedia formats like WBMP file.

Positioning of a WAP gateway in the network

1. WAP gateway provided by **network operator**.
2. WAP gateway provided by **content provider**.
3. WAP gateway provided by **ISP** (internet service provider).

1. by Network Operator:

Advantage:

- One single gateway installation to get access any internet content.

Disadvantages:

- a) The network operator might introduce additional content.
- b) Even if secure HTTP (HTTPS) and SSL are used, the requested content will be in an unencrypted form in the main memory (cache) of the WAP Gateway.

c) The network operator may choose to block access to all but a few 'approved' WAP sites.

2.by Content Provider:

Advantage:

- Secure applications.

Disadvantages:

- Mobile user must to have all necessary gateway configurations setup on their devices, for example, Nokia 7110 supports up to 10 gateway configurations, so he must to switch configurations every time he needs to access a different WAP sites.

3.by ISP

- This solution is technically possible; it would hardly make any sense commercially.

Gateway examples

- **Ericsson:**
 - WAP gateway / proxy for GSM networks.
 - Jambala WAP gateway for TDMA networks.
- **Kannel**, open- source WAP gateway (free for unix)
- **KNO** software, free personal WAP gateway.
- **Up.link** server.
- **Nokia** server