

1 – Wireless IP Surveyed

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2 – 3G

Wireless data comm is moving into the 3rd Generation.

- 1G - 1st Generation — 1979 Analog, voice only
- 2G — 1990 Digital wireless
 - Circuit Switched
 - Slow
 - Higher latency
 - Still in use
- 2.5 G — Incremental movement to packet switching
 - Supports more advanced data functionality.
 - Europe and US going this route now
 - Japan is skipping this step
- 3G — High speed packet switched (ATM) 2 Mbps.
 - Japan in 2001.

– U.S., Europe in 2003?

3 – Wireless Data

Wireless data communications fill a range of niches:

- Fixed Stations (already talked about)
- Fixed Base Stations with Mobile Clients
 - Support for remote peripherals — IR, bluetooth
 - Mobile I/P (and voice) — Depends on country
 - * Wireless Application Protocol (WAP) — North America (U.S.A.) (maybe Korea too?).
 - * Universal Mobile Telecommunications System (UMTS) — Europe
 - * iMode — Japan (could be replaced with UMTS)
- All nodes mobile (hard problem, Los Alamos and Ravi investigating)

4 – Wireless Data — Preliminary Findings

Wireless communications can best be characterized by

- A lot of hype.
- A lot of potential.
- A need to meet disparate requirements:
 - Voice
 - Streaming Video
 - IP
 - WWW browsing
 - Two way messaging
 - E-mail
- According to Reiter in mid 1990's
 - Wireless Network Markets were Saturated
 - IP was booming (WWW induced)
 - But both looking for new markets, next killer APP.
- A lot of confusing jargon.

5 – WAP

Wireless Application Protocol (WAP)

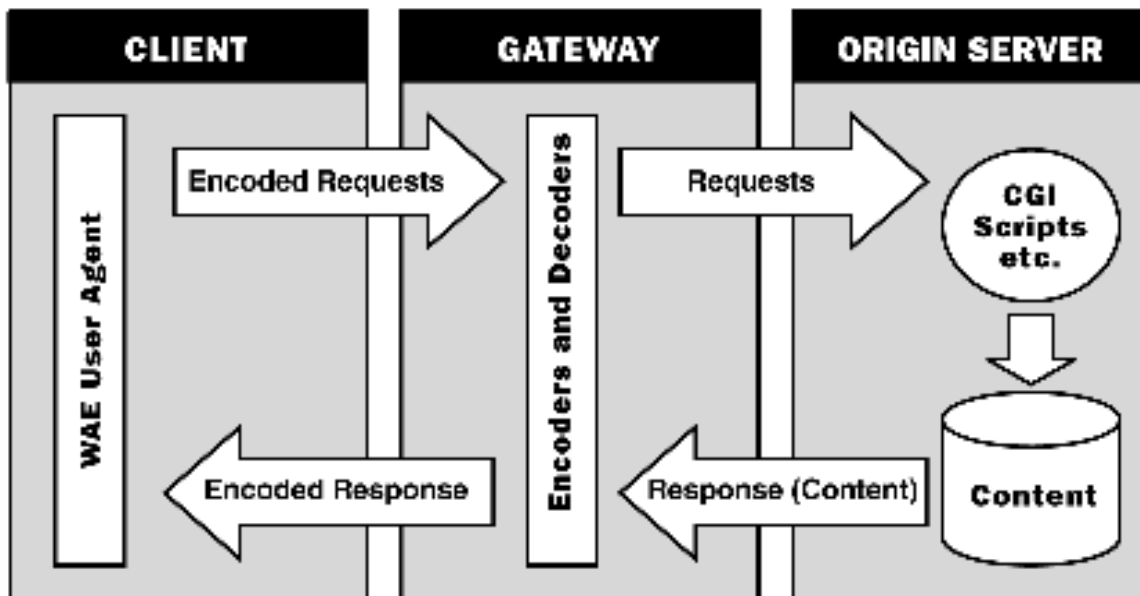
- Administered by WAP Forum
- Focuses on IP over
- Goals:
 - Bring Internet Content and Data Services to Wireless Terminals.
 - Develop a single global wireless protocol on top of all wireless technologies.
 - Enable the content creation and application hosting across diverse networks and devices.
 - “Embrace and Extend” existing standards

6 – WAP's Driving Forces

- Market Differences:
 - Ease of Use More Stringent
 - Larger (potential) market size
 - Increased Price Sensitivity
 - Usage patterns (traffic)
 - Essential Tasks (applications)
- Network Differences
 - Less Bandwidth
 - More Latency
 - Less stable connectivity
 - Less predictable availability
- Device Differences
 - Slow CPU's
 - Less Memory
 - Limited Power Consumption
 - Smaller Displays
 - Different input devices

7 – WAP's Design, The Big Picture

- WAP Uses WML (a form of XML) and IP as Base Technology
- Users carry *clients* which communicate with *gateways*
- Gateways connect to *origin servers*
- Gateways translate WML/XML into a device dependent binary encoding.
- Clients and Gateways cache translated encodings.



8 – TCP Connection Establishment

TCP/IP supports client/server connections via a *3 way handshake*:

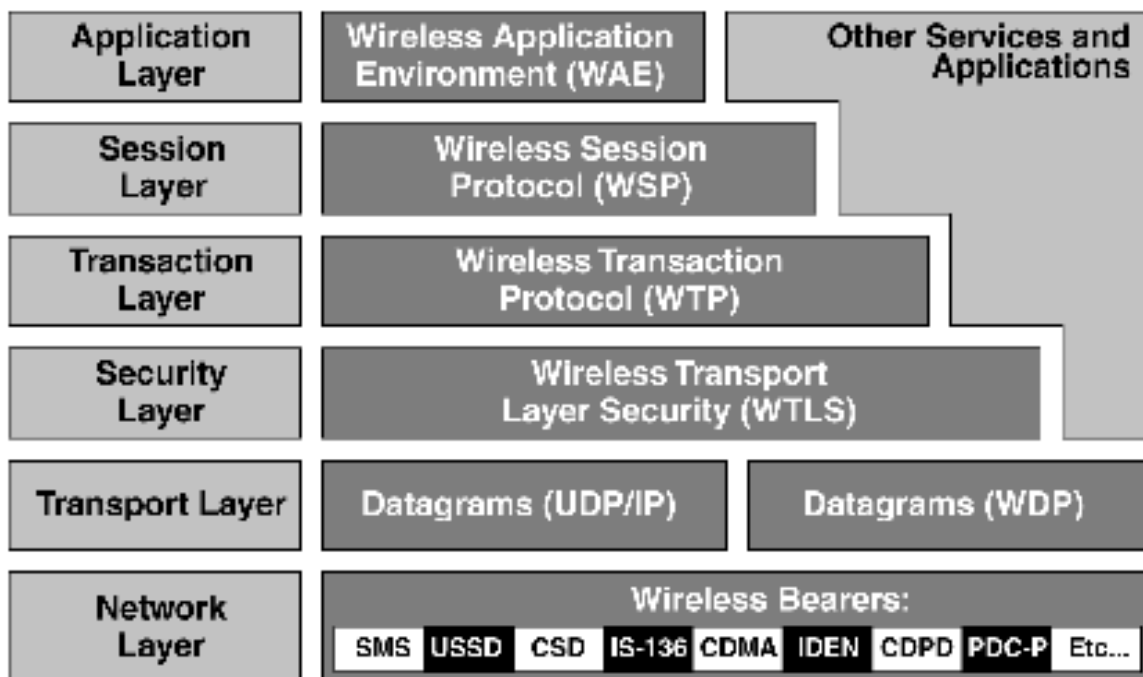
- Initiator (client) sends request with ID (ISN in TCP)
- Responder sends ack of initiator's ID (ISN) plus its own ID (ISN)
- Initiator sends ack of responder's ID (ISN) and includes its ID

Some Notes about 3 way handshake:

- Ensures that new connection attempts don't get “faked out” by packets from previous (aborted) connection attempts.
- Recall that timeouts are necessary for confirming reliable delivery (handshake can't work without timeout!).
- Works for normal disconnect too (although server may initiate).

9 – WAP's Protocol Stack

- Clients and servers never swap roles in WAP
- Gateways' act like proxies
- WAP has its own protocol stack layered on wireless network layer



10 – WSP Vs. HTTP

- WSP has less overhead than HTTP
- Doesn't need 3 way handshake for connect/disconnect.
- Lower level protocol guarantees delivery.

HTTP/TCP/IP	WSP/WTP/UDP	<i>Bold packets contain payload Non bold items are overhead</i>
1. → TCP SYN	1. → Data Request	
2. ← TCP SYN, ACK of SYN	2. ← ACK. Reply	
3. → ACK of SYN, Data Request	3. → ACK. Data Request	
4. ← ACK of Data	4. ← ACK. Reply	
5. → Reply	5. → ACK. Data Request	
6. ← ACK of Reply	6. ← ACK. Reply	
7. → Data Request	7. → ACK	
8. ← ACK of Data		
9. → Reply		
10. ← ACK of Reply		
11. → Data Request		
12. ← ACK of Data		
13. → Reply		
14. ← ACK of Reply		
15. → TCP FIN		
16. ← TCP FIN, ACK of FIN		
17. → ACK of FIN		

Typical Handset Session — 3 Requests, 3 Responses	
<u>HTTP/TCP/IP</u>	<u>WSP/WTP/UDP</u>
17 packets	7 packets
65% Overhead*	14% Overhead*
<i>*Does not account for DNS, SSL, Authentication or Cookies</i>	

11 – So is WAP great or What?

Well, maybe not.

- WML (by default) assumes lowest common denominator of display technology.
- But what if user has better display?
- Simple (for WAP that is), the CONTENT PROVIDER just makes a special case in their XML (and you bet they hate this!).
- Most content is HTML, most web browsers forgiving about malformed HTML.
- But gateways compile, they tend to be strict.
- So if the content doesn't compile the CLIENT sees an error.
- BUT the error is not reported to the content provider (HTTP is one way).
- Assumptions about small memory and wimpy processors will be bogus in a few years.

12 – UMTS

Seems more all-encompassing than WAP.

- Transport (data) Plane — Uses ATM for low level protocol design.
 - ATM physical layer (T-1, STM, OC3, etc...).
 - ATM Layers (cell switching network)
 - ATM Adaptation Layer (AAL) interface
 - * AAL1 — Support CBR streams (Fixed frame size)
 - * AAL2 — Support CBR stream (Variable frame size) e.g.compressed video frames.
 - * AAL3/4 — AAL5 now preferred, AAL3 discontinued.
 - * AAL5 — Supports VBR streams.
 - Control Plane — Uses ATM VCI techniques.



13 – UMTS Initial Impressions

- Two ways to improve effective bandwidth
 - Boost physical bandwidth (can be cheap)
 - Make smarter system with QoS guarantees. (UMTS)
- ATM is complicated.
- So is UMTS.
- Low level wide band CDMA (W-CDMA) conflicts with Qualcomm's intellectual property claims, so USA's Qualcomm influence (backward compatibility) is felt.

References