

Application Perspective on Wireless Communication Medium

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Outline

- Background
- Basic wireless medium challenges
- Reasons behind the problems
- Effects of the problems to applications and their use
- Some ways to handle the problems
- Conclusions



Background

- Wireless environment has its own challenges yet the applications are developed like they are using reliable communication channel.
- Developers of wireless technologies try to find ways to avoid these problems.
 - The extent of problem depends on the selected lower layer solutions
 - At the end the problems are affecting on the usability of your application.
- Application developer should not just hope that lower layers will handle the problems
 - Problems are not know, understood or they are just plainly ignored.

• Wireless Communication Medium

- Unreliable
 - Disconnections
 - Packet losses
- Performance issues
 - Latency
 - One-Way
 - Round Trip Time (RTT)
 - Low data transfer rates
- Extent of problems depends on utilised technology

Disconnections

- Reasons behind disconnections
 - Blocking elements
 - Moving element like bus
 - User moves in Tunnel, Building
 - Different magnetic fields within e.g. factory
 - User moves out from coverage area
 - Gap /void in coverage area
 - Lack of mobility management technologies
 - Vertical & horizontal handoff /roaming
 - Automatic fail over from one medium to another to maintain connectivity

Problems disconnection causes

- Did all the messages got through
 - What messages were lost?
 - Did the action get through
 - Was the entire transaction successful
 - Is the customer/client aware of it?
- Is the connection going to be re-established
 - When?
 - What happens when the connection is re-established?
- State of interruption stored

• Packet loss

- Really short term disconnection
- Causes:
 - Interferences
 - Congested medium - E.g. too many users of same frequency in small area
- Problems
 - Similar to disconnected communication to some degree
 - Audio/Video streams heavily affected

Handling packet loss & disconnected communications

- Non-blocking communications
 - e.g. Threading
 - Prevent application to hang during network problems
 - Loss of network should not interrupt/deter writing of email
- Store the state of interruption
 - Synchronize the state of peer entities once the connection is re-established

Let the user know what is going on

- Enlighten

- Allow user to react
 - User can move to area with better coverage
- Not knowing why application has delays causes frustration → Frustration causes extreme measure
 - Repeated push of send button
 - Restart application
 - Reboot the device
- Anticipate already in your application design phase that connection loss may happen at any time.

Performance

- Small data transfer rate & bandwidth
- Delays between sending & receiving
 - Round trip time (RTT) between sending & getting response
- What affects on RTT and latency
 - Distance Amounts of hops
 - Number of users on same base station (AP)
 - Processing of messages and application latency
- Caused problems due the performance
 - Communication delays
 - Slow start on applications

Remedies to performance problems

- Say No! to chatty protocols
 - E.g. HTTP 1.0
 - Avoid unnecessary waits for ACKs and other responses
- Use existing open connections
 - e.g. Avoid unnecessary handshakes
- Avoid unnecessary meta-data
 - Predetermined fields vs XML based notations
- Use compression
 - Requires computational power, drains battery.

Conclusions

- Wireless challenges are not only the problem for the low layer technologies
- Know what challenges are relevant for your target environment
- Take the challenges into account already at design phase.
- Don't forget the application user!