Walking is Good for the Health of Your Wi-Fi

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Agenda

• What makes a good Wi-Fi network?
• From Tampa to Miami in 2 hours
• Site survey methodologies
• Annotation & documentation
About me

• Jussi Kiviniemi

• Sr. Vice President at Ekahau

• Working with Wi-Fi since 2000...

• ... and with Wi-Fi design since 2002
Timelapse video
What makes a good Wi-Fi network?

- Transparent user experience
  - High signal strength
  - High signal-to-noise ratio
  - Low channel interference
  - High data rates
  - Low latency, fast roaming
  - Modern Wi-Fi gear
Drive from Tampa to Miami in 2 hours
200 miles
At 120 mph
= under 2 hours
“100% Self Configuring Network”
Interferer demo
Ideal Wi-Fi experience

- High signal strength
- High signal-to-noise ratio
- Low channel interference
- \( \Rightarrow \) High data rates
- Low latency, fast roaming
- Modern Wi-Fi gear
The best Wi-Fi gear in the world cannot fix a bad Wi-Fi design
Adding more APs to solve capacity problems often makes things worse
Ways to survey
Site Survey Methodologies

• What to measure?
  – Passive Survey (can I hear you)
  – Active Survey (do I understand you?)
  – Throughput Survey (how fast can you talk to me?)
  – Spectrum Survey (raw audio)
  – Packet capture (letter by letter) – *not really a “survey”*

• When to measure?
  – Predictive Design (I’m planning to say this) – *not really a “survey”*
  – Pre-Deployment Survey (let me rehearse my speech with you)
  – Post-Deployment Survey (was I understood correctly)
  – Troubleshooting Survey (what’s the communication problem here?)
What to measure?
Passive measurements

• “Can I hear you all?”

• Listen to all audible AP’s at once

• Measure
  – AP MAC
  – AP technology
  – Signal strength
  – Noise floor
  – MCS index (for theoretical data rate)
  – Other AP characteristics, such as AP name
Active measurements

- “Is the line of communication OK end-to-end?”

- Test connectivity **end-to-end** using test equipment

- Measure
  - Packet loss
  - Round-trip time
  - Roaming locations & roaming impact
  - Data rate (actual)
Throughput measurements

• “How fast can we talk and still be understood?”

• Test throughput end-to-end
• Measure
  – Throughput
  – Packet loss
  – Jitter

• Not the same as data rate
  – Data rate = theoretical maximum talking speed
Spectrum measurements

• “What kind of audio activity is out there?”

• Sweep the entire Wi-Fi spectrum (2.4 & 5GHz)

• Detect
  – Wi-Fi activity
  – Non-Wi-Fi Interference
    • Constant
    • Periodic
Functional validation testing

• “Does the audience fully understand and apply in practice what I’m saying?”

• Real world tests using
  – actual, production devices
  – actual applications
  – on the production network

• Prior to rolling out large-scale production

• Not highly scientific, still very useful
Packet Capture
(not really a "survey")

- “Analyze the speech letter by letter”
- Capture all or some of the packets in the air
- Analyze
  - Raw packets
  - Traffic source & destination flow
- Wi-Fi expert often required
When to measure?
Predictive Design
(Wi-Fi Planning)

• “I’m planning to say this”

• Determine
  – AP types
  – AP locations
  – Antennas & their alignment
  – AP Channels

• How will my signal strength & SNR & channel overlap look like?
• How to meet the capacity needs?
Predictive demo
Pre-Deployment Site Survey

• “Let me rehearse this first”

• **Before** installing the network infrastructure,
  – Validate your plan with real-world measurements
  – Understand how the radios behave in this environment

• Often passive and spectrum
AP on a Stick Explained
Post-Deployment Site Survey

• “Am I being understood”

• Once the network is up and running, validate the network coverage and performance

• Often passive, active and spectrum measurements
• Functional validation testing
• Sometimes throughput
Post-Deployment Survey Demo
Troubleshooting

Site Survey

• “Where’s the problem?”

• Should problems occur in the network, either
  – Walk around the problematic area to survey or...
  – ... troubleshoot on the spot

• Passive / active / spectrum / throughput / functional
Live troubleshooting demo
Client device differences

- “Hearing varies per person”
- An iPhone may be 10dB weaker than a laptop
- Measure (passive) using standardized hardware – then add margin
- Remember functional validation testing
Annotations during survey

- AP placement pictures
- AP mounting & antenna
- Cabling routes
- Areas of interference
Notes demo
Generating documentation

• AP placement pictures
• Notes about Aps
• Cabling routes
• Areas of interference
Reporting demo