# Walking is Good for the Health of Your Wi-Fi

Jussi Kiviniemi
Ekahau

2017 BICSI Winter Conference & Exhibition
January 22-26 • Tampa, FL

# Agenda

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

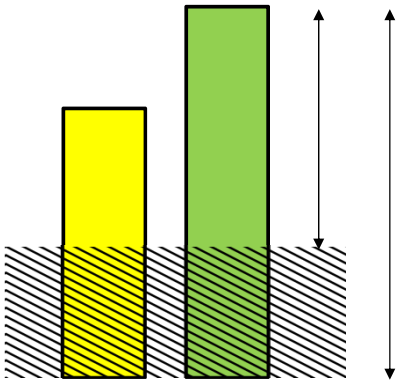
# About me

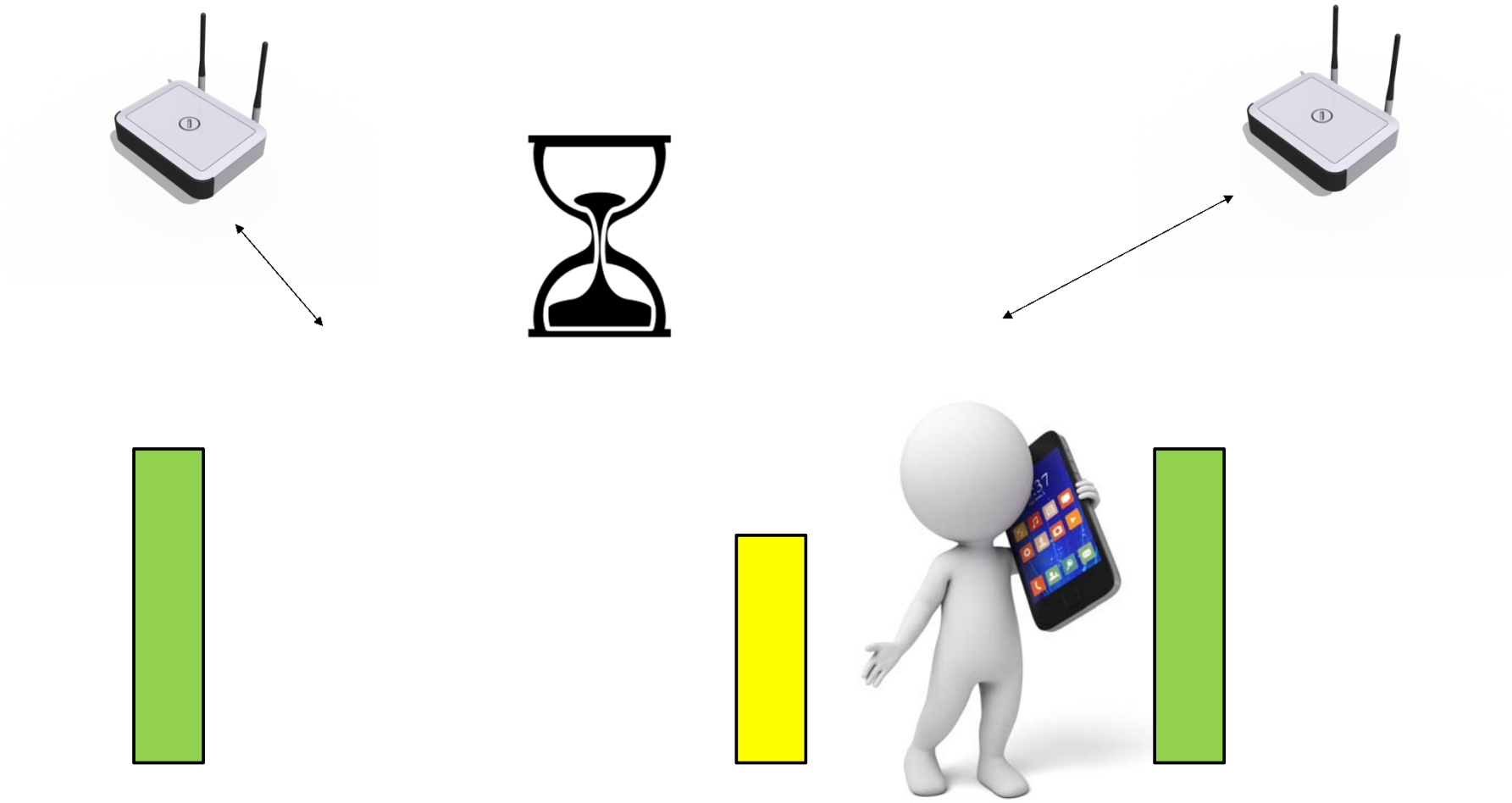
- Jussi Kiviniemi
- Sr. Vice President at Ekahau
- Working with Wi-Fi since 2000…
- … and with Wi-Fi design since 2002

# Timelapse video

# What makes a good Wi-Fi network?

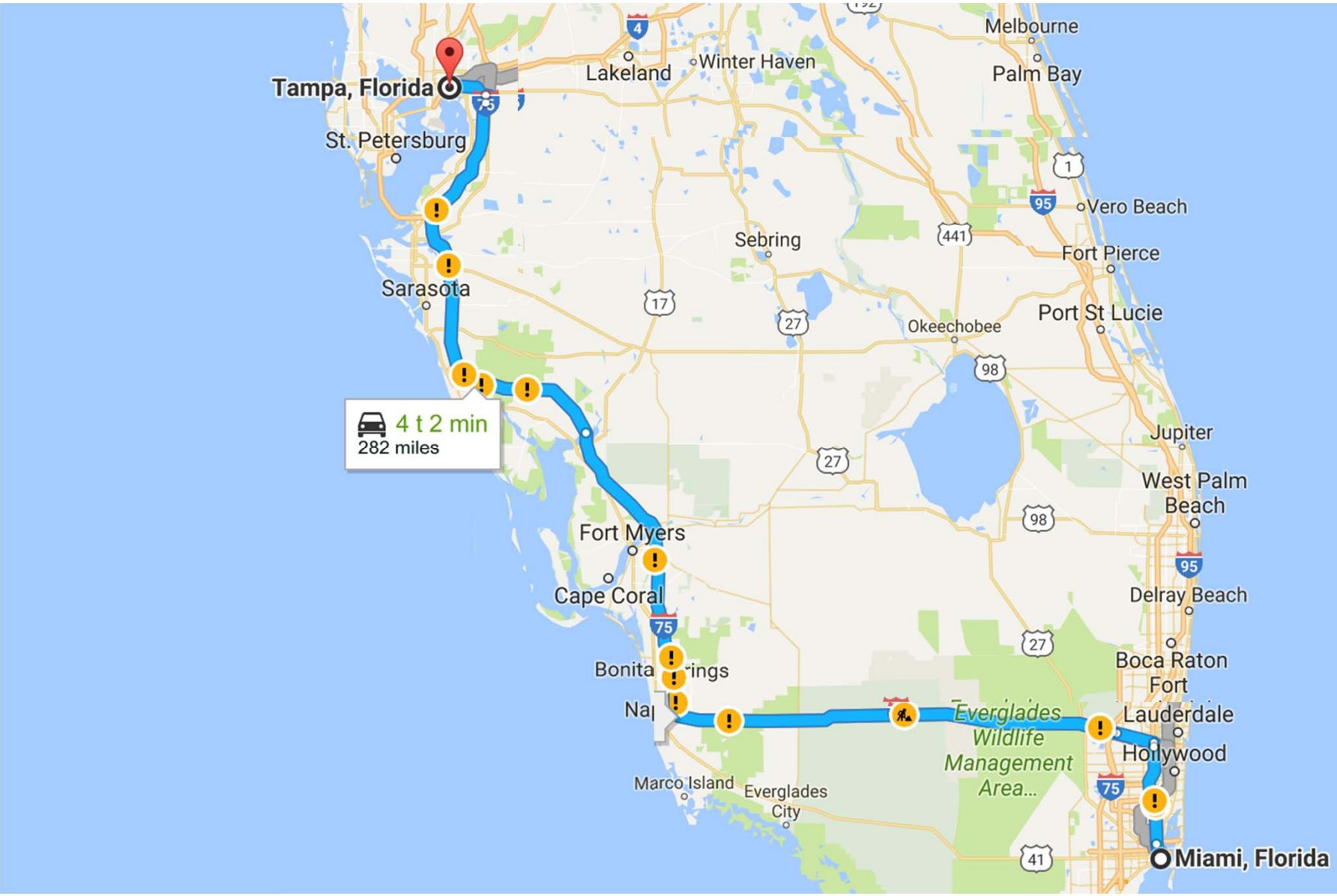
- Transparent user experience
  - High signal strength
  - High signal-to-noise ratio
  - Low channel interference
  - ➔ High data rates
  - Low latency, fast roaming
  - Modern Wi-Fi gear



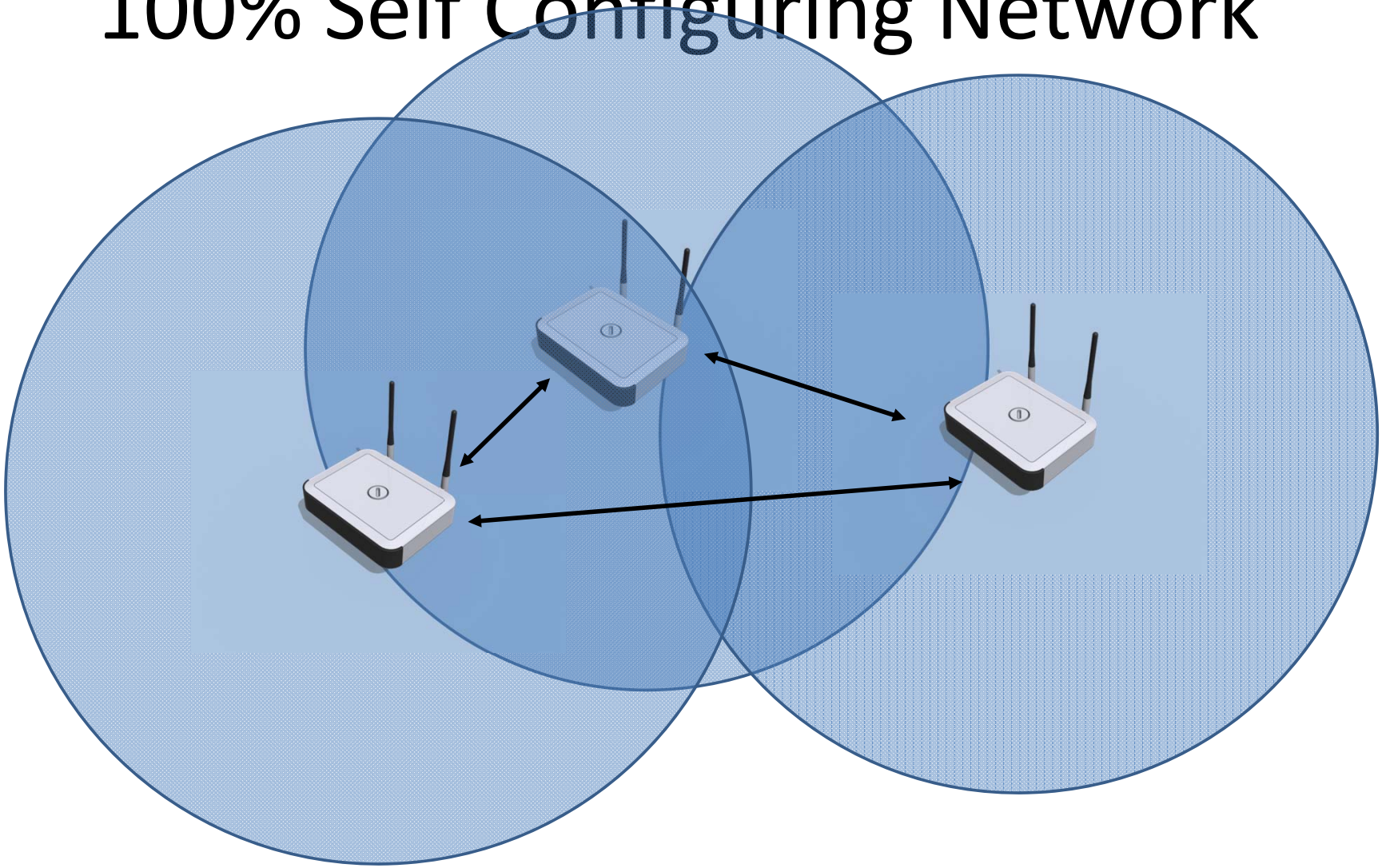


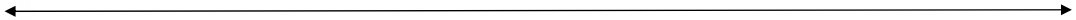
Drive from Tampa to Miami in 2 hours

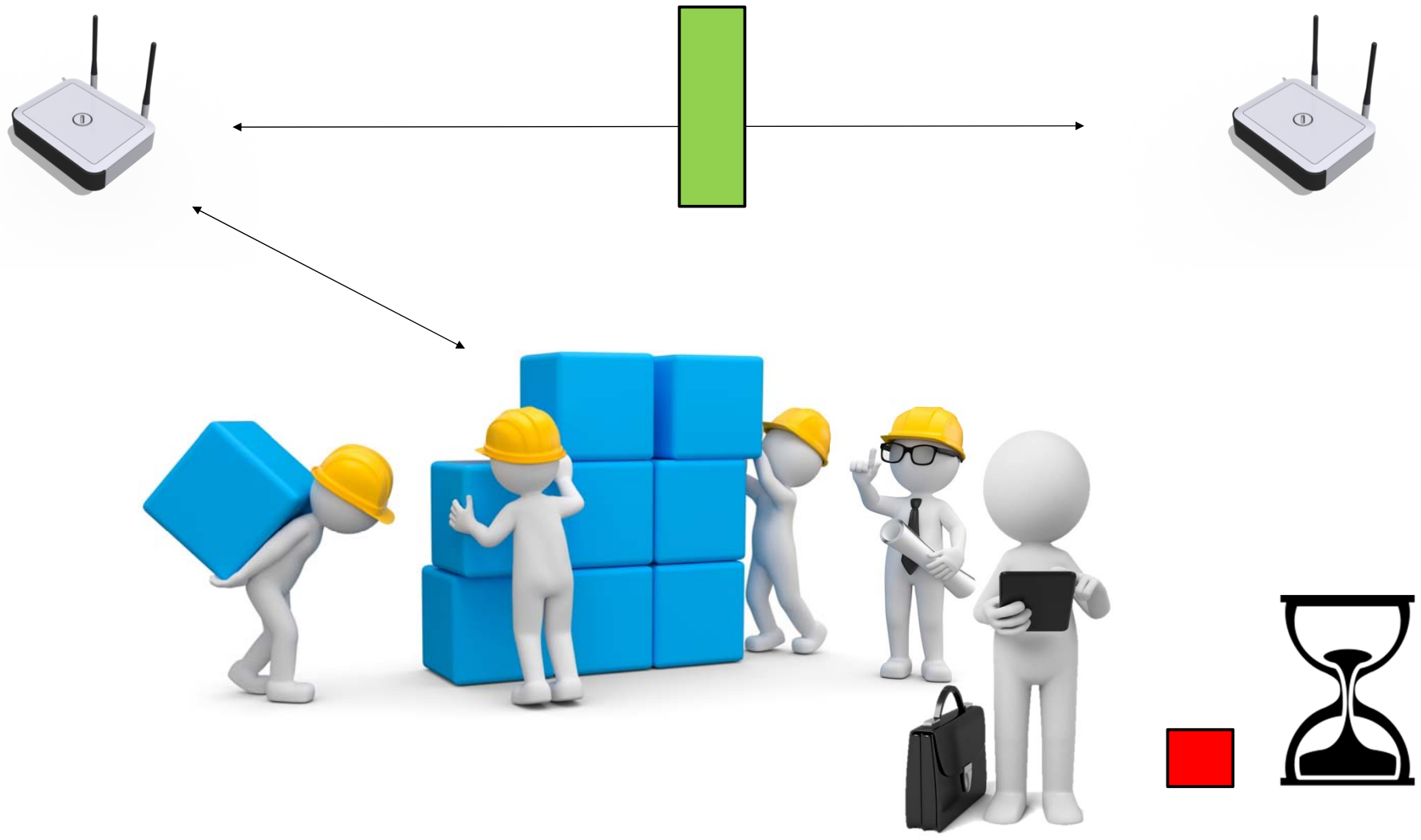

200 miles
At 120 mph
= under 2 hours

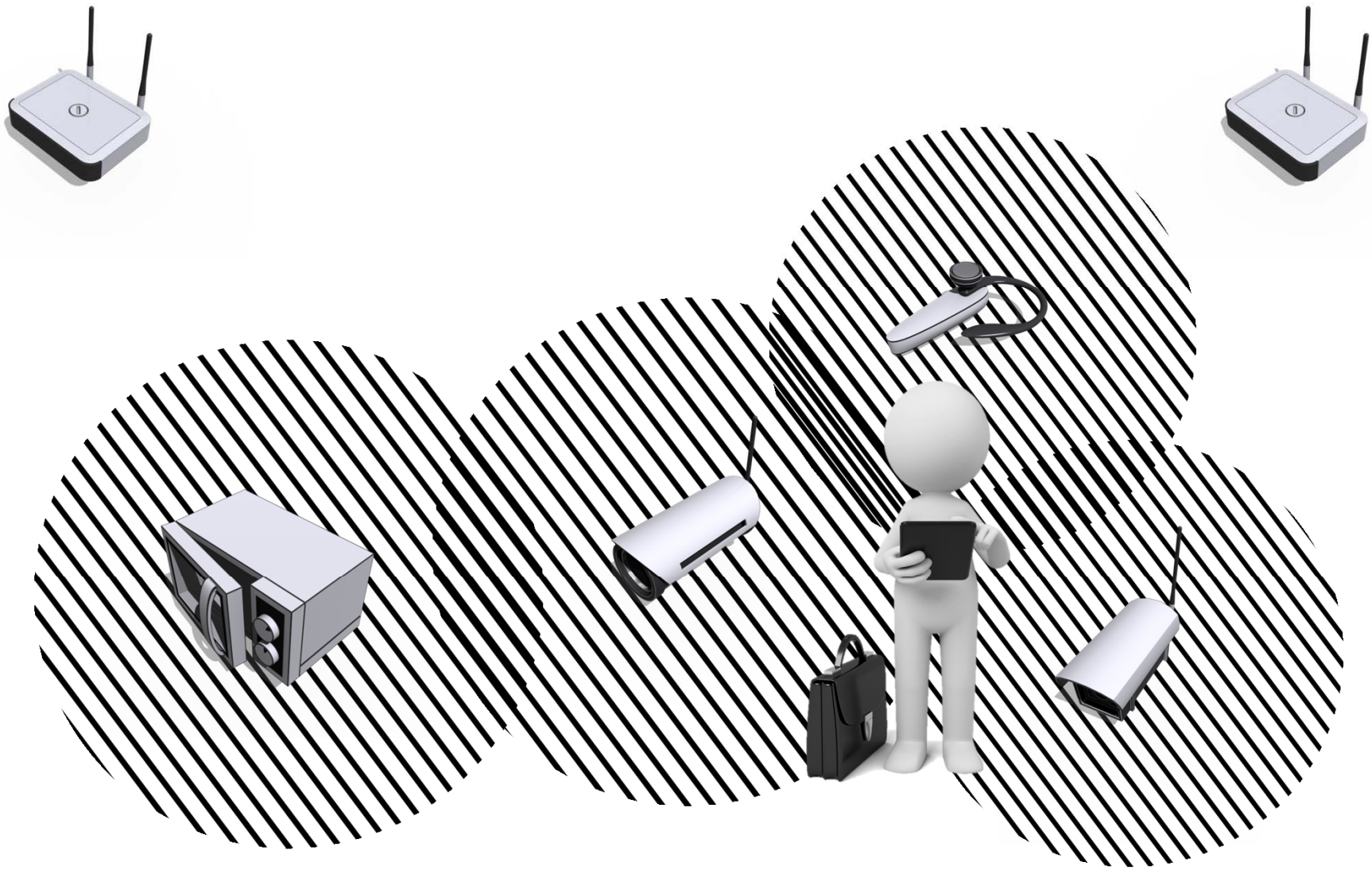

Tampa, Florida
St. Petersburg
Lakeland
Winter Haven
Melbourne
Palm Bay
Vero Beach
Sebring
Fort Pierce
Sarasota
Okeechobee
Port St Lucie
4 t 2 min
282 miles
Jupiter
West Palm Beach
Fort Myers
Cape Coral
Delray Beach
Boca Raton
Fort Lauderdale
Hollywood
Everglades Wildlife Management Area...
Marco Island
Everglades City
Miami, Florida

# “100% Self Configuring Network”





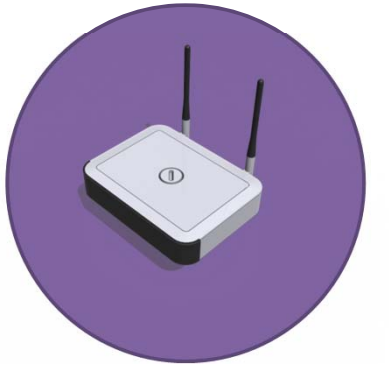


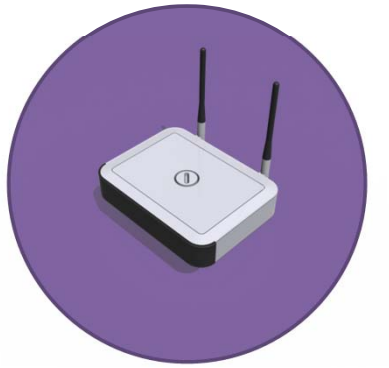


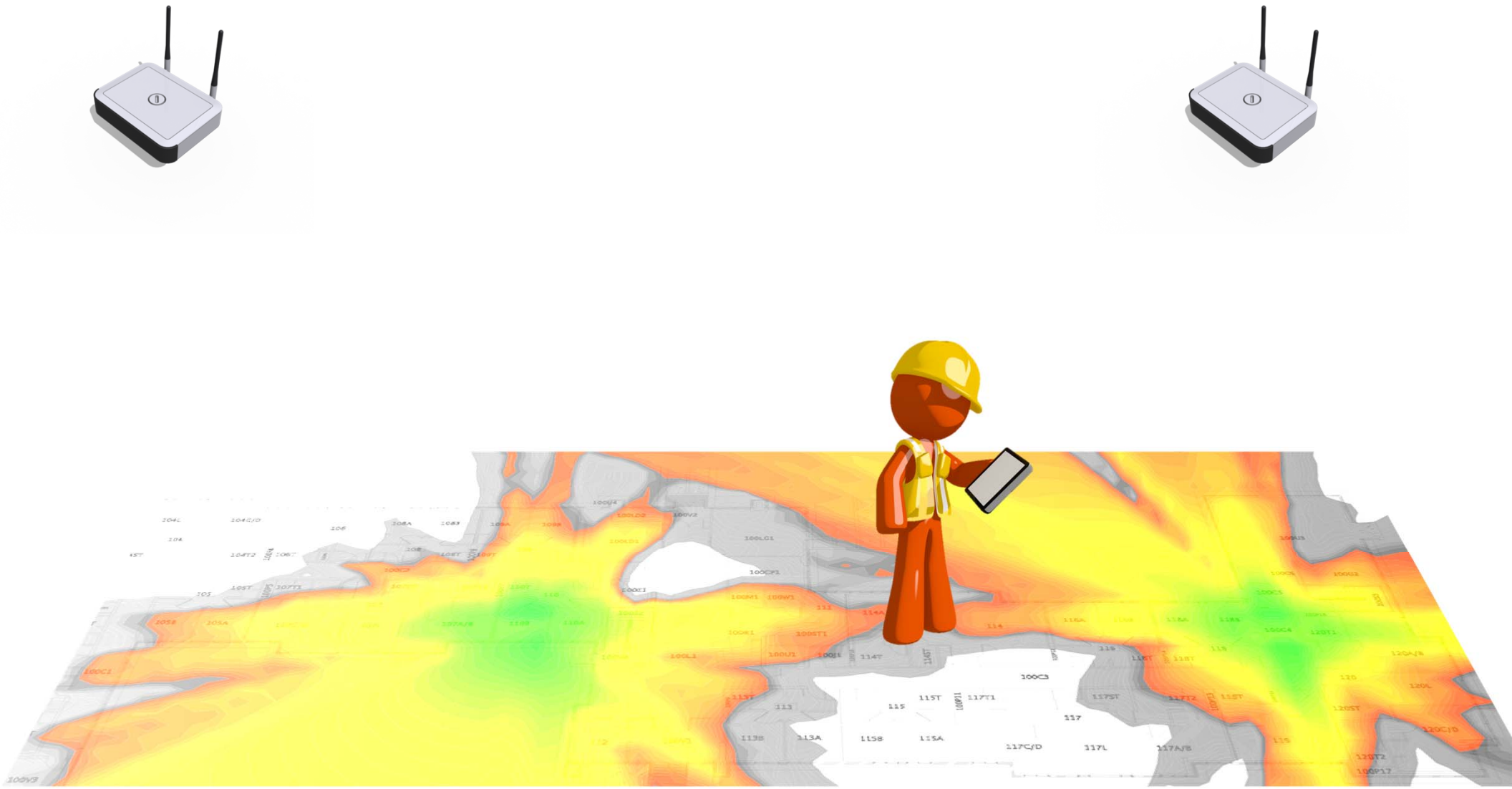
# Interferer demo

# Ideal Wi-Fi experience

- High signal strength
- High signal-to-noise ratio
- Low channel interference
- ➔ 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 charcteristics, 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

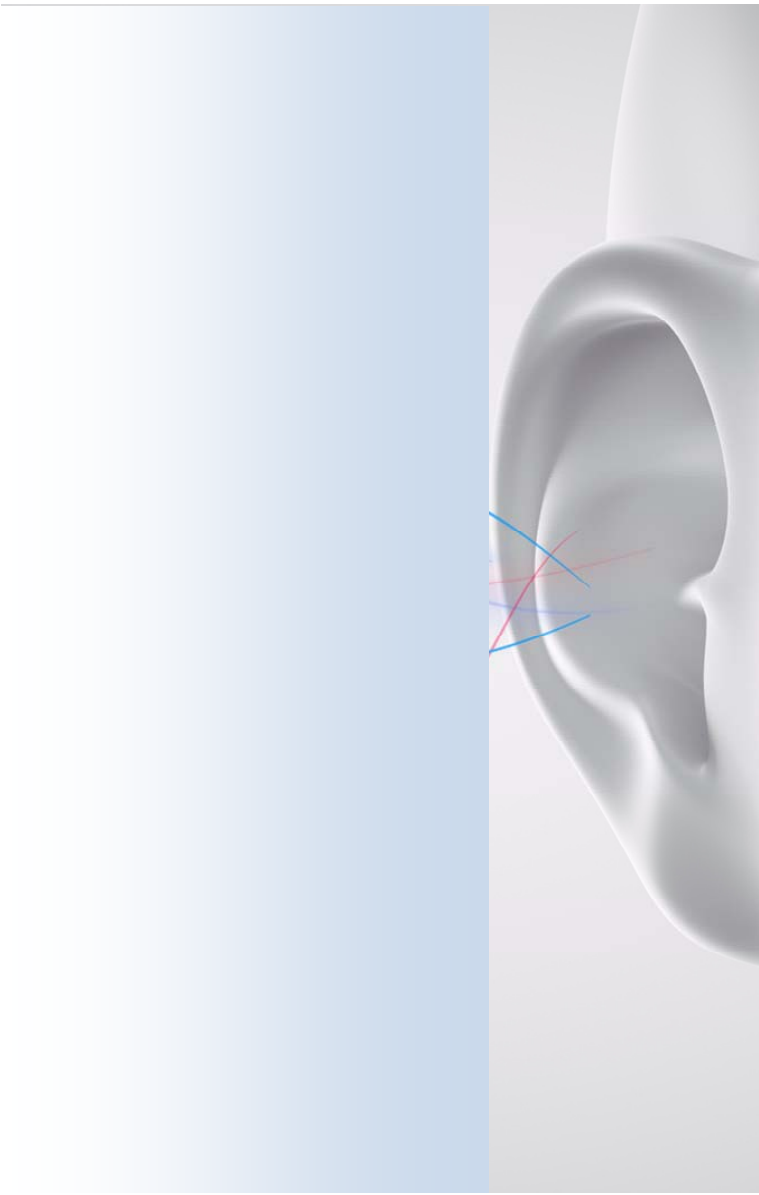
- **“How fast can we talk and still be understood?”**

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

- Not the same as **data rate**
  - Data rate = theoretical maximum talking speed

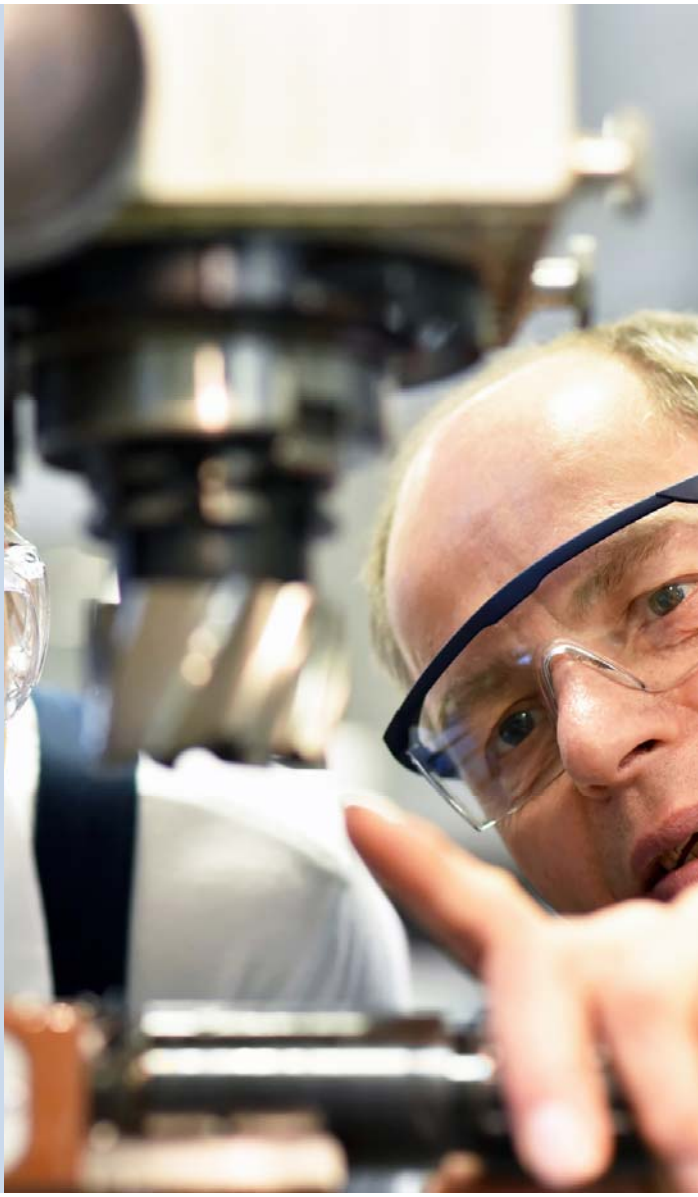
# **Spectrum** measurements

- **“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 an 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