

Návrh a monitoring Wi-Fi sítí

Praha

16. dubna 2015



Přehled standardů IEEE 802.11

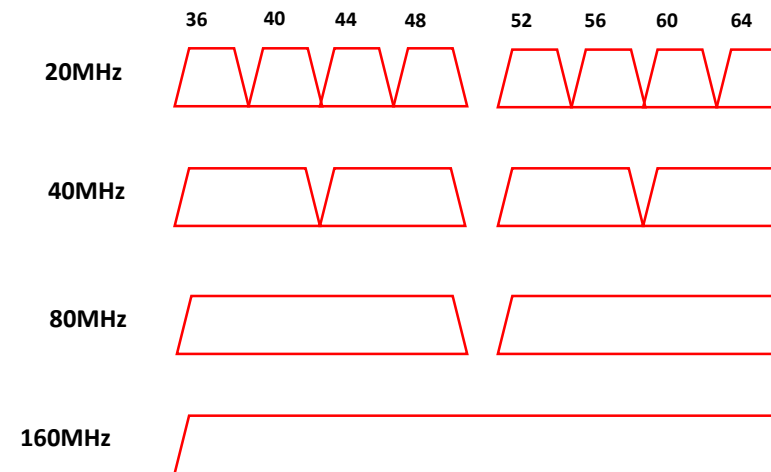
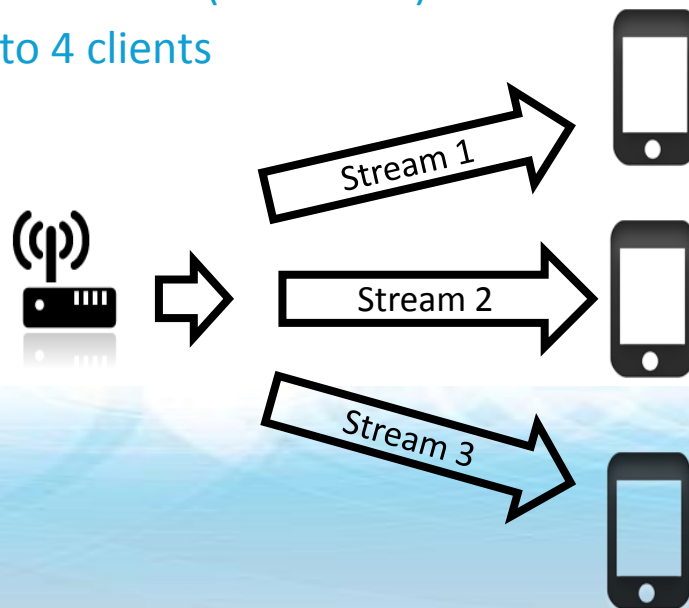
Standard	Rok vydání	Pásmo [GHz]	Maximální rychlost [Mbit/s]	Fyzická vrstva
původní IEEE 802.11	1997	2,4	2	DSSS a FHSS
IEEE 802.11a	1999	5	54	OFDM
IEEE 802.11b	1999	2,4	11	DSSS
IEEE 802.11g	2003	2,4	54	OFDM
IEEE 802.11n	2009	2,4 nebo 5	600	MIMO OFDM
IEEE 802.11y	2008	3,7	54	
IEEE 802.11ac	2014	5	1000	MU- MIMO OFDM

Standard 802.11ac

- Potřeba zvýšení kapacity (BYOD - bring your own device)
- Výrazné rozšíření šířky pásma za účelem prolomení 1Gbps bariéry
- IEEE 802.11ac builds on 802.11n
 - Omezeno na 5GHz pásmo
 - Zvyšuje spektrální účinnost
 - Zlepšuje využití kanálu
 - Využívá pokročilejší anténní technologie

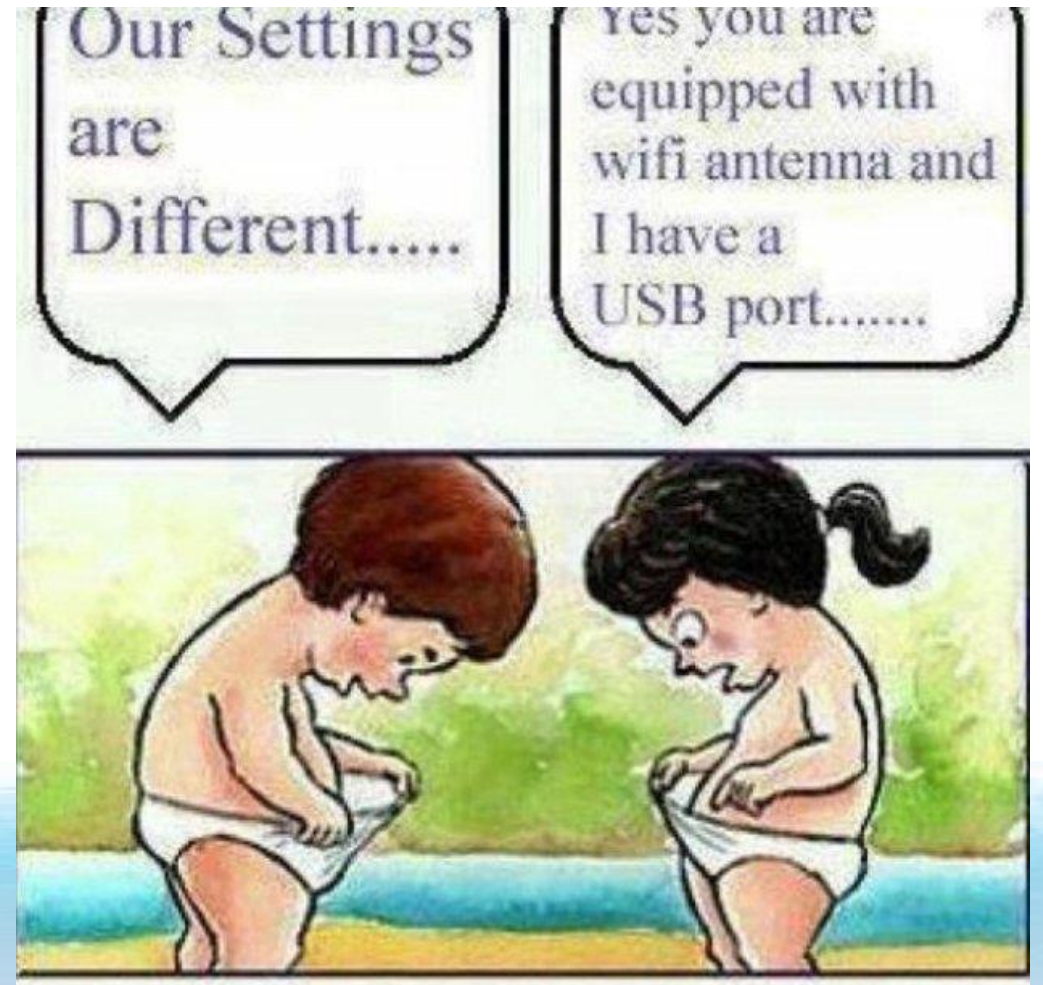
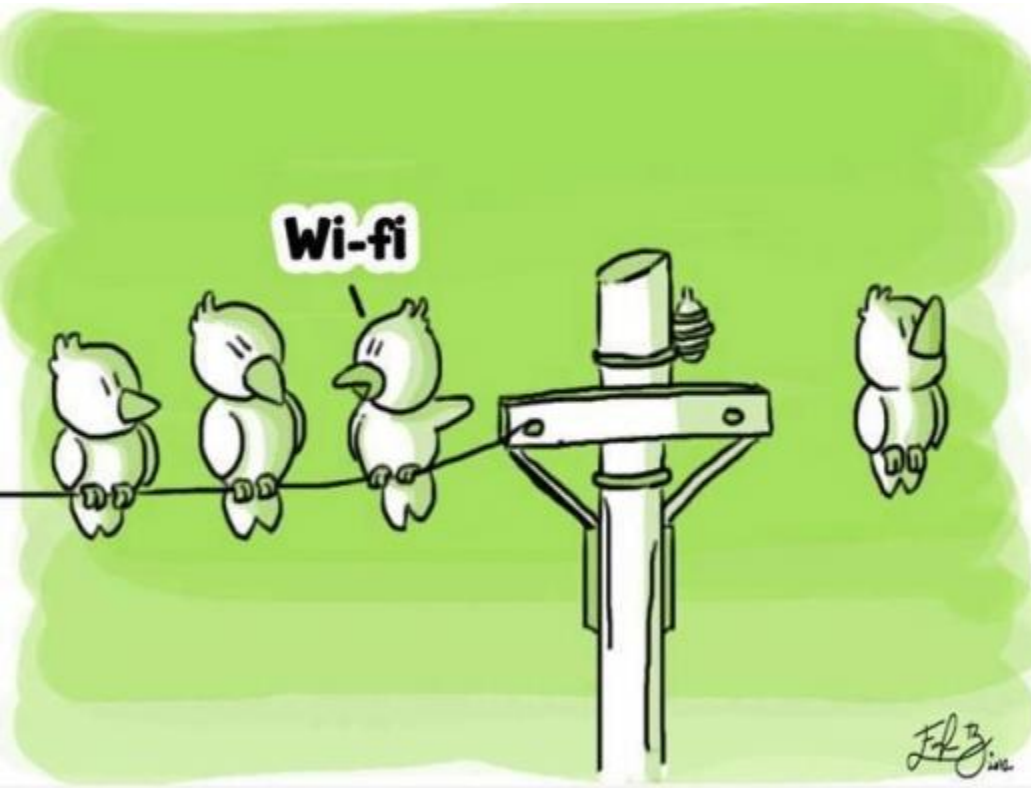
Main 802.11ac Feature Enhancements

1. Wider channels
 - 80MHz & 160MHz
2. More Spatial Streams
 - Up to 8 SS possible
3. Multi-User MIMO (2nd Wave)
 - Up to 4 clients



4. Standardized Beamforming (2nd Wave)
5. Higher Modulation
 - QAM 256

Návrh Wi-Fi sítě



1 Requirements

Coverage:

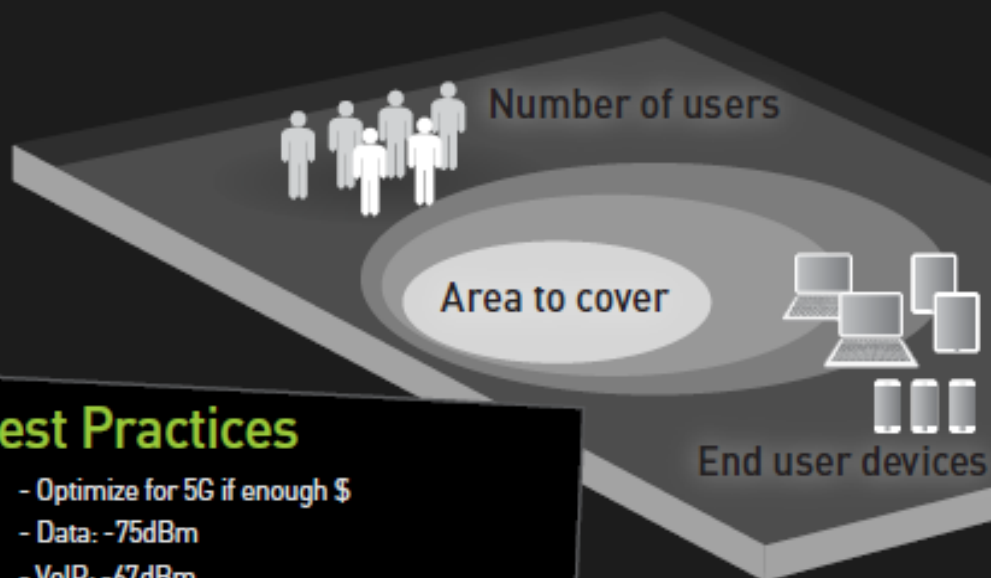
- Area to cover
- Optimize for 2.4 (lower cost) or 5GHz (capacity)?
- Use VoIP, video or data?

Capacity:

- Number of end user Wi-Fi devices
- Applications run on each device type

3.3 The average number of connected devices per knowledge worker by 2014

Cisco IBSG: Future of ITCO and Virtualization Survey Report



Applications to use

HD video
E-mail
Web browsing / FTP
Skype,....

Global Mobile Data Traffic will increase **13X** from 2012 - 2017.

Cisco Visual Networking Index: Global Mobile Data Traffic Forecast for 2012 to 2017

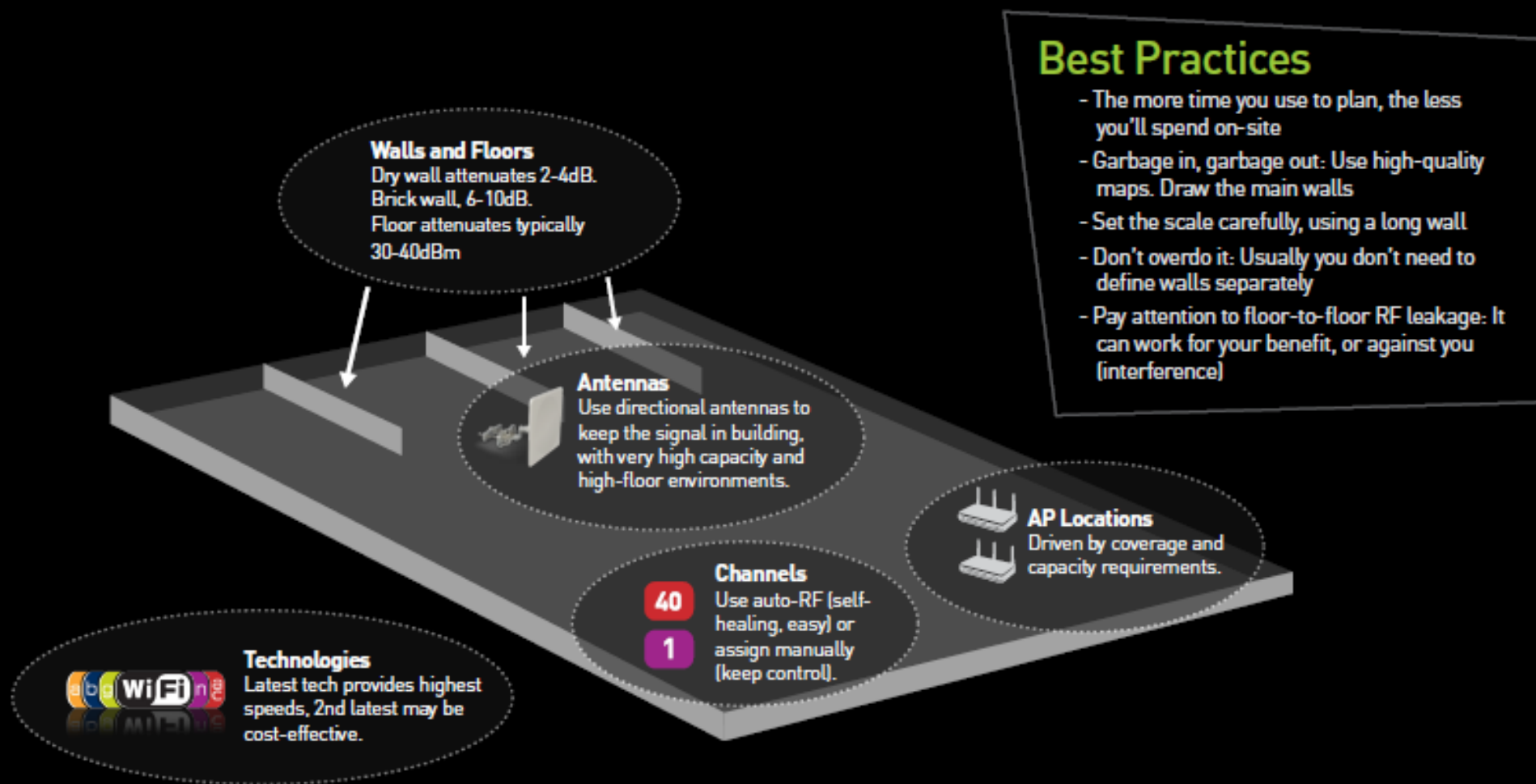
Best Practices

- Optimize for 5G if enough \$
- Data: -75dBm
- VoIP: -67dBm
- RTLS: 3APs at -75dBm, corner placement
- Talk to the network users!

2

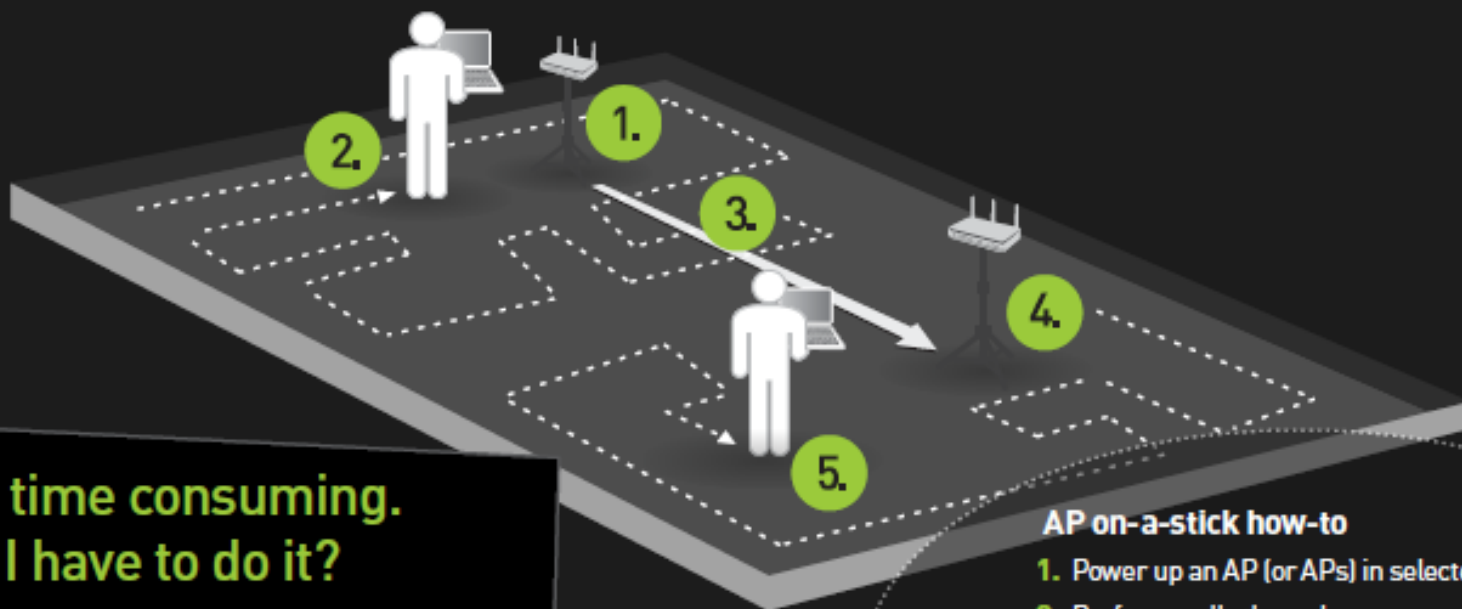
Wi-Fi Planning - Predictive Survey

Figure out where to place the APs, and how to configure them.



3 Pre-Deployment Site Survey “AP on a stick”

Use one or a couple of APs to make real-world signal measurements **prior** to purchasing all infrastructure.



It's time consuming. Do I have to do it?

You ask 3 different Wi-Fi professionals, you get 3 different answers.

We'd say, do at least 2 of these 3

- Predictive design
- Pre-deployment survey
- Post-deployment survey

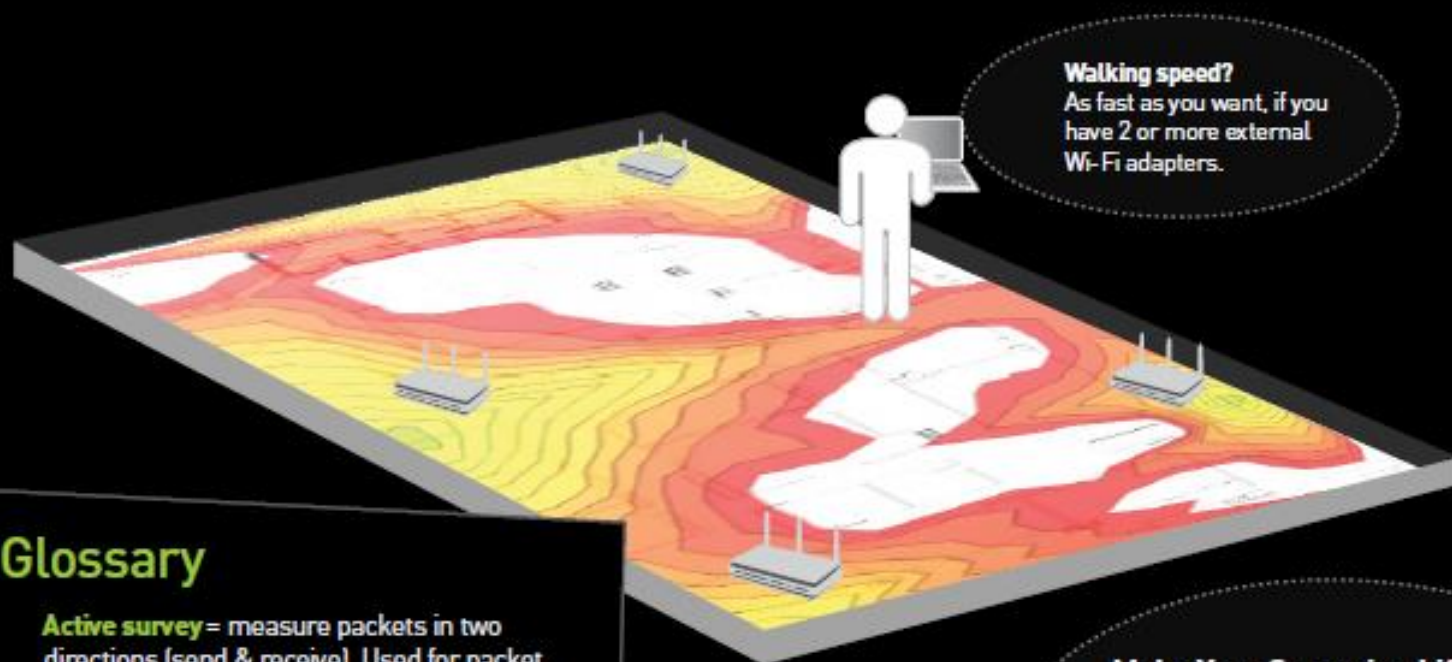
AP on-a-stick how-to

1. Power up an AP (or APs) in selected locations
2. Perform walk-through survey around the AP(s)
3. Move the AP(s) NOTE: freeze the APs in the survey tool when moved
4. Power up the AP
5. Perform walk-through survey around the AP(s)

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Validation Site Survey aka Post-Deployment Survey

Verify coverage, connectivity and capacity with a single walk-through throughout the site – after Wi-Fi has been deployed.



Glossary

Active survey = measure packets in two directions (send & receive). Used for packet loss, packet delay,...

Passive survey = listen to probes & beacons passively. Used for coverage & SNR maps, etc.

Hybrid survey = passive & active simultaneously

Make Your Surveying Life Easier

1. Cut your surveys in short segments
2. Use touch screen
3. Get a lighter tablet or laptop
4. Get several people to survey
5. Use a Segway ;)

5 Troubleshooting

Verify coverage, connectivity and capacity with a single walk-through throughout the site – after Wi-Fi has been deployed.

Eliminating Wi-Fi interference (Co-channel and adjacent channel)

- Perform a quick survey
- Check channel separation
- Reduce AP Tx power
- Stagger APs between floors
- Neutralize interfering rogue APs
- Play nice with your neighbors

Resolving capacity problems

- Move to 5GHz
- Reduce SSIDs
- Ensure channels are OK
- Add APs
- Use directional antenna
- Migrate to newer techs

How to identify?

- Customers complaining
- APs monitoring the network
- Dedicated Sensors
- Periodic site surveys / S.A.
- NEW: client-side monitoring

Troubleshooting Tools

Wi-Fi infrastructure tools (NCS, Airwave, etc)

Spectrum Analyzer (Ekahau, Metageek)

Packet Analyzer (WildPackets)

Site Survey Tool (Ekahau)

Android Tool (Ekahau)

Packet visualizer (Metageek)

Eliminating Non-Wi-Fi Interference

- Fire up spectrum analyzer
- See what's 802.11 and what's not
- Identify non-802.11
- Locate interferer
- Smash it or cope with it

Interference Sources

- Microwave ovens
- Wireless cameras
- Wireless mics
- Bluetooth
- Zigbee
- Wireless speakers
- Cordless phones

Multi-Adapter Support / Refreshed UI

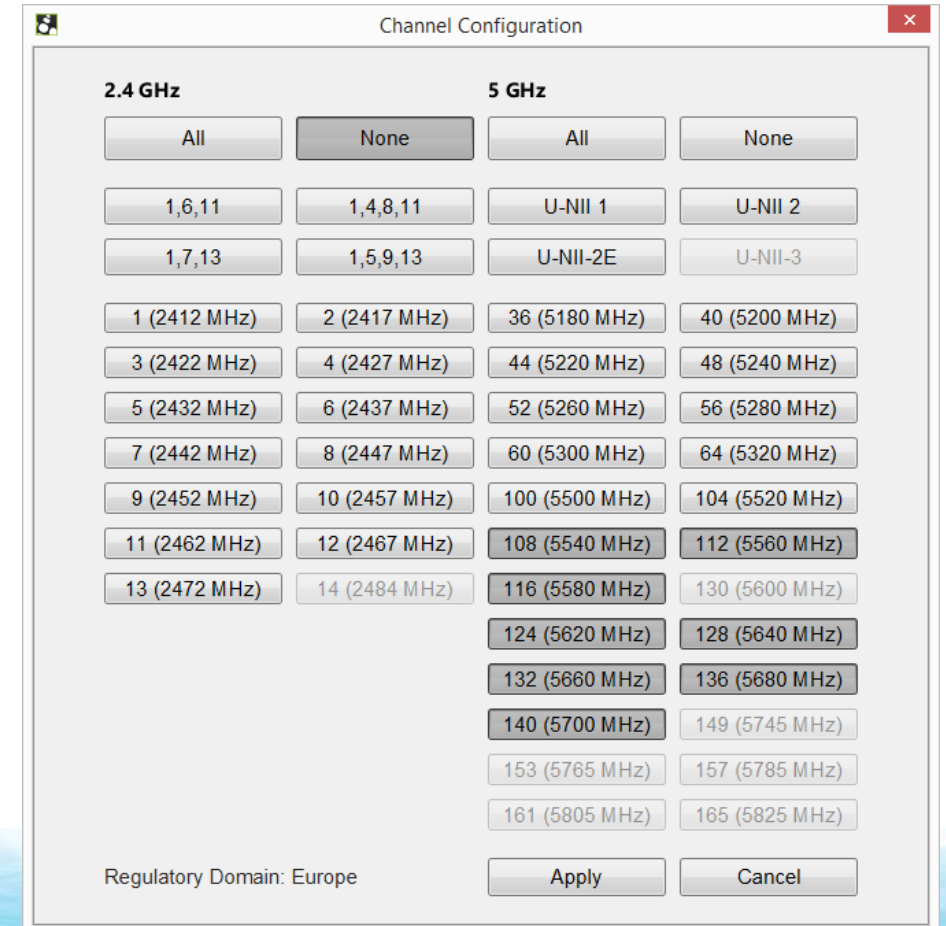
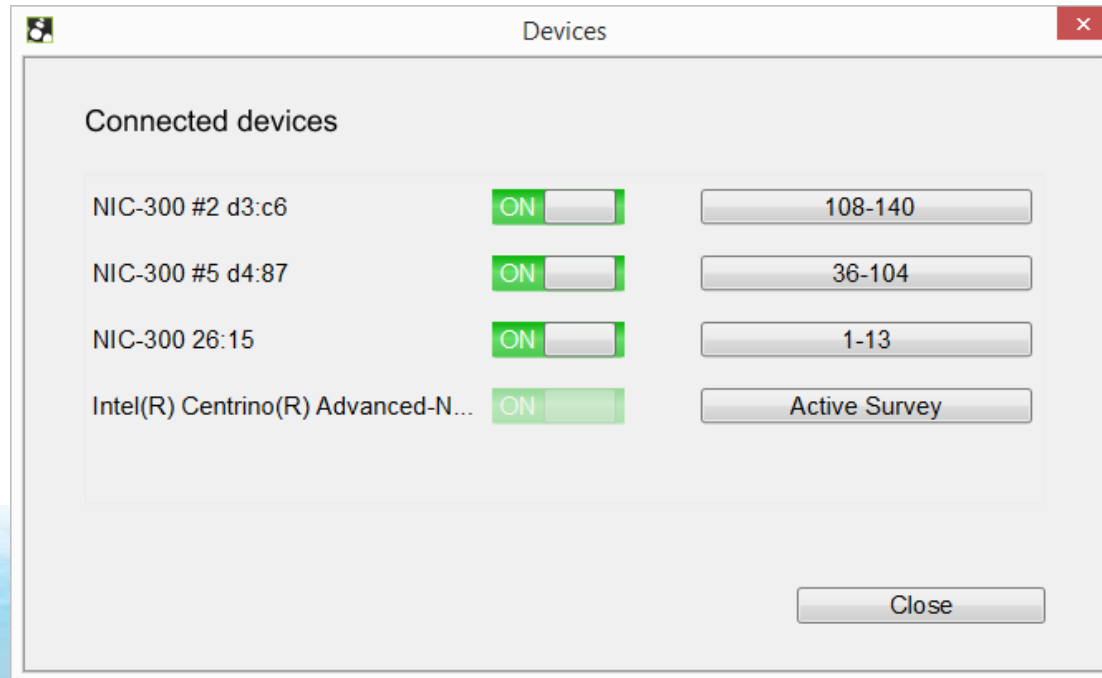
The screenshot shows a software interface with several components highlighted by green boxes and callouts:

- Network Status:** A row of four green boxes containing the values: -27dBm, 76dB, 289Mbps, and 35APs. A callout box below explains: "Is the network working OK? (RSSI, SNR, Data rate, overlap)".
- Association Status:** A grey box containing the text "No Wi-Fi Association". A callout box below explains: "Active survey (integrated NIC)".
- Passive Survey:** Three green bar charts showing signal levels. The first chart has a blue box with the number "24", and the other two have orange boxes with the number "5". A callout box below explains: "Passive survey 3 external NICs: One on 2.4 2 on 5GHz".
- Configuration:** A gear icon. A callout box below explains: "Configure scanned channels for passive survey".
- Spectrum Analysis:** A spectrum analysis icon showing a waveform. A callout box below explains: "Launch spectrum analysis".

Novinky verze 7.x

New NIC channel configuration

- Supports multi-adapter & multi-tag
- Works better with touch screen



Signal Difference Heatmap

Select difference in Signal Strength, SNR, or # of APs.

diff asus.esx* - Ekahau Site Survey

File Edit View Site Device Help

-29dBm 70dB 300Mbps 17APs No Wi-Fi Association 24

Show Difference in Signal Strength for My Access Points on

Planning Survey

yet_another_office_nofurn2 +

Survey	Device	Primary	Secondary	Notes
2013-09-11-13:07	NIC-300 #4 24:21	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
2013-09-11-13:22	NIC-300 #4 24:21	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
2013-09-11-13:51	NIC-300 #4 24:21	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

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Assign the surveys to be compared as "Secondary"

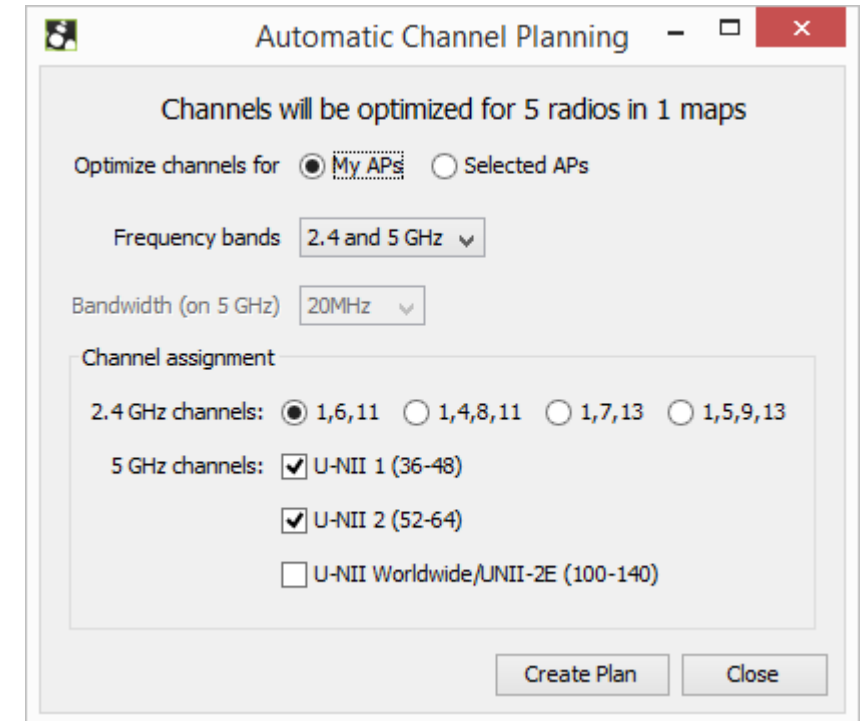
Blue = weaker signal in Secondary survey
(Broken radio? Tx power reduced? AP removed?)

Red = stronger signal in Secondary survey
(AP added? Rogue AP? Tx power increased?)

Green = similar signal during both surveys

Channel Planner

- Previously, channels were planned only for simulated APs, only when using Auto AP placement (Auto-Planner)
- Now, channels can be planned for simulated or measured network, at any time



Novinky verze 8.x (vyjde v dubnu 2015)

Wall Outlining Wizard (WOW)
- No More Wall Drawing

CAD floor plan (DXF or DWG)

The screenshot shows the 'CAD Import - File: Floor.2.dwg' window. On the left is the 'WOW' wizard with a table of layers and wall types. The 'WALLS' layer is selected, and a dropdown menu shows various wall materials with their corresponding colors and dB values. On the right is a 'Map preview' of a floor plan with blue outlines. A scale bar at the bottom right indicates 56.7 ft. Arrows point from text boxes to specific elements in the interface.

Layer Name	Wall Type	Include in Background Map
Border_frame		<input checked="" type="checkbox"/>
Column		<input checked="" type="checkbox"/>
DOORS		<input checked="" type="checkbox"/>
Doors_in		<input checked="" type="checkbox"/>
Enclosures		<input checked="" type="checkbox"/>
Logo		<input checked="" type="checkbox"/>
Mezzanine		<input checked="" type="checkbox"/>
North_arrow		<input checked="" type="checkbox"/>
PLUMBING&KIT		<input checked="" type="checkbox"/>
Paper_edge		<input checked="" type="checkbox"/>
ROOM_NO		<input checked="" type="checkbox"/>
Roof_line		<input checked="" type="checkbox"/>
STAIRS		<input checked="" type="checkbox"/>
Scale		<input checked="" type="checkbox"/>
T_Border		<input checked="" type="checkbox"/>
WALLS		<input checked="" type="checkbox"/>
Windows		<input checked="" type="checkbox"/>

WOW Wall Materials List:

- Network Cabling (0dB)
- Shelf, Retail (5dB)
- Shelf, Warehouse (27dB)
- Unknown (0dB)
- Wall, Brick (10dB)
- Wall, Concrete (12dB)
- Wall, Dry (3dB)
- Wall, Dry, Hollow (2dB)
- Window, Interior (1dB)
- Window, Thick (3dB)

Map preview. Highlighted layer = Blue Selected layers = black

CAD Layers

ESS wall materials

Scale. Adjust if necessary.

56.7 ft

Import Cancel

Novinky verze 8.x

Wall Material Editor

Hiilikatu3_Inbound_iPerfV3-2.esx* - Ekahau Site Survey

File Edit View Map Project Measurement Help

S.Str -35dBm SI.R 52dB Data 144Mbps #APs 2APs Ch.O 11APs RTT 1.4ms Loss 0% Active: Throughput Passive: 24 5 -32dBm

Show Throughput for My Access Points on 2.4 5 GHz Options

Wall, Concrete (24.0dB/m)

12 dB 1.6 ft 24 dB/m

16 11

Wall, Concrete

Left to right: Attenuation, width, dB/meter, height from floor, height from ceiling, color, name

Add, edit, remove walls

Access Points Surveys Building

Showing: 74/74 APs Quick Select Actions

Not placed on any Map (67/67 APs)

Hillkatu 1 (7/7 APs)

Hillkatu 1

Hillkatu 1

My Aerohive

AH-bdca00_ac WPA, GoESS WPA2, Unko

n 5 40:18:b1:bd:ca:14 (3)

n 40 40:18:b1:bd:ca:28 (3)

Hillkatu 1

My Cisco: anttla

of2 WPA2, of5 WPA2, testissid2 WEP, t

n 1 00:1f:9e:8d:1c:60 (3)

n 52 @ 40 00:1f:9e:8d:1c:61 (5)

Hillkatu 1

My Cisco: gameroom

of2 WPA2, of5 WPA2, testissid2 WEP, t

n 6 00:1f:9e:8d:20:81 (3)

n 112 00:1f:9e:8d:20:8f (5)

Hillkatu 1

My Cisco: hakala

of2 WPA2, of5 WPA2, testissid2 WEP, t

g 11 00:19:07:8c:5b:50 (3)

a 140 00:19:07:8c:5b:5f (8)

Hillkatu 1

My Cisco: seppanen

Novinky verze 8.x

Throughput Site Surveys

Second computer required in the network to act as the throughput server (iPerf v3)

The screenshot shows the main interface of the Ekahau Site Survey software. At the top, there's a menu bar with 'File', 'Edit', 'View', 'Map', 'Project', 'Measurement', and 'Help'. Below the menu bar, there are several status indicators: S.Str (-35dBm), SNR (53dB), Data (144Mbps), #APs (3APs), Ch.O (11APs), RTT (1.5ms), Loss (0%), Active: Ping (1.3ms), and Passive: 2.4 5 -30dBm. A callout box with a black background and white text points to the 'Active: Ping' status, stating 'Active Survey status. Click to configure.' Below the status indicators, there are tabs for 'Access Points', 'Surveys', and 'Building'. The 'Access Points' tab is active, showing a search bar and 'Showing: 0/0 APs'. The 'Options' section shows 'Show Signal Strength' for 'My Access Points' on '2.4 5 GHz'. The 'Planning' section shows 'No maps'. At the bottom right, there is a color scale legend for dBm, ranging from -90 to >= 0.

The screenshot shows the 'Devices' window in the software. It lists two connected devices: 'NIC-300 (26:15)' with a status of 'Passive' and 'Marvell AVASTAR Wireless-AC Network Controller (03:...)'. The status dropdown menu for the Marvell device is open, showing options: 'Throughput', 'Disabled', 'Passive', 'Ping', and 'Throughput'. A callout box with a black background and white text points to the 'Throughput' option, stating 'Pretty obvious, eh?'. The 'Close' button is visible at the bottom right of the window.

Děkuji za pozornost

