Novinky v bezdrátových sítích

- MOB2 - NOVINKY/L1

Jaroslav Čížek, SE
Zuzana Humajová, PSS
Agenda

• Aktuální trendy, proč používat 802.11ac wave 2
• Nové 802.11ac wave 2 Cisco AP
  • Cisco AP1800/2800/3800 a venkovní AP, Meraki MR42
• Architektury bezdrátových sítí
  • AireOS a IOS XE – vlastnosti nových verzí 8.2 a 16.1
  • Meraki – novinky nejen z wirelessu
• Související Cisco produkty
  • Cisco Prime Infrastructure, Cisco ISE
  • Cisco CMX – novinky verze 10.2, hyperlokace, API
• Shrnutí a Q&A
Wireless: Primary Access in a Digital World

10X Growth in mobile data traffic between 2014-2019

*Cisco 2015 VNI Study

Higher Expectations for Peak Network Performance
Increased Velocity for Business Demands
Expanded Threat Landscape

A “one size fits all” wireless network cannot deliver results
Addressing Growth
802.11ac Wave 2

Highest Wi-Fi Performance Ever
- Higher data rate than previous standard
- Allows for more wireless data with wider channels

Better End Device Efficiency
- Simultaneously deliver data to multiple devices
- Conserve end-device battery

For Highly Demanding Environments
Wi-Fi Connectivity Speed Timeline

Gigabit Wi-Fi As Primary Access

- **3SS**: Desktops / Laptops
- **2SS**: Laptops / Tablets
- **1SS**: Tablets / Smartphones

- **802.11**: 2 Mbps
- **802.11b**: 11 Mbps
- **802.11a/g**: 54 Mbps
- **802.11n**: 65 Mbps
- **802.11ac Wave 1**: 2400 Mbps
- **802.11ac Wave 2**: 1300 Mbps
- **2Gigabit Ethernet Uplinks**: 2630 Mbps
- **Multi-Gigabit Uplinks**: 5260 Mbps
- **Dual 5GHz**: 3500 Mbps

- **1 Spatial Stream**
- **2 Spatial Streams**
- **3 Spatial Streams**

- **= Connect Rates (Mbps)**
- **SS = Spatial Streams**

*Assuming 80 MHz channel is available and suitable

**Assuming 160 MHz channel is available and suitable
How 802.11ac Wave 2 Works

80% speed boost compared to Wave 1, thanks to:

- Multiuser MIMO (MU-MIMO)
- Wider RF Channels
- Four Spatial Streams
Simultaneous Data Delivery to Many Devices
Multi-User, Multi-In, Multi-Out

Single-User MIMO (SU-MIMO)
-> Multi-User MIMO (MU-MIMO)

Devices Get On and Off the Network Quicker, Allowing More Devices to Be Served
Better Traffic Handling
802.11ac Wave 2 with 160MHZ - Wider Channels

Wider Channels
Allows More Traffic
to Pass

Multi-User MIMO
Uses the Channel to
Max Capacity

20–40 MHz  80-160 MHz
How 802.11ac Wave 2 Works – Up To Four Spatial Streams

- Multi-user MIMO (MU-MIMO)
- Wider RF channels
- Four spatial streams

The access point transmits "abcdefgijkl" to the client. The Wi-Fi client receives "abcdefgijkl" through four streams of data. Up to four spatial streams support using single-user MIMO.
Delivers up to 5X Speeds in Enterprise without replacing Cabling Infrastructure.
Know what this is?

http://www.engadget.com/2015/02/16/wifi-mapping-in-3d/


Cisco CleanAir - Spectrum
Innovations Only Cisco Delivers
Radio Frequency Excellence for High-Density Environments

- **Zero Impact AVC**: Remediates Device Impacting Interference. Hardware Based Application Visibility and Control without Impact to Performance.
- **Flexible Radio Assignment**: Adjust Radio Bands to Better Serve the Environment.
- **Multi-Gigabit Uplinks**: Free Up Wireless With Faster Wired Network Offload.
- **802.11ac Wave 2 MU-MIMO**: Standards based Wave 2 MU-MIMO.
- **Optimized Roaming**: Intelligently Connects the Proper Access Point as People Move.
- **Smart Antenna Connector**: 2nd Antenna Connection, Dual 5 GHz & Band specific Antennas.
- **Cisco CleanAir®**: Improves Performance of Legacy and 802.11ac Devices.
- **Turbo Performance**: Scales to Support More Devices Running High Bandwidth Apps.
- **Flex Dynamic Frequency Selection**: Automatically Adjusts So Not to Interfere With Other Radio Systems.
- **Expandability**: Add Functionality Via Module, Smart Antenna Port or USB Port.
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Cisco Aironet Portfolio
Positioned to Capture the 802.11ac Wave 2 Transition

Enterprise Class

1810 Wall Plate
- 2x2:2SS 80 MHz; 867 Mbps
- Tx Beam Forming
- 1 GE Port uplink
- 3 GE Local Ports, including 1 PoE out
- Local ports 802.1x ready
- Integrated BLE Gateway*

1810 Teleworker
- 2x2:2SS 80 MHz; 867 Mbps
- 3 GE Local Ports downlink, including 1 PoE out
- One or Two Local Ports can be tunneled back to corporate

1830
- 3x3:2SS 80MHz; 867Mbps
- Spectrum Analysis*
- Internal antenna
- Tx Beam Forming
- 1 GE Port
- USB 2.0
- Centralized, FlexConnect and Mobility Express

1850
- 4x4:4SS 80MHz; 1.7 Gbps
- Spectrum Analysis*
- Internal or External antenna
- Tx Beam Forming
- 2 GE Ports
- USB 2.0
- Centralized, FlexConnect and Mobility Express

Mission Critical

2800
- 4x4:3SS 160 MHz; 5 Gbps
- 2.4, 5GHz or Dual 5GHz
- 2 GE Ports
- Internal or External antenna
- Smart Antenna Connector
- Enhanced Location* (External Antenna)
- CleanAir 160MHz
- ClientLink 4.0
- USB 2.0
- Centralized, FlexConnect and Mobility Express

Best in Class

3800
- 4x4:3SS 160 MHz; 5 Gbps
- 2.4, 5GHz or Dual 5GHz
- 1 GE + 1 mGig (5G)
- Smart Antenna Connector
- Enhanced Location* (External Antenna)
- CleanAir 160 MHz
- ClientLink 4.0
- StadiumVision
- USB 2.0
- Modularity
- Centralized, FlexConnect and Mobility Express*

* Future availability
Next-Generation Wave 2 802.11ac Access Points

- Industry leading 4x4 MIMO:3 spatial streams (SS) 
- Wave 2 802.11ac access points
- Dual radio, 802.11ac Wave 2, 160 MHz
- Combined Data Rate of 5.2Gbps
- 2 x 5 GHz: 4x4: 3SS supporting
  - SU-MIMO / MU-MIMO
  - Flexible Radio Assignment: 2.4GHz, 5GHz, Wireless Security Monitoring, Wireless Service Assurance, or Enhanced Location*
- AP2800: 2xGE, AP3800: GE and multi-Gig Eth (1G, 2.5G, 5G)
- HDX Technology
- Enhanced Location using External Antennas*
- USB 2.0
- Internal and external antenna models
- Smart Antenna Connector - 2\textsuperscript{nd} Antenna Connector
- AP3800 - Modularity: Side Mount Modular

Cisco Aironet\textsuperscript{®} 2800/3800 Series

Multi-Gigabit Wi-Fi has fully arrived.

* Post-FCS
The World’s Most Versatile Access Points

All The Benefits of 802.11ac Wave 2

- Highest Wi-Fi Performance Ever
  - Higher Data Rate
  - Wider Channels

- Better End Device Efficiency
  - Simultaneous Data Delivery
  - Better Battery Life

NEW: Cisco Aironet 2800
NEW: Cisco Aironet 3800

Plus Cisco Innovations for High Density Environments

Self-Optimizing Network
- New Flexible Radio Assignment
- New Multi-Gigabit Uplinks
- Improved Modularity

Optimized Mobile User Experience
- Improved ClientLink
- Turbo Performance
- New Smart Antenna Connector
- Improved Enhanced Location*
- Optimized Roaming

*Future
Flexible Radio Assignment

- Default operating mode
- Serve Clients on both 2.4GHz and 5GHz

- Dual 5GHz Support, both radios serving clients on 5GHz
- Maximum over the air data rate up to 5.2Gbps

- Wireless Security Monitoring
- Scan both 2.4GHz and 5GHz for security threats
- Serve Client of 5GHz

- Wireless Service Assurance*
- Proactively monitors the network performance
- Serve Client of 5GHz

- Enhanced Location*
- Improves the client location accuracy
- Serve Client of 5GHz

* Denotes feature availability post-FCS
Dual 5GHz – Macro/Micro Cell

Improves Client Performance and Capacity

- Improves the Effective Spectrum Usage
- Micro-Radio
  - High Performance 802.11ac Clients near the AP at 802.11ac data rates
  - Excellent speed and performance
- Macro-Radio
  - All legacy Clients join macro-cell

*but …*

- Cells must be isolated
  - overlap in RF Frequency = shared airtime = lost efficiency
- Begins in the Silicon design, extends to the AP/Antenna selections

Users have a better overall experience on a Dual 5GHz Access Point
2800/3800 Macro/Micro

Dual 5 GHz

- Creating two RF diverse 5 GHz cells – Doubles the Air Time available
- Optimizing Connections (Macro vs Micro) keeps like performing clients together, rather than have one drag down the other
- RRM will optimize, based on received RSSI only at FCS – Other possibilities exist (protocol, SS Capability)
Dual 5GHz – External Antennas

2x the Coverage Area and Capacity

- Provide 2x the coverage area from a single Access Point
- Improve the total Network Performance
- Utilizes Smart Antenna Connector
- Mix and match all Cisco Supported Antennas
**802.11ac Wireless Throughput Use Cases**

### 802.11ac wave 2 – Dual - 5GHz 80 MHz Channels

<table>
<thead>
<tr>
<th></th>
<th>Radio 1 – 5GHz</th>
<th>Radio 2 – 5GHz</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Data Rate</td>
<td>1.3Gbps</td>
<td>1.3Gbps</td>
<td>2.6 Gbps</td>
</tr>
<tr>
<td>Actual Throughput*</td>
<td>845Mbps</td>
<td>845Mbps</td>
<td>1.69 Gbps</td>
</tr>
</tbody>
</table>

### 802.11ac wave 2 – 2.4GHz + 5GHz 160 MHz Channel

<table>
<thead>
<tr>
<th></th>
<th>Radio 1 – 2.4GHz</th>
<th>Radio 2 – 5GHz</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Data Rate</td>
<td>216Mbps</td>
<td>2.6Gbps</td>
<td>2.81 Gbps</td>
</tr>
<tr>
<td>Actual Throughput*</td>
<td>140Mbps</td>
<td>1.69Gbps</td>
<td>1.79 Gbps</td>
</tr>
</tbody>
</table>

### 802.11ac wave 2 – Dual - 5GHz 160 MHz (not available in ETSI reg.)

<table>
<thead>
<tr>
<th></th>
<th>Radio 1 – 5GHz</th>
<th>Radio 2 – 5GHz</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Data Rate</td>
<td>2.6Gbps</td>
<td>2.6Gbps</td>
<td>5.2 Gbps</td>
</tr>
<tr>
<td>Actual Throughput*</td>
<td>1.69Gbps</td>
<td>1.69 Mbps</td>
<td>3.38 Gbps</td>
</tr>
</tbody>
</table>

**Summary:**
- 802.11ac wave 2 utilizes key technologies such as Multi-user MIMO and 160MHz wide channels to push wired throughput above 1Gbps
- Cisco Dual-5GHz radio technology more effectivity utilizes the 5GHz RF spectrum to drive the wired throughput toward multi-gigabit speeds

* Denotes 65% Duty Cycle which emulates normal wireless network operation
## Comparing the Cisco Wave 2 AP Portfolio

<table>
<thead>
<tr>
<th>Feature</th>
<th>Cisco Aironet 1830</th>
<th>Cisco Aironet 1850</th>
<th>Cisco Aironet 2800</th>
<th>Cisco Aironet 3800</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MAX DATA RATE</strong></td>
<td>1.087Gbps.</td>
<td>2.4Gbps.</td>
<td>5Gbps.</td>
<td>5Gbps.</td>
</tr>
<tr>
<td><strong>ANTENNAS: SPATIAL STREAMS</strong></td>
<td>3X3:2SS - 80MHz.</td>
<td>4X4:3SS - 80MHz.</td>
<td>4X4:3SS - 160MHz.</td>
<td>4X4:3SS - 160MHz.</td>
</tr>
<tr>
<td><strong>GIGABIT / MULTIGIGABIT PORTS</strong></td>
<td>1Gig</td>
<td>2Gig</td>
<td>2Gig</td>
<td>2Gig or 1Gig / 1MGig (1Gig, 2.5Gig, 5Gig)</td>
</tr>
<tr>
<td><strong>USB 2.0 PORT</strong></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Spectrum Analysis</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>TX Beam Forming</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>CleanAir / ClientLink</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Dual 5GHz Radios</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Optimized Roaming</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>FlexSmart: Optimized Radios</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Smart Antenna Connector</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Side Mount Modularity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
New Controllers and Switches
Preparing for the Impact of 802.11ac Wave 2

- **Cisco® 5520 WLAN Controller**
  - 10 to 1500 access points
  - 20,000 clients
  - 20 Gbps

- **8540 WLAN Controller**
  - 100 to 6000 access points
  - 64,000 clients
  - 40 Gbps

- **Cisco Catalyst® 3560**
  - 8-port multigigabit switch
  - 2-port multigigabit-capable
  - 10-Gbps uplink

- **Catalyst 3850 (converged wired and wireless)**
  - 48/24-port multigigabit switch
  - 24/12-port multigigabit-capable
  - 40-Gbps uplink

- **Catalyst 4500 with Supervisor 8-E**
  - 48-port multigigabit line card
  - 12-port multigigabit-capable

10X Increase in Performance
5X Increase in Performance
Cisco Unified Access Portfolio
Robust Converged Wired and Wireless Solution

One Policy
Identity Services Engine (ISE)

MDM/MAM
SIEM

One Management
Prime Infrastructure

(‡ MSE – Mobility Services Engine)

One Network
Controllers and Access Switches

Wireless Controllers
Access Switch
Converged Access Switches
Backbone Switches

2500, 5508, 5520, 5760, 8500, 7500
Catalyst 2960-X
Catalyst 3650
Catalyst 4500
Catalyst 6500
Catalyst 6800

Small-Mid Enterprise, Home Offices
Feature-Optimized Enterprise
Mid-Large & HD Enterprise
IoE. Industrial
Low Profile
Larger Deployments

1810, 1700/1830/1850
2700/2800
3700/3800
IW3700
1530
1570

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Introducing Meraki MR42: 802.11ac Wave 2

802.11ac Wave 2
   3x3 antenna with 3 spatial streams
   Support for MU-MIMO

Dedicated third radio
   Air Marshal, Auto RF, CMX

Fourth Bluetooth LE radio
   Enabling Beacon engagement & BLE scanning

PoE+ 802.3at power for full operation

Sleek industrial design of MR32/34
Cisco Meraki AP Lineup – Spring 2016

**Indoor APs**

- **MR18**
  - 2 Stream Triple-Radio
  - 802.11a/b/g/n

- **MR32**
  - 2 Stream Triple-Radio
  - 802.11ac
  - Bluetooth LE

- **MR34**
  - 3 Stream Triple-Radio
  - 802.11ac

- **MR42**
  - 3 Stream Triple-Radio
  - 802.11ac Wave 2
  - Bluetooth LE

**Outdoor APs**

- **MR62**
  - Single-Radio
  - 802.11b/g/n

- **MR66**
  - Dual-Radio
  - 802.11a/b/g/n

- **MR72**
  - 2 Stream Triple-Radio
  - 802.11ac
  - Bluetooth LE
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Cisco Unified Wireless Deployment Options

**MOBILITY EXPRESS**
- Single site
- Distributed network
- Low IT footprints
- SP hotspots

Controller function on AP
- 11ac: 1850/1830, 2800/3800 (with 8.3)

**FLEX CONNECT**
- Distributed network
- Highly scalable
- Best for distributed networks

Controllers
- New 8540 controller
- New 5520 controller
- or other Cisco WLC

**CONVERGED**
- Simplified campus/branch
- Consistent wired/wireless
- Common OS

Controllers
- Integrated 3650/3850/Sup 8E

**CENTRALIZED**
- Core or DC hosted WLC
- Distributed enterprises

Controllers
- New 8540 controller
- New 5520 controller
- Or other Cisco WLC

**Small Networks**
- Distributed network
- Highly scalable
- Best for distributed networks

**Branch**

**Small Campus/Branch**
- Simplified campus/branch
- Consistent wired/wireless
- Common OS

**Large Campus**
- Core or DC hosted WLC
- Distributed enterprises

**Aironet Access Points**
- 11ac Wave 2: 1800 / 2800 / 3800 and outdoor APs

Prime Infrastructure, Identity Service Engine, Connected Mobile eXperiences
Cisco Mobility Express
Cisco’s Enterprise Class Wi-Fi in a Simple, Affordable Solution

Same HW – Flexible Deployment Modes
A Enterprise Class feature-rich solution

Affordable Enterprise Class Wi-Fi Solution without feature compromise

Ideal for Small and mid-sized business
For customers who prefer on-prem managed solution

Simplicity with the speed, reliability of an On-Prem Managed Wi-Fi Solution

Setup in < 5 Minutes
Reduces deployment complexity
With no Network configuration changes

Simple, Easy to use Interface allows for Over-the-air configuration

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Self-Service Experience

• Initial Setup via Wizard
• 3 Steps in <5 Mins
• Best Practices defaults
• Approachable
• Simple screens
• Guide users, focus on basic features
• Supported with PI 3.0.1
• Supported with CMX10.2 presence

ME Local UI and Mobile App
Mobility Express: Built-In Enterprise-Class Wi-Fi
Integrated WLC Capability on the Wave 2 Access Points

- Multi-Purpose AP: AP or AP+WLC
  - Controller running on Access Point
- Based on next generation 802.11ac Wave 2 Access Points (1830/1850)
- Manage various Aironet AP’s in cluster in addition to Wave 2 series (i.e. AP-1700, 2700, 3700, 1600, 2600, 3600, 700 series)
- Simplified Configuration & S/W Image Management
- Global Availability
- No Additional License/Cost

<table>
<thead>
<tr>
<th>Key Features</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scalability</td>
<td>1-25 AP’s</td>
</tr>
<tr>
<td>Max WLAN’s</td>
<td>16</td>
</tr>
<tr>
<td>RRM</td>
<td>Yes</td>
</tr>
<tr>
<td>Roaming</td>
<td>Yes - L2 Intra-Controller</td>
</tr>
<tr>
<td>Rogue AP Detection</td>
<td>Yes</td>
</tr>
<tr>
<td>Application Visibility</td>
<td>Yes</td>
</tr>
<tr>
<td>Guest Network</td>
<td>Yes</td>
</tr>
<tr>
<td>Management</td>
<td>WEBUI, Mobile App</td>
</tr>
<tr>
<td>High Availability</td>
<td>N+1</td>
</tr>
<tr>
<td>Local Radius Server</td>
<td>Yes</td>
</tr>
<tr>
<td>Policies</td>
<td>AAA, ACL Over-ride, QOS Over-ride, ACL, Voice CAC</td>
</tr>
</tbody>
</table>
What’s New in Cisco AireOS 8.2

Simple Flexible Deployments

Deployment & Management Simplicity

Services & Security

Continue 8.1 focus on RF Excellence & Ease of Use

Additional Highlights
8.2 GUI – What's New

- **AP View Enhancements:**
  - Wireless Dashboard
  - RF Troubleshooting Dashboard

- **Client View Enhancements:**
  - Client Signal Strength and SNR values
  - Connectivity Score
  - Mobility Visualization
Mobility Visualization – Examples

Local Client

FlexConnect Client

Foreign / Anchor Client

Foreign / Guest Anchor Client
Client Troubleshooting – Packet Capture

- 802.11 packet capture tool for administrators and TAC
  - Previously only available in the CLI
  - Enabled per client (1 session max)
  - Capture times 1 – 60 minutes (default 10 minutes)
  - 802.11 and Protocol based capture filters
- Packet captures are streamed to a FTP server in .pcap format for offline analysis
  - Capture files are automatically named using <AP-NAME><WLC-NAME>-<DATE>_<TIME>
Cisco Dynamic Bandwidth Selection (DBS)

- Automatic Optimization for 20-40-80 MHz channel widths
- DBS applies an additional layer of channel and width recommendations on top of those applied in Core DCA
- Useful for 11n-11ac mix AP networks and Wave-2 (160MHz)

### Dynamic Channel Assignment Algorithm

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel Assignment Method</td>
<td>Automatic</td>
</tr>
<tr>
<td>Interval</td>
<td>10 minutes</td>
</tr>
<tr>
<td>AnchorTime</td>
<td>0</td>
</tr>
<tr>
<td>Avoid Foreign AP Interference</td>
<td>Enabled</td>
</tr>
<tr>
<td>Avoid Cisco AP load</td>
<td>Enabled</td>
</tr>
<tr>
<td>Avoid non-802.11a noise</td>
<td>Enabled</td>
</tr>
<tr>
<td>Avoid Persistent Non-WiFi Interference</td>
<td>Enable</td>
</tr>
<tr>
<td>Channel Assignment Leader</td>
<td>Shivesh-Feature (192.168.5.20)</td>
</tr>
<tr>
<td>Last Auto Channel Assignment</td>
<td>549 secs ago</td>
</tr>
<tr>
<td>DCA Channel Sensitivity</td>
<td>Medium (15 dB)</td>
</tr>
<tr>
<td>Channel Width</td>
<td>Best</td>
</tr>
<tr>
<td>Avoid check for non-DFS channel</td>
<td>Enabled</td>
</tr>
</tbody>
</table>

**DBS:** Auto Configure Globally
Cisco Enhanced Interference Mitigation

Before
Rogue Wi-Fi interference decreases reliability and performance until next dynamic channel assignment (DCA) cycle

After
Mitigated RF interference for improved reliability and performance

Improved Client Performance

Air Quality
Performance

Rogues seen as security threat only
Non-Wi-Fi interference prioritized

Air Quality
Performance

Wi-Fi and non-Wi-Fi aware
Dynamic mitigation ED-RRM
Granular spectrum visibility and control

Complete Automatic Interference Mitigation Solution for Rogues and Non-Wi-Fi Interference
Cisco Air Time Fairness (ATF)

Before
Rate limiting can only specify a bit rate (throughput) limit. There is no way to limit the duration that the bit rate will use.

After
Air time is allocated per SSID, per realm, per client. There is now better control over how air time is shared.

Gain the Ability to Meet SLAs

Improved Predictability and Performance

SSID 2
30%
SSID 1
70%

Before
SSID 2
48%
SSID 1
52%

Time-based
Automatic calculation on availability
Ongoing recalculation

Client-dependent fluctuation
Not time-based

Bandwidth rate unpredictable
Problems with Wi-Fi QoS

- RF spectrum is non-deterministic
  - APs, Clients, Interferers, Noise Cannot be controlled!

- For Over the Air the AP needs to know
  - Total Air-time available
  - Air-time used by clients and APs
  - Rogue client traffic patterns (client rates may change depending on many factors such as range, capabilities etc.)

- To solve this problem
  - RF ownership needs to be measured dynamically
  - Dynamic measurements allow our QoS strategies to change on the AP for different BSSIDs, clients, ACs, flows etc as the RF environment changes around us
ATF Per SSID and Per Client Optimization Enforcement

ATF per SSID

Venue Owner
- Policy 1 with 10% of the airtime
- 1 SSID: MNGT uses Policy 1

Provider A
- Policy 2 45% of the airtime
- SSIDs: A

Provider B
- Policy 3 with 45% of the airtime
- 2SSIDs: B, C

ATF per Client (ATF Policy 1 with 80% of the airtime)

Client A
- Fair Share ATF 25% of the airtime/ data

Client B
- Fair Share ATF 25% of the airtime/ data

Client C
- Fair Share ATF 25% of the airtime/ data

Client D
- Fair Share ATF 25% of the airtime/ data

Fair share of 25% is used by every client
Cisco AVC on Controllers and on FlexConnect APs

DPI engine (NBAR2) identifies applications using L7 signatures

Controller collects application info and presents on controller every 90 seconds or exports to Netflow Collector

AireOS 8.2
NBAR2 on WLC for Local mode
NBAR2 on AP for FlexConnect

Static Netflow

App Visibility & User Experience Report

<table>
<thead>
<tr>
<th>App</th>
<th>BW</th>
<th>Transaction Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>WebEx</td>
<td>3 Mb</td>
<td>150 ms</td>
</tr>
<tr>
<td>Citrix</td>
<td>10 Mb</td>
<td>500 ms</td>
</tr>
</tbody>
</table>

Cisco Prime Infrastructure 3rd Party Tools LanCope, Live Action and other

Use QoS Rate Limiting to control application bandwidth usage to improve application performance

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Enhanced Netflow Export on Cisco WLC

- Enhanced Netflow export of 17 new flow records to better integrate with Lancope and other Netflow partners
- Helps track applications & Traffic flows by User ID
- Supported on 5520 and 8500 series controllers

Enhanced Netflow on Cisco WLC

- Application Tag
- Client Mac Address
- AP Mac address
- WlanID
- Source IP
- Dest IP
- Source Port
- Dest Port
- Protocol
- Flow Start Time
- Flow End Time
- Direction
- Packet count
- Byte count
- VLAN Id – Mgmt/Dyn
- TOS - DSCP Value
- Dot1x username

Lancope NetFlow Visibility
Converged Access – IOS-XE 3.x and 16.x

Innovations
- Distributed System-model
- Software-Defined Digital Enterprise

Enhanced Architecture
- One Converged OS Feature Consistency
- Controller-based NW Management

Easy Manageability
- Plug-n-Play Smart-Licensing
- Network Programmability

Operation Efficiency
- IT simplicity with APIC-EM and PI
- Ease-of-troubleshooting Modularized Upgrades
Converged Access – NEW IOS-XE 16.2

New AP Support

- Cisco 3800 Wave 2 APs
- Cisco 2800 Wave 2 APs
- Cisco 1800 Wave 2 APs
- Cisco Outdoor Wave 2 APs
- Hyperlocation (HALO) Module

New Software features

- Full AVC on APs
- RF Profiles in CA mode
- EoGRE - Anchorless Guest Access
- Airtime Fairness

New Enhanced WebGUI
Meraki: MDM - Systems Manager update

iOS branding option
Integration with Android for Work
Granular controls ideal for BYOD
Networking for Windows 10

Automatic configuration of WiFi & VPN settings
Dynamically managed with tags
Seamless delivery of functionality through the cloud
# Meraki Switches

## Available Models & Options

<table>
<thead>
<tr>
<th>Access</th>
<th>Aggregation</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS220</td>
<td>MS320</td>
</tr>
</tbody>
</table>

### Features

- **8, 24, 48 port models**
- **Layer 2**
- **Gigabit SFP uplinks**
- **24, 48 port models**
- **Layer 3**
- **10Gb SFP+ uplinks**
- **Hot-swappable, redundant PSU**
- **24, 48 port models**
- **Physical stacking (160Gbps)**
- **High performance Layer 3**
- **10Gb SFP+ uplinks**
- **Hot-swappable, field-replaceable fans and power supplies**
- **Management port**
- **24, 48 port models**
- **High performance Layer 3**
- **10Gb SFP+ interfaces**
- **Hot-swappable, redundant PSU and fans**
- **Management port**

### Positioning

- **Branch access switching (L2)**
- **Branch and Campus access switching (L3)**
- **Stackable Branch and Campus access switching (L3)**
- **Campus aggregation switching (L3)**

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# Meraki Security Appliances

## Choosing the right MX

<table>
<thead>
<tr>
<th>Where</th>
<th>Unique Features</th>
<th>Adv Sec Throughput</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small branches (~50 users)</td>
<td>Wireless (MX64W/65W)</td>
<td>100 Mbps</td>
</tr>
<tr>
<td>Mid-size branches (~200 users)</td>
<td>2x SFP ports</td>
<td>300 Mbps</td>
</tr>
<tr>
<td></td>
<td>1 TB Storage for Web Caching</td>
<td></td>
</tr>
<tr>
<td>Mid-size branches (~500 users)</td>
<td>2x SFP ports</td>
<td>600 Mbps</td>
</tr>
<tr>
<td></td>
<td>1 TB Storage for Web Caching</td>
<td></td>
</tr>
<tr>
<td>Large branch/campus (~2,000 users)</td>
<td>SFP (1 Gbps), and SFP+ (10 Gbps) interfaces</td>
<td>1 Gbps</td>
</tr>
<tr>
<td></td>
<td>1 TB Storage for Web Caching</td>
<td></td>
</tr>
<tr>
<td>Large branch/campus (~10,000 users)</td>
<td>SFP (1 Gbps), and SFP+ (10 Gbps) interfaces</td>
<td>1 Gbps</td>
</tr>
<tr>
<td></td>
<td>4 TB Storage for Web Caching</td>
<td></td>
</tr>
</tbody>
</table>

- **MX64/64W/65/65W**
- **MX84**
- **MX100**
- **MX400**
- **MX600**

**Unique Features**
- **Wireless (MX64W/65W)**
- **2x SFP ports**
- **1 TB Storage for Web Caching**
- **SFP (1 Gbps), and SFP+ (10 Gbps) interfaces**
- **4 TB Storage for Web Caching**

**Adv Sec Throughput**
- **100 Mbps**
- **300 Mbps**
- **600 Mbps**
- **1 Gbps**

**For teleworkers (1-5 users)**
- Dual-radio wireless
- FW throughput: 50 Mbps

**Z1**
- All devices support 3G/4G
Agenda

• Aktuální trendy, proč používat 802.11ac wave 2
• Nové 802.11ac wave 2 Cisco AP
  • Cisco AP1800/2800/3800 a venkovní AP, Meraki MR42
• Architektury bezdrátových sítí
  • AireOS a IOS XE – vlastnosti nových verzí 8.2 a 16.1
  • Meraki – novinky nejen z wirelessu

• Související Cisco produkty
  • Cisco Prime Infrastructure, Cisco ISE
  • Cisco CMX – novinky verze 10.2, hyperlokace, API
• Shrnutí a Q&A
APIC-EM Path Visualization
Enhanced Application Flow Visibility

Ingress/Egress Interface

CAPWAP tunnel visualization

Link source information

Accuracy note (in percentage)
Cisco Identity Services Engine – ISE 2.0

A centralized security solution that automates context-aware access to network resources and shares contextual data

<table>
<thead>
<tr>
<th>Identity Profiling and Posture</th>
<th>Role-based policy access</th>
<th>Network Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who</td>
<td>Traditional</td>
<td>Network Door</td>
</tr>
<tr>
<td>What</td>
<td>TrustSec</td>
<td>pxGrid controller</td>
</tr>
<tr>
<td>When</td>
<td>Guest Access</td>
<td></td>
</tr>
<tr>
<td>Where</td>
<td>BYOD Access</td>
<td></td>
</tr>
<tr>
<td>How</td>
<td>Role-based Access</td>
<td></td>
</tr>
<tr>
<td>Compliant</td>
<td>Secure Access</td>
<td></td>
</tr>
</tbody>
</table>

- **ISE Portal Builder** – build your own guest portals here - [https://isepb.cisco.com](https://isepb.cisco.com)
- **ISE Guest Setup Wizard App** - Configure ISE and WLC at the same time.
- **ISE Express Bundle** - Cisco ISE in an entry-level bundle offered at an aggressive discount
Cisco CMX - Gain Insights & Innovate

**DETECT**
- Presence and location detection
- Visibility (Wi-Fi, BLE)

**CONNECT**
- Easy Wi-Fi login, custom or social
- Zone-based, custom splash pages

**ENGAGE**
- App-based mobile engagement
- Context-aware in-venue experiences

**ANALYTICS**

Presence • Location • Social
CMX - Understand How People Interact in the Location

- Number of people by venue and zones
- Peak time in venue
- New compared to repeat visitors
- Common traffic patterns
- Where people spend time
CiscoLive Berlin – What are the attendee totals?

We can see:

- How many total visitors
- How long they stayed on average
- How many devices connected to W-Fi
Almost ½ of attendees visited the DevNet Zone and spent average 34mins.
World Of Solutions was VERY popular!!

- Total Unique Devices: 15,343
  - New Visitors: 100%
  - Repeat Visitors: 0%

- Dwell Time Breakdown:
  - 0-5min: 13%
  - 5-20min: 27%
  - 20-60min: 18%
  - 60-120min: 13%
  - >120min: 33%

- Path:
  - Focus Area: H4-L2-WOS_P
  - Total Paths: 71342

- Correlation:
  - Devices: 11213
  - H2-L2-WOS_P

- Additional Graphs:
  - Unique Devices by Zone
  - Average Dwell Time
  - Total Visitors
  - Dwell Time Breakdown
  - Path
  - Correlation
Cisco’s location use case vision

**Presence**
- Greater customer insights
  - **Accuracy**: 20m
  - **Type**: In-zone Detection
  - **Use Cases**: Venue-level, Visitors, Dwell Time

**Basic and Enhanced location**
- **Accuracy**: 5-10m
- **Type**: X,Y coordinates, Fast Loc - Optimized refresh
- **Use Cases**: Zone/subzone-level Correlation

**Hyperlocation**
- **Accuracy**: 1-3m
- **Type**: Real time refresh, app required
- **Use Cases**: Way Finding / Indoor navigation

**Hyperlocation**
- **Accuracy**: 1-3m
- **Type**: Refresh every 10 seconds, no app
- **Use Cases**: Sub-zone-level Work space optimization

**Bluetooth Low Energy**
- **Accuracy**: 1-3m
- **Type**: Real time refresh, app required
- **Use Cases**: Way Finding / Indoor navigation
CMX Deployment Models: On-Premises and Cloud Managed

Cloud Managed
- Easily deployable installation and management

Optimized for Ease of Management

On-Premises Managed
- High-density and advanced use cases

Optimized for Flexibility and Control

No Matter Which Infrastructure Is Best for You Go with Cisco® CMX
TRY IT NOW - http://cmxcloud.cisco.com (Presence Analytics + CMX Connect)
Agenda

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 • Shrnutí a Q&A
Cisco WLAN Solution – Differentiators

**Cisco High Density Experience (HDX)**

- **Turbo Performance**: Improves the efficiency of airtime utilization and channel capacity
- **Optimized Roaming**: Intelligently determines the optimum time to roam
- **Cisco CleanAir up to 160MHz**: Mitigates interference and improves channel capacity
- **Cisco ClientLink 4.0**: Improves legacy and 802.11ac Client performance
- **Noise Reduction**: Enables Dense Access Point Coexistence / implementation

**802.11ac Wave 2**
Flexible Radio Assignment, mGig

**Modularity**
3k AP only modular and future proofed access point in the industry

**App Visibility and Control**
without impact to performance

**High Availability**
Stateful Switchover

**Highly Accurate Location**
Hyperlocation module for 3k APs
Most inclusive License - Cisco One
Portable, Perpetual & Inclusive license

Simplified License with Greater Value

Cisco Prime Infrastructure
- WLAN Management and Analytics
- Full Visibility & Control
- Prime Assurance – NetFlow
- Advanced Client Troubleshooting
- Quality of Infrastructure Reports
- Quality of Experience Reports

CMX
- Highly Accurate Location Services
- Wi-Fi and Bluetooth location tracking
- Connected Mobile Experience
- Presence Analytics
- Location Analytics
- CMX Connect- Onboarding

ISE
- AAA Radius and data base Integration
- 802.1x & CoA
- Enhanced Guest Management Portal
- TrustSec Policy Control

Any Controller
Any AP
Děkujeme za pozornost.