Cisco Expo 2008

Aplikace nad metropolitní WiFi infrastrukturou
(TECH3)

Pavel Křižanovský

Systems Engineer, CCIE#11457

pkrizano@cisco.com

Enable Your Network
Empower Your Business

Agenda

- Úvod do metropolitní a outdoor WiFi
- Technologie a architektury pro metropolitní sítě WiFi
  - Komponenty WiFi Mesh
  - Vlastnosti WiFi Mesh
  - End-to-end architektura metropolitních WiFi sítí
  - Zajímavé produkty
- Aplikace
  - Využití jedné fyzické infrastruktury pro oddělené logické sítě
  - Fyzická bezpečnost, kamerové systémy
  - Mobilita, dopravní prostředky
  - Služby lokalizace, informace pro turisty
  - Digital Media Signage

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Outdoor wireless – what do we need to solve ?

- Outdoor wireless access to wired networks

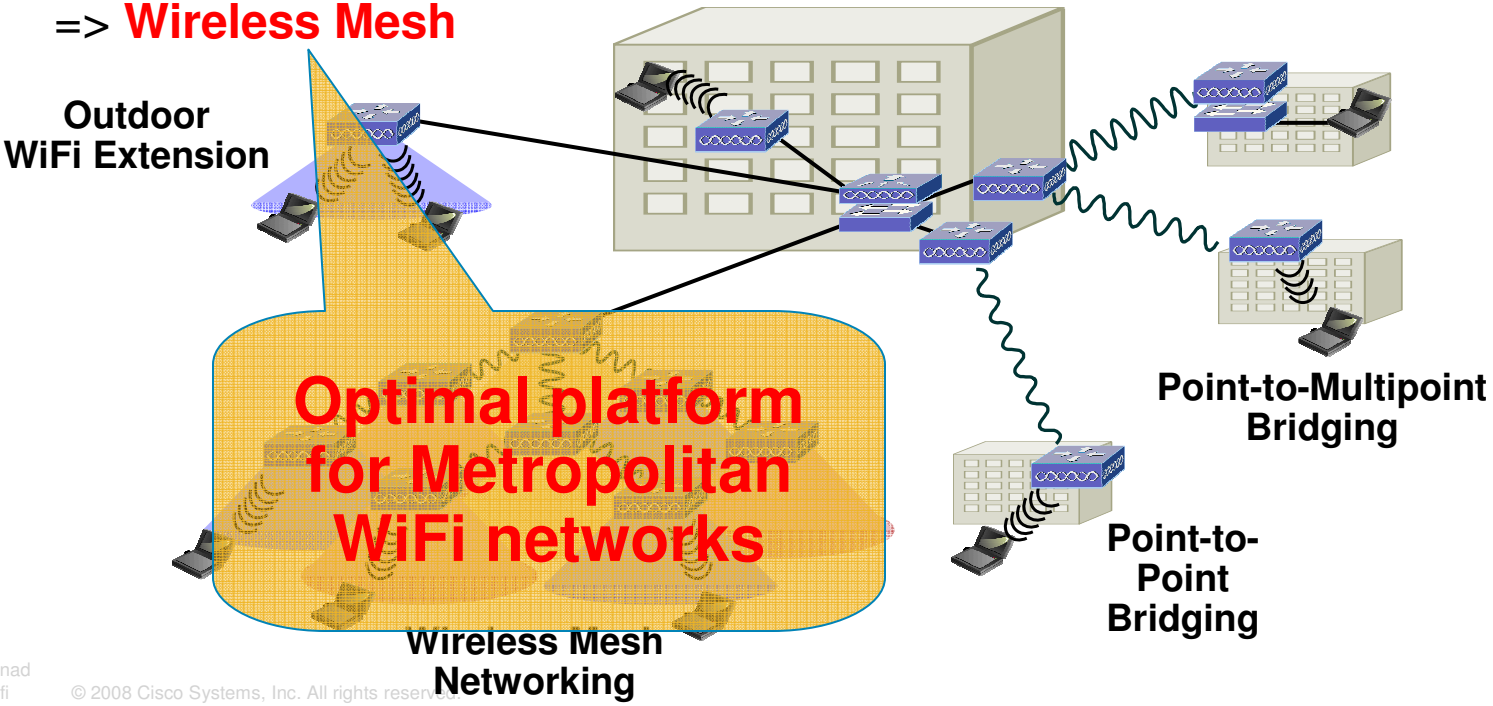
  => Outdoor APs

- Networks interconnection via wireless

  => Outdoor Wireless Bridging

- Outdoor areas wireless coverage

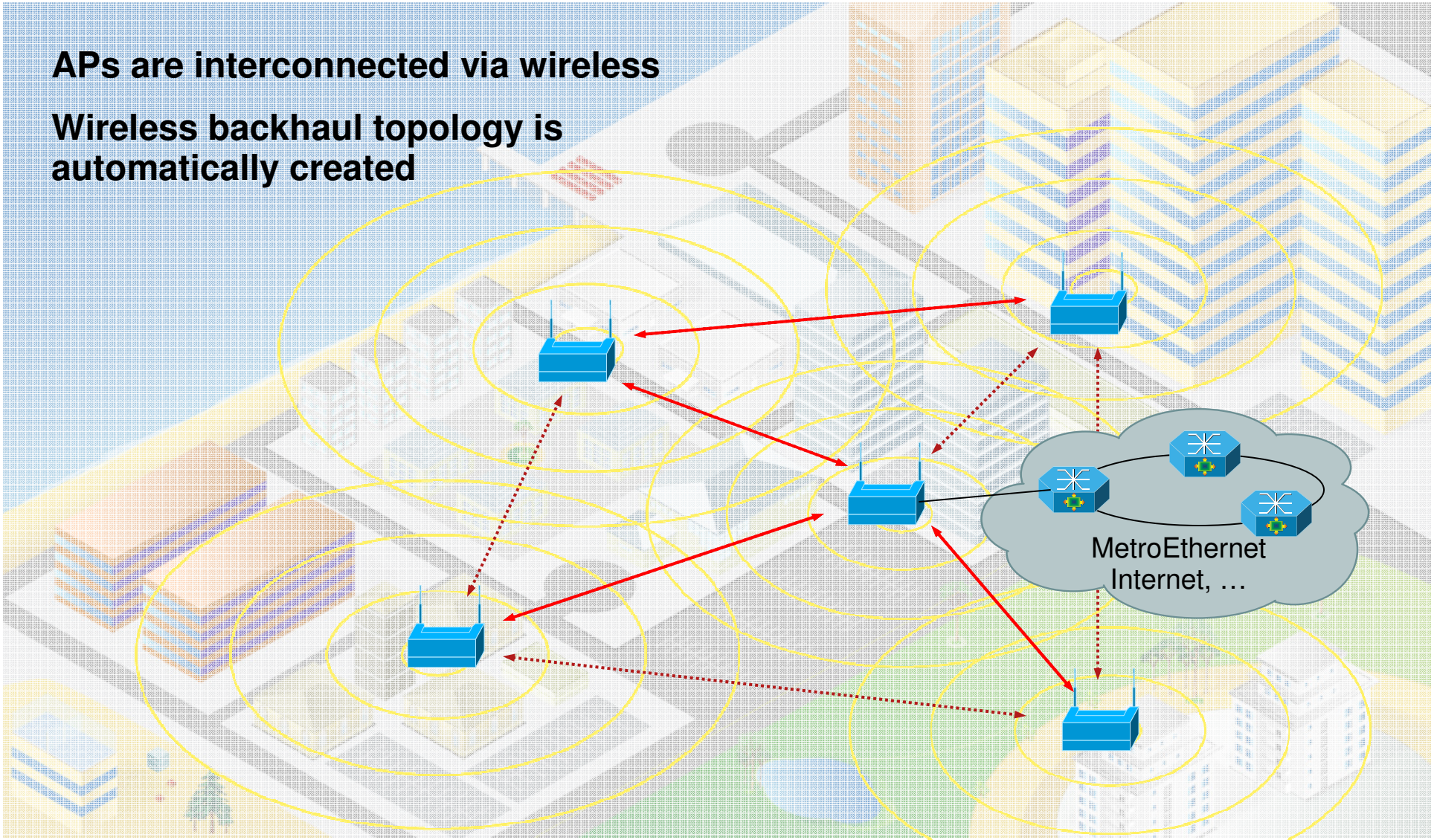
  => **Wireless Mesh**



What is wireless mesh ?

APs are interconnected via wireless

Wireless backhaul topology is automatically created



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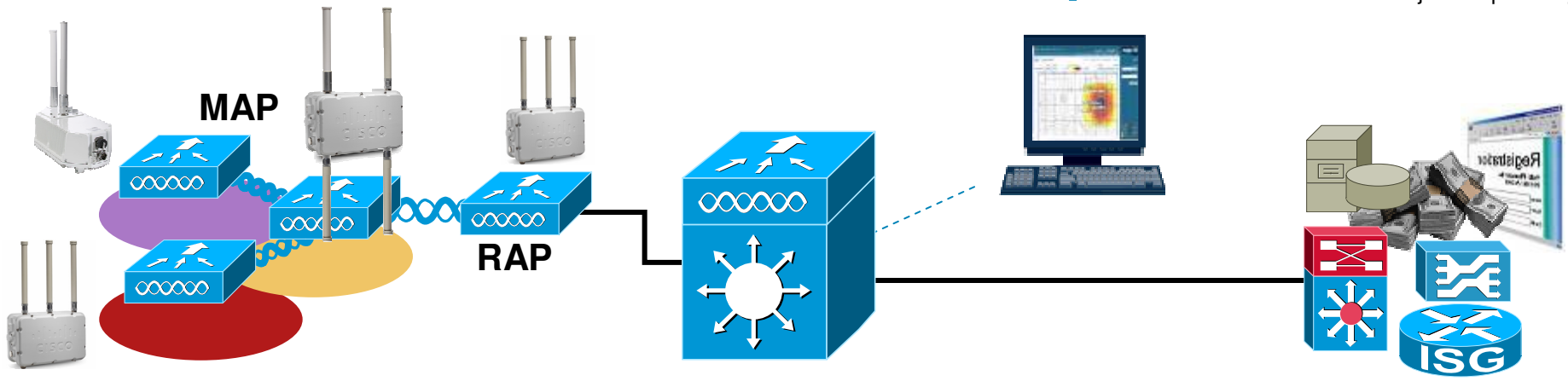
Outdoor Wireless Mesh Solution Components



Mesh Access Point

- 802.11b/g client access
- Connects to Root AP via 802.11a
- AC/DC power; PoE capable
- Ethernet port for connecting peripheral devices (POE)
- Battery backup

Root Access Point

- Serves as “Root” AP to the wired network
- Typically located on roof-tops or towers
- Connects up to 35 Mesh APs using 802.11a
- Access QoS and encryption

Wireless LAN Controller

- Links Wireless Mesh APs to wired network
- Handles RF algorithms and optimization
- Seamless WiFi mobility
- Provides security/ mobility mgt

Wireless Control System (WCS)

- Wireless Mesh Management System enables network-wide policy configuration and device management\
- SNMPv3, Syslog, IPSec, AAA, etc

Back Office Systems

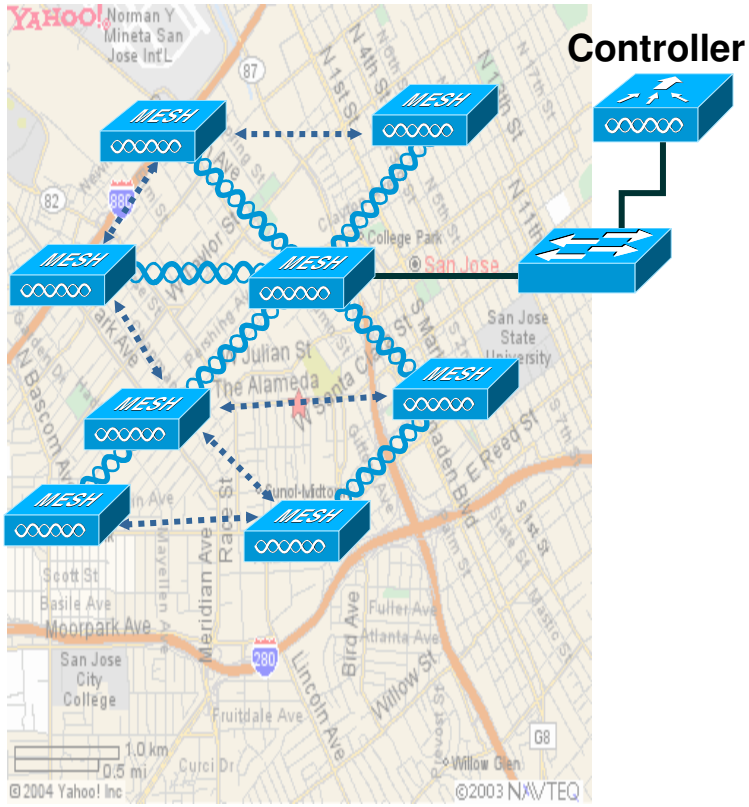
- Bandwidth Monitoring and Management
- Policy Definitions
- Subscriber Database Management
- Billing and OSS Systems

Industry Proven Devices at Every Layer

Reliable Hardware

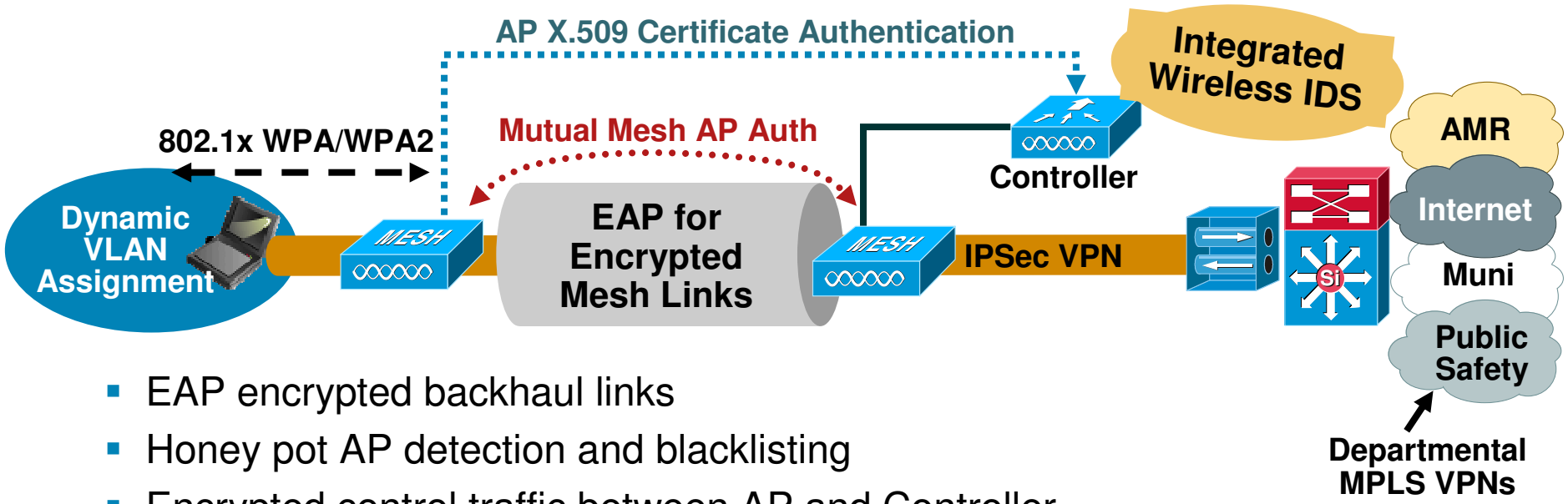
Cisco Intelligent Wireless Mesh Solution

- Ease of Deployment & Management
  - Identical Indoor/Outdoor Management
  - Based on LWAPP
    Used for automatic AP management , and data tunneling
  - Self-Configuring,
    (Zero-Touch Configuration)
  - Self-Healing Mesh
    (Cisco's new Adaptive Wireless Path –AWP- Protocol)
- 802.11e QoS Capable
- Robust Embedded Security
- Seamless L3 Mobility



Dynamic Foundation — **Self-Configuring, Self-Healing, Dynamic Path Optimization**

Providing Security at Each Step



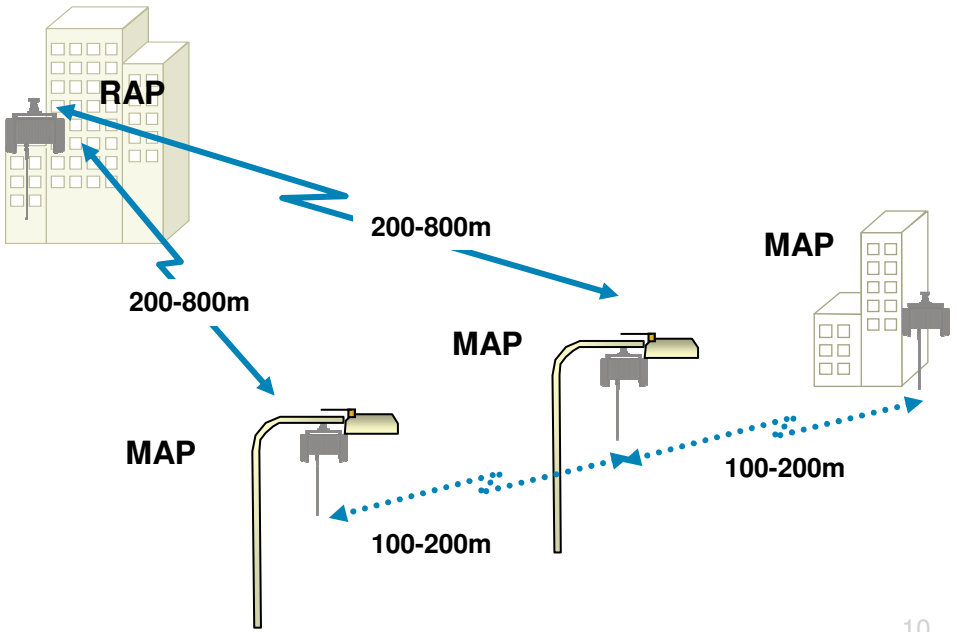
- EAP encrypted backhaul links
- Honey pot AP detection and blacklisting
- Encrypted control traffic between AP and Controller
- Integrated Wireless IDS and Attack correlation software
- Dynamic WLAN VLAN assignment + 802.11i WPA/WPA2 security
- Mobile IPSec VPNs for “confidential” mesh client traffic

  Cisco’s new Mobile VPN Client uninterrupted IPSec roaming between Wi-Fi, cellular, etc. networks

Secure Control | **Delivering Mission-Critical Wi-Fi Access**

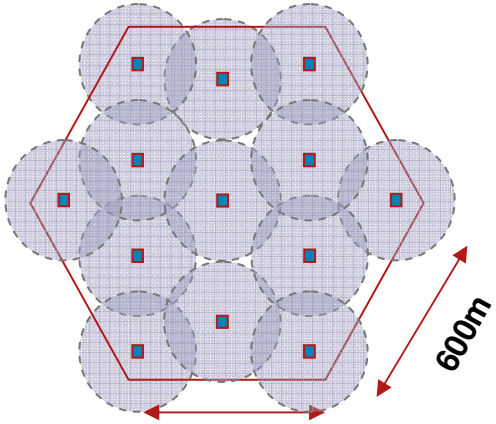
Distances and coverage

- Typical distances
  - RAP to MAP : 200-800 m
    - Location are towers or tall buildings
  - MAP to MAP : 100-200 m
    - Locations are short buildings top or street lights
    - More subject to interference, noise, non-LOS, multi-path
  - MAP to Client : 80-150 m
  - MAP should not exceed
    - 12m height above street

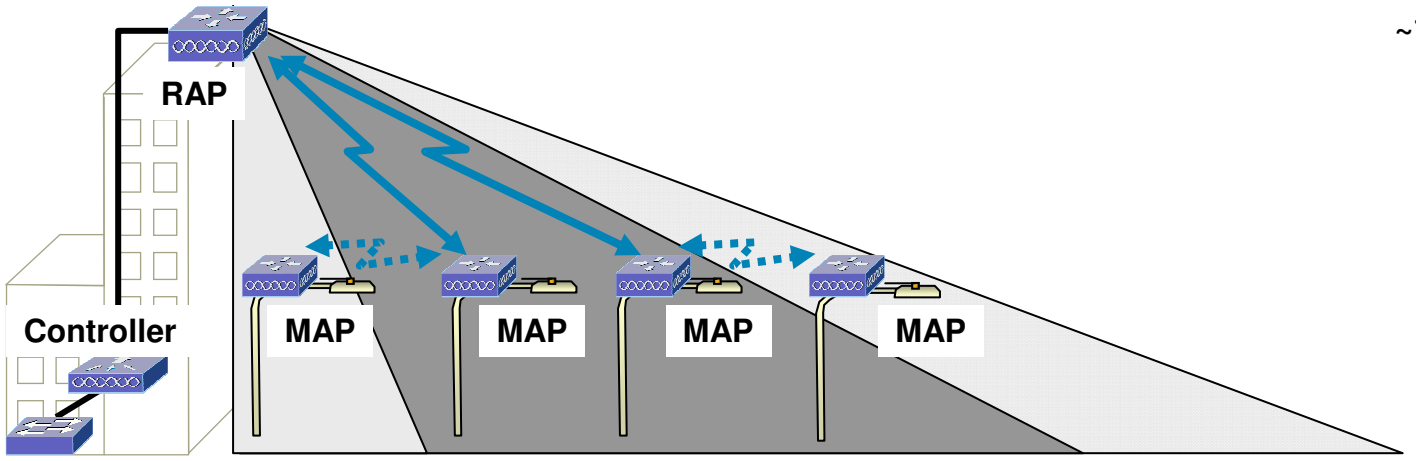


Distances and coverage

- Typical minimal coverage is 12/13 cells for ~1km^2
  - Greenfield installations
  - More for historical citycenters
- Design impact of RF Shadow and beyond coverage



600m
~1 Km^2 = 12/13 Cells



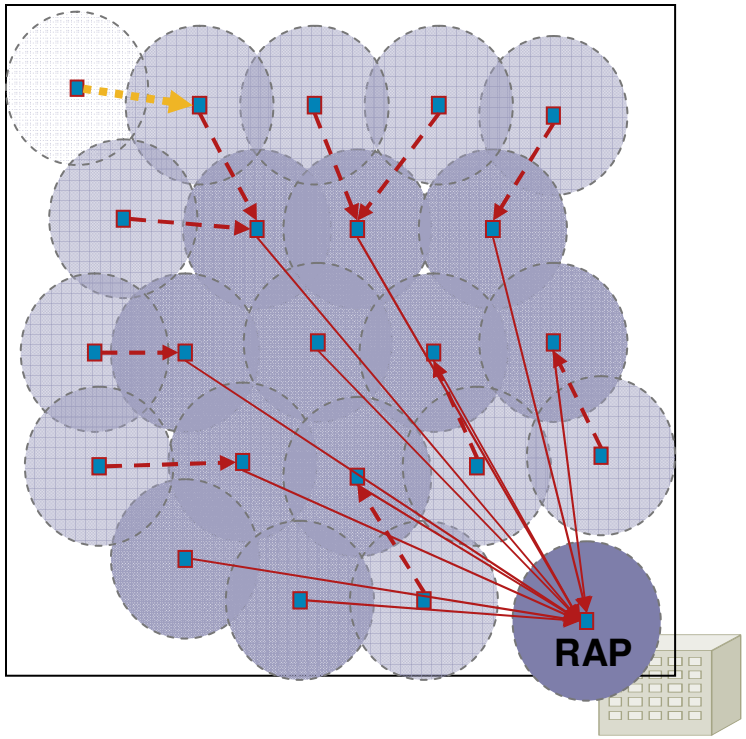
RF "Shadow" Poor SNR

24Mbps Coverage Area; SNR >20 dB

Beyond RF Coverage Area Poor SNR

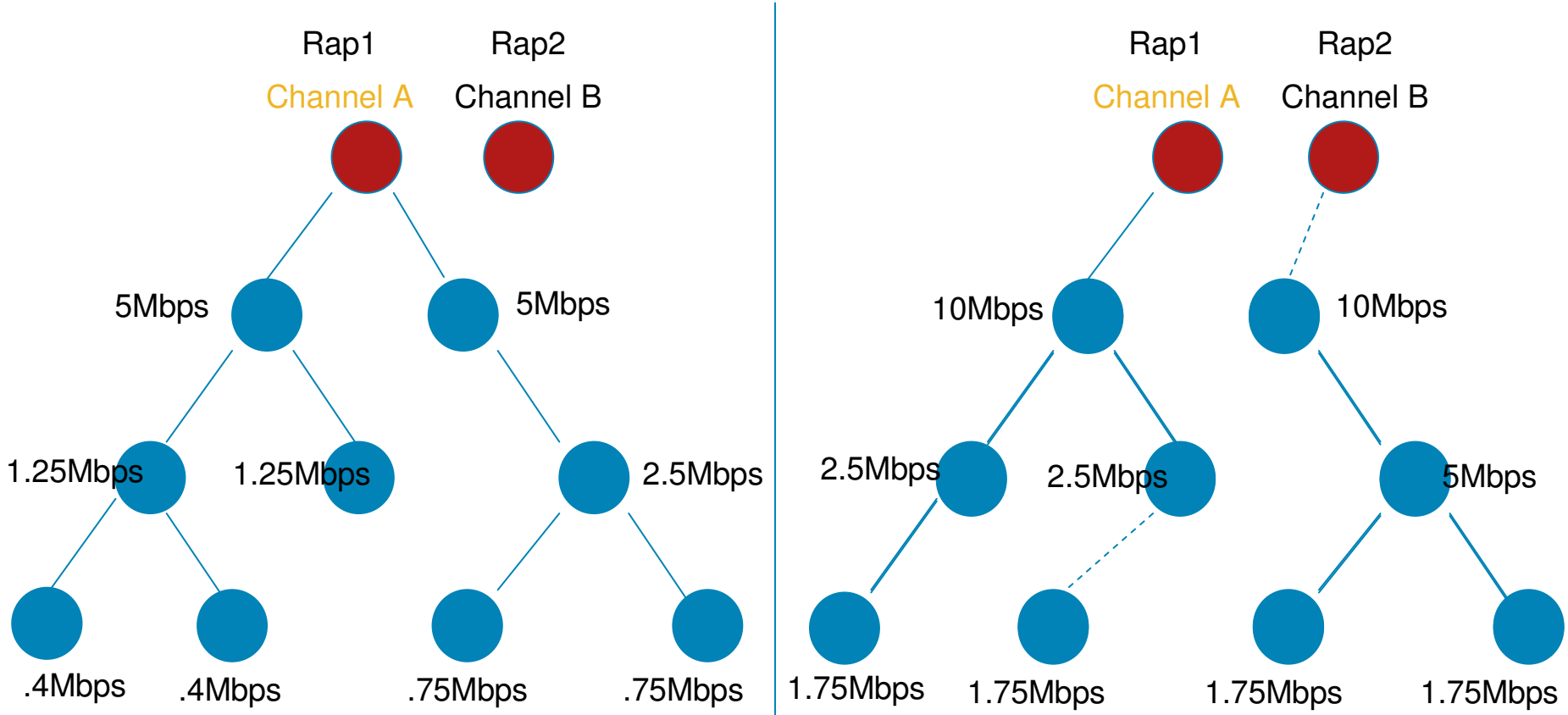
Bandwidth & number of hops

- 8 hops depth theoretical maximum, max 3-4 hops recommended
- Adding hop level impacts overall throughput
- ~2 / 3 msec latency per hop
- 24 Mbps is the default fixed rate set for the backhaul (recommended)
- Data rates for all the MAPs/RAPs in a bridge group must match



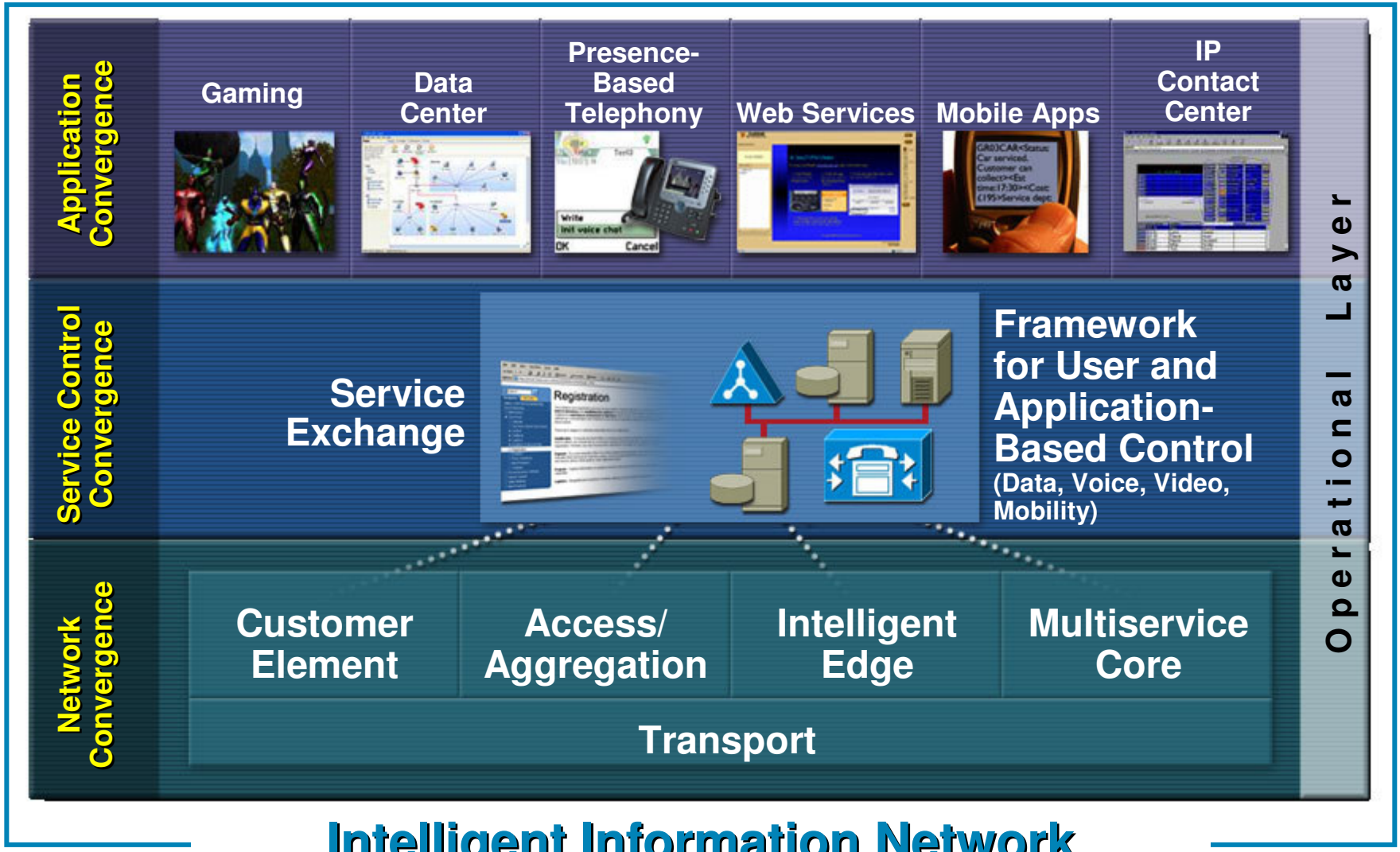
Hops	1	2	3	4
Throughput BH 18 Mbps	~10Mbps	~5Mbps	~3Mbps	up to 1Mbps
Throughput BH 24 Mbps	~14Mbps	~7Mbps	~4Mbps	up to 1Mbps

Comparison of Same Hop Depth Level Throughput (BH rate set to 18Mbps)

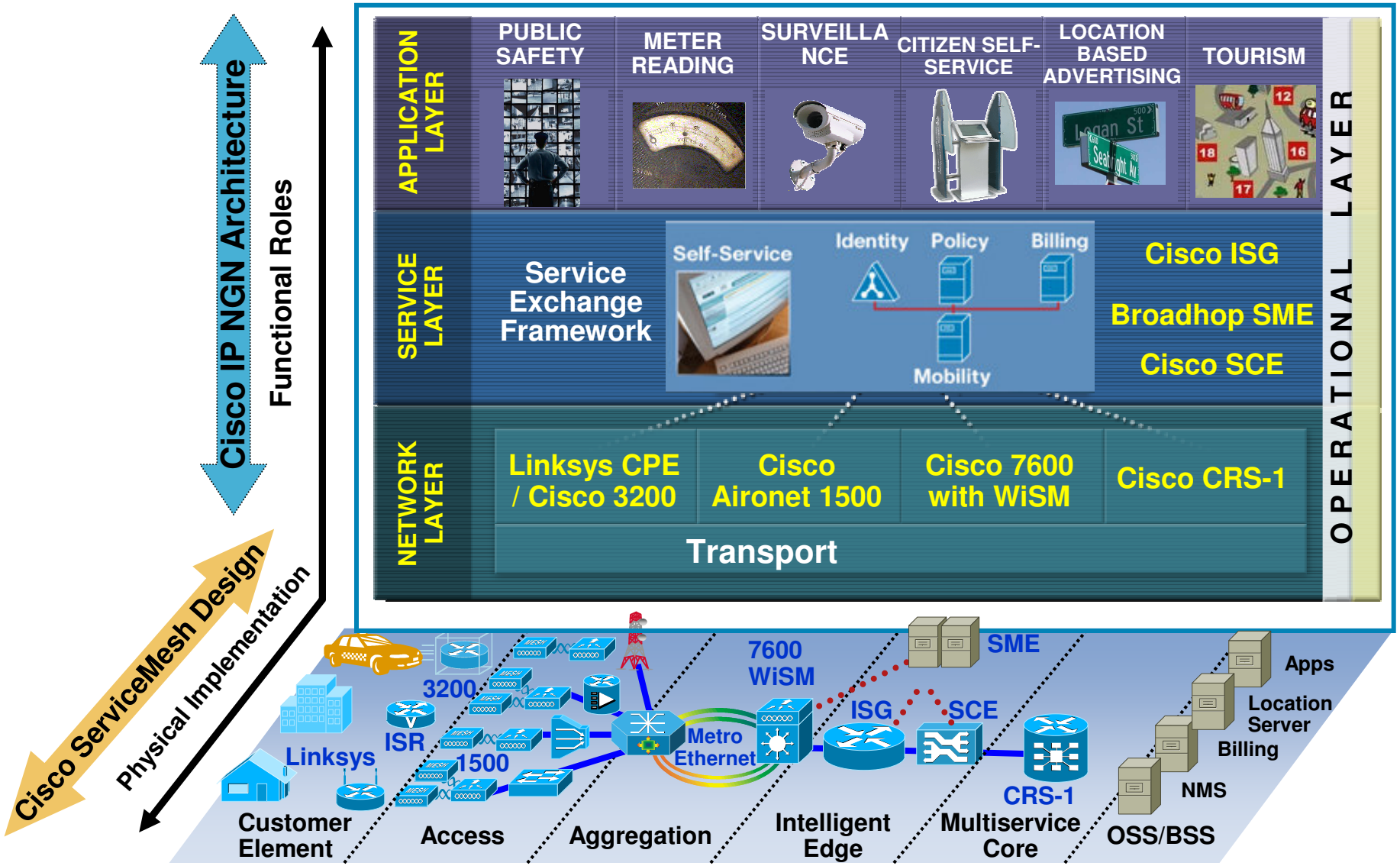


*Assumes 100% duty cycle. Assuming equal sharing of bandwidth across the same Hop level. Cumulative Bandwidth shown is max across hop level given equal sharing with siblings. When looking at a level, assume that node consumes all bandwidth the parent had available, given the parent stops delivering the computed TPUT to its clients.

Cisco IP Next-Generation Network (NGN) Architecture

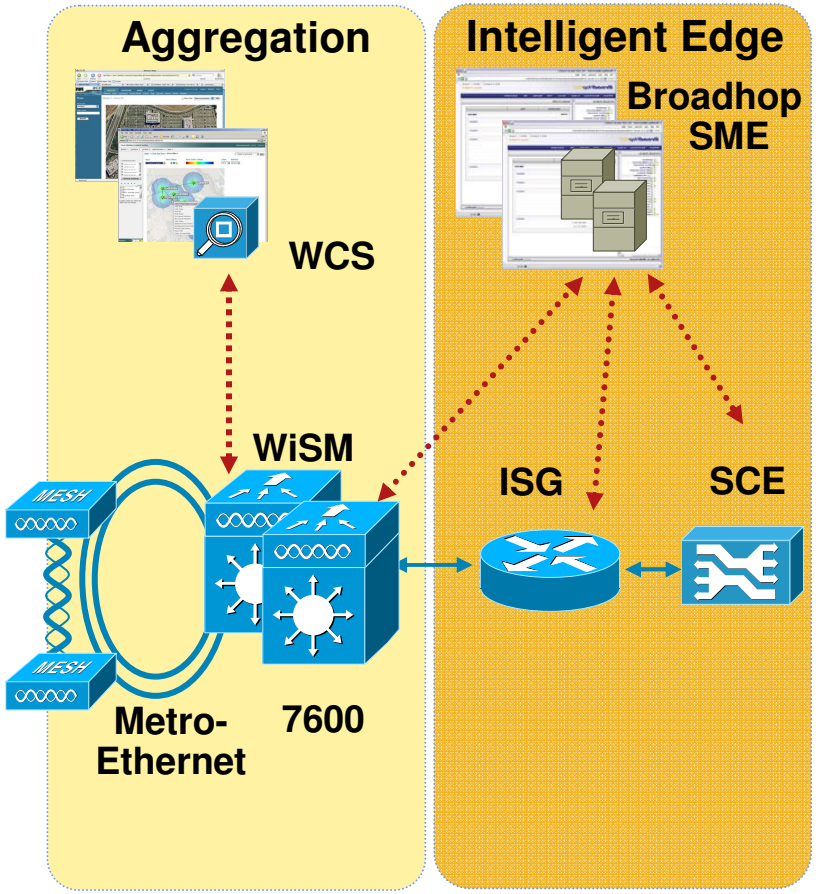


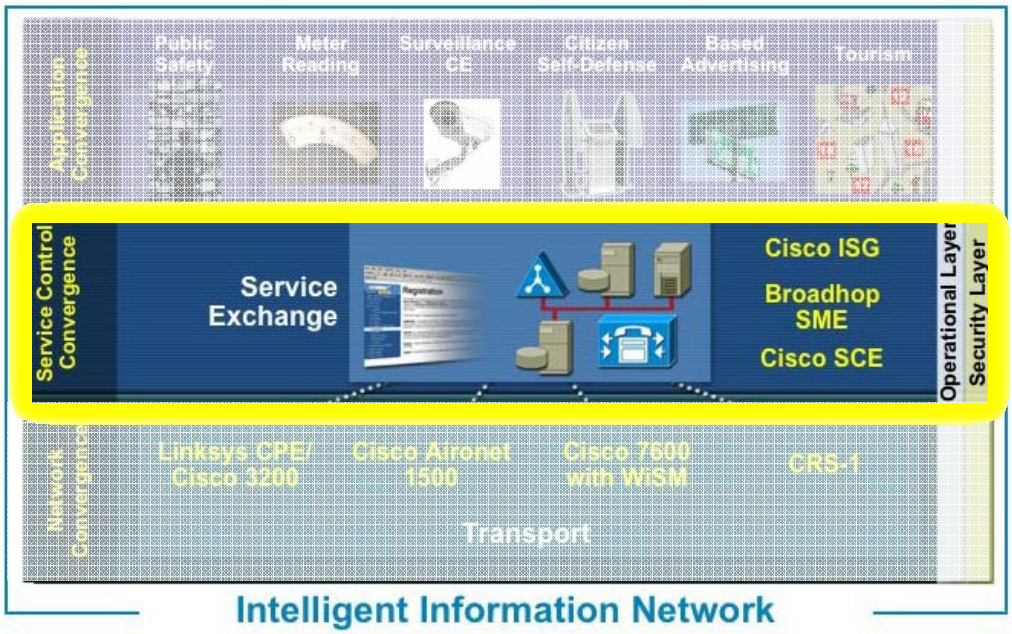
Cisco IP NGN Architecture and ServiceMesh Design



Service Exchange Layer

- Service control



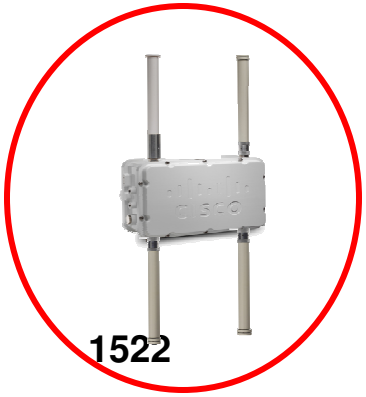


Product Positioning

1524

3/4-Radio Mesh AP

- **Modular platform for added flexibility**
- **For Public Safety & Public Access**
- **Linear deployment (Railway)**
- **Dual-Backhaul**
- **Integrated backhaul (future WiMax)**



1522

Dual Radios

- **For standard muni mesh deployment**
- **For enterprise-campus deployment**

1510

Dual Band Mesh AP

1521

Single Radio

- **For countries not supporting 5GHz**
- **Fill-in coverage gaps**

1505

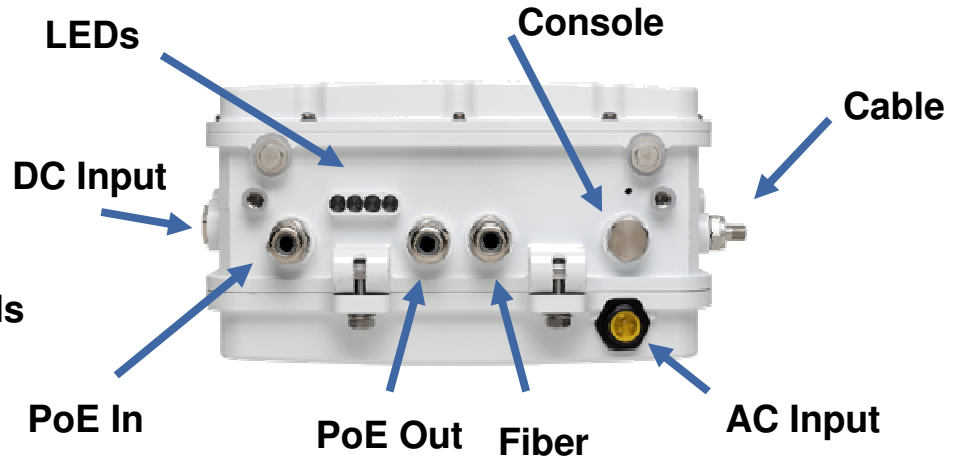
Single Band Mesh AP

Radio Functionality

Cisco 1520 Mesh AP

- Modular design to maximize flexibility, higher performance, IOS Platform
- Dual-band 802.11a (4.9 to 5.8 GHz) for Backhaul, 802.11b/g 2.4GHz for Access
- Improved higher power radio performance
  - 5 levels of transmit power (no antenna)
  - 5 GHz: 28 dBm
  - 2.4GHz: 28 dBm / 14dBm ETSI
  - 4.9GHz: 20 dBm (Mask M), 20 MHz channels
  - Antennas to maximize EIRP
- Uplink options
  - Cable Modem DOCSIS 2.0 with Cable Power Supply
  - Fiber Interface with 100BaseBX SFP
  - 1000BT Gig Ethernet
- Internal Battery Backup
- POE out (802.3af) to power peripheral devices
- Ruggedized Paintable Enclosure
  - -40 to +55 C with Solar Loading
  - IP67, NEMA 4X
  - 165 MPH wind gusts, 100 MPH sustained winds
  - Hazardous Loc Class 1, Zone/Div 2

➢Federal Compliance (FIPS 140-2)



Cisco Wireless Controller Family

4400, WiSM(6500/7600) & 2106 Platforms supported for Mesh

Network Device Limits

4400 (100 APs)

RAPs	MAPs
1	149
50	100
75	50

ISR WLC Module
6 AP

REAP
H-REAP

3750G WLC Switch
25-50AP

Cisco 2106
6 APs

Cisco 4402-12
12 APs

Cisco 4402-25
25 APs

Cisco 4402-50
50 APs

Cisco 4404
100 APs

Cisco WiSM
300 APs

12 18 38 75 150 375

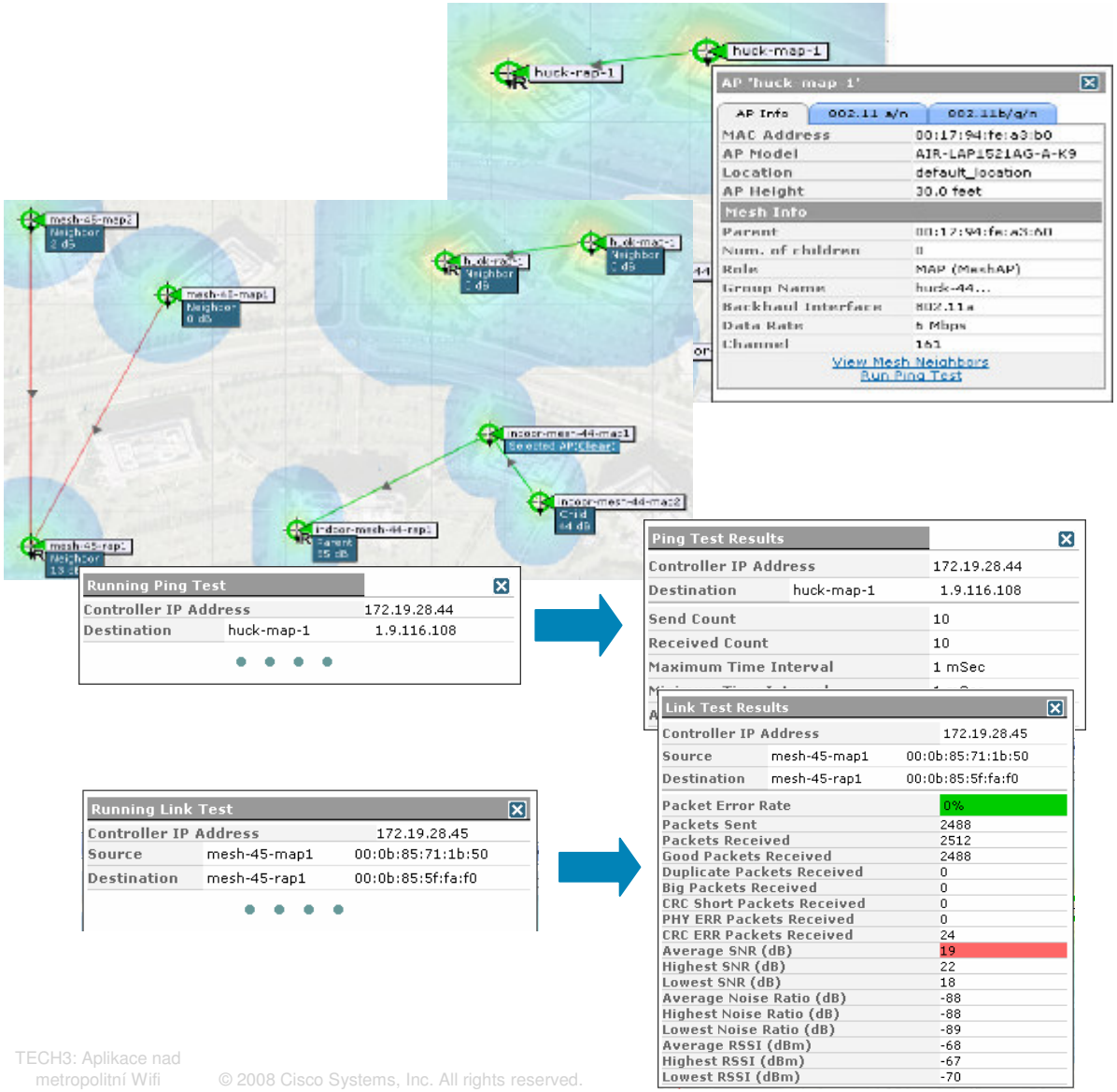
RAPS Are Counted as 1, Since MAPs Are Not Connected Directly to the Controller, Each MAP Is Considered as .5 (Half) an AP for the Purposes of Supported Controller Count

X + 0.5 Y = Supported AP Count
Key: X = RAP, Y = MAP

1–2 APs >=2–6 APs >=12 APs >=25 APs >=100 APs

Deployment Size

WCS Mesh Management



- Mesh Info on mouse roll over
- Neighbor AP Info
- Ping Test from Controller to AP
- Link Test from AP to AP

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  - Digital Media Signage

Cisco ServiceMesh Applications

Municipal

- Public safety (video&voice)
- Land management
- RFID tracking applications
- Surveillance
- Meter reading (utility/parking)
- Traffic management

Residential

- Data connectivity
- Choice of payment method
- Turbo-button
- Family member additions
- Parental Control
- Location-based applications

Businesses

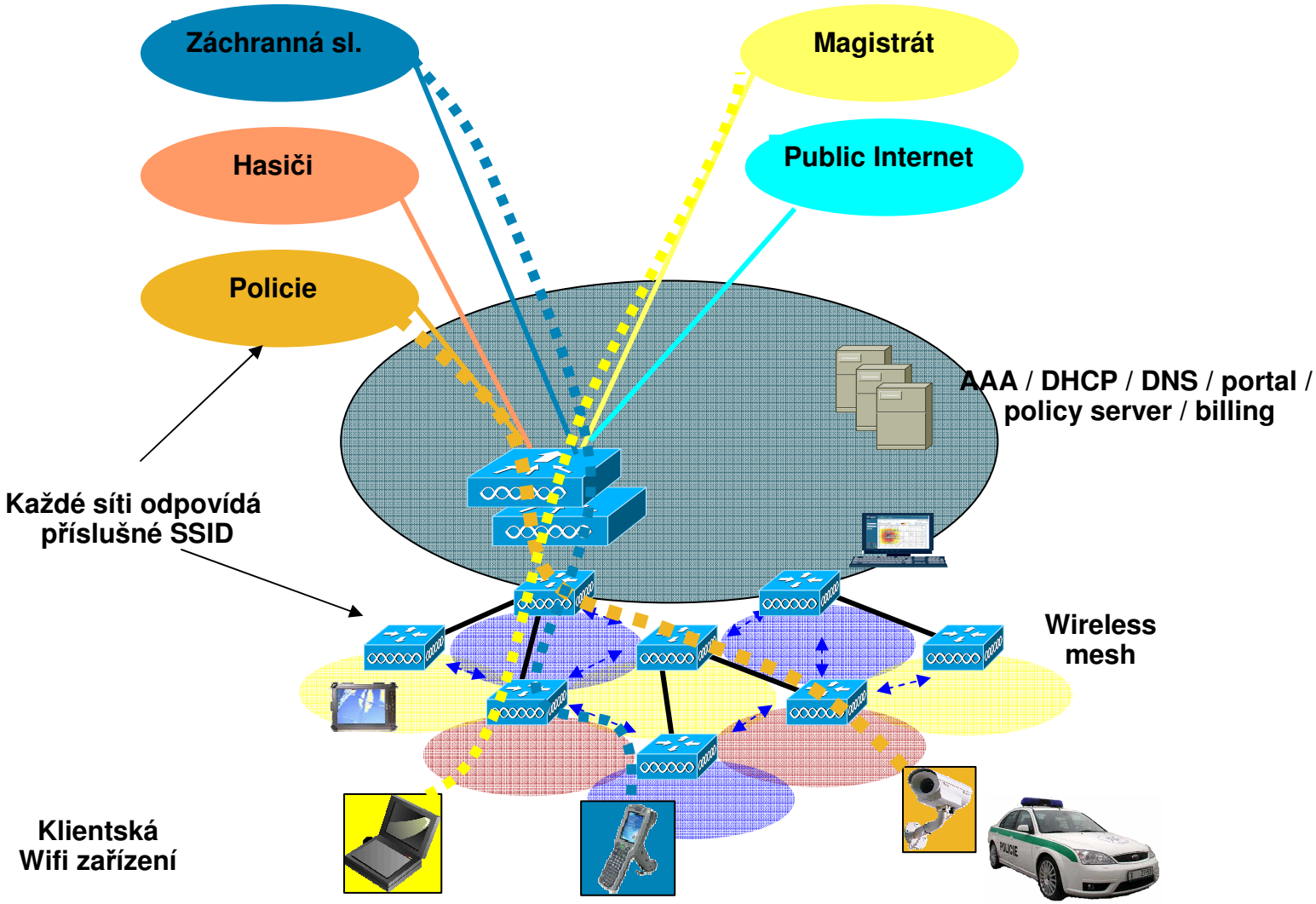
- Data connectivity
- Guest access
- Hospitality offerings

Tourism

- Convention directions
- City events and sightseeing
- Emergency help

Multifunctional: Several logical networks across single metro wireless infrastructure

Oddělené logické sítě
Kamerové systémy
Mobilita, dopravní prostředky
Lokalizace, informace pro turisty
Digital Media Signage



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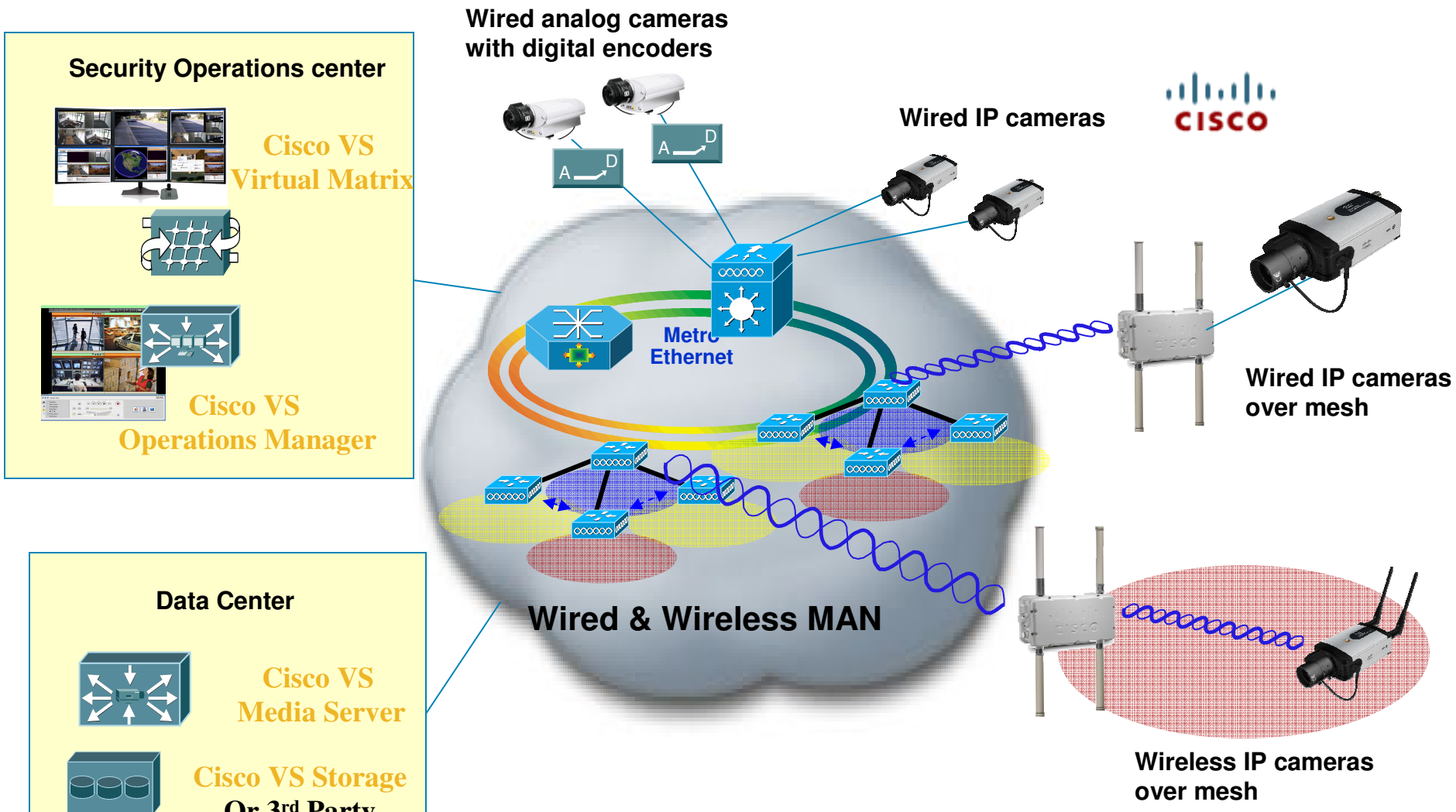
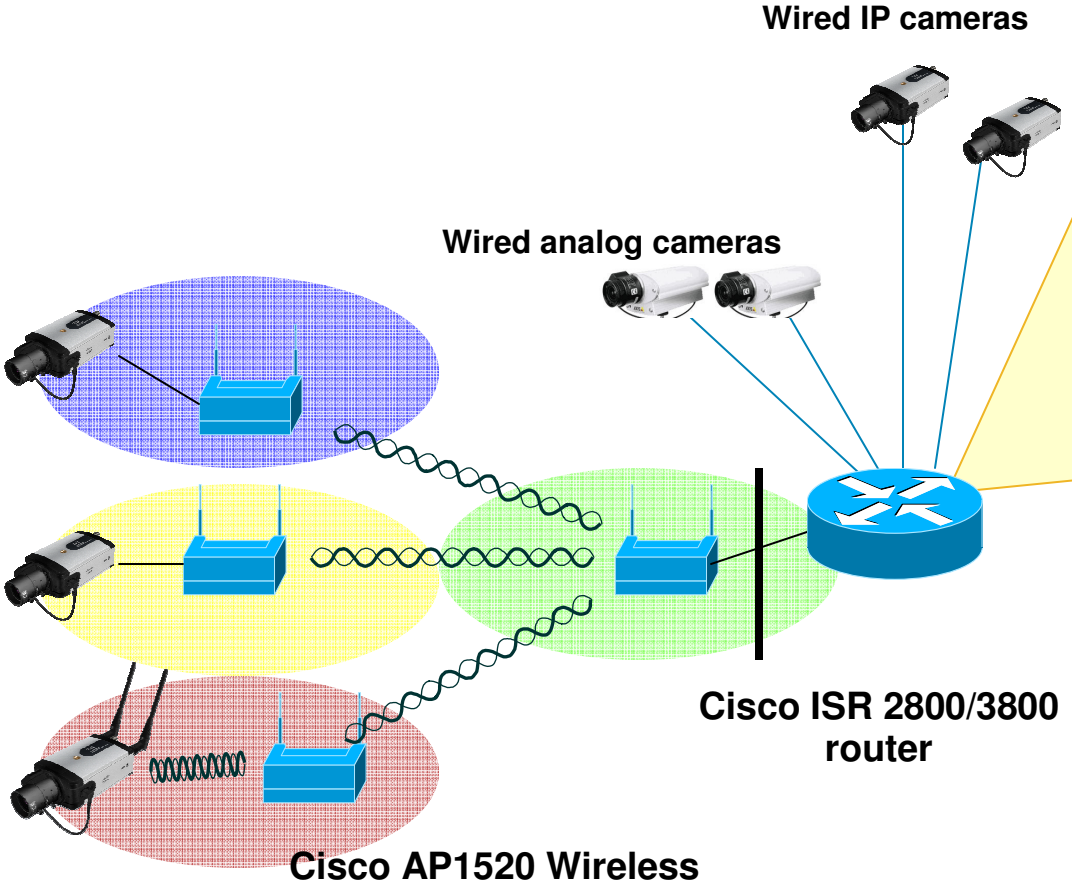
VideoSurveillance over MetroWiFi

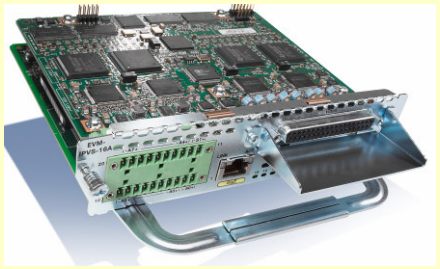


Video over wireless mesh specifics

- Wireless is shared media
  - Videostream bandwidth depends on resolutin and FPS
    - MPEG4, CIF (352x240), 12fps => ~0.5 Mbps
    - MPEG4, 4CIF (704 x 480), 24fps => ~3-4 Mbps
- Assuming Mesh Depth 2 hops max.
- Assuming RAP:MAP ratio max cca 1:5 (depends on image quality)
- Wifi Mesh supports QoS, but cameras have to support QoS marking !!!
  - Some vendors lack DSCP marking mechanisms
  - Cisco IP cameras support QoS ☺

New Cisco ISR videosurveillance modules used with wireless mesh





EVM-IPVS-16A: Analog Video Encoding Module

NME-VMSS: Video Management and Storage System

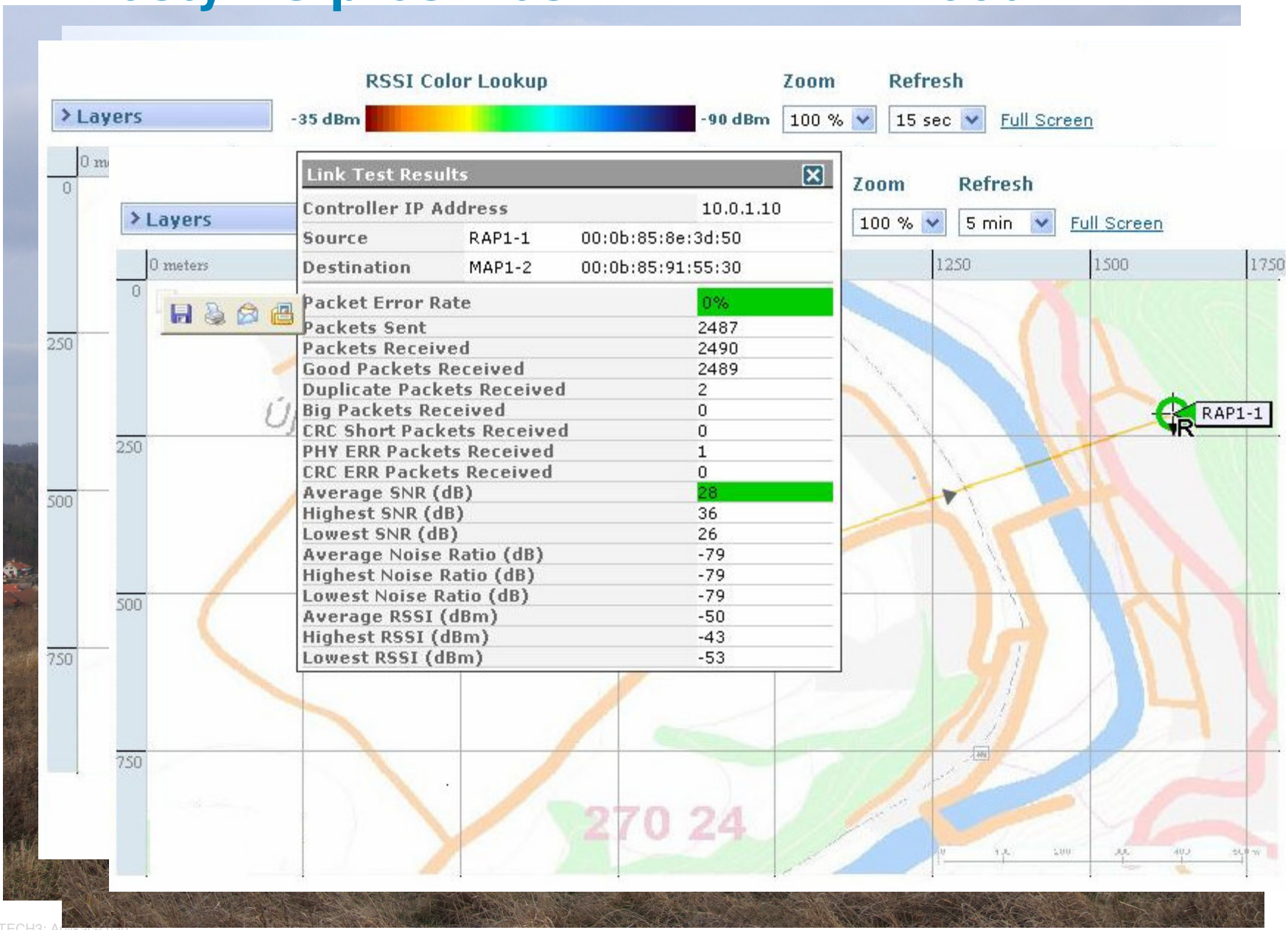
Cisco IP Video Surveillance Cameras 2500 Series

- Cisco Standard Definition IP Cameras
  - Wired Power over Ethernet (POE)
  - Wireless 802.11b, g, n
- High Quality, Excellent Video Images – On Par with Analog Cameras (NTSC, PAL)
- Fully Featured - Day/Night, Audio, Contacts, Alarms
- Networking Features, QoS, Multicast
- More IP Cameras are on the Roadmap incl. HD, outdoor, PTZ

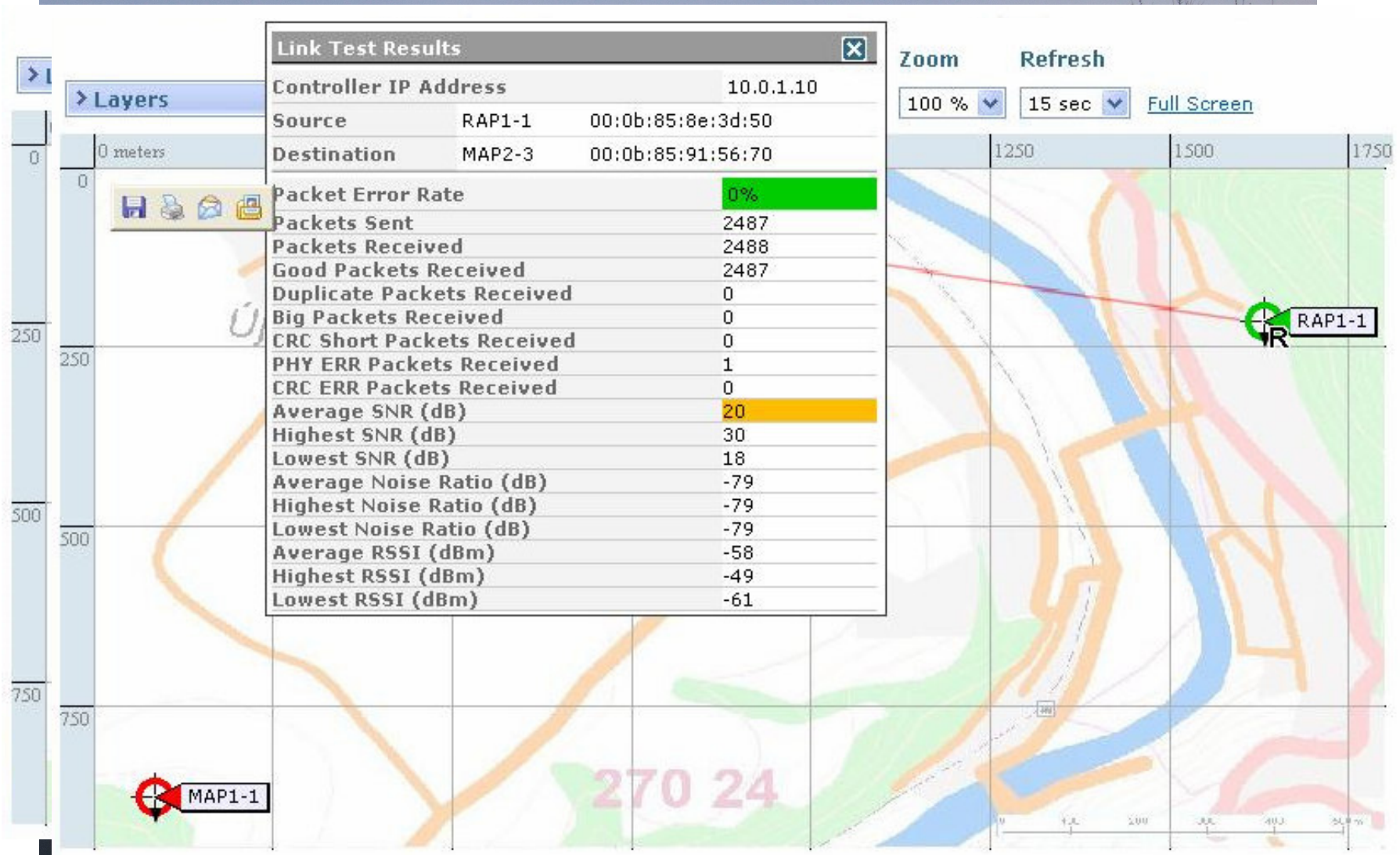
- CIVS-IPC-2500
- Orderable: March 2008

- CIVS-IPC-2500W
- Orderable: June 2008
- FCS: June 2008

Testy VS přes Mesh – RAP-MAP 880m



Testy VS přes Mesh – RAP-MAP 1300m



Metro WiFi as a mobility platform

Oddělené logické sítě
Kamerové systémy
Mobilita, dopravní prostředky
Lokalizace, informace pro turisty
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Technologicky vybavený policejní vůz

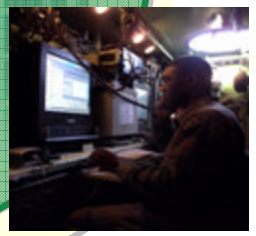
GSM-GPRS

802.11 wifi mesh

N
W
E
S

Mobilní směrovač

Policejní centrála



UMTS
802.16

Nepřerušovaný přístup = Pokrytí + Rychlost komunikace

Public Safety Vehicle Applications

Oddělené logické sítě
Kamerové systémy
Mobilita, dopravní prostředky
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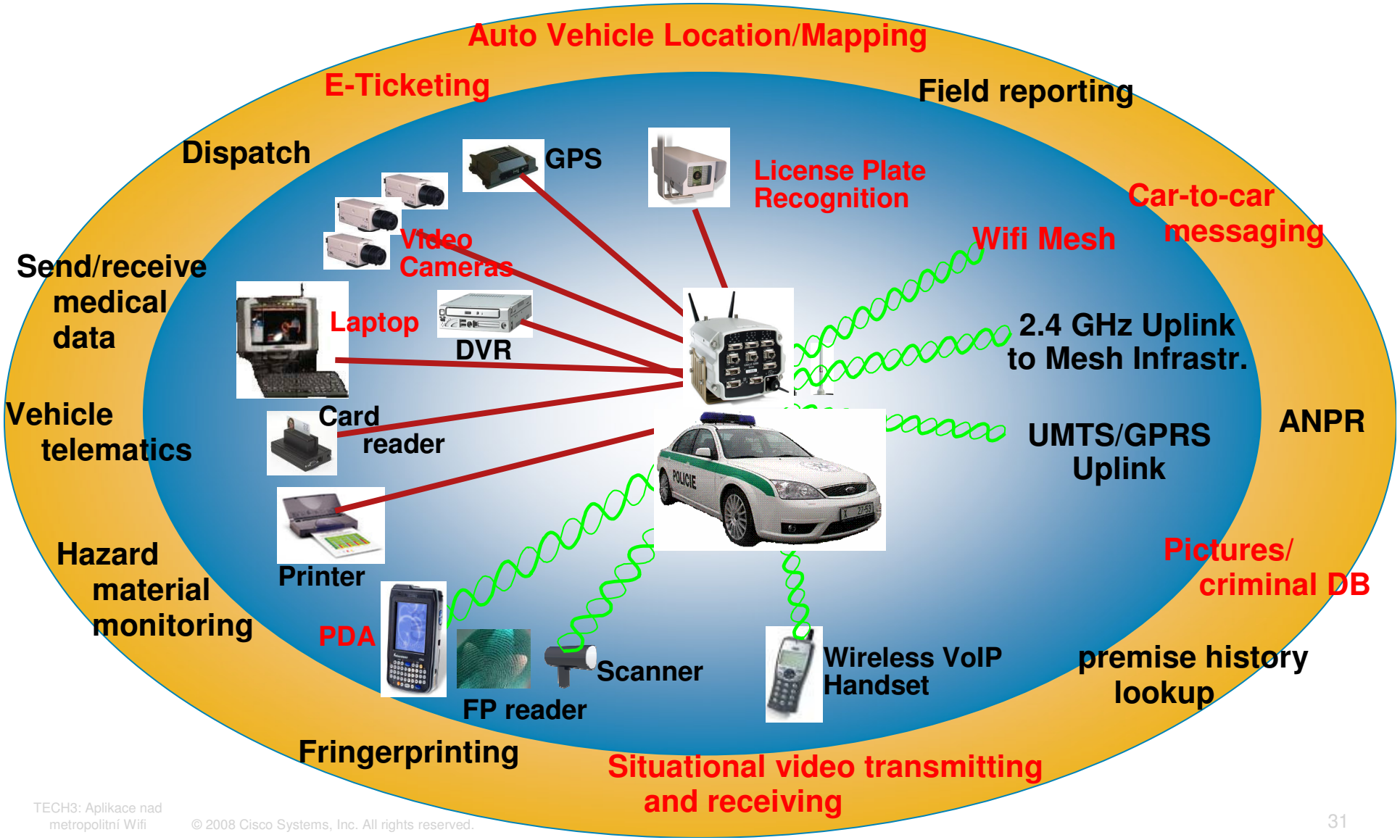
Using Mobile IP technology and MAR3200 mobile router in Metro Wifi



MAR3200 – Modular Standards-based PC104+ Hardware Platform

Oddělené logické sítě
Kamerové systémy
Mobilita, dopravní prostředky
Lokalizace, informace pro turisty
Digital Media Signage

Cisco PC104+ Cards:

- MARC-3250 (IOS Router)
- MARC-3270 (IOS Router)
- FESMIC (4-Port Switch)
- SMIC (4-Port Serial)
- WMIC 4.9 GHz (US)
- WMIC 2.4 GHz
- WMIC 5 GHz

3rd Party PC104+ Cards:

- Video Server (2/4 Port)
- EVDO / GPS Modem
- UMTS Modem
- Linux Application Blade
- 30-40GB Automotive HDD
- Windows PC Blade
- 4 Port Ethernet Hub
- DSL Modem
- Satellite Blade

PC104+ Stack with Thermal Plates (no moving parts)

Rugetized enclosure

- Cisco IOS Software router platform that helps create the Metro Mobile Network
- Flexible, high performance & rugged design for mobile & fixed environments
- Integrated 802.11a/b/g
- Secure, scalable, and managed data, voice and video communications
- Seamless mobility across wireless networks independent of location or movement
- Advanced IP services and interoperability through Cisco IOS Software

Why Choose a Mobile Network vs. a Mobile PC?

Oddělené logické sítě
Kamerové systémy
Mobilita, dopravní prostředky
Lokalizace, informace pro turisty
Digital Media Signage

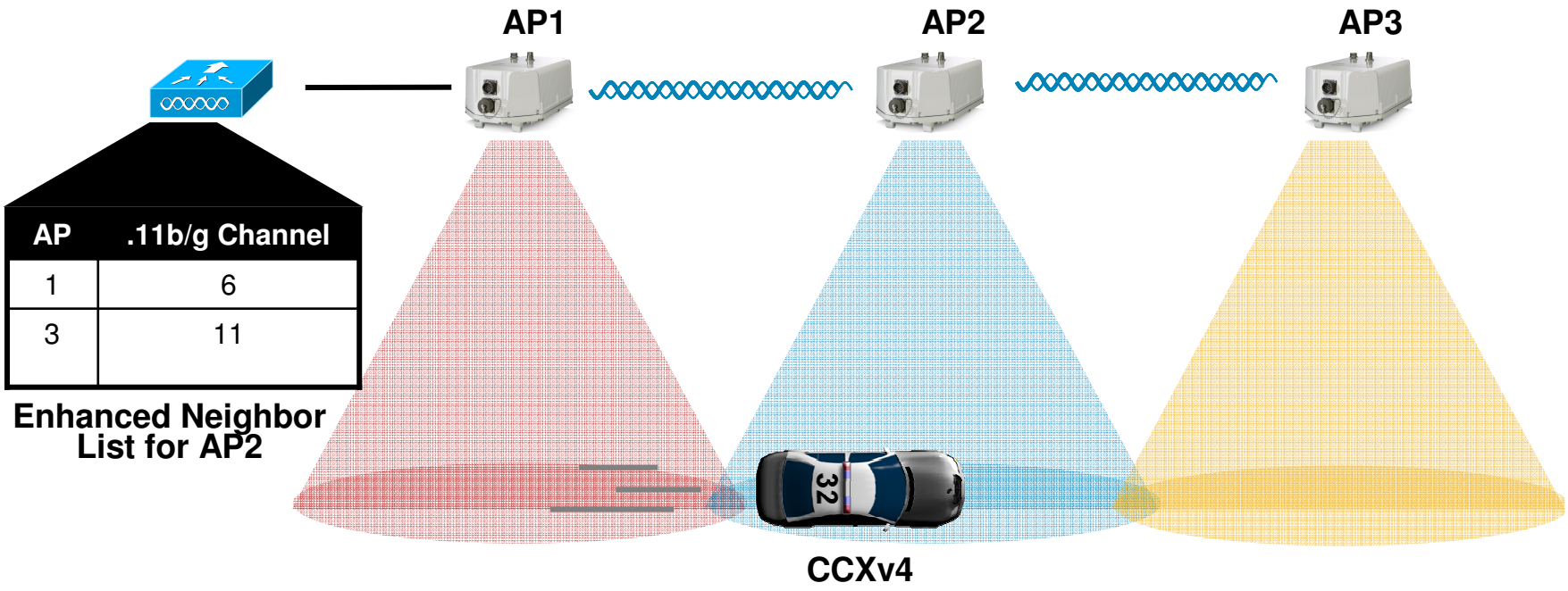
Car with PC Based Access

- Single networked device (PC)
- Multiple devices may require individual radios & subscriptions
- Windows OS for both access and applications
- Mobility client SW installation required for each device
- Limited 802.11 range for client to AP
- Lack of integrated security (separate SW installed and maintained)
- PC crash from virus, security patch, or application conflict, etc. will cause all devices & applications to lose network connectivity
- Limits on number of wireless technologies supported at once and in the future

Car with Cisco Mobile Networking Solution

- Multiple wired & wireless devices
- Integrated radio subscriptions for all apps
- Increased Radio Range with externally mounted high-gain antennas over a simple PC client card
- Investment protection : compatible with future wireless technologies
- 802.11 Access Point for vehicle Hotspot
- Connects to any WAN link including 700-900 MHz, cellular, & future WAN technologies
- Cisco IOS Software OS for network reliability
- Cisco integrated network security (Firewall, Encryption, AAA, IDS)
- QoS & Multicast for voice and video
- Flexible, rugged hardware designs meeting MILSPEC and SAE specs.
- Standards based mobility (Mobile IP)
- Remote debug and troubleshooting tools through Cisco IOS software

High-speed Roaming



Client can roam at up to 70 MPH / 112 Km/h

CCXv4 clients only

Updated with AP neighbor information

Roam time <50 ms

Intelligent Vehicle Network Roaming with Multiple Client Profiles

Oddělené logické sítě
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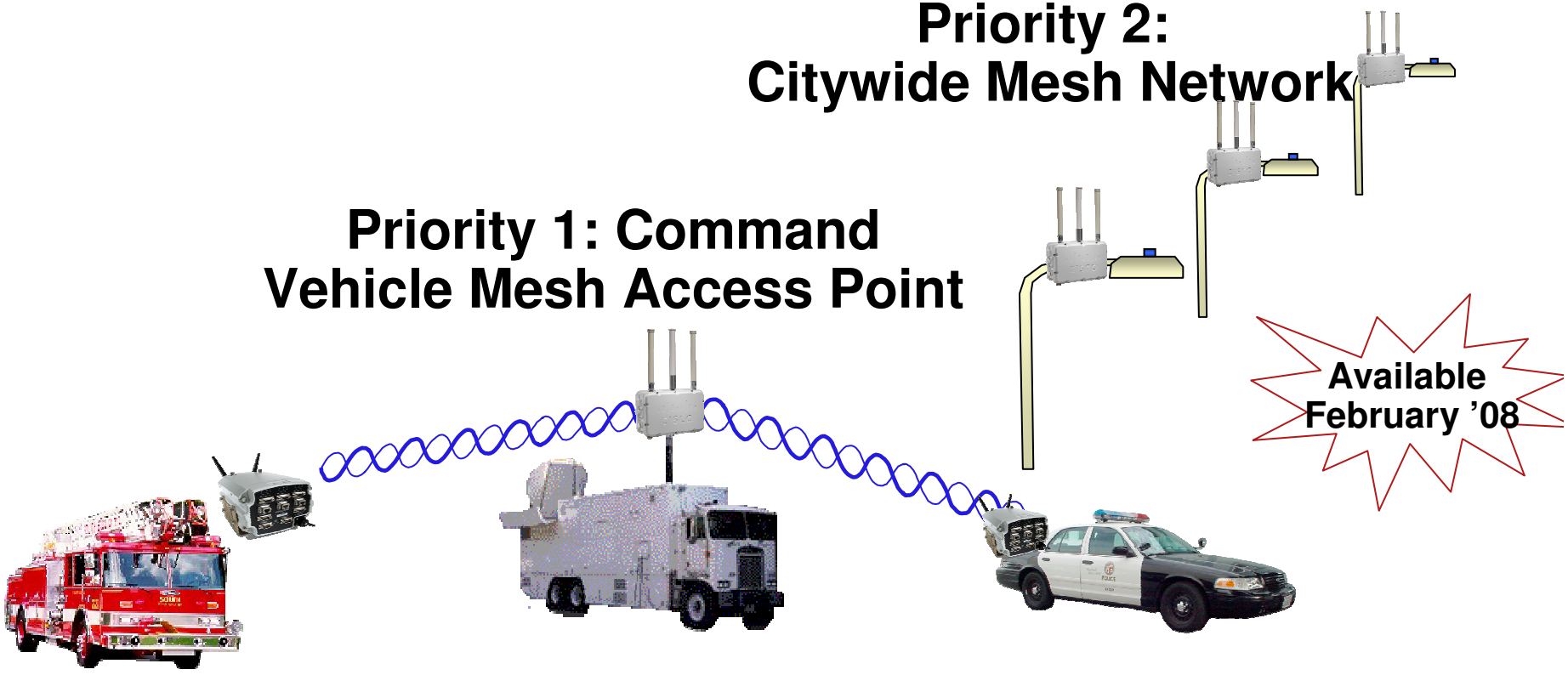

In this example, prioritized client profile feature on the Cisco 3200 enables the mobile network to prioritize command vehicle AP over citywide mesh

Case Study
Zurich Police, Mobile IP over 3G & WiFi

- Mobile communication system is a mobile IP network in the patrol vehicle, terminal and peripheral devices are linked via Ethernet.
- In addition to in-car PCs or laptops, other possible devices may include IP video cameras, scanners, printers or VoIP phones.
- Access technologies
  - WiFi (City Police bases)
  - UMTS/HSDPA (mobile operator)
  - Edge/GPRS (mobile operator)
- The device will always select the connection that allows the greatest bandwidth.
  - Mobile IP technology
- Plan for 50+ vehicles

Case Study
Oxford Buses – MobileIP over 3G & WiFi

Oddělené logické sítě
Kamerové systémy
Mobilita, dopravní prostředky
Lokalizace, informace pro turisty
Digital Media Signage

- GoAhead Group operate a busy commuter service between London and Oxford
- Company wanted to add value to their service and allow for additional applications such as CCTV and online ticket purchase
- Additionally pressure from competitive service..
- Deploying MAR3200 with 2 x 3G HSDPA/UMTS data cards per vehicle and allowing connections to bundle for higher throughput.
- Plan to extend 25 buses and deploy to 65 vehicles.

Location-Based Services

Web Portal Advertising Insertion

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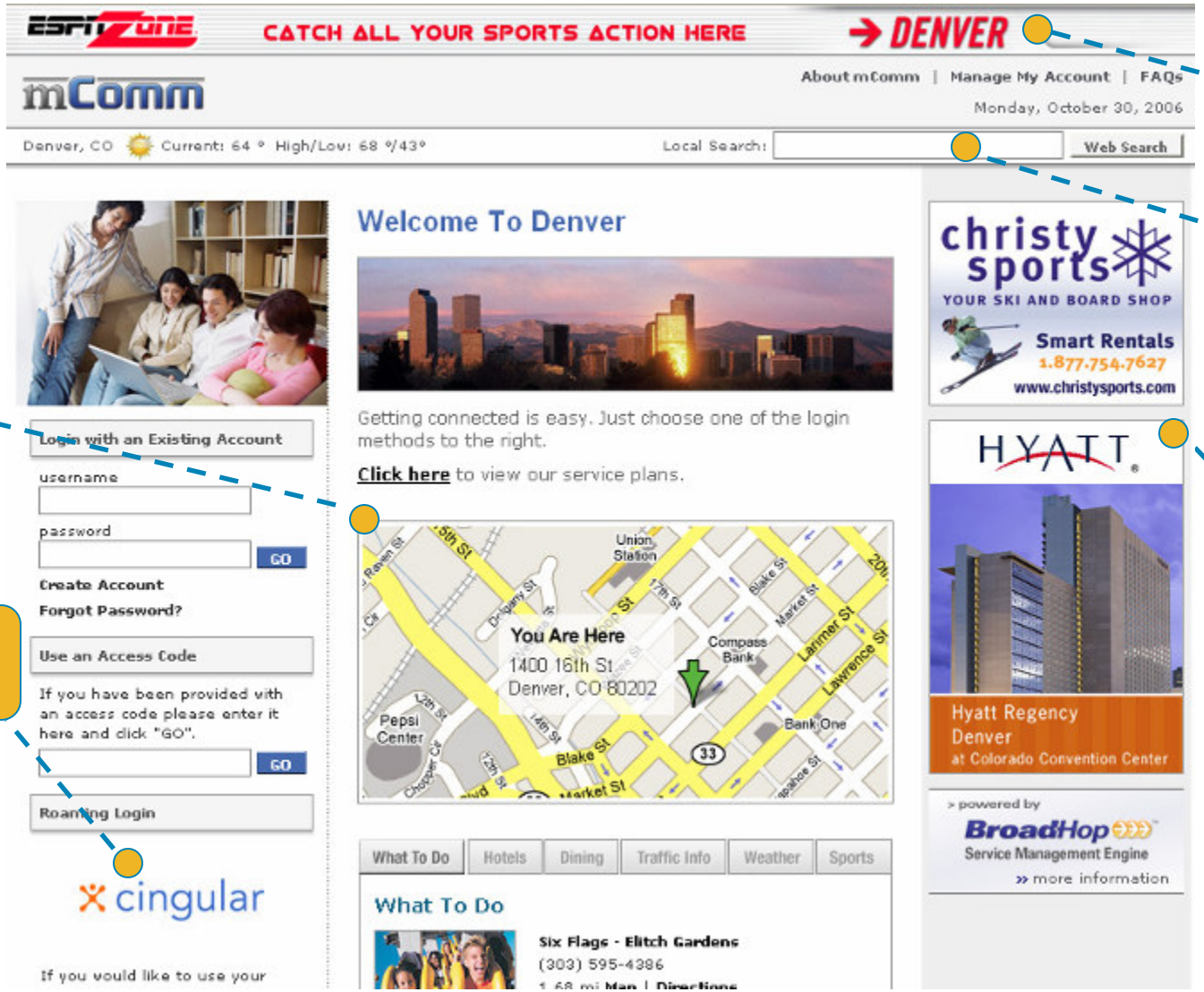


Local Banner

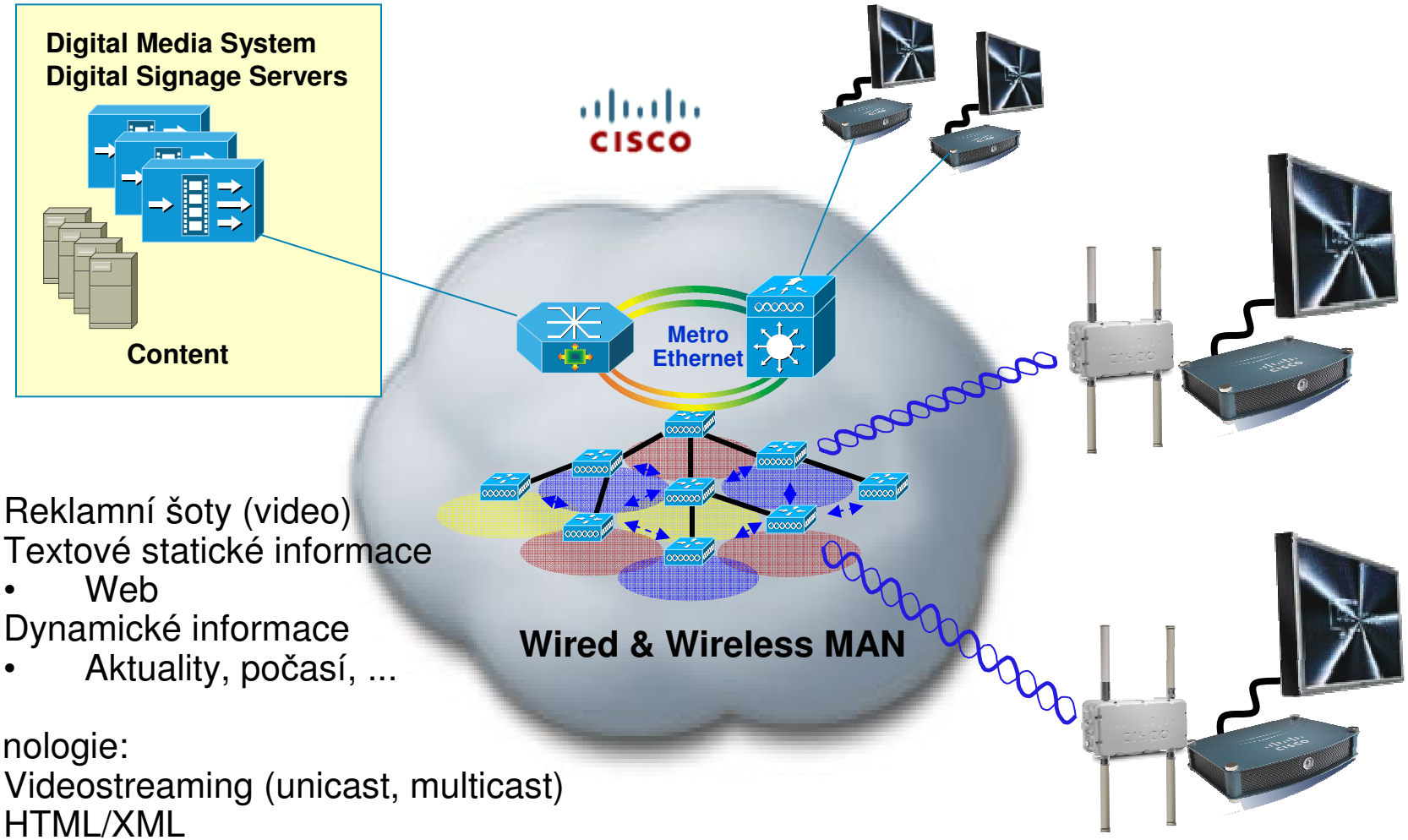
Local Search

Local Content

Local Ads

Local Roaming

Digital Media Signage over MetroWiFi



1. Reklamní šoty (video)
2. Textové statické informace
   - Web
3. Dynamické informace
   - Aktuality, počasí, ...

Technologie:

- Videostreaming (unicast, multicast)
- HTML/XML
- Dávkový přenos FTP

Dotazy?

Pavel Křižanovský: Aplikace nad metropolitní WiFi infrastrukturou (TECH3)