



# Cisco Catalyst 9000

Způsoby nasazení při budování podnikové sítě

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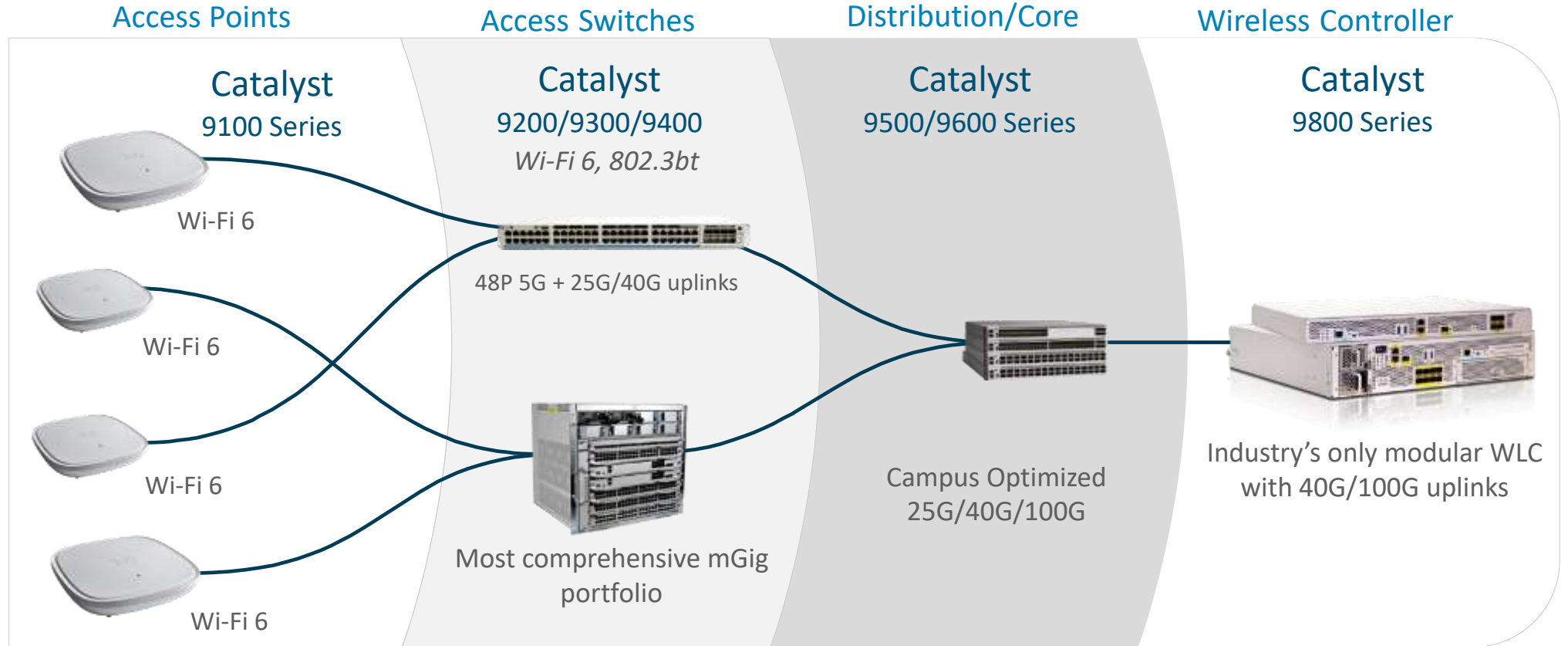
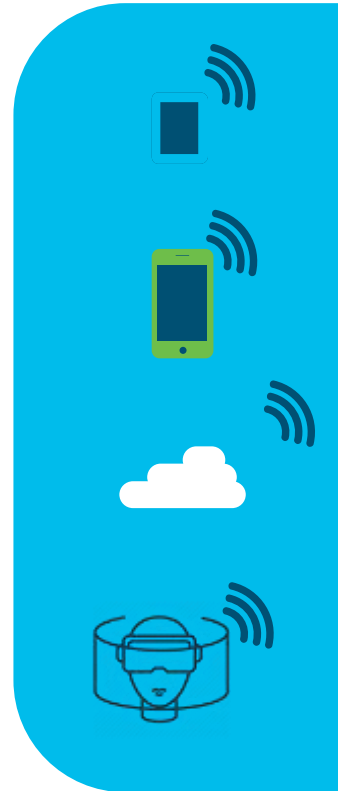
29.3.2022

# Agenda

- Catalyst 9000 - kompletní řada pro budování podnikových sítí
- Přepínané sítě
  - Možnosti návrhu
  - Tradiční vícevrstvý model
  - Síťový fabric
- Bezdrátové sítě
- Diskuze, otázky a odpovědi

# Cisco Catalyst Access Network

## Best Access Experience for IT and IoT



← Fully Integrated End to End →

Built for intent-based networking



Automation



Security



Analytics

# Catalyst Switching - Fully Refreshed Portfolio



**Catalyst  
9000  
Switching  
Platform**

**Cisco Catalyst 9200 Series**



**Cisco Catalyst 9300 Series**



**Cisco Catalyst 9400 Series**



**Cisco Catalyst 9500 Series**



**Cisco Catalyst 9600 Series**



Cisco Catalyst 2960-X/XR



Cisco Catalyst 3650/3850



Cisco Catalyst 4500E Series



Cisco Catalyst 3850F/4500-X



Cisco Catalyst 6840-X/6880-X



Cisco Catalyst 6500-E/6807-XL



**Access switching**

**Core switching**

**Common UADP ASIC, IOS-XE operating system and licensing**

# Catalyst Wireless - Fully Refreshed Portfolio

## Catalyst 9000 Wireless Platform



Access Points

Wireless LAN Controllers

Common IOS-XE operating system and licensing

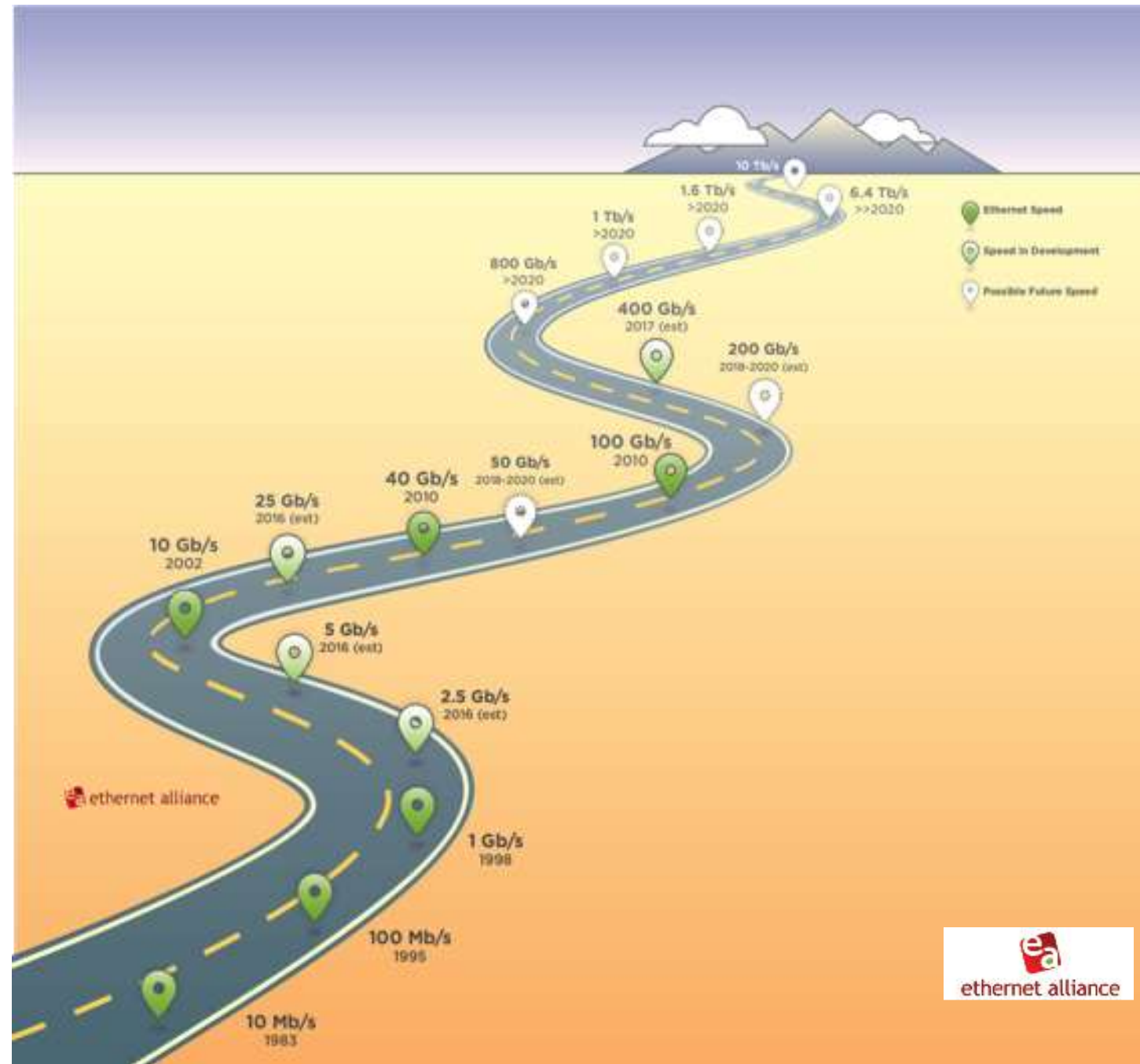
# Ethernet Roadmap

Evolution of New speeds:

**25Gb/s, 50Gb/s, 200Gb/s, 400Gb/s**  
**2.5Gb/s & 5Gb/s for wireless**

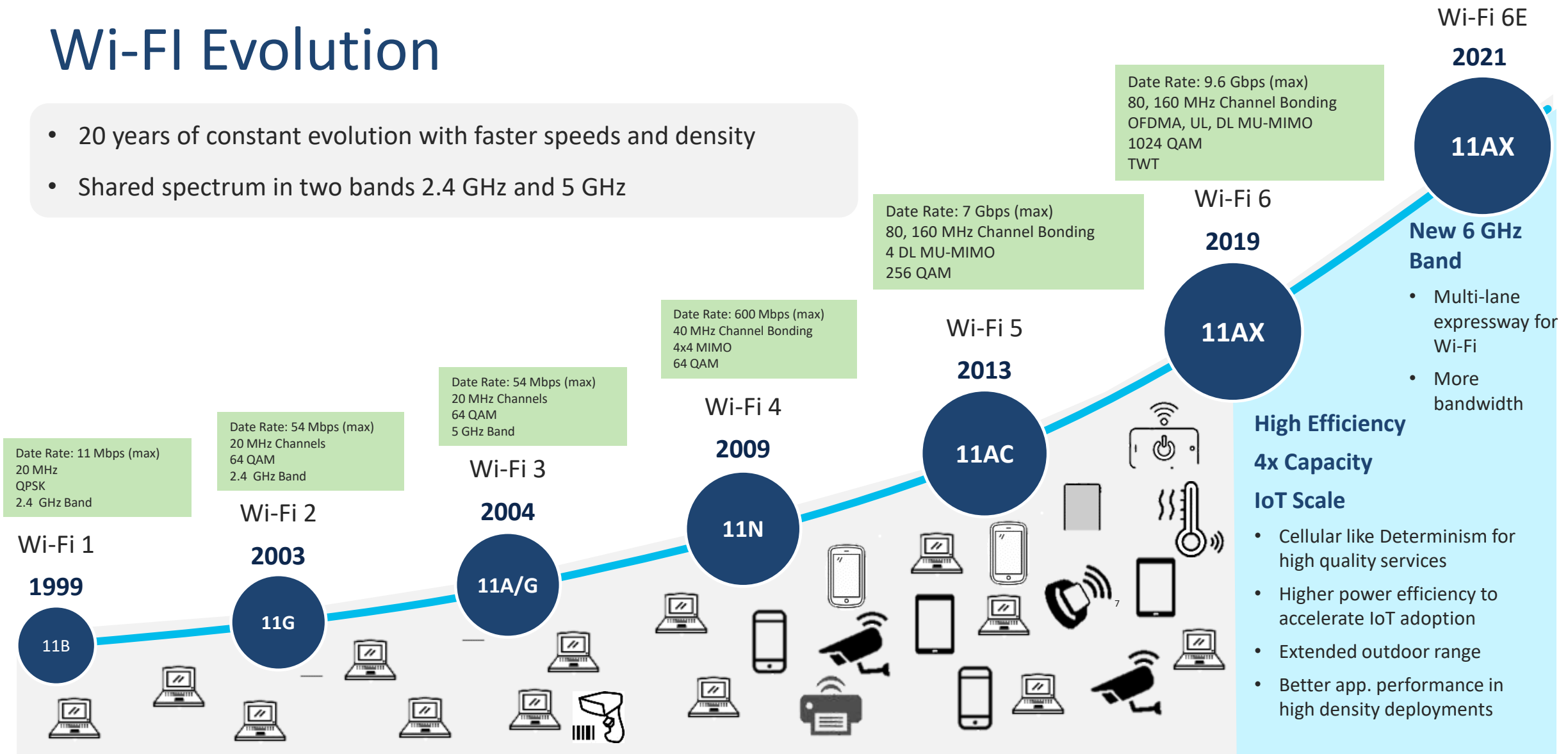
Development and deployment at points all along the Ethernet value chain have exploded!!

6 Ethernet speeds in 5 years, same amount as the previous 40 years provided !!



# Wi-Fi Evolution

- 20 years of constant evolution with faster speeds and density
- Shared spectrum in two bands 2.4 GHz and 5 GHz

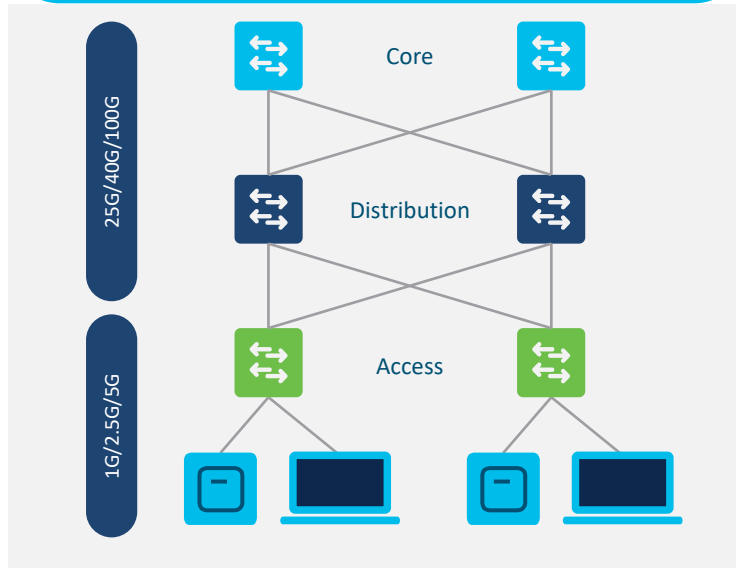


# Využití přepínačů Catalyst 9000 v síťových řešeních

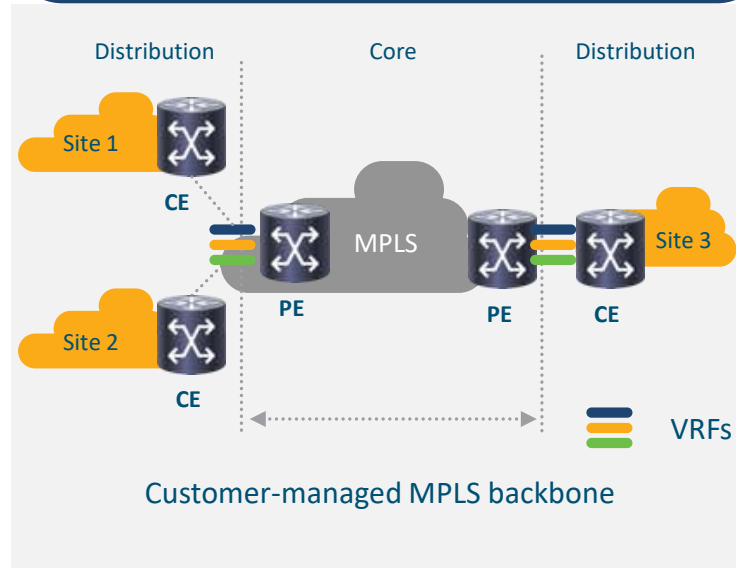


# Cisco Catalyst 9000 – flexibilita nasazení

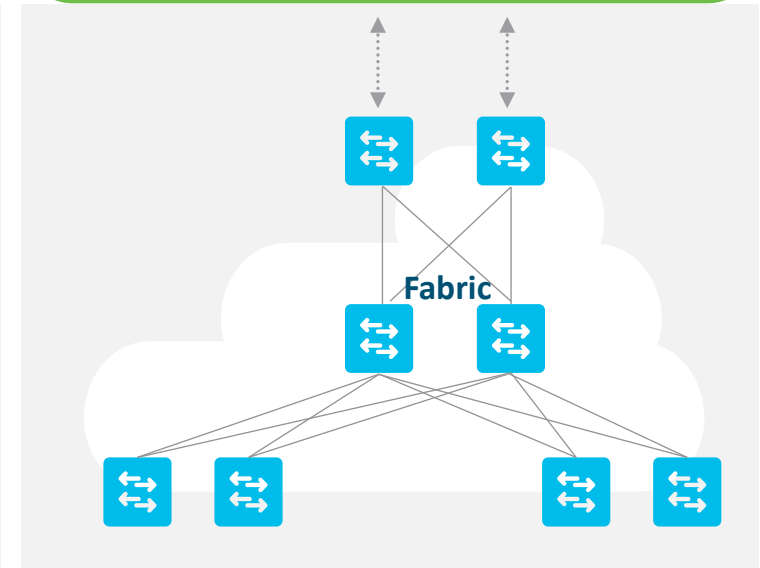
## Klasický vícevrstevný model



## Layer 3 Core, MPLS, VPLS,...



## Fabric: SDA, BGP-EVPN



### Cisco řešení "na klíč"

- SD-Access
- Cisco DNA Assurance
- Cisco DNA Service for Bonjour
- Cisco DNA Application Visibility Service
- Encrypted Traffic Analytics



### Do-It-Yourself (DIY) řešení

- BGP-EVPN
- MPLS/VPLS
- Tradiční 2/3-vrstvé topologie
- Programabilita – YANG modely s Netconf, Restconf, gNMI API

One platform. Any place. Any speed (10M to 400G)

# Klasický vícevrstvý model

*Přístupová vrstva*

# Hlavní role přístupové vrstvy

- Připojení zařízení do sítě
  - Fyzické připojení (10/100/1000, mGig)
  - Napájení (PoE)
  - Autentizace uživatele a jeho autorizace k přístupu (dACL, SGT/SGACL)
  - Automatická detekce připojených zařízení, profiling, voice VLAN, ...
- Monitoring provozu
  - Full Flexible Netflow
  - NBAR/AVC
  - ThousandEyes
- Bezpečnostní funkce
  - Encrypted Traffic Analytics
  - First Hop Security (port security, DHCP snooping, DAI, IPSG, ..)
  - Trustworthy technologie (relevantní pro všechny vrstvy sítě)
  - MACsec (relevantní pro všechny vrstvy sítě)

# Důvody pro MultiGigabit v podnikové síti



11ac Wave2 APs  
11ax WiFi6/6E APs

9100 APs



Uplinks for Access  
Extension



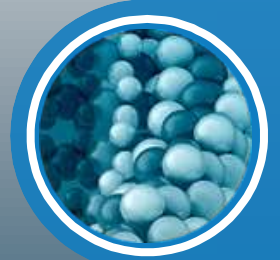
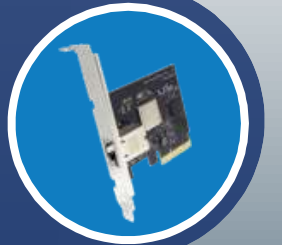
C3560-CX



Machine Vision Cameras,  
Professional Surveillance



Server in a Branch



Digital Imaging

Healthcare

Education

Finance

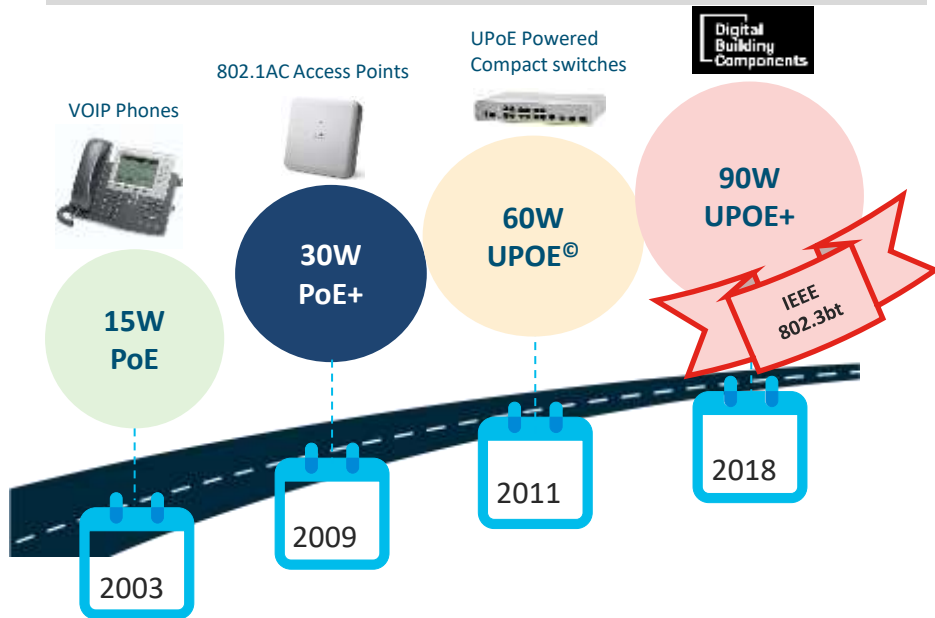
Manufacturing

Retail

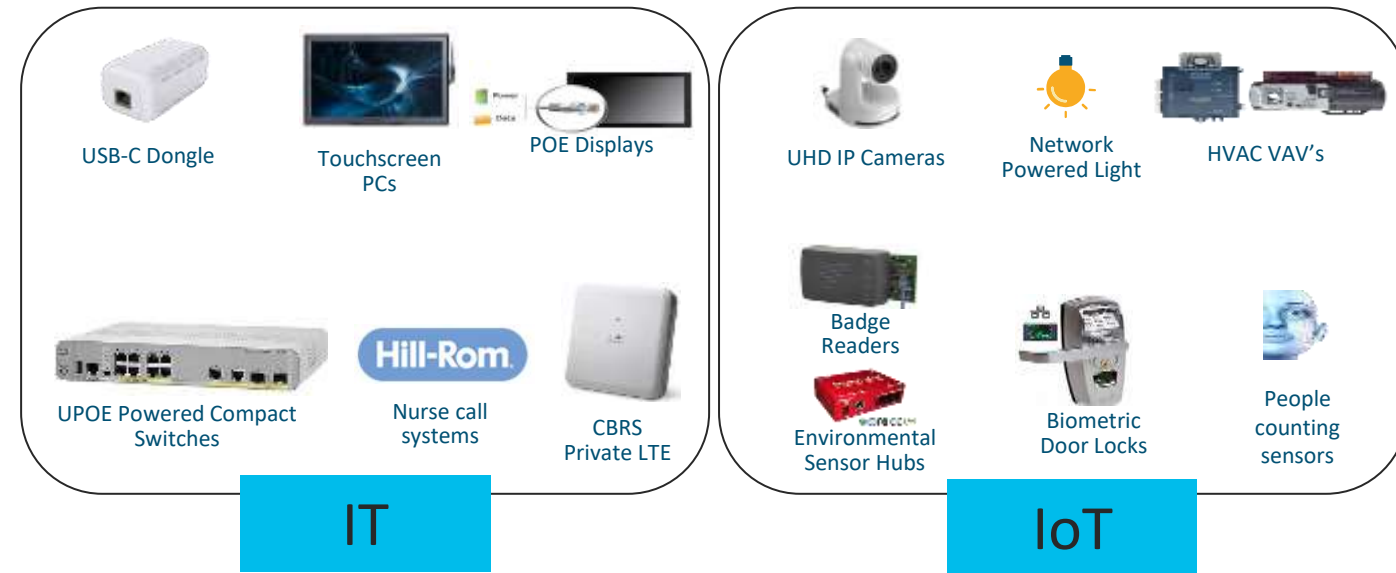
Hospitality

# Vývoj PoE

## UPOE+ Standardizace



## Rostoucí ecosystem



### IEEE standardization expands the PoE ecosystem

- IEEE 802.3bt complements Cisco UPOE® by adding 4 new classes of devices
  - Safety measures ensure up to 90W of power is safely delivered

# Cisco innovations in Power over Ethernet (PoE) deliver a robust low-voltage infrastructure

## 2-event classification

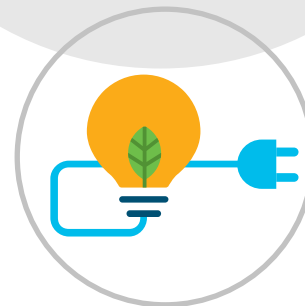
- Fast power negotiation without Link Layer Discovery Protocol (LLDP)
- Physical layer negotiation < 1s

## Perpetual PoE\*

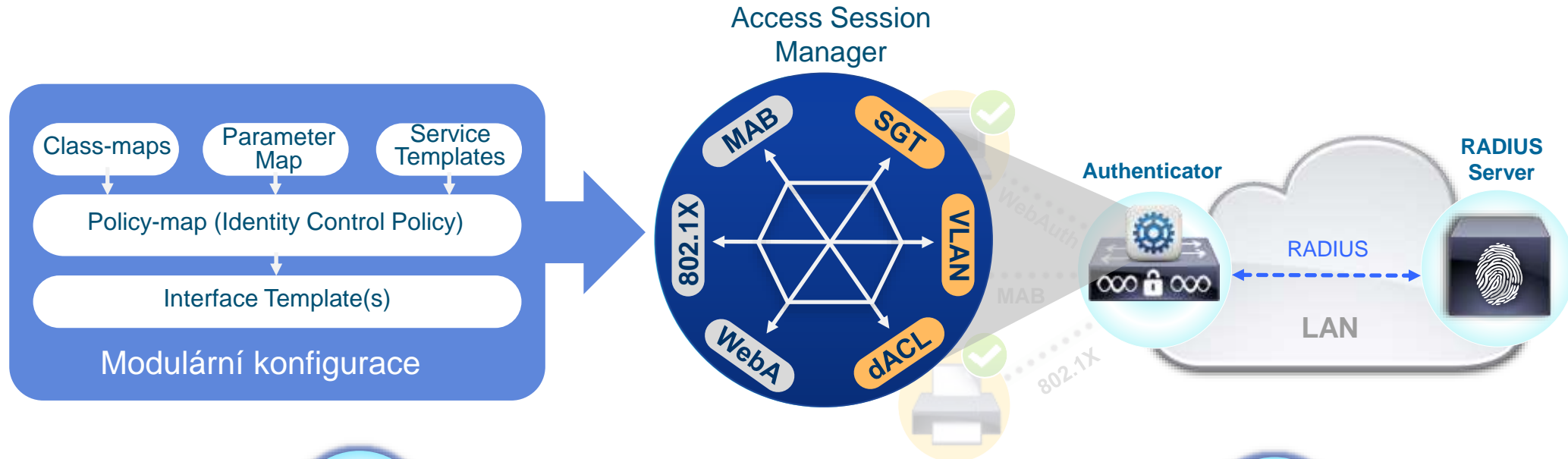
- Uninterrupted PoE power during control plane reboot

## Fast PoE\*

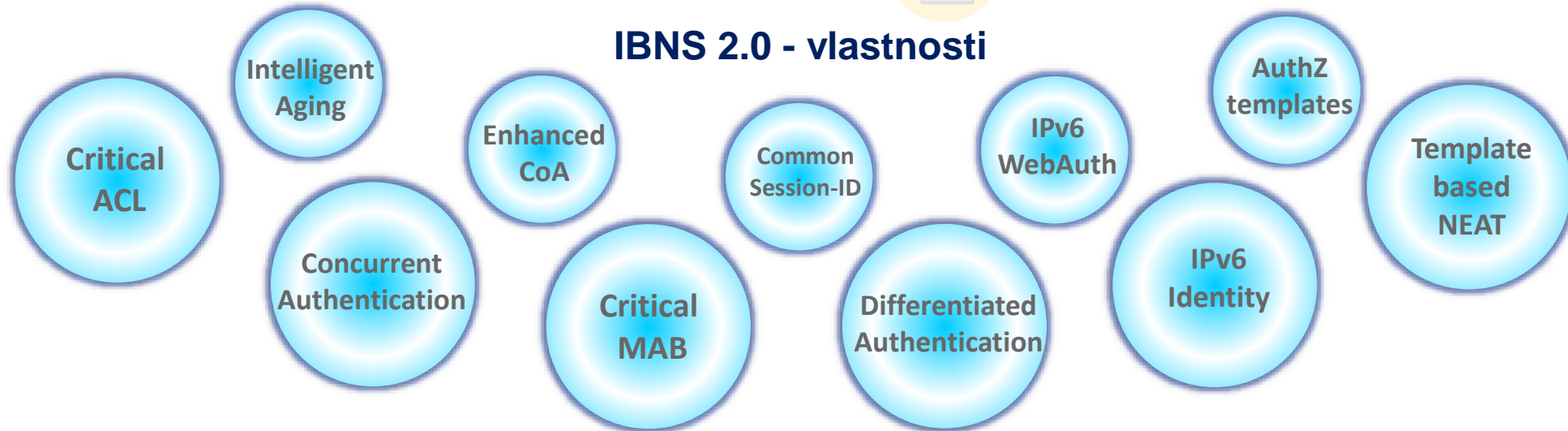
- Bypasses Cisco IOS® control plane boot
- Restores power to PD within 30 seconds of power resumption



# Identity Based Networking Services 2.0



## IBNS 2.0 - vlastnosti





# Varianty bezpečnostní politiky

## Tradiční přístup



```

access-list 102 deny udp 14.43.206.20 0.0.0.255 lt 419 101.24.239.100 0.0.0.255 lt 2740
access-list 102 permit udp 252.40.175.155 0.0.31.255 lt 4548 87.112.10.20 0.0.1.255 gt 356
access-list 102 deny tcp 124.102.192.59 0.0.0.255 eq 2169 153.233.253.100 0.255.255.255 gt 327
access-list 102 permit icmp 68.14.62.179 255.255.255.255 lt 2985 235.228.242.243 255.255.255.255 lt 2286
access-list 102 deny tcp 91.198.213.34 0.0.0.255 eq 1274 206.136.32.135 0.255.255.255 eq 4191
access-list 102 deny udp 76.150.135.234 255.255.255.255 lt 3573 15.233.106.211 255.255.255.255 eq 3721
access-list 102 permit tcp 126.97.113.32 0.0.1.255 eq 4644 2.216.105.40 0.0.31.255 eq 3716
access-list 102 permit icmp 147.31.93.130 0.0.0.255 gt 968 154.44.194.206 255.255.255.255 eq 4533
access-list 102 deny tcp 154.57.128.91 0.0.0.255 lt 1290 106.233.205.111 0.0.31.255 gt 539
access-list 102 deny ip 9.148.176.48 0.0.1.255 eq 1310 64.61.88.73 0.0.1.255 lt 4570
    
```

Význam položek je skrytý, mnoho řádků, závisí na adresaci, může vyžadovat časté změny, typicky je vynuocováno pouze mezi VLANy/subnety (typicky v distribučních přepínačích nebo firewallech)

## Přístup založený na skupinových značkách

● Permit ● Deny ● Custom ● Default

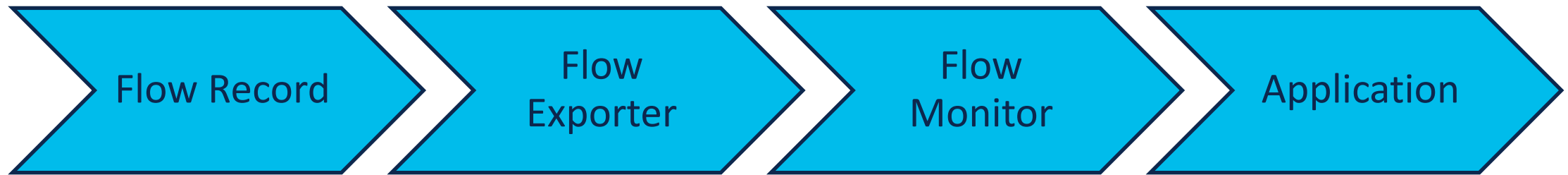


Jasná vazba na organizační strukturu, přehledná matice pravidel, pravidla nemusí být vůbec navázaná na adresní schéma, jsou implicitně vynuocována jak mezi VLANy/subnety, tak uvnitř VLANů/subnetů (t.j. i v přístupových přepínačích)



# Full NetFlow Configuration on Catalyst 9000

- Configuring FNF involves 4 major steps:



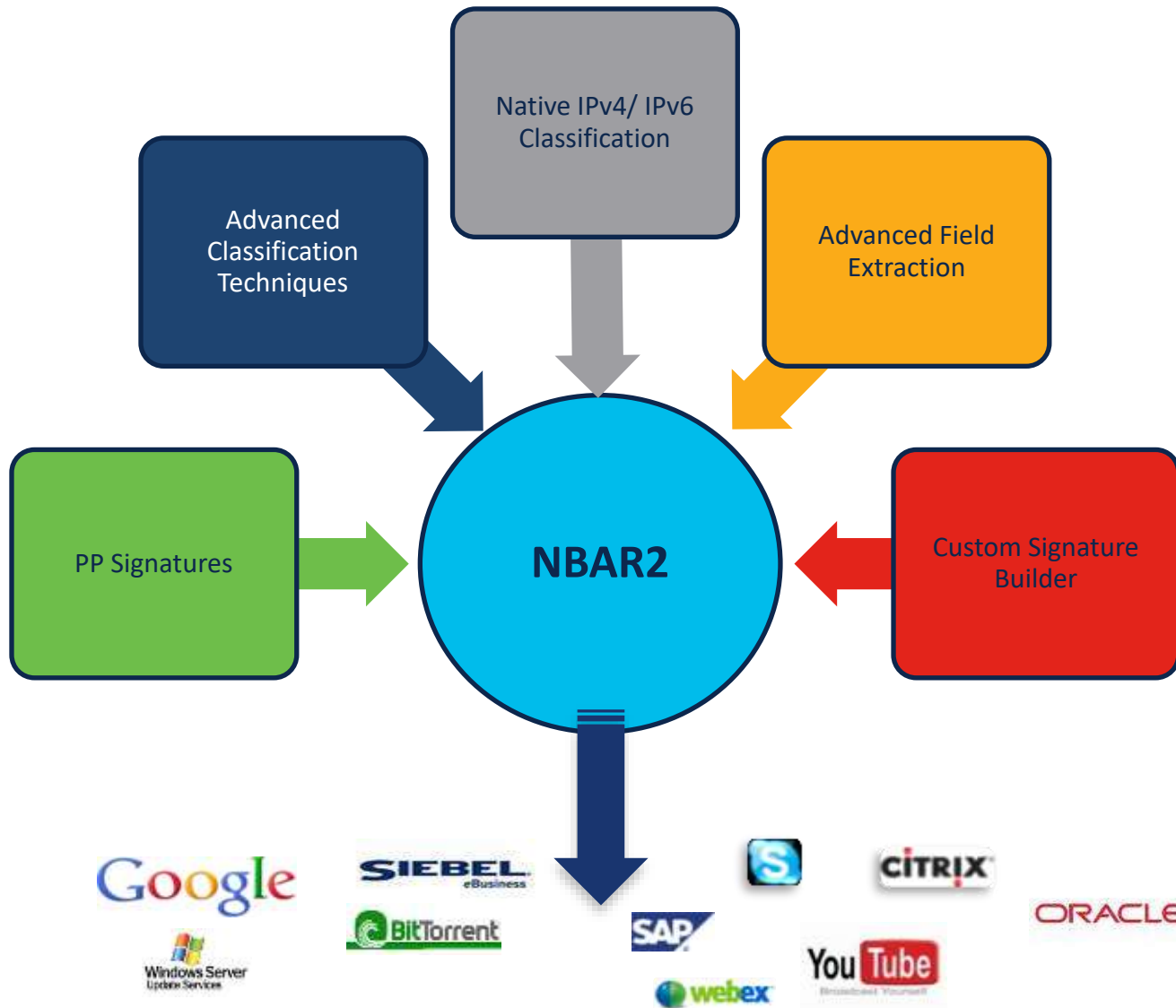
- What data do I want to meter?

- Where do I want to send the flow data?

- How do I want to cache the information?

- Which interface/VLAN to monitor?

# Network Based Application Recognition 2 (NBAR2)



- Optimize the Application experience in the network
- Hitless Protocol Pack update allows adding more applications.
- Supported devices :
  - from 16.6(3): **Catalyst 9300**
  - from 16.9.1: **Catalyst 9400**
  - from 16.11.1: **Catalyst 9200**

Recognizes  
~1500 Apps  
~140 Encrypted Apps

# Cisco Catalyst 9200 Series



Security



Resiliency



Application experience

## Catalyst 9200L Fixed uplinks, limited scalability



48 ports Full POE+/Data, 1G/10G Uplink



48 ports Full POE+, 12xmGig, 10G Uplink

48 ports Full POE+, 8xmGig, 25G Uplink



24 ports Full POE+/Data, 1G/10G Uplink



24 ports Full POE+, 8xmGig, 10G Uplink

24 ports Full POE+, 8xmGig, 25G Uplink

## Catalyst 9200 Modular uplinks



48 ports Full POE+/Data

48 port Full POE+ with 32 VN\*\*

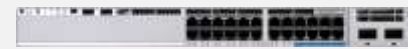


48 ports Full POE+, 8xmGig



24 ports Full POE+/Data

24 ports Full PoE+ with 32 VN\*\*



24 ports Full POE+, 8xmGig

## Modular fans Higher Efficiency AC FRU Power Supplies

FRU Fan



Silver Rated



125W

FRU PSU

Platinum Rated



600W

Platinum Rated



1000W

## Modular uplinks

FRU Uplinks\*



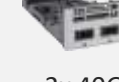
4x 1G



4x 10G



2x 25G



2x 40G

\*C9200 1G skus support 1/10G uplinks while C9200 mGig will support 10/25/40G uplinks

\*\*C9200 32 VN skus only support 1/10G uplinks and these skus cannot be stacked with other C9200 skus

# Cisco Catalyst 9300L Series

Fixed Uplink Models

## Fixed Uplinks ( C9300L Models )

1G & PoE+



48/24 ports Data

Fixed 1G or 10G  
uplinks



48/24 ports PoE+

Fixed 1G or 10G  
uplinks

UPOE & mGIG models



C9300L-48UXG-2Q 36 x 1 G Ports 12 x 100/1/2.5/5/10G UPOE Ports

Fixed 40G  
uplinks



C9300L-24UXG-2Q 16 x 1 G Ports 8 x 100/1/2.5/5/10G UPOE Ports



C9300L-48UXG-4X 36 x 1 G Ports 12 x 100/1/2.5/5/10G UPOE Ports

Fixed 10G  
uplinks



C9300L-24UXG-4X 16 x 1 G Ports 8 x 100/1/2.5/5/10G UPOE Ports

Optional StackWise-320 Kit

Common  
components



Stack Adapters



50CM-1M-3M

Platinum-rated power supplies



315W AC



715W AC/DC



1100W AC



1900W AC

Modular Fans



\* DC PS is Gold-Rated

# Cisco Catalyst 9300 Series

## C9300 SKUs with Modular Uplinks

1G Copper ports with PoE/UPOE/UPOE+



48/24 ports **Data** 1G



48/24 ports **UPOE** 1G



48/24 ports **PoE+** 1G



48/24 ports **UPOE+** 1G



48/24 ports UPOE 1G – **9300B**

2-4x  
Scale/Buffer

Multigigabit Models with UPOE



48/24 ports mGig

1G Fiber Models



48/24 ports SFP 1G

C9300 Only Modular Uplinks



4x Multigigabit



4x 1G SFP



8x 1/10G SFP/SFP+



2x 1/10/25 G SFP/SFP+

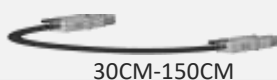


2x 40G QSFP

StackWise and StackPower Cables



50CM-1M-3M



30CM-150CM

Platinum rated power supplies



315W AC



715W AC/DC



1100W AC



1900W AC



Modular Fans

## C9300X SKUs with Modular Uplinks

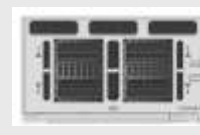
High Density Multigigabit Models with UPOE+



1/10/25G Fiber Models



C9300X Only Modular Uplinks



4x 40/100G



2x 40/100G



8x 10/25G



8x mGig

Common  
Components

# Cisco Catalyst 9400X



**Up to 240G**  
bandwidth



**1/2.5/5/10/25/40G**  
Supports Different Speeds



**Forwarding + ACL Scale**  
Up to 96K MACs  
Up to 64K Routes



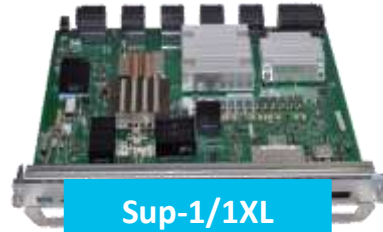
**Up to 32 MB**  
(2 x 16MB) packet  
buffer

**240/120/80Gbps/Slot with Sup-1XL** (4/7/10 Slot  
Chassis)  
**80Gbps/Slot with Sup-1** (All Chassis)

**UADP 2.0XL**



**Sup-1/1XL**

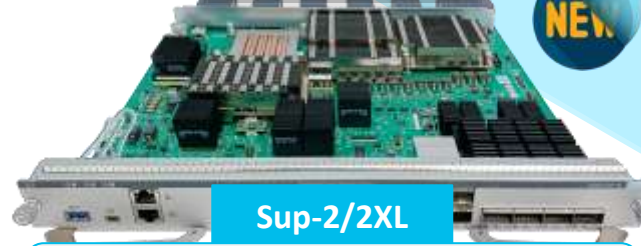


**UADP 3.0sec**



**Sup-2/2XL**

**480Gbps/Slot with Sup-2XL**  
**240Gbps/Slot with Sup-2**



**Up to 1.6T**  
Bandwidth



**1/2.5/5/10/25/40/100G**  
Supports Different Speeds



**Increased**  
Forwarding + ACL Scale  
Up to 128K MACs\*  
Up to 256K Routes\*



**Up to 36 MB**  
Unified packet  
buffer



**Up to 100G**  
Encryption  
IPSec\*, WAN-MACsec\*



**Customizable**  
Templates for  
higher Scale\*

\* Hardware Capable, Software Support not committed

**Unmatched Flexibility**

**Maximum Investment Protection**

**100G Leadership in Access**

**Same Series, Chassis options – New SUPs and Line cards**

# Klasický vícevrstvý model

## *Agregační vrstva*



# Hlavní role agregační vrstvy

- Připojení přepínačů přístupové vrstvy do sítě
  - Fyzické připojení (GE, 10GE, 25GE, 40GE, 100GE)
  - Agregace několika fyzických spojů do jednoho logického
  - Typicky hranice mezi L2 a L3 (routing, sumarizace, redundance prvního hopu - HSRP, VRRP)
  - Podpora škálovatelnosti tvorbou agregačních bloků
- Vysoká dostupnost
  - Snaha o minimalizaci nasazení Spanning Tree Protokolu
  - StackWise (HW stacking) - maximální délka kabelu až 3 metry
  - StackWise Virtual - obdoba VSS
  - ISSU
- Bezpečnostní funkce
  - Filtrace (Access Control List)
  - Trustworthy technologie (relevantní pro všechny vrstvy sítě)
  - MACsec (relevantní pro všechny vrstvy sítě)



# StackWise 480/1T

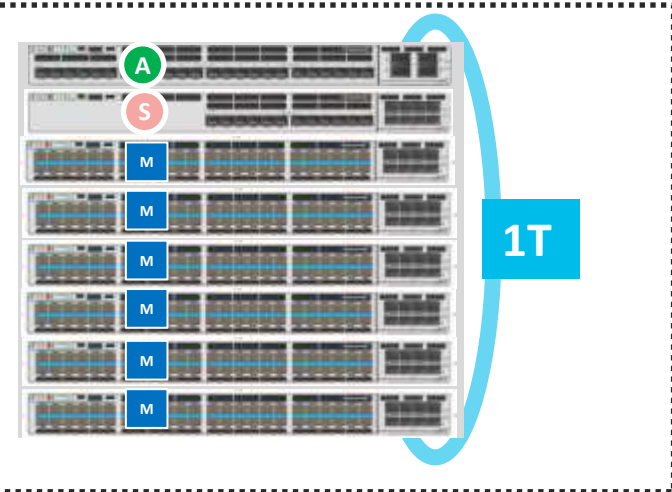
8 Individual Switches



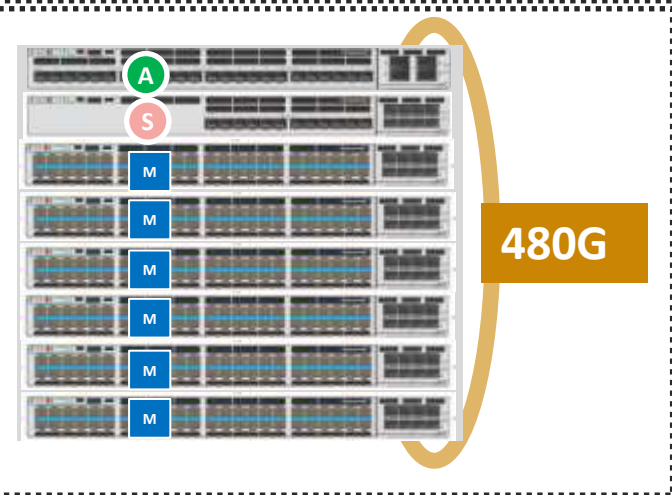
Pouze C9300X



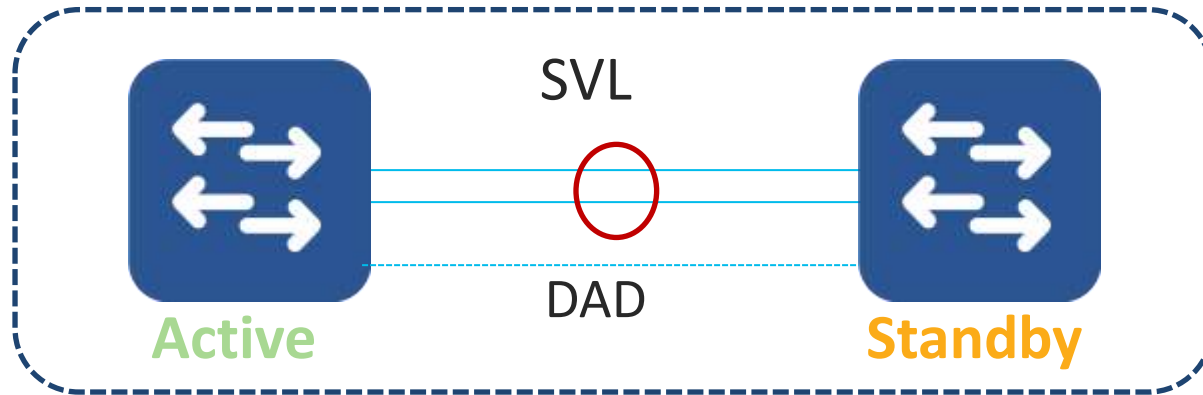
One Logical Switch



C9300 a C9300X



# StackWise Virtual



Catalyst 9400 Series



PLATFORM	SUPERVISORS
9404	Sup1
9407	Sup1XL
9410	Sup1XL-Y

Catalyst 9500 Series



PLATFORM	UPLINK MODULE
9500-12Q	NM-10X
9500-24Q	NM-2Q
9500-40X	
9500-16X	

PLATFORM	
9500-24Y4C	9500-32QC
9500-48Y4C	9500-32C

Catalyst 9600 Series



PLATFORM
Supervisor1
9600-LC-48TX
9600-LC-24C
9600-LC-48YL

## SOFTWARE

- Unicast Local Forwarding
- Separate Queuing for Control
- Graceful Auto Recovery
- Breakout Support
- In-Service Software Upgrade
- BUM Local Forwarding
- Quad-Sup RPR (C9600)

# Cisco Catalyst 9300 Series

## C9300 SKUs with Modular Uplinks

### 1G Fiber Models



48/24 ports SFP 1G

### C9300 Only Modular Uplinks



4x Multigigabit



4x 1G SFP



8x 1/10G SFP/SFP+



2x 1/10/25 G SFP/SFP+

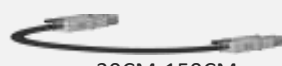


2x 40G QSFP

### StackWise and StackPower Cables



50CM-1M-3M



30CM-150CM

### Platinum rated power supplies



315W AC



715W AC/DC



1100W AC



1900W AC

### Modular Fans

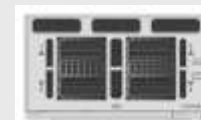


## C9300X SKUs with Modular Uplinks

### 1/10/25G Fiber Models



### C9300X Only Modular Uplinks



4x 40/100G



2x 40/100G



8x 10/25G



8x mGig

Common Components

# Cisco Catalyst 9400X



**Up to 240G**  
bandwidth



**1/2.5/5/10/25/40G**  
Supports Different Speeds



**Forwarding + ACL Scale**  
Up to 96K MACs  
Up to 64K Routes



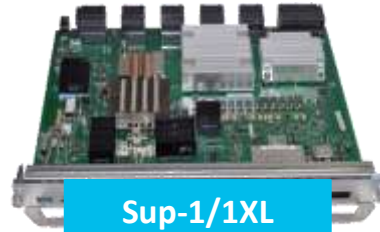
**Up to 32 MB**  
(2 x 16MB) packet  
buffer

**240/120/80Gbps/Slot with Sup-1XL (4/7/10 Slot Chassis)**  
**80Gbps/Slot with Sup-1 (All Chassis)**

**UADP 2.0XL**



**Sup-1/1XL**



**UADP 3.0sec**



**Sup-2/2XL**

**480Gbps/Slot with Sup-2XL**  
**240Gbps/Slot with Sup-2**



**Up to 1.6T**  
Bandwidth



**1/2.5/5/10/25/40/100G**  
Supports Different Speeds



**Increased Forwarding + ACL Scale**  
Up to 128K MACs\*  
Up to 256K Routes\*



**Up to 36 MB**  
Unified packet  
buffer



**Up to 100G**  
Encryption  
IPSec\*, WAN-MACsec\*



**Customizable**  
Templates for  
higher Scale\*

\* Hardware Capable, Software Support not committed

**Unmatched Flexibility**

**Maximum Investment Protection**

**100G Leadership in Access**

**Same Series, Chassis options – New SUPs and Line cards**



# Catalyst 9500 High Performance Series

## Catalyst 9500H (UADP 3.0)



C9500-32C / C9500-32QC



C9500-48Y4C / C9500-24Y4C

Total Capacity

**3.2 Tbps**

32 x 100G or  
48 x 25G + 4 x 100G



# Catalyst 9600 Series

UADP 3.0



**Supervisor 1**

Total Capacity

**4.8 Tbps**

Slot B/W

**1.2 Tbps**



**Gen1**  
1.2T /slot



**Gen1**  
1.2T /slot

# Klasický vícevrstvý model

*Páteřní vrstva*

# Hlavní role páteřní vrstvy

- Propojení agregačních bloků
  - Fyzické připojení (10GE, 25GE, 40GE, 100GE, 400GE)
  - Typicky pouze L3 (routing, vysoký výkon)
  - U menších sítí může roli převzít agregační vrstva
- Vysoká škálovatelnost a stabilita
  - Existence páteřní vrstvy usnadňuje růst sítě v budoucnosti
  - Typicky málo funkcí, důraz na stabilitu
- Bezpečnostní funkce
  - Trustworthy technologie (relevantní pro všechny vrstvy sítě)
  - MACsec (relevantní pro všechny vrstvy sítě)



# Catalyst 9500H/9500X Series

Non-XL Scale

**Catalyst 9500H (UADP 3.0)**



C9500-32C / C9500-32QC



C9500-48Y4C / C9500-24Y4C

Total Capacity

**3.2 Tbps**

32 x 100G or  
48 x 25G + 4 x 100G

XL Scale

**Catalyst 9500X (S1 Q200)**



C9500X-28C8D

Total Capacity

**6.0 Tbps**

36 x 100G or  
28 x 100G + 8 x 400G

**2x**

# Catalyst 9600/9600X Series



**Supervisor 1**

Total Capacity  
**4.8 Tbps**  
Slot B/W  
**1.2 Tbps**



**Supervisor 2**

Total Capacity  
**12.8 Tbps**  
Slot B/W  
**3.2 Tbps**

**Gen1**  
1.2T /slot

**Gen2**  
3.2T /slot

**Gen1**  
1.2T /slot

**Gen2**  
3.2T /slot

**400G**



40x 1/10/25/50G + 2x 200G + 2x 400G

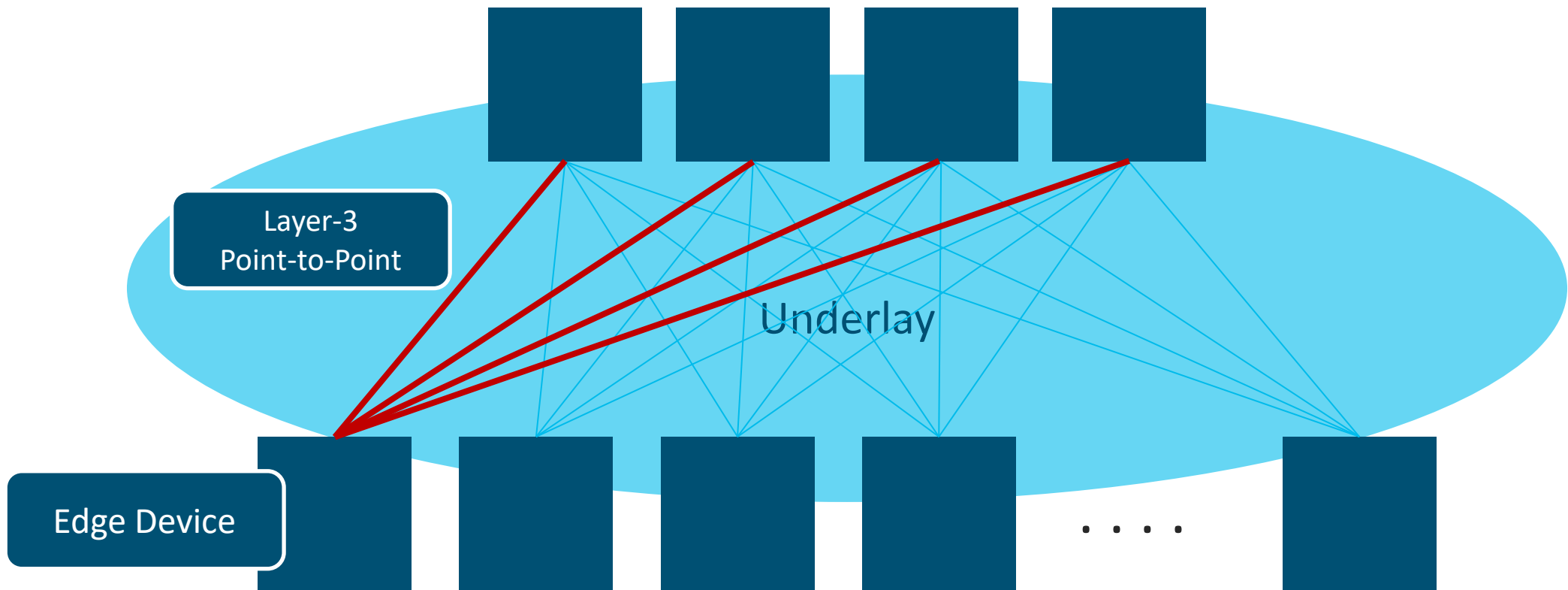


# Síťový fabric

## *Varianty*

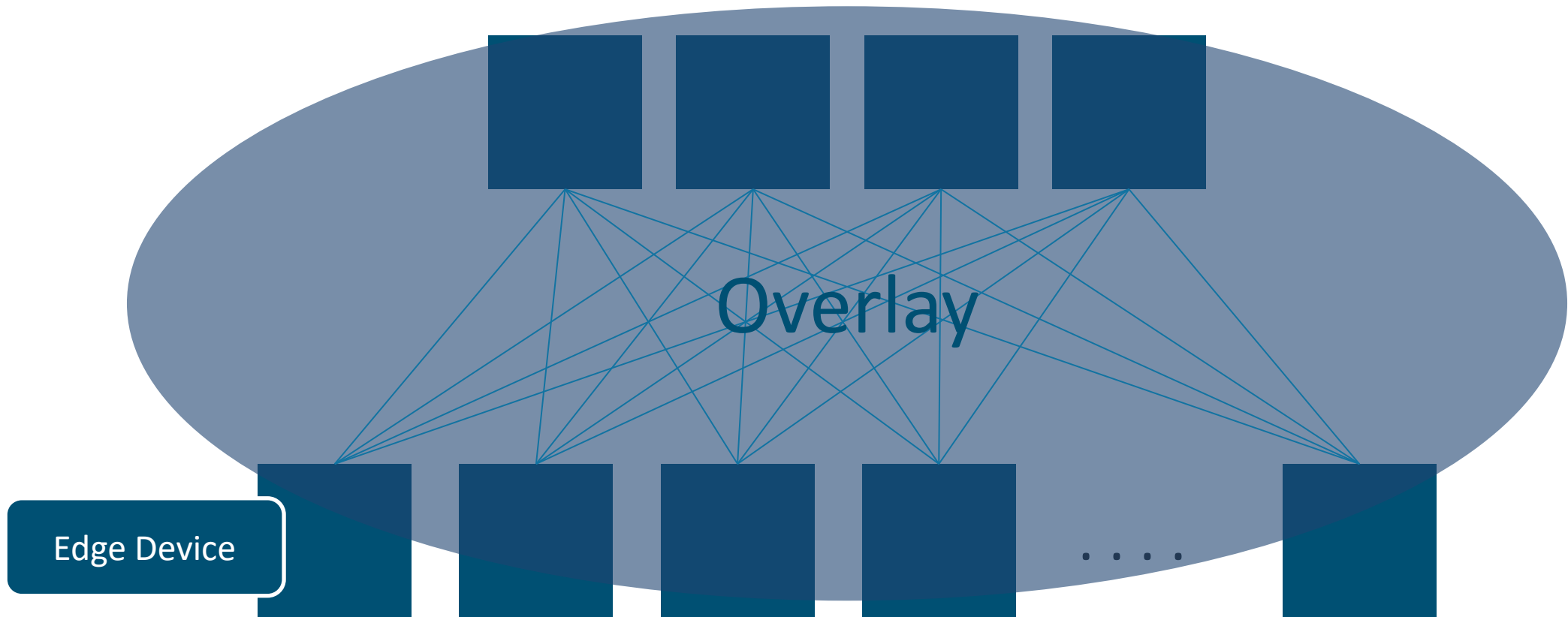
# Co tvoří fabric

## Underlay - konektivita



# Co tvoří fabric

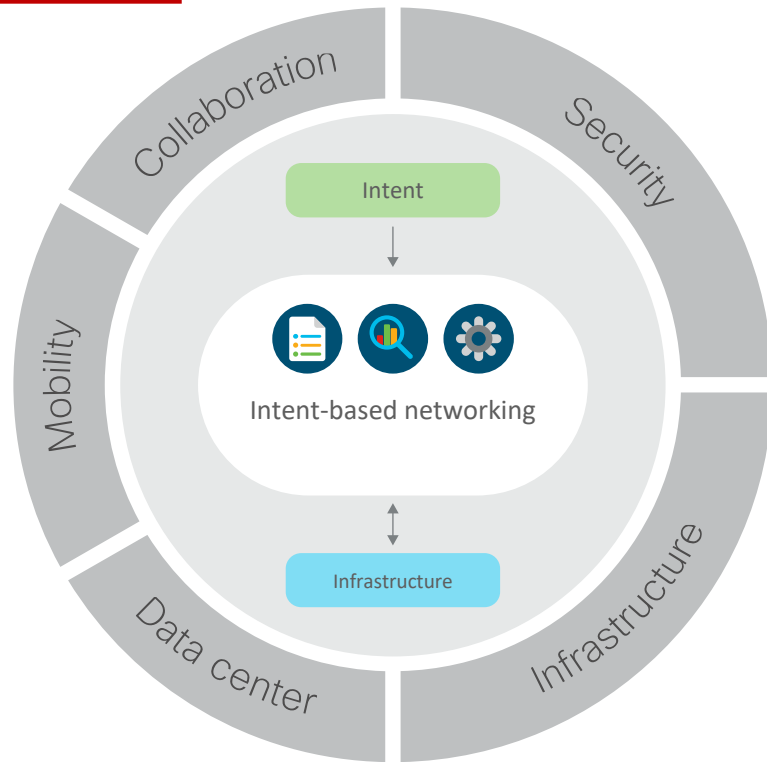
## Overlay - “intelligence” a funkce



# Catalyst 9000 – SD-Access vs. BGP-EVPN

## Cisco SD-Access

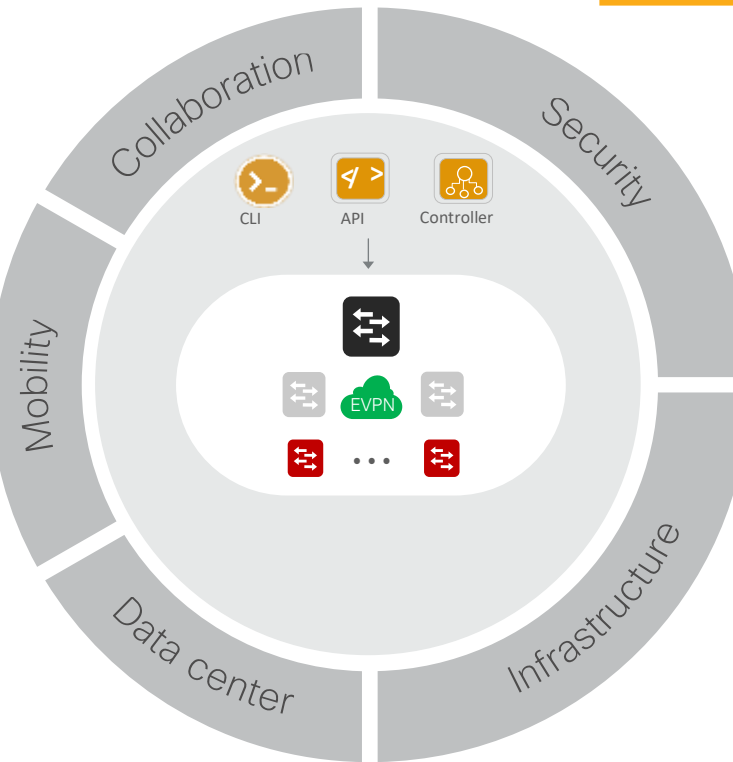
Fully Automated



- Preskriptivní design založený na CVD
- Automatizovaný workflow
- Wired/wireless integrace
- Segmentace (VN) a mikrosegmentace (SGT)
- Multidoménová integrace

## BGP EVPN

DIY



- Flexibilní design plně založený na standardech
- Konfigurace pomocí CLI, šablon nebo Ansible
- Wireless pouze OTT
- Segmentace (VN)
- Multidoménový fabric (Catalyst, Nexus, ...)

BGP-EVPN

# VXLAN and EVPN

## VXLAN

- Standards based Encapsulation
- RFC 7348
- Uses UDP-Encapsulation
- Transport Independent
- Layer-3 Transport (Underlay)
- Flexible Namespace
- 24-bit field (VNID) provides ~16M unique identifier
- Allows Segmentations

## EVPN

- Standards based Control-Plane
- RFC 8365 (and RFC 7432)
- Uses Multiprotocol BGP
- Uses Various Data-Planes
- VXLAN (EVPN-Overlay), MPLS, Provider Backbone (PBB)
- Many Use-Cases Covered
- Bridging, MAC Mobility, First-Hop & Prefix Routing, Multi-Tenancy (VPN)



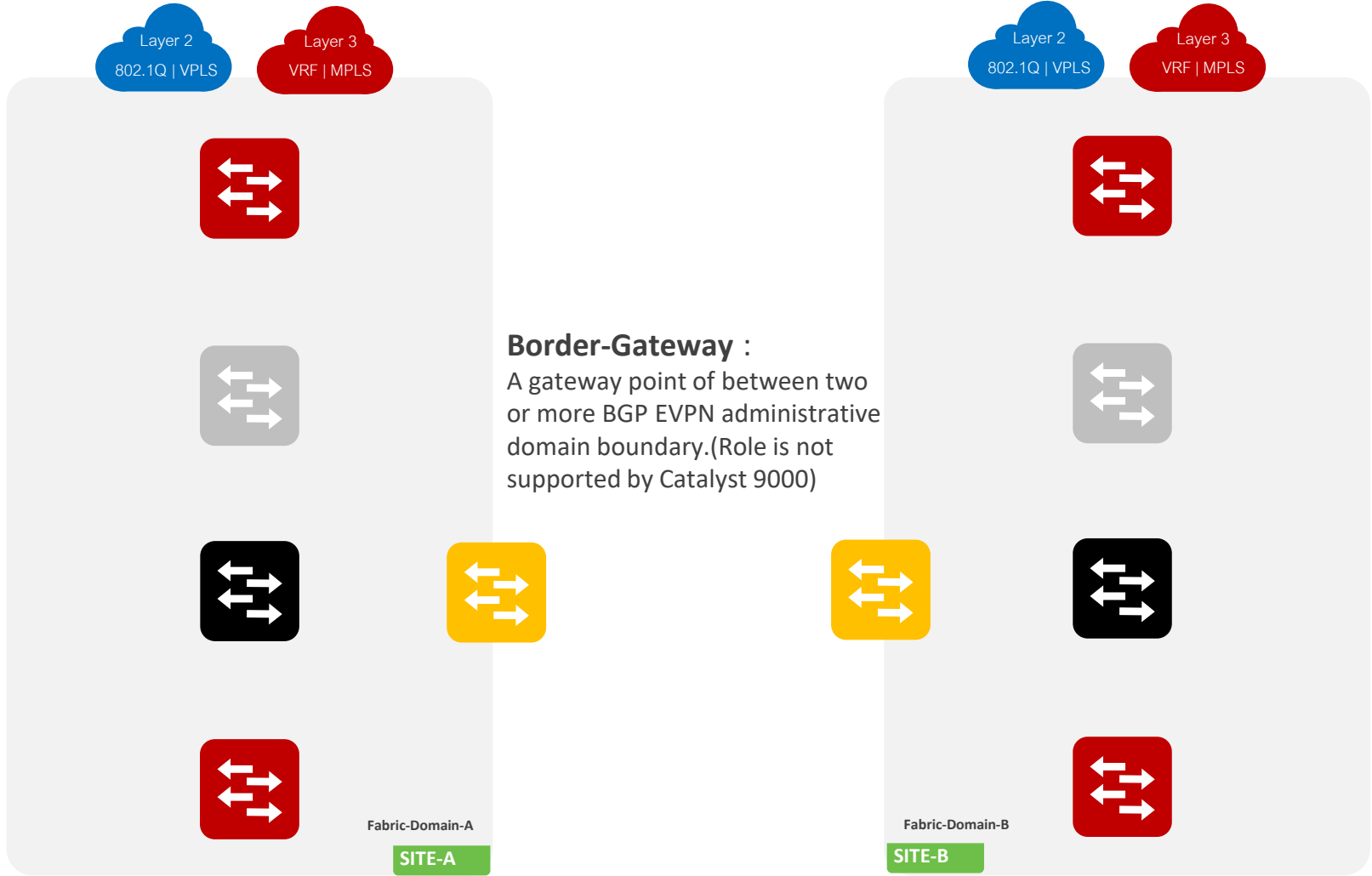
# BGP EVPN System Role \*

**BORDER :**  
A gateway point of between EVPN fabric and external network domain.

**INTERMEDIATE :**  
Underlay network system providing basic transport and forwarding plane.

**SPINE :**  
An BGP EVPN reflects the L2/L3 VPN prefixes providing hierarchical neighbor peering, learning and distribution point.

**VTEP :**  
An origination and termination point of VXLAN enabled overlay network.

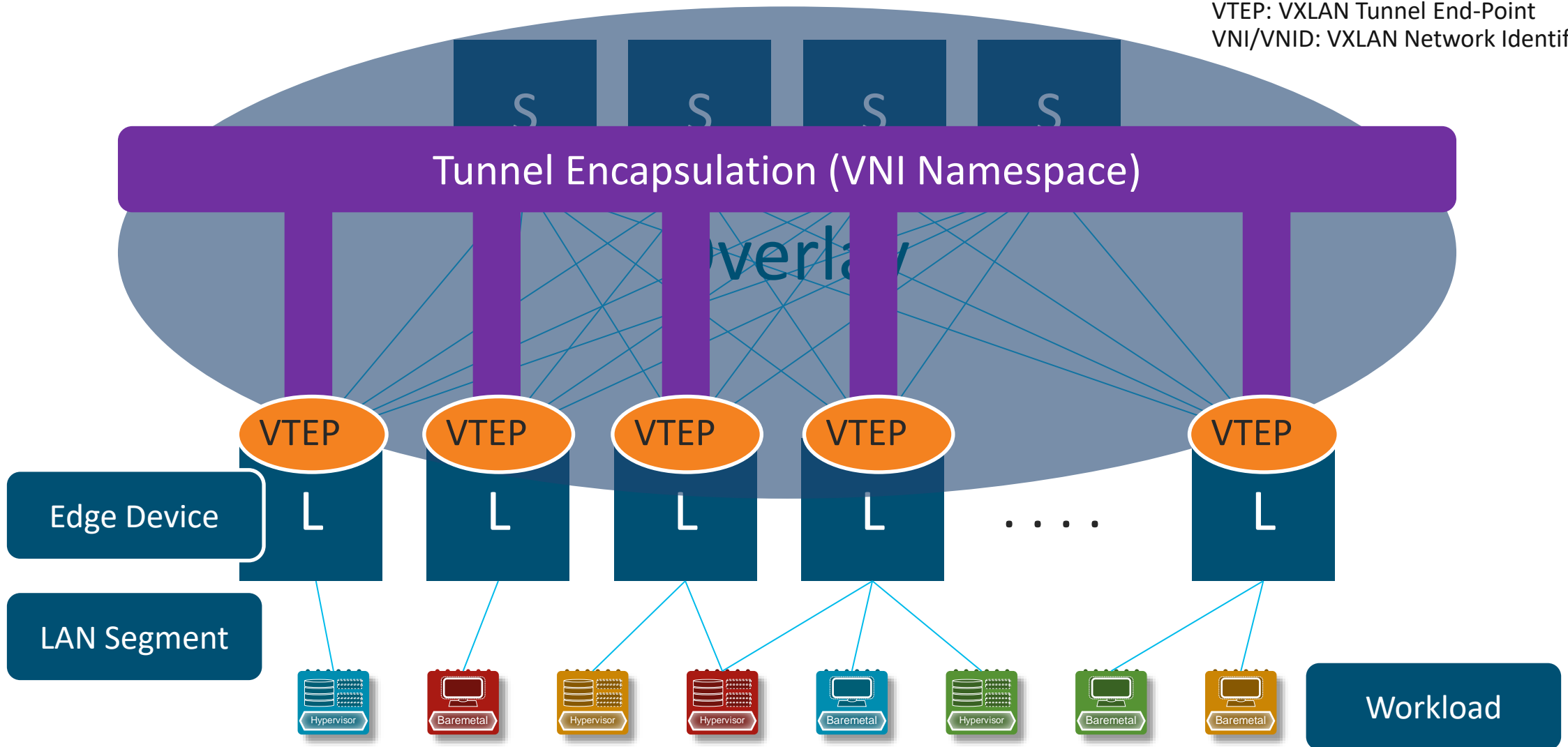


**Border-Gateway :**  
A gateway point of between two or more BGP EVPN administrative domain boundary.(Role is not supported by Catalyst 9000)

\* BGP-EVPN not supported at Catalyst 9200/9200L

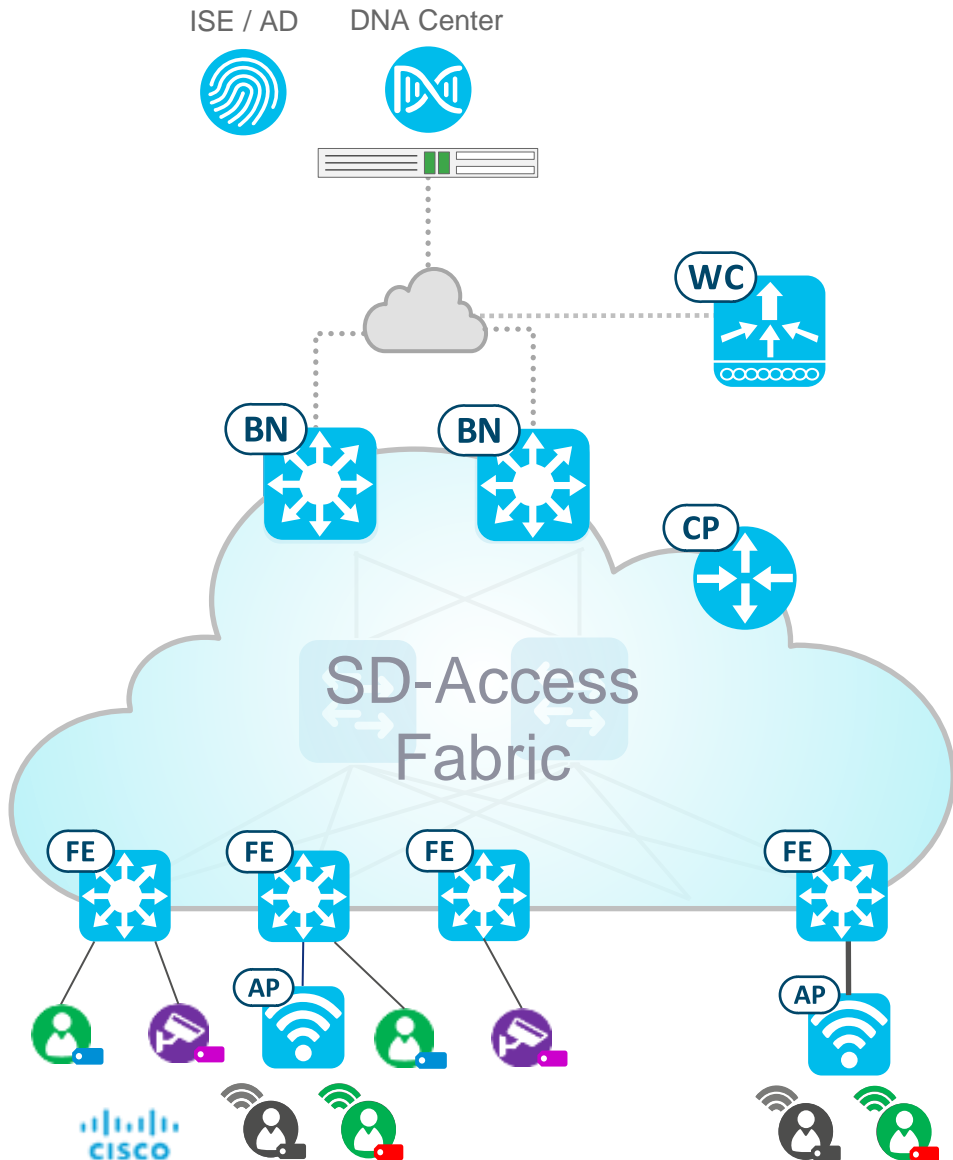
# BGP-EVPN Overlay

VTEP: VXLAN Tunnel End-Point  
VNI/VNID: VXLAN Network Identifier



SD-Access

# Architektura SD-Access a role zařízení



## SD-Access - „underlay“ vrstva

- Poskytuje základní IP konektivitu
- L3 access
- MTU > 1500 B

## SD-Access - „overlay“ vrstva

- Poskytuje inteligentní funkce SD-Access sítě
- Control Plane protokol - LISP
- Data Plane enkapsulace - VXLAN
- Policy Plane - Cisco Trustsec

## SD-Access - základní role zařízení

- Intermediate node (volitelná součást „underlay“ vrstvy)
- Fabric Edge node
- Border node
- Control Plane node
- Podpora „kumulace“ rolí
- Podpora redundance důležitých komponent

# Hlavní přínosy technologie SD-Access

- 1) Makrosegmentace a mikrosegmentace
- 2) Autentizace a autorizace přístupu do sítě (automatizace nasazení 802.1x)
- 3) Možnost přechodu na bezpečnostní politiku založenou na skupinových značkách – politika platí pro celou síť, není nutné je měnit při změně adresace
- 4) Možnost integrace pevné a bezdrátové přístupové sítě
- 5) Možnost integrace s VPN přístupem
- 6) Možnost integrace s dalšími částmi sítě (datové centrum, pobočková síť)
- 7) Automatizace a unifikace konfigurací
- 8) Centralizuje se pouze orchestrace a dohled, ale funkcionality zůstává distribuovaná do prvku sítě (kontrolér není v datové cestě)
- 9) Vysoká škálovatelnost (od jednoho přepínače až po velmi velké lokality, multisite)
- 10) Zvýšení stability prostředí (L3 access, absence spanning tree protokolu, ...)

# Integrace SD-Access s podnikovou sítí

## Integrace s datovým centrem

- Přenos skupinových značek mezi SD-Access a ACI
- Bezpečnostní politika založená na značkách (kontrakty)
- Využití identity pro řízení přístupu k aplikacím

## Integrace s firewallem (Cisco i 3<sup>rd</sup> party)

- Přenos skupinových značek do firewallu
- Bezpečnostní politika založená na značkách (pravidla)
- Využití identity pro řízení přístupu k externím aplikacím / internetu

## Integrace s AD

- Vazba mezi ISE a AD

## Integrace s bezpečnostní analýzou

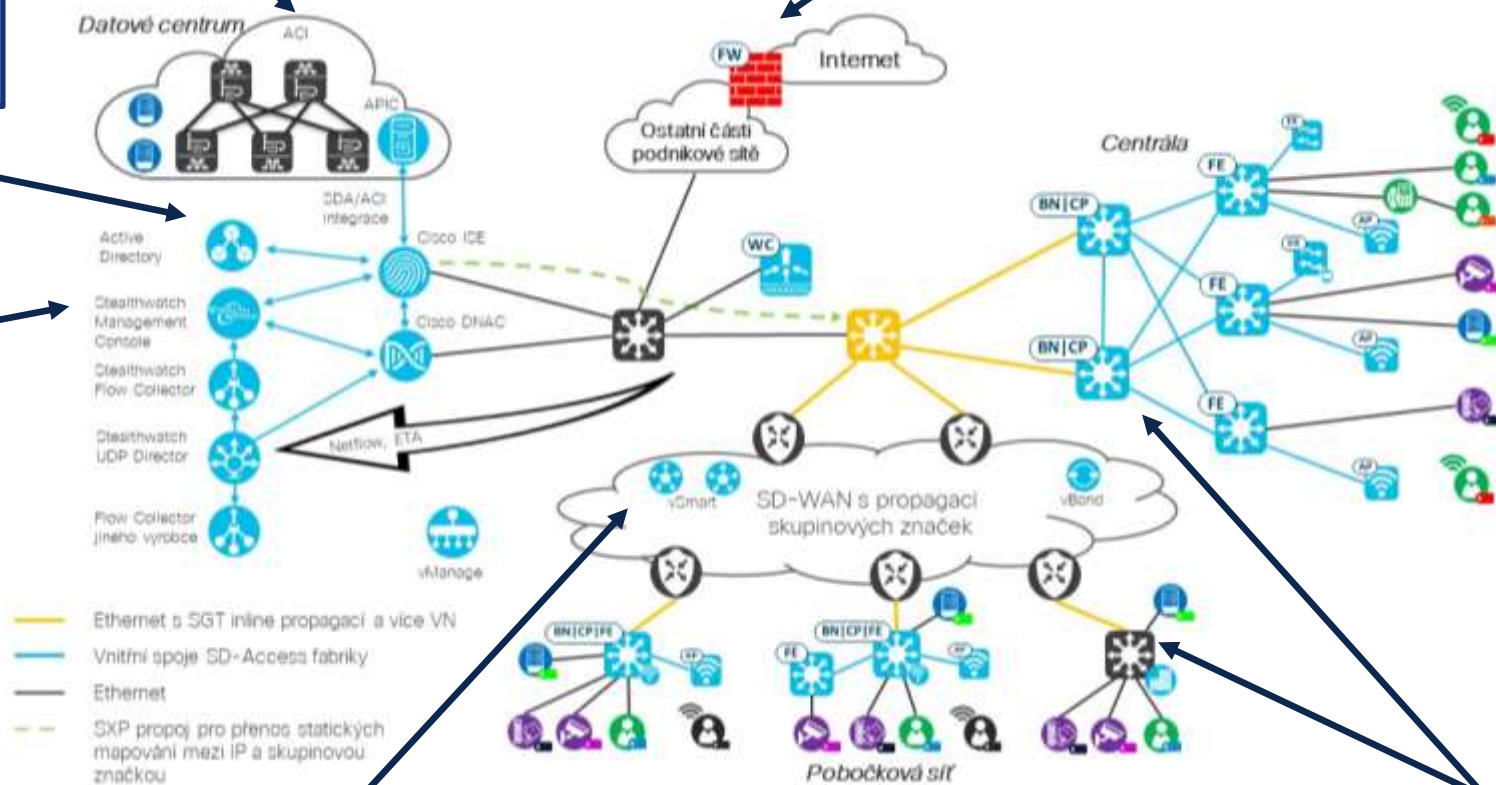
- Export informací o datových tocích
- Analýza datových toků mezi skupinami
- Analýza šifrovaného provozu (ETA)
- Remediacce bezpečnostních incidentů (CoA)

## Integrace s pobočkovou sítí

- Přenos skupinových značek ve WAN nebo SD-WAN
- Identita je jednotná v celé síti

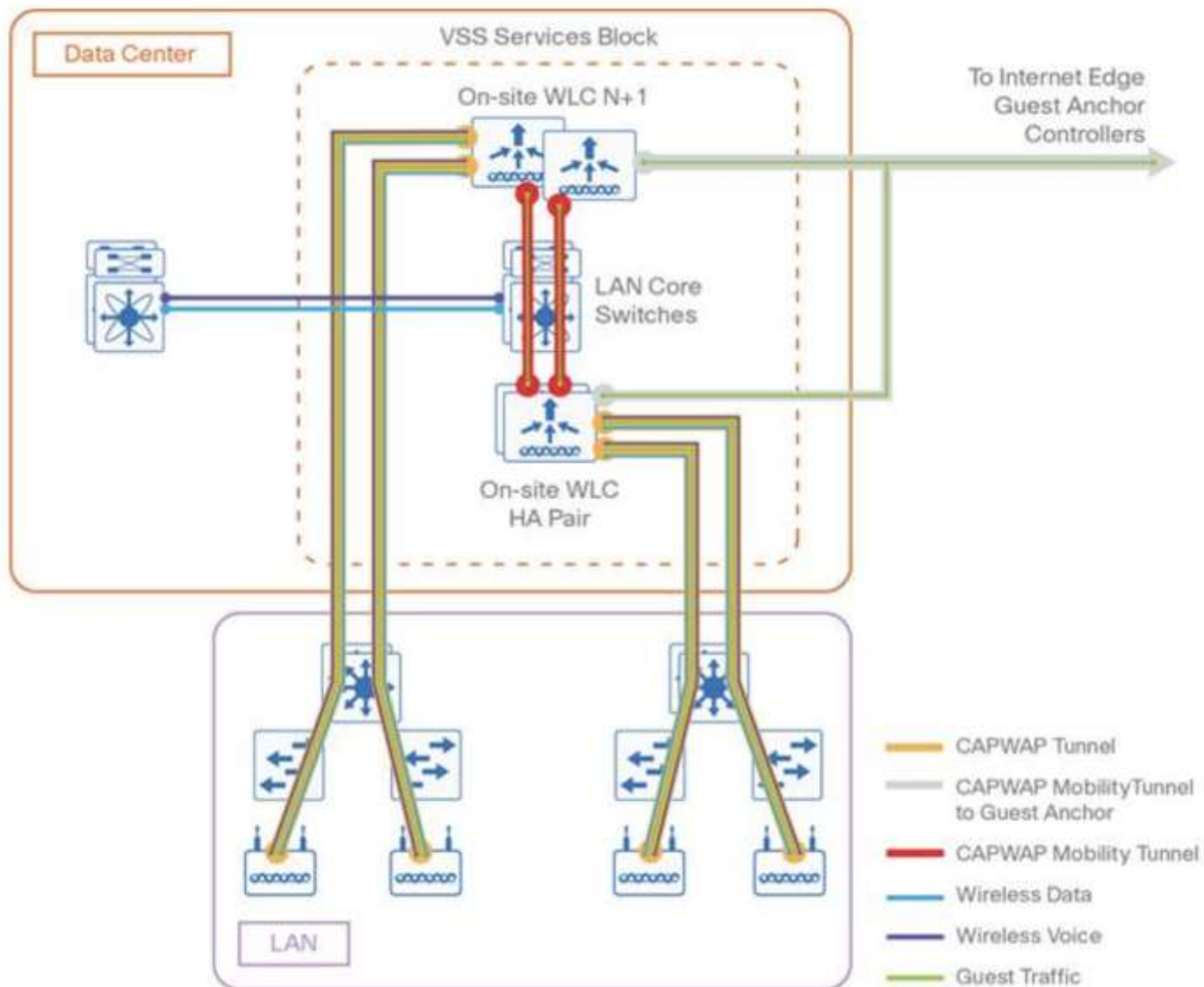
## Integrace s tradiční infrastrukturou

- L3 „handoff“ a L2 „handoff“ (včetně podpory stejného subnetu uvnitř i vně SDA domény)
- Přenos značek (inline nebo SXP protokol)



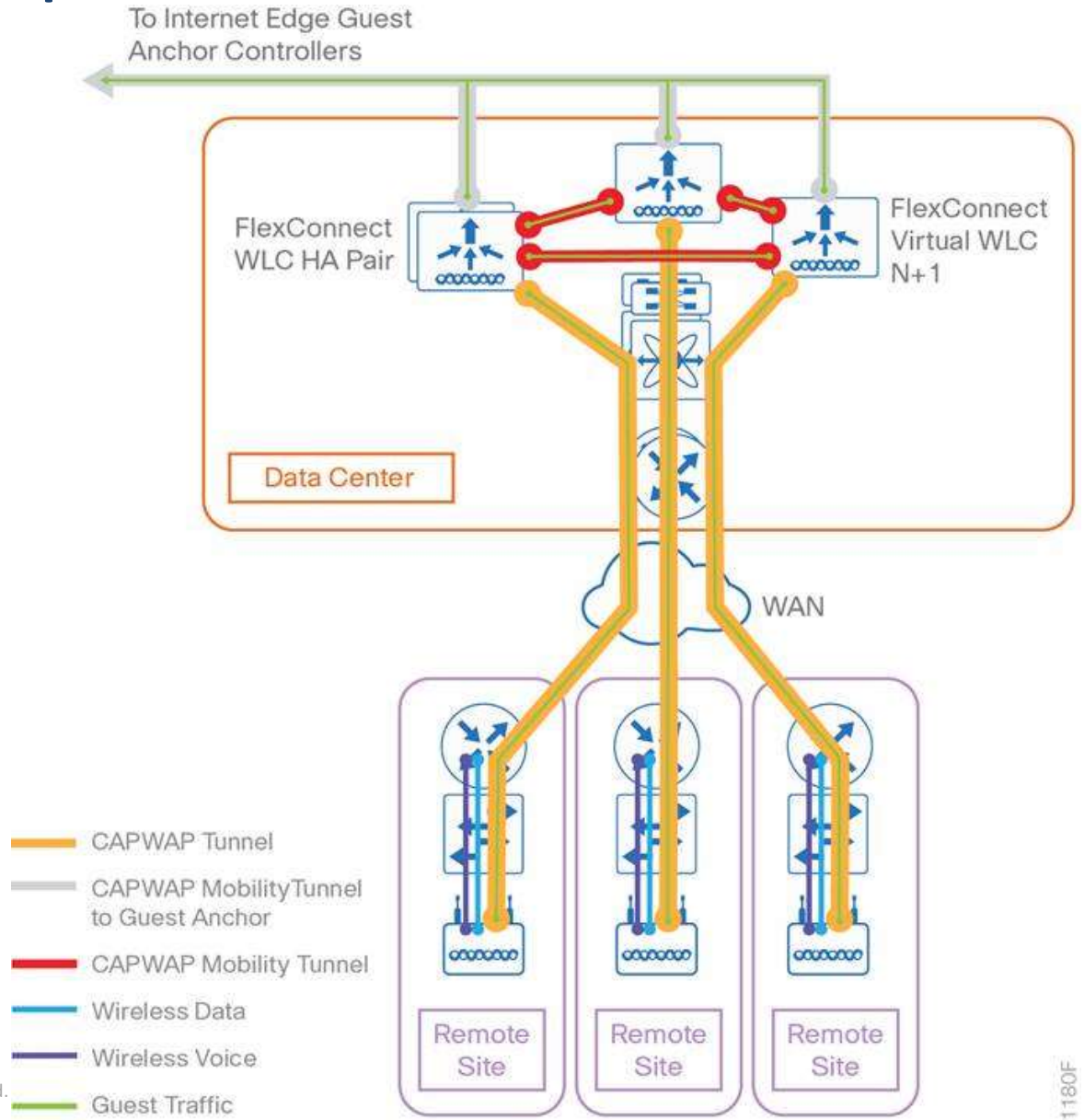
Wireless

# Základní režimy provozování – Local Mode

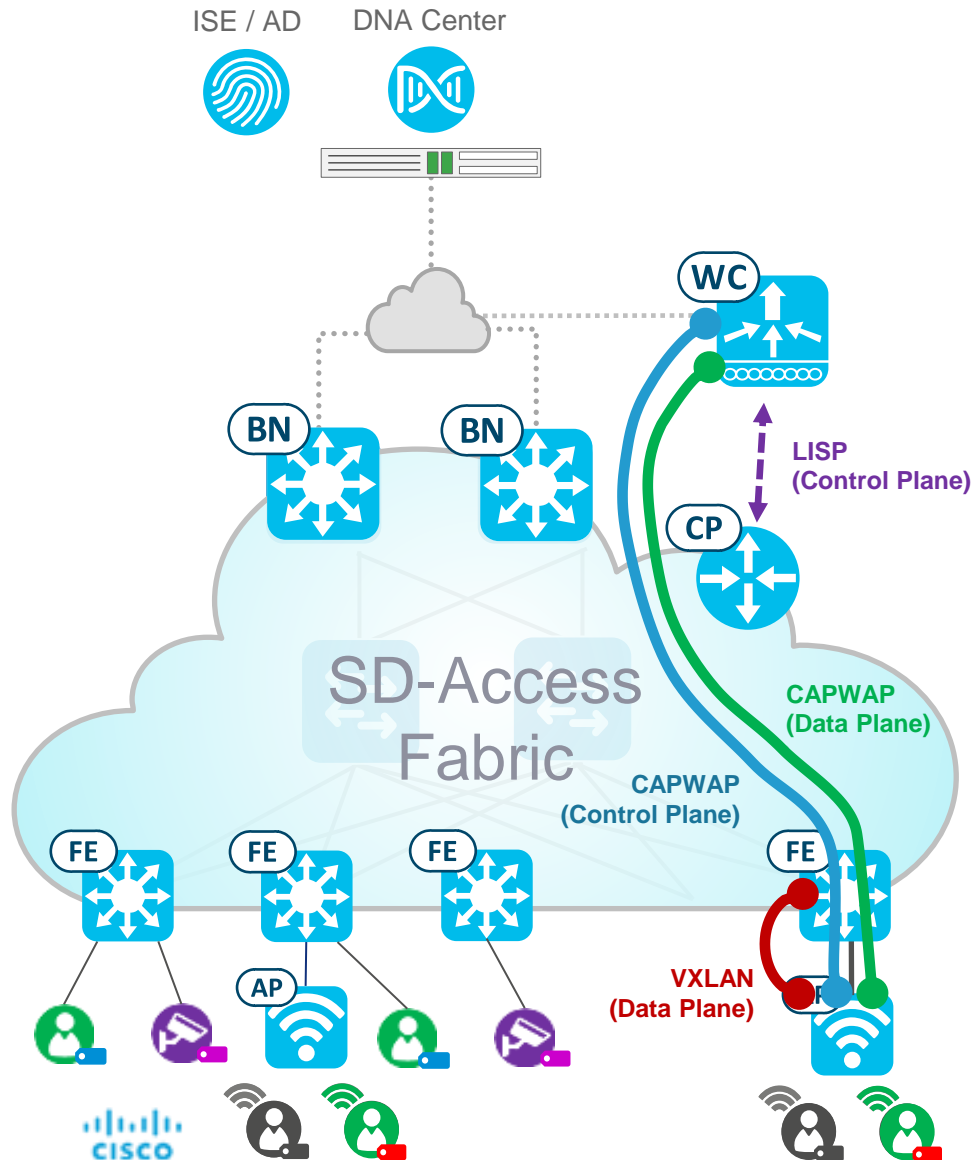




# Základní režimy provozování – FlexConnect Mode



# Možnost integrace pevné a bezdrátové přístupové sítě



## „Over-The-Top“ (OTT)

- Tradiční přístup
- Centralizovaný control plane i data plane (CAPWAP)
- Možnost využití makrosegmentace (celá WiFi v samostatné virtualní síti (např. Guest))
- Možnost využití řešení třetích stran

- CAPWAP Data plane
- CAPWAP Control plane

## „Fabric Enabled Wireless“ (FEW)

- Integrovaný přístup
- Centralizovaný control plane (CAPWAP), distribuovaný data plane (VXLAN)
- Možnost využití makrosegmentace a mikrosegmentace stejně, jako pevné přístupové sítě (t.j. až do úrovně jednotlivých uživatelů bezdrátové sítě)
- Datový provoz je „vybalen“ na přepínači přístupové vrstvy a lze na něj uplatnit stejné funkce jako na provoz z pevné sítě (např. monitoring pomocí NetFlow pro zlepšení visibility, QoS, atd.)

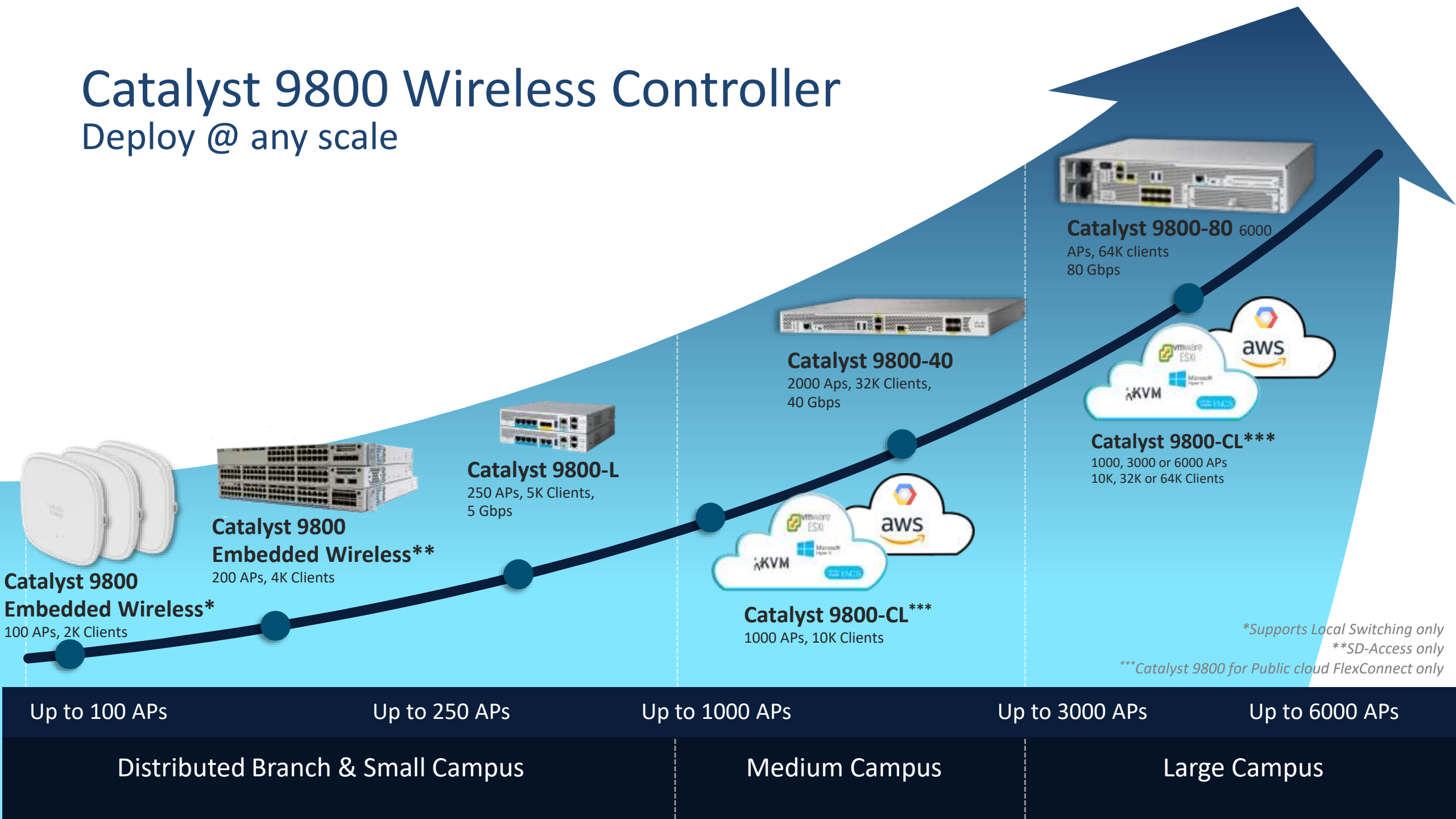
- VXLAN Data plane
- CAPWAP Control plane
- - - LISP Control plane

# Infrastruktura



# Catalyst 9800 Wireless Controller

Deploy @ any scale



**Catalyst 9800 Embedded Wireless\***  
100 APs, 2K Clients



**Catalyst 9800 Embedded Wireless\*\***  
200 APs, 4K Clients



**Catalyst 9800-L**  
250 APs, 5K Clients, 5 Gbps



**Catalyst 9800-40**  
2000 Aps, 32K Clients, 40 Gbps



**Catalyst 9800-CL\*\*\***  
1000 APs, 10K Clients



**Catalyst 9800-80 6000**  
APs, 64K clients 80 Gbps



**Catalyst 9800-CL\*\*\***  
1000, 3000 or 6000 APs  
10K, 32K or 64K Clients

Up to 100 APs

Up to 250 APs

Up to 1000 APs

Up to 3000 APs

Up to 6000 APs

Distributed Branch & Small Campus

Medium Campus

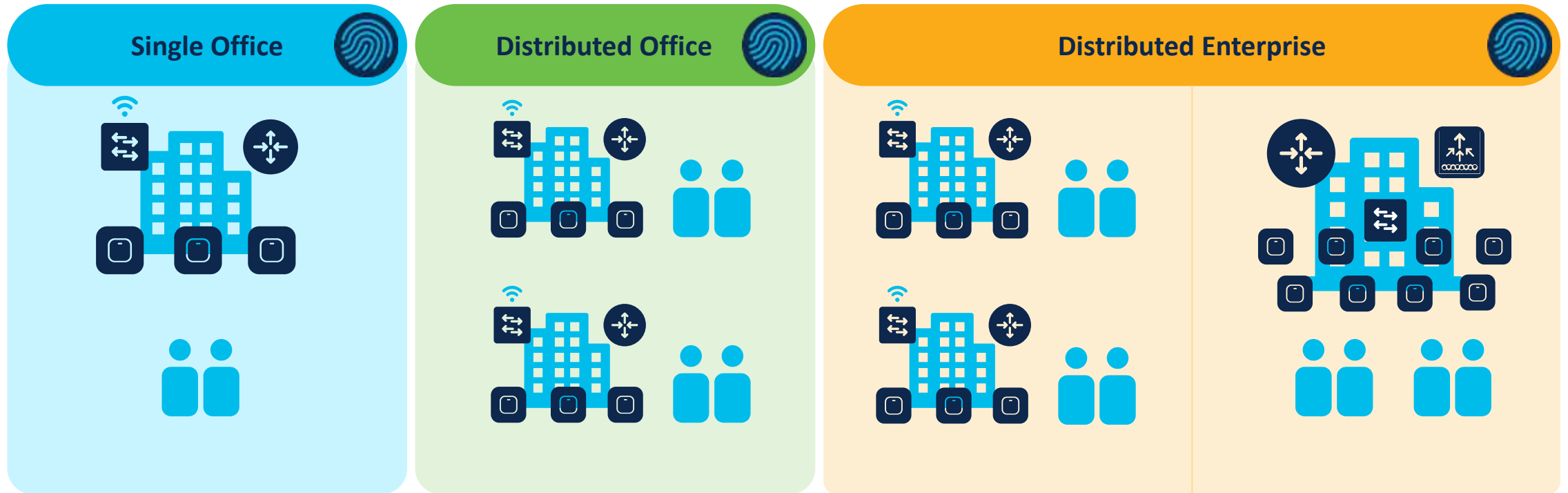
Large Campus

*\*Supports Local Switching only*

*\*\*SD-Access only*

*\*\*\*Catalyst 9800 for Public cloud FlexConnect only*

# Nasazení Wi-Fi

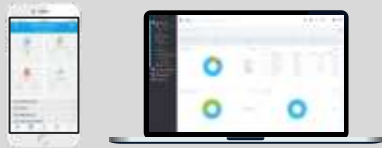


# C9800-CL for Private Cloud vs. AireOS vWLC

	AireOS vWLC	C9800-CL
SSO High Availability	No	Yes
Deployment Modes	Flex Only	Flex, Local, Fabric
Guest Anchor	No	Yes
Cisco DNA-C Automation & Assurance	No	Yes
Max central throughput	500 Mbps	5 Gbps
Max AP and Client Scale	3k APs, 32k Clients	6k APs, 64k Clients
Installation Image	Multiple	Single for any scale

# Nasazení Wi-Fi

Mobile app or WebUI



Cisco DNA Center



Policy



Automation



Assurance



Security



ISE



CMX



Single Office

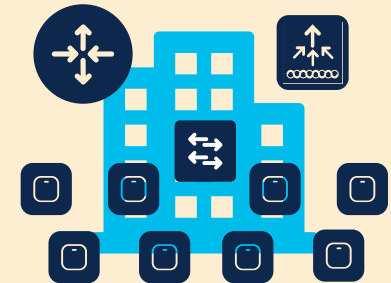


Embedded wireless controller

Distributed Office



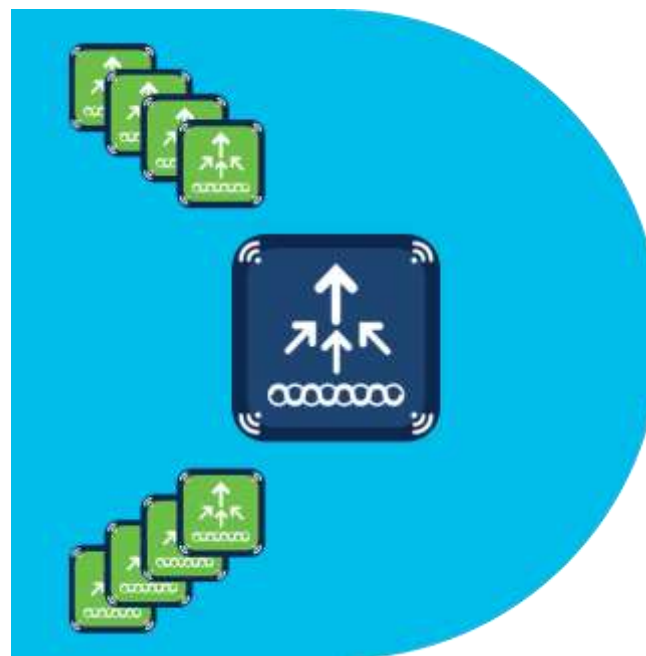
Distributed Enterprise





# Cisco Embedded Wireless Controller - EWC

- Úspora instalovaného HW
- Zachování pokročilých funkcí pro kvalitní Wi-Fi včetně Cisco inovací
- Nevyžaduje licence
- Škálování pro další růst
- Podpora získávání analytických dat o komunikaci i klientech



Jednoduché



Flexibilní



Bezpečné



# Enhanced Catalyst Wi-Fi 6/6E Product Line

Purpose-built for Immersive Experiences


## Catalyst 9136 Series

Industry-leading Wi-Fi 6E AP, with hexa-radio architecture and concurrent tri-radio with 16SS for client serving

 Powered by Cisco's AI/ML-Driven Scanning Radio


## Catalyst 9130 Series

Industry-leading Wi-Fi 6 AP with 8x8, tri-radio architecture

 Powered by Cisco RF ASIC


## Catalyst 9124 Series

Delivering best-in-class connectivity in outdoor and challenging environments

 Powered by Cisco RF ASIC

## Catalyst 9120 Series

For mission-critical deployments using dual 5 GHz and integrated IoT radio

 Powered by Cisco RF ASIC

## Catalyst 9115 Series

For small to medium-sized deployments with dual radios

## Catalyst 9105 Series

Perfect for teleworkers, and smaller branch sites

# Catalyst 9136I has Three-Built in Environmental Sensors with Full DNA Spaces Integration in 17.8.1



## Air Quality

The built-in Gas Sensor Module will enable the reading of TVOC concentration and IAQ rating



## Humidity

The built-in module is a fully calibrated sensor with the ability to measure the humidity in the air.



## Temperature

The built-in module can also capture the temperature to provide a reading of the environment remotely.

Note: The temperature generated by the AP will be considered during Temperature and AQI reading

# High Level DNA Spaces Setup Flow

01

## Activate Cisco DNA Spaces Account

- Activate Account for Purchased licensing
- Start a Free Trial

02

## Integrate Wi-Fi Components

- Install Connector
- Integrate AireOS/Catalyst WLC
- Integrate with Meraki

03

## Build Location Hierarchy

- Import Wi-Fi Maps
- Organize Meraki Networks
- Fill in Location Data

04

## Use Cisco DNA Spaces Apps

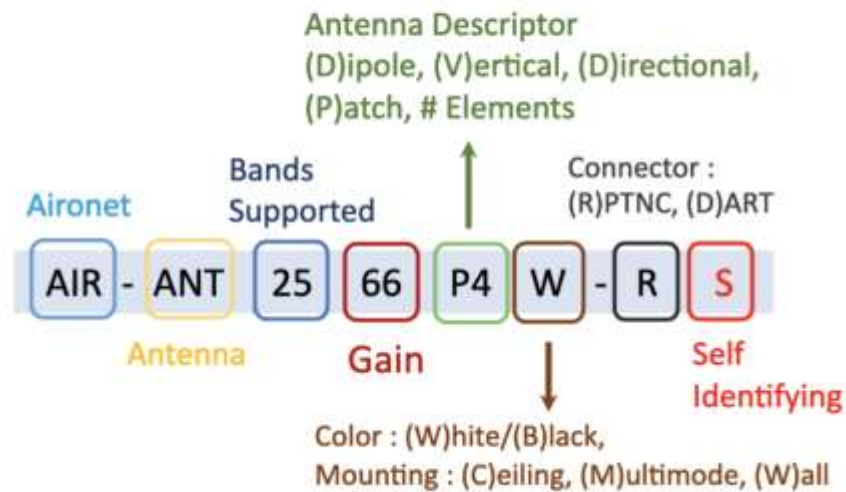
- Start Using Apps
- Define Rules to Power Apps

Interactive Setup Guide (Recommended): <https://dnaspaces.cisco.com/setupguide/welcome-setupguide/>

# Externí antény

## What are Self Identifying Antennas (SIA)?

Self Identifying Antennas (SIA) have an integrated EEPROM that identifies the Antenna by storing a unique value that maps to the PID and provides details of the Antenna Gain, Direction, Polarization etc.



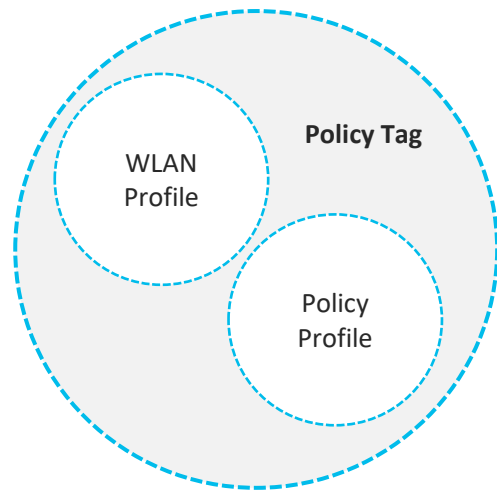
AIR-ANT2568VG-NS



AIR-ANT2588P4M-NS

*Doporučení*

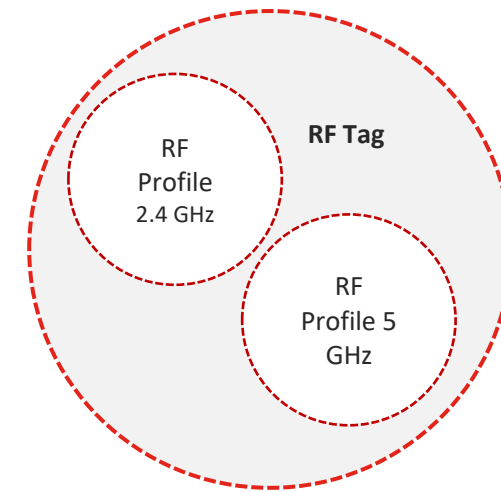
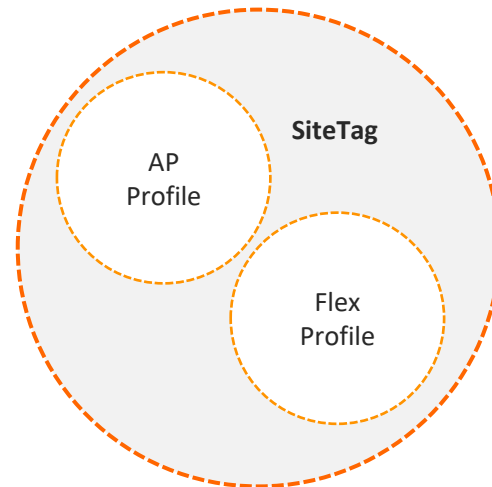
# Catalyst 9800 Config Model



- Defines the **Broadcast domain** (list of WLANs to be broadcasted) with the policies of the respective SSIDs
- “Equivalent” to AP Group in AireOS



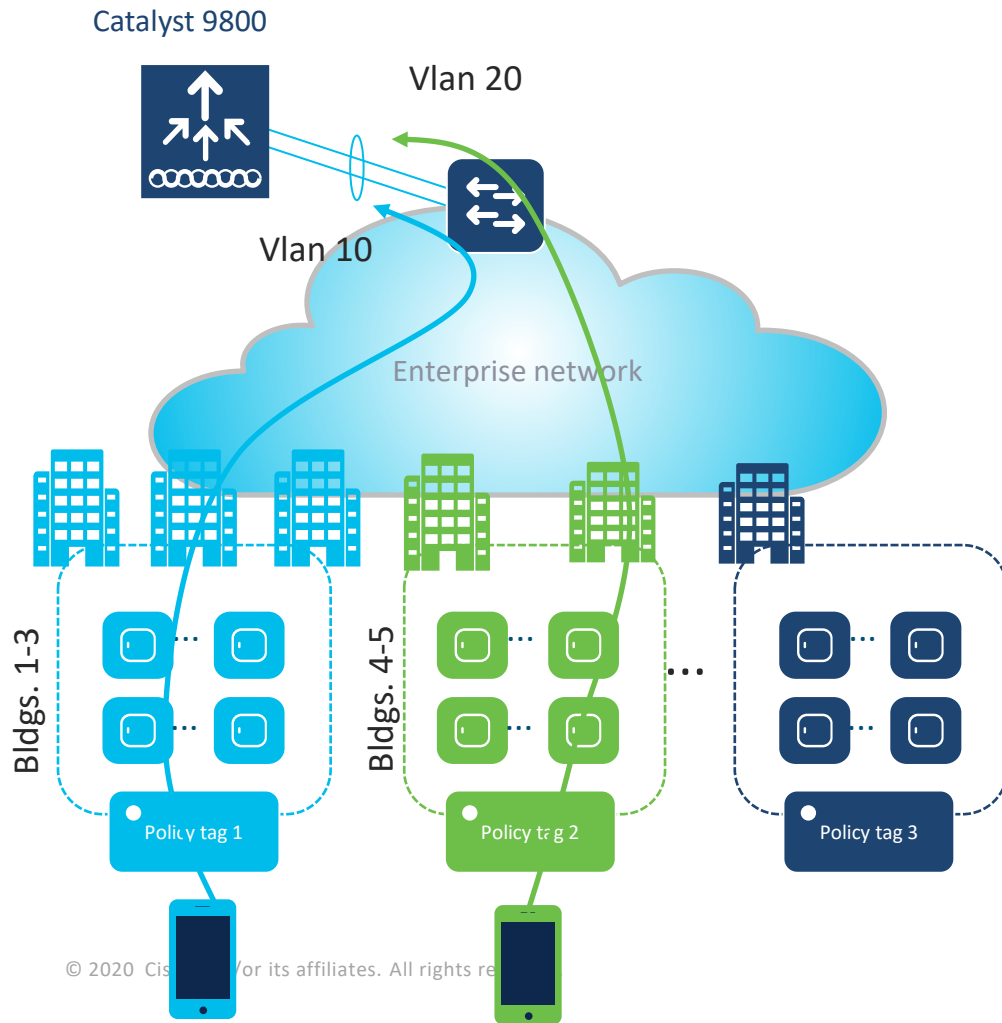
Access Points



- Defines the RF properties of the group of APs

- Defines the properties of the central/remote sites
- Defines the **roaming domain for Flex APs**
- “Equivalent” to Flex Groups in AireOS but only for Flex APs
- Max Flex APs per site tag is 100 for seamless roaming

# Policy Tags – Roaming across Policy Profiles



- Before 17.3, if two policy tags are created to associate a different policy profile to same SSID (e.g. different client VLAN), upon roaming, client will need to go through a reauth to re-evaluate the change in policy > client roaming is not seamless
- **Starting from 17.3**, if the policy profiles differ only for certain parameters (VLAN and ACL being the most important), then **seamless roaming is allowed across policy profiles** (and related policy tags)
- To configure the feature, enter the following command in global config mode:  

```
c9800 (config) #wireless client vlan-persistent
```
- For a complete list of attributes please go to:  
[https://www.cisco.com/c/en/us/td/docs/wireless/controller/9800/17-3/config-guide/b\\_wl\\_17\\_3\\_cg/m\\_client\\_roaming\\_policy\\_profile.html](https://www.cisco.com/c/en/us/td/docs/wireless/controller/9800/17-3/config-guide/b_wl_17_3_cg/m_client_roaming_policy_profile.html)

This is only applicable for intra-WLC roaming, inter-WLC this is already supported

# Doporučené nastavení

- Adaptive 11r/k/v
- RX-SOP / RRM
- Vysoká dostupnost
- Device analytics
- WIPS
- Bezpečnost – preference WPA3 nebo 802.1x



Q Search Menu Items

- Dashboard
- Monitoring >
- Configuration >
- Administration >
- Licensing
- Troubleshooting**

## Troubleshooting



### Logs

Manage Syslog, Webserver Log, License Log



### Packet Capture

Capture packets with different filter options to feed into Wireshark for debugging



### Radioactive Trace

Collect conditional trace logs using MAC address of a Client, AP etc.



### Core Dump and System Report

View the list of core files and System Reports captured in the device



### Ping and Trace Route

Check Ping-ability and Trace route info of a target destination through different sources



### Debug Bundle

Capture require info like CLI outputs, logs as a single bundle for error reporting and debugging



### AP Packet Capture

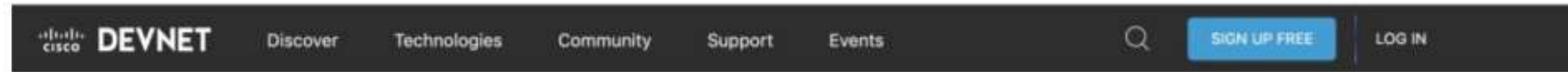
AP Packet Capture for troubleshooting wireless clients

Rectangular Shp

# Other Tools

## Wireless Troubleshooting Tools

<https://developer.cisco.com/docs/wireless-troubleshooting-tools/>



Documentation > Wireless Troubleshooting Tools

The image shows the main content area of the "Wireless Troubleshooting Tools" page. On the left side, there is a vertical sidebar with a search icon at the top, followed by the word "Tools" and "ges" (partially visible). The main content area has a large heading "Wireless Troubleshooting Tools" in a light blue font. Below the heading is a paragraph of introductory text. This is followed by a list of five tools, each with a bullet point, a title, a link to download or GitHub, and a brief description of its functionality.

### Wireless Troubleshooting Tools

In order to help people in the field, doing Wireless networks troubleshooting and RF analysis, the WNG Escalation and Development teams have made available several tools to facilitate some of the most common tasks.

- [Wireless Lan Config Analyzer - WLCCA - Download V4.4.12](#)  
It is desktop Windows application, oriented primarily towards AireOS controllers Provides around 300+ configuration checks, RF analysis and RF Health evaluation
- [WLAN Poller - Download AireOS or IOS-XE](#)  
Bulk data collection script system, focused on capturing debugging data, flash checks and DFS stats collections for large groups of Access points
- [Wireless Config Analyzer Express - WCAE](#)  
It is a cloud application, capable of providing a summary of the features supported on WLCCA, with 180+ checks, and RF Health summarization. Now with IOS-XE support!
- [9800 Traces to ELK - Github](#)  
Example application to automatically retrieve traces from the new Cisco 9800 Wireless controller and display different information on a Kibana dashboard.
- [9800 Telemetry Pipeline - Github](#)  
Real time visualization and analysis of C9800 wireless controller telemetry data streaming. It uses dial-out telemetry to push a periodic stream

Dashboards ▾ Trends

Layer 2 loop symptoms > Issue Instance

## P2 Host flaps observed in 1 VLAN(s)

Status: ▾

Device: [SFO13-D9300-1](#)  
 Role: DISTRIBUTION  
 Time: May 25, 2020 2:06 pm  
 Location: Global/North\_America/USA/California/San\_Francisco/SFO13  
 Potential Root Cause: MAC\_FLAPPING

### INITIAL ASSESSMENT

1 VLANs in the Potential Loop

2 Ports in the Potential Loop

### Top 10 Issue Types

Priority	Issue Type
P1	Fabric Device
P1	TCAM Utiliza
P1	Interface Co
P2	Layer 2 loop
P3	Wireless clie
P3	Wireless clie
P3	Wireless clie

### Problem Details

#### Root Cause Analysis <sup>MRE</sup>

### Problem Details

Host MAC Address flaps are detected along with other events that are indicative of a STP loop. Go to [Root Cause Analysis](#) for detailed troubleshooting and see the exact impact and the devices involved in the loop.

Relevant Events May 25, 2020 2:01 pm-May 25, 2020 2:11 pm

EVENT TYPES SW\_MATM\_MACFLAP\_NOTIF (26)

Filter

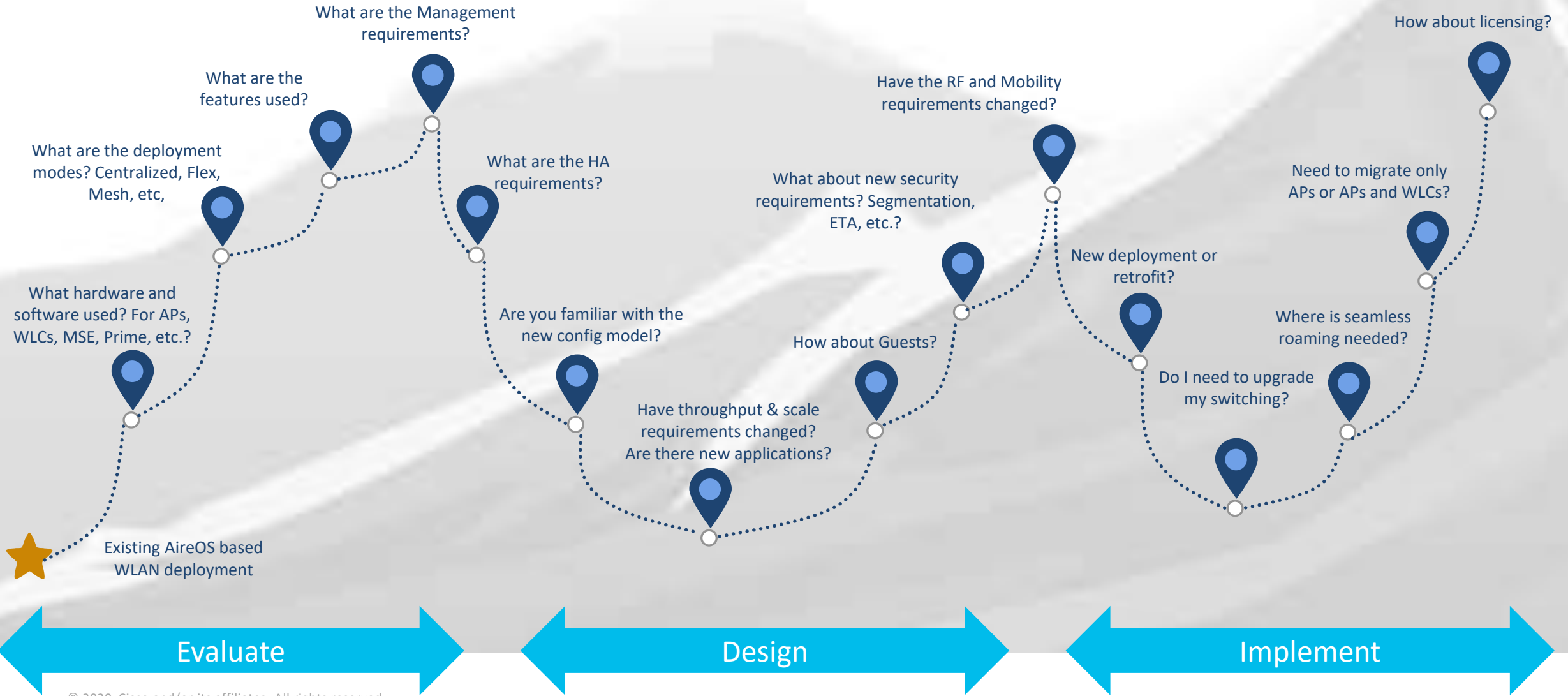
Find

May 25, 2020		
Warning	SW_MATM:MACFLAP_NOTIF	05/25 2:05:20.514 PM
Warning	SW_MATM:MACFLAP_NOTIF	05/25 2:00:20.514 PM
Warning	SW_MATM:MACFLAP_NOTIF	05/25 1:50:20.514 PM
Warning	SW_MATM:MACFLAP_NOTIF	05/25 1:45:20.514 PM

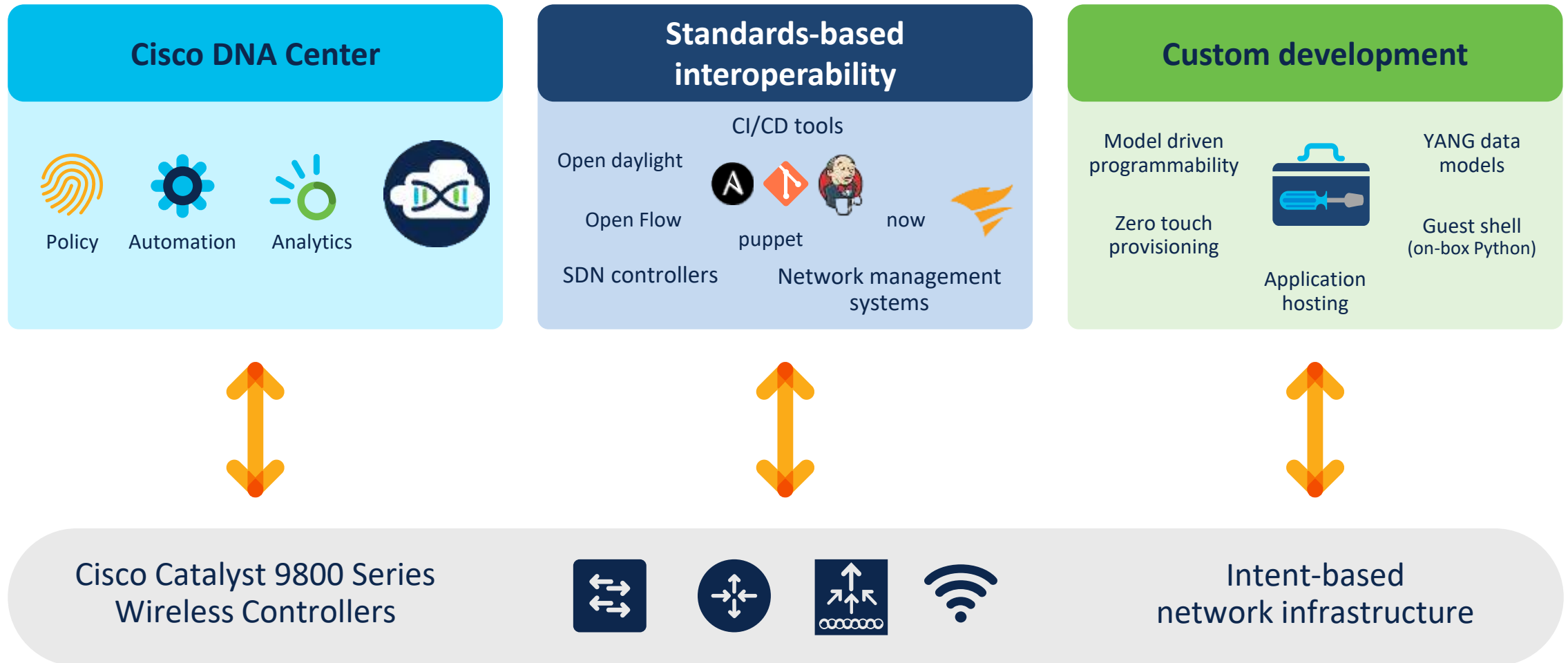
### Detailed Information

Severity	Warning
Mnemonic	MACFLAP_NOTIF
Facility	SW_MATM
Message Text	Host Flap Observed in vlan 31 is

# Key Questions for Migration



# Flexible management options with Cisco Catalyst 9800 Series Wireless Controllers



# Detailní veřejné testování

- [Cisco Catalyst 9800 Wireless Controller Testing Review](#)
- [WiFi 6 and DNAC Testing Review](#)

# Catalyst WLC - Reference

- [C9800 Best Practices](#)
- [C9800 YouTube channel](#)
- [C9800 Release Notes](#)
- [C9800 Configuration Guides](#)
- [C9800 Technical References](#)
- [C9800 Command References](#)
- [C9800 Configuration Examples and Tech Notes](#)
- [Campus WLAN CVD](#)
- [C9800 Best Practices](#)
- [C9800 WLC Configuration Model](#)
- [WLC Configuration Converter](#)
- [WLC Compatibility Matrix](#)
- [AireOS to IOS-XE Command Mapping](#)
- [AireOS to C9800 Wireless Controller Feature Comparison Matrix](#)

# Catalyst APs - Reference

- Catalyst APs starting page: <https://www.cisco.com/c/en/us/products/wireless/catalyst-9100ax-access-points/index.html>
- AP 9120 deployment guide: <https://www.cisco.com/c/en/us/products/collateral/wireless/catalyst-9100ax-access-points/guide-c07-742311.html>
- AP 9130 deployment guide: <https://www.cisco.com/c/en/us/products/collateral/wireless/catalyst-9100ax-access-points/deployment-guide-c07-743490.html>
- Catalyst APs and 11ax FAQs: <https://www.cisco.com/c/en/us/products/collateral/wireless/catalyst-9100ax-access-points/nb-06-802-11ax-faq-cte-en.html>
- AP feature Matrix for 11ac and 11ax APs: [https://www.cisco.com/c/en/us/td/docs/wireless/access\\_point/wave2-ap/feature-matrix/b-wave2-ap-feature-matrix.html](https://www.cisco.com/c/en/us/td/docs/wireless/access_point/wave2-ap/feature-matrix/b-wave2-ap-feature-matrix.html)
- [Antennas Reference Guide](#)



# Lokální webináře zaměřené na novinky v podnikových sítích

- Webex webinar recording: 22.2. **Softwarově definovaná řešení Cisco pro přístupové sítě a jejich začlenění do celé podnikové sítě**
  - Password: Customer22
  - Recording link: <https://cisco.webex.com/cisco/lr.php?RCID=efbb44160d14bb5ab25e9276722b529c>
- Webex webinar recording: 23.2. **Monitorování, testování a troubleshooting podnikové sítě, klientů a aplikací**
  - Password: Customer22
  - Recording link: <https://cisco.webex.com/cisco/lr.php?RCID=541429b5126c1d84764e01d854ae0785>
- Webex webinar recording: 24.2. **Novinky v produktové řadě Catalyst 9000**
  - Password: Customer22
  - Recording link: <https://cisco.webex.com/cisco/lr.php?RCID=9589772067dc4391e7f3060c2501994c>

