nV Technology

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ASR9000 nV Technology Drivers
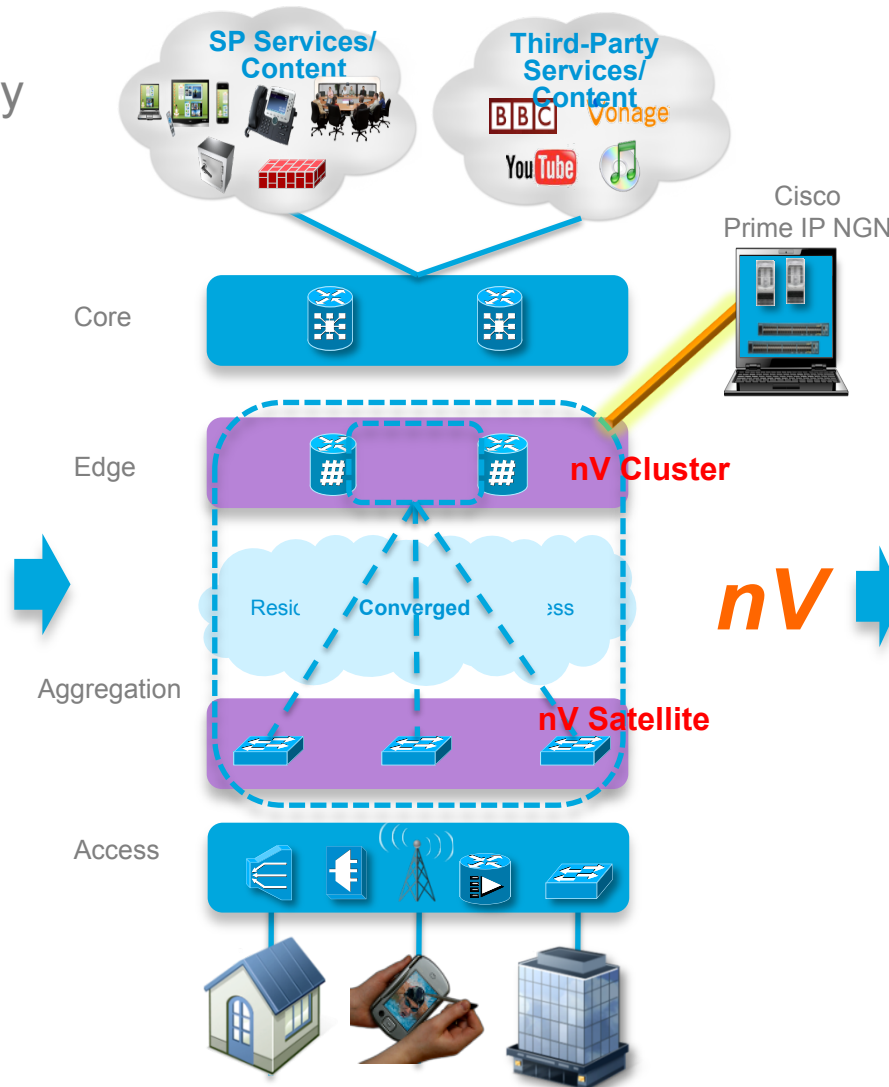
Before: *nV* Technology

Each device managed separately.

Inconsistent features between edge and aggregation.

Siloed service domains.

Inconsistent service outages upon device failure.

Port scale limited to chassis.

SP Services/Content

Third-Party Services/Content

BBC Vonage

YouTube

Cisco Prime IP NGN

Core

Edge

nV Cluster

Resi... **Converged** ...ess

Aggregation

nV Satellite

Access

nV

After: *nV* Technology

Edge and aggregation managed as one virtual system through Cisco Prime IP NGN.
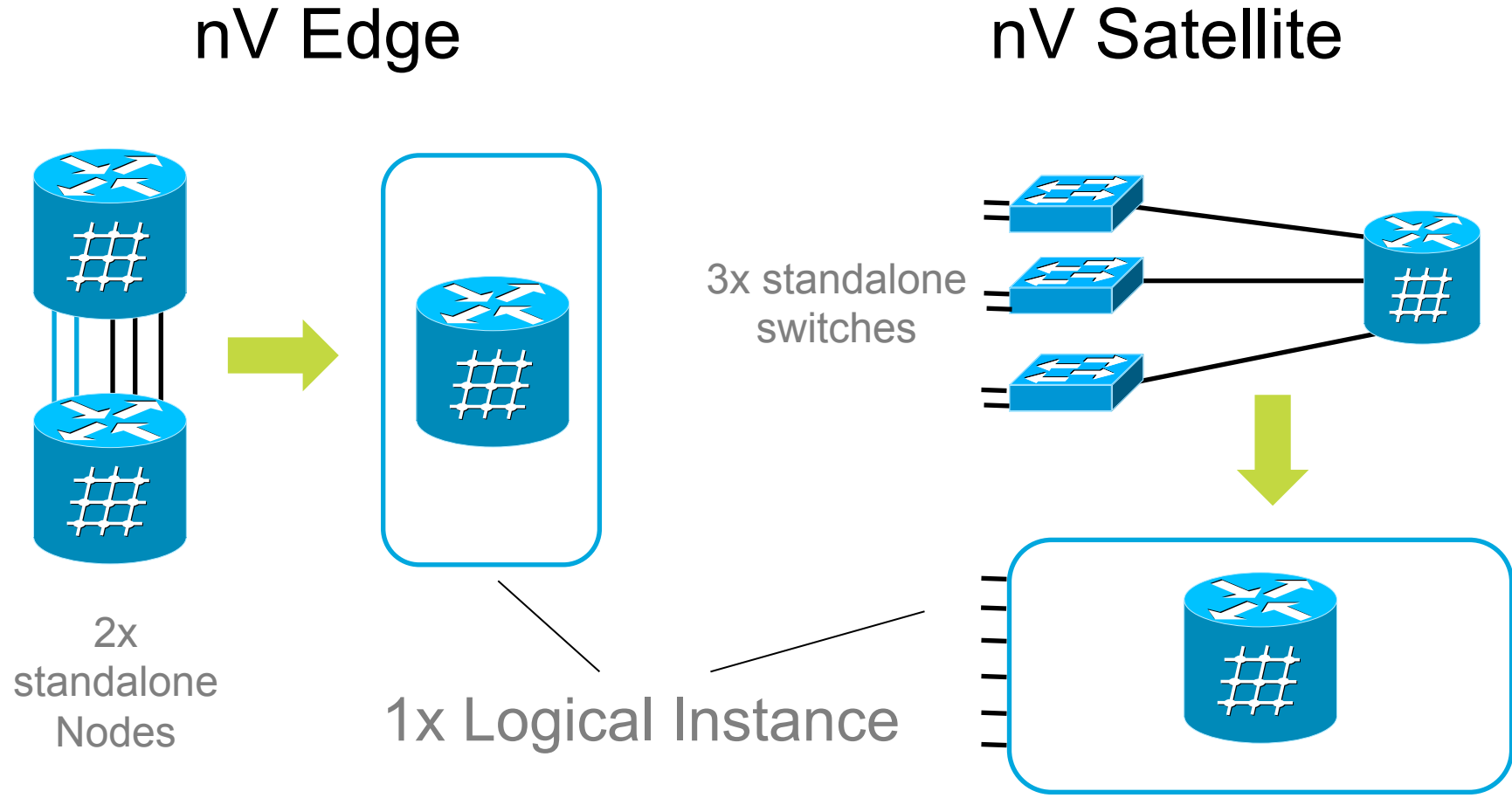
Single release vehicle offering feature consistency.

Offers up to 71% reduction in OPEX over 6 years vs competitors.

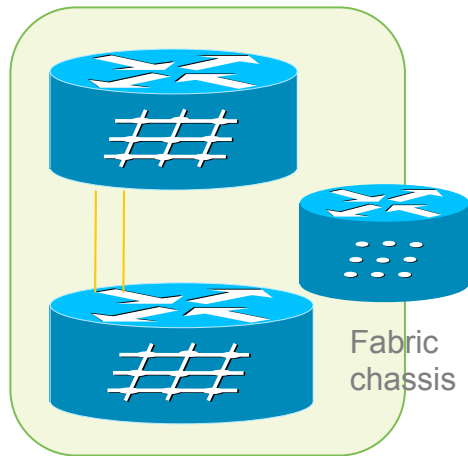Reduced protocol complexity between edge and aggregation

Up to 84,480 GE ports managed through a single virtual system
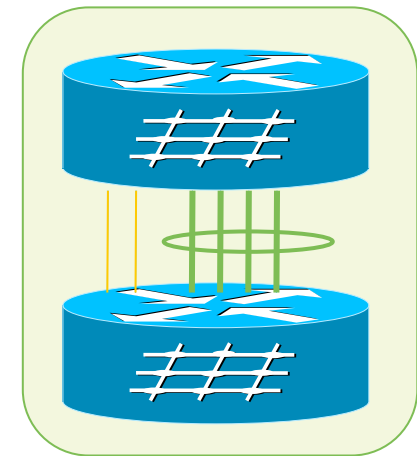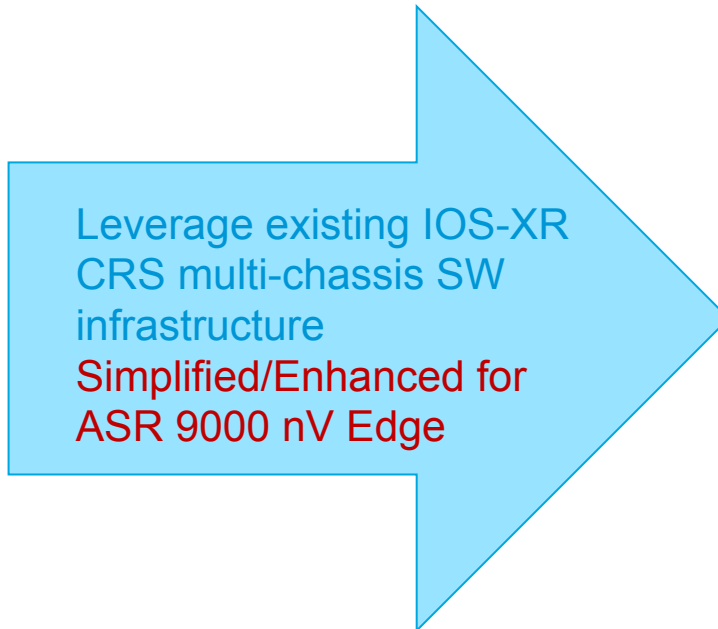
ASR9000 nV Technology Overview

nV Edge

nV Satellite

2x standalone Nodes

3x standalone switches

1x Logical Instance

ASR 9000 nV Edge Overview
Super, Simple Resiliency and more Capacity

Leverage existing IOS-XR CRS multi-chassis SW infrastructure
Simplified/Enhanced for ASR 9000 nV Edge

Fabric chassis
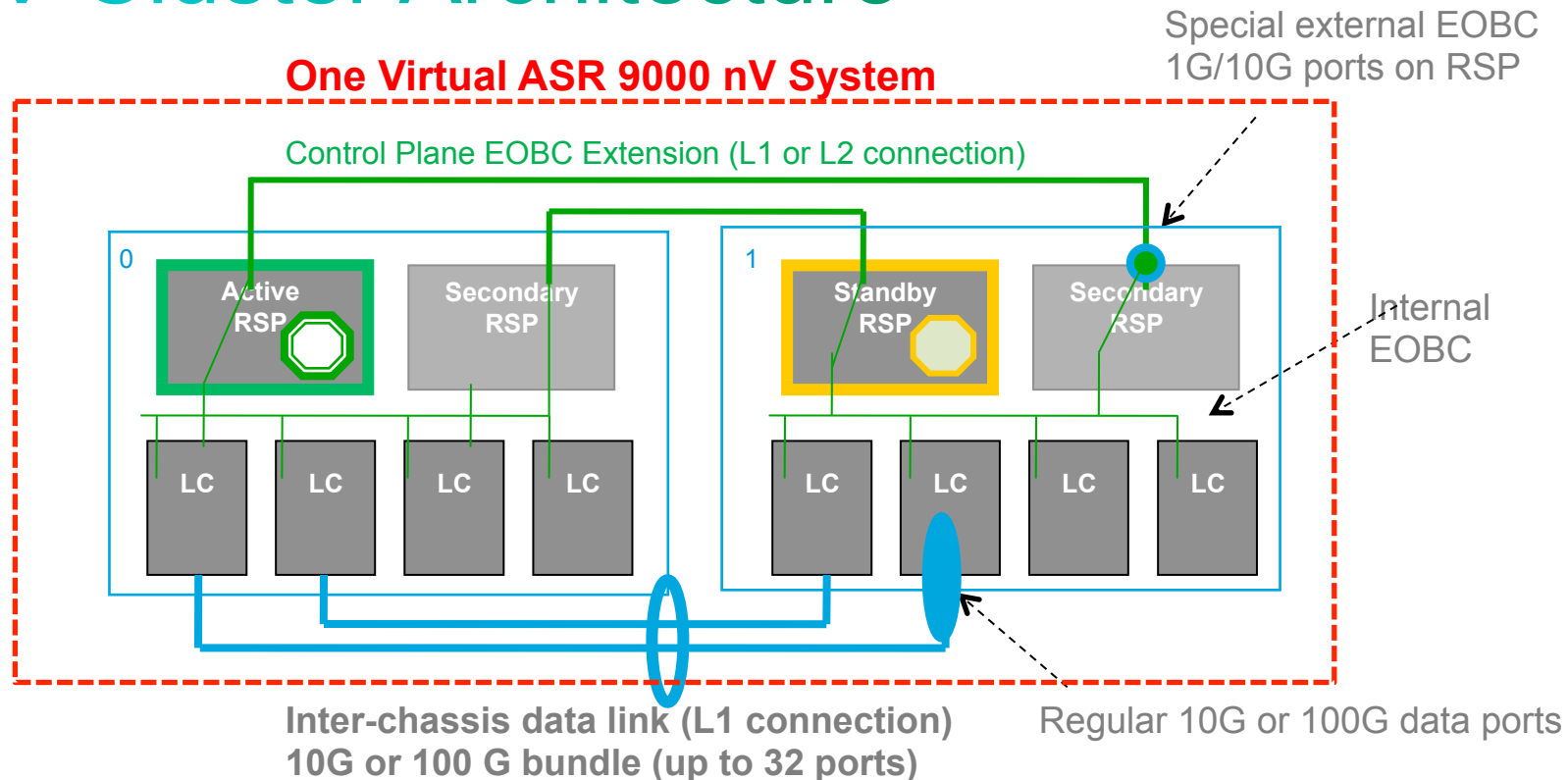
CRS Multi-Chassis

ASR 9000 nV Edge

Single control plane, single management plane, fully distributed data plane across multiple* physical chassis → one virtual nV system

Super, Simple network resiliency, and extensible node capacity

nV Cluster Architecture

One Virtual ASR 9000 nV System

Special external EOBC 1G/10G ports on RSP

Control Plane EOBC Extension (L1 or L2 connection)

0

Active RSP

Secondary RSP

1

Standby RSP

Secondary RSP

Internal EOBC

LC LC LC LC   LC LC LC LC

**Inter-chassis data link (L1 connection)
10G or 100 G bundle (up to 32 ports)**

Regular 10G or 100G data ports

- **Control plane extension**: Active RSP and standby RSP are on the different chassis, they sync up via external EOBC links "AS IF" they are in the same physical chassis

- **Data plane extension**: bundle regular data links into special "nV fabric link" to simulate switch fabric function between two physical chassis to data packet across

- No dedicated fabric chassis → flexible co-located or different location deployment

RSP400 enabling nV Edge

- nV Edge Control Plane Extension Ports
  1GE (XR4.2.1), 10GE (future)
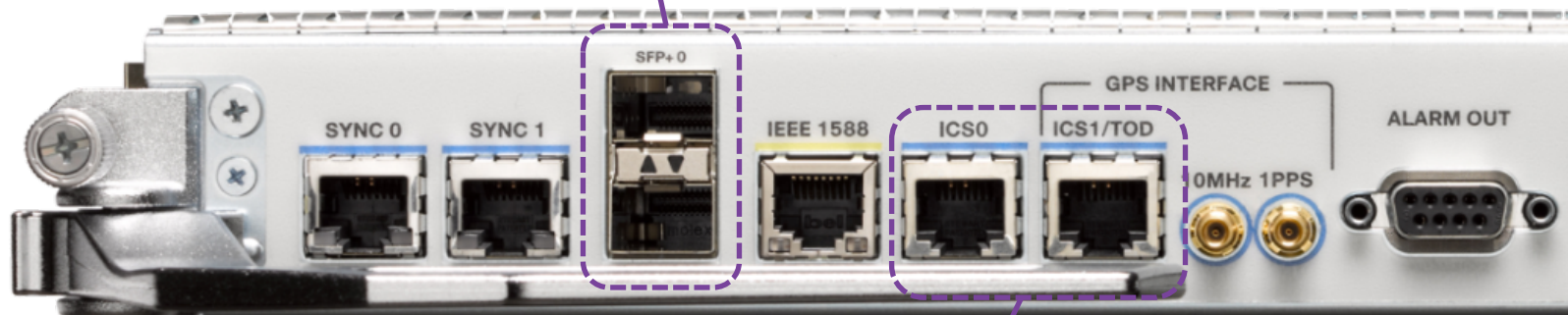
- nV Edge Sychronization Extension Ports
  Future use for IEEE1588 and SyncE on nV Edge

nV Edge Configuration

1 **Configure nv Edge globally**

```
Nv
  edge-system
    serial FOX1437GC1R rack 1   ← static mapping of chassis serial# and rack#
    serial FOX1439G63M rack 0
```

2 **Configure the inter-chassis fabric(data plane) links**

```
interface TenGigE0/2/0/0
   nv
     fabric-link edge-system
interface TenGigE1/2/0/0
   nv
     fabric-link edge-system
```

After this configuration, rack 1 will reload and then join cluster after it boot up
Now you successfully convert two standalone ASR 9000 into one ASR 9000 nV Edge

As simple as that !!!

1st nV Satellite - ASR9000v

Power Feeds

- Redundant -24vDC, & -48vDC Power Feeds
- Single AC power feed

1 RU ANSI & ETSI Compliant Design

LEDs

Field Replaceable Fan Tray

- Redundant Fans
- ToD/PSS Output
- Bits Out

4x10G SFP+

- Initially used as Inter-Connect Ports
- Plug-n-Play In-Band Management
- Automatic Discovery and Provisioning
- Co-Located or Remote Distribution

44x10/100/1000 Mbps Pluggables

- Full Line Rate Packet Processing and Traffic Management
- Pay As You Grow Licensing (11 port Increments)

Industrial Temp Rated for Flexible Deployments

- -40C to +65C Operational Temperature
- -40C to +70C Storage Temperature

nV Satellite Overview

One ASR 9000 nV System
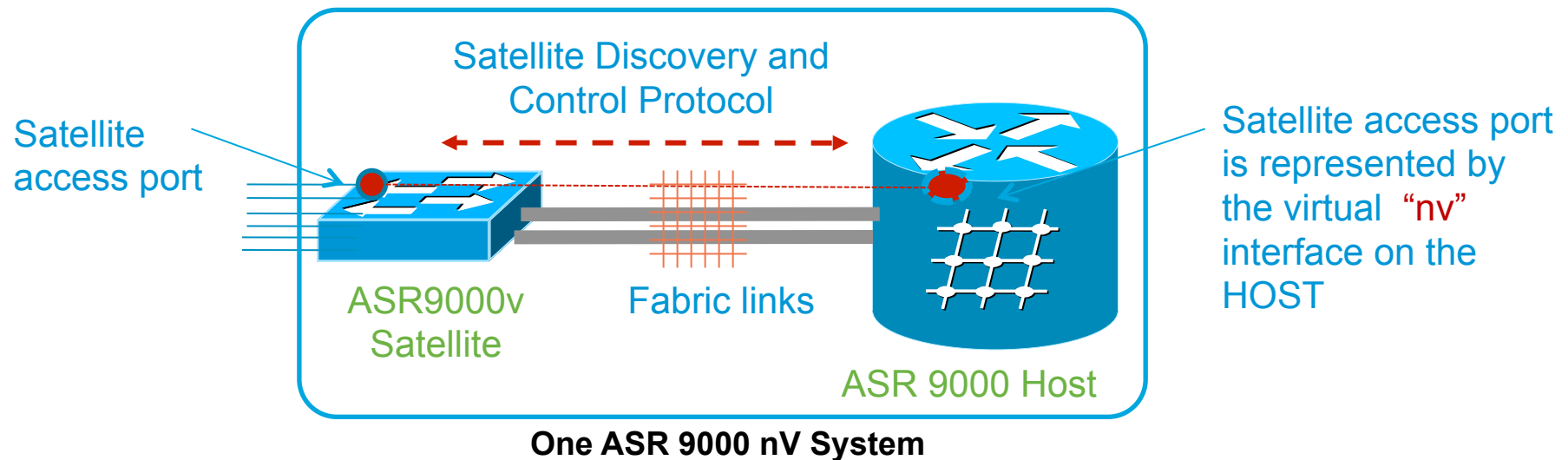
- Satellite is discovered upon connection to the host

- Satellite requires SW support to understand Satellite Discovery/ Control messages

- Satellite can be co-located or geographically separated (no distance limitation)

nV Satellite Control Plane

CPU

| MAC-DA | MAC-SA | Control VID | Payload/FCS |

CPU

ASR 9000v
Satellite

ASR 9000 Host
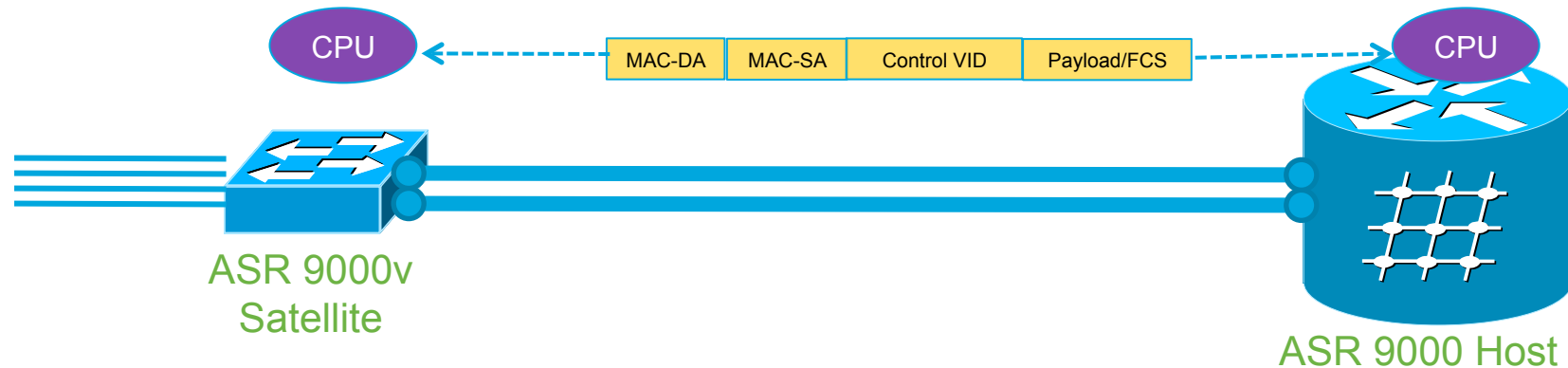
- ## Discovery Phase
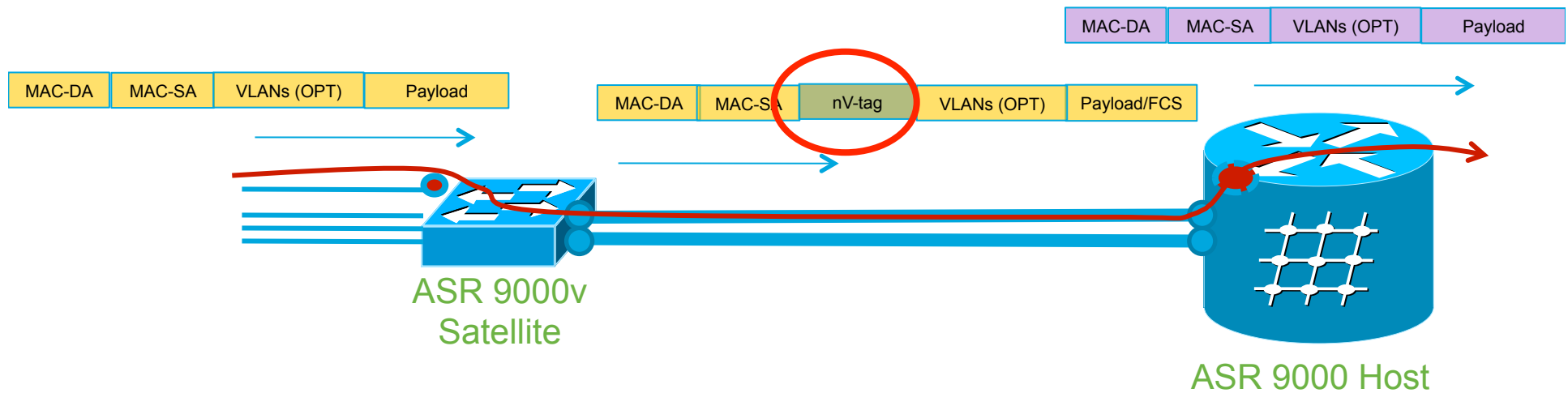
  CDP like protocol to discover Satellites

  Heartbeat messages sent every second to detect Satellite and Fabric Link Failures

- ## Control Phase

  Inter-process Communication Channel (TCP socket)

  Get/Set style messages to provision the Satellite and its ports and to retrieve statistics

nV Satellite Dataplane

MAC-DA	MAC-SA	VLANs (OPT)	Payload

MAC-DA	MAC-SA	VLANs (OPT)	Payload

MAC-DA	MAC-SA	nV-tag	VLANs (OPT)	Payload/FCS

ASR 9000v
Satellite

ASR 9000 Host

- ## On the Satellite
  Receive Ethernet Frames on a port → add nV-Tag for this port onto the frame
  Forward the Frame out on the Fabric Link (no MAC learning, static connect)

- ## On the Host
  Receive Frames on a fabric link → nV-Tag identifies Satellite Virtual Interface
  Normal Features processing as for local ports (QoS, ACL, L2/L3/MPLS, …)

Configuration Examples

(1)
```
nv
 satellite 100 ← define satellite ID
   description my love satellite
   type asr9000v

 satellite 101 ← define satellite
  description your love satellite
  type asr9000v
```
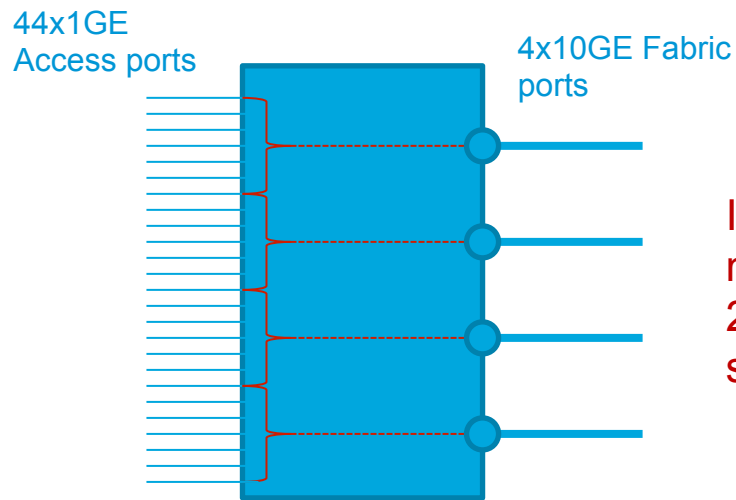
(2)
```
interface TenGigE 0/2/0/2
   nv
      satellite-fabric-link satellite 100
        remote-ports
           GigabitEthernet 0/0/0-9


interface bundle-ethernet 10
   nv
     satellite-fabric-link satellite 101
       remote-ports
          GigabitEthernet 0/0/10-19
```
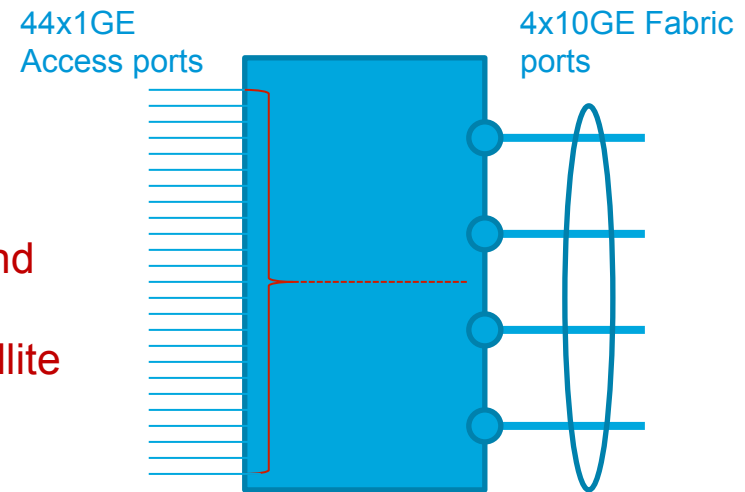
Minimal configuration is required to define satellite , fabric port and port mapping (default port mapping is used if no explicit configuration)

Satellite Deployment Models

44x1GE
Access ports

4x10GE Fabric
ports

It can mix
model 1 and
2 on the
same satellite

44x1GE
Access ports

4x10GE Fabric
ports

Mode 1: Static pinning
No fabric port redundancy

Mode 2: Fabric bundle
Fabric port redundancy

- Any access ports could be mapped to any single fabric port.

   Default mapping behavior: all access ports mapped to the first configured fabric port

- If fabric link fails, ALL mapped access ports will be brought down as well

- Access ports are mapped to a fabric bundle

- Per Access port Load-balancing across fabric bundle members

- If fabric member port fail, re-hashing to different fabric member happens automtically

Configuration – Example
Virtual "nv" interface configuration

3

```
interface GigabitEthernet 100/0/0/1
   ipv4 address 2.2.2.2 255.255.255.0


interface Bundle-ethernet 200
   ipv4 address 1.1.1.1 255.255.255.0

interface GigabitEthernet 100/0/0/2
   bundle-id 200
interface GigabitEthernet 100/0/0/3
   bundle-id 200


interface GigabitEthernet 101/0/0/3.10 l2transport
   encapsulation dot1q 101 second 100
   rewrite ingress tag pop 1 sym
   service-policy output test
   ethernet oam ...
```
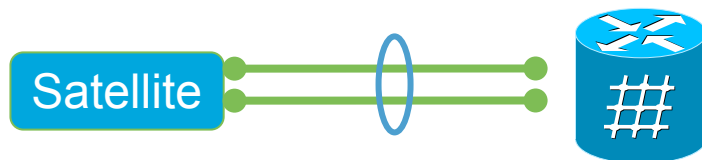
Same IOS-XR interface naming convention as local interface. First number is the satellite ID

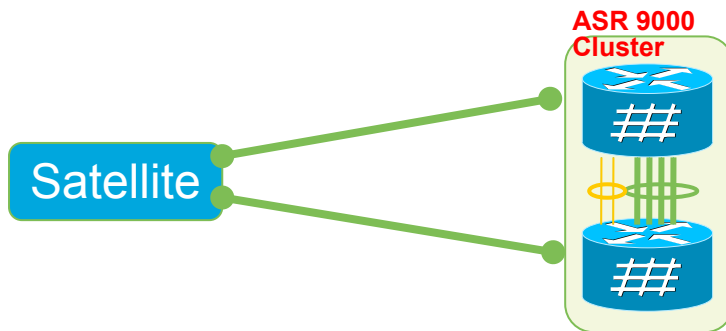Satellite-ID/satellite-slot/satellite-bay/satellite-port
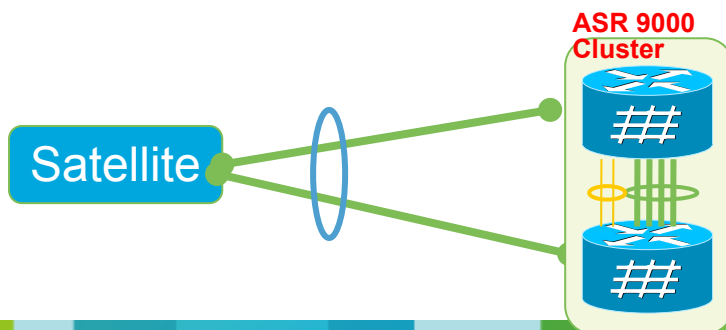
Initial nV Satellite Topologies

Single home
with static pinning

Single home
with fabric link bundle

ASR 9000
Cluster

Dual home to cluster
with static pinning

ASR 9000
Cluster

Dual home to cluster
with fabric link bundle

HW Support (XR 4.2.1)

|	nV Satellite	nV Edge
ASR9001	No *)	No *)
ASR9006	yes	yes
ASR9010	yes	yes
ASR9000v	yes	N/A
RSP	yes	no
RSP440	yes	yes
1st Generation Cards (4x10GE, 8x10GE, Combo, 40xGE, …)	Yes (if not connected to satellite)	no
2nd generation cards (24x10GE, 2x 100GE, MOD80/160, …)	yes	yes
SIP700	yes	yes
ISM	Yes (but no streaming to satellites)	No *)

SW Support (XR4.2.1)

- Generally all features a standalone ASR9000 does support

- Some exceptions:

	nV Satellite	nV Edge
BNG	no *)	yes
IEEE1588	no *)	no *)
SyncE	no *)	no *)
IC-SSO for MLPPP (SIP700)	N/A	N/A

POP Scaling Design Options
Platforms

CE

PE

PE

?

MPLS

?

CE

PE

— 1GE
— 10GE

PE

ASR9000	Catalyst 6500E
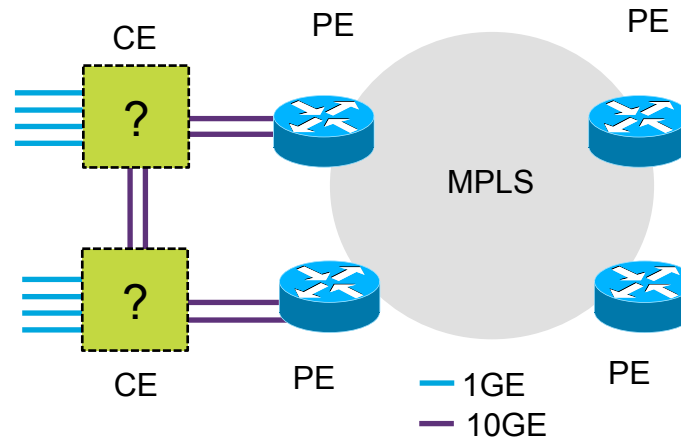
ASR9000

- MST support
- 32k PWs per Node
- Flexible VLAN Mapping via EVC
- Feature-rich per Port QoS
- High Density 1GE and 10GE
  - 440Gbits per Slot Capacity
- IOS XR Operating System
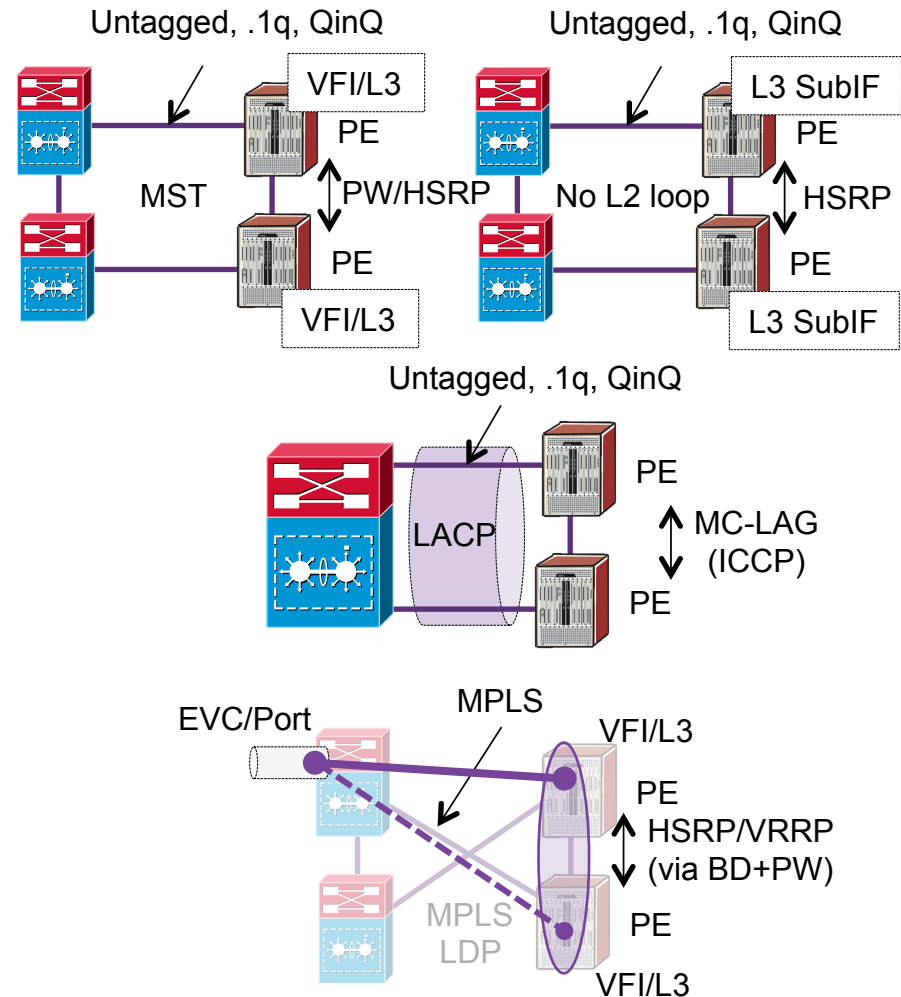 - Cluster and Satellite Support

Catalyst 6500E

- MST support
- 4k PWs per Node
- Per Port Group VLAN Rewrite
- Campus centric per Port QoS
- Medium Density 1GE and 10GE

- IOS Operating System
  - Virtual Switching System (VSS)
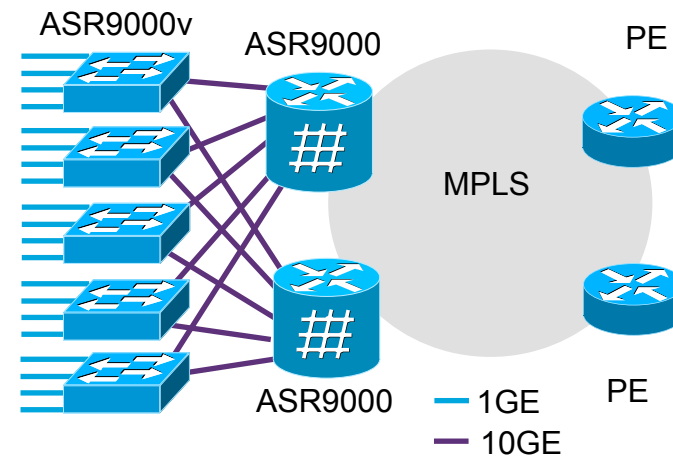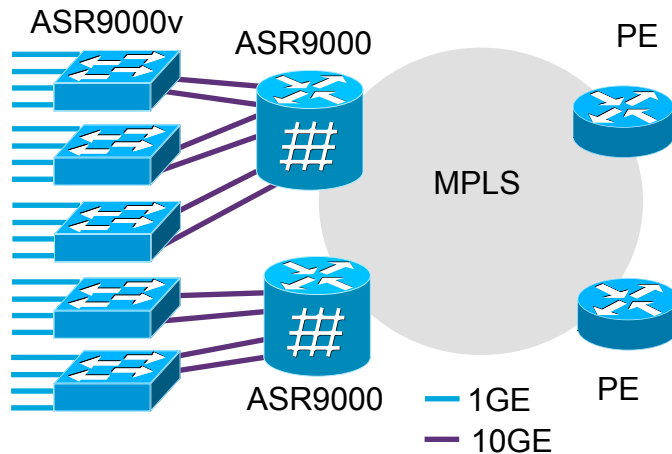
POP Scaling Design Options
Technology Choices

- Layer 2 CPE with or without MST
  - Standard/legacy design
  - End-Device/Host attachment?

- VSS/Cluster with LACP (LAG)
  - MC-LACP (LAG) on PE
  - Two cat6500s look like "one switch"

- Spoke Pseudo-wires
  - aka H-VPLS
  - No L2 MAC learning on CE
  - PW is terminated at L3 in PE
  - HSRP/VPLS on PE for PW failover

- Cisco nV Technology
 - See next slide

Untagged, .1q, QinQ
VFI/L3
PE
MST
PW/HSRP
PE
VFI/L3

Untagged, .1q, QinQ
L3 SubIF
PE
No L2 loop
HSRP
PE
L3 SubIF

Untagged, .1q, QinQ
LACP
PE
MC-LAG (ICCP)
PE

EVC/Port
MPLS
VFI/L3
PE
HSRP/VRRP (via BD+PW)
PE
VFI/L3
MPLS LDP

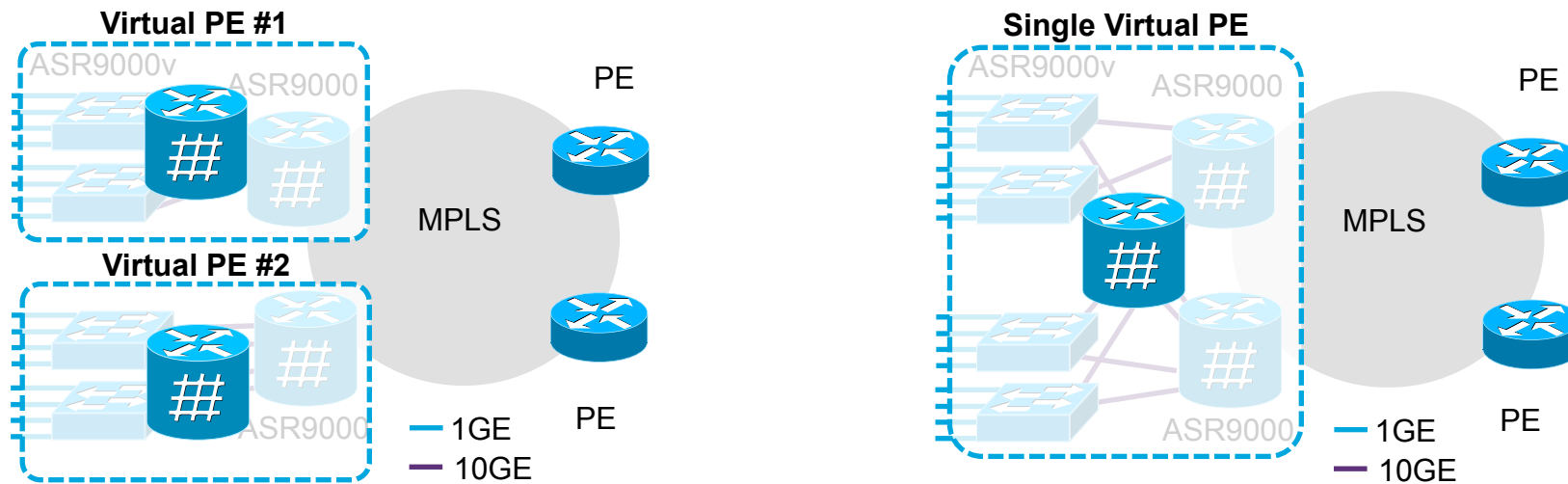# Scaling POP Design with ASR9000
Cisco nV Technology

- "Unlimited" Access Port Scale

  44x 1GE Ports per ASR9000v & up to 4x10GE toward ASR9000

  24x 10GE per Slot on ASR9000
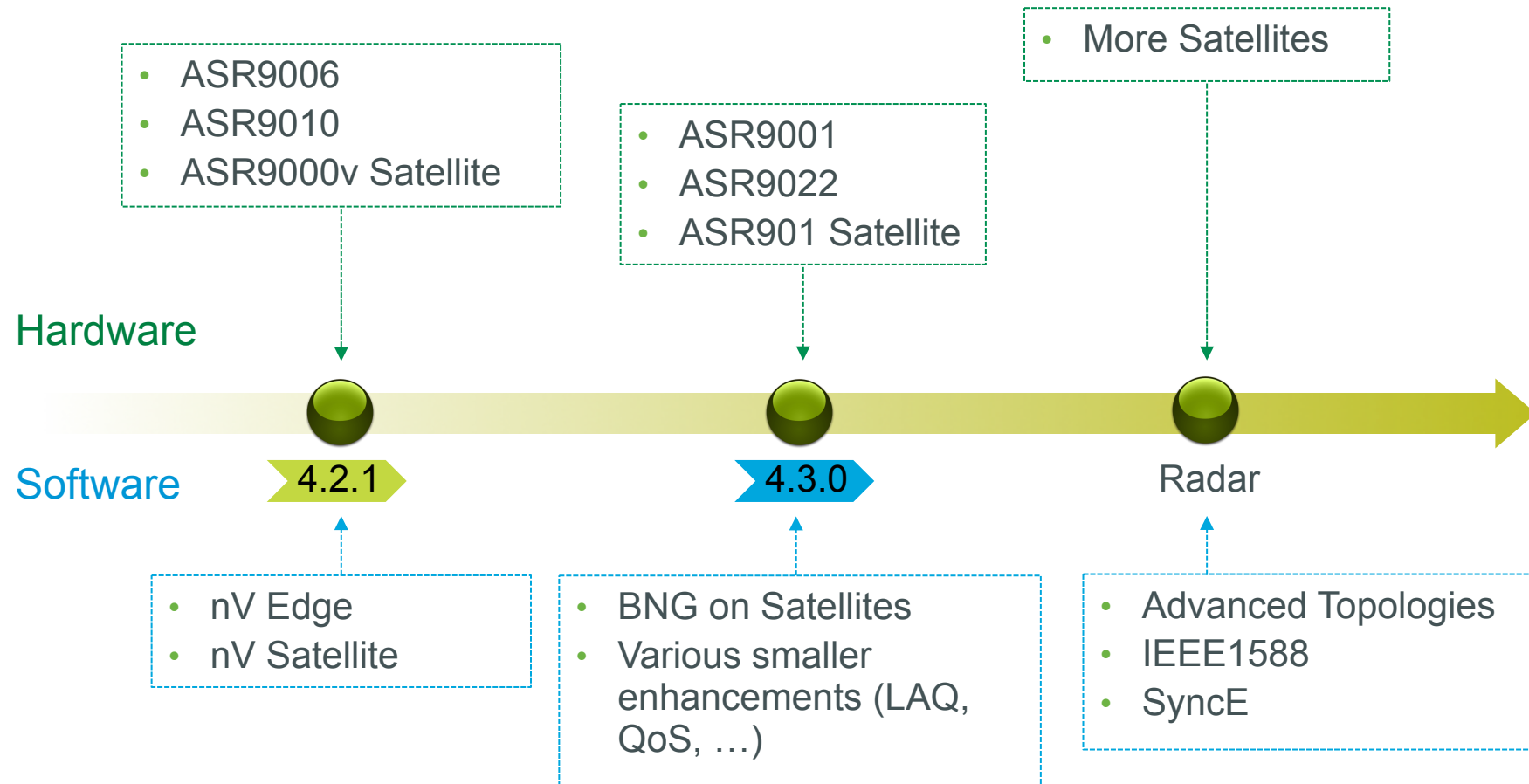
  → ~240-900x GE ports per ASR9000 slot

ASR9000v

1GE Ports (SFP)   10GE Ports (SFP+)
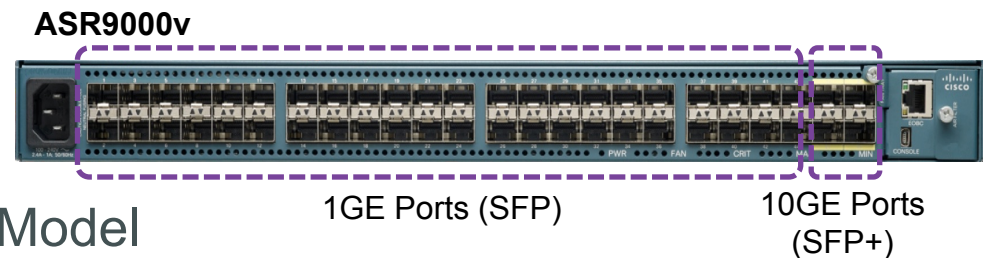
- Cost effective "pay as you grow" Model

Scaling POP Design with ASR9000
Cisco nV Technology

Virtual PE #1

ASR9000v   ASR9000

Virtual PE #2

ASR9000

PE

MPLS

PE

— 1GE
— 10GE

Single Virtual PE

ASR9000v   ASR9000

ASR9000

PE

MPLS

PE

— 1GE
— 10GE

- **Simplified Operations** – no Pseudo-wires, no Spanning-Tree, etc
    ASR9000v act as "Port Extenders"
    2x ASR9000s can act as 1x PE to the MPLS network
    Central Software Management

- **Enhanced Network Resiliency**
    No network-wide IGP and BGP convergence required for many failures
    No STP required for MGW attachment

nV Technology – Roadmap

- ASR9006
- ASR9010
- ASR9000v Satellite

- More Satellites

- ASR9001
- ASR9022
- ASR901 Satellite

Hardware

Software

4.2.1

4.3.0

Radar

- nV Edge
- nV Satellite

- BNG on Satellites
- Various smaller enhancements (LAQ, QoS, …)

- Advanced Topologies
- IEEE1588
- SyncE

References

- nV Technology on cisco.com

  http://www.cisco.com/en/US/solutions/ns341/ns524/ns562/ns592/asr_9000_system_video.html

- nV Whitepaper

  http://tools.cisco.com/search/display?url=http%3A%2F%2Fwww.cisco.com%2Fen%2FUS%2Fsolutions%2Fcollateral%2Fns341%2Fns524%2Fns562%2Fns592%2Fasr_nv_100611.pdf&pos=4&strqueryid=1&websessionid=wbcVwjsH_VXZN4TCS1yjNuF

- ASR9000 goes Mobile with nV Technology

  http://newsroom.cisco.com/release/466676/authorbio-detail?articleId=614033