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.

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

2x standalone Nodes

1x Logical Instance

3x standalone switches

nV Satellite
Super, Simple Resiliency and more Capacity

Leverage existing IOS-XR CRS multi-chassis SW infrastructure
Simplified/Enhanced for 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
**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 Synchronization 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

Field Replaceable Fan Tray
- Redundant Fans
- ToD/PSS Output
- Bits Out

LEDs

4x10G SFP+
- Initially used as Inter-Connect Ports
- Plug-n-Play In-Band Management
- Automatic Discovery and Provisioning
- Co-Located or Remote Distribution

Industrial Temp Rated for Flexible Deployments
- -40C to +65C Operational Temperature
- -40C to +70C Storage Temperature

44x10/100/1000 Mbps Pluggables
- Full Line Rate Packet Processing and Traffic Management
- Pay As You Grow Licensing (11 port Increments)
nV Satellite Overview

- 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

- **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

• 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

- 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

Mode 1: Static pinning
No fabric port redundancy

- 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 automatically

It can mix model 1 and 2 on the same satellite
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 ...
```
Initial nV Satellite Topologies

Satellite

- Single home with static pinning

Satellite

- Single home with fabric link bundle

Satellite

- Dual home to cluster with static pinning

Satellite

- Dual home to cluster with fabric link bundle
## HW Support (XR 4.2.1)

<table>
<thead>
<tr>
<th></th>
<th>nV Satellite</th>
<th>nV Edge</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASR9001</td>
<td>No *)</td>
<td>No *)</td>
</tr>
<tr>
<td>ASR9006</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>ASR9010</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>ASR9000v</td>
<td>yes</td>
<td>N/A</td>
</tr>
<tr>
<td>RSP</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>RSP440</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; Generation Cards (4x10GE, 8x10GE, Combo, 40xGE, …)</td>
<td>Yes (if not connected to satellite)</td>
<td>no</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; generation cards (24x10GE, 2x 100GE, MOD80/160, …)</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>SIP700</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>ISM</td>
<td>Yes (but no streaming to satellites)</td>
<td>No *)</td>
</tr>
</tbody>
</table>

*) Planned for future release
SW Support (XR4.2.1)

- Generally all features a standalone ASR9000 does support
- Some exceptions:

<table>
<thead>
<tr>
<th>Feature</th>
<th>nV Satellite</th>
<th>nV Edge</th>
</tr>
</thead>
<tbody>
<tr>
<td>BNG</td>
<td>no *)</td>
<td>yes</td>
</tr>
<tr>
<td>IEEE1588</td>
<td>no *)</td>
<td>no *)</td>
</tr>
<tr>
<td>SyncE</td>
<td>no *)</td>
<td>no *)</td>
</tr>
<tr>
<td>IC-SSO for MLPPP (SIP700)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*) Planned for future release
POP Scaling Design Options
Platforms

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
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

• Cost effective “pay as you grow” Model
Scaling POP Design with ASR9000
Cisco nV Technology

- **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

Hardware

- ASR9006
- ASR9010
- ASR9000v Satellite

Software

- nV Edge
- nV Satellite

4.2.1

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

4.3.0

Radar

- More Satellites

- Advanced Topologies
- IEEE1588
- SyncE

- ASR9001
- ASR9022
- ASR901 Satellite

- More Satellites
References

• nV Technology on cisco.com

• nV Whitepaper

• ASR9000 goes Mobile with nV Technology
  http://newsroom.cisco.com/release/466676/authorbio-detail?articleId=614033