Nexus 7000
Product & Roadmap Update

Brian Kvisgaard
3rd May 2017
Nexus 7000 Series – Designed for DC Core

**STP BASED DESIGN**
- Classic STP Limitation
- 50% of all Links not utilized
- Complex to Harden

**VPC BASED DESIGN**
- No STP Blocked Ports
- Full Links Utilization
- Faster Convergence

**FABRIC BASED DESIGN**
- Simple to Configure
- Higher Fabric Bandwidth
- Consistent Latency

Spine Scales to provide fabric bandwidth
Leaf Scales to provide access port density
Nexus 7000 Series – Designed for DCI

SOLUTION

- L2 INTERCONNECT
- FABRICPATH, VPC, OTV, VPLS, VXLAN
- L3 INTERCONNECT
- IP VRF-LITE, MPLS, LISP

BENEFITS

- PROVEN & MATURE DCI TECHNOLOGIES
- HITLESS ISSU
- STATEFUL PROCESS RESTART
- GRACEFUL INSERT & REMOVAL
N7700/M3 in Campus network

Design requirements:
- High performance
- 10G and 40G Mix
- Full L3 Feature Set
- HA features (GIR, ISSU)

Topology Description:
- Mix of 10G and 40G southbound
- L3 Link’s Downstream and upstream
- MPLS/IP Northbound
- 40G to 10G Breakout

Collapsed Core/Aggregation Layer

Design requirements:
- High performance
- 10G and 40G Mix
- Full L3 Feature Set
- HA features (GIR, ISSU)

Topology Description:
- Mix of 10G and 40G southbound
- L3 Link’s Downstream
- MPLS/IP Northbound
- vPC Southbound
- vPC Peer Link
FABRIC BORDER:

- A Fabric Border Node in SDA connects traditional L3 networks and/or different Fabric domains to the local domain. It is where different domains exchange Endpoint reachability, context (VRF, SGT) and policy information.

Design requirements:
- High performance
- 10G and 40G Mix
- Full L3 Feature Set
- HA features (GIR, ISSU, SMU)

Topology Description:
- Mix of 10G and 40G southbound
- L3 Link’s Downstream and Upstream
- MPLS/IP Northbound
Position for the following requirements:
- Optimized for 1G/10G and low density 40G
- Full Campus Fabric support
- Proven Catalyst 6K Class of feature set
- Single O/S requirement in the Campus

Offers: C6807-XL-S6T-BUN / C6807-3850-10G-

Caveats: No 100G support

Position for the following requirements:
- High-density 10/40/100-Gbps connectivity
- Full Cisco SDA Capability
- Closest in features (MPLS), buffers, tables to C6K

Offers: N7706-EN-B22S2E/ N7710-EN-B23S2E

Caveats: NexOS in Campus
## Cisco Nexus 7700 Series Switch Family

### Fabric Bandwidth
- 1.32 Tbps

### Smaller Footprint
- More compact

### Environmental Efficiency
- True front-to-back airflow

### Specifications

<table>
<thead>
<tr>
<th>Density</th>
<th>100G Density</th>
<th>40G Density</th>
<th>1G / 10G Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>(RU) 18-Slot</td>
<td>192</td>
<td>384</td>
<td>768</td>
</tr>
<tr>
<td>(RU) 10-Slot</td>
<td>96</td>
<td>192</td>
<td>384</td>
</tr>
<tr>
<td>(RU) 6-Slot</td>
<td>48</td>
<td>96</td>
<td>192</td>
</tr>
<tr>
<td>(RU) 2-Slot</td>
<td>12</td>
<td>24</td>
<td>48</td>
</tr>
</tbody>
</table>
Cisco Nexus 7000 Series Module Evolution

M3 (2016) 1.2T/slot
F3 (2013) 1.2T/slot
F2 (2011) 480G/slot
F1 (2010) 230G/slot
M2 (2012) 240G/slot
M1 (2008) 80G/slot

- Layer 2
  - FabricPath
  - FCoE
- Layer 3
  - Sampled NetFlow
  - OTV
  - EoMPLS/VPLS
- L2-L2 GW
- 10G FSA
- 256-bit MACsec
- VXLAN
- FSA Offload
- 40G / 100G
- MPLS
- Large Tables
- Deep Buffers
- FEX
- LISP
- Full NetFlow
- 1.2T/slot
- 480G/slot
- 230G/slot

Cisco Nexus 7000 Series Module Evolution

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Cisco Nexus 7000 F3 Series Modules

Nexus 7000 10G
F3 48-port 10G Module
N7K-F348XP-25

Nexus 7000 40G
F3 12-port 40G Module
N7K-F312FQ-25

Nexus 7000 100G
F3 6-port 100G Module
N7K-F306CK-25

Nexus 7700 10G
F3 48-port 10G Module
N77-F348XP-23

Nexus 7700 40G
F3 24-port 40G Module
N77-F324FQ-25

Nexus 7700 100G
F3 12-port 100G Module
N77-F312CK-26
Cisco Nexus 7000 M3 Series Modules

Enhanced Scale  |  Enhanced Security  |  Deployment Flexibility  |  Investment Protection
Cisco Nexus 7000 M3 Series Modules

256-bit AES MACsec
- 48 1/10 GE Ports (SFP+)
- 24 40 GE Ports (QSFP)
- 12 100 GE Ports (QSFP28)
On all ports/speeds

Deeper Buffers
- 31.25MB per 10GE Port
- 125MB per 40GE Port
- 375MB per 100GE Port

Larger Tables
- 2M* FIB Entries
- 384K* MAC Entries
- 128K ACL/QOS Entries

New Cisco M3 ASIC
- VXLAN, OTV, LISP*, MPLS
- FabricPath*, Classic L2/L3
- Cisco TrustSec – SGT, SXP, SGACLs

Advanced Parser
- Layer 2 to Layer 2 Gateway*
- GTP Hashing

Multi-Core Fabric Services Accelerator (FSA)
Enhanced Performance for BFD, Netflow, and Other Distributed Fabric Services

* MKA support may be available in a later release.

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Nexus 7700 M3 12-Port 100G I/O Module

QSFP28 Optics for 100G connectivity
QSFP Optics for 40G connectivity
Approximately 6µs cross-fabric latency
M3 12-Port 100G Card

Notes

**N + N Power Supply Redundancy**
- Nexus 7706 with 4 M3 100G cards requires 3.5KW Power Supplies

**NEBS Compliance**
- Nexus 7718, 7710, and 7706 switches may require new fan trays if they are fully loaded with M3 100G cards
- New fan trays are planned for H2CY17

No M3 100G card planned for Nexus 7000
High Voltage AC/DC Power Supply

- Input Voltage Range:
  - AC: 110V – 305V
  - DC: 192V – 400V

- Up to 3.5KW
- 17% More Output Power
- Energy Efficient*

* To be certified

Input Voltage Range Table:

<table>
<thead>
<tr>
<th>Input Type</th>
<th>Input Voltage</th>
<th>Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC input</td>
<td>100 to 120 VAC</td>
<td>1500W</td>
</tr>
<tr>
<td></td>
<td>200 to 210 VAC</td>
<td>3100W</td>
</tr>
<tr>
<td></td>
<td>215 to 240 VAC and 277 VAC</td>
<td>3500W</td>
</tr>
<tr>
<td>DC input</td>
<td>200 to 215 VDC</td>
<td>3100W</td>
</tr>
<tr>
<td></td>
<td>220 to 380 VDC</td>
<td>3500W</td>
</tr>
</tbody>
</table>

For Nexus 7004, 7702, 7706, 7710, and 7718
Mix & Match with 3KW AC & 3KW DC
Online Insertion & Removal Capable
Introducing the M3-Series into new & existing chassis

(F3 + M3) VDC

M3

F3

Full Layer2 and Layer3 Interoperability

No L3 Proxy

(M3 only) VDC

M3 – 48p 10G

M3 – 24p 40G

Full Layer2 and Layer3 Interoperability

M and F modules interoperate at the Lowest Common Feature Set
VDC Interface Allocation – M3-Series Modules

- M3 10G 24-port port-group
- M3 40G 6-port port-group
- M3 100G 2-port port-group

Port-group size varies depending on I/O module type
VDC Allocation on port-group boundaries – Aligns ASIC resources to VDCs
4x10G Port Breakout Capability

- Direct-attach active/passive copper breakout cables
- Direct-attach active optical breakout cables
- Fiber breakout cables (not included with optics transceivers)

Seamless 10G aggregation into dense 40G/100G ports
Breakout per port not per line card | No need to reload
NX-OS Continuing Enhancements & Innovations 7.3 and 8.0

- vPC Hitless Role Change
- GIR Enhancements
- OTV Enhancements
- iCAM, CATENA, Integrity Management Architecture
- Smart Licensing
- ACI DCI - GOLF
vPC Hitless Role Change (7.3)

- vPC hitless role change provides a framework to swap vpc roles between vpc peers without traffic interruption.
- Provide a new cli – “vpc role preempt”
- This feature provides a graceful method to perform insertion or removal on layer two
Replacement of the traditional way of role changing

• vPC needs role change occasionally: Topology change, system maintenance, switch reload/dual-active recovery, etc.
• Traditional way need a peer-link flapping – peer-link and all secondary vpc legs flapping, traffic interruption occurs
• Customers need a hitless way
• vPC STP hitless role change feature pioneers a hitless way of perform system level layer two network change
• This feature will serve as a replacement of the traditional way of performing role change
<table>
<thead>
<tr>
<th></th>
<th>Hitless role change</th>
<th>Traditional role change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability</td>
<td>Helsinki</td>
<td>Day 1 design with vpc</td>
</tr>
<tr>
<td>Need role priority config</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Peer-link flap</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Vpc legs flap on new secondary</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Error recovery</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>System maintenance support</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
### NX-OS Software Upgrade

#### In Service Software Upgrade (ISSU)
- Hitless – Non-Stop Forwarding
- Layer 2 and Layer 3
- Upgrade & Downgrade
- Only Platform in the Industry to Support Hitless ISSU for L2/L3

**Direction:**
- No support for ISSD
- More structured recommendations for software upgrades

#### Patching – Software Maintenance Update (SMU)
- Non-Disruptive Bug Fix for restartable/ stateful processes
- Works with or without ISSU
- Chef and Puppet Agent Support
- Patch Management Tool

**Direction:**
- Limited number of Patches supported
- May be disruptive for certain processes

#### Graceful Insertion & Removal (GIR)
- Per VDC or entire switch
- Support per protocol used
  - vPC/FabricPath/vxlan
  - BGP/OSPF/..
- Faster Reboot Improves Availability

### NX-OS HA
- Industry Leading Data Center HA Solution
- Mandatory for Mission Critical Data Centers
- Focus on Operational Excellence

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Graceful Insertion and Removal (GIR)

Change Window Begins

[system mode maintenance]

Change Window Ends

[no system mode maintenance]
# Methods – Shutdown vs Isolate

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Shutdown (optional)</th>
<th>Isolate (default)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMODE CLI to use</td>
<td>system mode maintenance shutdown</td>
<td>system mode maintenance</td>
</tr>
<tr>
<td>Protocol behavior</td>
<td>Protocols go to “shutdown” mode</td>
<td>Protocols go to “isolate” mode</td>
</tr>
<tr>
<td></td>
<td>Neighborship goes down</td>
<td>Neighborship maintained</td>
</tr>
<tr>
<td>Interface behavior</td>
<td>Interfaces are shutdown</td>
<td>No change</td>
</tr>
<tr>
<td>List of L3 protocols</td>
<td>BGP, EIGRP, OSPF, OSPFv3, ISIS, RIP</td>
<td>BGP, EIGRP, OSPF, OSPFv3, ISIS</td>
</tr>
<tr>
<td>supported</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Route withdrawal</td>
<td>Happens always as i/f and neighborship go down</td>
<td>Happens for some protocols (e.g. - BGP)</td>
</tr>
<tr>
<td>Local Routes</td>
<td>Cleaned up</td>
<td>Not changed</td>
</tr>
<tr>
<td>Gracefulness</td>
<td>Less graceful (data traffic loss can happen)</td>
<td>More graceful (avoids data traffic loss)</td>
</tr>
</tbody>
</table>

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GIR Enhancements

- Snapshot Delay
- CLI Prompt Indicator
- Mode Change Syslogs
- SNMP Trap Notifications
OTV Enhancements

Loopback Address as Join Interface

50% more MAC Addresses per Site

50% more MAC Addresses across all Sites
Physical Interface as OTV Join Interface

Only one uplink is connected to the Core from the OTV Device
Loopback Address as OTV Join Interface – Benefits

Enables the use of multiple uplinks & ECMP in the core for better resiliency and traffic depolarization
Interconnecting Fabrics – Nexus 7000 Switches and F3/M3 Series Cards

Interconnecting fabrics using Nexus 7000 Switches and no L2-L2 gateway requires two VDCs.
Interconnecting fabrics using Nexus 7000 Switches and L2-L2 gateway requires only one VDC
NX-OS Innovations

Integrity Management Architecture
- Uses open source trusted computing component
- Ensures genuine software is used
- Provides boot-time and runtime software integrity verification

iCAM
- Visual representation of TCAM usage

Catena
- Wire-speed selective traffic redirection for service chaining
Smart Licensing

Simplify Purchases
License Repository
License Pooling and Portability
Smart Licensing Simplifies The Customer Experience

Today’s Experience

1. Customer or Partner Places Order (9 tools)
2. Customer Enters PAK for each License
3. Customer Receives or Downloads and Installs Software (2 of 5 tools)
4. Customer stores records of devices, software, licenses (no tool)
5. Customer uses software
6. Customer Manages Software (10 tools)

Customer System
- Routers
- Switches
- Video
- Unified Comms

Tomorrow’s Experience

1. Customer or Partner Places Order in CCW
2. Customer Activates and Uses Software
3. Customer Manages licenses

Customer System
- Routers
- Switches
- Video
- Unified Comms
From Today to Tomorrow…

Smart Software Licensing is not just a new licensing tool. It transforms how you think about Cisco and the Software Lifecycle Management.

**Limited View**
Customers do not know what they own.

**PAK Registration**
Manually register each device. Unlock with license key.

**Device Specific**
Licenses specific to only one device.

**Locked**
You cannot use more than you paid for.

**Complete View**
Software, services, devices in one easy to use portal.

**Easy Registration**
No PAKs. Easy activation. Device is ready to use.

**Company Specific**
Flexible licensing, use across devices.

**Unlocked**
Add users and licenses as needed.
Nexus 7000 Series – ACI WAN/DCI Handoff

SOLUTION

- GROUP POLICY AUTOMATION WITH OPFLEX
- PER-TENANT REACHABILITY WITH MP-BGP
- SECURITY POLICY ENFORCEMENT AT ACI LEAF

BENEFITS

- MULTI-DC WORKLOAD MOBILITY
- LEVERAGE PROVEN/MATURE DCI TECHNOLOGIES AND IMPLEMENTATIONS
Layer 3 EVPN Services for Fabric WAN
‘GOLF’ Design (ACI 2.0 Release – N7K 7.3(1)D1(1))

- Connect an ACI Fabric to the **external L3 domain** (no support for L2 GOLF with ACI)
  - WAN Edge devices **functionally** behave as ACI ‘border leafs’
  - Control plane and data plane scale
  - OpFlex for automating the exchange of config parameters (VRF names, BGP Route-Targets, etc.)

- **VXLAN handoff** with MP-BGP EVPN control plane
- Better scalability, one protocol session for all VRFs, no longer constraint by border leaf HW table
- **Simplified tenant L3Out configuration**
Python on Nexus

• Python provides
  o Advanced language constructs: loops, conditions
  o Robust selection of libraries

• Python on Nexus provides
  o Extensive support on-box and off-box
  o Interactive and non-interactive modes
  o NX-OS Python package
  o Integration with NX-OS Embedded Event Manager (EEM)
  o Sandboxing

• Python on Nexus is useful for automating tasks
  o CLI commands
  o Generate syslogs
  o Process information and act upon it quickly
Python Cisco CLI Command Module

- **cli.cli**
  - Passes CLI configurations
  - Returns the raw output of CLI commands, including control/special characters

- **cli.clid**
  - Returns JSON of command output
  - Can be converted to dictionary

- **cli.clip**
  - Prints command output to stdout

---

```python
>>> import cli
>>> cli.cli("conf t ; interface eth4/1 ; shut")
```

```text
Nexus9k-A
```

```python
>>> cli.clid('show switchname')
'\{"hostname": "Nexus9k-2"\}'
```

```text
Nexus9k-2
```
Python IDE on Nexus7K

```
switch# python
Python 2.7.5 (default, Oct 8 2013, 23:59:43)
[GCC 4.6.3] on linux2
Type "help", "copyright", "credits" or "license" for more information
>>> from cli import *
>>> import json
>>> cli('configure terminal ; interface loopback 5 ; no shut')
''
>>> intflist=json.loads(clid('show interface brief'))
>>> i=0
>>> while i < len(intflist['TABLE_interface']['ROW_interface']):
...    intf=intflist['TABLE_interface']['ROW_interface'][i]
...    i=i+1
...    if intf['state'] == 'up':
...        print intf['interface']
...mgmt0
Ethernet2/7
Ethernet4/7
loopback0
loopback5
```
NX-API

- Supports off-box Python scripting
- Open RPC API – Extensible to support REST
- HTTP(S) interface to standard NXOS commands on switch
- CLIs are encoded into the HTTP/HTTPS POST body
- Allows read/write with RBAC support
- Data encoding formats include XML/JSON*
NX-API Usage

- Enabling NXAPI
- Send well-formed XML/JSON to http(s)://<switch-ip-address>/ins
- NX-API Sandbox via web browser at: http://<switch-ip-address>/
- Online help and user interface via switch web interface

Nexus9k (config)# feature nxapi
Nexus9k # show nxapi
enabled  Listen on
port 80   Listen on
port 443
Generating Python Code Using the NX-API Sandbox

```
# Interface ethernet2/1
description nx-api sandbox
```

```python

import requests
import json

# Modify these please
url = 'http://YOURIP/ins'
switchuser = 'USERID'
switchpassword = 'PASSWROD'

myheaders = {'content-type': 'application/json'}
payload = {
    "ins métier": {
        "version": "1.0",
        "type": "cli_conf",
        "cli_conf": {
            "edit": "interface ethernet2/1 description nx-api sandbox"
        }
    }
}

response = requests.post(url, headers=myheaders, data=json.dumps(payload)).json()

```

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Popular Configuration Management Tools

Chef is a configuration management tool used for writing system configuration “recipes” and is used to streamline the task of configuring & maintaining a company's servers.

Puppet is a tool designed to manage the configuration of Unix-like and Microsoft Windows systems. It includes its own declarative language to describe system configuration.

Ansible is an open source software platform for configuring and managing computers using “playbooks”. Similar to Chef and Puppet, it is used to automate the configuration of a company’s compute resources.
Configuration Management Tools Overview

Inter-Process Communication (IPC)
Nexus 7000 M3 Series

Roadmap

- Nexus 7004 Support
- L2-L2 Gateways
- FEX Support
- FabricPath
- Campus Fabric
- LISP
- MKA Key Exchange for MACsec
### Terms Used

- **Planning** – A committed date is not established
- **Commit** – Engineering/QA has high confidence in the target FCS date
- **Shipping** – Code can be downloaded on CCO

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**Nexus 7000 NX-OS Software Release Planning**

**Feature Releases**

- **7.3.0D1(1)**
  - February, CY2016
  - Status: Shipping

- **7.3.0DX(1)**
  - May, CY2016
  - Status: Shipping

- **8.0(1)**
  - December, CY2016
  - Status: Shipping

- **8.1**
  - Target: Q2, CY2017
  - Status: Planning

- **8.2**
  - Target: H2, CY2017
  - Status: Planning

**Maintenance Releases**

- **6.2.16**
  - April, CY2016
  - Status: Shipping

- **7.2.2D1(1)**
  - July, CY2016
  - Status: Shipping

- **7.3.1D1(1)**
  - September, CY2016
  - Status: Shipping

- **6.2.18**
  - February, CY2017
  - Status: Planning

- **8.0(2)**
  - Target: Q2, CY2017
  - Status: Planning

- **7.3.2D1(1)**
  - Target: Q2, CY2017
  - Status: Shipping
## Nexus 7000 NX-OS Software Roadmap

<table>
<thead>
<tr>
<th>Hardware</th>
<th>Programmable Fabric</th>
<th>DCI WAN Converged LAN and SAN</th>
<th>Security, Availability, Serviceability</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.3(0)D1(1), 7.3(0)DX(1)</td>
<td>8.0(1)</td>
<td>8.1</td>
<td>8.2</td>
</tr>
<tr>
<td>• Nexus 7700 M3 40G I/O Module</td>
<td>• Nexus 7700 M3 100G I/O Module</td>
<td>• Nexus 7700 M3 40G I/O Module</td>
<td>• Nexus 7700 M3 100G I/O Module</td>
</tr>
<tr>
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</tr>
<tr>
<td>• GTP Hashing</td>
<td>• M3 parity with NX-OS 7.3 and NX-OS 7.2 features (VXLAN OAM, VXLAN-EVPN, GIR, Link OAM)</td>
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</tr>
<tr>
<td>• 256 bit AES MACSec (M3)</td>
<td>• VxLAN/EVPN, VXLAN OAM</td>
<td>• DNA-SDA ACI Integration</td>
<td>• RFC7130 BFD LAG member link</td>
</tr>
<tr>
<td>• FCoE over FEX with F3</td>
<td>• DCI – MPLS L3VPN, L2, LISP</td>
<td>• DNA-SA Border router handoff (Q3 CY2016)</td>
<td>• Light Weight DHCP v6 Relay</td>
</tr>
<tr>
<td>• VxLAN/EVPN, VXLAN OAM</td>
<td>• DNA-SA Border router handoff (Q3 CY2016)</td>
<td>• DNA-SA Border router handoff (Q3 CY2016)</td>
<td>• BFD support for HSRP IPv6</td>
</tr>
<tr>
<td>• DCI – MPLS L3VPN, L2, LISP</td>
<td>• ACI Integration with GOLF (F3)</td>
<td>• ACI Integration with GOLF (F3)</td>
<td>• GIR – Protocol Isolate</td>
</tr>
<tr>
<td>• DNA-SA Border router handoff (Q3 CY2016)</td>
<td>• VxLAN/EVPN, VXLAN OAM</td>
<td>• DNA-SA Border router handoff (Q3 CY2016)</td>
<td>• CTS Enhancements</td>
</tr>
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<td>• ACI Integration with GOLF (F3)</td>
<td>• VxLAN/EVPN, VXLAN OAM</td>
<td>• DNA-SA Border router handoff (Q3 CY2016)</td>
<td>• ITD – Include ACL</td>
</tr>
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<td>• DNA-SA Border router handoff (Q3 CY2016)</td>
<td>• DNA-SA Border router handoff (Q3 CY2016)</td>
<td>• Syslogs, Snapshot, CLI Indicator, SNMP Trap</td>
</tr>
<tr>
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<td>• SAP IPv4 Speaker and Listener</td>
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