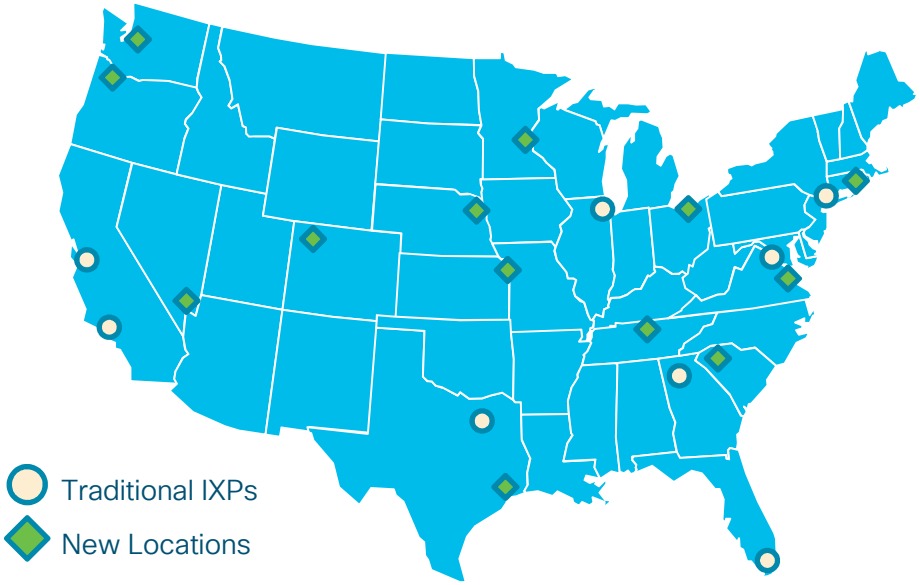
Changes in Peering

Cisco Intelligent Peering

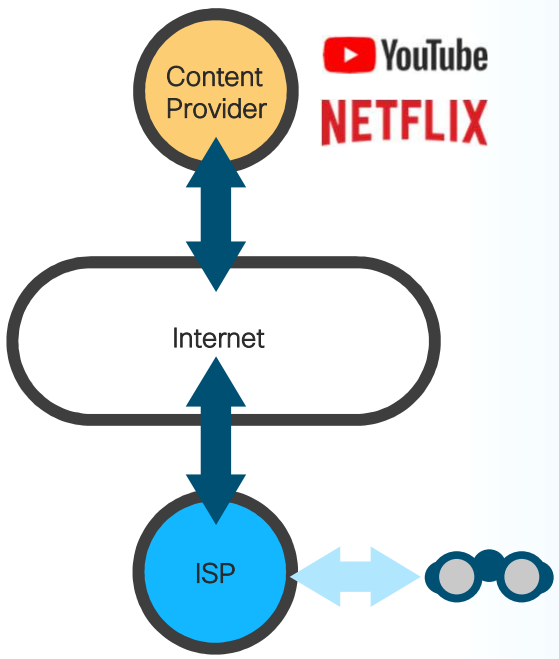
Phil Bedard
TME SPNSA
06/27/2018

Peering Traffic Growth and Distribution



The “Flattening” of the Internet

Traditional content peering

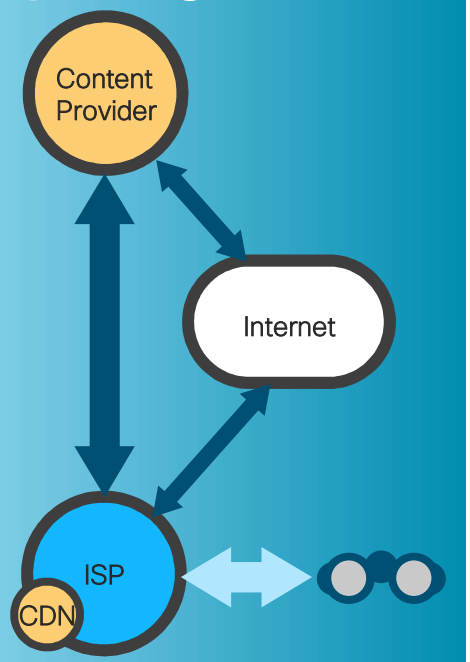


Video will be 82% of internet traffic by 2021

Subscriber BW consumption growing at a CAGR of 31%

Direct interconnection, less reliance on transit backup

Optimized content peering



http://hightechforum.org/mysteries-and-loopholes-in-the-open-internet-order/

While video dominates . . .

... other trends are driving advancements in peering design:

- Increasing use of SaaS creates stricter SLAs on peering performance
- 5G requirements accelerate relocation of network functions and data storage to distributed Multi-Access Edge Computing (MEC) locations

Peering moves deeper into the network

Peering placement in *Metro* locations **reduces** ISPs long-haul **costs** and **assists** with **SLA assurance**

Shift to Regional and Metro Peering drives new requirements in Peering network design

- Flexible port density to satisfy variable local user base sizes
- Low environmental footprint
- Resilient network design to avoid long-haul backup cost
- More sites require Automation to operate, optimize, and plan

Traditional single peering location transforms into 3 metro peering locations

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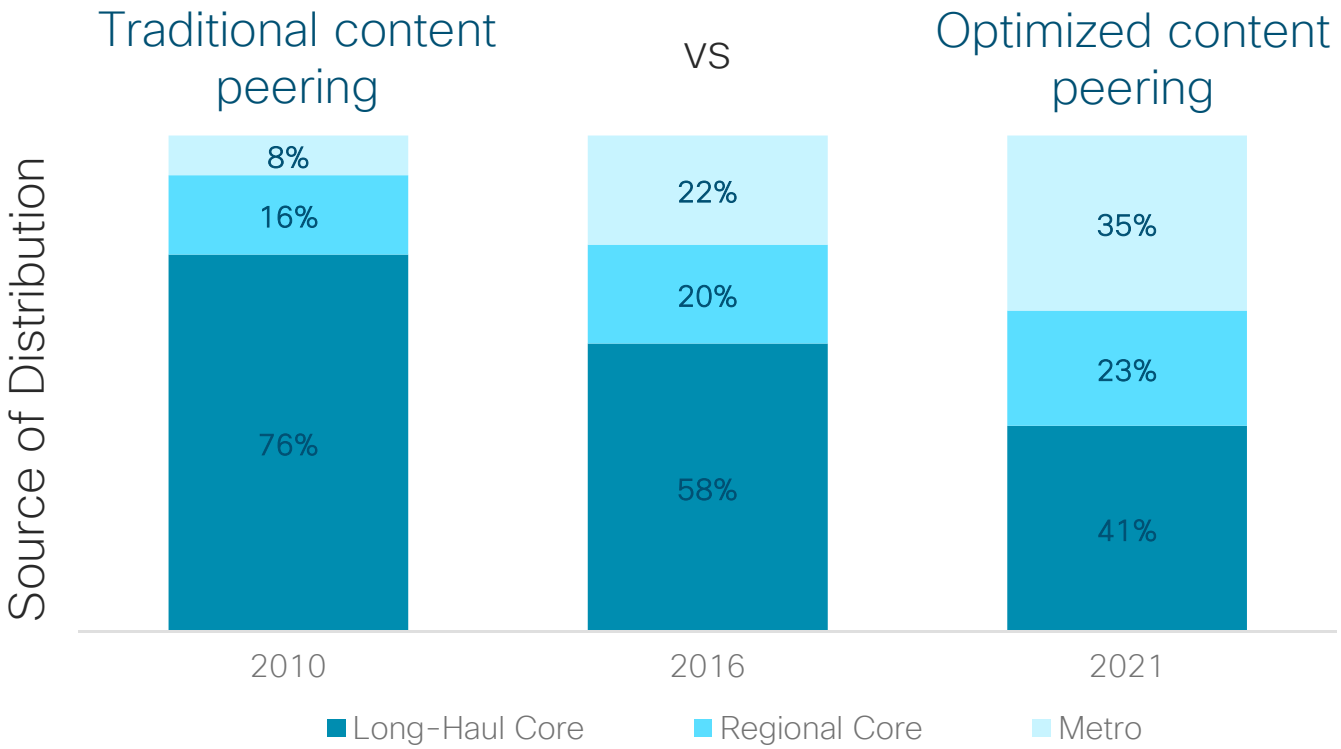
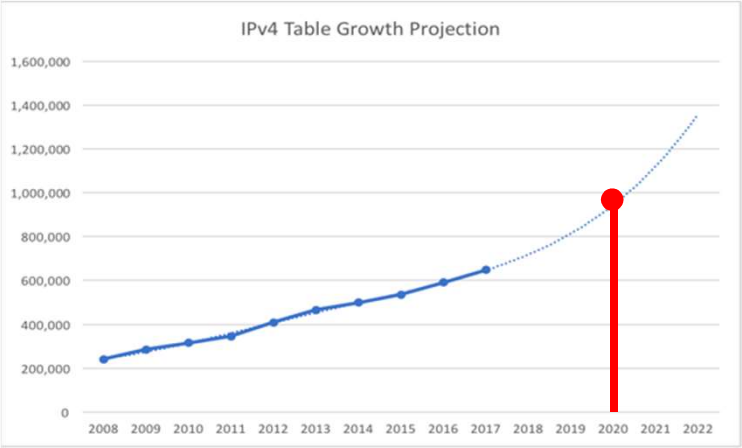
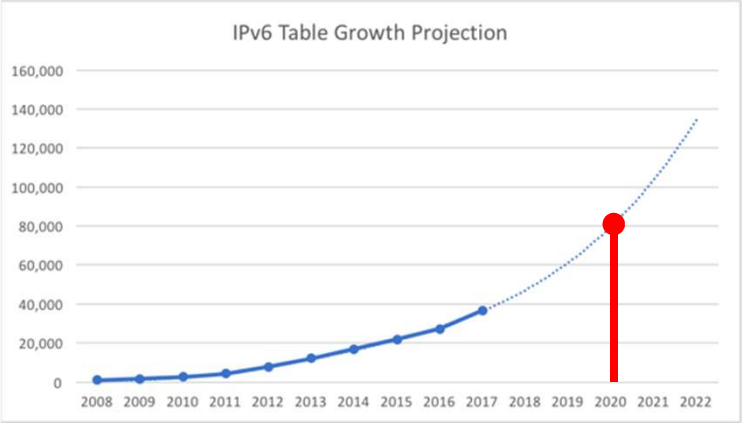
Trends in content distribution



An ever growing routing table





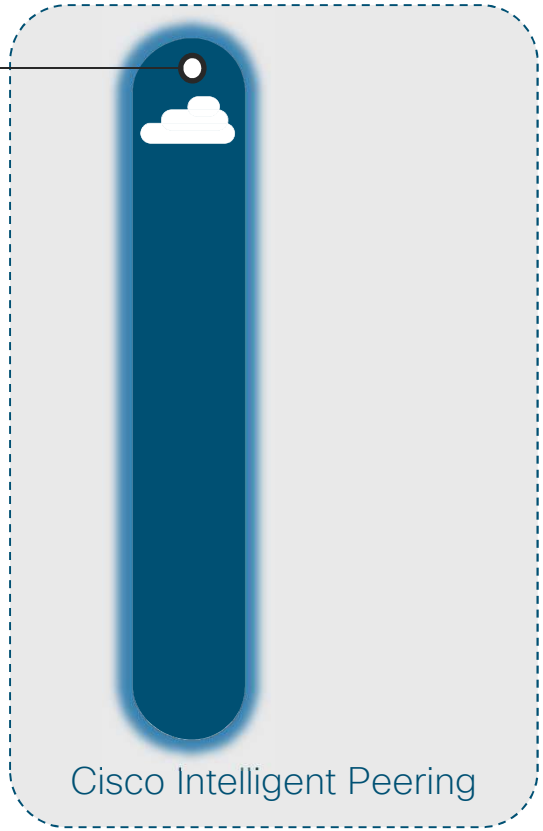
- IPv4 and IPv6 networks continue to grow
  - 5G, IoT, Remote PHY will increase number of infrastructure device endpoints 5-10x
- Global routing table and device scale not the only concern
  - Internal routing will continue to grow as more services are distributed and cloud-native

Router longevity requires route scale without compromise

Cisco’s Intelligent Peering Solution

Distribution & Traffic Growth

- Resilient network design
- Simplified control-plane with Segment Routing
- Flexible high density and low environmental footprint routers
- RIB and FIB scale for 5+ years



Cisco Intelligent Peering Design Guidelines

Resilient, Scalable and Cost Effective

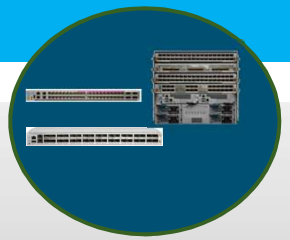
Simplified deployment and operation

Proactive security through analytics, automated remediation, and IOS-XR capabilities

Intelligent analytics-driven traffic engineering

Peering Fabric Design Building Blocks

Cisco Hardware

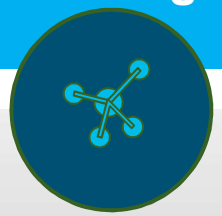


Highly dense and scalable NCS 5500 routers

Automation

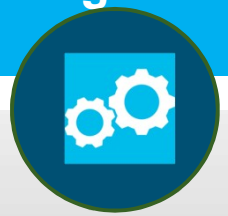
Programmability and analytics with YANG data models and telemetry

Segment Routing



Unified forwarding plane with network abstraction and TE capabilities

Prescriptive Configuration

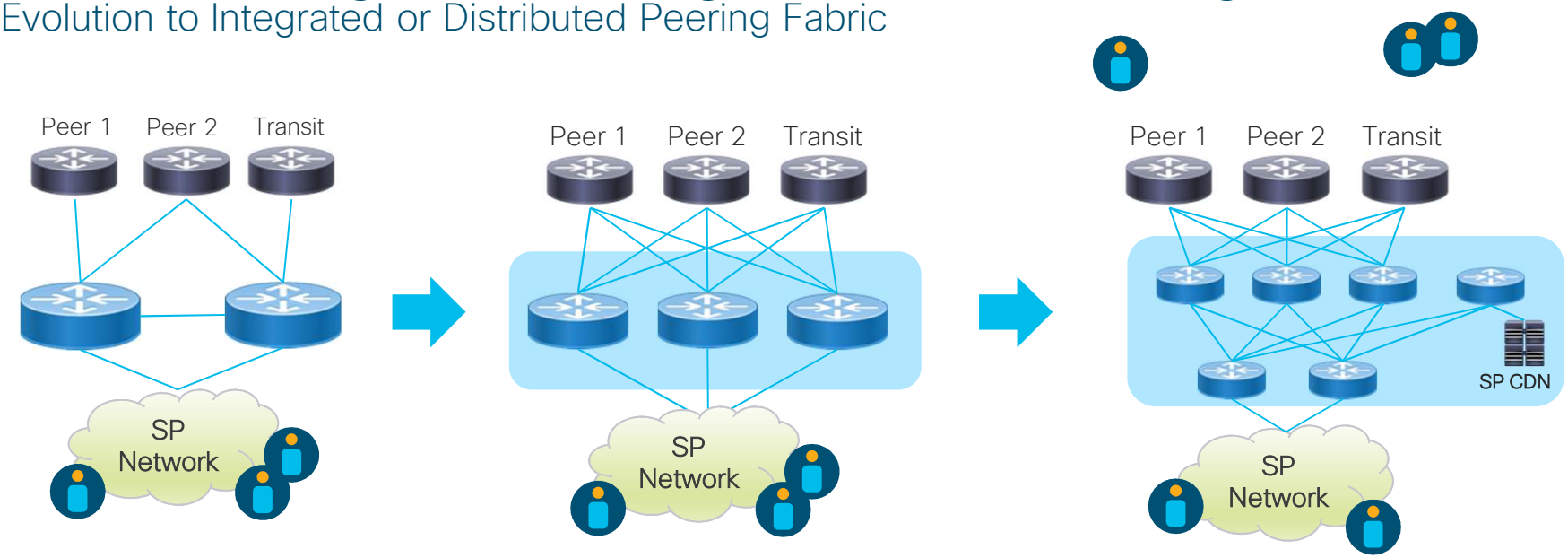


Configuration best practices covering control-plane, telemetry, and security

End-to-End networking operations with IOS-XR

Cisco Intelligent Peering – Network Design

Evolution to Integrated or Distributed Peering Fabric

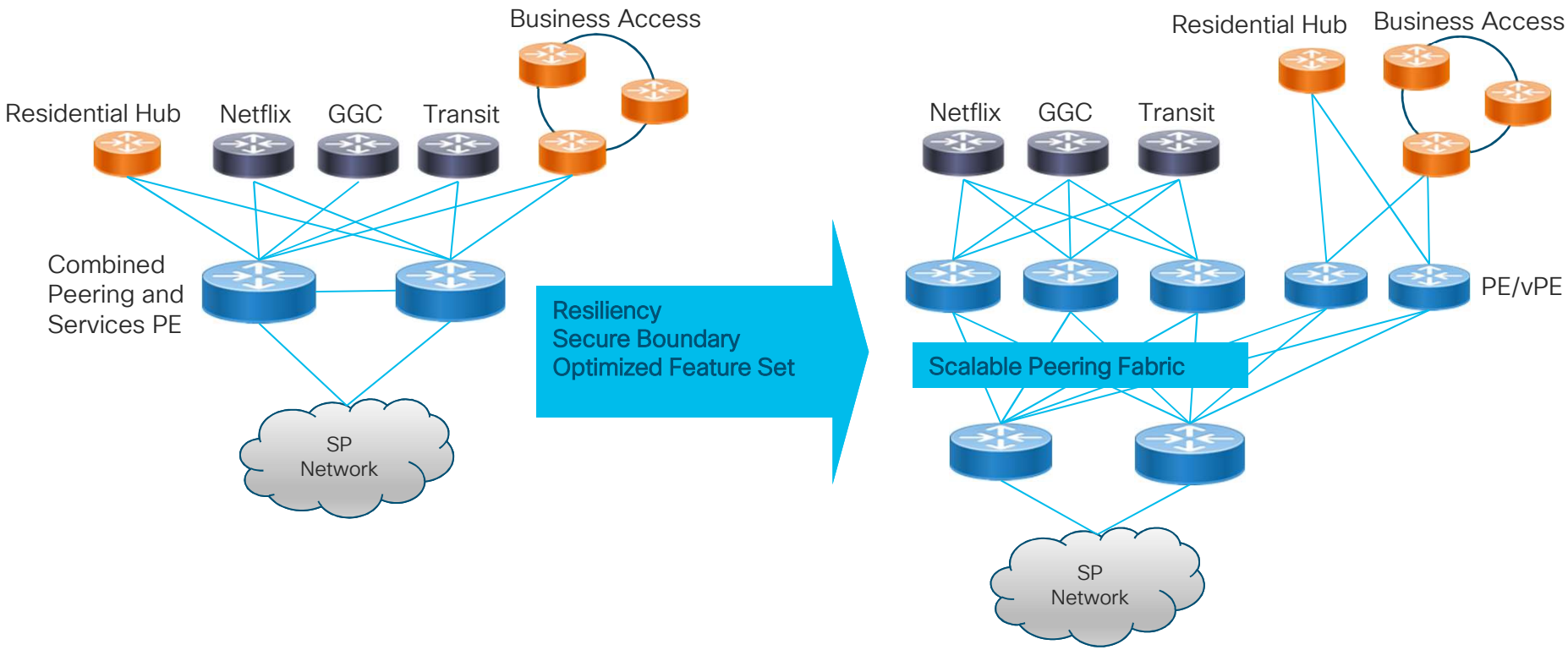


Traditional Peering

- Horizontal scaling adds resiliency
- Less reliance on long-haul backup for metro or DC Peering
- Reduced blast radius during maintenance or failure
- Simplified SR control-plane

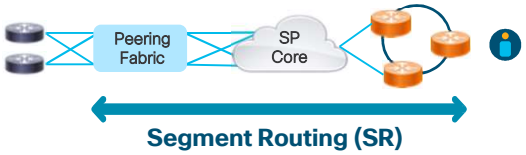
- Greater resiliency and capacity scale
- Optimized feature sets at each layer
- Optimized fabric for both ingress and egress content delivery

Collapsed Edge vs. Distributed Network Functions



Cisco Intelligent Peering

Segment Routing

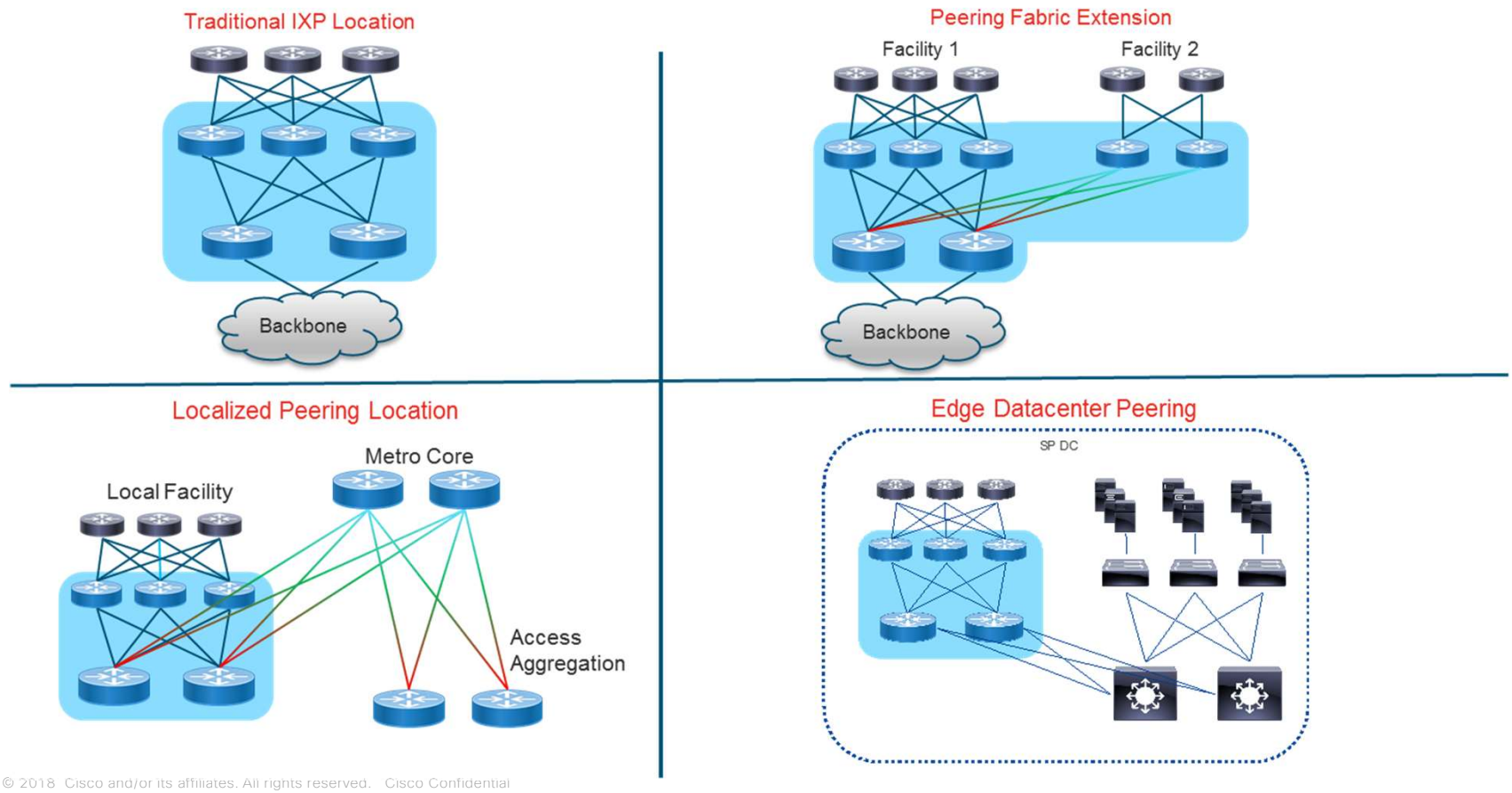


Foundation for Network Operations Simplification and Automation, and Service Agility via Programmability

Simplification of network protocols Improved scalability	Automated 50ms convergence
Simplification of Traffic Engineering	Built-in Redundancy & HA
Application enabled policy using SDN techniques	Support MPLS & v6 Forwarding

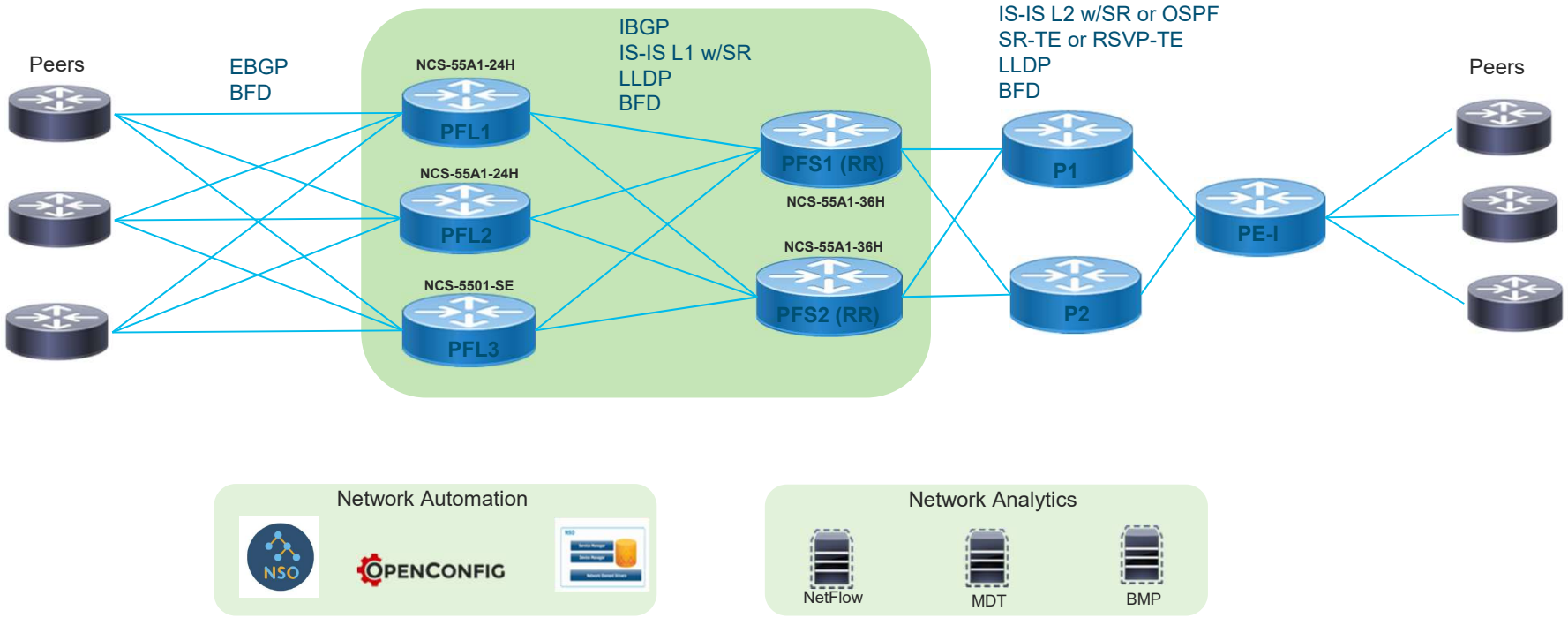
Universal Forwarding Plane
From Access to Peering

Place In The Network



Cisco Peering Fabric Validation

Continuous validation



Cisco Intelligent Peering – NCS-5500 Routers

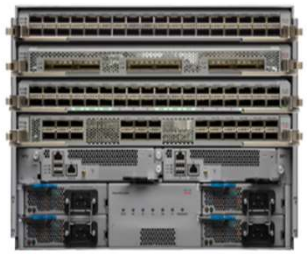
Class-leading density and power efficiency

Peering scale buffers, FIB longevity of 5+ years

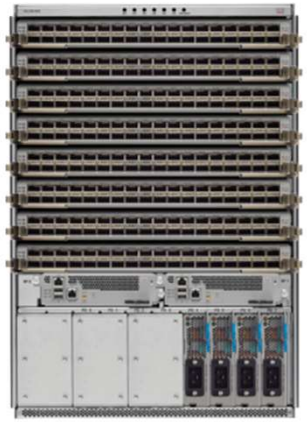
Trustworthy Systems Certified

Powered by IOS-XR

NCS-5504



NCS-5508



NCS-55A1-36H-SE

NCS-55A1-24H

NC55-36X100G-A-SE

Peering Fabric Hardware – Fixed Chassis Detail

NCS-55A1-36H-SE

36x100GE QSFP28
144x10GE QSFP+
4M IPv4 / 1M IPv6 FIB
Enhanced scale
1150W Typical
64GB RAM
MACSEC Capable
Jericho+ w/OP eTCAM

NCS-55A1-24H

24x100GE QSFP28
96x10GE QSFP+
2x900Gbps NPU
12x100G per NPU
1.3M+ IPv4 / 256K IPv6
675W Typical
32GB RAM
Jericho+ No eTCAM

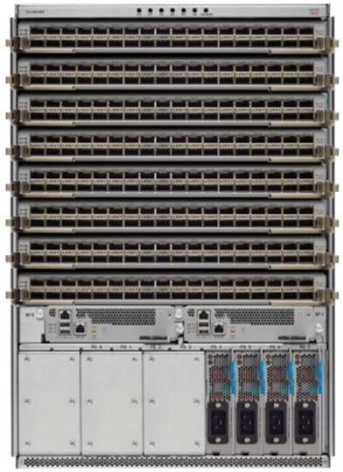
NCS-5501-SE

40x10GE SFP+
4x100GE QSFP28
4M IPv4 / 1M+ IPv6 FIB
Enhanced scale
320W Typical
4x25G Capable
32GB RAM
Qumran w/ eTCAM

Peering Fabric Hardware – Modular Chassis / LC

NCS-5504

7RU
4 line card slots
5310W w/144x100GE



NCS-5508

13RU
8 line card slots

NC55-36X100G-A-SE

36x100GE QSFP28
4M IPv4 / 1M+ IPv6 FIB
Enhanced scale
Jericho+ with eTCAM

Previous Generation vs Next Generation Peering Routers

Previous Generation Modular Peering Router

16 RU

44 x 100GE Ports

~11.7kW Typical
~260 Watts per Port

NCS-5508 Next Generation Modular Peering Router

13 RU

288 x 100GE Ports

~8kW Typical
~28 Watts per Port

NCS55A1–36-SE Next Generation Fixed Peering Router

1 RU

36 x 100GE Ports

~1,360 Watts Typical
~38 Watts per Port

89% Reduction in Power per Port

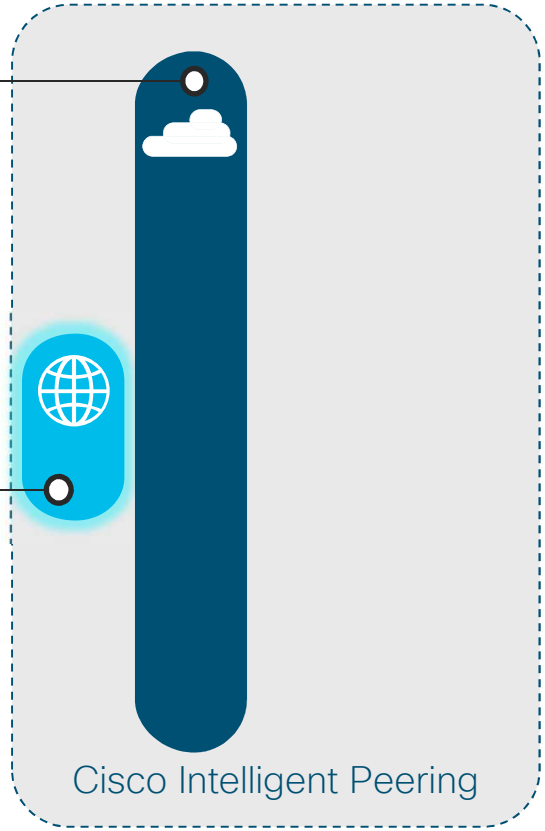
Cisco's Intelligent Peering Solution

Distribution & Traffic Growth

- Resilient network design
- Simplified control-plane with Segment Routing
- Flexible high density and low environmental footprint routers
- RIB and FIB scale for 5+ years

Traffic Optimization

- SR enables SDN programmability end to end
- SR Traffic Engineering for optimal forwarding
- SR provides in-network application SLA



Optimization and SLAs drive Peering SDN

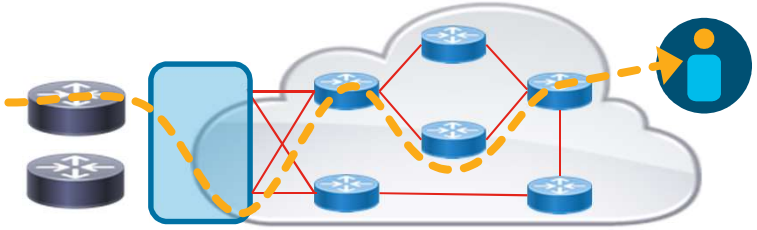
Egress

Best network exit path that is both cost-efficient and provides good user experience metrics (latency, link utilization & traffic loss)

Optimal exit link chosen:
- Low cost (private peer)
- Low utilization link

Ingress

Optimal path across SP network for ingress traffic from peering location to SP end users



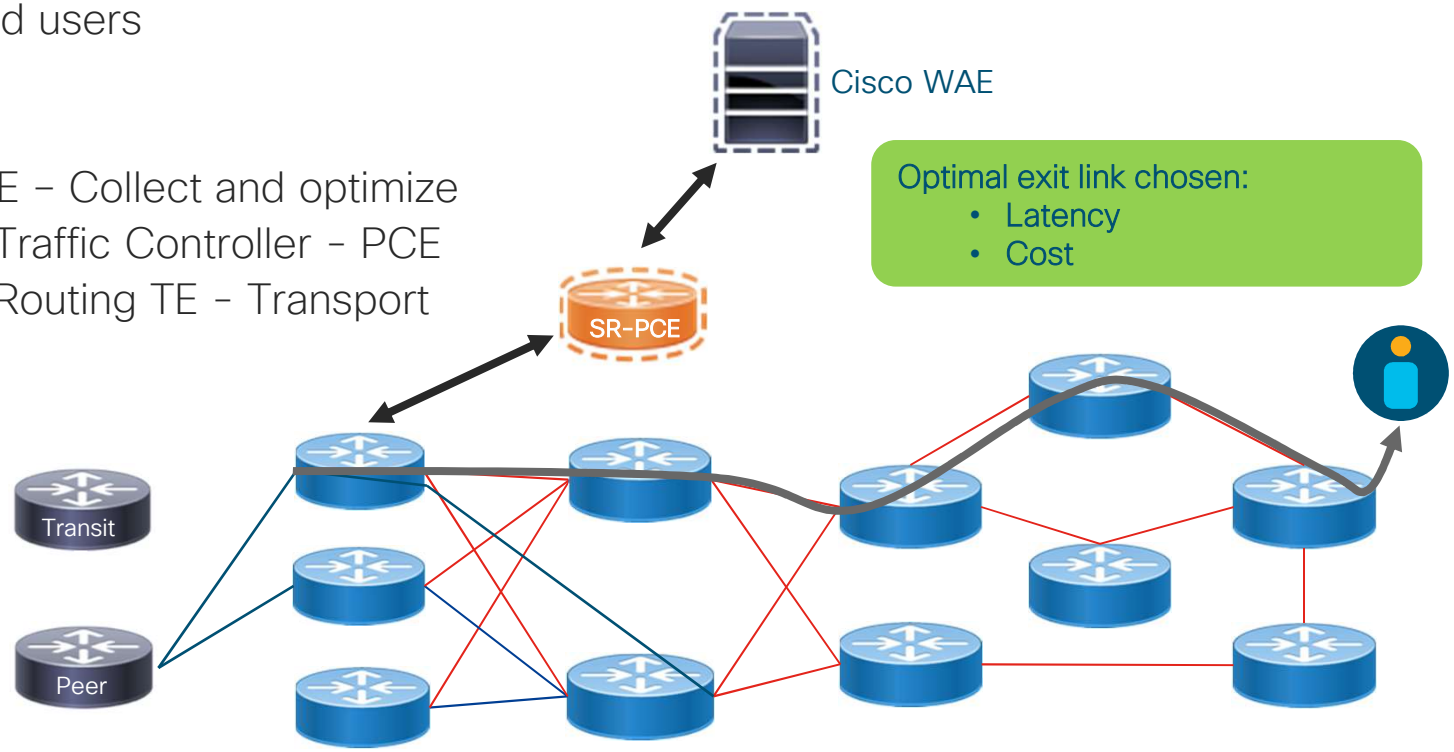
Optimal exit link chosen:
- Latency
- Cost

SR-TE SP Ingress Peering Traffic Optimization

Problem: Engineering optimal path across SP network for ingress traffic from peering location to SP end users

Solution:

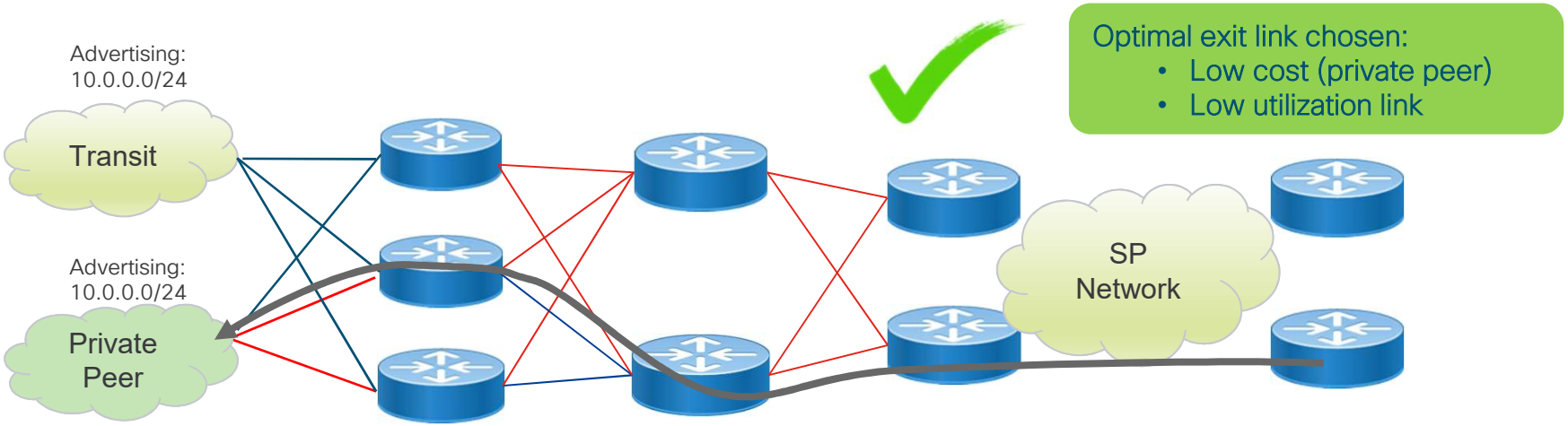
- Cisco WAE – Collect and optimize
- Cisco XR Traffic Controller – PCE
- Segment Routing TE – Transport



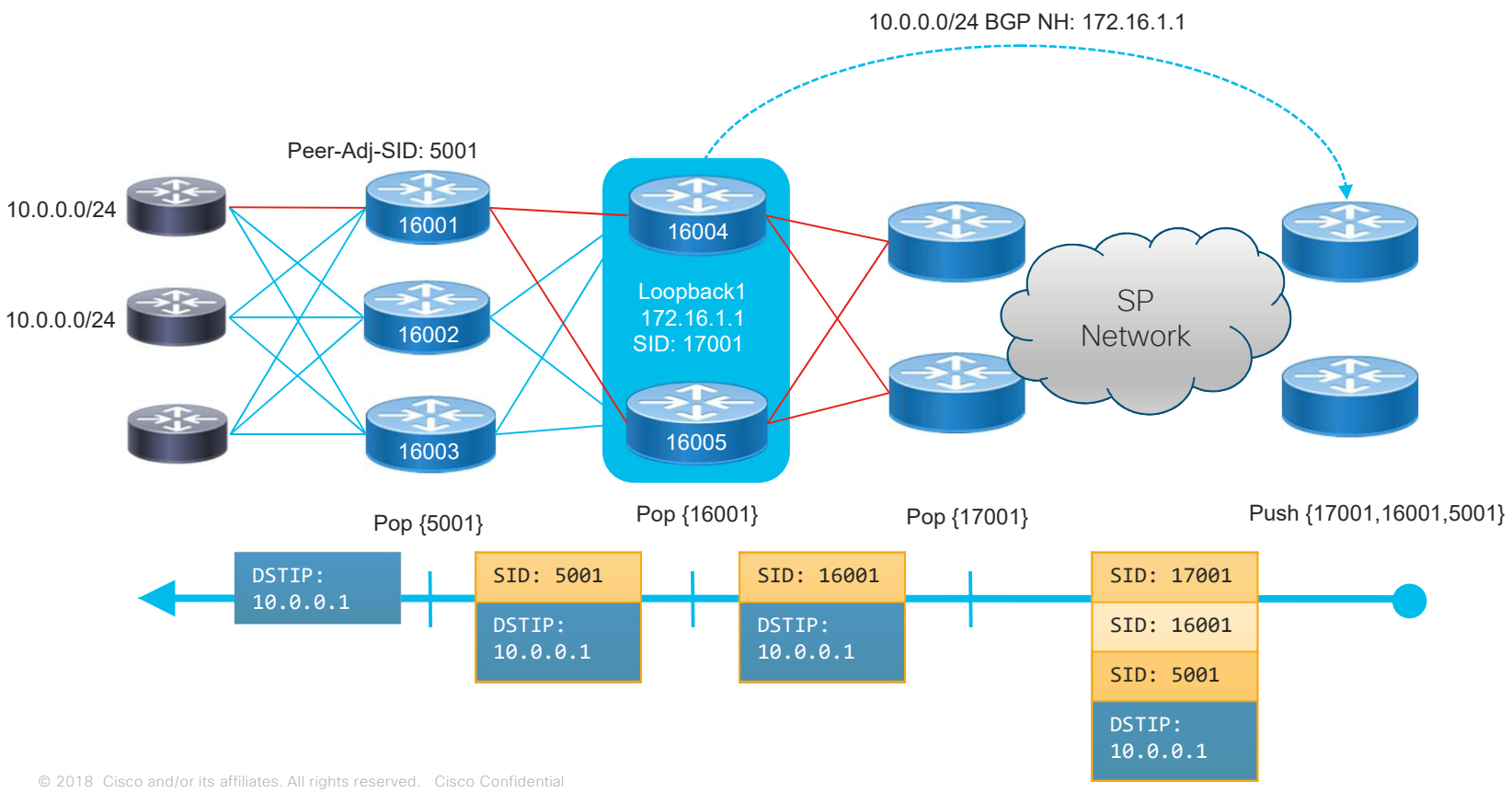
SR-TE Egress Peer Engineering

Problem: Engineering the best network exit path that is cost-efficient while providing good user experience metrics (latency, link utilization & traffic loss).

Solution: Segment Routing Egress Peer Engineering (EPE).

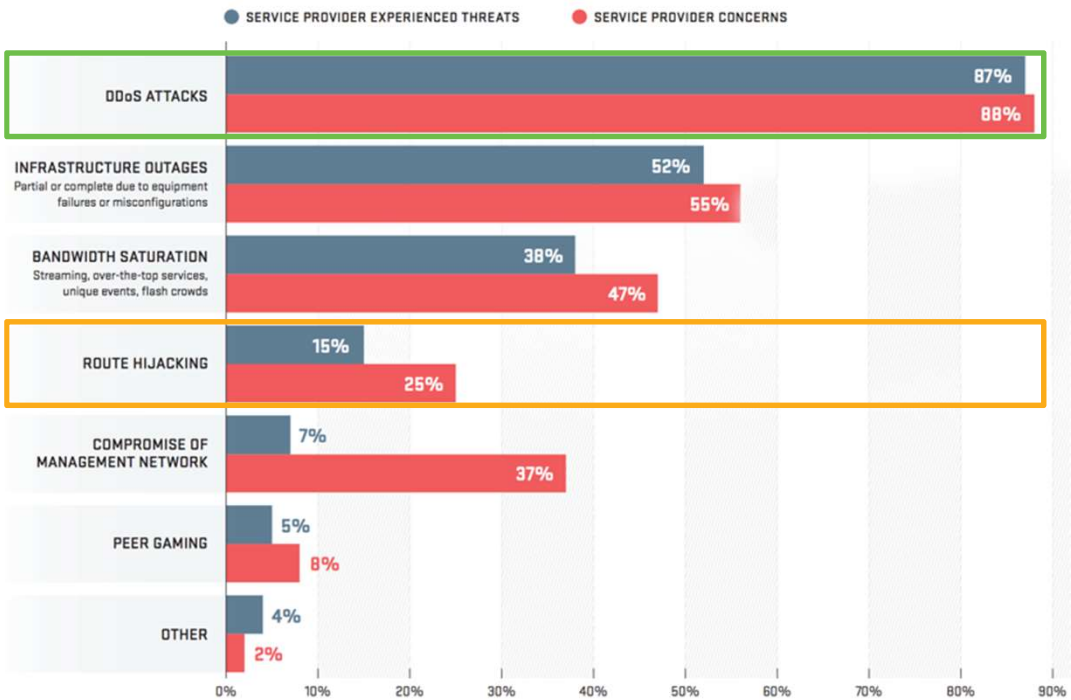


Egress Peer Engineering Low Level

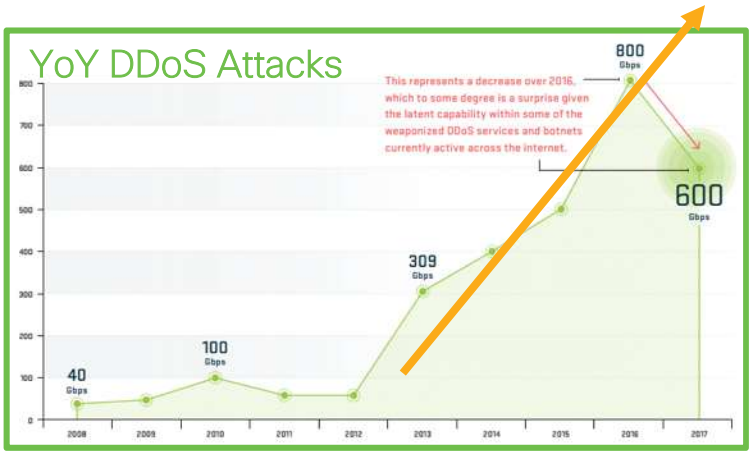


Peering Security

Your network is under attack, and Peering is the gateway



Source: Arbor 2018 Worldwide Infrastructure Security Report



Source: Arbor 2018 Worldwide Infrastructure Security Report

Route Hijacking in 2017

13,935 route leaks and hijacking incidents
38% were considered attacks

https://www.internetsociety.org/blog/2018/01/14000-incidents-2017-routing-security-year-review/

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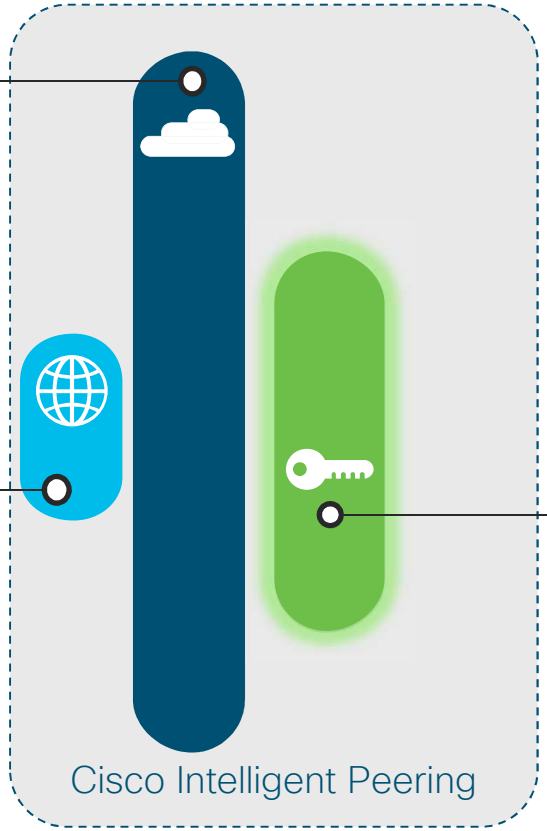


Security

- Trusted Hardware
- IOS-XR Control and Data Plane Security
- DDoS Protection
- Crosswork Network Insight BGP Analytics and Monitoring

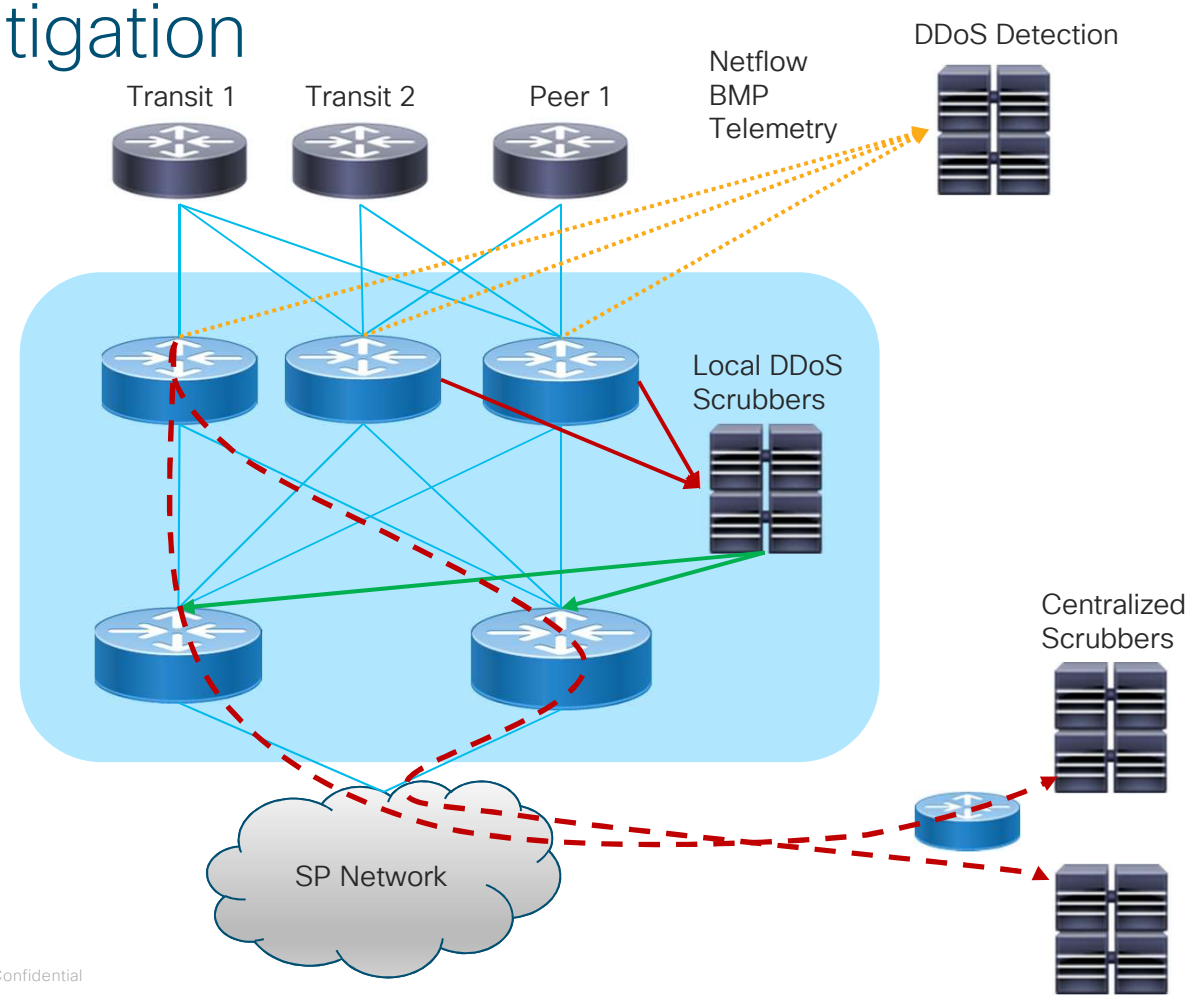
Cisco Intelligent Peering – Security

Leading 2017 SP Concerns*	Cisco Peering Solutions			
DDoS Attack (88%)	Arbor DDoS Mitigation Cloud and Local DDoS detection and remediation tool	BGP Flowpsec Automated Distributed Threat Filtering	Netflow @ 1:1000 Sampling High Rate of Traffic Flow Information for Analysis	User-Defined Payload Filters Granular payload filters for surgical mitigation at edge
Compromised Network (37%)	Trustworthy Systems Prevent supplier counterfeits and tampering	XR Control Plane Security Restricting access to network interfaces and packets	Arbor Threat Detection Real-Time visibility into threat activities	
BGP Route Hijacking (25%)	Crosswork Network Insight Real-time network health monitoring and remediation	RPKI BGP Route Origin Authorization BGP Prefix Origin ASN Validation		

* Arbor 2018 Worldwide Infrastructure Security Report – SP Survey

Peering DDoS Mitigation

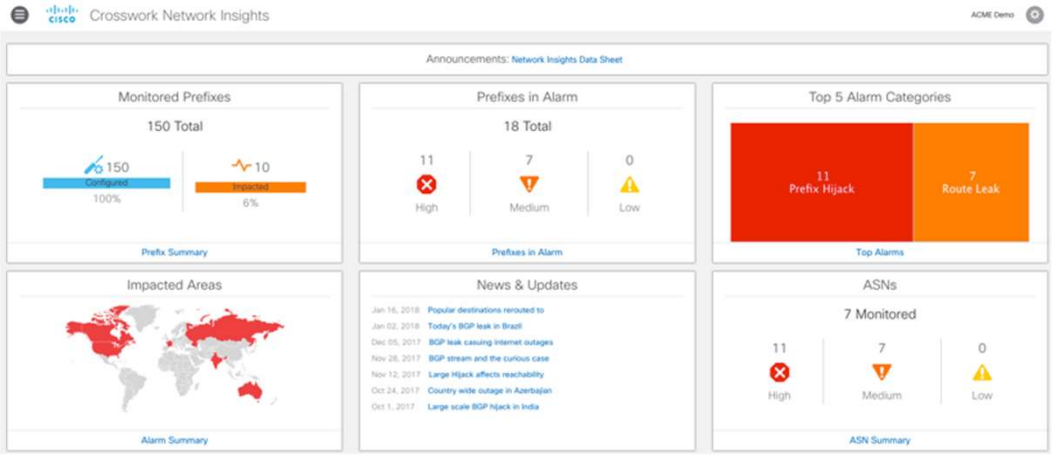
- Granular Netflow helps identify attacks faster
- High scale 5-tuple ACLs block high-volume identified traffic
- Full BGP Flowspec support for automated traffic filtering, policing, and redirection
- SR-TE to steer and load-balance traffic to end scrubbers

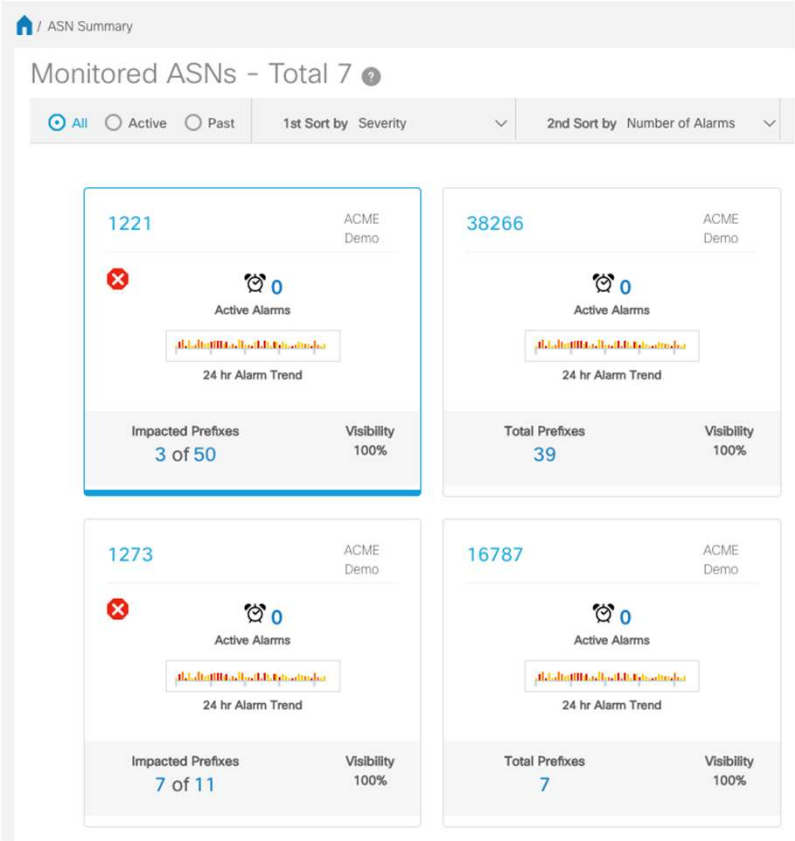


Address Route Hijacking using BGP Monitoring

Cisco Crosswork Network Insights

- Prefix and ASN monitoring to identify BGP prefix anomalies including **prefix hijacking**
- Global Internet BGP monitoring reveals scope and impact of Internet BGP routing events

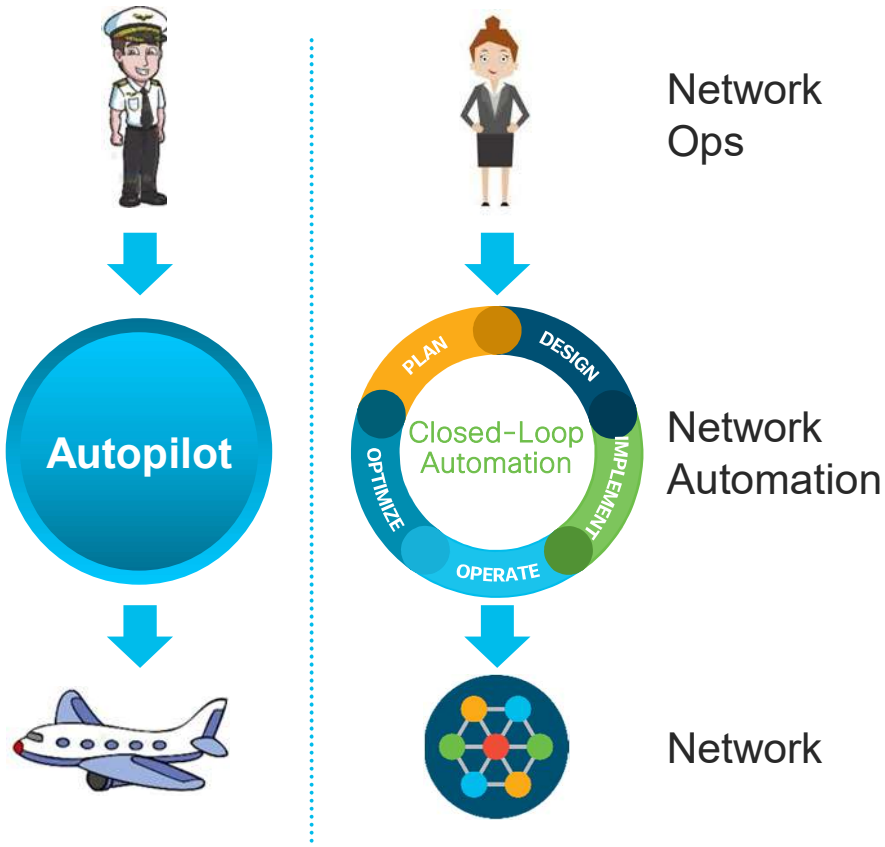




*Crosswork Network Insights Screen Shots

Automation & Analytics:

Not to Replace, but Enhance Value



Peering Locations and Devices Require Automation

What's the Shortcoming

- Incomplete and slow data collection from many locations and devices
- Monitoring individual routers or locations gives a fragmented network routing view
- Lack of centralized real-time and historical BGP routing data
- Traditional peering data lacks real-time agility to operate faster with reliability

New approaches

What's Needed

- A better way of getting router metrics than SNMP
- A tool to collect BGP prefix data and unify the view for route analysis at scale
- Route event visibility past, present, and trending to identify immediate issues and plan for future growth
- Automatic response and automation of tasks

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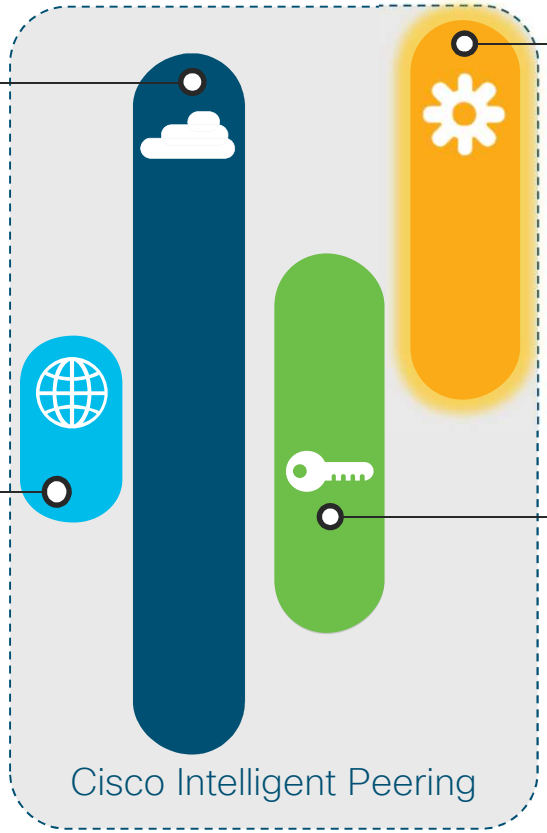


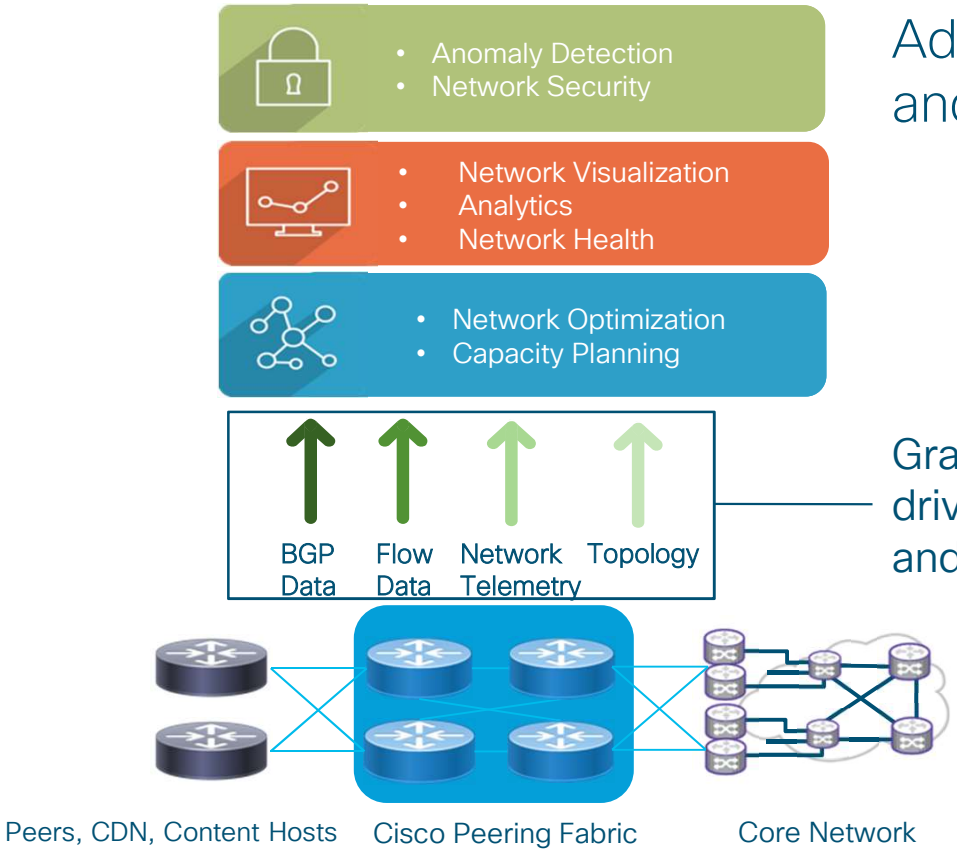
Peering Automation

- High-Frequency Network Data
- NSO Peering Service Models and Task Automation
- Crosswork Network Insight

Security

- Trusted Hardware
- IOS-XR Control and Data Plane Security
- DDoS Protection
- Crosswork Network Insight BGP Analytics and Monitoring

Cisco Intelligent Peering – Extracting Data



Advanced automation, analytics, and visibility requires network data

Granular periodic and event driven data @ much higher scale and speed vs SNMP

Peering Automation Using Cisco NSO

- Peer Management
- Peering Telemetry Deployment
    - Deploys peering-specific Model-Driven Telemetry and BMP
- Peering ACL Deployment
- Peering AS-Set and Prefix-Set Deployment
- Peering Route-Policy Deployment
- Netflow Enablement

Deployment services can load templates with pre-defined policies or allow the creation of new elements for deployment to peering nodes.

Peering Automation

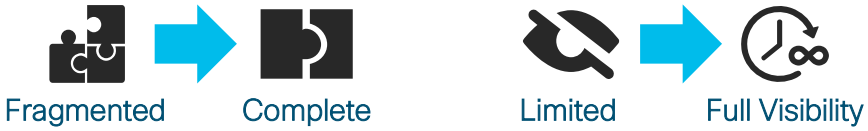
Peer Management Service

- Manage peering sessions like any other service typej
- Configures interfaces and BGP using recommended attributes and configuration

```
services peering-service test-peer-1
 pfl-list pfl1
  peer-interface-type Bundle-Ether
  peer-interface-id   1
  member-interface member-interface-type TenGigE
  member-interface bundle-mode on
  member-interface bundle-member 0/0/0/1
  !
  member-interface bundle-member 0/0/0/2
  !
 !
!
```

```
admin@ncs(config)# show configuration
devices device pfl1
 address 192.168.100.101
 device-type cli ned-id cisco-ios-xr
!
services peering-service test-peer-2
 pfl-list pfl1
  peer-interface-type   TenGigE
  peer-interface-id     0/0/0/1
  int-ipv4-address      1.1.1.1/30
  service-policy        reset-ipp
  ipv4-in-access-group  peer-interface-in
  ipv4-out-access-group peer-interface-out
  bgp-id                65000
  peer-bgp-neighbor 1.1.1.2
   bgp-description  Peer #1
   remote-as        65501
   neighbor-group   peers
   in-route-policy  peer-in
   out-route-policy peer-out
  !
 !
!
```

What Can Peering BGP Data Show You?



Cisco Network Insights provides network operators insightful **real-time** and **historical** BGP **routing data analytics** to enhance operations and **reduce** the **mean time to repair**

Routing Operational Assistance	Routing Security	Planning & Optimization Assistance	Routing Analytics
Topology	Collaboration Tool Integration	IP & ASN Asset Protection	Internet Registrar Integration

Network Insight Monitoring

Example from Spark room notifications

spnaa-cto-ni Yesterday, 9:53 AM

⚠️ *Monitored ASN*: **37215** (MAREN, MW) **Country**: MW

- **2018-06-04 13:45:45.159** - Origin 37215 withdrawn for prefix 41.70.16.0/20 : Possible outage (No longer active) [**Prefix History**]

spnaa-cto-ni Yesterday, 10:03 AM

⚠️ *Monitored ASN*: **37215** (MAREN, MW) **Country**: MW

- **2018-06-04 13:52:41.000** - Origin 37215 withdrawn for prefix 41.70.16.0/20 : Possible outage (No longer active) [**Prefix History**]

⚠️ *Monitored ASN*: **49206** (PeakFactory, a MSP on IPTV, OTT and VOD with it_s own CDN, NL) **Country**: NL

- **2018-06-04 13:58:50.000** [Offending ASN] - New upstream 60068 detected for prefix 185.41.49.0/24 affected origin 49206 : Possible Leak [**Prefix History**]

⚠️ *Monitored ASN*: **262493** (Global Tech Internet Banda Larga EPP - ltda, BR) **Country**: BR

- **2018-06-04 13:49:51.000** [Offending ASN] - New upstream 28287 detected for prefix 177.55.48.0/20 affected origin 262493 : Possible Leak [**Prefix History**]

Cisco Intelligent Peering Resources

Cisco Peering Fabric 1.0 high level design:
https://xrdocs.io/design/blogs/2018-05-08-peering-fabric-hld

Cisco NCS 5500 information:
https://cisco.com/c/en/us/products/routers/network-convergence-system-5500-series

Cisco Crosswork Network Automation:
https://cisco.com/c/en/us/products/cloud-systems-management/crosswork-network-automation

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