The bridge to possible

SP Service Creation & Edge Transformation

Brian Meaney, Cisco Distinguished Architect

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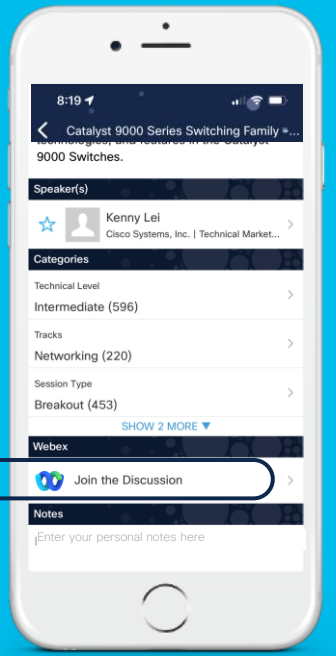

Agenda

- Market Trends
- SP Organizational & “Service” Evolution
- Network Platform – Network Company ”NetCo”
- Service Creation – Service Company “ServCo”
- Summary

Market Trends: Beyond Connectivity

Economic Value Creation

Hot Topics in MWC22: IoT and Private Networks, B2B Offering

GSMA leaders say this is a new era of hypersector collaboration

Multiple private network announcements from SPs, vendors and hyperscalers, like Microsoft, AWS

Sovereignty & Resilience

92% of data from the West is hosted in the US

EU concerned its citizens, businesses and governments are losing control over their data, capacity to innovate, and ability to enforce legislation

New digital economy could amount to €2.2 trillion in the EU by 2030

Sustainability

40% of the Net 0 goals can be achieved by using mobile solutions in energy, transport, building and manufacture industries alone

Telecoms committed to Net 0 by 2025

GSMA leaders state there's no energy transition w/o digitalization, there's no digitalization w/o telecoms

Traffic growing 50% per year

Telecoms to invest $600B CAPEX until 2025, of which 85% will be in 5G

Digital technologies are a powerful growth engine

Digitalization could create $100 trillion of value across multiple industries over the next decade

SP Organizational & “Service” Evolution

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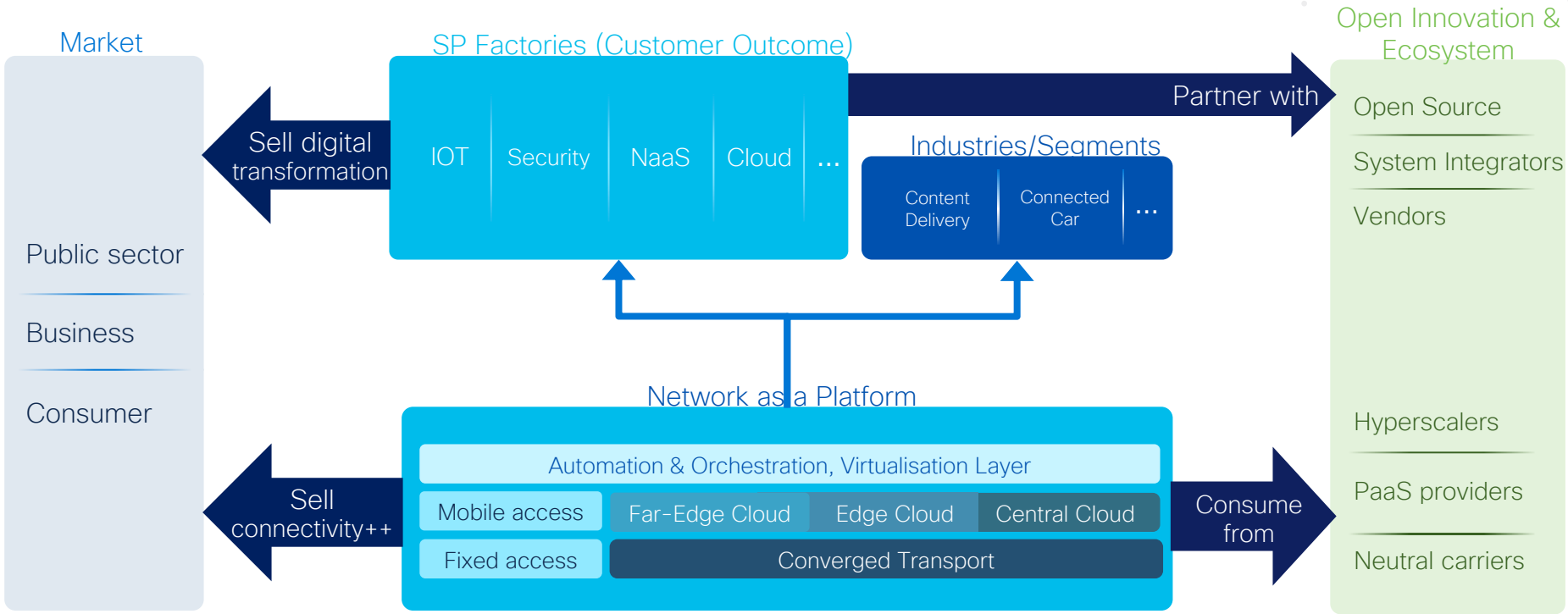
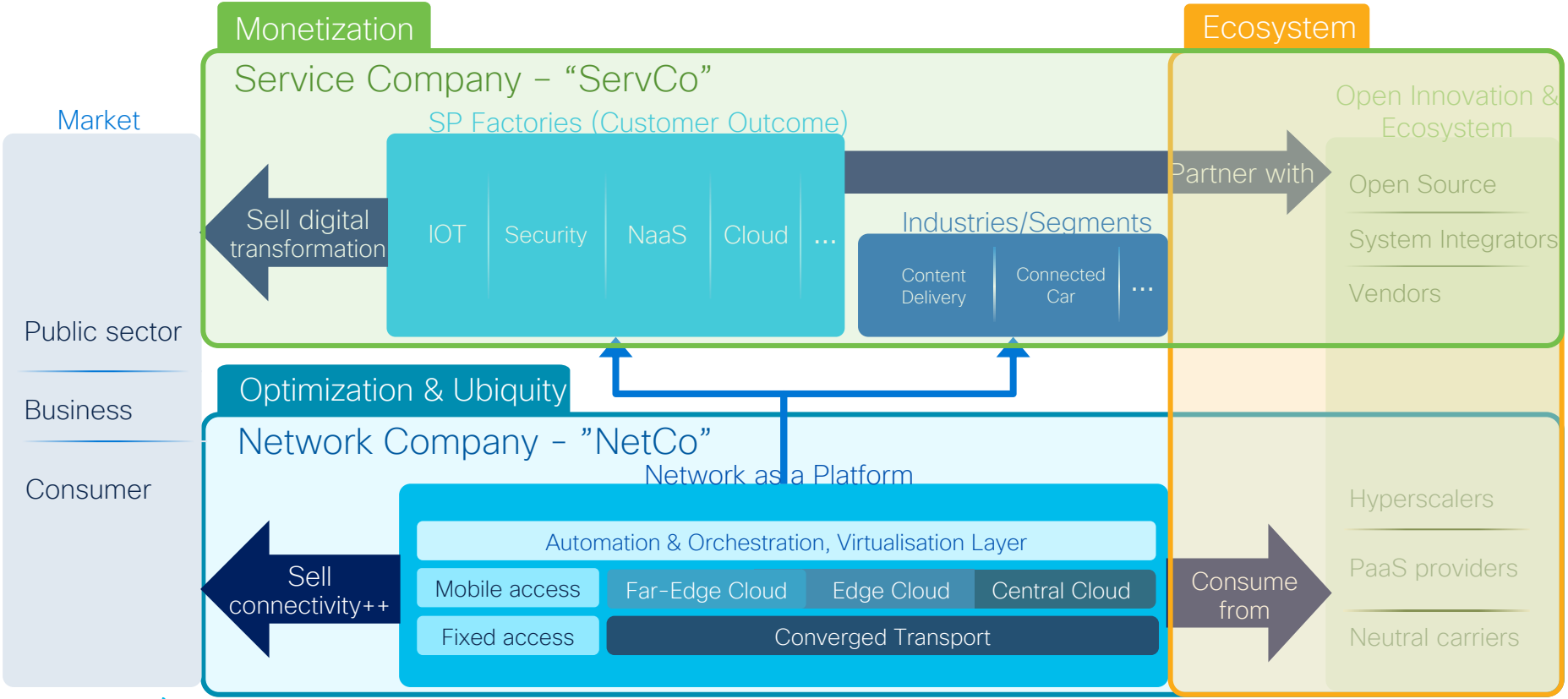
SP Org. Evolution – Service & Network Layer Separation



Critical Factors in SP Organisational Redefinition

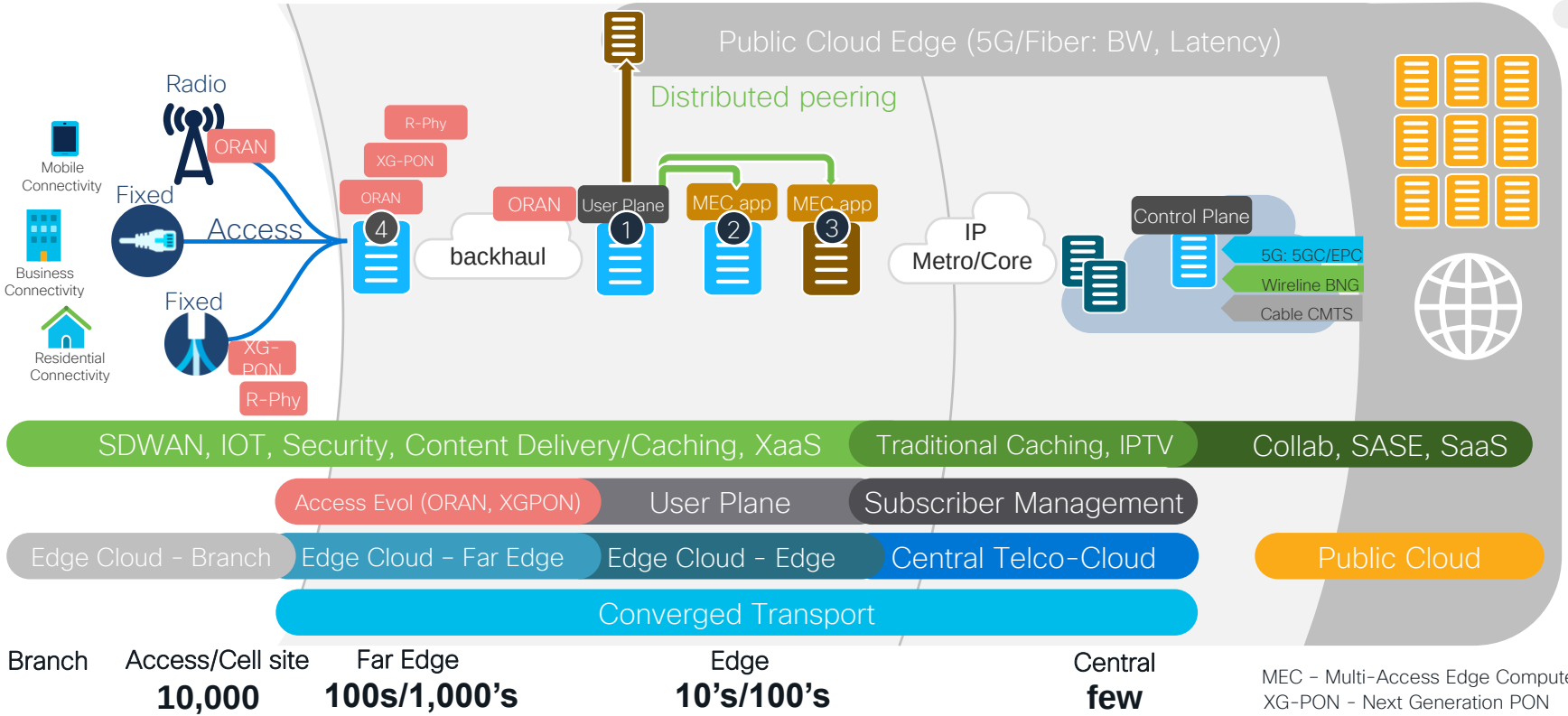


Scale of applicability

“Service” Classification & Implementation Models

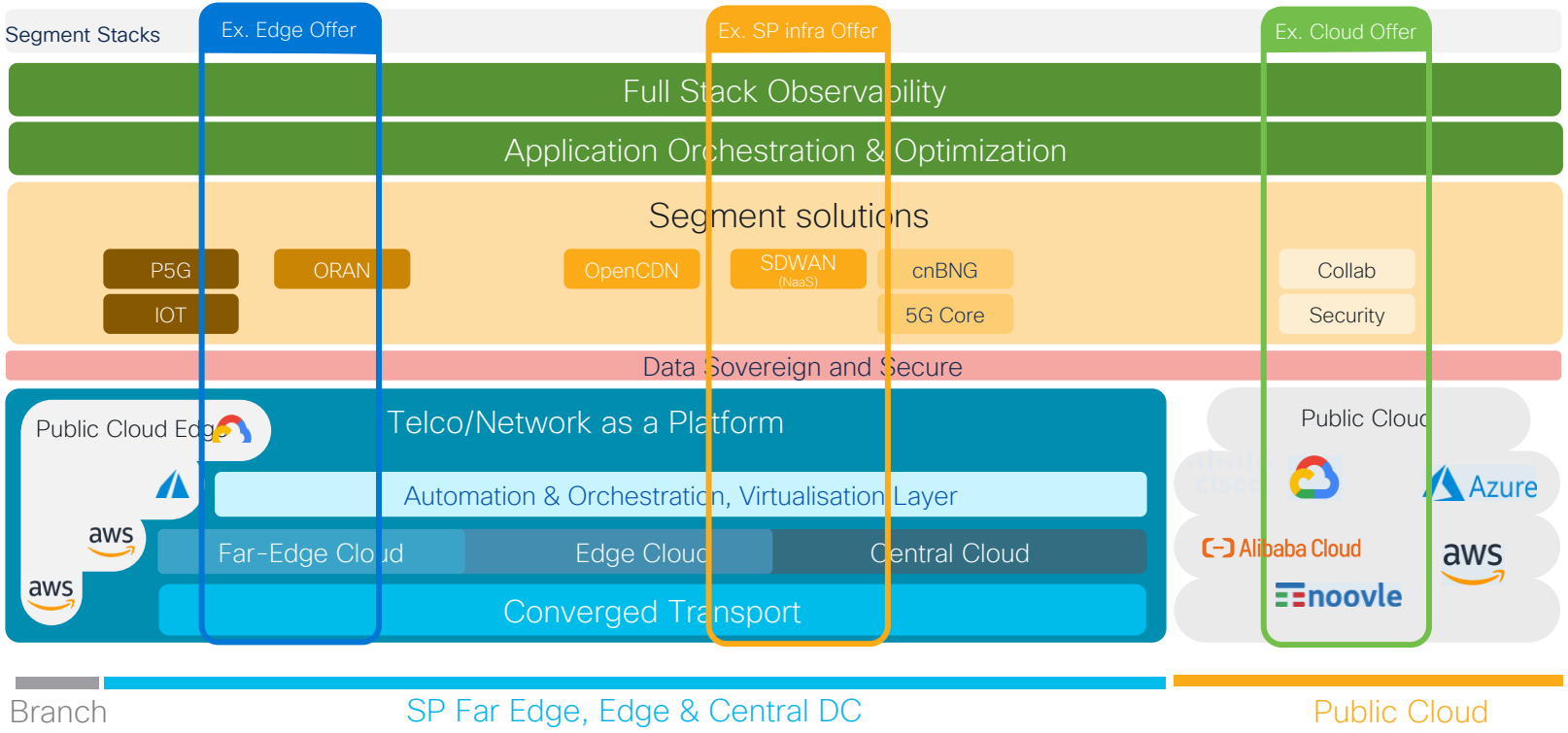
	“SP Owned” Private Stack option	SP/Hyperscaler Hybrid Stack option	Hyperscaler Public Stack option
SP Infrastructure vRAN / Cloud RAN, CUPS/ Decomposed Mobile Packet Core, CUPS based BNG, (v)OLT, vCMTS with R-PHY etc	✓	✓	✓
Operator Branded/Franchise Services Content streaming via CDN, Live TV with CDN, IOT, AR/VR based services etc.	✓	✓	✓
Services to Businesses (B2B), IT, aaS Online Gaming, Connected Vehicle, P5G, IOT Services, SaaS, Public Cloud Hosting, 3rd Party App hosting, Edge Analytics	✓	✓	✓

Where is the Service Edge for these “Services”?

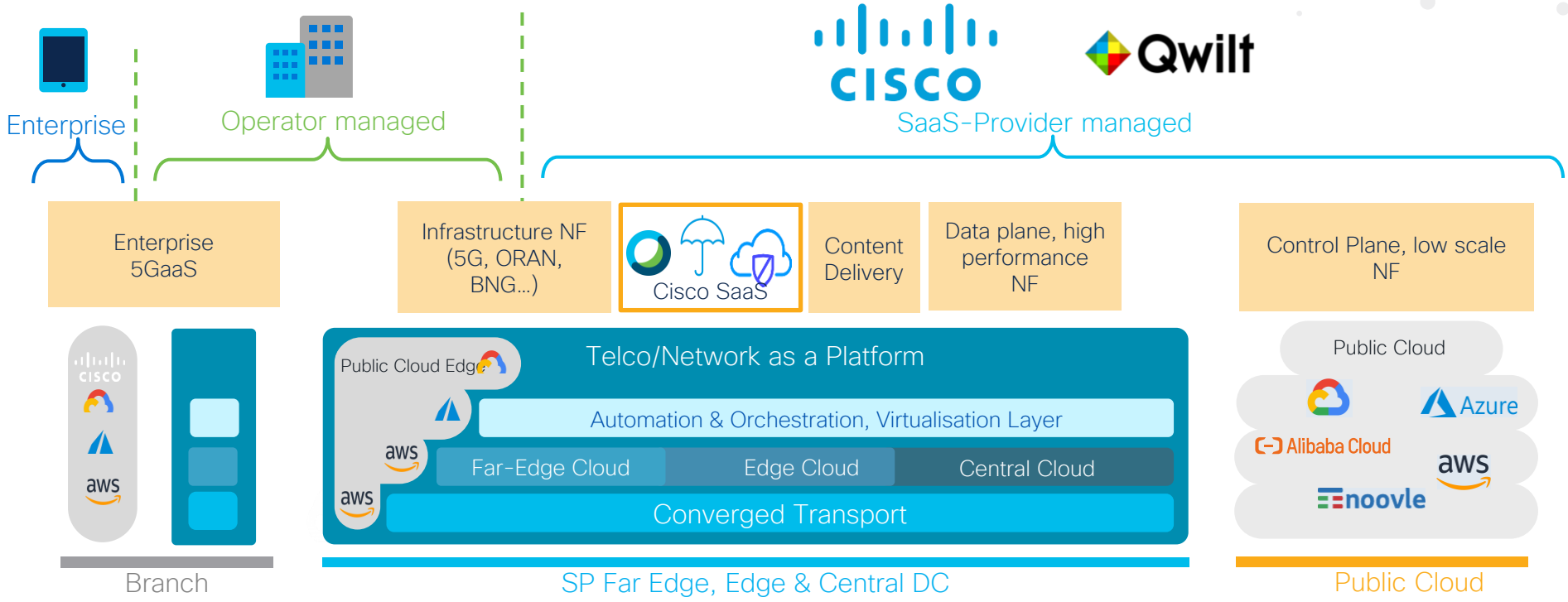


MEC – Multi-Access Edge Compute
XG-PON – Next Generation PON
ORAN – Open Radio Access Network

“Service Factory” Offering with Platform Flexibility



“Service” Operating Models – Different Revenue Model



Network Platform "NetCo"

Optimization & Ubiquity

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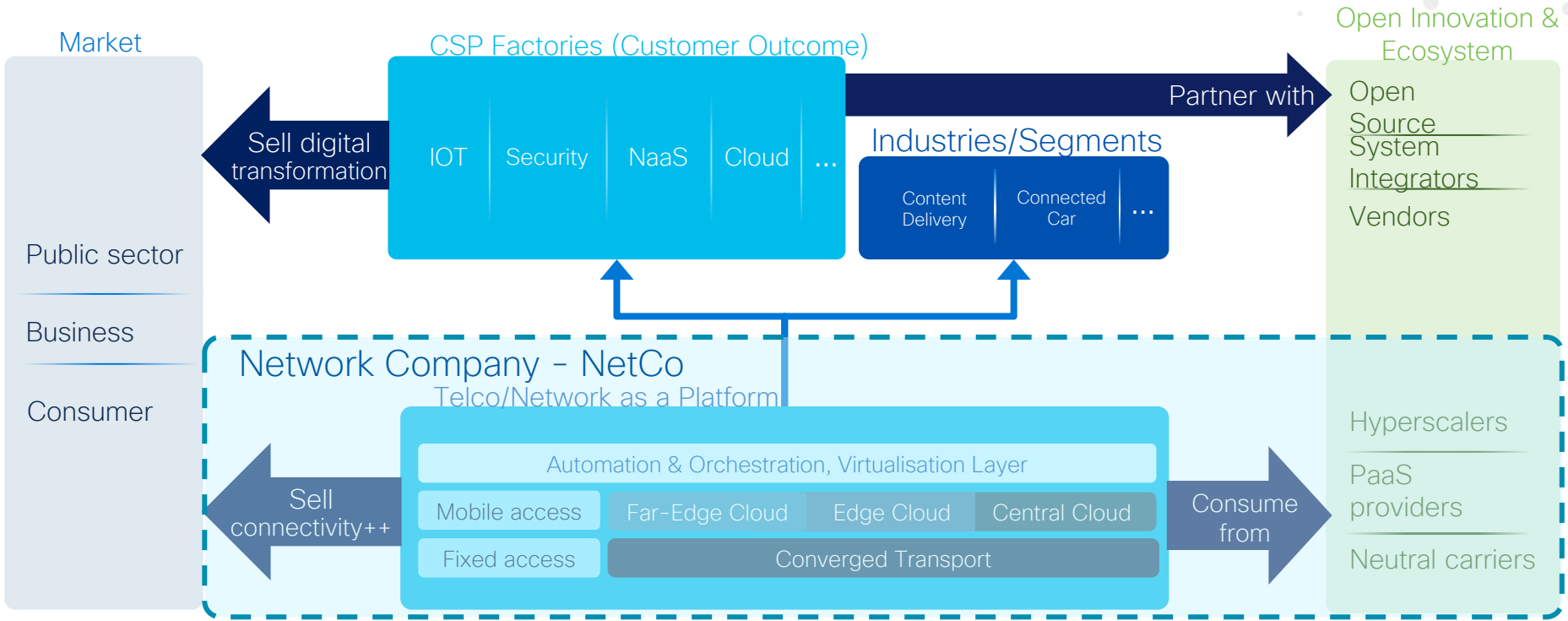
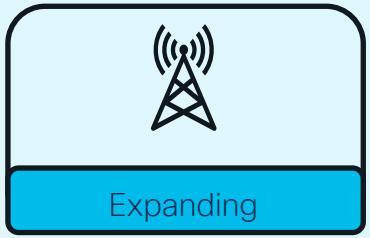
NetCo – Network Platform



Network Enabling Evolving Needs

Mobility

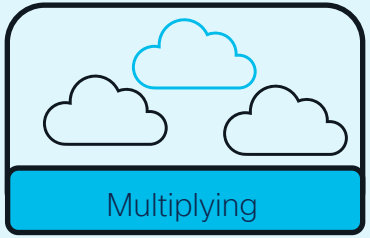


Private/Public 5G

MEC/IOT applications using real-time communications

Distributed telco workloads (e.g, ORAN, User Plane Function (UPF))

Cloud

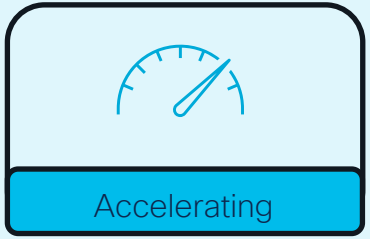


Public/Private/Hybrid

Multi-cloud

Edge clouds (far-edge, edge)

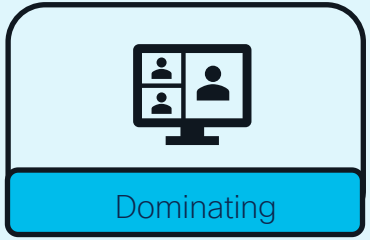
Broadband



Higher user access speeds across fixed & mobile

Services driving broadband (SD-WAN, Hybrid Work, SASE)

Video



Bandwidth-intensive latency-sensitive applications

Distributed CDN

Evolving Network Requirements

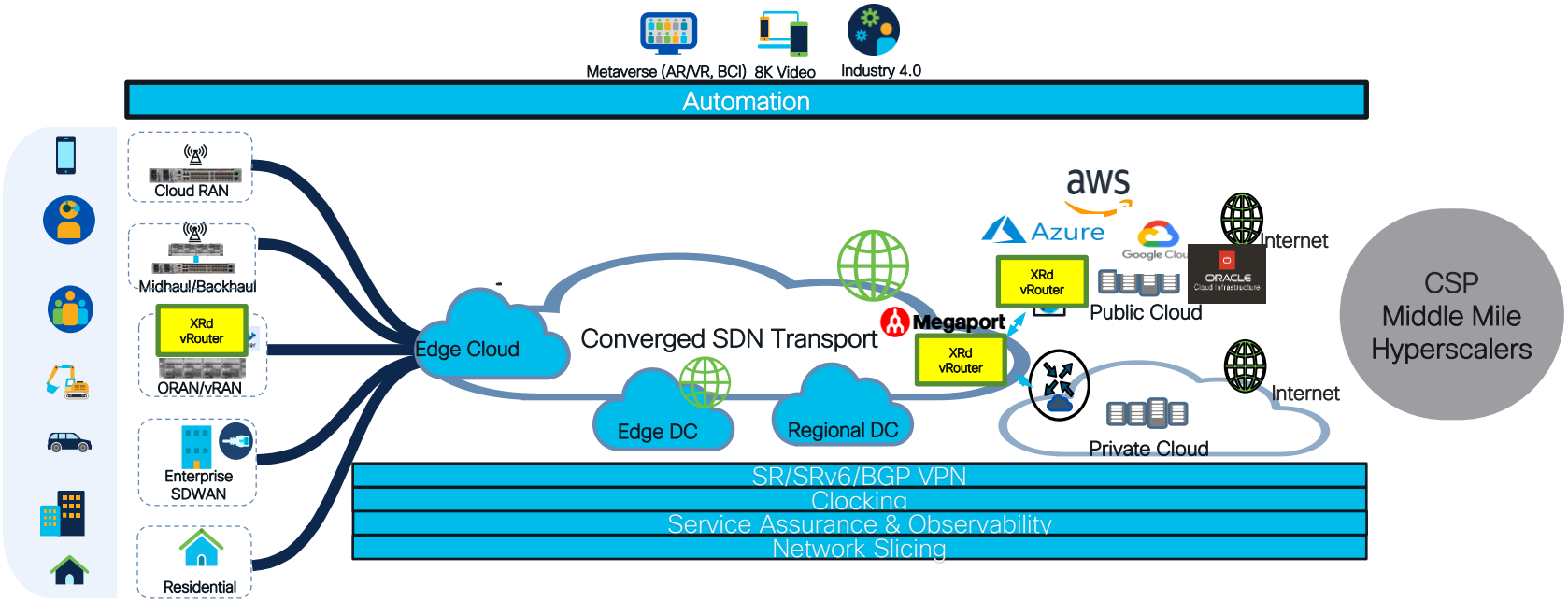
Latency/Priority Control

High Performance/Scale

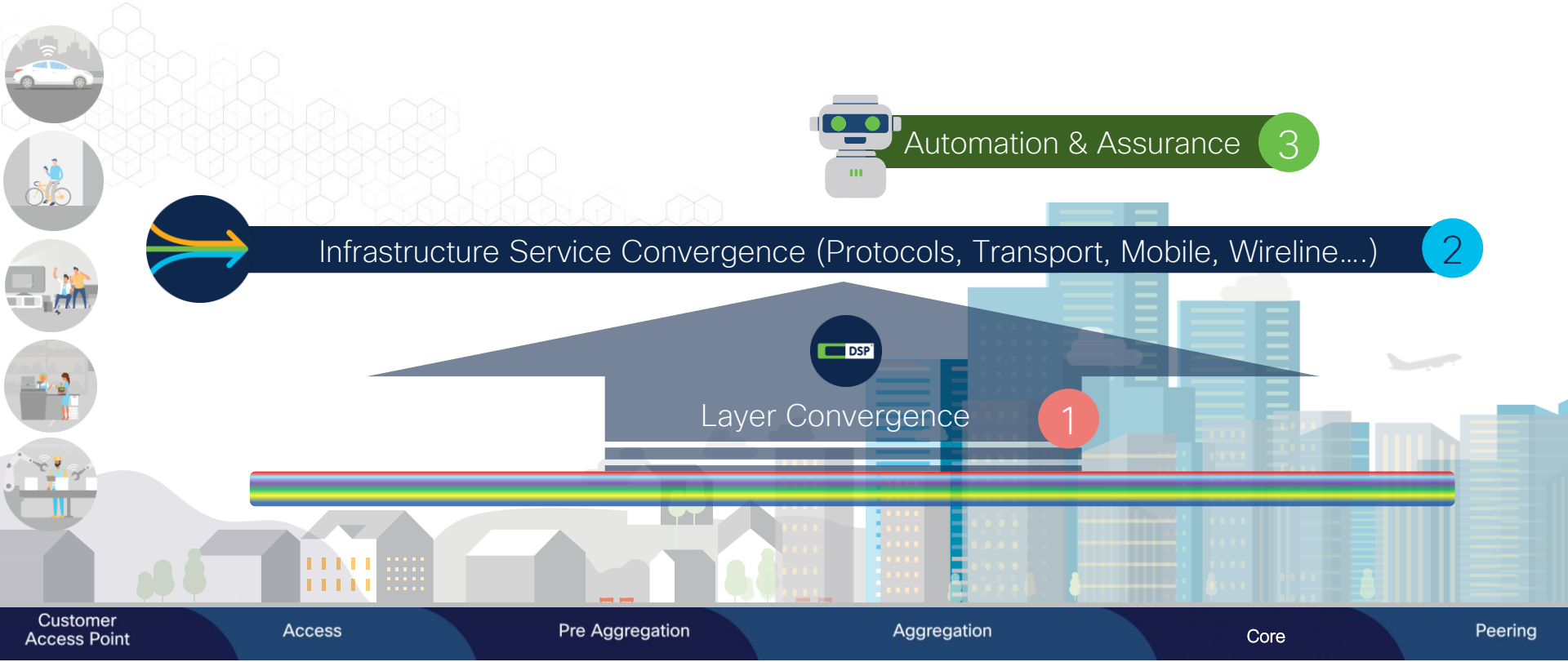
Automated

Flexible Service Placement

Cloud-Ready Converged Network



Path to Optimisation and Ubiquity



Routed Optical Networking

IP & Optical Convergence

Sustainable Architecture

OPTICS

High speed pluggable

Small footprint Silicon photonics + CMOS wafer

Low cost

Low power

Standard and interoperable

Transponder → Pluggable Silicon Photonics

SILICON

2Tb in a single chip

Extremely Low power

No compromise on functionalities

3 times more efficient than any other existing chipset

Massively Scalable Silicon

SOFTWARE

IP and Optical

Segment Routing

Openconfig

Telemetry

Packet and circuit transport services

Cloud Enhanced application

AUTOMATION

Multi Layer IP and Optical

Open Standard Telemetry, Restconf/Yang, Openconfig, TAPI

Multi vendor IP and Hierarchical Controllers

IP+Optical Automation

Routed Optical Networking

End-to-End Architecture

Automation

Simplify IP & optical convergence

Multi-layer, multi-vendor

End-to-end visibility & assurance

Service Convergence

Circuit and PLE services over IP/MPLS

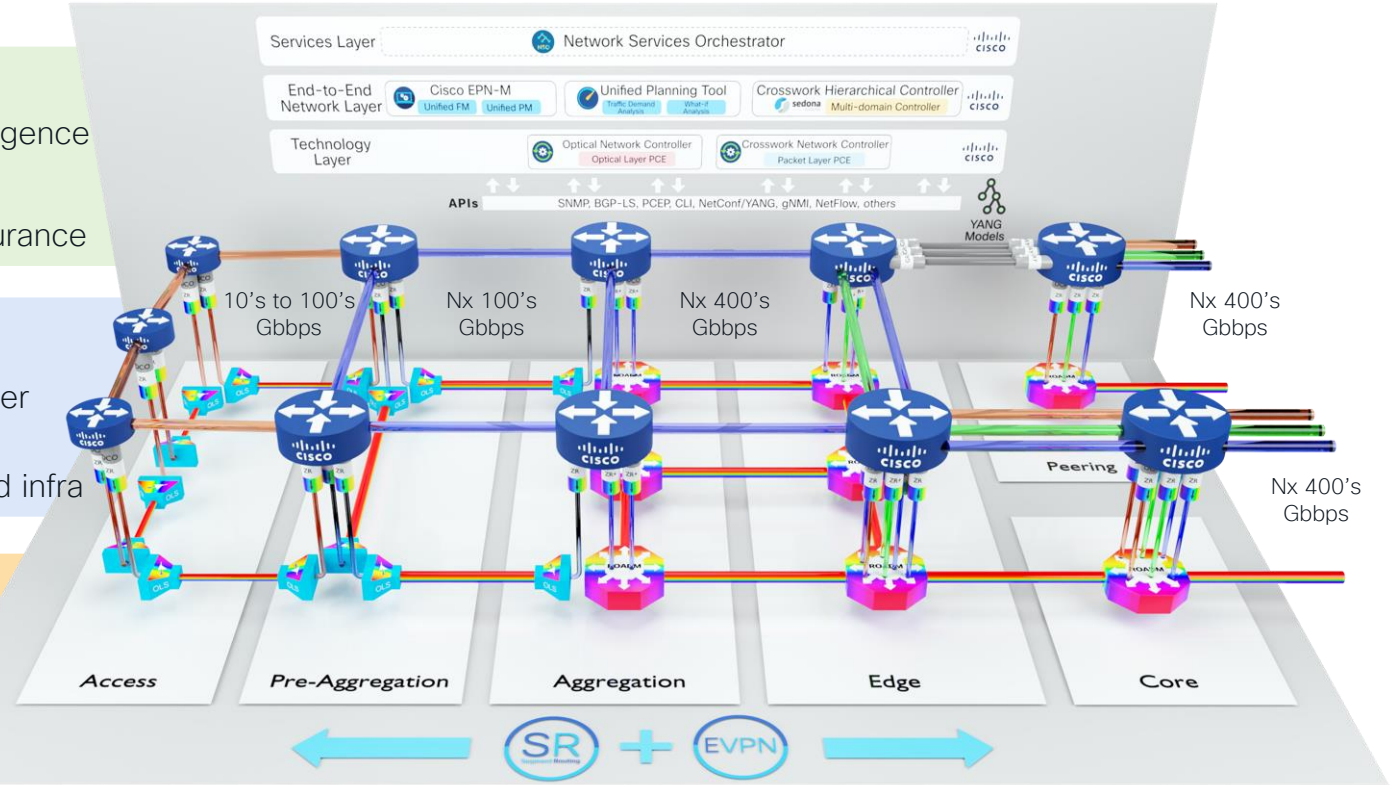
Any service over converged infra

Pluggable Innovations

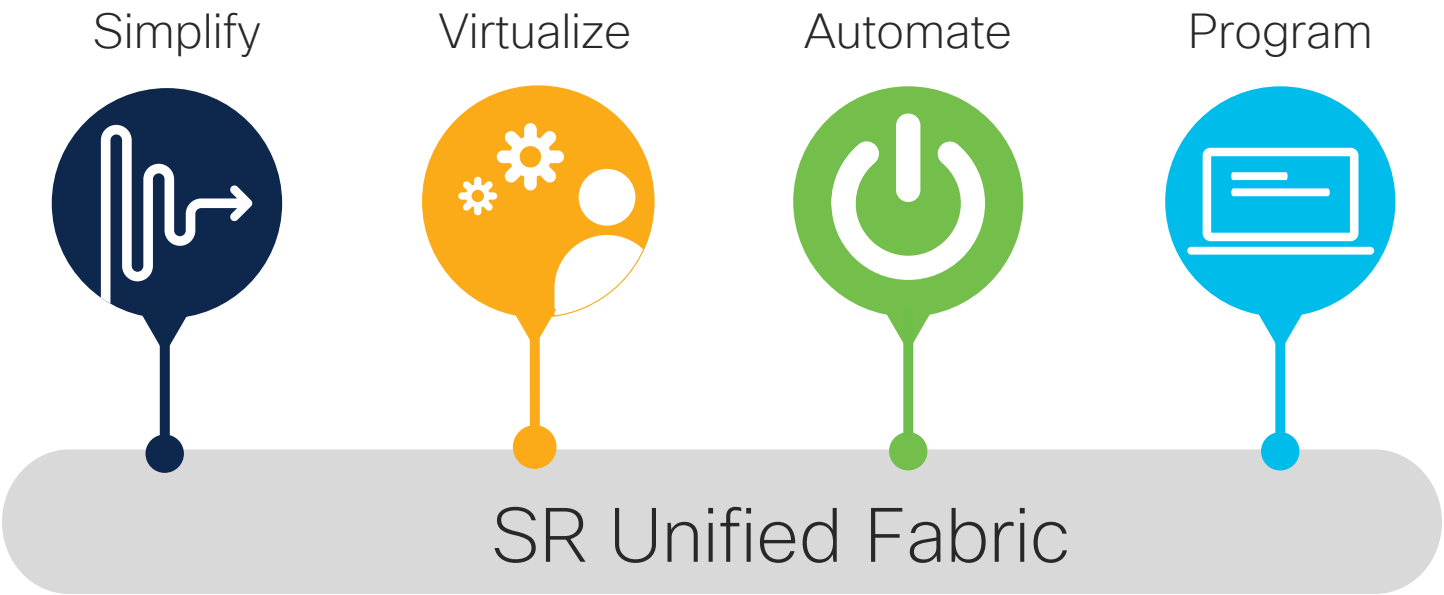
OIF 400ZR

OpenZR+ MULTI-SOURCE AGREEMENT

Bright ZR+ QDD OLS

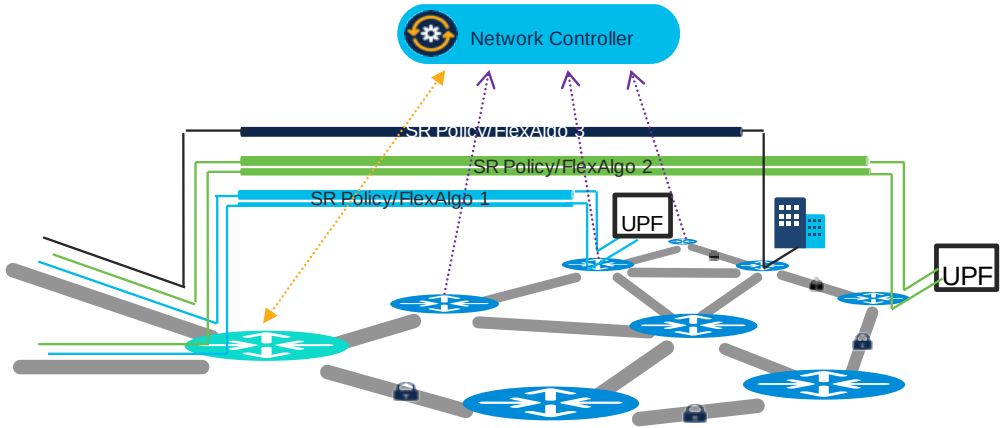


Common Platform for Any Service



New business capabilities built on the network as the platform;
Enabling customers to achieve business outcomes faster with ruthless ease

Enabling Slicing, Convergence,Flexible Placement



ODN and AS per Flow/destination

- Significant operational simplification
- Automatically builds the path
- Scalable – only used destinations are known
- Different flows to same destination, e.g, UPF, can be mapped to different slices

FlexAlgo

- Creates independent forwarding planes that natively deliver an SLA
- Different slices with similar transport requirements use same FlexAlgo plane
- Scalability with minimal state in the transport

SR Perf. Monitoring & Fast convergence

- Continuous monitoring of key infrastructure performance parameters (delay, loss, liveness)
- Actions can be automatically triggered to remediate/ensure SLA
- TI-LFA (Topology Independent) offering 100%-coverage 50-msec link, node, and SRLG protection

ODN: On-demand-next-hop; AS: Automated Steering

Segment Routing Evolution

SR-MPLS

Integration in existing install base with software upgrade

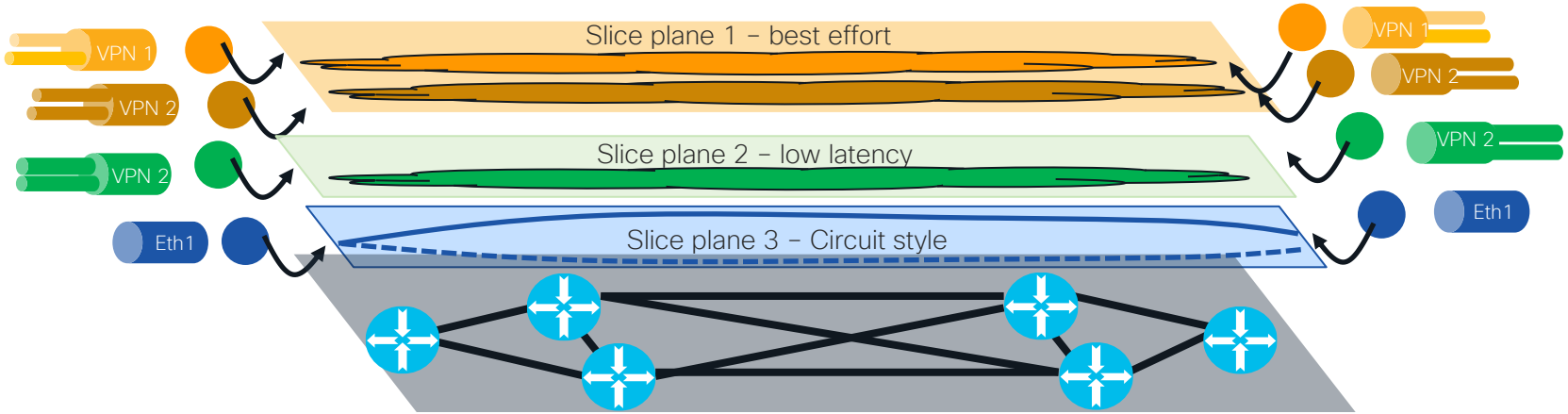
- Services unchanged (VPN's)
- Simple (no LDP, no RSVP, ODN)
- Automate Network Protection (Ti-LFA + uLoop)
- Rich operational automation (DPM, OAM, Perf Monitoring)
- Newer SLA with SR-TE
  - Multi-Domain TE
  - Low Latency
  - Disjointedness / Multi-plane
  - Bandwidth optimization
- SDN and 5G ready

SRv6

Requires SRv6-ready hardware

- Services integrated with transport
- Simpler (SR is in IPv6 Header)
- Automate Network Protection
- Enhanced operational automation
- Newer SLA with SR-TE
- Hyper Scale for 5G & IOT (Route Summarization)
- Network programmability for NfV
  - Network API to application developers via Segment Routing Header (SRH)
- Native SDN, NFV & 5G at hyperscale

Toolset for Transport Slicing and Multi-service



- Packet services (O-RAN WG9)
  - EVPN VPWS services for FH with priority queuing
  - BGP L3 VPN for O-RAN 7.2X M-Plane
  - BGP L3 VPNs for midhaul / backhaul control plane and user plane – 4G and 5G
- Circuit Style services
  - Controller computation with end to end b/w admission control and reservation

- Traffic pushed into correct transport slice plane
  - SR ODN and Automated Steering
- Forwarding behaviours with SR policies, FlexAlgo, QoS and admission control
- Monitoring transport and & layers (SR PM, VPN PM)
- A single slice could involve multiple VPNs, Data Plane, Control Plane, N6 / GiLAN

Network Slice Innovation

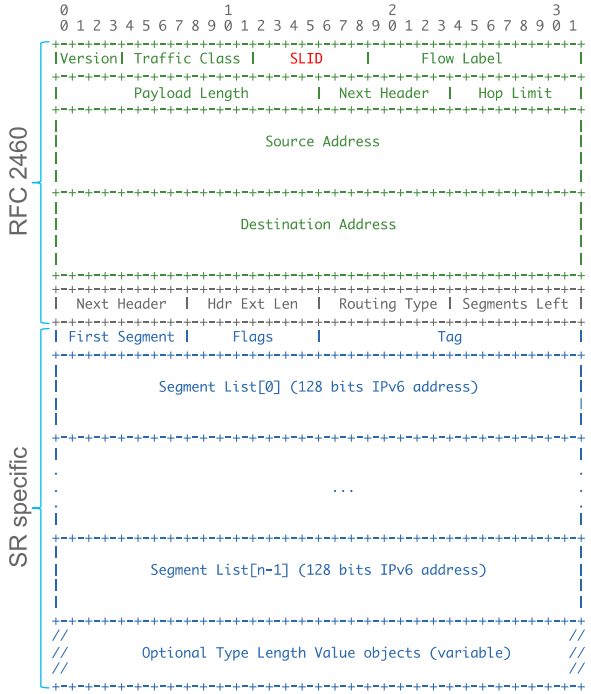
IETF

The Segment Routing specification already contains the various building blocks required to create network slices. This includes the following.

- SR Policy with or without Flexible Algorithm.
- TI-LFA with O(50 msec) protection in the slice underlay.
- SR VPN.
- SR Service Programming (NFV, SFC).
- Operation, Administration and Management (OAM) and Performance Management (PM).
- QoS using DiffServ.
- Stateless Network Slice Identification
- Orchestration at the Controller.

draft-ali-teas-spring-ns-building-blocks-01

Building blocks for Network Slice Realization in SR



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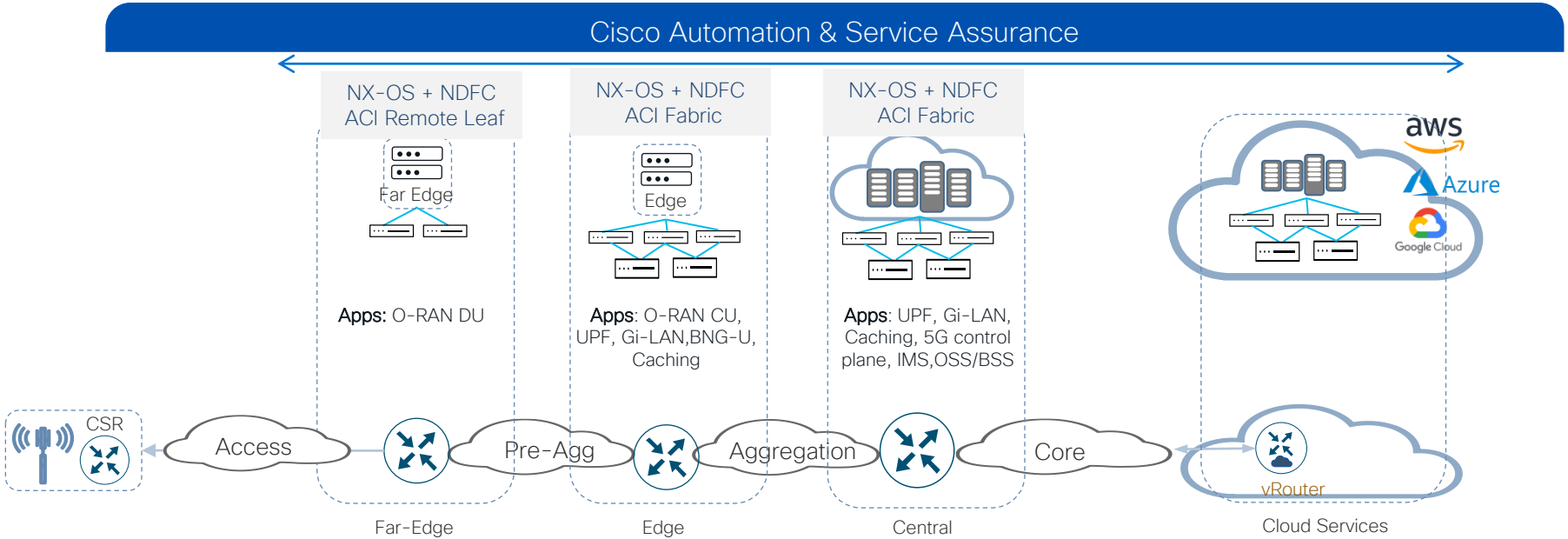
Stateless & Scalable Network Slice Identification for SRv6

Distributed and Common Telco Cloud Platform

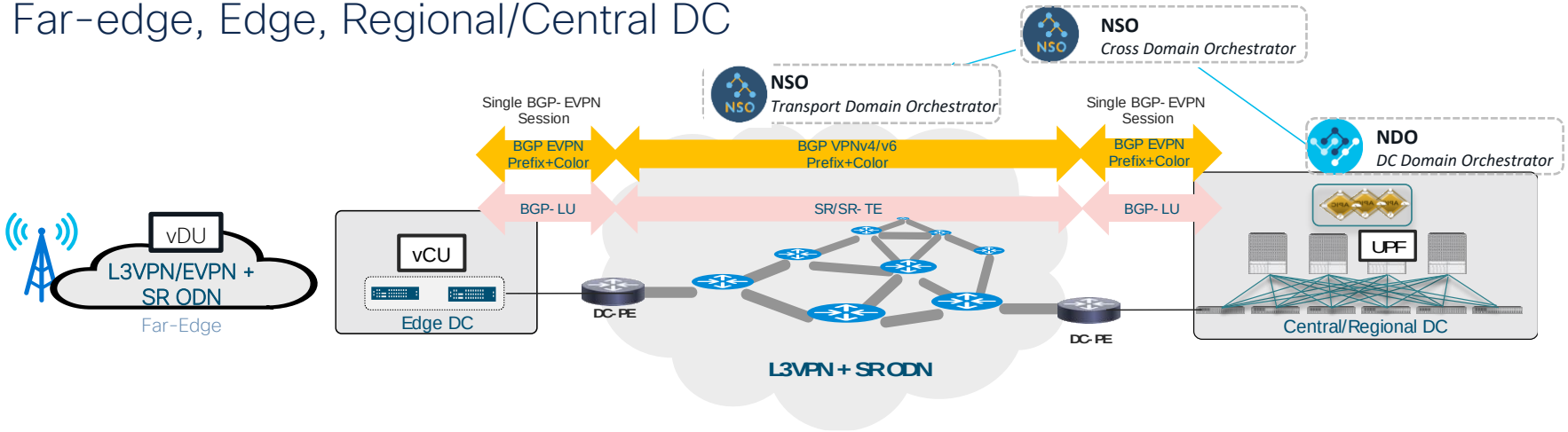
Multiple Fabric Scale and Topology Options



*NDFC – Nexus Dashboard Fabric Controller

Seamless Integration Transport and DC Fabric

Far-edge, Edge, Regional/Central DC



SR Handoff

- Seamless Telco DC interconnectivity with the WAN, extending dynamic/fine grained policies from the DC to the transport
- Single control and data plane integration point
- Simplifies Network Slicing deployment across 5GC, transport and RAN
- Increasingly relevant with ORAN/UPF/App distribution – emerging edge cloud

Extending Connectivity to the Cloud

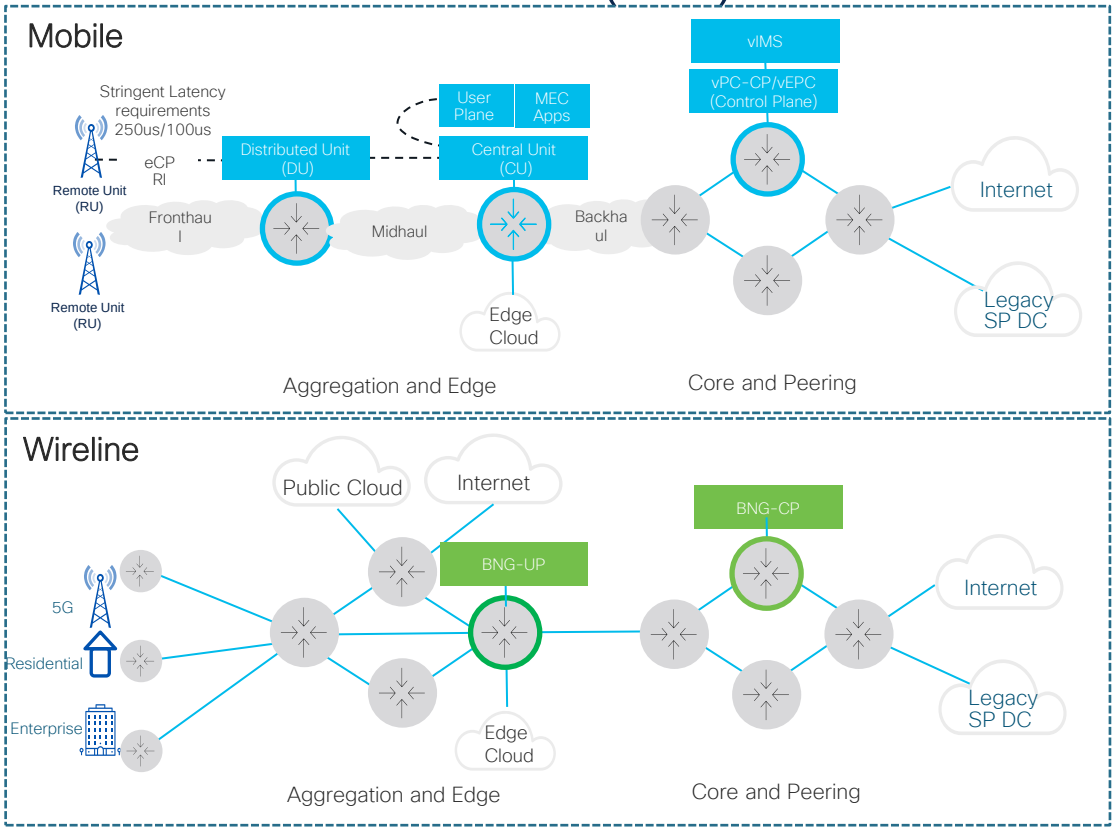
Growing Telco – Public Cloud partnerships: telco workloads and telco offered B2B services running in hybrid cloud and multi-cloud

Telco traditional capabilities still required: HA, SLA commitments, traffic segregation and differentiation

Path control and visibility extended to the public cloud: create an overlay routing service over public cloud providers with end-to-end Segment Routing (SR)

Cisco Virtual Routing portfolio integrated with hyperscaler stack extends SP converged network into the cloud

Service Provider (SP) Architecture shift



Trends

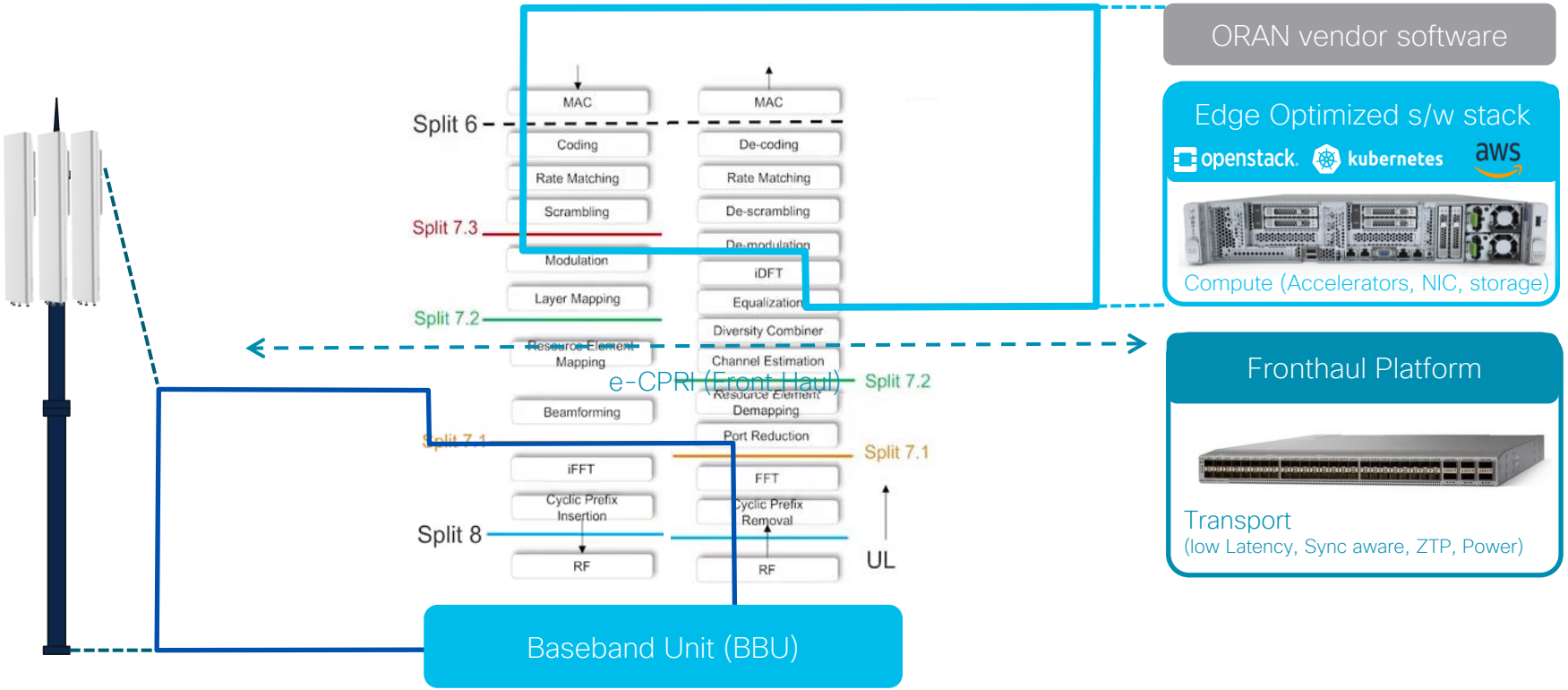
- Moving applications/content closer to users - SP services and cloud handoff moving to Agg/Edge
- Growth in broadband driven by hybrid work, SASE, and higher user speeds
- CapEx/OpEx pressures driving convergence of wireless and fixed IP, TDM and optical networks

Implications

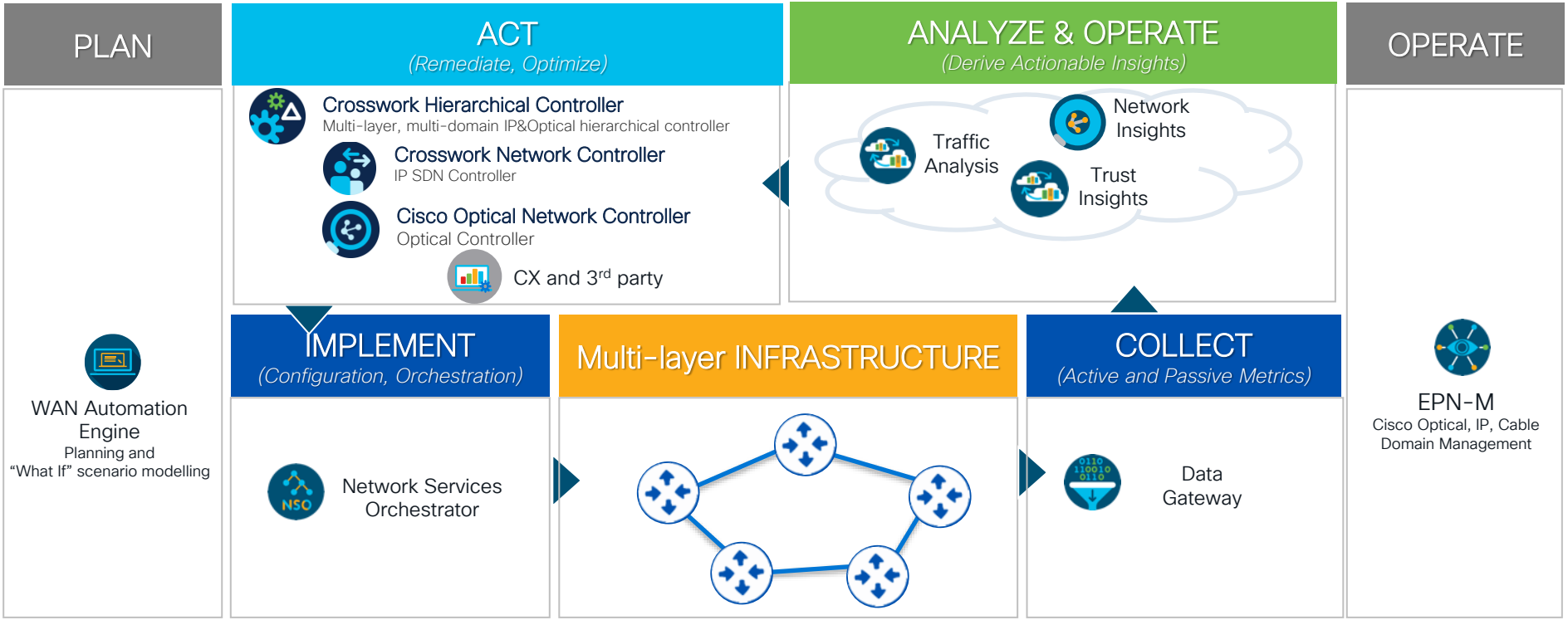
- Traffic concentration in Agg/Edge
- Agg/Edge as new point of service delivery
- Shift to converged, service-rich, Agg/Edge networks
- Subscriber GWs distribution

BNG – Broadband Network Gateway
EPC – Evolved Packet Core
RU – Remote Unit
DU – Distributed Unit
CU – Central Unit
UPF – User Plane Function

Open RAN (ORAN) pushing Cloud to Far Edge



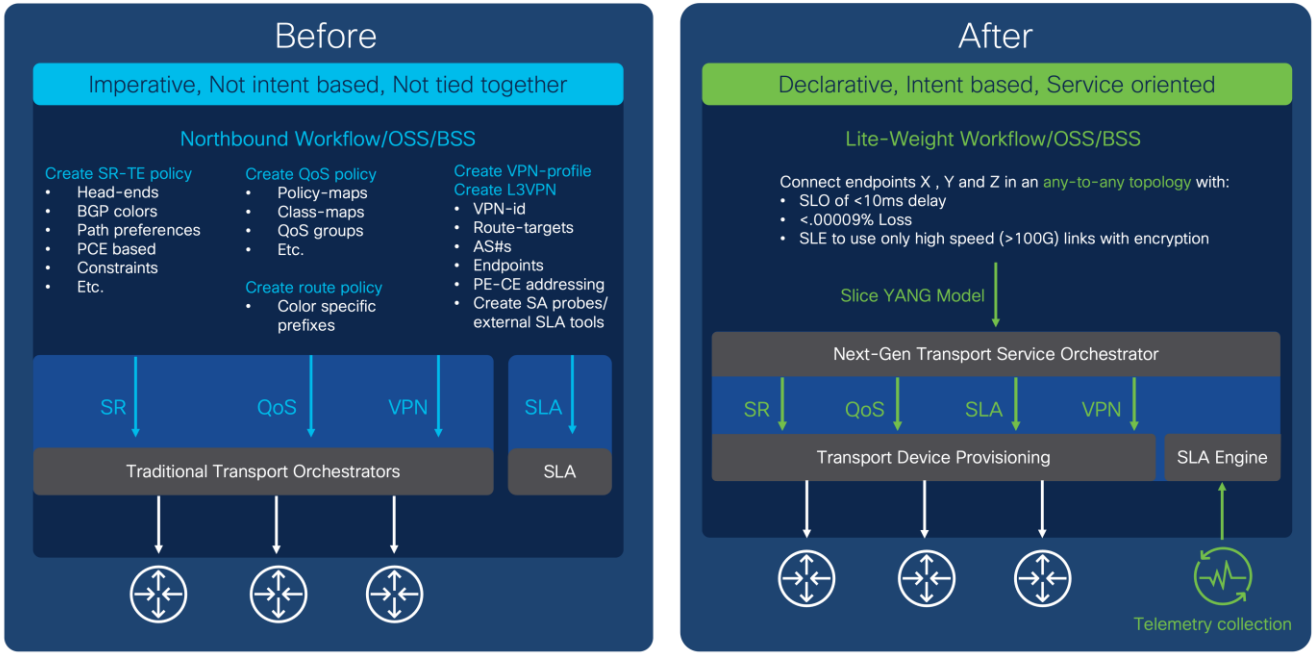
Cisco SP Network Automation End-to-End



Enhanced Standardized Programmability

IETF Network Slice Service YANG Model - draft-ietf-teas-ietf-network-slice-nbi-yang.

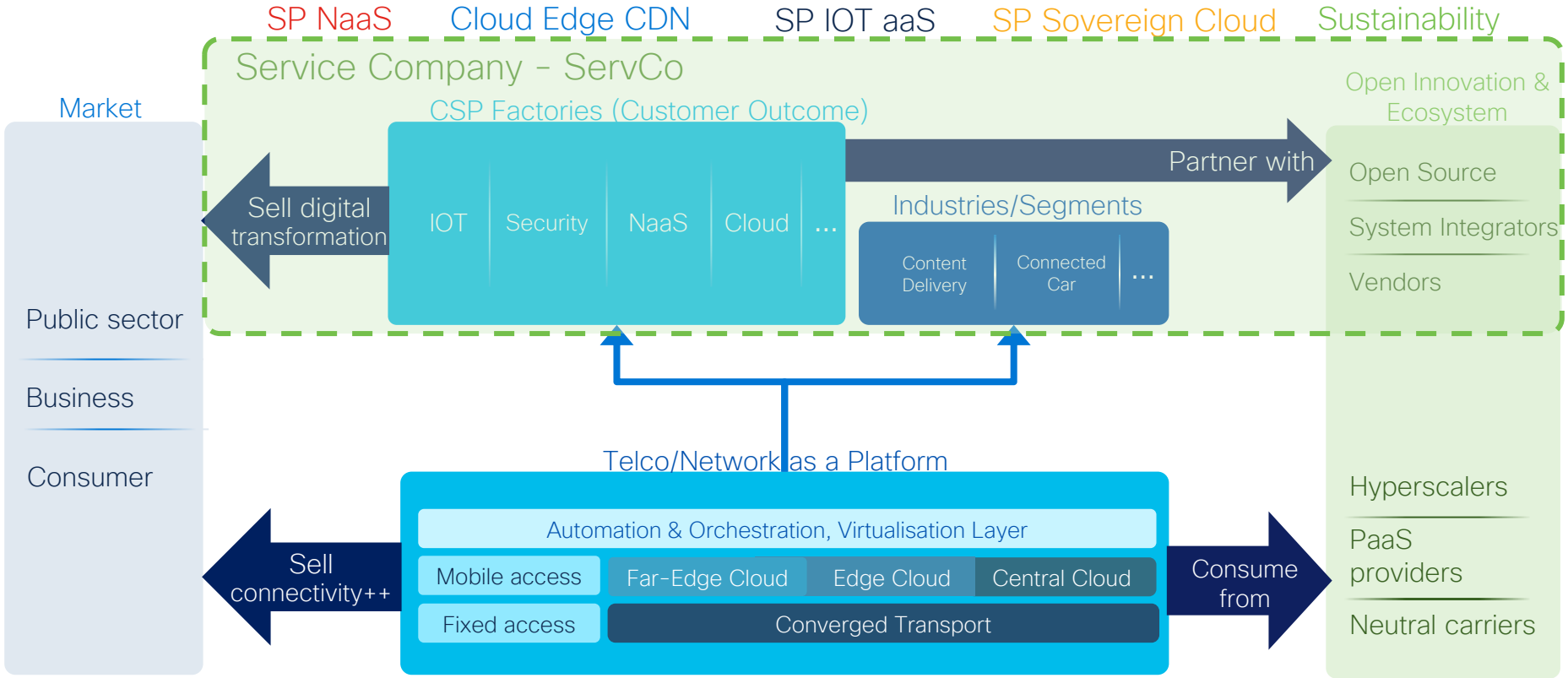
Abstracting the Service Intent



Service Creation
“ServCo"
Service Factories

ServCo - Service Creation

"Service Factory" solutions for internal use, for 3rd Party or direct to end-users



SP NaaS

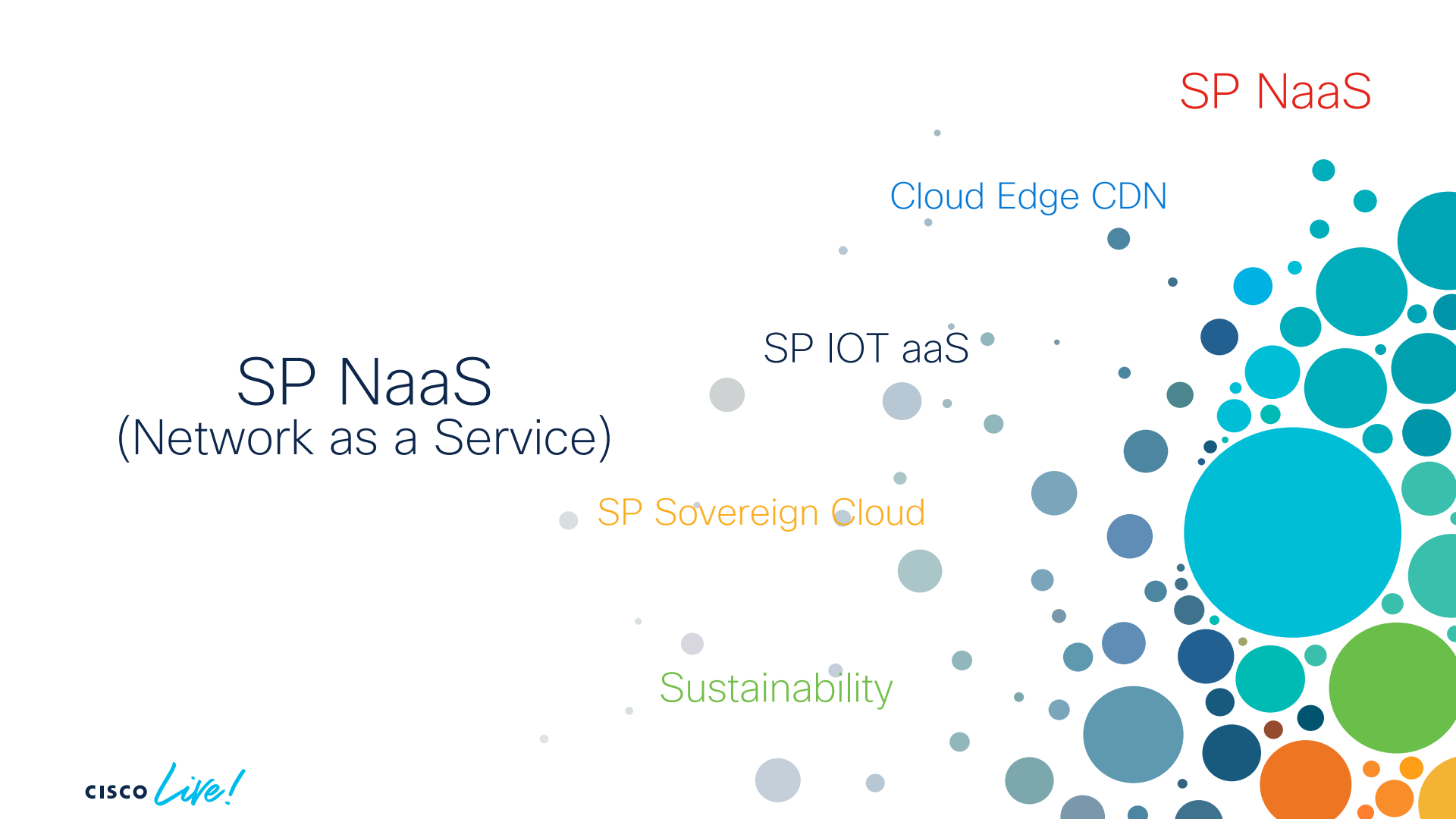
Cloud Edge CDN

SP IOT aaS

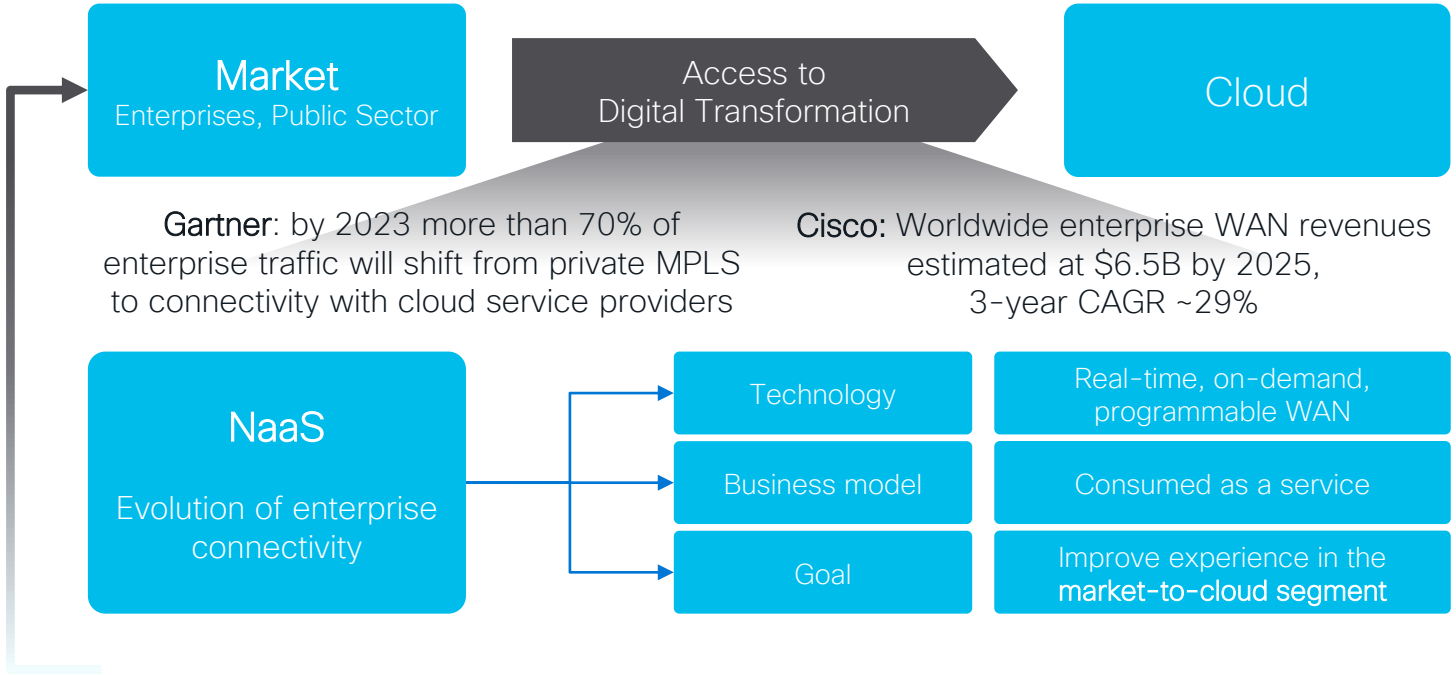
SP NaaS
(Network as a Service)

SP Sovereign Cloud

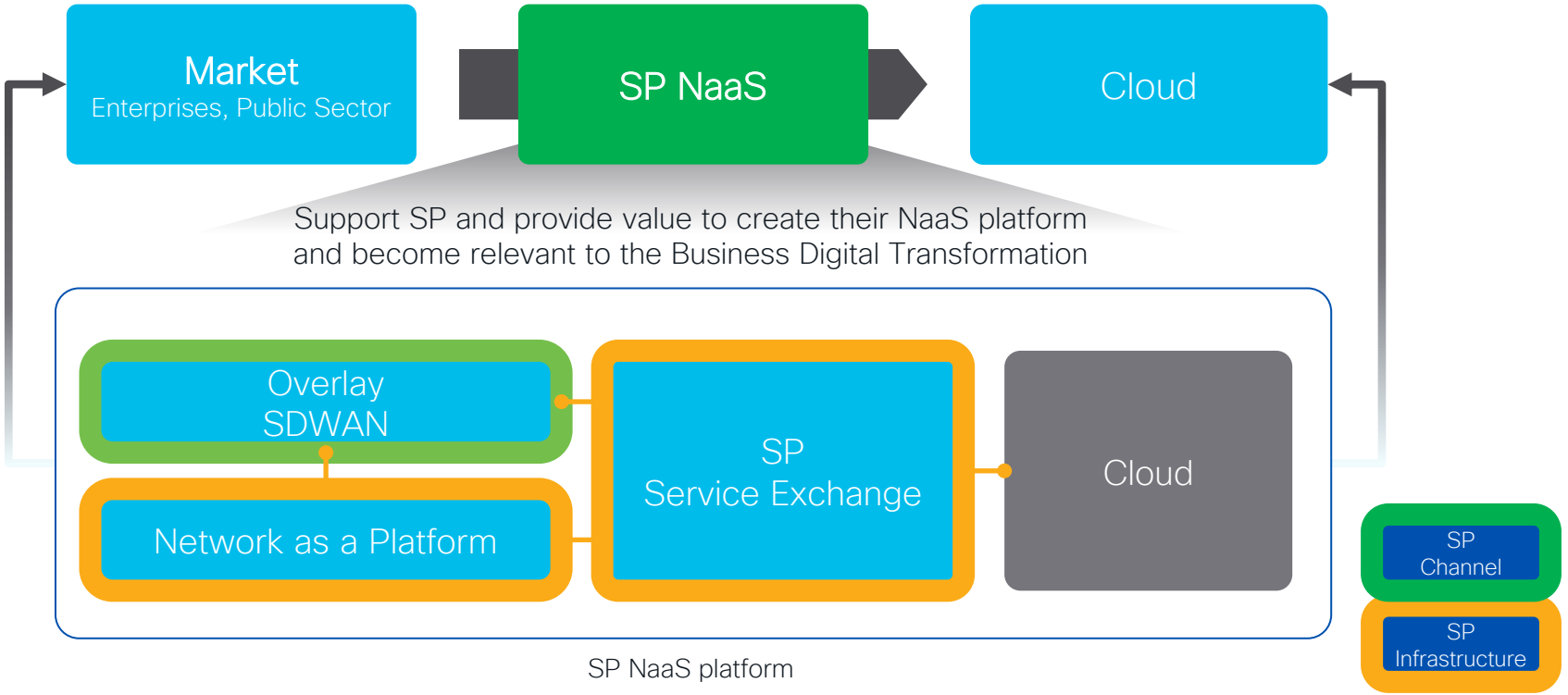
Sustainability



Network as a Service (NaaS) for Business Segment



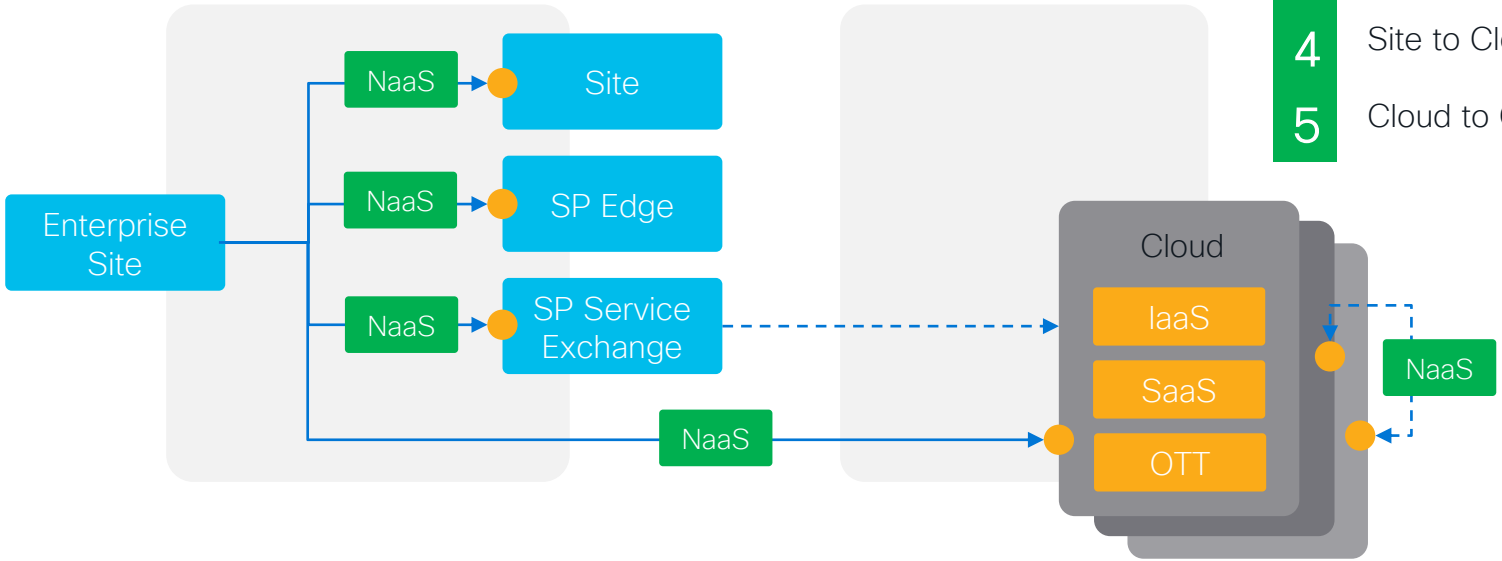
SP Network as a Service



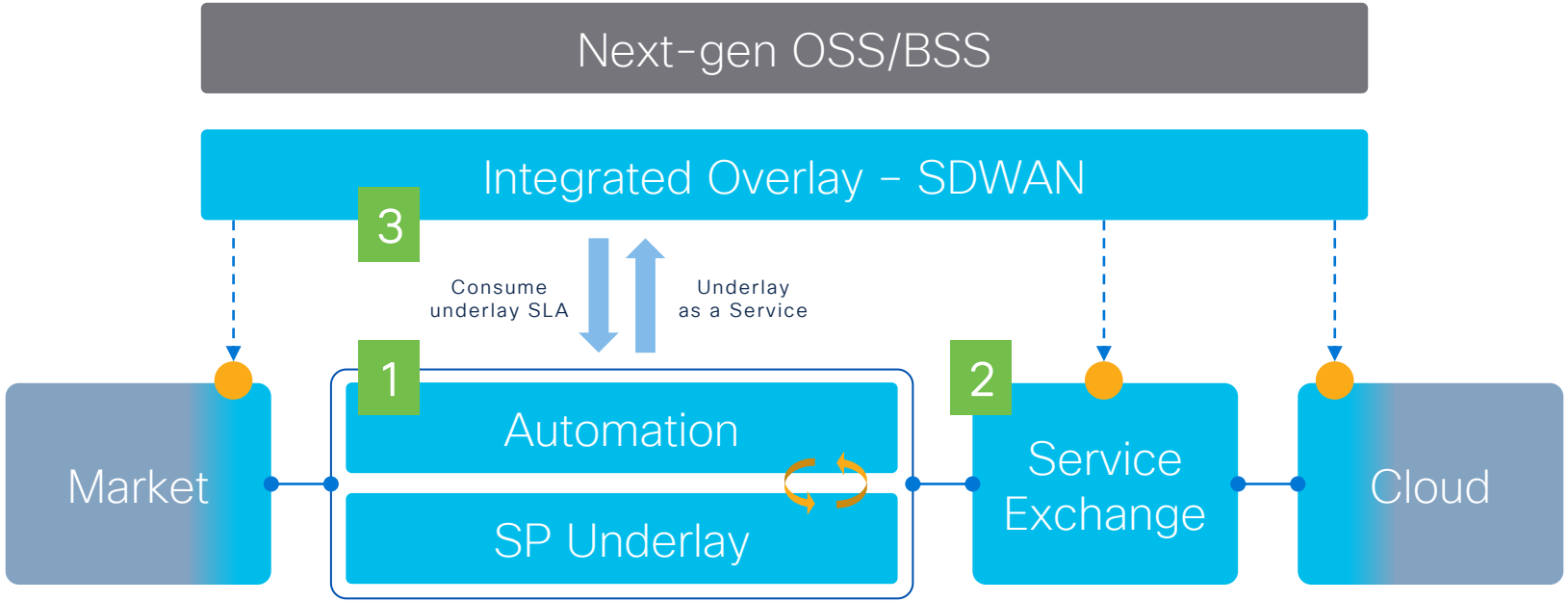
SDWAN – Software Defined Wide Area Network

Network as a Service use-cases

1. Site to site/DC
2. Site to SP Edge
3. Site to SP Service Exchange
4. Site to Cloud
5. Cloud to Cloud



SP NaaS Framework and Components

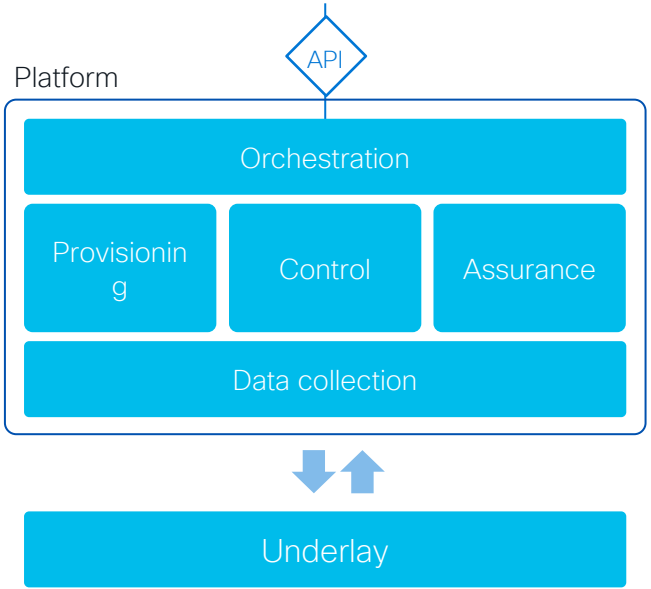


1 Abstract and expose

2 Optimize access to Cloud

3 Differentiate with SLA

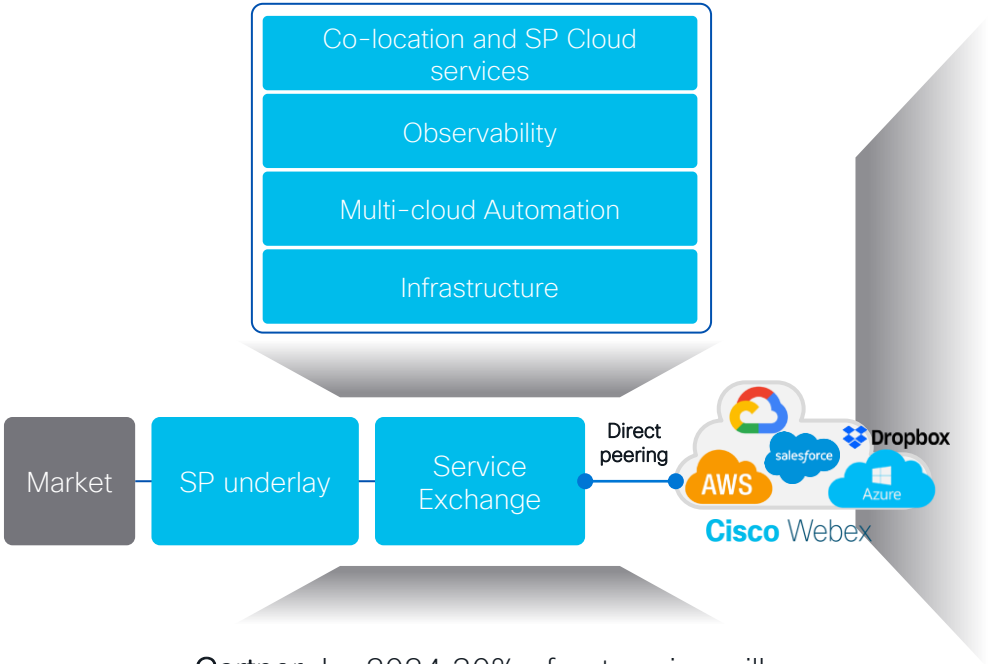
Network as a Platform



Goal

- Abstract & expose network **via API**
- A **consumable service** offering for any overlay service (SP or 3rd Party)
- **Full-lifecycle management** of network constructs and services

SP Service Exchange

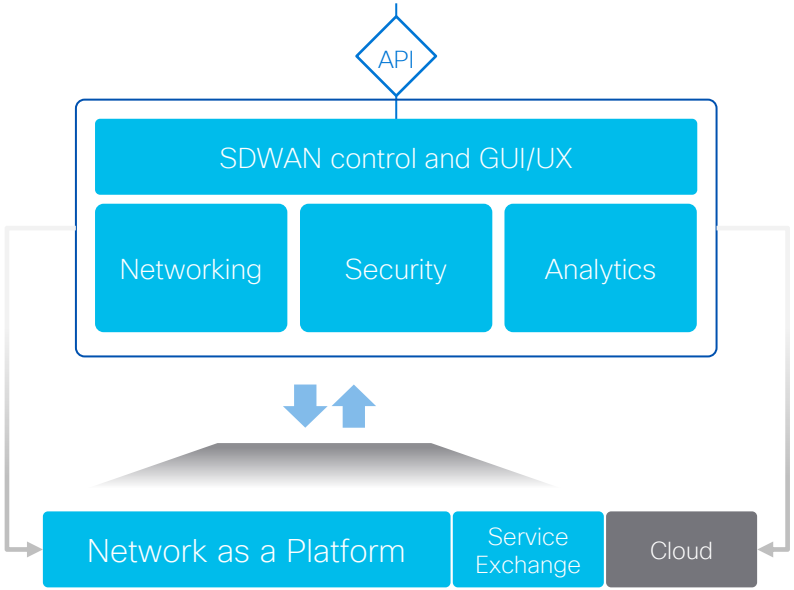


Gartner: by 2024 30% of enterprise will use SDCI to connect to public CSPs

Goal

- SP hub towards cloud optimizing **performance, cost, reach and billing**, with a programmable **xConnect** between SP underlay and Cloud
- Offer optimized access from **Cloud marketplace**
- Meet @ the Colo, connecting the market to SP cloud offering (colocation and services)

Integrated Overlay - SDWAN



Goal

- Address business requirements of **top priority/high-touch business customers**
- Seamless integration **between SDWAN and underlay/MPLS/SR network**
- Offer SP differentiation with **SLA based offer** for SDWAN customer/apps

SP NaaS

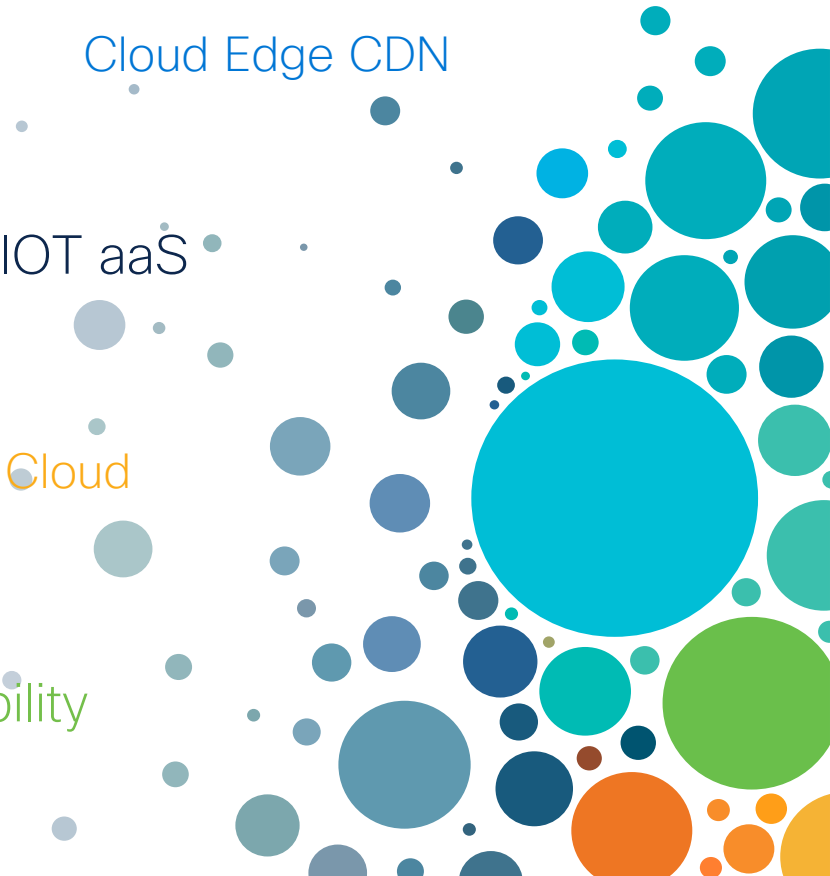
Cloud Edge CDN

SP IOT aaS

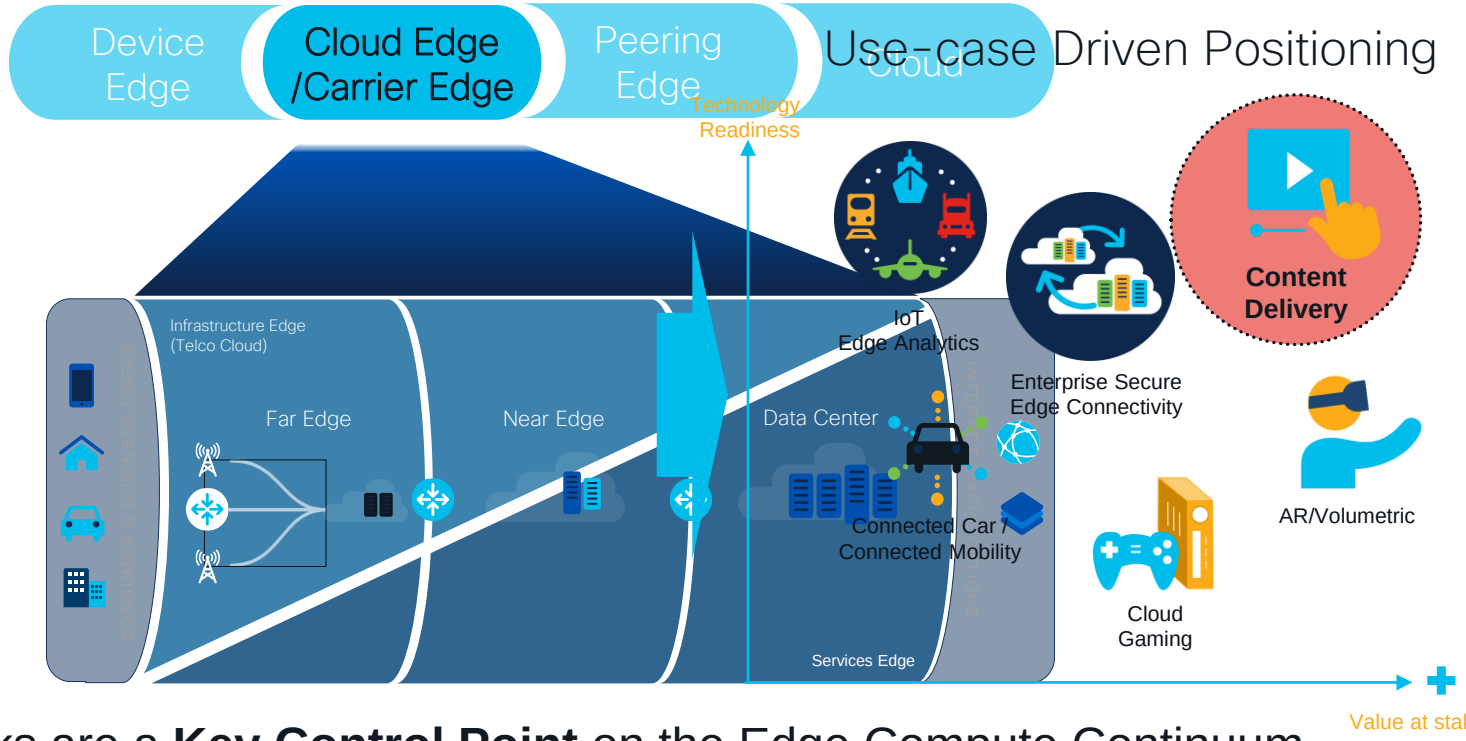
Cloud Edge CDN
(Content Delivery Network)

SP Sovereign Cloud

Sustainability



Cloud Edge Evolution



SP Networks are a **Key Control Point** on the Edge Compute Continuum

OTT Streaming is Experiencing Three Concurrent Trends

33%

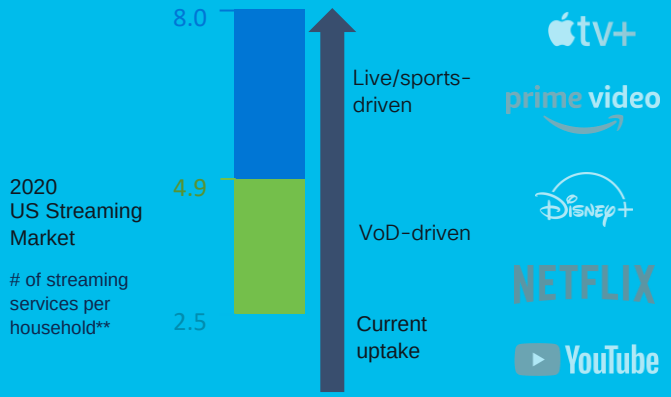
YoY global internet video traffic (CAGR 2017 – 2022)

82%

Video is projected to account for of all Internet traffic in 2022*

growth

of video traffic



fragmentation

of content sources

73%

YoY global LIVE internet video traffic (CAGR 2017 – 2022)*

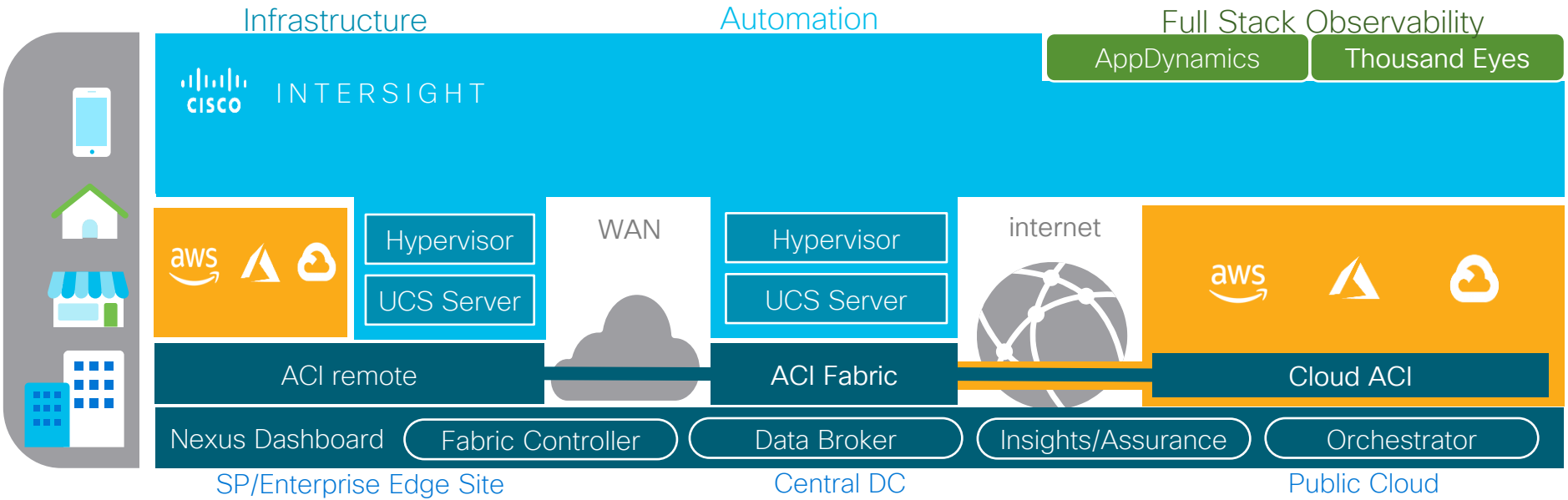
live streaming

proliferation

*Cisco VNI 2017-2022, **Ampere Analysis 2020

Cloud Edge/Carrier Edge Cisco Offering

- Cisco focus on the **leading use cases** (Open Caching/CDN & SDWAN)
- **Full Stack Observability (FSO), Networking,** (Physical/virtual, container), **Security**



Opening Caching (Qwilt) and Cisco Edge Cloud Solution

Cost savings & End user experience

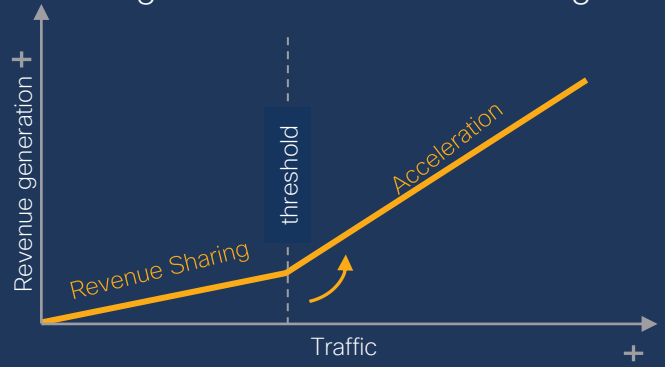
QWILT

DIGITAL ALPHA

CONTENT DELIVERY PLATFORM

A CDN solution tailored for deployment inside SP networks including revenue sharing with carrier

Caching aaS with Revenue Sharing



CISCO

EDGE COMPUTE INFRASTRUCTURE

Compute/storage/ networking infrastructure, management technology and services

Global Content Publisher go-to-market

Disney+

hulu

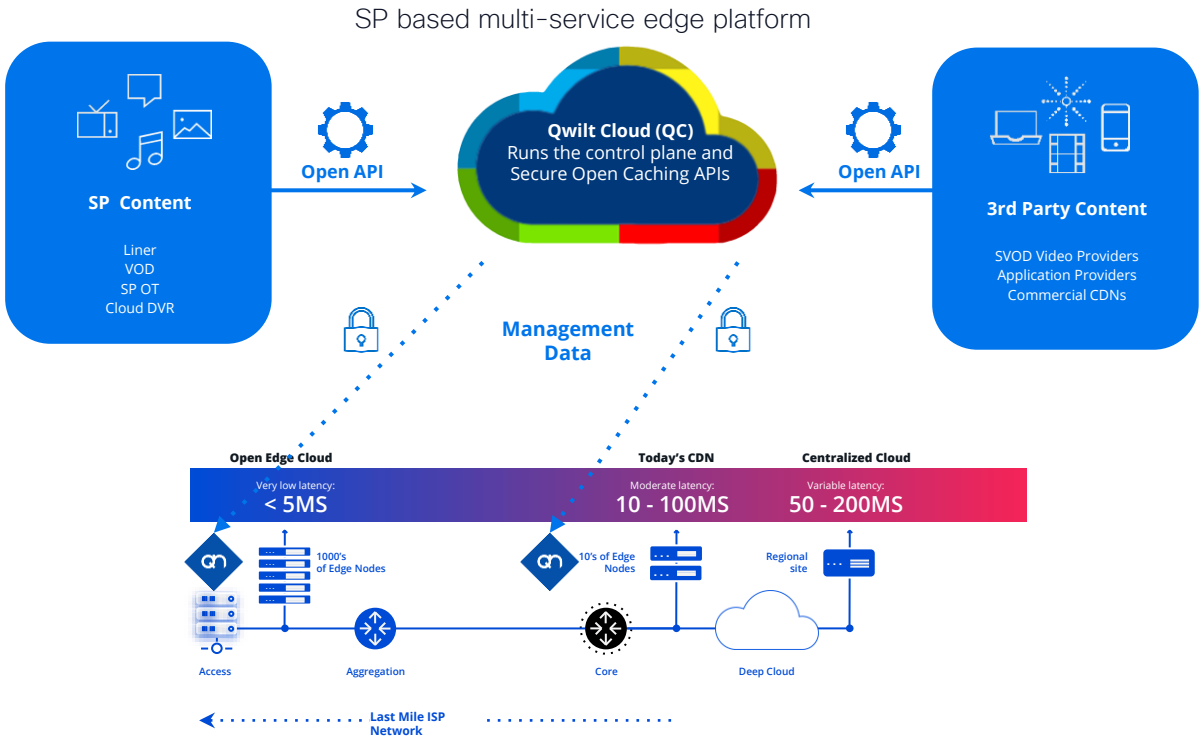
VALVE

dailymotion

STAR

"Through our partnership with Cisco, Qwilt, and Digital Alpha, we introduced the platform we wanted with zero capital expenditure. And now we have a flexible platform that also opens up new opportunities for TIM Brasil. In fact, content distribution has become one of the main pillars of our business strategy." Angelo Faverzani, Executive Manager, TIM Brazil

Qwilt CDN and Cisco Edge Cloud Solution (extending)



SP NaaS

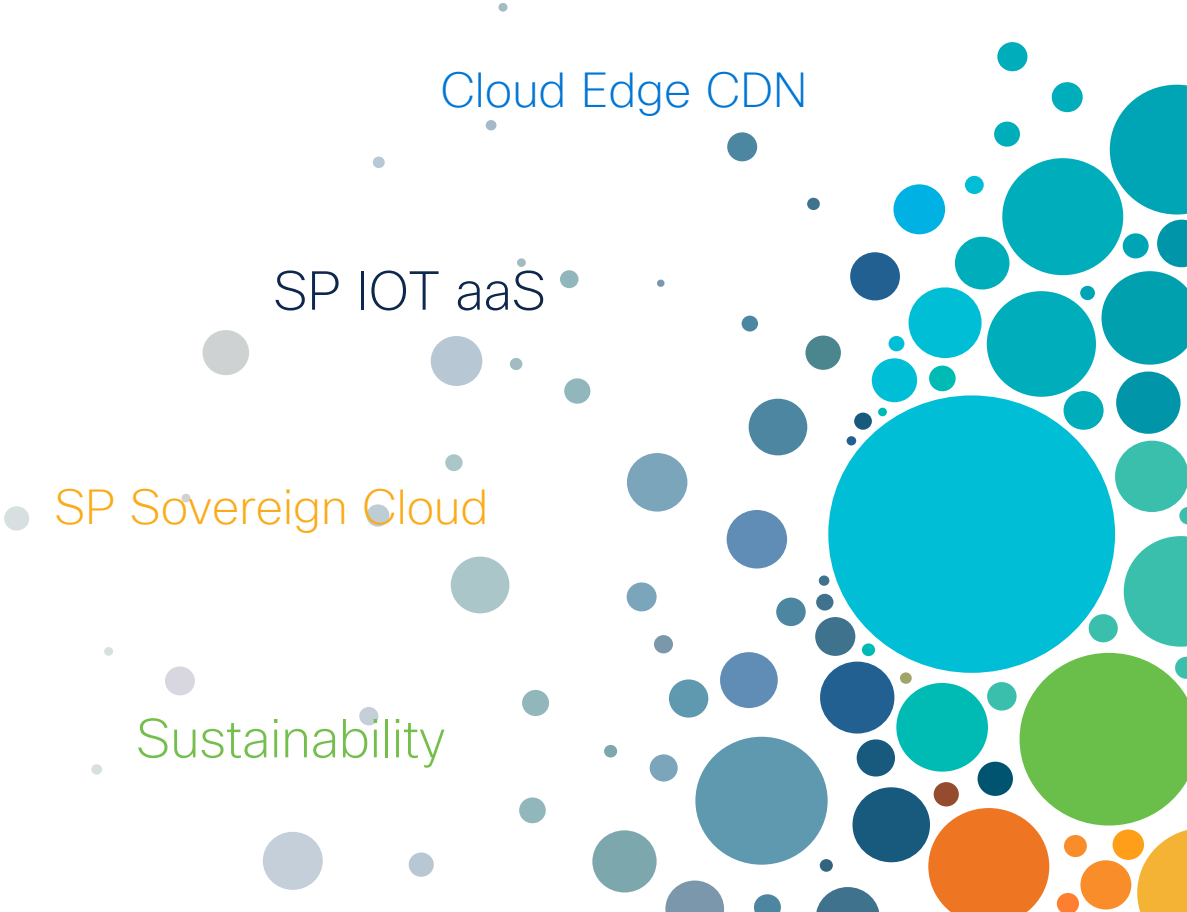
Cloud Edge CDN

SP IOT aaS

SP IOT aaS
(Public/Private)

SP Sovereign Cloud

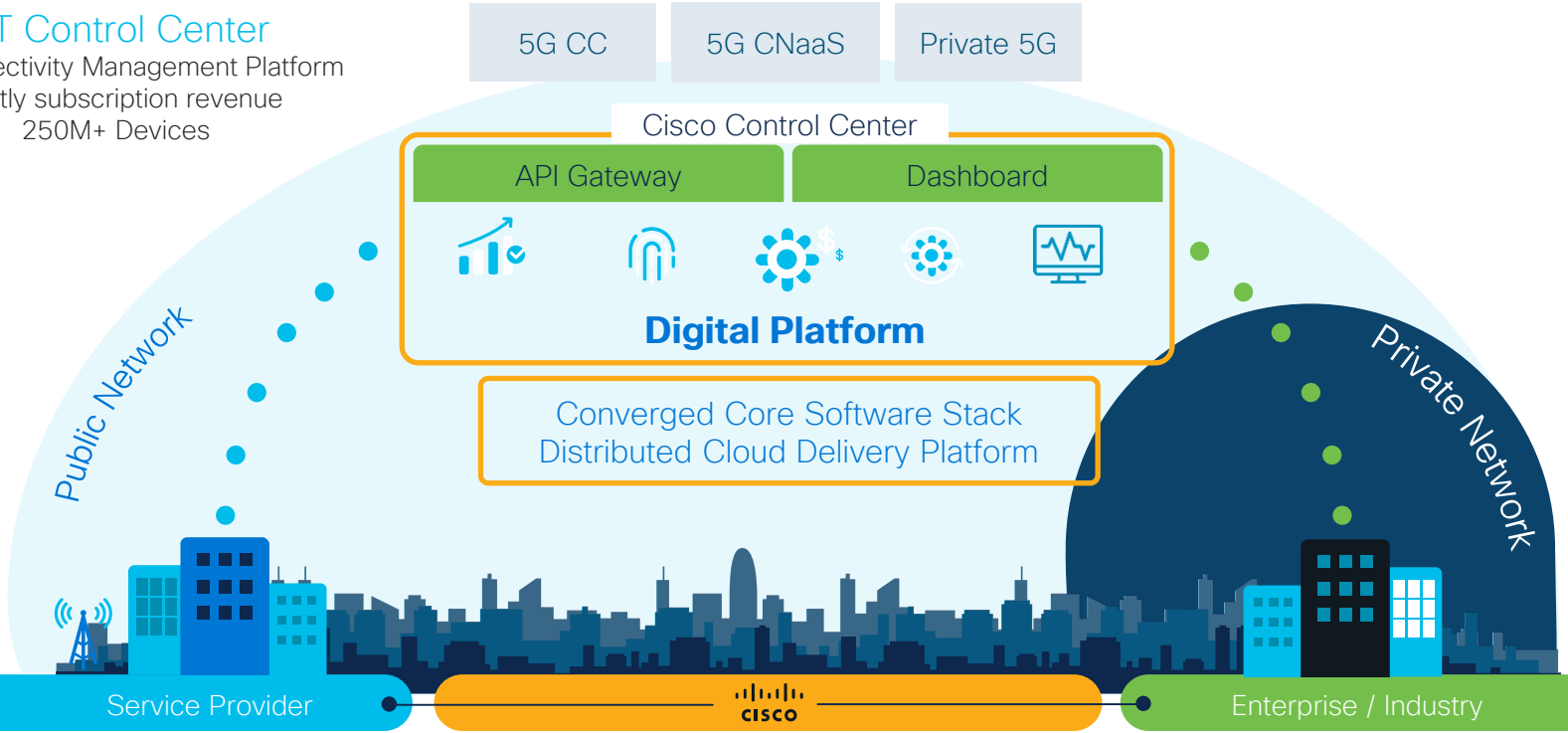
Sustainability



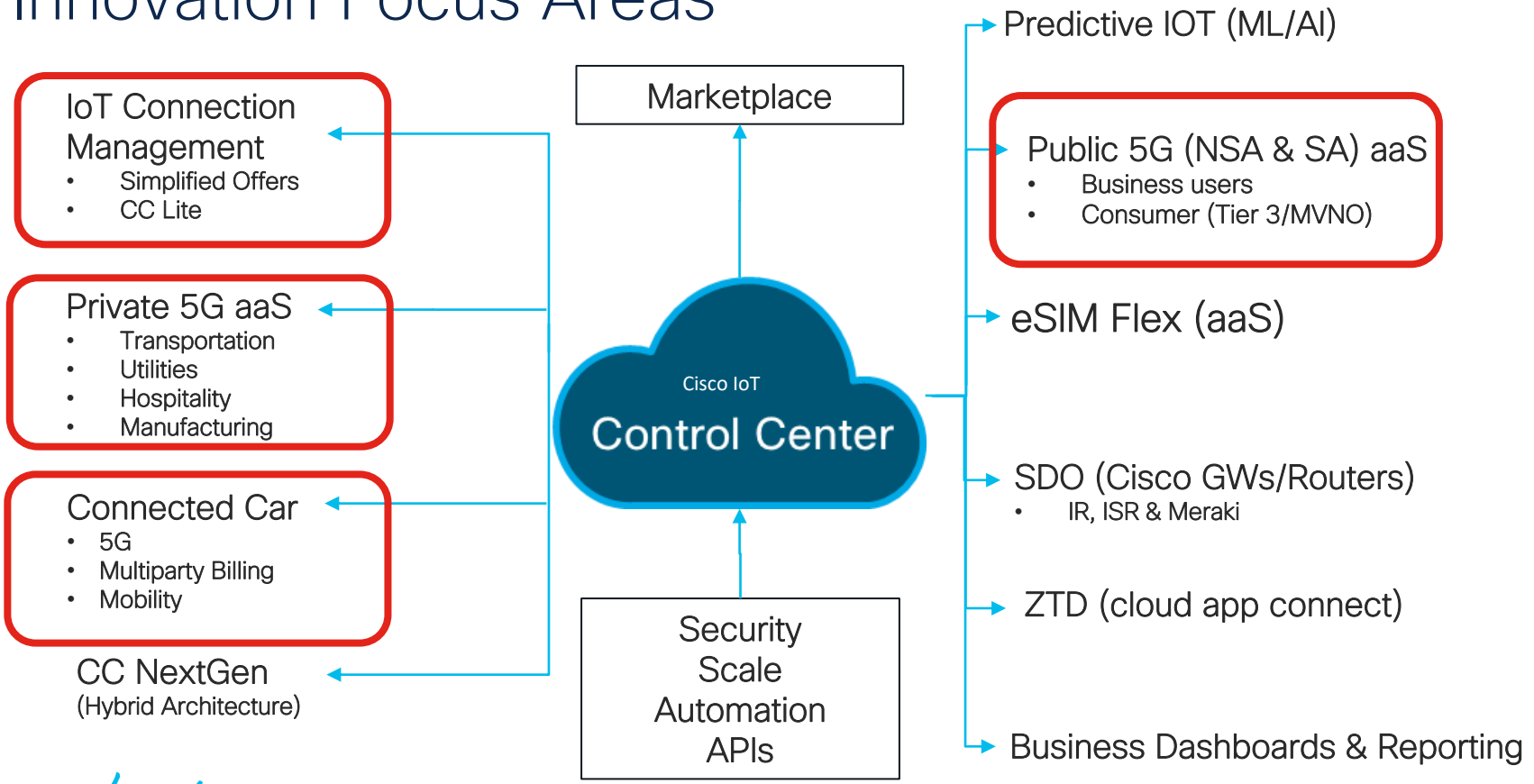
SP IoT Solution for Public and Private networks

IoT Control Center

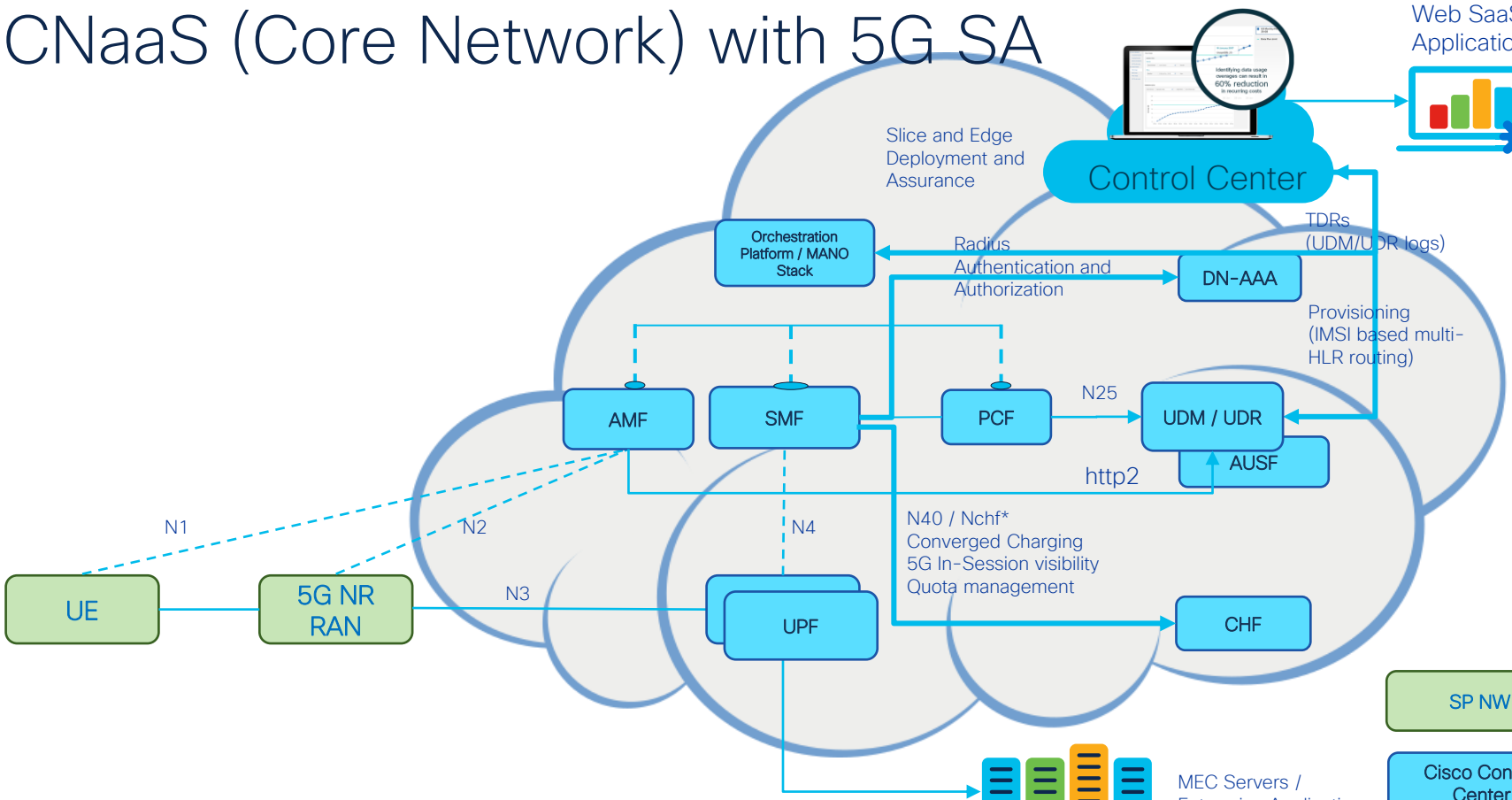
#1 Connectivity Management Platform
Mostly subscription revenue
250M+ Devices



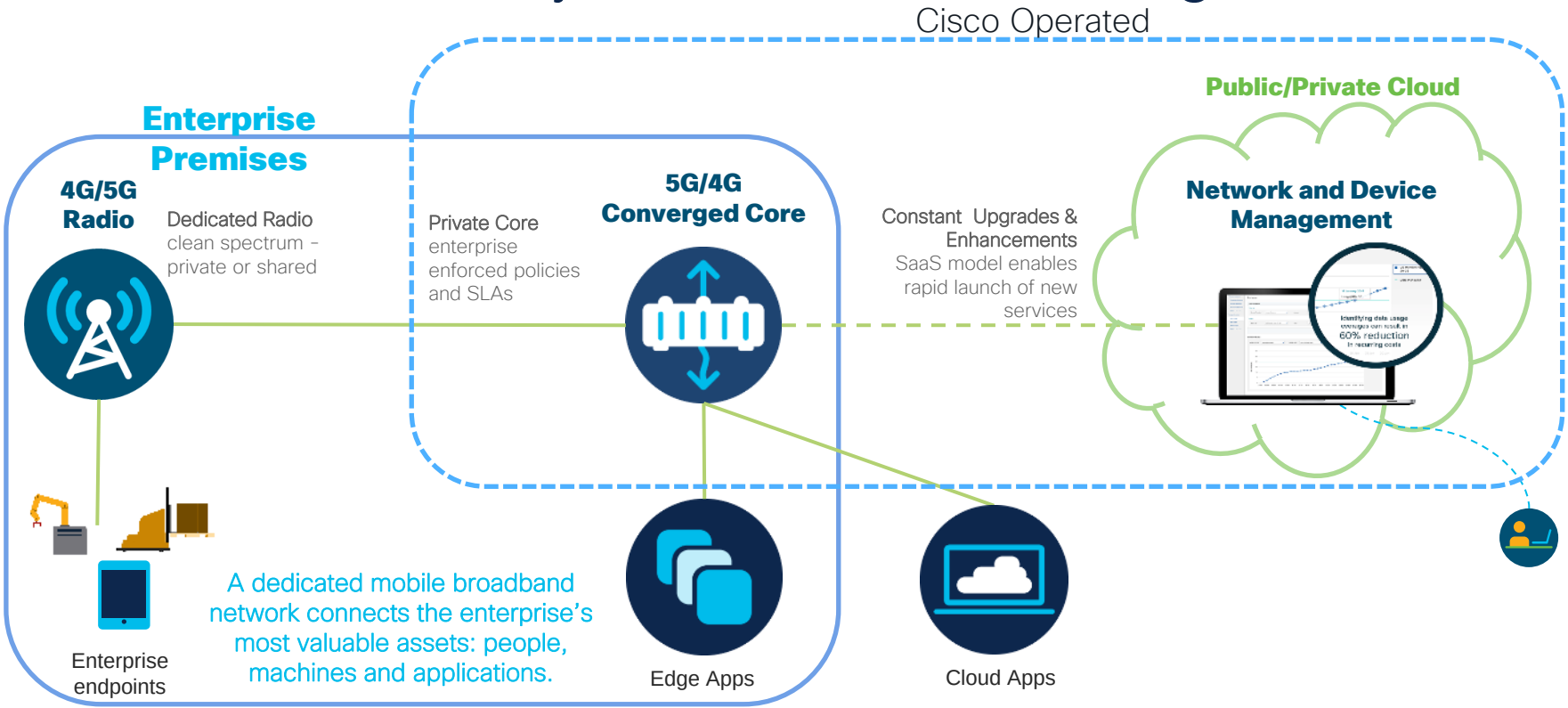
Innovation Focus Areas



CNaaS (Core Network) with 5G SA



Private 5G – aaS Hybrid Solution Offering



SP NaaS

Cloud Edge CDN

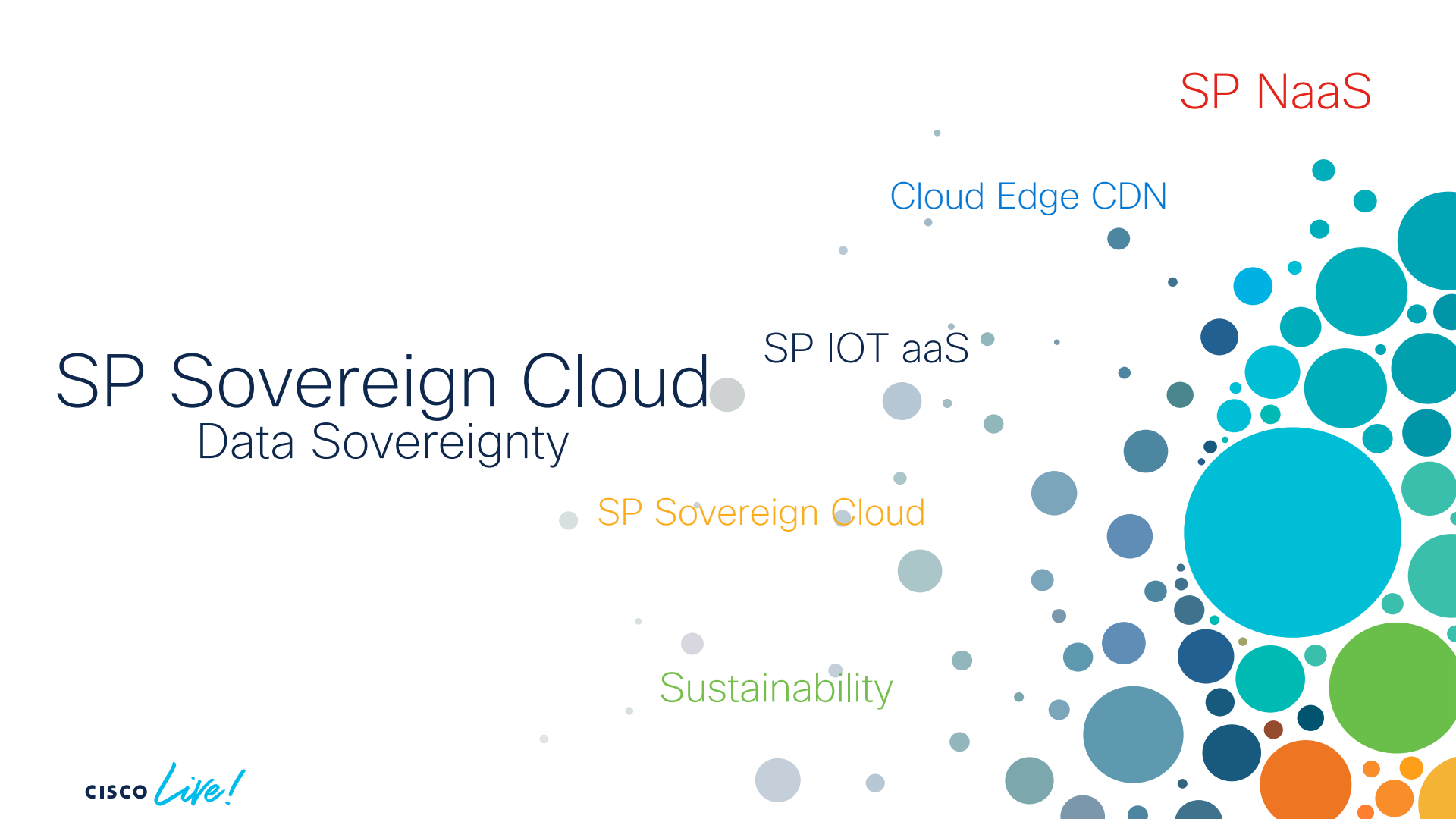
SP IOT aaS

SP Sovereign Cloud

Data Sovereignty

SP Sovereign Cloud

Sustainability



Sovereign Cloud Market Trends and Opportunity

Legislation

EUCS certification labels under definition – intent to harmonize requirements

92% of data from the **West is hosted in the US**[2]

60% of regulated industries believe there is a national **mandate** to **improve data security**[5]

Opportunity

724B EUR (2021-2027) EU recovery and resiliency funds – e.g, Italy Public Sector Sovereign Cloud project, French Public Sector Cloud[2]

Cloud Trends

By 2024 40% of Forbes G2000 will **move part of their workloads to a sovereign cloud**[4]

62% of regulated industries cited **increased security** for data the reason for using private cloud[1]

Hyperscalers offering sovereign cloud options

SP role

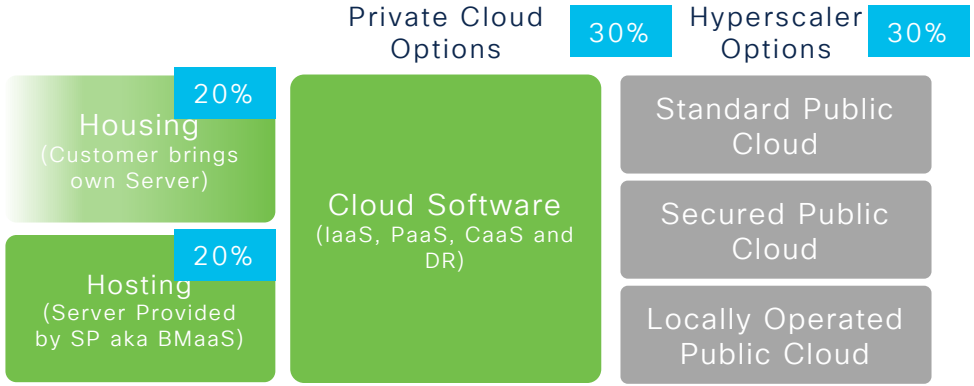
47% prefer local / regional partners and service providers[1]

94% prefer a managed/shared services model for private cloud[1]

Sovereign Cloud drives private cloud motion conflicting with cloud-first strategy
Hybrid Cloud strategy being reenforced by sovereignty needs

What is the SP Opportunity?

Bare-Metal and Private Cloud are Key Sovereign Assets



Server **housing** or server colocation means **customer have their own server hardware**, installed in the SP Data Center.

Bare-metal cloud is a public cloud service where the **customer rents dedicated hardware**. **BMaaS offers a full stack (network, storage, compute) deployment** with a cloud-like capability.

30%

The global private cloud server market size was valued at USD 30.24 billion in 2018 and is expected to grow at a compound annual growth rate (CAGR) of 29.6% from 2019 to 2025. *(GrandViewResearch Private Cloud Server Market Forecast 2019-2025.)*

152%

Dedicated IaaS (provided by an SP) - 151.8% CAGR
(Worldwide Dedicated Cloud Infrastructure and Dedicated Cloud Infrastructure as a Service, 2022)

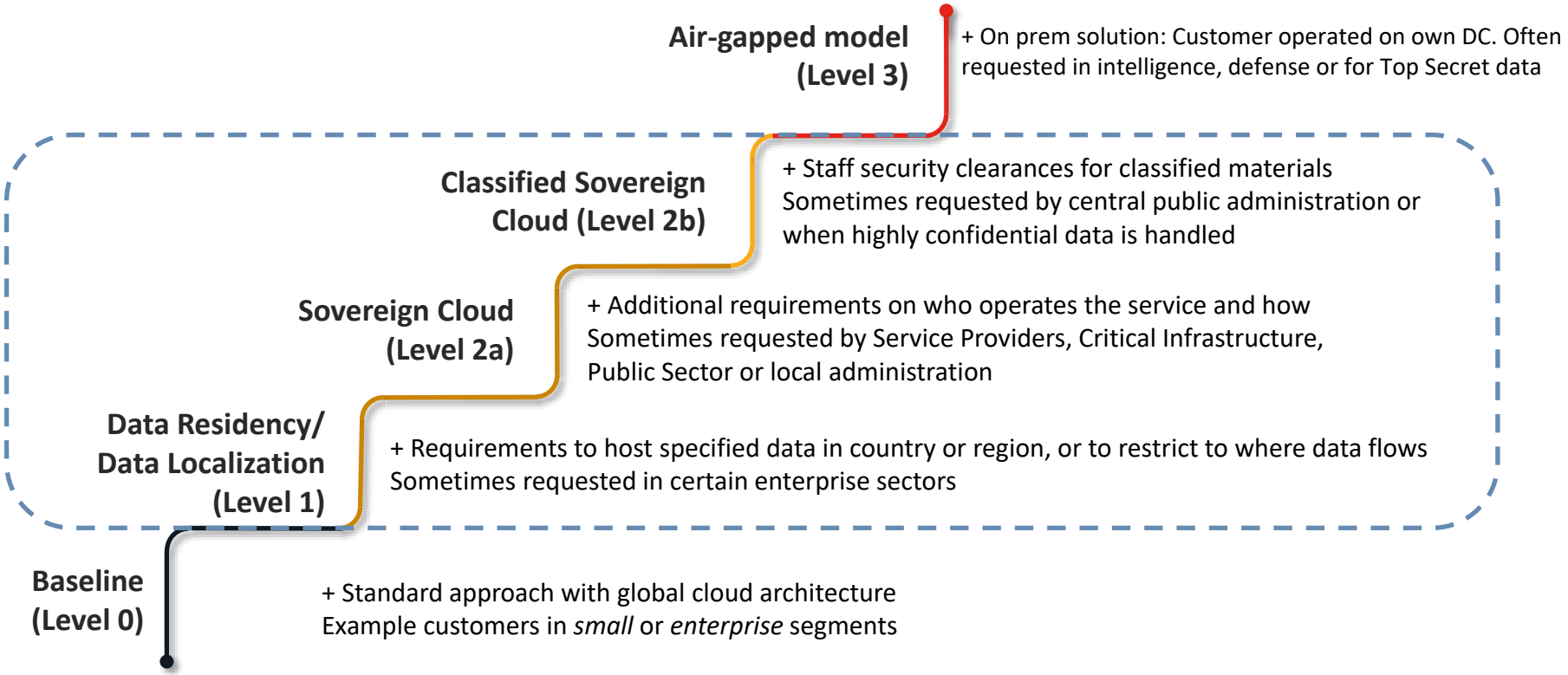
30%

About 30% of enterprise workloads are still running as bare-metal
(Source: Future of Digital Infrastructure 2022 Global Sentiment Survey, IDC, June, 2022)

Recent Opportunity Example

Analyst

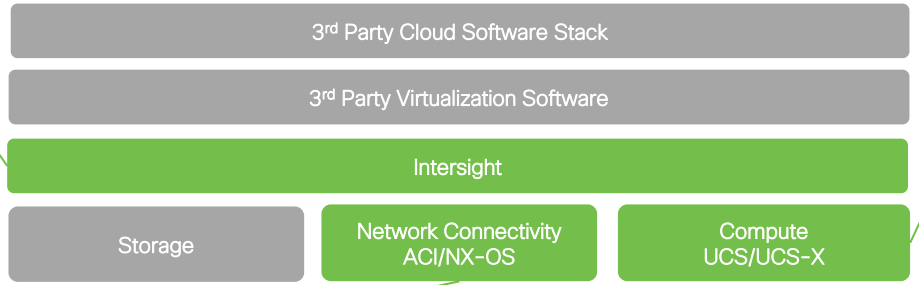
Levels of Sovereignty – Cisco Proposed Internal Taxonomy



Components contained in SP-driven Sovereign offerings

Programmability Enables Physical Server Hosting

Policy driven automation enables provisioning of dedicated pre-configured servers per tenant (BMaaS).



B2B market is very often a blade server discussion.

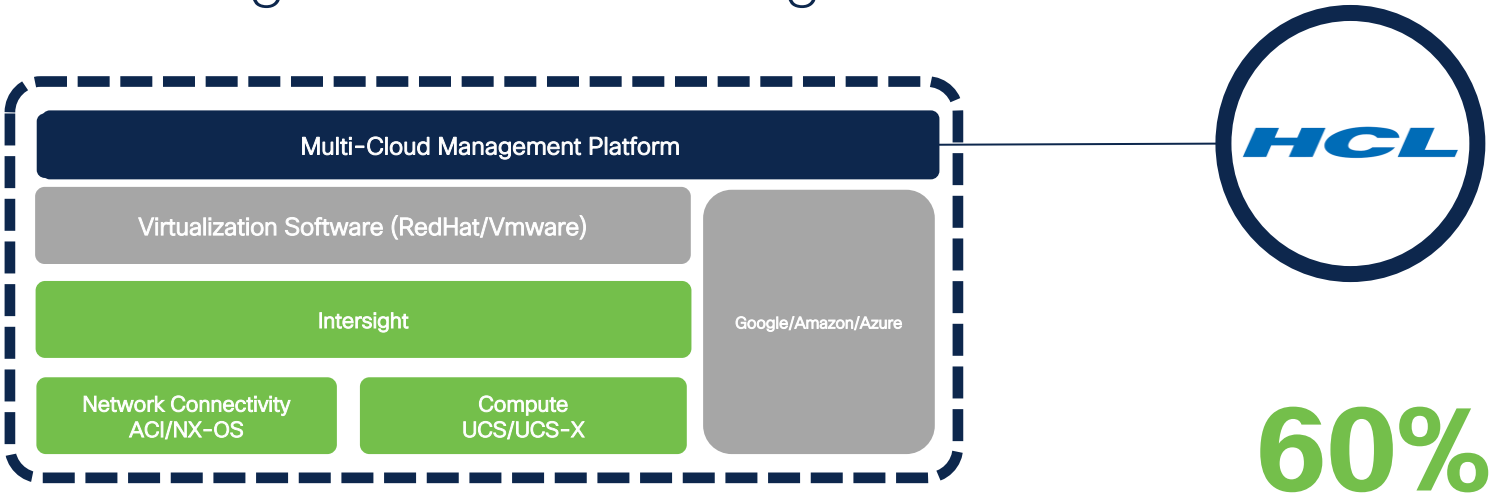
Ciso have a unique UCS-X Blade Architecture that differentiates Cisco in the market.

Nexus

Superior Automation Capabilities through Infrastructure as Code

Rich set of Day-2 Operations Tools
Best interop with SDN controllers
- Pure Underlay + SDN
- Integrated with existing SDN
- Replacing existing SDN

Sovereign Solution Offerings with Partners - HCL example



"Cloud management tooling enables organizations to manage **hybrid and multicloud** (that is, on-premises, public cloud and edge) services and resources. This includes providing **governance**, **life cycle management**, **brokering** and **automation for managed cloud infrastructure** resources across multiple functional areas."
Gartner Definition

60%

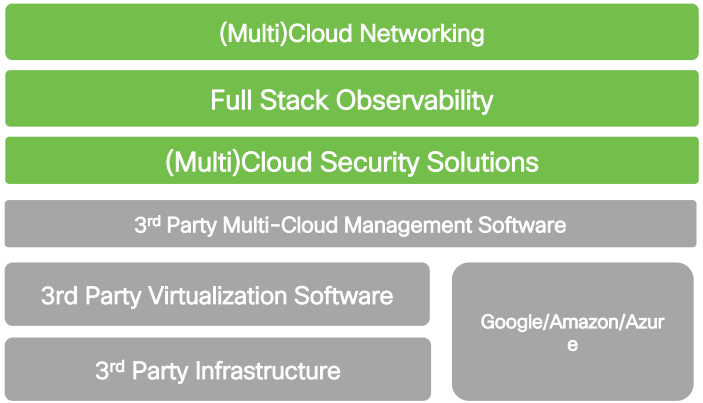
Worldwide 60% Plan or Have Already Implemented a Unified Infrastructure Mgmt Control Plane Across Most On-Prem and Public Cloud Resources; Europe Lags in Overall Level of Commitment.

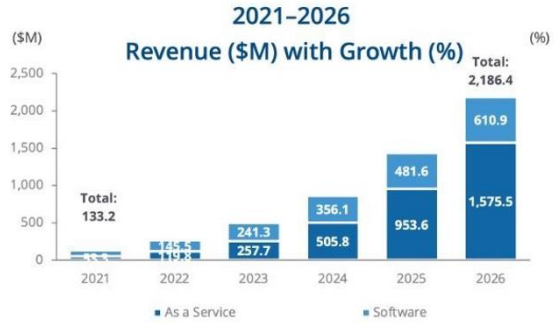
Source: Future of Digital Infrastructure 2022 Global Sentiment Survey, IDC, June, 2022

Sovereignty Add-Ons - Additional Tooling

Observability is tied into all aspects of sovereignty. It increases reliability and provides visibility into data paths and location of components.
Full Stack Observability is key

Security is the #1 reason for cloud repatriation (IDC).
Enterprises are expecting SP's to help them with the security aspects of the cloud.
Multi Cloud Security is key





Multi-Cloud Networking is expected to grow to 2.2Bn$ Market in 2026.
(IDC Multi-Cloud Networking Forecast)

The solutions have yet to reach maturity.
(Peak Of Inflated Expectations – Gartner Hype Cycle)

ACI/SD-WAN Cloud networking is key

SP NaaS

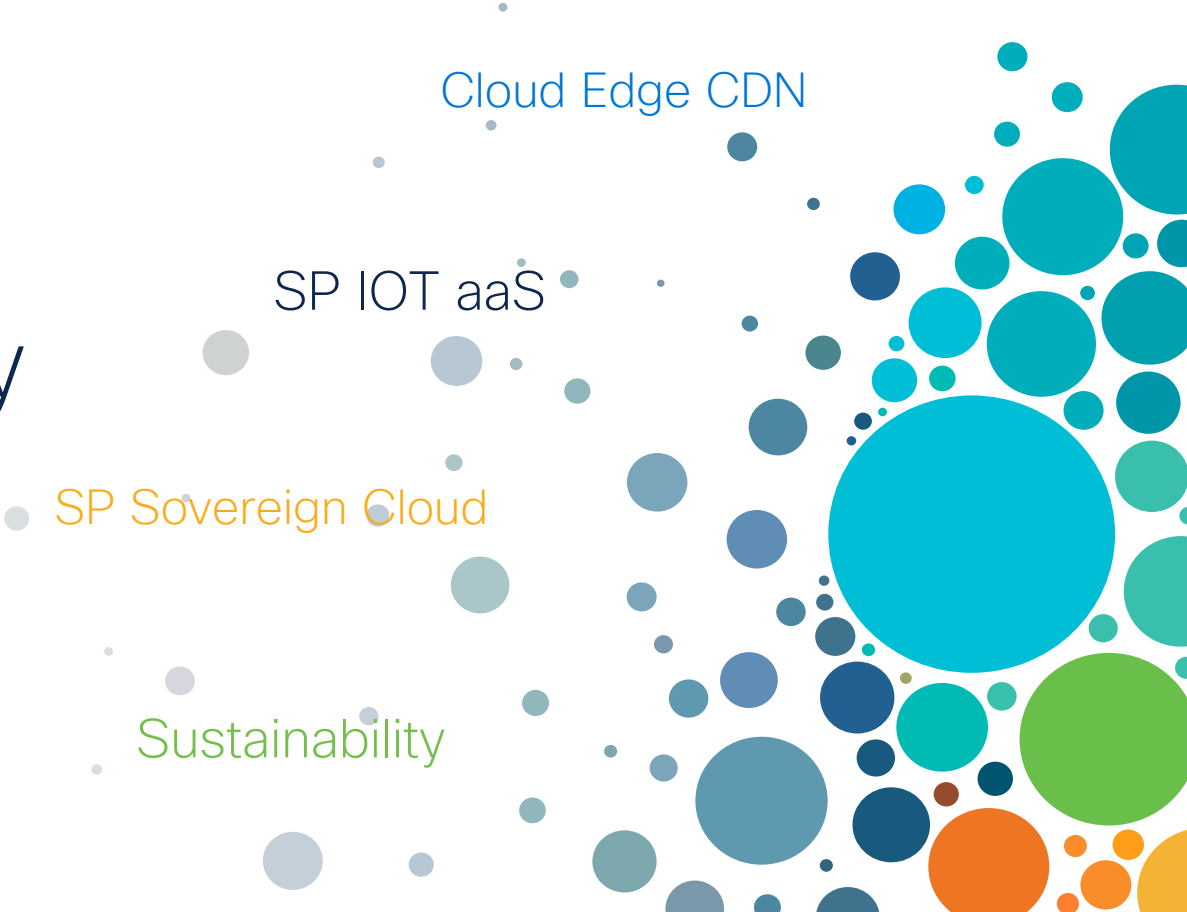
Cloud Edge CDN

SP IOT aaS

Sustainability

SP Sovereign Cloud

Sustainability



Sustainability is more than energy efficiency, current focus

Water

Carbon

Land use

Plastics & waste

Energy Efficiency & transition

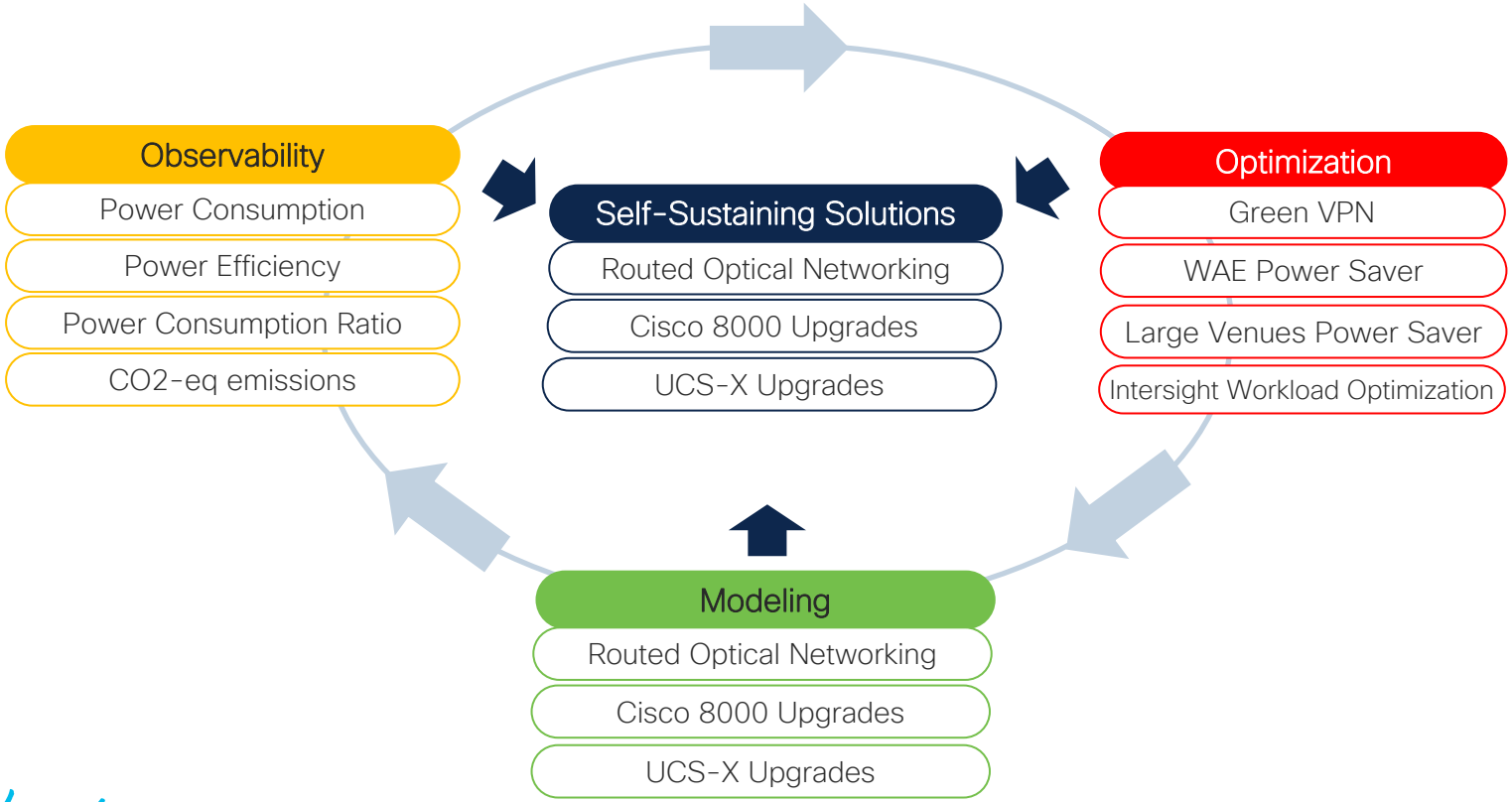
Migration & Demand

Extreme Weather

Security

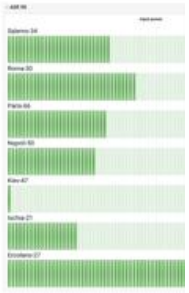
cisco Live!

Enabling Sustainability-driven Selling

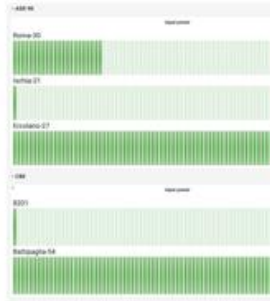


Observability Dashboard Prototypes

Observability Dashboard Power Supply Efficiency & Load

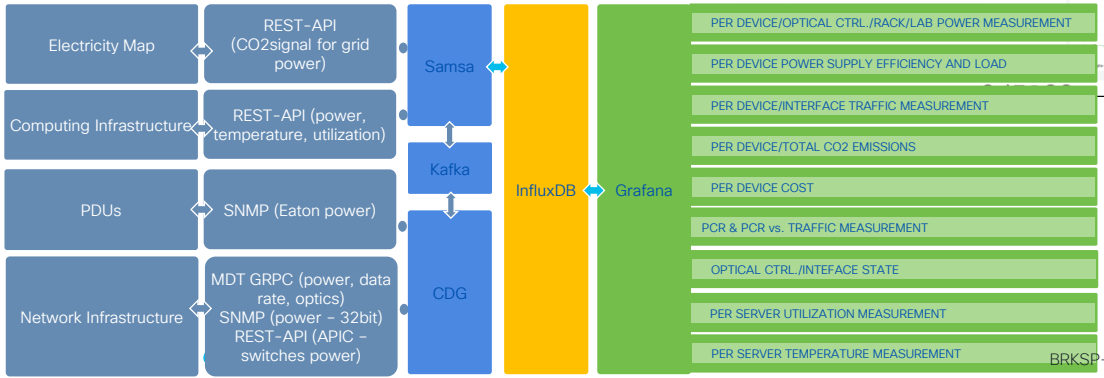


Observability Dashboard Power Efficiency, CO2-eq focus

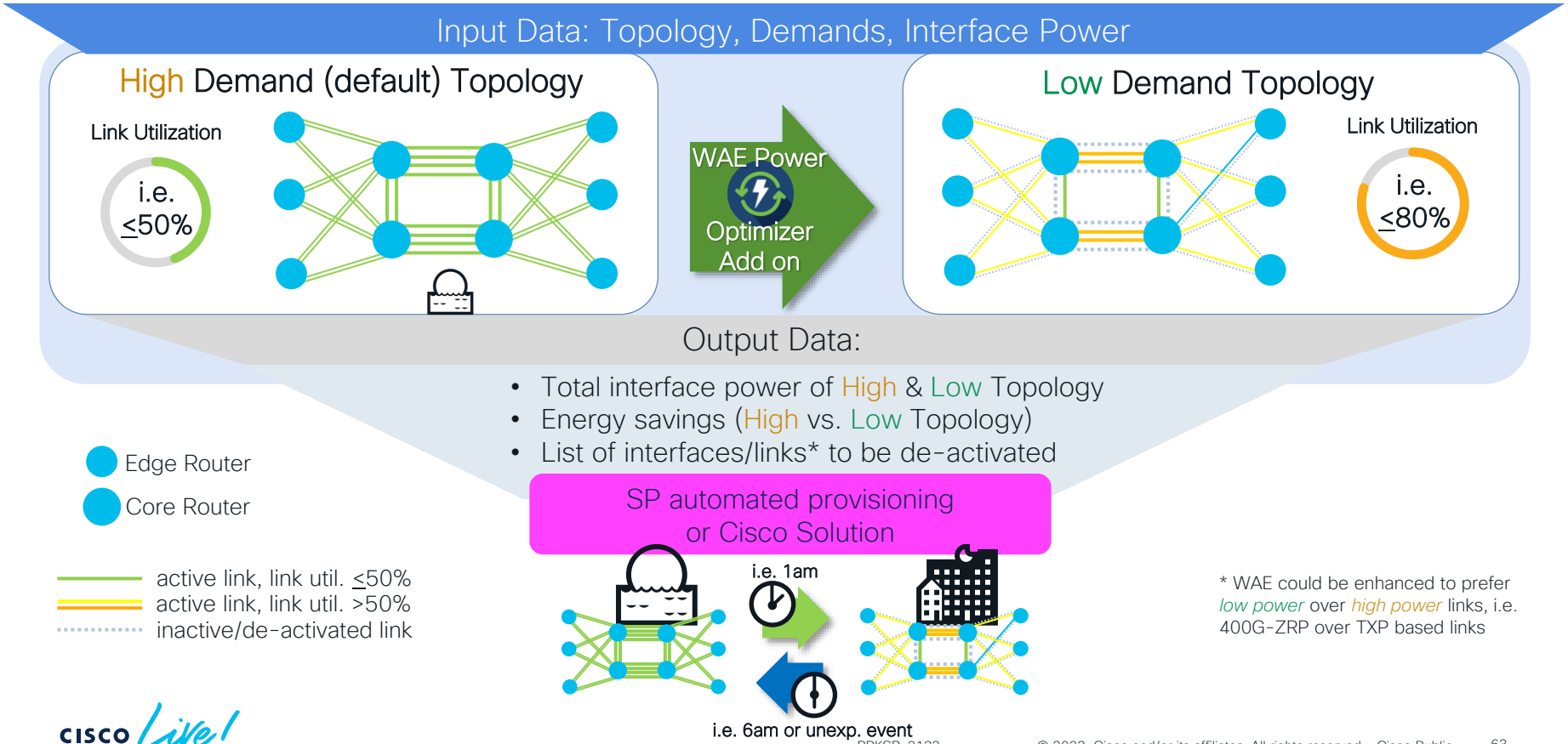


Observability Dashboard Example #3
Power Efficiency, cost focus

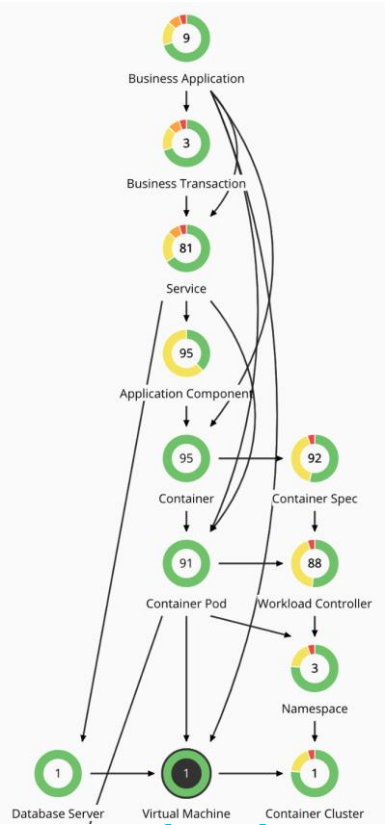
Observability Dashboard
Power Consumption Ratio focus

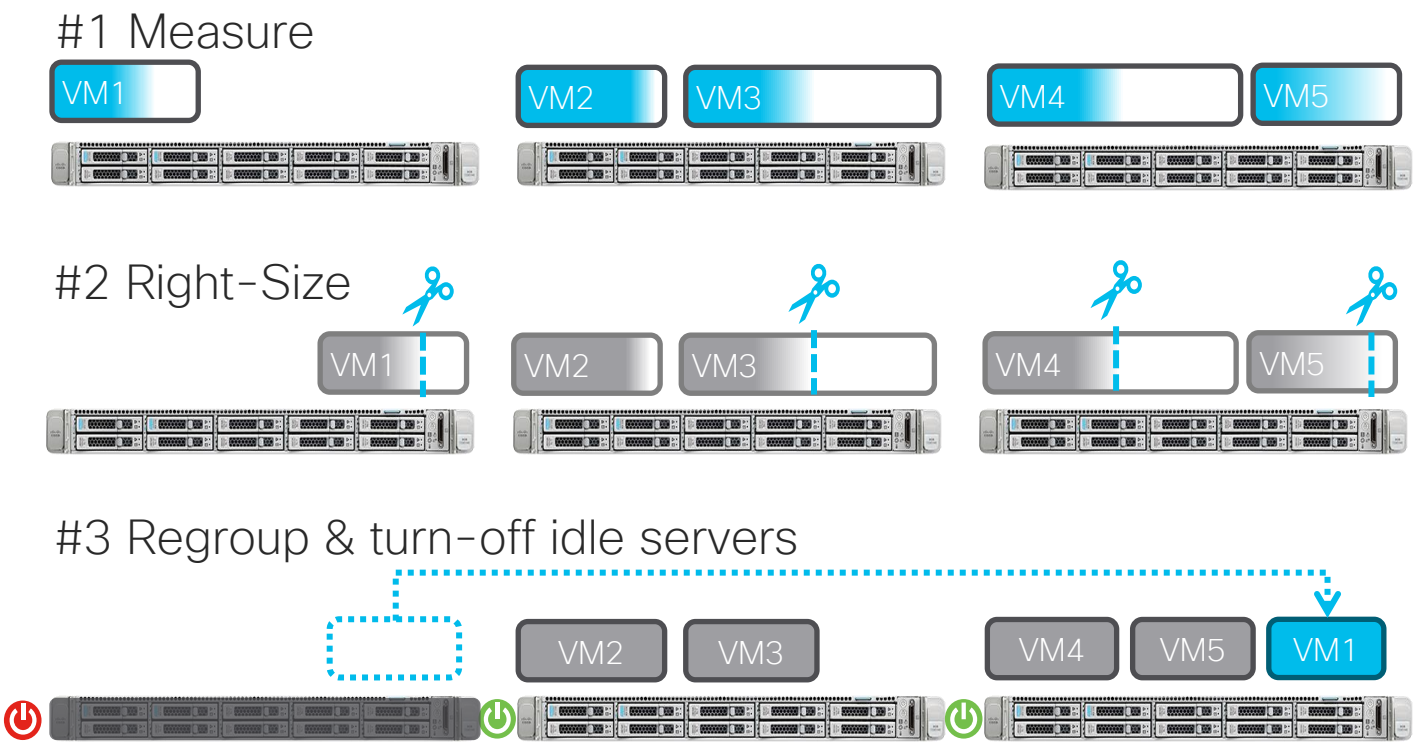


Demand-Based Energy Optimization Prototype

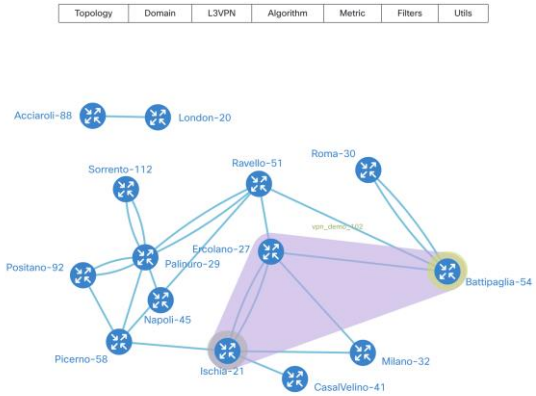


Workload Optimizer for Power reduction Prototype





Green VPN – Segment Routing Service Centric Prototype



Topology view

Pwr info

Customer
L3VPN, E-line, ELAN
service

L3VPN: vpn_demo_105

SR Policies

Headend	Name	Traffic	Power	CO2-eq
Picerno-58	srte_c_105_ep_30.30.30.30	3.8 Gbps	1987 VA	679 g/h
Roma-30	srte_c_105_ep_58.58.58.58	4.8 Gbps	2298 VA	788 g/h

SR Policies (24 hours)

Headend	Name	Traffic	Power	CO2-eq
Picerno-58	srte_c_105_ep_30.30.30.30	5114 GB	48 kWh	17 kg
Roma-30	srte_c_105_ep_58.58.58.58	5114 GB	47 kWh	17 kg

Headend Nodes

Node	Traffic	Power attributed / total	CO2-eq attributed / total
Picerno-58	15.4 Gbps	1027 VA / 1855 VA	322 g/h / 581 g/h
Roma-30	7.8 Gbps	1484 VA / 1354 VA	569 g/h / 519 g/h

Intermediate Nodes

Node	Traffic	Power attributed / total	CO2-eq attributed / total
Ischia-21	15.5 Gbps	533 VA / 969 VA	173 g/h / 314 g/h
Battipaglia-54	15.4 Gbps	307 VA / 556 VA	100 g/h / 180 g/h
Ercolano-27	15.5 Gbps	934 VA / 2060 VA	303 g/h / 667 g/h

Total traffic: 8.5 Gbps (last 24 hours: 10228 GB)
Total power attributed: 4285 VA (last 24 hours: 95 kWh)
CO2 equivalent (based on grid power): 1467 g/h (last 24 hours: 33 kg)

SP NaaS

Cloud Edge CDN

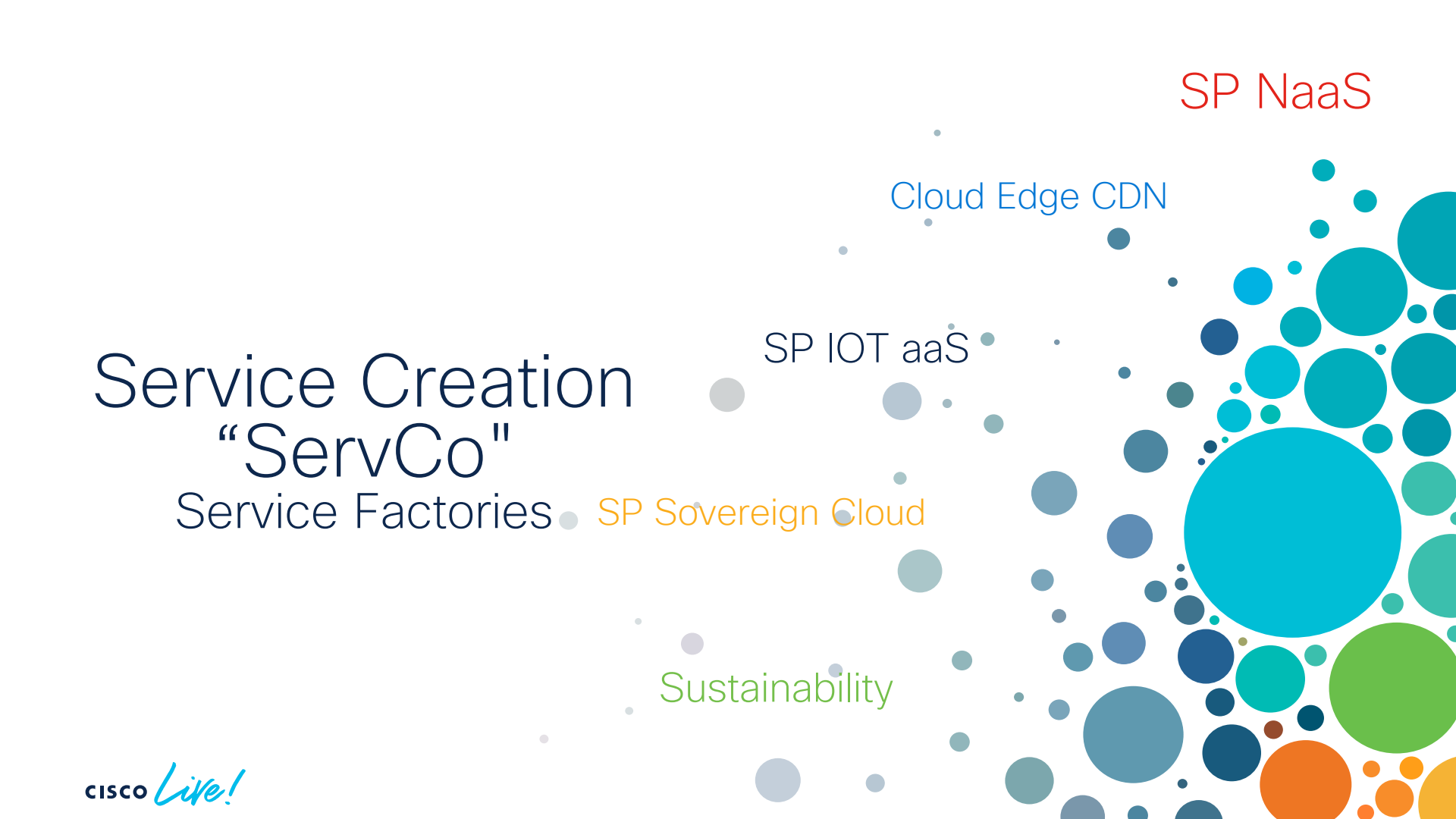
SP IOT aaS

Service Creation "ServCo"

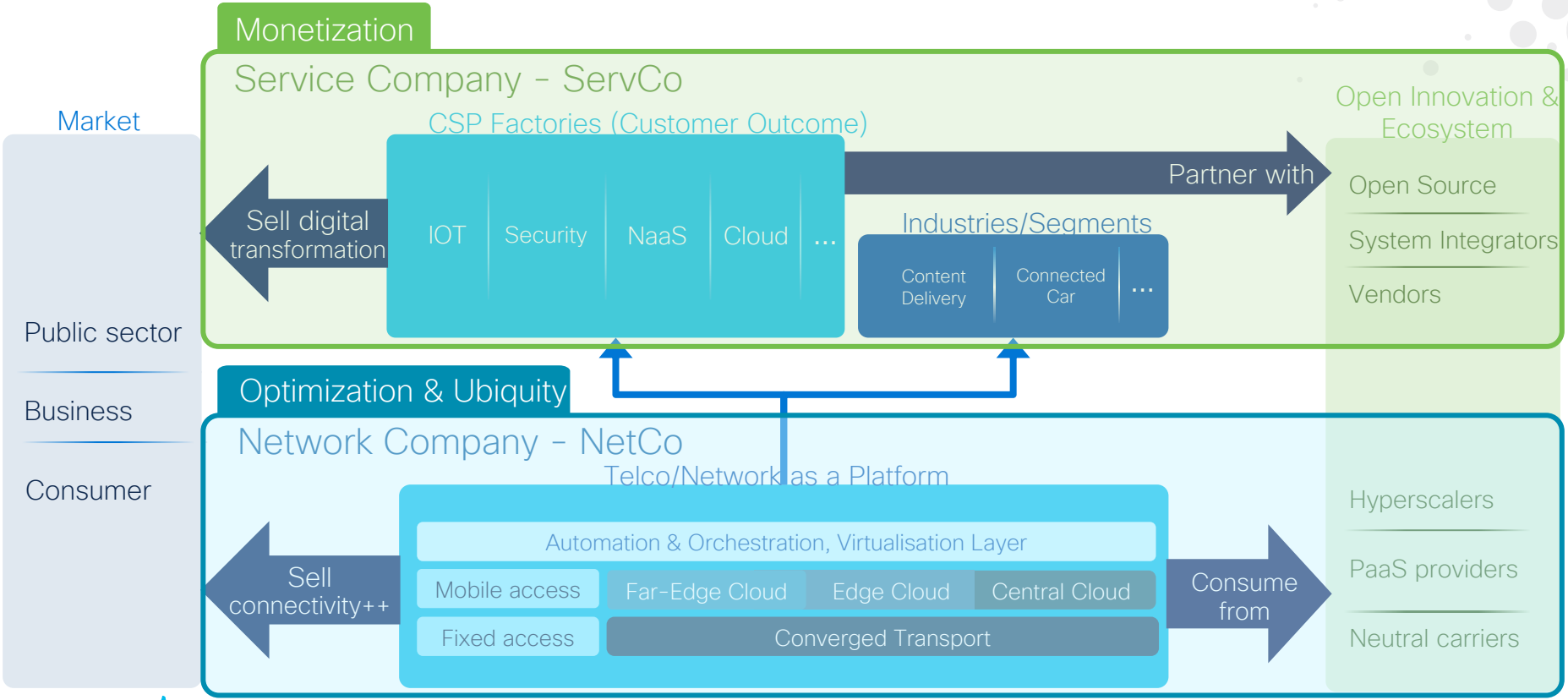
Service Factories

SP Sovereign Cloud

Sustainability



Summarisation of Session



The bridge to possible

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The bridge to possible

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