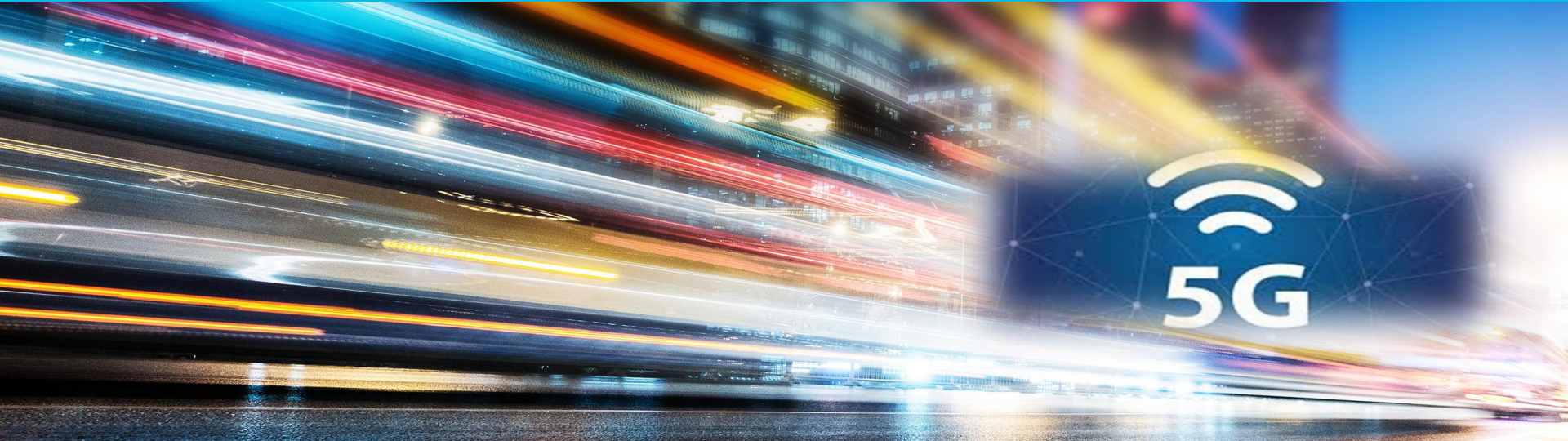# IPv6 Deployment in Cable Broadband
IPv6 Statistics, Cisco IPv6 Leadership, IPv6 Drivers, IPv6 Deployment

錢小山

首席技術顧問

思科大中華區數據中心架構事業部

二〇一九年六月

IPv6 Statistics

Worldwide Internet Usage 2019 (IPv4+IPv6)
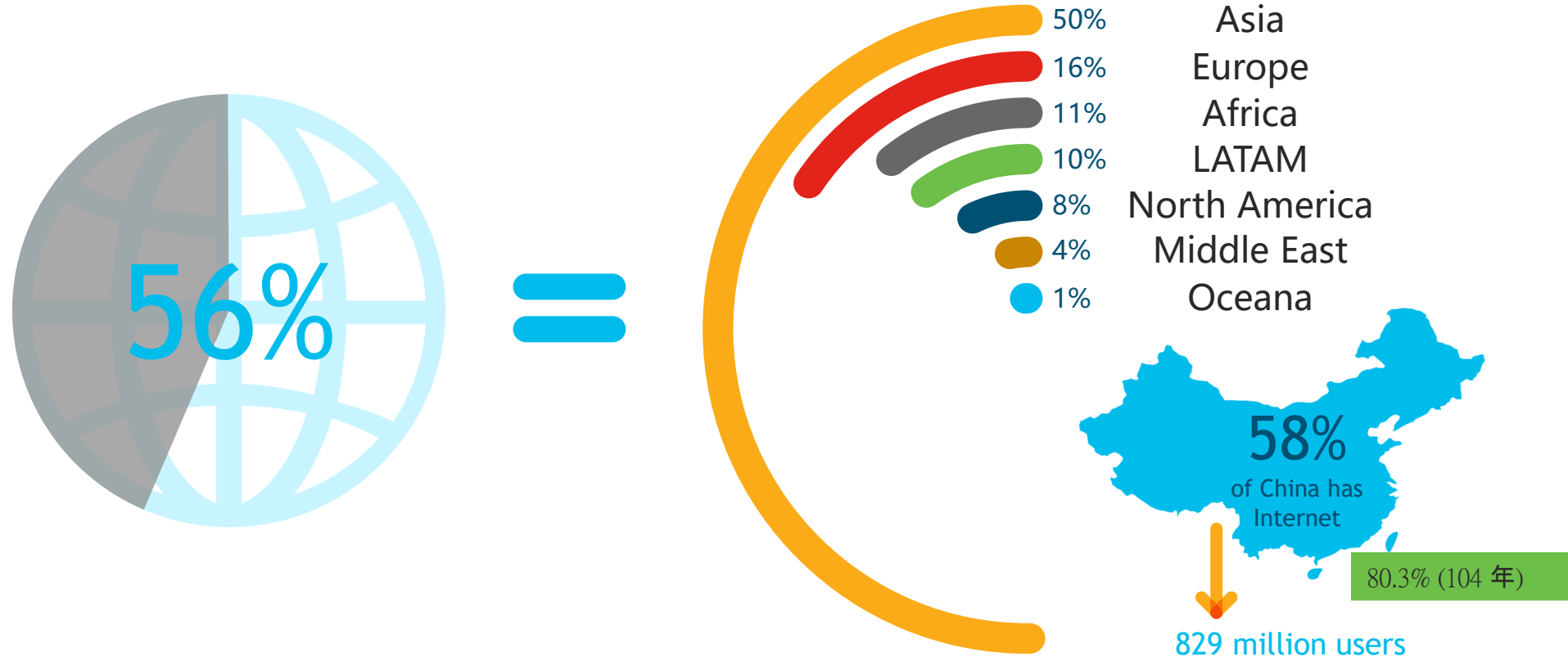
56%

of the world
has Internet access

4.34B users

Worldwide Internet Population by Region

56%

=

50%   Asia
16%   Europe
11%   Africa
10%   LATAM
8%   North America
4%   Middle East
1%   Oceana

58%
of China has
Internet

80.3% (104 年)

829 million users

IPv6 Usage Around The World

26%

Global IPv6 traffic

台灣排名全球第六, 比例 : 37.25%)
https://ipv6now.twnic.net.tw/ipv6/index.html
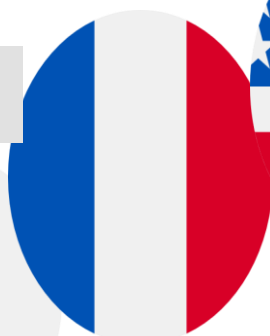
Russia 3%

China 8-9%**

Australia 16%

Canada 22%

UK 23%

France 25%
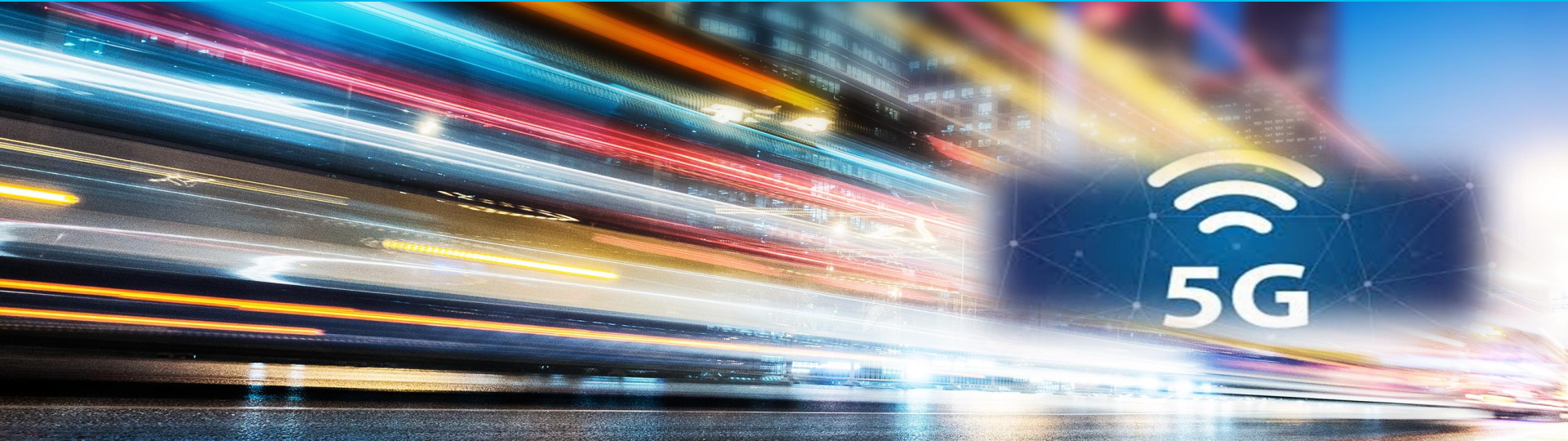
Brazil 27%

Japan 30%

India 35%

USA 37%

Germany 41%

** Estimated based on data from various sources

Source: https://www.google.com/intl/en/ipv6/statistics.html#tab=per-country-ipv6-adoption

Flag icons made by Freepik from www.flaticon.com

IPv6 Ready Certified Websites

台灣 IPv6 網站名錄 :12005
https://v6directory.twnic.net.tw/directory.cgi

647

https://www.ipv6ready.org/

Cisco IPv6 Leadership

Cisco IPv6 Pedigree

Steve Deering, Cisco Fellow (ret)
Lead Designer IPv6
Inventor IP Multicast

Clarence Filsfils, Cisco Fellow
Inventor of Segment Routing
Inventor of SRv6 (Segment Routing for IPv6)

Cisco IPv6 First-Hop (FHS) Security Solutions

New IPv6 link capabilities bring different security vulnerabilities
Cisco is unique in addressing these issues

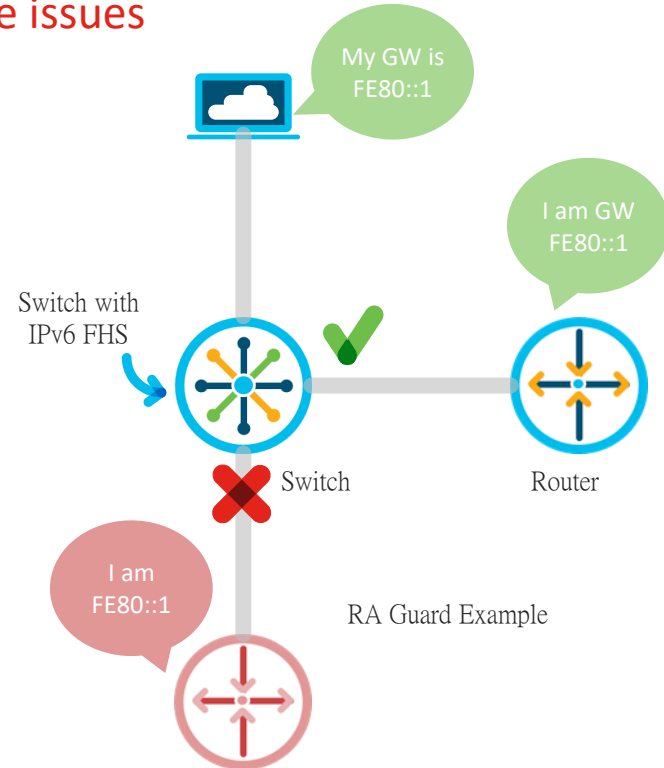|	
RA Guard	Blocks unauthorized router advertisements (RA)
DHCP Guard	Blocks unauthorized DHCP servers
IPv6 Snooping	Creates IPv6 address bindings, stores and analyzes
Src/Prefix Guard	Detects IP addresses, stores and analyzes
Dest Guard	Validates destination address of packets reaching link
RA Throttler	Facilitates scale by converting multicast RA into unicast
ND Mcast Suppress	Controls ND traffic required for proper link operatopms

My GW is FE80::1

I am GW FE80::1

Switch with IPv6 FHS

Switch

Router

I am FE80::1

RA Guard Example

Segment Routing IPv6 (SRv6)

❖ Source Routing
 - the topological and service (NFV) path is encoded in packet header

❖ Scalability
 - the network fabric does not hold any per-flow state for TE or NFV

❖ Simplicity
 - automation: TILFA sub-50msec FRR
 - protocol elimination: LDP, RSVP-TE, NSH⋯

❖ End-to-End
 - DC, Metro, WAN

Segment Routing IPv6 (SRv6)

SR was designed from the start to work in a native IPv6 network

IP/MPLS Architecture
Uses MPLS/IPv6 data planes

Simplified Control Plane
No LDP, TE, Segment IDs carried in IGP

Segment ID
Represents any type of instruction
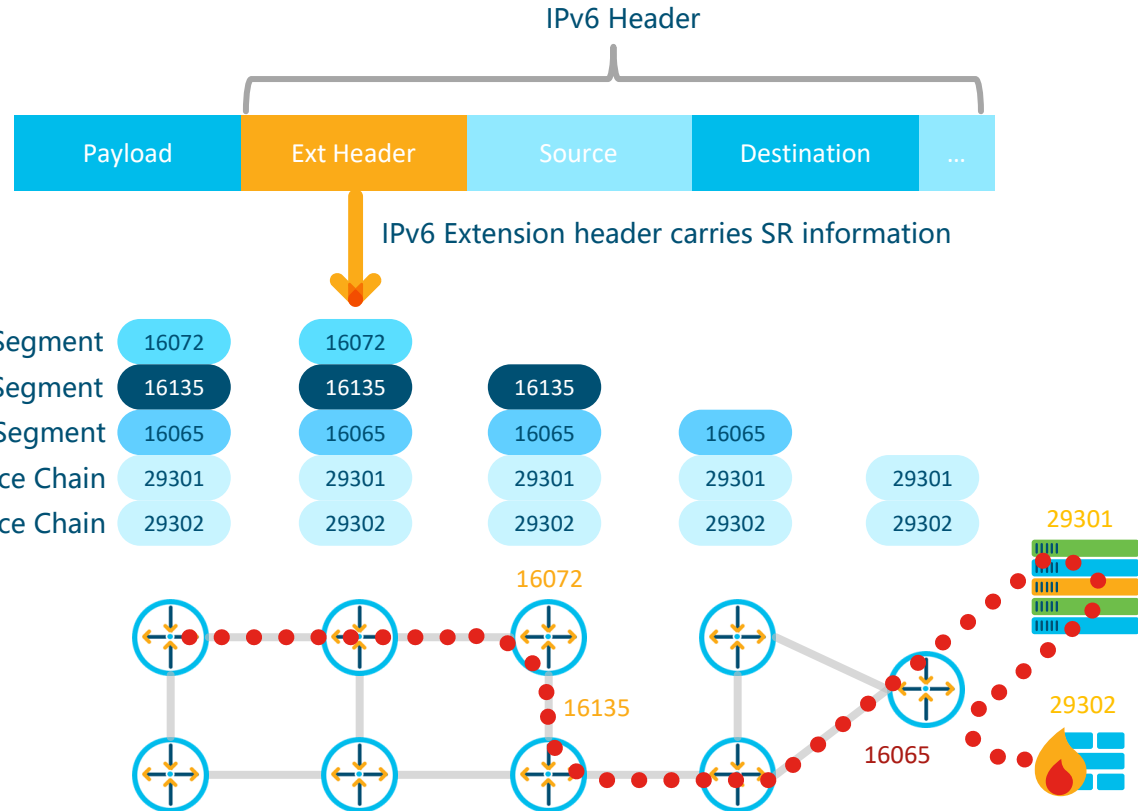Service, Context, Locator, Path
Global Node Segment
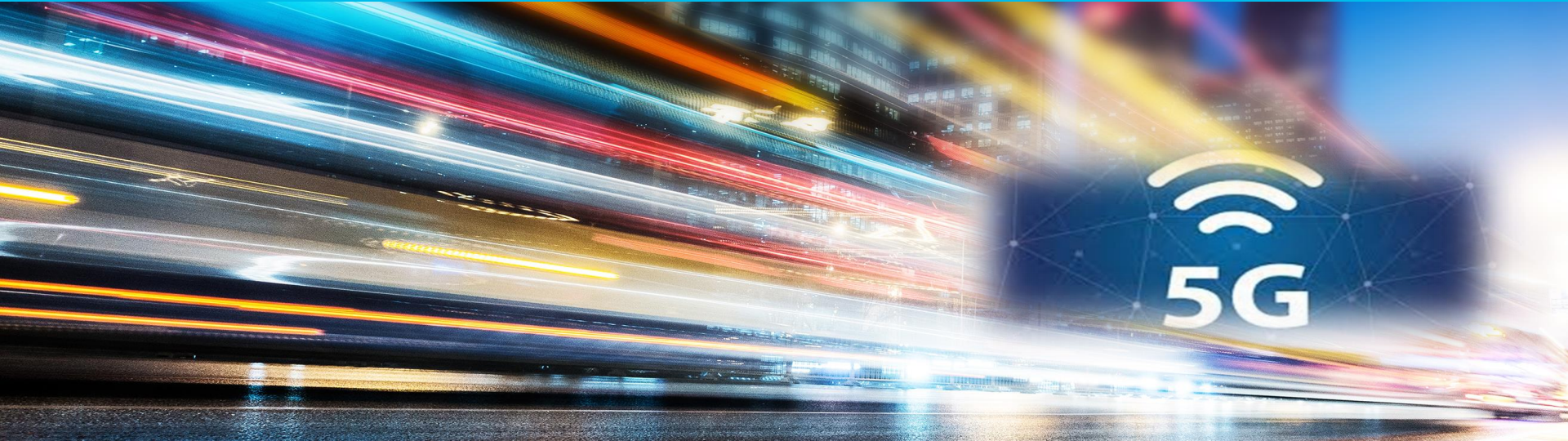**Local** Adjacency Segments

Source Routing
Path encoded in packet header
Uses MPLS labels or
IPv6 extension headers

Minimal State
Nodes only hold node segments
and their local adjacencies

IPv6 Header

Payload	Ext Header	Source	Destination	...

IPv6 Extension header carries SR information

Node Segment	16072	16072		
Adjacency Segment	16135	16135	16135	
Node Segment	16065	16065	16065	16065
Service Chain	29301	29301	29301	29301	29301
Service Chain	29302	29302	29302	29302	29302

16072

16135

16065

29301

29302

IPv6 Drivers

IPv6 Is Like IPv4
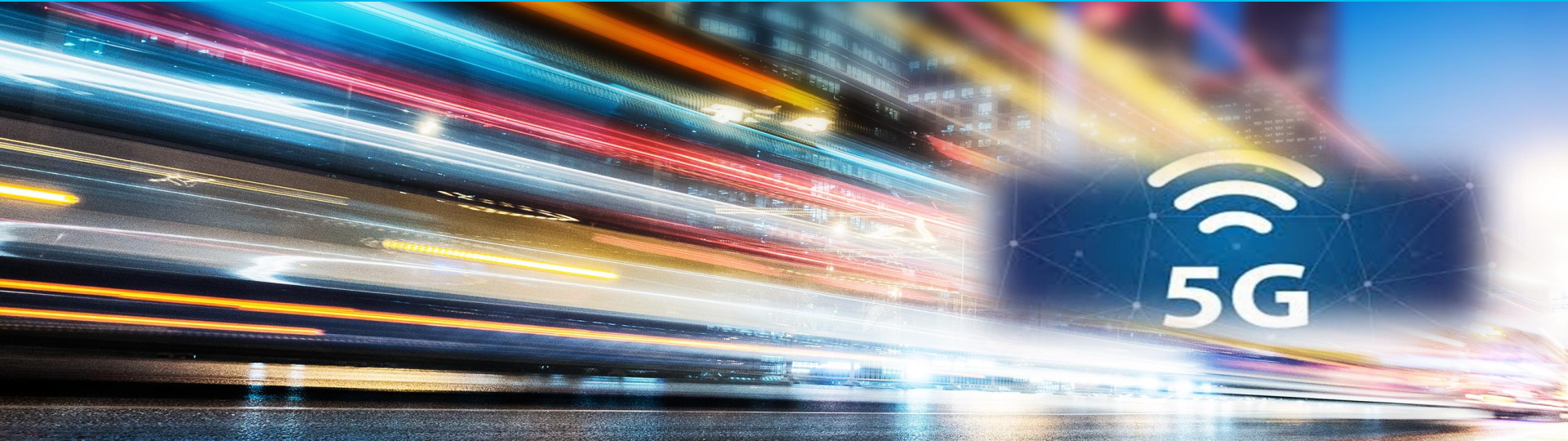
It is NOT a new service

IPv6 is an enabler

Massive connectivity

Network Simplification

(e.g., Segment Routing V6)

IPv6 Drivers

- Mandatory
  - Government Mandates
  - IPv4 address pool exhausted
  - NGN Capabilities to Defence
- Large Address Consumption
  - Population densities in APAC
  - 4G deployments
- IPv6 Technologies
  - Smart Grids/Sensor Networks/6LowPAN
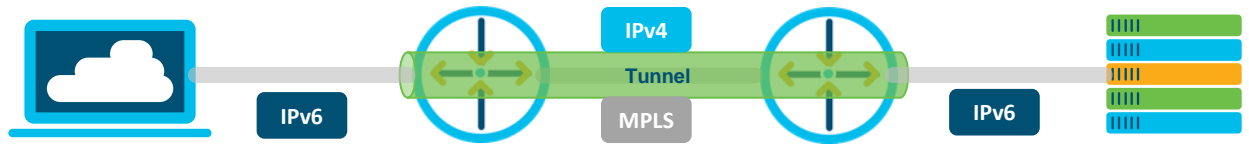 - Connected Communities
  - SRv6

IPv6 Deployment

IPv6 Deployment Options

Dual Stack (in devices/hosts and networks)
IPv4 and IPv6 operate in tandem over shared or dedicated links

ApplicationsIPv4/IPv6 capable

IPv4

IPv6

IPv4

Dedicated Links

IPv6

IPv4

IPv6

Shared Link

Tunnelling over IPv4 or MPLS
IPv6 confined to the edge of the IPv4 / MPLS core

IPv4

Tunnel

MPLS

IPv6

IPv6

IPv6 Only
IPv6 is the only protocol running in the network

IPv6

IPv6

IPv6

IPv4 : Limited End-to-End

End Point	Customer Edge	Access Network :	SP Edge	Core Transport	DC Edge	DC Edge Services	DC Network	Servers/VM
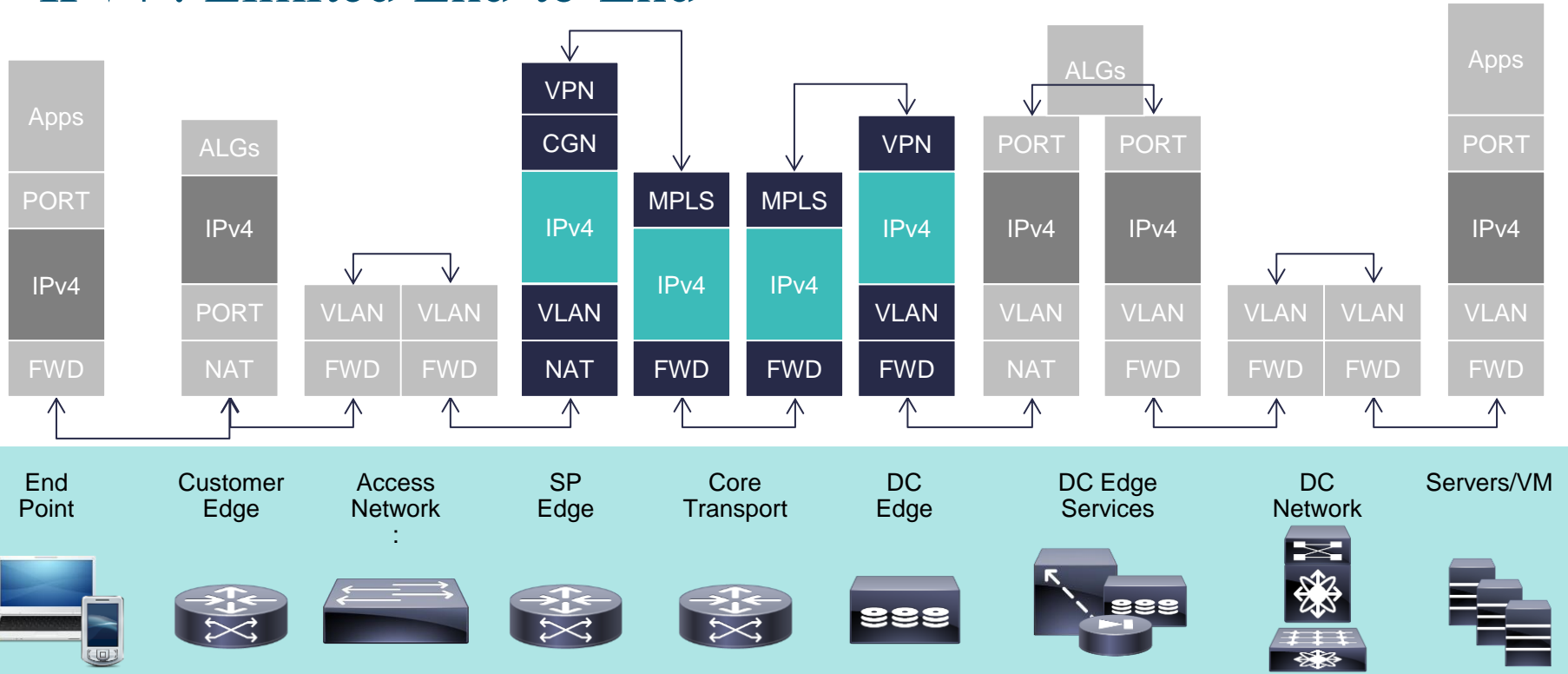
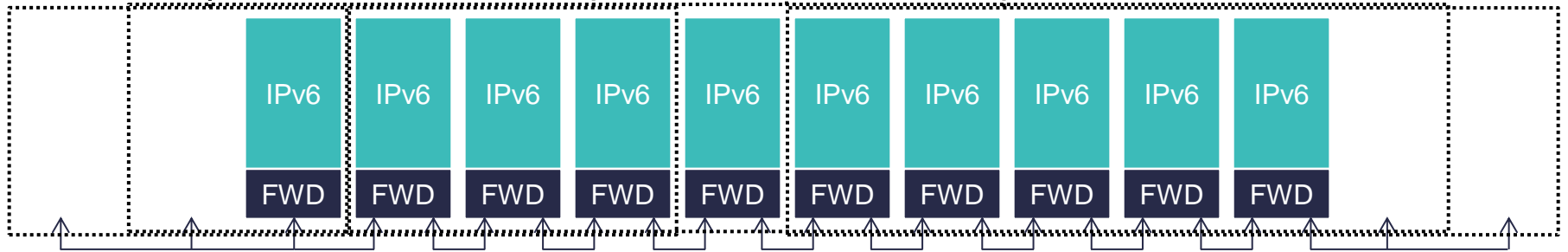# IPv6: Redefining End-to-End

IPv6 SR: "IPv6 with Segment Routing is SDN done right"

– John Leddy, SVP Network Architecture, Comcast

IPv6	IPv6	IPv6	IPv6	IPv6	IPv6	IPv6	IPv6	IPv6	IPv6
FWD	FWD	FWD	FWD	FWD	FWD	FWD	FWD	FWD	FWD

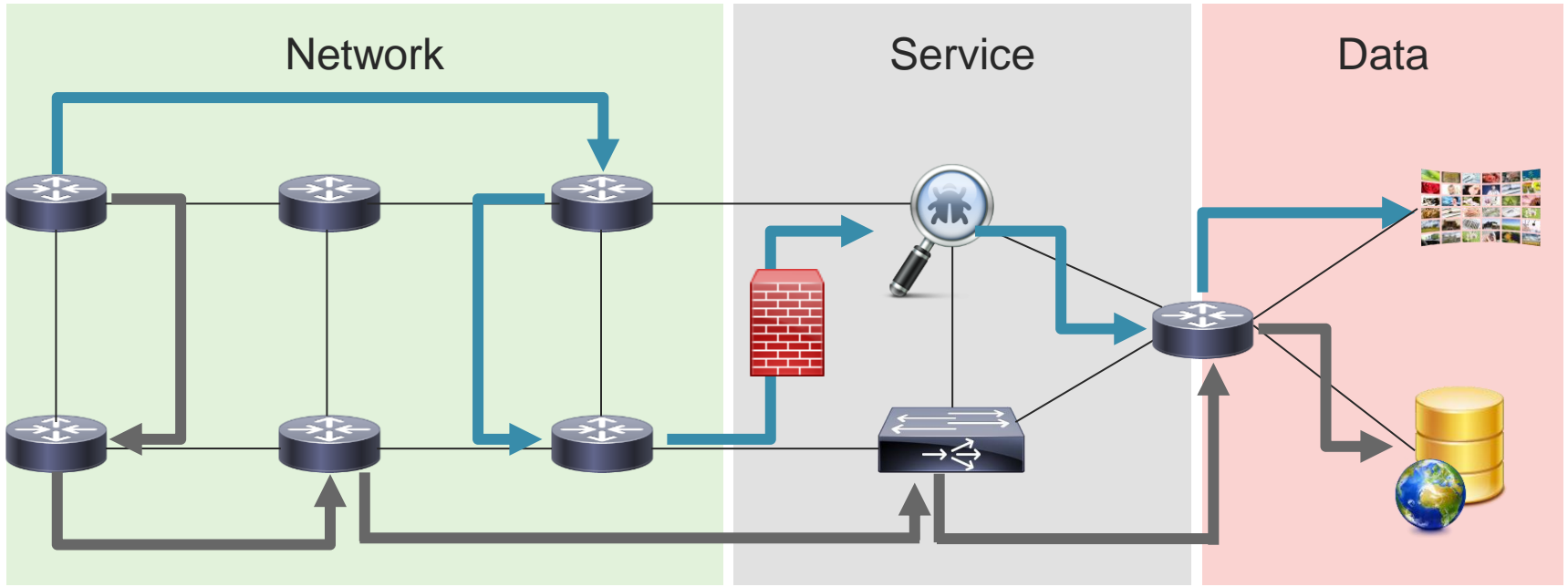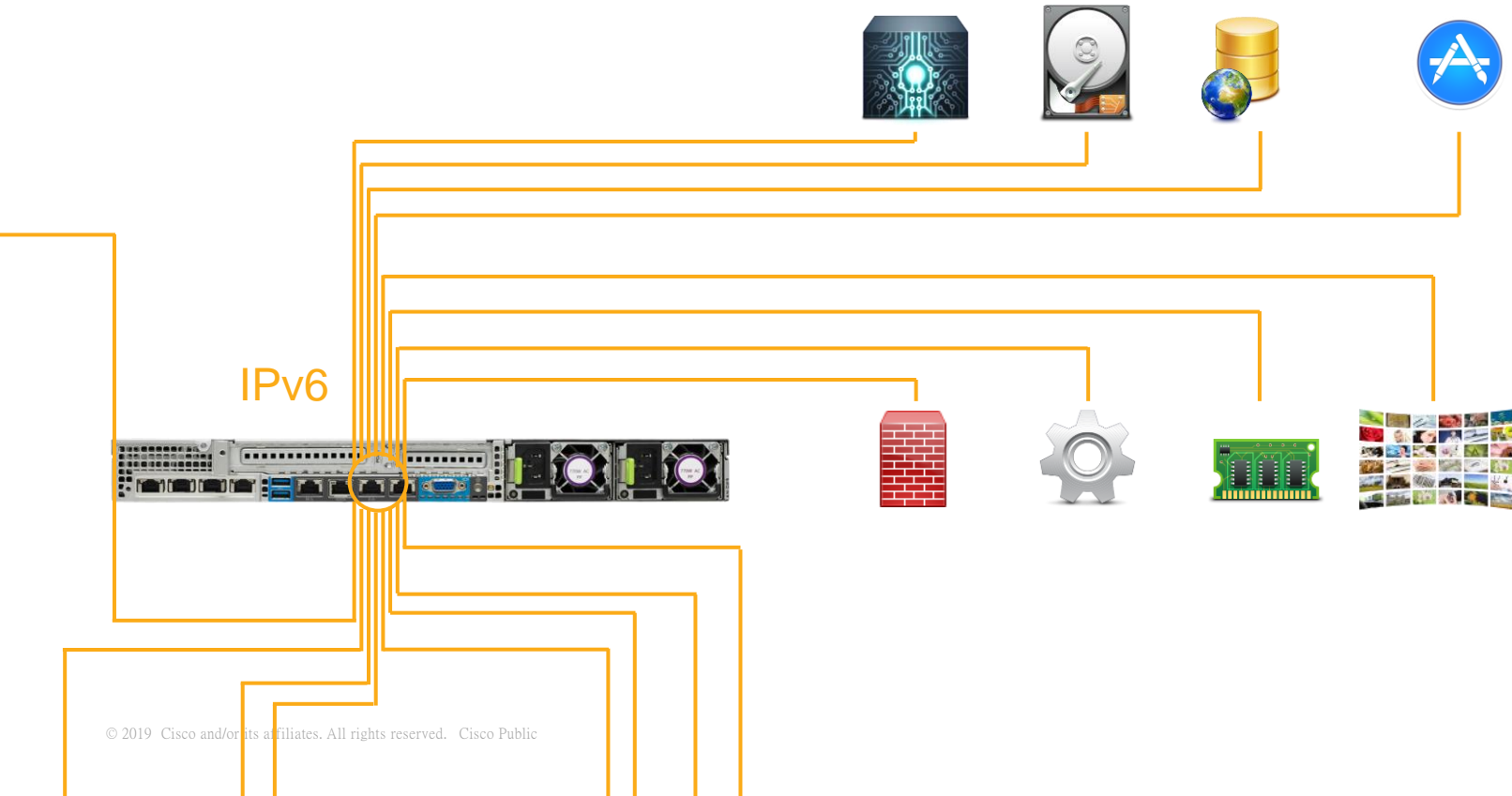| Apps	Services	End Point	Customer Edge	Access Network:	SP Edge	Core Transport	DC Edge	DC Edge Services	DC Network	Servers/ VM	Services	Processes

IPv6 Segment Routing

Stack of 128-bit Segment IDs within the IPv6 header

Routing beyond the network interface

IPv6

IPv6 SRCD

Simplify Operations	Optimize Network Utilization
IPv6-based v6/SR content delivery Automatic server selection Compatible with video standards (DASH, ⋯)	Delivery from "nearest" server Dynamic content placement Distributed caching Dynamic cache management Works on any v6 network