

The Risks and Opportunities of Future Network Architectures... ... in Australia

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Legal Disclaimer

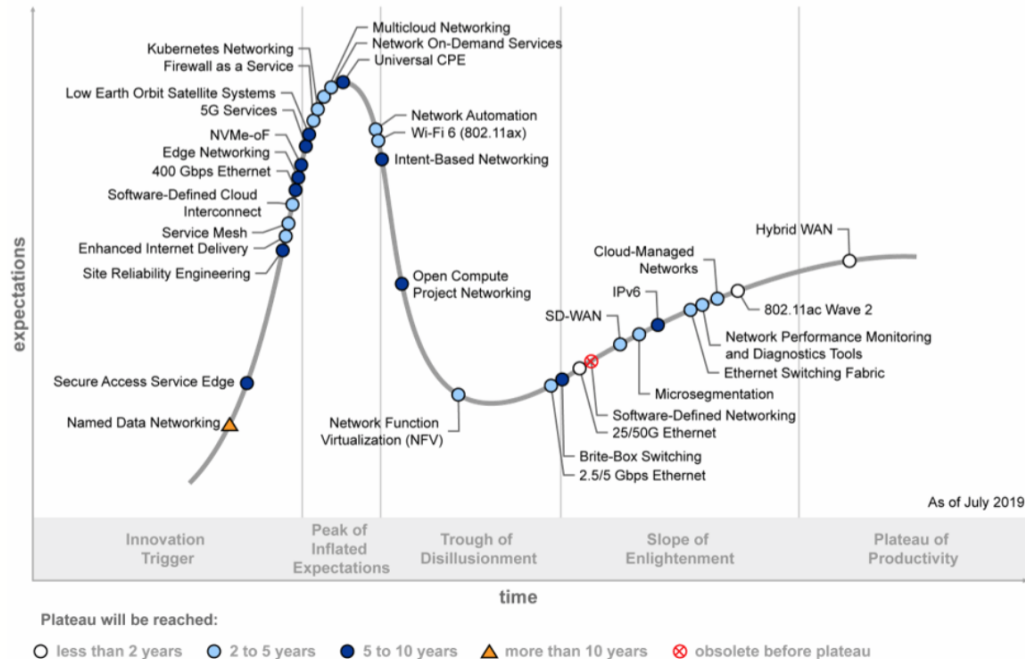
This presentation is generalised discussion of standards development and not intended to outline Arista's general production direction.

The development, release and timing of any feature or functionality described is subject to change and remains at Arista's sole discretion.

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August 2019: 'The Future Never Looked So Bright'



Source: <https://searchnetworking.techtarget.com/feature/Gartner-Hype-Cycle-deems-software-defined-networking-obsolete>

Is Leading Edge Worth The Risk?

Why New Standards Are Hard To Adopt

- Fear of Bleeding Edge
- Requires Software Upgrades
- Requires Hardware Upgrades
- Have to Learn New Skills
- Design Pattern Proliferation
 - (eg BGP communities)
- Time to do All The Things
- Security Policies and Regulation
- Consensus Leadership
- Vendor Selection
- Budget Constraints



20 Years Ago We Succeed with MPLS

IEEE Internet Computing



www.computer.org/internet

1996/1997:

- RFC1953: Ipsilon's Flow Management Protocol (IFMP)
- ID: IBM's Aggregate Route Based IP Switch (ARIS)
- RFC2105: Cisco's Tag Switching (TDP)
- RFC2129: Toshiba's Flow Attribute Notification Protocol (FANP)

2001:

- **RFC 3031: Multi Protocol Label Switching (MPLS)**

Source: <https://www.computer.org/csdl/magazine/ic/1999/05/w5016/13rRUwhHcMC>

<https://ieeexplore.ieee.org/document/650179?arnumber=650179>

ARIS: <https://tools.ietf.org/html/draft-viswanathan-aris-overview-00>

Why MPLS? 'Scale Data Plane By Removing IP-Based Forwarding'

Why Do Carrier Solutions Success?



Good Ideas Can Still Fail To Gain Adoption. Bad Ideas Still Sneak Through.

Why Was MPLS Successful?



'Gigabit IP'



From Months
to Weeks



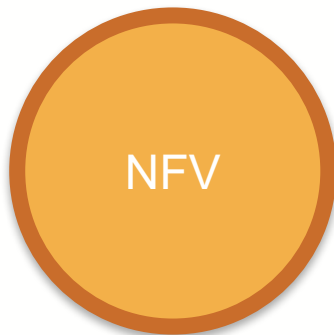
IP VPN

MPLS Was So Successful That We Even Built New Network Platforms

Do We Succeed All the Time?



2009
'OpenFlow'



2009
ETSI ISG



2011
World IPv6 Day

Test: If We Removed X From Our Networks What Would Break?

Future Architectures

Management

CI/CD, DevOps, NetOps, ZTN, NoOps

Services

BGP, EVPN, NFV, Network Slicing

Control

IGP, BGP, Controller

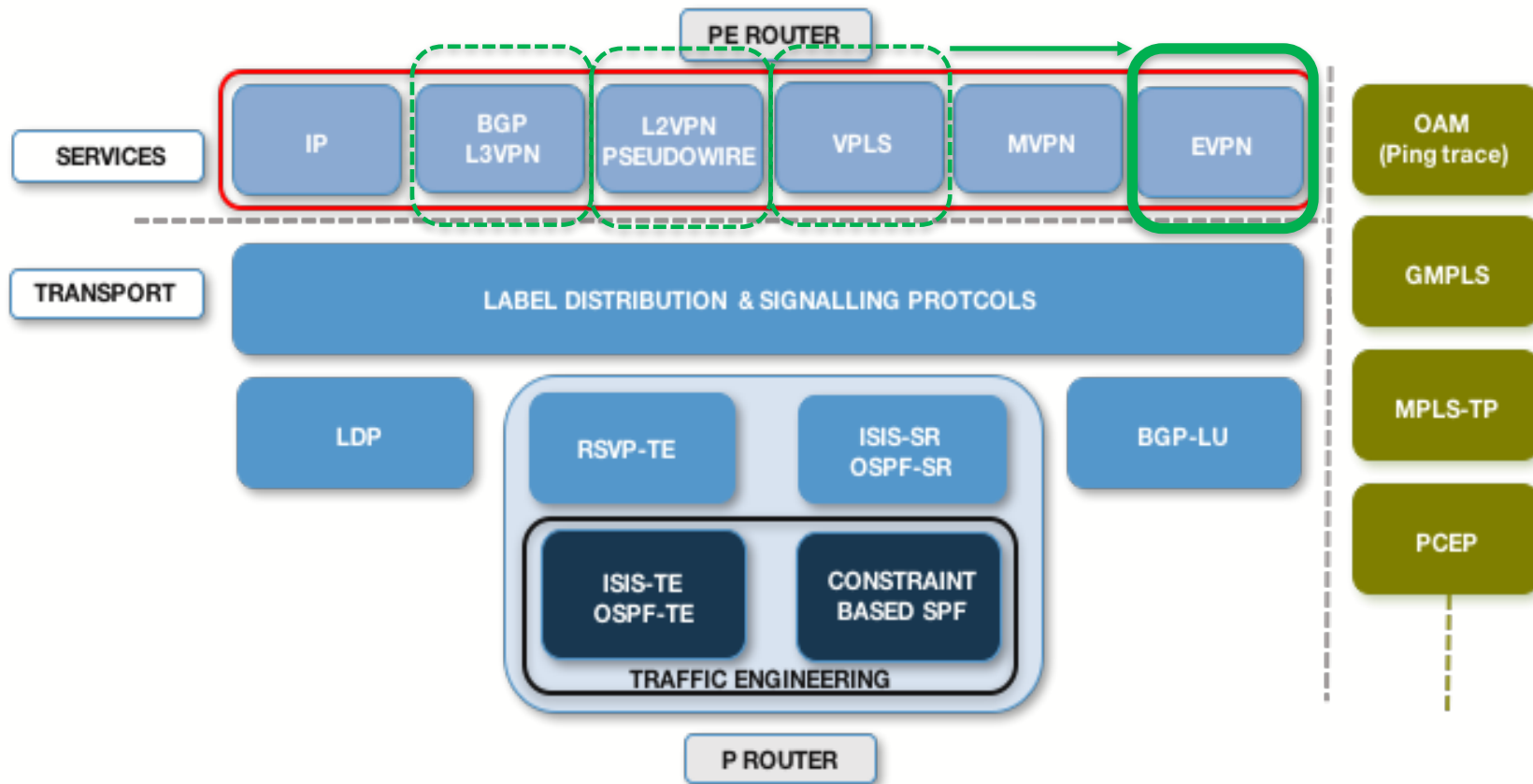
Data

SR, SR-TE, SRv6, FlexE

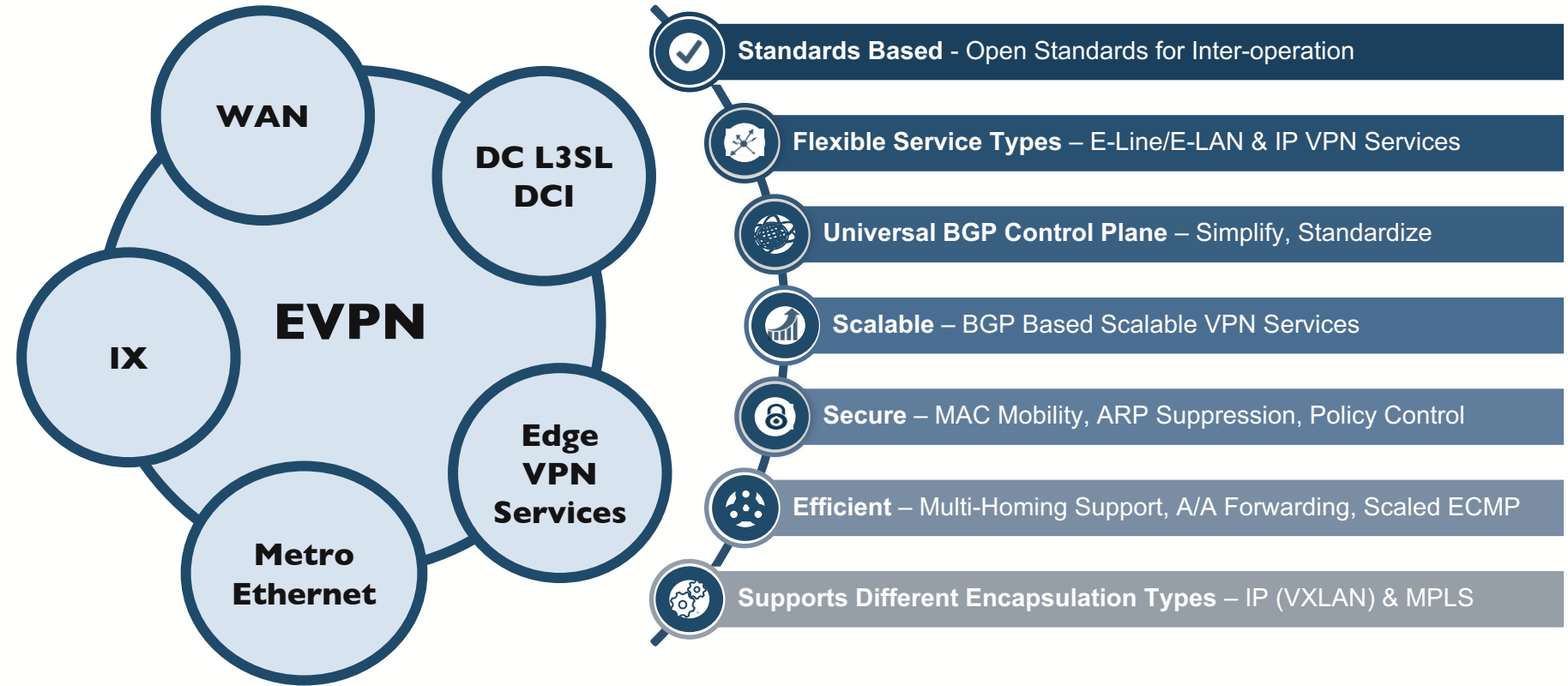


Services Plane EVPN

MPLS Services Overview

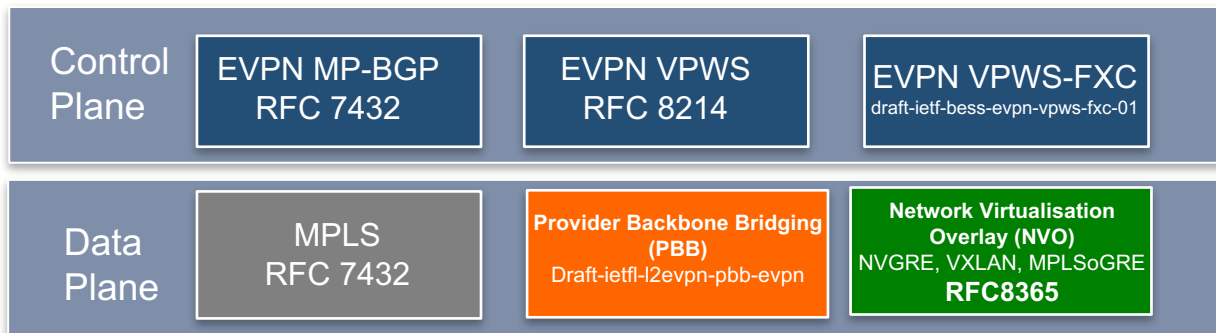


EVPN RFC – The All-in-One Address Family



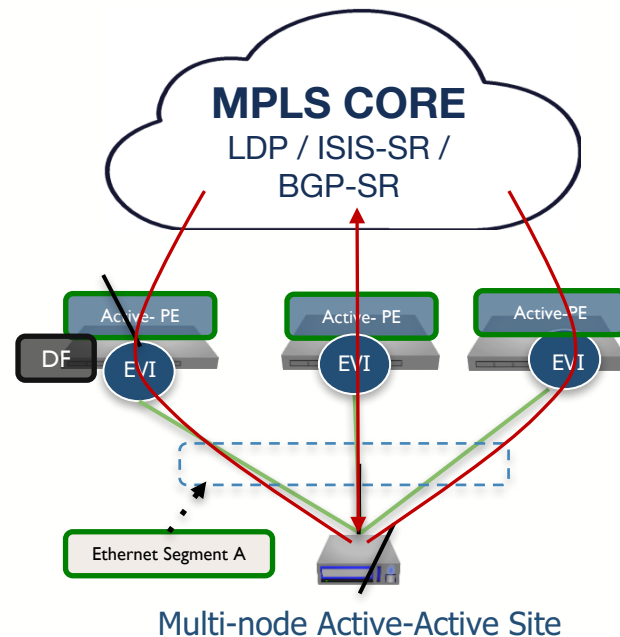
EVPN Main Standards Summary

- EVPN Standards RFC 7432, RFC 8214 (VPWS), Draft for VPWS-FXC
 - Specifics an BGP EVPN control plane with a MPLS data plane
 - BGP control plane, new address family to signal services and advertise MAC/IP and IP prefixes.
 - Previously known as draft-ietf-l2vpn-evpn
 - Multi-vendor authors involving vendors and operators
- EVPN Standard RFC 8365 – Network Virtualisation Overlay
 - Same EVPN control plane with a VXLAN Data plane (NVGRE, MPLSoGRE)



Benefits of EVPN VPWS Services Over LDP

- **Active-Active Multi-homing**
 - Flow based A/A forwarding
- **BGP Control Plane**
 - Standardize, Interoperable, Scalable
 - No separate control protocol for PW signaling (LDP)
 - Can use BGP fast convergence techniques BGP PIC
- **Efficient**
 - Multi-Homing Support with A/A Forwarding
 - Fast convergence (Mass withdrawal)
 - Scaled ECMP
- **Flexible**
 - Inter-AS deployments
 - BGP-based control plane provides ability to apply fine-grained policies



Is EVPN Likely to Succeed?



VXLAN Permits
Wider HW Choices



BGP CP
DC + Net UC



'Retire VPLS
and LDP PWE'

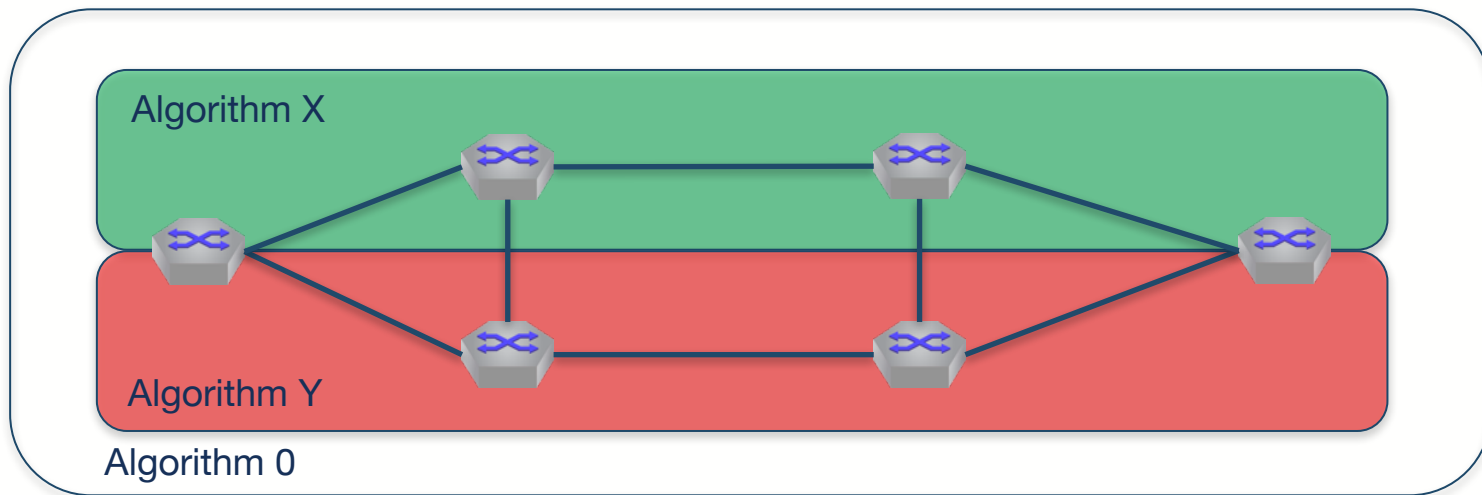
Yes. EVPN is Worth Our Time and Attention.



Control Plane IGP Evolution

Flex Algo (ID)

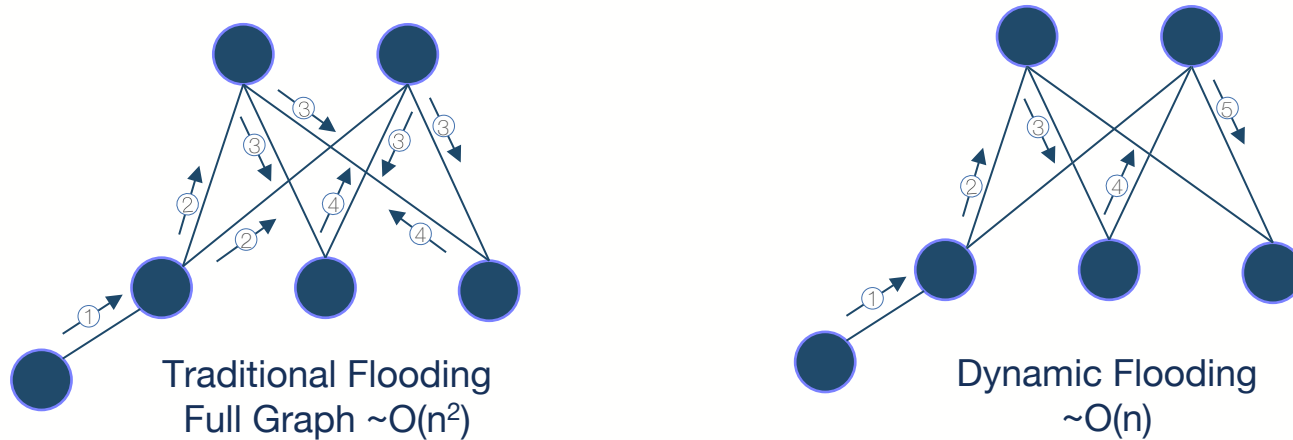
- Defines optimization objectives/constraints: Metric, Delay, SLRG, Affinity
- User defined 'Algorithms' to minimize or exclude certain properties
- 'Algorithm 0' is always SPF based on Link Metric



FlexAlgo: <https://tools.ietf.org/html/draft-ietf-lsr-flex-algo-03>

IGP Dynamic Flooding (ID)

- IGP flooding is opportunistic and complete – flood everywhere while maintaining transmission lists to prevent endless reflooding, w/split horizon
- In dense topologies the amount of information flooded overwhelms the control plane at scale, with no solution to date other than avoidance
- Goal is to reduce flooding to a minimal (not nec. optimal) flooding topology



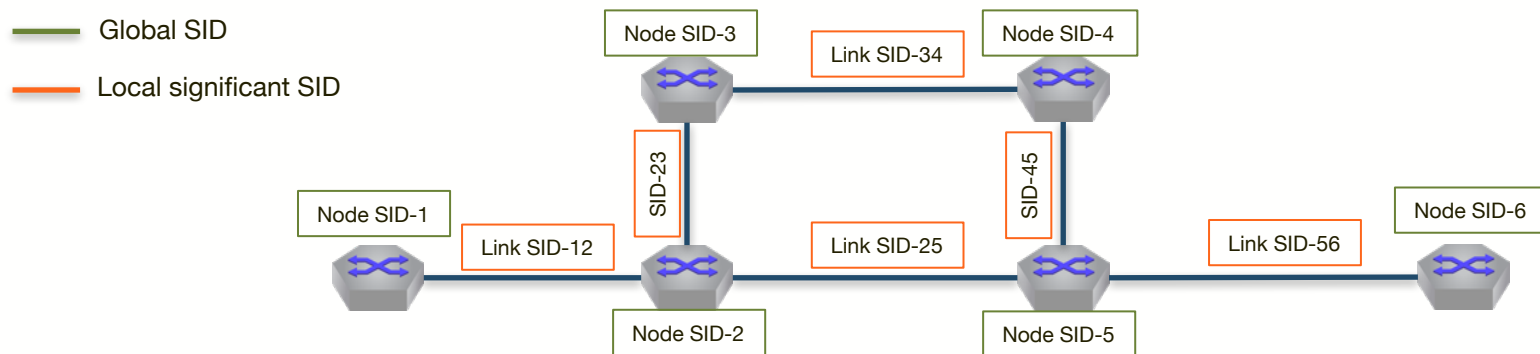
Dynamic Flooding: <https://tools.ietf.org/html/draft-ietf-lsr-dynamic-flooding>



Data Plane Segment Routing

Segment Routing Overview RFC 8402

- SR divides the network into “segments” identified by a Segment ID (SID)
 - Global SIDs identify nodes (loopback ip), prefix or Anycast SID (shared loopback IP)
 - Local significant Adjacency SIDs identify the Adjacency links in the network
 - Both local and global SIDs are advertised as TLV extensions to the IGP (IS-IS/OSPF)
 - The SID is encoded as an MPLS Label in the forwarding plane



Why? ‘Scale Control Plane By Removing Forwarding State’

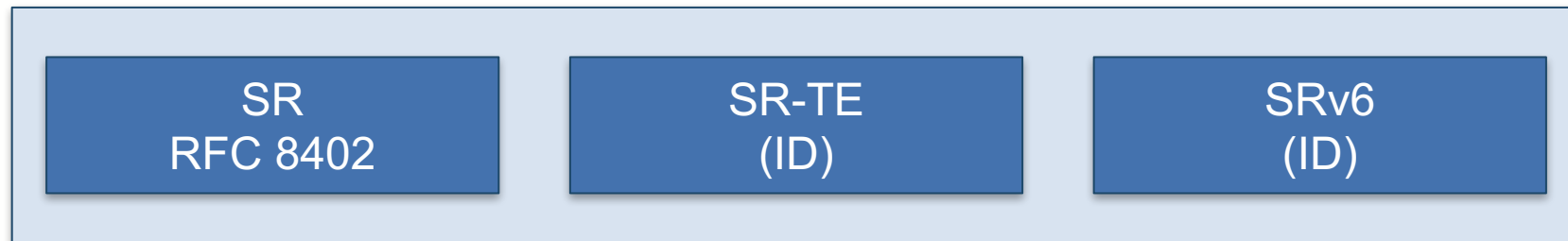
Segment Routing – Comparison to LDP and RSVP

	LDP	RSVP-TE	SR
Overview	MP2P	P2P	MP2P
Operation	Simple	Difficult	Simple
Separate Label Distribution Protocol	Yes	Yes	No
Dependencies	Relies on IGP	Relies on IGP extensions	Relies on IGP
Label Allocation	Locally significant	Locally significant	Global (local ADJ SID)
MPLS ECMP	Yes	No	Yes
Traffic Engineering (TE)	No	Yes	Yes
TE Scale	N/A	Medium/Low N(N-1)	High
Fast Reroute	Partial LFA (<100%)	Yes Node/Link Protection	Yes TI-LFA
Multicast	Yes mLDP	Yes P2MP LSP	No Deployed With Parallel MC Control Plane
IPv6	Limited Extensions Required	Limited Extensions Required	Native

Source: MPLS Segment Routing, Driving a modern approach to MPLS transport - https://www.arista.com/assets/data/pdf/Whitepapers/MPLSSegmentRouting_Whitepaper.pdf

Biggest Claims About SR

- Simplification: Removing state from the network
- Fewer Protocols: No need for RSVP/LDP
- Service Chaining: Personalised Services with NSH/SRH
- TE/Network Slicing: Differentiated Services, New 5G Revenue Generation
- 5G: SR (SRv6) is seen by many as a defacto requirement for 5G networking.



Do We Have A Common Understanding of What Segment Routing Is?

SR-TE: <https://tools.ietf.org/html/draft-ietf-idr-segment-routing-te-policy-07>

SRv6: <https://tools.ietf.org/html/draft-ietf-spring-srv6-network-programming-01>

Do These Benefits Apply in Australia?



Challenges Facing Australian Operators

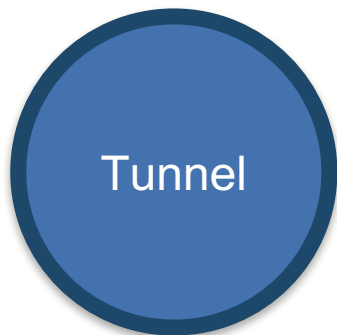
Challenges Facing Australian Market:

- Finding rack space, power and fiber
- Operating in a NBN world
- Regulation (LI, Metadata, TSSR)
- Adapting existing hardware platforms to emerging solutions
- Integrating new technologies into existing architectures

Integrating Segment Routing Into Existing Networks



SRMS
(ID)



Binding SIDs
RFC 8426



e.g. EVPN VPWS
RFC8214



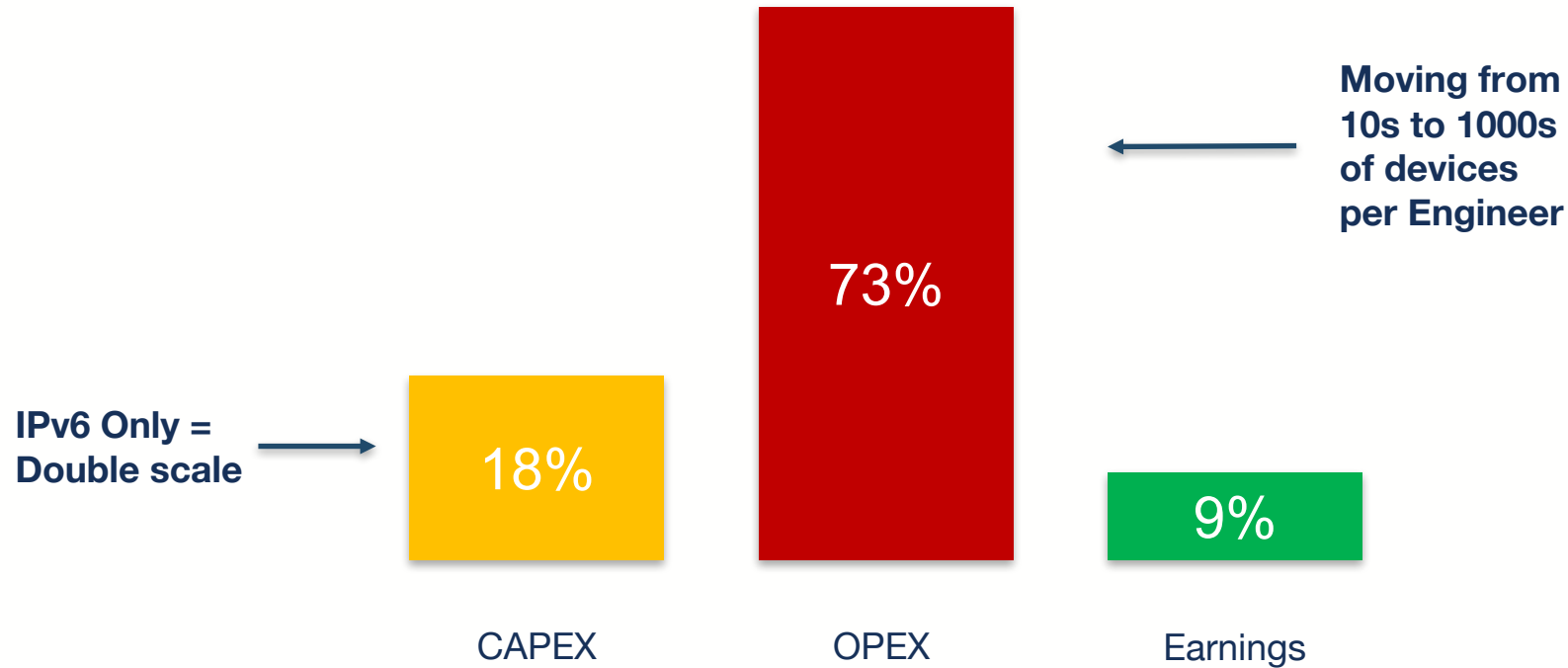
e.g. 'Supercore'
(\$\$\$\$)

SRMS: <https://tools.ietf.org/html/draft-ietf-spring-segment-routing-ldp-interop-15>



Management Plane Operations

Carrier Revenue Example: Telstra FY2018



Source: <https://www.telstra.com.au/content/dam/tcom/about-us/investors/pdf%20F/2018-Annual-Report-singlepages.pdf>

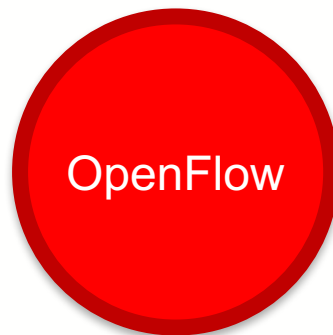
Changing The Way We Operate

Data continued...

<i>Date</i>	<i>Type</i>	<i>Volume(KB)</i>	<i>Gross Amount in \$</i>	<i>Nett Amount in \$</i>
22 Jul	Included	138431	0.00	0.00
23 Jul	Included	415194	0.00	0.00
24 Jul	Included	677990	0.00	0.00
25 Jul	Included	215024	0.00	0.00
26 Jul	Included	162034	0.00	0.00
27 Jul	Included	50586	0.00	0.00
28 Jul	Included	301634	0.00	0.00
29 Jul	Included	129300	0.00	0.00
30 Jul	Included	643454	0.00	0.00
31 Jul	Included	415826	0.00	0.00
01 Aug	Included	207351	0.00	0.00
02 Aug	Included	80942	0.00	0.00
03 Aug	Included	245491	0.00	0.00
04 Aug	Included	126	0.00	0.00
05 Aug	Included	199	0.00	0.00
06 Aug	Included	44350	0.00	0.00
07 Aug	Included	112688	0.00	0.00

Controller Driven Models Require HA Connection to Each Node

Do Controllers Solve Operations?



Controller Driven Models Require HA Connection to Each Node

The Challenge With Network Controllers

- Someone in Ops still needs to define what the controller does.
- Conflicting business rules
- Ensuring high-availability of controller systems
- Sourcing is complex
- SBI: BGP-LU, SR-TE, OpenConfig
- NBI: ?
- Federation/Communication with other Controllers (eg OpenStack)

Controllers Aren't Evil. But They Can Be Misused



Summary

Summary

- Once in a 20 year opportunity to redefine carrier networks. Let's get this right!
- Let's keep talking about what standards mean for Australian Networks.
- Global service provider scaling issues are less relevant in AU market.
- Future networks wont be defined by self-driving cars and augmented reality
- Gradual but constant evolution of operations may be only way forward.
- Please complete the speaker evaluation. Thanks!



Thank You

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