Programmable, model driven & application aware multi layer softwa with segment routing

ERICSSON

Jeff tantsura

Head of technology strategy routing &

IETF RTGWG chair

agenda

ERICSSON

Why segment routing

what is going on with segment routing

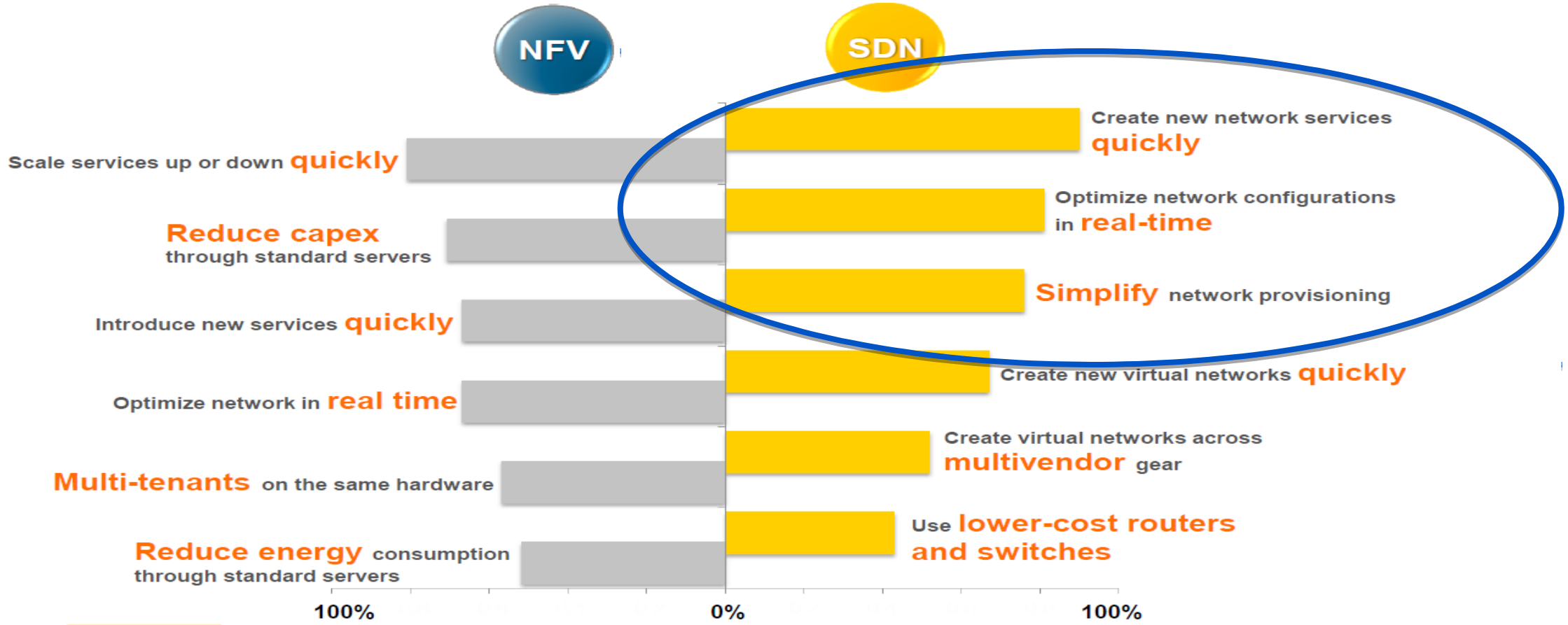
YANG and models – industry trends

segment routing + open daylight sdn controller: how it is done

use cases

summary

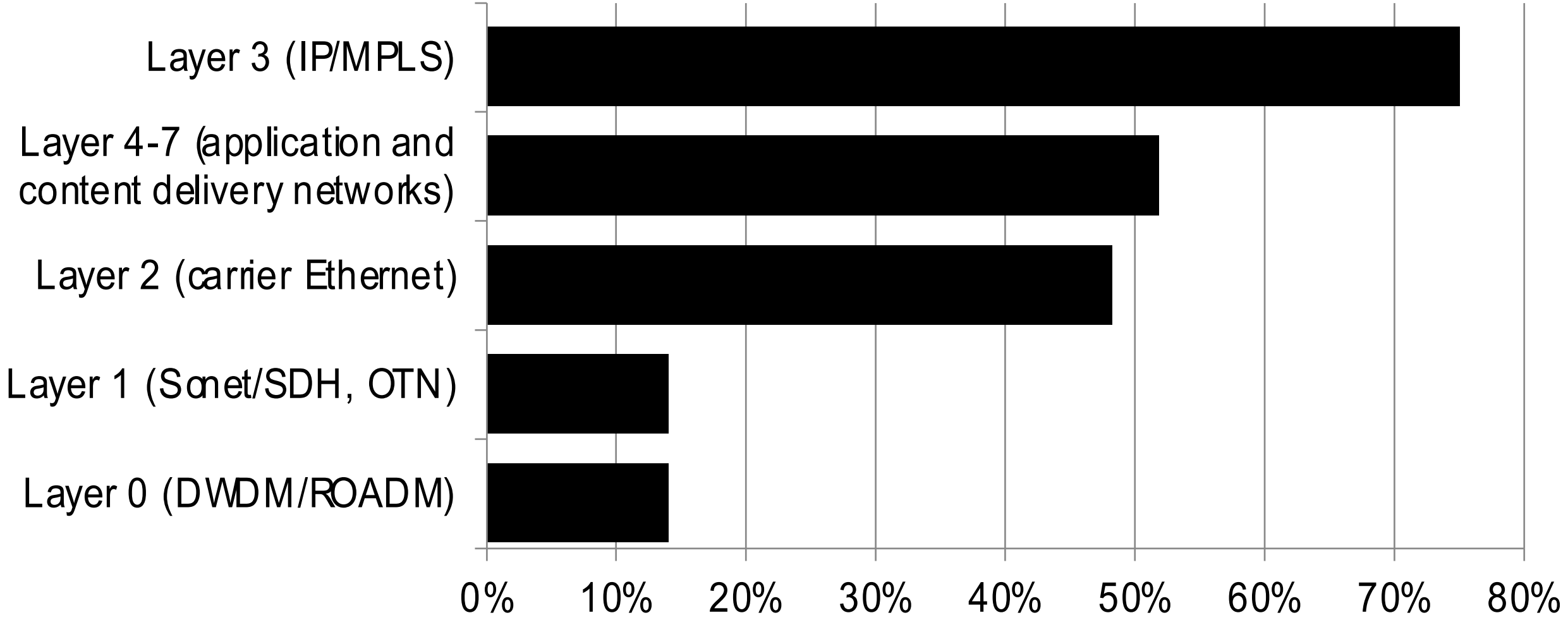
SDN ambitions
service provider expectations



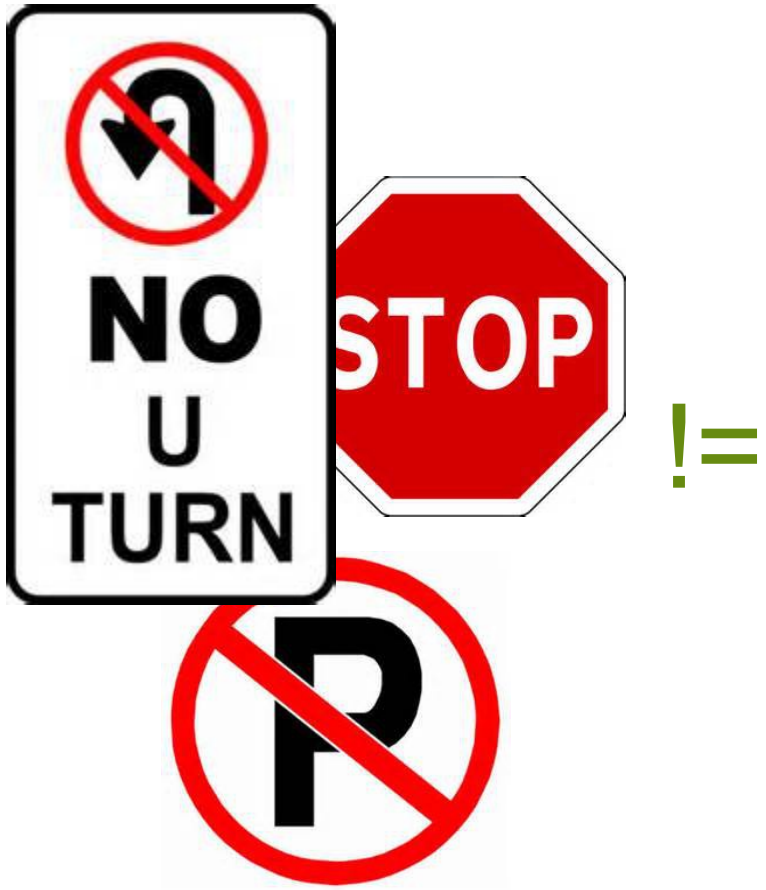
INFONETICS RESEARCH

© Infonetics Research: *SDN and NFV Strategies: Global Service Provider Survey*, July 2013. (53% of world telecom capex)

Network Layers Expected to Benefit the Most From SDN



We need to separate policy from reachability



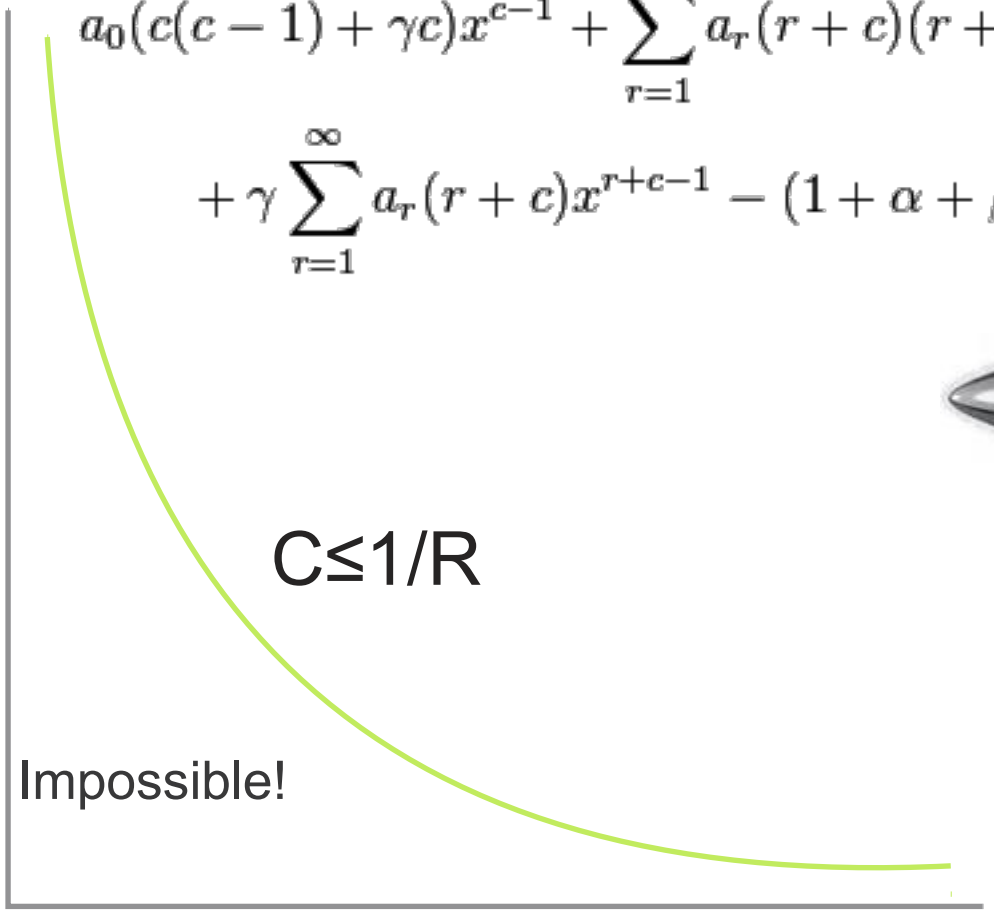
!=

There is no Silver Bullet for Complexity with centralized model

ERICSSON

$$a_0(c(c-1)+\gamma c)x^{c-1}+\sum_{r=1}^{\infty}a_r(r+c)(r+c-1)x^{r+c-1}-\sum_{r=1}^{\infty}a_{r-1}(r+c-1)(r+c-2)x^{r+c-1}$$

$$+\gamma\sum_{r=1}^{\infty}a_r(r+c)x^{r+c-1}-(1+\alpha+\beta)\sum_{r=1}^{\infty}a_{r-1}(r+c-1)x^{r+c-1}-\alpha\beta\sum_{r=1}^{\infty}a_{r-1}x^{r+c-1}=0$$



ERICSSON

Scott Shenker – it's time for SDN V2

Scott Shenker, one of the minds behind the creation of SDN, has some misgivings about the technology. It's time for SDNv2!

Why is this different? Because Shenker and others started out assuming the network was homogeneous. The differences between core and edge switches — the existence of MPLS, essentially — wasn't taken into account.

"This one is unforgivable. We just ignored current systems," Shenker said. "One of the secrets, when you teach networking, [is that] nobody covers MPLS.

ERICSSON

Four Implicit SDN Assumptions

1. Control program configures all network switches
2. Switches relatively homogenous in role/function
3. Switches all use hardware (ASICs) for forwarding
4. Network dataplane is fairly simple (just forwarding)

We were wrong on all of them…..

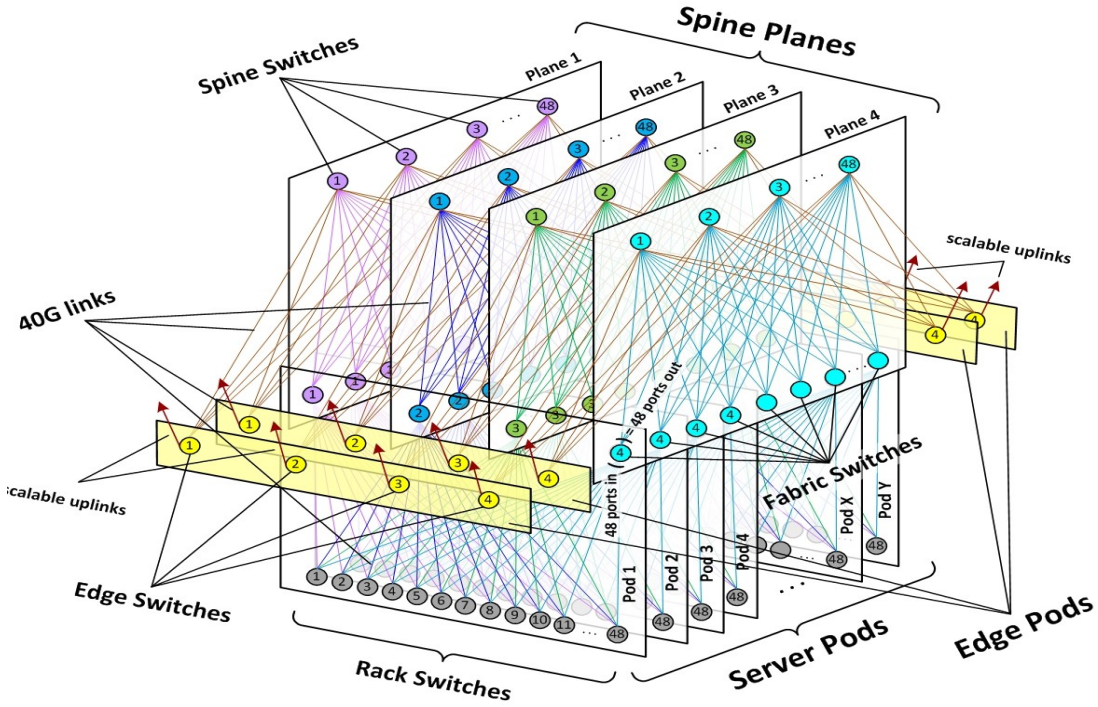
7

We Ignored MPLS's Edge/Core Split

- Operators have a variety of requirements:
  - Connectivity, isolation, access control, …
- All but connectivity can be implemented at edge
- The core only responsible for delivering packets
- The SDN equivalent of the End-to-End Principle
  - Keep the core of the network simple (just deliver packets)
  - Push all complexity to the edge
  - *Everyone but academics knew this a long time ago….*

13

FB and MS choose routing with “centralized override” in their DC’s



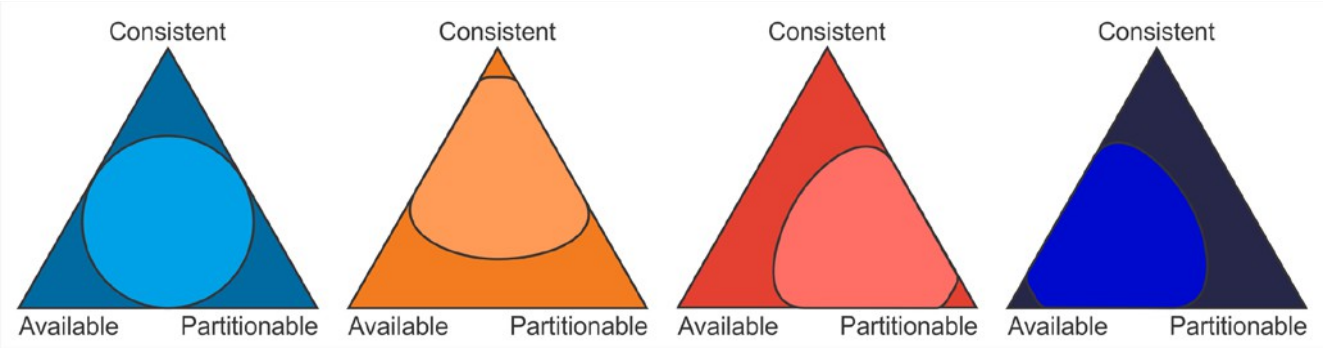
FB: We were able to build our fabric using standard BGP4 as the only routing protocol. This enabled us to leverage the performance and scalability of a distributed control plane for convergence, while offering tight and granular routing propagation management and ensuring compatibility with a broad range of existing systems and software. We call this flexible hybrid approach **“distributed control, centralized override.”**

Routing as a Database

ERICSSON

- CAP theorem says we can choose two of…
  - Consistent
  - Available
  - Partionable

- Routing protocols are eventually consistent, always available, and partitionable



Be open and pragmatic:
SDN is about programmability, not SB protocols

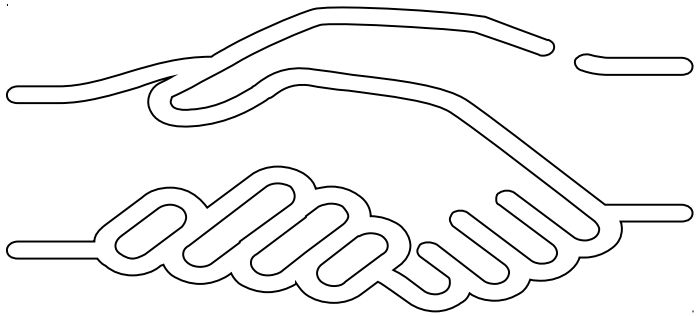

Logically centralized,
physically distributed !
“If you can’t explain it simply, you don’t understand it well enough ”
Albert Einstein

Sr Is Real and happening!

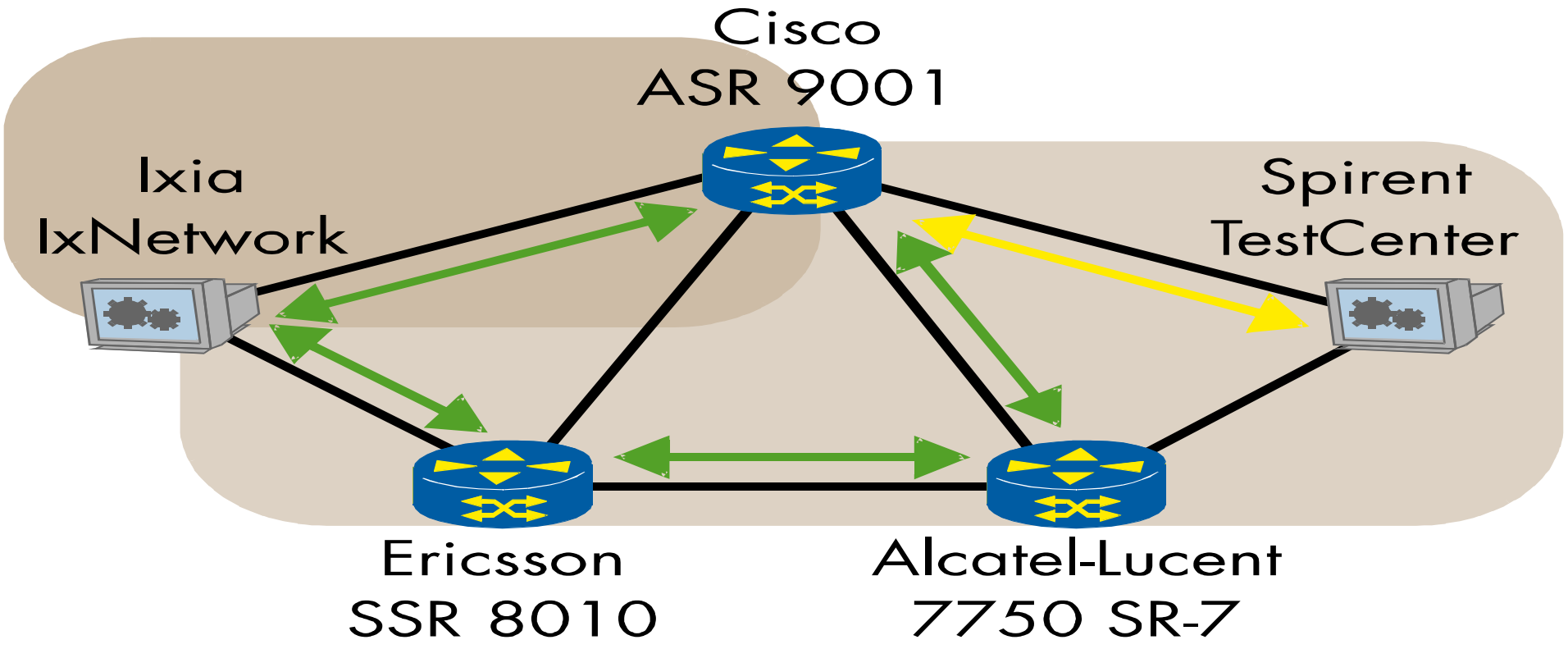
vidi, Ed.
Filsfils
Bashandy
ems, Inc.
. Gredler
rks, Inc.
Litkowski
Decraene
Orange
Tantsura
Ericsson
18, 2014

- Excellent **endorsement** and **leadership** from SP and Enterprise operators
- IETF: Multi-vendor consensus and collaboration:
  - Stefano/Clarence - Cisco
  - Jeff Tantsura - Ericsson
  - Wim Hendericks - ALU
  - Hannes Gredler - Juniper
- We have submitted detailed IETF drafts:
  - Architecture
  - Use-cases
  - ISIS extensions
  - OSPF extensions
  - BGP extensions
  - PCEP extensions
  - FRR with 100% coverage

S. Previdi, Ed.
C. Filsfils, Ed.
A. Bashandy
Cisco Systems, Inc.
M. Horneffer
Deutsche Telekom
B. Decraene
S. Litkowski
Orange
I. Milojevic
Telekom Srbija
R. Shakir
British Telecom
S. Ytti
TDC Oy
W. Henderickx
Alcatel-Lucent
J. Tantsura
Ericsson
March 20, 2013



Eantc 2015:
SR ISIS interworking e///, cisco and alu



Segment routing with ODL – structured agility

ERICSSON

- Segment Routing with ODL – winning proposal for Operators
- Open Source Open Daylight + Open Standards IETF

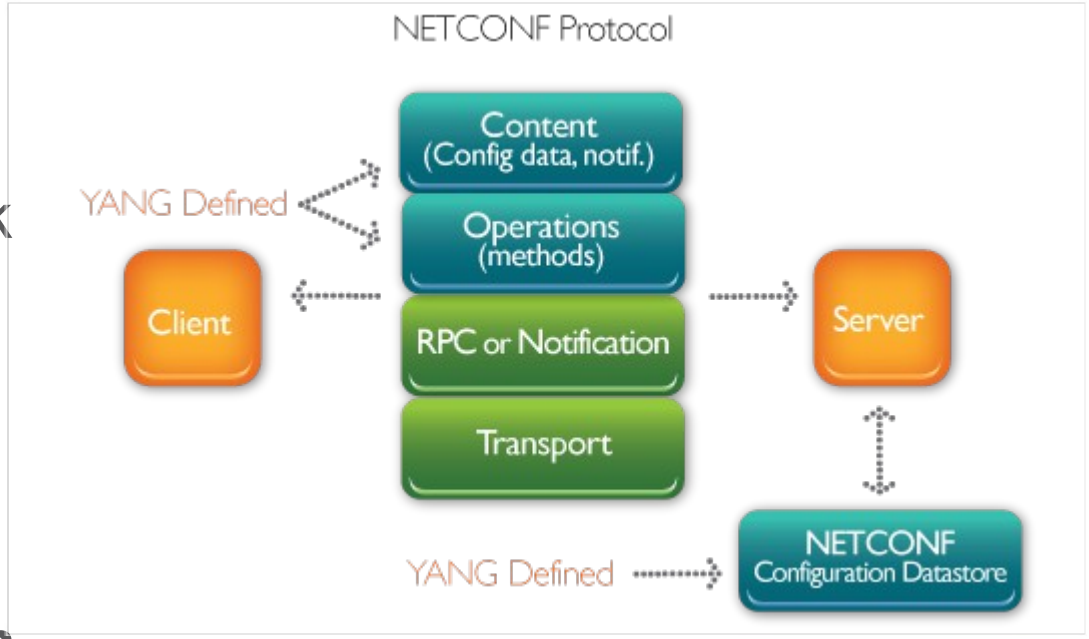
OPEN DAYLIGHT + IETF

Open Standards bring know-how and interoperability

Open Source brings agility and innovation

NETCONF/YANG

- **NETCONF**
  - A transport protocol
  - Designed to transport YANG encoded network entity information
- **YANG**
  - A modeling language
  - Designed to model network entity information
- **NETCONF/YANG standardization & definition work being done through the IETF:**
  - NETCONF WG
  - RTGWG for routing (non protocols)
  - Protocol relevant WG for protocols(OSPF/ISIS/etc)



What is OpenConfig?

ERICSSON

- **What is OpenConfig?**
  - Informal working group of large network operators (including carriers, cable operators, and online service providers).
  - Cross section of a large set of use cases, experiences, and pain points.
- **What is the primary goal of OpenConfig?**
  - Enable dynamic and programmable network infrastructure for the industry at large.
- **What will OpenConfig contribute?**
  - Models
  - Documentation & Tooling
- **Other openconfig efforts (so far, many more to come):**
  - BGP model draft-shaikh-idr-bgp-model
  - Policy model draft-shaikh-rtgwg-policy-model
  - MPLS / TE Model for SP Networks draft-openconfig-mpls-consolidated-model

Level (3) COMMUNICATIONS

BT

orange™

Microsoft

at&t

Deutsche Telekom

Openconfig key ideas

ERICSSON

Model Driven Configuration

Declarative, model-driven configuration and management is a Good Thing.

Be Vendor Neutral

Embrace vendor neutrality as much as possible for the data model.

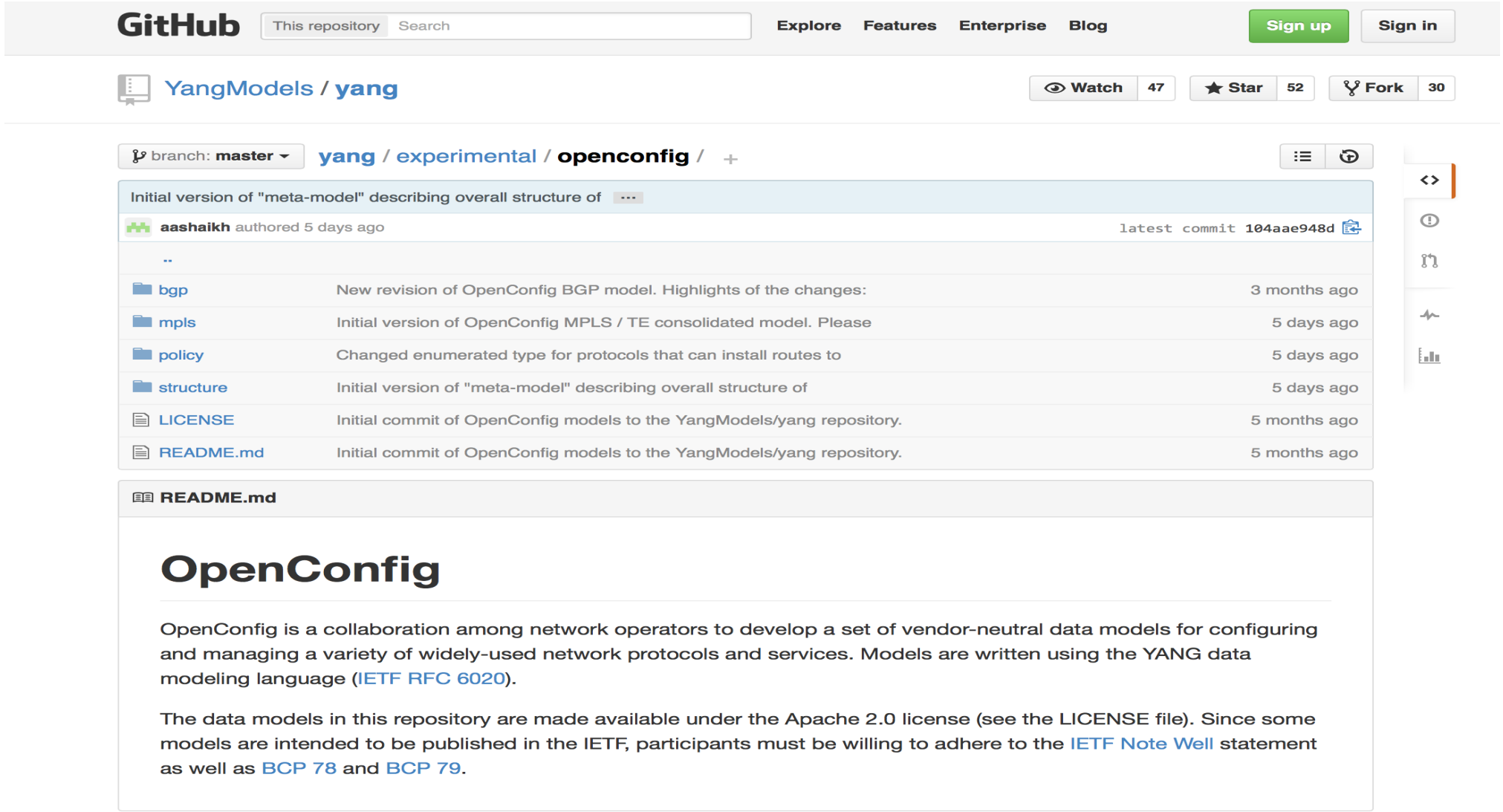
Focus on Use Cases

Shape and tune the model through real world use cases - keep it useful, but simple. Deliberately not exhaustive in coverage.

Make Telemetry Possible

Include operational state into the model.

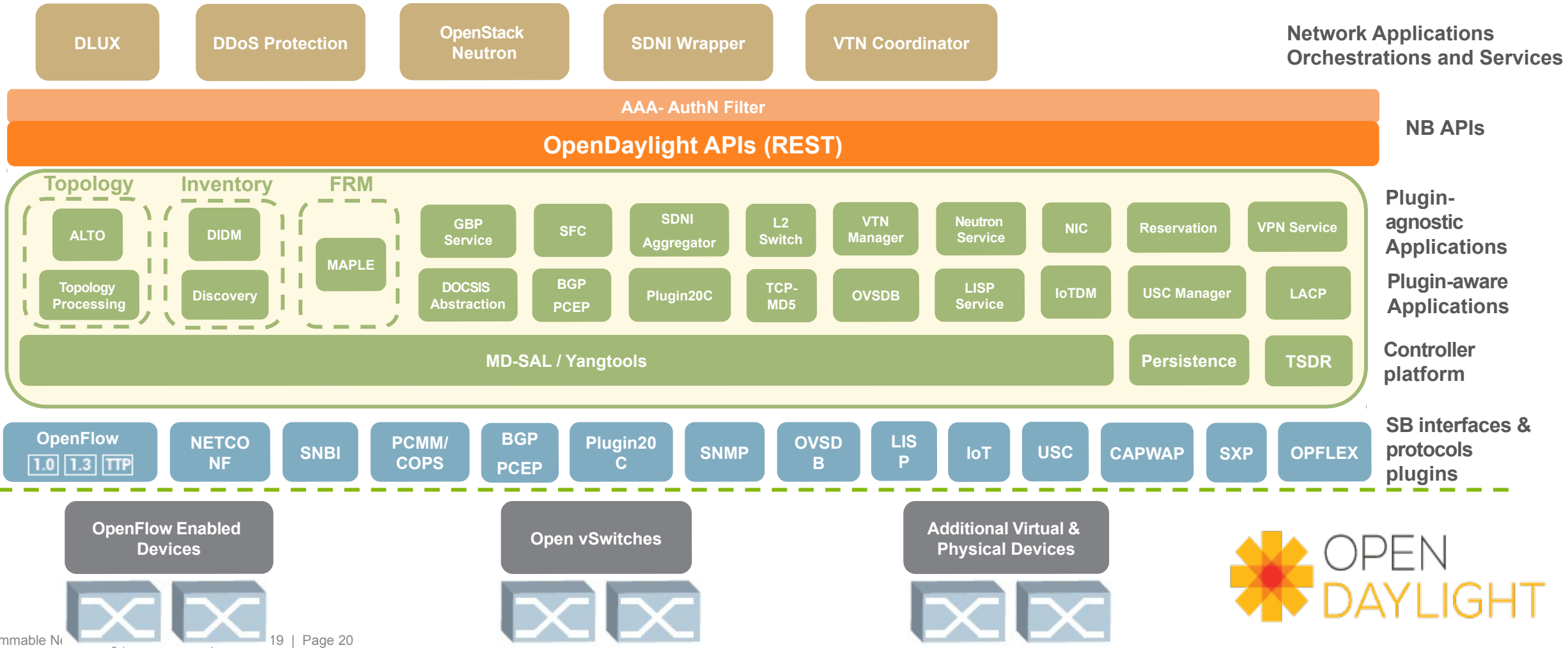
Openconfig is open for operators, come and join!



Legend

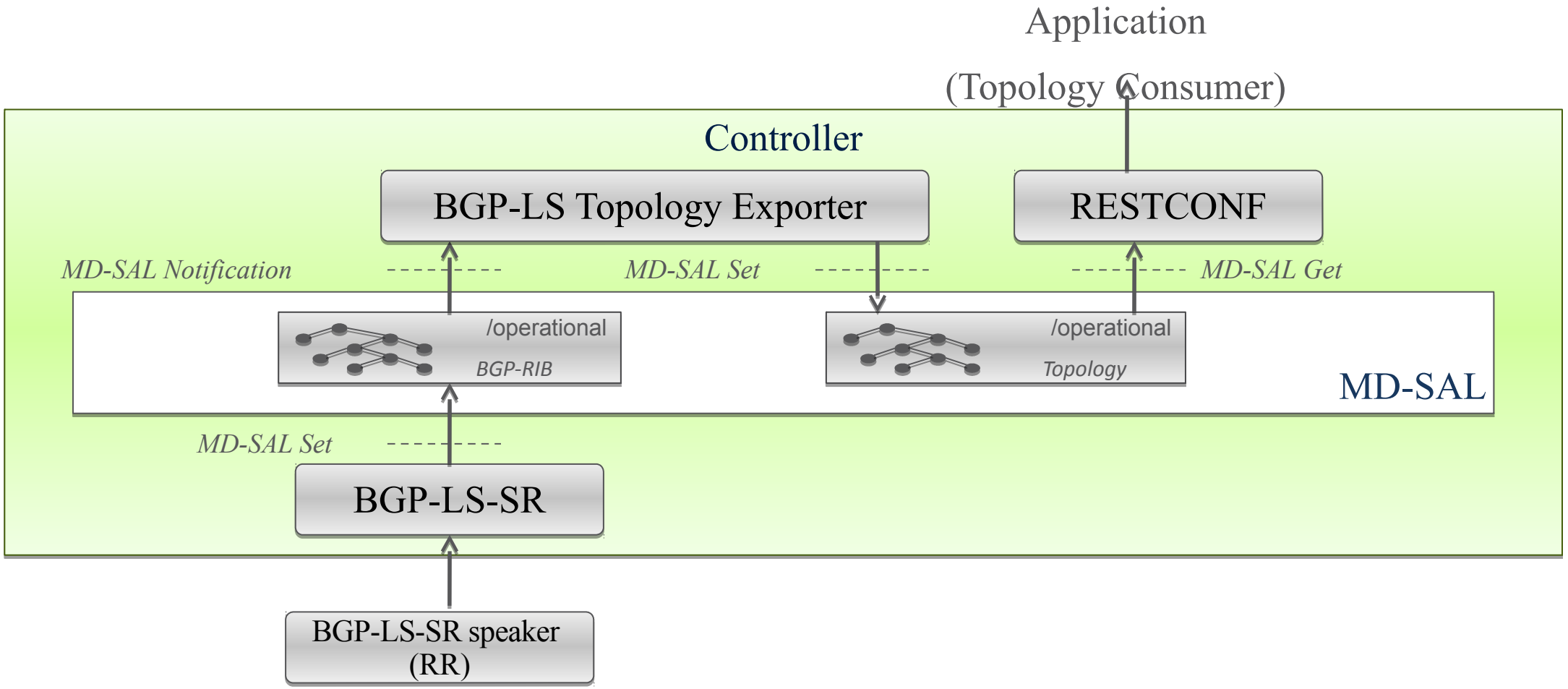
AAA: Authentication, Authorization & Accounting
ALTO: Application Layer Traffic Optimization
AuthN: Authentication
BGP: Border Gateway Protocol
CAPWAP: Control and Provisioning of Wireless Access Points
COPS: Common Open Policy Service
DIDM: Device Identification and Driver management
DLUX: OpenDaylight User Experience
DDoS: Distributed Denial Of Service
DOCSIS: Data Over Cable Service Interface Specification
FRM: Forwarding Rules Manager
GBP: Group Based Policy
IoTDM: Internet of Things Data Broker
LACP: Link Aggregation Control Protocol
LISP: Locator/Identifier Separation Protocol
MAPLE: Maple Programming
NIC: Network Intent Proposal
OVSDB: Open vSwitch DataBase Protocol
OPFLEX: Extensible Policy Protocol
PCEP: Path Computation Element Protocol
PCMM: Packet Cable MultiMedia
Plugin2OC: Plugin To OpenContrail
SDNI: SDN Interface (Cross-Controller Federation)
SFC: Service Function Chaining
SNBI: Secure Network Bootstrapping Infrastructure
SNMP: Simple Network Management Protocol
SXP: Source-Group Tag eXchange Protocol
TSDR: Time Series Data Repository
TTP: Table Type Patterns
USC: Unified Secure Channel
VTN: Virtual Tenant Network

ERICSSON



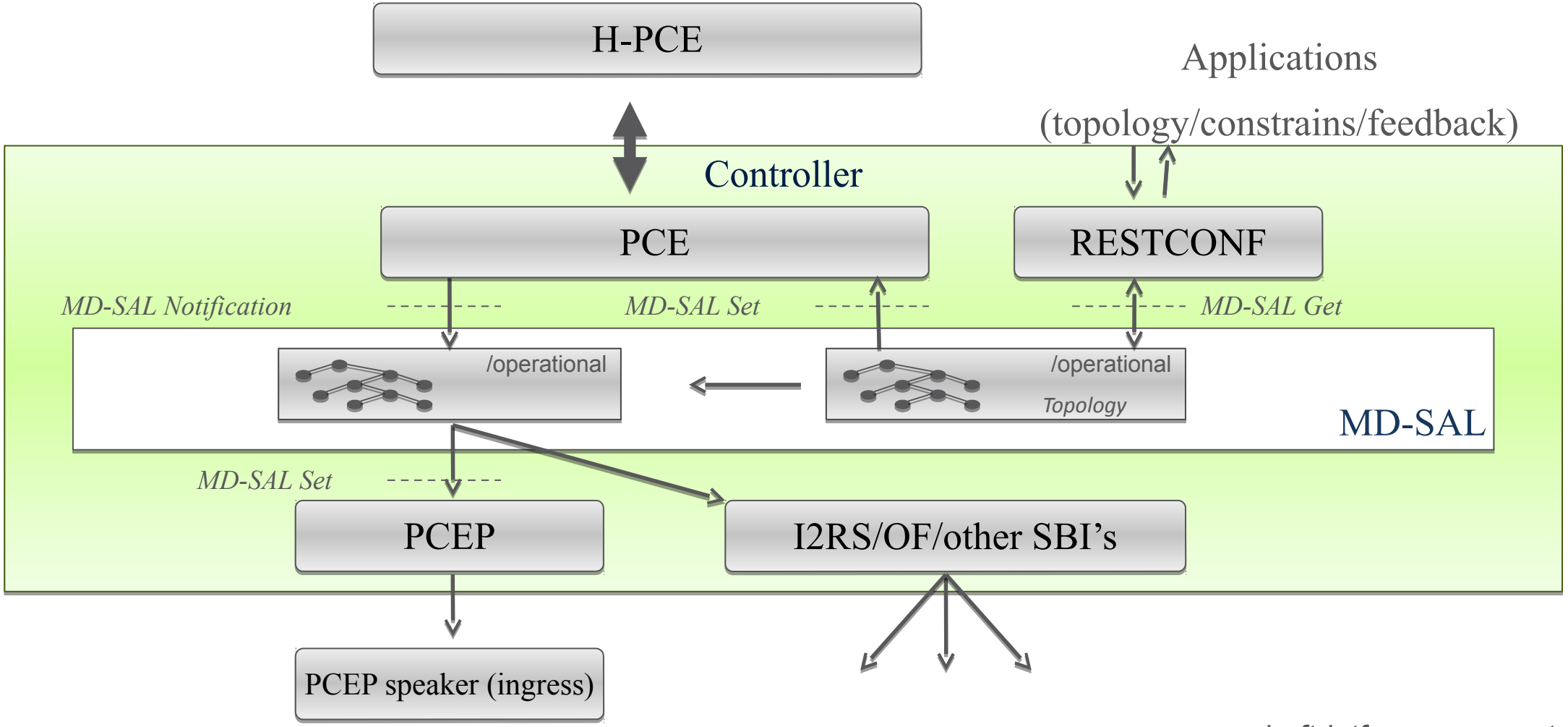
OPEN DAYLIGHT

ODL: BGP processing



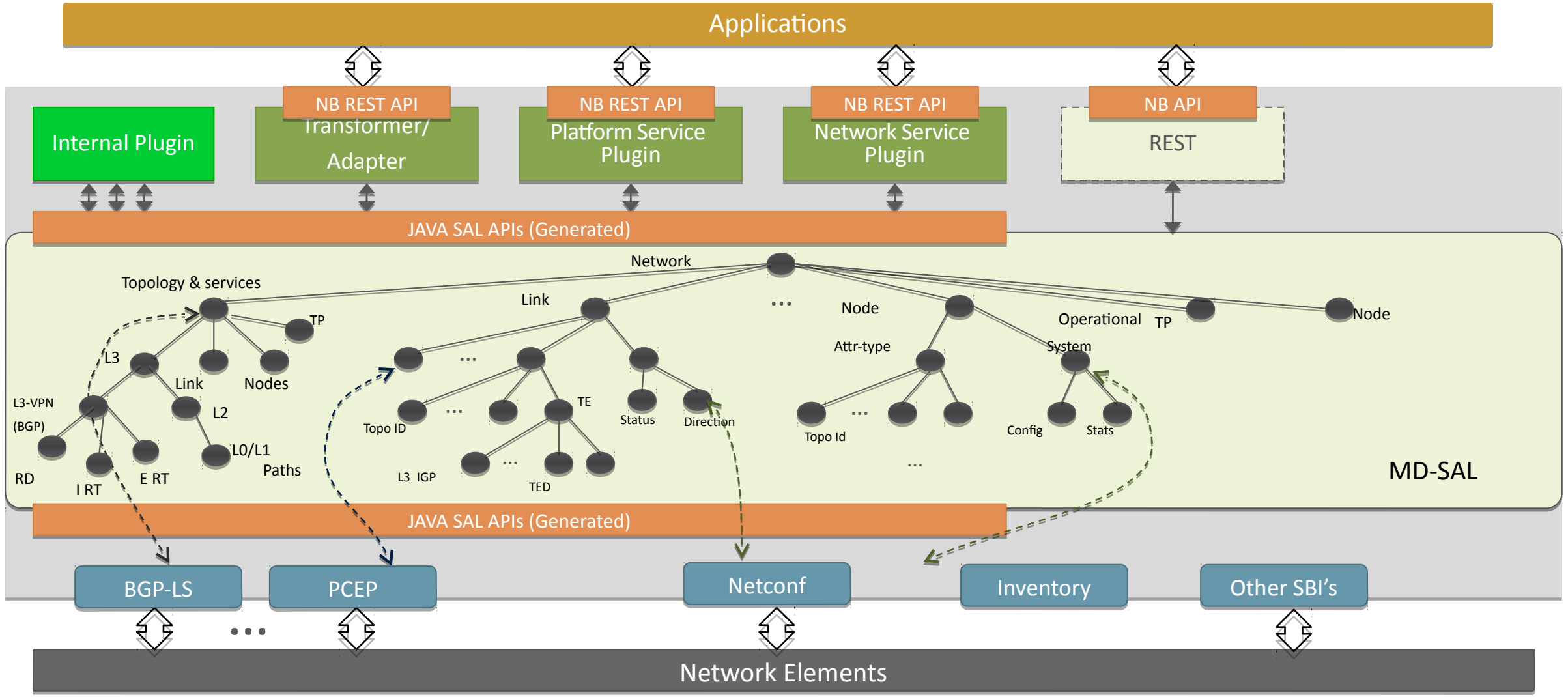
draft-ietf-idr-ls-distribution
draft-gredler-idr-bgp-ls-segment-routing-extension

ODL: PCEP processing



draft-ietf-pce-segment-routing
draft-ietf-pce-stateful-pce
draft-ietf-pce-pce-initiated-lsp

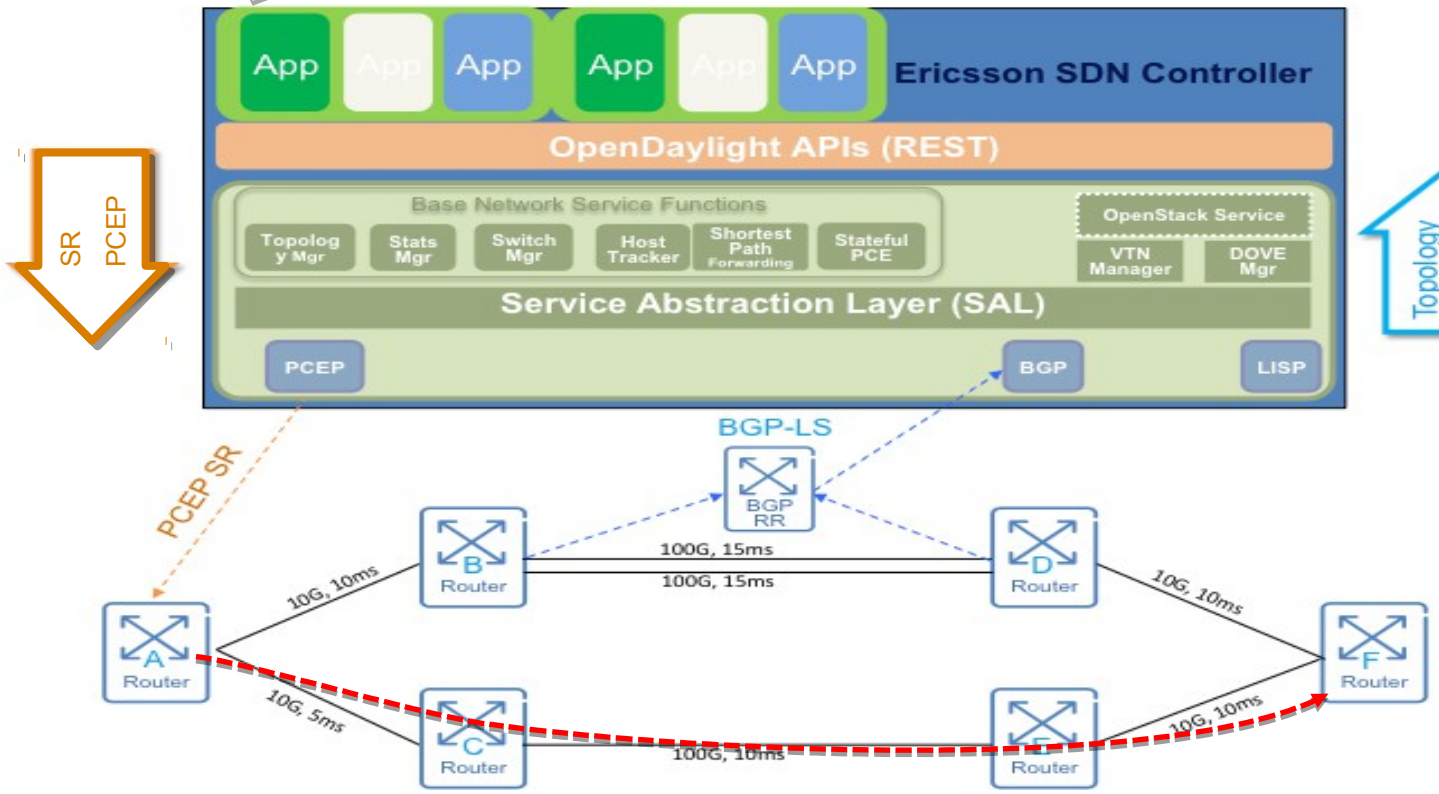
ODL – multilayer model
putting all together



I want a path from
A to F
Min link BW=10G
Min link delay < 10ms

SDN Orchestration

mainwan = wanproj.neutron.net.create(endpoints = {Node_A, Node_F}, bandwidth = 10G, delay = 10ms)



A->F Topology
A->B->D->F
A->C->E->F

Link	BW	Delay
A->B	10G	10ms
B->D	200 (G)	15ms
D->F	10G	10ms

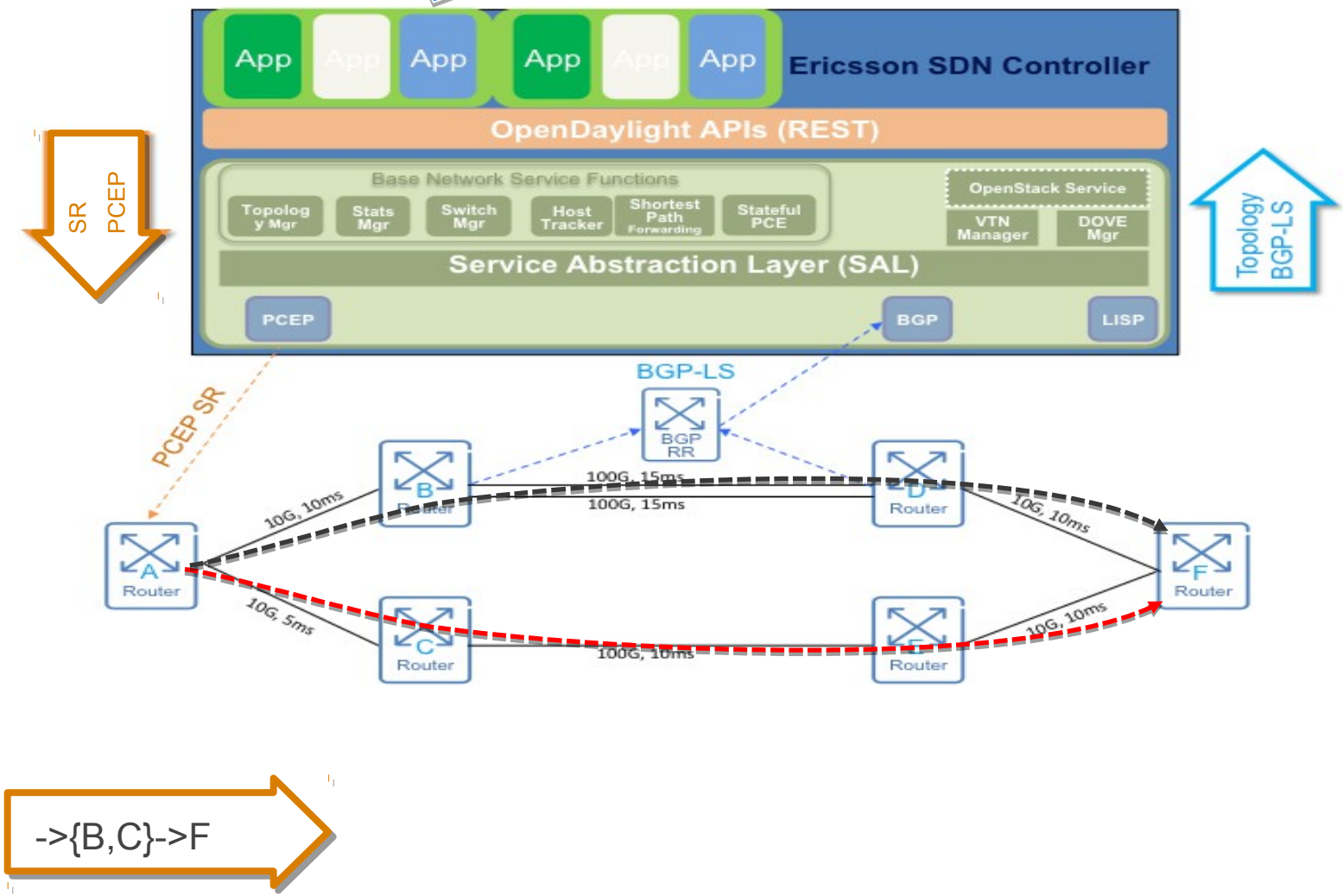
Link	BW	Delay
A->C	10G	5ms
C->E	100G	10ms
E->F	10G	10ms

->C(->E->F)

SDN Orchestration

I want a non-constrained 15G path from A to F

Optimize BW use == UCMP(weighed ECMP)



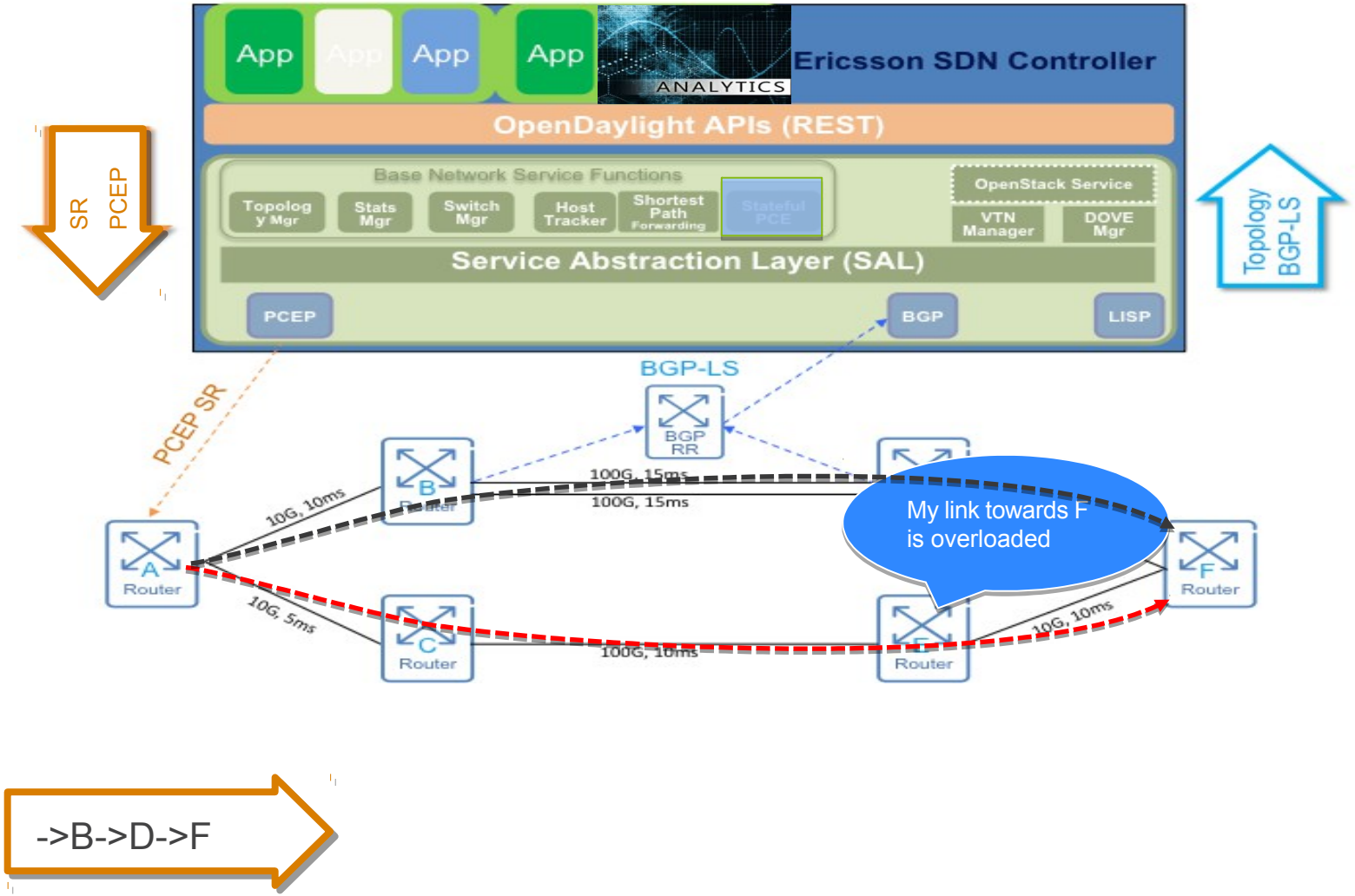
A->F Topology
A->B->D->F
A->C->E->F

Link	BW	Delay
A->B	10G	10ms
B->D	200G(SRLG)	15ms
D->F	10G	10ms

Link	BW	Delay
A->C	10G	5ms
C->E	100G	10ms
E->F	10G	10ms

->{B,C}->F

SDN Orchestration: analytics realtime feedback reoptimization

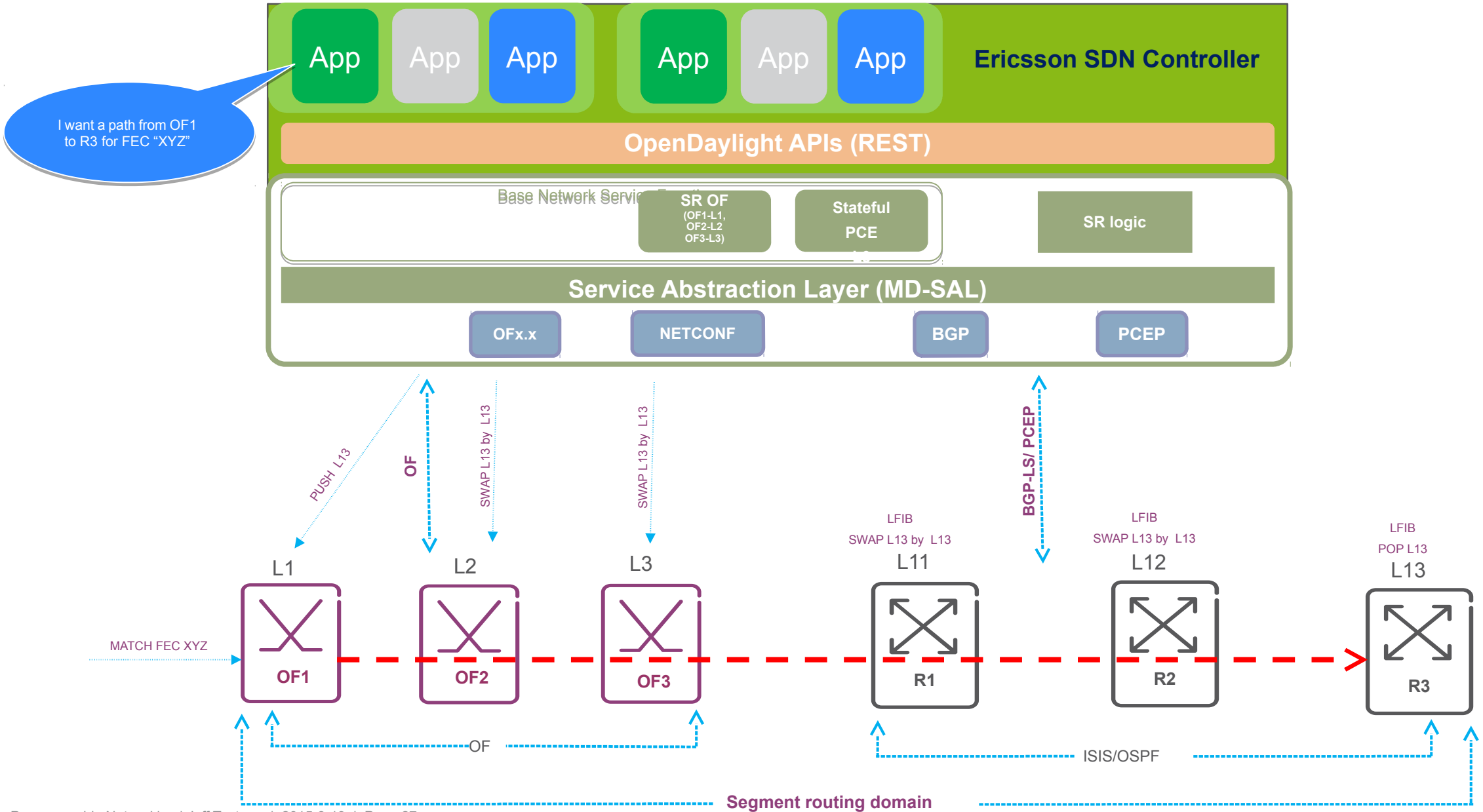


A->F Topology
A->B->D->F
A->C->E->F

Link	BW	Delay
A->B	10G	10ms
B->D	200G(SRLG)	15ms
D->F	10G	10ms

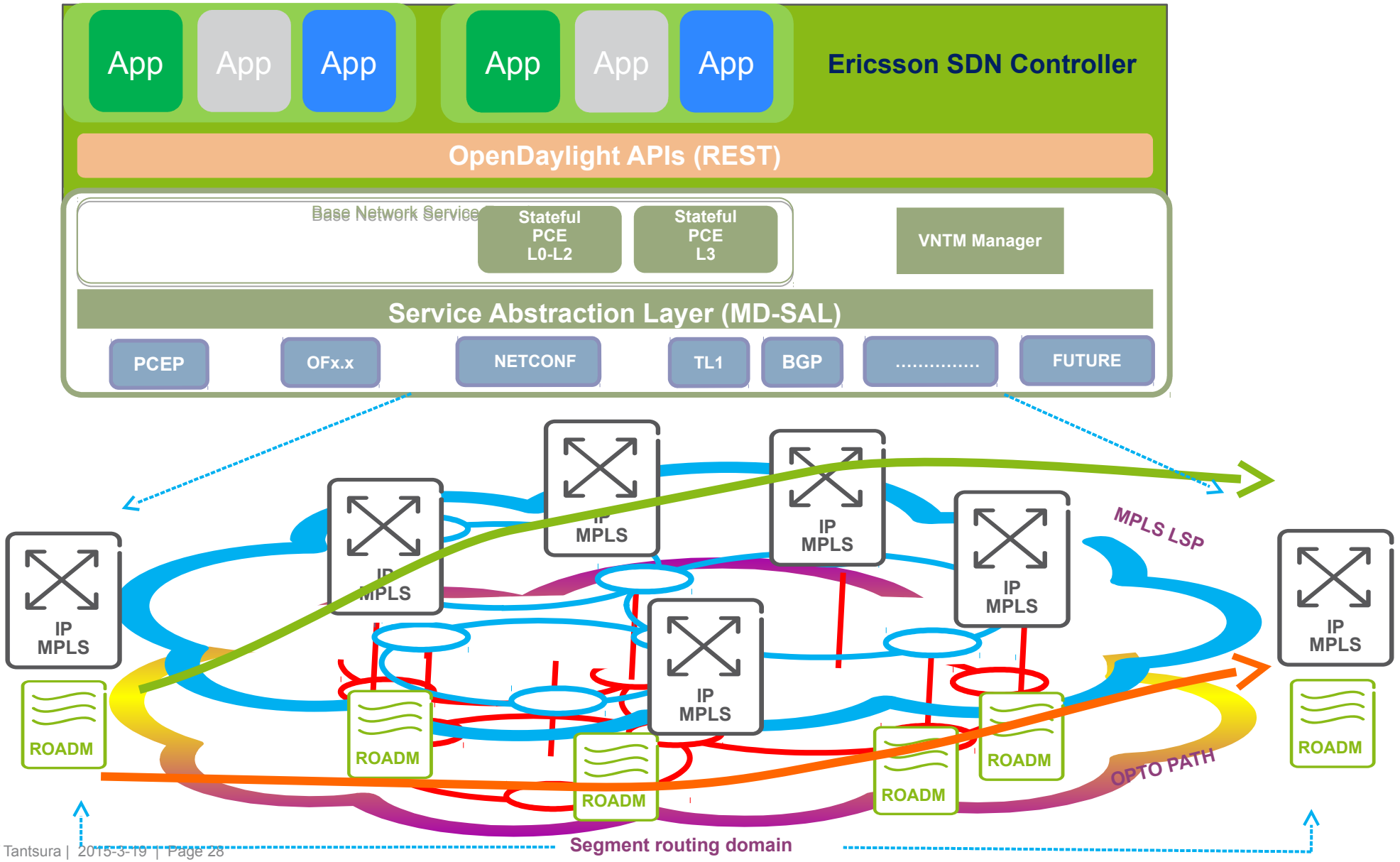
Link	BW	Delay
A->C	10G	5ms
C->E	100G	10ms
E->F	10G	10ms

Glue between OF & IP/Mpls networks

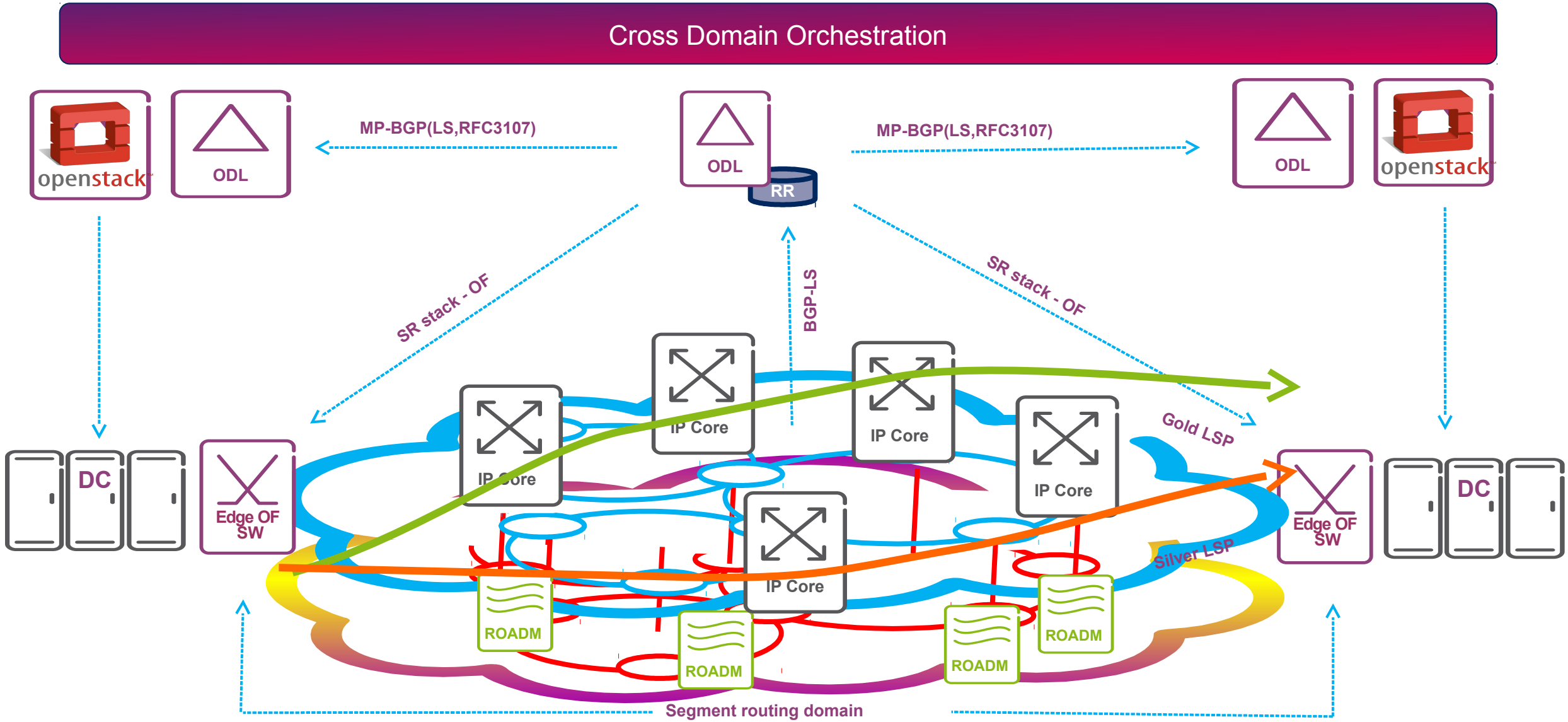


IP/MPLS + Optical interworking

brings connection-oriented transport into connectionless IP/MLPL world



US Tier1 SP: SR Core SDN + OF Edge use case



SR addresses operator's needs & makes SDN promises true

ERICSSON

- Faster TTM, simplification
  - Programmability and Application awareness
- OPEX reduction
  - Removes complexity from the network, no LDP/RSVP, state is in the packet, fully automatic 100% IP FRR coverage, native IPv6
- CAPEX optimization
  - Investment protection - can be used with the existing equipment, only SW upgrade needed (HW on ingress in some cases)
  - Reduces cost and complexity of core networks (long term)
- Packet/Opto integration
  - Coherent multilayer resource provisioning and dynamic reoptimization
  - On demand bandwidth and admission control
  - Connection-oriented connectivity, carrier grade OAM

More information

ERICSSON

- IETF WG covering Segment Routing
  - SPRING - http://tools.ietf.org/wg/spring/
- Relevant protocol extensions are defined in OSPF and ISIS WG:
  - draft-ietf-isis-segment-routing-extensions
  - draft-ietf-ospf-segment-routing-extensions
  - draft-psenak-ospf-segment-routing-ospfv3-extension
- BGP
  - draft-gredler-idr-bgp-ls-segment-routing-extension
- PCEP
  - draft-ietf-pce-segment-routing
  - draft-ietf-pce-pce-initiated-lsp

ERICSSON