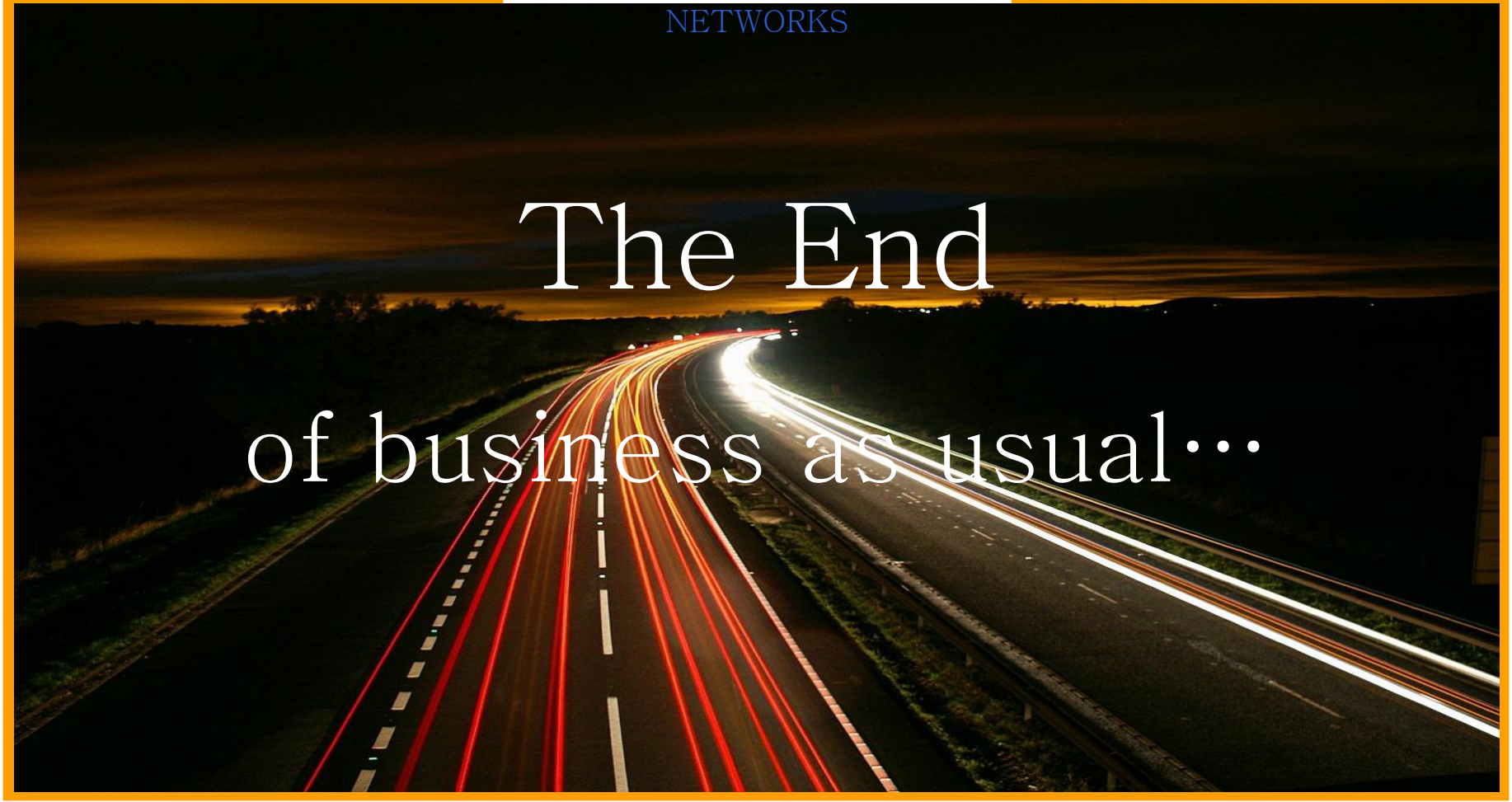
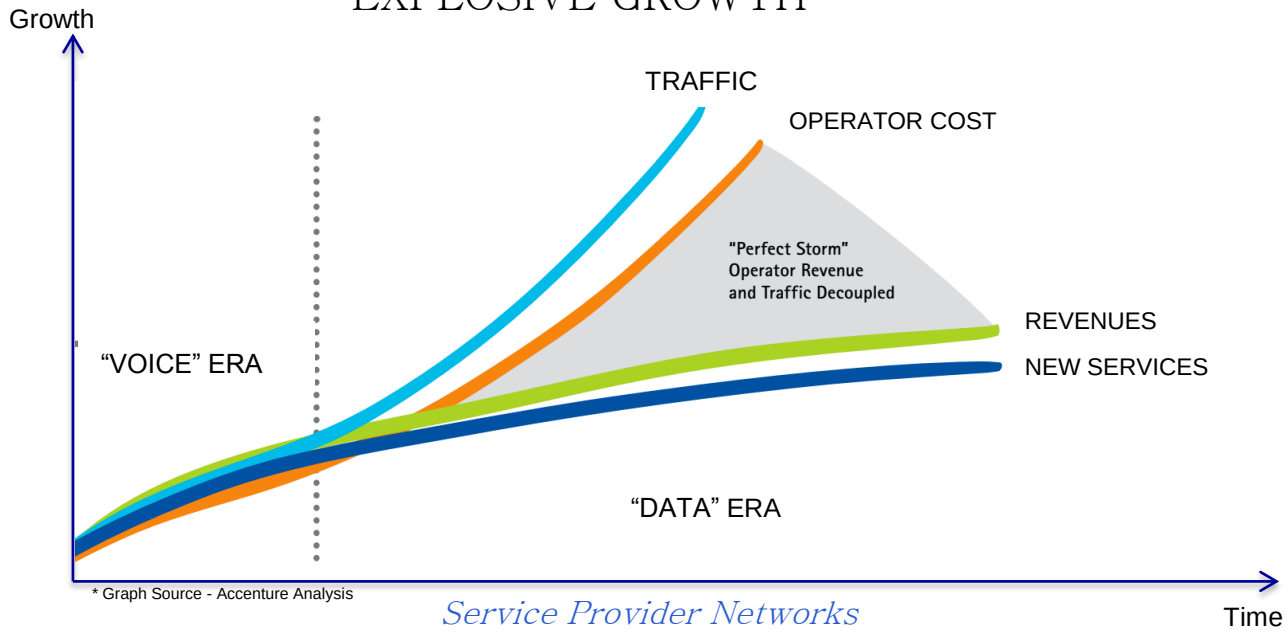
ONOS -
Enabling Software-defined Transformation Of Service Provider Networks

Prajakta Joshi
Director, Products @
ON.Lab


The End
of business as usual…

EXPLOSIVE GROWTH



Service Provider Networks

Unprecedented Traffic Growth	Orders of magnitude increase in users, devices, apps	Video, Mobile traffic exploding	CAPEX continues to rise
2016 traffic = triple of 2011	More mobile devices than people	IP Video: 79% of all IP traffic in 2018	AT&T spends $20 Billion per year on CAPEX

TURNING GROWTH INTO OPPORTUNITY

Open

- Open APIs
- Multi-vendor
- Multi-technology
- Open Source

Scale

Reduce CAPEX and OPEX

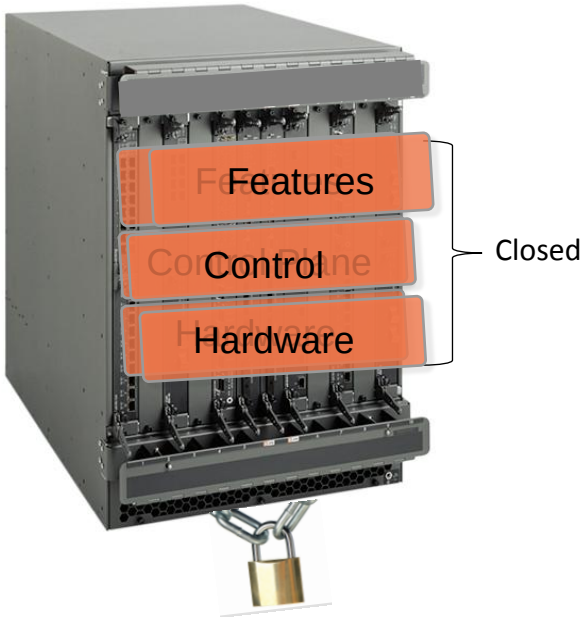
Bring in cloud-style agility, flexibility, Scalability

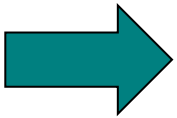
Lower operational complexity, increase visibility

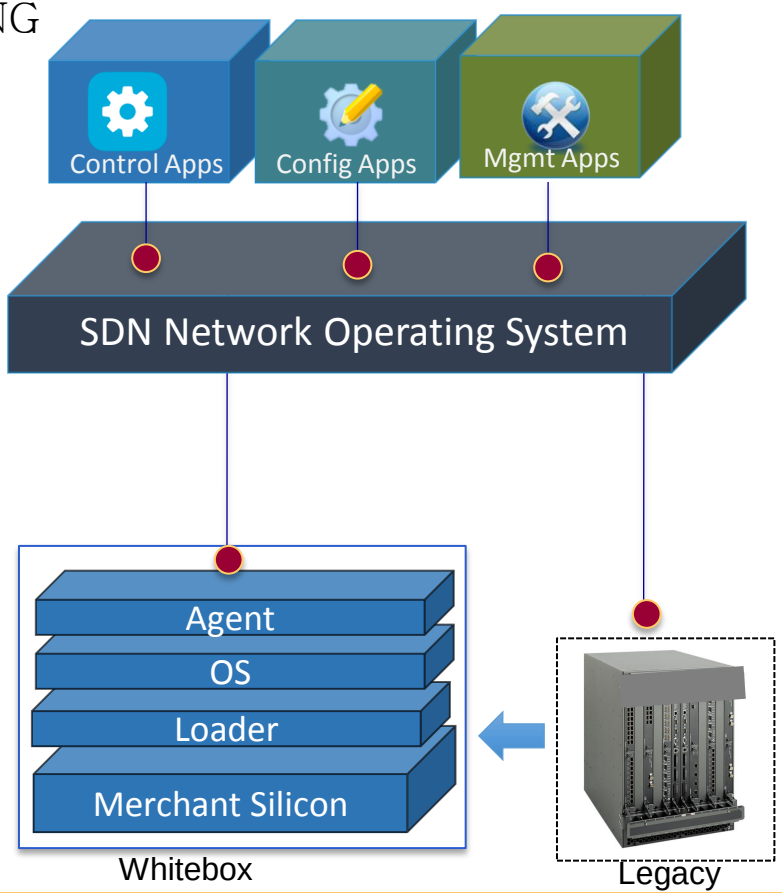
Monetize

Deliver new and customized Services rapidly

KEY ENABLER: SOFTWARE DEFINED NETWORKING

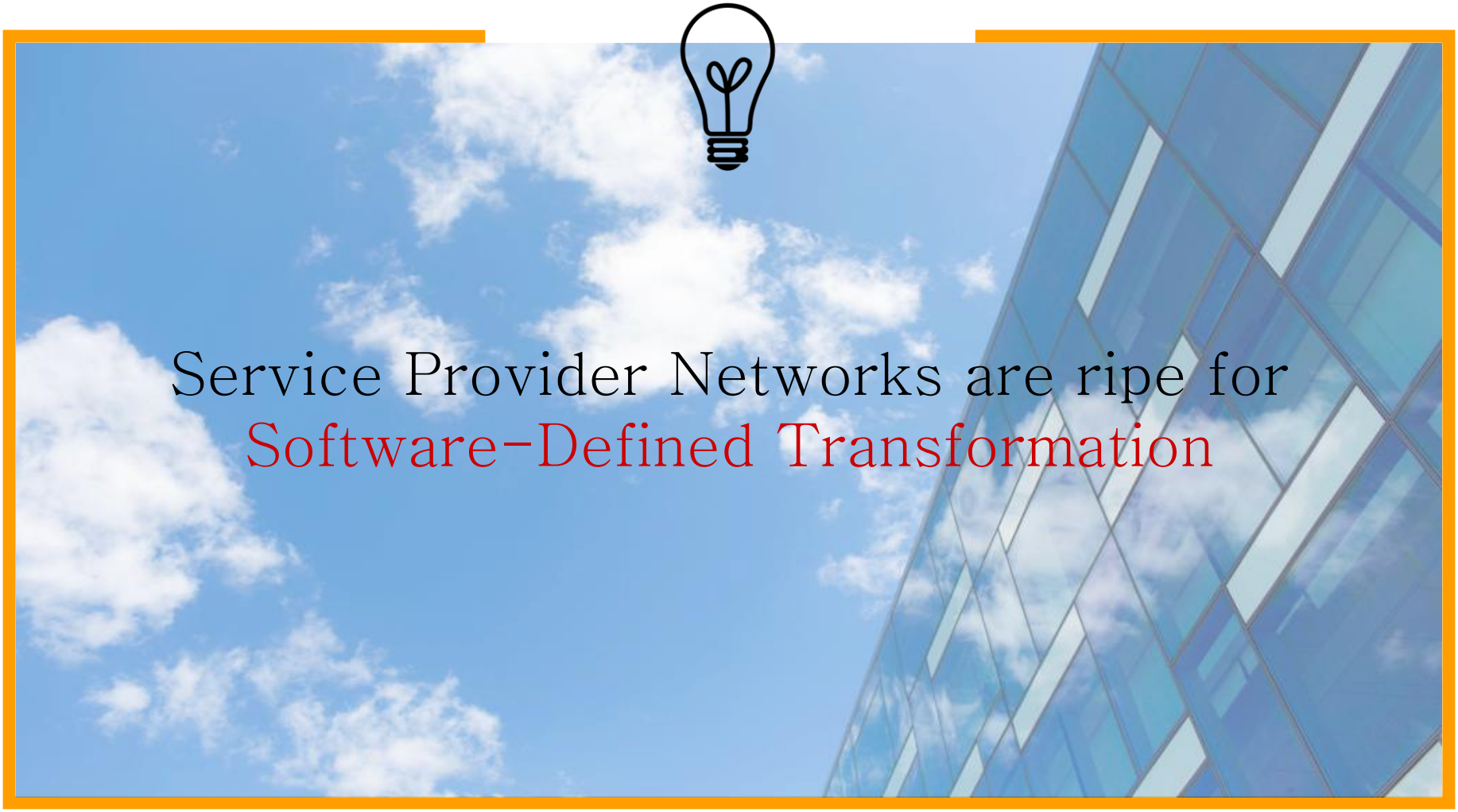






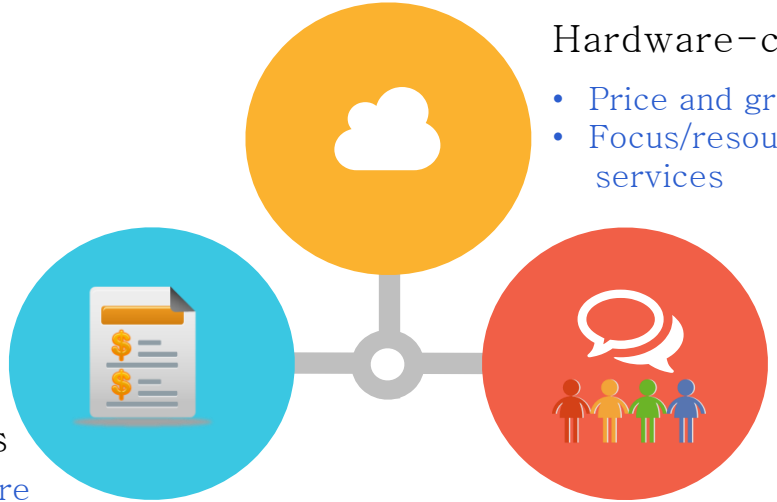
By 2020, SNS research estimates SDN and NFV can enable service providers (both wireline and wireless) to **save** up to **$32 Billion** in annual **CAPEX** investments.

Source- http://www.snstelecom.com


Service Provider Networks are ripe for
Software-Defined Transformation

What about Vendors?

VENDOR PARADIGM SHIFT



Hardware-centric to Software-centric

- Price and gross margin erosion for hardware
- Focus/resources move to software and services

Significant changes to Licensing/Sales models

- Focus moves from hardware to software => significant rethink of licensing and sales models

Open Source is mainstream

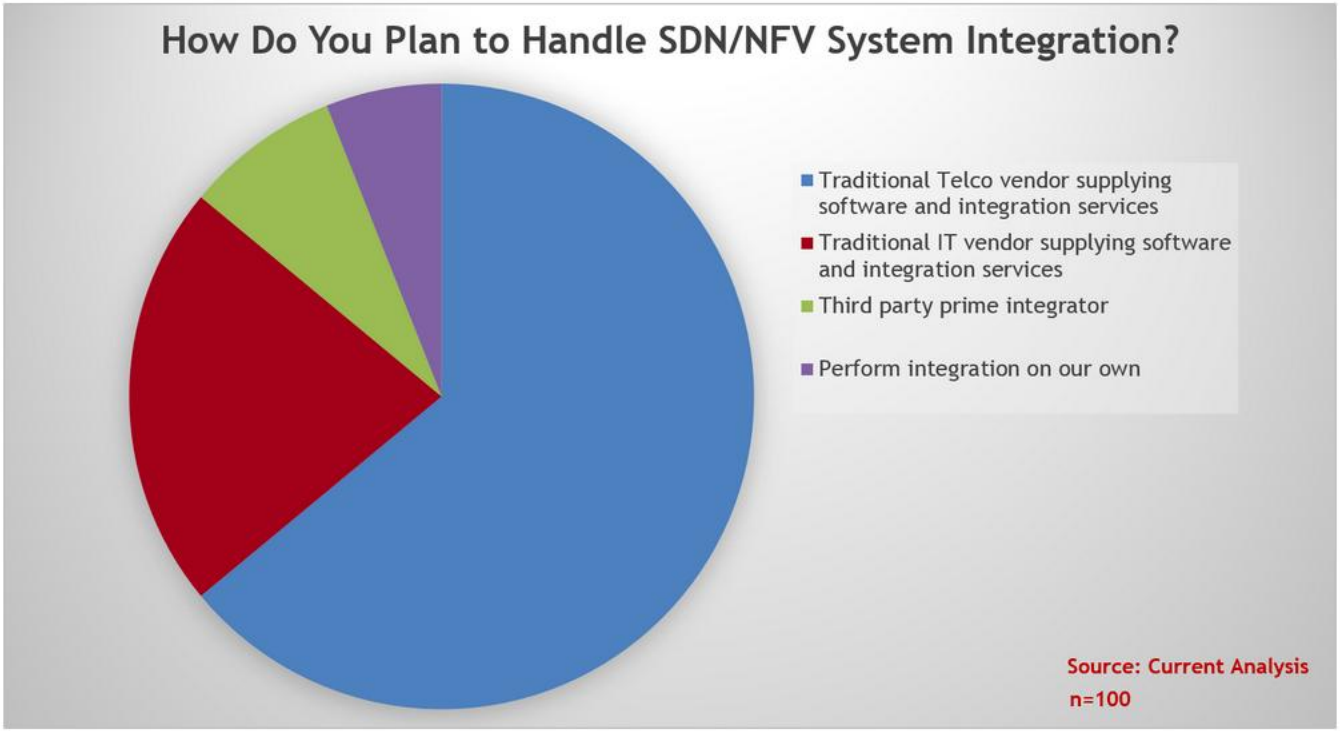
- (Non-differentiating) innovation, complex platforms, partnerships and business increasingly driven by active participation in and sponsorship of open ecosystems has never been higher.

With everything SDN enables, the barrier to entry into new markets has never been lower and the opportunity to innovate and

"Don't build a better mousetrap. Change the business model."

-Jim Whitehurst, CEO of Redhat

VENDOR OPPORTUNITY



Nearly two-thirds of Service Providers plan to rely on Telco vendors for SDN/NFV software and integration services.

Source- http://www.currentanalysis.com/

How many carrier-grade SDN network operating systems for service providers are available today?

How many in open source?

How many developed with the participation of all stakeholders including service providers?

THE CHALLENGE - 1

WAN core backbone

200-500 routers, 5-10K ports

Metro Network

10-50K routers, 2-3 Million ports

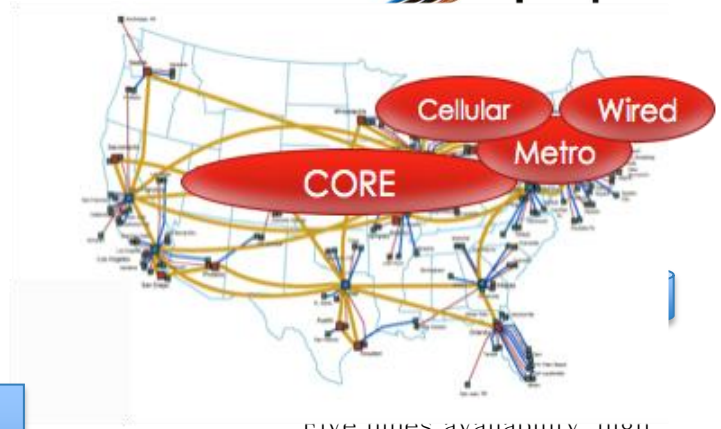
SIZING THE SERVICE PROVIDER NETWORK

20-100K routers, 10K-100 Million ports

Cellular Access Network

10-50K devices, 100K-1 Million ports

Wired Access/Aggregation Network



Five nines availability, high performance, low latency

Ease/agility of service creation

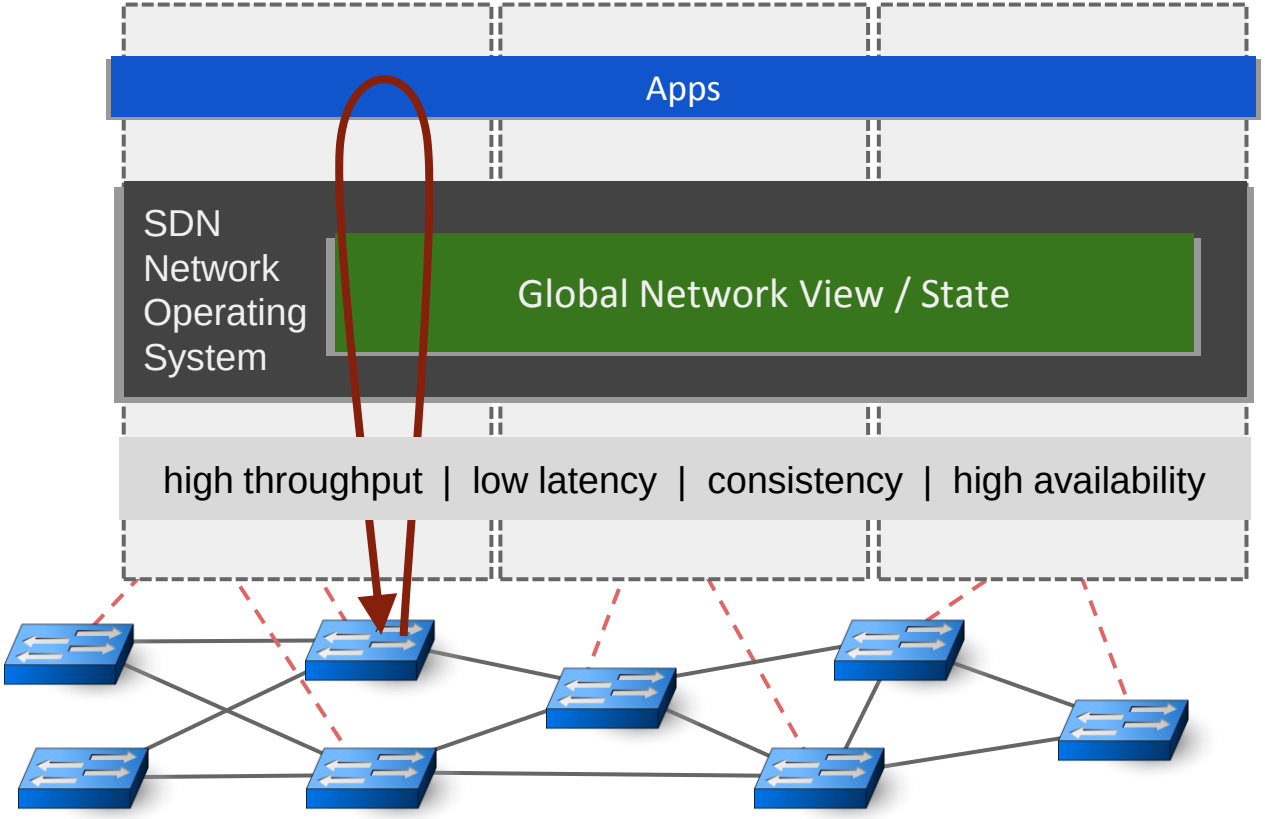
Phased migration of networks, support for white boxes

CHALLENGE-1 in NUMBERS

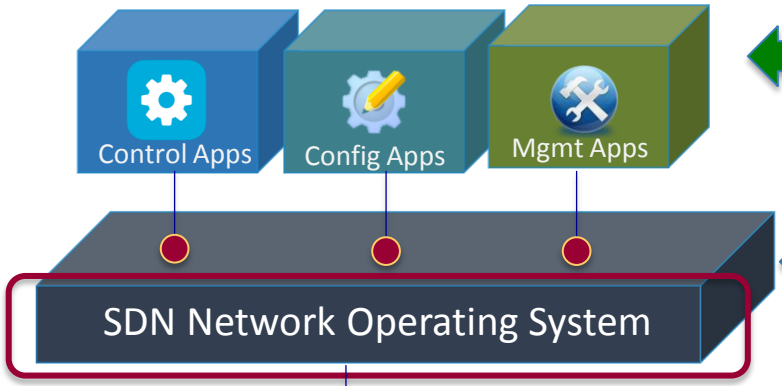
High Throughput:
~500K-1M paths setups / second
~3-6M network state ops / second

High Volume:
~500GB-1TB of network state data

Difficult challenge!



THE CHALLENGE – 2



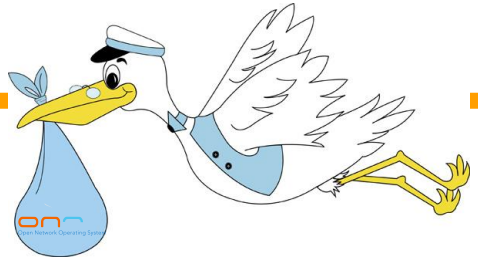
Value in apps and services

Strategic but difficult to monetize

Who builds this platform?

Value in commercial-grade solutions

Value in network and device innovation



ONOS Mission

To produce the Open Source SDN Network Operating System
that enables Service Providers to build
real Software Defined Networks

ON.Lab

"The **Open Networking Lab** was founded as a 501 (c) (3) non-profit to pursue our vision of what Software Defined Networking could be for the public good."

Nick McKeown
KP, Mayfield, Sequoia
Professor, Stanford

Scott Shenker
Professor, UC Berkeley
Chief Scientist, ICSI

Guru Parulkar
Executive Director, ON.Lab,
Executive Director ONRC
Consulting Professor, Stanford

Larry Peterson
Robert Kahn Professor
Princeton (Emeritus)

ONOS PARTNERSHIP

ON.LAB

ON.LAB

SERVICE PROVIDER
PARTNERS

at&t

NTT Communications

VENDOR
PARTNERS

ciena

ERICSSON

FUJITSU

HUAWEI

intel

NEC

COLLABORATORS

Infoblox
CONTROL YOUR NETWORK

SRI International

INTERNET2

BLACKDUCK

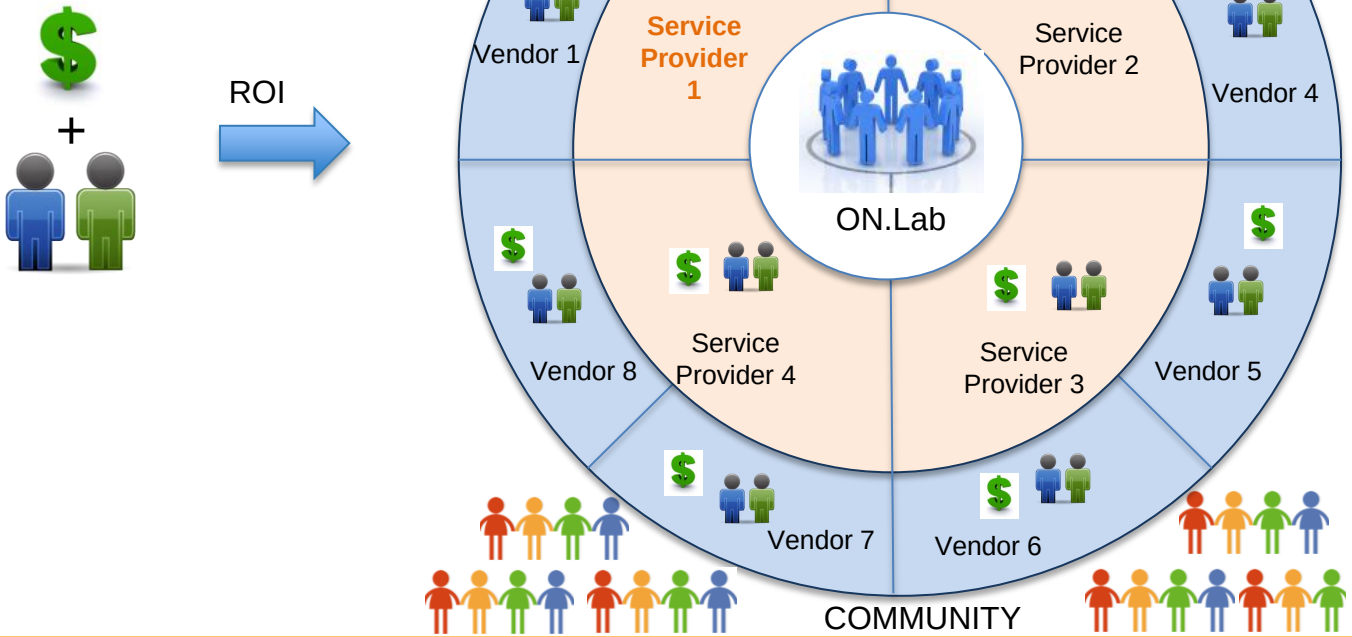
ONF

CREATE-NET

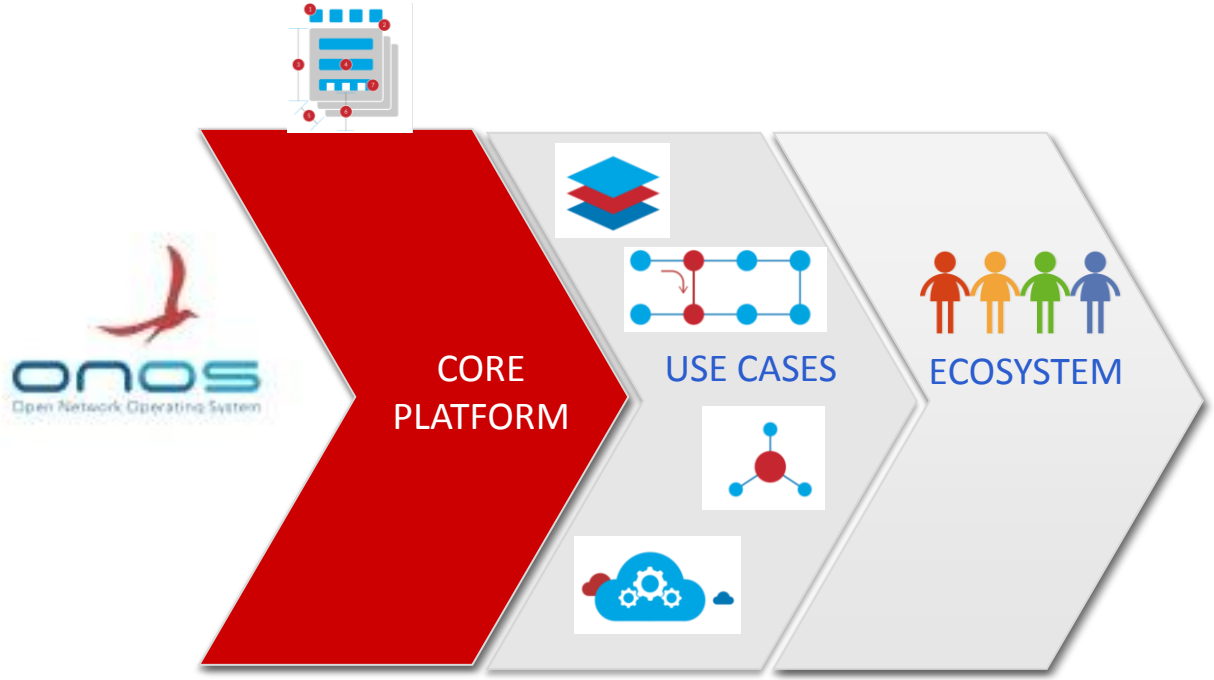
cnit

Consortium GARR

"ONOS ECOSYSTEM EFFECT"



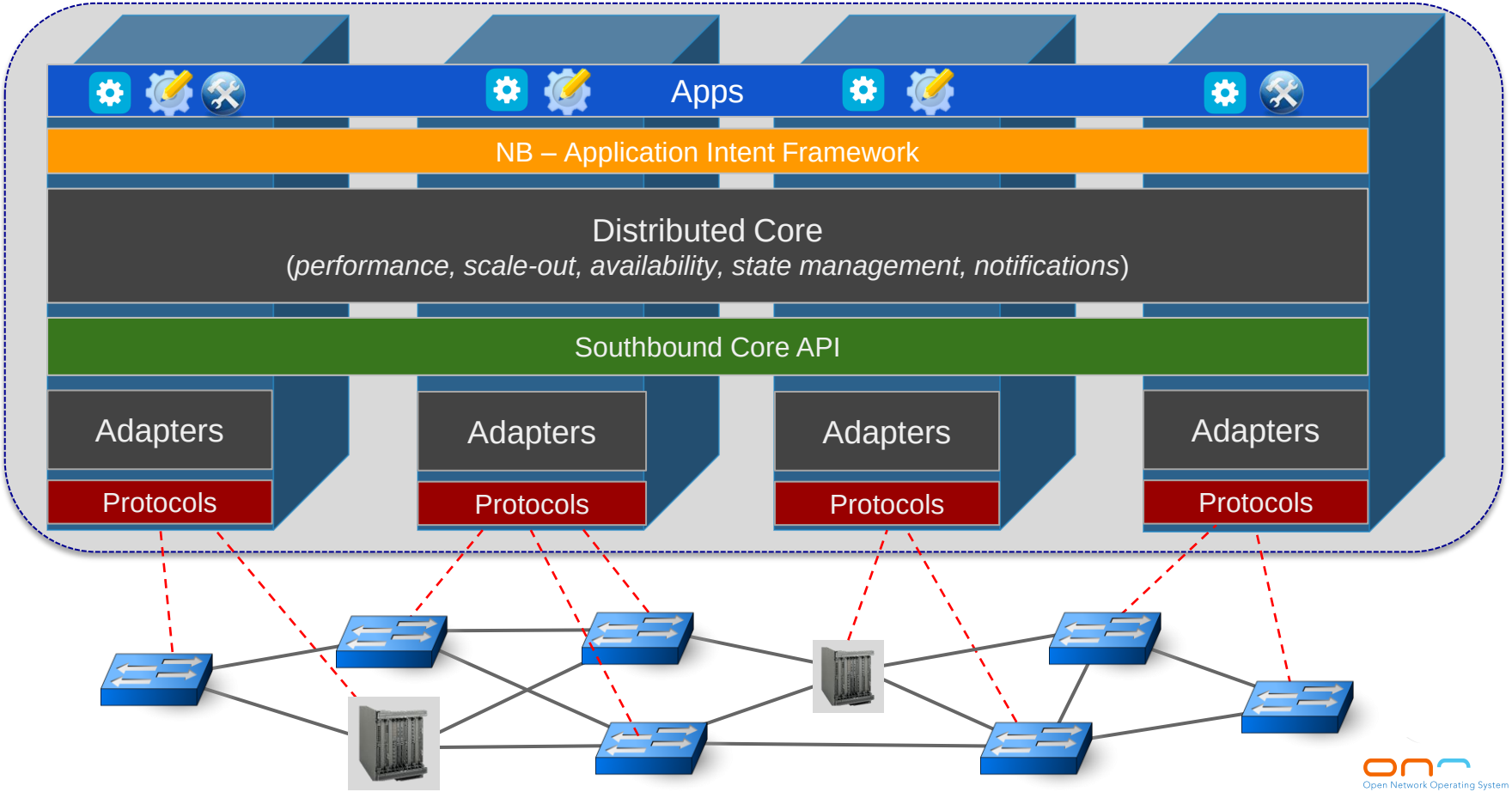

ONOS
Open Network Operating System
"Avocet" released on Dec 5th, 2014
Welcome to open source ONOS!
~1000 code downloads in one month after release…


onos
Open Network Operating System
CORE
PLATFORM
USE CASES
ECOSYSTEM

ONOS- A SDN NOS FOR SERVICE PROVIDER NETWORKS

- Scalability, High Availability & Performance
- Northbound & Southbound Abstractions
- Modularity

ONOS- Distributed

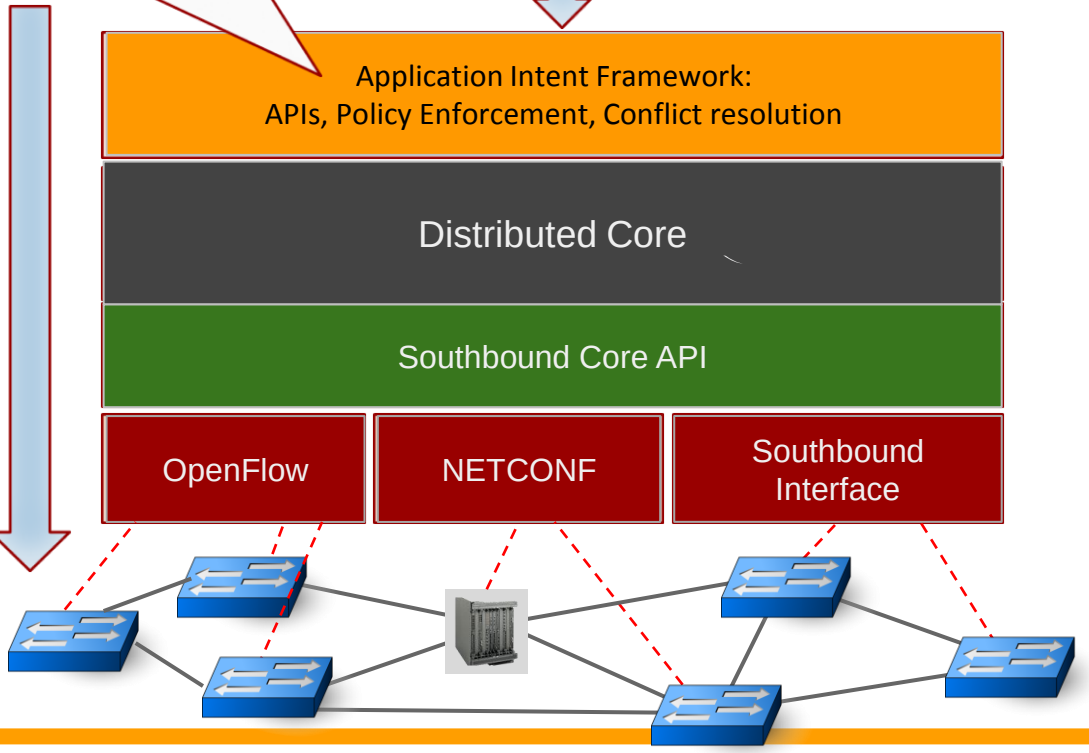


APPLICATION INTENT FRAMEWORK

Flexible and intuitive northbound abstraction and interface for user or app to define what it needs without worrying about how.

"Provision 10G path from Datacenter 1 to Datacenter2 optimized for cost"

Intents translated and Compiled into specific instructions for network Devices.



ONOS FOCUS -2015

1

PERFORMANCE,
CORE PLATFORM

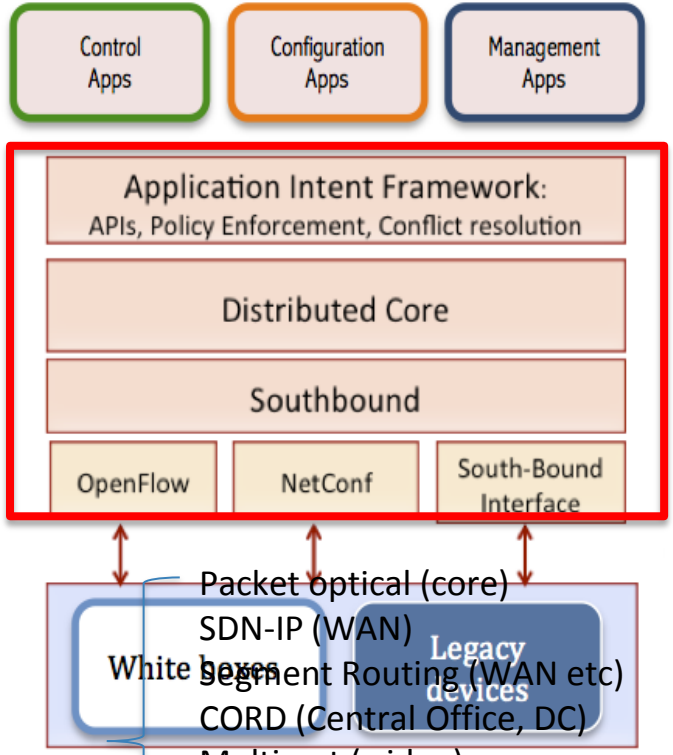
2

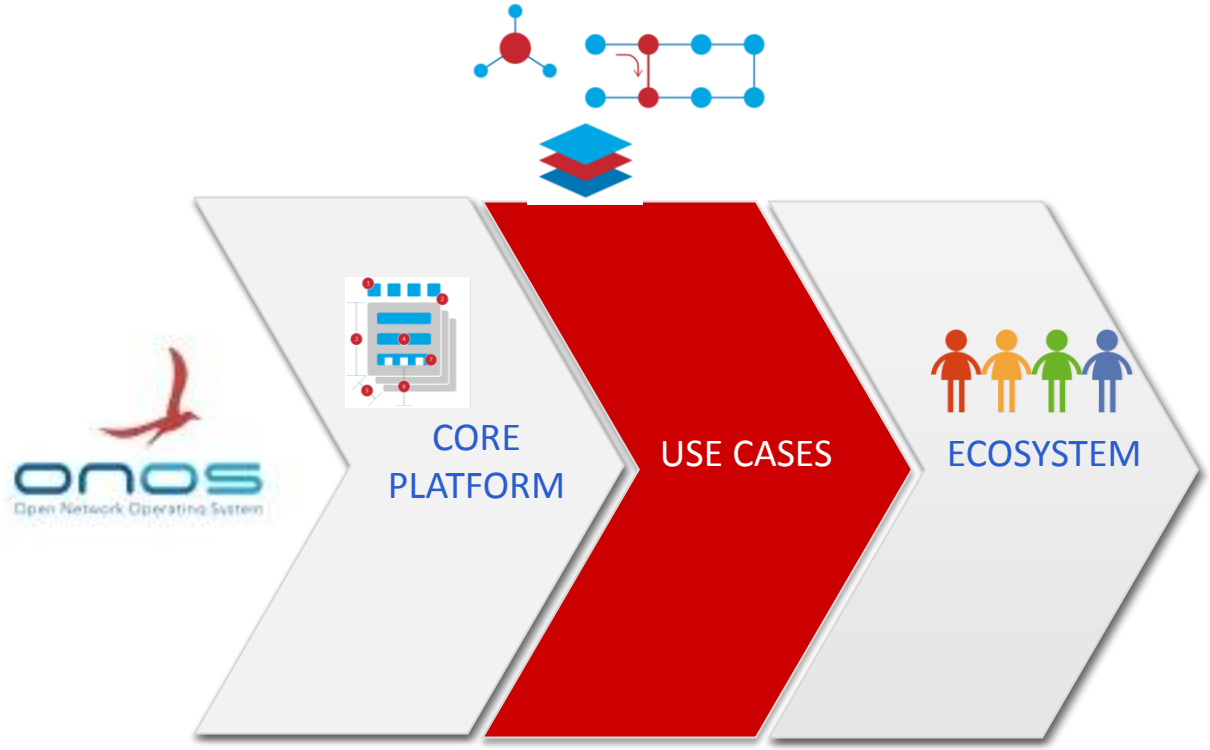
STABILITY
+ NEW AREAS

Ge
M
Op
IP
Se
M

3

USE CASES/DEPLOYMENTS

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PLATFORM
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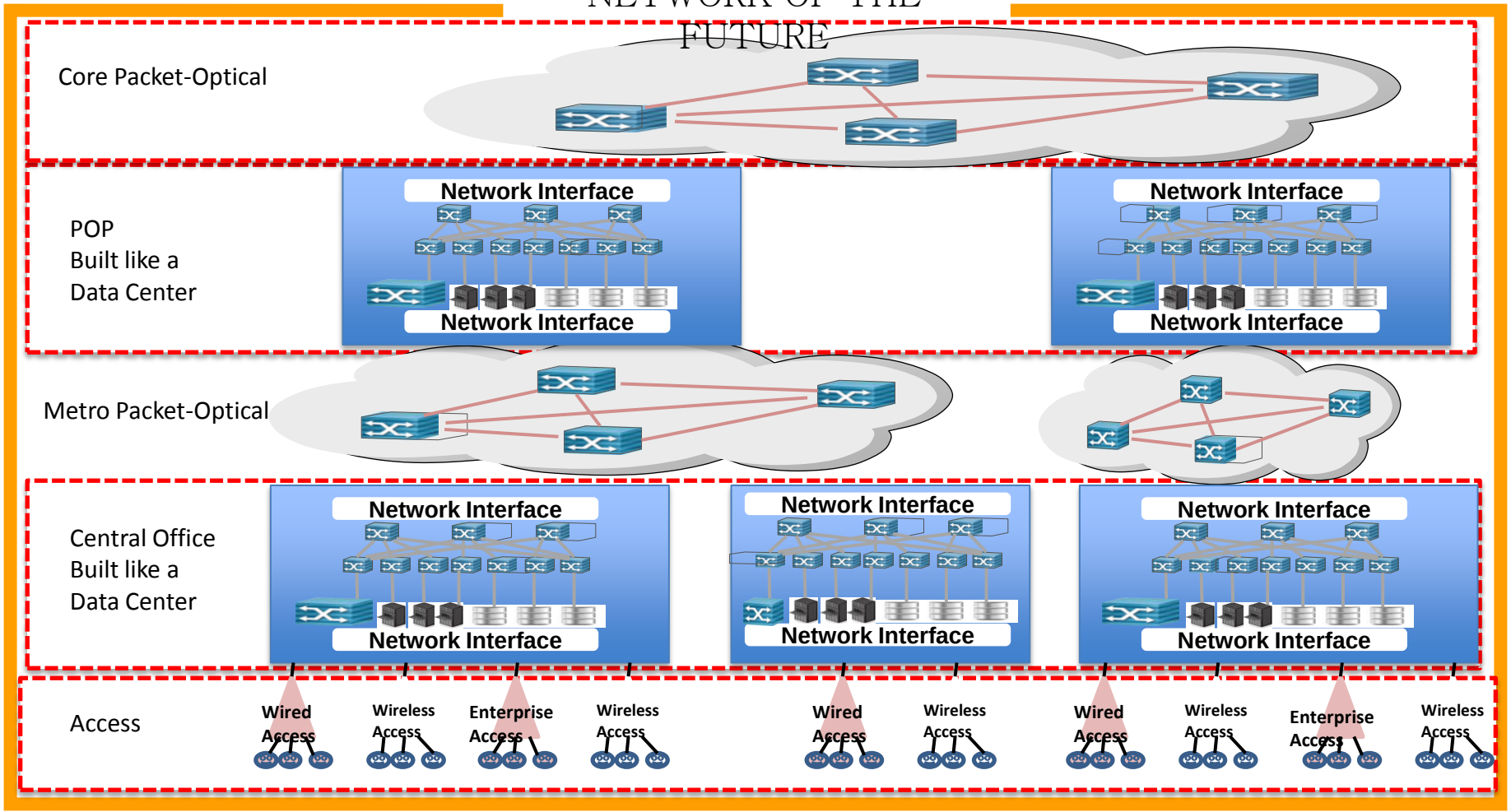
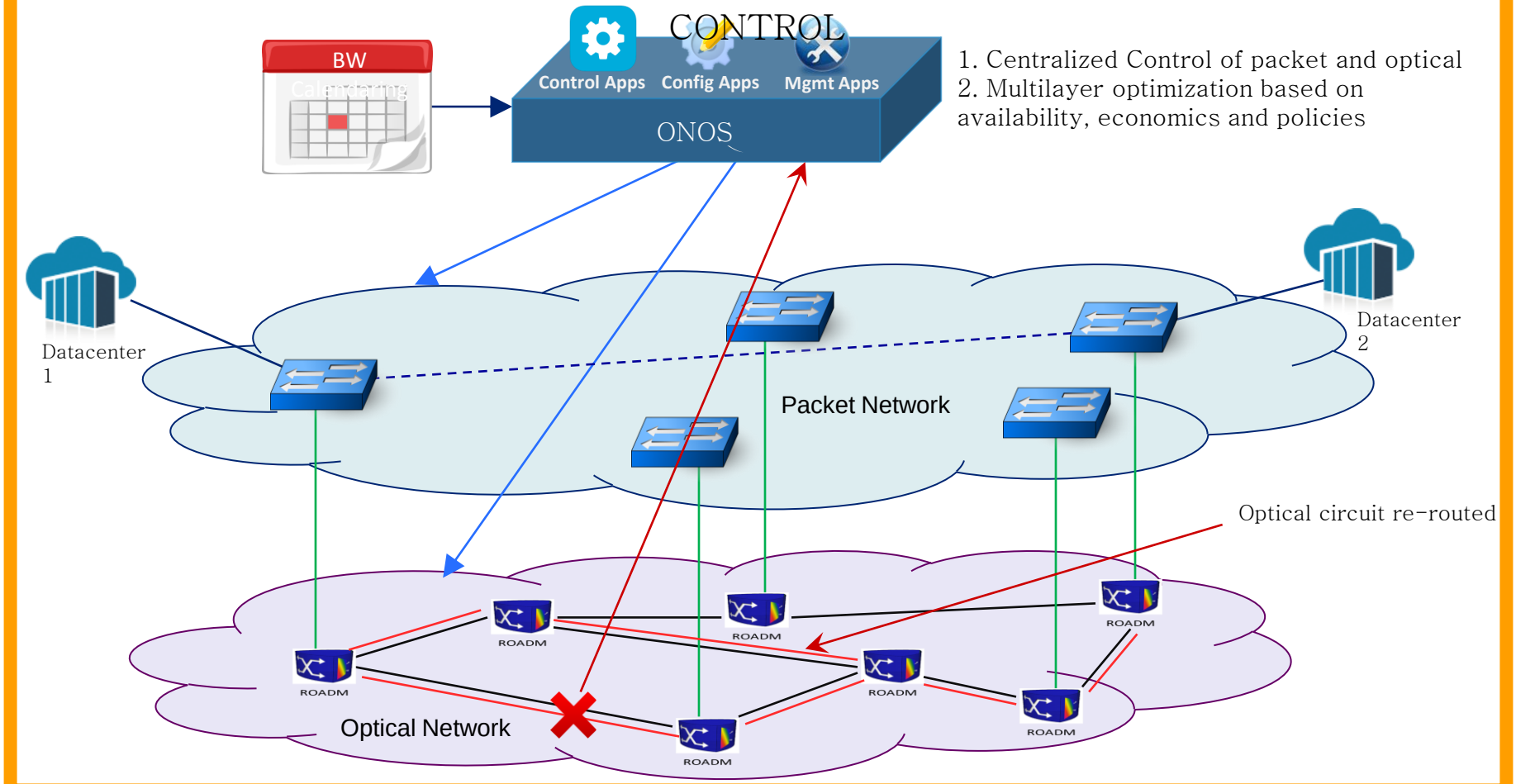
NETWORK OF THE FUTURE



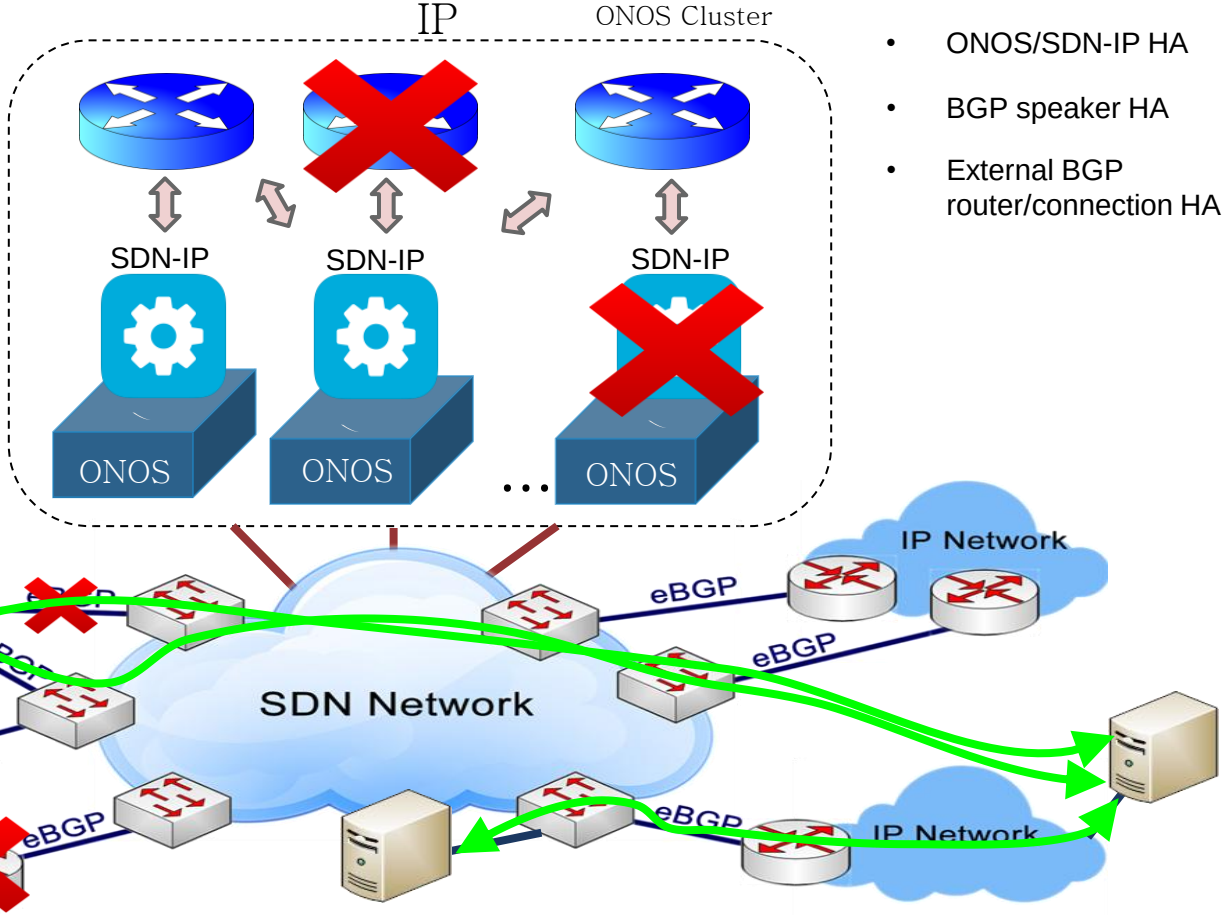
MULTILAYER SDN CONTROL



SEAMLESS PEERING - SDN-IP

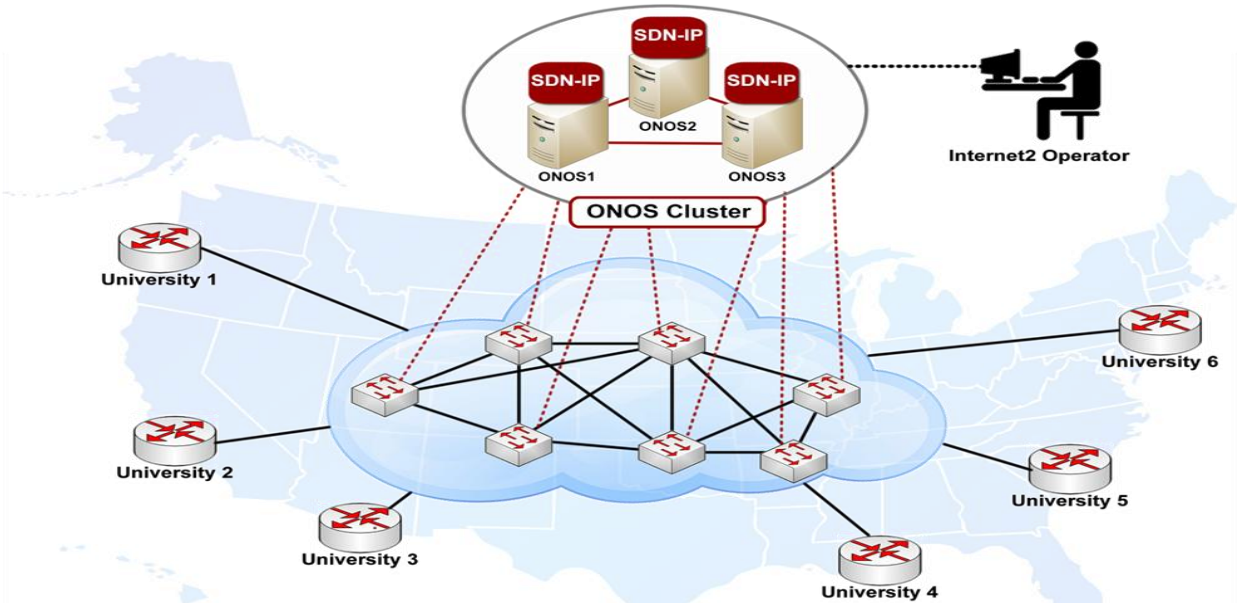
SDN-IP enables communication between:

- SDN network and external IP networks
- external networks across SDN island



- ONOS/SDN-IP HA
- BGP speaker HA
- External BGP router/connection HA

SDN-IP: INTERNET2 DEPLOYMENT

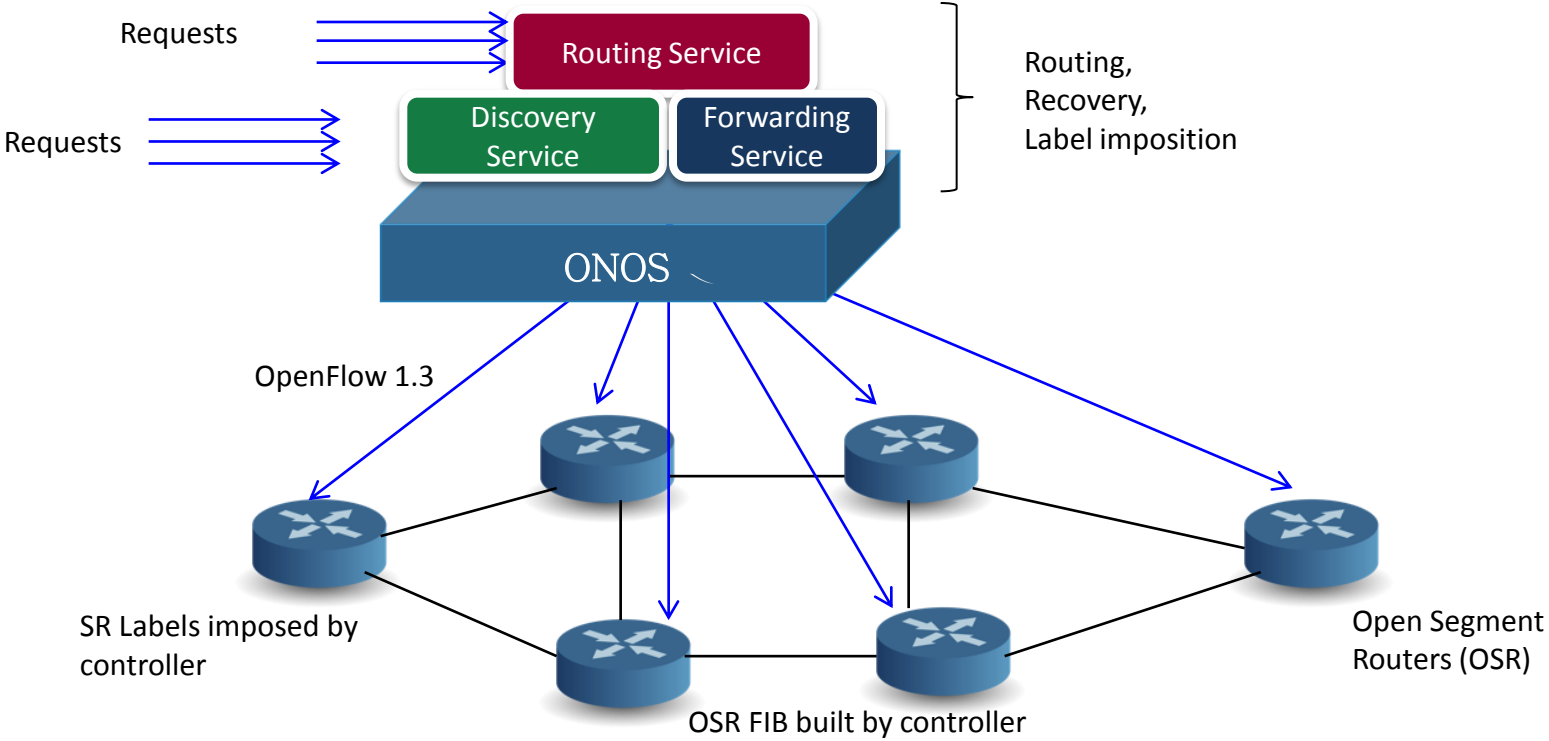


Goal: Provide L3 connectivity between 6 universities around US

- SDN switches in the core
- ONOS and SDN-IP will control the network

Seamless peering of SDN islands with existing networks = Migration strategy for real networks

SEGMENT ROUTING

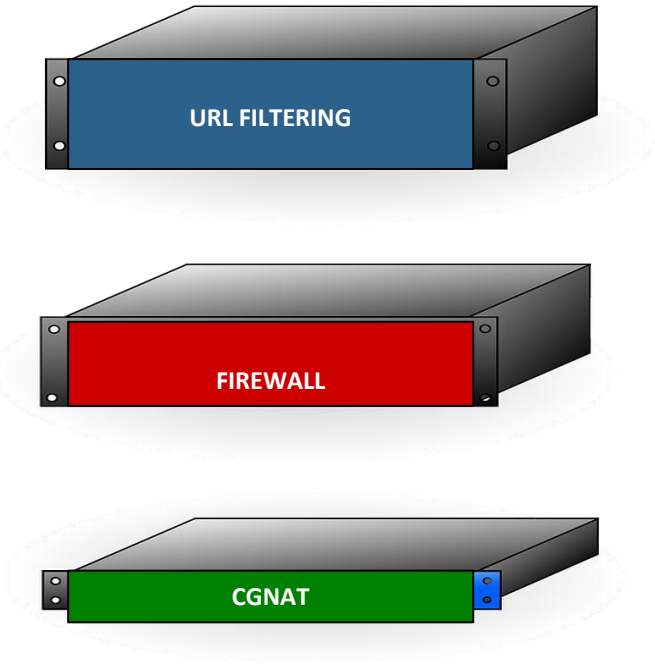


Open Network Operating System

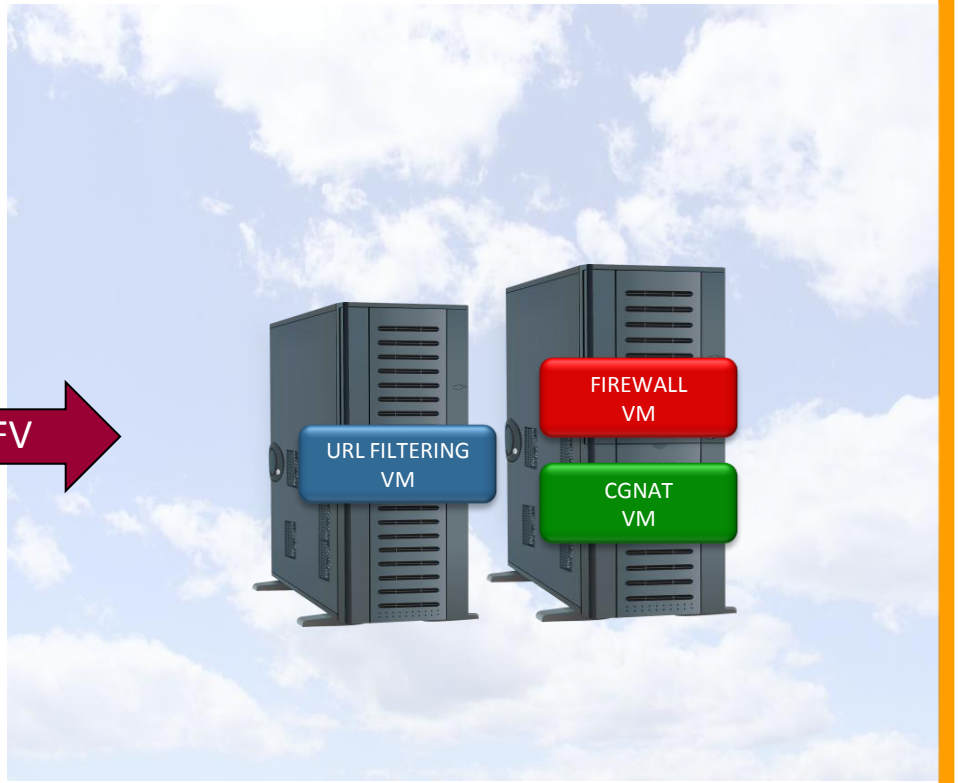
What about NFV?

Needs Further eVolution

NFV = OPEX Savings?



NFV



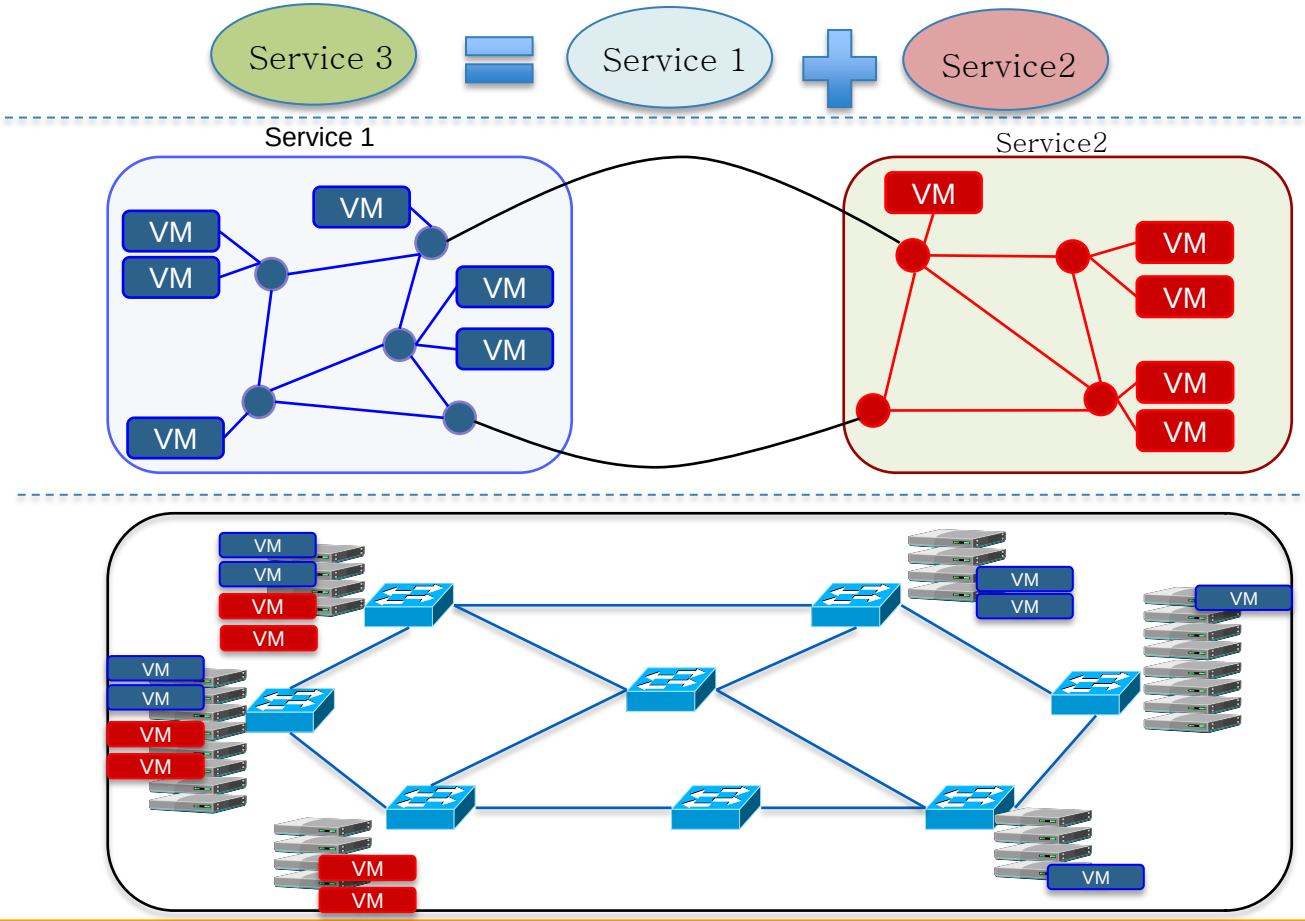
Before NFV:

Service Providers were managing devices

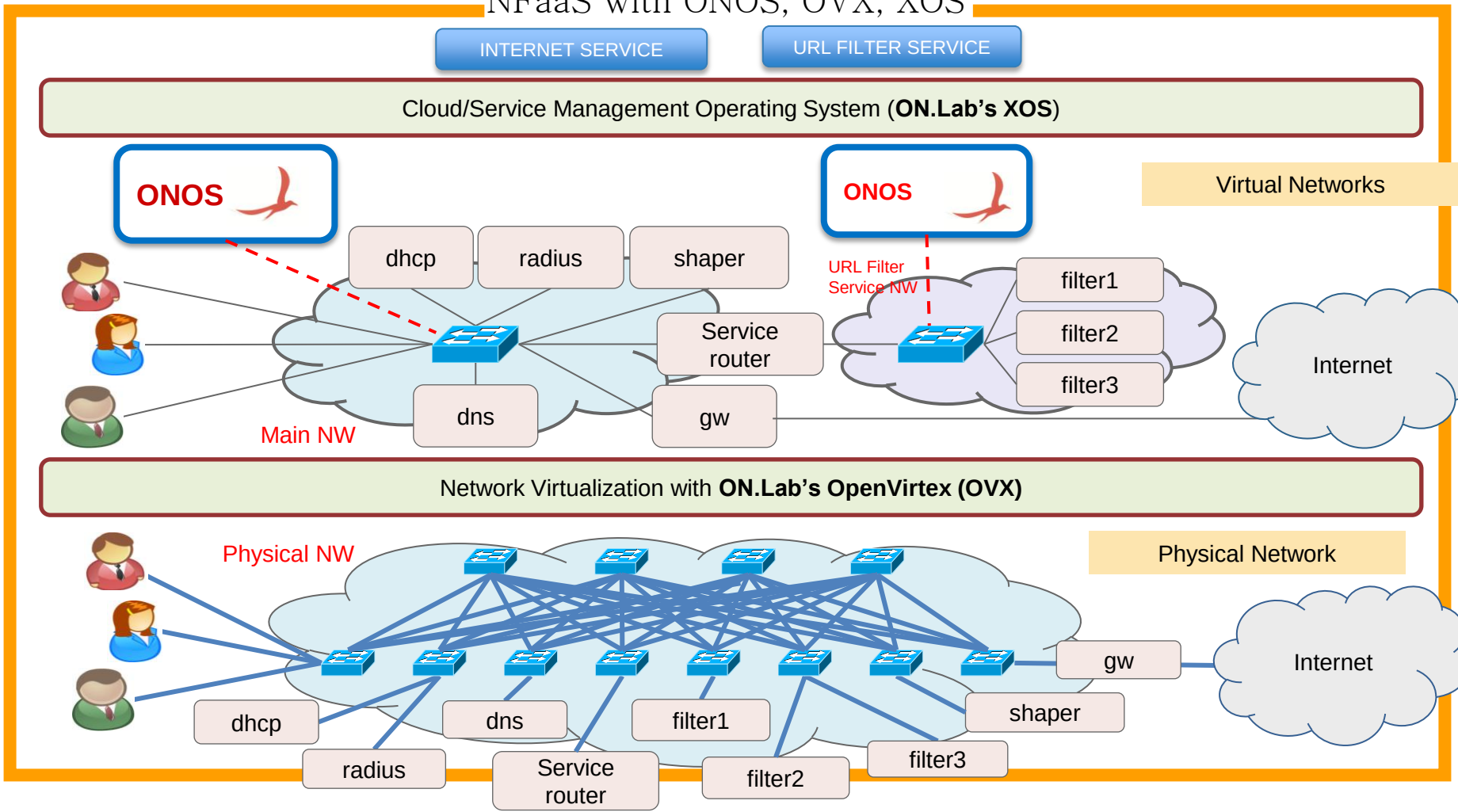
With NFV:

Service Providers are managing servers!

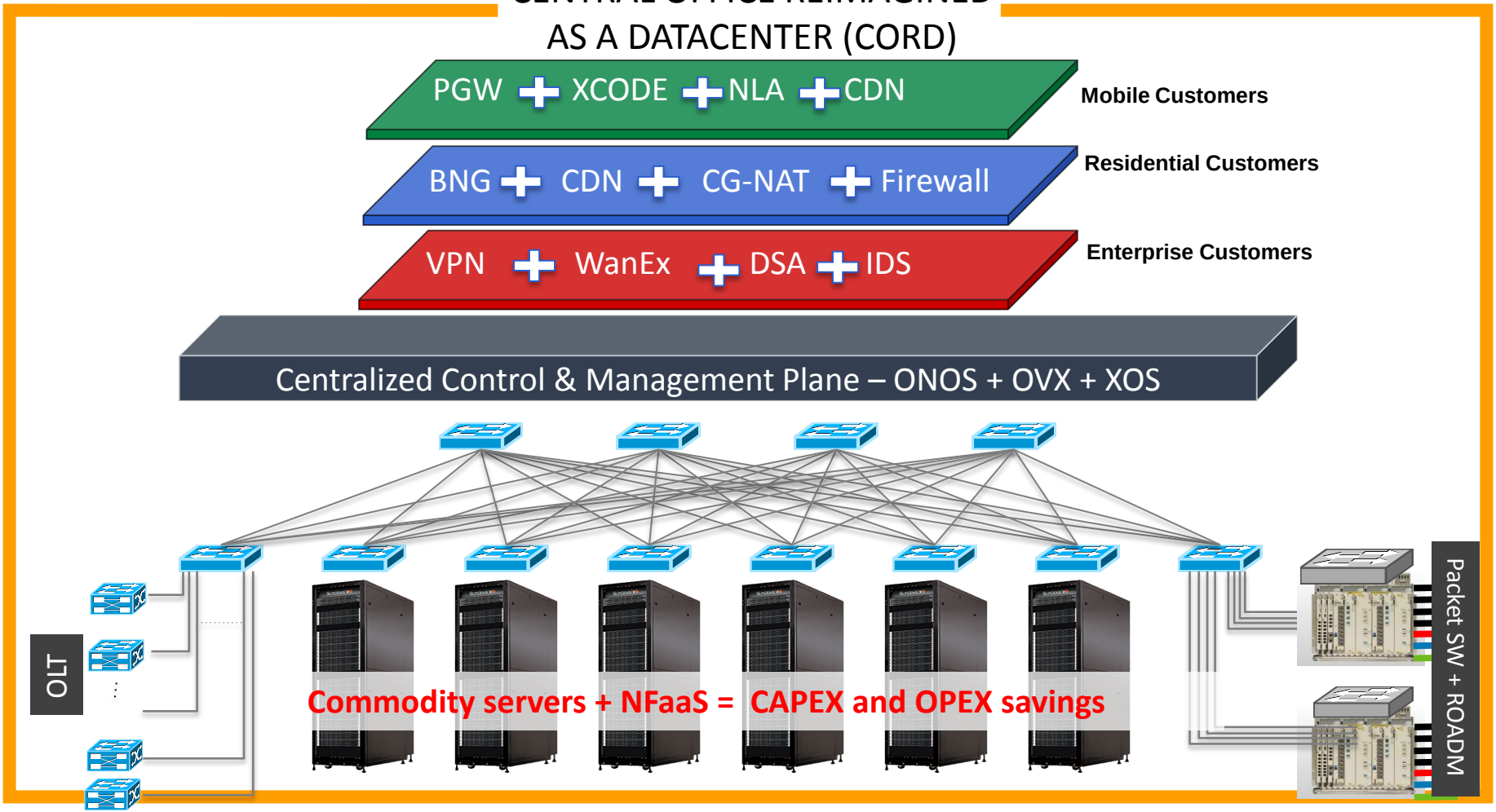
NFaaS: VM → Service

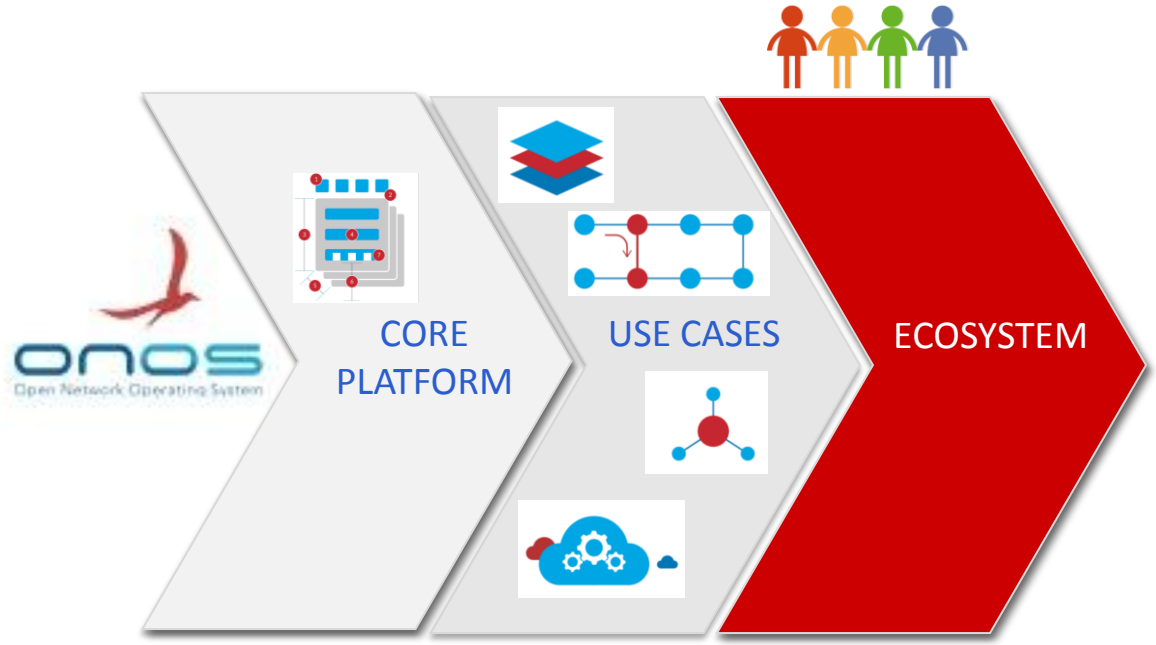


NFaaS with ONOS, OVX, XOS



CENTRAL OFFICE REIMAGINED AS A DATACENTER (CORD)

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ONOS ECOSYSTEM TODAY

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ONF

CREATE-NET

cnit

Consortium GARR

COMMUNITY

ONOS ECOSYSTEM

ON.LAB

- Non-profit, Carrier and vendor neutral
- Build core platform
- Provide technical shepherding, core team
- Build community

Service Providers

- Provide funding
- Provide requirements
- Develop use cases
- Drive POCs, deployments
- Bring vendors along

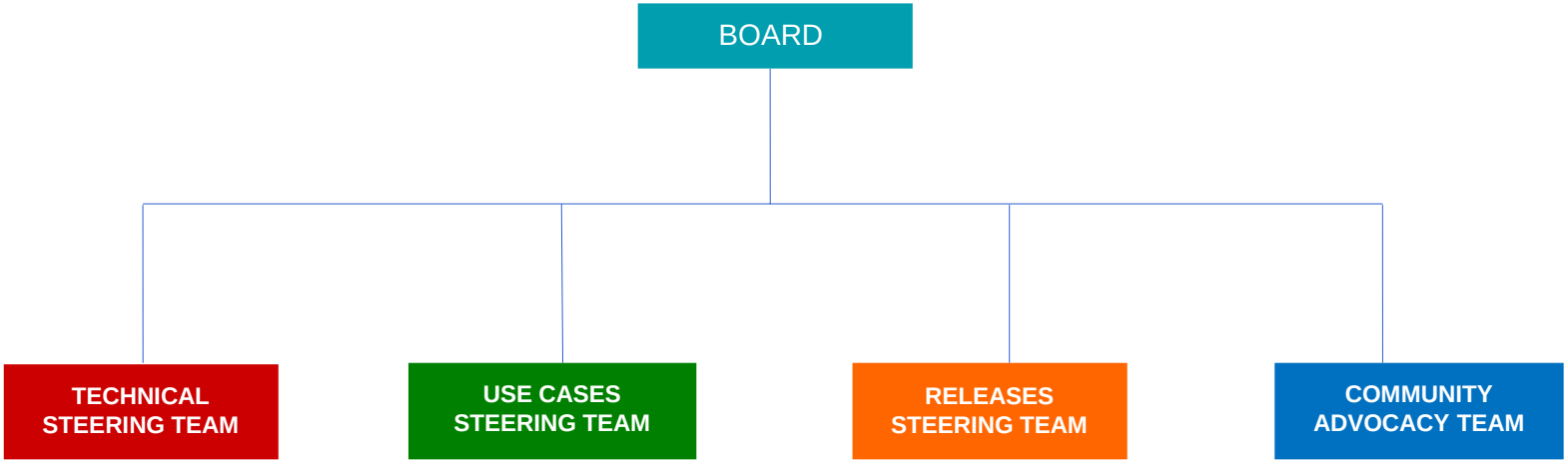
Vendors

- Provide funding
- Provide engineering resources
- Build products and solutions
- Provide integration, test and support services

Community

- Drive every aspect- technical, process, roadmap, deployments
- Bring in diversity
- Help ONOS evolve & thrive

ONOS GOVERNANCE



ONOS is a Technical Meritocracy.
ON.Lab plays the role of “benevolent” ~~dictator~~ steward.

ONOS IS UNIQUE

- Active participation of Service Providers 
- ONOS as SDN network operating system
  - Clean slate design with features for and focus on Service Providers 
- ON.Lab team 
  - A core team to architect, shepherd, and maintain focus 
- Active participation of Vendors – Vendors committed to bringing “real SDN” to service p[illegible]rs 
- Unique governance – Combination of technical meritocracy with ON.Lab’s “neutral” role

"Software-defined networking can radically reshape the wide area network. The introduction of ONOS provides another open source SDN option designed for service provider networks with the potential to deliver the performance, scale, availability and core features that we value."

John Donovan

Senior Executive Vice President, AT&T Technology & Operations

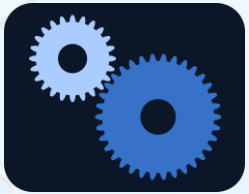
Success Metrics - 2015

Delivering quality code, timely releases, value

Service Provider and Vendor Sponsorship, Participation, Diversity

Open-ness, transparency, meritocracy

Community engagement, support and contributions



Industry and end user buy-in, trials, adoption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Software-defined Transformation of Service Provider Networks
The Beginning
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