

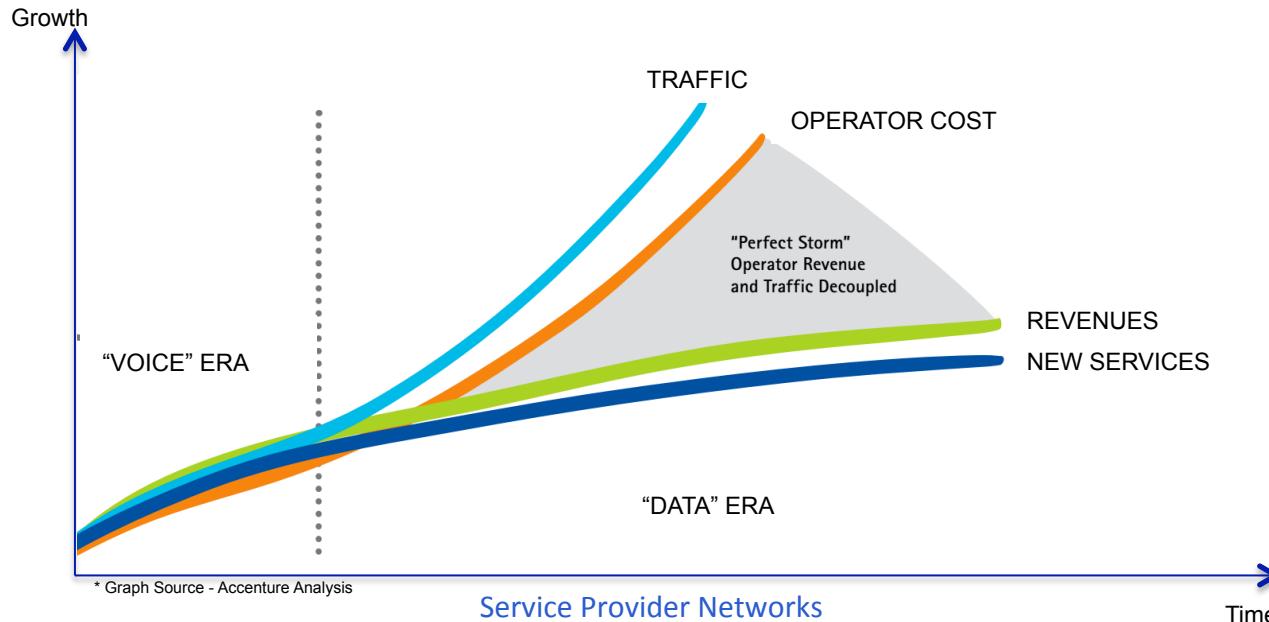


ONOS

The open SDN Network Operating System for Service Providers

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Director, Products @ ON.Lab

Explosive growth in Service Provider networks



Unprecedented
Traffic Growth

2016 traffic = triple of 2011

Orders of
magnitude
increase in users,
devices, apps

More mobile
devices than people

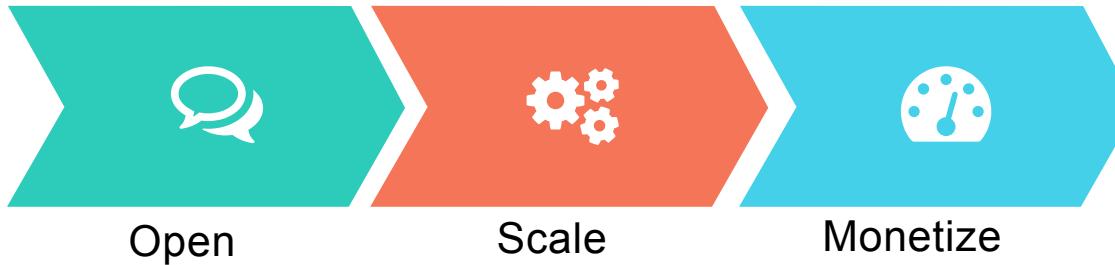
Video, Mobile
traffic exploding

IP Video: 79% of all
IP traffic in 2018

CAPEX
continues to rise

AT&T spends \$20 Billion
per year on CAPEX

Turning growth into opportunity



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



Reduce CAPEX and OPEX



Bring in cloud-style agility,
flexibility, Scalability

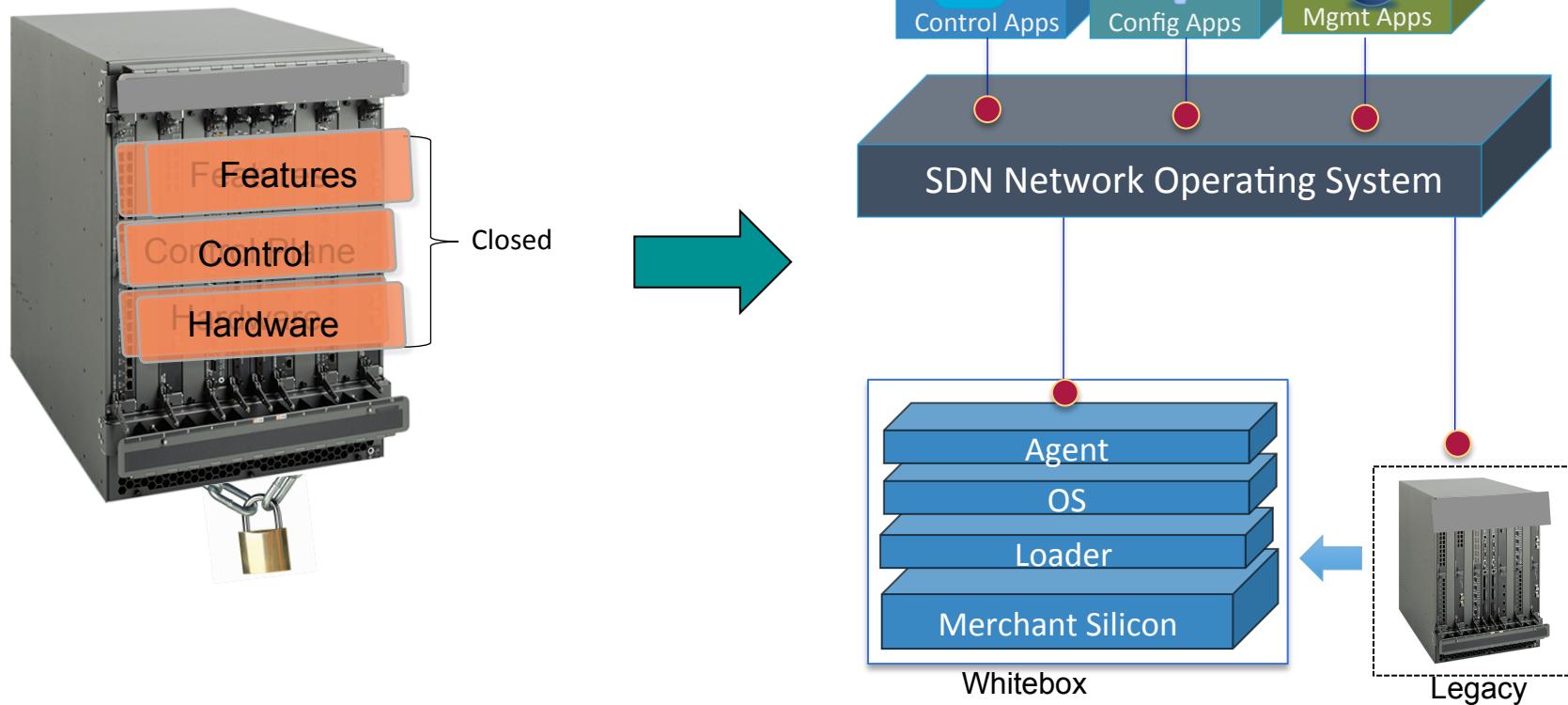


Lower operational complexity,
increase visibility



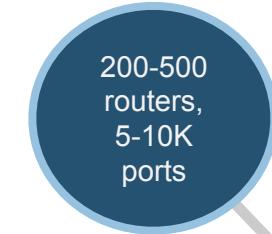
Deliver new and
customized
Services rapidly

Key enabler – Software Defined Networking



Challenge - 1

WAN core backbone



Metro Network

10-50K routers,
2-3 Million ports

SIZING THE SERVICE PROVIDER NETWORK

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

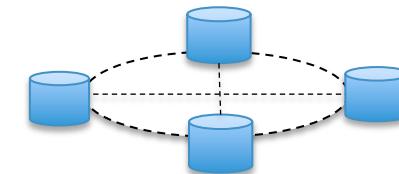
10-50K devices,
100K-1 Million ports

Cellular Access Network

Wired Access/
Aggregation Network



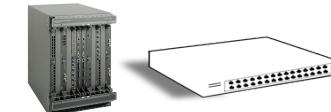
Tens of millions of fixed, hundreds of millions of wireless end points



Five nines availability (or a cloud style version of it), high performance, low latency



Ease/agility of service creation



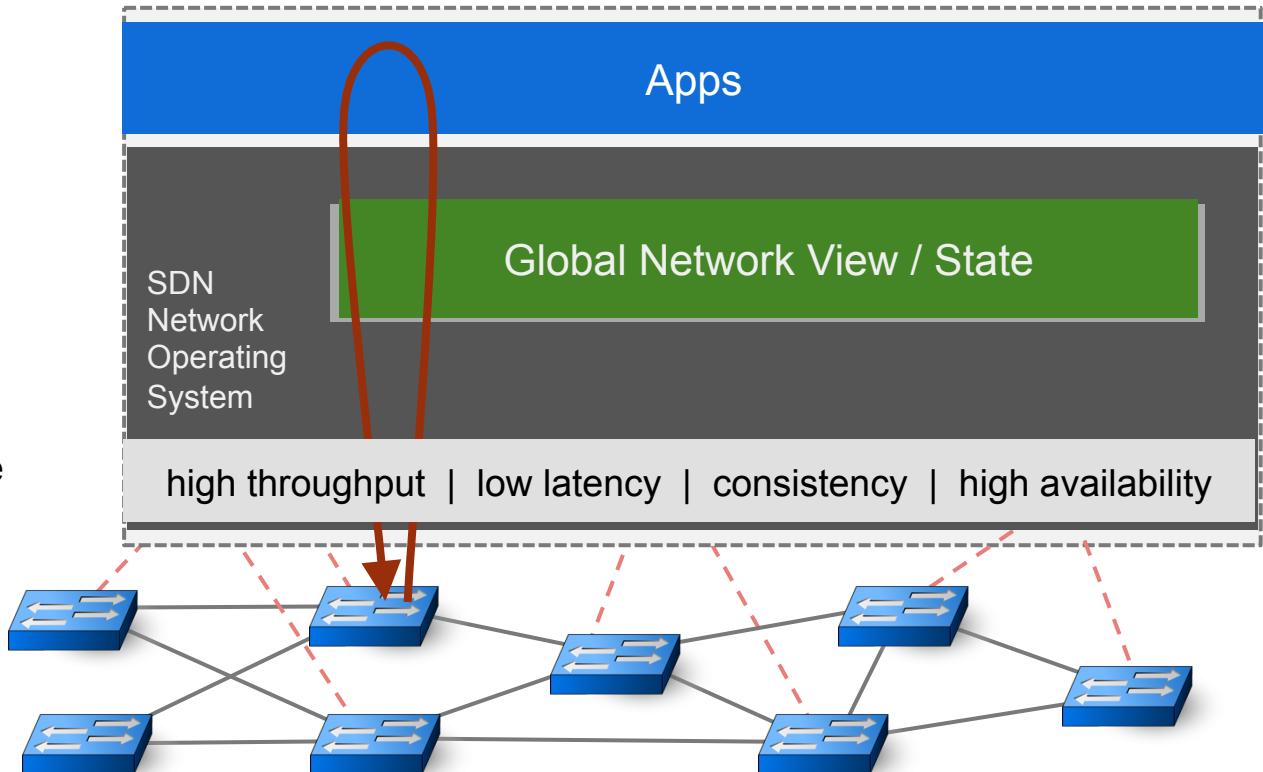
Phased migration of networks, support for white boxes



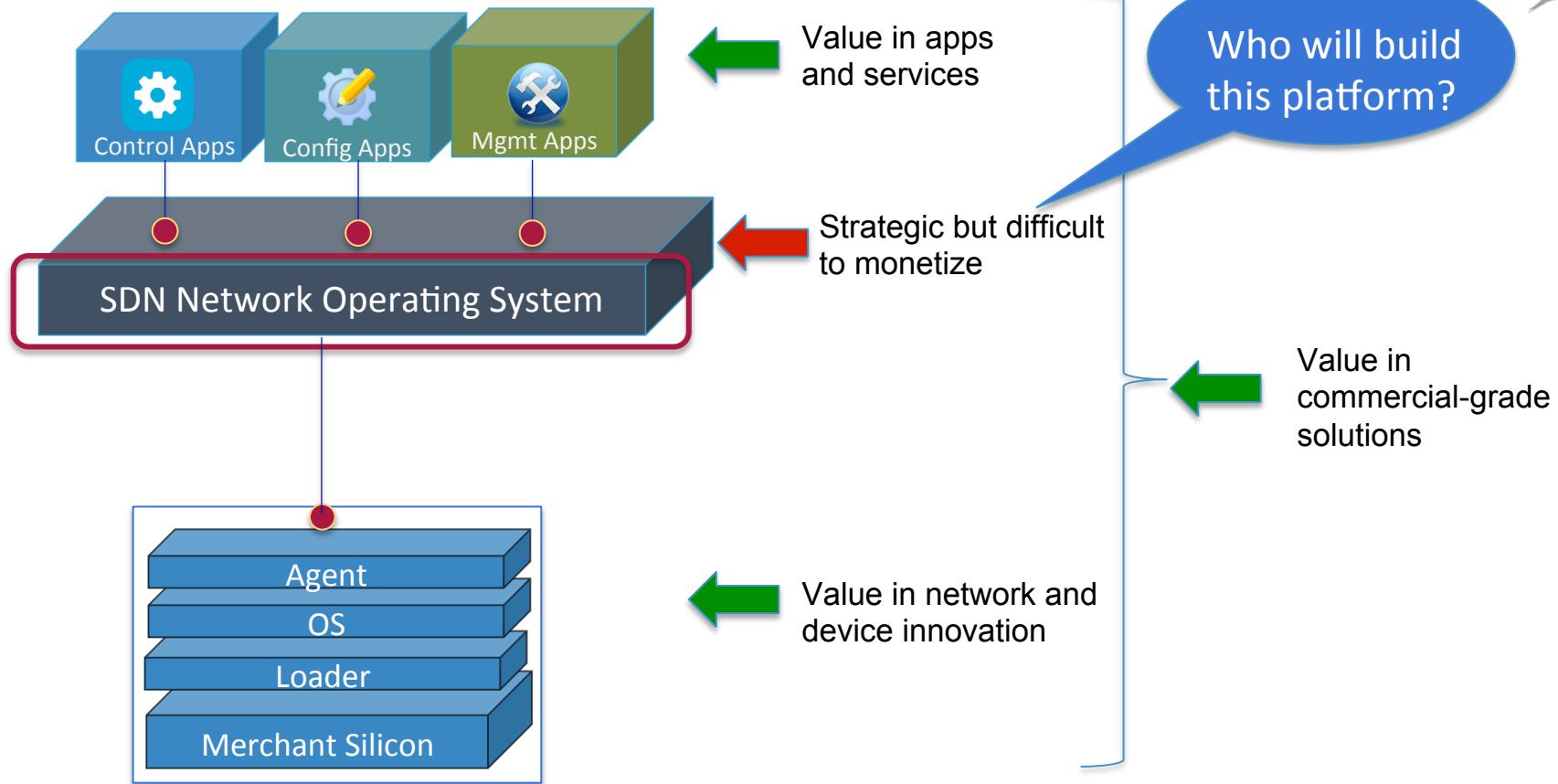
Challenge – 1 in numbers



- **High Throughput:**
~500K-1M paths setups / second
- ~3-6M network state ops / second
- **High Volume:**
~500GB-1TB of network state data



Challenge – 2



ONOS Mission



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



ONOS was open sourced on Dec 5th, 2014
Welcome to open source ONOS!

Open Source ONOS Ecosystem



ON.LAB

ON.LAB



**SERVICE PROVIDER
PARTNERS**



**VENDOR
PARTNERS**



COLLABORATORS



COMMUNITY



ONOS – SDN NOS For Service Providers



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

Key metrics for ONOS



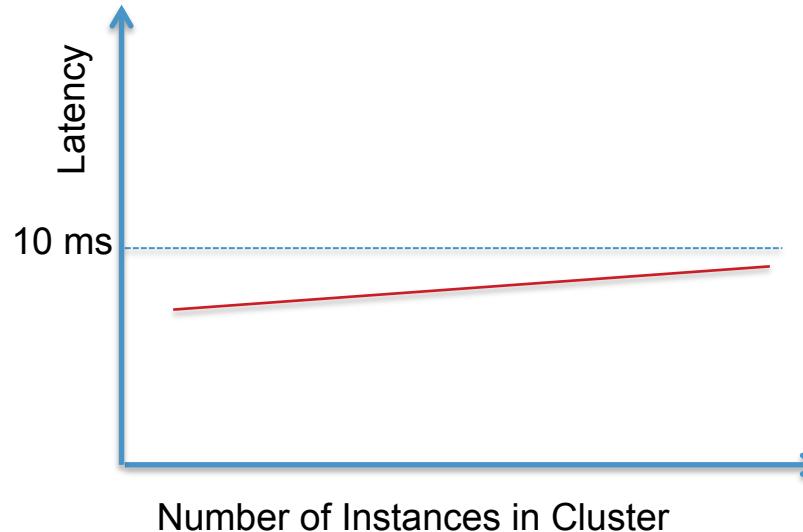
- Performance
 - Topology change latency
 - Topology change throughput
 - Northbound latency
 - Northbound throughput
- Scale-out
 - Ability to scale control plane by adding capacity
- High Availability
 - Uninterrupted operation in the wake of failures, upgrades

Challenging part -> providing performance, scale-out, HA together

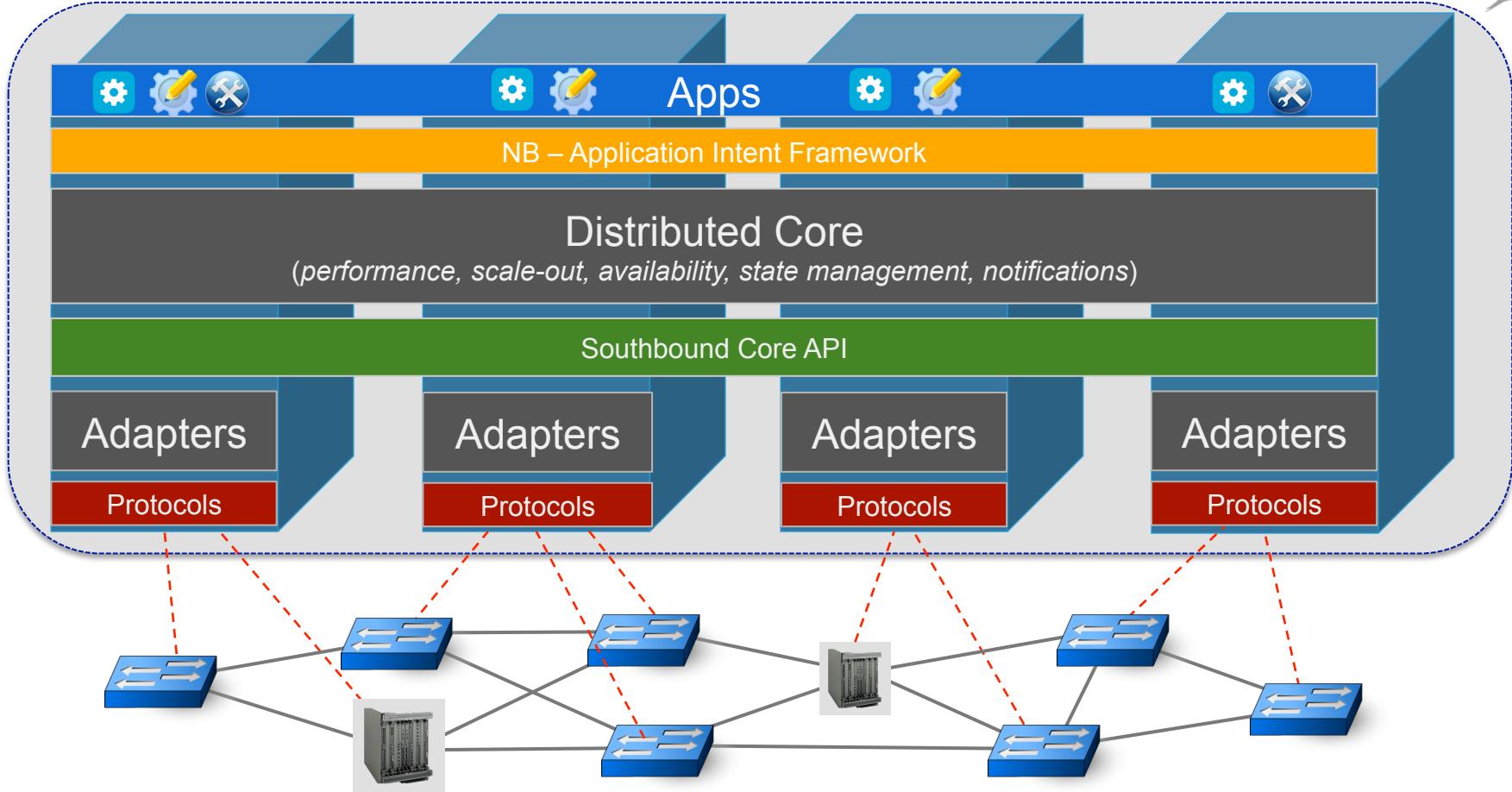
What's good enough? Simple Rule of thumb



- 1 M flow ops/sec
- Less than 100ms latency (ideally under 10ms)



ONOS Distributed Architecture



ONOS Application Intent Framework

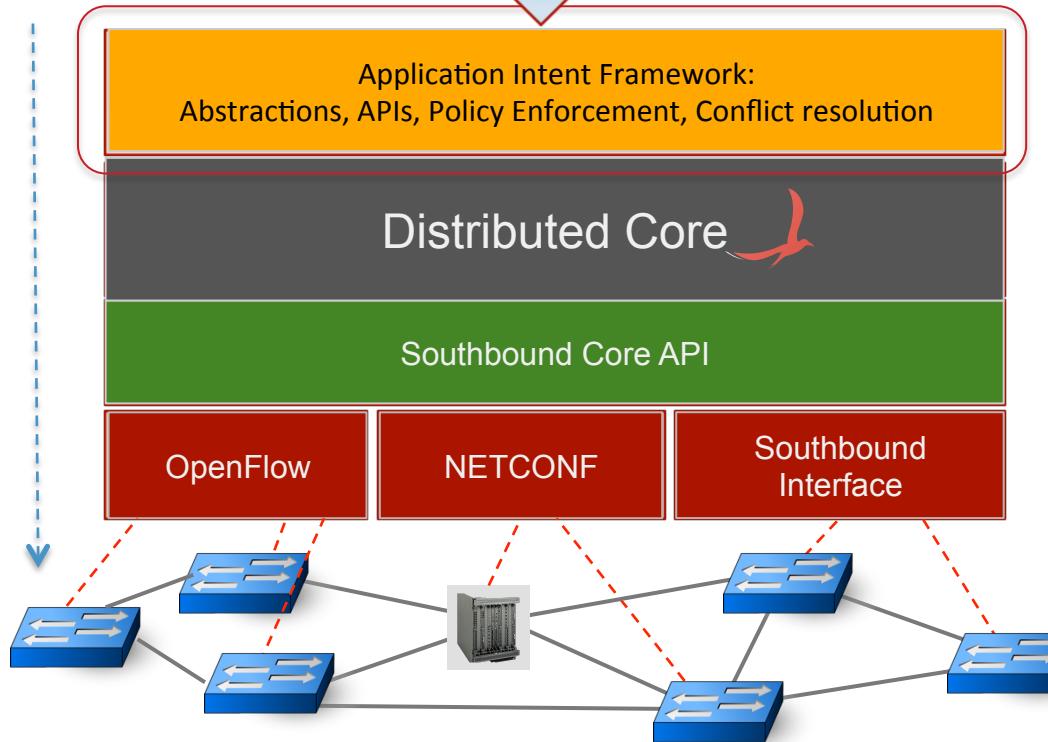


I want to define “what” I need without worrying about “how”...



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

Intents translated and Compiled into specific instructions for network devices.



ONOS Intent Example



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

COMPILEMENT

Host to Host Intent



Path Intent



Path Intent



INSTALLATION

Flow Rule Batch



Flow Rule Batch



Flow Rule Batch

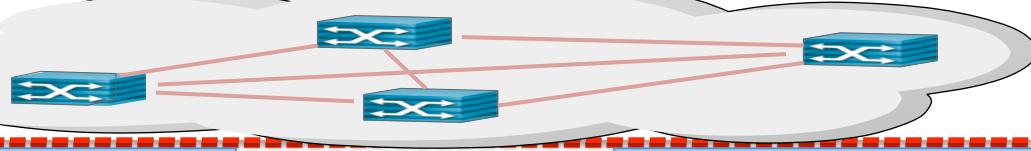


Flow Rule Batch

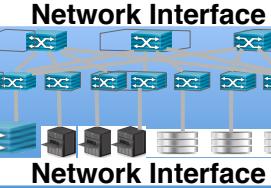
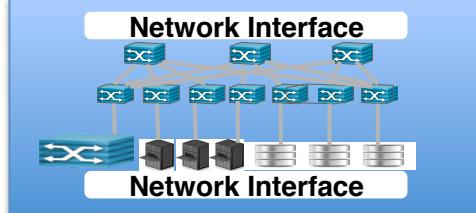


Service Provider Network of the Future

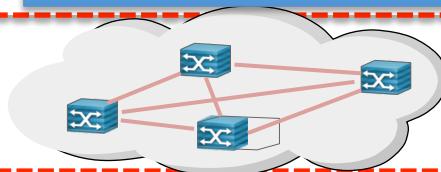
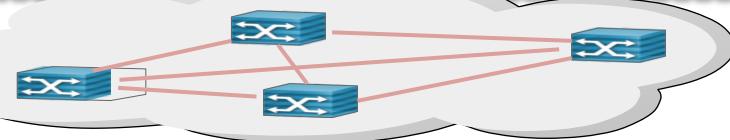
Core Packet-Optical



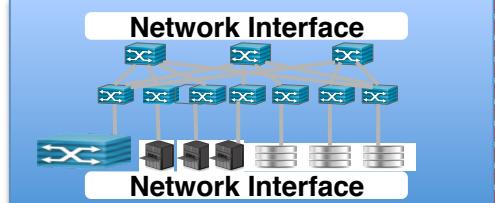
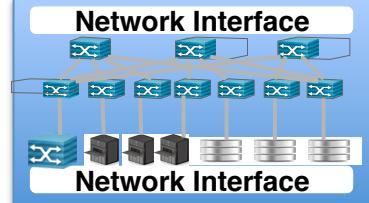
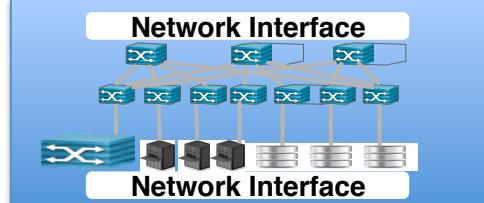
POP
Built like a
Data Center



Metro Packet-Optical



Central Office
Built like a
Data Center



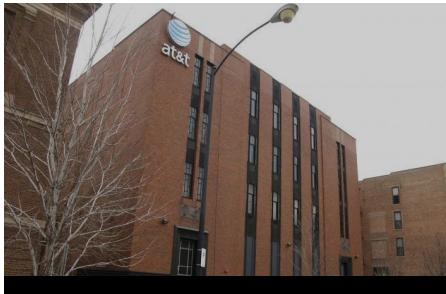
Access





ONOS Central Office POC

Central Office re-imagined as Datacenter



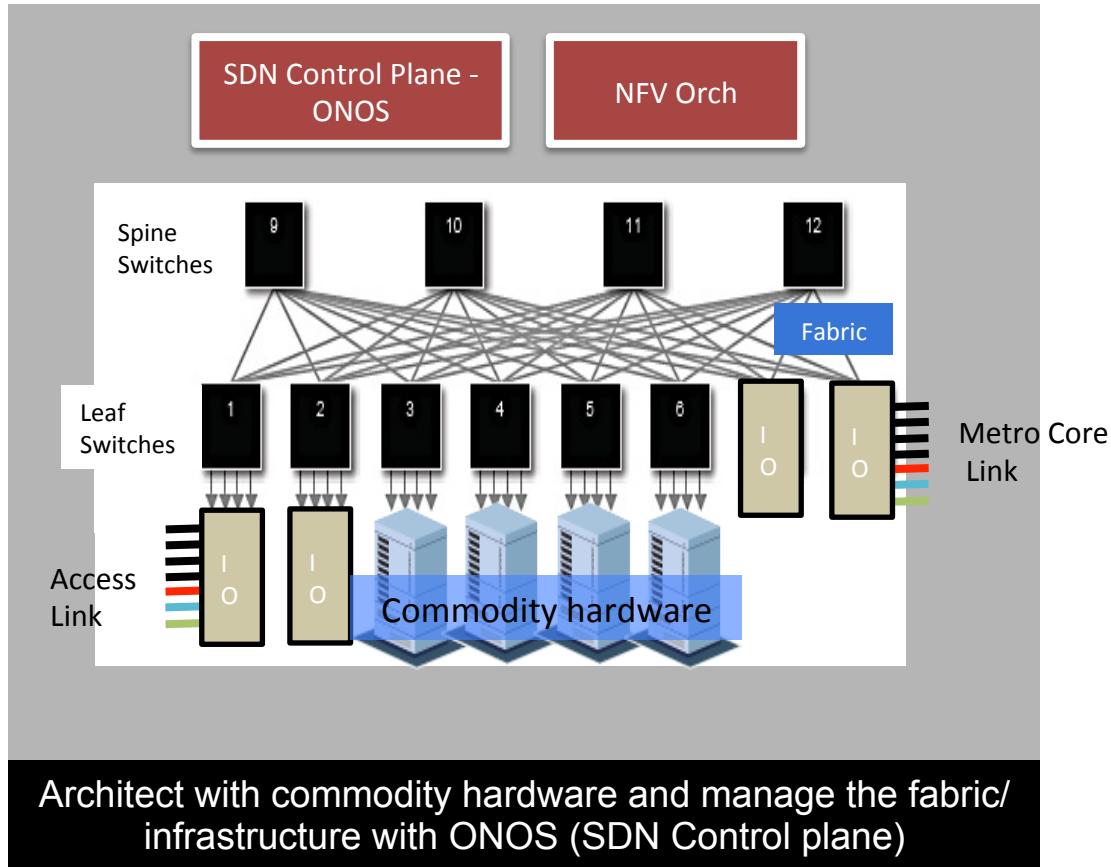
Large number of COs



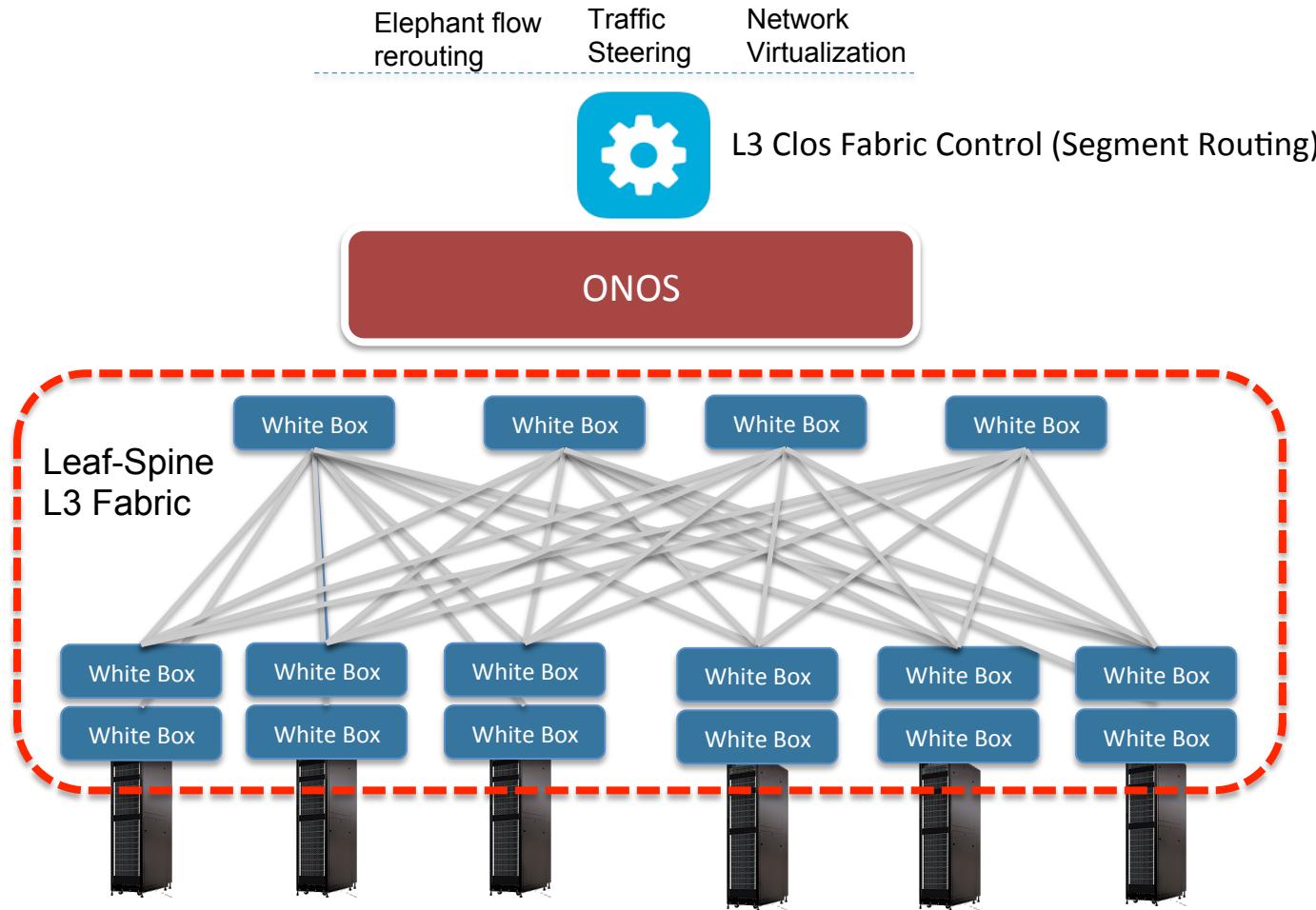
Evolved over 40-50 years



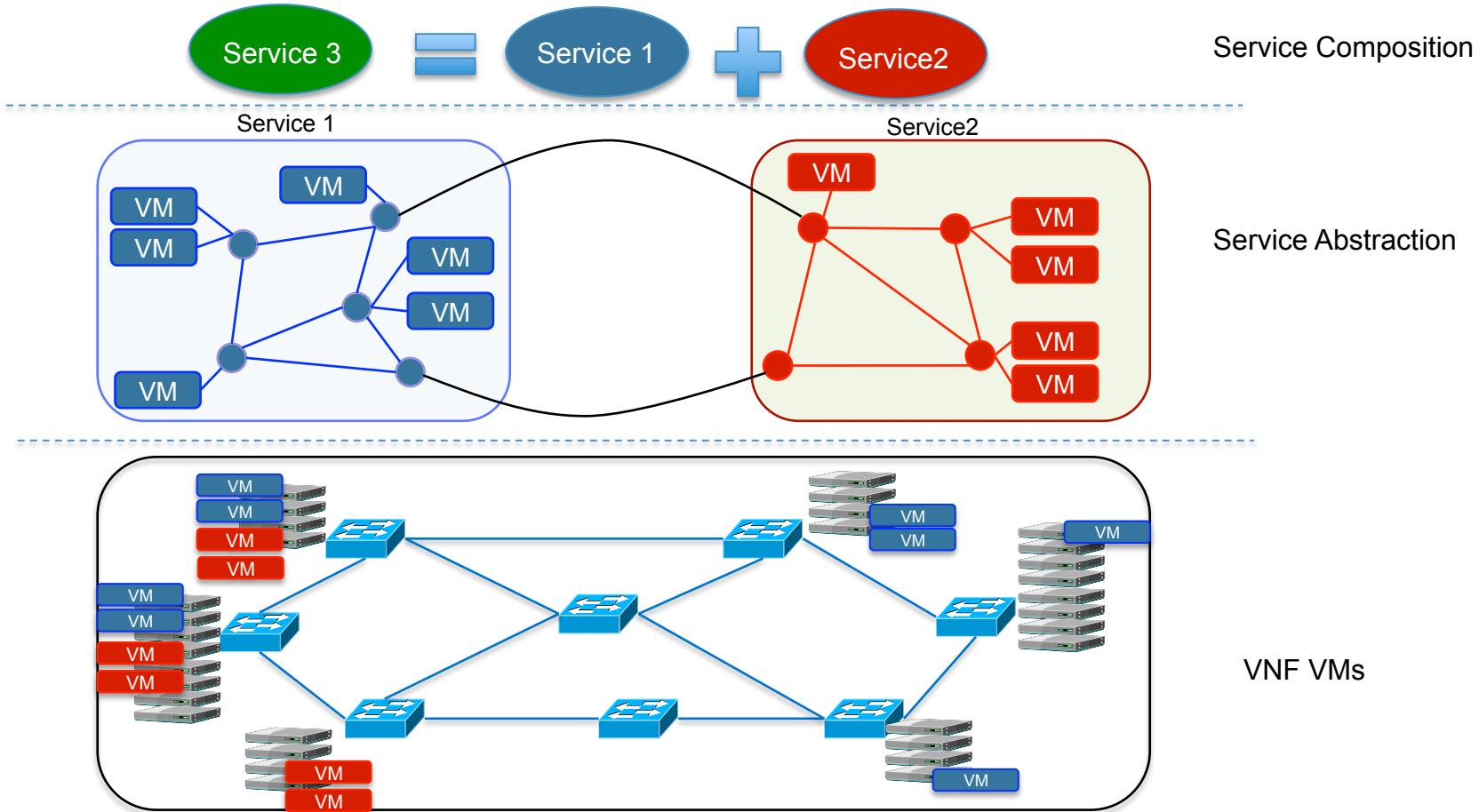
Huge source of CAPEX/OPEX



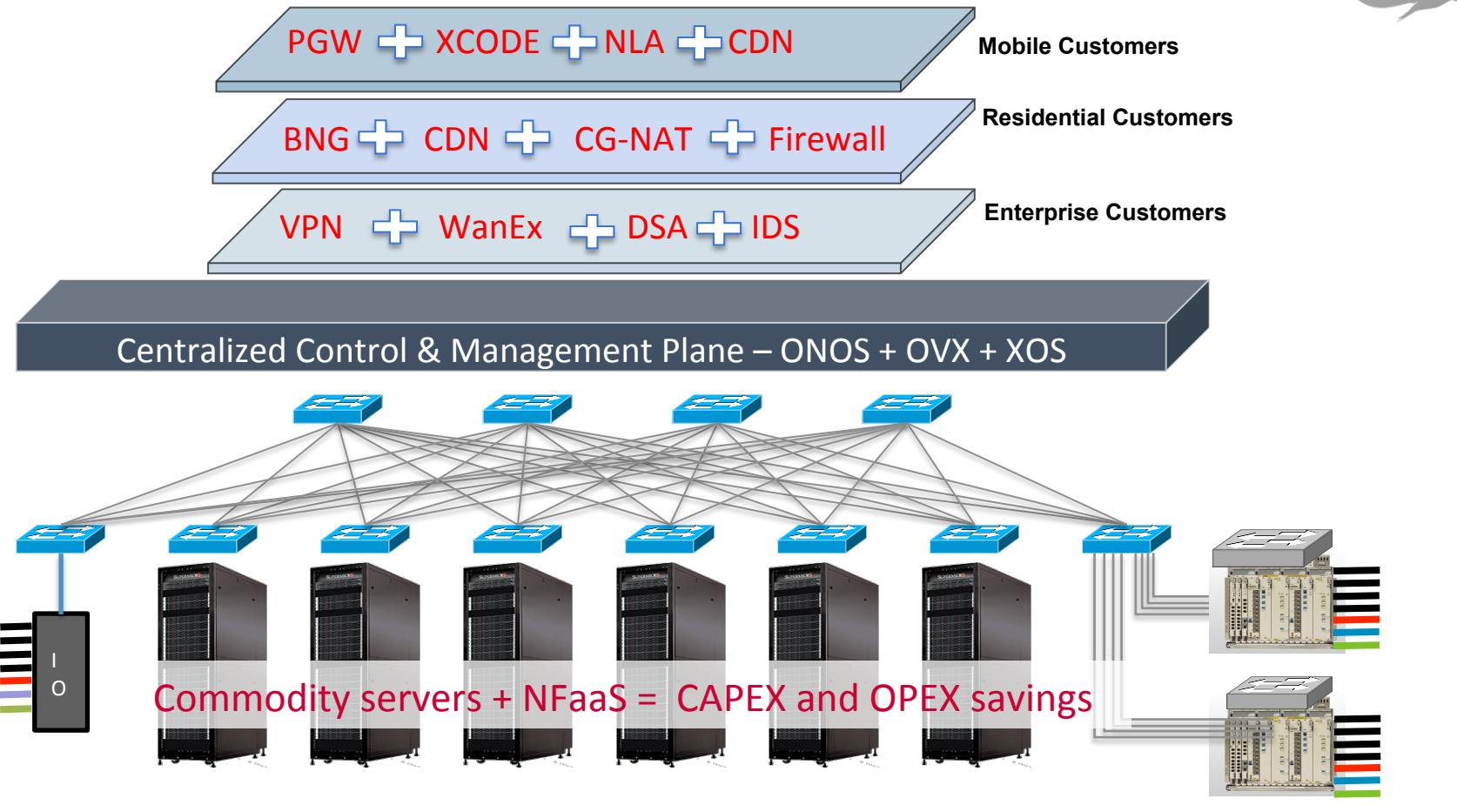
Central Office fabric control with ONOS



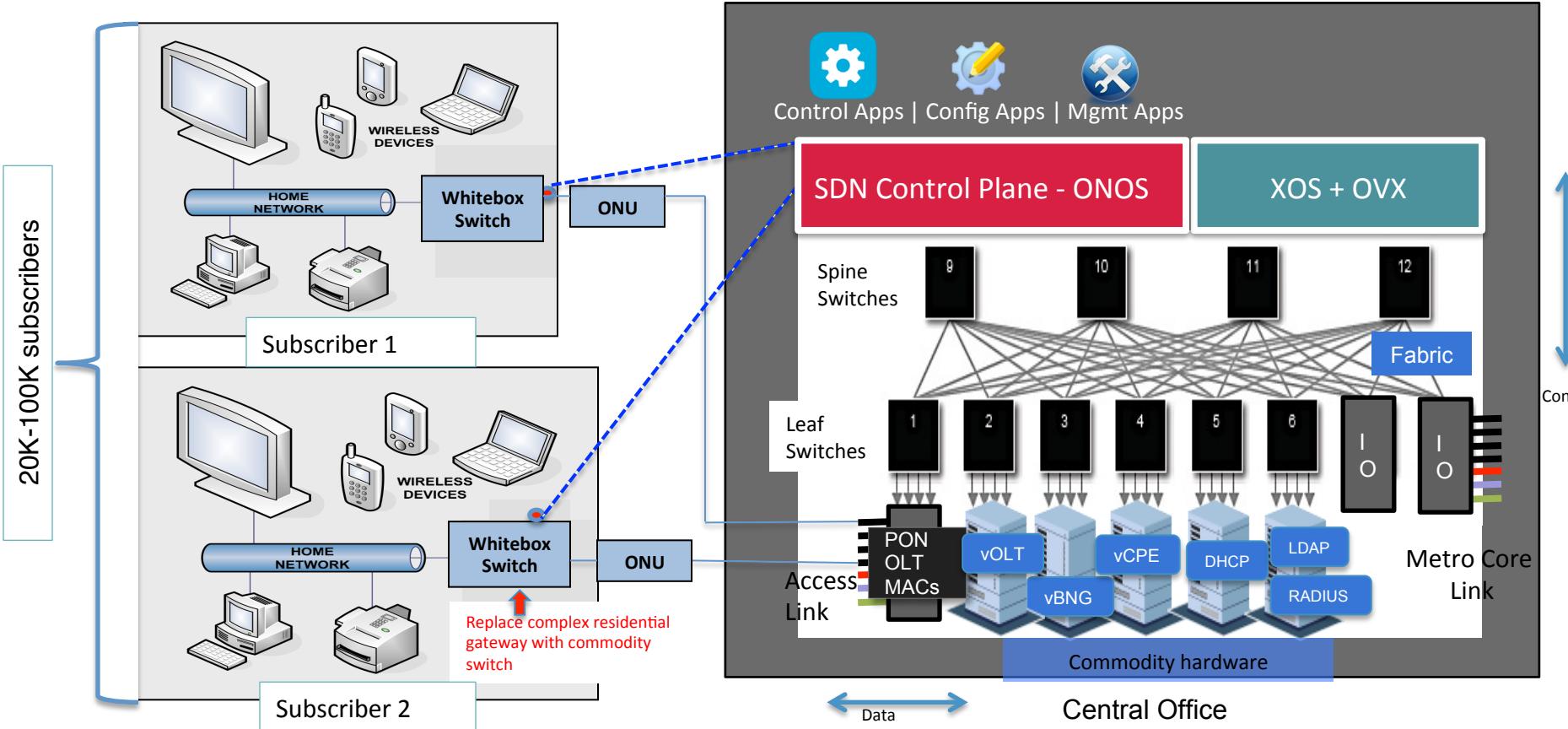
NFaaS: From VMs to Services



Central Office with NFaaS (NFV)



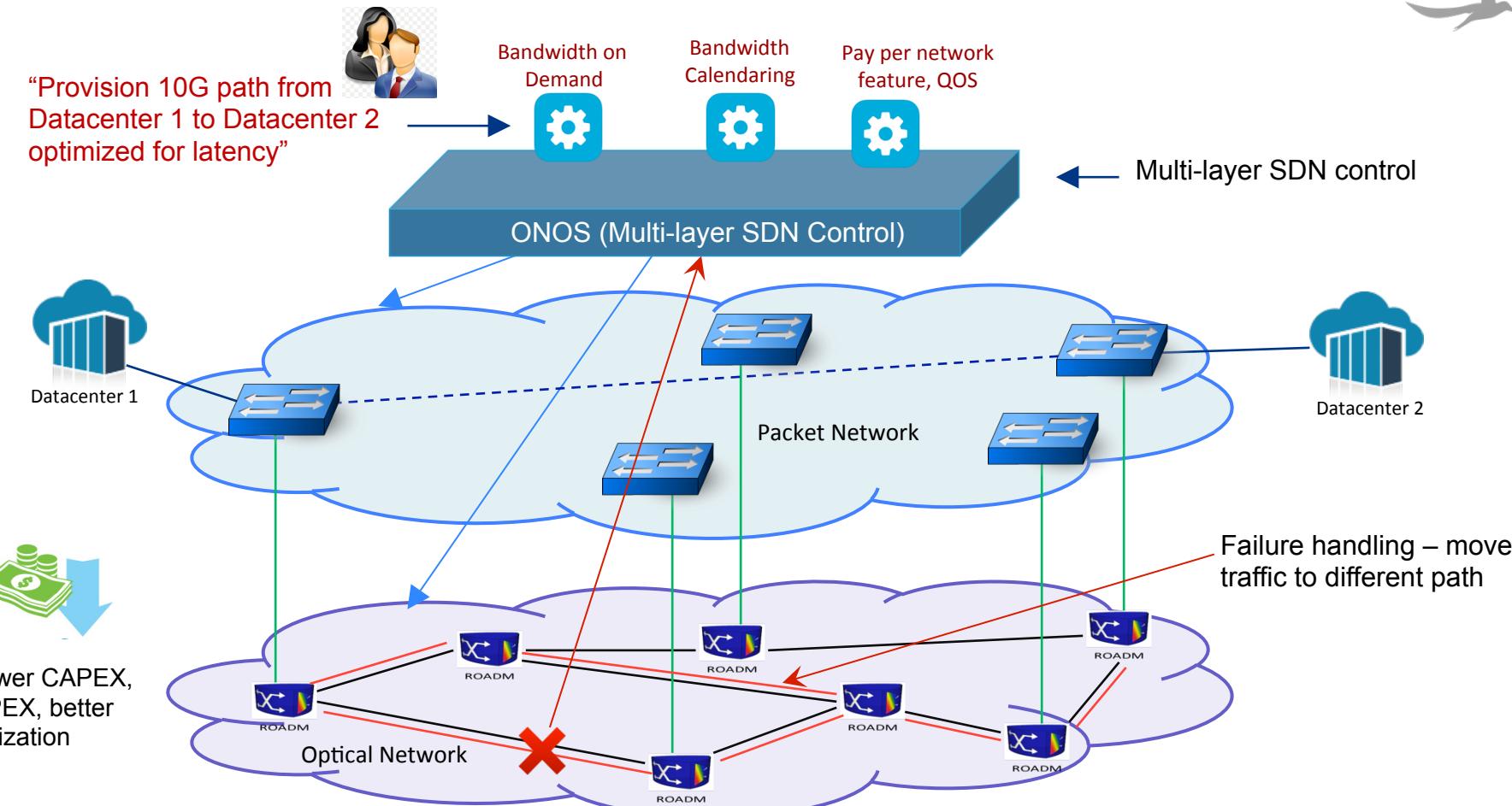
Virtualizing the CPE (vCPE) and OLT (vOLT)





ONOS Core POC

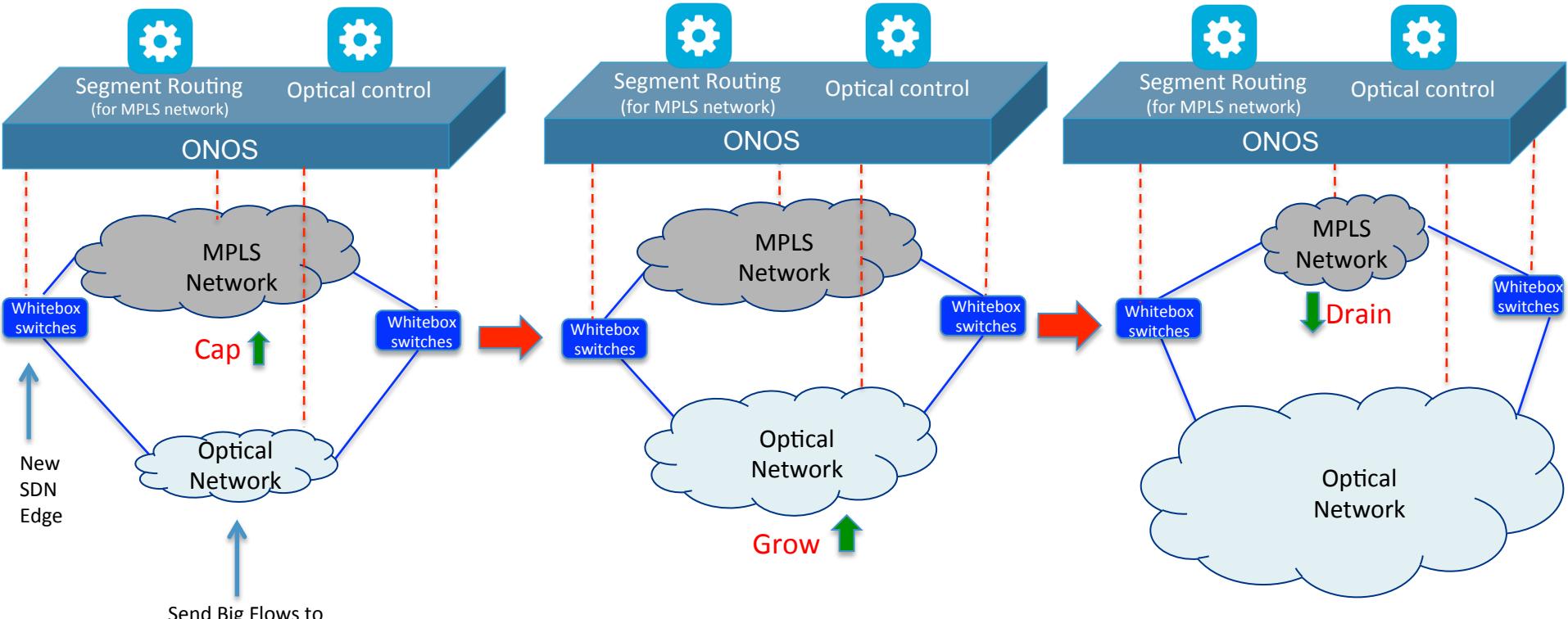
Multilayer Packet/optical SDN control





SDN Migration Strategy POCs

MPLS/optical SDN control with Cap-Grow-Drain



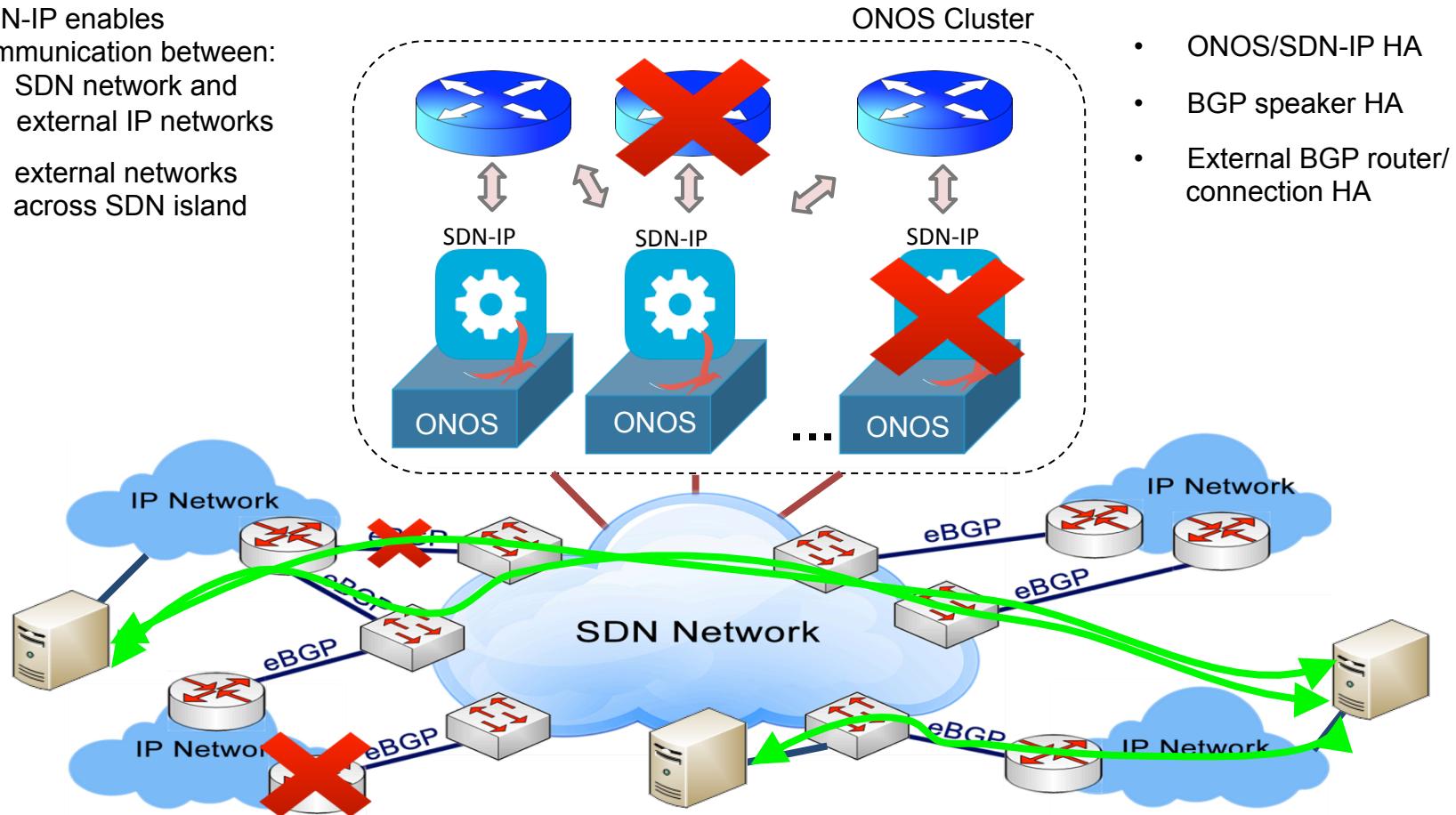
Cap-Grow-Drain = Bring SDN to backbone without fork lift upgrade

Seamless peering with SDN-IP



SDN-IP enables communication between:

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



ONOS Focus in 2015



PERFORMANCE,
CORE PLATFORM



STABILITY
+ NEW AREAS

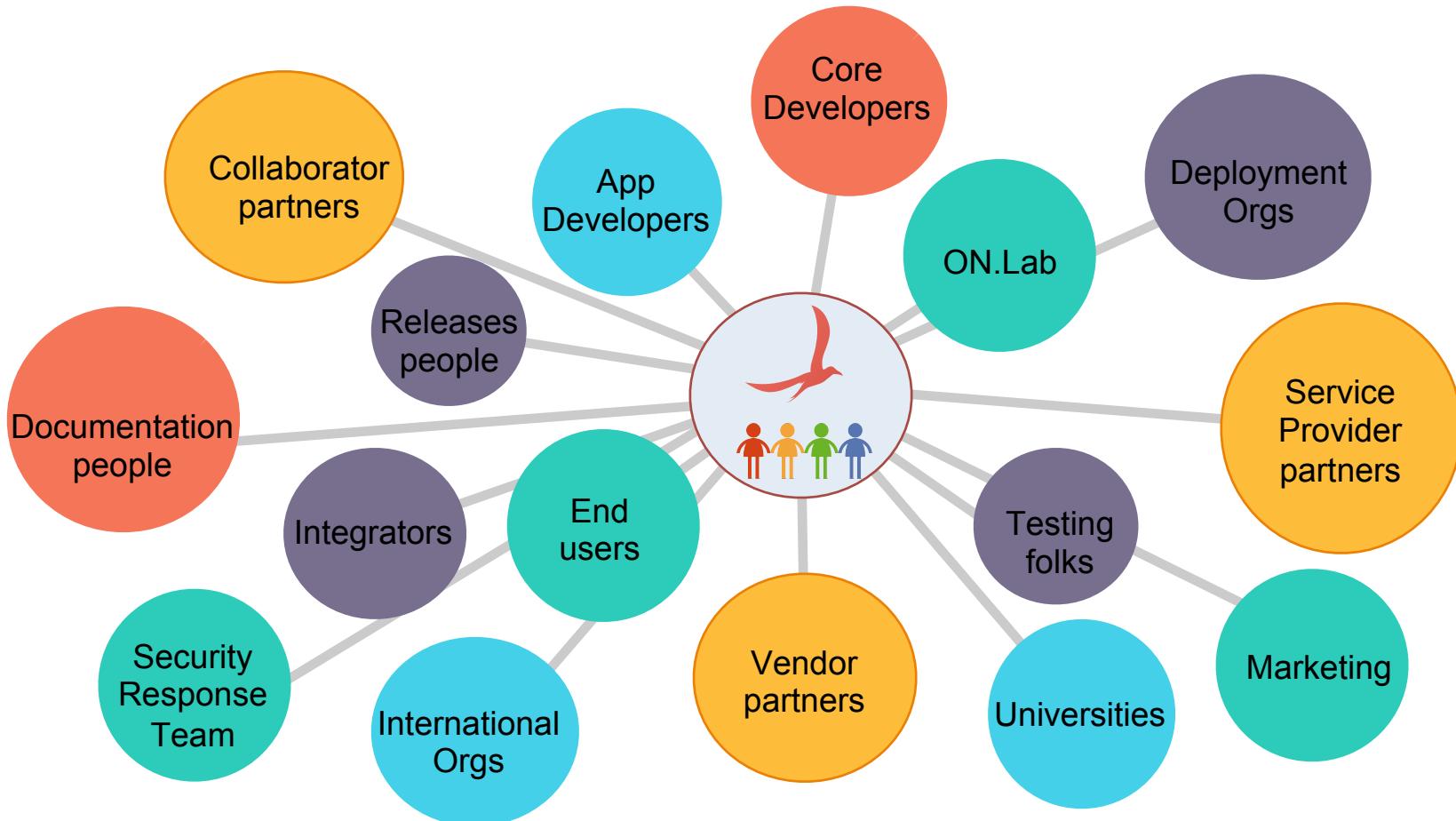
Geographically distributed ONOS cluster(s)
Multi-tenancy
Openstack Integration
IPv6 support
Security
Mobility



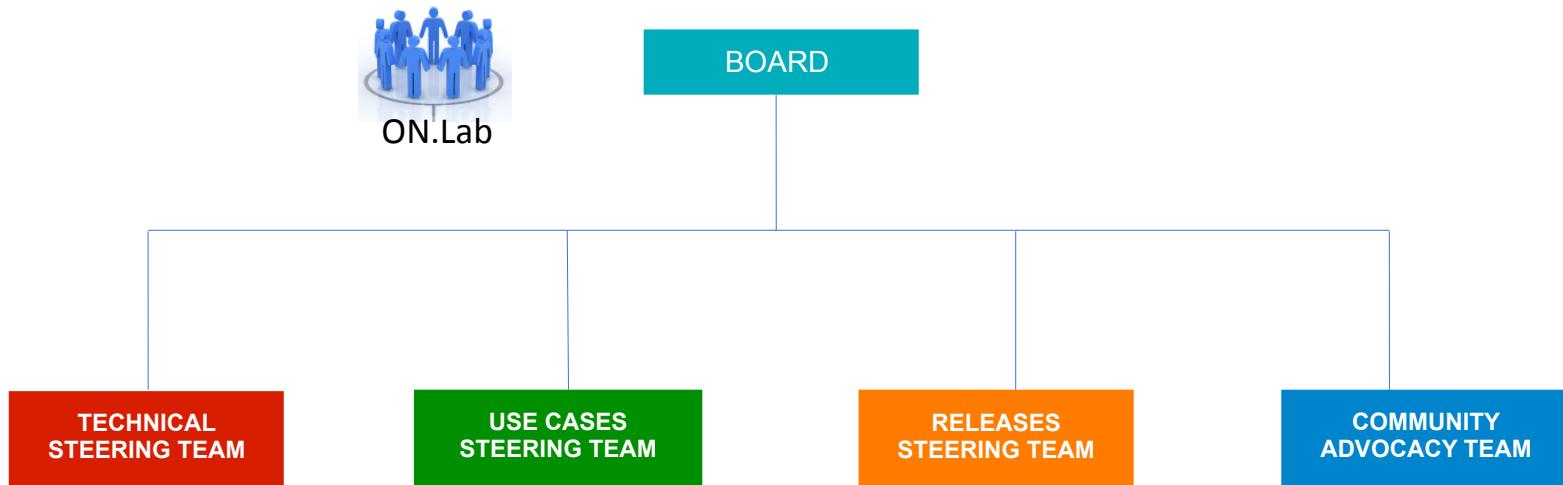
USE CASES/DEPLOYMENTS

CORD (Central Office)- Fabric – NFaaS - vCPE, MPLS/Packet optical (core)
SDN-IP (WAN), Segment Routing (WAN)
Multicast (video), IP RAN (Backhaul), Mobile, vEPC, Soft RAN, Internet2, CREATE-NET, Deployments, SP POCs/Trials (AT&T, NTT, SK Telecom, DIRECTV, Huawei, NEC...)

ONOS Focus in 2015—Its Vibrant Community



ONOS - Unique Governance



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

ONOS Success Metrics - 2015



Delivering quality code, timely releases, value



Service Provider and Vendor Sponsorship,
Participation, Diversity



Open-ness, transparency, meritocracy



Community growth, support and
contributions



Industry and end user buy-in, trials, adoption



Software Defined Transformation of Service Provider Networks

Join the journey @ onosproject.org