\Orchestrating a brighter world NEC

ONOS(Open Network Operating System)とは

NEC
金海 好彦

アジェンダ

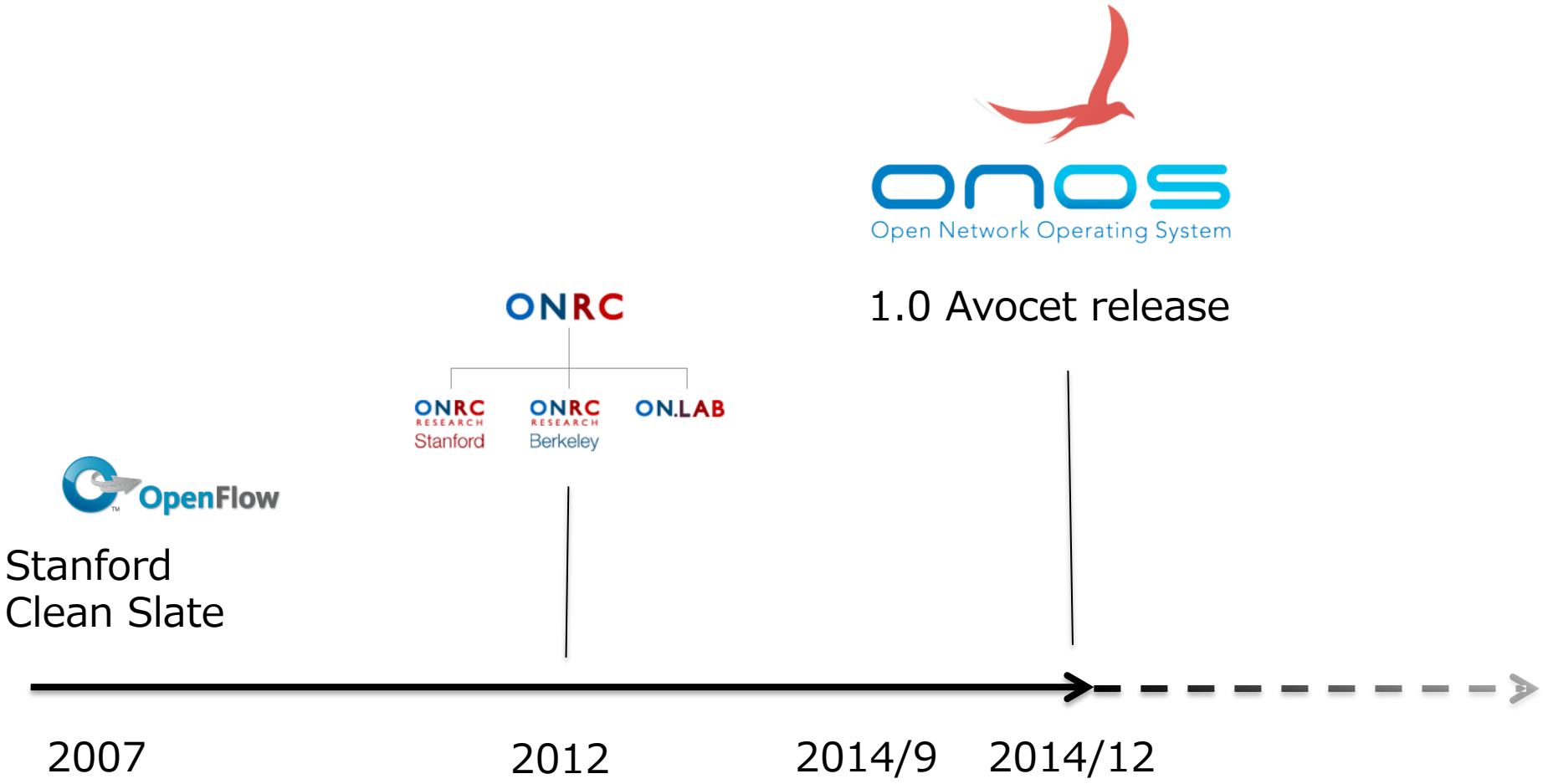
- ONOSの概要
- ONOSのアーキテクチャと内部構造
- Intentとは
- ONOS向きシナリオ例
- ユースケース
- デモ

ONOSとは、一言で

ONOS, a SDN network operating system designed for high availability, performance, scale-out, and rich abstractions.

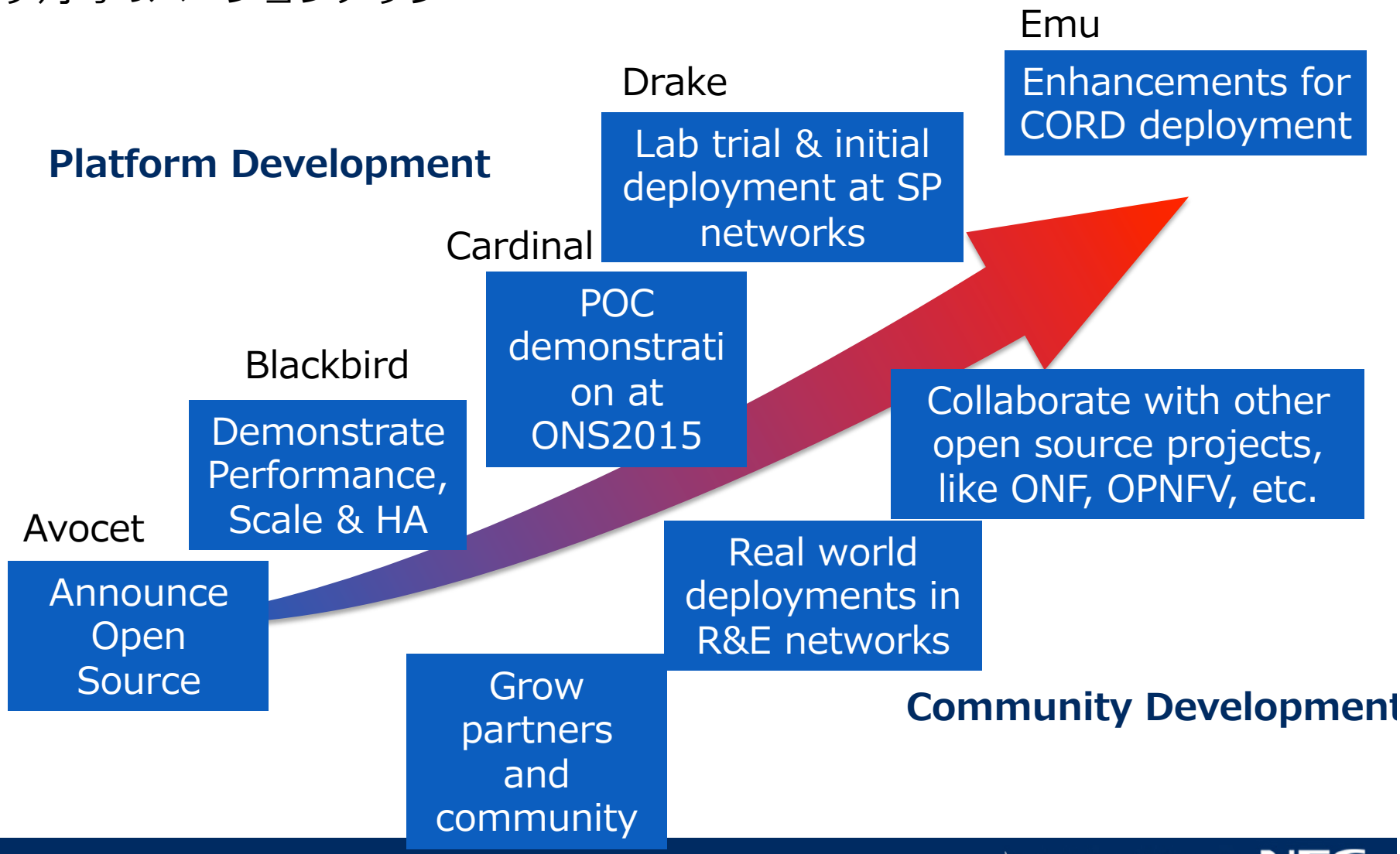
抽象化NEモデルを提供し、フローセットアップ性能に注力した、
分散SDNコントローラ基盤

ON.lab/ONOS ProjectへのNECの関与



バージョン毎の目標

3ヶ月毎のバージョンアップ

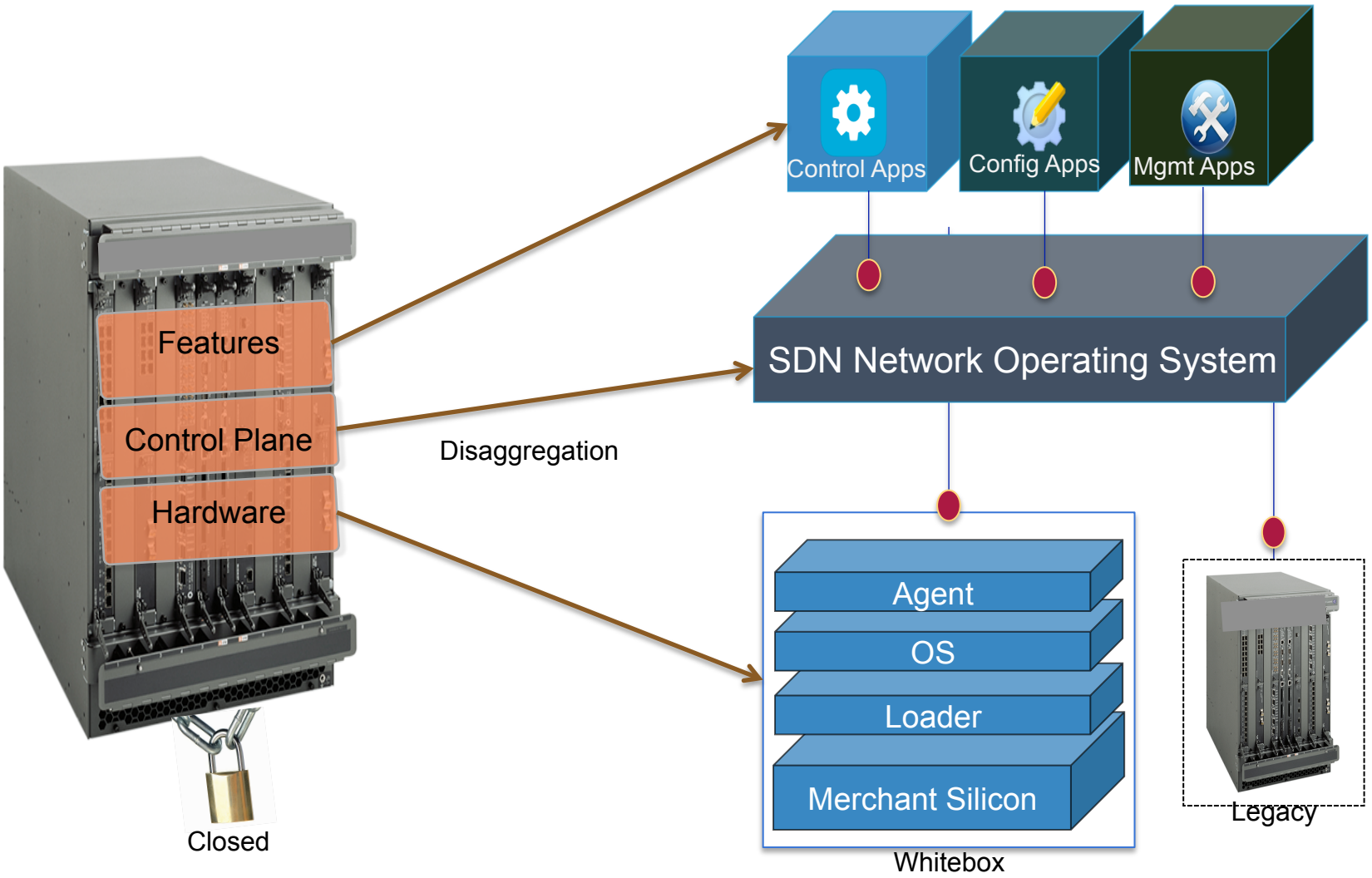


ONOS Partner and Collaborator

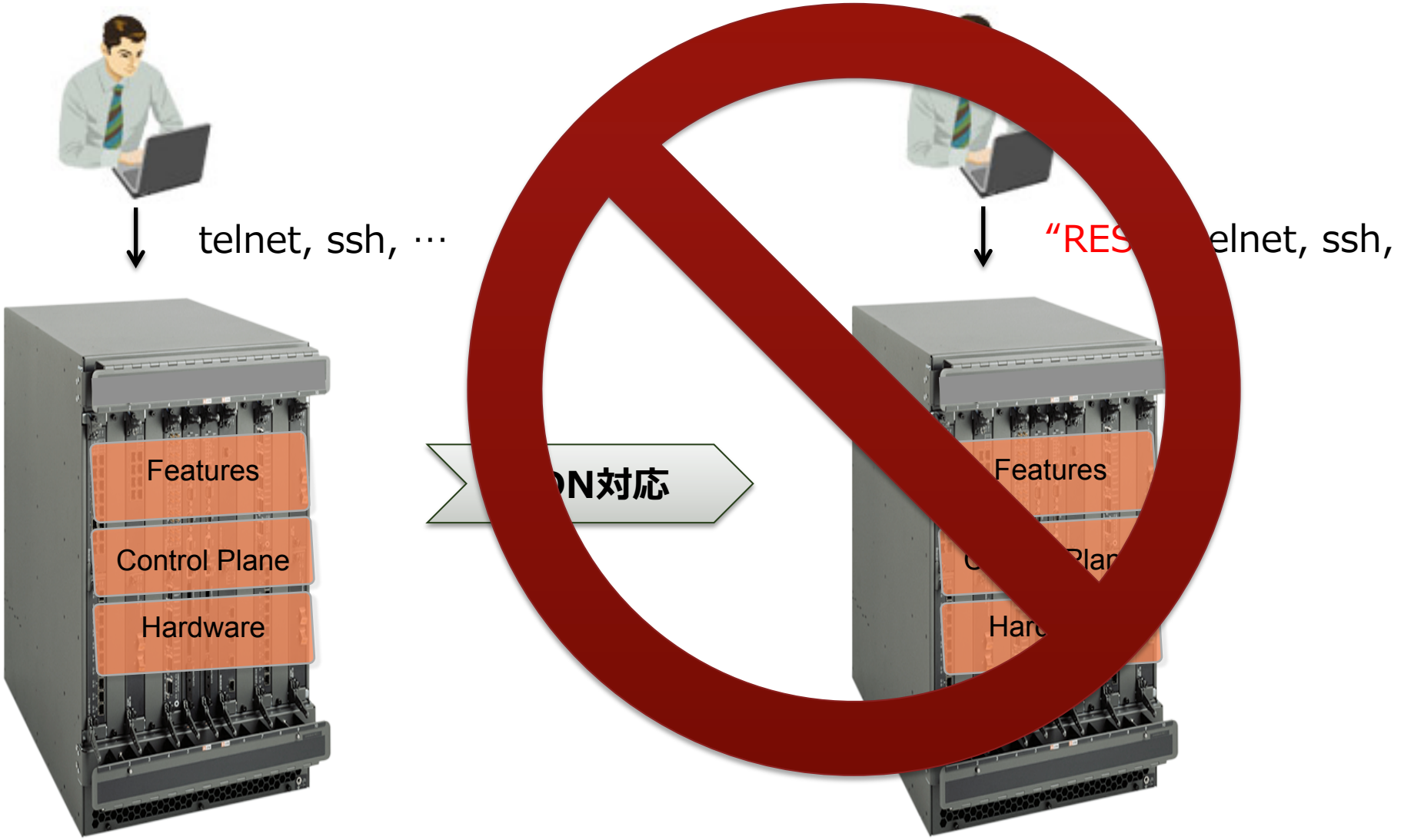
Partners

Collaborators

ONOSが考えるSoftware-Define Networking とは

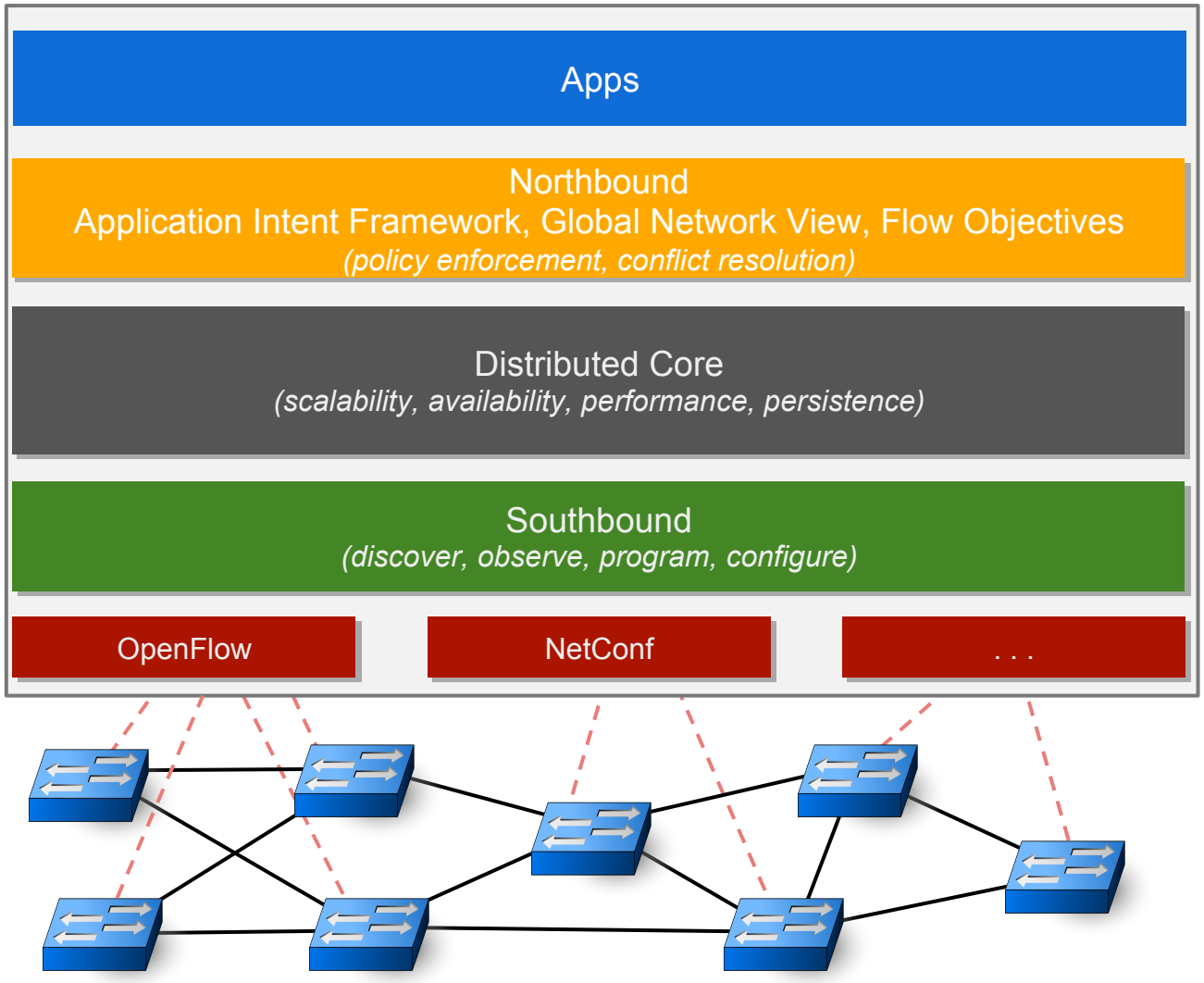


ONOSが考える望ましいSDNの姿



ONOSアーキテクチャ概観

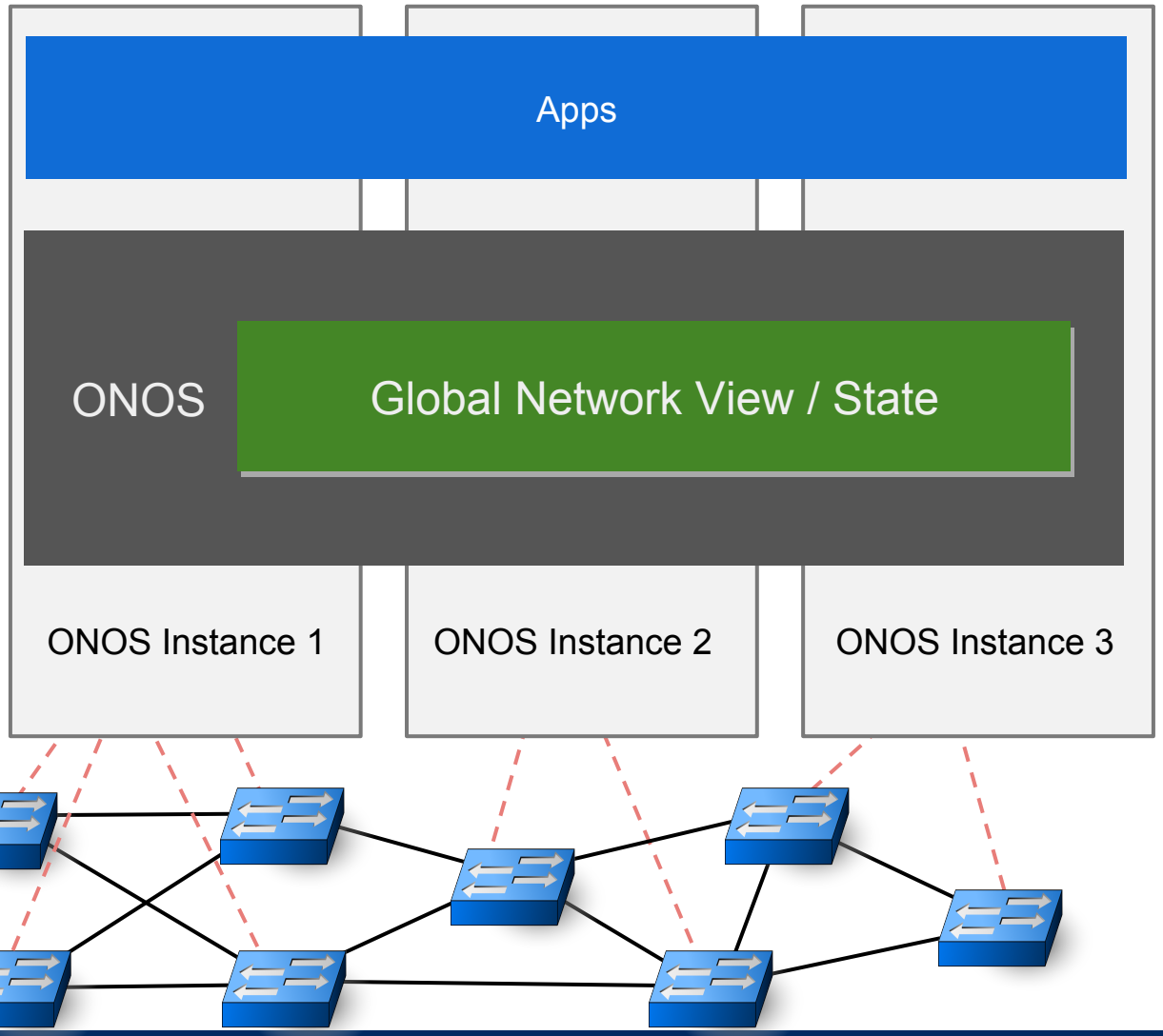
- SBプロトコル独立なNBI
- 論理的に集中した分散基盤
- NEを抽象化し、SBプロトコル独立なビューを提供



ONOSの構造(概要)

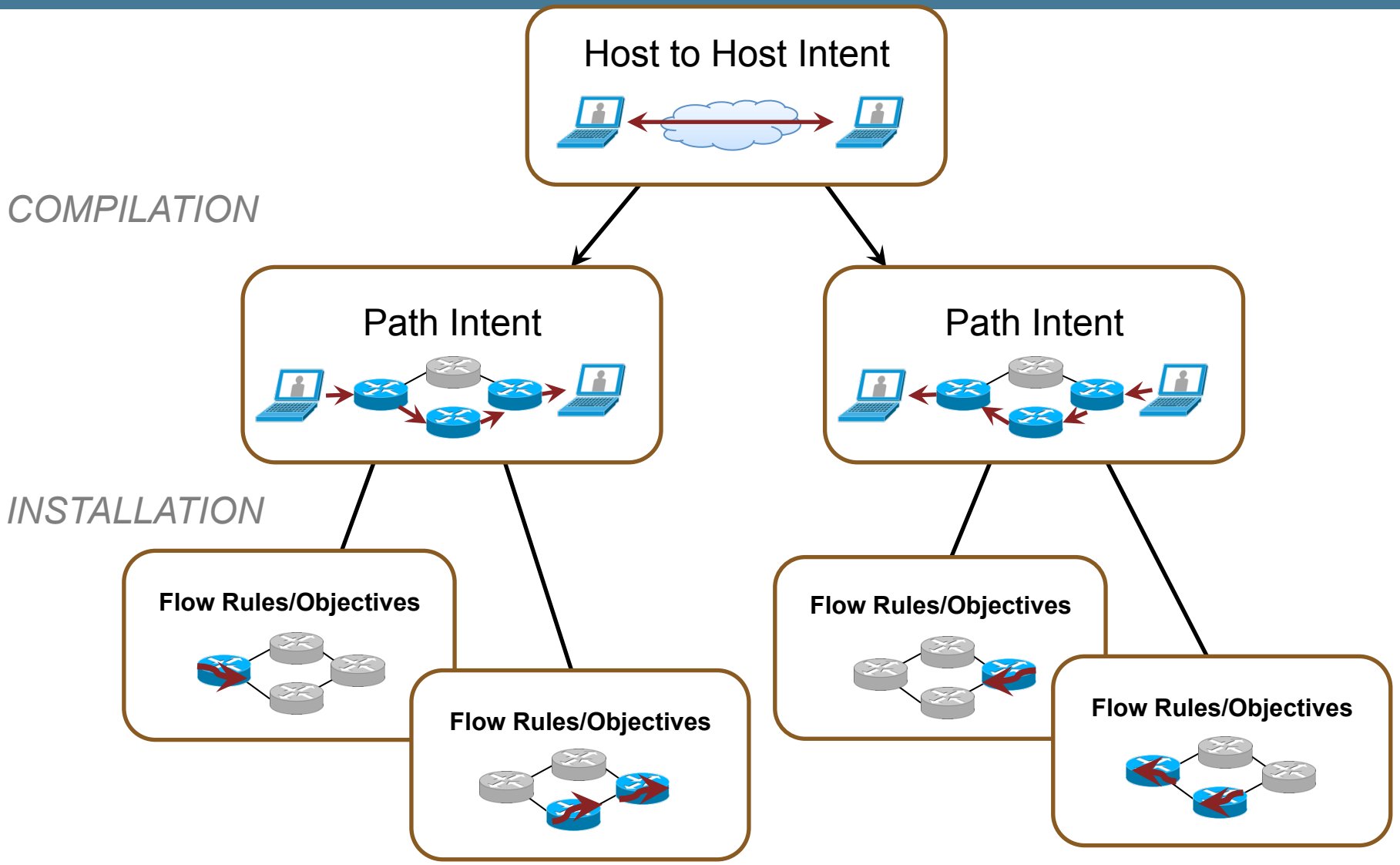
分散コントローラー

- 独立したインスタンス
- インスタンスを追加削除がシームレス
- スイッチ毎にマスターコントローラが異なる
- アプリケーションからは1つのコントローラとして見える



ONOS
Open Network Operating System

Intent Example



- Flow Rule/Flow Objectiveはフローテーブルの抽象化 (シングル/マルチテーブル抽象に対応)
- Flow Objectiveは、OpenFlow1.3+に近いが、それに加え装置のパイプライン差異を抽象化

ONOSの特徴

性能とスケーラビリティに注力

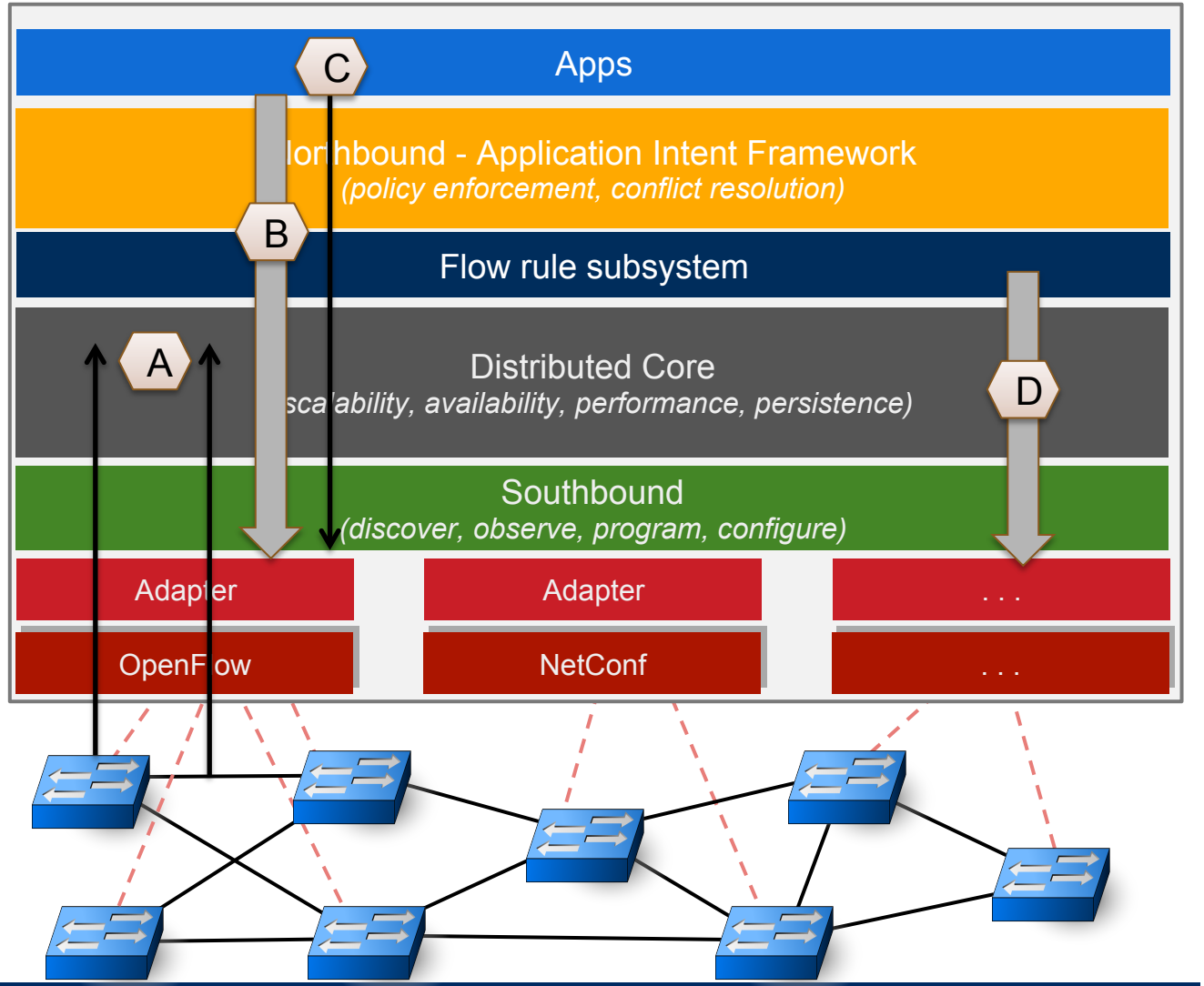
A. デバイスやリンク検知速度
- < 100ms
- ONOS part <10ms

B. Intent スループット
- 150k ops/sec

C. Intent の伝搬遅延
- < 50ms

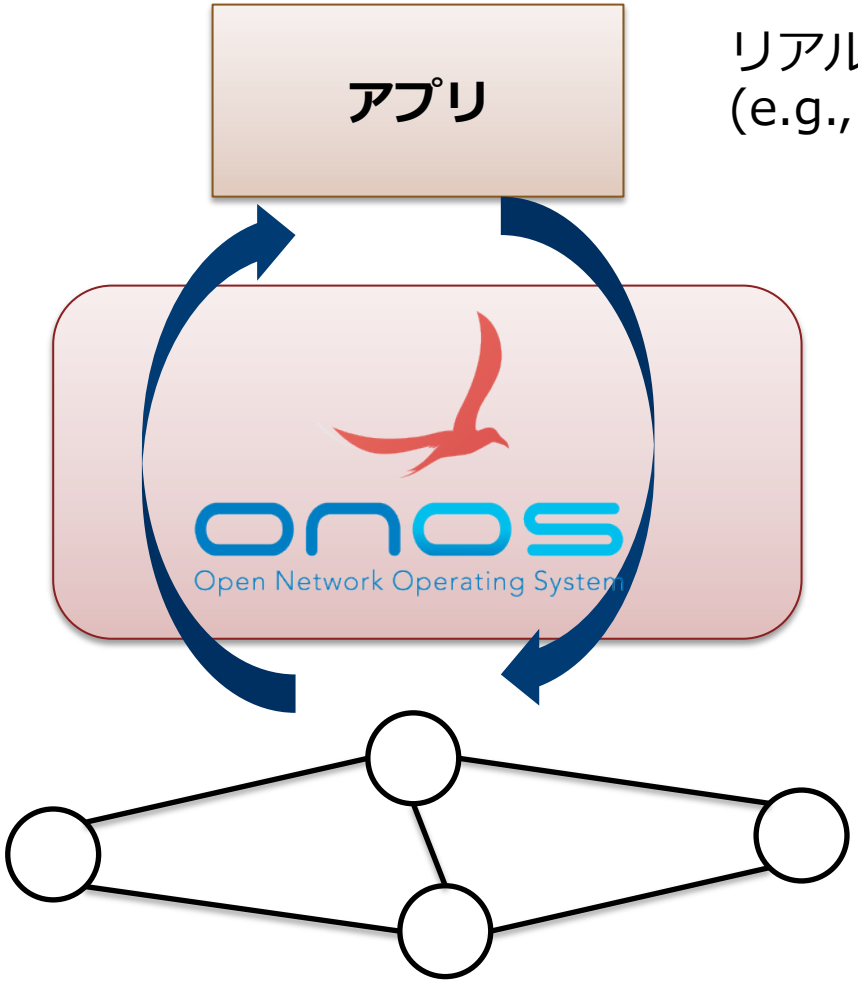
D. Flow フループット
- 500K to 3M ops/sec

詳しくはWeb上の White Paper参照



ONOS向きシナリオ例 (1/2)

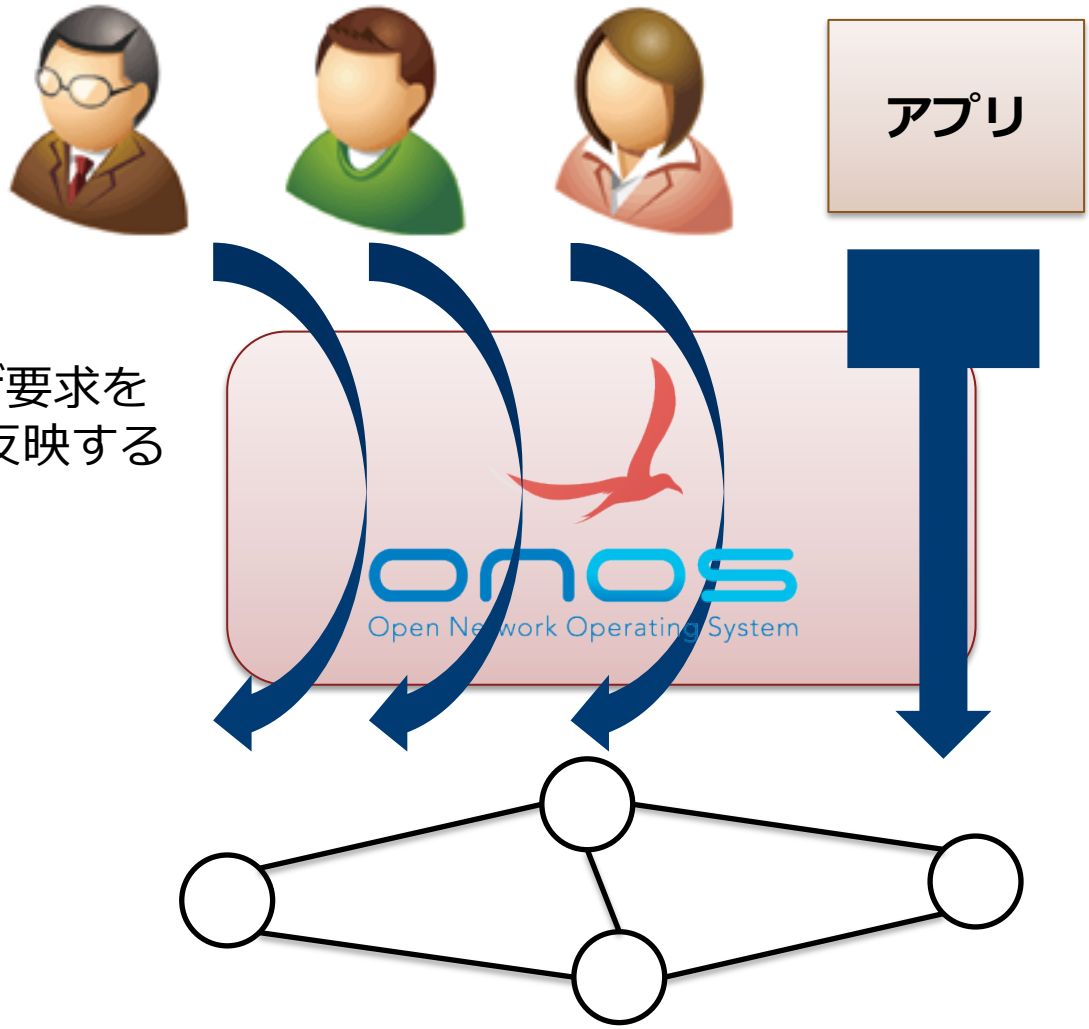
自動化された制御ループ



リアルタイムにTE等々
(e.g., CORD:fabric)

ONOS向きシナリオ例 (2/2)

高頻度制御、バースト制御



API公開し、
多数のユーザ要求を
迅速にNEに反映する
必要がある

NW全域に渡る
グローバル最適化

CORD (Central Office Re-architected as Datacenter)

SDNによる局舎の再設計

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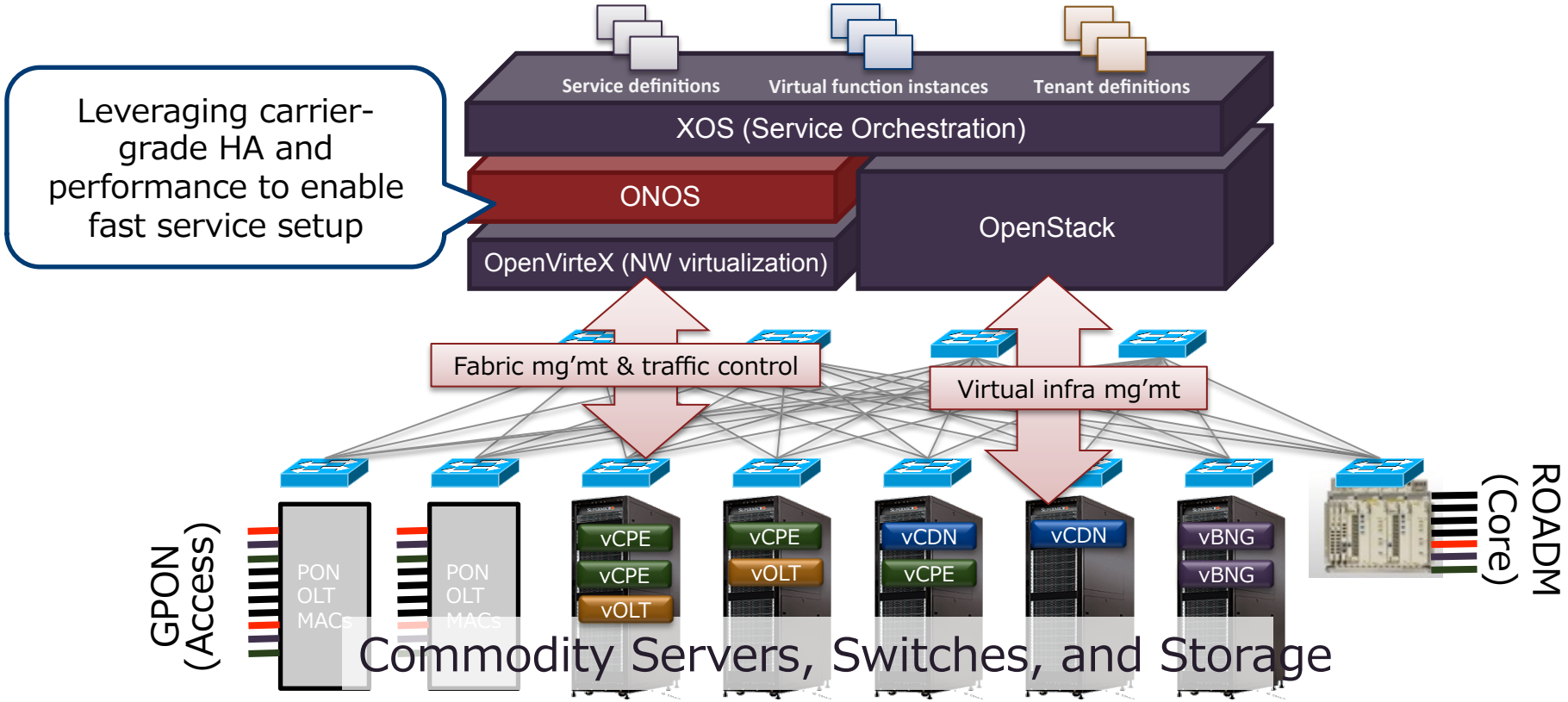
Central Office Re-architect as a DataCenter (CORD)

Goal: Achieves lower OPEX/CAPEX in central office by replacing legacy network appliances with commodity SDN devices and servers.

- Combine ONOS with OpenVirteX (virtualized network), OpenStack, and XOS (orchestrator of different IaaS modules (incl. Amazon EC2, OpenStack, ONOS, …)
- Develop virtual images of network functions (BNG, CPE, OLT, CDN server) and group them so that operator can use it as a "Service"

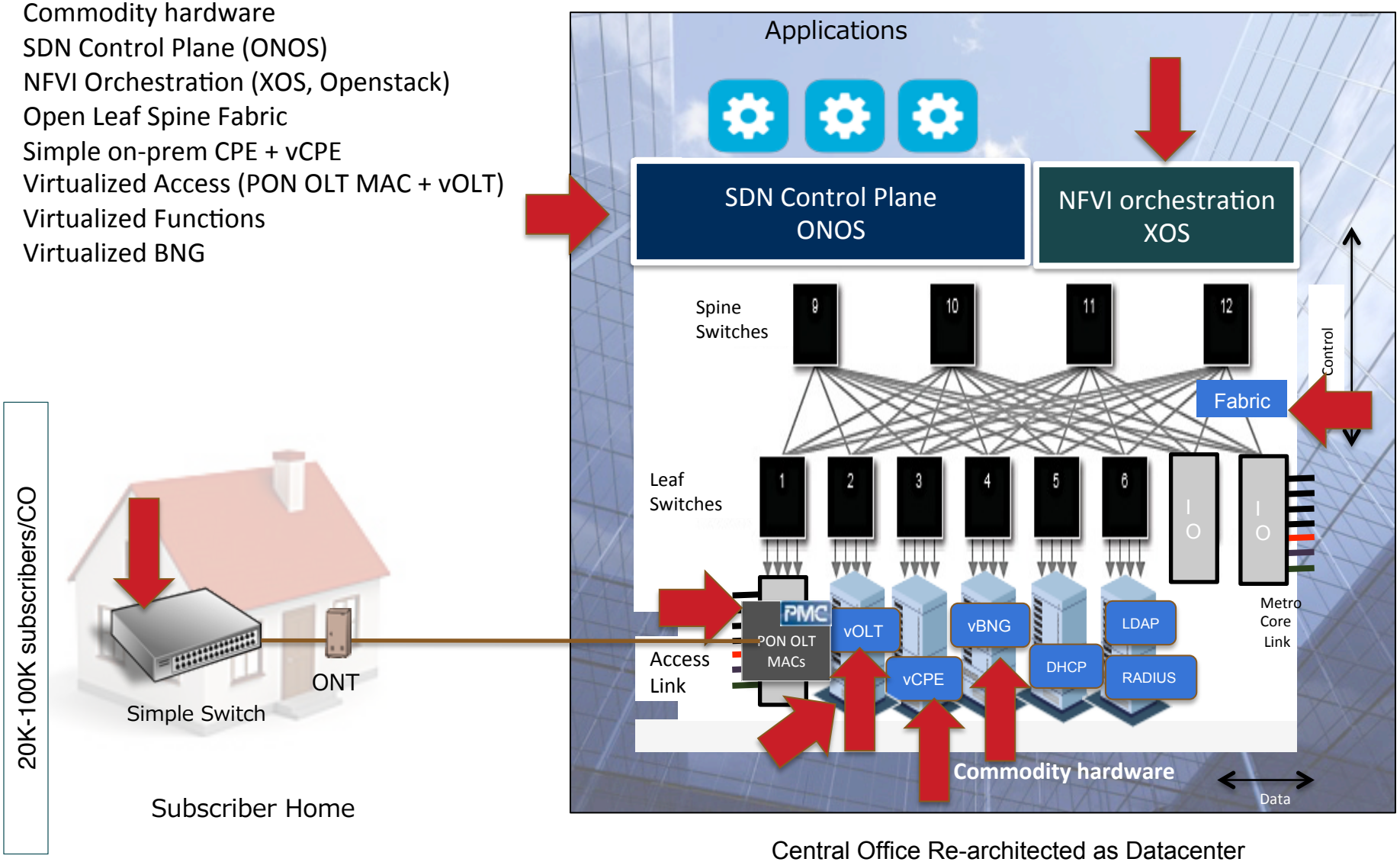
Main participants: AT&T and Ericsson



CORD Key Building Blocks

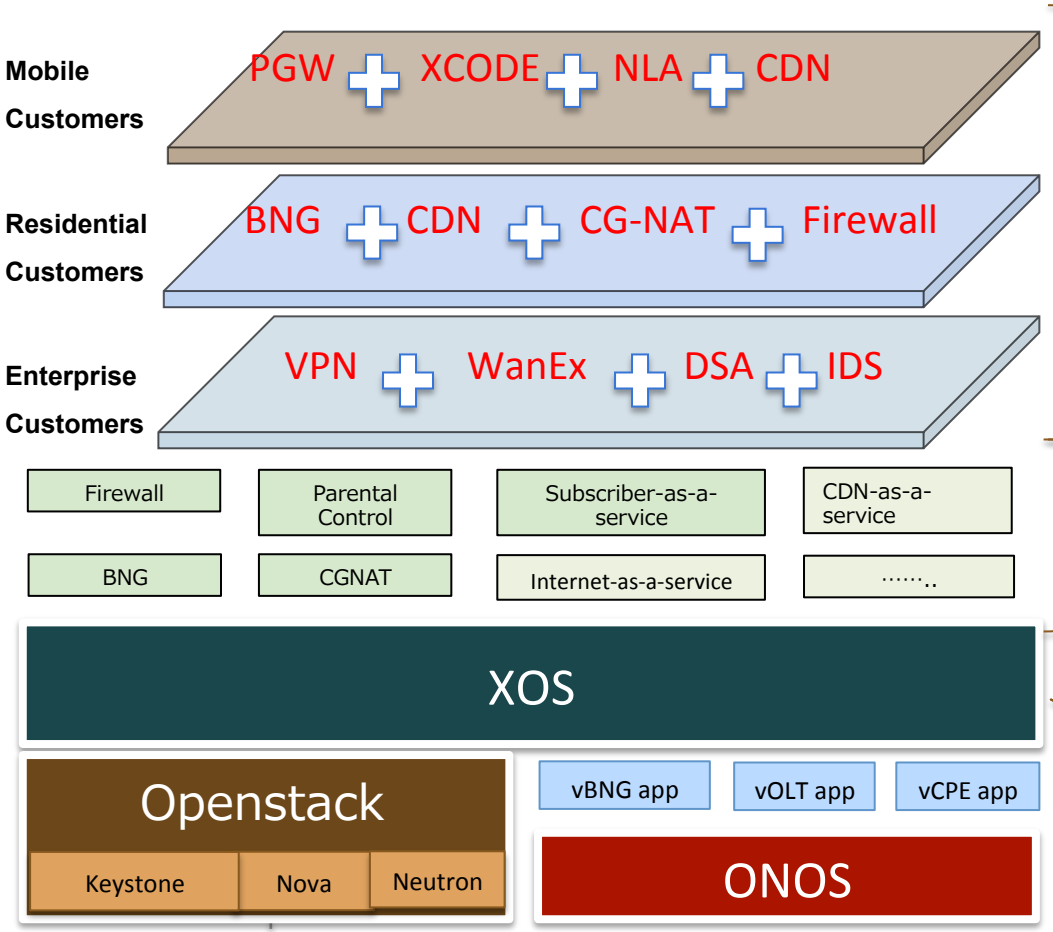
CORD key components-

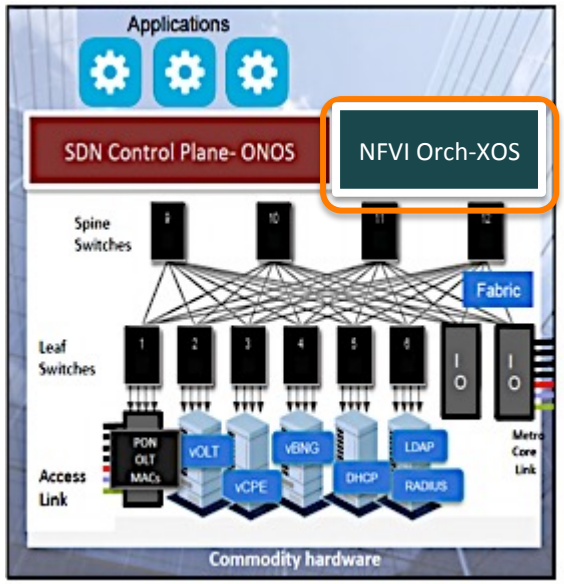
- Commodity hardware
- SDN Control Plane (ONOS)
- NFVI Orchestration (XOS, Openstack)
- Open Leaf Spine Fabric
- Simple on-prem CPE + vCPE
- Virtualized Access (PON OLT MAC + vOLT)
- Virtualized Functions
- Virtualized BNG



Central Office Re-architected as Datacenter

A closer look at XOS- Service Orchestration for CORD





Central Office Re-architected as Datacenter

- XOS is a cloud operating system built using Openstack
- XOS provides: service abstraction and service composition
- Network operators can provision services and let XOS worry about interfacing with Openstack and doing VM mgmt

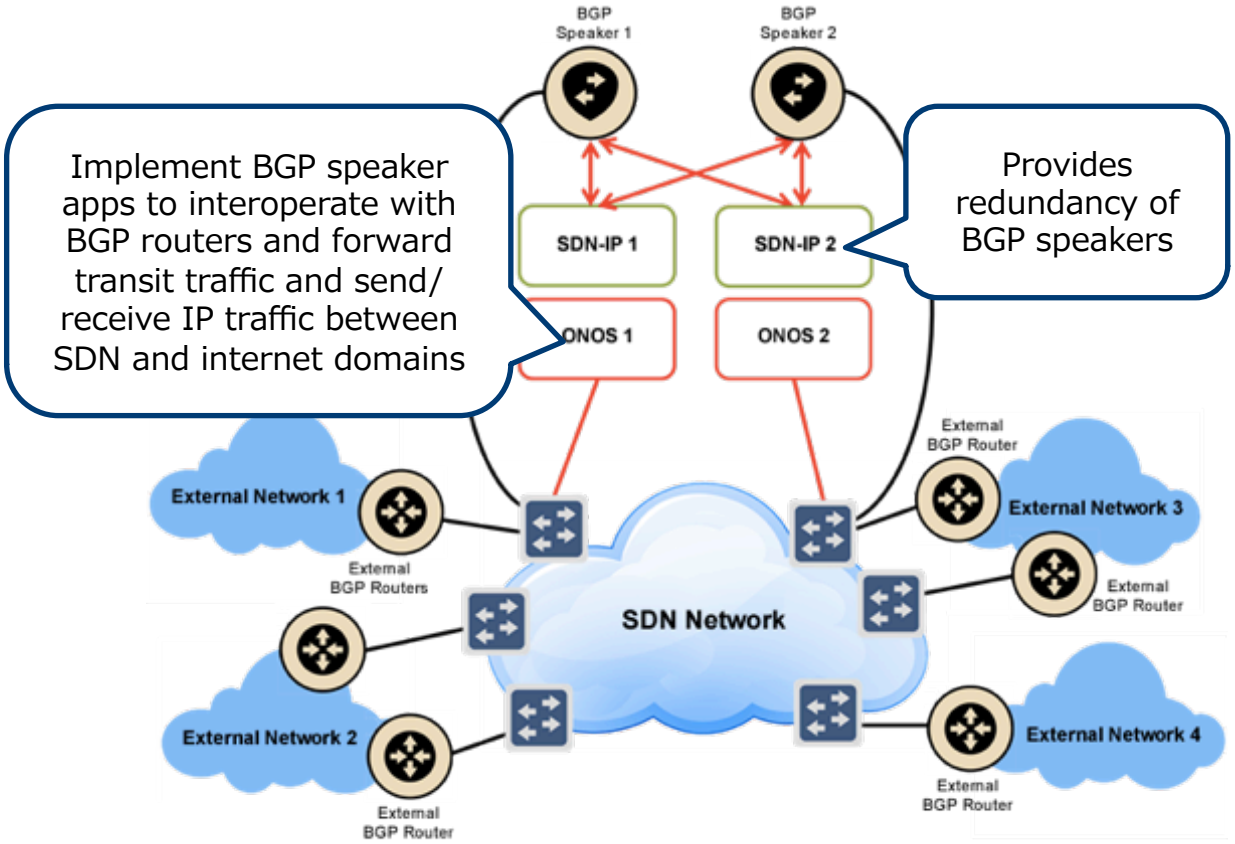
SDN-IP

レガシーIP NWとOpenFlow NWの相互接続
および実網試験

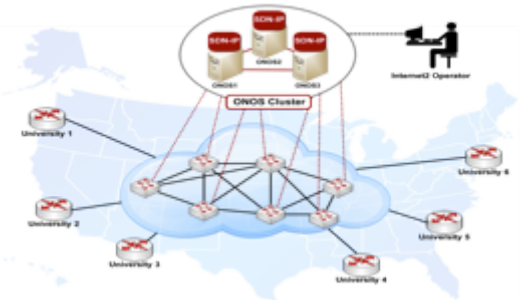
SDN-IP (SDN and legacy IP peering)

Goal: Make SDN network interoperate with legacy IP networks
- Enable SDN network to behave as an AS using ONOS
- Deploying ONOS to real environment to test its scalability and reliability

Main participants: Internet2, FIU/AmLight, and CSIRO



Deployments in operation

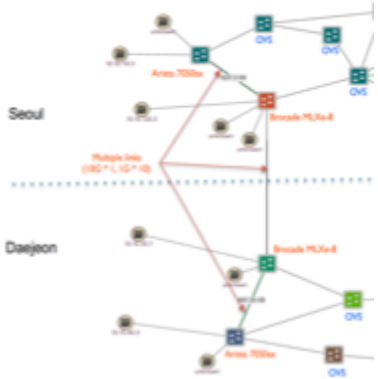


Internet2 (US)

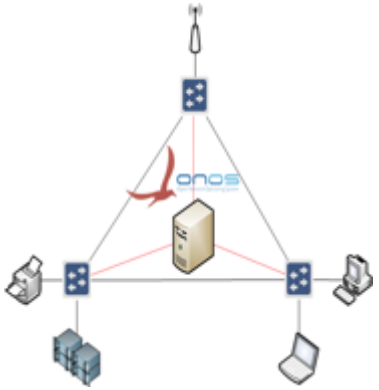
CSIRO (Australia)

FIU/AmLight (South America)

ONOS Deployments in Progress



KREONET/KISTI (Korea)
GigaPoP



ON.Lab
local office network
Reactive forwarding

ESnet (US) / AARNET (Australia)
BGP peering (15k routes announced)

Intercontinental deployment
(Internet2 , GEANT, GARR, FIU/AMLight, NAP, RedClara, Santiago)
12 universities and research institutes exchange routes.
L3 communication without core routers

ONOS starting to have a global footprint in R&E networks

Packet-Optical

WDM装置とOpenFlow装置の統合制御

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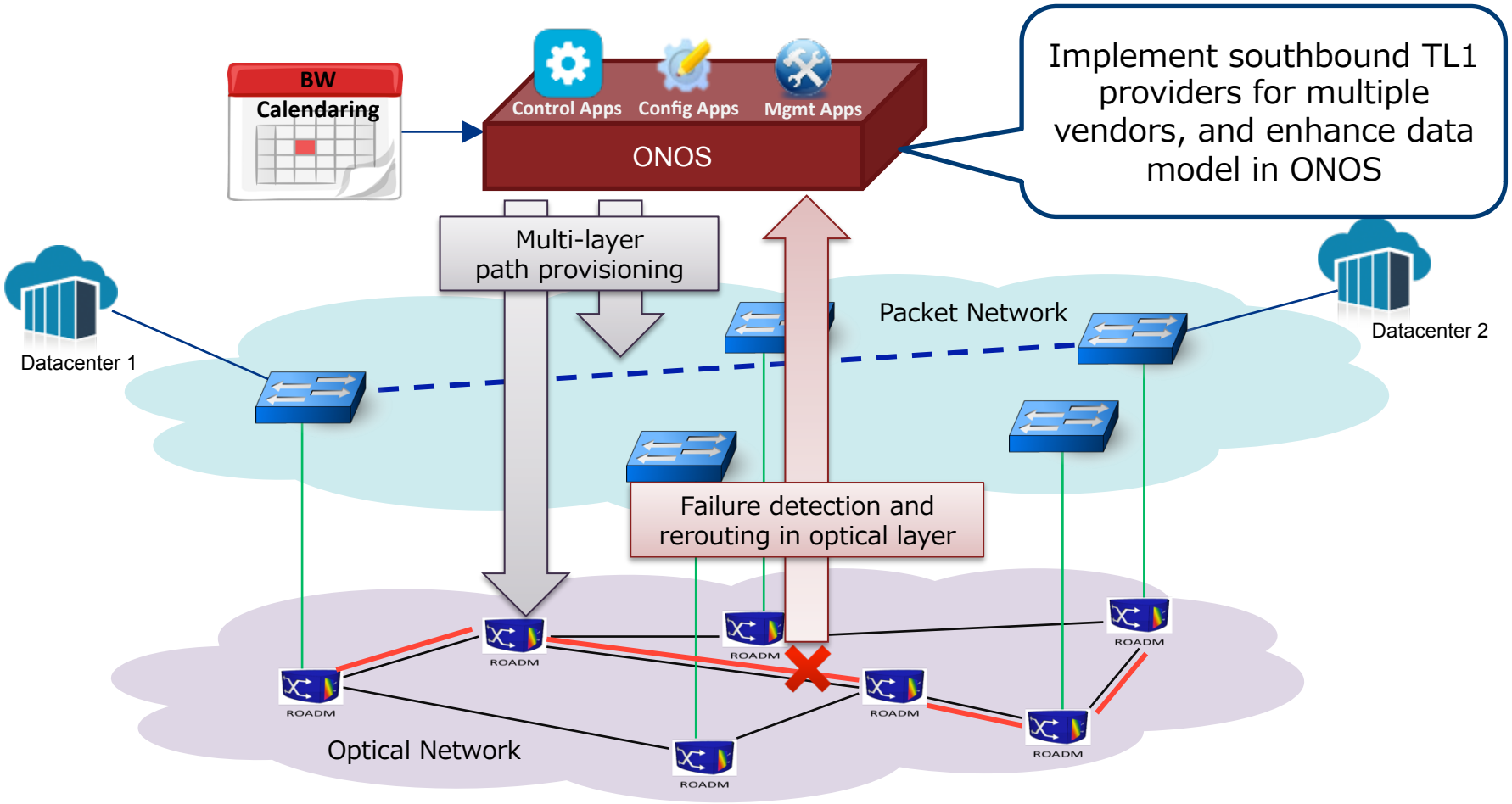
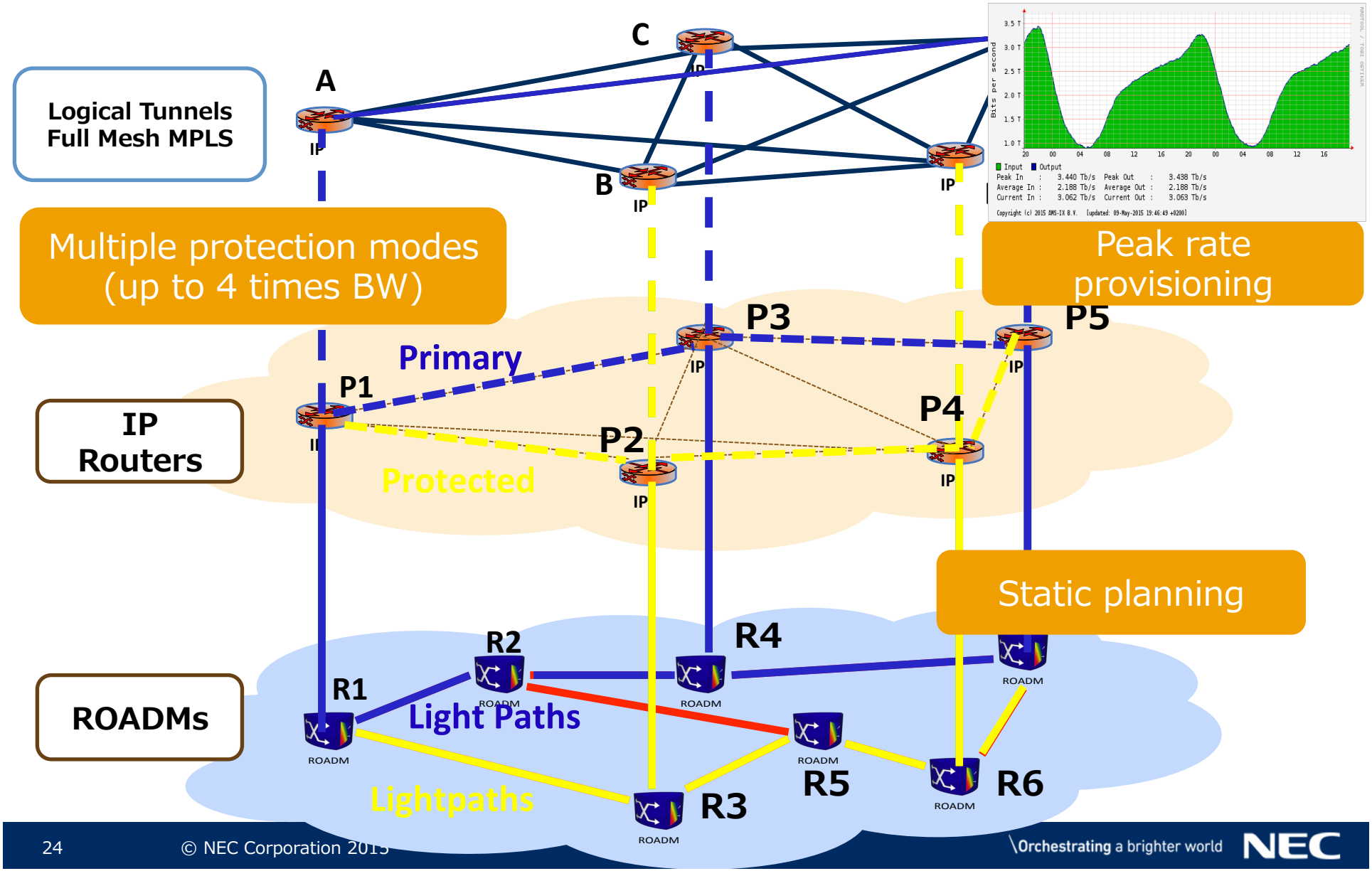
Packet/Optical Integration

Goal: Centralized multilayer control of packet-domain and optical-domain
- Optimize network usage over packet and optical layers
- Enable on-line path setup (Bandwidth on-demand, calendaring)

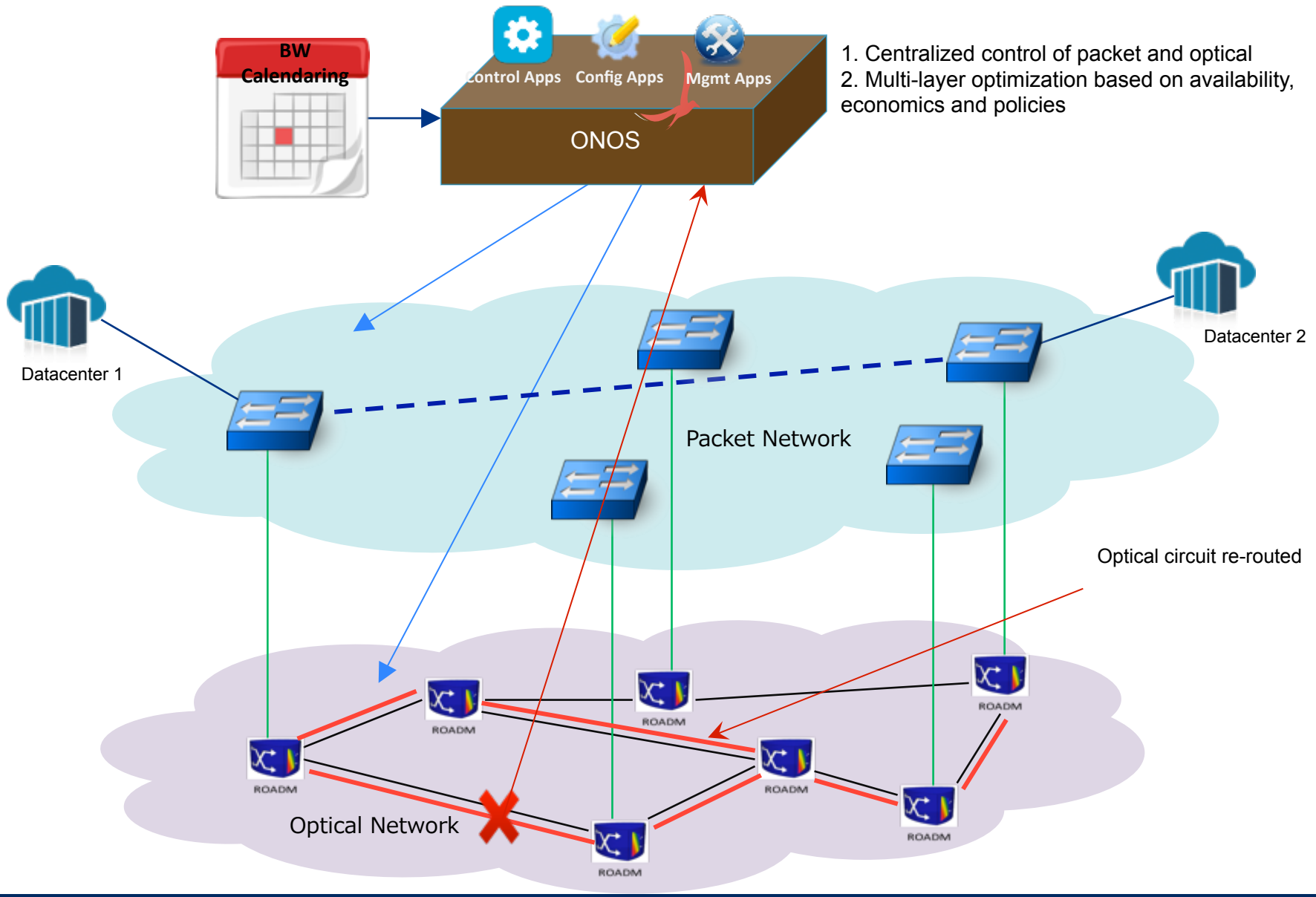
Main participants: AT&T, Ciena, Fujitsu, and Huawei



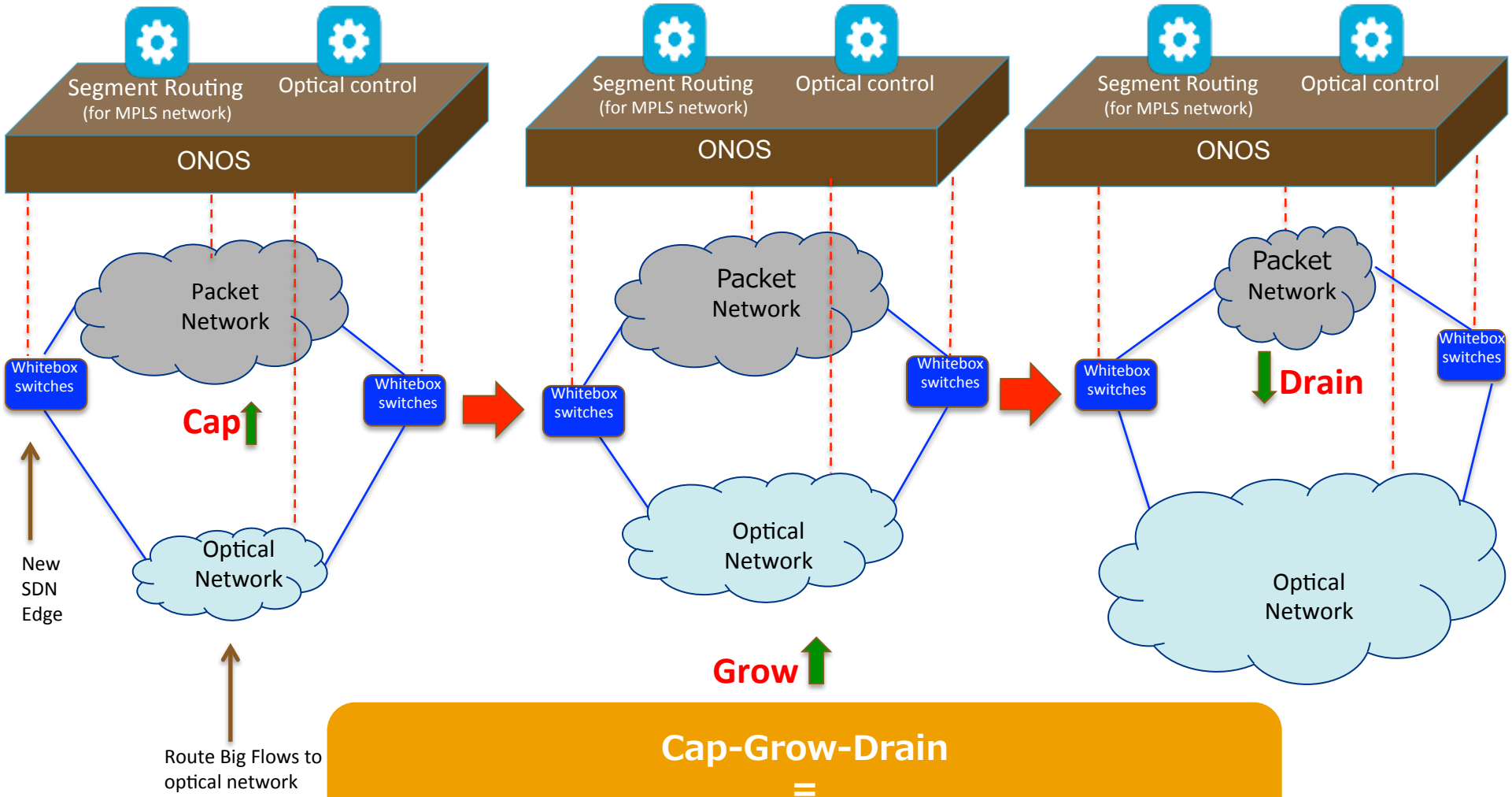
Multi-Layer Network without Converged Control Plane



Conceptual Solution: Multi-Layer SDN Control



Carrier's Potential Cap-Grow-Drain Strategy



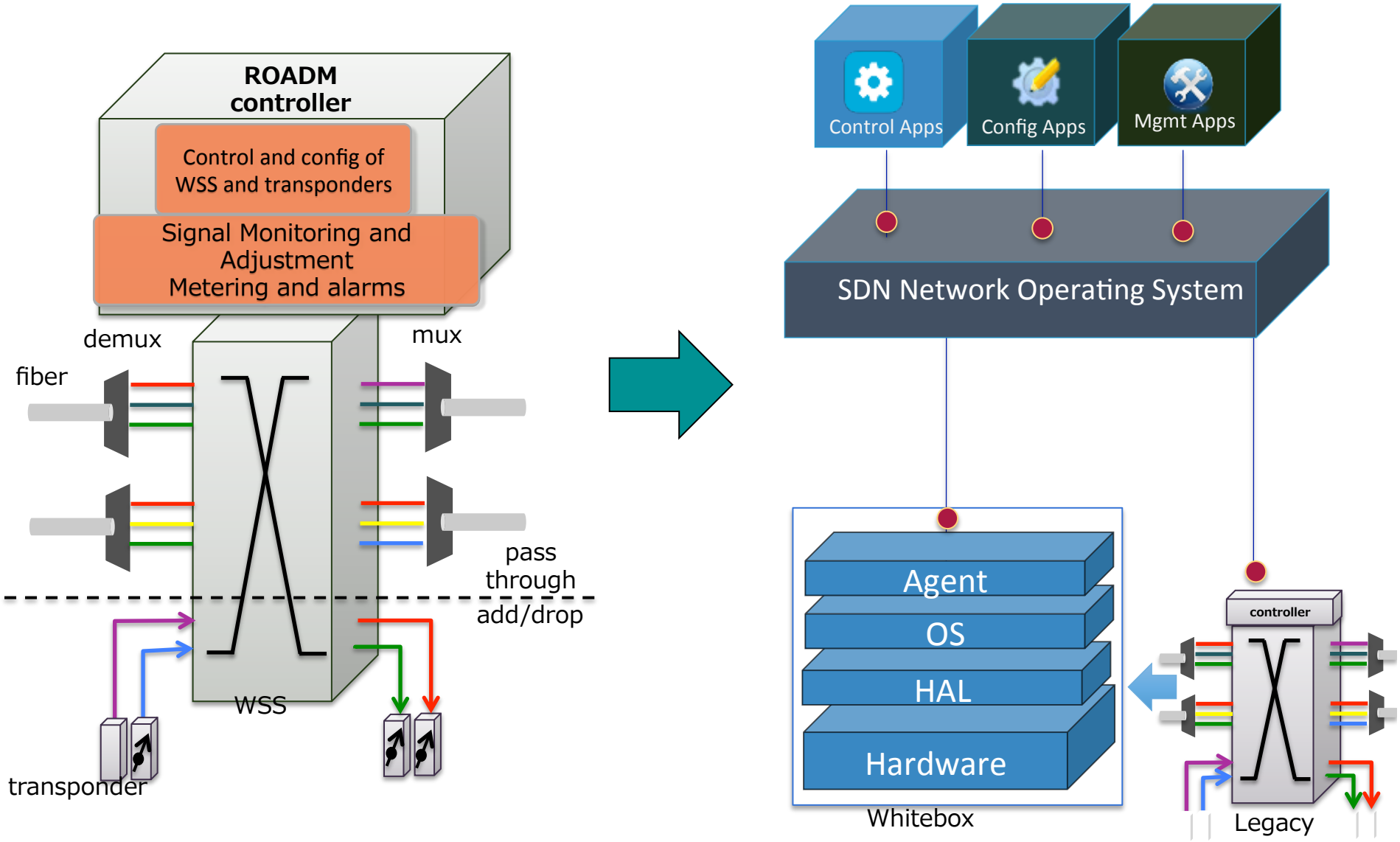
Cap-Grow-Drain
=
Bring SDN to backbone without fork lift upgrade

Cap Packet-based backbone – don't grow the legacy backbone of proprietary routers

Grow packet edge and optical core with SDN control plane and make the best use of packet-optical technologies

Drain the packet-based backbone as most traffic transitions to new packet edge and optical core network

Next Step: Vertical Integration of ROADMs



Transport SDN

トランスポートネットワーク制御の集中化

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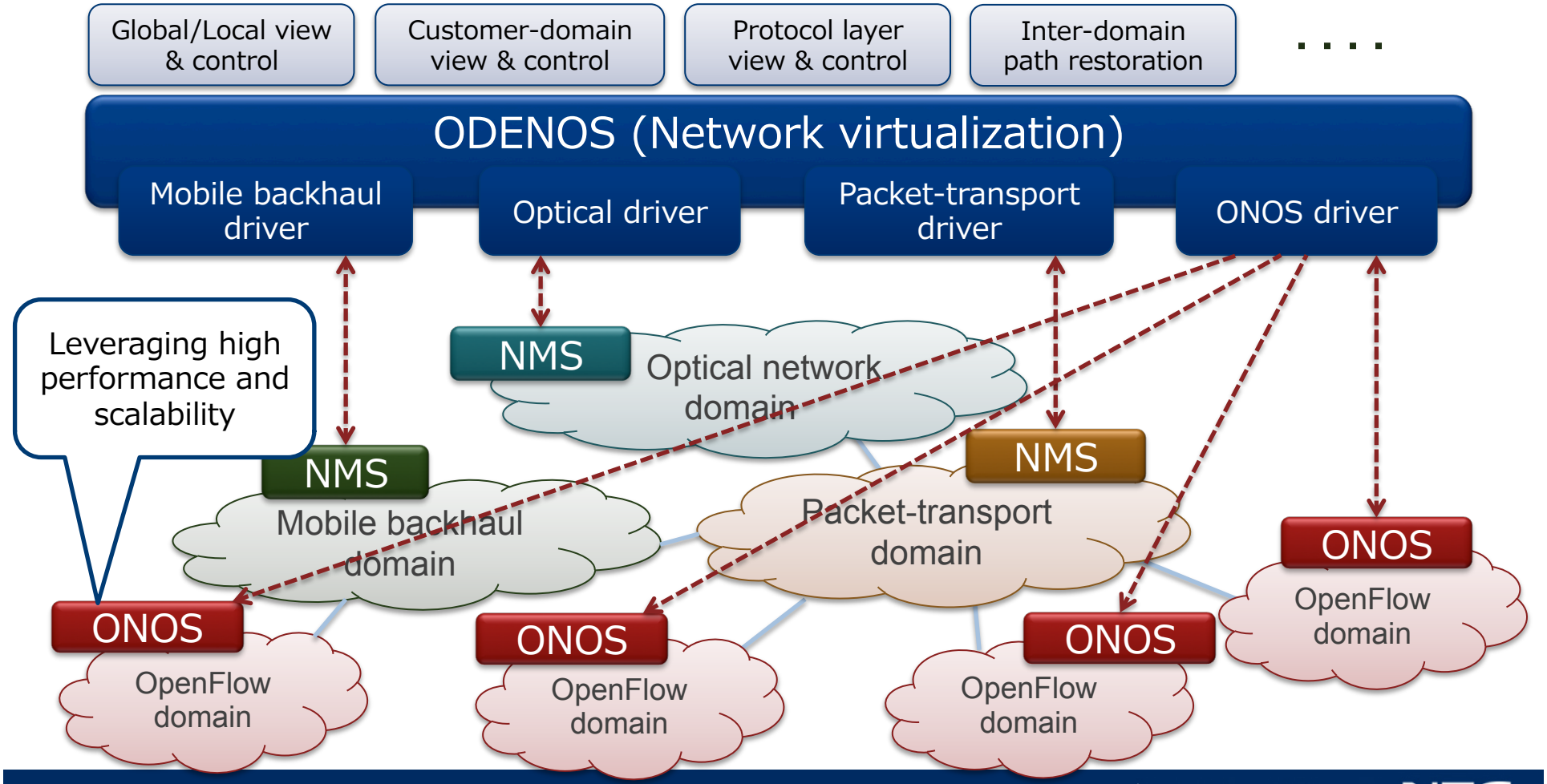
Transport-SDN

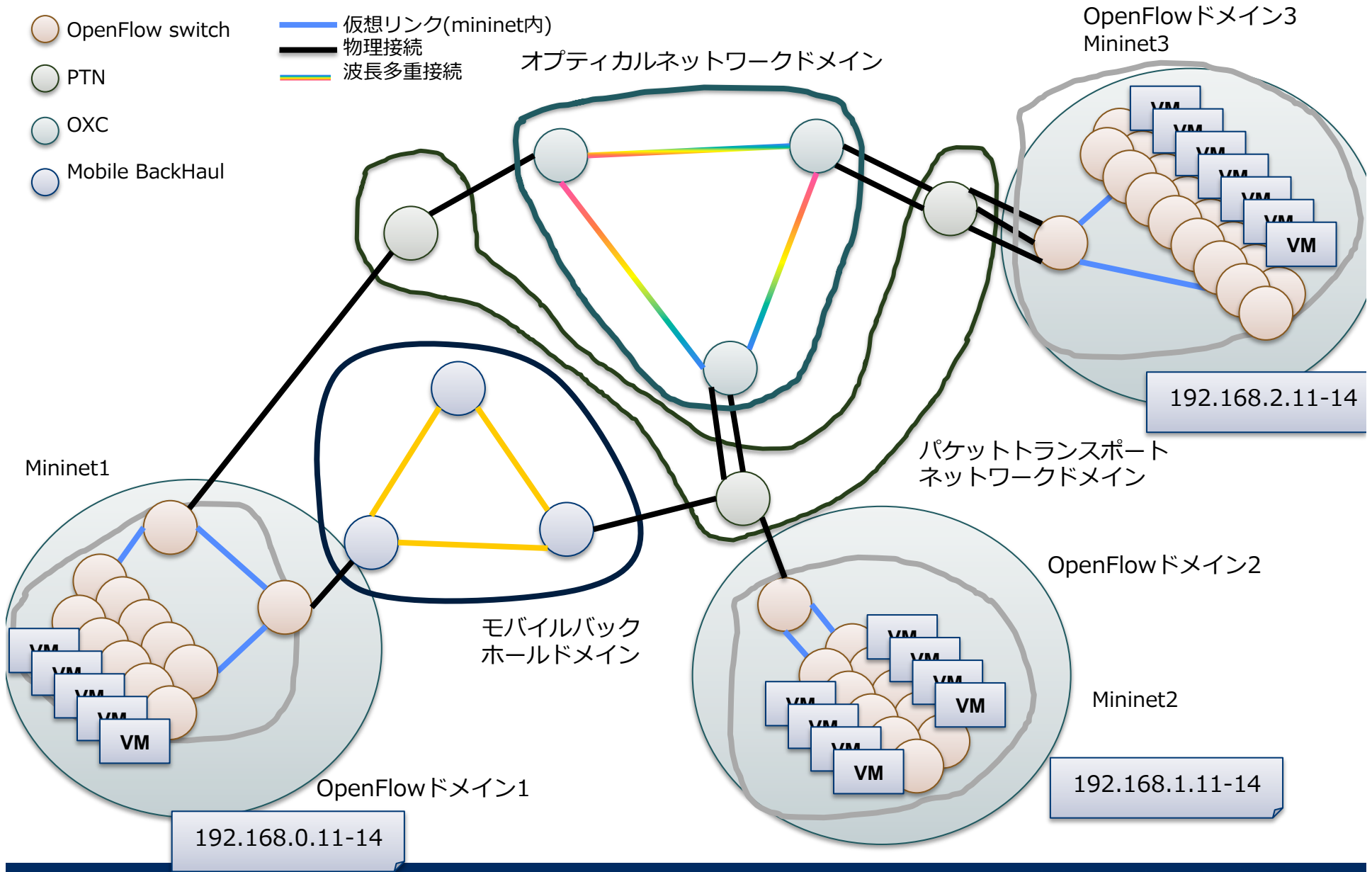
Goal: Offer flexible and easy-to-use multi-layer/multi-domain/multi-device view/ control of transport network which consists of legacy and pure-SDN domains.

- By combining with network abstraction layer functions (NEC's own ODENOS).

Main participants: NTT communications and NEC



Transport-SDN 構成(ONS2016)



デモ

まとめ

- ONOSのアーキテクチャと内部構造
- Intent
  - Host to Host Intent, Path Intent, Flow Intent
- ONOS向きシナリオ例
- ユースケース
- デモ