速報！SDNの最前線とONFの取り組み

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ネットワーク事業者のニーズ: 変化なし

Saving Money

- オートメーション
- 簡素化
- オーケストレーション

Making Money

- カスタマイズ
- タイムリーな売上
- ユーザ経験の向上

より具体的になったSDNの利用機会

Programmability
ソフトウエアによる制御

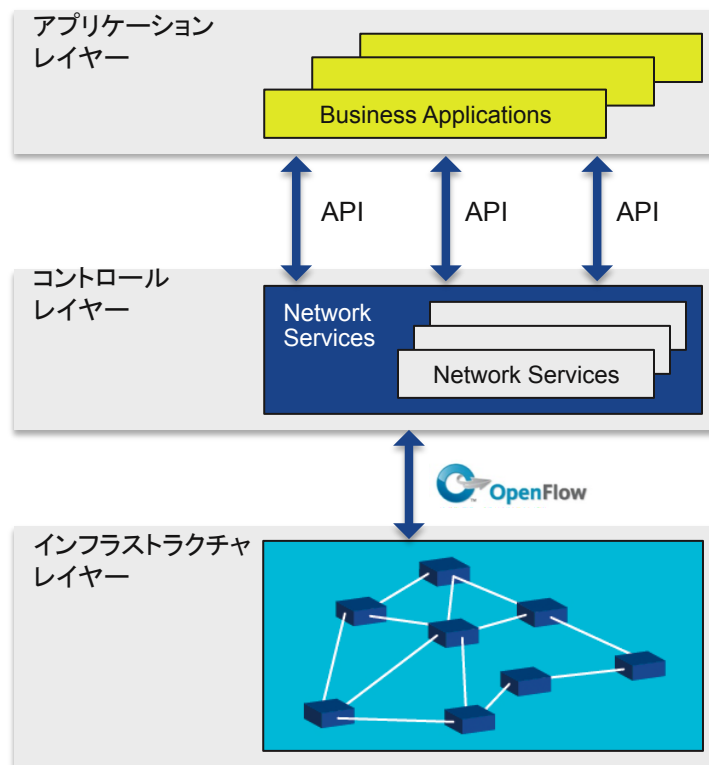- ポリシー管理
- モジュラー型 OSS

Centralized Intelligence
一括制御

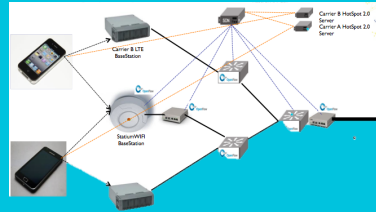- プロビの自動化/TE
- Virtualized network functions

Abstraction
抽象化

- パケット処理の最適化
- アプリから分離・独立した
ネットワークインフラ

アプリケーション
レイヤー

Business Applications

API   API   API

コントロール
レイヤー

Network Services

Network Services

OpenFlow

インフラストラクチャ
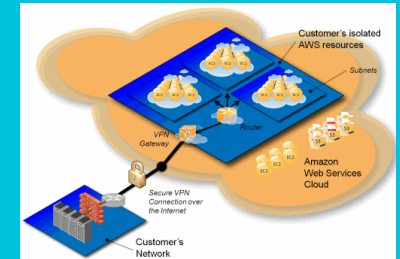レイヤー

世界中で進むSDNのトライアル

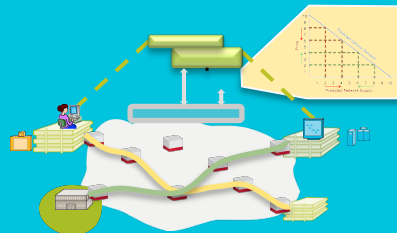## Seamless Roaming; WiFi Offload

モバイル事業者

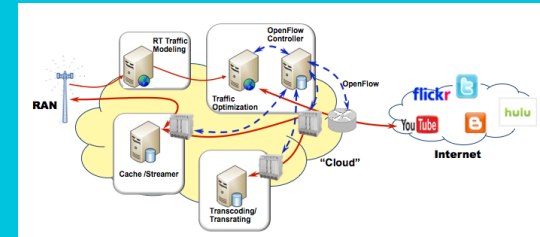## Customer Self-Provisioning; BW on Demand

クラウド事業者

NFV as a Service; Analytics For Sale

サービスモニタリング

Video Caching

コンテンツ配信

NTT Communications: Still the Pioneer

NTT Enterprise Cloud: SDN+OpenFlow, offered globally

- SDN-based services
  - Customer self-provisioning
  - Bandwidth on demand
  - Automated Cloud – WAN I/C
  - Migration w/o changing IP add.
- SDN technologies
  - Ryu open-source controller
  - Lagopus open-source switch

LB: Load Balancer
FW: Firewall
OFSW: OpenFlow Switch
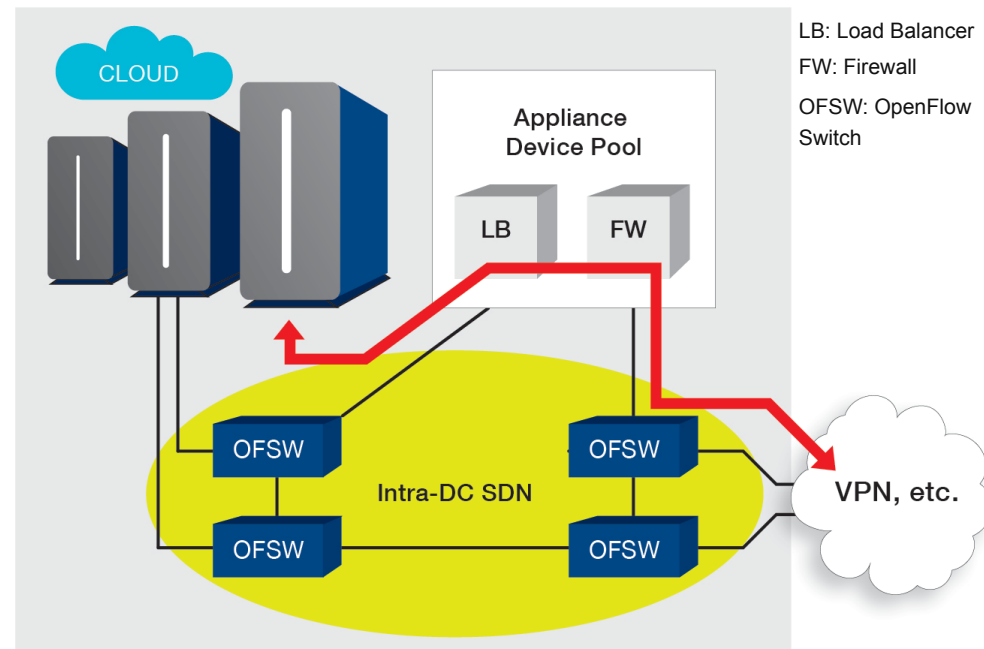
2014-2015年のおもな傾向

データセンター

- ベアメタル＆ホワイトボックスの台頭
- オープンソース S/W & H/W

新製品

- HW OpenFlow 1.3
- Orchestration/management SW
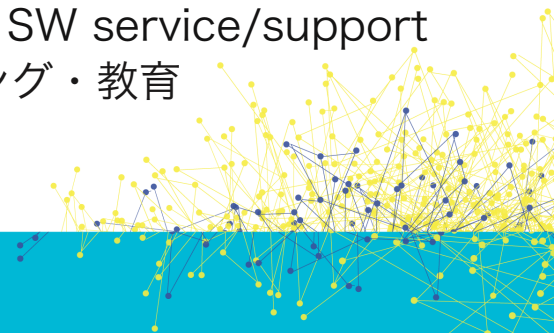
通信事業者

- NFV PoCs
- SDNがDCクラウドからネットワークへ
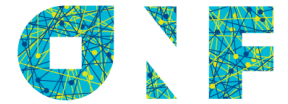
新サービス

- NFVaaS
- Analytics for sale

エンタープライズ

- Automation, orchestration, policy mgt
- 80% O/S, 20% custom SW

新しいビジネスモデル

- O/S networking SW service/support
- SDNのトレーニング・教育
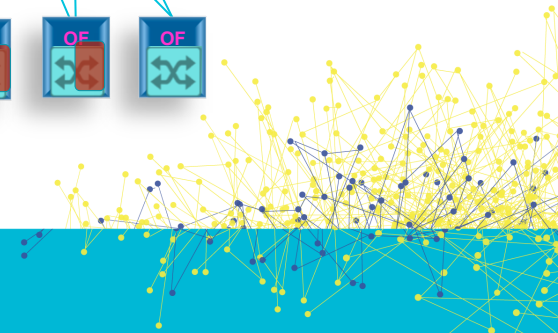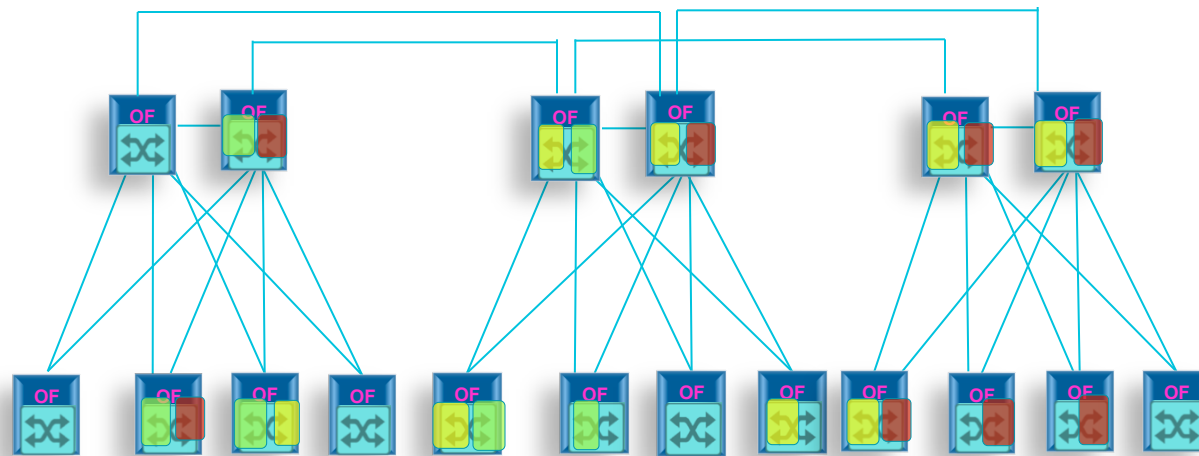
データセンターにおけるSDN

Within the DC

- Underlays gaining on Overlays
- Remote SW image load, control

Between DCs

- Dark fiber, Open Source Optics
- Central Traffic Engineering

通信事業者におけるSDN

ネットワーク・インフラ
- Single packet/circuit control
- SDN in WAN, mobile, WLAN

ネットワーク・サービス
- Elastic hybrid clouds
- Global enterprise CDN

| LineID | | Service Type | | Tenant |

Access Network — OLT

Backhaul Network

Carrier Network Gateway (BNG) — Router, Server

Metro/Core (IP/Optical) — Router, WDM/Router

DC Network Gateway — Router, Server

Datacenter Network — Switch
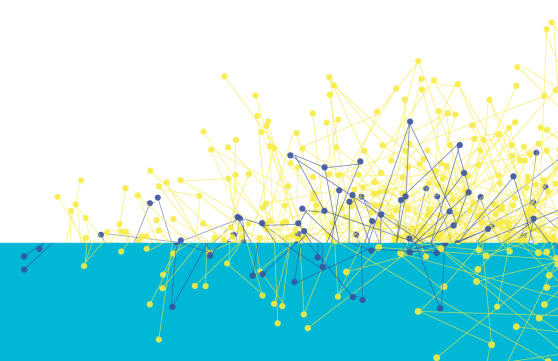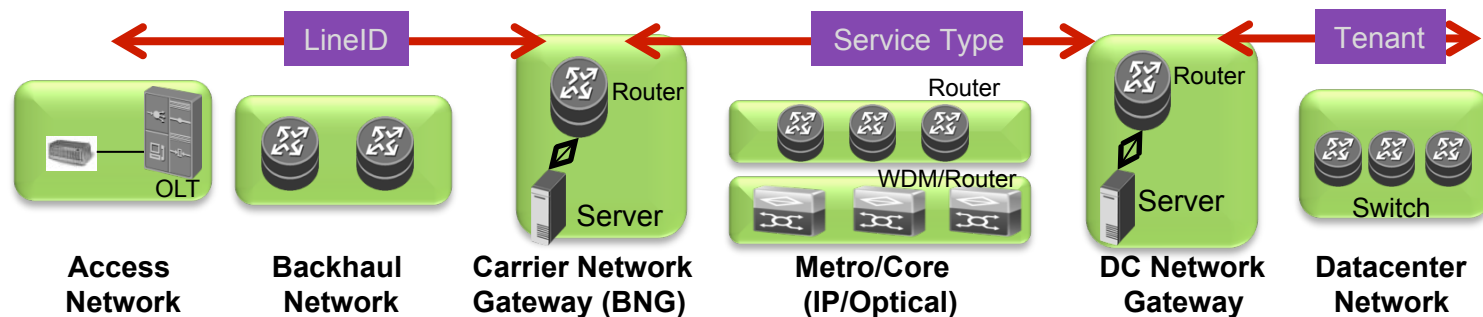
「オープン」の意味するところ
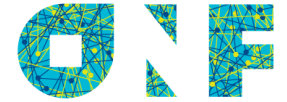
- Apps ⇔ Control Plane: NBI

- Control Plane ⇔ Data Plane: OpenFlow

- Client ⇔ Switching Silicon: HAL/SDK API
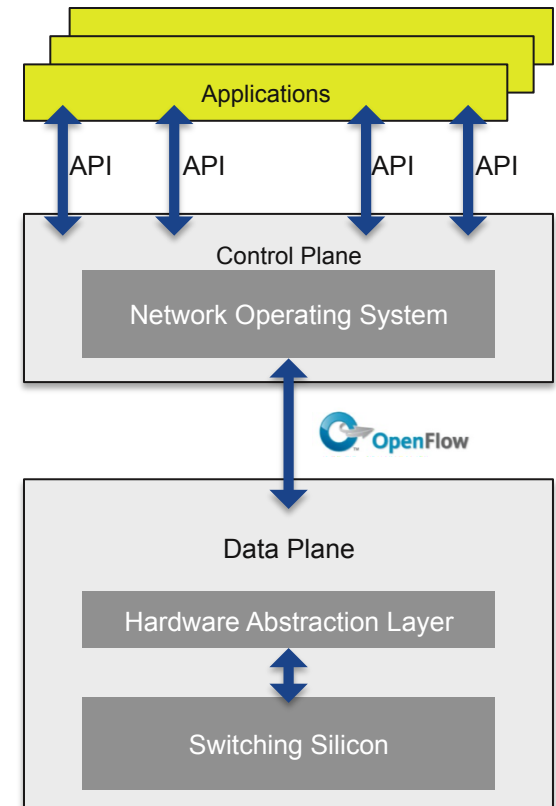
"Open" = Not controlled by a single party

Chip Innovation: SDN's Biggest Surprise

- Packet processing battle
  - Merchant silicon ASICs
  - NPUs
  - FPGAs
  - CPUs!

- Packet programming revolution
  - Protocol-oblivious forwarding
  - Pipeline compilers/TTPs

Open SDN in the Open Movement
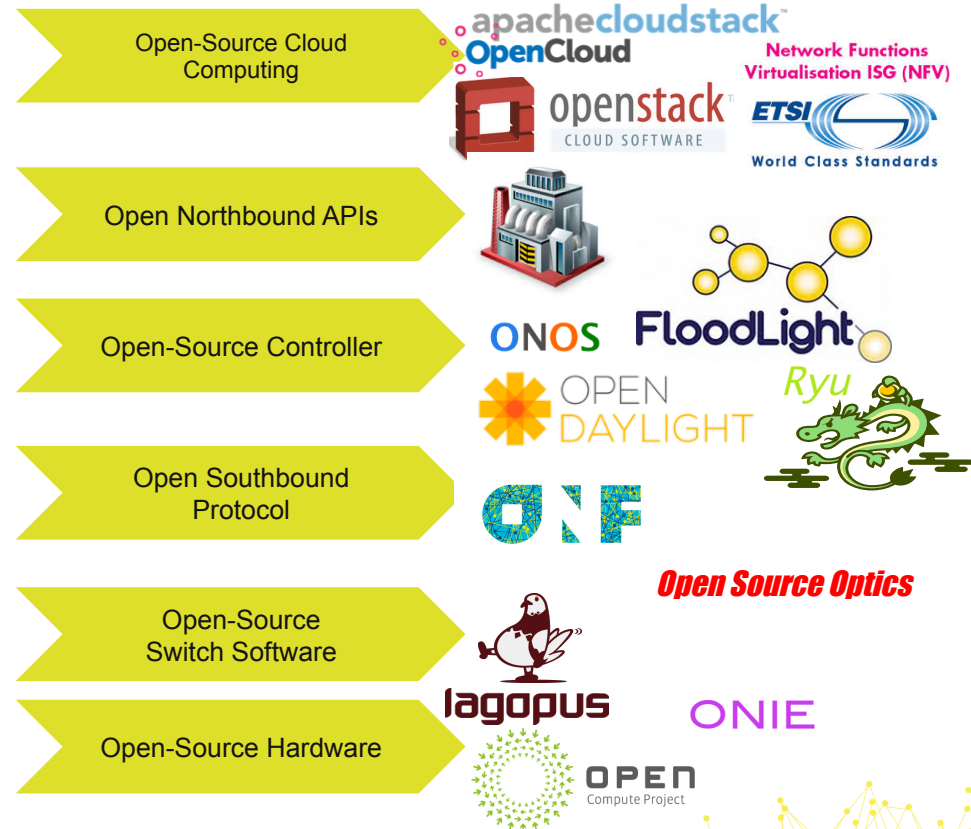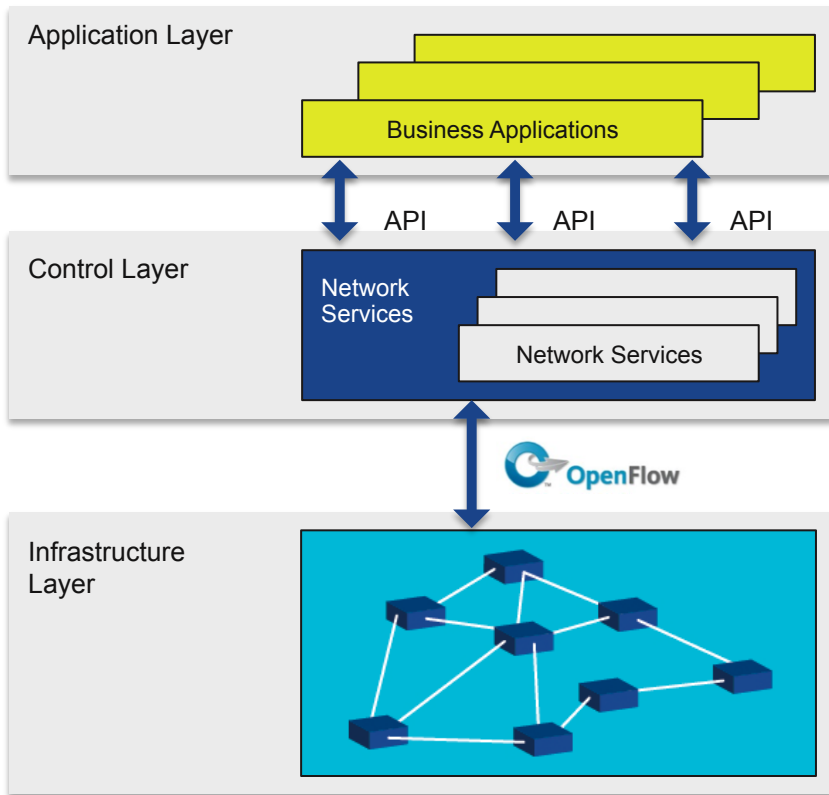
ONF 2014: Simple as A-B-C

A

Advance Open SDN
- OpenFlow substrate (OpenFlow, OF-Config, Optical Transport, Mobile & Wireless)
- Northbound I/Fs (to services above the OpenFlow substrate)
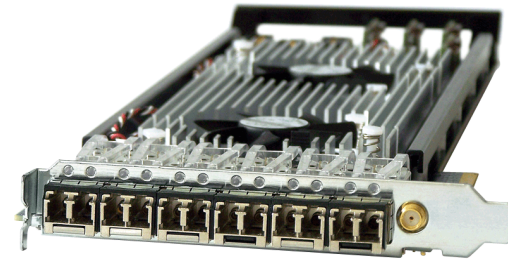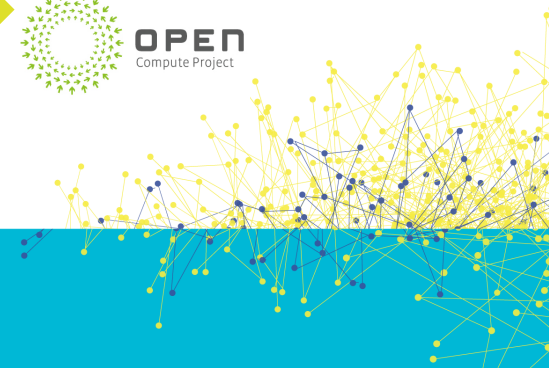- Liaisons: ODL, OIF, OSO, SDOs

B

Build Real OpenFlow
- Conformance Program 1.3, PlugFests, benchmarking
- Forwarding Abstractions, Chipmakers Advisory Board
- PoCs; SDN Solutions Showcase
- Open Source hardware (OCP)
- Open-source software (SampleTap, OF driver, more to come)

C

Connect Users to SDN
- Migration: use cases, methods, metrics, tools
- Inbound Requirements: L4-7, Security, Carrier-Grade SDN
- Liaisons: ETSI/NFV, OpenStack, TMF, ODCA, ONUG, US-Ignite

Carrier-Grade SDN

Applications

Open
From networks to applications

APIs

Flexible and scalable
Automating the network services layer

Policy Driven Provisioning

Resource Discovery & Control

SDN Controller

Network Services Layer

Centralized control

Increasing network efficiency & utilization

Simple
Simplified customer edge

Service Endpoint

Network APIs

Service Endpoint

Scalability of individual layers

Separated network service & transport layers

Simplified Customer Edge

Programmable IP/Optical Transport/Flexible access

Highly Scalable Datacenter

Wireless & Mobile

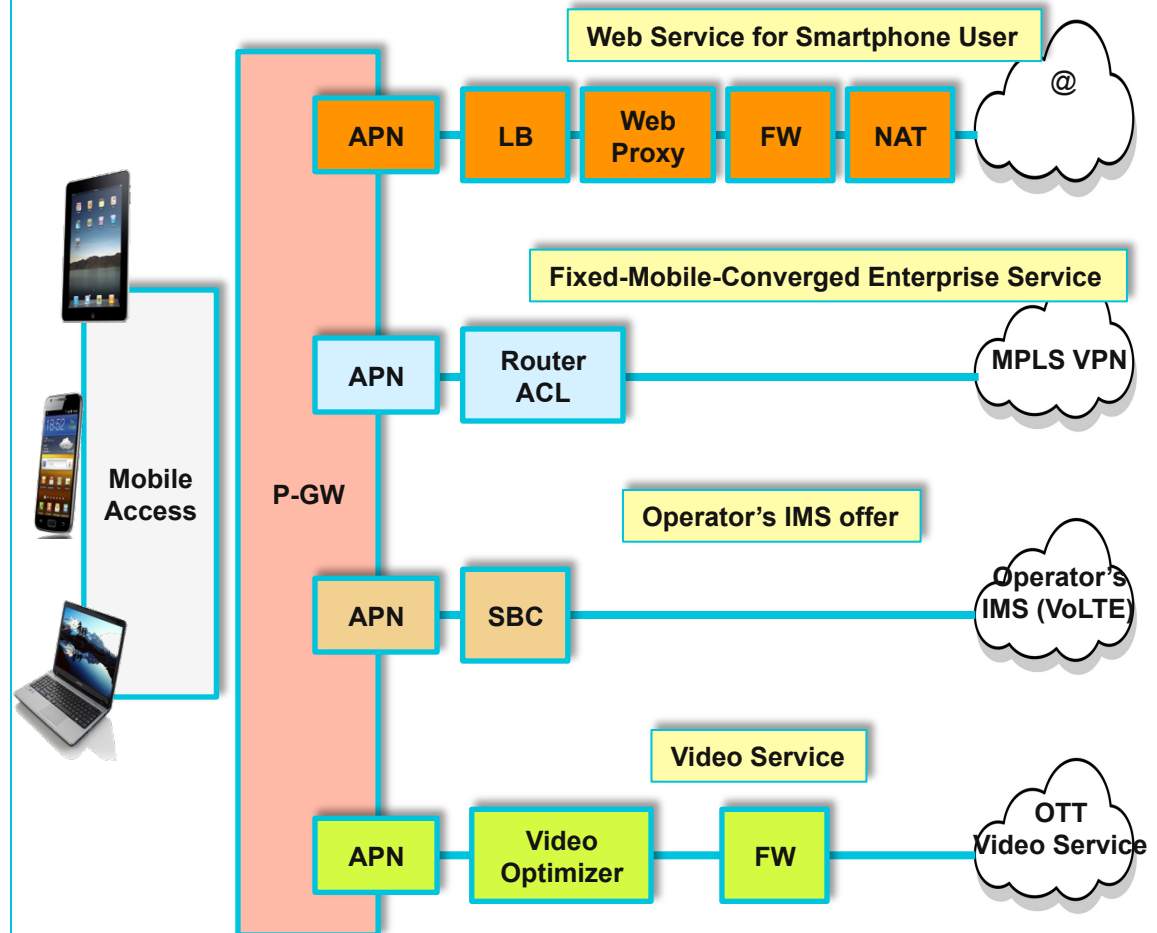| Mobile Packet Core	Wireless Backhaul	Unified Mgmt of Fixed/Wireless
Service Provider	Service Provider	Enterprise
Apply OpenFlow to 3GPP Evolved Packet Core (EPC) Many uses such as user/data plane separation in GW, mobility management and mobile flow steering for offload.	Backhaul links are wireless Central SDN controller optimizes radio parameters in data plane using OpenFlow	Develop a unified access network that uses a common controller to manage both wireless access points (AP) and wired switches
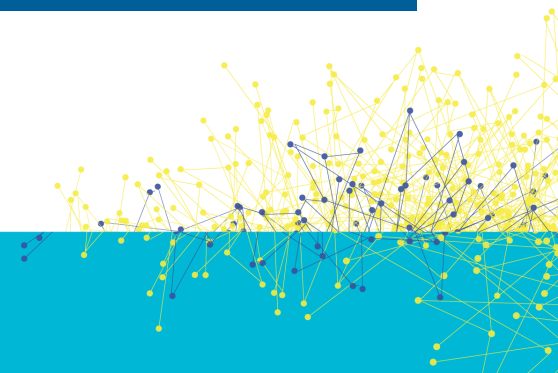
Layer 4-7 SDN-enabled Service Functions

Enterprise

- **Security**
  - Firewalling (L2-L4; L2-L7)
  - Intrusion detection / prevention
  - DDOS protection

- **Availability**
  - Load balancing
  - Floating IP** (NAT)
  - Intelligent DNS

- **Performance**
  - Caching / web proxys
  - WAN optimization

- **Voice/Video**
  - VOIP
  - SBCs

- **Remote Access**
  - SSL VPNs
  - Citrix Gateways

Mobile

Web Service for Smartphone User

Mobile Access → P-GW → APN — LB — Web Proxy — FW — NAT — @

Fixed-Mobile-Converged Enterprise Service

APN — Router ACL — MPLS VPN

Operator's IMS offer

APN — SBC — Operator's IMS (VoLTE)

Video Service

APN — Video Optimizer — FW — OTT Video Service

Optical Transport

Scope: OpenFlow/SDN extensions for optical transport networks (L0, L1, packet/optical)
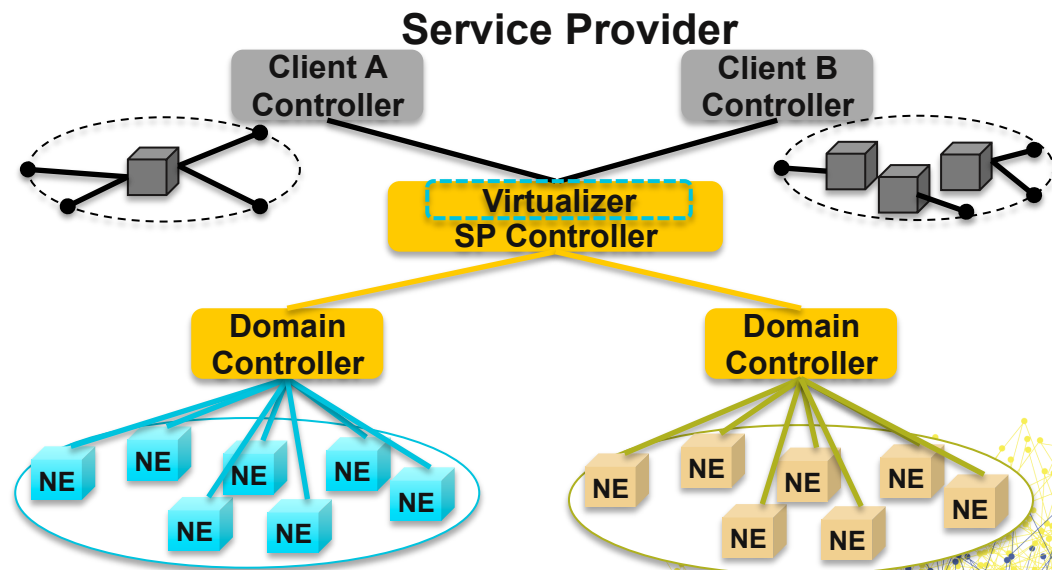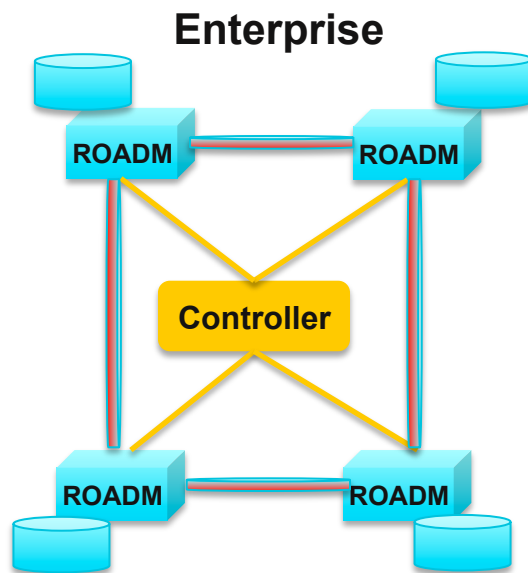
1. Photonic Enterprise Network
   – Green field, private L0 network connecting Enterprise data centers
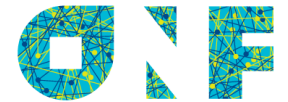2. SP Network Virtualization/Data Center Interconnection
   – Virtualization of Service Provider network resources to multiple clients
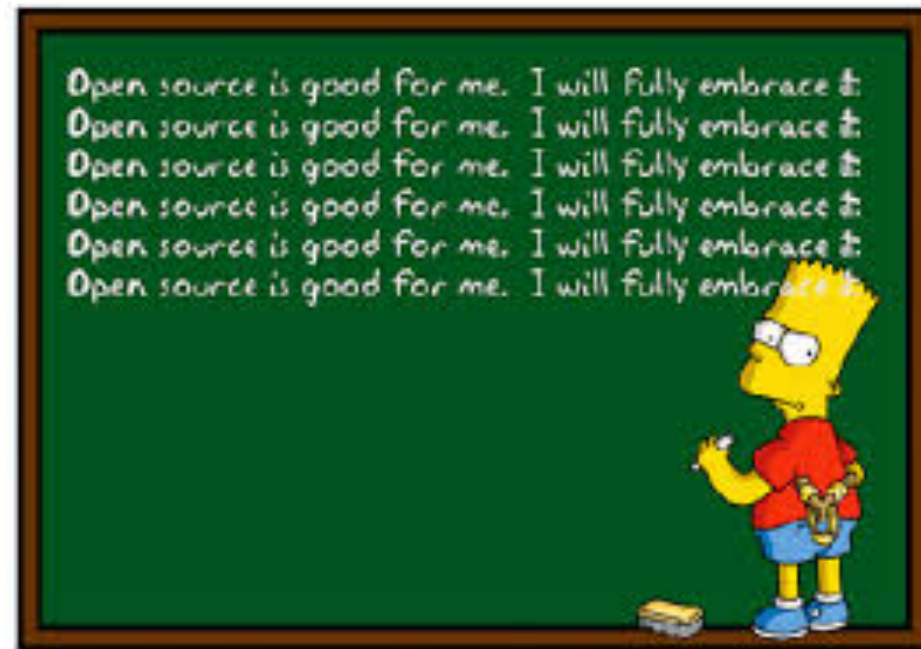3. SP Packet/Optical Integration
   – Integrated control of Service Provider IP and packet/optical domains

Open-Source Software in ONF

- Why
  - Learning, validation; not commercial
- Where
  - ONF GitHub repository; Apache 2.0 license
- What
  - OpenFlow driver
  - ONF SampleTap
  - Conformance test framework
  - Prototype NBIs
  - …

ONF Operator/User Members (100% growth)

Equinix
Facebook
Goldman Sachs
Google
Level 3
Microsoft
Rackspace
TW Telecom
Verizon
Virtela
Yahoo!

Colt
Deutsche Telekom
ECI Telecom
Orange
Swisscom
Telecom Italia
Telefonica
Vodafone

Alibaba
Baidu
China Mobile
China Telecom
ETRI
Korea Telecom
KDDI
NTT Communications
PCCW Global
SK Telecom
Tata Communications
Telecom Malaysia
Tencent

Total membership growth 50% (again)

ONF Startup Members

3TEN8
Barefoot Networks
Corsa Tech
Gencore Systems
Itential
NoviFlow
Saisei Networks
SDN Essentials
Tallac Networks

BISDN
Guardicore
Intelliment Security
Konodrac
Sanctum Networks
SDN Solutions

Atto Research
Blue Ocean Networks
Criterion Networks
Friesty
GreeNet
NAIM Networks
Xinguard
xNet
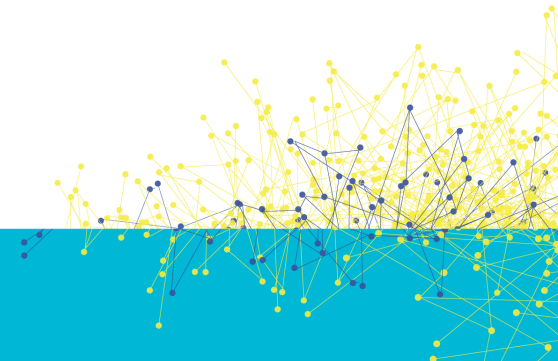
Conclusions

- No one sitting still
    - Leading operators deploying pure SDN
        - Others try some SW over legacy nets
    - Leading vendors embrace true Open SDN
        - Watch out for the others

- ONF reflects movement growth
    - Members
    - Geographies
    - Technical program