Empowered by Innovation NEC

# NFVとは何か？

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# Agenda

- NFVとは
- ユースケース
- デモンストレーションビデオ
- 関連標準化動向

# NFVとは

# Network Function Virtualizationとは

Aims to transform the way that network operators architect networks by evolving standard IT virtualization technology to **consolidate many network equipment types onto industry standard high volume servers, switches and storage**, which could be located in Data Centres, Network Nodes and in the end user premises.

出典：Network Functions Virtualisation – Introductory White Paper
http://www.tid.es/es/Documents/NFV_White_PaperV2.pdf

# NFVの登場背景

- Network Operators' networks are populated with a large and increasing variety of proprietary hardware appliances
  - **ルータとか**、CG-NAT**とか**、EPC**とか**、BRAS**とか**、etc…
- To launch a new network service often requires yet another variety and finding the space and power to accommodate these boxes is becoming increasingly difficult;
  - **サービスの追加・変更がますます頻繁になり、機器の追加・更新がままならない**
- compounded by the increasing costs of energy, capital investment challenges and the rarity of skills necessary to design, integrate and operate increasingly complex hardware-based appliances.
  - **固定的なハードウエアにまつわる**CAPEX/OPEX**を引き下げたい**

出典：Network Functions Virtualisation – Introductory White Paper

# NFVのコンセプト

## Classical Network Appliance Approach


Message Router


CDN


Session Border Controller


WAN Acceleration


DPI


Firewall


Carrier Grade NAT


Tester/QoE monitor


SGSN/GGSN

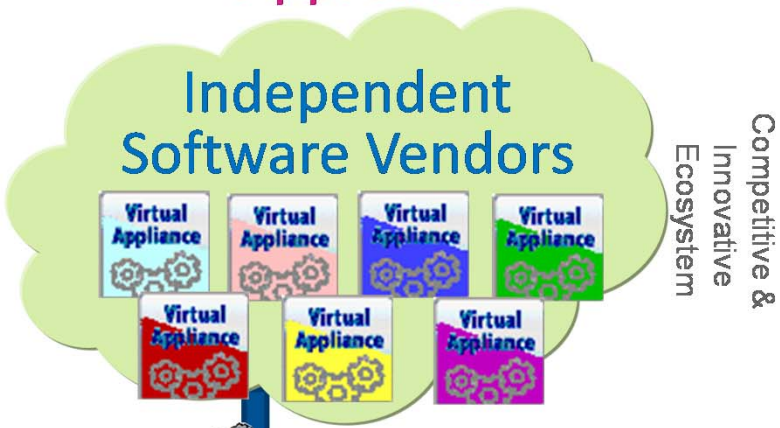

PE Router


BRAS


Radio/Fixed Access Network Nodes

- Fragmented non-commodity hardware.
- Physical install per appliance per site.
- Hardware development large barrier to entry for new vendors, constraining innovation & competition.

## Network functions Virtualisation Approach





High volume standard servers


High volume standard storage


High volume Ethernet switches

出典：Network Functions Virtualisation – Introductory White Paper

# NFVのメリット

- Reduced equipment costs and reduced power consumption

through consolidating equipment and exploiting the economies of scale of the IT industry.

- Increased speed of Time to Market

by minimising the typical network operator cycle of innovation. Economies of scale required to cover investments in hardware-based functionalities are no longer applicable for software-based development.

- Availability of network appliance multi-version and multi-tenancy,

which allows use of a single platform for different applications, users and tenants. This allows network operators to share resources across services and across different customer bases.

- **など**

出典：Network Functions Virtualisation – Introductory White Paper

# イメージによる理解 (1)

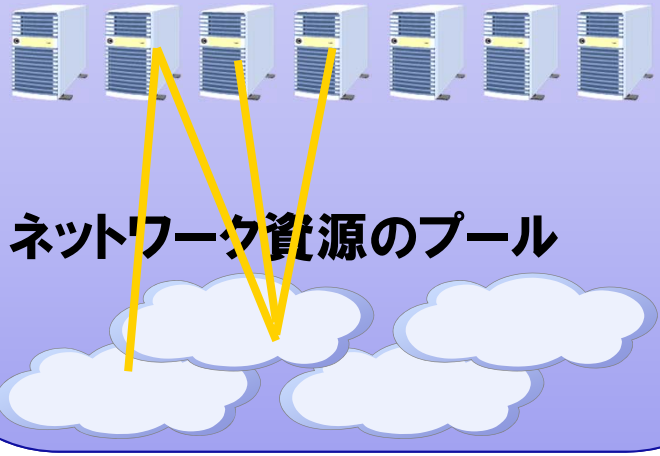
## Before

1. 専用装置を増設
2. サービスにあわせてカードを挿入する
3. 配線する & 各種設定を行う

## After

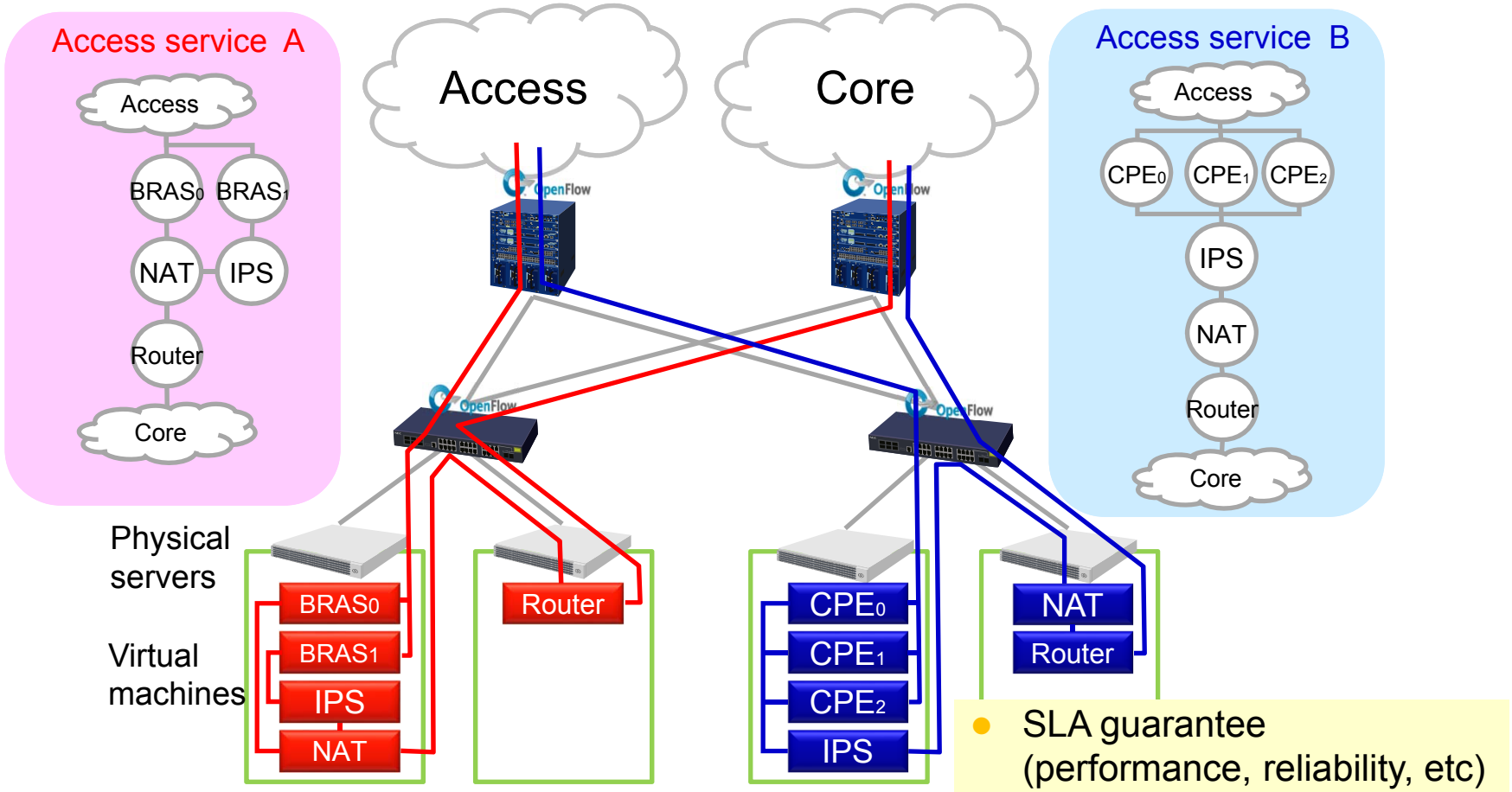

プロビジョニング
システム

仮想サーバによる
IT資源のプール



ネットワーク資源のプール

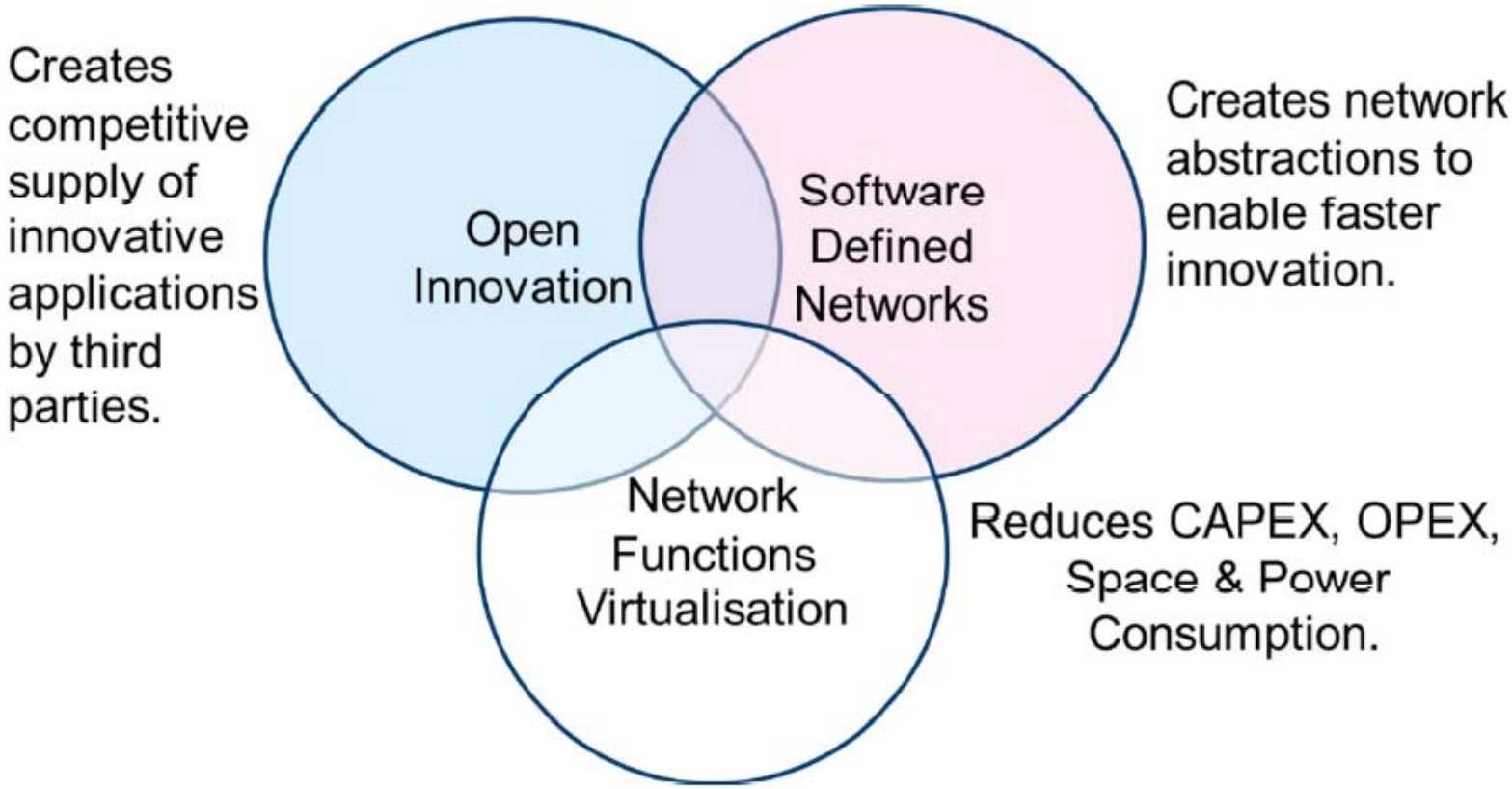
# イメージによる理解 (2)




- Traffic localization
- Fault domain localization

- SLA guarantee (performance, reliability, etc)
- Fault tolerant resource allocation
- Efficient use of resources

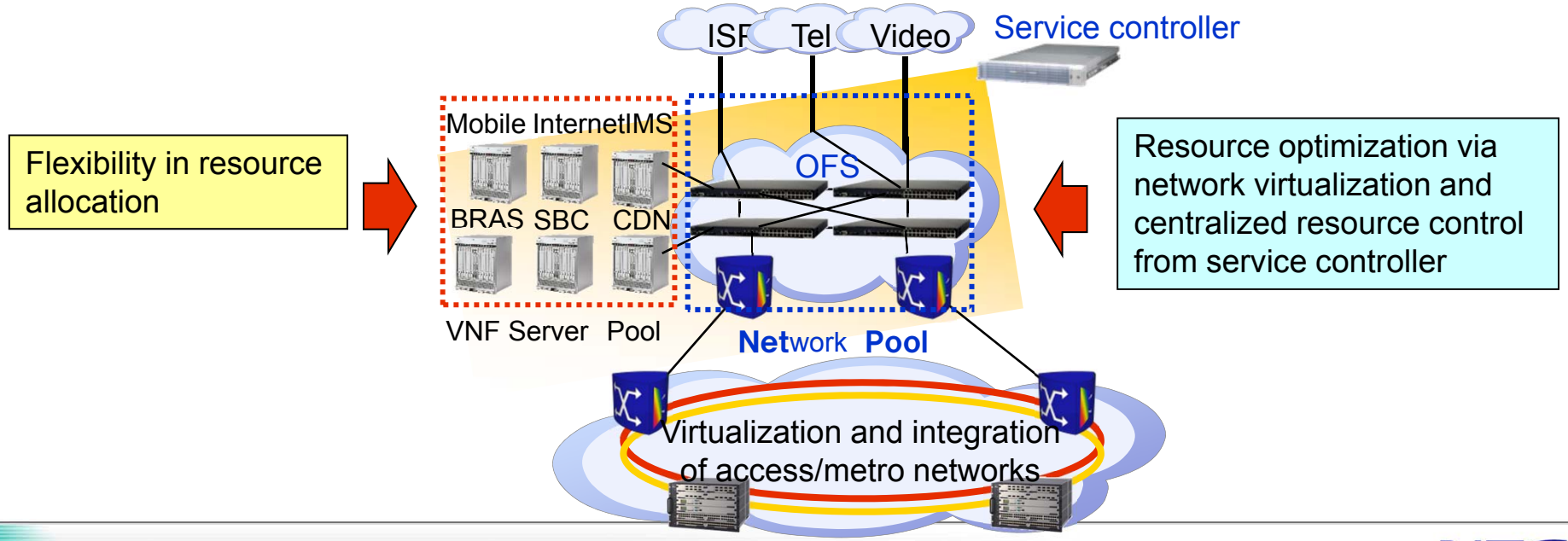
# SDNとNFV




- NFVとSDNは相補的であるが、依存関係にはない
- NFVの実装にSDNは必要ではないが、組み合わせることによる相乗効果はある

# SDN + NFV

- (1) Virtualization of network service functionalities - NFV
  - Flexibility in resource allocation
- (2) Virtualization of interconnect network - SDN
  - Network virtualization via SDN/OpenFlow with centralized control from service controller enables optimization of VNF server and network resource allocation
  - Flexibility in resource allocation with QoS/SLA



# ユースケース

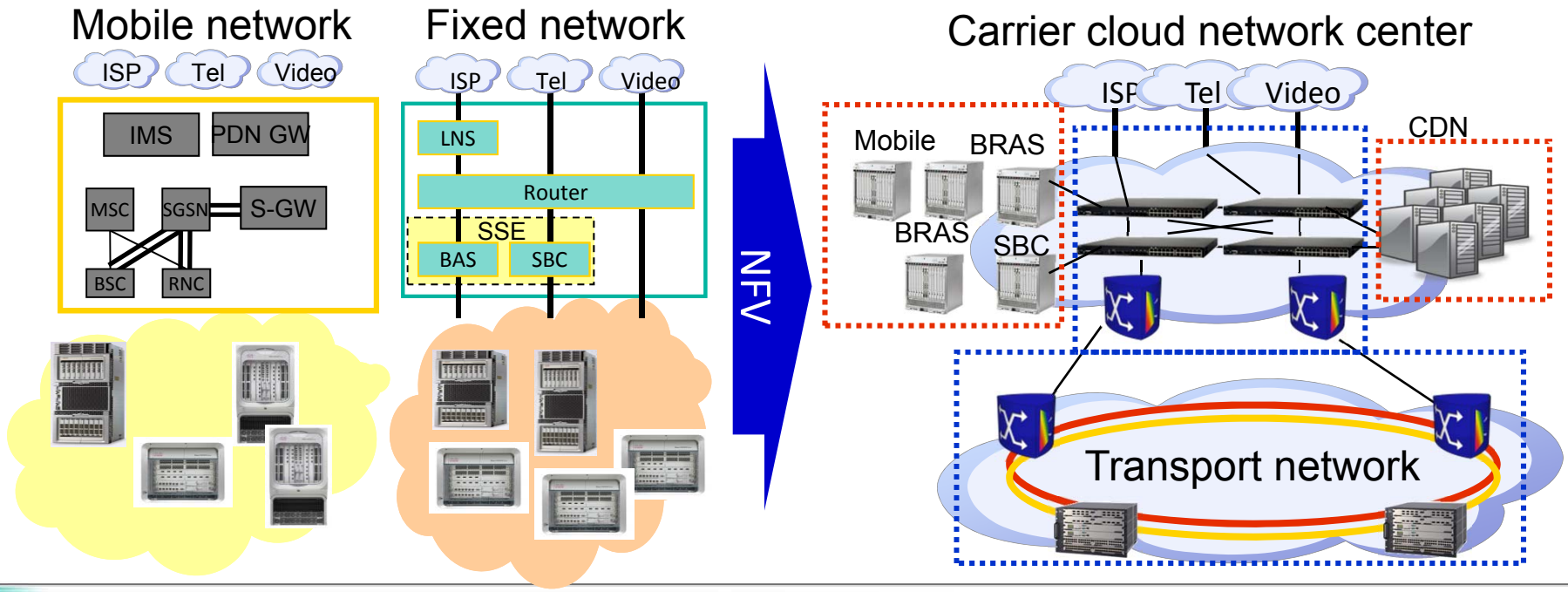
# 通信キャリアのエッジネットワークへの適用

## Current

- Different dedicated system for each service

## NFV

- COTS based scale-out architecture for various services to reduce CAPEX and OPEX and to gain revenue
- Provides new additional services on demand within a short lead time

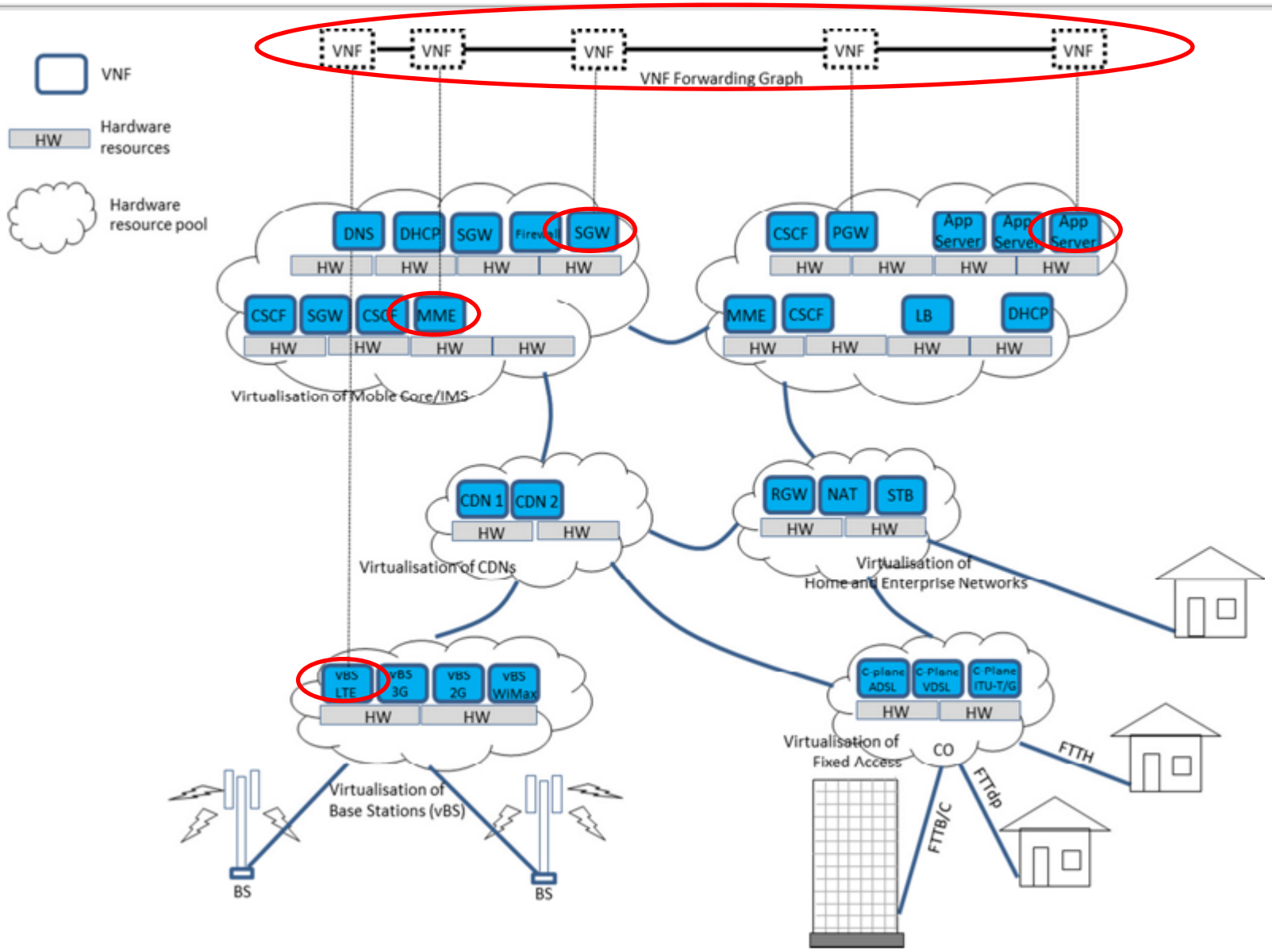


# NFVの適用例となるコンポーネント

- Switching elements: BNG, CG-NAT, routers.
- Mobile network nodes: HLR/HSS, MME, SGSN, GGSN/PDN-GW, RNC, Node B, eNode B.
- Functions contained in home routers and set top boxes to create virtualized home environments.
- Tunneling gateway elements: IPSec/SSL VPN gateways.
- Traffic analysis: DPI, QoE measurement.
- Service Assurance, SLA monitoring, Test and Diagnostics.
- NGN signaling: SBCs, IMS.
- Converged and network-wide functions: AAA servers, policy control and charging platforms.
- Application-level optimization: CDNs, Cache Servers, Load Balancers, Application Accelerators.
- Security functions: Firewalls, virus scanners, intrusion detection systems, spam protection.
- **など。つまり、通信キャリアが必要とする様々なネットワーク機能。**

出典：Network Functions Virtualisation – Introductory White Paper

# NFVを適用したネットワークの全体像




出典：Network Functions Virtualisation – Introductory White Paper

# 詳細なユースケースの例

## ETSIから公開されている詳細なユースケースの例

- http://www.etsi.org/deliver/etsi_gs/NFV/001_099/001/01.01.01_60/gs_NFV001v010101p.pdfより入手可能

## GS NFV 001: Network Functions Virtualisation (NFV); Use Cases

- Network Functions Virtualisation (NFV); Use Cases
- Network Functions Virtualisation Infrastructure as a Service
- Virtual Network Function as a Service (VNFaaS)
- Virtual Network Platform as a Service (VNPaaS)
- VNF Forwarding Graphs
- Virtualisation of Mobile Core Network and IMS
- Virtualisation of Mobile base station
- Virtualisation of the Home Environment
- Virtualisation of CDNs (vCDN)
- Fixed Access Network Functions Virtualisation

# デモンストレーションビデオ

# Demonstration overview

## Carrier edge system with OpenFlow switch + COTS server

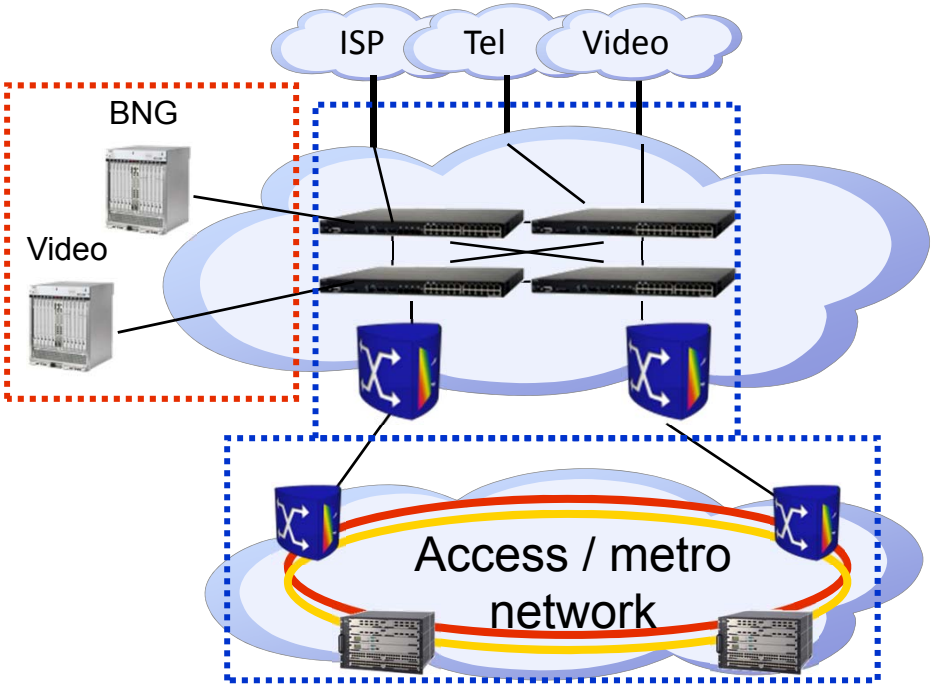
- BNG (broadband network gateway) providing internet access service
  - PPPoE termination + IPoE forwarding
- Streaming server providing video streaming service

## Scalability

- Capacity of 100,000 subscribers
  - Paths of each subscriber are controlled
- Network and server load balancing shown using the number of subscribers

## Service provisioning

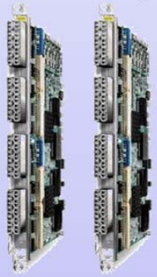
- On-demand automatic/manual deployment of VMs providing various services



# OpenFlow+汎用サーバによるBRASシステムの実現

## Before

ISP接続サービス用にBASカードを挿入



カード装備数に制限

筐体ごと増設の無駄

## After

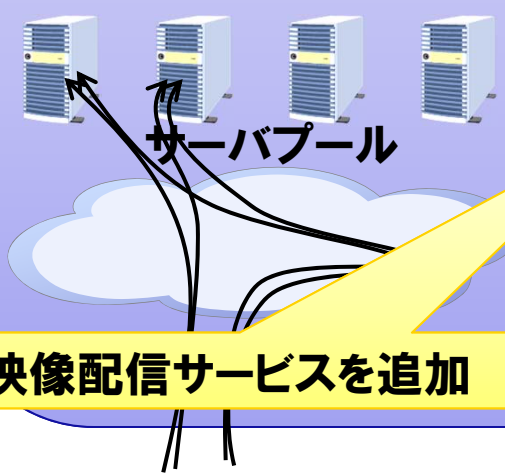
- 需要に応じた数のVMを配備
- OpenFlowコントローラにBASロードバランスソフトを導入

ネットワーク負荷に応じて経路ロードバランス

サーバ負荷に応じてBASロードバランス

映像VM　BAS VM

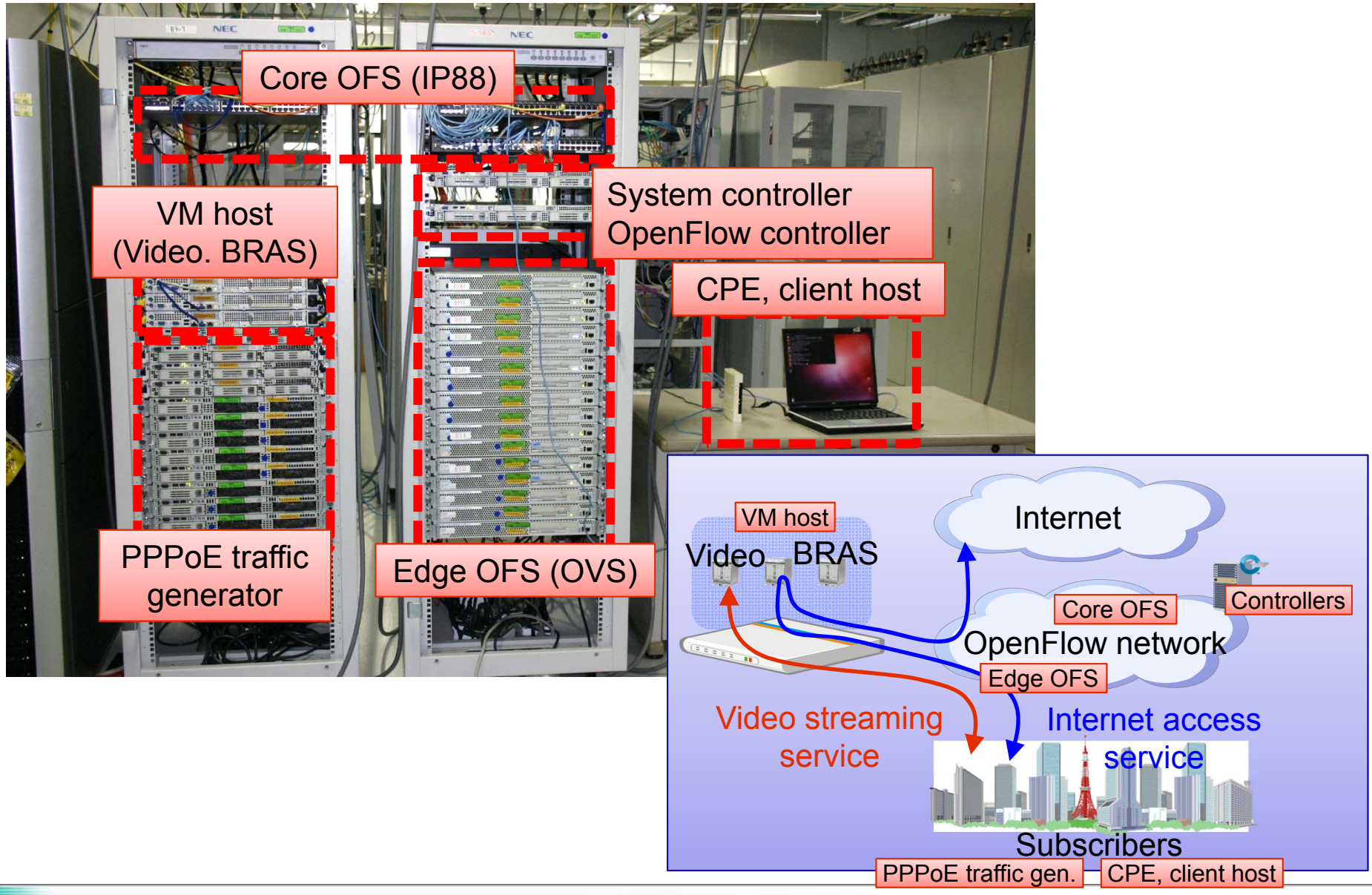
映像配信経路制御




Trema OpenFlow コントローラ

さらに映像配信サービスを追加

# Demonstration system



# 関連標準化動向

# IETF (1)

## Service Function Chaining (SFC)

- Define architecture, data plane protocols (encapsulation method), control plane mechanisms, and manageability to make “Service Chaining” concept which has been heavily discussed in ETSI NFV a reality
- https://datatracker.ietf.org/doc/charter-ietf-sfc/

## Network Virtualization Overlays (NVO3)

- Define architecture, requirements on control and data plane for VPNs accommodating millions of VMs running on 100K+ physical machines
- Defining new control or data plane protocols is out-of-scope
- http://datatracker.ietf.org/wg/nvo3/charter/

## Interface to the Routing System (I2RS)

- http://datatracker.ietf.org/wg/i2rs/charter/
- Define architecture, common use case, abstracted information models, and requirements on I2RS protocols to define common interface for routing systems/routers
- I2RS interfaces allow applications to centrally control/manage IP networks

# IETF (2)

## Source Packet Routing in Networking (SPRING)

- http://datatracker.ietf.org/doc/charter-ietf-spring/
- Define procedures that allow a node to steer a packet along an explicit route using information attached to the packet and without the need for per-flow state information to be held at transit nodes
- Both control plane and data plane protocols will be discussed/defined
- Both centralized and distributed control are considered

## Locator/ID Separation Protocol (LISP)

- http://datatracker.ietf.org/wg/lisp/
- Define architecture description, deployment models, impacts, and etc. of entire LISP system
- Experimental RFCs that define LISP protocol and other essential building blocks have already been published

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