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Impact of SDN and NFV on Carrier Ethernet Service Standards and Regulation

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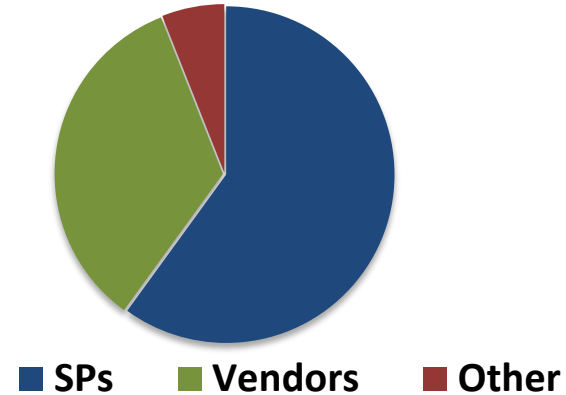MEF.net   wiki.mef.net   thirdnetworknews.com   ethernetacademy.net

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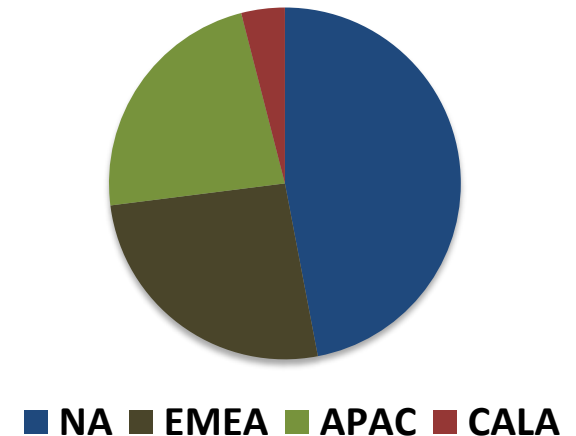# **Brief Introduction to MEF**

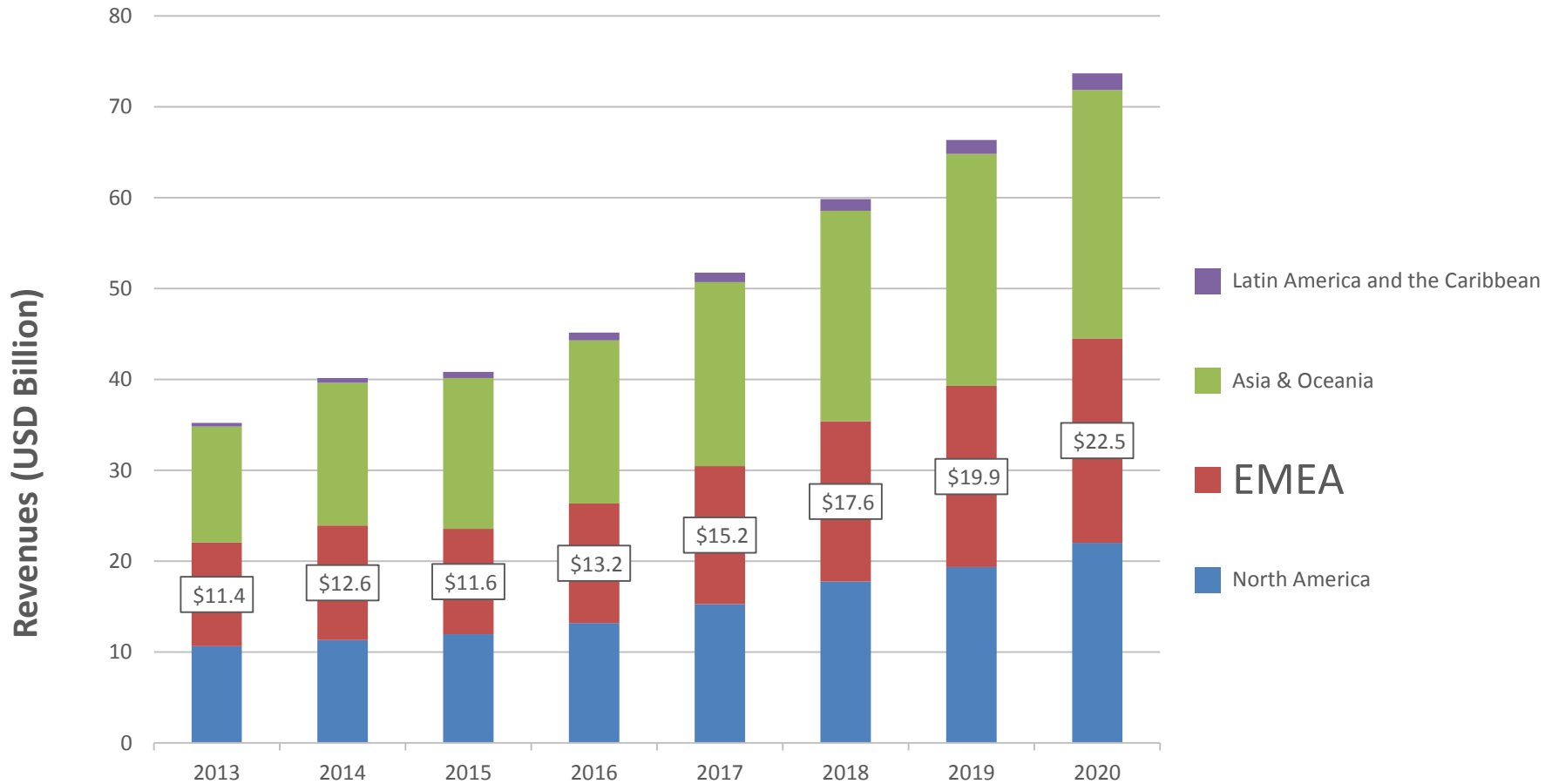MEF legal name changed from Metro Ethernet Forum to MEF Forum

MEF in 2016

MEF Forum is the catalyst behind the **$80+ USD Billion global market for Carrier Ethernet services** and technologies and the defining body for **Lifecycle Service Orchestration** (LSO) standards that underpin emerging Third Network services with **Carrier Ethernet 2.0** (CE 2.0), **Software Defined Networking** (SDN), and **Network Function Virtualization** (NFV).

■ SPs ■ Vendors ■ Other

220 Member Companies

■ NA ■ EMEA ■ APAC ■ CALA

Ethernet Leased Line Global Revenue Forecast

Revenues (USD Billion) — stacked bar chart by region (North America, EMEA, Asia & Oceania, Latin America and the Caribbean), 2013–2020.

North America values labeled: $11.4 (2013), $12.6 (2014), $11.6 (2015), $13.2 (2016), $15.2 (2017), $17.6 (2018), $19.9 (2019), $22.5 (2020)

'Ethernet Leased Line' also known by the MEF term 'Carrier Ethernet'

Ovum: Ethernet Services Forecast Spreadsheet: 2015–20

'Questions Regarding Regulatory Implications of SDN and NFV'

The MEF Perspective

(1) Do SDN and NFV enable fixed network access which gives alternative network operators more control over the network of the incumbent compared to current layer 2 wholesale access products (also known as Ethernet bitstream or virtual unbundled local access (VULA)?
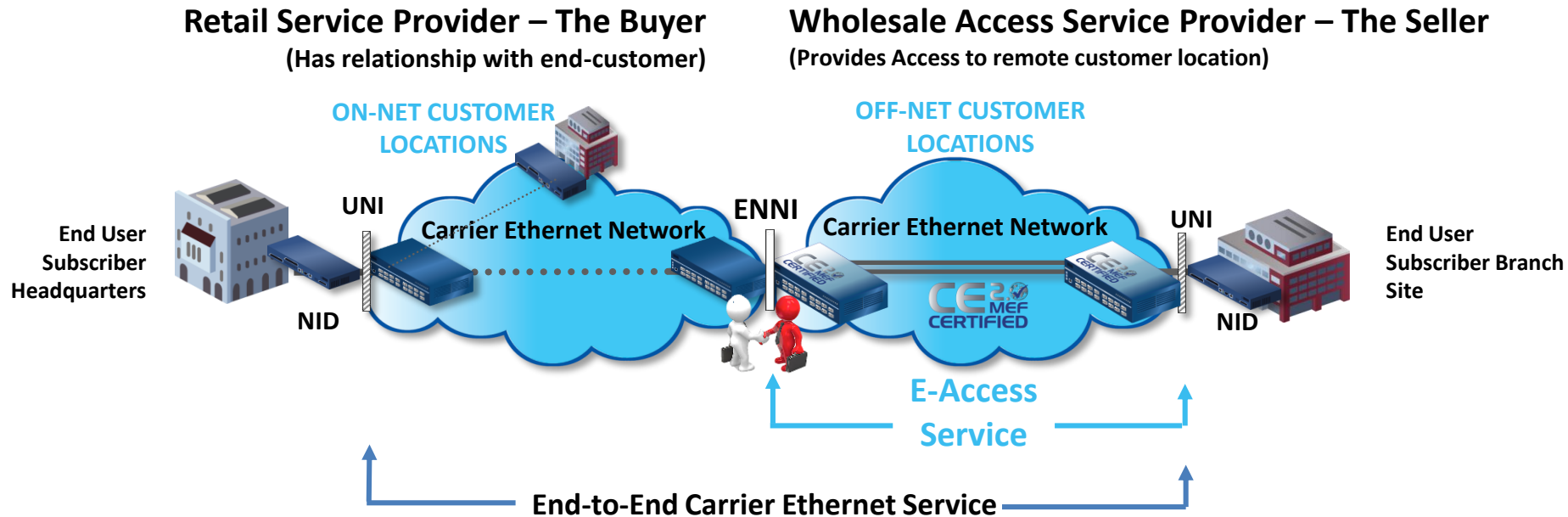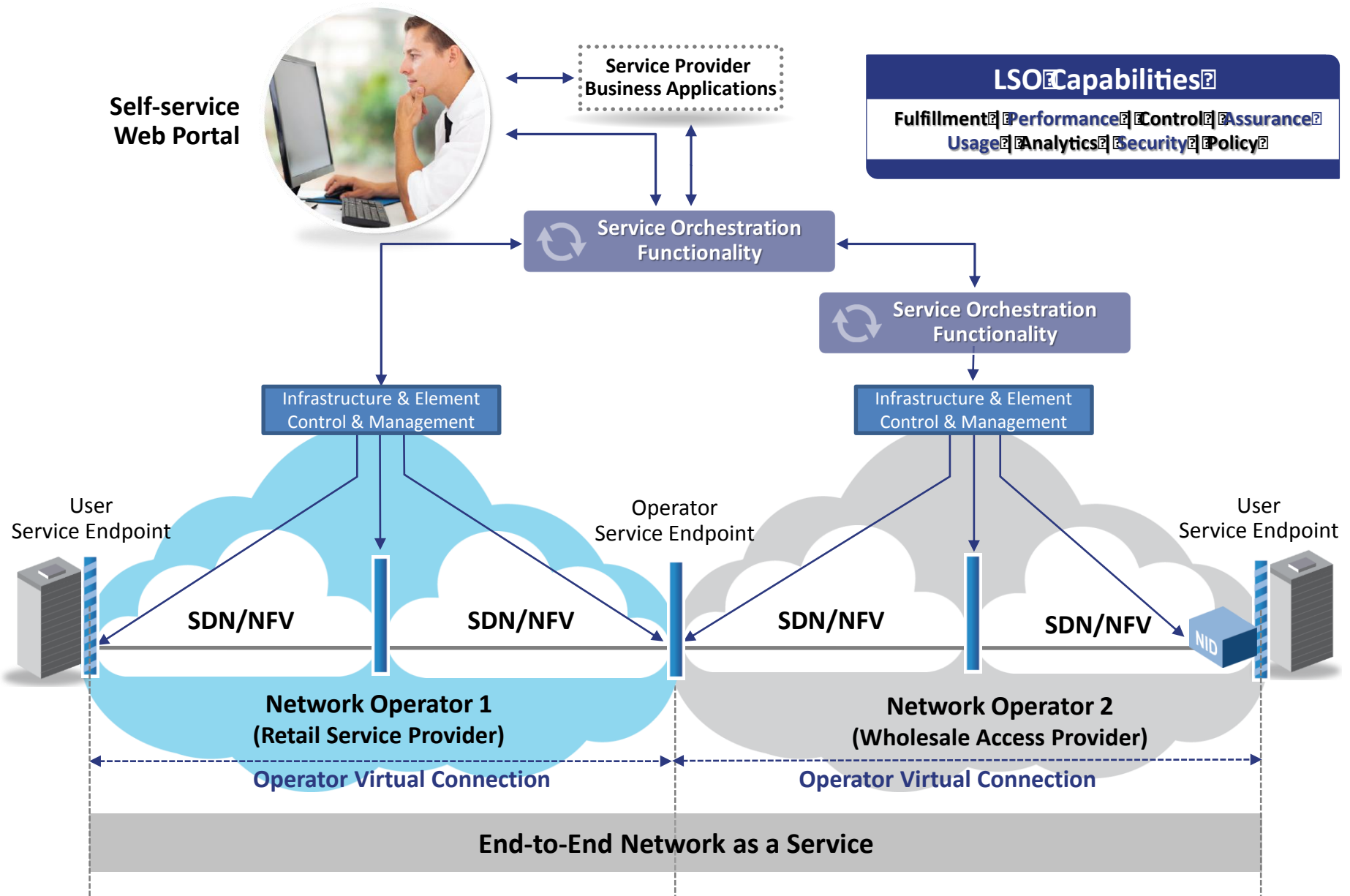**a. Is this possible in principle?**

Yes

- **SDN and NFV can provide more control by the alternate service provider over the network of the incumbent compared to current layer 2 wholesale access Ethernet Leased Lines also known as E-Access Services defined in MEF 51.**

- **The virtualization of network functions will enable alternate service providers to program resources on incumbent networks made available to them to deliver value-added services. These capabilities require a standardized orchestration layer that can be implemented by all actors.**

- **The standardized orchestration layer must be capable of configuring both legacy as well as SDN and NFV-based network functions.**

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Current Carrier Ethernet Wholesale E-Access Service

- **Retail Service Provider buys E-Access services to reach off-net customer locations**
- **Wholesale Access Provider sells E-Access services to provide access to locations on its network**
- **ENNI is point of interconnection between Retail and Wholesale service providers**

Retail Service Provider – The Buyer
(Has relationship with end-customer)

Wholesale Access Service Provider – The Seller
(Provides Access to remote customer location)

ON-NET CUSTOMER LOCATIONS

OFF-NET CUSTOMER LOCATIONS

UNI

ENNI

UNI

Carrier Ethernet Network

Carrier Ethernet Network

End User Subscriber Headquarters

NID

NID

End User Subscriber Branch Site

E-Access Service

End-to-End Carrier Ethernet Service

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Future Carrier Ethernet Wholesale E-Access Service

Self-service Web Portal

Service Provider Business Applications

LSO Capabilities

Fulfillment | Performance | Control | Assurance
Usage | Analytics | Security | Policy

Service Orchestration Functionality

Service Orchestration Functionality

Infrastructure & Element Control & Management

Infrastructure & Element Control & Management

User Service Endpoint

Operator Service Endpoint

User Service Endpoint

SDN/NFV   **SDN/NFV**   **SDN/NFV**   **SDN/NFV**

NID

Network Operator 1 (Retail Service Provider)

Network Operator 2 (Wholesale Access Provider)

Operator Virtual Connection   **Operator Virtual Connection**
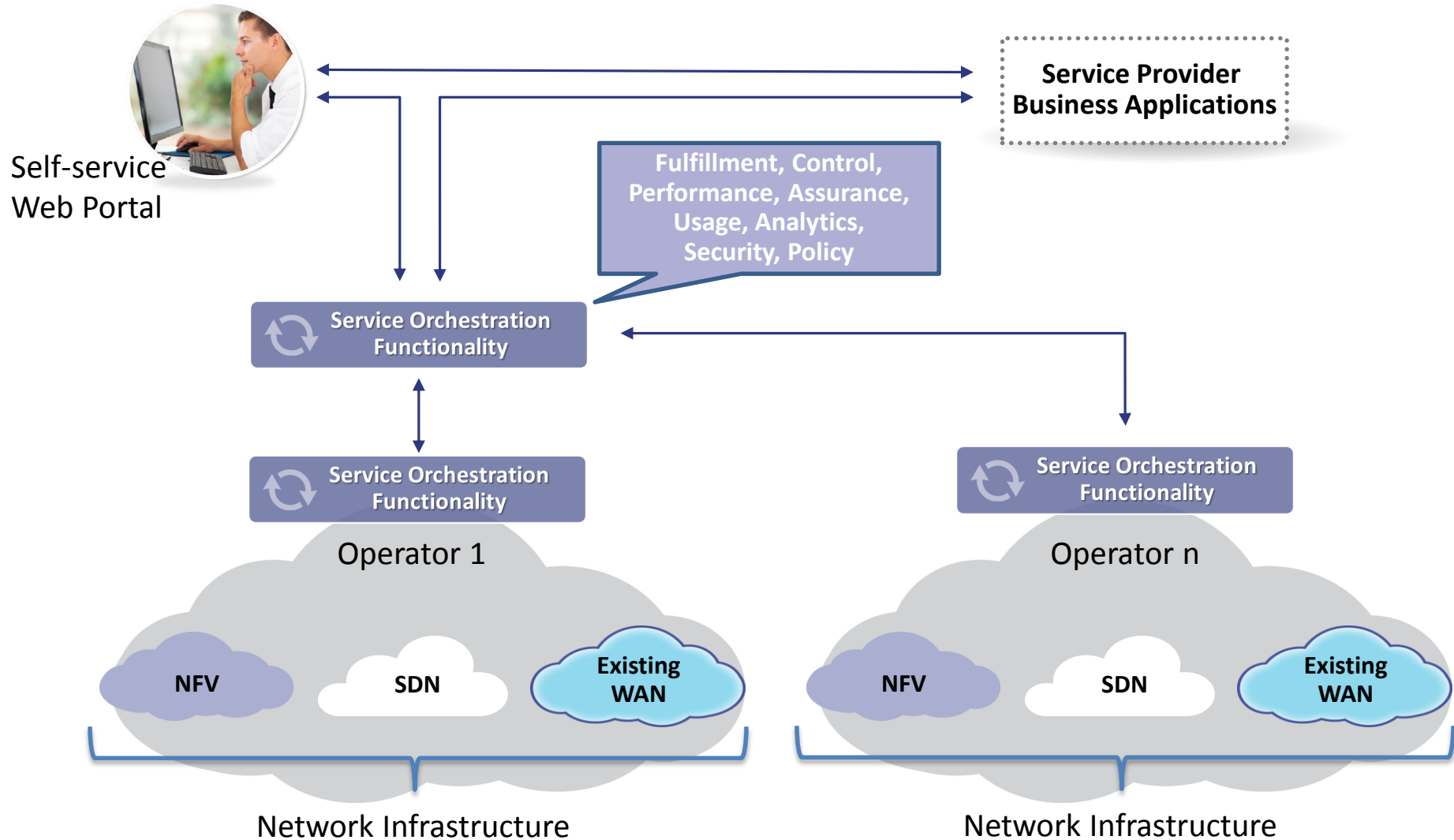
End-to-End Network as a Service

(1) b. Will SDN and NFV also be standardized in a way (including multi-tenant support) which will make such forms of network access possible based on SDN/NFV?

Yes

- **The implementation of SDN and NFV is typically confined to a single network domain.**
- **SDN and NFV are on a path to standardization, however, further challenges to create open software interfaces to such standardized networking functions must be met if resources are to be readily shared among service providers.**
- **This work has started at MEF for Ethernet Leased Lines under the name of Lifecycle Service Orchestration that includes the open control of SDN and NFV implementations within and across Service Provider domains.**

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MEF's Lifecycle Service Orchestration

Self-service
Web Portal

**Service Provider
Business Applications**

**Fulfillment, Control,
Performance, Assurance,
Usage, Analytics,
Security, Policy**

**Service Orchestration
Functionality**

**Service Orchestration
Functionality**

**Service Orchestration
Functionality**

Operator 1

Operator n

NFV

SDN

**Existing
WAN**

NFV

SDN

**Existing
WAN**

Network Infrastructure

Network Infrastructure

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(1) c. Will SDN and NFV also be offered by vendors (and/or open source) which will make such forms of network access possible based on SDN/NFV?

Yes

- **Vendors providing SDN and NFV solutions are participating in open source projects, such as MEF's Lifecycle Service Orchestration to develop solutions that will enable alternate service providers to have programmability within allocated portions the partner's network.**

Broad Range of Open Source Project for Network Access

Category	Open Source Project
SDN Controller	• OpenDaylight • ONOS • RYU
Network Virtualization	• Open vSwitch (OVS) • MidoNet • OpenVirteX (OVX)
I/O Optimization	• Data Plane Development Kit (DPDK) • IO Visor • OpenVirteX (OVX) • SocketPlane • ODP
VMs and Containers	• Kernel Virtual Machine (KVM) • Xen • Docker
Open SDN Platform	• Central Office Re-architected as Data Center (CORD) • Open Cloud Project (OCP) • Open Network Install Environment (ONIE)
SDN Applications	• Open Aspen • Quagga • Open Prism

Category	Open Source Project
Orchestration	• Lifecycle Service Orchestration - MEF • OpenStack • CloudStack • Cloudify • OpenNebula • Helion Eucalyptus • XOS
Platform as a Service	• Cloud Foundry • OpenShift
Provisioning and Management Tool	• Puppet • Ansible • Salt Stack • JuJu • Chef
Virtual Network Functions	• CloudRouter • XORP • CPqD RouteFlow, • NetFilter • Snort • OpenWRT • Clearwater

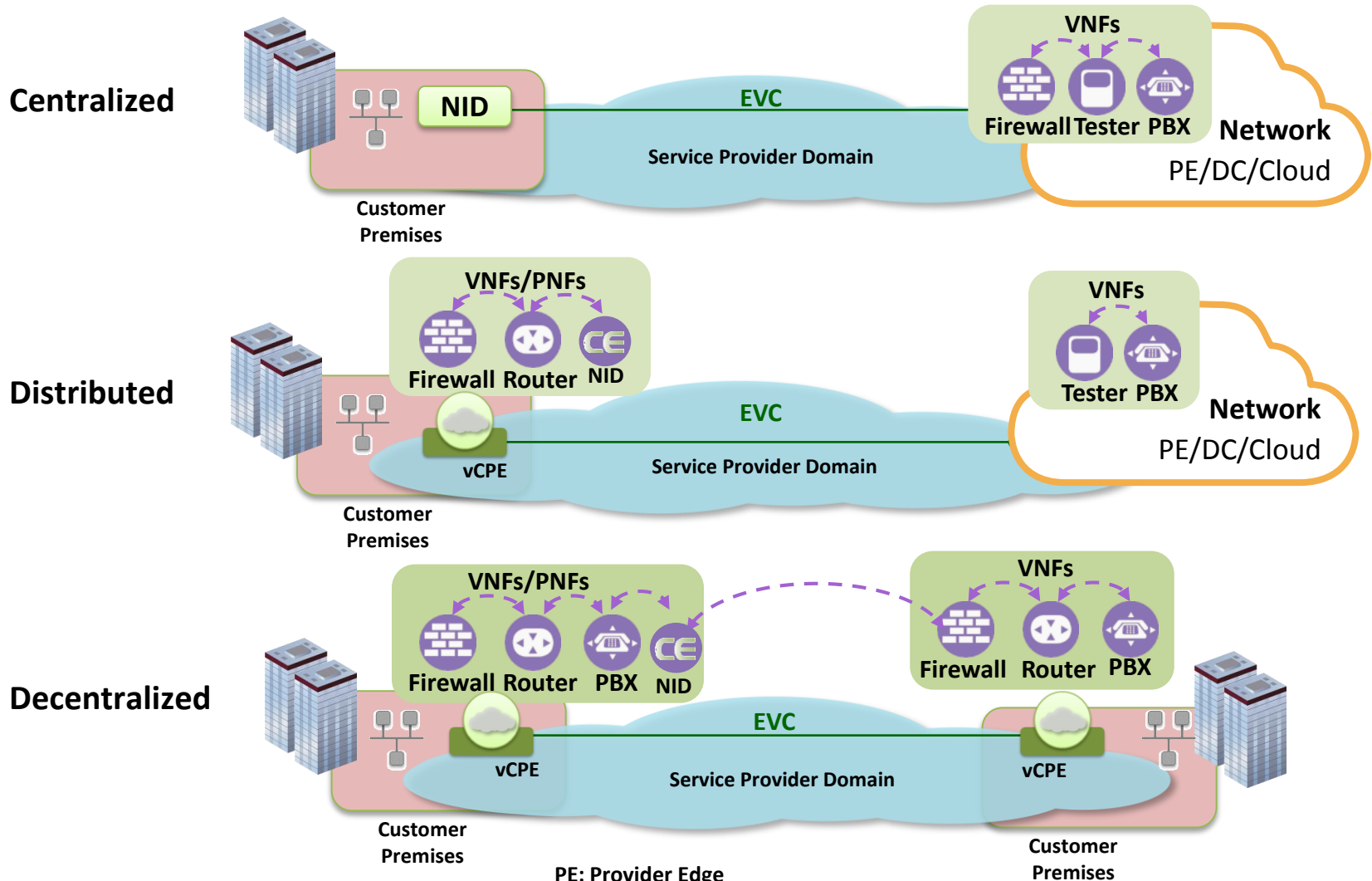**Above list shows some examples of open source projects**

(2) Will SDN and NFV enable other new forms of network access or network sharing?
a. If this is the case, please present them?

Yes

- **SDN and NFV enable network programmability opening new perspectives for alternate providers to better compete in an open market by creating and delivering innovative value-added services.**

- **Programmability eliminates manual processes leading to the acceleration of service delivery, not possible in the past.**

New Types of Network Access with NFV

Centralized

NID — EVC — Service Provider Domain — VNFs: Firewall, Tester, PBX — Network PE/DC/Cloud — Customer Premises

Distributed

VNFs/PNFs: Firewall, Router, NID — vCPE — EVC — Service Provider Domain — VNFs: Tester, PBX — Network PE/DC/Cloud — Customer Premises

Decentralized

VNFs/PNFs: Firewall, Router, PBX, NID — vCPE — EVC — Service Provider Domain — VNFs: Firewall, Router, PBX — vCPE — Customer Premises — Customer Premises

PE: Provider Edge
DC: Data Center
VNF/PNF: Virtual/Physical Network Function
EVC: Ethernet Virtual Connection

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(2) b. Will SDN and NFV facilitate new services which enable end-users to set up data (Ethernet) connections dynamically on-demand similar to phone calls?

Yes

- **If we take the telephone network as an example, all operators use the same signaling protocol, the same service standards and the same billing standards.**

- **For data connections to be realized in a similar manner we will need to standardize service definitions, information models, processes and architectures to be used by all operators involved in the delivery of a multi-domain end-to-end service.**

SDN/NFV in an Open Multi-Domain Architecture Supporting Dynamic Services
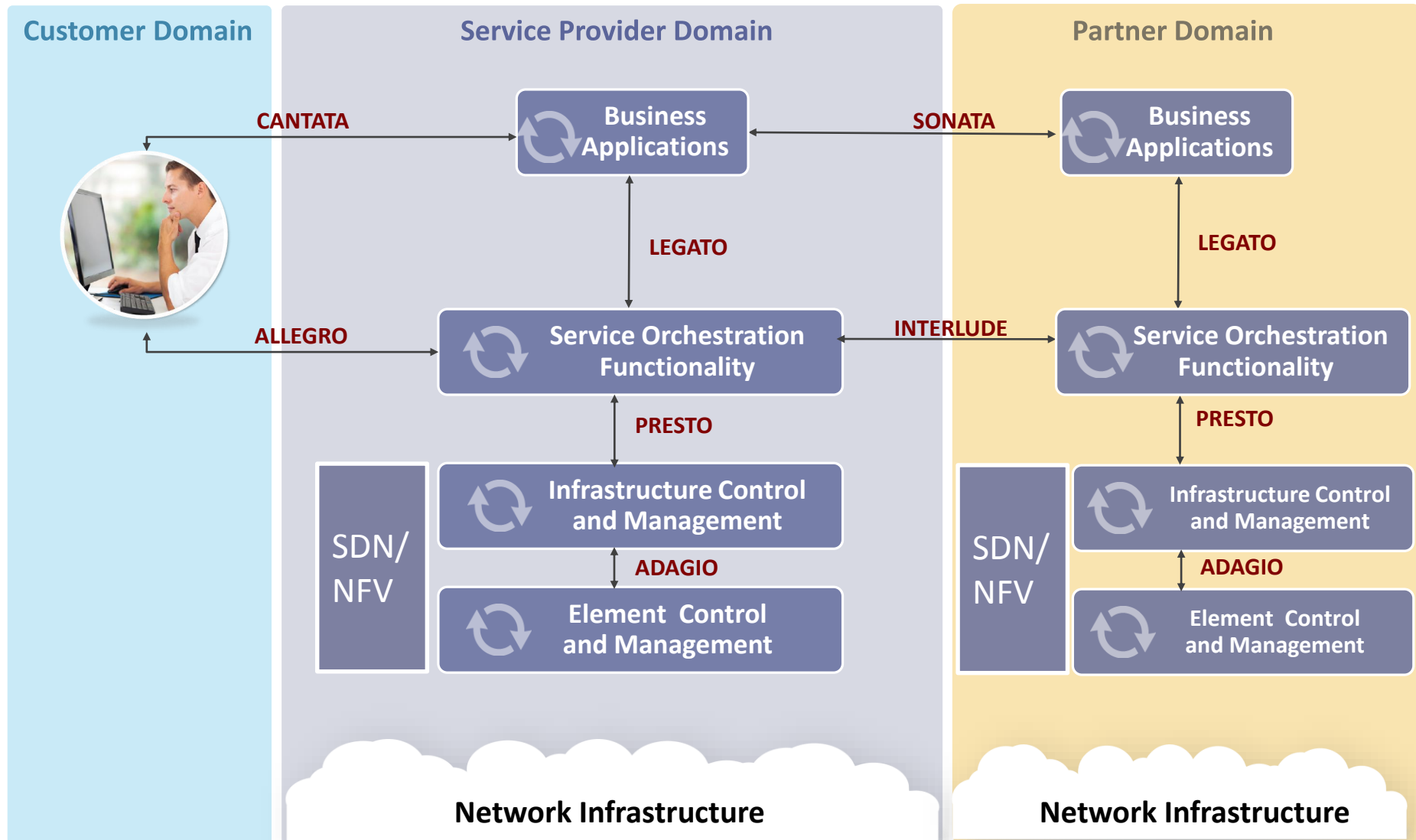
(2) c. Will SDN and NFV enable network operators to offer Virtual Network Functions (VNF) as a service to other operators? Do you expect that this will happen? Which VNFs?

Yes

- **The development of a market for productized virtualized network function is in its very early stages. Cloud providers have successfully created a market for virtualized functions available within the confines of the data center, and so one may expect a similar market to emerge from the nascent virtualized network functions such as vFirewall and vCPE.**

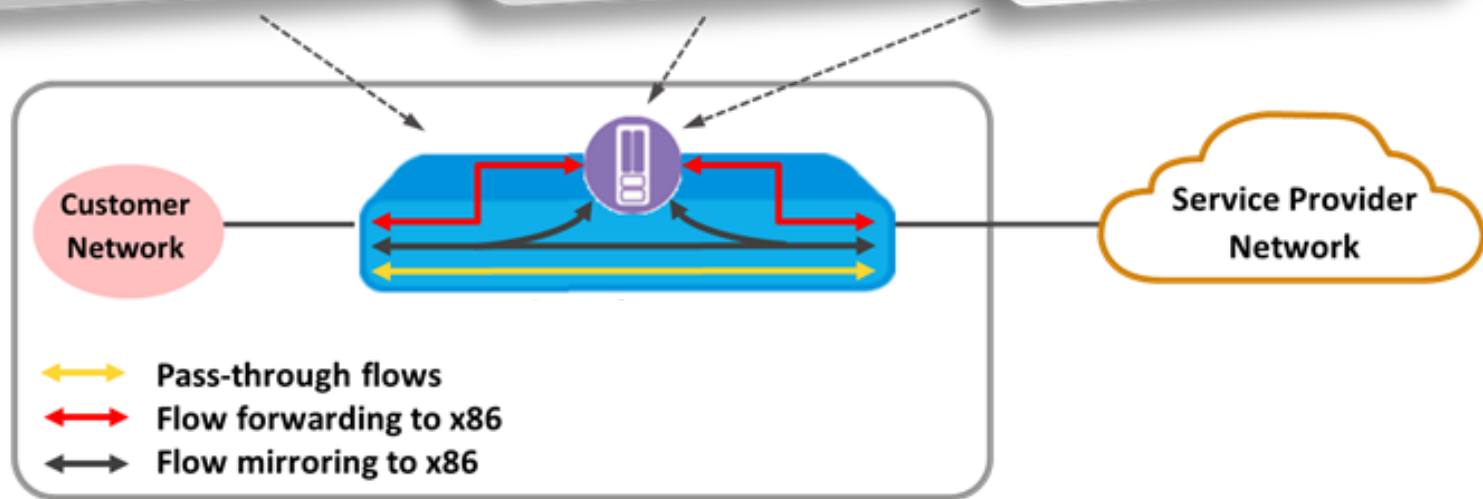# Network Interface Device with Integrated VNF

Embedded Capabilities

✓ CE 2.0
✓ L2 / L3, hardware-based
✓ Service assurance tools
✓ Circuit emulation
✓ Timing (SyncE/1588-2008)
✓ Any uplink: Eth/DSL/TDM

Virtualized Network Functions

✓ Routing (VM based)
✓ Diagnostic & testing tools
✓ Available BW estimation
✓ Application awareness
✓ More...

Virtualized Value-Added Apps

✓ Firewall
✓ Encryption
✓ WAN optimization
✓ IP telephony
✓ More...

Customer Network

Service Provider Network

Pass-through flows
Flow forwarding to x86
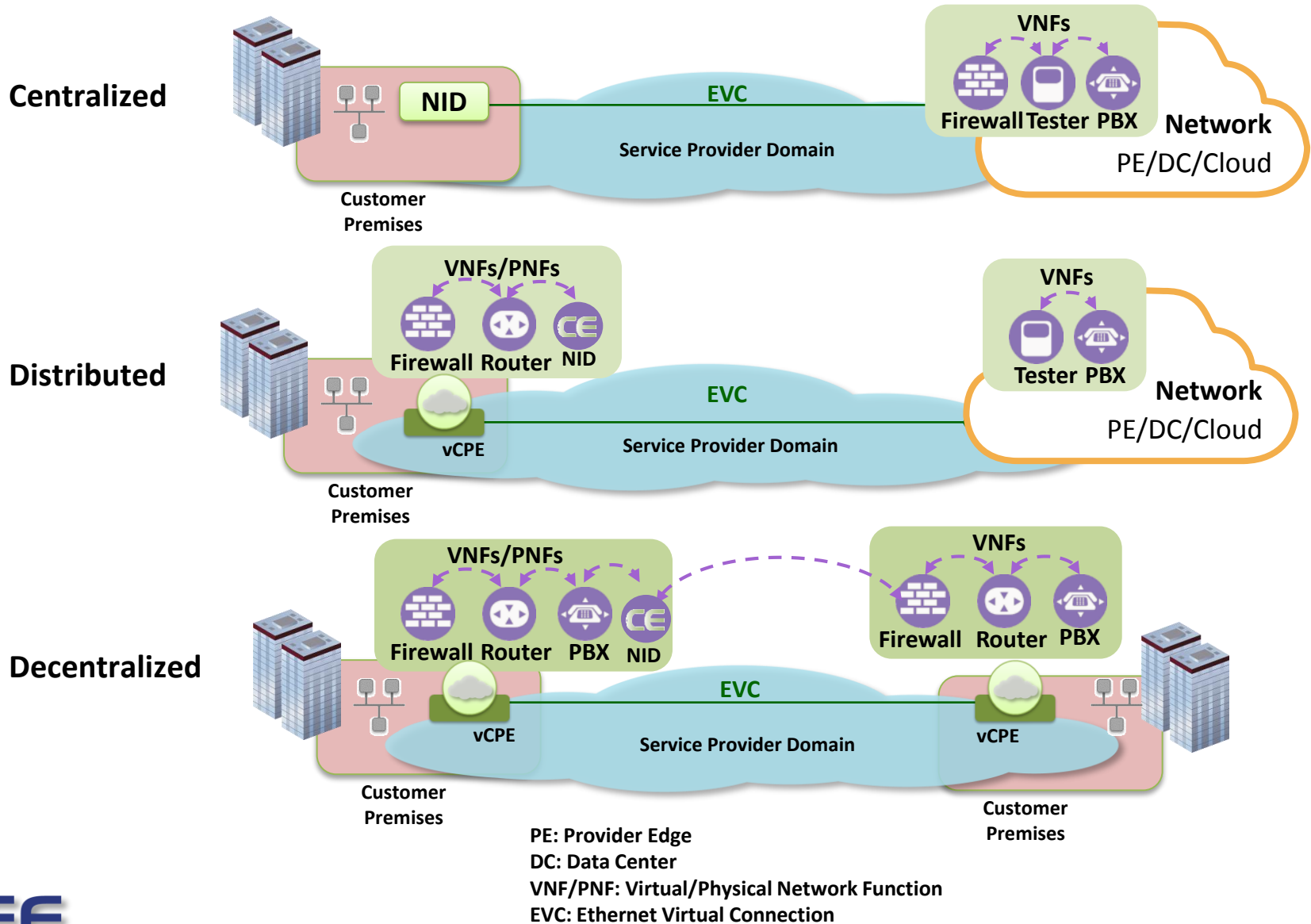Flow mirroring to x86

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(3) Will SDN and NFV have an (further) impact on the current value chain? If this is the case, please present how SDN and NFV will alter the current value chain.

Yes

- **One may expect new economic actors to arise from the productization of virtualized network functions such as centralized virtualized firewalls, that may be sold in the form of a subscription either directly by the end-user or by the service provider.**

- **The activity of such new economic actors could be absorbed into service provider offerings, could be marketed directly to end-users or could lead to revenue sharing arrangements. All three options could prove to be challenging to startup organizations working in this field.**

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New SDN and NFV Value Chain

Centralized

NID — EVC — Service Provider Domain — VNFs: Firewall, Tester, PBX — Network PE/DC/Cloud — Customer Premises

Distributed

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Decentralized

VNFs/PNFs: Firewall, Router, PBX, NID — vCPE — EVC — Service Provider Domain — VNFs: Firewall, Router, PBX — vCPE — Customer Premises

PE: Provider Edge
DC: Data Center
VNF/PNF: Virtual/Physical Network Function
EVC: Ethernet Virtual Connection

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(4) Will SDN and NFV have an impact on the relation between OTT and telecommunications service providers? If this is the case, please present how SDN and NFV will alter the role and possibilities of OTT and telecommunications service providers.

No for Ethernet Leased Lines

- **For Ethernet Leased Lines, the connectivity service is point-to-point, point-to-multipoint or multipoint-to-multipoint. Therefore, access to the OTT player would need to be designed to have connectivity to the OTT facility and consequently be integrated into the network.**

(5) Do SDN and NFV have other regulatory implications?

Yes

- **From a regulatory perspective, the ordering, performance reporting and billing in the new context of highly dynamic services, will require processes that are standardized, transparent and broadly adopted to ensure that all actors receive equal treatment.**

- **For Ethernet Leased Line services, the development of such standards is being actively pursued by the MEF in its new Service Operations Committee with the active participation of European and International Service Providers and a broad range of other industry players.**

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Q&A