Distributed NFV

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Presented by

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Agenda

- Background on the Distributed NFV (D-NFV) Approach
- Virtualization at the Customer Site
- RAD's D-NFV Proposal: Customer-Site Virtualization

NFV: Network Functions Virtualization

NFV advocates virtualizing service-provider networking and IT functionalities using software hosted on general-purpose servers

Expanding NFV's Implementation Scope

Primarily Mobile Services

- Addressing and facilitating migration to LTE/LTE-A
- Functionality: ePC, IMS, PCRF,…

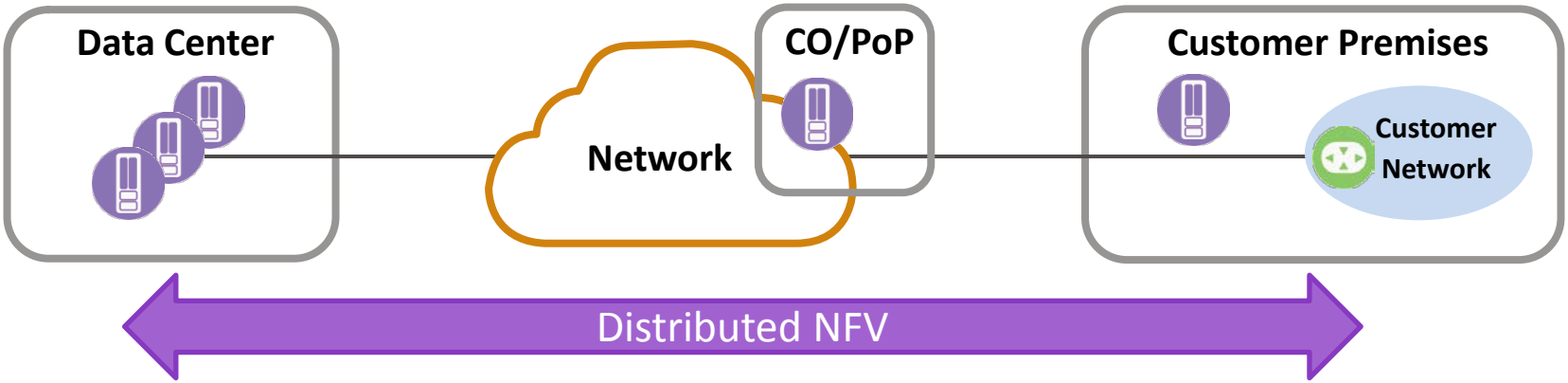
Networks & Enterprise Services

- New network capabilities
- Value-added services

NFV: The Distributed Model

The most prevalent approach to NFV concentrates functions in centrally-located data centers (DC) or network nodes (CO/POP)

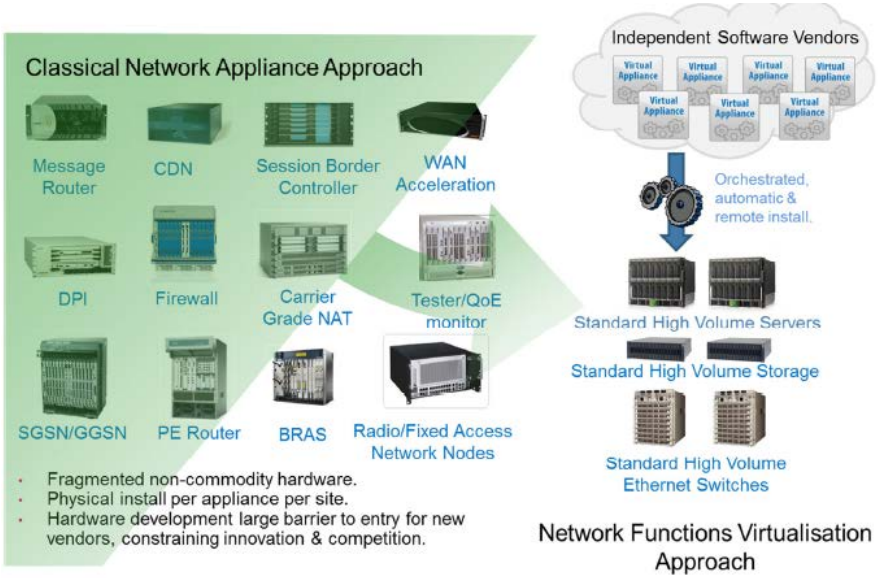
Distributed NFV allows service provider-controlled functions to reside anywhere – including at the customer premises



The D-NFV Approach: From *the* NFV White Paper…

Explicitly declared from the very beginning in the introductory NFV White Paper

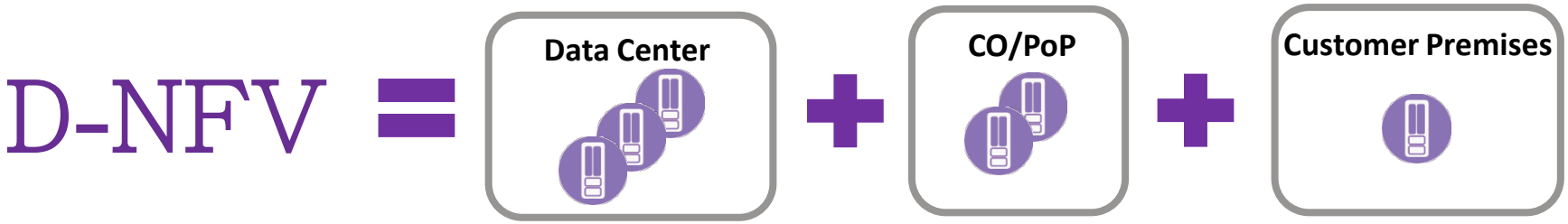
"…Leverage standard IT virtualization technology to consolidate many network equipment types onto industry standard high volume servers, switches and storage that can be located in ***DCs, Network Nodes and in the end-user premises."***[1]



[1] Network Functions Virtualization – Introductory White Paper, October 2012

…To New Documents by the ETSI NFV Industry Specification Group

- ***Terminology Paper***
  - Network Point of Presence: A location where a Network Function is implemented…Example of NPOP locations include central offices, **customer premises**, mobile devices, and data centers
- ***End-to-End Architecture Paper*** : One of NFV's objectives is to ensure greater flexibility in assigning VNFs to hardware
  - Software to be located at the most appropriate places, e.g., at **customer premises,** at network PoP, in central offices or data centres



Why *Distributed* NFV?

Distributed NFV bucks the trend of hosting all functionalities in centrally-located Data Centers

What is the rationale behind D-NFV ?

The following arguments make the D-NFV case:

- **Costs**
  - Networking vs. computing/IT resources

As well as:

- **Functions Feasibility**
- **Performance**
- **Policy Conformance**

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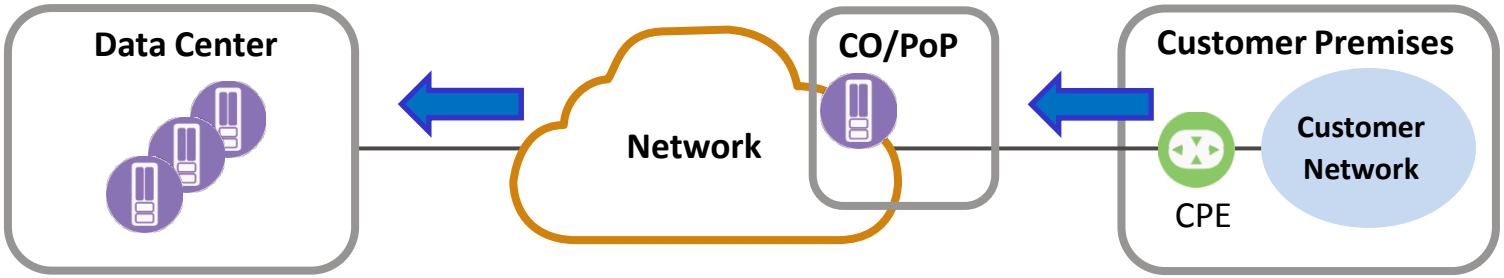
Virtualization at the Customer Site: CPE Virtualization

Re-locating CPE functionality in the network:

- Replace vendor-specific **embedded** functionality with…
- … a next-generation customer-site device, paired with **virtualized** functionality running in the network
  - some functionalities (OAM, QoS) remaining at the customer site

Addressed in the NFV ISG "Use Cases" document (Oct'13)

- Virtualization meaning: shared or/and run as VNF on VM infrastructure



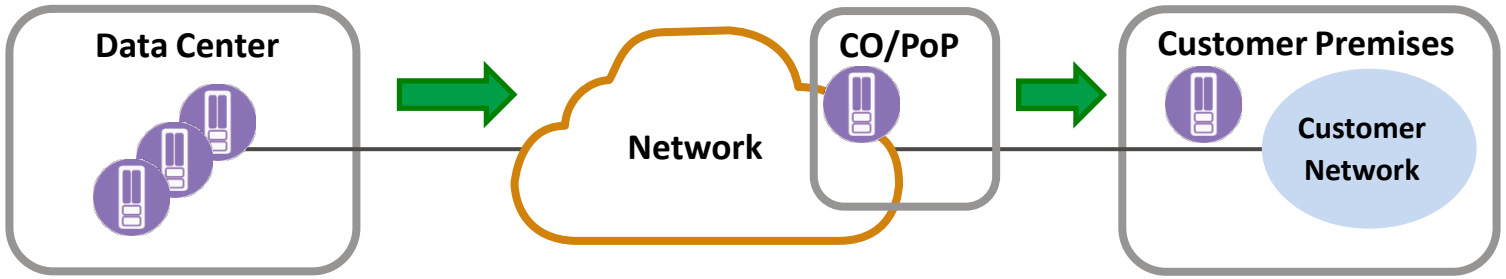
"Centripetal" NFV: From the customer site towards the network

Virtualization at the Customer Site: Distributed NFV

Enable D-NFV implementation beyond the datacenter

- Locating NVF at the most appropriate* places

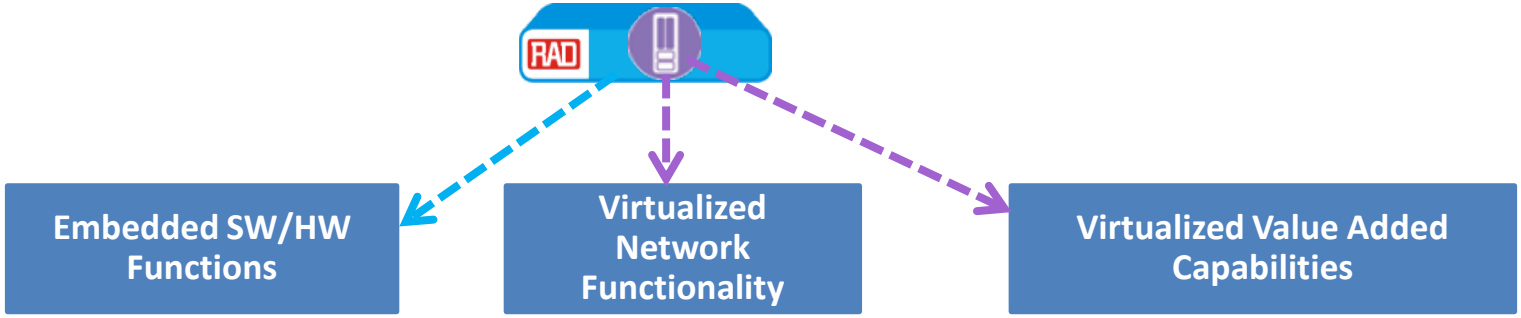
* - *Based on:* ***Feasibility, performance, cost, policy***



"Centrifugal" NFV: From the network towards the customer site

NFV at the Customer Site: Why?

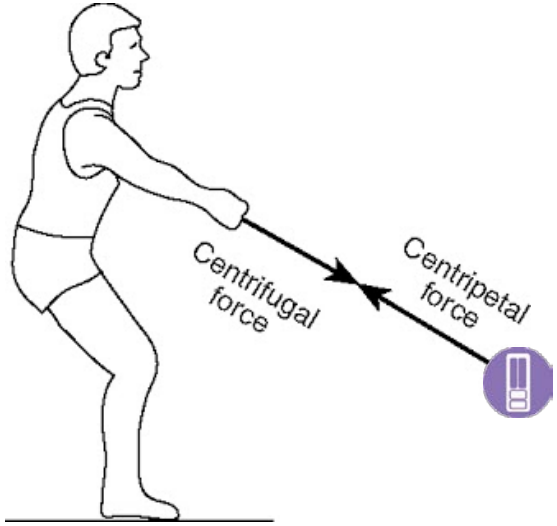
Criteria	Description
Feasibility	• Some functions must be located at the customer site, e.g., end-to-end security, traffic conditioning , encryption, WAN optimization
Performance	• Some functions perform better at the customer site, e.g., end-to-end QoS, application QoE monitoring • Some functions may degrade due to network constraints (bandwidth, delay, availability)
Cost	• Need for higher network performance and resiliency may lead to cost increase, even with data centers' economies of scale
Policy	• Some functions need to remain close to the customer due to corporate privacy, security and access policies • Regulatory restrictions (e.g., on moving data across jurisdictions)



Physics: Resultant Force

Once embedded functionalities are virtualized:

- Customer site functionalities are free to move towards the (data) center
- Functionalities conventionally located at the (data) center are free to move towards the customer premises



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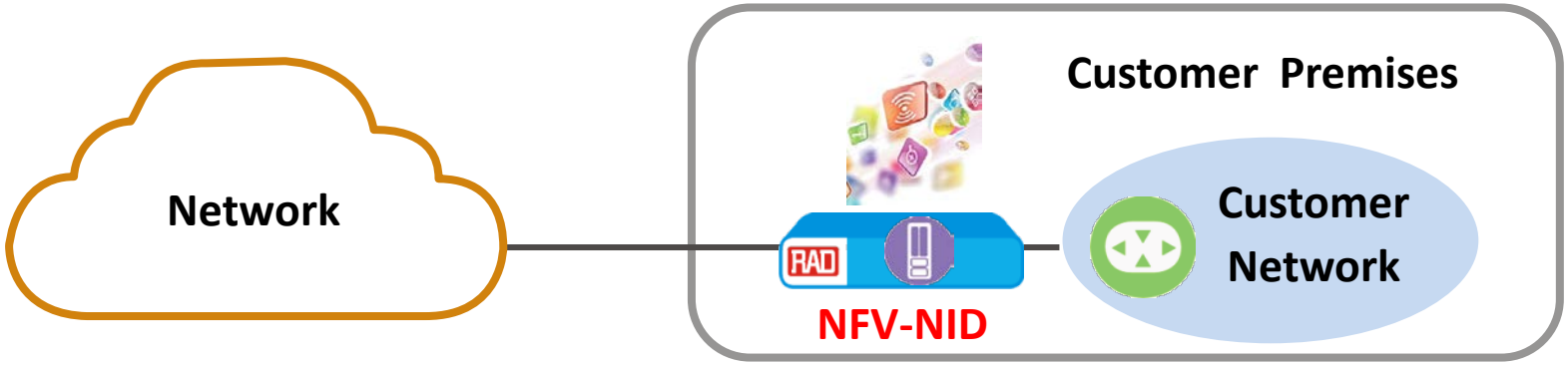
RAD's Solution

The solution that integrates SP-controlled network termination and virtual machine hosting:

L2/L3 NID with integrated standard x86 platform



- Application examples (by 3rd-parties or RAD's)
  - Firewall
  - Analysis tools (TCPdump, Wireshark)
  - Application awareness
  - IP telephony
  - WAN optimization

Customer-Site NFV Economics

Increased Revenues and Service Agility

- More premium services (SLA assurance, QoE, policy compliance)
- Reduce Time-to-Market (quicker time to revenue, less churn)
- Flexible service packaging
- Ubiquitous services over any access
- Higher service adoption ("try-and-buy" offering)

Reduced Costs

- Faster service introduction, activation and upgrade without truck-rolls
- Reduced equipment footprint at customer site
- Lower on-site installation, maintenance and energy costs
- Effective deployments

Thank You For Your Attention

www.rad.com