Network Slicing Roles and Interfacing in NFV Systems

Pedro Martinez-Julia

Network Science and Convergence Device Technology Laboratory, Network System Research Institute
National Institute of Information and Communications Technology
pedro@nict.go.jp

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Context

- Current networks are evolving towards <u>deeper virtualization schemes</u>, mainly reflected in NFV.

- **Slicing** physical and virtual resources in NFV is essential for <u>exploiting their capabilities</u>.

- **Plasticity** and **composability** provide enormous benefit to current and future NFV systems.

- **Ubiquity** of VNF hosting services, in distributed datacenters, adds <u>additional flexibility</u>.

- Also improved isolation, scalability, and reusability.

(*) http://sdn.ieee.org/newsletter/january-2017/challenges-of-network-slicing

Technical Viewpoints (I)

- From-Provider-to-Consumer:
  - NFV providers aim to **maximize** the exploitation of their resources.
  - NFV providers **slice** their infrastructure resources to get a larger set of <u>smaller resources</u> to "sell" to their customers:
    - The <u>link</u> between the <u>original and resulting resources</u> forms the main **key** of their **management operations**.
  - Sliced resources allow NFV providers to concentrate on their business:
    - Consumers will be responsible of embedding their infrastructure onto the new resource abstraction.

Technical Viewpoints (II)

- From-Consumer-to-Provider:
  - **NFV slice consumers** (NFV-O) aim…
    - …to meet the requirements of their networks (set by ASPs),
    - …reduce the cost of ownership and possibly operation,
    - …be able to adapt their networks to changing environments,
    - …adding and removing resources as they need,
    - …<u>as fast as possible</u>,
  - Therefore, they…
    - …obtain a **slice of resources**, possibly from different providers, possibly raw (e.g. L2 link) or processed (e.g. secured tunnel),
    - …and build an overlying service by integrating obtained resources as their main <u>business goal</u>.
  - The **two-hop link** that connects the final services to their slice and to the NFV provider is the **key** of their **management operations**.

- # NFV Provider (NFV-P):

  - **Owns** the <u>physical or virtual resources</u>:
    - Links, switches, routers, computers, etc.

  - **Slices** the NFV infrastructure / resources to get:
    - Arbitrarily smaller portions => **Increased granularity**.
    - Easy/fast topology/purpose changes => **Enlarged flexibility**.
    - Dynamically specified parameters => **Enlarged plasticity**.

  - Interacts with upper layers (NFV-O) and execute their **CRUD** requests on the sliced resources.

  - The **main concerns** of the NFV-P are:
    - Managing their physical and virtual infrastructure
    - Addressing slice requirements.
    - Improving resource efficiency and efficacy.

Functional Roles (II)

- NFV Operator (NFV-O):
  - Manages **slices of VNFs** to build managed (or self-managed) network systems for upper layers.
    - *Packages* VNF-P resources into **Composite Services**.
  - Its main concern is requesting **CRUD** on **VNFs**.

- NFV Controller (NFV-C):
  - Main software solution used by NFV-O to control their resources through their corresponding underlying infrastructure controllers.
  - Interacts with the **Slice Manager** of the NFV-P and the NFV Orchestrator to reflect **required adaptations**.

- Recursivity:
  - An NFV-O can slice its resources and act as an NFV-P, so they will support an NFV-P protocol/interface transaprently.
  - Example vertical structure:
    - **NFV-O <=> NFV-P + NFV-O <=> NFV-P + NFV-O <=> NFV-P**.

Functional Roles (III)

- Application Service Provider (ASP):

  – Interacts with the end users.

  – Requests the NFV-O the <u>instantiation</u> and required adaptation of their network services:

    - Translated to VNF hierarchies.

  – Its main <u>business goal</u> is centered on negotiating, managing, and meeting **end user requirements**.

Functional Roles (IV)

- Variations:
  - The same entity plays all the roles (NFV-P, NFV-O, ASP).
  - Two entities, bottom:
    - An entity plays NFV-P and NFV-O,
    - Other entity plays ASP.
  - Two entities, top (most common):
    - An entity plays NFV-P,
    - Other entity plays NFV-O, ASP.
  - Each role is played by a separated entity (best option).
- Multiple, vertical NFV-Os (recursivity) can be easily fomented on the last variation.

Viewpoints, Roles, and Interfaces

Interfacing Requirements
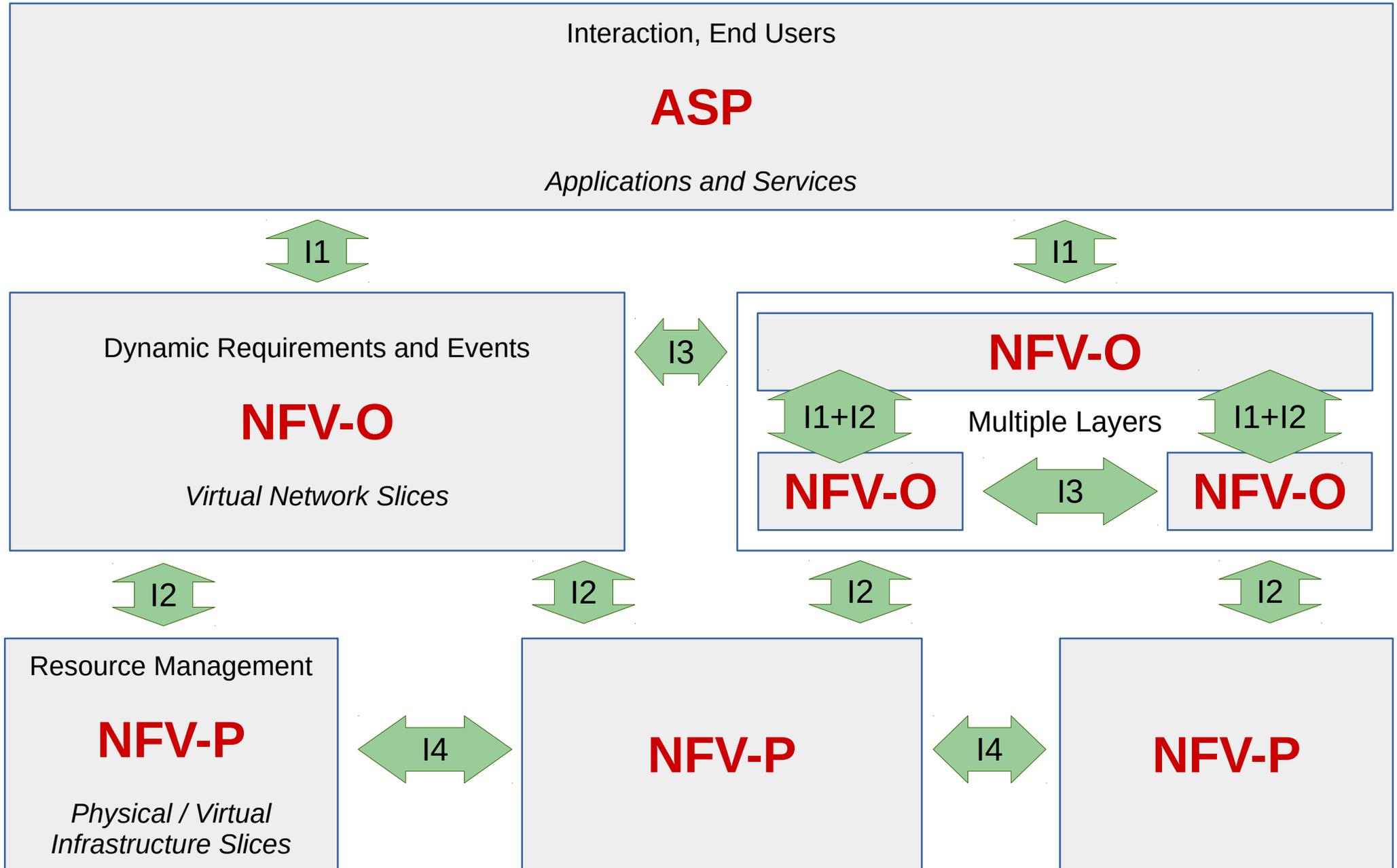
- NFV-O <=> ASP: **I1**
  - ASP requests to CRUD on VNs.

- NFV-P <=> NFV-O: **I2**
  - Allows the NFV-O to manage the "slice" of network resources from a provider.
    - Vertical interaction to request and instantiate (embed) virtual networks (VNs) onto the underlying physical infrastructure.
  - Possibly recursive when a NFV-O also acts as NFV-P.

- NFV-O <=> NFV-O: **I3**
  - Allows NFV-Os to coordinate:
    - Inter-operator tasks (e.g. resource migration) requested by ASPs.
    - Interconnection and interoperability among VNFs managed by different operators.
  - Horizontal (non-recursive) communication among operators.

(?) NFV-P <=> NFV-P: **I4**
  - Horizontal communication between providers to coordinate the interaction among slices of infrastructure resources, with some support for migrating VNFs among providers.

Thanks for Your Attention

Questions?

– EOF –