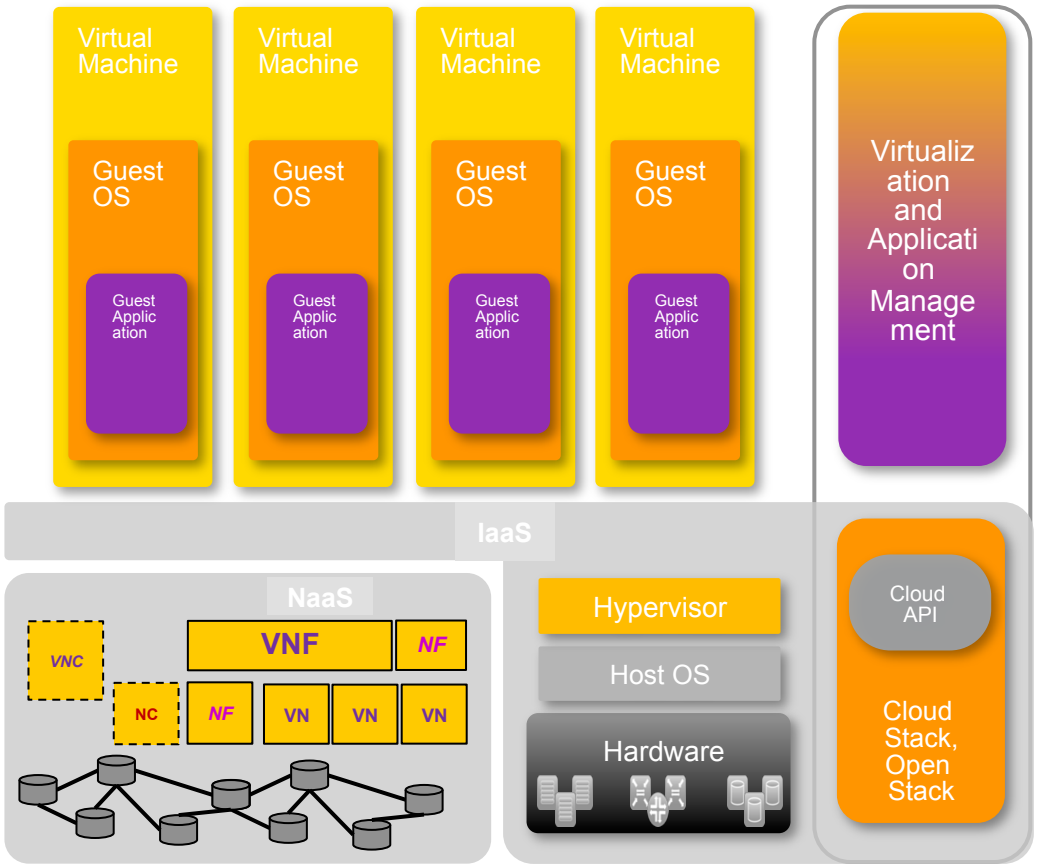
ETSI NFV Management and Orchestration - An Overview

Mehmet Ersue
ETSI NFV MANO WG Co-chair
(mehmet.ersue@nsn.com)

IETF #88, Vancouver, Canada

Virtualization as a Paradigm

Virtual Network Functions (VNF)

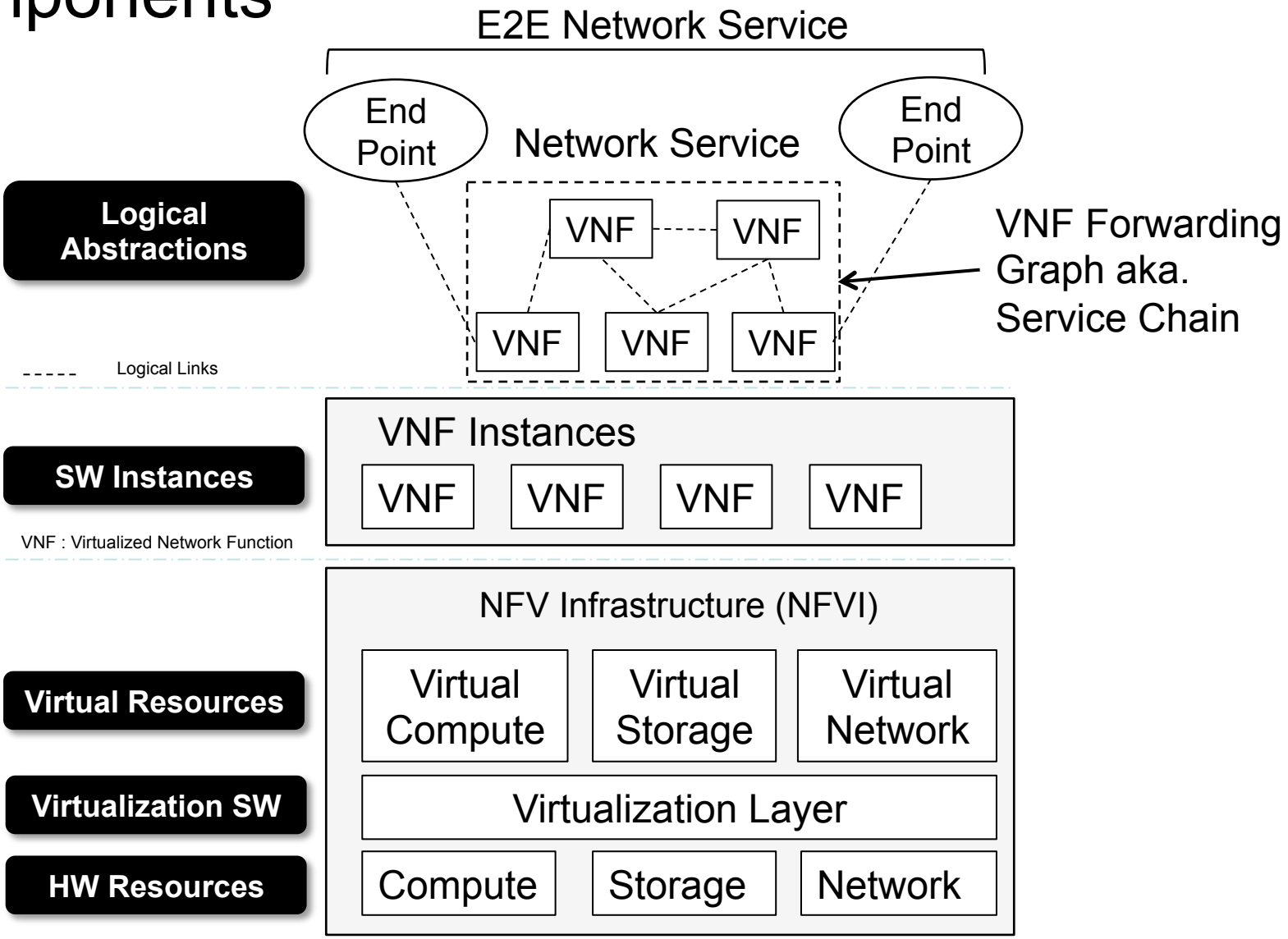


Examples of VNFs:

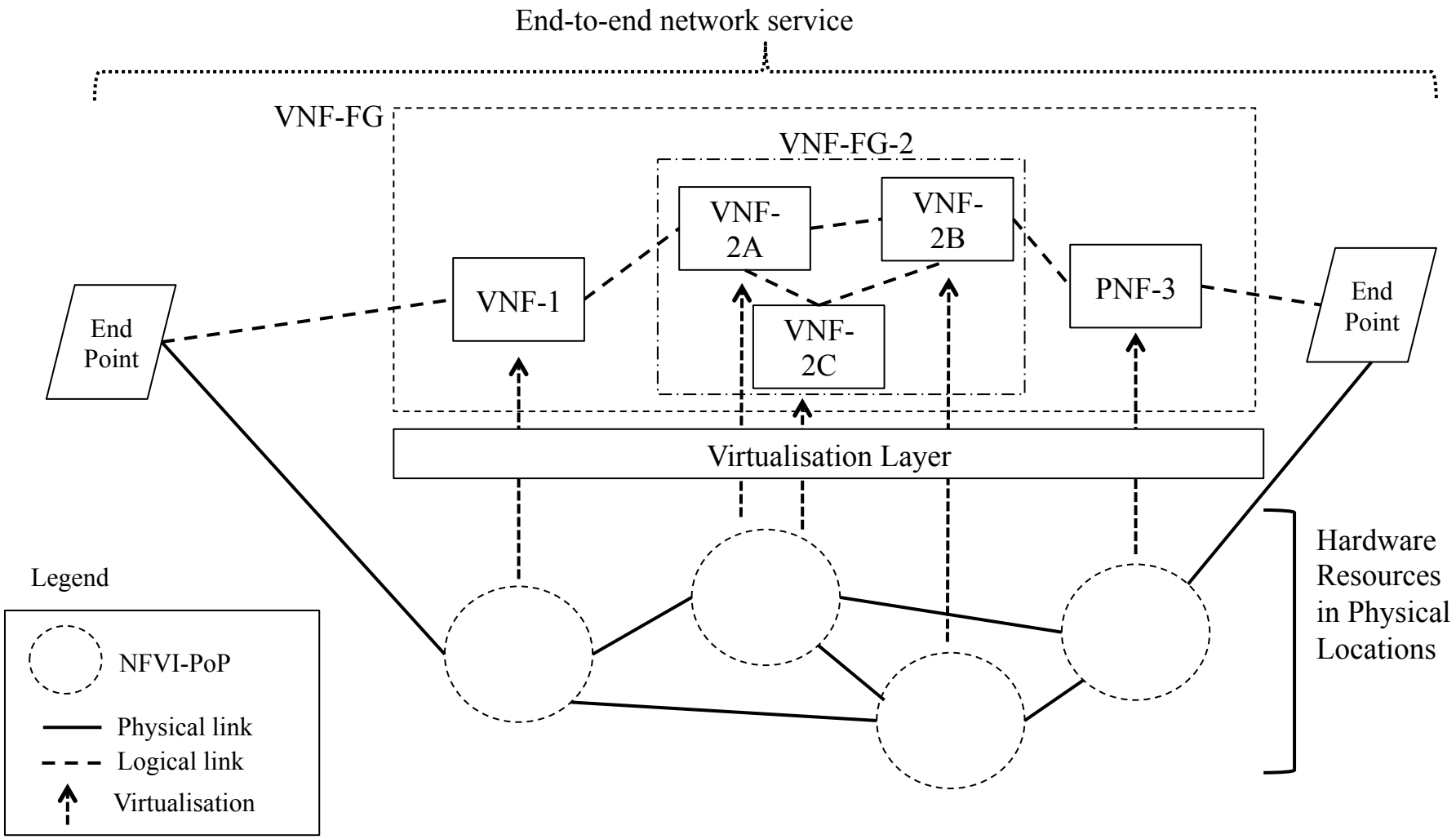
- Switching: BNG, CG-NAT, routers.
- Mobile network nodes: HLR/HSS, MME, SGSN, GGSN/PDN-GW, RNC.
- Home routers and set top boxes.
- Tunnelling gateway elements.
- Traffic analysis: DPI.
- Signalling: SBCs, IMS.
- Network-wide functions: AAA servers, policy control.
- Application-level optimisation: CDNs, Load Balancers.
- Security functions: Firewalls, intrusion detection systems.

NF: Network Function
VNF: Virtual Network Function
NC: Network Controller
VN: Virtual Network

Network Function Virtualization Components



Example of an E2E Network Service with VNFs and nested VNF Forwarding Graphs



Source: ETSI NFV E2E Architectural Framework

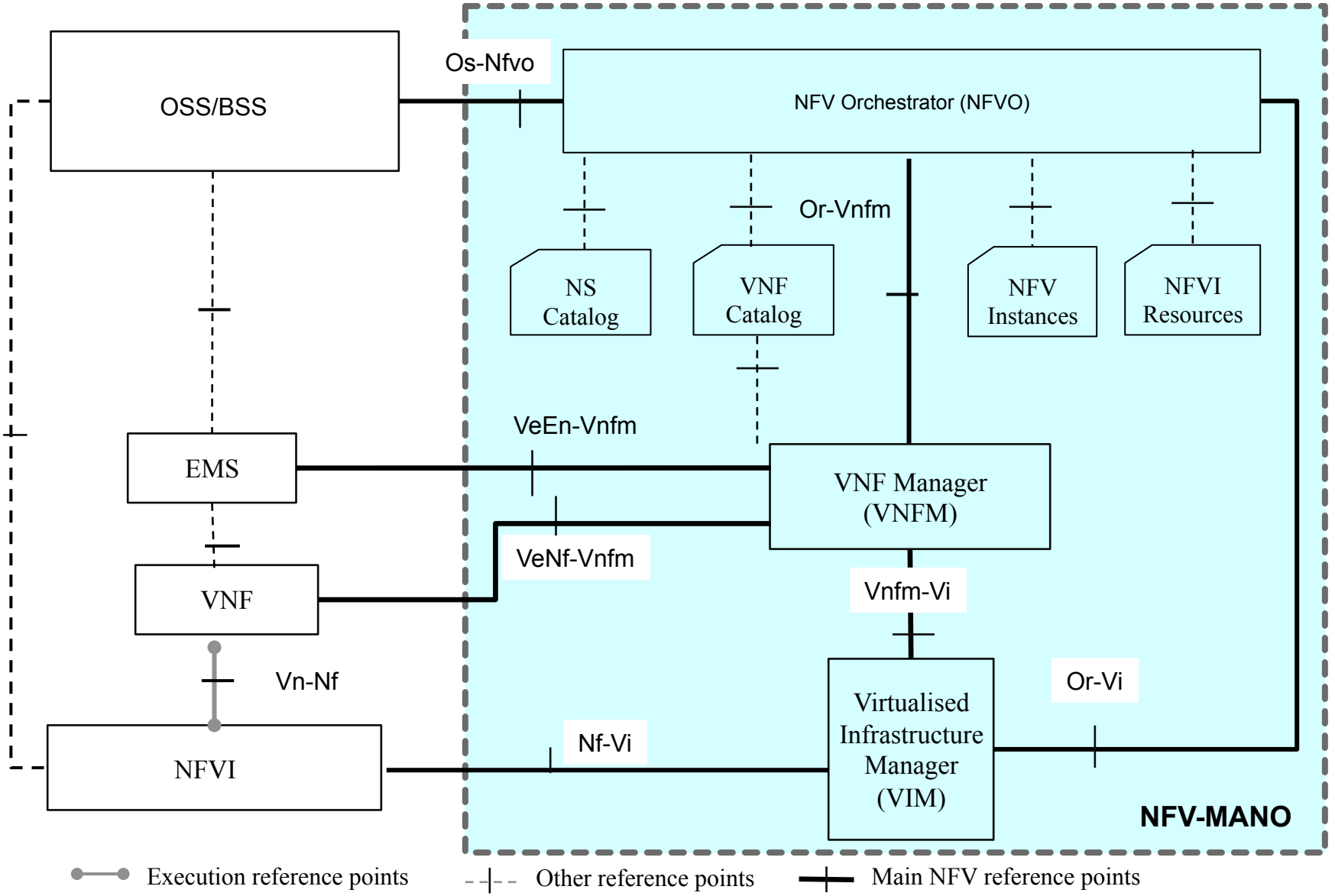
MANO Functional Blocks

- NFV Orchestrator:
  - on-boarding of new Network Service (NS), VNF-FG and VNF Packages
  - NS lifecycle management (including instantiation, scale-out/in, performance measurements, event correlation, termination)
  - global resource management, validation and authorization of NFVI resource requests
  - policy management for NS instances

- VNF Manager:
  - lifecycle management of VNF instances
  - overall coordination and adaptation role for configuration and event reporting between NFVI and the E/NMS

- Virtualised Infrastructure Manager (VIM):
  - controlling and managing the NFVI compute, storage and network resources, within one operator's infrastructure sub-domain
  - collection and forwarding of performance measurements and events

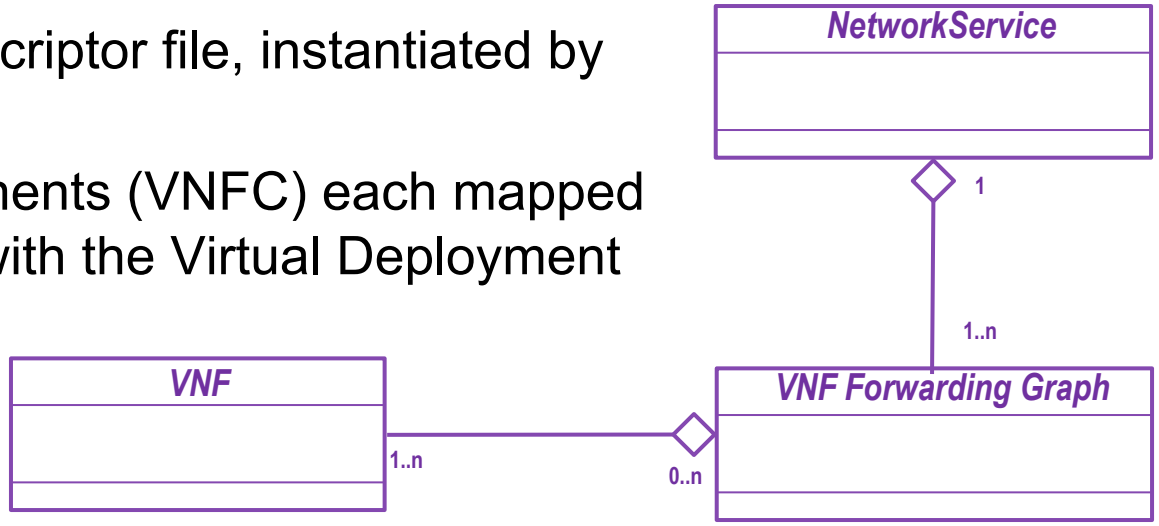
NFV Management and Orchestration Architecture



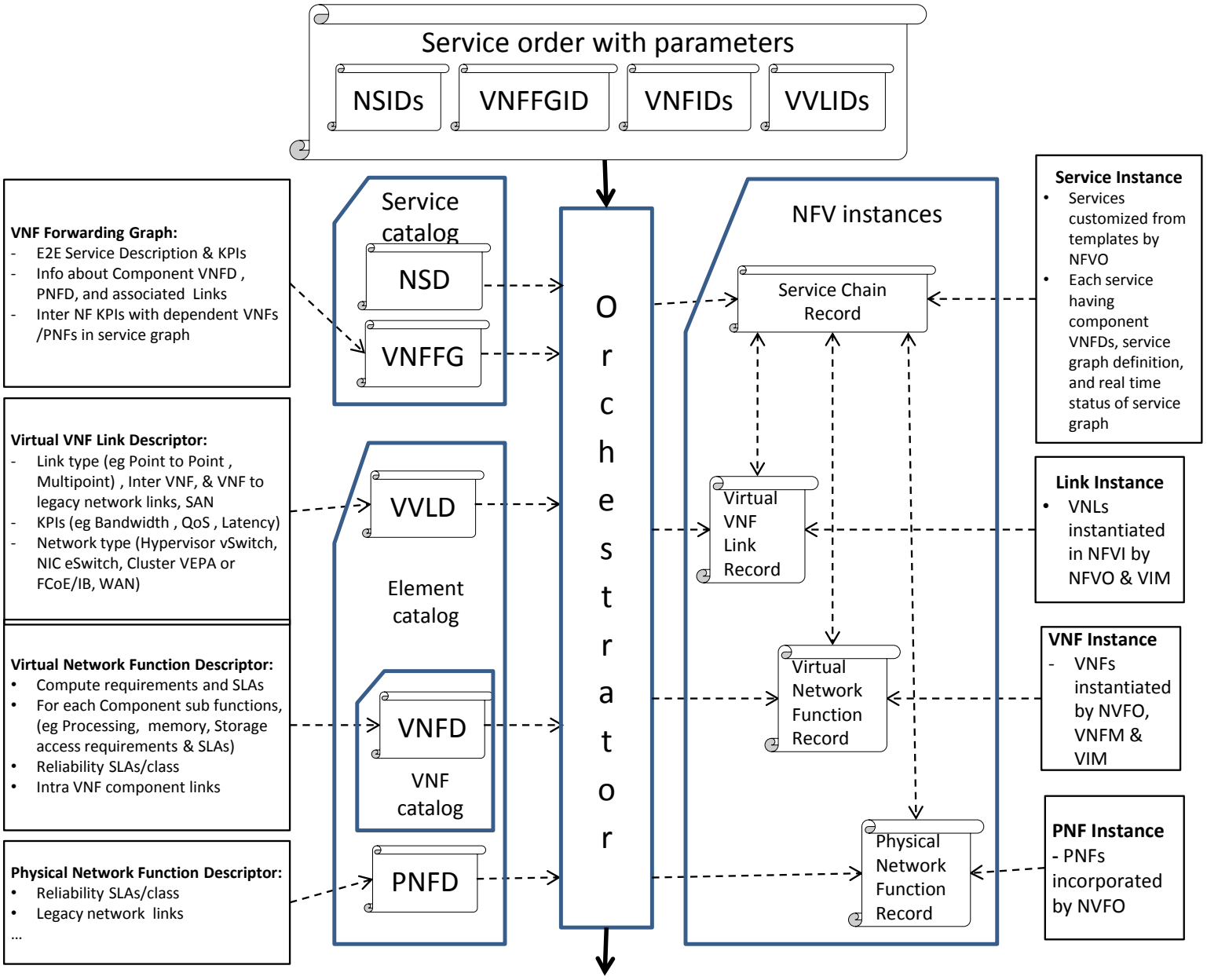
Source: ETSI NFV MANO WI document (ongoing work)

NFV Entities to deploy and manage

- Network Service (NS):
  - described by its descriptor file, orchestrated by NFVO,
  - may cover 1 or more VNF Graphs, VNFs and PNFs.
- VNF Forwarding Graph (VNF-FG):
  - described by its descriptor file, orchestrated by NFVO,
  - may cover VNF-FGs, VNFs and NFs
- VNF:
  - described by its descriptor file, instantiated by the VNF Manager,
  - covers VNF components (VNFC) each mapped to a VM described with the Virtual Deployment Unit descriptor.



Overview of MANO Descriptor Files



Source: ETSI NFV MANO WI document (ongoing work)

Overview of MANO Descriptor Files (ongoing work)

- Network Service descriptor:
  - E2E service description including supported SLA parameter, references to covered VNF-FG and VNFs, list of supported service monitoring parameters.
- VNF Forwarding Graph descriptor:
  - VNFFG description, VNFs and VNFDs needed for orchestration, reference to link information, description of Physical/Logical interfaces
- VNF Descriptor:
  - Links to scripts for initiation and termination, description of internal and external connectivity, dependencies between VNFCs.
  - VDU Description:
    - VM specification, required storage and computation resources, initiation and termination scripts, high avaliability redundancy model, scale_out/in limits.
- PNF Descriptor:
  - reference to link information, exposed external interfaces, PNF addresses, PNF status, systems subscribed for notifications

Overview of MANO Descriptor Files (ongoing work) (ctd.)

- Network Service Instance Descriptor:
  - Network service category , network attachment points, scaling methodology and policy, list of SLA descriptors, and monitoring parameter.
- VNF Instance Descriptor:
  - VNF category, information on external connectivity, scaling methodology and policy, list of SLAs, and the list of monitoring parameter.

VNF DESCRIPTOR MODEL (ongoing work)

Name	Cardinality	Description
VNFD_elements	1	This describes a set of elements related with the entire template (VNFD).
VNF_elements	1	This describes a set of elements related with a particular VNF instance.
VDU_elements	1…N	This describes a set of elements related to a particular VDU. Each VDU will have a set of its own elements.

Name	Cardinality	Description
Vendor	1	Specify the vendor generating this VNFD.
VNF_id	1	Specify the identifier (e.g. name)

Name	Cardinality	Description
VDU_no	1	Specify the number of VDUs present in this VNF. This can be used to validate VNFD.
Initiation	1	Defines the VNF initiation workflow including the functional script.
Termination	1	Defines the VNF termination workflow including the functional script
Graceful_Shutdown	0…1	Defines the VNF graceful shutdown workflow(VNF is pre-warned and can take actions before the shutdown), including the functional script.
Internal_conn	1...N	This element describes the internal connectivity/interfaces between this VDU and other VDUs of this VNF, including Key Quality Indicators (KQIs) for performance and reliability/availability.
External-conn	1...N	This element describes the external interfaces exposed by this VDU enabling connection with other VNFs.
Other lifecycle events	0...N	Defines VNF functional scripts for specific lifecycle events (e.g. scaling out/in)
Dependencies	0…1	Describe dependencies between VNFCs. Defined in terms of source and target VNFC, i.e., target VNFC "depends on" source VNFC. In other words sources VNFC must exists before target VNFC can be initiated/deployed,

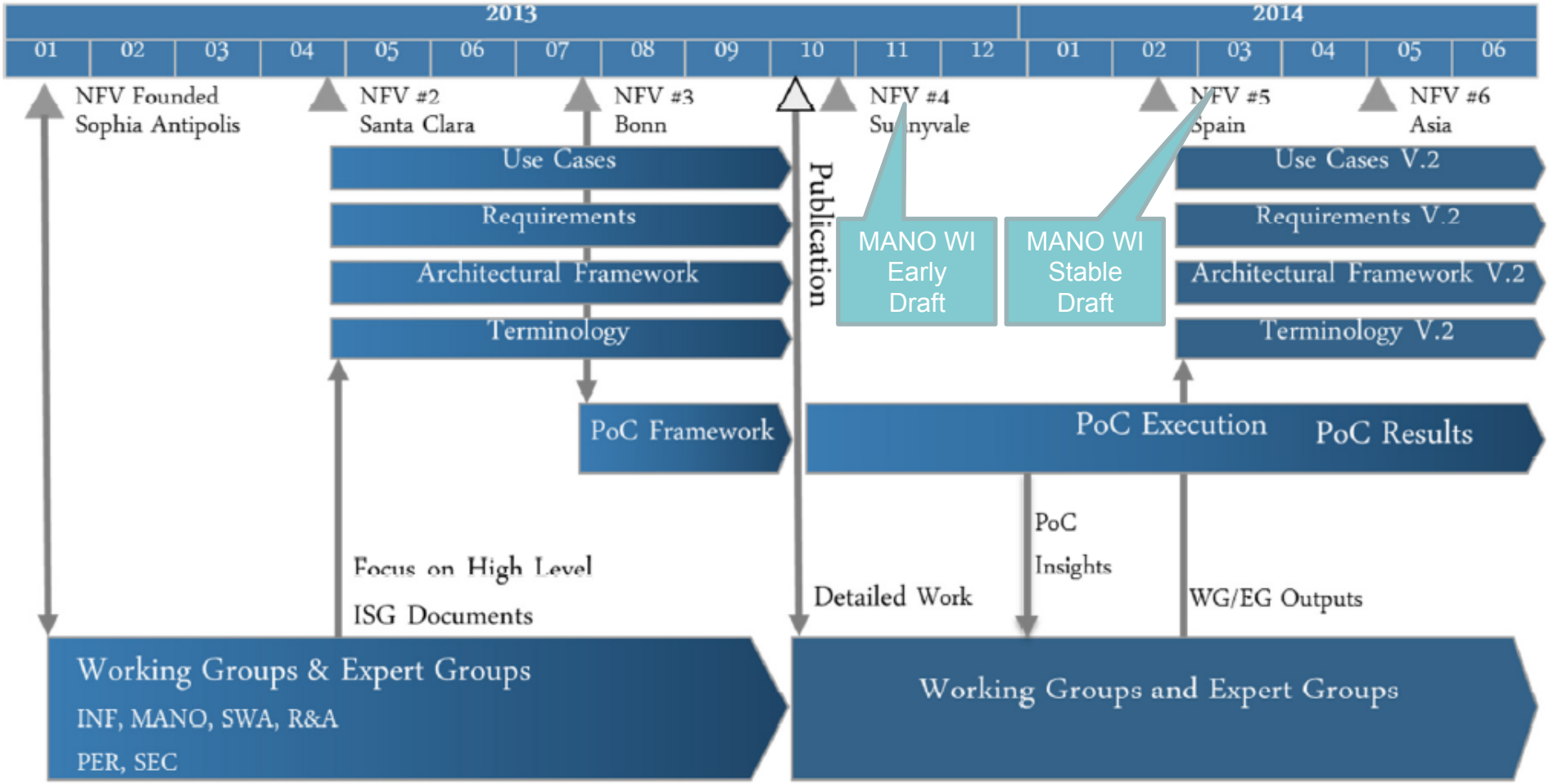
Name	Cardinality	Description
VDU_id	1	A unique identifier of the said VDU, including version functional description and other identification information. This will be used to refer to VDU when defining relationships between them.
VM_specification	1	This provides a VM Image or a reference.
Storage_req	0…1	Describes the required storage characteristics (e.g. size), including Key Quality Indicators (KQIs) for performance and reliability/availability.
Computation_req	0…1	Describe the required computation resources characteristics (e.g. processing power), including Key Quality Indicators (KQIs) for performance and reliability/availability..
Initiation	1	Defines the VDU initiation workflow including the functional script.
Termination	1	Defines the VDU termination workflow including the functional script
Graceful_Shutdown	0…1	Defines the VDU graceful shutdown workflow (VDU is pre-warned and can take actions before the shutdown), including the functional script.
Other constraints	0...1	Placeholder for other constraints.
High_avaliability	0…1	Defines redundancy model to ensure high availability examples include: **ActiveActive**: Implies that two instance of the same VDU will co-exists with continuous data synchronization. **ActivePassive**: Implies that two instance of the same VDU will co-exists without any data synchronization.
Scale_out/in	0…1	Defines minimum and maximum number of instances which can be created to support scale out/in.

Current Development in NFV MANO WG

- NFV MANO WG recently developed:
  - Network Service and VNF lifecyle management message flows:
    - including onboarding, instantiation, scaling and termination,
    - yet to do: VNF Forwarding Graph lifecyle management
  - Information elements for the entities VNF, VNFFG, NS and their instances,
- Current focus is on NFV operational management:
  - Fault and event management
  - planned: capacity planning, migration, etc.
- Provide gap analysis and recommendations to SDOs as well as open source organizations,
  - Collaboration for further development in selected organizations planned based on a cooperation on working group level.

GS: Group Specification

Timeline for ETSI NFV Work Programme



Source: ETSI NFV White Paper 2

References

- Published E2E Arch, REQ, Use Case, Terminology documents in ETSI NFV Open Area:
  - http://docbox.etsi.org/ISG/NFV/Open/Published/
- Published ETSI NFV white paper:
  - http://portal.etsi.org/NFV/NFV_White_Paper.pdf
  - http://portal.etsi.org/NFV/NFV_White_Paper2.pdf
- ETSI member area:
  - Current NFV MANO WG WI document: DGS/NFV-MAN001 (ongoing work)
    - http://docbox.etsi.org/ISG/NFV/MAN/70-DRAFT/MAN1/NFV-MAN001v0011.zip
  - ETSI NFV ISG portal:
    - http://portal.etsi.org/portal/server.pt/community/NFV/367?tbId=789
  - NFV MANO WG on ETSI portal:
    - http://portal.etsi.org/portal/server.pt/community/NFV/367?tbId=796