



**Network Functions Virtualisation (NFV);
Virtualisation Technologies;
Hypervisor Domain Requirements specification;
Release 3**

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Reference

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Foreword

This Group Specification (GS) has been produced by ETSI Industry Specification Group (ISG) Network Functions Virtualisation (NFV).

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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1 Scope

The present document provides requirements for the hypervisor domain as it pertains to an operator's network. It focuses on gaps between Network Functions Virtualisation (NFV) use cases and the industry state of art at the time of publication. Therefore requirements that are deemed to be supported by most hypervisor solutions at the time of publication are not repeated in the present document.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

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The following referenced documents are necessary for the application of the present document.

- [1] ETSI GS NFV 003: "Network Functions Virtualisation (NFV); Terminology for Main Concepts in NFV".
- [2] ETSI GS NFV-IFA 002: "Network Functions Virtualisation (NFV); Acceleration Technologies; VNF interfaces specification".
- [3] ETSI GS NFV-IFA 004: "Network Functions Virtualisation (NFV); Acceleration Technologies; Management aspects specification".
- [4] ETSI GS NFV-IFA 018: "Network Functions Virtualisation (NFV); Acceleration Technologies; Network Acceleration Interface Specification".
- [5] ETSI GS NFV-IFA 019: "Network Functions Virtualisation (NFV); Acceleration Technologies; Acceleration Resource Management Interface Specification".
- [6] ETSI GS NFV-SEC 012: "Network Functions Virtualisation (NFV); Security; System architecture specification for execution of sensitive NFV components".
- [7] Unified Extensible Firmware Interface Forum: "Advanced Configuration and Power Interface Specification (ACPI)".

NOTE: Available at <http://www.uefi.org/specifications>.

- [8] ETSI GS NFV-TST 008: "Network Functions Virtualisation (NFV); Testing; NFVI Compute and Network Metrics Specification".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] ETSI GS NFV-INF 004: "Network Functions Virtualisation (NFV); Infrastructure; Hypervisor Domain".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ETSI GS NFV 003 [1] and the following apply:

hypervisor: piece of software which partitions the underlying physical resources and creates Virtual Machines, and isolates the VMs from each other

NOTE: The hypervisor is a piece of software running either directly on top of the hardware (bare metal hypervisor) or running on top of a hosting operating system (hosted hypervisor). The abstraction of resources comprises all those entities inside a computer/server which are accessible, like processor, memory/storage, NICs.

hypervisor domain: general area for focus which includes hypervisors

NOTE: Other elements such as a vswitch can be implemented in the hypervisor domain.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI GS NFV 003 [1] and the following apply:

ACPI	Advanced Configuration and Power Interface
CD	Compute Domain
DOPFR	Dynamic Optimization of Packet Flow Routing
EPD	Extended Para-virtualised Device
eSwitch	embedded Switch
HD	Hypervisor Domain
IND	Infrastructure Networking Domain
INF	Infrastructure
MWAIT	Monitor Wait

NOTE: x86 Instruction Set Reference.

NFVI	NFV Infrastructure
NIC	Network Interface Controllers
RDMA	Remote Direct Memory Access
RDTSC	Read Time-Stamp Counter

NOTE: x86 Instruction Set Reference.

RDTSCP Read Time-Stamp Counter and Processor identifier

NOTE: x86 Instruction Set Reference.

VIM	Virtualisation Infrastructure Manager
VM	Virtual Machine
VN	Virtual network
VNFC	Virtualised Network Function Component
vRouter	virtual Router
vSwitch	virtual Switch

4 Hypervisor Domain Overview

Figure 4-1 describes the logical placement of the hypervisor domain, which is circled in dotted lines, within the NFV architectural framework. The hypervisor domain abstracts the hardware resources from the compute domain. The hypervisor domain overlaps with the network domain in that it can include virtual switch (vSwitch) and virtual router (vRouter) software elements and abstract network-related hardware resources provided by the compute domain such as network interface controllers (NIC) and embedded switches (eSwitch).

There is a direct reference point to the Virtualisation Infrastructure Manager (VIM) from the hypervisor domain.

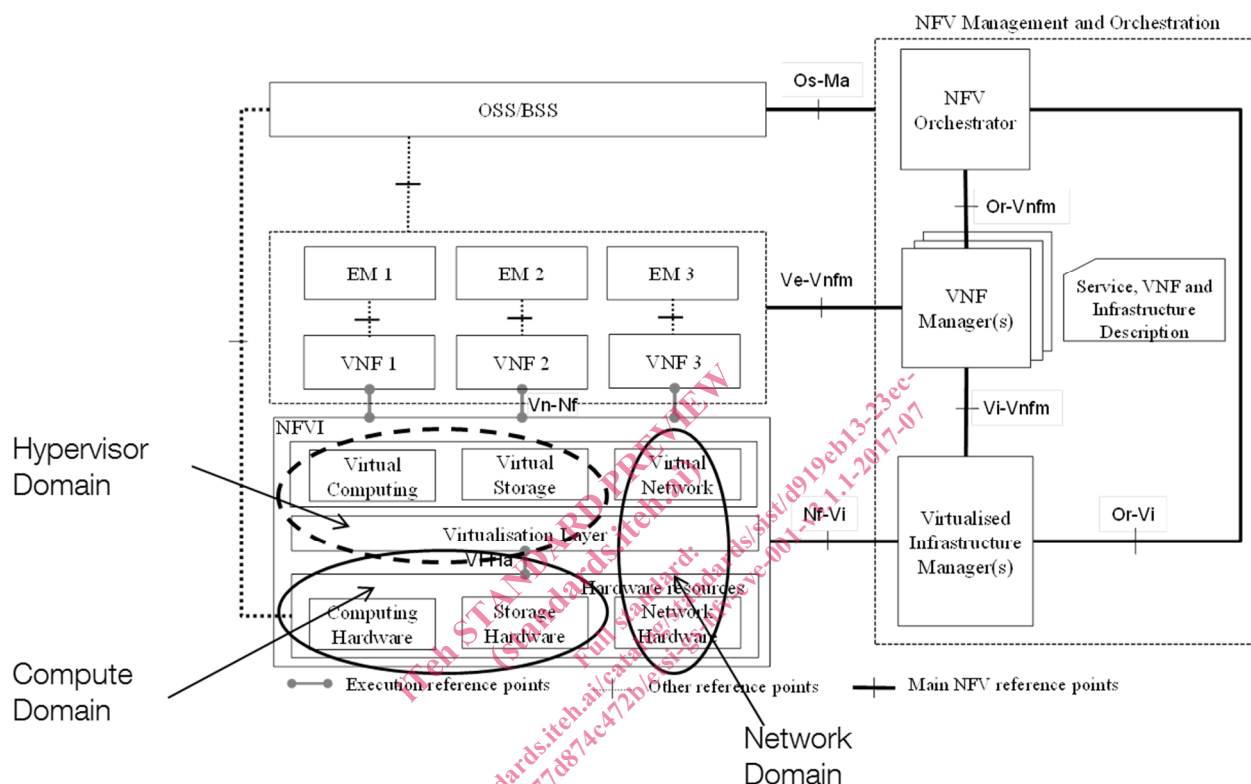


Figure 4-1: Logical placement of the hypervisor domain

The hypervisor domain itself is a software environment which abstracts hardware and implements services, such as starting a Virtual Machine (VM), terminating a VM, acting on policies, scaling, live migration, and high availability.

Figure 4-2 provides a more detailed view of the hypervisor domain and its reference points to the other elements of the architectural framework.

The following reference points are identified:

- The [Nf-Vi]/H reference point provides the interfaces to the VIM. This is where the requests for hypervisor services occur. Only the VIM shall interact with the hypervisor through these interfaces. Hypervisors shall not implement services autonomously unless within the context of the VIM applied policy.
- The [Vi-Ha]/Csr reference point provides the interfaces that the hypervisor pulls hardware information from and uses to create virtual hardware components which the VM utilizes.
- The [Vn-Nf]/VM reference point represents the execution environment provided by the NFVI to a VNF. A VNF is created essentially via one or more VMs. A VM is in essence software running a function, algorithm, application without being aware of the type, model or number of actual physical units 'underneath' the function, algorithm and/or application.

The purpose of the other reference points identified in figure 4-2 are described in table 1 of ETSI GS NFV-INF 004 [i.1].

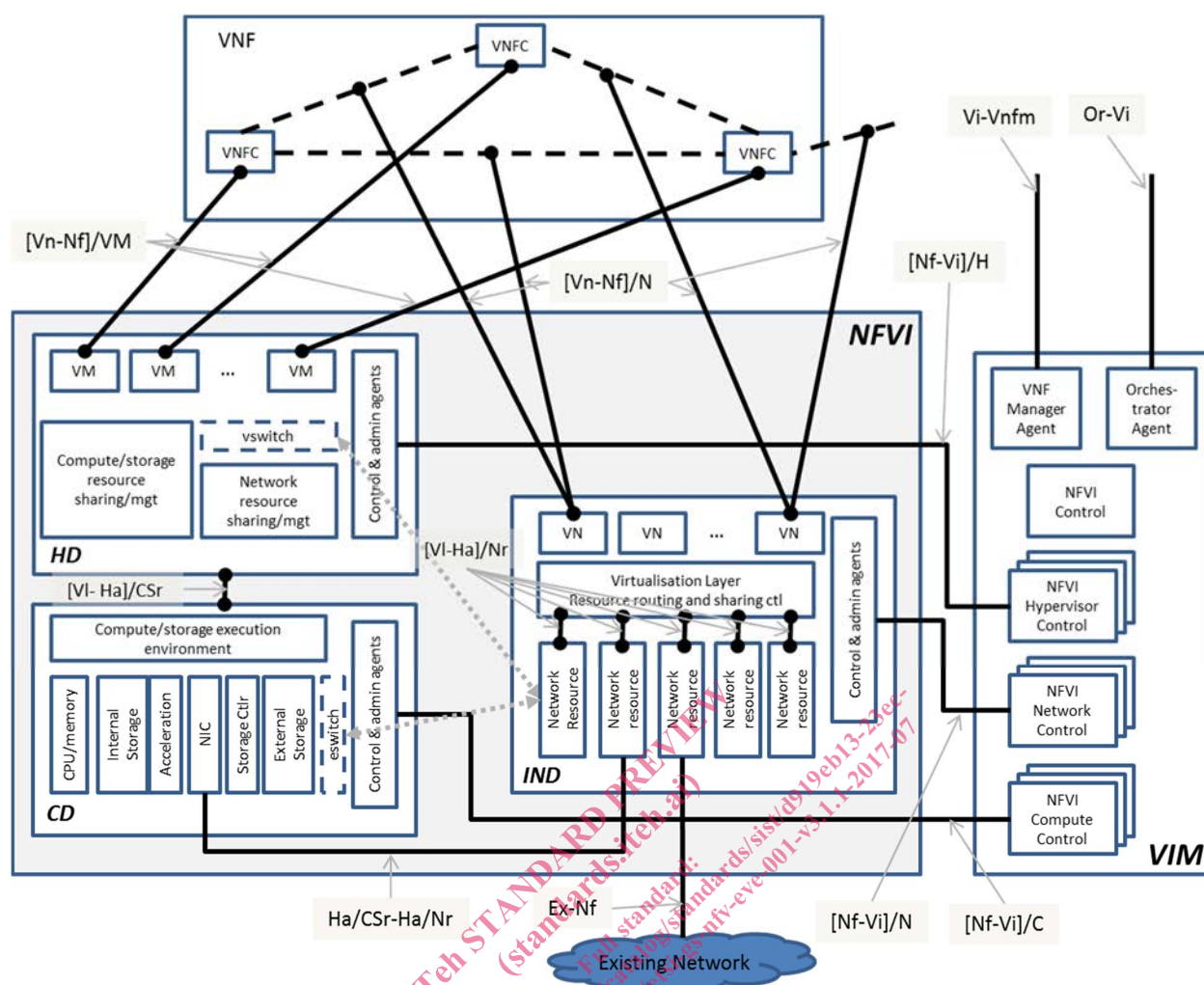


Figure 4-2: Hypervisor domain reference points

The general architecture of the hypervisor domain is shown in figure 4-3.

Figure 4-3 also illustrates how VMs interact with CPU cores, NICs and vSwitches. It highlights that high performance VMs can be given:

- exclusive access to specific CPU cores;
- exclusive access to allocated memory regions;
- direct access the physical NICs using direct memory mapped polled drivers and user mode instructions requiring no 'context switching';
- direct memory mapped polled drivers for interVM communications using user mode instructions requiring no 'context switching'.

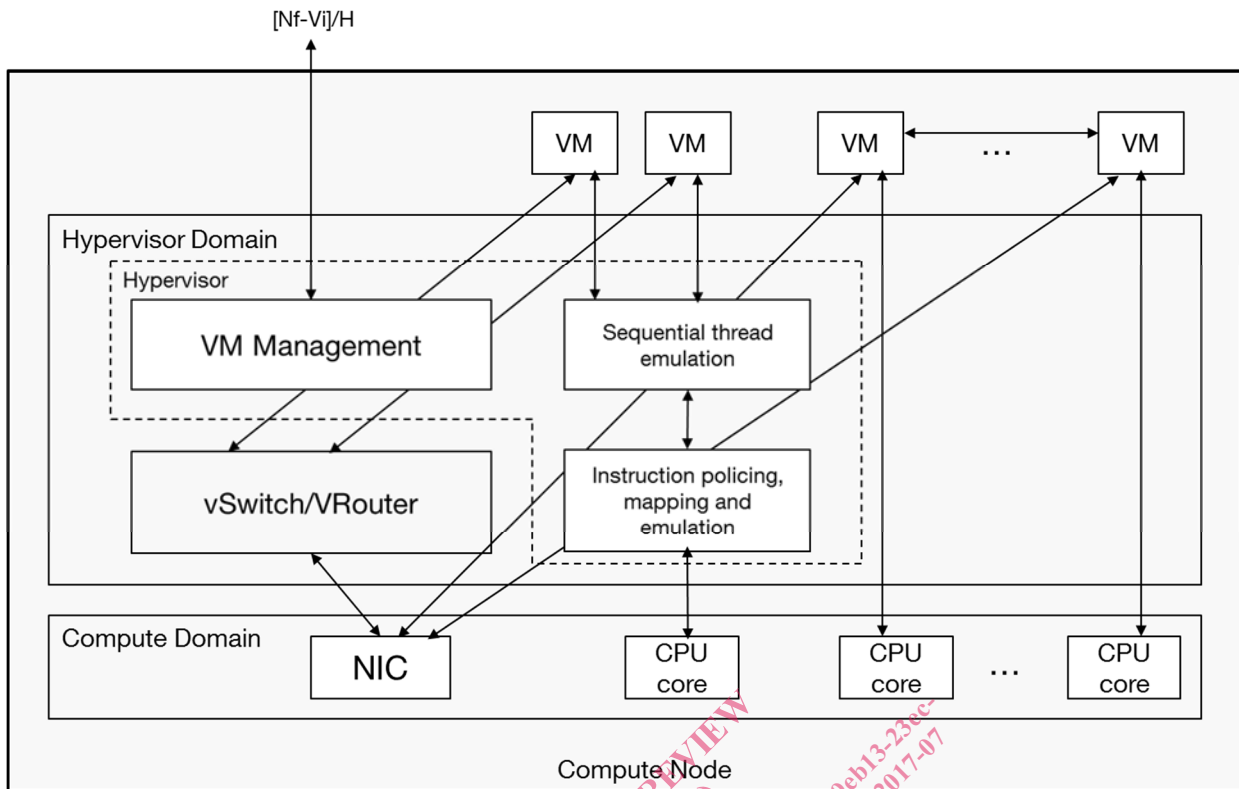


Figure 4-3: Example hypervisor architecture

5 Requirements of the Hypervisor Domain

5.1 Introduction

Some of the requirements on the hypervisor domain are implicitly placing requirements on the underlying hardware. If the hardware does not fulfil such requirements, then the corresponding hypervisor requirements cannot be fulfilled.

5.2 General Requirements

Table 5.2-1 specifies general requirements applicable to the hypervisor domain.

Table 5.2-1: general requirements

Numbering	Requirement description
REQ.HYP.GEN.001	The hypervisor shall support partitioning of the resources of a compute node.
REQ.HYP.GEN.002	The hypervisor should support nested virtualisation.
REQ.HYP.GEN.003	The hypervisor shall support acceleration requirements as specified in ETSI GS NFV-IFA 002 [2].
REQ.HYP.GEN.004	The hypervisor should support partitioning of the resources.