

Oracle Communications Policy Management

Virtual Network Function Overview and Direction (R12.2)

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Glossary

This section lists terms and acronyms specific to this document.

Acronym/Term	Definition
CMP	Configuration Management Platform
Guest	The VM running on the Host server.
HA	High Availability
HDD	Hard Disk Drive
Host	The server on which the VM (Guest) is running.
KPI	Key Performance Indicator
MPE	Multimedia Policy Engine
NFA	Network Function Agent
NFV	Network Function Virtualization
OAM	Operations, Administration and Management
PCRF	Policy and Charging Rules Function
PDP	Packet Data Protocol
PFE	Policy Front End
RAM	Random Access Memory
vCPU	Virtual CPU
VM	Virtual Machine
VNF	Virtual Network Function
VNFC	Virtual Network Function Component (MPE, PFE, VMs)



Introduction

Oracle Communications Policy Management is a highly scalable and robust 3GPP PCRF system that supports 3G, 4G, IMS, VoLTE, VoWiFi, and Fixed Mobile Convergence. ORACLE COMMUNICATIONS POLICY MANAGEMENT is the leading independent policy vendor and interoperates with commonly deployed GGSNs, PGWs, DPs, TDFs, P-CSCFs, SDPs, Application Servers, OTT Gateways, OCSs and HSSs.

When deployed on bare metal servers, ORACLE COMMUNICATIONS POLICY MANAGEMENT components (MPE, PFE and CMP) are available on a well-defined set of servers. In addition, each component can be deployed as a Virtual Network Function Component (VNFC). This enables Oracle Communications Policy Management to run on a broad range of hardware configurations.

While adding flexibility, virtualized deployment increase complexity and associated costs. To minimize the impact, Oracle has introduced the Network Function Agent (NFA). The new function adds automation to simplify the process of deploying, modifying and terminating PFE and MPE clusters.

This paper outlines the Oracle Communications Policy Management virtualized deployment information including supported hypervisors, NFV performance testing, and current deployment options. It also provides an introduction to NFA and summarizes Oracle's direction.

Oracle Communications Policy Management as a Virtualized Network Function

A Policy Management system consists of three components that can operate independently with different lifecycles (instantiate and deploy, scale, turn down). The Policy Front End (PFE) enables communication with Policy Control & Enforcement Functions (PCEF), Traffic Detection Functions (TDF) and Application Functions (AF). The Multimedia Policy Engine (MPE) performs policy decisions based on these communications and interacts with User Data Repository (UDR) or Subscriber Profile Repository (SPR) and Online Charging System (OCS). The Configuration Management Platform (CMP) performs the role of an Element Management System (EMS). Each component can run directly on specified hardware or as a guest under the supported hypervisors.

Oracle Communications Policy Management operates in two modes: high availability or geo-redundant configuration. In the high availability mode, each cluster consists of an active and standby server. In geo-redundant systems, each PFE and MPE cluster includes three servers, with active and standby servers at a single site, and a third server located at geo-redundant site.

Oracle Communications Policy Management can run as a guest on the following hypervisors with the associated Virtual Infrastructure Managers, using the following minimum release levels:

- KVM (qemu-kvm-1.5.3-105.el7_2.4)/Oracle Openstack Oracle Linux 2.0 (based on Kilo release)
- VMware ESXi version 5.5/VMware vSphere
- Oracle Virtual Machine Server version 3.3/Oracle Virtual Machine Manager

To provide scaling guidelines, Oracle validates Oracle Communications Policy Management operation on Oracle X5-2 and HP Gen9 servers using a NFV reference profile which specifies the Virtual CPU (vCPU), memory (RAM), Hard Disk Drive (HDD) sizing and virtual NICs which are available to the VM. The profile definition is independent of which hypervisor and VIM is used. The Oracle Communications Policy Management VNFC reference profile definition is listed in Table 1.

Component	Profile
CMP, PFE or MPE	12 vCPUs, 60GB RAM, 108GB HDD, and 6 vNICs

Table 1: Oracle Communications Policy Management VM Reference Profile for Production

Oracle validates the performance and capacity on each server. *Capacity* is determined by the available memory. MPE capacity is measured by the number of concurrent sessions supported, while PFE capacity is measured by the number of bindings. For a VM with 60 GB of RAM, the following subscriber capacities are supported when using the reference profile:

- PFE: 20 million bindings
- MPE: 5 million sessions

Performance is measured in transactions per seconds (TPS) for both MPE and PFE. The performance can vary based on both the selected hypervisor and the underlying hardware. These results utilize a representative call model derived from customer experience using the reference profile. The call model that was used in virtualized Oracle Communications Policy Management benchmarking includes a distribution of transactions on Gx, Rx, Sd, Sy, and Sh 3GPP interfaces. Performance testing results are summarized in Table 2.

Server Hardware	Hypervisor	PFE Performance per Guest	MPE Performance per Guest	Number of VM Guests per Server
Oracle X5-2	KVM	22,000 TPS	3,400 TPS	4
Oracle X5-2	VMware	38,000 TPS	4,500 TPS	4
Oracle X5-2	OVM	29,000 TPS	3,500 TPS	4
HP BL460 (Gen9)	KVM	26,000 TPS	3,500 TPS	4
HP BL460 (Gen9)	VMware	29,000 TPS	3,500 TPS	4

Table 2: Performance using Reference Profile

Operators can also run Oracle Communications Policy Management on different hardware servers, or can use different profiles. In this case the operator can validate the performance and capacity independently or can use Oracle Consulting Services to perform this validation.

Oracle Communications Policy Management Automation using Network Function Agent (NFA)

While virtualization reduces hardware costs by allowing multiple applications to reside on the same physical server, introducing virtualization increases complexity and the associated operational costs. *Automation* reduces the number of manual steps required to deploy new instances of Oracle Communications Policy Management components, allowing new clusters to be brought up more quickly and with less chance of error.

Oracle Communications Policy Management automation is provided by the *Network Function Agent (NFA)*. This Oracle Communications Policy Management component operates in conjunction with CMP to reduce the complexity of deploying new (or removing) PFE or MPE clusters running as VM guests. Oracle Communications Policy Management NFA conforms to ETSI's Management and Network Orchestration (MANO) framework, which is the evolving standard for NFV automation and orchestration depicted in Figure 1. NFA performs the role of the *VNF Manager* defined by this architecture, while CMP is enhanced to automate the Element Management (EM) functions required to deploy new virtual clusters.

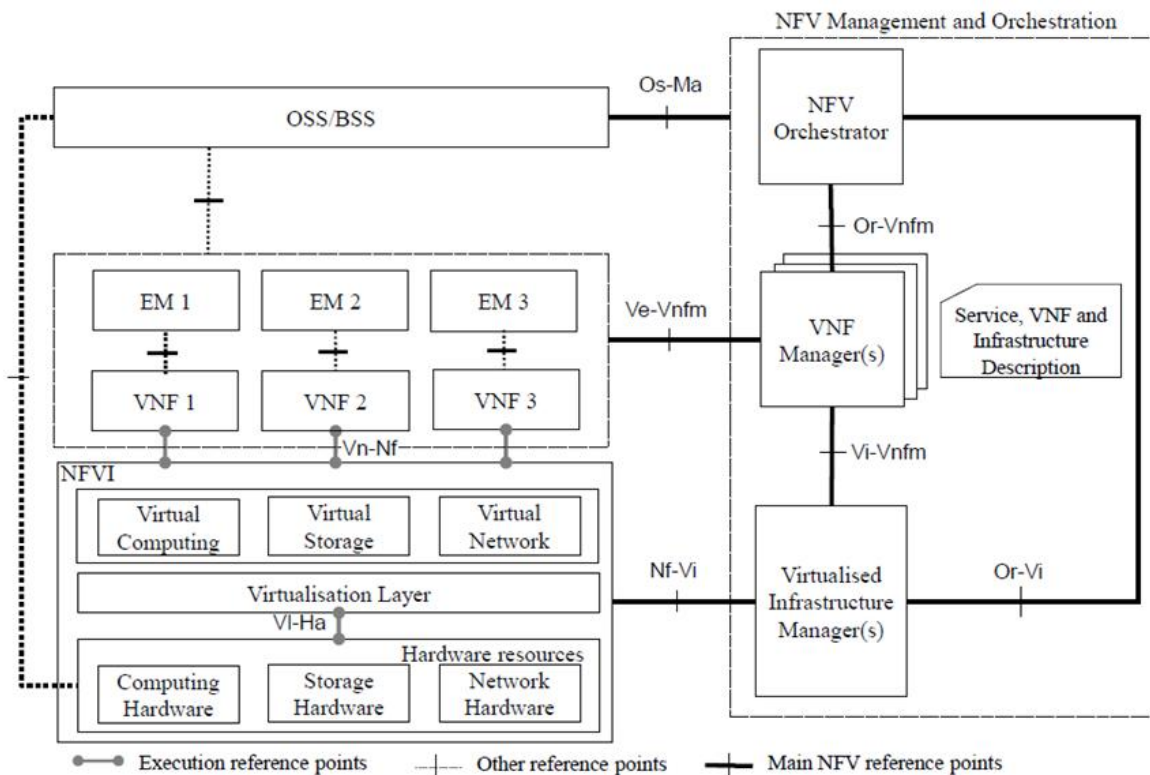


Figure 1: MANO Framework

As shown in Figure 2, NFA works with CMP and the VIM to speed up deployment of new PFE or MPE clusters. Under operator control, OpenStack allocates resources for new PFE or MPE instances, places them onto appropriate hosts, configures these components based on Openstack catalog information and adds them into the Oracle Communications Policy Management system topology. Using NFA, you can streamline the steps required to perform tasks such as:

- Create an individual server instance, high-availability cluster or geo-redundant cluster
- Add an additional server to migrate from a high-availability to a geo-redundant deployment
- Terminate a server or cluster
- Upgrade to a new release by sequentially deleting each server instance in a cluster and creating a new instance which runs the upgraded software

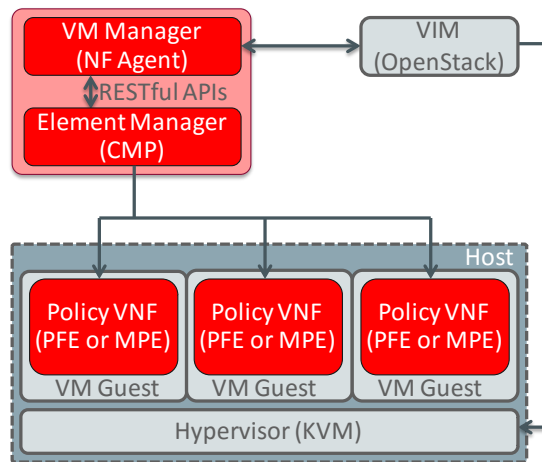


Figure 2: NFV Automation Overview Using NFA

NFA works in conjunction with CMP and the VIM to create new PFE and MPE guests as follows:

- Oracle Communications Policy Management systems profiles and images are populated in the OpenStack catalog using the following steps:
 - The PFE and MPE *software images* are loaded into the VIM
 - The VNF *profiles* are defined to within the VIM.
 - The Openstack resources which can be used by Oracle Communications Policy Management are grouped into Availability Zones and Security Groups
- Using standard OpenStack Compute API or HEAT Template interfaces, you create a new (or modify an existing) cluster by:
 - Choosing the desired cluster type (high availability, geo-redundant or individual server)
 - Selecting the software image, resource profile and affinity/security zones from the OpenStack catalog options
 - Providing initial required server configuration such as the instance name, DNS server and NTP server.
- After the VIM creates the instances, NFA instructs CMP to add the new servers into its Topology database. The operator then uses CMP to provide additional information such as associating a newly created MPE with an existing PFE, and assigning virtual IP addresses such as signaling (SIG-A).

While NFA runs as a separate process, the user interface is integrated into CMP. This approach provides a single GUI interface for all management, while enabling other authorized tools such as network service orchestrators (NSOs) to interface with the NFA using open RESTful APIs in the future.

NFA has been verified with Oracle OpenStack v2 (Kilo) as well as the OpenStack Liberty and Mitaka releases.



Direction

Introducing the NFA to simplify instantiating new Oracle Communications Policy Management components in a KVM/OpenStack environment is an important step towards integrating Oracle Communications Policy Management into orchestrated NFV deployments. Oracle is looking to enhance NFA automation capabilities by:

- Adding support for other virtual environments (hypervisors and VIMs).
- Further automating the process of deploying new instances by automatically mapping the service attributes, such as by dynamically assigning a Configuration Templates.
- Deploying and terminating new PFE and MPE instances based on capacity (sessions and bindings) or performance (TPS) requirements,
- Deploying new Oracle Communications Policy Management systems (CMP, PFE and MPEs) to support new customers and opportunities.
- Enabling external orchestrators to instantiate, modify or terminate PFE and MPE instances by exposing an open RESTful API.

Summary

Oracle Communications Policy Management can be deployed in virtualized environments using KVM, VMware, and OVM hypervisors as well as on specific bare metal servers. Oracle tests and validates the performance of the defined Oracle Communications Policy Management VNFC profiles on combinations of hypervisors running on selected hardware. In addition to this, operators can run Oracle Communications Policy Management on other hardware platforms or using profiles using the specified hypervisors. In this case the service provider should validate the performance of the virtualized system in their labs and production environments or can optionally use the Oracle Consulting Services team.

For KVM/OpenStack environments, Oracle Communications Policy Management's Network Function Agent (NFA) simplifies the process of adding, modifying and removing virtual servers and clusters. NFA can communicate with multiple KVM/OpenStack VIMs and integrates with CMP, allowing customers to easily take advantage of this important capability.

Appendix A: Entry Level and Lab Systems

Entry Level System

Oracle Communications Policy Management provides an Entry Level Oracle Communications Policy Management System for small operators and lab testing. This system is deployed in Virtual Machines on a pair of Oracle X5-2 RMS systems executing Oracle Enterprise Linux with the KVM hypervisor, as a fully functional, highly available, minimal footprint solution. Each server includes one CMP, one PFE and two MPEs. The high availability (two servers per cluster) mode is shown in Figure 3. A third server can be added to support geo-redundancy. Each component uses the Oracle Communications Policy Management VNF reference profile.

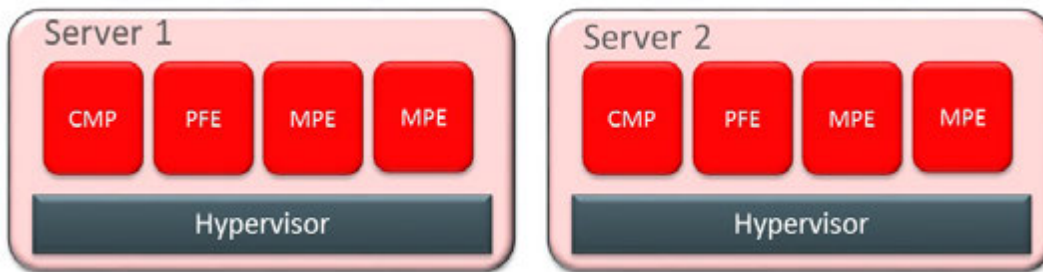


Figure 3: Entry Level Oracle Communications Policy Management Configuration

Lab System

For customers looking to run Oracle Communications Policy Management in a lab on a system with a smaller CPU and memory footprint, Oracle supports a simpler configuration for which can be used for functional testing, as shown in Figure 4:

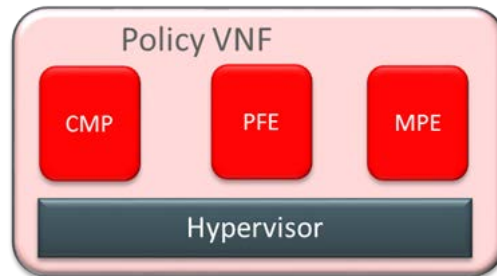


Figure 4: Lab System Configuration

All servers within a cluster must be configured with the same virtual profile. The cluster also cannot be a mixture of bare metal and VM-based servers. The profile for lab configuration is shown in Table 3.

Component	vCPU	RAM	HDD	vNIC
MPE, PFE or CMP	4	8GB	75G	4

Table 3: Virtualization Profile for Lab System

This configuration has been tested on Oracle X3-2, Oracle X4-2, Oracle X5-2, HP Gen8, and HP Gen 9 with KVM, OVM and VMware hypervisors. (Not all hypervisors are supported on all hardware.) It is recommended that feature testing using this lab configuration be performed using the high availability (dual server) mode.



Appendix B: Hardware Validation

Oracle Communications Policy Management operates on bare metal or as a VM guest. VNF performance shown in this paper reflects testing performed using the VNF reference profile on the following servers:

- Oracle Server X5-2 rack-mounted server
 - CPU: 72x Intel® Xeon® CPU E5-2699 v3 @ 2.30GHz
 - Number of hyperthreaded vCPU: 72
 - RAM: 256 GB
 - HDD: 2x HGST (1.2 TB each)
 - NICs: 10GbE SFP+ NIC with minimum of 2 ports, or 10GbE RJ45 NIC with minimum of 2 ports
- HP BL460C (Gen 9) blade server
 - CPU: Two 14-core E5-2600v3-series Intel® Xeon® Processors
 - Number of hyperthreaded vCPUs: 56
 - RAM: 256 GB
 - HDD: 2x EG0900FCSPN (900 GB each)
 - NICs:
 - Two 10G ports (on motherboard)
 - Two additional 10G ports via mezzanine slot corresponding to I/O bays 3-4
 - One of the following:
 - Four additional 1000BASE-T ports corresponding to I/O bays 5-8
 - Two additional 10G ports corresponding to I/O bays 5-6
- HP DL380 Gen 9 rack-mounted server
 - CPU: Two 12-core E5-2600v3-series Intel® Xeon® Processors
 - Number of hyperthreaded vCPUs: 48
 - RAM: 256 GB
 - HDD: 2x900GB
 - NICs: Four 1000BASE-T ports (on motherboard), four additional 1000BASE-T ports







Oracle Corporation, World Headquarters

500 Oracle Parkway
Redwood Shores, CA 94065, USA

Worldwide Inquiries

Phone: +1.650.506.7000
Fax: +1.650.506.7200

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