

Hardware Platform Enablement In ONAP

Overview

This page is being used to track the realization of the Hardware Platform Awareness (HPA) functional requirement defined in support of VoLTE, vCPE and 5G use cases. The requirement calls for enablement of hardware platform feature awareness (HPA) inside the ONAP management platform, or means by which knowledge about underlying compute hardware platform capabilities is exposed to VNFs running on top of the platform in order to optimize, accelerate and/or otherwise augment their execution. In ONAP, HPA enablement focuses on discovery, health monitoring and configuration of hardware platform capabilities within the NFV infrastructure, and their consumption by the virtual network functions and network services deployed on top of the infrastructure.

More Information (Intel-specific)...

- <https://software.intel.com/en-us/articles/openstack-epa-feature-breakdown-and-analysis>
- <https://docs.openstack.org/nova/pike/admin/cpu-topologies.html>
- <https://networkbuilders.intel.com/network-technologies/enhancedplatformawareness>
- <http://events17.linuxfoundation.org/sites/events/files/slides/High%20performance%20VMs%20using%20OpenStack%20Nova.pdf>

Business Requirements

This requirement is required in support of commercial VNF implementations, that are used as part of vCPE, VoLTE and 5G use cases, and require hardware assisted acceleration. This requirement is also needed by the ONAP Optimization Framework (OOF) project in order to optimize homing and placement of hardware assisted VNFs.

Scope

The scope of this requirement is limited to consumption of hardware platform capabilities for the purpose of VNF performance acceleration and optimization. Other uses of HPA are not in scope.

Participating Companies

- AT&T, Intel, Cloudify, China Mobile, Orange, ARM

Terminology Introduced

Term	Definition
Hardware Platform Awareness (HPA)	The means by which the underlying NFV-I hardware platform capabilities are exposed to the network service orchestration and management functionality, for the purpose of fulfilling VNF instantiation-time hardware platform requirements.
HPA Enablement	The implementation of HPA awareness in ONAP.

Discussion Pages

- [Blocking Issues to HPA Casablanca Integration](#)
- [Conversion from high-level TOSCA DM to low-level format](#)

Projects that enable HPA

	Project	PTL
1	VNFSDK (impact)	Chris Donley Lianhao Lu
2	SDC (impact)	Michael Lando
3	SO (impact)	Seshu Kumar Mudiganti
4	AAI (impact)	James Forsyth
5	Multi-Cloud	Bin Yang
6	Policy	Pamela Dragosh
7	OOF	Sarat Puthenpura

Limitations

1	Specification of VNF's hardware platform capability requirements is limited to TOSCA based VNFD's.
2	Specification of VNF's hardware platform capability requirements using HEAT is not supported.
3	Supported capabilities are limited to the ones discoverable via OpenStack APIs.
4	Use of container based VNF placement is not supported.
5	Specification of capability requirements is bounded by the set of capabilities discovered in #2.
6	Implementation of southbound (Multi-Cloud) facing SO workflows is limited to HEAT only.
7	Use of TOSCA based resource orchestration is a stretch goal.
8	There is no dynamic discovery of HPA capabilities.
9	HPA capabilities are not under monitoring.

Projects that make use of HPA

	Project	PTL	Notes
1	APP-C	Randa Maher	There is no direct impact on APP-C, given that all instantiation actions are "outsourced" to the SO/OOF.
2	VF-C	Yan Yang	Changes to VF-C will be required in order to incorporate use of HPA into instantiation and operation.
3	DCAE	Lusheng Ji	

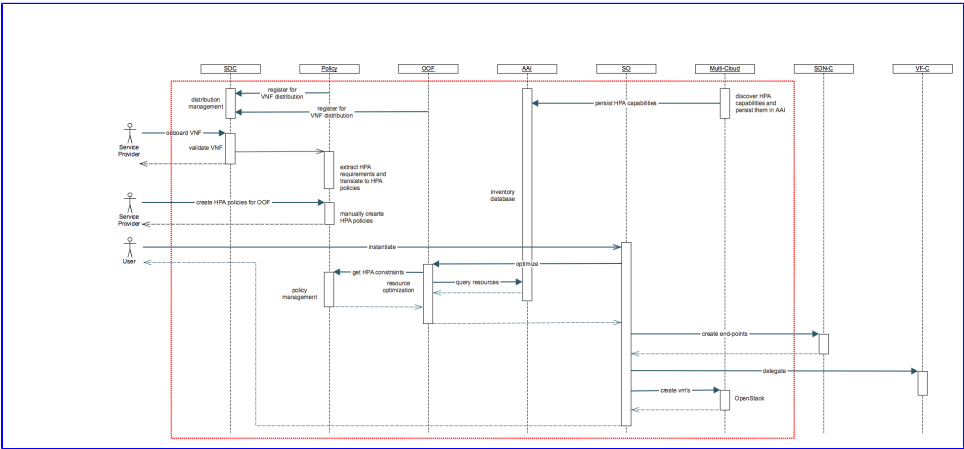
- Discovery of HPA related information in MultiCloud
- DRAFT ONAP Virtual Network Function Descriptor (VNFD) based on TOSCA Simple YAML Profile Specification
- FPGA and GPU support
- Gap between TOSCA DM and low level used
- HPA & Cloud Agnostic Intent - R3 Test Plan (In Progress)
 - OOF - HPA guide for integration testing
 - vFW with HPA demo videos
- HPA Architecture & Design Considerations
- HPA Beijing Testing
- HPA Enhancements (For Casablanca Release)
 - HPA Score - Objective Function
 - OOF Metrics
- HPA Hardening Issues
- HPA Impact on the AAI Project
- HPA Impact on the SDC Project
- HPA impact on the SO project
- HPA Impact on the VNF SDK Project
- HPA Policies and Mappings
- HPA Related Personas
- HPA Release 4.0 focus
- HPA Requirement & Capability Specification
- HPA - SR-IOV NIC design
 - How about physical_network in TOSCA for SR-IOV
- HPA Telemetry Monitoring - Design
- HPA - Telemetry OOF and A&I
- Persistence of HPA related information in AAI
- Specifying HPA Capability Requirements using TOSCA-based VNF Descriptors
- Success Criteria for HPA Enablement
- Supported HPA Capability Requirements(DRAFT)
- TOSCA VNFD Orchestration Issues and Limitations
- VF-C Casablanca HPA Design

Internal HPA Documentation

	Project	PTL
1	VNFRQTS	Steven Wright

External HPA Documentation

Organization	Contact
ETSI NFV SOL	Alexander Vul , Intel
	Thinh Nguyenphu , Nokia
	Bruno Chartras, Orange



HPA Casablanca Enhancements

Feature	Projects	Status	Notes

Support for vFW and vDNS use cases In R2, only the vCPE SO workflow was enhanced to call OOF for homing decisions. In R3, SO workflows for vFW and vDNS will also call OOF for homing decisions.	SO	GREEN	Most of code will be in by Wednesday. Test plan to ensure that both vFW and vDNS use cases are tested with HPA feature	
Use of Multi-Cloud Service instead of SO for direct communication with OpenStack instances in cloud regions In R2, as part of the vCPE workflow, SO bypassed the Multi-Cloud service and called OpenStack directly.. In R3, this will no longer be the case and SO will call the Multi-Cloud Service. Multi-Cloud service will, in turn, communicate with OpenStack instances within different cloud regions.	SO Multi-Cloud	YELLOW	Code being integrated late on Wednesday. Test plan should ensure that SO is configured to work with Multi-Cloud Service.	
Derivation of HEAT parameters from OOF homing decisions in the Multi-Cloud Service In R2, vCPE HEAT template parameters and their values were generated by SO, based on OOF homing decisions because SO was calling Openstack directly. In R3, communication with OpenStack is moved to the Multi-Cloud Service and SO will no longer generate HEAT template parameters. Instead, the Multi-Cloud API will accept directives from OOF and SDN-C, passed as API call parameters. Multi-Cloud service will generate HEAT template parameters based on these directives.	SO OOF Multi-Cloud	GREEN	Dependency on #2. Test plan should ensure that HEAT parameters and values generated by Multi-Cloud are as expected.	
SRIOV-NIC HPA feature support SRIOV-NIC HPA feature is added in R3.	Multi-Cloud SO	GREEN	Dependency on #2 and #3. Test plan should ensure that OOF makes right decisions and right Openstack flavor is selected.	
Cloud-region and flavor selection enhancements in OOF In R2, OOF always selected the first cloud region to satisfy all mandatory HPA requirements, even if multiple cloud regions were able to satisfy the requirements. In R3, OOF will use scoring to pick the right cloud region, such that the region with the highest score is always chosen.	OOF	GREEN	Test plan should cover to ensure that the right region with best score is selected in case of multiple regions. Missing E2E integration testing, can be done after M4	

Support for vCPE use case In R2, vCPE orchestration was only possible using SO and HEAT templates. In R3, vCPE orchestration will also be possible using VF-C and partially ETSI NFV SOL001 v0.6.0 compliant TOSCA templates. As part of this change, VF-C (NSLCM) will be enhanced to communicate with OOF and use OOF supplied recommendations for placement.	VF-C SDC Policy		Test plan should ensure that vCPE use case is tested using both VF-C and SO. In either case, the same OpenStack flavor and cloud region should be selected for VNF placement.	
HPA telemetry and HPA state based placement decisions Stretch goal, may not happen in R3 time frame		RED		

HPA Functionality Enablement Plan

	Functionality	MVP	Projects Involved	Availability	Status
1	Modeling of VNF hardware platform requirements and dependencies as part of the VNFD information model and TOSCA data models.	Yes	Modeling Subcommittee	R3	COMMITTED
2	Specification and validation of VNF hardware platform requirements and dependencies as part of the VNF package (TOSCA).	Yes	VNFSDK	R3	COMMITTED
3	Use of VNFD supplied hardware platform requirements at on-boarding time to verify that infrastructure is capable of supporting VNF instantiation and operation.	No	SDC	R3	STRETCH R3
4	Translation of VNFD supplied VNF hardware platform requirements into HPA related OOF homing and placement policies.	Yes	SDC, Policy	R3	COMMITTED
5	Manual specification of HPA related OOF homing and placement policies based on hardware platform requirements.	Yes	Policy	R2	DONE
6	Use of VNF hardware platform requirements as constraint policies for optimized homing and resource placement of VNF components during VNF instantiation.	Yes	OOF, SO, Policy	R2	DONE
7	Use of hardware platform telemetry in determination of the VNF instance health.	No	AAI, DCAE	R4	SCHEDULED
8	Use of hardware platform telemetry to enhance OOF homing and placement decisions.	No	Multi-Cloud, AAI, OOF	R3	COMMITTED
9	Use of VNF hardware platform dependencies as constraints for operation and remediation of running VNF instances.	No	VF-C, APP-C	R3	DELAYED R4
10	Use of VNF hardware platform dependencies as constraints for VNF autoscaling.	No	Scaling FR	R3	DELAYED R4
11	Use of VNF hardware platform dependencies as constraints for VNF change management.	No	Change Management FR	R3	DELAYED R4
12	Discovery of hardware platform capabilities exposed by different VIMs.	Yes	Multi-Cloud	R2	DONE
13	Modeling and persistence of discovered platform capabilities in the AA&I database.	Yes	Multi-Cloud, AAI	R2	DONE
14	SRIOV Discovery.	No	Multi-Cloud	R3	COMMITTED
15	SRIOV Day 0 Configuration.	No	TBD	R3	COMMITTED
16	VF-C/HPA integration.	No	VF-C	R3	COMMITTED

Casablanca Test Plan (DRAFT)

Please see this link: [HPA & Cloud Agnostic Intent - R3 Test Plan \(In Progress\)](#)

Assumptions

VoLTE and vCPE use cases will be used to validate the function of HPA end-to-end. The HPA test plans for Casablanca make the following assumptions with respect to function of ONAP components affected by HPA enablement functional requirement.

1. There are no changes to the HPA capability discovery process.
2. There are no changes to how discovered HPA capabilities are persisted in AAI.
3. There are no changes to specification of HPA constraint policies used by OOF.
4. Existing VoLTE and vCPE tests are sufficient to perform the end-to-end HPA testing.

Based on the above assumptions, the scope of the testing effort is limited to the following:

VNF On-Boarding (VNFSdk/SDC)

Test ID	Test Description	Status
101	Format and content of the VNFD, as supplied via the CSAR file are unaffected by VNF on-boarding.	TO BE DONE
102	HPA requirements are unaffected by VNF on-boarding.	TO BE DONE
103	On-boarding of VNFs with HPA requirements fails if appropriate ONAP components (e.g. HPA requirement interpreter plugin) are not found.	TO BE DONE
104	HPA requirement validation errors result in termination of the VNF on-boarding process.	TO BE DONE

VNF Design (SDC)

Test ID	Test Description	Status
201	VNFs with TOSCA-encoded VNFDs can be used to build network services.	TO BE DONE
202	VNFD and all of its content, HPA requirements included, remain immutable.	TO BE DONE

VNF Distribution (SDC/SO/Policy)

Test ID	Test Description	Status
301	Policy and SO components are able to register as SDC distribution clients.	TO BE DONE
302	VNFD can be distributed through the SDC distribution framework.	TO BE DONE
303	HPA requirement parsing errors result in termination of the VNF distribution process.	TO BE DONE

VNF Instantiation (SO/VF-C/OOF)

Test ID	Test Description	Status
401	VNFs with TOSCA-encoded VNFDs can be instantiated using VF-C.	TO BE DONE
402	VNFs with TOSCA-encoded VNFDs can be instantiated using SO.	TO BE DONE
403	The same VNF package can be used with all ONAP orchestrators.	TO BE DONE

404	HPA requirements are consistently interpreted by all orchestrators.	TO BE DONE
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SR-IOV NIC Support

Test ID	Test Description	Status
501	VNFs including SR-IOV NIC requirements with TOSCA-encoded VNFDs can be instantiated using VF-C.	TO BE DONE
502	VNFs including SR-IOV NIC requirements with TOSCA-encoded VNFDs can be instantiated using SO.	TO BE DONE

HPA Service Assurance (Platform Telemetry)

Test ID	Test Description	Status
601		TO BE DONE