

TOSCA complementing NFV (Network Function Virtualization)

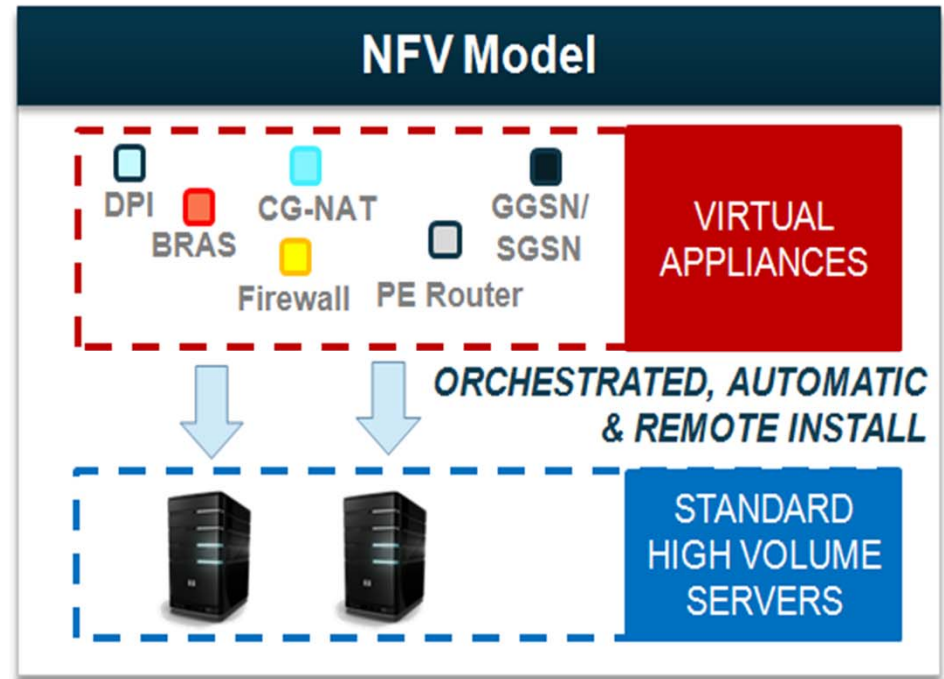
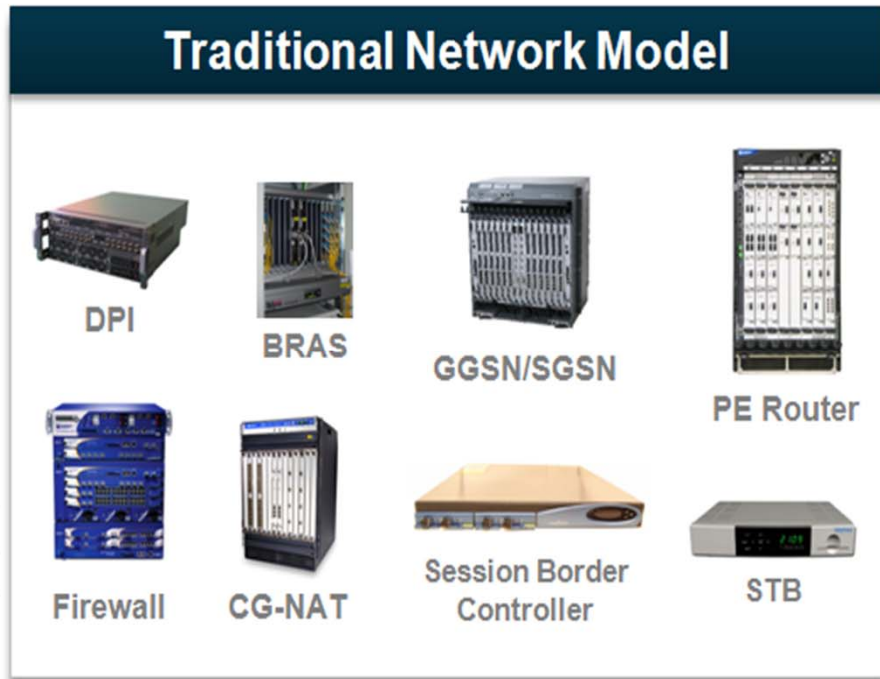
Shitao li

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Objectives

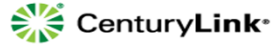


Removing tightly coupled network function's software from underlying hardware

Members Community

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 Broadcom Corporation
 BT Group PLC
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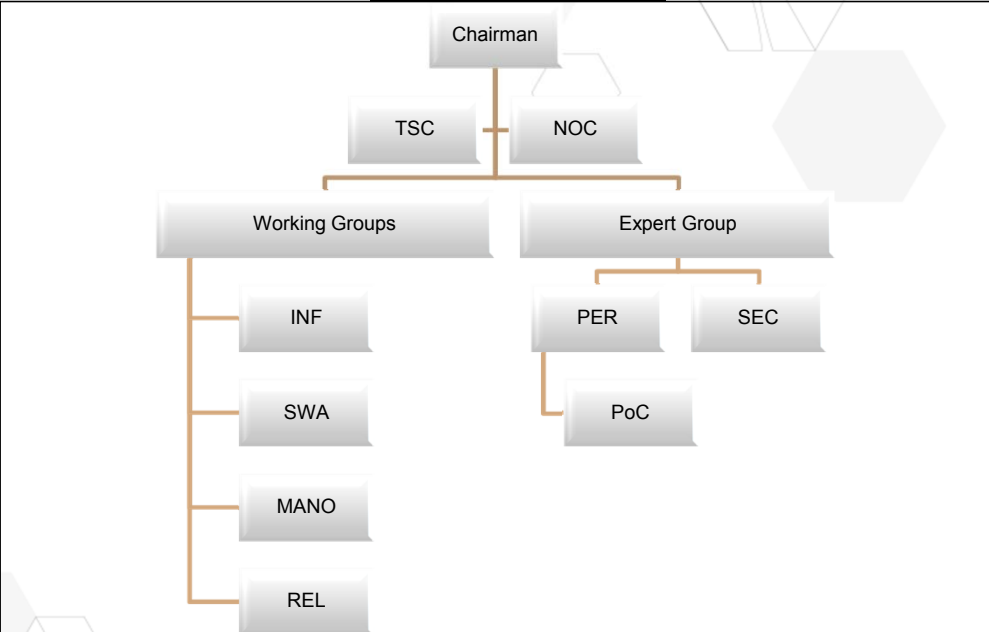


LIST OF PARTICIPANTS (47)

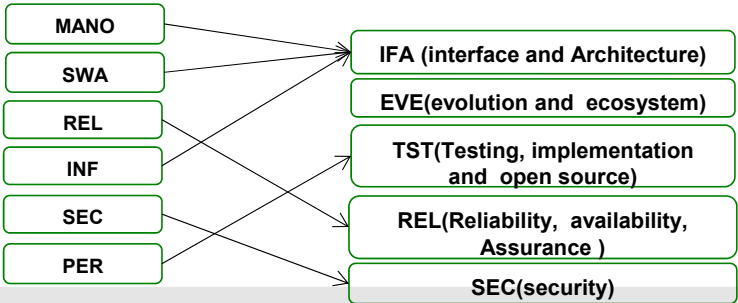
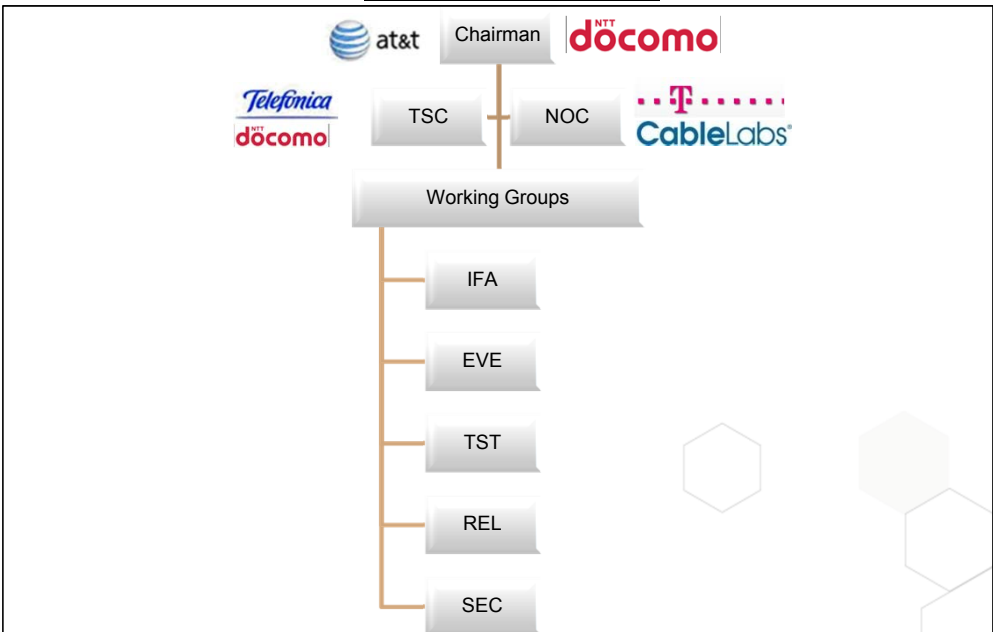
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 VMware
 6WIND

NFV organization Phase 1 Vs. Phase 2

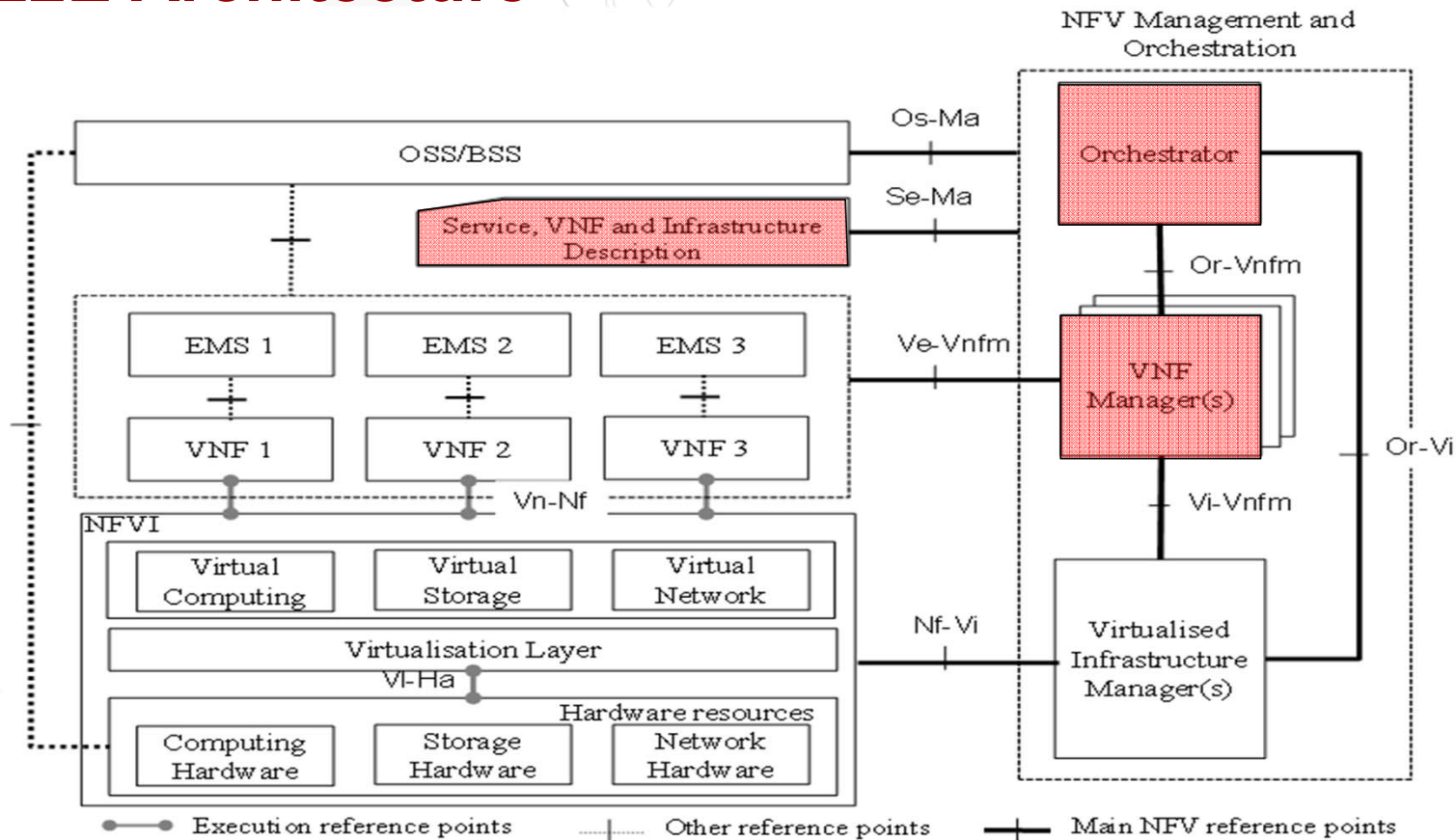
Phase 1 structure



Phase 2 structure



E2E Architecture



General mapping: NFV NSD and VNFD to TOSCA template

NFV

TOSCA

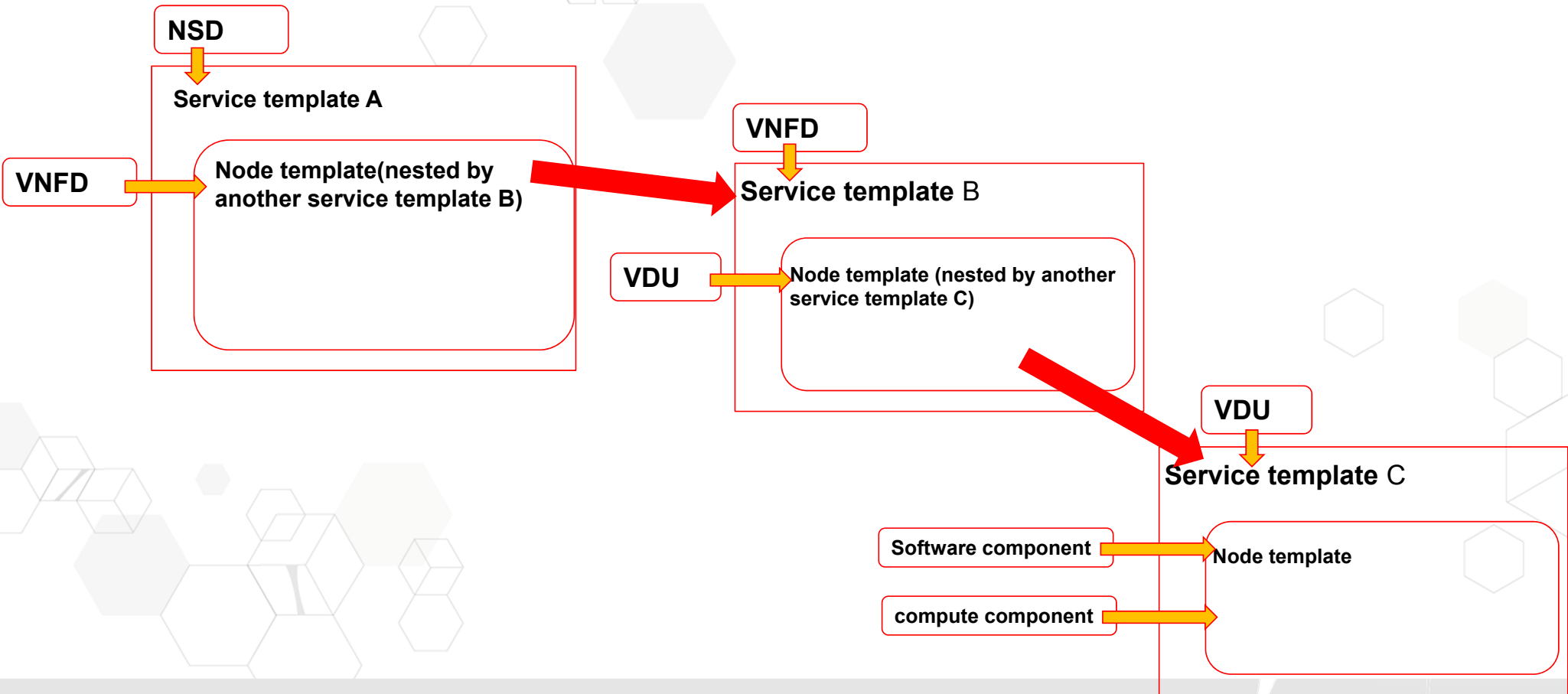
NSD(network service descriptor) Service template

VNFD(VNF descriptor) VNFD Note template(defined by a nested Service template)

VDU(virtualisation deployment unit) ...VDU VDU ...VDU Note template(defined by a nested Service template)

Software component Compute component Note template

General mapping: NFV NSD and VNFD to TOSCA template



NSD mapping to a service template

Tosca service template

6.2.1.1 nsd base element

Identifier	Type	Cardinality	Description
Id	Leaf	1	ID of this Network Service Descriptor
vendor	Leaf	1	Provider or vendor of the Network Service
version	Leaf	1	Version of the Network Service Descriptor
vnfd	Reference	1..N	VNF which is part of the Network Service, see section 6.3.1. This element is required, for example, when the Network Service is being built top-down or instantiating the member VNFs as well.
vnffgd	Reference	0..N	VNFFG which is part of the Network Service, see section 6.5.1. A Network Service might have multiple graphs, for example, for: 1. control plane traffic 2. management-plane traffic 3. User plane traffic itself could have multiple NFPs based on the QoS etc. The traffic is steered amongst 1 of these NFPs based on the policy decisions.
vld	Reference	0..N	Virtual Link which is part of the Network Service, see section 6.4.1
lifecycle_event	Leaf	0..N	Defines NS functional scripts/workflows for specific lifecycle events (e.g., initialization, termination, scaling)

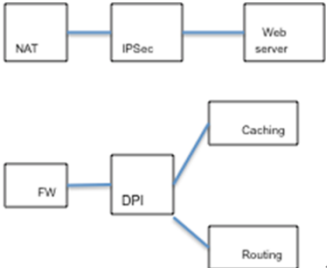
Keyname	Required	Description
tosca_definitions_version	yes	Defines the version of the TOSCA Simple Profile specification the template (grammar) complies with.
tosca_default_namespace	no	Defines the namespace of the TOSCA schema to use for validation.
template_name	no	Declares the name of the template.
template_author	no	Declares the author(s) of the template.
template_version	no	Declares the version string for the template.
description	no	Declares a description for this Service Template and its contents.
imports	no	Declares import statements external TOSCA Definitions documents (files).
dsl_definitions	no	Declares optional DSL-specific definitions and conventions. For example, in YAML, this allows defining reusable YAML macros (i.e., YAML alias anchors) for use throughout the TOSCA Service Template.
inputs	no	Defines a set of global input parameters passed to the template when its instantiated. This provides a means for template authors to provide points of variability to users of the template in order to customize each instance within certain constraints.
node_templates	no	Defines a list of Node Templates that model the components of an application or service's topology within the Service Template.

Could map to TOSCA plan element

Gaps:

1. Vnffgd: can not map to TOSCA, may need a new node type (forwarding graph node type).
2. Virtual link: can not map to TOSCA, may need a new node type (virtual link node type).

NSD mapping to a service template

vnf_dependency	Leaf	0...N	Describe dependencies between VNF. Defined in terms of source and target VNF i.e. target VNF "depends on" source VNF. In other words a source VNF must exist and connect to the service before target VNF can be initiated/deployed and connected. This element would be used, for example, to define the sequence in which various numbered network nodes and links within a VNF FG should be instantiated by the NFV Orchestrator. 
monitoring_parameter	Leaf	0...N	Represents a monitoring parameter which can be tracked for this NS. These can be network service metrics that are tracked for the purpose of meeting the network service availability contributing to SLAs (e.g. NS downtime). These can also be used for specifying different deployment flavours for the Network Service in Network Service Descriptor, and/or to indicate different levels in Network service availability. Examples include specific parameters such as calls-per-second (cps), number-of-subscribers, no-of-rules, flows-per-second, etc. 1 or more of these parameters could be influential in determining the need to scale-out.
service_deployment_flavour	Element	1...N	Represents the service KPI parameters and its requirement for each deployment flavour of the NS being described, see section 6.2.1.3. For example, there could be a flavour describing the requirements to support a vEPC with 300k calls per second. There could be another flavour describing the requirements to support a vEPC with 500k calls persecond.
auto_scale_policy	Leaf	0...N	Represents the policy meta data, which may include the criteria parameter & action-type. The criteria parameter should be a supported assurance parameter. An example of such a descriptor could be: <ul style="list-style-type: none"> Criteria parameter: calls-per-second, Action-type: scale-out to a different flavour ID
connection_point	Element	1...N	This element describes a Connection Point which acts as an endpoint of the Network Service, see section 6.2.1.2. This can, for example, be referenced by other elements as an endpoint.
pnfd	Reference	0...N	PNFs which are part of the Network Service, see section 6.6.1.

Tosca service template

6.2.1.3 Service deployment flavour (nsd:service_deployment_flavour)

6.2.1.3.1 Base element

Identifier	Type	Cardinality	Description
id	Leaf	1	ID of the deployment flavour.
flavour_key	Leaf	1	Assurance parameter against which this flavour is being described. The key could be a combination of multiple assurance parameters with a logical relationship between them. The parameters should be present as a monitoring_parameter supported in section 6.2.1.1. For example, a flavour of a virtual EPC could be described in terms of the assurance parameter "calls per second" (cps).
constituent_vnf	Element	1...N	Represents the characteristics of a constituent flavour element, see section 6.2.1.3.2.

6.2.1.3.2 Constituent VNF

(nsd:service_deployment_flavour:constituent_vnf)

Identifier	Type	Cardinality	Description
vnf_reference	Reference	1	Reference to a VNFD declared as vnfd in the Network Service via vnf:id.
vnf_flavour_id_reference	Reference	1	References a VNF flavour (vnfd:deployment_flavour:id) to be used for this service flavour, see section 6.2.1.3.1.
redundancy_model	Leaf	0...1	Represents the redundancy of instances, for example, "active" or "standby".
affinity	Leaf	0...1	Specifies the placement policy between this instance and other instances, if any.
capability	Leaf	0...1	Represents the capabilities of the VNF instances. An example of capability is instance capacity (e.g., capability = 50% * NS capacity).
number_of_inst			

Gaps:

1. Monitoring_parameter: can not be mapped into the TOSCA service template now, but TOSCA just start a monitoring WG, It may solve this gap problem
2. Service_Deployment_flavour: inputs?group? Or new node template
3. Pnfd: needs to consider whether TOSCA can be used to describe physical devices.

VNFD mapping to a service template

6.3.1.1 vnfd base information elements

Identifier	Type	Cardinality	Description
Id	Leaf	1	ID (e.g., name) of this VNFD.
vendor	Leaf	1	The vendor generating this VNFD.
descriptor_version	Leaf	1	Version of the VNF Descriptor.
version	Leaf	1	Version of VNF software, described by the descriptor under consideration.
vdu	Element	1...N	This describes a set of elements related to a particular VDU, see section 6.3.1.2.
virtual_link	Element	0...N	Represents the type of network connectivity mandated by the VNF vendor between two or more Connection Points, see section 6.3.1.3.
connection_point	Element	1...N	This element describes an external interface exposed by this VNF enabling connection with a VL, see section 6.3.1.4. NOTE: The connection between the VNF and the VL is expressed by the VLD referencing this Connection Point. The Connection Point may also be attached to internal Virtual Vinks (vnfd:virtual_link:id).
lifecycle_event	Leaf	0...N	Defines VNF functional scripts/workflows for specific

Keyname	Required	Description
tosca_definitions_version	yes	Defines the version of the TOSCA Simple Profile specification the template (grammar) complies with.
tosca_default_namespace	no	Defines the namespace of the TOSCA schema to use for validation.
template_name	no	Declares the name of the template.
template_author	no	Declares the author(s) of the template.
template_version	no	Declares the version string for the template.
description	no	Declares a description for this Service Template and its contents.
imports	no	Declares import statements external TOSCA Definitions documents (files).
dsl_definitions	no	Declares optional DSL-specific definitions and conventions. For example, in YAML, this allows defining reusable YAML macros (i.e., YAML alias anchors) for use throughout the TOSCA Service Template.
inputs	no	Defines a set of global input parameters passed to the template when its instantiated. This provides a means for template authors to provide points of variability to users of the template in order to customize each instance within certain constraints.
node_templates	no	Defines a list of Node Templates that model the components of an application or service's topology within the Service Template.

Gaps:

1. Version: this version represents the version of software used in this VNF. This information might be put into the description element.
2. Virtual link: can not map to TOSCA, may need a new node type (virtual link node type).

Could map to a node template with port node type

lifecycle_event	Leaf	0...N	Defines VNF functional scripts/workflows for specific lifecycle events (e.g., initialization, termination, graceful shutdown, scaling out/in, update/upgrade, VNF state management related actions to support service continuity).
dependency	Leaf	0...N	Describe dependencies between VDU. Defined in terms of source and target VDU, i.e., target VDU "depends on" source VDU. In other words source VDU must exist before target VDU can be initiated/deployed.
monitoring_parameter	Leaf	0...N	Monitoring parameters, which can be tracked for this VNF. Can be used for specifying different deployment flavours for the VNF in a VNFD, and/or to indicate different levels of VNF service availability. These parameters can be an aggregation of the parameters at VDU level e.g., memory-consumption, CPU-utilisation, bandwidth-consumption etc. They can be VNF specific as well such as calls-per-second (cps), number-of-subscribers, no-of-rules, flows-per-second, VNF downtime, etc. One or more of these parameters could be influential in determining the need to scale.
deployment_flavour	Element	1...N	Represents the assurance parameter(s) and its requirement for each deployment flavour of the VNF being described, see section 6.3.1.5.
auto_scale_policy	Leaf	0...N	Represents the policy meta data, which may include the criteria parameter and action-type. The criteria parameter should be a supported assurance parameter (vnf:monitoring_parameter). Example of such a descriptor could be: Criteria parameter → calls-per-second, Action-type → scale-out to a different flavour ID, if exists.
manifest_file	Leaf	0...1	The VNF package may contain a file that lists all files in the package. This can be useful for auditing purposes or for enabling some security features on the package.
manifest_file_security	Leaf	0...N	The manifest file may be created to contain a digest of each file that it lists as part of the package. This digest information can form the basis of a security mechanism to ensure the contents of the package meet certain security related properties. If the manifest file contains digests of the files in the package, then the manifest file should also note the particular hash algorithm used to enable suitable verification mechanisms. Examples of suitable hash algorithms include, but are not limited to SHA-256, SHA-384, SHA-512, and SHA-3.
			In conjunction with an appropriate security signing mechanism, which may include having a security certificate as part of the VNF package, the digest information can be used to help ensure the contents of the VNF package have not been tampered with.

Can be mapped to TOSCA plan element

inputs	no	Defines a set of global input parameters passed to the template when its instantiated. This provides a means for template authors to provide points of variability to users of the template in order to customize each instance within certain constraints.
node_templates	no	Defines a list of Node Templates that model the components of an application or service's topology within the Service Template.
relationship_templates	no	Defines a list of Relationship Templates that are used to model the relationships (e.g., dependencies, links, etc.) between components (i.e., Node Templates) of an application or service's topology within the Service Template.
node_types	no	This section contains a set of node type definitions for use in service templates. Such type definitions may be used within the node_templates section of the same file, or a TOSCA Definitions file may also just contain node type definitions for use in other files.
relationship_types	no	This section contains a set of relationship type definitions for use in service templates. Such type definitions may be used within the same file, or a TOSCA Definitions file may also just contain relationship type definitions for use in other files.
capability_types	no	This section contains an optional list of capability type definitions for use in service templates. Such type definitions may be used within the same file, or a TOSCA Definitions file may also just contain capability type definitions for use in other files.
artifact_types	no	This section contains an optional list of artifact type definitions for use in service templates. Such type definitions may be used within the same file, or a TOSCA Definitions file may also just contain capability type definitions for use in other files.
outputs	no	This optional section allows for defining a set of output parameters provided to users of the template. For example, this can be used for exposing the URL for logging into a web application that has been set up during the instantiation of a template.
groups	no	This is an optional section that contains grouping definition for node templates.

Gaps:

1. Monitoring_parameter: can not be mapped into the TOSCA service template now, but TOSCA just start a monitoring WG, It may solve this gap problem
2. Deployment_flavour: inputs?group? Or new node template
3. Manifest_file: same concept as CSAR, but in the different layer
 - NFV will do some changes, so manifest file can be mapped to CSAR
4. Manifest_file_security: out of scope of TOSCA

Main gaps between NFV describer and TOSCA template

1. VNF forwarding graph and virtual link

- › Need a solution(Now, it discussed at networking ad hoc group)

2. Deployment flavour

- › Need a solution

3. Monitoring parameter

- › Can be cooperated with Monitoring Group

4. Pnfd

- › Needs to consider whether TOSCA can be used to describe physical device.

Output white paper

- 1. Fulfil all the gaps between TOSCA and NFV**
 - › E.g, introduce NFV specific new node types,
- 2. Examples for NSD, VNFD, VDU, VLD and VNF forwarding graph using TOSCA**
- 3. Other recommendations to NFV**

Thank you

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