



Network Functions Virtualisation (NFV) Release 2; Protocols and Data Models; NFV descriptors based on TOSCA specification

Disclaimer

The present document has been produced and approved by the Network Functions Virtualisation (NFV) ETSI Industry Specification Group (ISG) and represents the views of those members who participated in this ISG. It does not necessarily represent the views of the entire ETSI membership.

ReferenceRGS/NFV-SOL001ed281

Keywordsdata, information model, model, NFV

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 - Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

The present document can be downloaded from:

<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format at www.etsi.org/deliver.

Users of the present document should be aware that the document may be subject to revision or change of status.

Information on the current status of this and other ETSI documents is available at

<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:

<https://portal.etsi.org/People/CommiteeSupportStaff.aspx>

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2020.

All rights reserved.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members.

3GPP™ and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.

oneM2M™ logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners.

GSM® and the GSM logo are trademarks registered and owned by the GSM Association.

Contents

Intellectual Property Rights	19
Foreword.....	19
Modal verbs terminology.....	19
1 Scope	20
2 References	20
2.1 Normative references	20
2.2 Informative references.....	21
3 Definition of terms, symbols and abbreviations.....	22
3.1 Terms.....	22
3.2 Symbols.....	22
3.3 Abbreviations	22
4 Overview of TOSCA model.....	23
5 General concept of using TOSCA to model NFV descriptors	23
5.1 Introduction	23
5.2 Network Service Descriptor	23
5.3 Virtualised Network Function Descriptor	23
5.4 Physical Network Function Descriptor.....	24
5.5 toasca_definitions_version and Namespace prefix	24
5.6 Imports statement	25
5.6.1 VNFD TOSCA service template	25
5.6.2 NSD TOSCA service template	25
5.6.3 PNFD TOSCA service template	26
5.7 Type extension	26
5.7.1 Introduction.....	26
5.7.2 Rules	26
5.7.3 VNFD Types.....	27
5.7.4 NSD types.....	28
5.8 Non-Backward Compatible changes	28
6 VNFD TOSCA model.....	28
6.1 Introduction	28
6.2 Data Types.....	29
6.2.1 toasca.datatypes.nfv.CpProtocolData	29
6.2.1.1 Description	29
6.2.2 toasca.datatypes.nfv.AddressData	30
6.2.2.1 Description	30
6.2.3 toasca.datatypes.nfv.L2AddressData	30
6.2.3.1 Description	30
6.2.4 toasca.datatypes.nfv.VirtualNetworkInterfaceRequirements	30
6.2.4.1 Description	30
6.2.4.2 Properties	30
6.2.4.3 Definition	31
6.2.4.4 Examples	31
6.2.4.5 Additional Requirements	31
6.2.5 toasca.datatypes.nfv.L3AddressData	31
6.2.5.1 Description	31
6.2.6 toasca.datatypes.nfv.RequestedAdditionalCapability.....	32
6.2.6.1 Description	32
6.2.6.2 Properties	32
6.2.6.3 Definition	33
6.2.6.4 Examples	33
6.2.6.5 Additional Requirements	33
6.2.7 toasca.datatypes.nfv.VirtualMemory	33
6.2.7.1 Description	33
6.2.7.2 Properties	34

6.2.7.3	Definitions	34
6.2.7.4	Examples	34
6.2.7.5	Additional Requirements	35
6.2.8	tosca.datatypes.nfv.VirtualCpu	35
6.2.8.1	Description	35
6.2.8.2	Properties	35
6.2.8.3	Definition	35
6.2.8.4	Examples	36
6.2.8.5	Additional Requirements	36
6.2.9	tosca.datatypes.nfv.VirtualCpuPinning	36
6.2.9.1	Description	36
6.2.9.2	Properties	36
6.2.9.3	Definition	37
6.2.9.4	Examples	37
6.2.9.5	Additional Requirements	37
6.2.10	tosca.datatypes.nfv.VnfcConfigurableProperties	37
6.2.10.1	Description	37
6.2.10.2	Properties	38
6.2.10.3	Definition	38
6.2.10.4	Examples	38
6.2.10.5	Additional Requirements	39
6.2.11	tosca.datatypes.nfv.VnfcAdditionalConfigurableProperties	39
6.2.11.1	Description	39
6.2.11.2	Properties	39
6.2.11.3	Definition	39
6.2.12	tosca.datatypes.nfv.VduProfile	39
6.2.12.1	Description	39
6.2.12.2	Properties	40
6.2.12.3	Definition	40
6.2.12.4	Examples	41
6.2.12.5	Additional requirements	42
6.2.13	tosca.datatypes.nfv.VIProfile	42
6.2.13.1	Description	42
6.2.13.2	Properties	42
6.2.13.3	Definition	43
6.2.13.4	Examples	43
6.2.13.5	Additional Requirements	43
6.2.14	tosca.datatypes.nfv.VirtualLinkProtocolData	43
6.2.14.1	Description	43
6.2.14.2	Properties	44
6.2.14.3	Definition	44
6.2.14.4	Examples	44
6.2.14.5	Additional Requirements	44
6.2.15	tosca.datatypes.nfv.L2ProtocolData	45
6.2.15.1	Description	45
6.2.15.2	Properties	45
6.2.15.3	Definition	45
6.2.15.4	Examples	46
6.2.15.5	Additional Requirements	46
6.2.16	tosca.datatypes.nfv.L3ProtocolData	46
6.2.16.1	Description	46
6.2.16.2	Properties	46
6.2.16.3	Definition	47
6.2.16.4	Examples	48
6.2.16.5	Additional Requirements	48
6.2.17	tosca.datatypes.nfv.IpAllocationPool	48
6.2.17.1	Description	48
6.2.17.2	Properties	48
6.2.17.3	Definition	49
6.2.17.4	Examples	49
6.2.17.5	Additional Requirements	49
6.2.18	tosca.datatypes.nfv.InstantiationLevel	49

6.2.18.1	Description	49
6.2.18.2	Properties	49
6.2.18.3	Definition	50
6.2.18.4	Examples	50
6.2.18.5	Additional Requirements	50
6.2.19	tosca.datatypes.nfv.VduLevel	50
6.2.19.1	Description	50
6.2.19.2	Properties	50
6.2.19.3	Definition	51
6.2.19.4	Examples	51
6.2.19.5	Additional Requirements	51
6.2.20	tosca.datatypes.nfv.VnfLcmOperationsConfiguration	51
6.2.20.1	Description	51
6.2.20.2	Properties	51
6.2.20.3	Definition	52
6.2.20.4	Examples	53
6.2.20.5	Additional Requirements	53
6.2.21	tosca.datatypes.nfv.VnfInstantiateOperationConfiguration	53
6.2.21.1	Description	53
6.2.21.2	Properties	53
6.2.21.3	Definition	53
6.2.21.4	Examples	53
6.2.21.5	Additional Requirements	53
6.2.22	tosca.datatypes.nfv.VnfScaleOperationConfiguration	54
6.2.22.1	Description	54
6.2.22.2	Properties	54
6.2.22.3	Definition	54
6.2.22.4	Examples	54
6.2.22.5	Additional Requirements	54
6.2.23	tosca.datatypes.nfv.VnfScaleToLevelOperationConfiguration	55
6.2.23.1	Description	55
6.2.23.2	Properties	55
6.2.23.3	Definition	55
6.2.23.4	Examples	55
6.2.23.5	Additional Requirements	55
6.2.24	tosca.datatypes.nfv.VnfHealOperationConfiguration	55
6.2.24.1	Description	55
6.2.24.2	Properties	56
6.2.24.3	Definition	56
6.2.24.4	Examples	56
6.2.24.5	Additional Requirements	56
6.2.25	tosca.datatypes.nfv.VnfTerminateOperationConfiguration	56
6.2.25.1	Description	56
6.2.25.2	Properties	57
6.2.25.3	Definition	57
6.2.25.4	Examples	57
6.2.25.5	Additional Requirements	57
6.2.26	tosca.datatypes.nfv.VnfOperateOperationConfiguration	57
6.2.26.1	Description	57
6.2.26.2	Properties	58
6.2.26.3	Definition	58
6.2.26.4	Examples	58
6.2.26.5	Additional Requirements	58
6.2.27	tosca.datatypes.nfv.ScaleInfo	59
6.2.27.1	Description	59
6.2.27.2	Properties	59
6.2.27.3	Definition	59
6.2.27.4	Examples	59
6.2.27.5	Additional Requirements	59
6.2.28	tosca.datatypes.nfv.ScalingAspect	59
6.2.28.1	Description	59
6.2.28.2	Properties	60

6.2.28.3	Definition	60
6.2.28.4	Examples	61
6.2.28.5	Additional Requirements	61
6.2.29	tosca.datatypes.nfv.LinkBitrateRequirements	61
6.2.29.1	Description	61
6.2.30	tosca.datatypes.nfv.ConnectivityType	61
6.2.30.1	Description	61
6.2.31	tosca.datatypes.nfv.VnfConfigurableProperties.....	61
6.2.31.1	Description	61
6.2.31.2	Properties	61
6.2.31.3	Definition	63
6.2.31.4	Examples	64
6.2.31.5	Additional Requirements	65
6.2.32	tosca.datatypes.nfv.VnfAdditionalConfigurableProperties.....	66
6.2.32.1	Description	66
6.2.32.2	Properties	66
6.2.32.3	Definition	66
6.2.32.4	Examples	66
6.2.32.5	Additional Requirements	67
6.2.33	tosca.datatypes.nfv.VnfInfoModifiableAttributes	67
6.2.33.1	Description	67
6.2.33.2	Properties	67
6.2.33.3	Definition	67
6.2.33.4	Examples	67
6.2.33.5	Additional Requirements	68
6.2.34	tosca.datatypes.nfv.VnfInfoModifiableAttributesExtensions	68
6.2.34.1	Description	68
6.2.34.2	Properties	68
6.2.34.3	Definition	68
6.2.34.4	Examples	68
6.2.34.5	Additional Requirements	68
6.2.35	tosca.datatypes.nfv.VnfInfoModifiableAttributesMetadata	68
6.2.35.1	Description	68
6.2.35.2	Properties	68
6.2.35.3	Definition	69
6.2.35.4	Examples	69
6.2.35.5	Additional Requirements	69
6.2.36	tosca.datatypes.nfv.Qos	69
6.2.36.1	Description	69
6.2.37	tosca.datatypes.nfv.LogicalNodeData	70
6.2.37.1	Description	70
6.2.37.2	Properties	70
6.2.37.3	Definition	70
6.2.37.4	Examples	70
6.2.37.5	Additional Requirements	71
6.2.38	tosca.datatypes.nfv.SwImageData	71
6.2.38.1	Description	71
6.2.38.2	Properties	71
6.2.38.3	Definition	72
6.2.38.4	Examples	73
6.2.38.5	Additional Requirements	73
6.2.39	tosca.datatypes.nfv.VirtualBlockStorageData	73
6.2.39.1	Description	73
6.2.39.2	Properties	74
6.2.39.3	Definition	74
6.2.39.4	Examples	74
6.2.39.5	Additional Requirements	75
6.2.40	tosca.datatypes.nfv.VirtualObjectStorageData	75
6.2.40.1	Description	75
6.2.40.2	Properties	75
6.2.40.3	Definition	75
6.2.40.4	Examples	75

6.2.40.5	Additional Requirements	75
6.2.41	tosca.datatypes.nfv.VirtualFileStorageData	76
6.2.41.1	Description	76
6.2.41.2	Properties	76
6.2.41.3	Definition	76
6.2.41.4	Examples	76
6.2.41.5	Additional Requirements	76
6.2.42	tosca.datatypes.nfv.VirtualLinkBitrateLevel	77
6.2.42.1	Description	77
6.2.42.2	Properties	77
6.2.42.3	Definition	77
6.2.42.4	Examples	77
6.2.42.5	Additional Requirements	77
6.2.43	tosca.datatypes.nfv.VnfOperationAdditionalParameters	77
6.2.43.1	Description	77
6.2.43.2	Properties	78
6.2.43.3	Definition	78
6.2.43.4	Examples	78
6.2.43.5	Additional Requirements	78
6.2.44	tosca.datatypes.nfv.VnfChangeFlavourOperationConfiguration	79
6.2.44.1	Description	79
6.2.44.2	Properties	79
6.2.44.3	Definition	79
6.2.44.4	Examples	79
6.2.44.5	Additional Requirements	79
6.2.45	tosca.datatypes.nfv.VnfChangeExtConnectivityOperation Configuration	79
6.2.45.1	Description	79
6.2.45.2	Properties	80
6.2.45.3	Definition	80
6.2.45.4	Examples	80
6.2.45.5	Additional Requirements	80
6.2.46	tosca.datatypes.nfv.VnfMonitoringParameter	80
6.2.47	tosca.datatypes.nfv.VnfcMonitoringParameter	80
6.2.47.1	Description	80
6.2.47.2	Properties	80
6.2.47.3	Definition	82
6.2.47.4	Examples	82
6.2.47.5	Additional Requirements	82
6.2.48	tosca.datatypes.nfv.VirtualLinkMonitoringParameter	82
6.2.48.1	Description	82
6.2.48.2	Properties	83
6.2.48.3	Definition	83
6.2.48.4	Examples	83
6.2.48.5	Additional Requirements	84
6.2.49	tosca.datatypes.nfv.InterfaceDetails	84
6.2.49.1	Description	84
6.2.49.2	Properties	84
6.2.49.3	Definition	84
6.2.49.4	Examples	84
6.2.49.5	Additional Requirements	85
6.2.50	tosca.datatypes.nfv.UriComponents	85
6.2.50.1	Description	85
6.2.50.2	Properties	85
6.2.50.3	Definition	85
6.2.50.4	Examples	86
6.2.50.5	Additional Requirements	86
6.2.51	tosca.datatypes.nfv.UriAuthority	86
6.2.51.1	Description	86
6.2.51.2	Properties	86
6.2.51.3	Definition	87
6.2.51.4	Examples	87
6.2.51.5	Additional Requirements	87

6.2.52	tosca.datatypes.nfv.VnfProfile	87
6.2.52.1	Description	87
6.2.53	tosca.datatypes.nfv.ChecksumData	88
6.2.53.1	Description	88
6.2.53.2	Properties	88
6.2.53.3	Definition	88
6.2.53.4	Examples	88
6.2.53.5	Additional Requirements	89
6.2.54	tosca.datatypes.nfv.VnfmInterfaceInfo	89
6.2.54.1	Description	89
6.2.54.2	Properties	89
6.2.54.3	Definition	89
6.2.54.4	Examples	90
6.2.54.5	Additional Requirements	90
6.2.55	tosca.datatypes.nfv.OauthServerInfo	90
6.2.55.1	Description	90
6.2.55.2	Properties	90
6.2.55.3	Definition	90
6.2.55.4	Examples	90
6.2.55.5	Additional Requirements	90
6.2.56	tosca.datatypes.nfv.BootData	91
6.2.56.1	Description	91
6.2.56.2	Properties	91
6.2.56.3	Definition	92
6.2.56.4	Examples	92
6.2.56.5	Additional Requirements	92
6.2.57	tosca.datatypes.nfv.KvpData	92
6.2.57.1	Description	92
6.2.57.2	Properties	93
6.2.57.3	Definition	93
6.2.57.4	Examples	93
6.2.57.5	Additional Requirements	93
6.2.58	tosca.datatypes.nfv.ContentOrFileData	93
6.2.58.1	Description	93
6.2.58.2	Properties	93
6.2.58.3	Definition	94
6.2.58.4	Examples	95
6.2.58.5	Additional Requirements	95
6.2.59	tosca.datatypes.nfv.BootDataVimSpecificProperties	95
6.2.59.1	Description	95
6.2.59.2	Properties	95
6.2.59.3	Definition	96
6.2.59.4	Examples	96
6.2.59.5	Additional Requirements	96
6.3	Artifact Types	96
6.3.1	tosca.artifacts.nfv.SwImage	96
6.3.1.1	Description	96
6.3.1.2	Description	96
6.3.2	tosca.artifacts.Implementation.nfv.Mistral	97
6.3.2.1	Description	97
6.3.2.2	Definition	97
6.4	Capability Types	97
6.4.1	tosca.capabilities.nfv.VirtualBindable	97
6.4.1.1	Description	97
6.4.1.2	Properties	97
6.4.1.3	Definition	97
6.4.2	tosca.capabilities.nfv.VirtualLinkable	98
6.4.2.1	Description	98
6.4.3	tosca.capabilities.nfv.VirtualCompute	98
6.4.3.1	Description	98
6.4.3.2	Properties	98
6.4.3.3	Definition	98

6.4.4	tosca.capabilities.nfv.VirtualStorage	99
6.4.4.1	Description	99
6.4.4.2	Definition	99
6.5	Requirements Types	99
6.6	Relationship Types	100
6.6.1	tosca.relationships.nfv.VirtualBindsTo.....	100
6.6.1.1	Description	100
6.6.1.2	Properties	100
6.6.1.3	Definition	100
6.6.2	tosca.relationships.nfv.VirtualLinksTo.....	100
6.6.2.1	Description	100
6.6.3	tosca.relationships.nfv.AttachesTo	100
6.6.3.1	Description	100
6.6.3.2	Properties	100
6.6.3.3	Definition	101
6.7	Interface Types	101
6.7.1	tosca.interfaces.nfv.Vnflcm	101
6.7.1.1	Description	101
6.7.1.2	Definition	102
6.7.1.3	Additional Requirements	103
6.7.1.4	Support of LCM scripts.....	104
6.7.1.5	Examples	105
6.7.2	tosca.interfaces.nfv.VnfIndicator	107
6.7.2.1	Description	107
6.7.2.2	Definition	107
6.7.2.3	Examples	107
6.8	Node Types	108
6.8.1	tosca.nodes.nfv.VNF.....	108
6.8.1.1	Description	108
6.8.1.2	Properties	108
6.8.1.3	Attributes.....	110
6.8.1.4	Requirements	110
6.8.1.5	Capabilities.....	110
6.8.1.6	Definition	110
6.8.1.7	Artifact	112
6.8.1.8	Additional Requirements	112
6.8.1.9	Example	114
6.8.2	tosca.nodes.nfv.VnfExtCp.....	116
6.8.2.1	Description	116
6.8.2.2	Properties	117
6.8.2.3	Attributes.....	117
6.8.2.4	Requirements	117
6.8.2.5	Capabilities.....	117
6.8.2.6	Definition	117
6.8.2.7	Additional Requirements	118
6.8.2.8	Example	118
6.8.3	tosca.nodes.nfv.Vdu.Compute	118
6.8.3.1	Description	118
6.8.3.2	Properties	118
6.8.3.3	Attributes.....	119
6.8.3.4	Requirements	119
6.8.3.5	Capabilities.....	120
6.8.3.6	Definition	120
6.8.3.7	Additional requirements.....	121
6.8.3.8	Example	122
6.8.4	tosca.nodes.nfv.Vdu.VirtualBlockStorage.....	126
6.8.4.1	Description	126
6.8.4.2	Properties	126
6.8.4.3	Attributes.....	127
6.8.4.4	Requirements	127
6.8.4.5	Capabilities.....	127
6.8.4.6	Definition	127

6.8.4.7	Additional requirements	127
6.8.5	tosca.nodes.nfv.Vdu.VirtualObjectStorage	127
6.8.5.1	Description	127
6.8.5.2	Properties	128
6.8.5.3	Attributes	128
6.8.5.4	Requirements	128
6.8.5.5	Capabilities	128
6.8.5.6	Definition	128
6.8.5.7	Additional requirements	128
6.8.6	tosca.nodes.nfv.Vdu.VirtualFileStorage	129
6.8.6.1	Description	129
6.8.6.2	Properties	129
6.8.6.3	Attributes	129
6.8.6.4	Requirements	129
6.8.6.5	Capabilities	129
6.8.6.6	Definition	130
6.8.6.7	Additional requirements	130
6.8.7	tosca.nodes.nfv.Cp	130
6.8.7.1	Description	130
6.8.8	tosca.nodes.nfv.VduCp	130
6.8.8.1	Description	130
6.8.8.2	Properties	130
6.8.8.3	Attributes	131
6.8.8.4	Requirements	131
6.8.8.5	Definition	132
6.8.9	tosca.nodes.nfv.VnfVirtualLink	132
6.8.9.1	Description	132
6.8.9.2	Properties	133
6.8.9.3	Requirements	133
6.8.9.4	Capabilities	133
6.8.9.5	Definition	133
6.8.10	tosca.nodes.nfv.VipCp	134
6.8.10.1	Description	134
6.8.10.2	Properties	134
6.8.10.3	Attributes	134
6.8.10.4	Requirements	135
6.8.10.5	Definition	135
6.8.10.6	Example	135
6.9	Group Types	135
6.9.1	tosca.groups.nfv.PlacementGroup	135
6.9.1.1	Description	135
6.9.1.2	Properties	136
6.9.1.3	Definition	136
6.9.1.4	Additional Requirements	136
6.9.1.5	Examples	136
6.10	Policy Types	136
6.10.1	tosca.policies.nfv.InstantiationLevels	136
6.10.1.1	Description	136
6.10.1.2	Properties	137
6.10.1.3	Definition	137
6.10.2	tosca.policies.nfv.VduInstantiationLevels	137
6.10.2.1	Description	137
6.10.2.2	Properties	138
6.10.2.3	Definition	138
6.10.2.4	Additional Requirements	138
6.10.3	tosca.policies.nfv.VirtualLinkInstantiationLevels	138
6.10.3.1	Description	138
6.10.3.2	Properties	139
6.10.3.3	Definition	139
6.10.3.4	Additional Requirements	139
6.10.4	Void	139
6.10.5	tosca.policies.nfv.ScopingAspects	139

6.10.5.1	Description	139
6.10.5.2	Properties	140
6.10.5.3	Definition	140
6.10.5.4	Examples	140
6.10.6	tosca.policies.nfv.VduScalingAspectDeltas	140
6.10.6.1	Description	140
6.10.6.2	Properties	141
6.10.6.3	Definition	141
6.10.6.4	Examples	141
6.10.7	tosca.policies.nfv.VirtualLinkBitrateScalingAspectDeltas	141
6.10.7.1	Description	141
6.10.7.2	Properties	142
6.10.7.3	Definition	142
6.10.7.4	Examples	142
6.10.8	tosca.policies.nfv.VduInitialDelta	142
6.10.8.1	Description	142
6.10.8.2	Properties	143
6.10.8.3	Definition	143
6.10.8.4	Examples	143
6.10.9	tosca.policies.nfv.VirtualLinkBitrateInitialDelta	143
6.10.9.1	Description	143
6.10.9.2	Properties	143
6.10.9.3	Definition	144
6.10.9.4	Examples	144
6.10.10	AffinityRule, AntiAffinityRule	144
6.10.10.1	Description	144
6.10.10.2	Properties	144
6.10.10.3	targets	145
6.10.10.4	Definition	145
6.10.10.5	Examples	146
6.10.11	tosca.policies.nfv.Abstract.SecurityGroupRule	146
6.10.11.1	Description	146
6.10.12	tosca.policies.nfv.SupportedVnfInterface	146
6.10.12.1	Description	146
6.10.12.2	Properties	147
6.10.12.3	Definition	147
6.10.12.4	Additional requirements	147
6.10.12.5	Example	147
6.10.13	tosca.policies.nfv.SecurityGroupRule	148
6.10.13.1	Description	148
6.10.13.2	Properties	148
6.10.13.3	targets	148
6.10.13.4	Definition	148
6.10.13.5	Additional Requirements	148
6.11	VNFD TOSCA service template design	149
6.11.1	General	149
6.11.2	Single or multiple deployment flavour design with TOSCA-Simple-Profile-YAML-v1.2	149
6.11.3	Single deployment flavour design with TOSCA-Simple-Profile-YAML-v1.1	150
7	NSD TOSCA model	151
7.1	Introduction	151
7.2	Data Types	151
7.2.1	tosca.datatype.nfv.ServiceAvailability	151
7.2.1.1	Description	151
7.2.1.2	Properties	151
7.2.1.3	Definition	152
7.2.1.4	Examples	152
7.2.2	tosca.datatypes.nfv.VnfProfile	152
7.2.2.1	Description	152
7.2.3	tosca.datatype.nfv.NsVIPProfile	152
7.2.3.1	Description	152
7.2.3.2	Properties	152

7.2.3.3	Definition	153
7.2.3.4	Examples	153
7.2.3.5	Additional Requirements	153
7.2.4	tosca.datatypes.nfv.ConnectivityType	154
7.2.4.1	Description	154
7.2.5	tosca.datatypes.nfv.NsVirtualLinkQos	154
7.2.5.1	Description	154
7.2.5.2	Properties	154
7.2.5.3	Definition	154
7.2.5.4	Examples	154
7.2.5.5	Additional Requirements	154
7.2.6	tosca.datatypes.nfv.LinkBitrateRequirements	155
7.2.6.1	Description	155
7.2.7	Void	155
7.2.8	Void	155
7.2.9	Void	155
7.2.10	Void	155
7.2.11	tosca.datatypes.nfv.CpProtocolData	155
7.2.11.1	Description	155
7.2.12	tosca.datatypes.nfv.AddressData	155
7.2.12.1	Description	155
7.2.13	tosca.datatypes.nfv.L2AddressData	155
7.2.13.1	Description	155
7.2.14	tosca.datatypes.nfv.L3AddressData	155
7.2.14.1	Description	155
7.2.15	tosca.datatypes.nfv.Qos	155
7.2.15.1	Description	155
7.2.16	tosca.datatypes.nfv.NsProfile	155
7.2.16.1	Description	155
7.2.16.2	Properties	156
7.2.16.3	Definition	156
7.2.16.4	Example	157
7.2.16.5	Additional Requirements	157
7.2.17	tosca.datatypes.nfv.Mask	157
7.2.17.1	Description	157
7.2.17.2	Properties	157
7.2.17.3	Definition	157
7.2.17.4	Examples	158
7.2.18	tosca.datatypes.nfv.NsOperationAdditionalParameters	158
7.2.18.1	Description	158
7.2.18.2	Properties	158
7.2.18.3	Definition	158
7.2.18.4	Examples	158
7.2.19	tosca.datatypes.nfv.NsMonitoringParameter	159
7.2.19.1	Description	159
7.2.19.2	Properties	159
7.2.19.3	Definition	160
7.2.19.4	Examples	160
7.2.19.5	Additional Requirements	160
7.2.20	tosca.datatypes.nfv.VnfMonitoringParameter	161
7.3	Artifact Types	161
7.4	Capabilities Types	161
7.4.1	tosca.capabilities.nfv.VirtualLinkable	161
7.4.1.1	Description	161
7.4.2	tosca.capabilities.nfv.Forwarding	161
7.4.2.1	Description	161
7.4.2.2	Properties	161
7.4.2.3	Definition	161
7.5	Requirements Types	161
7.6	Relationship Types	162
7.6.1	tosca.relationships.nfv.VirtualLinksTo	162
7.6.1.1	Description	162

7.6.2	tosca.relationships.nfv.ForwardTo.....	162
7.6.2.1	Description	162
7.6.2.2	Properties	162
7.6.2.3	Definition	162
7.7	Interface Types	162
7.7.1	tosca.interfaces.nfv.Nslcm	162
7.7.1.1	Description	162
7.7.1.2	Definition	163
7.7.1.3	Additional Requirements	164
7.7.1.4	Support of LCM scripts.....	164
7.7.1.5	Examples.....	165
7.8	Node Types	165
7.8.1	tosca.nodes.nfv.NS	165
7.8.1.1	Description	165
7.8.1.2	Properties	166
7.8.1.3	Attributes.....	166
7.8.1.4	Requirements	166
7.8.1.5	Capabilities.....	166
7.8.1.6	Definition	166
7.8.1.7	Artifact	167
7.8.1.8	Additional requirements.....	167
7.8.2	tosca.nodes.nfv.Sap.....	168
7.8.2.1	Description	168
7.8.2.2	Properties	168
7.8.2.3	Attributes.....	168
7.8.2.4	Requirements	168
7.8.2.5	Capabilities.....	168
7.8.2.6	Definition	168
7.8.2.7	Additional requirements	169
7.8.2.8	Example	169
7.8.3	tosca.nodes.nfv.NsVirtualLink	169
7.8.3.1	Description	169
7.8.3.2	Properties	169
7.8.3.3	Attributes.....	170
7.8.3.4	Requirements	170
7.8.3.5	Capabilities.....	170
7.8.3.6	Definition	170
7.8.3.7	Artifact	170
7.8.3.8	Additional Requirements	171
7.8.3.9	Example	171
7.8.4	tosca.nodes.nfv.Cp.....	171
7.8.4.1	Description	171
7.8.5	tosca.nodes.nfv.NfpPositionElement	171
7.8.5.1	Description	171
7.8.5.2	Properties	171
7.8.5.3	Attributes.....	171
7.8.5.4	Requirements	171
7.8.5.5	Capabilities.....	172
7.8.5.6	Definition	172
7.8.5.7	Artifact	172
7.8.5.8	Additional Requirements	172
7.8.5.9	Example	172
7.8.6	tosca.nodes.nfv.NFP	172
7.8.6.1	Description	172
7.8.6.2	Properties	173
7.8.6.3	Attributes.....	173
7.8.6.4	Requirements	173
7.8.6.5	Capabilities.....	173
7.8.6.6	Definition	173
7.8.7	tosca.nodes.nfv.NfpPosition	173
7.8.7.1	Description	173
7.8.7.2	Properties	173