Welcome to the World of Standards

ETSI MANO

Accessing NFV-MANO functionality through APIs
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AGENDA

- APIs for accessing MANO functions
- MANO API work status and future plans
- Focus on NFVO Northbound APIs
- Using MANO APIs in ONAP

MANO = Management and Orchestration
PART 1

APIs for accessing ETSI MANO functions
The ETSI Group Specifications (GS) NFV-SOL 002, NFV-SOL 003 and NFV-SOL 005 define RESTful APIs for the Ve-Vnfm, Or-Vnfm, and Os-Ma-nfvo reference points, respectively.

They enable multi-vendor integration on these reference points.
RESTful APIs in the ETSI NFV MANO architecture

NFV-SOL 005
NSD Management
NS Lifecycle Management
NS Performance Management
NS Fault Management
VNF Package Management

NFV-SOL 002
VNF Indicator
VNF Lifecycle Management
VNF Performance Management
VNF Fault Management

NFV-SOL 003
VNF Lifecycle Operation Granting
VNF Package Management
Virtualised Resources Quota Available Notification

OSS/BSS
NFVO = NFV Orchestrator
VNF = Virtualised Network Functions
VNFM = VNF Manager
EM = Element Manager
OSS = Operations Support Systems
BSS = Business Support Systems

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A functional view: NSD and VNF package management

- **NSD Management**
- **NS Lifecycle Management**
- **NS Performance Management**
- **NS Fault Management**
- **VNF Package Management**

- **NFV-SOL 005**
  - NSD Management
  - NS Lifecycle Management
  - NS Performance Management
  - NS Fault Management
  - VNF Package Management

- **NFV-SOL 002**
  - VNF Lifecycle Management
  - VNF Performance Management
  - VNF Fault Management

- **NFV-SOL 003**
  - VNF Lifecycle Operation Granting
  - VNF Package Management
  - Virtualised Resources Quota Available Notification

- **NFV-SOL 003**
  - VNF Lifecycle Management
  - VNF Performance Management
  - VNF Fault Management
  - VNF Indicator

- **NFV-SOL 002**
  - VNF Indicator
A functional view: NS and VNF LCM

- **OSS/BSS**
  - NFV-SOL 002: VNF Indicator
  - VNF Configuration

- **EM**
  - NFV-SOL 002: VNF Indicator
  - VNF Fault Management

- **VNF**
  - NFV-SOL 002: VNF Indicator
  - VNF Configuration

- **NFVO**
  - NFV-SOL 005: NS Lifecycle Management
  - NS Performance Management
  - NS Fault Management
  - VNF Package Management

- **VNFM**
  - NFV-SOL 002: VNF Lifecycle Management
  - VNF Performance Management
  - VNF Fault Management

- **OSS/BSS** to **NFVO**
  - Os-Ma-nfvo

- **EM** to **VNFM**
  - Ve-Vnfm-em

- **VNF** to **VNFM**
  - Ve-Vnfm-vnf
A functional view: FM/PM

- **OSS/BSS**
  - NFV-SOL 002
    - VNF Indicator
    - VNF Configuration
  - NFV-SOL 005
    - NSD Management
    - NS Lifecycle Management
    - NS Performance Management
    - NS Fault Management
    - VNF Package Management

- **EM**
  - NFV-SOL 002
    - VNF Indicator
    - VNF Performance Management
    - VNF Fault Management

- **VNFM**
  - NFV-SOL 002
    - VNF Lifecycle Management
    - VNF Performance Management
    - VNF Fault Management

- **NFVO**
  - NFV-SOL 003
    - VNF Lifecycle Operation Granting
    - VNF Package Management
    - Virtualised Resources Quota Available Notification
  - NFV-SOL 002
    - VNF Indicator
    - VNF Lifecycle Management
    - VNF Performance Management
    - VNF Fault Management

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A functional view: Miscellaneous functions

NFV-SOL 005
NSD Management
NS Lifecycle Management
NS Performance Management
NS Fault Management
VNF Package Management

NFV-SOL 002
VNF Lifecycle Management
VNF Performance Management
VNF Fault Management

NFV-SOL 003
VNF Lifecycle Operation Granting
VNF Package Management
Virtualised Resources Quota Available Notification

NFV-SOL 002
VNF Indicator

OSS/BSS

EM

VNF

NFV-SOL 002
VNF Indicator
VNF Configuration (*)

(*) The VNF Configuration API handles virtualization-related data, not application data.
PART 2

Work progress and future plans
NFV-MANO API WORK PROGRESS

- 1st publication of GS NFV-SOL 002 (version 2.3.1).
- 1st publication of GS NFV-SOL 003 (version 2.3.1).
- 1st publication of GS NFV-SOL 005 (version 2.4.1).
- Publication of revised versions of GS NFV-SOL 002/003 (Version 2.4.1)

OpenAPI descriptions publically available for all APIs specified in GS NFV-SOL 002/003 (version 2.4.1)

July 2017

February 2018

March 2018
OpenAPI for NFV-MANO

OpenAPI descriptions available as YAML, JSON and PDF form.

Direct Links to open YAML files in the Swagger UI or Editor.

In case of discrepancies the published ETSI Group Specification (GS) takes precedence.

Bugs can be reported using Bugzilla

https://nfvwiki.etsi.org/index.php?title=API_specifications#OpenAPIs
2018H1 NFV-MANO API ENHANCEMENTS

NFV-SOL002/003

- Support of API client authentication/authorization based on TLS-supported certificates as an alternative to Oauth
- Clarifying normative statements regarding the support of the resources and HTTP methods
- Various small bug fixes and editorial corrections

NFV-SOL 003

- Major bug fix to the configuration parameters for external connection points
- Update of the VNF Package Management interface to allow consistent cross-API design in NFV-SOL 005

NFV-SOL 002

- Fixing misalignment between stage 2 and stage 3 w.r.t. treatment of VNFC in PM interface
API FUTURE WORK PLAN

2018H1 maintenance ongoing for NFV-SOL002, 003 and 005
- Bug fixing
- Consolidation of the API framework by addressing version management.

Enhance existing APIs to support NFV Release 3 features.
Develop OpenAPI descriptions for the NFV-SOL 005 APIs.
Specifications of new APIs on new reference points identified as part of the Release 3 specification effort (e.g. NFVO-NFVO).
Work started on conformance testing specifications for MANO APIs. A Specialists Task Force (STF) is about to be set-up to accelerate the work.
PART 3

Focus on NFVO Northbound APIs
The following APIs are exposed by the NFVO towards the OSS/BSS:

- NSD Management
- NS Lifecycle Management
- NS Performance Management
- NS Fault Management
- VNF Package Management

Different OSS/BSS components can consume different APIs.
After the necessary descriptors have been on-boarded to the NFVO using the VNF Package Management and NSD Management APIs, the OSS/BSS can deploy, manage, modify and then remove NS instances using the NS LCM API.

**ETSI GS NFV-SOL 005** specifies the resources and methods that the OSS/BSS can use to perform Lifecycle Management operations on Network Services.
VNF LIFECYCLE MANAGEMENT VIA THE NFVO LCM API

For an OSS/BSS to affect a VNF, that VNF must be associated with at least one Network Service Instance under its control.

A simplified mapping of VNF LCM operations to NS LCM operations is shown here.

<table>
<thead>
<tr>
<th>VNF operation</th>
<th>Triggered by NS LCM operation(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VNF instantiation</td>
<td>Instantiate NS or Update NS or Scale NS</td>
</tr>
<tr>
<td>VNF Scaling</td>
<td>Scale NS</td>
</tr>
<tr>
<td>VNF Healing</td>
<td>Heal NS</td>
</tr>
<tr>
<td>VNF Termination</td>
<td>Terminate NS or Update NS or Scale NS</td>
</tr>
<tr>
<td>Other VNF operations (e.g. changing: VNF deployment flavour, VNF operational state, configurable properties...)</td>
<td>Update NS</td>
</tr>
</tbody>
</table>
RESOURCE URI STRUCTURE OF THE VNF PACKAGE MANAGEMENT INTERFACE

{(apiRoot)/vnfpkgm/v1

/vnf_packages

/{vnfPkgId}

/vnfd

/package_content

/{upload_from_uri}

/artifacts

/{artifactPath}

/subscriptions

/{subscriptionId}

VNF packages (POST | GET)

Individual VNF package (GET | PATCH | DELETE)

VNFD of an individual VNF Package (GET)

VNF package content (GET | PUT)

Upload VNF package from URI task

Individual VNF package artifact (GET)

Subscriptions for VNF package notifications (POST | GET)

Individual subscription (GET | DELETE)
RESOURCE URI STRUCTURE OF THE NSD MANAGEMENT INTERFACE

{apiRoot}/nsd/v1

/ns_descriptors

/nsd_{nsdInfold}

/nsd_content

NSDs (POST | GET)
Individual NSD (GET | PATCH | DELETE)
NSD content (GET | PUT)

/pnf_descriptors

/pnf_{pnfdInfold}

/pnfd_content

PNFDs (POST | GET)
Individual PNFD (GET | PATCH | DELETE)
PNFD content (GET | PUT)

/subscriptions

/subscription_{subscriptionId}

Subscriptions for NSD/PNFD notifications (POST | GET)
Individual subscription (GET | DELETE)
RESOURCE URI STRUCTURE OF THE NETWORK SERVICE LIFECYCLE MANAGEMENT INTERFACE

/apiRoot/nslcm/v1

/ns_instances
  /{nsInstanceId}
    /instantiate
    /scale
    /update
    /terminate
    /heal

NS Instances (POST | GET)
Individual NS Instance (GET | DELETE)

Task Resources for NS lifecycle management (POST)

/ns_lcm_op_occs
  /{nsLcmOpOccId}
    /retry
    /rollback
    /continue
    /fail
    /cancel

NS LCM operation occurrences (GET)
Individual VNF LCM operation occurrence (GET)

Task Resources for LCM operation error handling (POST)

/subscriptions
  /{subscriptionId}

Subscriptions for NS lifecycle notifications (POST | GET)
Individual subscription (GET | DELETE)
NS LIFECYCLE MANAGEMENT EXAMPLE: NS INSTANTIATION

Os-Ma-nfvo (SOL005)

1. POST .../ns_instances (CreateNsRequest)
2. 201 Created (NsInstanceState)
3. Send NsIdentifierCreationNotification
4. POST .../ns_instances/{nsInstanceId}/Instantiate (InstantiateNsRequest)
5. 202 Accepted()
6. Send NsLcmOperationOccurrenceNotification (STARTING)

7. Allocate Virtualised Network Resource(s)

for each new VNF instance

8. POST .../vnf_instances (CreateVnfRequest)
9. 201 Created (VnfInstanceState)
10. Send VnfIdentifierCreationNotification
11. POST .../vnf_instances/{vnfInstanceId}/Instantiate (InstantiateVnfRequest)
12. 202 Accepted()
13. Send VnfLcmOperationOccurrenceNotification (STARTING)
14. POST .../vnf_instances/{vnfInstanceId}/Instantiate (InstantiateVnfRequest)
15. 201 Created (Grant)
16. Send VnfLcmOperationOccurrenceNotification (PROCESSING)

17. Allocate Virtualised Storage Resource(s)
18. Allocate Virtualised Network Resource(s)
19. Allocate Virtualised Compute Resource(s)
20. Send VnfLcmOperationOccurrenceNotification (COMPLETED)
21. Send NsLcmOperationOccurrenceNotification (COMPLETED)
PART 4

Using MANO APIs in ONAP or other E2E management platforms
The Os-Ma-Nfvo reference point represents the boundary between application-independent resource-oriented service management and application-specific service management.

MANO can be regarded as a building block of a wider end-to-end service management platform.

“Application”-Layer FCAPS management and other Operations Support Systems (OSS) functions (incl. application-aware service orchestration) deliberately left out of the scope of NFV-MANO to enable

- Re-use of already fielded components
- Use of independently specified new components (e.g. service orchestrators, IA/analytics modules, etc.)

Many components of the ONAP architecture are outside the scope of NFV-MANO and can complement MANO functions to create an end-to-end platform, providing that the ONAP software architecture exposes the NFV-SOL APIs.
More information:

NFV Technology Page (information)  
http://www.etsi.org/nfv

NFV Portal (working area)  
http://portal.etsi.org/nfv

NFV Proofs of Concept (information)  
http://www.etsi.org/nfv-poc

NFV Plugtest (information & registration)  
http://www.etsi.org/nfvplugtest

Access to specifications and feedback:

Drafts in Open Area:  
http://docbox.etsi.org/ISG/NFV/Open/Drafts/

Published specifications:  
http://www.etsi.org/standards-search

Issue tracker  