Integrating 3GPP 5G management framework with ONAP

2019 ONAP Joint Subcommittees Silicon Valley

Anatoly Andrianov, Nokia
On behalf of 3GPP / SA5
Objective / Expectation

Specify how to integrate 3GPP and ONAP for the Management and Orchestration of 3GPP 5G networks

ONAP and 3GPP shall:
- complement each other
- not overlap
Content

✓ 3GPP in a nutshell
✓ 3GPP Management Framework
✓ Integrating 3GPP Management Framework with ONAP
  ✓ Positioning
  ✓ Fault & Performance Management
    ✓ General
    ✓ FM
    ✓ PM
  ✓ Provisioning (Config. Management)
  ✓ Misc.
✓ Useful links
3GPP Structure

TSG RAN
 Radio Access Network
- RAN WG1 Radio Layer 1 spec
- RAN WG2 Radio Layer 2 spec Radio Layer 3 RR spec
- RAN WG3 Iub spec, Iur spec, Iu spec UTRAN O&M requirements (Radio CN Interfaces)
- RAN WG4 Radio Performance Protocol aspects
- RAN WG5 Mobile Terminal Conformance Testing
- RAN WG6 GSM EDGE Radio Access Network

TSG CT
 Core Network & Terminals
- CT WG1 MM/CC/SM (Lu) (end-to-end aspects)
- CT WG3 Interworking with external networks
- CT WG4 MAP/GTP/BCH/SS (protocols within the CN)
- CT WG6 Smart Card Application Aspects

TSG SA
 Service & Systems Aspects
- SA WG1 Services
- SA WG2 Architecture
- SA WG3 Security
- SA WG4 Codec & Media
- SA WG5 Telecom Management
- SA WG6 Mission-Critical Applications

Project Coordination Group (PCG)
### 3GPP Releases

#### 2017
- Q4: Rel-15 NSA (option-3) freeze

#### 2018
- Q1: Rel-15 NSA (option-3) ASN.1
- Q2: Rel-15 freeze (incl 5G SA)
- Q3: Rel-15 ASN.1 (incl 5G SA)
- Q4: Rel-15 late drop freeze

#### 2019
- Q1: Rel-15 late drop ASN.1

#### 2020
- Q1: Rel-16 freeze

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**“Early drop”**
- Rel-15 NSA (option-3) freeze

**“Main drop”**
- Rel-15 NSA (option-3) ASN.1
- Rel-15 freeze (incl 5G SA)
- Rel-15 ASN.1 (incl 5G SA)

**“Late drop”**
- Rel-15 late drop freeze
- Rel-15 late drop ASN.1

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*Not contractual. May change over time.*
3GPP System
3GPP 5G Management Concepts

Methodology to produce Technical Specifications

- Concepts, Use Cases, Requirements – Stage 1
- Protocol-neutral Information Model – Stage 2
- Protocol-specific Solution Set(s) (REST/JSON, YANG, etc.) – Stage 3

Managing what?

- Network Resource Model
- Management Services

How?
5G network may comprise:

- Stand Alone / Non-Stand Alone
- Single / Dual Connectivity
- NG-RAN Non Split / 2-Split / 3-Split options
- 5G Core Network Service-Based Architecture
- Network Slicing
5G Management Services

From a Reference Point-Based management architecture to a Service-Based Management Framework

Management Services (MnSs)

- Provisioning Services (CM)
  - Provisioning services
  - Provisioning data report services

- Fault Supervision MnSs
  - Fault supervision control services
  - Fault supervision data report services

- Performance Assurance MnSs
  - Performance management job control services
  - Performance data file reporting services
  - Performance data streaming services
Positioning ONAP wrt. 3GPP MnSs

ONAP R3 (Casablanca) architecture

3GPP Management Services consumers

3GPP MnS producers (e.g. VNFs, PNFs, EMF)

Service Interface

Management Service

Management Service

Management Service

Management Service
ONAP DCAE collection framework

- Aims at collecting all sorts of events from xNFs (but not only)

- In ONAP R1 and R2:
  - VES (VNF Event Stream) Collector, via REST / HTTPS / JSON API
  - SNMP Trap Collector, via SNMP

- In ONAP R3:
  - Data File Collector, to support 3GPP Bulk PM data file collection
  - VES-HV (High-Volume) Collector, to support Real-Time Performance Measurement (RTPM), using Google Protocol Buffer (GPB)
## How 3GPP will adapt to ONAP DCAE Collectors

### 3GPP Performance Assurance services

<table>
<thead>
<tr>
<th>Candidate consumers in ONAP R3</th>
<th>Candidate 3GPP Rel-16 solution sets</th>
</tr>
</thead>
</table>
| VES JSON Collector (for FileReady notification) | Protocol: REST  
Payload: JSON |
| Data File Collector (for PM file upload) | Protocol: FTP  
File content: XML |

### Performance data file reporting services

| VES JSON Collector for low-medium volume PM | Protocol: REST  
Payload: JSON |
| HV Collector for real-time (less than 1 minute) high volume PM (TCP, GPB) | Protocol: TCP  
Payload: ASN.1 Binary |

### Performance data streaming services

### 3GPP Fault Supervision services

<table>
<thead>
<tr>
<th>Candidate consumers in ONAP R3</th>
<th>Candidate 3GPP Rel-16 solution sets</th>
</tr>
</thead>
</table>
| VES JSON Collector for alarm notifications under normal conditions | Protocol: REST  
Payload: JSON |
| HV Collector for alarm notifications under alarm flooding conditions | Protocol: TCP  
Payload: ASN.1 Binary |
## Subscribe vs. No Subscribe to 3GPP events

<table>
<thead>
<tr>
<th>ONAP</th>
<th>3GPP</th>
<th>Proposed action</th>
</tr>
</thead>
</table>
| DCAE Collectors as recipients of any sorts of events from 5G xNFs. | Based on Subscribe / Notify paradigm and filtering conditions. | **AI 3GPP**: Specify a solution to model the association between 5G NRM IOC instances and the address(es) of ‘notification consumers’, configurable via ‘NF Provisioning Management Service’.

Address of DCAE Collectors configured at xNF instantiation time and/or later. | N-to-M relationship b/w notification emitters and recipients. |  |

### 3GPP in a nutshell

**Integrating 3GPP Management Framework with ONAP**  
Positioning - **Fault & Performance Management - Provisioning**

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### ONAP vs. 3GPP

<table>
<thead>
<tr>
<th>Type of event</th>
<th>JSON VES Collectors’ address list</th>
<th>HV VES Collectors’ address list</th>
<th>Data File Collectors’ address list</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘fault’</td>
<td>{VES Coll#1 IP@}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘measurement’</td>
<td>{VES Coll#1 IP@}</td>
<td>{HV Coll#1 IP@}</td>
<td>{DFC Coll#1 IP@}</td>
</tr>
<tr>
<td>‘heartbeat’</td>
<td>{VES Coll#1 IP@}</td>
<td></td>
<td></td>
</tr>
<tr>
<td>…</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Introducing ‘fault3GPP’ as new type of Technology Specific Record
Defining JSON schema for ‘fault3GPP’

```json
"fault3GPPFields": {  
  "description": "3GPP alarm notifications format, based on 3GPP TS 28.532.\n  
  
  "type": "object",  
  "properties": {  
    "fault3GPPFieldsVersion": {  
      "description": "The version of the Fault Supervision Management Service in TS 28.532 - Clause A.2",  
      "type": "string"  
    },  
    "alarmNotification": {  
      "oneOf": [{  
        "SRef": "#/definitions/notifyNewAlarmType"  
      },  
      {  
        "SRef": "#/definitions/notifyNewSecurityAlarmType"  
      },  
      {  
        "SRef": "#/definitions/notifyClearedAlarmType"  
      },  
      {  
        "SRef": "#/definitions/notifyAlarmListRebuiltType"  
      }  
      ]  
    }  
  }  
}
```
## Fault Management operations

<table>
<thead>
<tr>
<th>Retrieving missing alarms</th>
<th>ONAP</th>
<th>3GPP</th>
<th>Proposed action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not addressed by ONAP</td>
<td><code>getAlarmList()</code> – used to deal with alarm loss. Two modes of operation: a) <strong>Synchronous mode</strong>: the list of missing alarms is returned synchronously with the operation b) <strong>Asynchronous mode</strong>: the list of missing alarms is returned via alarm notifications. In this mode of operation, the only information returned synchronously is the status of the operation.</td>
<td><strong>AI ONAP</strong>: Introduce Use Case and operation <code>getAlarmList</code> to APPC API, where: - APPC is consumer of 3GPP <code>getAlarmList()</code> operation - DCAE is consumer of 3GPP alarm notifications - Only asynchronous mode is supported</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Acknowledging Alarms</th>
<th>ONAP</th>
<th>3GPP</th>
<th>Proposed action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not addressed by ONAP</td>
<td><code>acknowledgeAlarms()</code> – used to indicate that the activity to resolve the problem has started</td>
<td><strong>AI ONAP</strong>: Introduce Use Case and operations to APPC API</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clearing Alarms</th>
<th>ONAP</th>
<th>3GPP</th>
<th>Proposed action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not addressed by ONAP</td>
<td><code>clearAlarms()</code> – used for clearing alarms</td>
<td><strong>AI ONAP</strong>: Introduce Use Case and operations to APPC API</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Setting comments</th>
<th>ONAP</th>
<th>3GPP</th>
<th>Proposed action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not addressed by ONAP</td>
<td><code>setComments()</code> - used to set comments to alarms</td>
<td><strong>AI ONAP</strong>: Introduce Use Case and operations to APPC API</td>
<td></td>
</tr>
</tbody>
</table>
### OA&M Data Communication Management

<table>
<thead>
<tr>
<th>Heartbeat</th>
<th>ONAP</th>
<th>3GPP</th>
<th>Proposed action</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Used by xNFs to communicate information about their health</td>
<td>No equivalent in 5G (Rel-15) &lt;br&gt;‘Communication Surveillance’ IRP (Integration Reference Point) applies to pre-5G technologies.</td>
<td>AI 3GPP: define a new Management Service (consumer would be VES Collector)</td>
</tr>
</tbody>
</table>
Collecting 3GPP PM measurement data

**Bulk PM data file**
- VES Collector receives *FileReady* notification
- Data File Collector retrieves PM data file
- 3GPP and ONAP aligned already

**PM data streaming**
- VES Collector
  - JSON schema for PM records
- HV Collector
  - ASN.1

Re. REST/JSON PM data streaming, 3GPP will define a new Solution Set and may reuse ONAP Dublin VES *pmMeasResult* events schema.

Overview – Dublin

PM support in Dublin proposal:
- 3GPP PM Mapper microservice
- `perf3gpp: pmMeasResult VES` event
- UC to convert PM data from 3GPP XML input to VES `pmMeasResult` output:
  - micro-service subscribes to PM feed from DR
  - measurements from the PM files are extracted and mapped to VES `pmMeasResult` events
Defining new ‘Perf3GPP’ as new type of Technology Specific Record for 3GPP PM data streaming
## Performance Management control

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<th>3GPP</th>
<th>Proposed action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control of Performance Management</td>
<td>Parameters are provisioned (as other xNF configuration parameters) at instantiation time and/or later</td>
<td>AI 3GPP (Ongoing): Extend 5G Network Resource Model with PM control object classes / attributes.</td>
</tr>
<tr>
<td>(e.g. measurement start time, end time, Granularity Period, Reporting Period, measurements to be collected, etc.)</td>
<td>Based on PM job (createMeasurementJob (), stopMeasurementJob (), ...)</td>
<td></td>
</tr>
</tbody>
</table>

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# Provisioning Services

<table>
<thead>
<tr>
<th>CRUD operations</th>
<th>ONAP</th>
<th>3GPP</th>
<th>Proposed action</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRUD operations</td>
<td>NETCONF / YANG as option</td>
<td>YANG NRM</td>
<td><strong>AI 3GPP</strong>: Add NETCONF-based solution set for Provisioning Services.</td>
</tr>
</tbody>
</table>
| CRUD notifications       | Not supported in R3.      | Supported (REST / JSON) | **AI ONAP**: Introduce ‘Config3GPP’ as new 3GPP Specific Record in VES API  
AI 3GPP: Specify a new REST JSON Solution Set for:  
- objectCreationNotification ()  
- objectDeletionNotification ()  
- attributeValueChangeNotification ()  
Working assumption: VES Collector would be the consumer of CRUD notifications. |

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**3GPP in a nutshell**

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**Integrating 3GPP Management Framework with ONAP**

Positioning - Fault & Performance Management - Provisioning

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3GPP SA5 OpenAPI Specifications

- Contained in annex of the 3GPP Technical Specification which specifies the corresponding MnS

- Also stored as separate physical files, accessible at [http://www.3gpp.org/ftp/Specs/2018-12/Rel-15/OpenAPI/](http://www.3gpp.org/ftp/Specs/2018-12/Rel-15/OpenAPI/)
  - TS 28xxx series
  - One .json file per Management Service
  - Publicly available
  - Still under discussion in 3GPP
Some useful links


* Completed in 03/2019
Thank you!