3GPP management and orchestration of 5G networks and network slicing

Thomas Tovinger, 3GPP SA5 chair
Contents

- Brief 3GPP introduction
- The role of 3GPP SA5
- 5G Management and orchestration framework
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Participation in 3GPP is made possible by companies and organizations becoming members of one of the 3GPP Organizational Partners, the seven Standards Developing Organizations (SDOs) - from China, Europe, India, Japan, Korea and the United States.

Specific inputs, in the form of market requirements may also come in to the Project via any of the twenty Market Representation Partners in 3GPP. These organizations have all signed up to the 3GPP Project scope and objectives.

There is also a lot of external cooperation with other standards bodies and a broad variety of other groups, by way of formal Liaisons.
The role of 3GPP

- 3GPP is part of the invention, proof of concept, standardization, trials, commercialization … cycle
- Its role is to specify and maintain a complete system description for mobile telecommunications
- The system description is characterized by a number of standardized interfaces, not a description of standardized deployment
- This standardization approach enables an interoperable, multi-vendor approach to deployment and generates mass market economies of scale, without stifling innovation
Where are we now on 5G?

- 3GPP continues to expand the LTE platform to improve its efficiency to meet the mobile broadband demand
- 3GPP is on schedule with the standardization of 5G, addressing the expanded connectivity needs of the future
- Phases for the normative 5G work
  - Phase 1 (Rel-15): Addresses the more urgent subset for commercial deployments
  - Phase 2 (Rel-16): Completes the IMT 2020 submission, addresses all identified use cases & requirements

### Timeline

<table>
<thead>
<tr>
<th>Release 15</th>
<th>Release 16</th>
<th>Release 17</th>
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<tbody>
<tr>
<td>5G Phase 1</td>
<td>5G Phase 2</td>
<td>5G …</td>
</tr>
<tr>
<td>June 2018</td>
<td>Dec 2019</td>
<td></td>
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Project Coordination Group (PCG)

3GPP organization

TSG RAN
Radio Access Network
- RAN WG1
  Radio Layer 1 spec
- RAN WG2
  Radio Layer 2 spec
  Radio Layer 3 RR spec
- RAN WG3
  lub spec, lur spec, lu 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

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ONAP M-SDO workshop, San Jose 1-2 April 2019
**Bringing the work in to the groups**

<table>
<thead>
<tr>
<th>Use Cases</th>
<th>Overall Goals</th>
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<tbody>
<tr>
<td>Higher Data Rates</td>
<td>Enable new business</td>
</tr>
<tr>
<td>Higher User Mobility</td>
<td>Greater Efficiency (lower cost per bit for capital investment, operations &amp; energy)</td>
</tr>
<tr>
<td>Highly variable data rates</td>
<td>Flexibility (not one-size fits all system)</td>
</tr>
<tr>
<td>Diverse Deployments</td>
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<td>Improved Coverage</td>
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### 3GPP Specifications and Reports:

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<td>Service aspects (&quot;stage 1&quot;)</td>
<td>22 series</td>
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<td>Technical realization (&quot;stage 2&quot;)</td>
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<td>Signalling protocols (&quot;stage 3&quot;) - user equipment to network</td>
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<td>Radio aspects</td>
<td>25 series</td>
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<tr>
<td>CODECs</td>
<td>26 series</td>
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<tr>
<td>CODECs</td>
<td>27 series</td>
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<tr>
<td>Radio aspects</td>
<td>28 series</td>
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<tr>
<td>Signalling protocols (&quot;stage 3&quot;) - (RSS-CN) and OAM&amp;P and Charging (overflow from 32.- range)</td>
<td>29 series</td>
</tr>
<tr>
<td>Signalling protocols (&quot;stage 3&quot;) - intra-fixed-network</td>
<td>30 series</td>
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<tr>
<td>Programme management</td>
<td>31 series</td>
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<tr>
<td>Subscriber Identity Module (SIM / USIM), IC Cards. Test specs.</td>
<td>32 series</td>
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<tr>
<td>Security aspects</td>
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<td>UE and (U)SIM test specifications</td>
<td>34 series</td>
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<tr>
<td>Security algorithms</td>
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<tr>
<td>LTE (Evolved UTRA), LTE-Advanced, LTE-Advanced Pro radio technology</td>
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<td>Multiple radio access technology aspects</td>
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<tr>
<td>Radio technology beyond LTE</td>
<td>38 series</td>
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</table>
The role of 3GPP SA5

- The sole group responsible for management, orchestration and charging standards for 3GPP networks
- Coordinates with all 3GPP working groups
- Communicates with other SDOs and industry fora
Management and orchestration framework

- Service oriented
- Based on management service components (MnS): type A, B, C
Management and orchestration framework

Examples of MnSs and component type A, B and C
Management and orchestration framework

Management Function (MnF): Plays the role of either Management Service (MnS) producer or MnS consumer, or both.
Example of deployment scenario for management of a mobile network including network slicing
Management and orchestration framework

Example deployment scenario for NSSI management with interface to NFV-MANO

 NSS Management service

 NF provisioning service

 NFV Orchestrator (NFVO)

 NFV Manager (VNF)

 Virtualised Infrastructure Manager (VIM)

 NFV-MANO

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Key 5G management specifications / contents

- Management concept, use cases, requirements, framework and architecture: 3GPP TS 28.530, 28.533
- Provisioning: TS 28.531
- Generic management services (for Provisioning, FM, PM): 28.532
- Network Resource Model (NRM): TS 28.540, 28.541
- Performance measurements/KPIs & assurance: TS 28.550/552/554
Provisioning

_requirements: E.g. Requirements for network slice provisioning service

_use cases: E.g. Network slice instance creation

_management services for provisioning: E.g.
  • Management services for network slice provisioning:
    • createMOI operation
    • allocateNsi operation
    • notifyProvisioning notification
    • etc.
Network Resource Model (NRM)

Scope and structure of the NRM

- Requirements /Use Cases
- Information Service Definitions (UML)
- Solution Set (XML, JSON, YANG)

NG RAN  5G Core  Network Slice

Generic NRM

- Relatively stable over long period
- Changes only with respect to addition and extensions
- Changes with new better technologies
Network Resource Model (NRM)

Generic NRM

- InformationObjectClass
  - Subnetwork
- InformationObjectClass
  - ManagedElement
  - MeasurementControl
- InformationObjectClass
  - EP_RP
- InformationObjectClass
  - ManagedFunction
Network Resource Model (NRM)

NG-RAN – High-level and cell relation view
Network Resource Model (NRM)

NG-RAN – Combined gNB cell state diagram
Network Resource Model (NRM)

5GC – High-level view
Network Resource Model (NRM)

5GC - Transport view of SMF NRM
Network Slicing

Definition of concepts & terms for network slicing in addition to the basic terms defined by SA2 in TS 23.501

Provisioning operations, notifications etc. (seen above)

Measurements/KPIs

NRM definitions:
5G Performance measurements/KPIs & assurance

- Performance measurements and KPIs are defined for network functions including NG-RAN and 5GC, and for network slice instances in terms of E2E QoS.
- Measurement job control service: To allow the consumer to create, stop and list the measurement jobs.
- The consumer can choose to get the measurement results by file or by streaming.
SA5 work plan
Summary of ongoing work items (1/3)

<table>
<thead>
<tr>
<th>WI Title</th>
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<tbody>
<tr>
<td>Volume Based Charging Aspects for VoLTE</td>
<td>SA#84 (06/2019)</td>
</tr>
<tr>
<td>Nchf Online and Offline Charging Services</td>
<td>SA#85 (09/2019)</td>
</tr>
<tr>
<td>Charging Enhancement of 5GC interworking with EPC</td>
<td>SA#85 (09/2019)</td>
</tr>
<tr>
<td>Network Exposure Charging in 5G System Architecture</td>
<td>SA#86 (12/2019)</td>
</tr>
<tr>
<td>Charging AMF in 5G System Architecture Phase 1</td>
<td>SA#85 (09/2019)</td>
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<tr>
<td>Study on Charging Aspects of Network Slicing</td>
<td>SA#85 (09/2019)</td>
</tr>
<tr>
<td>WI Title</td>
<td>Target date</td>
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<tr>
<td>Management of QoE measurement collection</td>
<td>SA#85 (09/2019)</td>
</tr>
<tr>
<td>Energy efficiency of 5G</td>
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<tr>
<td>Network policy management for mobile networks based on NFV scenarios</td>
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<tr>
<td>Methodology for 5G management specifications</td>
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<td>Intent driven management services for mobile network</td>
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<tr>
<td>Enhancement of performance assurance for 5G networks including network</td>
<td>SA#86 (12/2019)</td>
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<td>slicing</td>
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<td>Discovery of management services in 5G</td>
<td>SA#85 (09/2019)</td>
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<tr>
<td>NRM enhancements</td>
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<tr>
<td>Trace Management in the context of Services Based Management</td>
<td>SA#84 (06/2019)</td>
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<tr>
<td>Architecture</td>
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<tr>
<td>Integration of ONAP and 3GPP 5G management framework</td>
<td>SA#87 (03/2020)</td>
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## Summary of ongoing work items (3/3)

<table>
<thead>
<tr>
<th>WI Title</th>
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<tr>
<td>Study on management aspects of edge computing</td>
<td>SA#85 (09/2019)</td>
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<tr>
<td>Study on protocol enhancement for real time communication</td>
<td>SA#86 (12/2019)</td>
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<tr>
<td>Study on tenancy concept in 5G network and network slicing management</td>
<td>SA#85 (09/2019)</td>
</tr>
<tr>
<td>Study on management aspects of communication services</td>
<td>SA#85 (09/2019)</td>
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<tr>
<td>Study on Self-Organizing Networks (SON) for 5G</td>
<td>SA#86 (12/2019)</td>
</tr>
<tr>
<td>Study on non-file-based trace reporting</td>
<td>SA#84 (06/2019)</td>
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<td>Study on non-public networks management</td>
<td>SA#86 (12/2019)</td>
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<tr>
<td>Study on management and orchestration aspects with integrated satellite components in a 5G network</td>
<td>SA#86 (12/2019)</td>
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Conclusions

- 3GPP is an industry driven standardization activity with truly global reach
- Standardization of interfaces enables an interoperable, multi-vendor approach to deployment and generates mass market economies of scale
- NR remains high focus for RAN groups
- IMT-2020 ‘5G’ process progressing – 3GPP leading the way
- Release 16 focus continues to expand towards new use cases and new sectors
- 5G will be a multi-Release technology (beyond Release 16)
- SA5 remains the focal point for management and orchestration
Acknowledgements

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Thank you!

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