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

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Contents

- Brief 3GPP introduction
- The role of 3GPP SA5
- 5G Management and orchestration framework
- Key 5G management specification contents
- Network Slicing
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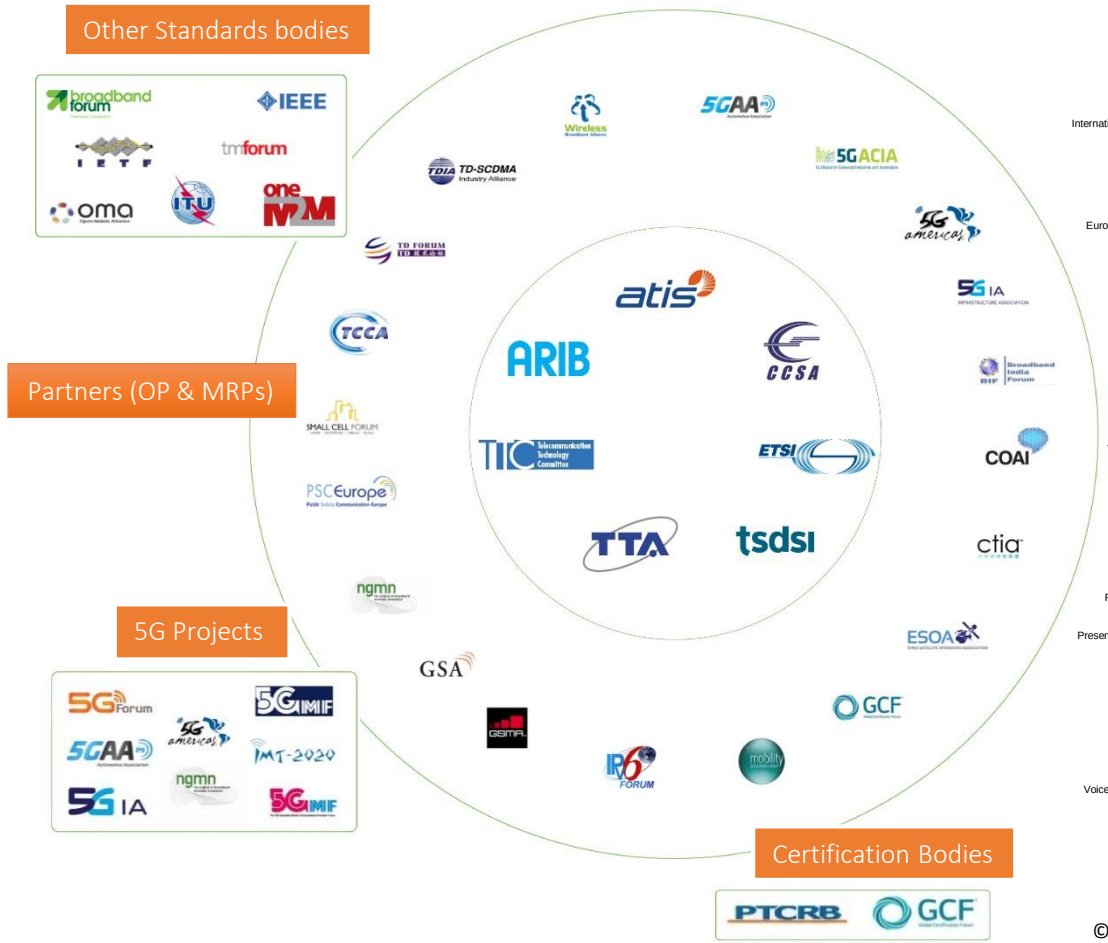
3GPP standards eco-system

- 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.

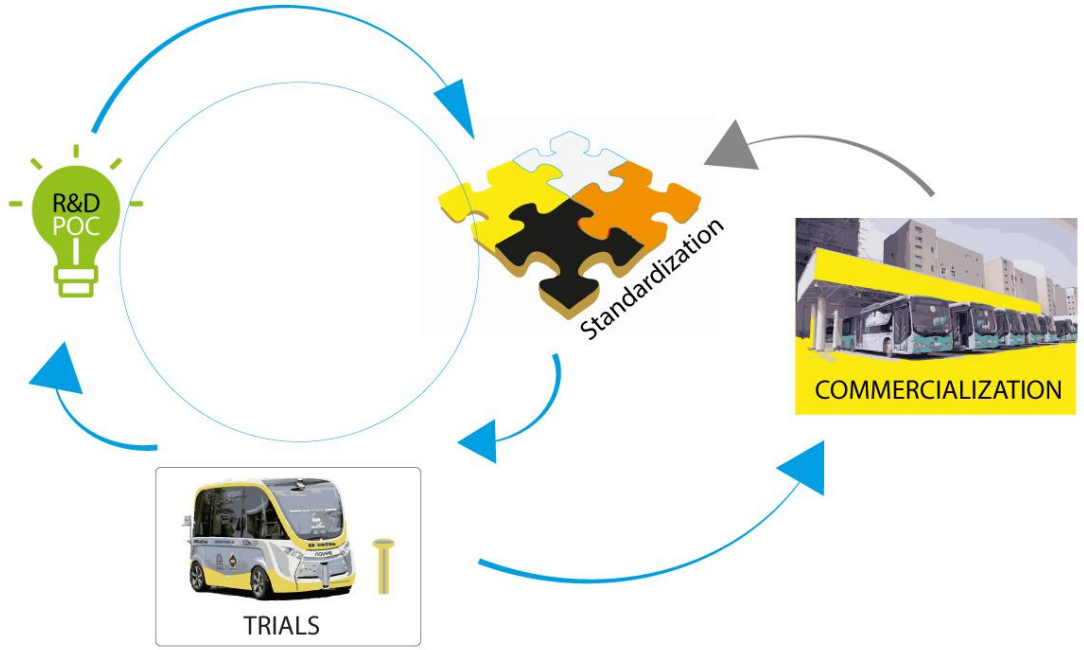


Formal External Liaisons

450 MHz Alliance
AISG
Bluetooth
Broadband Forum (BBF)
CableLabs
International Special Committee on Radio Interference (CISPR)
CTIA
Digital Video Broadcasting (DVB) Project
Ecma International
Expert Group for Emergency Access (EGEA)
Eurescom
COST 273
European Radiocommunications Committee (ERC)
Fixed Mobile Convergence Alliance (FMCA)
Global Certification Forum (GCF)
Global TD-LTE Initiative (GTD)
GPS Industry Council
GSM Association
HomeRF Forum
IDB Forum
IEEE
Internet Engineering Task Force (IETF)
IrDA
International Multimedia Telecomunications Consortium (IMTC)
Internet Streaming Media Alliance
ISO-ITU expert group
ISO MPEG / JPEG
ITU-T SG2
JAIN tm (Javatm APIs for Integrated Networks)
The Java Community Process (JCP)
Liberty Alliance Project
LTE/SAE Trial Initiative (LSTI)
Metro Ethernet Forum (MEF)
NENA
NGMN (Next Generation Mobile Networks)
oneM2M
OMA (Open Mobile Alliance)
Open Networking Foundation (ONF)
Open IPTV Forum
Object Management Group (OMG)
PCS Type Certification Review Board (PTCRB)
Portable Computer and Communications Association (PCCA)
Presence and Availability Management (PAM) Forum
RSA Laboratories
SDR Forum
Sun Micro Systems Inc
Steerco
SyncML Initiative
Trusted Computing Group (TCG)
TeleManagement Forum (TMF)
TCCA
TIA /TR45
TIA/TR47
TV-anytime Forum
Voice eXtensible Mark-up Language (VXML) Forum
Wi-Fi Alliance
Wireless Broadband Alliance (WBA)
WLAN Smart Card Consortium
Wireless World Research Forum (WWRF)
World Wide Web Consortium (W3C)

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

June 2018

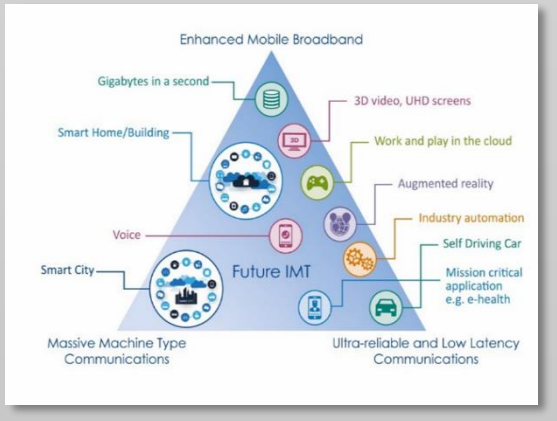
Dec 2019

3GPP organization

Project Coordination Group (PCG)

TSG RAN **Radio Access Network**	**TSG CT** **Core Network & Terminals**	**TSG SA** **Service & Systems Aspects**
RAN WG1 Radio Layer 1 spec	CT WG1 MM/CC/SM (lu) (end-to-end aspects)	SA WG1 Services
RAN WG2 Radio Layer 2 spec Radio Layer 3 RR spec	CT WG3 Interworking with external networks	SA WG2 Architecture
RAN WG3 lub spec, lur spec, lu spec UTRAN O&M requirements (Radio CN Interfaces)	CT WG4 MAP/GTP/BCH/SS (protocols within the CN)	SA WG3 Security
RAN WG4 Radio Performance Protocol aspects	CT WG6 Smart Card Application Aspects	SA WG4 Codec & Media
RAN WG5 Mobile Terminal Conformance Testing		SA WG5 Telecom Management
RAN WG6 GSM EDGE Radio Access Network		SA WG6 Mission-Critical Applications

Bringing the work in to the groups

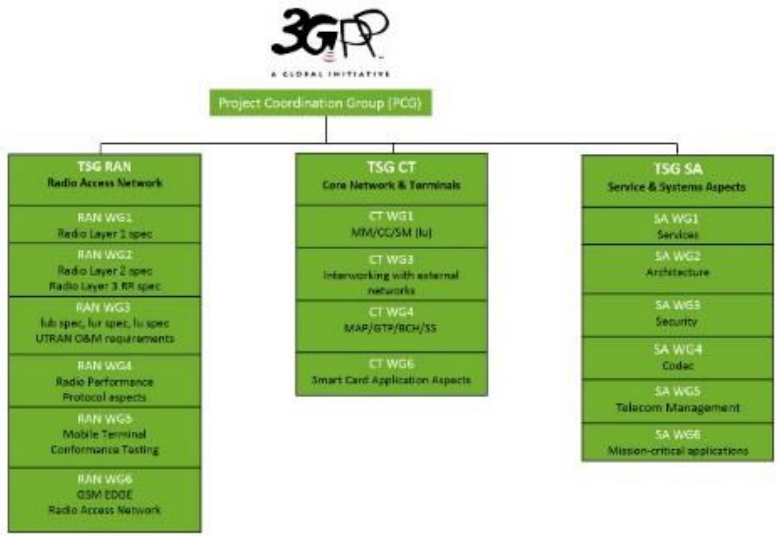


Use Cases

- Higher Data Rates
- Higher User Mobility
- Highly variable data rates
- Diverse Deployments
- Improved Coverage

Overall Goals

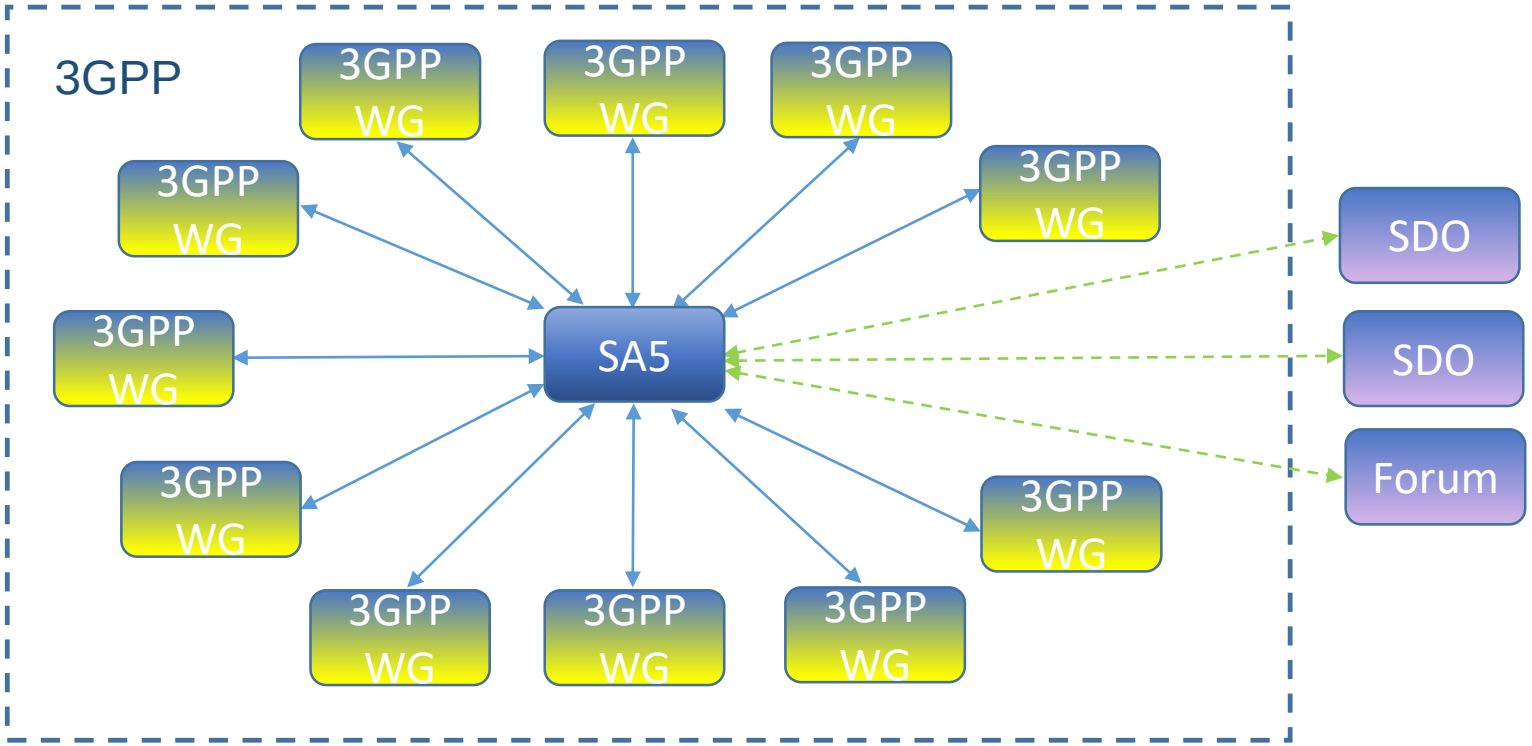
- **Enable new business**
- **Greater Efficiency (lower cost per bit for capital investment, operations & energy)**
- **Flexibility (not one-size fits all system)**



3GPP Specifications and Reports:	
Requirements	21 series
Service aspects ("stage 1")	22 series
Technical realization ("stage 2")	23 series
Signalling protocols ("stage 3") - user equipment to network	24 series
Radio aspects	25 series
CODECs	26 series
Data	27 series
Signalling protocols ("stage 3") -(RSS-CN) and OAM&P and Charging (overflow from 32.- range)	28 series
Signalling protocols ("stage 3") - intra-fixed-network	29 series
Programme management	30 series
Subscriber Identity Module (SIM / USIM), IC Cards. Test specs.	31 series
OAM&P and Charging	32 series
Security aspects	33 series
UE and (U)SIM test specifications	34 series
Security algorithms	35 series
LTE (Evolved UTRA), LTE-Advanced, LTE-Advanced Pro radio technology	36 series
Multiple radio access technology aspects	37 series
Radio technology beyond LTE	38 series

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

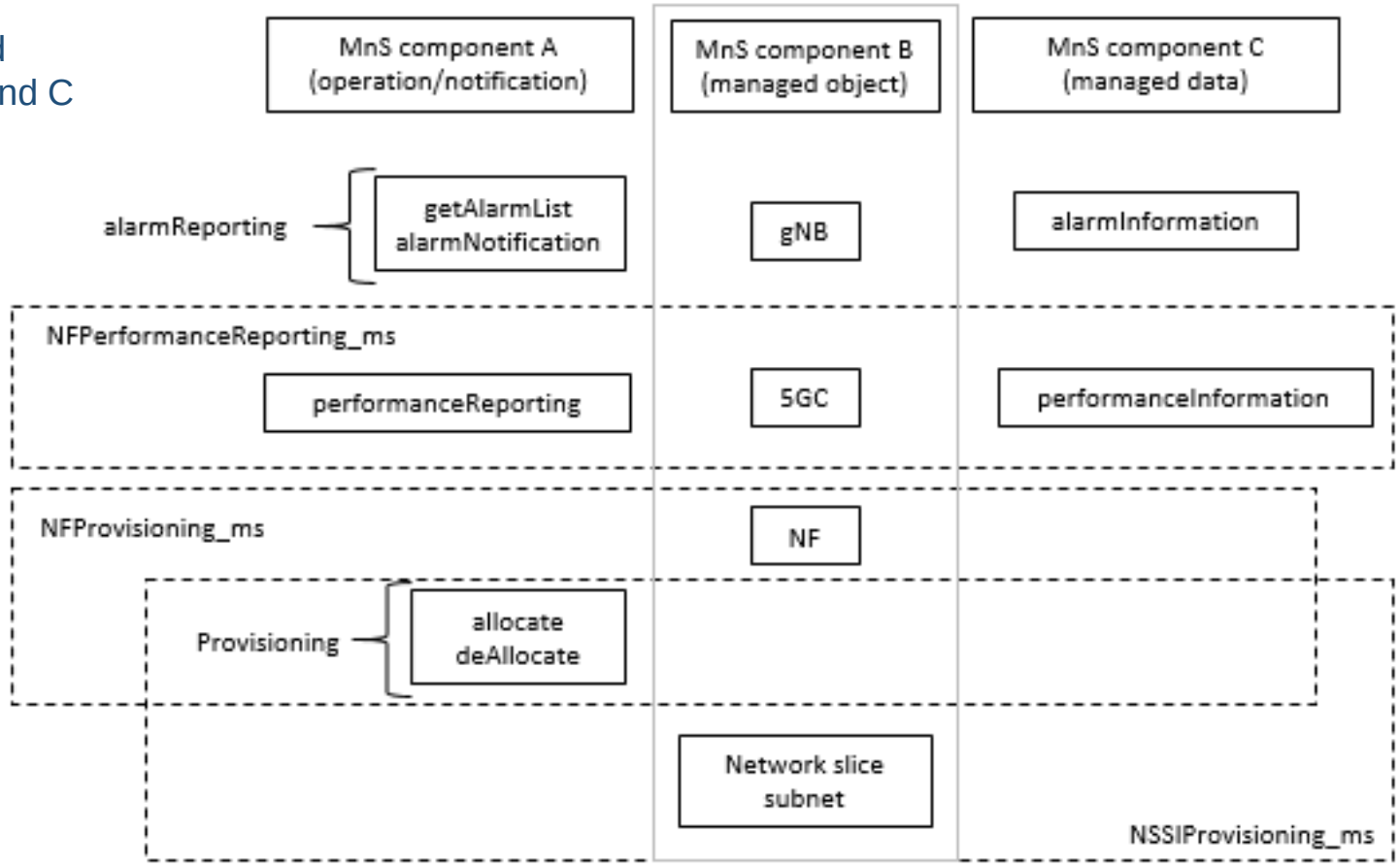


Management and orchestration framework

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

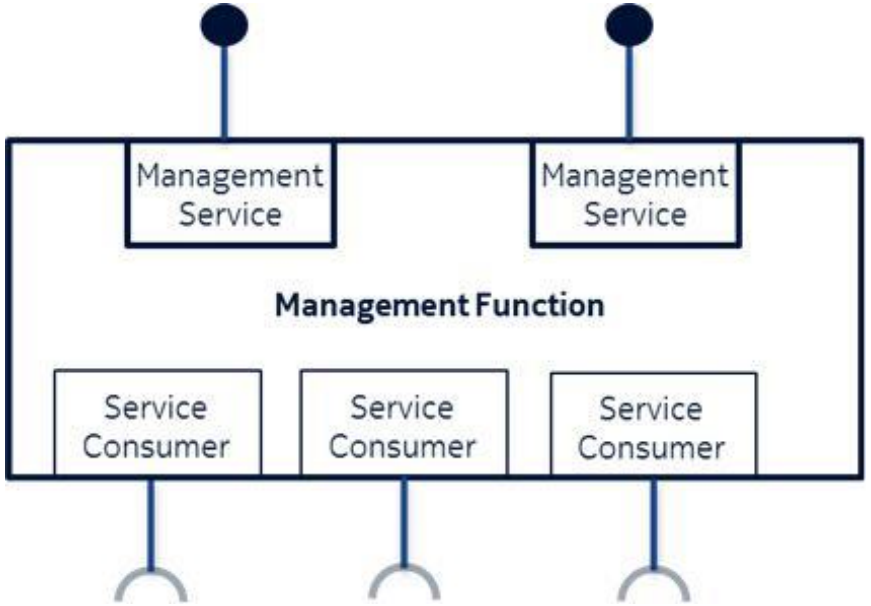
Management and orchestration framework

Examples of MnSs and component type A, B and C



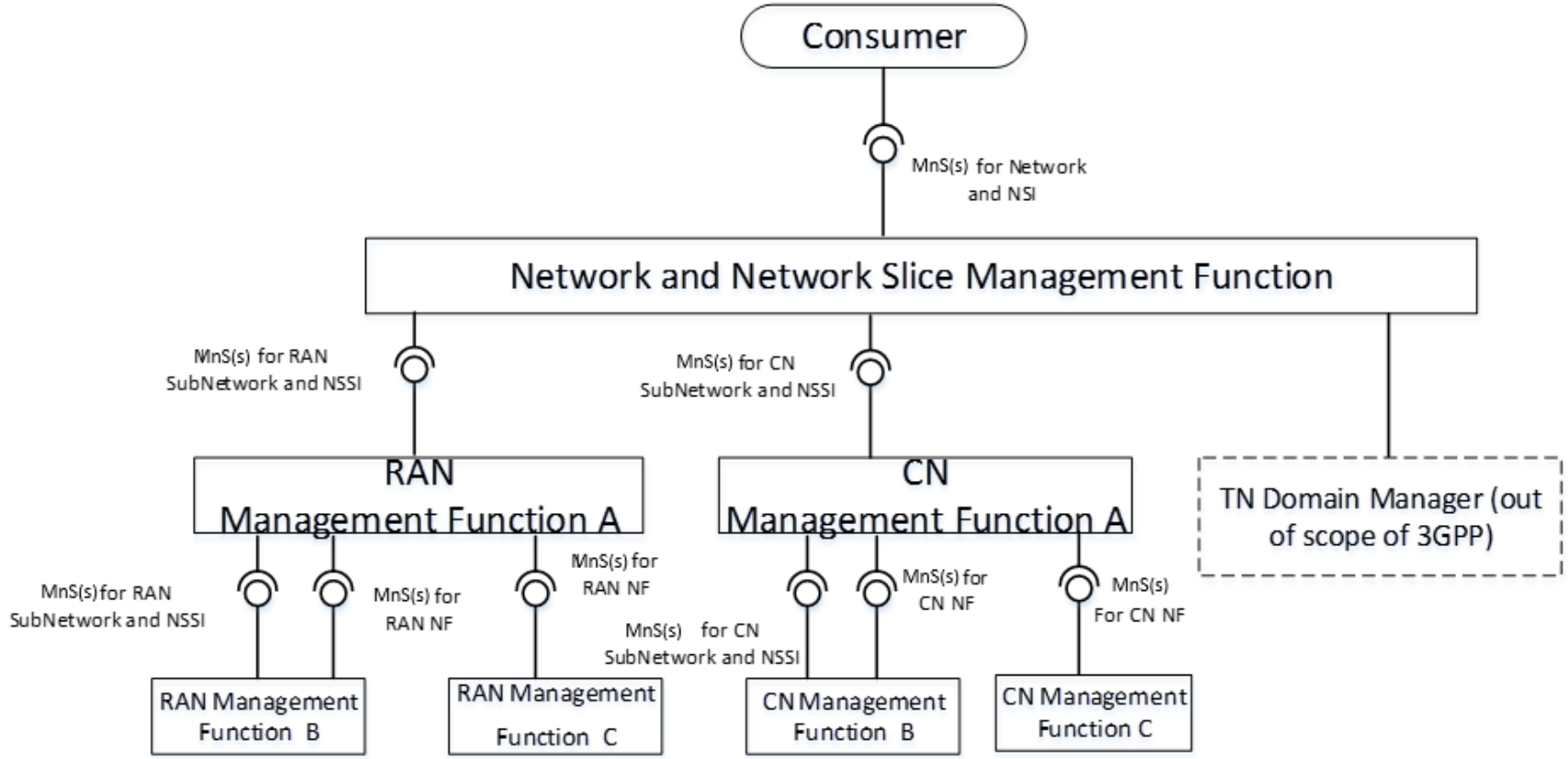
Management and orchestration framework

- Management Function (MnF): Plays the role of either Management Service (MnS) producer or MnS consumer, or both.



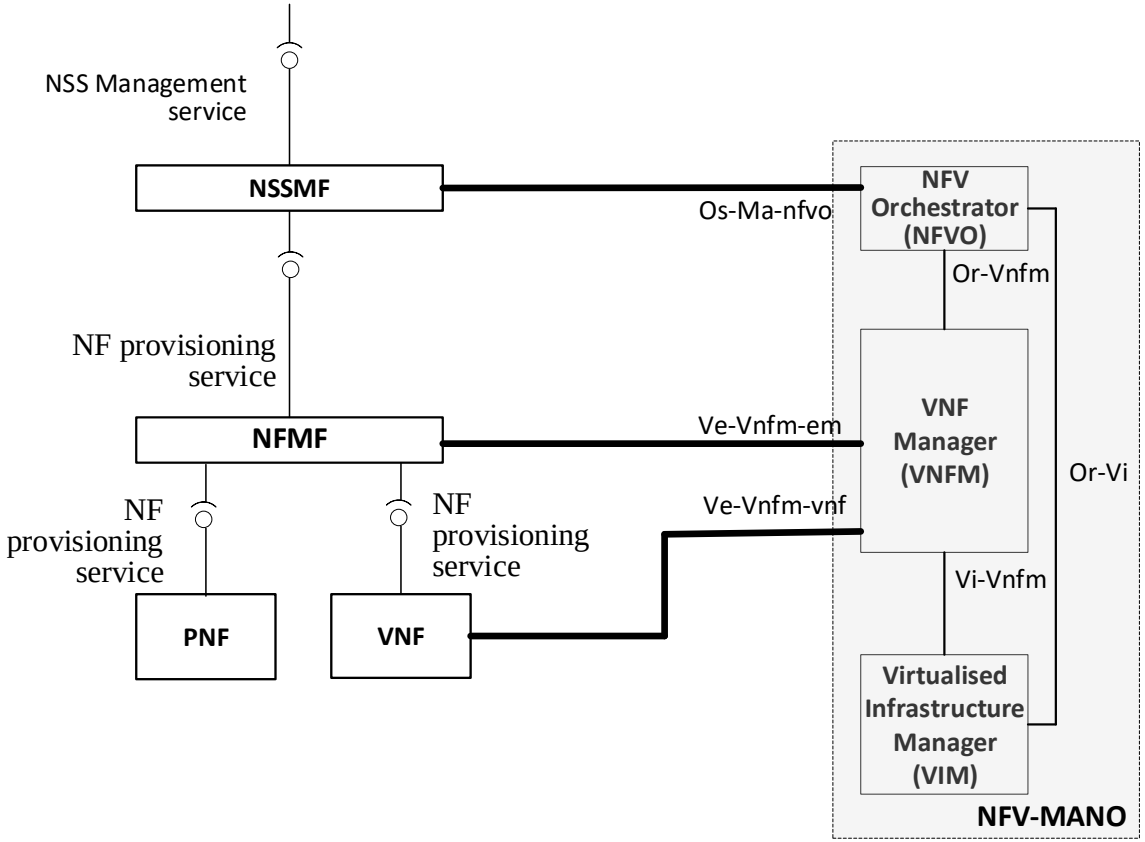
Management and orchestration framework

- 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



Key 5G management specifications / contents

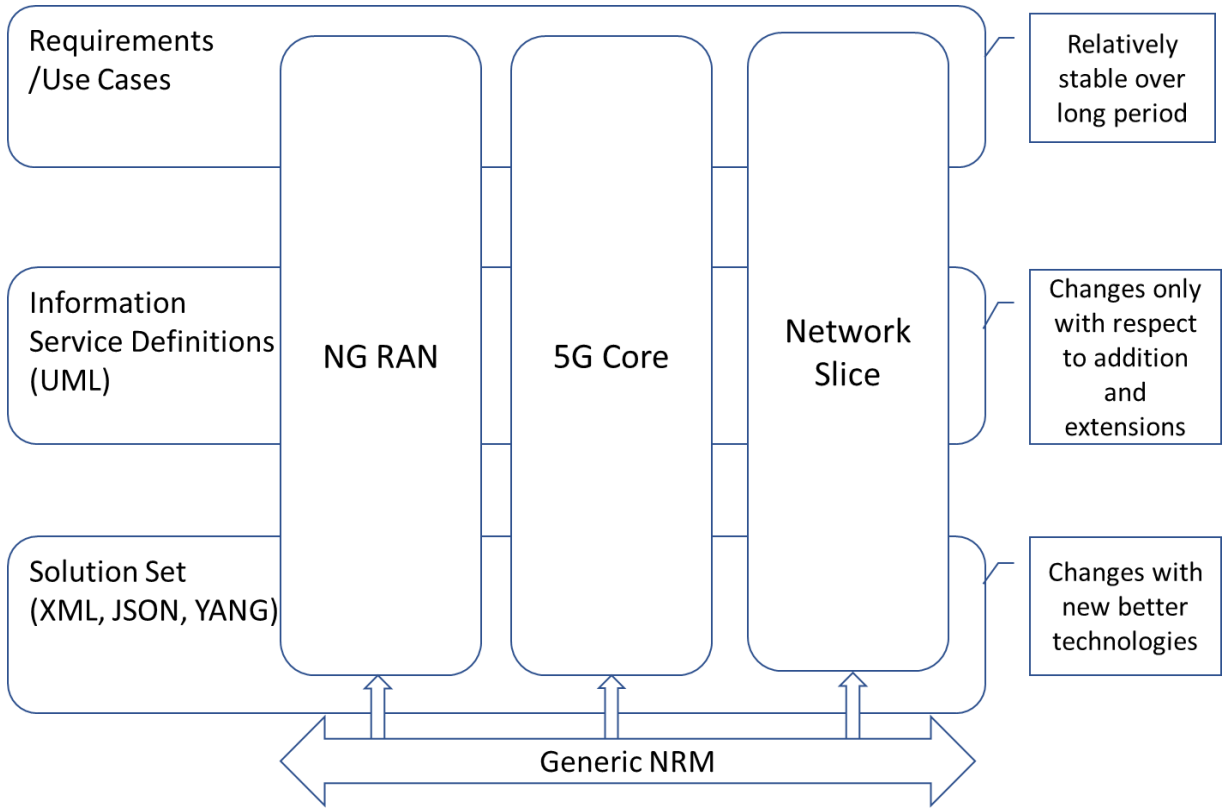
- Management concept, use cases, requirements, framework and architecture: 3GPP TS 28.530, 28.533
- Provisioning: TS 28.531
- Generic management services (for Provisioning, FM, PM): 28.532
- Network Resource Model (NRM): TS 28.540, 28.541
- Performance measurements/KPIs & assurance: TS 28.550/552/554

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.

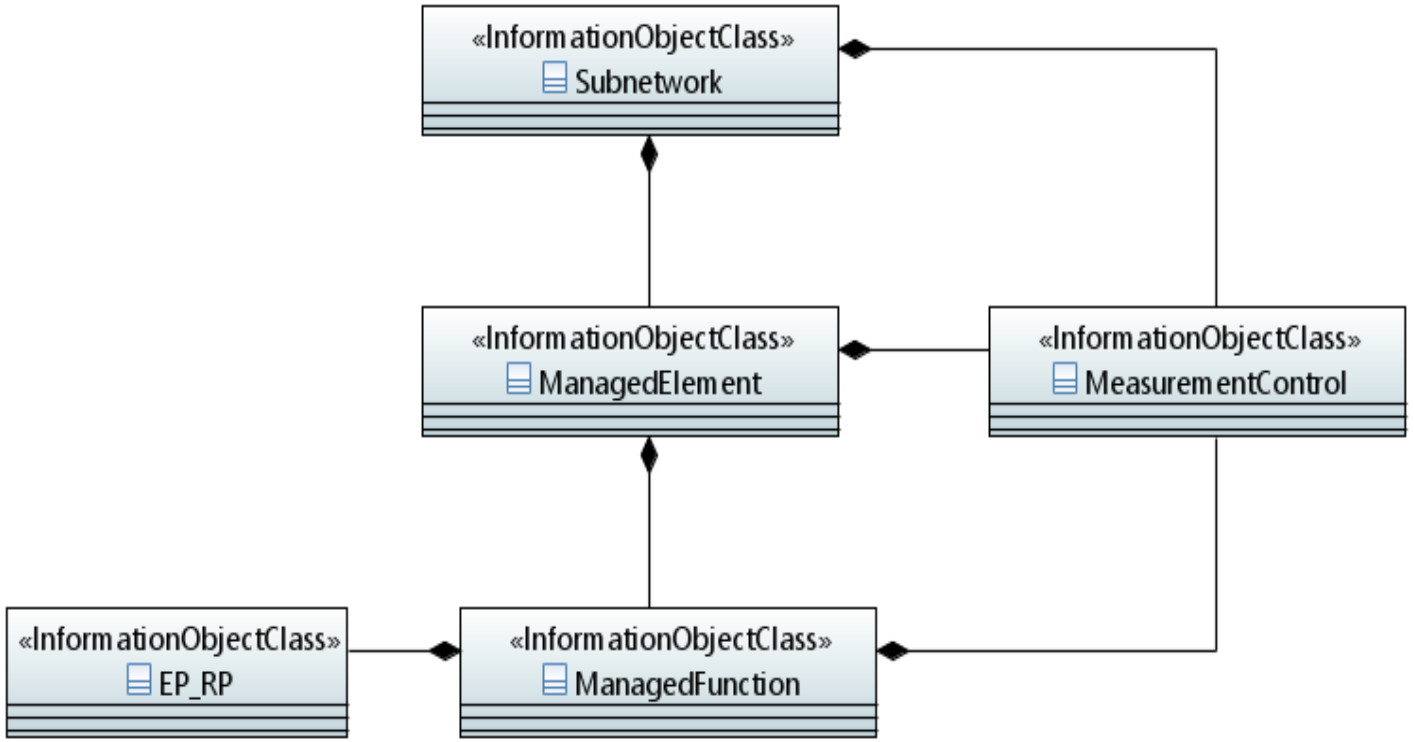
Network Resource Model (NRM)

- Scope and structure of the NRM



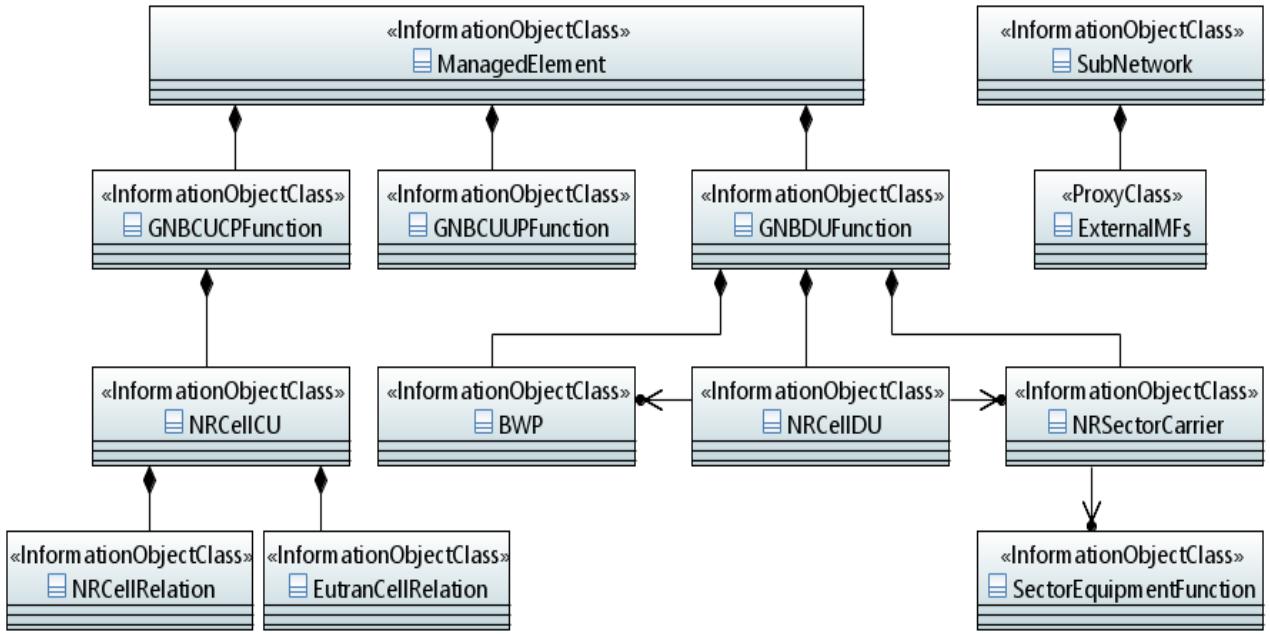
Network Resource Model (NRM)

- Generic NRM



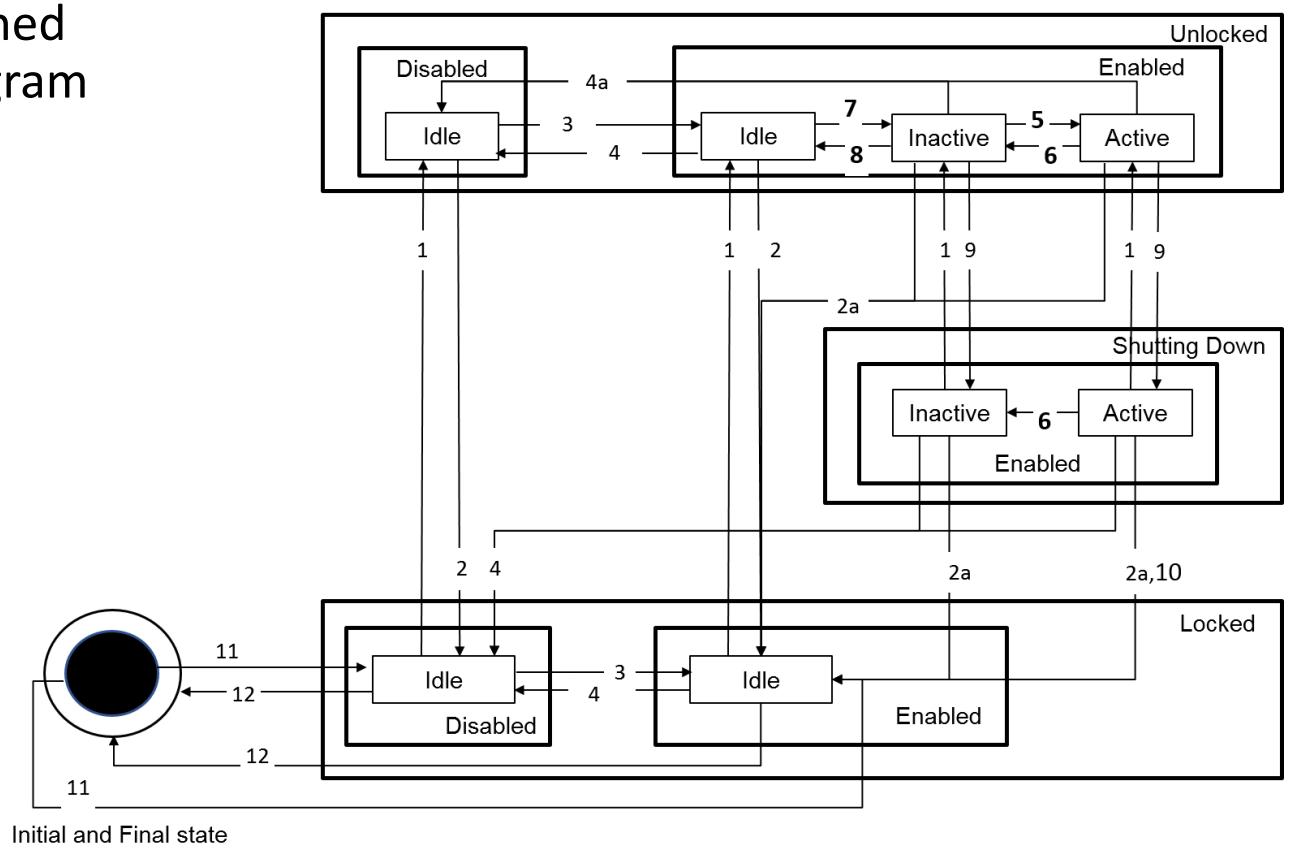
Network Resource Model (NRM)

- NG-RAN – High-level and cell relation view



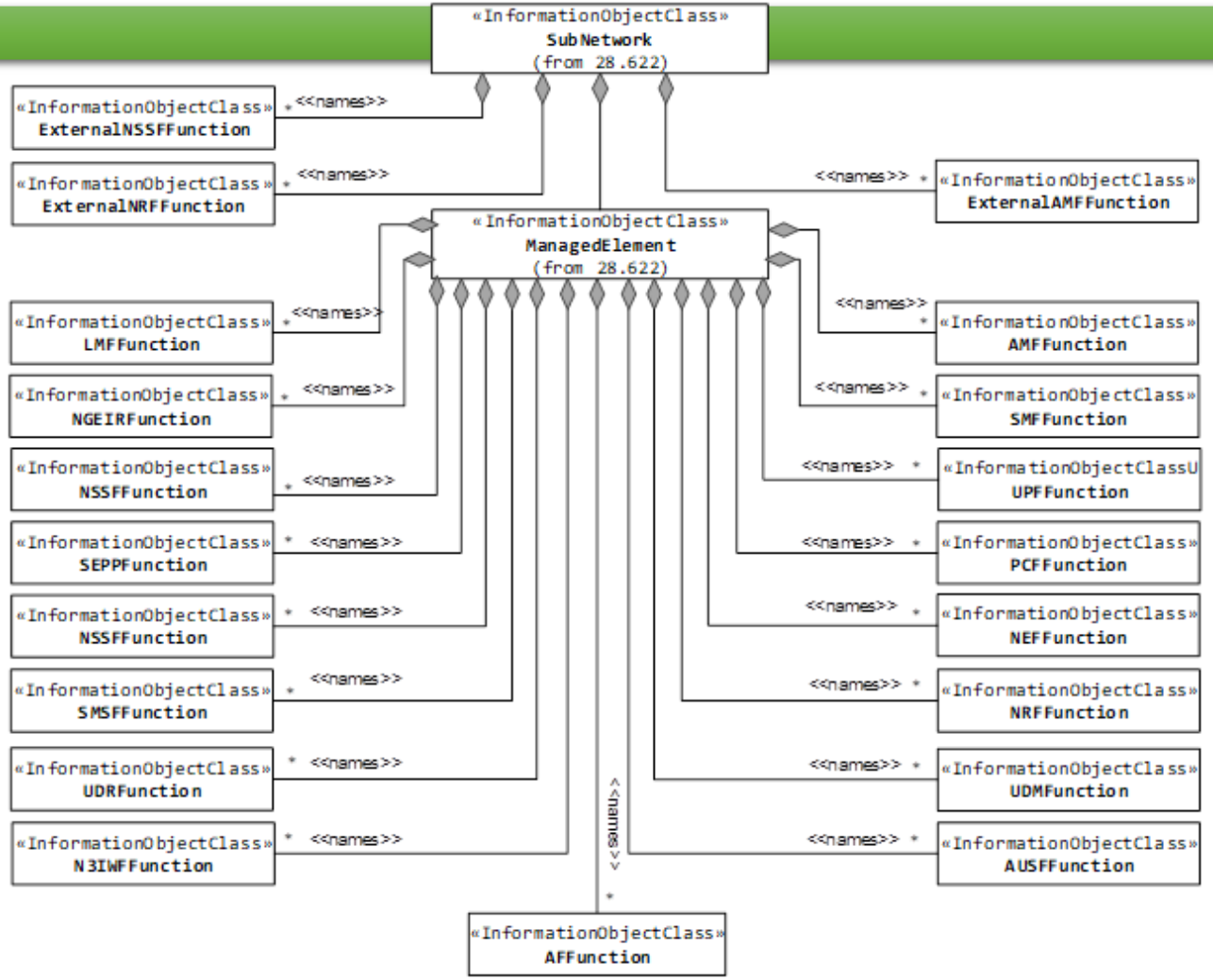
Network Resource Model (NRM)

- NG-RAN – Combined gNB cell state diagram



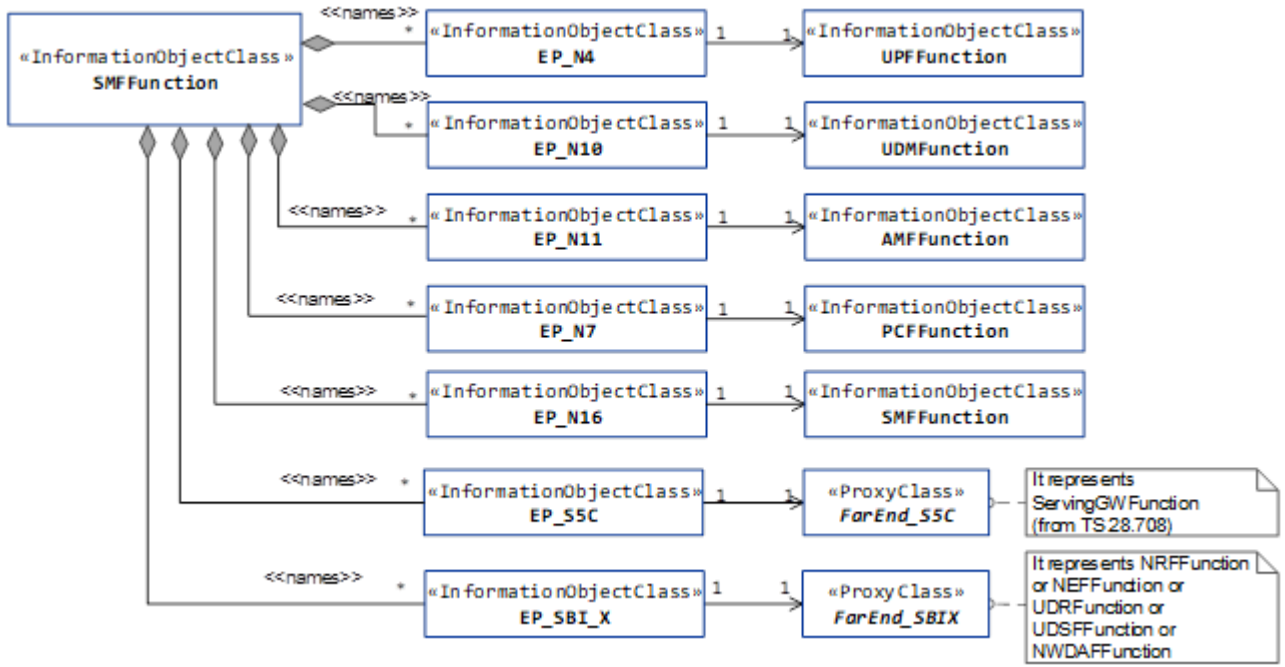
Network Resource Model (NRM)

- 5GC – High-level view



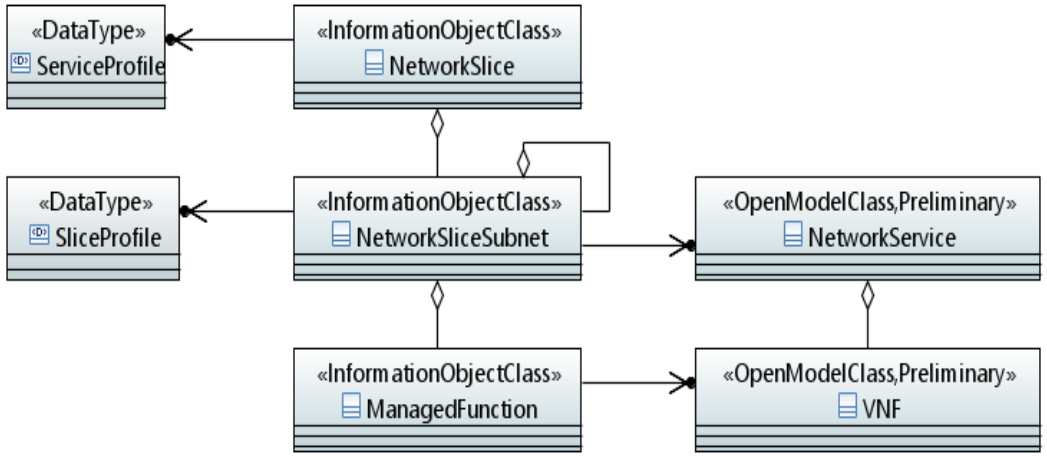
Network Resource Model (NRM)

- 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)

WI Title	Target date
Volume Based Charging Aspects for VoLTE	SA#84 (06/2019)
Nchf Online and Offline Charging Services	SA#85 (09/2019)
Charging Enhancement of 5GC interworking with EPC	SA#85 (09/2019)
Network Exposure Charging in 5G System Architecture	SA#86 (12/2019)
Charging AMF in 5G System Architecture Phase 1	SA#85 (09/2019)
Study on Charging Aspects of Network Slicing	SA#85 (09/2019)

Summary of ongoing work items (2/3)

WI Title	Target date
Management of QoE measurement collection	SA#85 (09/2019)
Energy efficiency of 5G	SA#86 (12/2019)
Network policy management for mobile networks based on NFV scenarios	SA#85 (09/2019)
Methodology for 5G management specifications	SA#84 (06/2019)
Intent driven management services for mobile network	SA#86 (12/2019)
Enhancement of performance assurance for 5G networks including network slicing	SA#86 (12/2019)
Discovery of management services in 5G	SA#85 (09/2019)
NRM enhancements	SA#85 (09/2019)
Trace Management in the context of Services Based Management Architecture	SA#84 (06/2019)
Integration of ONAP and 3GPP 5G management framework	SA#87 (03/2020)

Summary of ongoing work items (3/3)

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

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

- To Ms. Jing Ping (Nokia) for designing the NRM diagrams used in this presentation, originally made for a special “Operations” issue of the Journal of ICT standardization (https://www.riverpublishers.com/journal.php?j=JICTS)
- To Ms. Zou Lan (SA5 rapporteur, Huawei) and Dr. Jean-Michel Cornily (SA5 VC and rapporteur, Orange) for constructive suggestions and comments on this presentation.

Thank you!

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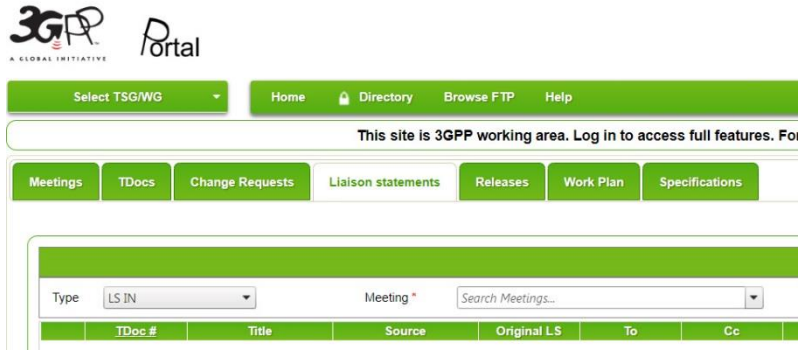

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