5G Network Slicing Summit – MWC Shanghai 2018

3GPP Standards Progress on 5G Network Slicing

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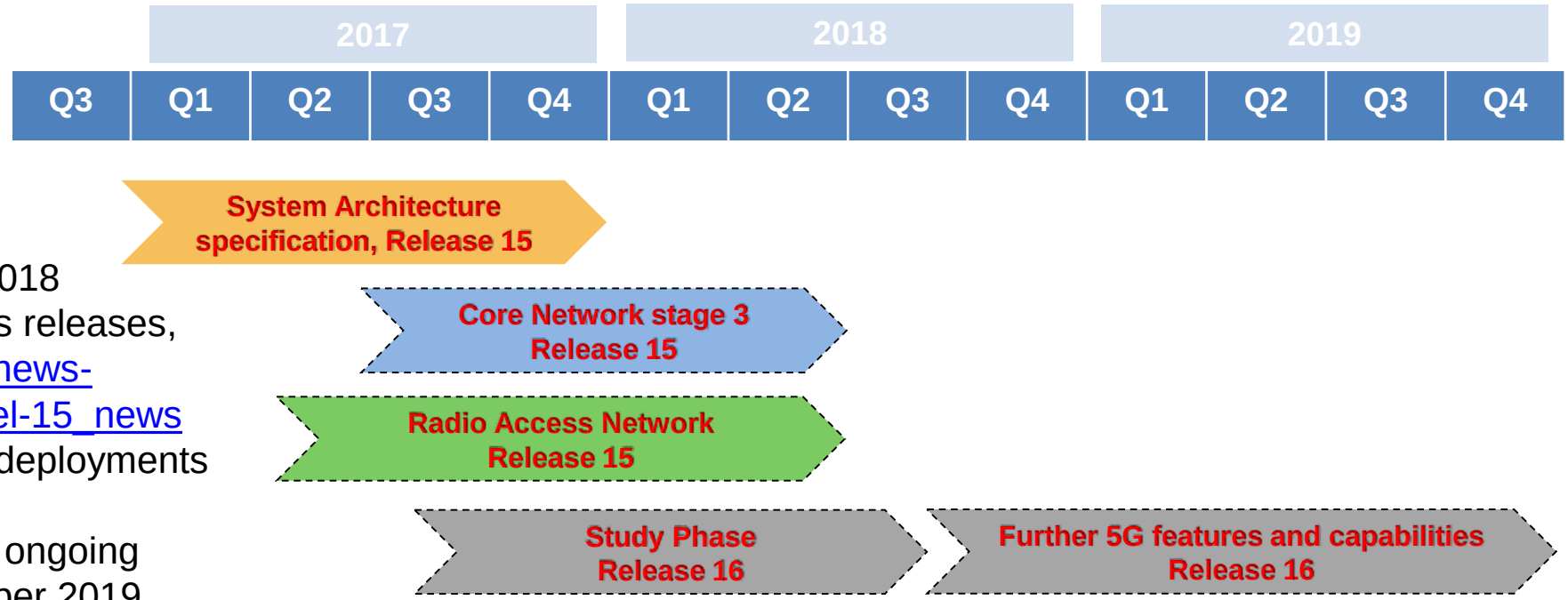
Outline

- 3GPP 5G phase 1 standards completed
- What is 3GPP network slicing?
- The main enablers of network slicing
- Network Slicing - deployment examples
- Network Slicing - specific system aspects
- RAN support for network slices
- A slice differentiator: Session/Service Continuity
- Network slice management
- Outlook
- Backup

3GPP 5G phase 1 standards completed



Release 15 (phase 1)

- Was completed by June 2018
- Numerous news and press releases, e.g.: http://www.3gpp.org/news-events/3gpp-news/1965-rel-15_news
- enables first phase of 5G deployments

Release 16 (phase 2)

- Related studies started or ongoing
- Completion target December 2019
- Meets ITU IMT-2020 submission requirements

What is 3GPP network slicing?

- **Earlier generations of mobile networks defined a single network supporting all options and features for various usage and business scenarios. Network slicing transforms the 3GPP network from a "one size fits all" paradigm, to a new paradigm where logical networks or partitions are created, called network slices, each with appropriate resources and topology to serve a particular purpose or an individual customers.**

- **Network slicing improves the manageability of the networks (slices), the time to market for new features and services and also the economics as each network slice can be managed and customized independently for different application scenarios/usages and for business scenarios or customers like verticals.**

- **3GPP specifications define network slicing mainly in the scope of features, functions and capabilities of a 3GPP system, i.e. a mobile network. There are interactions with functionality or features defined by other standards organizations.** (see backup slide on the 3GPP eco-system)

- **Together with other 3GPP system advances and leveraging technologies like virtualization 5G network slicing enables instantiating networks (slices) on demand, i.e. providing networks (slices) as a service.**

The main enablers of 3GPP network slicing

3GPP system features enabling network slicing

- A mobile network shares certain resources and features so that the 3GPP standard defines means for steering UEs and applications to the different slices of a network. This includes subscription of slice types, policies on UEs and in the network for routing applications to different slices used by a UE, access control and overload handling per slice, standardized slice types for receiving the same services also when roaming, and more.

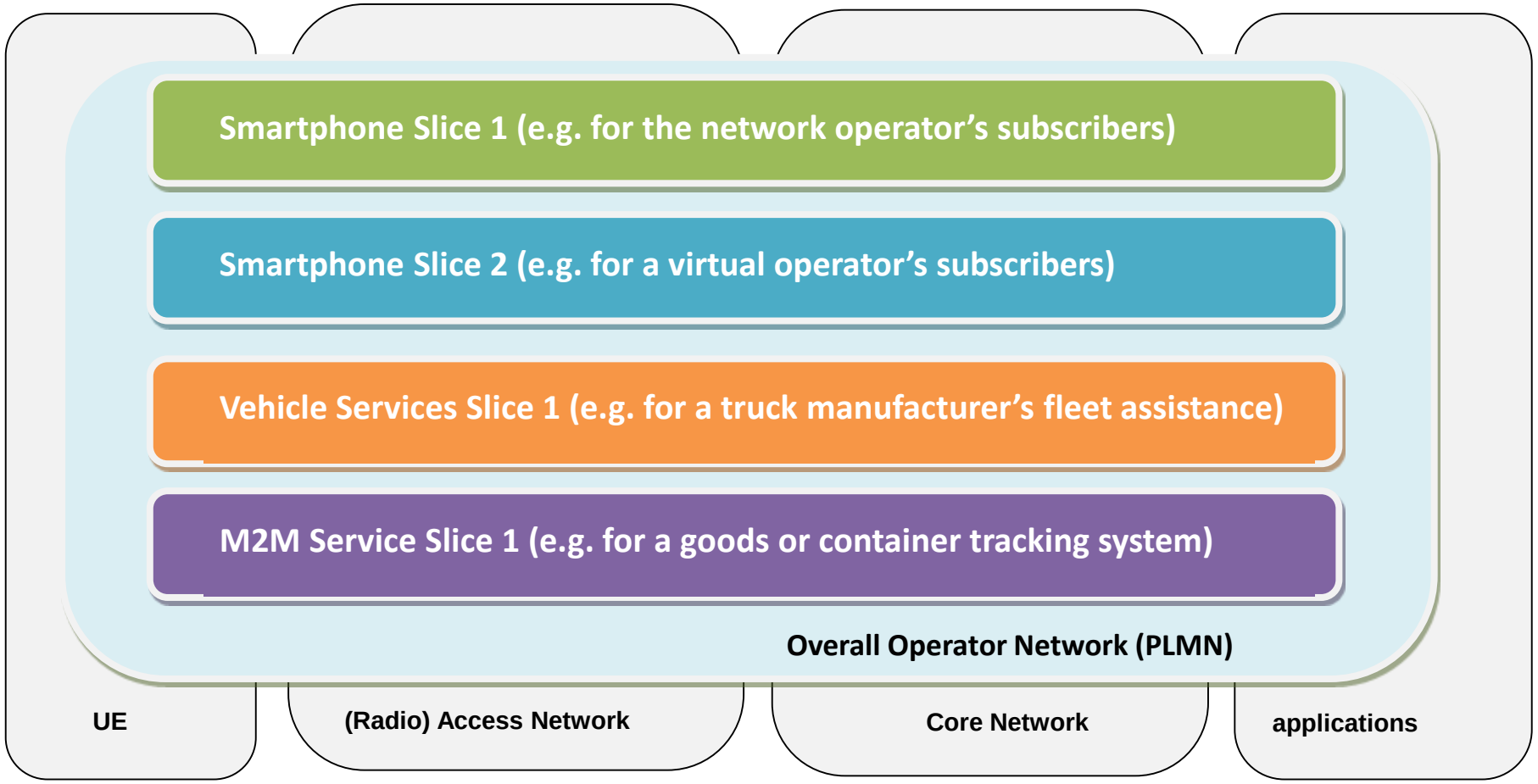
Leverage what other standards organization define

- 3GPP systems always adopt latest platform technologies as a basis. For 5G it is softwarization and virtualization, which enable the economics and agility of customizing and deploying networks (slices) on demand. The overall system design enables this by a service based architecture where network functions offer their services via interfaces of a common framework to any network functions permitted to use those. This is also the domain of 3GPP network management where 3GPP defined network functions are managed on common virtualization platforms for instantiating network slices with the required characteristics.

3GPP system services, features and capabilities that differentiate network slices

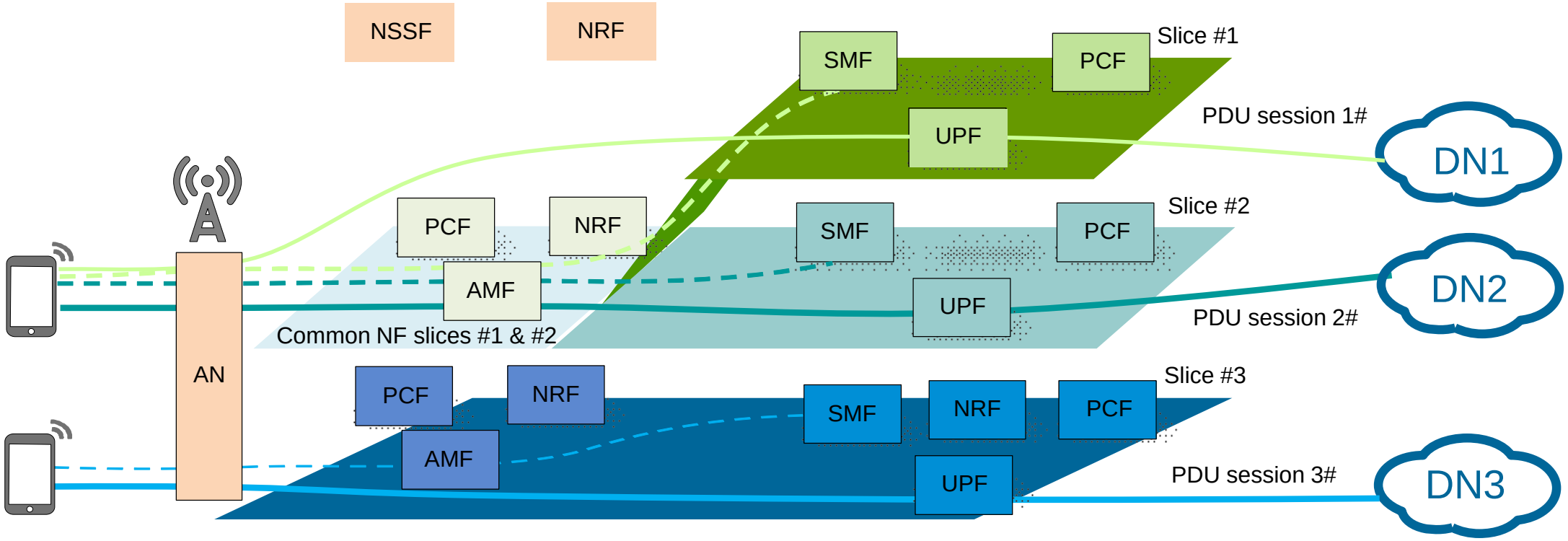
- Despite basic functionality that each network (slice) requires, like subscription and access control, there are features, services and capabilities that are relevant for certain usage scenarios only and need to be deployed for every network slice. These are features like mobile originated only for certain M2M usage, for supporting low latency services or edge computing, secondary authentication by the service user, differentiated Quality of Service including (ultra) low latency and reliability or priority services support, and more.

Network Slicing – deployment examples



These examples demonstrate that network slices of the same slice type (characteristics), but for different users may be deployed within a network. Typically with different capacity and resources then. But at the same time also network slices may be deployed with different features and capabilities, i.e. slices of different slice types.

Network Slicing – specific system aspects



A UE may receive service from multiple network slices simultanoulsy. Thanks to mobile system specifics there is always one AMF and one signalling connection for all slices of a UE. As an example, network slices #1 and #2 are for different IoT usages with on the same UEs sharing common NFs. While network slice #3 could be for smartphones.

RAN Support for Network Slices

Radio Access Network (RAN) awareness of slices

- NG-RAN selects the RAN part of the network slice based on assistance information provided by the UE or the 5G Core Network
- NG-RAN provides differentiated handling of traffic for network slices by differentiated radio resource scheduling and by applying specific L1/L2 configurations

Slice specific Radio Resource Management

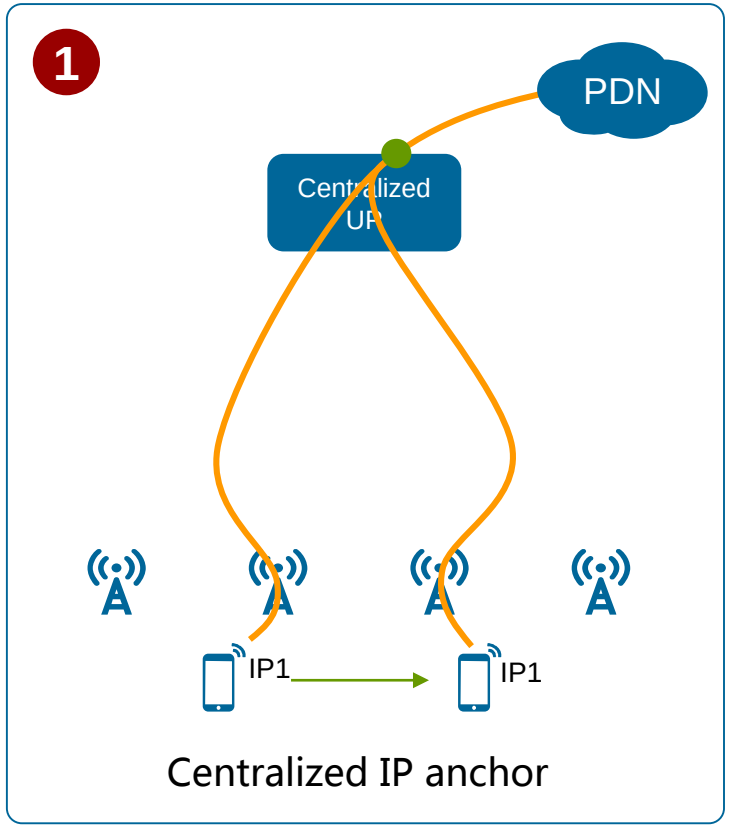
- NG-RAN applies Radio Resource Management policies specific per slice (type)
- An NG-RAN node can support multiple network slices
- Resources may be reserved exclusively for certain slices to fulfil SLAs, e.g. to prevent service degradation in one slice due to shortage of resources in another slice

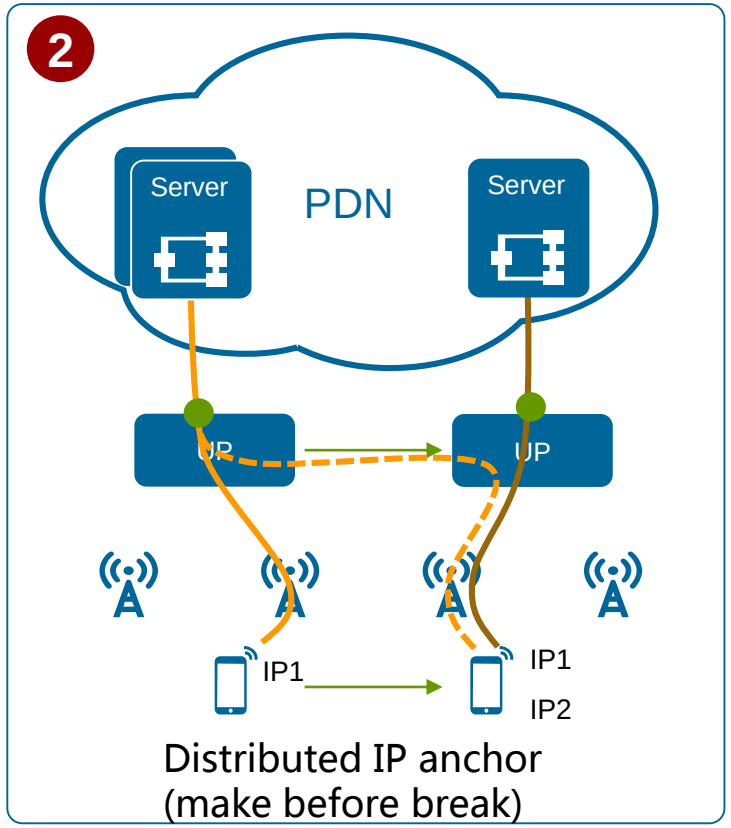
Slice Availability and steering of UEs

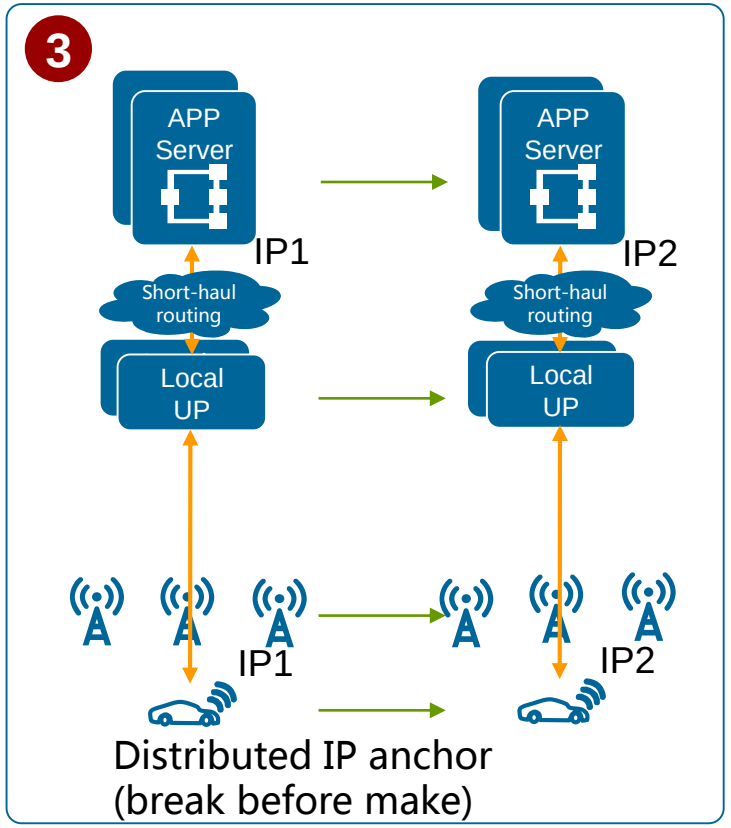
- Some slices may be deployed only in part of the network coverage area, dependent on service needs
- Regardless of the number of slices used simultaneously there is one signaling connection with the network and the network steers the UE to the slice related resources
- UEs in idle mode the network provides with selection policies to steer the UE to its slice related radio resources

A Slice Differentiator: Session/Service Continuity

this one supporting edge computing and low latency







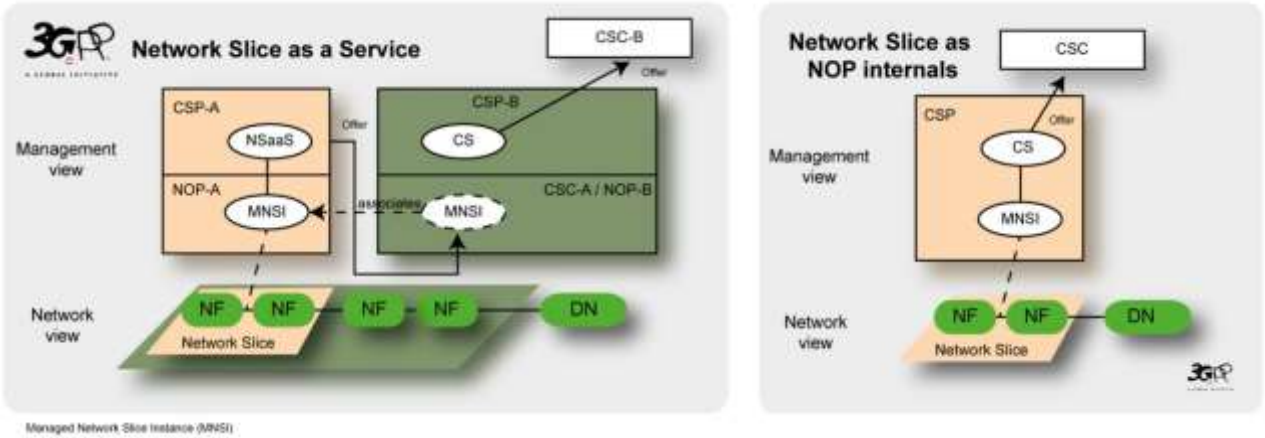
Target scenarios: deployment scenarios in a traditional way, and can meet basic requirements of latency and mobility.

Target scenarios: 1) service scenarios with low latency and limited moving range, such as factory coverage. 2)Distributed UP scenarios with latency insensitive services.

Target scenarios: Services with wide coverage and low latency

Network (Slice) Management

- Provisioning of network slices according to required network characteristics (e.g. latency, coverage, resource sharing level etc.)
- Offers management model choices for business customers like verticals (i.e. NSaaS, operator managed)
- Monitoring of network slice's performance and fault status on different levels of details (e.g. network slice level, network slice subnet level etc.)

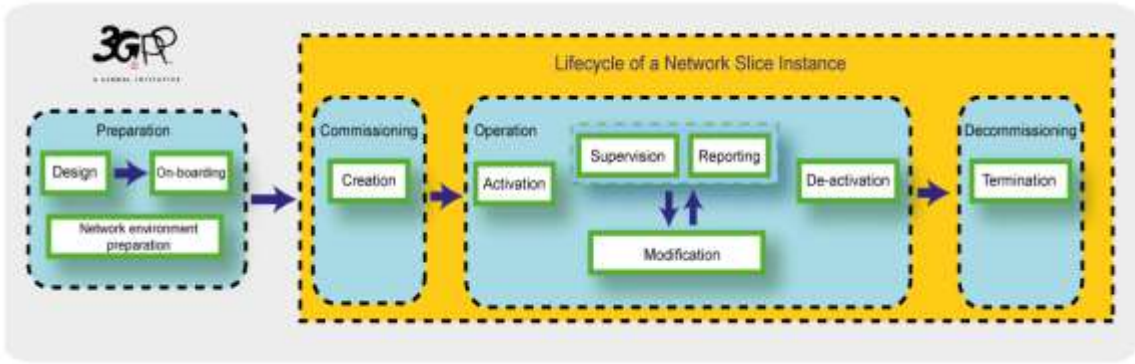


Management models for network slices

Network Slice as a Service (NSaaS) or managed by Network OPerator (NOP)

Managed Network Slice Instance MNSI, Communication Service [Consumer] CS[C]

Life cycle of network slice instances



Outlook

- 3GPP Release 15 definition is complete.
- 3GPP Release 16 started studies on defining additional slice specific features, like for controlling what slices a UE may use simultanously or slice speciifc authentication.
- Further Release 16 works on features that allow for further differentiation of what slices may provide to slice customers or end users, with features like enabling private networks e.g. for factory automation, ultra reliable and ultra low latency, and more.
- 3GPP Release 16 will meet the ITU IMT-2020 requirements.

The content of these slides may relate to work in progress. Described features and functionality may change like also timeline and any other presented content.

For more and up-to-date information:

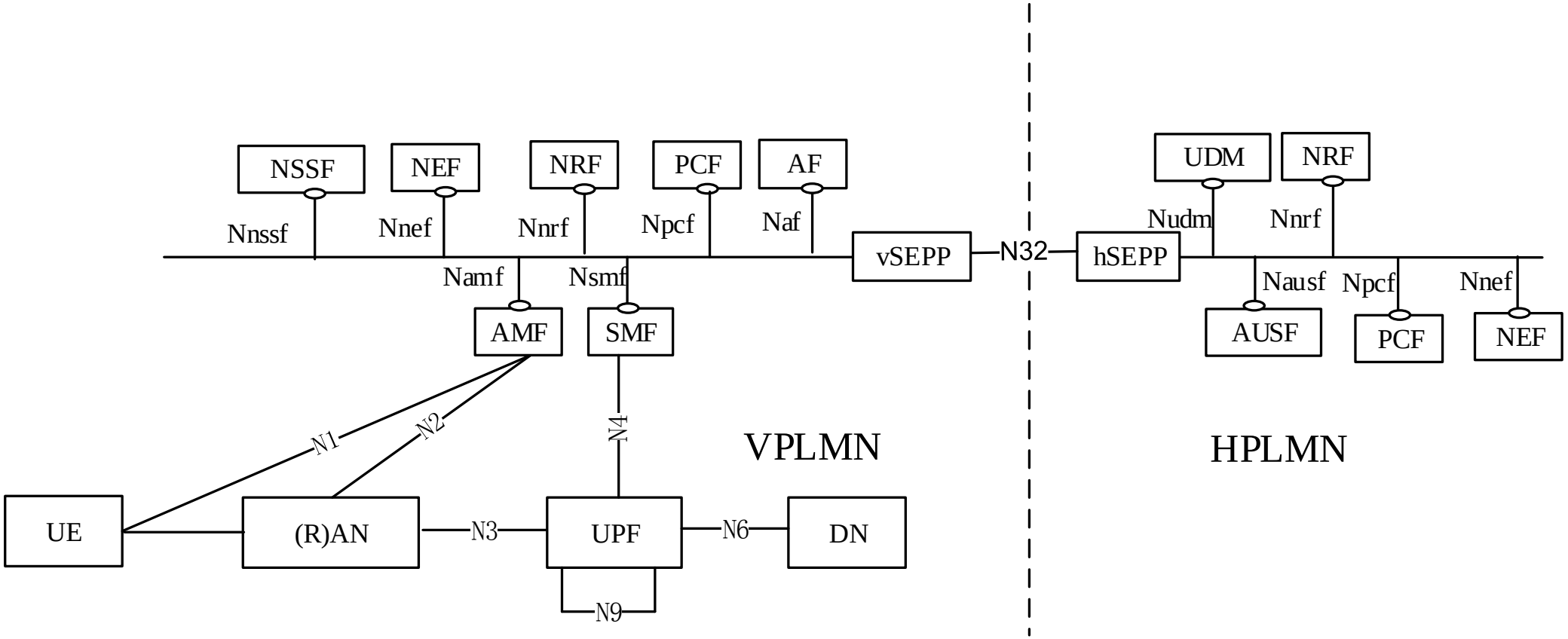
info@3gpp.org

www.3gpp.org

Search for WIDs at http://www.3gpp.org/specifications/work-plan and http://www.3gpp.org/ftp/Information/WORK_PLAN/ (See excel sheet)

3GPP 5G System Architecture

roaming with local breakout - service based representation



AMF - Access and Mobility Management Function
SMF – Session Management Function
PCF – Policy Control Function
UDM – Unified Data Management

UPF – User Plane Function
DN – Data Network
NRF – Network Resource Function
NEF – Network Exposure Function

AUSF – Authentication Server Function
UE – User Equipment
(R)AN – (Radio) Access Network
H - Home V - Visited

3GPP 5G System Release 15
Characteristics and Features

- Service based, modular architecture design as a set of self-contained Network Functions allows for flexible as well as customized deployments; also enabling deployments taking advantage from virtualized environments
- Network Slicing enabling operators to run customized networks for various operational and business scenarios
- Flexible QoS Framework supporting different Access Networks
- Various options for IP session or service continuity to support Edge Computing and various other scenarios
- Common Core Network that intends to support various Access Networks
- Separate Authentication Function and all other required security functionality
- Access Control and Mobility Management
- Support of IP and other types of data sessions
- Policy and Charging Control functionality
- Support of Interworking and Migration from LTE
- Support for applications, like support for IMS providing voice or emergency services
- Network Exposure of capabilities and features for usage by internal and external users
- Support of access via un-trusted non-3GPP access networks
- Public Warning System, Short Message Service

Partnership (1/2)

Organizational Partners (SDOs)

- ARIB (Japan)
- ATIS (USA)
- CCSA (China)
- ETSI (Europe)
- TTA (Korea)
- TTC (Japan)
- TSDSI (India)

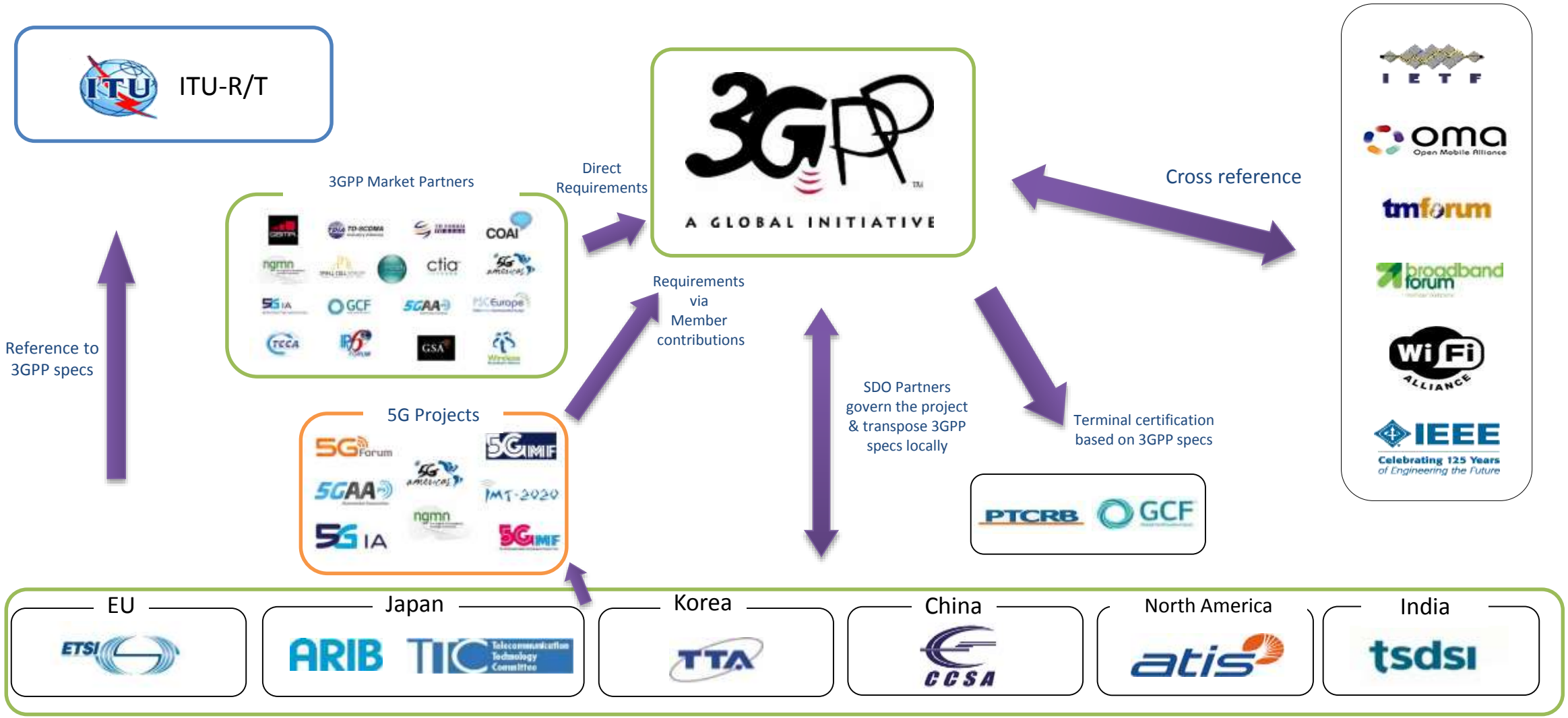
Partnership 2/2

Market Representative Partners

- 17 Market partners representing the broader industry:

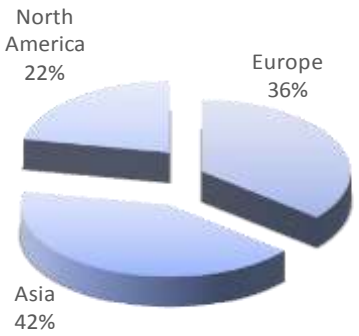
- 5G Americas,
- 5G Automotive Association (5GAA),
- 5G Infrastructure Association,
- COAI (India),
- CTIA,
- GCF,
- GSA,
- GSMA,
- IPV6 Forum,
- MDG (formerly CDG),
- NGMN Alliance,
- Public Safety Communication Europe (PSCE) Forum,
- Small Cell Forum,
- TCCA,
- TD Industry Alliance,
- TD-Forum,
- Wireless Broadband Alliance

The 3GPP Eco-system

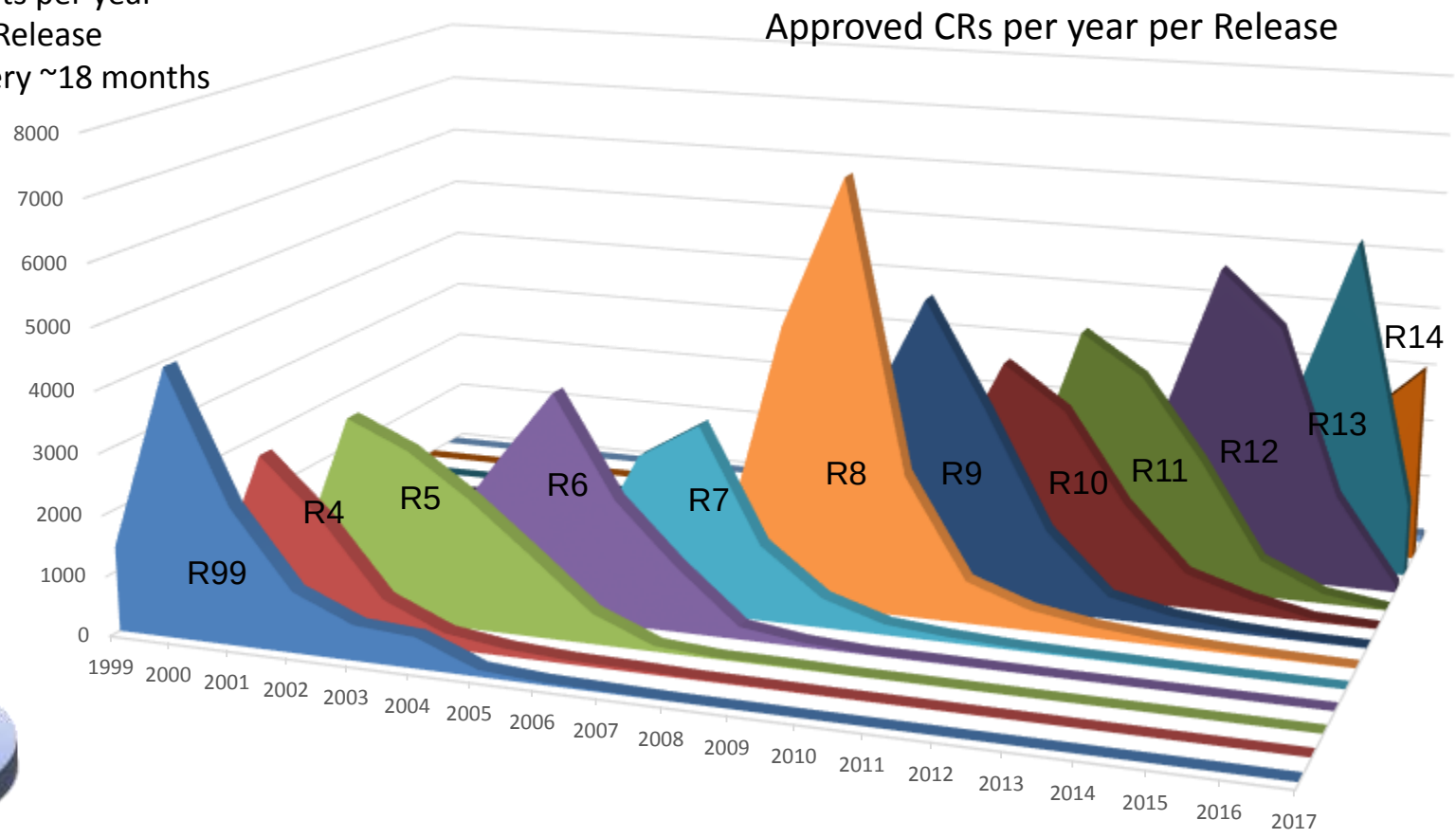


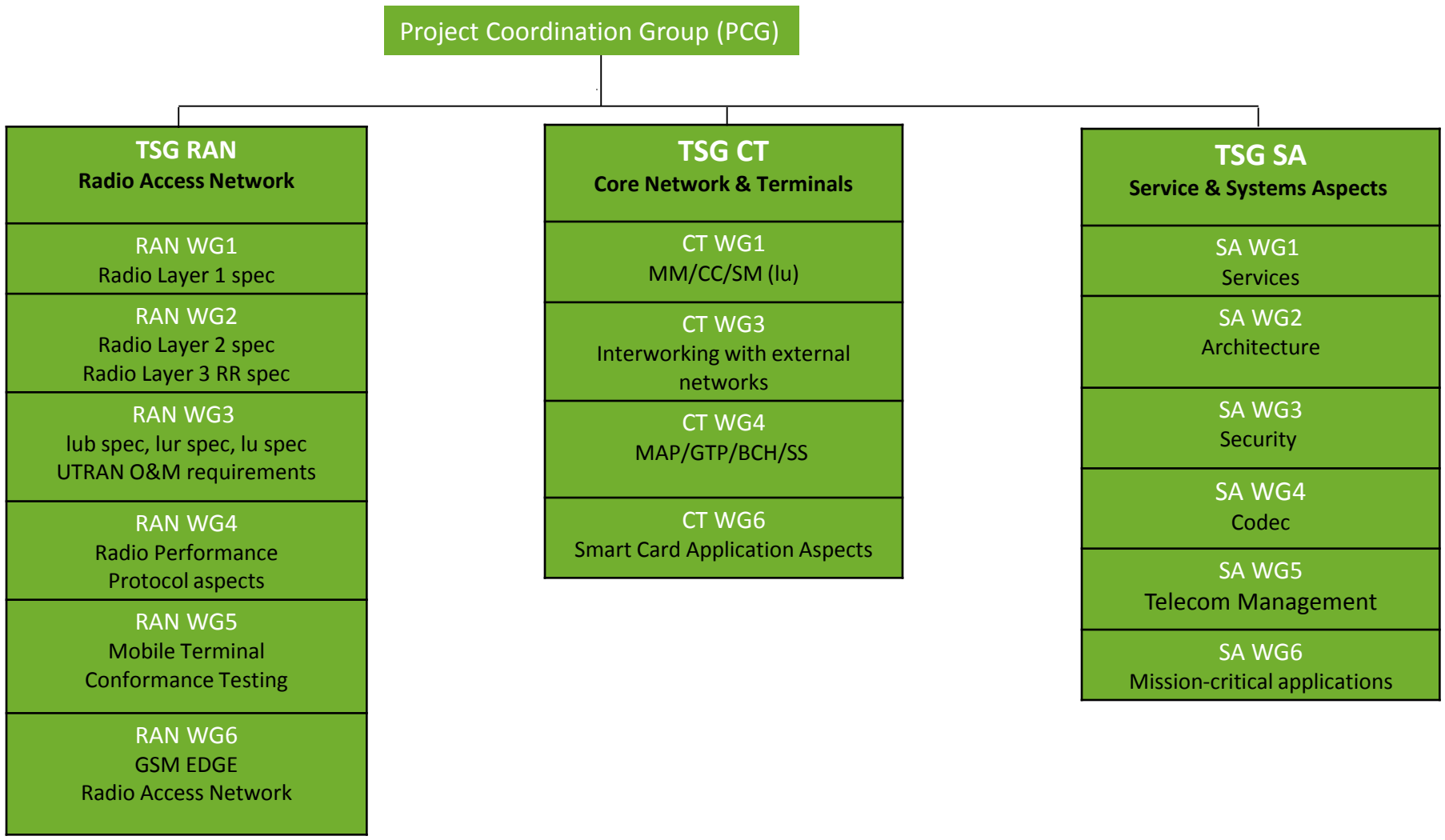
3GPP Facts and Figures

- ~400 Companies from 39 Countries
- 50.000 delegate days per year
- 40.000 documents per year
- 1.200 specs per Release
- New Release every ~18 months



Participation by Region (by TSG#77)




Project Coordination Group (PCG)
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
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)
CT WG3
Interworking with external networks
CT WG4
MAP/GTP/BCH/SS
CT WG6
Smart Card Application Aspects
TSG SA
Service & Systems Aspects
SA WG1
Services
SA WG2
Architecture
SA WG3
Security
SA WG4
Codec
SA WG5
Telecom Management
SA WG6
Mission-critical applications