



# Überblick über 3GPP 5G und Satelliten Aktivitäten

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Workshop „Satellitenkommunikation im Wandel - 5G, das  
Netz der Zukunft“ – 28. September 2017

# Nomor Research GmbH

- ▶ Industry: IT Telecommunication
- ▶ Headquarter: Munich, Germany
- ▶ Founded: September 2004
- ▶ Spin off from Munich University of Technology
  - First real-time simulations GPRS/UMTS in 1999
  - Fully privately owned, always profitable from day one
  - Successful sale of LTE eNB Protocol Stack business in 2013
  - Today 16 highly qualified R&D engineers + admin staff
- ▶ Vendor independent research / consultancy services
- ▶ Service focused around 4G/5G technology
  - Demonstrator and prototype development
  - Research/development projects and system simulation services
  - Consultancy, standardization and patents support
  - Technology training and knowhow transfer

# Outline

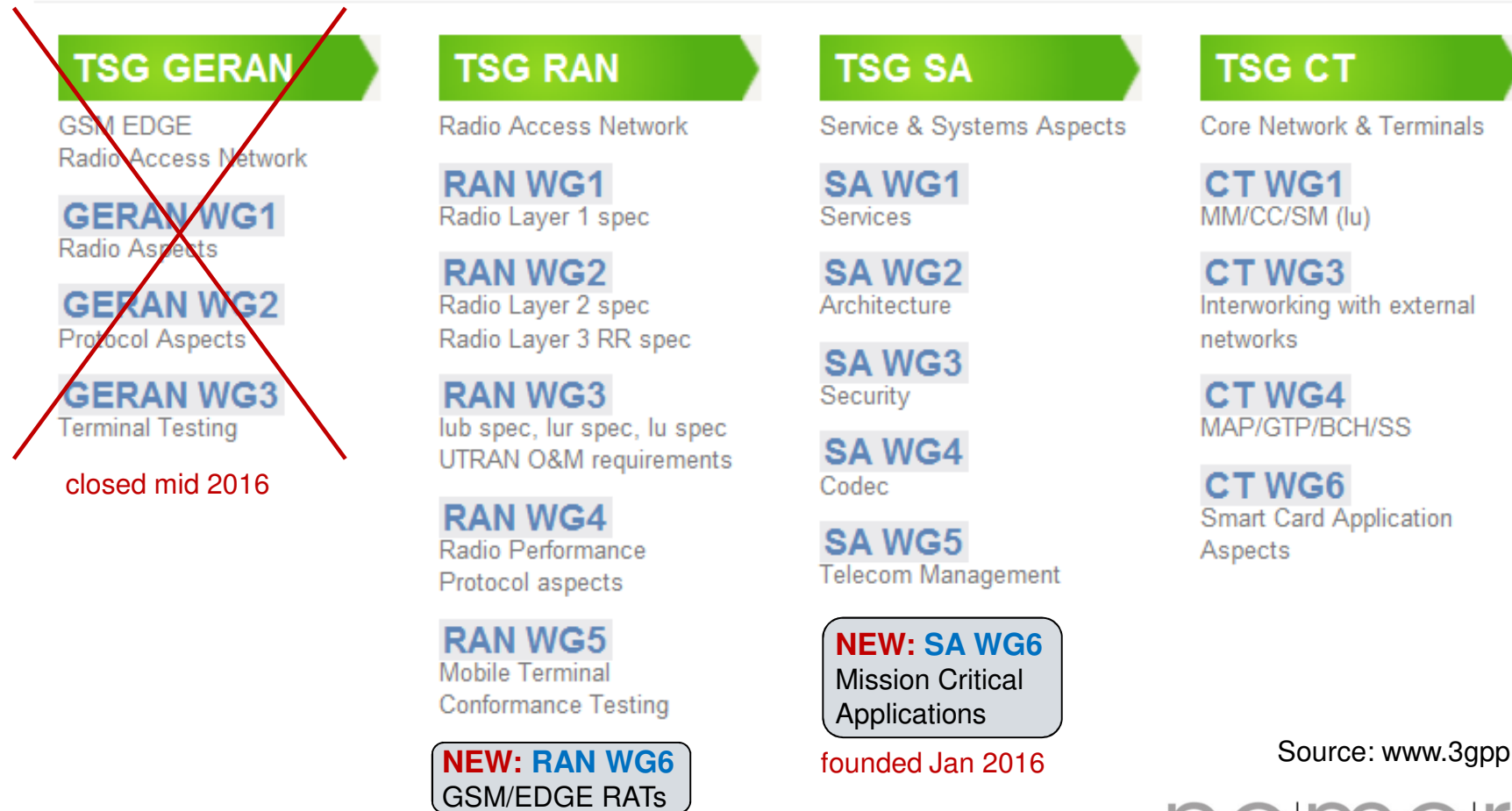
- ▶ Introduction of 3GPP
- ▶ Overview 3GPP 5G Standard
- ▶ Status of Satellite related Activities in 3GPP

# What is 3GPP?

- ▶ UMTS targeted a universal mobile standard
  - European Telecommunication Standardization Institute is limited to European companies
- ▶ 3G Partnership Project was founded in 1998
- ▶ A collaborative agreement between Standards Development Organizations (SDOs) and other bodies
  - ARIB (Japan), CCSA (China), ETSI (Europe), ATIS (USA), TTA (Korea), TTC (Japan), TSDSI (India)
- ▶ Within scope of Intern. Mobile Telecommunication (IMT) project of Intern. Telecommunication Union (ITU)
- ▶ 3GPP produces and maintains specifications for:
  - 2G, 3G, 4G, 5G and corresponding core networks and services

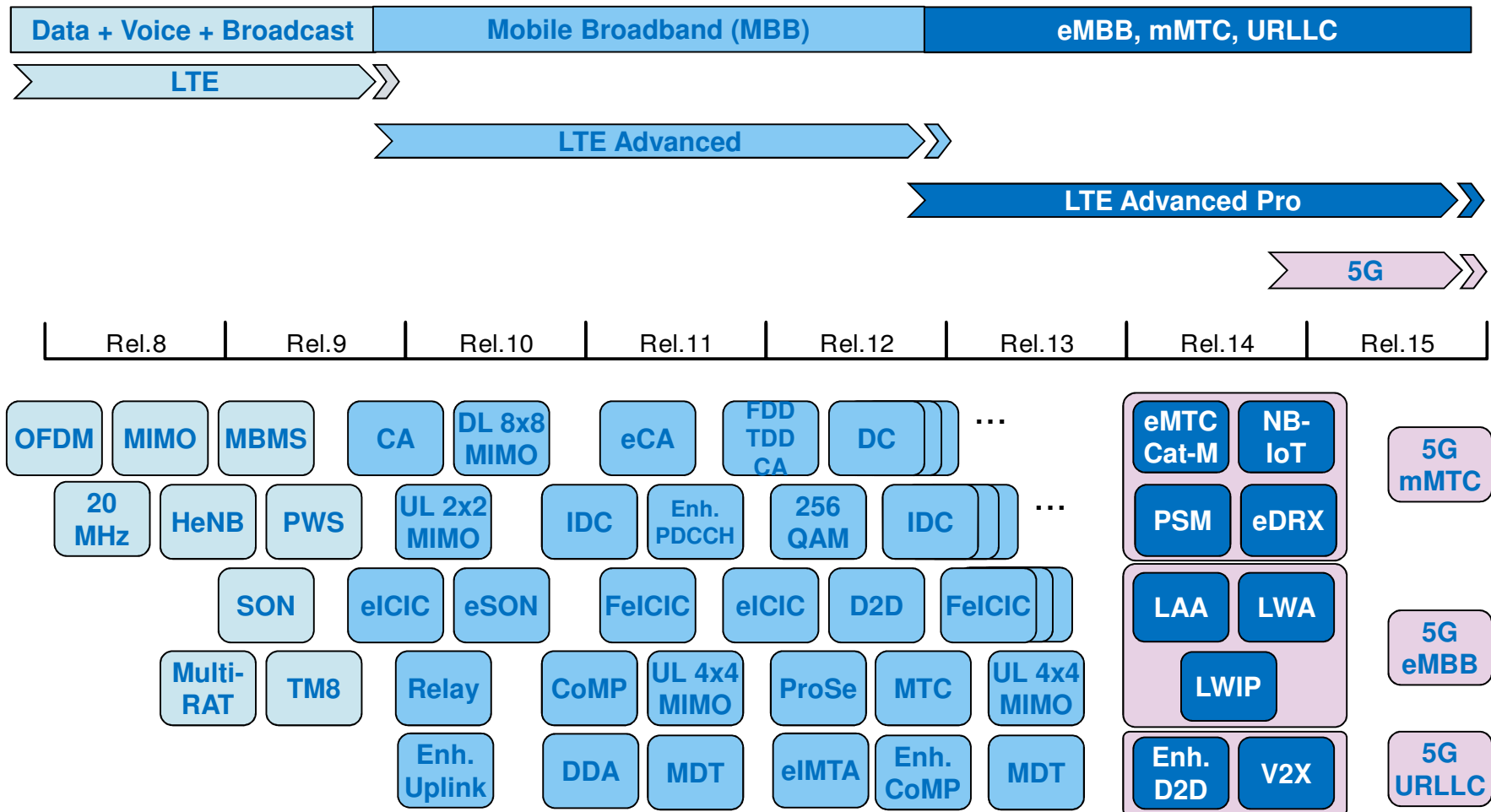
# 3GPP Structure and History

## Project Co-ordination Group (PCG)

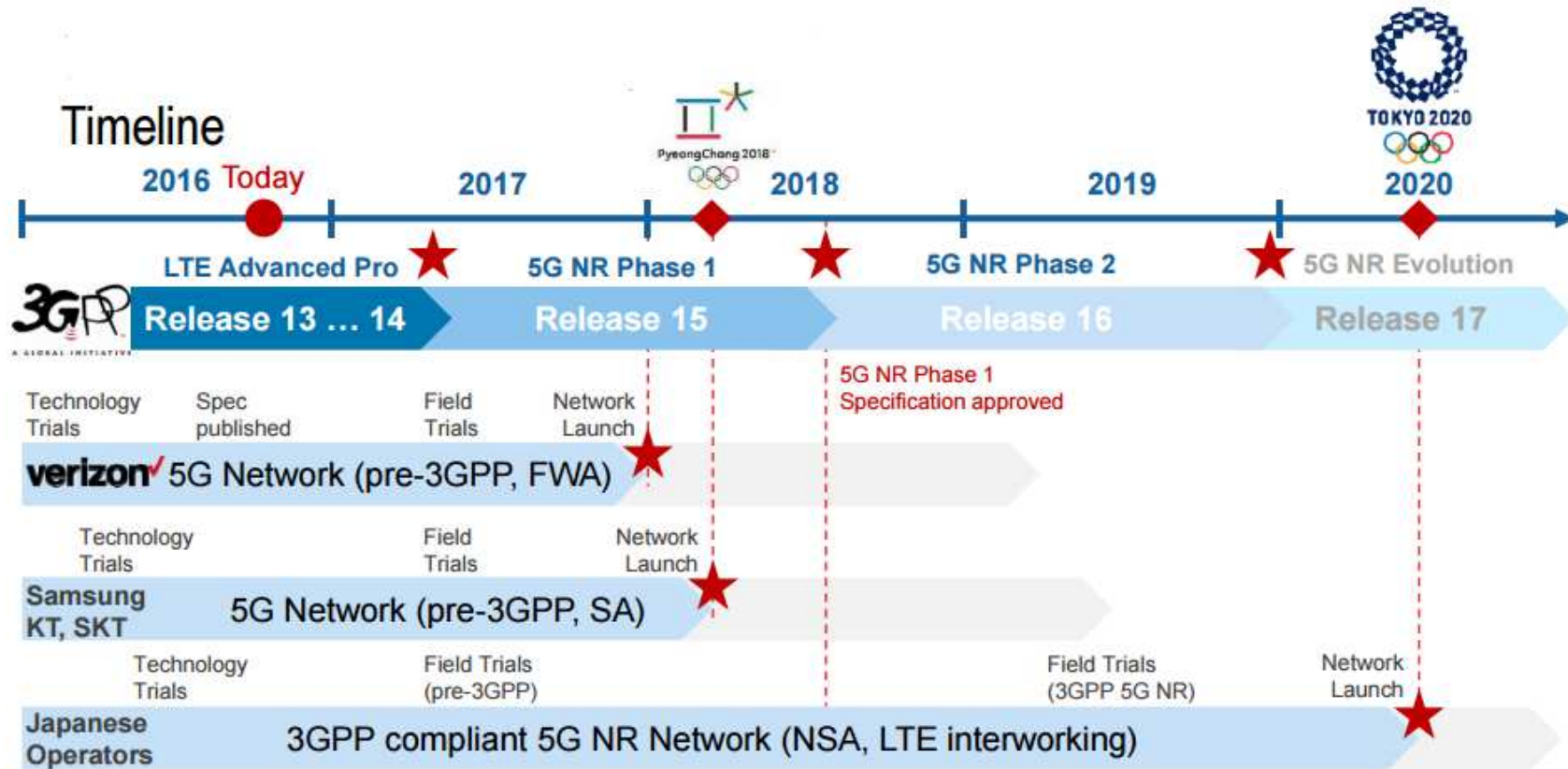


Source: [www.3gpp.org](http://www.3gpp.org)

# We got Long Term Evolution – Why 5G ?



# Schedule and Pre-3GPP 5G Activities



Source: R&S, Eichler and Rowell „The 5G Technology Ecosystem“ 5G Seminar Korea

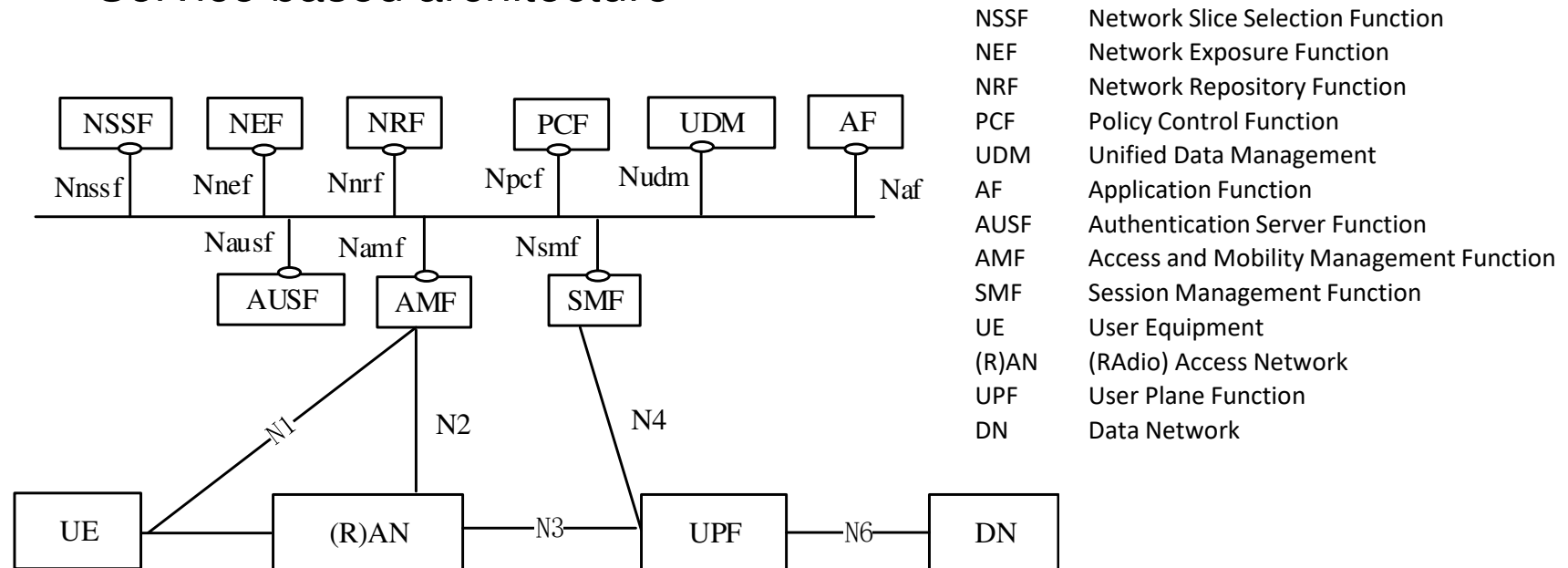


# Overview 3GPP 5G Standard



# 5G Core Network

- Service based architecture

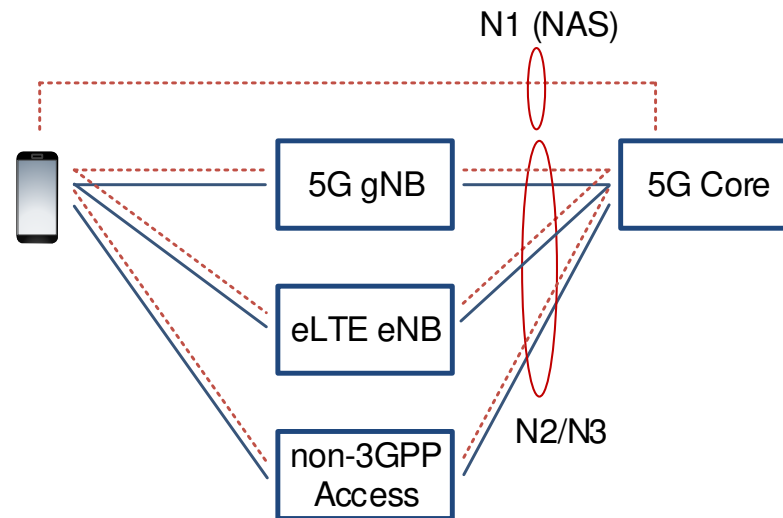


Source: 3GPP TS23.501

- New concept of a message bus is defined
- Network functions (NF) communicate via internal APIs
- A network functions (NF) provides services to other NFs

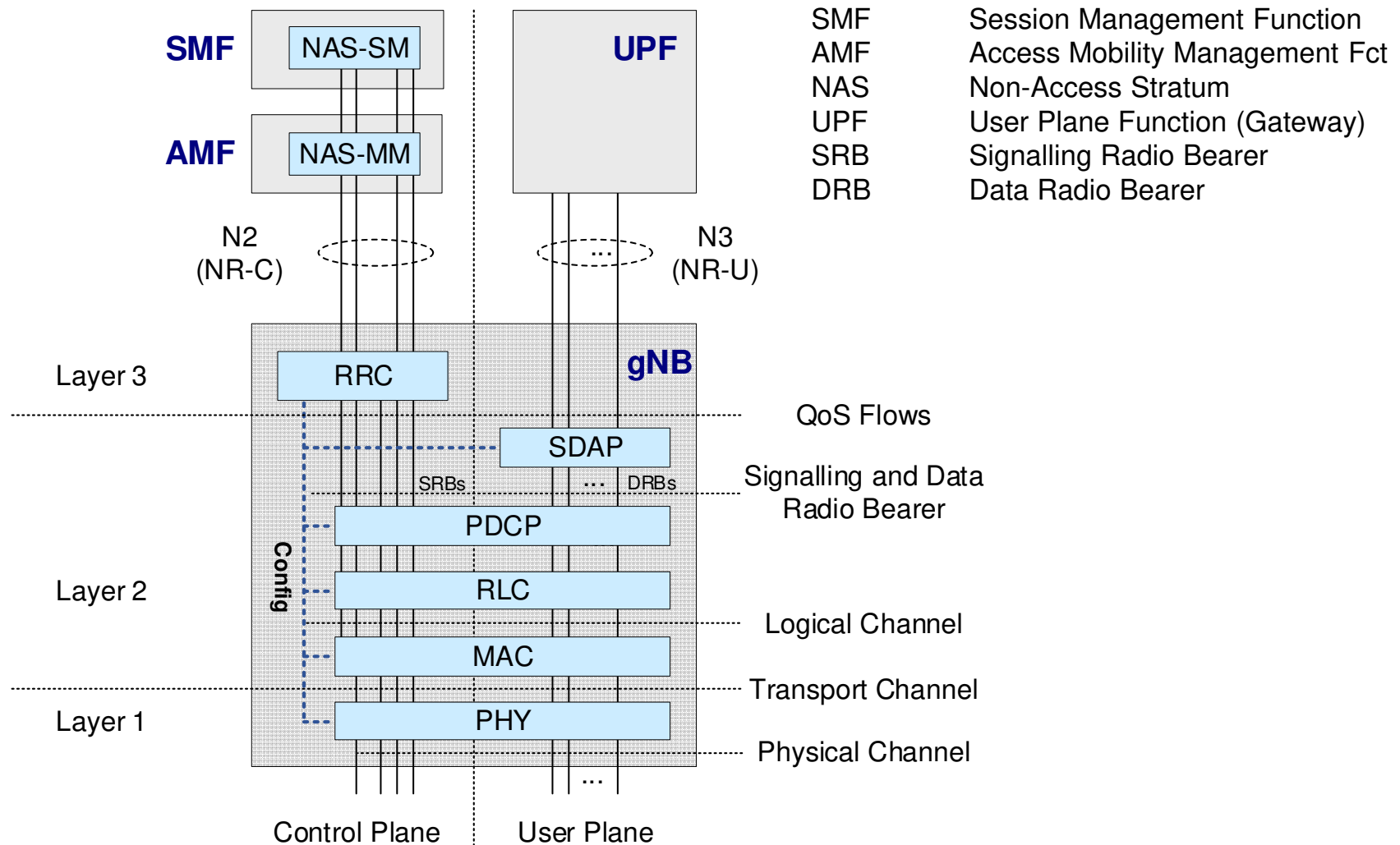
# Access Agnostic Design

- ▶ The future 5G Core shall be access agnostic
  - N2/N3 will be generic and not designed for 5G access only



- ▶ Clear split between access and core network required
  - minimize access dependencies in the core network  
e.g. idle mode tracking, paging partly moved to radio access

# gNB Protocol Architecture

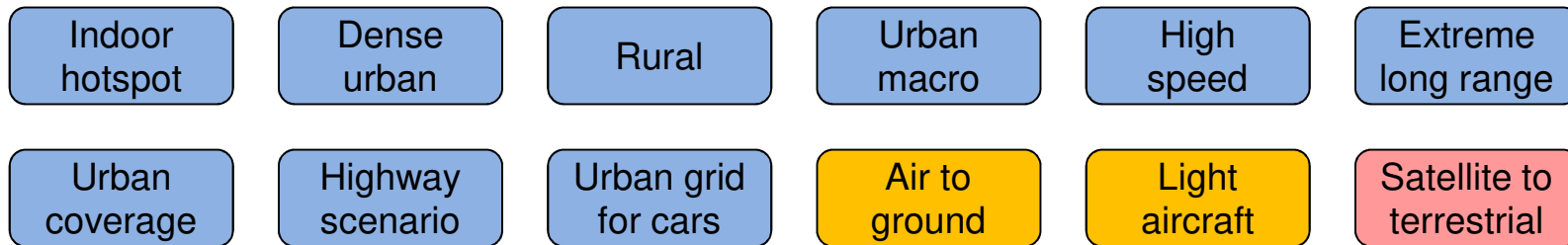




# Status of Satellite Activities in 3GPP

# 3GPP Deployment Scenarios (TR38.913)

- ▶ 12 deployment scenarios have been defined recently
  - cell range from 20 m indoor up to 150-300 km extreme range
  - frequency range from 450 MHz to 70 GHz
  - up to 32 antenna elements for the UE and 256 for the eNB



- example satellite scenarios TR38.913

Attributes	Deployment-1	Deployment-2	Deployment-3
Carrier Frequency	Around 1.5 or 2 GHz for both DL and UL	Around 20 GHz for DL Around 30 GHz for UL	Around 40 or 50 GHz
Duplexing	FDD	FDD	FDD
Satellite architecture	Bent-pipe	Bent-pipe, On-Board Processing	Bent-pipe, On-Board Processing
Satellite system position in the 5G architecture	Access network	Backhaul network	Backhaul network
System Bandwidth (DL+UL)	Up to 2*10 MHz	Up to 2*250 MHz	Up to 2 * 1000 MHz
Satellite Orbit	GEO, LEO	LEO, MEO, GEO	LEO, MEO, GEO
UE Distribution	100% Outdoors	100% Outdoors	100% Outdoors
UE Mobility	Fixed, Portable, Mobile	Fixed, Portable, Mobile	Fixed, Portable, Mobile

# RAN1 Study on “Non-Terrestrial Networks”

## ▶ NEW RAN1 study item on non-terrestrial networks

- RAN#75 Mar 2017 in Dubrovnik, Croatia
- large number of supporting companies
- objective is to study
  - a new channel model for non-terrestrial networks
  - deployment scenarios and the related system parameters and architecture
  - identify potential key impact areas on the NR

## ▶ Current status

- discussion at RAN#77 Sep. 2017 in Sapporo, Japan
- several approved contributions e.g.
  - RP-171579 Considerations on NR impacts by ...
- updated draft TR38.811v0.2.0 available in RP-172074
- Upcoming workshop on channel model in Prague in Oct
- All study items on hold

Supporting IM name
Thales
Fraunhofer IIS
Nomor Research
Dish Network
HUGHES Network Systems Ltd

# SA1 Study on “Satellite Access in 5G”

## ▶ New SA1 study item on satellite access in 5G approved

- SA#77 Sep. 2017 in Sapporo, Japan
- supporting companies ...
- objective
  - identify new requirements for 5G system with integrated satellite based access
  - incl. requirement for UEs supporting satellites

Supporting IM name
Thales
TNO
Fraunhofer IIS
Nomor Research
HUGHES Network Systems Ltd
European Space Agency (ESA)

## ▶ New targets for satellite advocates

- progress with existing study items
- create an SA2 and a RAN1 work item for Rel.16
- standardize a satellite component in 5G

# Summary

- ▶ 5G is a huge ongoing global industry effort
- ▶ 3GPP is THE standardization organization for 5G
- ▶ 5G will be specified in multiple phases
- ▶ New Radio and 5G Core Network specification is already well advanced – Phase 1 completion mid 2018
- ▶ Commercial start of 3GPP compliant 5G networks is expected around 2020
- ▶ Successful Satellite groundwork in 3GPP by Thales
- ▶ Still huge effort required to take off eventually
- ▶ Nomor Research involved in related activities
  - Nomor Research signed Joint Statement between ESA and European Space Industry on „Satellite for 5G“ on 20.09.2017



# Contact Eiko Seidel



3GPP Expert / Consultant / Training  
Simulation / Patents / Research

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Satellites and 3GPP  
5G  
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Eiko Seidel is Chief Technical Officer at Nomor Research GmbH, a leading company in the research and development of future and emerging mobile communication systems, offering related consultancy and simulation services.

He has been working in mobile communication R&D for more than 20 years. Since 3GPP was founded in 1998, Eiko has been contributing actively to 3G, 4G and 5G standardisation. Besides numerous contributions to 3GPP, he published 20+ conference papers, submitted 100+ patent applications and contributed to various books. Eiko works as consultant, advisor, trainer and independent expert for different organisations.

Let me know if we can be of any help to you !

no|mo|re|novel  
research mobile  
radio

# Need for 5G Technology Training

- ▶ Training by standardisation and R&D experts
- ▶ Demonstrations with simulation tools
- ▶ Most popular courses
  - LTE (3d) and LTE-Advanced (3d)
  - LTE-A Pro Radio Technology (3d)
  - LTE-A Pro Protocol / Architecture (2d)
  - LTE Public Safety Systems (3d)
  - **5G Radio Access Technology (3d)**
  - **5G Protocol/Architecture (2d)**
- ▶ In-house or public training in collaboration with
  - Carl-Cranz-Gesellschaft Germany ([www.ccg-ev.de](http://www.ccg-ev.de))
  - Continuous-Education-Institute Sweden ([www.cei.de](http://www.cei.de))

