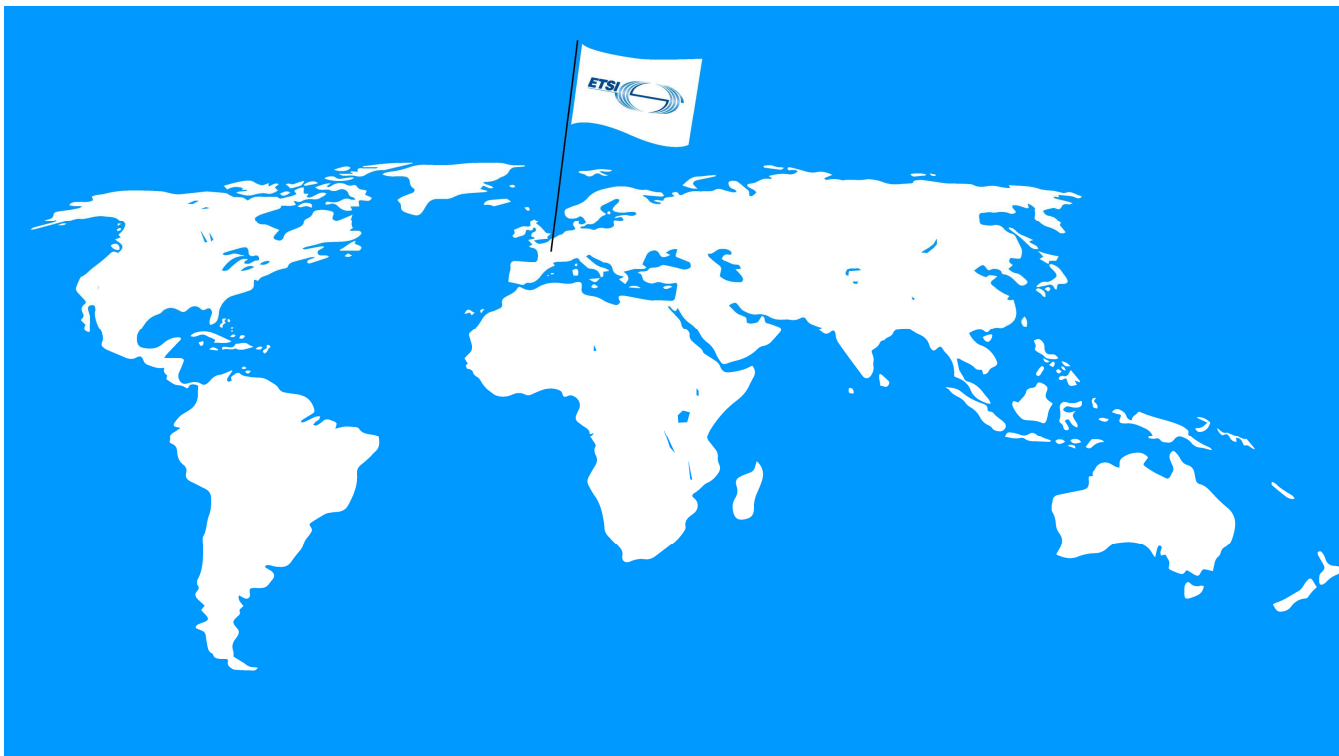




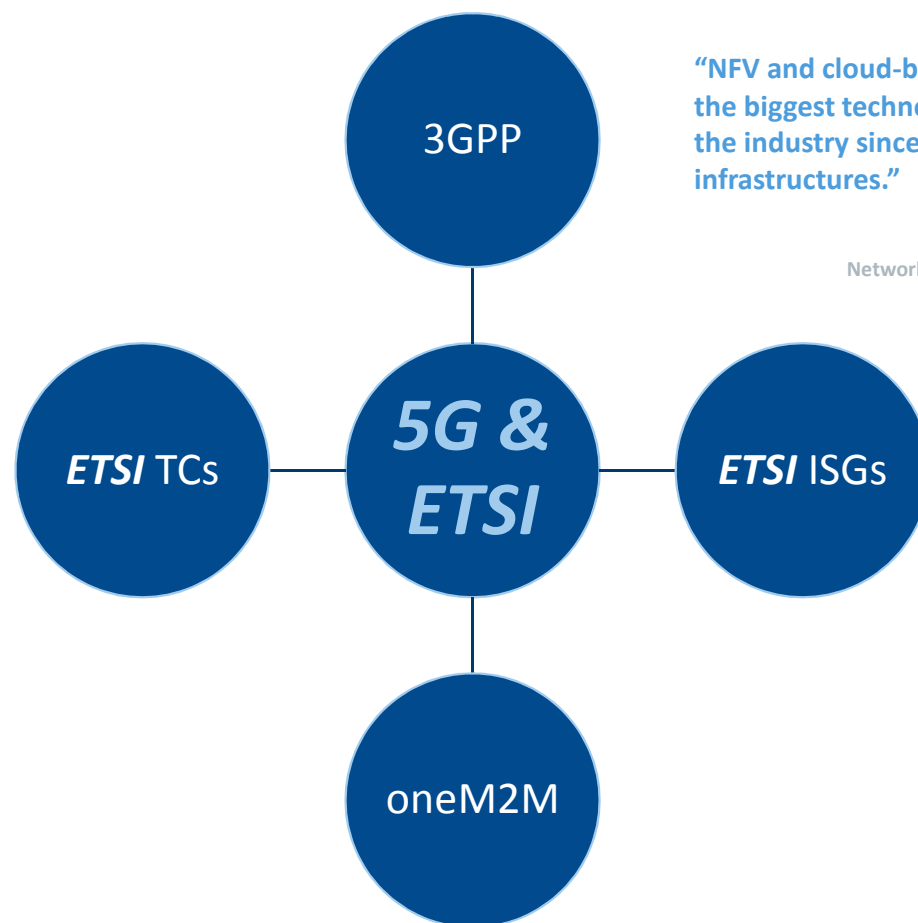
ETSI and 3GPP work on 5G standards

Presented by: **Kevin Flynn**
3GPP Marketing and
Communications Officer

ETSI's Role & Reputation in 5G standardization



- ETSI is at the forefront of emerging technologies
- Direct participation & consensus based
 - ✓ ETSI has over 850 member companies and organizations
 - ✓ 436 ETSI members are active in 3GPP - out of 683 members in total



“NFV and cloud-based deployment practices will bring the biggest technological and business transformation of the industry since the creation of mobile communication infrastructures.”

ETSI [White Paper No. #32](#)
Network Transformation; (Orchestration, Network and Service
Management Framework)
October 2019

5G Related Activities in ETSI (1/4 - non-exhaustive list)

ISG NFV – Network Functions Virtualisation

Standard IT servers, switches and storage are at the base of the NFV infrastructure.

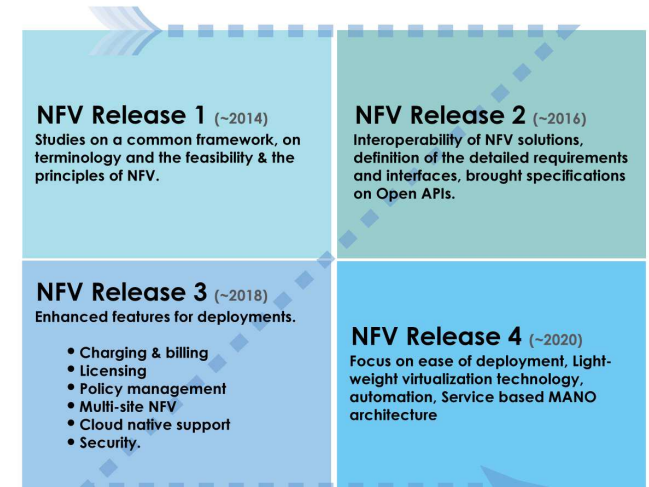
The ETSI ISG NFV community has evolved through several phases, moving from defining the initial framework and pre-standardization studies to detailed specifications over three 'Releases'.

While NFV was originally conceived to help network service providers find cost reduction and agility, it has proven to be an essential tool to enhance how these services are requested and consumed by users of 5G.

ISG MEC – Multi-Access Edge Computing

An enabler for 5G use cases, key in fixed-mobile integration. ETSI MEC enables applications to be hosted in a multi-vendor multi-access edge computing environment.

Offers a cloud computing capability at the edge of the network and is a step towards convergence of IT and telecommunications networking. The MEC Server provides RAN API services for the development of network optimization applications: Radio Network Information Service (RNIS); Location Information Service; and Bandwidth Manager Service.



Source: ETRI presentation June 2019; of 4Rnet.

Group Report

MEC 001	Terminology
MEC 002	Phase 2: Use Cases and Requirements
MEC 003	Framework and Reference Architecture
MEC 005	Proof of Concept Framework
MEC 009	General principles for MEC Service APIs
MEC 010-1	Mobile Edge Management; Part 1: System, host and platform management
MEC 010-2	Mobile Edge Management; Part 2: Application lifecycle, rules and requirements management
MEC 011	Mobile Edge Platform Application Enablement
MEC 012	Radio Network Information API
MEC 013	Location API
MEC 014	UE Identity API
MEC 015	Bandwidth Management API
MEC 016	UE application interface
MEC 017	Deployment of Mobile Edge Computing in an NFV environment
MEC 018	End to End Mobility Aspects
MEC 022	Study on MEC Support for V2X Use Cases
MEC 026	Support for regulatory requirements
MEC 029	Fixed Access Information API
MEC-DEC 025	MEC Testing Framework
MEC-IEG 004	Service Scenarios
MEC-IEG 005	Proof of Concept Framework
MEC-IEG 006	Market Acceleration; MEC Metrics Best Practice and Guidelines

5G Related Activities in ETSI (2/4)

ISG ZSM - Zero touch network and Service Management

Goal: To provide a framework that enables zero-touch automated network and service management in a multivendor environment. This holistic end-to-end network and service management concept enables the integration of ETSI ENI, NFV and MEC management demands.

ZSM supports enablers for closed loop automation and for data-driven management algorithms that can be based on machine learning and artificial intelligence.

ISG ZSM recent Group Specifications (GS) :

ETSI **GS ZSM 001** (10/2019): Requirements based on documented scenarios

ETSI **GS ZSM 002** (08/2019): Reference Architecture

ETSI **GS ZSM 006** (05/2018): Proof of Concept Framework

ETSI **GS ZSM 007** (08/2019): Terminology concepts in ZSM

ISG ENI – Experiential Networked Intelligence

The assessment of Networked Experience using Artificial Intelligence in 5G communications systems.

Experiential Networked Intelligence OUTPUT IN 2019:

- ✓ Group Report (GR) on definition of networked intelligence categorization
- ✓ Revision to Group Specification (GS) on ENI PoC framework
- ✓ GS on ENI system architecture
- ✓ Revision to GR on terminology for main concepts in ENI
- ✓ Revision to GSs on ENI requirements and use cases

ISG mWT – mm Wave Transmission

Facilitating the use of the V-band (57-66 GHz) for Fixed Wireless Access, E-band (71-76 & 81-86 GHz) and in the future higher frequency bands above 100 GHz (i.e. W/D-Band) for large volume applications in the back-hauling and front-hauling to support 5G deployment; Identification of spectrum regulations and licensing scheme more suitable and sustainable with respect to current ones in order to better match the challenging requirements of 5G mainly in terms of capacity increase; technical analysis and reports on the benefits of new features (phase array, interference cancellers, ..) that may require upgrade of the harmonized standards.

ISG MWT WORK IN PROGRESS:

- ✓ Group Specification (GS) on Definition of a Wireless Transport Profile for Standard SDN Northbound Interfaces
- ✓ Group Report (GR) on FS RF frequency ranges above 174,8 GHz
- ✓ GR on current status of standards and activities in RF bands above D-band
- ✓ GR on W-Band - Performance Management overview, covering metrics needed to describe error performance related aspects in radio equipment used for FS
- ✓ Miscellaneous Work Item - survey of E-Band deployments and status of international and national regulation worldwide

5G related activities in ETSI (3/4)

ISG ARF – Augmented Reality Framework

Developing an interoperability framework for Augmented Reality components, systems and services and 5G will significantly improve network performance for cloud services in particular in terms of bandwidth and latency

Image (right): Two Work Items completed...

TC CYBER

To ensure the security of the 5G network, devices and infrastructure from inception, service, improvement and end of life including detailed security work within 5G groups.

TC CYBER QSC – Quantum Safe Cryptography

Creating and selecting cryptographic techniques that are resistant to attack by next-generation quantum computers. QSC is fundamentally the security approach to next-generation computing. QSC is extremely appropriate for certain components of the new 5G architecture.

ISG Securing Artificial Intelligence

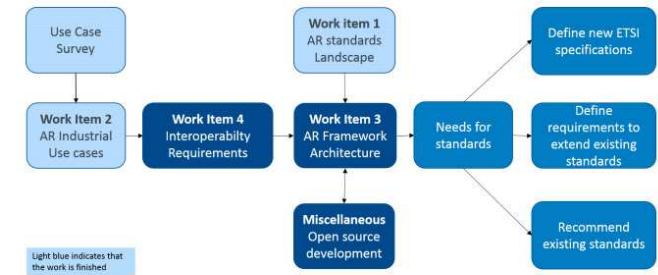
Securing AI from attack, Mitigating against AI where AI is the ‘problem’ and Using AI to enhance security measures against attack from other things – as part of the ‘solution’.

TC LI – Lawful Interception

Development of a suite of standards allowing ETSI standards to support industry compliance to the requirements of national and international law. This touches many 5G aspects.

ETSI GR ARF 002 V1.1.1 (2019-07)

Report describes typical industrial use cases for AR components, systems and services



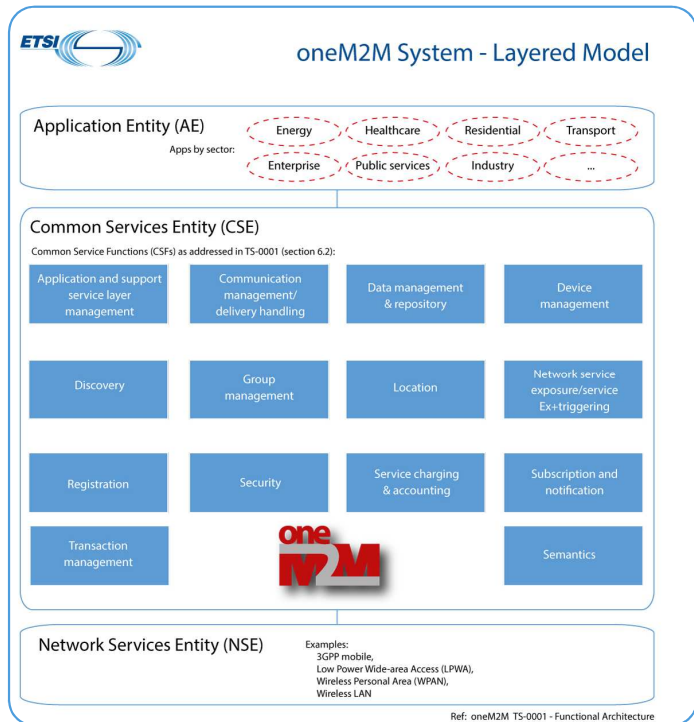
5G related Activities in ETSI (4/4)

TC ITS – Intelligent Transport Systems

Vehicle connectivity with the capability of using a 5G infrastructure

Intelligent Transport Systems NEW TS output in 2019:

- ✓ Technical Specification (TS) on GeoNetworking extensions for MCO
- ✓ TS on Multi-Channel Operation (MCO) for ITS; covering definition of MCO architecture, channel management mechanisms and interfaces
- ✓ TS on Communication Architecture for MCO
- ✓ TS on OSI cross-layer topics
- ✓ TS on security management messages
- ✓ TS on interoperability test specifications for security
- ✓ TS on manoeuvre coordination service - basic set of applications
- ✓ TS on conformance test specifications for ITS PKI management
- ✓ TS on awareness service for Vulnerable Road Users (VRU)
- ✓ TS on Access Layer / ITS Performance Analysis Framework and 5,9 GHz Channel Models
- ✓ TS on Multimedia Content Dissemination (MCD) basic service specification
- ✓ TS on facilities layer protocol for communication congestion control



oneM2M (Partnership)

oneM2M specifications address the need for a common IoT Service Layer that can be readily embedded within various hardware and software, and relied upon to connect devices in the field.

A critical objective of oneM2M is to attract organizations from M2M-related business domains such as: telematics and intelligent transportation, healthcare, utilities, industrial automation, smart homes.

<http://www.onem2m.org>



The 3GPP perspective on 5G

Content

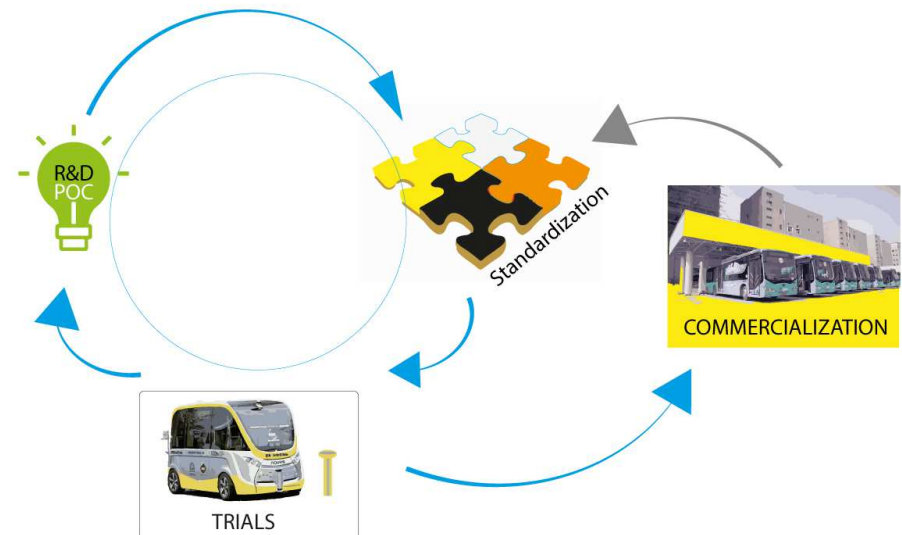


- The role of 3GPP
- The Partners & their members
- Organizing the work
- Our role in 5G
- Release 15 - NR to meet market needs
- Release 16 - 5G use cases
- Release 17 - An early look
- Conclusions

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



Evolution ...thanks to GSM



Generation	Systems
1G	Analogue technology, from the 1980s onwards (NMT, AMPS, TACS, A-Netz to E-Netz, Radiocom 2000, RTMI, JTACS and TZ-80n)
2G	First digital systems, deployed in the 1990s introducing voice, SMS and data services (GSM/GPRS & EDGE, CDMAOne, PDC, iDEN, IS-136 or D-AMPS).
3G	3GPP evolved Global System for Mobile communication (GSM) with the evolution of General Packet Radio Service (GPRS) and Enhanced Data rates for GSM Evolution (EDGE), as well as further developments with the Universal Mobile Telecommunications System (UMTS) and High Speed Packet data Access (HSPA). 3G brought a global vision to the evolution of mobile networks, with the creation of the ITU's family of IMT-2000 systems which included EDGE, CDMA2000 1X/EVDO and UMTS-HSPA+ radio access technologies.
3G/4G	LTE and LTE-Advanced have crossed the “generational boundary” with high speed data, significant spectral efficiencies and adoption of advanced radio techniques, their emergence Evolution to LTE has been the direction of travel for [all] new mobile systems from Release 8 onwards.
5G	5G brings another major technology step, with the creation of a 'New Radio' (NR), slated to be used alongside LTE-Advanced Pro in early 5G network launches.

Why Standards?



“Modems are the embodiment of the wireless standards developed by the industry body 3GPP (3rd Generation Partnership Project). **3GPP adopts the best technologies** among numerous proposals from its members into standards. If one wants to be modem leaders, they’ve got to be leaders in standardization.

Standards leadership allows companies to incorporate their technology into standards, which gives them a significant head start against the competition in productizing that technology. Such leadership requires not just modem competence, but end-to-end systems expertise, built over many years with large, sustained investments. Additionally, it requires **close collaboration with other 3GPP members to build trust** through open sharing of ideas, intentions, objectives, and aspirations.”

Prakash Sangam, September 6, 2019

Article [“Apple Will Be Hard-Pressed to Build a Rock Star 5G Modem”](#)

Why 3GPP?



“With so many players within the IoT space, from device makers to network providers and even traditional enterprises adopting technical solutions, **it has been difficult to establish a standard for connectivity**, creating a “wild west” of different standards that had held back interoperability of devices/sensors and the growth of the IoT overall.

But the advent of 5G, and the 3GPP standards that are part of the next generation of mobile wireless’ development, might be a way to tame the IoT and unlock new value and innovation...

We stand at a critical juncture. As costs have come down, and the advent of **5G provides an opportunity for consistent standards** as well as reliable, secure and low-latency connections, the wilds of the IoT can be tamed and great leaps in innovation unlocked.”

Daniel Elizalde, September 24, 2019

Article: [The Wild West of Connections – how 5G standards could supercharge the IoT](#)



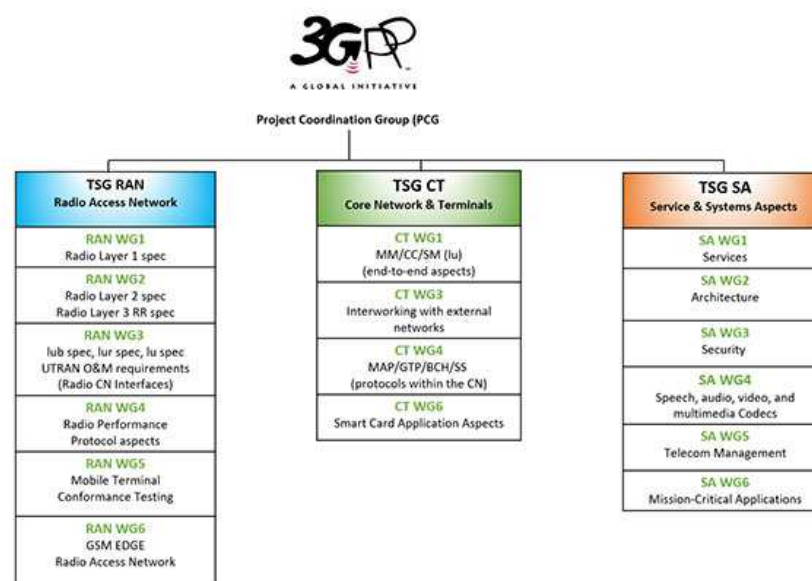
3GPP standards eco-system



- The 3GPP [Organizational Partners \(OP\)](#) are the seven Standards Developing Organizations (SDOs) - from China, Europe, India, Japan, Korea and the United States.
- Participation in 3GPP is made possible by companies and organizations becoming [Individual Members \(IM\)](#) of one of the OPs.
- Specific inputs, in the form of market requirements may also come in to the Project via any of the twenty [Market Representation Partners \(MRP\)](#) in 3GPP. These organizations have all signed up to the 3GPP Project scope and objectives.
- Lots of external cooperation with other standards bodies and a broad variety of other groups, by way of formal Liaisons.

Other Standards bodies

Formal External Liaisons



3GPP
JSG
oath
IBP
abs
inse
PR1
TIA
2gect
onal
EA
com
272
RC
ICA
ICF
ITD
anil
slon
rum
EEE
E1F
IDA
ions
ITC
inse
oup
EG
SG2
ink
ICP
2gect
S1U
IEF
ENA
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Certification Bodies

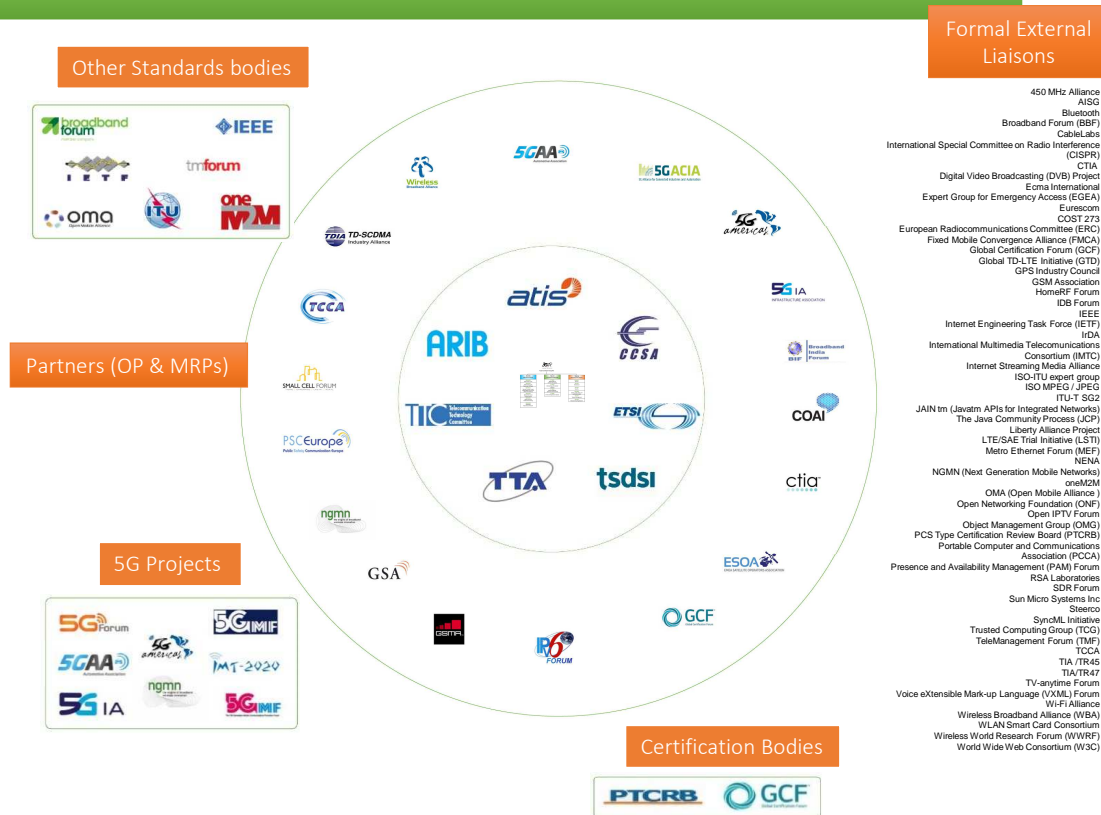


Wireless World Research Forum (WWRF)
World Wide Web Consortium (W3C)

3GPP standards eco-system

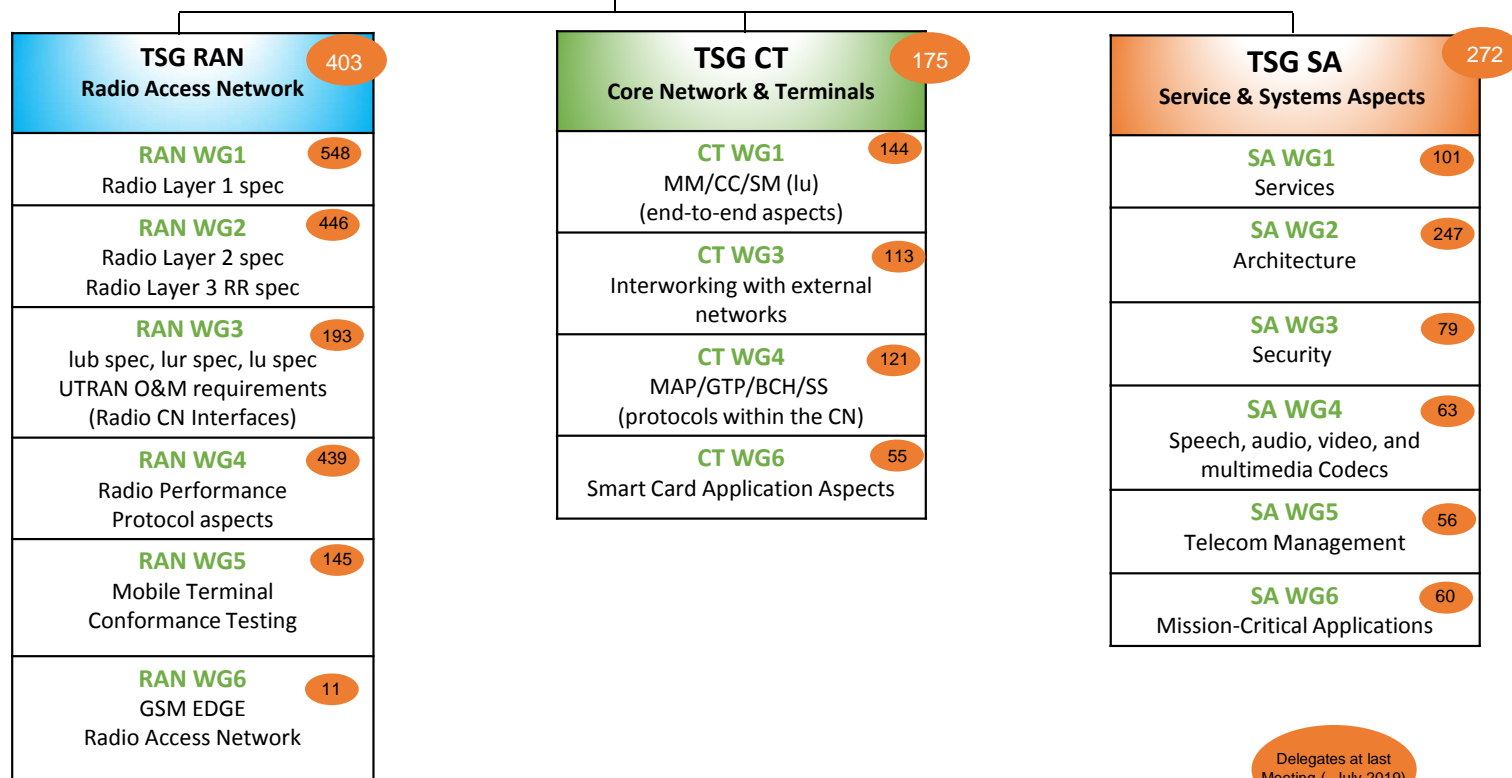


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Project Coordination Group (PCG)



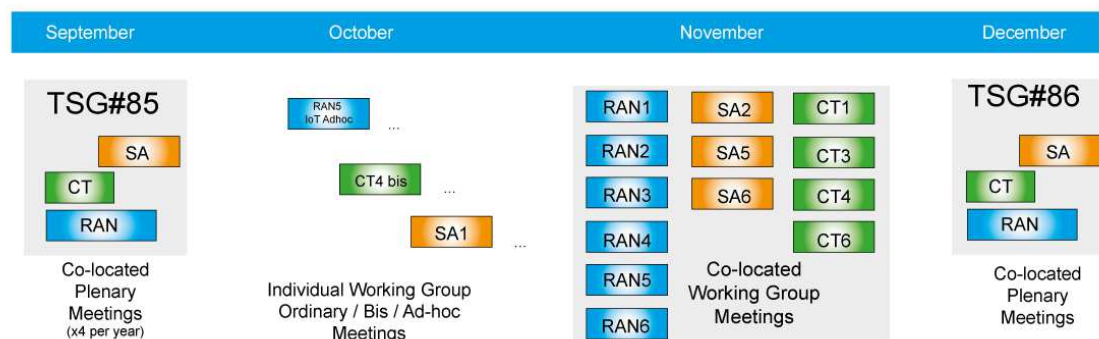
Delegates at last Meeting (~July 2019)

Schedule driven by meetings



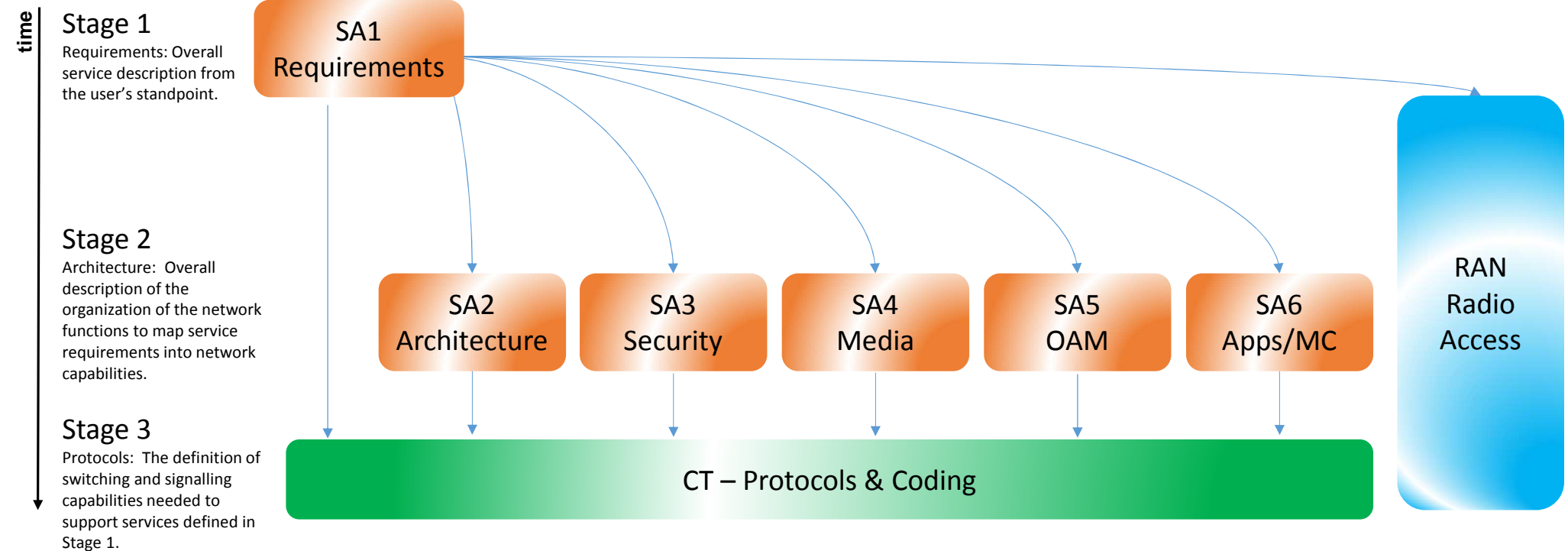
- New work initiated by member companies via Work Items as Tdocs at meetings
- Work Items prioritised and allocated time for discussions in meetings
- 3GPP member companies contribute on equal terms to any work item
- 3GPP seeks consensus on all technical matters (but has mechanisms if consensus cannot be reached)
- Release deadline respected, unfinished work deferred to a later release

3GPP's Meeting Cycle (Q4 example)



These examples are to demonstrate the principle and are not based on actual meeting dates.

Three stage approach



3GPP Work Plan



Release-based work

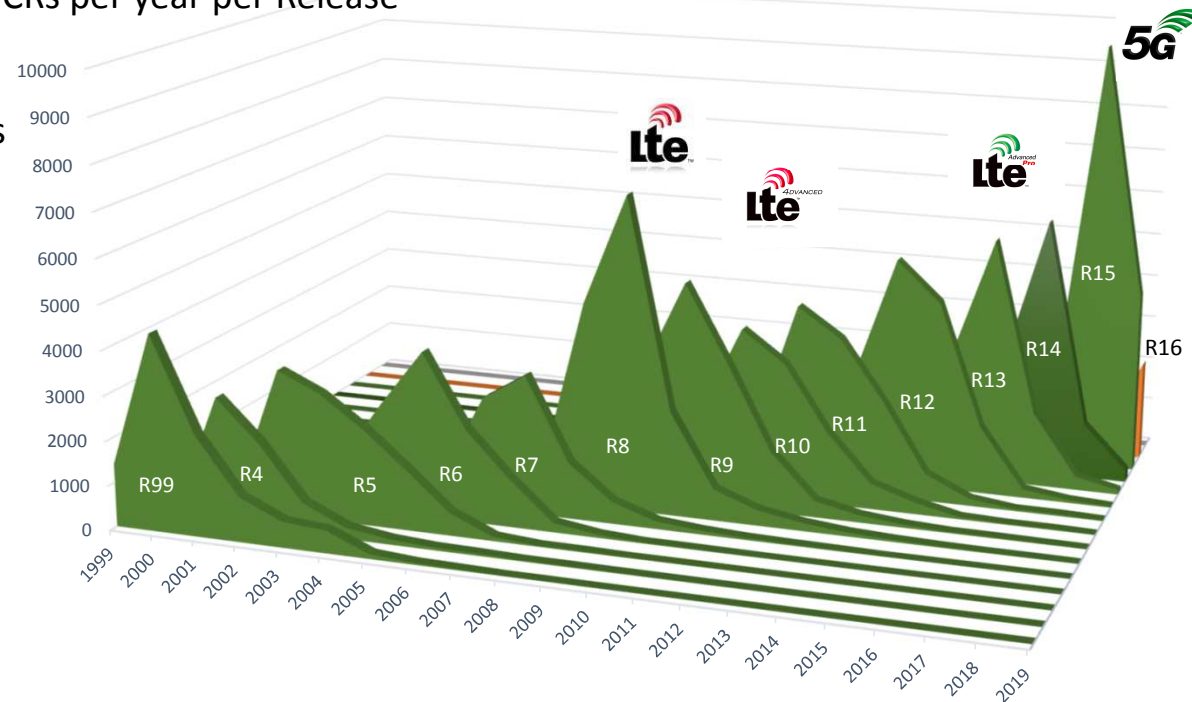
- Releases are major packages of Features (new Release ~ every 15 – 24 months)
- Strong commitment to time-lines guarantees reliable planning and time-to-market
- Work plan built using Work Items that deliver the Features
- Work Item Description exists for each of these
 - WI may cover more than one specification
 - WI may cover more than one TSG or WG
 - WI Description document exists for each WI

Multiple releases maintained in parallel

3GPP WorkPlan:

- <http://www.3gpp.org/Work-Plan>

CRs per year per Release





5G – brings new growth

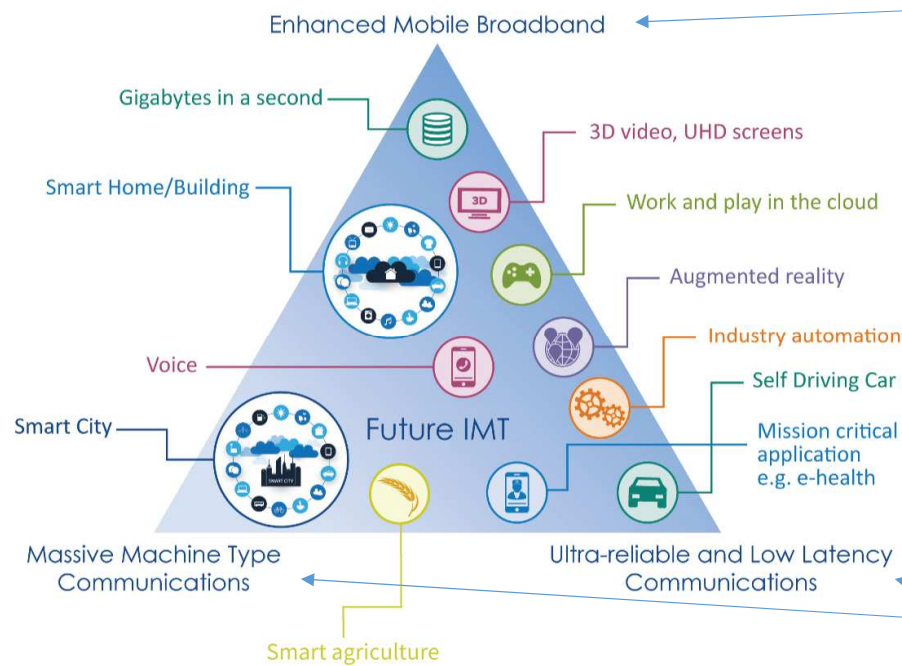


Perfect storm of Multiple breakthrough technologies:

- Low latency radio with fully flexible network
- Artificial Intelligence and Automation
- Device revolution for AR/VR
- Vertical industries going cellular



The IMT vision: towards IoT



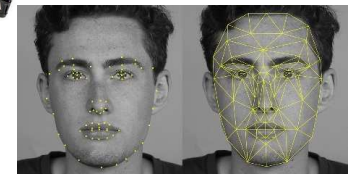
Initial driver for early adopters of 3GPP 5G



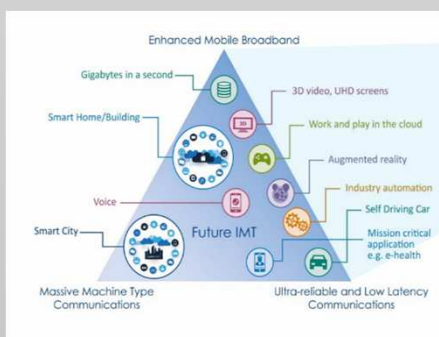
Copyright: Dave Simonds and the Economist



Future capabilities will tip the balance of network load towards IoT



Bringing the work in to the groups



Use Cases

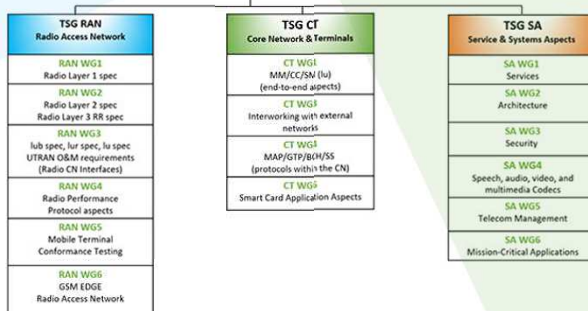
- Higher Data Rates
- Higher User Mobility
- Highly variable data rates
- Diverse Deployments
- Improved Coverage

Overall Goals

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



Project Coordination Group (PCG)



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

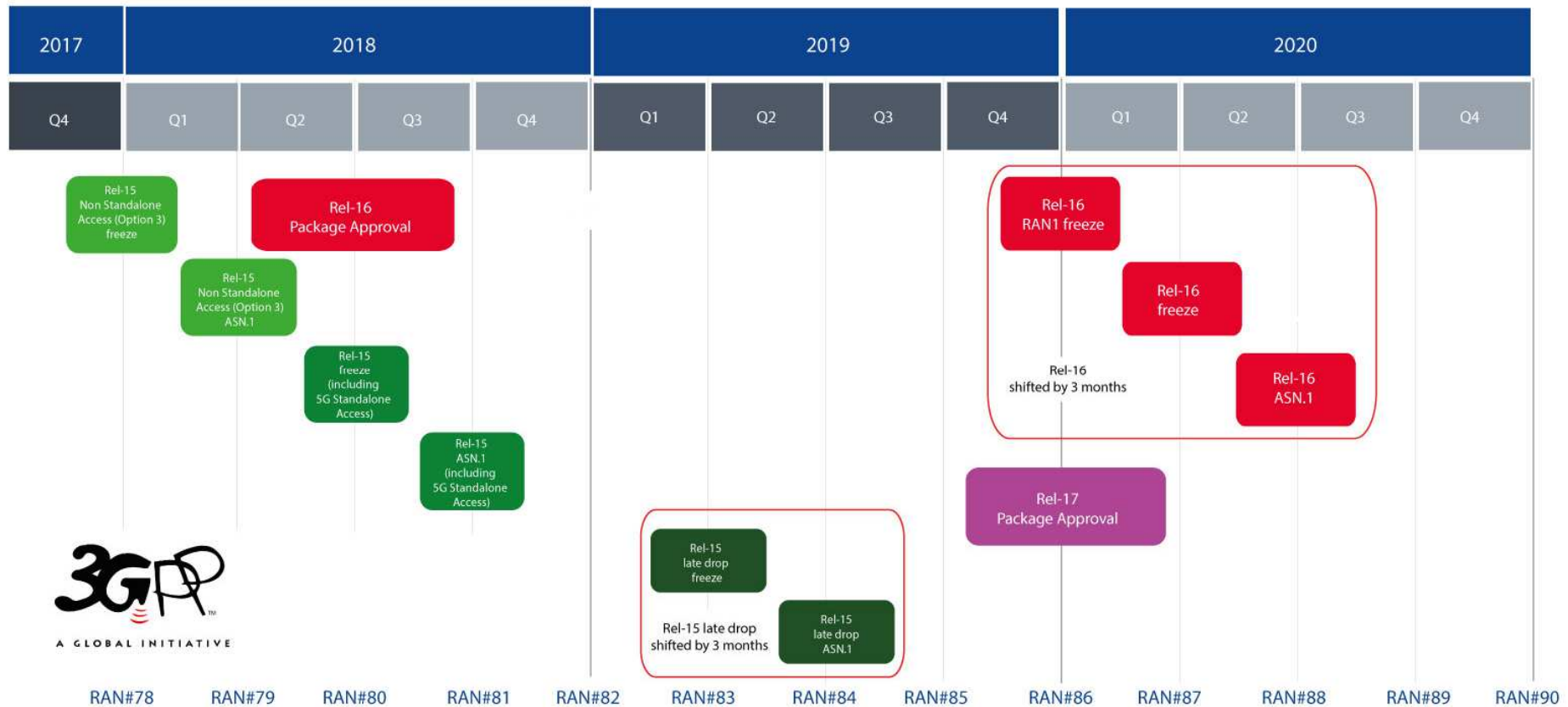
Where are we now on 5G?



- 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 (eMBB, mMTC, IoT, URLLC, 'verticals')
- 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



The three 5G Releases...

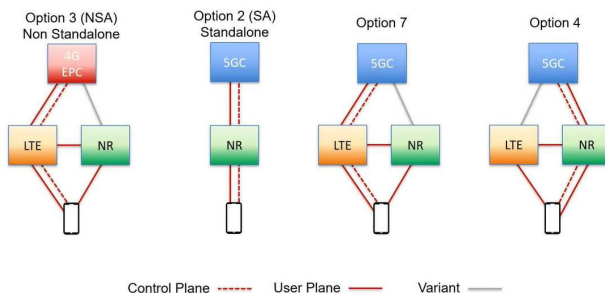


Release 15 – NR to meet market needs



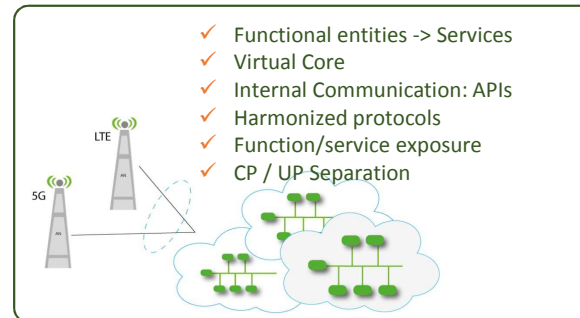
3GPP 5G NR

- Operation from low to very high bands: 0.4 –100Ghz
- Ultra wide bandwidth (Up to 100MHz in <6GHz, Up to 400MHz in >6GHz)
- Set of different numerologies for optimal operation in different frequency ranges
- Native forward compatibility mechanisms
- New channel coding
- Native support for Low Latency and Ultra Reliability
- Flexible and modular RAN architecture: split fronthaul, split control- and user-plane
- Native end-to-end support for Network Slicing



5G Services and Systems capabilities

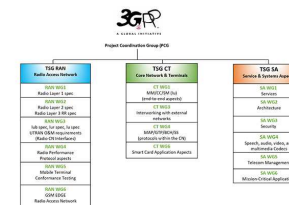
- 5G Core Network
- 5G Security Architecture (SA3)
- 5G Media codecs (SA4)
- 5G Charging and Management (SA5)
- New 'Vertical' Applications (SA6)



3GPP Release 15

- NR
- The 5G System – Phase 1
- Massive MTC and Internet of Things (IoT)
- Vehicle-to-Everything Communications (V2x) Phase 2
- Mission Critical (MC) interworking with legacy systems
- WLAN and unlicensed spectrum use
- Slicing – logical end-2-end networks
- API Exposure – 3rd party access to 5G services
- Service Based Architecture (SBA)
- Further LTE improvements
- Mobile Communication System for Railways (FRMCS)

Release 16 – 5G use cases



RADIO - 5G NR features:

- **5G Expansion:** Vehicle to everything (V2X), Industrial IoT, Ultra reliable low latency enhancements, 5G NR Unlicensed spectrum operation
- **5G Efficiencies:** Interference Mitigation, SON & Big Data, MIMO enhancements, Location and positioning, Power Consumption, Dual Connectivity, Device capabilities exchange, Mobility enhancements

Services and Systems capabilities in Rel-16:

URLLC support in the 5G Core network, Service requirements for cyber-physical control applications in vertical domains, 5G Enhanced support of Vertical and LAN Services, LAN support in 5G, Cellular IoT support and evolution for the 5G System, 5G message service, Improvement of V2X service Handling, Application layer support for V2X services, Architecture enhancements for 3GPP support of advanced V2X services, 5G positioning services, Enhancement to the 5G LoCation Services, Optimisations on UE radio capability signalling, Integration of Satellite Access in 5G, Enablers for Network Automation for 5G, Enhanced Mission Critical Push-to-talk architecture phase 2, Enhancements to Functional architecture and information flows for Mission Critical Data, MBMS APIs for Mission Critical Services, Enhanced Mission Critical System Migration and Interconnection, Mission Critical Services Security Enhancements, Maritime Communication Services over 3GPP System, Enhancement of LTE for Efficient delivery of Streaming Service, Enhancements to Framework for Live Uplink Streaming, Coverage and Handoff Enhancements for Multimedia, Media streaming architecture, Media Handling Extensions for 5G Conversational Services, EVS Floating-point Conformance for Non Bit-Exact, Addition of HLG HDR to TV Video Profiles, User Identities and Authentication, Multi-device and multi-identity, Business Role Models for Network Slicing, Enhancement of performance assurance for 5G networks including network slicing, Enhancements to the Service-Based 5G System Architecture, SBA aspects of enhanced IMS to 5GC integration, Media Handling Aspects of RAN Delay Budget Reporting in MTSI, User data interworking, Coexistence and Migration, Volume Based Charging Aspects for VoLTE, Enhancements to IMS for new real time communication services, Energy efficiency of 5G, New Services and Markets Technology Enablers – Phase 2, 5G Voice Service Continuity, Security Assurance Specification for 5G, 5GS Transfer of Policies for Background Data Transfer, Service Interactivity, Alternative EVS implementation using updated fixed-point basic operators, Usage of CAPIF for xMB API, Policy delivery to UE for background data transfer, QoS Monitoring, Inter-RAT Mobility requirements for real time service, Management of QoE measurement collection, Network policy management for mobile networks based on NFV scenarios, Intent driven management service for mobile network, OAM aspects of LTE and WLAN integration, Methodology for 5G management specifications, Nchf Online and Offline charging services, Charging Enhancement of 5GC interworking with EPC, NRM enhancements, Network Exposure Charging in 5G System Architecture, Charging AMF in 5G System Architecture Phase 1, Discovery of management services in 5G, Lawful Interception Rel-16, Reliable Data Service Serialization Indication, S6b Optional for ePDG connected to 5GS, Self-Organizing Networks (SON) for 5G networks, Integration of ONAP and 3GPP 5G management framework.

3GPP Release 16

- **The 5G System – Phase 2**
- **V2x Phase 3:** Platooning, extended sensors, automated driving, remote driving
- **Industrial IoT**
- **Ultra-Reliable and Low Latency Communication (URLLC) enhancements**
- **NR-based access to unlicensed spectrum**
- **5G Efficiency:** Interference Mitigation, SON, eMIMO, Location and positioning, Power Consumption, eDual Connectivity, Device capabilities exchange, Mobility enhancements
- **Enhancements for Common API Framework for 3GPP Northbound APIs (eCAPIF)**
- **FRMCS Phase 2**

Release 17 – IoT driven



5G support for verticals

- Vehicle Communication, Mission Critical Communications, Industrial IoT, Audio Visual Production...

Enhancements for the system coming:

- 5G LAN, High Precision Positioning, Cellular IoT for 5G, URLLC capabilities, Fixed and Satellite as 3GPP accesses, ONAP interworking, QoS Monitoring, Network Automation, protocol and core network improvements...

5G will span several releases, look out for the Rel-17 work plan soon

3GPP Release 17 Content Approval*

TSG SA Work Areas under discussion at SA#85 (September 2019):

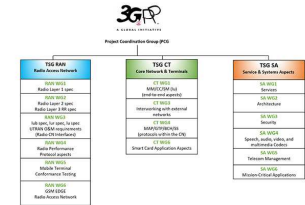
- 5G System Enhancement for Advanced Interactive Services (5G_AIS)
- Cellular IoT enhancement for the 5G System (5G_MCIoT)
- System enhancement for Proximity based Services in 5G (5G_ProSe)
- Enhancement of support for 5G LAN-type service (5GLAN_enh)
- Integration of Satellite in 5G Systems (5GSAT_ARCH)
- Architectural enhancements for 5G multicast-broadcast services (5MBS)
- Study on enhancement of support for 5G Wireless and Wireline Convergence (5WWC_enh)
- Application Awareness Interworking between LTE and NR (AAL_LTE_NR)
- Extended Access Traffic Steering, Switch and Splitting support in the 5G system architecture (eATSSS)
- 5G Enhancement for unmanned aerial vehicles - UAVs (EAV)
- Enhanced IMS to 5G Integration (eIMSSG)
- Enhancement to the 5G Coexistence Services-Phase 2 (eLCS_ph2)
- Enablers for Network Automation for 5G - phase 2 (eNA_Ph2)
- Enhancement of support for Edge Computing in 5G (enh_EC)
- Enhanced support of Non-Public Networks (eNPN)
- Enhancement of Network Slicing Phase 2 (eNS_Ph2)
- Enhancement of 5G UE Policy (eUEPC)
- Architecture enhancements for 3GPP support of advanced V2X services - Phase 2 (eV2XARC_Ph2)
- Supporting Flexible Local Area Data Network (FLADN)
- Supporting Unmanned Aerial Systems Connectivity, Identification and Tracking (ID-UAS)
- Enhanced support of Industrial IoT - TSC/URLLC enhancements (IIoT)
- Support for Minimization of service Interruption (MINT)
- Multimedia Priority Service Phase 2 (MPS2)
- Support for Multi-USIM Devices (MUSIM)
- System architecture for next generation real time communication services (NG_RTC)
- Service-based support for SMS in 5G (SB_SMS)
- Smarter User Plane (SUP)
- UPF enhancement for control and Service Based Architecture (UPCAS)
- Usage of User Identifiers in the 5G System (UIIS)

TSG RAN Work Areas under discussion For final decision at RAN#86 (December 2019):

- NR Light
- Small data transfer optimization
- Sidelink enhancements
- NR above 52.6 GHz (incl 60GHz unlicensed)
- Multi SIM operation
- NR multicast broadcast
- Coverage enhancements
- NB-IoT and eMTC enhancements
- Industrial IoT & URLLC enhancements
- MIMO enhancements
- NR for Non Terrestrial Networks
- Integrated Access and Backhaul enhancements
- Generic enhancements to NR-U
- Power saving enhancements
- RAN data collection enhancements
- Positioning enhancements

* Mainstream Rel-17 specification work will start at the beginning of 2020, with the functional freeze of physical layer aspects scheduled for the second quarter of 2021.
The ASN.1 freeze should follow in September 2021.
There are a large number of work areas to be discussed. Realistically, we will only be able to take on board a sub-set of them within Rel-17.

Joint TSG SA and TSG RAN items under consideration for Rel-17 inclusion (Joint 1/2)



- TSG#85 – In September – advanced the discussion on these features.
- The final decisions on what will be in Release 17 will be made in December, at TSG#86.
- ‘Downscaling’ of some features may be necessary to get the work done in the available Time Units.

Network Slicing:

- Enable UE awareness & access of RAN support of network slice
- Applied for both TDD and FDD.
- Intra-RAT handover service interruption
- POn-demand and dynamic deployment of diverse network slices
- Slice-specific idle and inactive UE access
- Asses Generic Slice Template impact on RAN & 5G

Industrial IoT and URLLC:

- Focus on:
- NR Time Sensitive Communications (TSC)
 - Enhanced diversity support / Multi-TRP / Multipanel / beam management
 - QoS predictability
 - Unlicensed IIoT/URLLC and URLLC FR2 enhancements
 - Feedback enhancements for IIoT
 - Faster UE processing times
 - Interference management for URLLC in mixed URLLC/eMBB network
 - 5G Architecture optimization for machine control
 - New IIoT channel model
 - Alignment with XR for NR

NR coverage:

- Indoor scenario, Rural scenario, Extreme long distance coverage, urban & dense urban considered.
- Services - VoIP, eMBB.
- Channels - DL and UL to be taken into account, PUSCH enhanced (PDSCH/PDCCH/PRACH also studied).

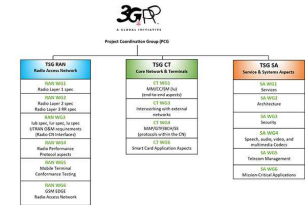
NB-IoT and eMTC:

- Scheduling and latency
- Peak data rates
- Interference and load management
- Power consumption reduction
- Relaying (UE-based or NW-based)
- Mobility (intra-RAT, to/from NR, Reduced reading of neighbor cells)
- Improved multi-carrier operation
- Connection to NR/5G

RAN data collection:

- leftovers of R16 RAN centric data collection and utilization SID/WID,
- data collection for new R16 features
- AI/Machine Learning

Joint TSG SA and TSG RAN items under consideration for Rel-17 inclusion (Joint 2/2)



Localized User Plane (LUP):

Rel-17 should support RAN architecture enhancements to support Localized User Plane for Public Network Integrated NPN (PNI-NPN)

NR Multicast Broadcast:

- Use cases include: V2X, critical communications, IoT - Software updates, TV Video and Radio distribution, Xreality.
- Limit work to Standalone NR and 5GCore?
- Start with Single-Cell Point-To-Multipoint (SC-PTM) and small number of cells operated in a single-frequency network (SFN) and study scalability
- FR1 first, FR2 also, but with lower priority
- Switching between unicast/multicast should be supported

Small data:

- Support small data transmission for UL (MO) use case
- Continue discussion on the DL aspects
- Support small data transmissions from RRC_INACTIVE state
- Discussion on IDLE state aspects ongoing
- Applicable to licensed carriers - no specific enh. for NR-U

Power Saving:

- Enh. NR UE Power Saving Features
- Enh. emerging NR use cases
- Study network power saving to improve overall NR energy efficiency

5G Audio-Visual (AV) Production:

- Multicast
- Easy deployment of SNPN
- Reliable wireless backhaul
- Synchronization

eXtended Reality (XR):

- Use Cases / Deployment Scenarios
- Power, Capacity, Mobility

Non-Terrestrial Networks:

- HAPS, LEO, GEO based access scenarios
- cell size for LEO and GEO based access
- transparent or regenerative payload options
- earth fixed or mobile beams
- UE with location determination capability (e.g. GNSS)
- targeted usage scenarios
- UE type (3GPP class 3 or other)
- NB-IoT and LTE-MTC

UAV:

- enhancements for reliable UAV remote controlling
- UAV-to-UAV communication
- enhancements on UL throughput
- beam management enhancements

Positioning:

- General NR Positioning Enhancements
- V2X positioning
- NR-U positioning
- Industrial IoT positioning aspects
- "RAT-independent" positioning aspects

Sidelink:

- Relay aspects, architecture aspects, related radio interface aspects
- Common functions across the key use cases
- Commonality between commercial, V2X, and Critical Communication

Multi-SIM:

Multi-SIM considers both inter-MNO and intra-MNO cases. The enablers for Dual-USIM should be applicable to more than two USIMs.

Discussions now move to UE types, RAT concurrencies, Use cases and the further Scoping of study objectives.

Integrated Access Backhaul:

- Duplex enhancements
- Potentials for network coding
- Mobile IAB

TSG SA Rel-17...content progress (SA 1/2)



Edge Computing in 5GC:

- Support for forwarding UE application traffic to the edge computing environment
- Investigate potential impacts on charging and policy control
- provide deployment guidelines for typical edge computing use cases including URLLC, V2X, AR/VR/XR, UAS, 5GSAT and CDN

5G Advanced Interactive Services:

- Defining potential QoS requirements for:
- latency for uplink transmission from UE to UPF plus downlink transmission from UPF to UE.
 - reliability for uplink sensor/pose data and downlink pre-rendered/rendered audio/visual data
 - data rate in downlink direction related to SA1 agreed KPIs including FPS (frame-per-second) and resolution etc.

UPF enhancement for control and SBA

- Study further the modular design of User Plane (UP) handling.
- Mechanism to support efficient service communication involving the UPF.

Non-Public Networks:

- Subscription / credentials owned by an entity separate from the Stand-alone Non-Public Network (SNPN).
- UE onboarding and provisioning for non-public networks.
- Service requirements for production of audio-visual.
- Customizations or optimizations of 5GS for NPN in different deployment scenarios.
- Additional exposure capabilities due to support for NPN.
- Support for SNPN and PLMN sharing the same NG-RAN.
- Support for voice/IIMS emergency services for SNPN.

Extended Access Traffic Steering, Switch and Splitting support in the 5G system architecture

5G LAN-type service:

- Enhancement of 5G VN group management;
 - Enhancement of 5G VN group communication.
- For UEs of a 5G VN group belong to the same HPLMN.

Multimedia Priority Service (MPS2)

- MPS for Voice, MPS for Data Transport Service (DTS), MPS for Video

Network Automation:

System enhancements for NWDAF, building on Rel-15 and Rel-16 to allow 5GS to develop new scenarios for network data analytics and NWDAF Deployment Options

Proximity based Services:

5G System needs to be enhanced to support the proximity based services with one common architecture to take advantage of economy of scale, for both public safety and commercial related proximity services, where applicable.

Advanced V2X services - Phase 2:

Architecture enhancements for 3GPP support of advanced V2X services, such as automated driving

5GC LoCation Services-Phase 2:

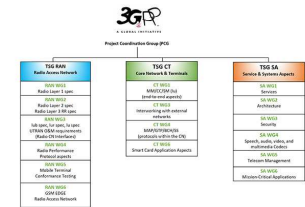
To further enhance the 5GC LCS architecture and corresponding Network Functions and procedures to meet the full set of 5G use case requirements

Wireless and Wireline convergence:

Trusted Non-3GPP access network.

- Wireless Wireline convergent network - needed?
- Improve mobility restriction granularity from TA granularity to a finer granularity.
- Support of L2 Bridge 5G-RG scenario.
- Support of MA PDU session for 5G-RG (post ATSSS_Ph2 study).
- Support of QoS for UE connected behind an RG via Untrusted and Trusted Non-3GPP access solution.

TSG SA Rel-17...content progress (SA 2/2)



- “In” & “In*” items should be broken down into work tasks by SA2 in Q4.
- Each work task should be in the form of a headline + an assigned Time Unit estimation.
- SA2 will NOT do any down-scoping of any items in Q4

“In” (worked on in Q4 by SA2)

- Edge computing in 5GC [enh_EC]
- Non-Public Networks [eNPN]
- 5G multicast-broadcast services [5MBS]
- Network Automation for 5G - phase 2 [eNA_Ph2]
- Proximity based Services in 5GS [5G_ProSe]
- Network Slicing Phase 2 [eNS_Ph2]
- Industrial IoT - TSC/URLLC enhancements [IIoT]
- 5G Advanced Interactive Services [5G_AIS]
- Support for Multi-USIM Devices [MUSIM]
- Integration of Satellite in 5G Systems [5GSAT_ARCH]
- Advanced V2X services - Phase 2 [eV2XARC_Ph2]
- Unmanned Aerial Systems Connectivity, Identification, and Tracking [ID-UAS]

“In*” (conditionally included and shall not be worked on in Q4 by SA2)

- Extended Access Traffic Steering, Switch and Splitting support in the 5G system architecture [eATSSS]
- UPF enhancement for control and SBA [UPCAS]
- 5GC LoCation Services-Phase 2 [eLCS_ph2]
- 5G LAN-type service [5GLAN_enh]
- 5G Wireless and Wireline convergence [5WWC_enh]
- Multimedia Priority Service (MPS) Phase 2 [MPS2]

Conclusions



- 3GPP is industry driven - Standardization of interfaces enables an interoperable, multi-vendor approach to deployment
- NR remains high focus for RAN groups
- IMT-2020 '5G' process progressing – 3GPP leading the way
- The 3GPP processes are necessarily complex, but we need to adapt to bring new sectors in to the work
- Release 17 focus will continue to expand towards new use cases and new sectors...with particular progress on IoT
- 5G will be a multi-Release technology (beyond Release 17)

Thank you

Jørgen Friis

Senior advisor to the ETSI DG

[jorgen.friis\[at\]etsi.org](mailto:jorgen.friis@etsi.org)

Kevin Flynn

3GPP Marketing and
Communications Officer

[kevin.flynn\[at\]3gpp.org](mailto:kevin.flynn@3gpp.org)

ETSI Takeaway...

ETSI [White Paper No. #32](#)
Network Transformation;
(Orchestration, Network and
Service Management Framework)
October 2019

...3GPP Takeaway

A full [Release Description](#) is
produced by the Work Plan
manager at the completion of the
work. TR 21.914 covers Rel-14 and
TR 21.915 is the Rel-15 description
document.