

# Welcome to the World of Standards



Doc: BOARD5GCOM(17)018\_002  
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Agenda item: 6  
For: Information

## **5G Communications Systems (5GCOM) ETSI views and contribution on 5G standardisation**

Board 5GCOM#18, 12<sup>th</sup> May 2017

- **Much of the 5G standardisation work will be done in 3GPP**
  - Radio access technology for submission to IMT2020 including
    - 4G/5G radio integration
    - Spectrum bands covering <6Ghz and >6Ghz
  - Core network technology for submission to IMT2020 including
    - Network Slicing
    - Fixed-Mobile Integration
  
- **5G is expected to integrate non-3GPP access technologies, e.g. Wi-Fi, wireline, non-terrestrial networks (e.g. satellite, HAPS)**
  
- **Several other organisations (including ETSI) are developing potential building blocks of an overall 5G system**
  - ETSI interacts with many of these
  
- **Whilst there is a wide variety of use cases driving 5G, and a variety of priorities and timescales across various industrial and governmental stakeholders, standardisation is primarily industry-driven, reflecting business opportunities.**

- **ETSI itself has several activities that are developing requirements and potential enablers/building blocks for a 5G system**
  - For example, Network Functional Virtualisation, Multi-Access Edge Computing, mWT,
  
- **ETSI's Technical Bodies and ISG are providing input to 3GPP and/or collaborating with 3GPP**
  - Some recent contributions to 3GPP include:
    - TC RT on user requirements for FRMCS (Future Railway Mobile Communication System)
    - TC SES on Satellite /HAPS in 5G (HAPS = High Altitude Platform Station)
    - TC ITS on ITS (V2X) requirements
    - TC TCCE on critical communications requirements
    - TC EE on power, energy and environmental parameters
    - TC ERM on IMT, V2X, PPDR
    - TC NTECH on autonomic networking
    - ISG NFV on network management & operation
    - ISG NGP on NGP activities
  
- **oneM2M addresses interworking with underlying networks. Interworking between the oneM2M platform and 3GPP networks is relevant to 3GPP's activities on 5G.**

- **5G is intended to meet the needs of several new market segments; consolidated requirements from these segments need to be properly captured**
  - ETSI membership includes members from these segments
  - ETSI can facilitate this requirements-capture
  
- **Several industry sectors are already represented in ETSI/3GPP, and have presented requirements to 3GPP**
  - ETSI will consider opportunities increasing the representation of these industry sectors' companies and associations in the 5G standardisation process.
  - ETSI will also consider opportunities to reach out to other sectors that are not currently represented in ETSI.
  - In both cases, the goal is to facilitate collation of user needs and long term vision in order to feed the 5G standardisation process.

# Engagement of industry sectors (as users) in 5G standardization (ETSI/3GPP)



**Some Examples** (note: in this context, these are users of 5G communication systems)

- **Public Safety (blue light):** very active in ETSI/3GPP, influential in LTE standards
- **Broadcasting/media delivery:** active in ETSI/3GPP, new activity in ISG MBC
- **Rail industry:** active in ETSI, recent contributor to 3GPP
- **Automotive industry:** active in ETSI, recent contributor to 3GPP
- **Education:** contributions made to 3GPP via Individual members
- **Aerial vehicles (e.g. airplanes, drones):** peripheral to 3GPP  
(note: new 3GPP SI on Aerial Vehicles approved in March 2017)
- **Health/wellbeing:** present in ETSI, but low level of activity/influence
- **Utilities:** institutional relationship, no standards influence yet
- **Factory automation:** institutional relationship, no standards influence yet
- **Agriculture**
- **Exploration, mining**



*Note: this should not be considered a complete list of all relevant industry sectors*

# Main Standards/Industry Organisations with 5G-related standardisation activities



Category	Organisation
Industry Alignment & Adoption	ITU-R
	GSMA
	NGMN
Access Technology	3GPP
	IEEE 802.11
	ETSI ISG mWT
	ETSI RRS

Category	Organisation
Network Architecture & Core Network	3GPP
	NGMN
	ETSI ISG NFV
	ETSI ISG MEC
	OPNFV
	IETF
	ITU-T SG13 IMT2020 FG
	Small Cell Forum
Network Management	TMF
	NGMN
	3GPP

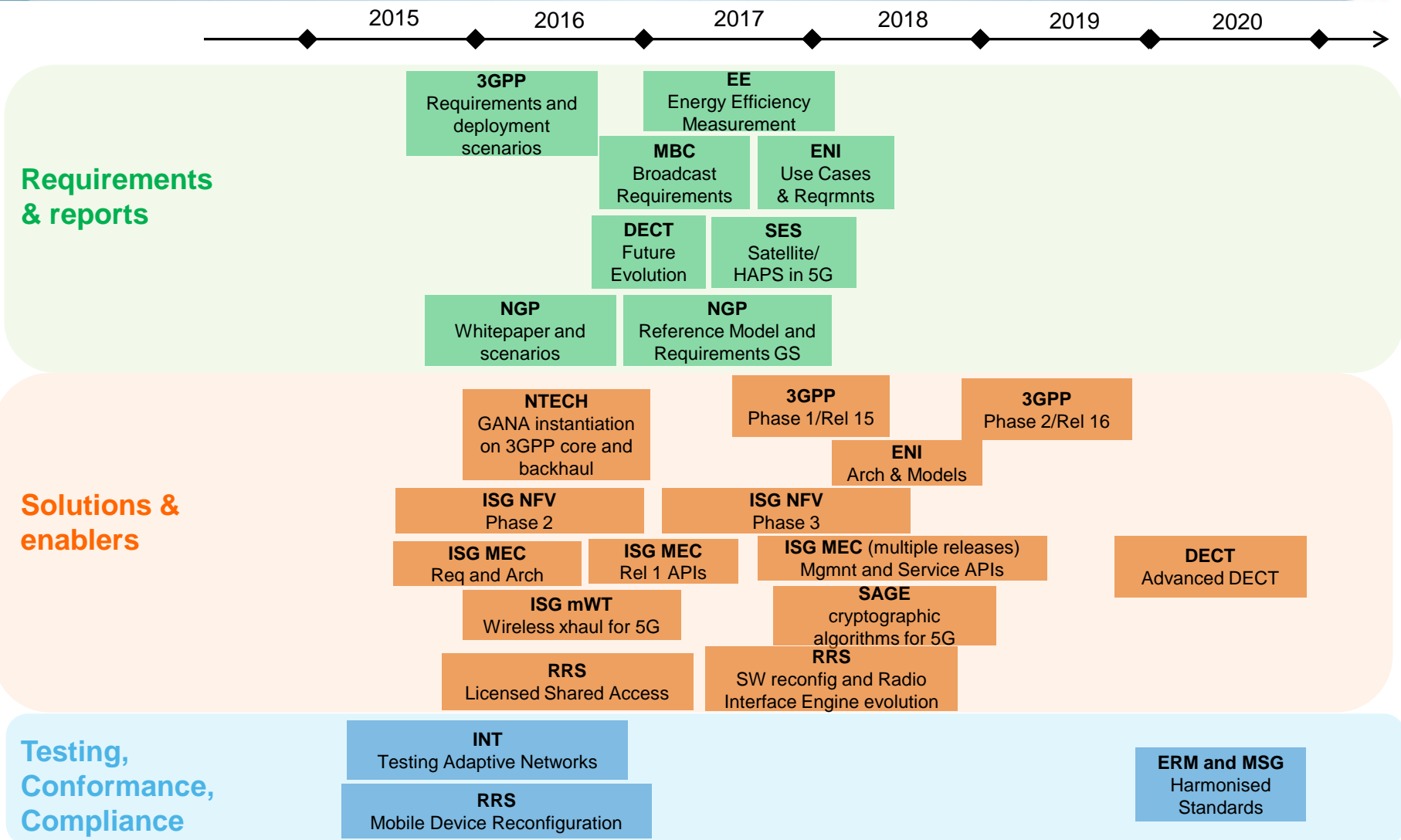
*Notes:*

- *this is not by any means exhaustive!*
- *nothing is implied by the order*
- *although not listed, 5GPPP is an important organisation expected to make contributions to standards organisations.*
- *details on the non-ETSI organisations are included in Annex 2*

- **ETSI has a number of ongoing activities that can contribute to a successful launch of 5G (IMT2020) networks**
  
- **These slides summarise the various activities in ETSI TBs and ISGs**
  - Note that some activities ETSI TBs and ISGs, whilst not impacting 5G specification directly, will be relevant in the “5G-era”
  - For example, service-level specifications that are independent of, or applicable to, access technologies.
  
- **An overall time-line of key activities is given, with more detail on relevant TBs and ISGs in Annex 1.**

# Indicative timeline - view 1

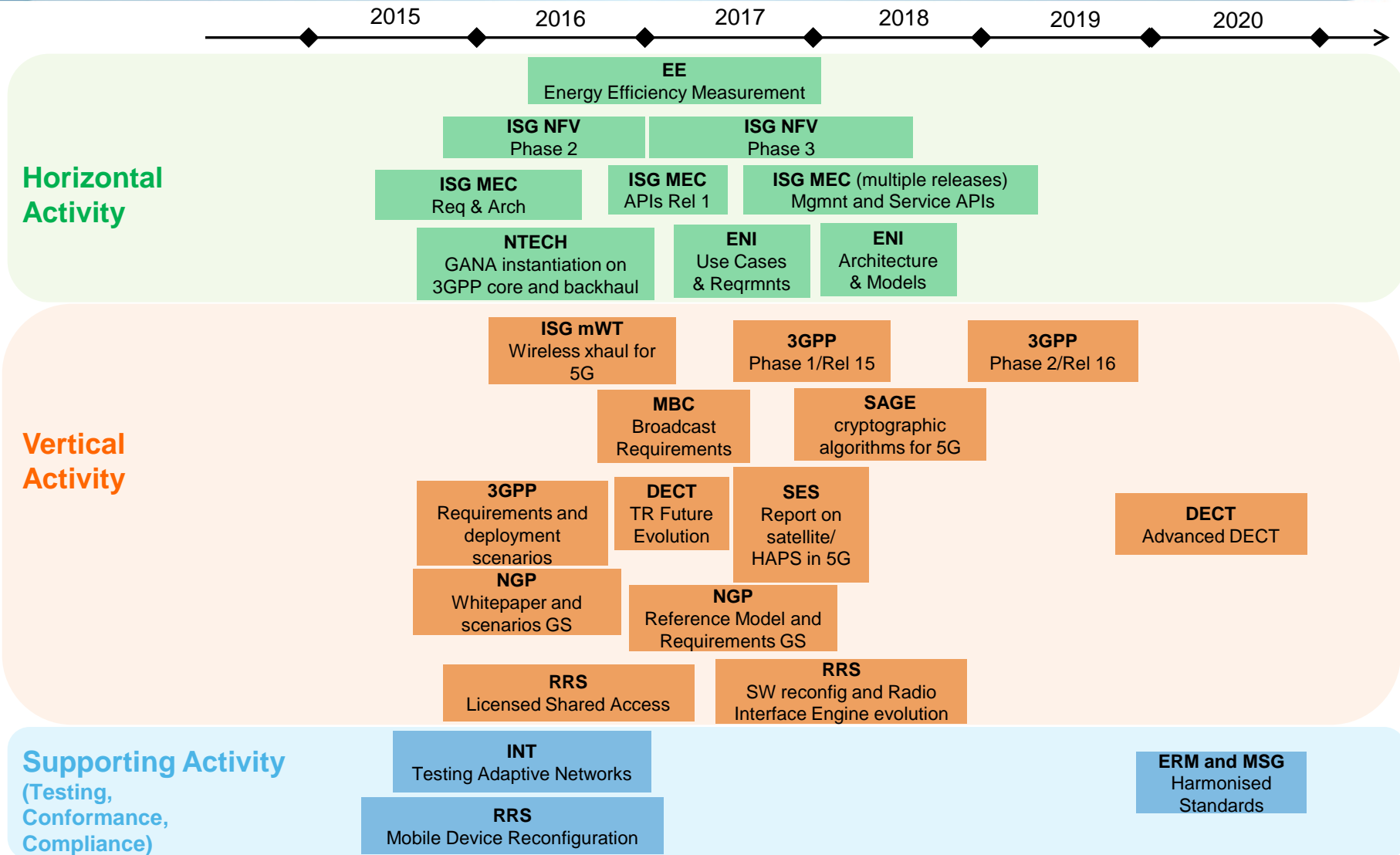
Note: the boxes show approximate completion dates, not duration





# Indicative timeline – view 2

Note: the boxes show approximate completion dates, not duration



**5G related activities in ETSI TBs and ISGs,  
including 3GPP and oneM2M.**

- **Scope of the 5G-related activity**
  - Specifications for a fixed, mobile/wireless and satellite access communication system, including system architecture, radio access technology(ies) and core network
- **The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems**
  - Specifications for a 5G communication system
- **Expected deliverables and timescales**
  - Release 15 (phase 1):
    - December 2017: L1/L2 for common aspects of non-standalone (NSA) and stand-alone (SA) New Radio (NR)
    - December 2017: NSA higher layers (including components common with standalone).
    - June 2018: Release 15 freeze, including SA NR
  - Release 16 (phase 2):
    - End 2019
- **Related external collaboration**
  - ITU-R (e.g. Radio Technology submission to ITU-R for IMT2020 evaluation)

## **Scope of the 5G-related activity**

- TC CABLE will investigate how 5G impacts fixed-mobile convergence and cable networks

## **The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems**

- TBD

## **Expected deliverables and timescales**

- TBD

## **Related external collaboration**

- TBD

## **Scope of the 5G-related activity**

- To ensure the security of the network, devices and infrastructure from inception, service, improvement and end of life.
- In order to help design a security model we must understand the planned technical solutions and business models.

## **The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems**

- It is to be expected that detailed security work will be done within 5G groups
- TC CYBER can contribute to secure development methodologies, understanding of the security landscape, similar tools and techniques
- Understanding of the requirements for security, including authentication, privacy issues, obligations etc..
- Helping to design cost effective security in from the start.
- See TC CYBER WI Drafts <https://portal.etsi.org/tb.aspx?tbid=824&SubTB=824>

## **Expected deliverables and timescales**

- It is envisaged that this may become a work item given suitable support, to produce a TR.

## **Related external collaboration**

- Other groups involved in 5G such as 3GPP, ITU-T, GSMA FSAG as well as ETSI.

## **Scope of the 5G-related activity**

- DECT is an IMT radio interface and TC DECT is regularly contributing to ITU-R WP5D.
- TC DECT has developed the 'Ultra Low Energy' (ULE) mode which enables DECT to cover more applications especially in the area of Machine to Machine communications.
- Continue the evolution of DECT to support 5G use cases
- Work on low latency, lower power consumption, security update, higher data rate and improved efficiency.

## **The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems**

- Access technology

## **Expected deliverables and timescales**

- TC DECT considers to contribute to the IMT-2020 work of ITU-R during the next 5 years.
- Technical Report 'Future evolution' : Mid 2017
- Technical Specifications 'DECT2020': Mid 2020

## **Related external collaboration**

- ITU-R WP5D

## • **Scope of the 5G-related activity**

- TC EE has in its responsibility the standards for energy efficiency, including the energy efficiency of wireless access networks and equipment

## • **The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems**

- The assessment of energy efficiency in 5G communications systems

## • **Expected deliverables and timescales**

- The following standards on energy efficiency of wireless access network/equipment have been published:
  - ES 203 228 “Environmental Engineering (EE); Assessment of mobile network energy efficiency”
  - ES 202 706 “Environmental Engineering (EE); Metrics and Measurement Method for Energy Efficiency of Wireless Access Network Equipment”
- The above standards will be revised to cover 5G technology
  - The work will be done in cooperation with 3GPP and is expected to be completed by end 2017

## • **Related external collaboration**

- 3GPP

## Scope of the 5G-related activity

- ISG ENI has in its responsibility the standards for Networked Experience using Artificial Intelligence. Simplifying and assisting complex network management scenarios. Proposing Policy-based Context-aware models. Illustrating Parameterisation of operator experience goals.

## The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems

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

## Expected deliverables and timescales

- The following reports aim to be published at the end of 2017:
  - GR on Use Cases for Networked Experience using Artificial Intelligence
  - GR on Requirements for Networked Experience using Artificial Intelligence
- Reports and standards are expected in 2018:
  - GR/GS on an Architecture for Networked Experience using Artificial Intelligence
  - GS on Policy-based Context-aware models using Artificial Intelligence

## Related external collaboration

- 3GPP
- NFV
- MEF
- TMF
- BBF
- NGP



## • **Scope of the 5G-related activity**

- TC ERM addresses a wide range of applications and frequencies, where it can be expected that at least parts of the TC ERM work will address 5G.
- In addition TC ERM has two horizontal groups dealing with EMC and Radio Matters, which may have relations with 5G standardisation activities.
- Already nowadays discussions have been initiated within ERM Task Groups/Task Forces/Joint Working Groups related to co-existence/co-operation with/between e.g. WLAN, SRD, SRR, UWB, PMSE, V2X, WIA, Broadcasting and LTE applications (also known as 4G). Therefore it can be expected that existing deliverables and ongoing Work Items under TC ERM will have relations to 5G evolution in future as well.

## • **The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems**

- Requirements and specifications for co-existence/co-operation between 5G and other systems

## • **Expected deliverables and timescales**

- Technical Report on radiated emissions requirements up to 40 GHz: End 2018

## • **Related external collaboration**

- ITU-R SG5 & WPs
- CEPT/ECC WGFM, WGSE, PT1
- 3GPP

## **Scope of the 5G-related activity**

- The work that TC HF is currently doing, in particular the activities related to accessibility under Mandates M/376 and M/473, will be equally applicable to and required for all activities related to 5G. This includes in particular:
  - HF aspects of the IoT
  - User experience in smart cities
  - Accessibility of environments with “invisible” user interfaces
  - New interface technologies and their accessibility issues
- Human factors and accessibility topics as well as design support for optimized user experience remain important cross-sectional topics relevant for many ETSI standardization areas.

## **The role it would play in a 5G communications system**

- Human Factors aspects of 5G

## **Expected deliverables and timescales**

- Several, and ongoing

## **Related external collaboration**

- ?

## • Scope of the 5G-related activity

- The main scope of TC INT is to reduce time to market for Core Network Elements increasing the Quality of Experience (QoE) through test specification for interoperability, conformance, performance and benchmarking.

## • The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems

- 5G will be the next major phase of mobile telecommunications standards beyond the current 4G standards.
- Pre-standardization PoC will provide feedback to the entire eco-system to standardize future networks.
- Interoperability and testing of 5G standards will ensure network optimization and Quality of Service (QoS) and Quality of Experience (QoE) from an end-user's perspective.

## • Expected deliverables and timescales

- Core Network Testing Specification under 3GPP mandate
- EG 203 341 document Approaches for Testing Adaptive Networks, June 2016
  - A definition of a framework of testing principles and guidelines that may be used to test networks that exhibit autonomous, adaptive behaviour, which allows them to dynamically change their configuration, structure or operational parameters.

## • Related external collaboration

- Cooperation with other SDOs (ITU, IETF) and other organizations (GSMA) allow to operators, network players and academy to share best practices for the whole industry.

## Scope of the 5G-related activity

- ETIS ISG IP6 is addressing the transition from IPv4 to IPv6, which will support the sustainability and growth of the Internet and enable it to cater for the new technologies based on it
- ETSI ISG IP6 has the ambition to define best practices, garner support and create awareness of the impact of IPv6 on critical infrastructure and on emerging topics such as Cloud Computing, IoT (Internet of Things), SDN/NFV (Software Defined Networking/Network Function Virtualization) and 5G

## The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems

- Analyses the deployment, the objectives, the technology guidelines, the step-by-step process, the benefits, the risks, the challenges and the milestones on the possible impact of IPv6 on 5G and IoT deployments, including: M2M, Energy, Smart city and Transportation deployments

## Expected deliverables and timescales

- IPv6-Based 5G Mobile Wireless Internet Deployment of IPv6-Based 5G Mobile Wireless Internet
- IPv6-based Internet of Things Deployment of IPv6-based Internet of Things
- To be published in 2017-Q2

## Related external collaboration

- Emerging 5G and IoT initiatives around the world, such as: ETSI SmartM2M, 3GPP, IETF, ITU-T, IEEE, OneM2M, IPv6 Forum, AIOTI

## • Scope of the 5G-related activity

- Vehicle connectivity

## • The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems

- Under the assumption that 5G is a concept encompassing new and existing radio systems in a common framework, existing deliverables and ongoing work items on V2X connectivity would provide a component of an overall 5G concept

## • Expected deliverables and timescales

- ?

## • Related external collaboration

- 3GPP

## **Scope of the 5G-related activity**

- Development of a suite of standards that allow ETSI standards to support industry compliance to the requirements of national and international law. The role of TC LI in these partnerships is in the development and publication of control and handover interfaces, and of rules for the delivery of technology specific interception or retained data.
- Capturing the requirements of users (law enforcement agencies) and translating those into requirements to be applied to technical specifications.

## **The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems**

- Support for LI, RD and other

## **Expected deliverables and timescales**

- TC LI will continue to monitor the requirements regarding Lawful Interception (LI), Retained Data (RD) and other related LEA Support items as they arise and will manage these with the various 5G related bodies

## **Related external collaboration**

- 3GPP

## • **Scope of the 5G-related activity**

- ISG MBC group will develop use cases and commercial requirements enabling future wireless networks to deliver more efficiently mass market broadcast services to mobile devices. Delivering both linear and non-linear media over converged networks will create appealing services and be very beneficial to existing standardisation work ongoing in the area of eMBMS in 3GPP as well as future 5G standards

## • **The role of the MBC ISG and/or its deliverables in standardisation of 5G communications systems**

- ISG MBC will specify the requirements supporting delivery of media including linear and non-linear elements over converged networks; these requirements will be submitted to relevant standardisation bodies, including those standardising 5G communications systems

## • **Expected deliverables and timescales**

- A Group Report, due in May 2017

## • **Related external collaboration**

- 3GPP, NGMN, MVA, DVB, ETNO, EU – 5GPPP, DG-CONNECT

## 🌐 Scope of the 5G-related activity

- MEC is a key enabler for a significant number of key 5G use cases as defined, for example, by NGMN and 3GPP SA.
- Moreover, with a scope now expanded to consider multi-access edge computing, MEC is positioned as a key contributor in fixed-mobile integration

## 🌐 The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems

- Much as NFV complements other activities by defining NFV architecture and APIs for management of NFV infrastructure, MEC defines architecture and APIs for management of MEC compute infrastructure. Additionally, MEC defines APIs for several key services which are believed to be widely adopted in the future – examples are Radio Network Information Service (RNIS) and Location Service.

## 🌐 Expected deliverables and timescales

- MEC architecture – completed
- Completed MEC metrics, best practices and guidelines deliverable
- APIs specification – Release 1 nearing completion. Multiple Releases planned
- PoCs – in progress

## 🌐 Related external collaboration

- 3GPP
- NFV
- Emerging 5G groups around IoT and MEC: OFC (Open Fog Consortium), OEC (Open Edge Consortium), SCF (Small Cell Forum)



## **Scope of the 5G-related activity**

- TC MSG along with its joint task force with ERM, ERM/MSG TFES is responsible for the development of European Harmonised Standards (HS) for technologies including GSM (and its evolutions) and IMT systems i.e. for all IMT family technologies

## **The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems**

- Harmonised Standards to be used for presumption of conformity for 5G equipment

## **Expected deliverables and timescales**

- Once the work on requirement specification for 5G takes form in 3GPP, we at MSG and TFES intend to create corresponding work items to produce Harmonised standards and relevant technical specifications for 5G (IMT) technologies.

## **Related external collaboration**

- 3GPP

## 🌐 Scope of the 5G-related activity

- Facilitate the use of the V-band (57-66 GHz), the E-band (71-76 & 81-86 GHz) and in the future higher frequency bands (from 50 GHz up to 300 GHz) for large volume applications in the back-hauling and front-hauling to support mobile network implementation.

## 🌐 The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems

- Wireless backhaul and front-haul serving the requirements of 5G in terms of capacity, topology, latency and any other technical or network feature

## 🌐 Expected deliverables and timescales

1. Analysis of the worldwide usage of spectrum above 6 GHz for backhaul and front-haul – completed review and update of the WI continue to capture changes of situations that is constantly evolving
2. Definition of applications and use cases of wireless backhaul and front-haul - completed review and update of the WI continue to capture changes of situations that is constantly evolving
3. Study of new frequency bands above 90 GHz – work in progress
4. Holistic view on how to use the spectrum for backhaul and front-haul
5. Coexistence and services sharing studies for the frequency bands in which both fixed services and access services may be foreseen by WRC

## 🌐 Related external collaboration

- Presentation to ITU-R WP5C, July 2015 on item 1.

## Scope of the 5G-related activity

- ETSI ISG NFV has defined the reference architecture for NFV which is/will be used as baseline architecture for 5G\* networks
- The ISG acts as a focal point for network virtualization technologies
- Strong collaboration with other SDOs, open-source projects, and industry forums to ensure NFV will deliver deployable solutions for 5G

## The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems

- Baseline architecture for 5G networks\*
- Strong commitment to addressing 5G requirements and use cases

## Expected deliverables and timescales

- Phase 1 completed in January 2015
  - Set the foundational concepts for NFV and created a common framework which has been widely shared in the industry
- Phase 2: Release 2 is completed in its Stage 2 (end 2016)
  - Focuses on enabling interoperability between the different components of an NFV system
  - Includes studies relevant to 5G (on SDN/NFV framework, alternative virtualization technologies, NFVI nodes, security...)
- Phase 3: Release 3 and Stage 3 specifications for Release 2 (planned to be completed by mid 2018)
  - Focuses on matters addressing network service automation
  - Include studies directly related to 5G (NFV constructs for network slicing, multi-domain issues...)
  - Ongoing work on the Stage 3 (essentially, data models) specifications

## Related external collaboration

- 3GPP
- Coordination forum on the alignment of Information Models with most relevant SDOs and open-source projects
- IETF (through the NFVRG)

\*source: NGMN 5G white paper, “the 5G architecture is a native SDN/ NFV architecture”  
Multiple H2020 European projects also reference ETSI NFV for 5G software defined architecture

## • Scope of the 5G-related activity

- Review and identify opportunities for an evolution of networking architectures and protocols to enhance 5G network implementation and performance. ISG NGP is studying the implementation of the TCP/IP protocol suite and 3GPP protocols in LTE to identify issues which need to be addressed in support of 5G systems development and standardisation.

## • The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems

- Identification of opportunities for improved throughput, reduced latency, enhanced security, reduced power consumption and more deterministic networking through the adoption of new or enhanced protocols and network architectures.
- To stimulate action in Internet and Telecoms SDOs to develop network protocols that can sustain 5G scenarios.

## • Expected deliverables and timescales

1. White Paper outlining the opportunities for enhanced networking performance through an evolution of network protocols and architectures - includes mobile network requirements and use cases (06/16)
2. Group Specification on NGP Scenarios - specify the minimum set of key scenarios for the NGP ISG and SDOs to evaluate new network architectures and protocols against (11/16)
3. Group Specification on NGP Self-Organizing Control & Management Planes - proposal for self-organizing characteristics; include self-configuration, self-optimization, self-protection, self-healing and self-learning (Q2/17)
4. Group Specifications on NGP Reference Model (Q2 17) and Requirements (Q2 17)
5. Group Recommendations on Identity Oriented Networking (Q3 17) and Packet Routing Technologies (Q2 17)

## • Related external collaboration

- Presentation delivered to ICANN and to WWRF 5G Huddle
- Presentation NGP workshops/presentations at SDN/NFV world congress (10/16), MPLS/NFV/SDN World (3/17), NFV World Congress (5/17)
- On-going discussions with GSMA
- Liaisons to 3GPP, IAB (IETF) , ITU-T and ISO/IEC
- Formal engagement with Internet community

## 🌐 **Scope of the 5G-related activity**

- As per TC NTECH ToR, the missions of this TC include being a competence centre in future network technologies

## 🌐 **The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems**

- TC NTECH develops reports and specifications on autonomic networking, a technology that is likely to be relevant to 5G networks.
- TC NTECH develops specification on emergency communications in configurations where the voice service provider is independent from the access network provider. This might be relevant to 5G networks.

## 🌐 **Expected deliverables and timescales**

- A Technical Report on the instantiation of the Generic Autonomic Network Architecture (GANA) model on 3GPP core and backhaul networks was published end of 2016 (TR 103 404). It can serve as a guide to design 5G core networks with built-in autonomic capabilities, as mentioned in the ETSI White Paper #16 on GANA.
- A Technical report on the evolution of the GANA reference model to take into account emerging technologies such as Software-Defined Networking (SDN) and Network Functions Virtualisation (NFV).
- A specification of the protocols required on the interfaces of the functional architecture for emergency caller location determination and transport, in support of European Commission (EC) Mandate M/493.

## 🌐 **Related external collaboration**

- 3GPP

## • Scope of the 5G-related activity

- oneM2M is a major initiative working on IoT service layer standards, and oneM2M architecture and protocols have been designed based on industry driven use cases and requirements for IoT.
- 5G is intended to meet the communication needs of various new IoT markets, in a multinet network integrated environment
- Ideally 5G should become the IoT Integrated Multi Service Network for wide range of IoT applications

## • The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems

- OneM2M is the only standard “de jure” offering an integrating framework for vertical and proprietary solution, to support an horizontal multi-network and multi-service layer enablement for 5G (Covering domains such as ; home, Smart Cities, ITS, Industrial, etc)
- oneM2M is ideally placed to support the 5G vision through providing or collaborating on requirements and IoT use cases

## • Expected deliverables and timescales

- OneM2M Release 2 documentation (available at [www.oneM2M.org](http://www.oneM2M.org) and republished by ETSI), Full set of communication, interworking framework inclusive of semantic interoperability
- oneM2M release 3 extensions (end 2017)

## • Related external collaboration

- 3GPP, BBF, ITU-T, CEN, CENELEC, ETSI TC SmartM2M

## 🌐 Scope of the 5G-related activity

- Create and select cryptographic techniques that are resistant to attack by next-generation quantum computers

## 🌐 The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems

- Quantum Safe Cryptography is fundamentally the security approach to next-generation computing. We expect a growing interest in QSC as the industry anticipates future security needs of 5G
- QSC may be extremely appropriate for certain components of the new 5G architecture

## 🌐 Expected deliverables and timescales

- Work Items thus far:
  - Quantum safe algorithmic framework
  - Cryptographic primitive characterization
  - Cryptographic primitive suitability assessment
  - Quantum safe threat assessment
- QSC expect to have these items completed by 2017 April
- Work intended to flow into TC CYBER for further development of normative specifications

## 🌐 Related external collaboration

- ?

## • **Scope of the 5G-related activity**

- Licensed Shared Access and TV White Space based spectrum sharing provide new spectrum usage paradigms for future applications
- A Software Reconfiguration Ecosystem is defined with a focus on Technical, Security and Regulation solutions. It will enable future flexibility in 5G related systems.
- Feasibility study on a Radio Interface Engine which will address efficient context information acquisition and the management of a heterogeneous radio environment.

## • **The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems**

- Technical Specifications and European Norms for technology definition

## • **Expected deliverables and timescales**

- Licensed Shared Access related work completed end 2016
- Mobile Device reconfiguration related work will be finalized H1 2017
- Future evolution of software reconfiguration will be ongoing until 2017 and beyond
- Future work on the Radio Interface Engine will be ongoing until 2017 and beyond.

## • **Related external collaboration**

- 3GPP



## • **Scope of the 5G-related activity**

- Standardization related to voice, data services and other applications over broadband and narrowband air interfaces for the Rail Transportation domain.
- Collection of requirements from relevant stakeholders from the Rail Transportation domain, including urban, suburban, regional, long distance for Professional Mobile Radio Access systems.
- Contribution to standards development to allow for taking into account these additional specific requirements.

## • **The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems**

- Consider benefits expected from Rail in some of the promised added benefits of 5G in terms of high speed mobility handling, security, extremely low access times and latency, which would enable enhanced critical communications systems (in particular for smart transport systems).

## • **Expected deliverables and timescales**

- Specification of interfaces that will allow interworking between GSM-R and various access technologies aimed at being developed for Next Generation radio for Rail (NG2R)

## • **Related external collaboration**

- 3GPP/ UIC/ ERA

- **Scope of the 5G-related activity**
  - Cryptographic algorithms used in 5G
- **The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems**
  - Specify standardised cryptographic algorithms for 5G
- **Expected deliverables and timescales**
  - Algorithm specifications, including test data, delivered to 3GPP SA3 and formulated as 3GPP technical Specifications.
- **Related external collaboration**
  - 3GPP SA3; possible informative liaison with GSMA FASG

## **Scope of the 5G-related activity**

- Enhancement of UICC specifications to support new requirements and markets of 5G
  - e.g. flexibility in the choice of form factors for IoT; support of other electrical interfaces; tighter timing requirements and lower latency in 5G systems; new modes of operation for IoT
- While it is not foreseen that each and every Thing in the IoT will contain subscription credentials and while that Thing may only be a satellite device connected to a gateway device (which would be holding the subscription credentials), UICC technology may be used to:
  - Make sure that the tethering between the satellite and the gateway is secure (secure pairing, etc)
  - Make sure that the satellite device and its identity are safe
  - Secure all or part of the communication between a satellite device and a gateway
  - Create end-to-end secure channels between devices (satellite or gateway) and remote servers
  - Authenticate the user (any method, including biometry)

## **The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems**

- Use of UICC technology in 5G

## **Expected deliverables and timescales**

- TC SCP has customer organizations, in particular 3GPP, and intends to further develop its specifications with a view to meet upcoming 5G-related requirements.

## **Related external collaboration**

- 3GPP

## • Scope of the 5G-related activity

- Standardisation relating to all types of satellite communication systems, services and applications

## • The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems

- The integration of satellite/HAPS systems in 5G communications systems

## • Expected deliverables and timescales

- Technical Report - « Seamless integration of satellite and/or HAPS (High Altitude Platform Station) systems into 5G system ». It aims at identifying:
  - 5G systems architecture integrating satellite and/or HAPS systems (communication and/or navigation) for relevant use cases.
  - the necessary related standardisation activities in 3GPP and ETSI
- The TR is expected to be presented to relevant 3GPP groups
- TC SES intends to pursue new work items related to the role of satellites in 5G

## • Related external collaboration

- 3GPP (LS regarding the TR)
- ITU

## 🌐 **Scope of the 5G-related activity**

- Ontologies and related testing in the 5G IoT environment
- Build and support community building in the European context for 5G IoT service layer
- Bridge the needs for 5G IOT between European Institution and stakeholders towards oneM2M and ETSI in the service layer enablement context.

## 🌐 **The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems**

- Standardize and provide test suites for the ontologies in different domains, based on oneM2M as communication framework and SAREF as ontology methodology and definitions
- Support stakeholders and community with 5G IoT related analysis

## 🌐 **Expected deliverables and timescales**

- Communication framework and ontology for Smart Appliances (oneM2M based) November 2015
- Extension to Home Energy and building environments (end 2015)
- Further extension foreseen in 2018 (Agriculture, Automotive, e-health, e-wellness, wearable, industrial domain)
- Landscape and gap analysis for IoT (completed October 2016)

## 🌐 **Related external collaboration**

- oneM2M, AIOTI, EEBus, Energy@home, CEN, Cenelec

## • **Scope of the 5G-related activity**

- TC STQ is currently progressing in several areas including, but not limited to, wideband and 'super-wideband' speech communication and multimedia in hands-free and video phone applications, and will tackle any necessary items as they arise in a 5G context, and will manage these in collaboration with the various 5G related bodies.

## • **The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems**

- Ensuring speech and multimedia transmission quality

## • **Expected deliverables and timescales**

- tbd

## • **Related external collaboration**

- ?

## **Scope of the 5G-related activity**

- TC TCCE's scope is to develop critical communications solutions specifications to meet the needs of public safety, PPDR, utilities etc, and TCCE is presently working closely with 3GPP on making LTE suitable for the special requirements of critical communications users.

## **The role of the TB/ISG and/or its deliverables in standardisation of 5G communications systems**

- 5G has some promised added benefits in terms of security, very low access times and latency, which would enable enhanced critical communications systems (in particular some utilities like electricity generation need very fast call access for telemetry).

## **Expected deliverables and timescales**

- Specification of interfaces that will allow interworking between TETRA and other LMR solutions and LTE

## **Related external collaboration**

- 3GPP
- TETRA and Critical Communications Association (TCCA), the primary critical communications vertical partner

## Other (non-ETSI) organisations activities related to 5G

- **The following slides provide high-level information on the non-ETSI organisations listed on slide 7**
  - Note: 3GPP is included in Annex 1
- **Caveat: some of this information may not be up to date**
  - No assurance is given on the accuracy of this information!
  - It is strongly recommended to check with the organisation concerned for further/more up to date information.



## 5G Vision:

*“5G is an **end-to-end ecosystem** to enable a **fully mobile and connected society**. It empowers **value creation** towards customers and partners, through existing and **emerging use cases**, delivered with **consistent experience**, and enabled by **sustainable business models**. ”*

## 5G-related activities:

- 5G Whitepaper published at MWC 2015 and shared at conference March 2015
- Several publications and contributions to 3GPP and other organisations during 2016 and 2017, including covering requirements, key capabilities, architecture, security, spectrum, vertical industries, testing/trialling and IPR.
- Activities in 2017 (and beyond):
  - Eco-system building and interaction:
    - Spectrum; IPR; V2X
  - Guidance to SDOs and the wider industry:
    - E2E Architecture Framework; Network Management and Operations; Security
  - Evaluation of test and proof of concept results:
    - Trail and Testing Initiative – test technology building block; PoC; pre-commercial trials
- NGMN is currently reviewing proposal for further projects

- **The GSMA Network 2020 programme (2016/17) includes two 5G-related streams:**
  - Evolution of 4G
  - 5G
- **Recent/ongoing deliverables:**
  - Liaison Statement to 3GPP on 5G Capabilities and Requirements (June 2016)
  - NFV and Broadcasting best practice implementation guidelines (Q1 17)
- **Future Networks programme for 2017/18 under finalisation**

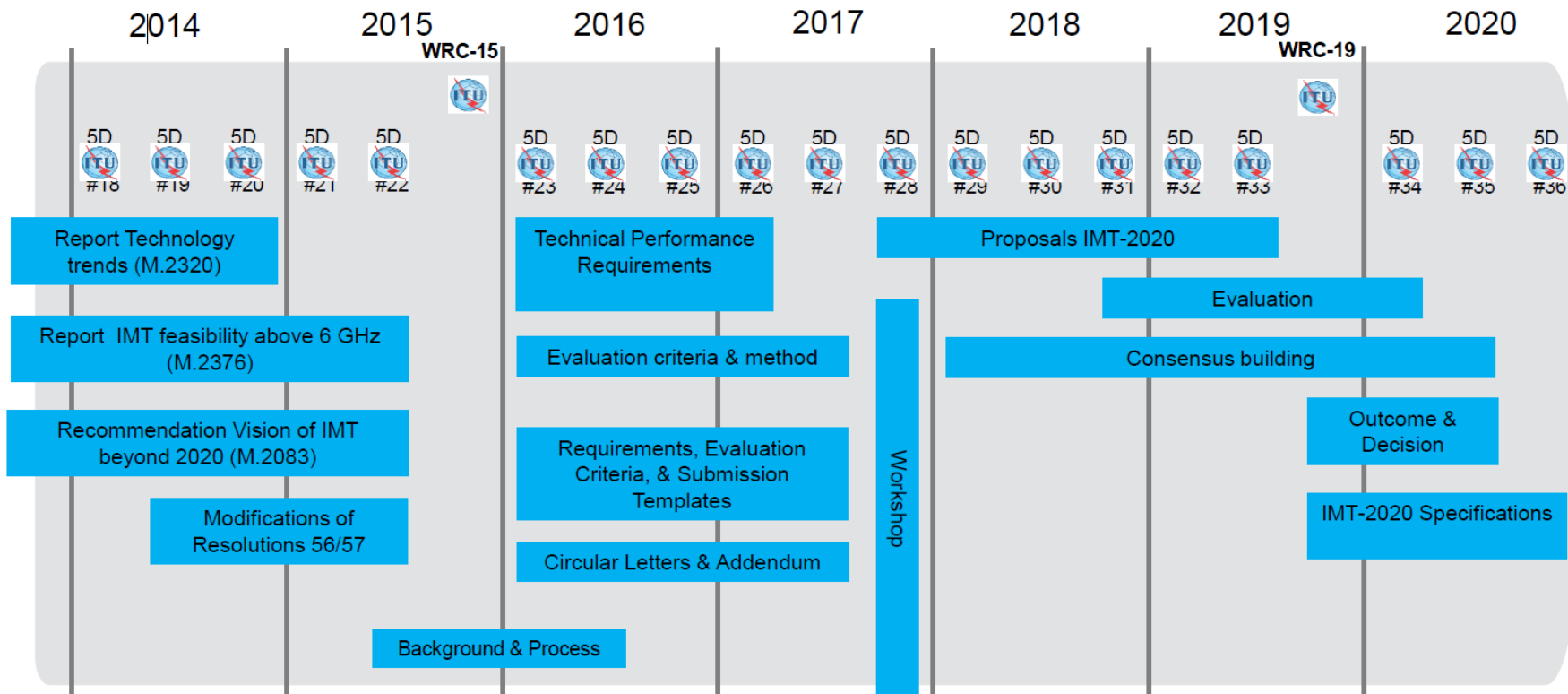
## **ITU-T SG13 IMT-2020 Focus Group:**

- Core network (does not include radio networks)
- Concluded in December 2016; presented deliverables to SG13 in February 2017, covering:
  - Requirements of IMT-2020 from network perspective
  - Framework of IMT-2020 network architecture
  - Application of Network softwarization to IMT-2020
  - Fixed and Mobile Convergence requirements and architecture
  - IMT-2020 Network Management Requirements and Framework
  - Application of information centric networking to IMT-2020

## **Studies on IMT-2020 networks and systems will continue on SG13 WP1, addressing:**

- QoS aspects
- Requirements and architecture;
- SDN, network slicing and orchestration
- Emerging network technologies
- Fixed-mobile convergence

# Detailed timeline & process for IMT-2020 in ITU-R



Note: While not expected to change, details may be adjusted if warranted.

- **802.11 evolution:** Previous generations of 802.11 focussed on increasing maximum theoretical throughputs; new generations target new usages and improvement of user experience
- **2.4 and 5Ghz - IEEE 802.11ax**
  - 802.11ax intended to improve efficiency in high-density 'real-life' scenarios
  - 802.11ax scope:
    - **Four times improvement** (compared to 11ac) in the average throughput per station in a **dense deployment scenario**
    - Maintaining or improving the **power efficiency** per station
    - Indoor and outdoor operations at 2,4 and 5 GHz
    - backward compatibility / coexistence with existing systems in the bands (2,4 and 5 GHz)
  - **802.11ax publication planned for 2018-2019**
- **60 Ghz - IEEE 802.11ay**
  - 802.11ay scope:
    - at least 20 Gbps, peak transmission at **100 Gbps**
    - explore **45 GHz** frequency band as well
    - improve **spatial reuse**
    - backward compatibility / coexistence with existing systems in the band (e.g. 11ad)
    - some objectives on power efficiency (not detailed)
  - **802.11ay publication planned for ~2020**
- **IEEE AANI (Advanced Access Network Interface)**
  - Define engagement with 3GPP RAN and SA and define suggested areas of engagement
  - Exchange of LS ongoing

- IEEE Future Directions 5G Initiative...
  - strives to aggregate information about the various endeavors occurring worldwide in order to provide a community of professionals in industry, academia, and government working to solve the challenges associated with 5G. Through various outlets, participants in 5G Technical Community can learn and collaborate on the 5G Initiative that has applications in many industries and markets. Members of the community have access to extensive resources including publications, videos, articles, interviews, webinars, newsletters, workshops, and conferences
  - is run by a Steering Group and is managed by a series of Working Groups, covering areas like Publications, Events, Standards, Education and Community Development. Learn more about the organisation of the Initiative here.
  
- Working groups include Publications, Education, Technology Roadmap, Industry Engagement, Conferences and Events
  - Technology Roadmap: identify short (~3 years), mid-term (~5 years) and long-term (~10 years) research, innovation and technology trends in the communications ecosystem. This will enable the development of a concrete innovation and engagement roadmap guiding the IEEE community towards maximum impact contributions across its societies, and in conjunction with its demand-side as well as the wider industry and standards ecosystem. The outcome shall be a live document with a clear set of (accountable) recommendations; the document shall be updated annually and be developed in conjunction with the other working groups.
  - Standards: little info/activity as yet; seems to be more a tracking activity
  
- Source/more info: <http://5g.ieee.org/>

- SCF has developed a 5G briefing paper, available [here](#) (June 2015)

## SCF Objectives on 5G (extracts from the paper):

- The Small Cell Forum believes that, like the NGMN Alliance, it has an important role to play in this respect. It shares the broad objectives set out in the NGMN white paper but can complement that work by:
  - Defining more specifically how small cells architectures can contribute to achieving objectives like network density and energy efficiency.
  - Providing leadership for the ecosystem in how to apply principles, such as the open ecosystem and consistent user experience, specifically to small cells.
- **“5G Vision: Defining the future HetNet and its evolution to 5G” issued May 2016**
- **5G workgroup developing deliverables in the areas of MEC, shared spectrum solutions for small cells, and indoor small cell-based IoT solutions.**

- **No “official” 5G effort by the IETF announced/identified**
  - Given the nature and culture of the IETF, it shouldn’t be expected that there would be any in the future.
- **However, there is ongoing work at the IETF in several areas which might have some relevance to 5G, some examples (by no means a complete list)**
  - Mobility
    - Work on more distributed approaches to mobility management.
    - Work on Locator/ID Separation Protocol (lisp) and Host Identity Protocol (hip).
  - Content Distribution and Information Centric Networking
    - The work of Content Delivery Networks Interconnection (cdni) WG could be relevant to 5G depending on how the 5G architecture ends up being defined.
    - Information Centric Networking (ICN) and Content Centric Networking (CCN) are presently more of “research” topics at the IETF, however some members consider them as being relevant to 5G
  - Software Defined Networking (SDN) and Network Function Virtualization (NFV)
    - The IRTF (the research-oriented sister organization to the IETF) has RGs on both SDN and NFV
    - The work of Service Function Chaining WG In the IETF may be also of some relevance
  - Internet of Things (IoT)
    - Mechanisms to enable IoT at various layers such as work of WGs on IPv6 over Networks of Resource-constrained Nodes, Routing Over Low power and Lossy networks, Constrained RESTful Environments, Authentication and Authorization for Constrained Environments
    - Work of a potential RG at the IRTF on “Thing-to-Thing”



## TM Forum's 5G Program

As the success of 5G will depend heavily on zero-touch management and orchestration of services across industry boundaries and different network technologies not managed by a single SDO, the TM Forum has a pivotal role to play in connecting the variety of digital ecosystems by adapting its in-flight programs to support 5G.

### A number of fundamental requirements impact management & orchestration:

- 5G needs to support new business models to justify investment in new technology tying in other industry verticals (Health, Smart City, Autonomous cars, etc)
- 5G needs to support an order of magnitude increase in capacity (10-100x)
- 5G needs to provide higher bandwidth (1000x) and lower latency (1ms) driven by specific service characteristics
- 5G will be based on the programmability of networks (SDN) and virtualized functions (VNF)

### What is expected by TM Forum?

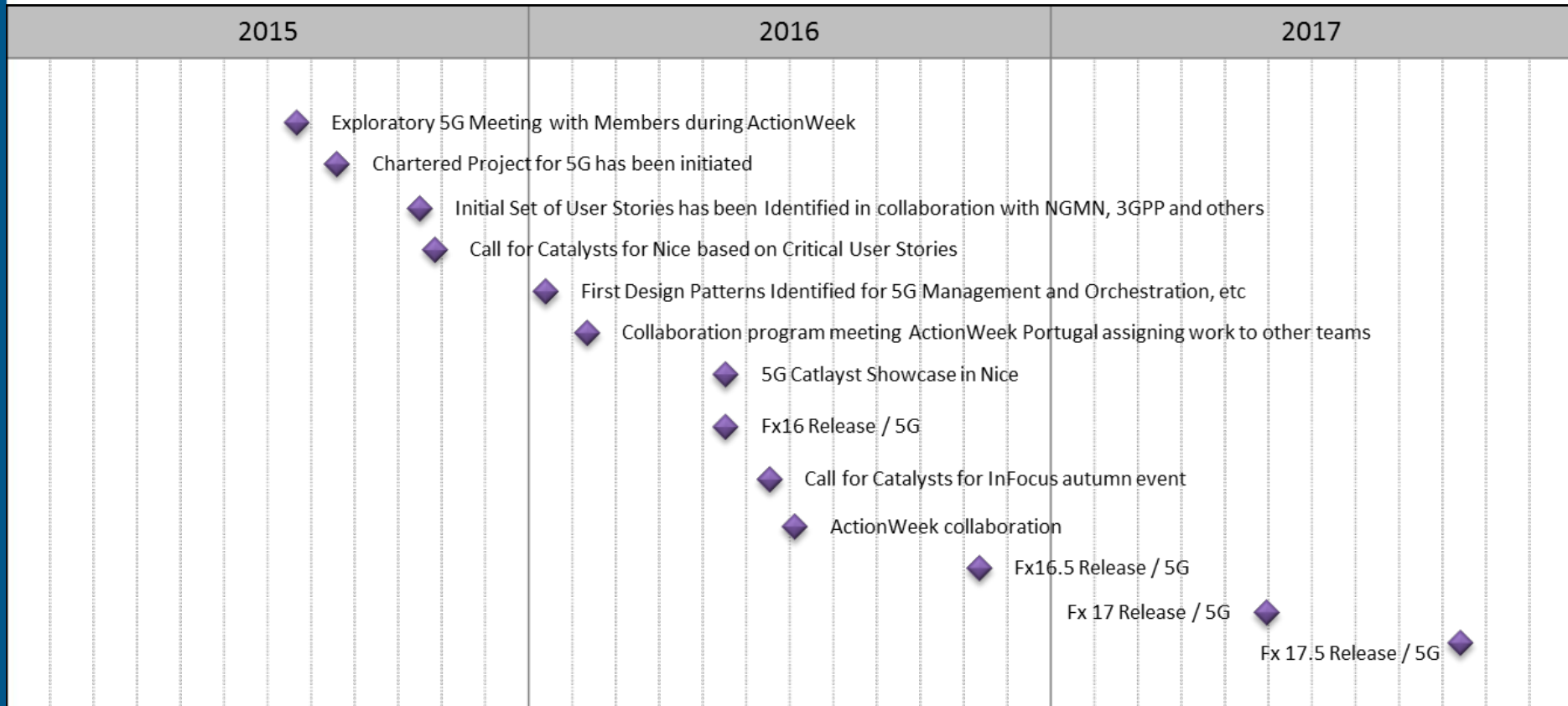
- The Forum is expected to play a role in connecting digital ecosystems and actors within ecosystems
- The Forum is expected to drive end-to-end management and orchestration across the digital value fabric
- The Forum is expected to develop best practice for SDN/NFV to make it fit for purpose
- The Forum is expected to drive innovation via its Catalyst program

### TM Forum in-flight programs will be adapted and extended to support 5G:

- Digital Ecosystem Reference Architecture
- Open Digital and Management APIs
- ZOOM (NFV/SDN)
- Framework extensions
- Best practice guides

### Initial participants:

- STC, Verizon, Orange, KDDI Labs
- Ericsson, Huawei, Oracle, JDSU, Trident and Netcracker
- TM Forum contact: [cpiva@tmforum.org](mailto:cpiva@tmforum.org)



◆ ActionDays will be added throughout the year