5G standards in 3GPP

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Outline

📶 About 3GPP

- how to get involved and influence standards

📶 Latest developments on 5G

- Accelerated timeline
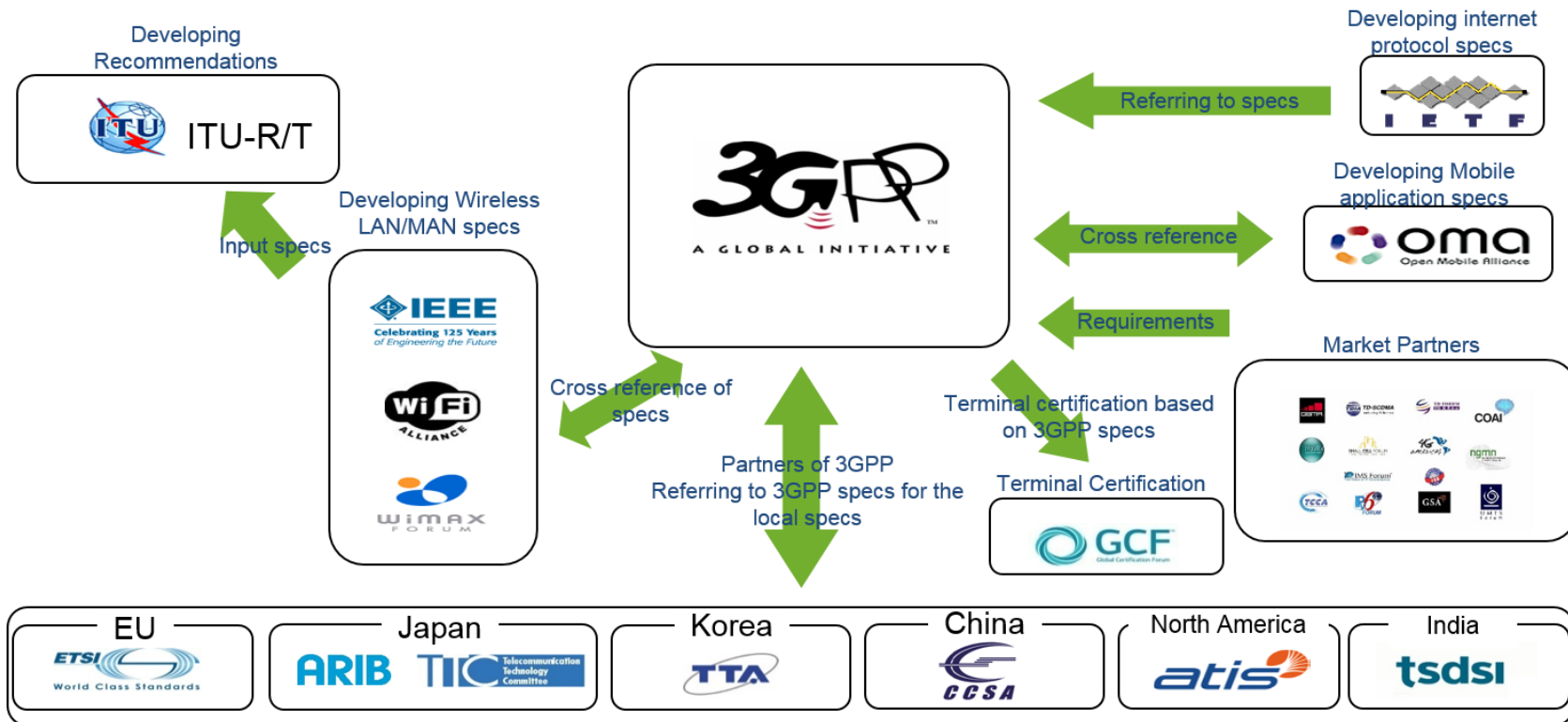- Ecosystem expansion

📶 Broadcast aspects

About 3GPP

About 3GPP

- *Global partnership* among regional Standard Development Organizations (SDOs)
  - Radio Access, Core Network, and Services
  - Anno 1998

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3GPP and other bodies

Developing Recommendations — **ITU-R/T**

Input specs

Developing Wireless LAN/MAN specs — IEEE, Wi-Fi Alliance, WiMAX Forum

Cross reference of specs

Referring to specs — Developing internet protocol specs (IETF)

Cross reference — Developing Mobile application specs (OMA Open Mobile Alliance)

Requirements

Market Partners

Terminal certification based on 3GPP specs

Terminal Certification — GCF

Partners of 3GPP Referring to 3GPP specs for the local specs

EU	Japan	Korea	China	North America	India
ETSI World Class Standards	ARIB / TTC Telecommunication Technology Committee	TTA	CCSA	atis	tsdsi

5G in 3GPP

Facts & Figures

- 514 Companies from 45 Countries

- 50,000 delegate days per year

- 40,000 meeting documents per year

- 10,000 change requests (CRs) per year

- 1,200 specifications per Release

- New Release every ~18 months

Approved CRs per year per 3GPP Release
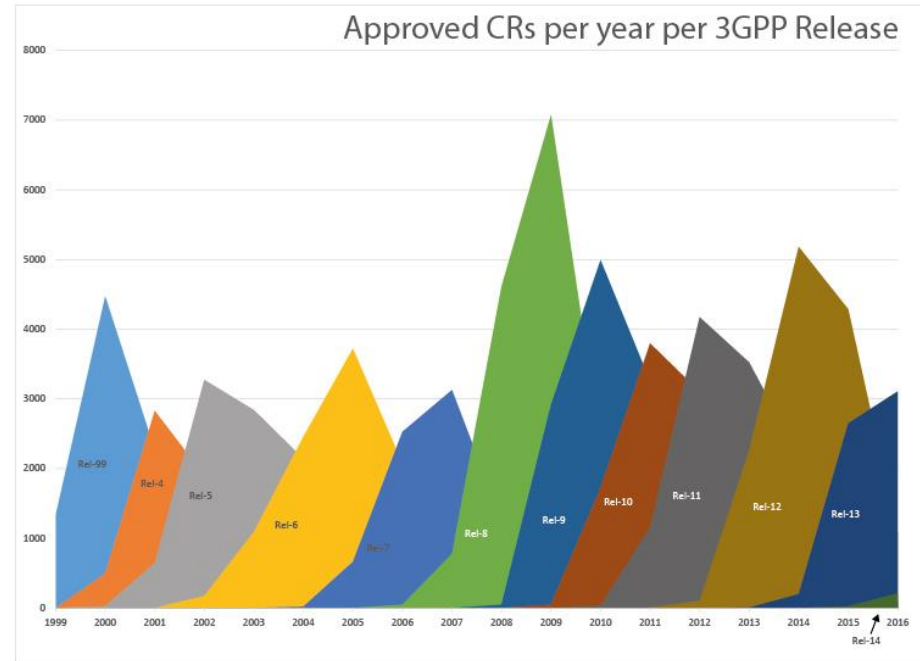
Influencing 3GPP

- 3GPP is a *contribution driven* organization and it works by *consensus* (i.e. lack of sustained objection)

- The process is meant to be *inclusive*, and this is what allowed 3GPP to build an incredibly successful global ecosystem
  - ~7-billion cellular connections to date, and Internet-of-Things is just coming

- 5G brings the next wave of ecosystem expansion
  - Automotive, Satellite, Critical IoT, etc…

- Now is a good time to enter!

Despite all odds … it works! ☺
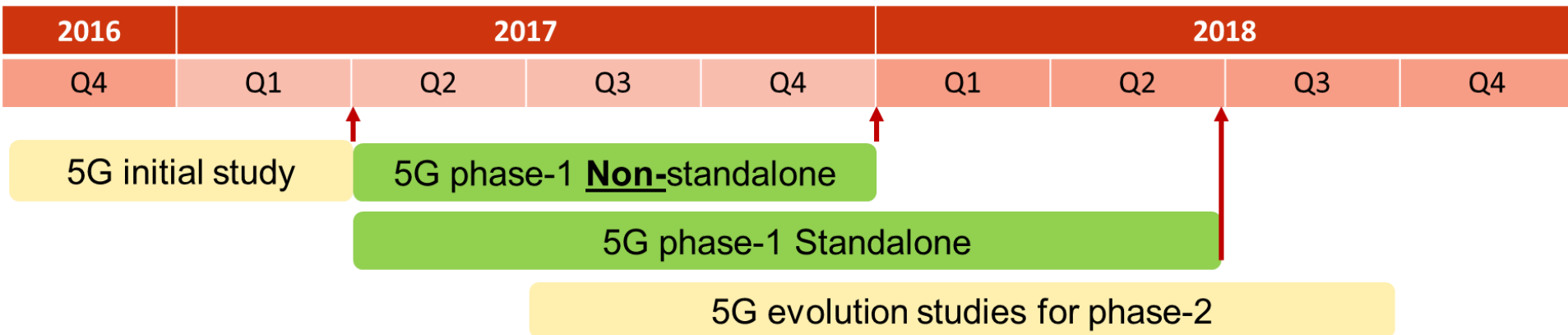
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Accelerated 5G timeline

5G timeline

Non-standalone 5G

- Uses LTE core and LTE radio anchor with a 5G small cell
- Mobile BroadBand capacity boost

Standalone 5G

- Uses 5G core and 5G radio anchor
- 5G overlay
- Expansion of the wireless ecosystem

2016	2017				2018			
Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

5G initial study

5G phase-1 **Non-**standalone

5G phase-1 Standalone

5G evolution studies for phase-2

5G in 3GPP

5G-driven ecosystem expansion
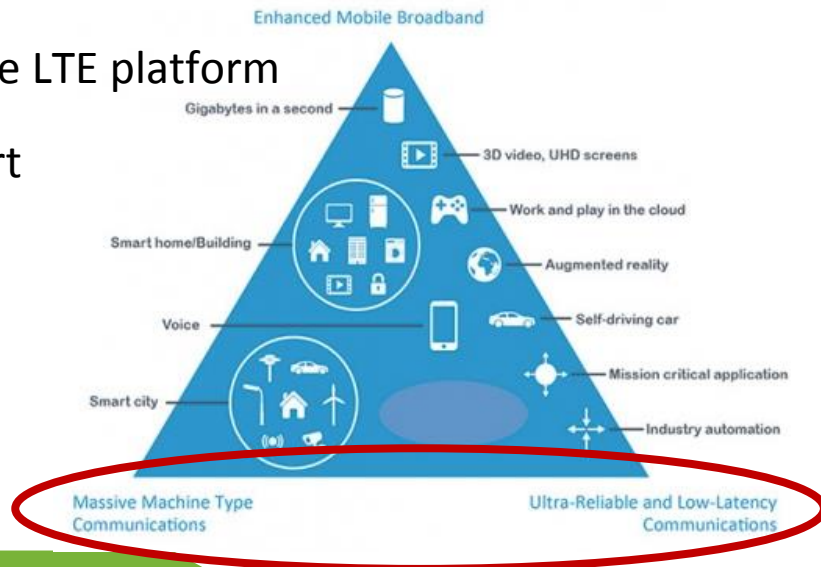
Internet of Things (IoT)

🔊 3GPP is making continuous effort to address the IoT market:

1. **LTE-M** LTE-based Machine Type Communications (1MHz bandwidth)
Higher data rates, VoLTE support, mobility, multicast, positioning

2. **NB-IOT** NarrowBand-IoT radio added to the LTE platform
Optimized for Low Power Wide Area
Several power classes, positioning support

🔊 5G will address the following segments
- Massive MTC
- Critical MTC
including Ultra Reliability and Low Latency

Enhanced Mobile Broadband

Gigabytes in a second — 3D video, UHD screens — Work and play in the cloud — Augmented reality

Smart home/Building

Voice — Self-driving car

Smart city — Mission critical application — Industry automation

Massive Machine Type Communications — Ultra-Reliable and Low-Latency Communications

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Low Latency

- Low Latency opens the door for a wide variety of new services **both consumer and IoT**
- Low Latency support will be added to LTE, and will inherently be supported in 5G from phase-1
- LTE needs the following enhancements
  - Shortened processing time
  - Shortened TTI operation (2-symbol, 4-symbol, and 1-slot)
  - Specifications to be completed 1H/2017
- 5G will address the full set of low latency requirements
  - <= 0.5ms for DL and UL user plane latency (without high reliability requirement)
  - Reliability of 10^{-5} for 32-byte packet with a user plane latency of 1ms

Vehicular Communications

- 3GPP is expanding the LTE platform to support V2X apps

- V2X will include two complementary transmission modes
  - Direct communication
    - High density, synchronization and low latency
  - Network communication
    - Broadcast from a V2X server to vehicles and beyond

- 5G to address potential add-on capabilities
  - Low latency and high reliability
  - High data rate
  - Spectrum above 6 GHz (e.g., 63-64GHz allocated for ITS in Europe), efficient V2X carrier aggregation
  - Advanced positioning

Pedestrian

Vehicle

Network

V2P

V2V

V2I

Vehicle
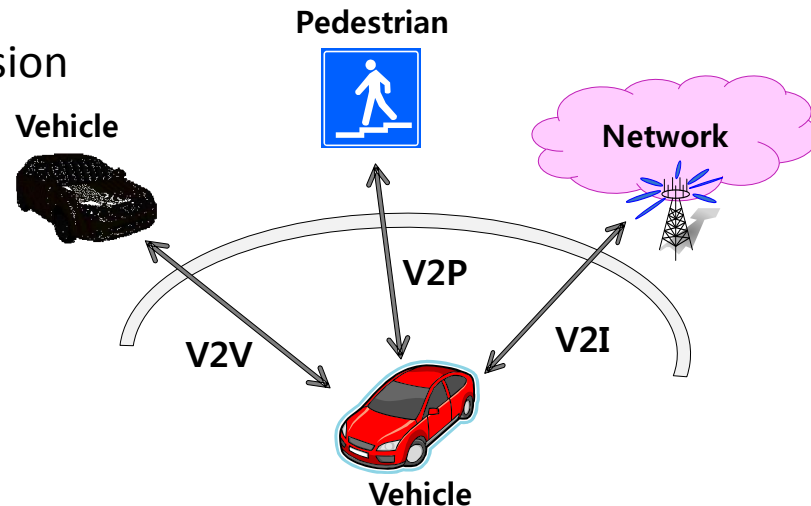
Unlicensed spectrum

- Licensed spectrum remains 3GPP operators' top priority to deliver advanced services and user experience
- Use of unlicensed spectrum will be an important complement to meet the growing traffic demand
- Currently operators have 2 options to offload traffic to unlicensed spectrum
  1. Wi-Fi (via **LTE/Wi-Fi interworking**)
  2. Unlicensed LTE Access aggregation with a Licensed LTE carrier (**LAA**)
- 5G will add the capability to support **Standalone Unlicensed Access**
  - New Study Item approved last week, specification work expected to be undertaken in Release-16 (target Dec/2018)

Non-terrestrial networks

📶 3GPP will study enhancing 5G for non-terrestrial networks

- Extending the reach to areas that cannot be optimally covered by terrestrial 5G network.

- 5G service reliability and resiliency for public safety systems

- Connectivity on board airborne vehicles (e.g. air flight passengers, UASs/drones, etc.), other moving platforms (vessels, trains)

Broadcast related 5G requirements

- 5G will support existing Multicast/Broadcast (M/B) services – no plans to re-invent the wheel → smooth evolution
  - **Currently this is foreseen to be addressed in 5G phase-3**
- Data rate up to 300Mbps (e.g. video streams such as 4k UHD or 8k UHD).
- 15 broadcast channels of 20Mbps each simultaneously over the same carrier.
- Roundtrip delay in the magnitude of 10-12ms running an 8k 3D video streaming of 250Mbps for uplink and downlink
- Dynamic area adjustment based on e.g. user density and service requirements.
- Static and dynamic resource allocation between M/B and unicast up to 100% of DL resources.
- Allow large cells (up to 100km radius), and local, regional and national broadcast areas.

Broadcast in the 3GPP world

- Radio-centric optimization of mixed unicast/multicast content delivery
  - It is expected that such optimizations will eventually be added to 5G radio by the traditional 3GPP community
- Standalone cellular broadcasting system
  - Latest version coming from 3GPP Release-14 – EnTV
  - Gap analysis to understand what is missing
  - The input of the broadcast community would be extremely beneficial

Thank you!
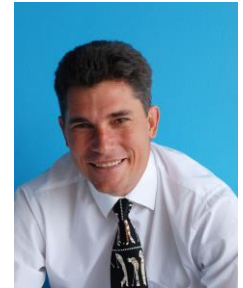
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