ETSI The Standards People

5G beyond mobile broadband

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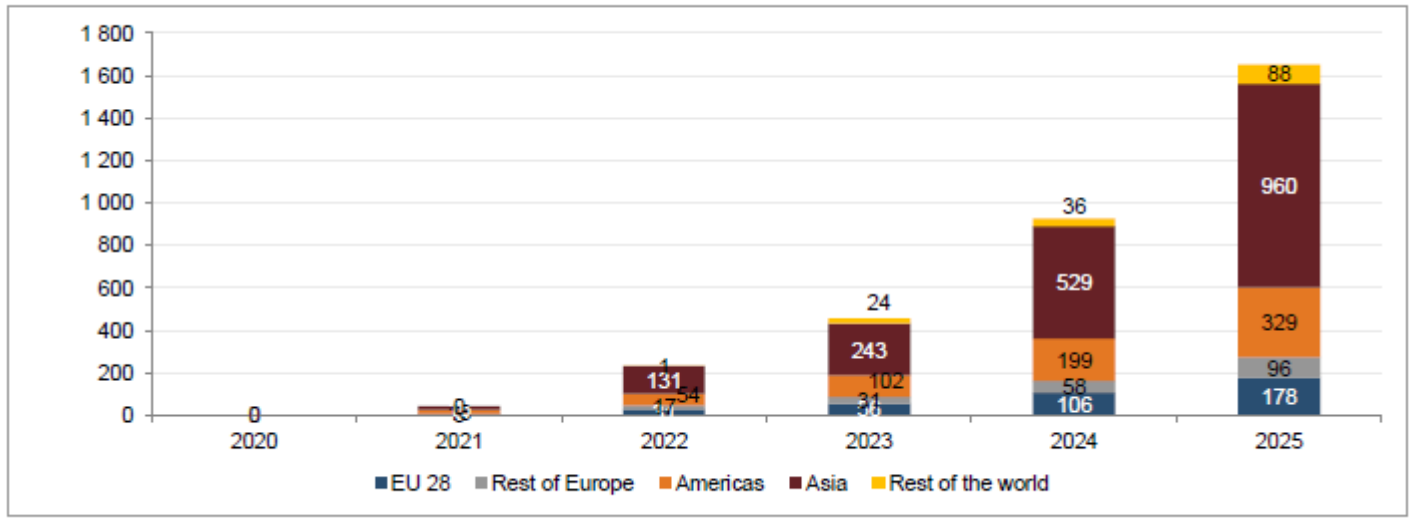
It’s much more than just Mobile Broadband!

- Evolved Mobile Broadband is important
  - The main priority for some early operators
  - Business models and revenue streams are well understood
  - 3GPP 5G Phase 1 addresses very well this use case family
- …but so are Ultra-Reliable Low-Latency Communications and Massive Machine Type Communications
  - Some URLLC features *are* contained in 3GPP 5G Phase 1
  - URLLC and mMTC are covered in 3GPP 5G Phase 2
- Many industry sectors will benefit from **all three** of these use case families: Mobile Broadband, URLLC and mMTC

5G where and when?

- 5G deployment is growing much faster than expected

Figure 5: 5G subscribers forecasts (million)



Source: IDATE DigiWorld, METIS-II

- The Global mobile Suppliers Association (GSA) has identified **392** operators (and operators-to-be) investing in 5G mobile and 5G FWA networks, in the form of tests, trials, pilots, etc
- **92** commercial 5G networks launched in **38** countries (August 2020).
- **86** vendors producing 5G equipment.
- **50** countries planning 5G spectrum auctions by end 2022.
- **47** countries have already assigned 5G spectrum

5G in unlicensed spectrum bands

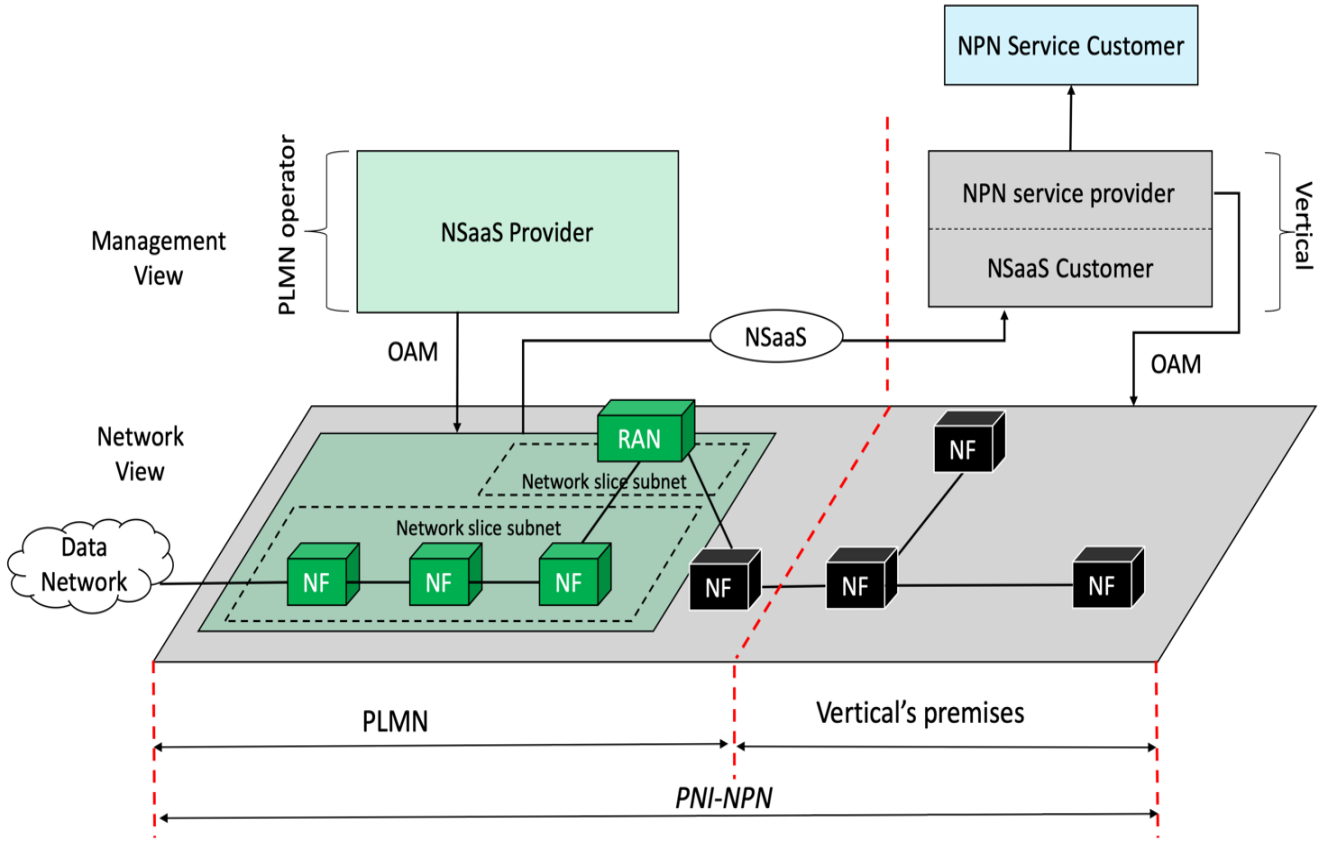
- 5G NR-based access to unlicensed spectrum (NR-U) included in 3GPP Release 16
  - Defines scenarios and solutions where NR-LAA is anchored to a legacy LTE carrier by dual-connectivity (DC)
  - aggregation with a 5G NR anchor
  - standalone operation of NR in unlicensed spectrum
- Focus is on bands below 7GHz
- Co-existence with LTE-LAA and other incumbent technologies
  "…essential to ensure that a NR-based unlicensed access wideband system operates as a "good neighbour" towards all forms of legacy systems

5G airborne/non-terrestrial connectivity

- Previous generations have either had no satellite component at all, or clunky non-integrated add-on solutions
- 3GPP has studied enhancement of 5G to include integrated non-terrestrial networks:
  - Extending the reach to areas that cannot be optimally covered by terrestrial 5G networks
  - Providing 5G service reliability and resiliency for public safety systems
  - Providing connectivity on board airborne vehicles (e.g. air flight passengers, UASs/drones, etc.), other moving platforms (vessels, trains)
- Normative work will be included in 3GPP Release 17

5G public and non-public networks

- A Non-public network (NPN) may be deployed in a variety of configurations, using both virtual and physical network functions. Specifically a NPN may be deployed as:
  - a Stand-alone Non-Public Network (SNPN), i.e. operated by an NPN operator and not relying on network functions provided by a PLMN; or
  - a Public network integrated NPN (PNI-NPN), i.e. a non-public network deployed with the support of a PLMN
  - (see 3GPP TR 28.807)



NSaaS =Network Slice as a Service

5G high precision positioning

- Going beyond basic regulatory requirements (E911)
- Latency, capacity and coverage requirements
- Commercial and regulatory scenarios
- Indoor and outdoor
- Low (FR1) and high (FR2) frequency bands
- Accuracy to 0.5 metres

TR 38.913 (upgraded in Release 16 publication)

5G will use state-of-art positioning techniques, such as RAN-embedded (Cell-ID, E-Cell ID, OTDOA, UTDOA, etc.) and RAN-external (GNSS, Bluetooth, WLAN, Terrestrial Beacon Systems (TBS), sensors, etc.).

5G positioning shall exploit high bandwidth, massive antenna systems, network architecture/ functionalities (e.g. heterogeneous networks, broadcast, MBMS) and deployment of massive number of devices. 5G positioning shall support indoors and outdoors use cases.

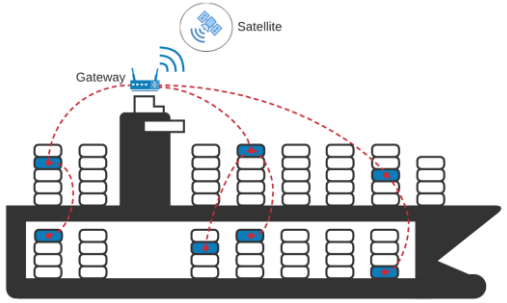
5G design targets for commercial positioning use cases include:

1. Support for range of accuracy levels, latency levels and device categories
2. Support accuracy and latency as defined in TR 22.862 for some (Critical comms) use cases
3. Reduced network complexity
3. Reduced device cost
4. Reduced device power consumption
5. Efficient signalling over the air interface and in the network
6. Support for hybrid positioning methods
7. Scalability (support for large number of devices)
8. High security
9. High availability
10. Support UE speed as defined in TR 22.862 (Critical Comms)

5G massive capacity

- Massive capacity is a key requirement for IoT-dedicated radio interfaces. Besides the physical layer itself, this is achieved by a set of improvements such as:
  - No data transmission when the device has “nothing to say” (also improves consumption)
  - Random spread of start transmit time, so e.g. all the electricity meters do not start sending their data at the same time
  - Devices Grouping, so e.g. all the electricity meters can be addressed at once
- Naming, numbering and addressing:
  - Alternatives to E.164 for Machine-Type Communications
  - Use of IPv6 addressing, instead of (capacity limited) E.164 numbering

(3GPP TR 22.836)



5G security

- Different fields of application require absolute confidence on the system:
  - E.g. Health, Banking, Automotive, Industrial application as a whole
- 3GPP has its Security Working Group (SA3), focussing on a trusted mutual identification between the end user and the network
- In addition - 3GPP is specifying IoT-and industrial-dedicated security mechanisms:
  - NR Industrial Internet of Things (IoT) (Release 16: 3GPP TR 38.825 published)
  - Enhancement to the 5G Location Services core (Release 16: 3GPP TR 38.814 published)

Conclusions

- Many industry sectors demand high availability, high reliability, low latency and secure communications which 5G inherently supports
- 5G is designed for use in licence and unlicensed spectrum in both public and non-public network configurations
- 5G is designed to provide coverage using both terrestrial and non-terrestrial technologies
- 5G is designed to cater for massive network capacity
- 5G is being deployed far faster than first predicted and will revolutionize many industrial sectors