

Telecom Italia vision and requirements on 5G

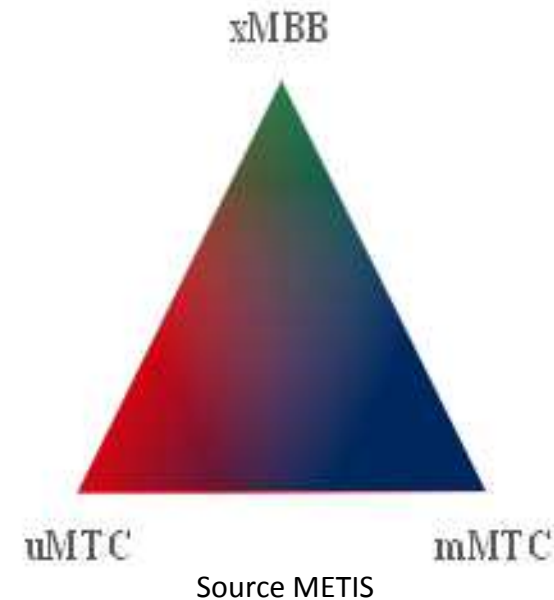


- ▶ **Telecom Italia endorses the contribution from NGMN**
- ▶ **This contribution describes the overall vision and highlights some requirements of relevance from Telecom Italia**

5G Pillars

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- xMBB Extreme Mobile Broadband
 - High dense scenario and extreme high throughput where and when needed
- mMTC Massive Machine-Type Communication
 - Extreme high number of low bit rate connections
- uMTC Ultra-reliable MTC
 - Including factory automation, mission critical services, Public Safety,....

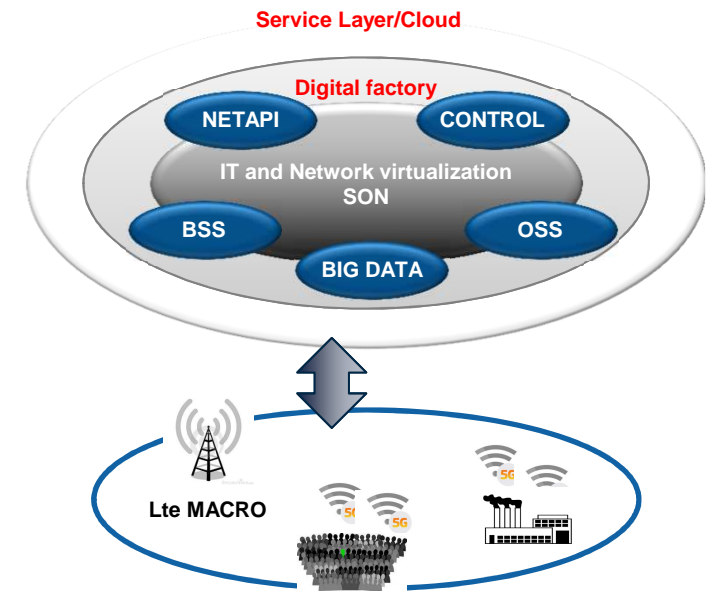


- ▶ **The identified pillars have the same importance and priority for Telecom Italia**
- ▶ **The radio design should encompass all use cases from the beginning and be forward compatible to new requirements**
- ▶ **5G RAN: a family of radio access techniques based on LTE Evolution plus new RAT(s) for specific use cases**

Spectrum framework evolution

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- ▶ New spectrum to be identified below and above 6 GHz
- ▶ Licensed and unlicensed, including tight interworking with WiFi
- ▶ From sub-GHz to mm-wave
 - ▶ Lower frequencies to be used for coverage, included deep indoor, and moderate traffic capacity → scenarios and use cases covered by LTE evolution
 - ▶ Higher frequencies to be used in a complementary approach for extreme traffic capacity in dense scenarios and specific use case → mainly for new RAT(s)



5G Wireless Access = LTE Evolution + new RAT(s)

▶ **xMBB**

- ▶ a new RAT shall be designed in order to benefit from large bandwidth and cope with radio propagation at high frequency ($> 6\text{GHz}$)
- ▶ integration with an LTE control layer at lower frequency ($<6\text{GHz}$) is a key enabler for early and successful deployment of 5G

▶ **uMTC and mMTC**

- ▶ Evolution of LTE and introduction of a new RAT depending on the use case specific requirements
- ▶ Flexible accommodation of the new RAT at the lower frequency in order to ensure efficient spectrum allocation and refarming

5G: use case driven, configurable, dynamic radio access (1/2)

- ▶ **Aware of user and application needs and always able to assign Network resources based on those needs**
 - ▶ E.g. in terms of required performance at IP layer and/or app/use-case specific (new KPIs and finer granularity QCI)
- ▶ **Extend Performance Management and MDT from network performance to user experience**
 - ▶ User / application level QoS and QoE monitoring capability supported by UEs and networks
 - ▶ Interaction between (RAN/CN) control/management layer and service management layers
- ▶ **Maximize synergies of new RAT(s) (e.g. tight interworking) with LTE evolution**
- ▶ **Management of 5G Radio Access Network shall benefit from Virtualization and provide:**
 - ▶ Standard definition of virtual RAN functions and interfaces to support management and orchestration in a flexible architecture, integrating LTE and new RAT
 - ▶ Convergence of control plane and network management plane to support Autonomic/Self-management functions coping with different use cases and deployment
 - ▶ A layered architecture, with standard and open API (open source)
- ▶ **Virtualized RAN shall be based on a standard and effective fronthauling solution:**
 - ▶ RAN and radio access dynamic re-configuration
 - ▶ Ultra-high bitrate on 5G local access have to be transported by efficient fronthaul solutions
 - ▶ Unique standard framework to allow simple operations and consistent behaviour in multi-vendor scenarios
 - ▶ Fast standardization to avoid fragmentation on de-facto standards

5G: use case driven, configurable, dynamic radio access (2/2)

Reinforce LTE techniques

- ▶ Network densification and HetNet
 - ▶ Massive MIMO (>> than 8x8 antennas)
 - ▶ Advanced receivers and interference coordination
 - ▶ Enhanced multi-RAT coordination
 - ▶ Wireless back/fronthaul; enhanced fronthaul (innovative split BBU-RRH)
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- ▶ Several services typically labeled as 5G services are already in the market or under development/regulation (smart capillary, m2m, Public Safety,...). The relations between ecosystems, markets, regulatory frameworks, assigned spectrum etc needs to be taken into consideration when defining service requirements and corresponding technical solutions
 - ▶ Standardization effort on LTE evolution shall be kept, being an integral part of 5G

5G radio access(es), including LTE evolution, shall be submitted to ITU-R to be included in IMT-2020

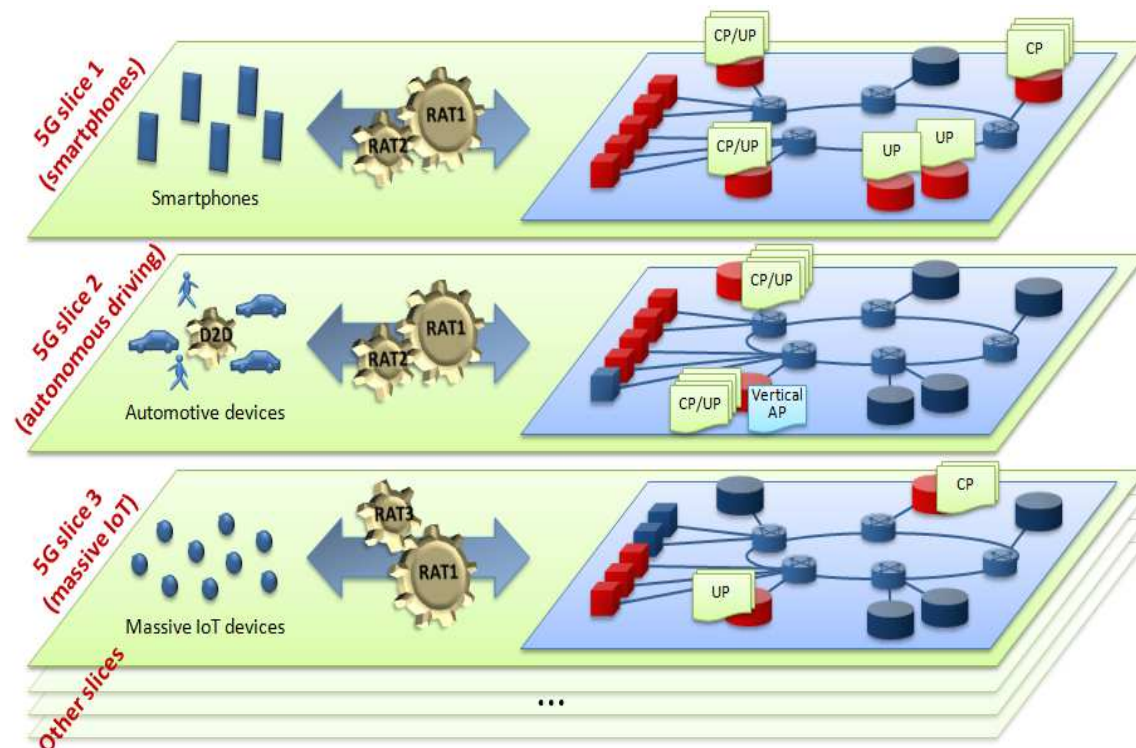
5G: virtualization

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- ▶ A **5G network architecture with native support for NFV** enables fast creation of dedicated network instances optimized for specific customers, service scenarios and/or terminal types (**network slices**), potentially improving **user experience** and **infrastructure resources**
- ▶ Network slices could be created by the operator **combining elementary functions available in a catalogue**. Composition of functions to create slices can be managed by the operator through the **NFV Orchestration Platform**
- ▶ **Integration of multiple RATs in the network slices**, including WiFi

Examples of slices:

- ▶ **Smartphone**: fully-fledged functions distributed across the network
- ▶ **Automotive**: security, reliability, latency at the edge. Cloud node + open API for vertical applications.
- ▶ **Sensors**: avoid mobility, basic Control plane functions (e.g. authentication)



- ▶ Energy efficiency must be one of the drivers from the beginning
- ▶ Holistic approach to define solutions to improve energy efficiency
 - ▶ E.g. to consider as normal operating conditions more challenging values (temperature, humidity, ...) in the meantime ensuring long life cycles → avoid as much as possible air conditioning in equipment rooms (where people stays only for emergency operations or to install equipment)
 - ▶ Switch on / switch off procedures
 - ▶ ...
- ▶ Define KPI to be fulfilled by RAN design

What is 5G for Telecom Italia

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An extremely flexible and highly programmable e2e system, including evolution of LTE access and providing complementary solutions to LTE use cases. The system shall:

Serve at best **high diversity** types of communications (Human & Machine) with different performance attributes

Natively leverage NFV technologies:

- ▶ Support **on demand** composition of network functions and capabilities, enforcing flexible assignment of capability/capacity “**where and when needed**”
- ▶ Compatible evolution of standardization activities on LTE virtualization

Profitably support new business opportunities and provide **sustainability** thanks to cost saving, solutions for services low cost deployment, synergies with LTE evolution

Be **future-proof** and ready to serve even not yet identified use case and radio technologies

Grazie

