International Scenario: what’s 5G?
Luigi Licciardi
Filmato Iniziale
The road to 5G
5G will cover new use cases and requirements

BroadBand access everywhere

- Seamless experience of connectivity anytime, anywhere, on any access technology

- Video services, possibly empowered by 3D and Augmented Reality

High user mobility

- High user mobility on trains, while still enjoying HD movie
  - Speed up to 500Km/h

+50Mbps everywhere

Up to 1 Gbps
Use cases and requirements

**Massive IoT**

- Ultra low power, integrated sensors, e.g. wearable devices to measure heart rate or blood pressure, ...

- Real-time sensing, data delivery, big data intelligence and real-time actuation to enable Tactile Internet

**Connection density:**

- 200,000 km²

**< 1ms latency**

**Extreme realtime communications**

**Emergency & Safety**

- Public Protection & Disaster Relief e.g. especially for communication among authorities and citizens

**Resilience & High Availability**
Use cases and requirements

Ultra-reliable communications

- Monitoring patients & fast medical treatment
- Vehicles realize critical situations fast, react accordingly and alert other cars…
- Information distribution in areas such as arenas, event locations

< 1ms latency

Ultra High Availability

One-to-Many transmission capability
Business Models

The Operators’ value proposition may leverage on new / relevant business models – particularly those related to new services (retail and wholesale)

- Partner service provider
  - Operator offer enriched by Partner (retail)
  - Partner offer enriched by Operator (wholesale)
- Asset provider
  - XaaS: IaaS, NaaS, PaaS (wholesale)
  - Network sharing (cost savings)
- Connectivity provider
  - Basic connectivity
  - Enhanced connectivity
What is 5G?

An extremely flexible and highly programmable e2e system, application, customer, time and location aware

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

Natively leveraging NFV technologies:
- Support **on demand** composition of network functions and capabilities
- Enforce required capability/capacity “**where and when needed**”

**Profitably** accommodating low- and high-ARPU traffic and **sustainability** thanks to cost saving and new business opportunities

Being **future-proof** and ready to serve even not yet identified use case and radio technologies
What’s different from 4G?
Beyond the usual x10, x 100, x 1000 improvements...

- Not only **improved performance** (or «doing better» what we can do today…)

- **Multi RAT**
  - LTE-Advanced for macro coverage
  - New RAT enabling new business
    - Higher data rate & lower latency

- **New design principles** for cost-effective deployment

- **Resource elasticity**: dynamic allocation of functions, processing and memory resources based on application requirements and load consumption over time/space

- **Greater cost efficiency to support IoT business**: simplified network to be tailored for different types of users
Key issues to reach 5G

Spectrum

Air interface

Architecture & Operations
From sub-GHZ to mm-wave

Lower frequencies to be used for macro-area coverage, included deep indoor

Higher frequencies to be used in a complementary approach for extreme traffic capacity in dense scenarios
Candidate radio access technologies for 5G

**New radio Access components**
- New Radio interface (FBMC for example, addressing also low cost M2M);
- New duplexing modes (i.e. full duplex)
- Ultra-lean signalling

**Innovative deployments**
- Mesh networks
- Massive use of direct communication

**Technologies for flexible use of spectrum**
- Use of frequencies above 6 GHz (up to 100 GHz)
- Opportunistic access to spectrum, including use of unlicensed bands

**Virtualized access network with base band pooling**
(towards Virtual – RAN)
and radio access dynamic re-configuration

**Reinforce LTE-A 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)
5G Common composable network

- **Use case driven** creation of dedicated networks optimized for specific service scenarios / customers (network slices)

- **Combination of functions available in a catalogue**, through the NFV Orchestration Platform
Mobile lifecycles: from early studies to standard

Is it too early to work on 5G?

- **Standardization** usually starts 4-5 years before the first commercial launch of a new generation.
- R&D activity usually starts 2-3 years before proposals come to standards…
- Major technology shift roughly **once every 10 years**.
- Approximately **20 year-cycle from launch to peak penetration**.
Objectives: 5G high-level use cases and related potential requirements.

Time Frame: April ’15 - March ’16 - More than 40 Telco companies worldwide (including Telecom Italia)
Filmato Finale
• EVOLUTION IN THE RADIO

• REVOLUTION IN THE CORE

• 5G: ONE NETWORK FOR A SEAMLESS ENRICHED CUSTOMER EXPERIENCE

Shoot for the moon. Even if you miss, you'll land among stars!

(les Brown)
Thanks

NGMN White Paper
https://www.ngmn.org/uploads/media/NGMN_5G_White_Paper_V1_0.pdf

For questions: luigi.licciardi@telecomitalia.it