RWS-150004

The road to 5G
Orange vision and priorities for Next Generation Radio Technology

Orange

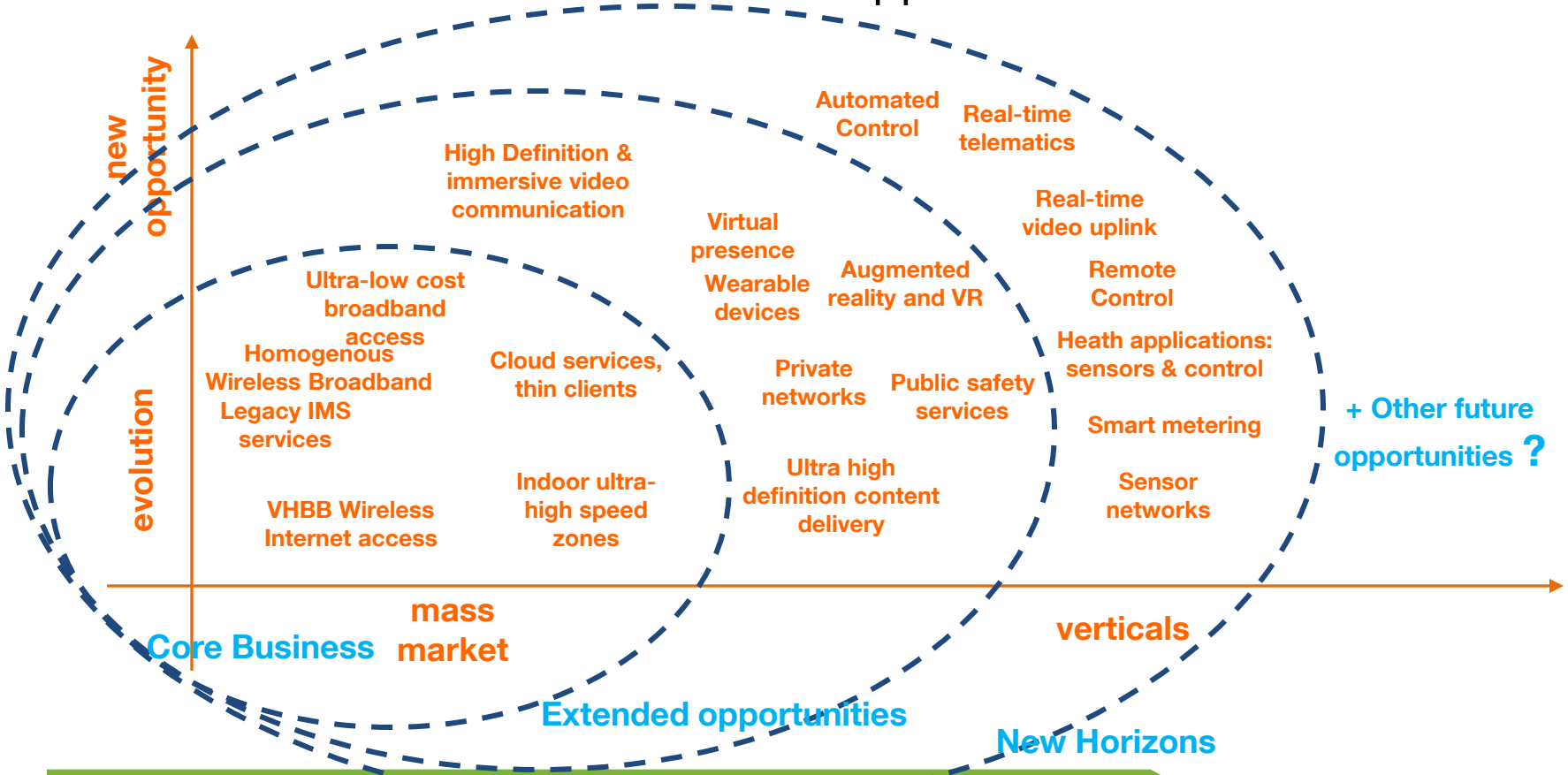
Orange 5G vision

5G is the technology we will deploy and operate in the 2020-2030 decade

- In our view, 5G is the future Internet as a whole, including
  - Radio Access Networks
    - 3GPP RAN(s)
    - non-3GPP RAN(s), e.g. High Efficiency WLAN
  - a convergent core network (CN) between fixed access and radio access(es) (3GPP and non-3GPP)

Orange 5G service vision

Evolution of Core business + extended opportunities and new horizons



Overview of Orange's key 5G Requirements

From service to technology requirements

Network

- Low power consumption
- Cost efficiency
- Security and Privacy
- Flexibility for future evolutions
- Fixed-mobile convergence
- Integration of 3GPP and non 3GPP RATs
- Resilience and robustness
- Higher capacity
- Higher spectrum efficiency
- Ease of deployment & operation
- Control of EMF exposure levels
- Support for high down to very low bit-rates
- Spectrum agility

User experience

- Homogenous experience over the coverage area, from static to high-speed-trains velocity, from outdoor to deep indoor
- Higher typical throughput per user/ application
- E2E latency of a few ms
- Connectivity transparency
- Experience optimisation on a per customer basis

Enablers for new business

- Internet of Things
- Vehicles connectivity (moving networks, V2V)
- Capabilities for ultra low cost networks

These requirements are ranked according to their priority, with the first priority ones on top of the lists.

Special focus:
Energy efficiency as a fundamental design principle

- 5G is a green field opportunity to apply lessons learned from 4G experience

5G should be designed since day 1 to be energy efficient and have the lowest energy consumption possible both for the network and devices

- 3GPP needs to develop clear metrics to evaluate how energy-efficient are the options/features proposed for 5G radio(s)
- Primary thoughts about areas of improvements on the network side:
  - Energy consumption scalability: make the hardware consumption mostly dependent on transmitted power and on network load
  - "Almost zero" Watt at zero load: efficient sleep mode whatever the load, Low latency (fraction of symbol duration) equipment activation/deactivation
  - Smart power consumption management & supply
  - Liquid free cooling in each product (component, board, …)

Special Focus
Ultra-low cost networks for low density and very low ARPU areas

Motivation

- Today 2 to 3 billions of inhabitants on Earth still do not have access to Internet
  - in many areas, the reason is the cost to deploy and operate networks and acquire terminals
- Bringing connectivity to such areas in an economically sustainable way requires
  - ultra-low cost network infrastructures (e.g. wide coverage)
  - ultra low-cost devices (e.g. ultra low complexity)
  - ultra-low cost operation and maintenance (e.g energy efficiency)
- Secure interoperability through standard solutions
  - stay ahead of proprietary solutions

Typical Services

Basics: voice, wireless Internet access with DSL-like data rates
(Refer to S1-152448)

Targeted environments

Rural and suburban areas in low population-density and very low ARPU regions

5G needs to offer capabilities for ultra-low cost deployments for low population-density and very low ARPU areas

How can we define target Radio perf. requirements?

- 3GPP Target requirements figures should be defined primarily based on available documents from ITU-R and NGMN

- For new verticals, especially the most demanding ones, the target technical requirements (e.g. for E2E latency <1ms and reliability 99,999%, etc) should be carefully checked with related end-users and justified by the service or use case need.
  - Avoid overdesigning the systems to optimize costs and complexity

- Energy efficiency as a fundamental design principle:
  - 5G should be designed since day 1 to be energy efficient and have the lowest energy consumption possible both for the network and devices
  - Need clear metrics to evaluate how energy-efficient are the options/features proposed for 5G radio(s)

Radio design principles for 5G

Do we need a new air interface below 6 GHz?

- Some « 5G » requirements are expected not to be satisfied by LTE evolutions

A new air interface below 6 GHz should be studied, its performance should be evaluated and gains compared with evolutions of LTE and CIoT

  - If significant gains in e.g. energy efficiency, cost efficiency, spectrum efficiency and/or performance are confirmed, our preference will be to define a new air interface below 6GHz
  - the reference for comparison should be “Rel-13+”: Rel-13 technologies + their evolutions studied during the Rel-13 timeframe

- We prefer a new 5G air interface that supports multi-services on the same carrier (e.g. MBB, MTC, various degrees of latency and reliability) to having several new dedicated radio interfaces:
  - provided performance is not too compromised

Radio design principles for 5G

- **Bandwidth aggregation with LTE**
  - If a new 5G RAT is introduced below 6 GHz, bandwidth aggregation with LTE shall be supported to offer appropriate 5G user experience at initial network roll-out and beyond

- **Standalone Licensed operation**
  - 5G RAT operation should support standalone licensed access

- **Spectrum :**
  - The Next Generation Radio Technology shall support in the first phase both FDD and TDD operation including new TDD configurations (9:1:0 and 10:0:0) and account for possible refarming of LTE spectrum
  - The channel model for bands above 6GHz should be aligned with ITU-R. Need of tight synchronization with ITU-R and with related research initiatives (e.g. 5GPPP)
  - For the Channel model study, Orange recommends the following intervals of bands: 21.4-22 GHz, 24.5-29.5 GHz, 31.8-33.4 GHz, 39.5-50.2 GHz and 66-71 GHz

Radio design principles for 5G

- **Forward compatibility**
  - The 5G technology and system basis that will be designed and specified to deliver the first 5G products shall allow for all the other 5G requirements and use cases to be fulfilled progressively in the future in a forward compatible manner
    1. if a new multi-services air interface is designed, it should support adding new modes in the future without redesigning the initial 5G devices (e.g. via “blank subframes”, as proposed at the end of LTE Rel-8 standardization)
    2. if dedicated air interfaces are optimized for different services, the system shall be able to seamlessly integrate new air interfaces in the future

- **Mobility support**
  - Air interface signaling shall allow seamless and full mobility between 5G and 2G/3G/4G

Recommendations and conclusion

Orange Top Priorities and Roadmap principles

- The standardization roadmap needs to take into account the market demand, the network efficiency and the new spectrum availability
- Specifications expected to be ready in 2018 should enable 5G deployments below 6 GHz from 2020 on, with significant gain compared to LTE
- Specifications ready by end of 2019 should enable 5G deployments in all candidate bands
- Orange priorities for 5G
  - significantly enhance user experience
  - significantly enhance network performance and operation, especially the energy and spectrum efficiency of mobile broadband
  - enable new services (low latency/high reliability, ultra low-cost networks)
  - ensure forward compatibility for future 5G releases (beyond 2022)
  - Ensure cost efficiency
  - Ensure security and privacy

Recommendations and conclusion

Orange Top Priorities and Roadmap principles

- All these aspects should be studied in 5G RAN WGs study item(s)
- Relevant features to be specified in the first phase should be decided ONLY at the end of the RAN WG feasibility study (ies), accounting for market demand and performance evaluation results of the candidate features
  - Note the RAN WIs should set the system basis right to ensure support of all other 5G requirements in a forward compatible manner
- 3GPP work on the Next Generation Radio Technology should bring considerable gains and benefits compared to evolutions of legacy technologies and should take advantage of mature and ambitious research initiatives e.g 5GPPP whose vision is supported by a large set of 3GPP and industry players