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# Mobile and Wireless Communications system for 2020 and beyond (5G)

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# Content

- Introduction
- 5G Challenges & Scenarios
- 5G Selected Technology Components

# Introduction

- METIS (Nov. 2012)
  - The first stage of the 5G EU “missile”
  - Contributed to the IMT.VISION Doc.

❑ **Lay** the foundation for
❑ **Build** an early global consensus for

⇨ **5G** mobile & wireless communications

- Several global initiatives started in 2013
  - China, Japan & Korea
  - An incredible amount of Workshops & Events

# Introduction

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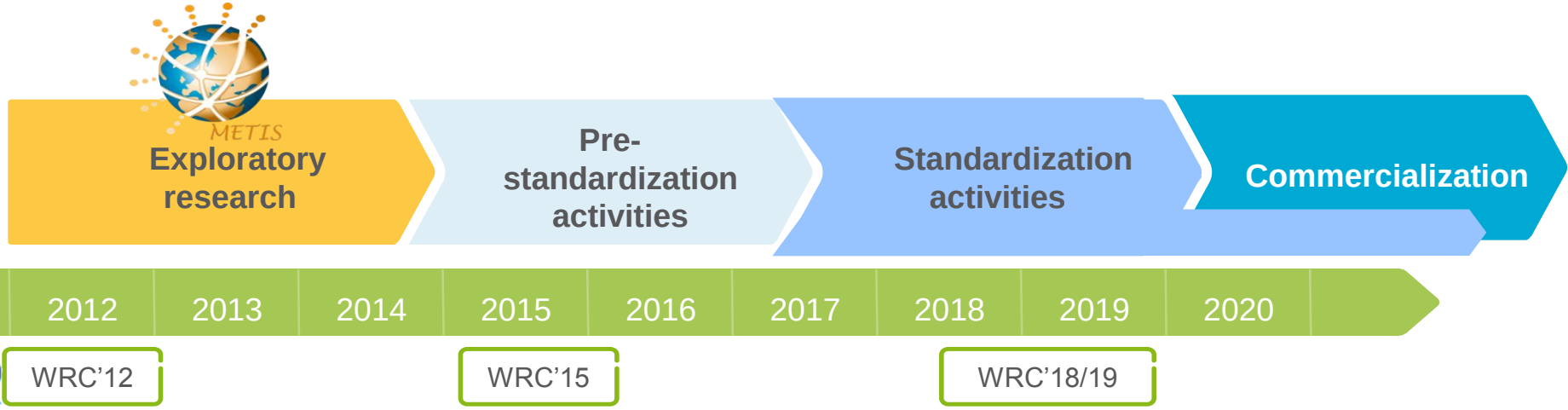


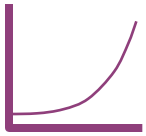
# 5G Challenges & Scenarios

# 5G Challenges

Avalanche of
**Traffic Volume**

**Further expansion of mobile broadband**

**Additional traffic due to communicating machines**



**“1000x in ten years”**

Massive growth in
**Connected Devices**
***“Communicating machines”***


**“50 billion devices in 2020”**

Large diversity of
**Use cases & Requirements**

**Device-to-Device Communications**

Car-to-Car Comm.

**New requirements and characteristics due to communicating machines**

# 5G Challenges

Avalanche of

**Traffic**

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Massive growth in

Large diversity of

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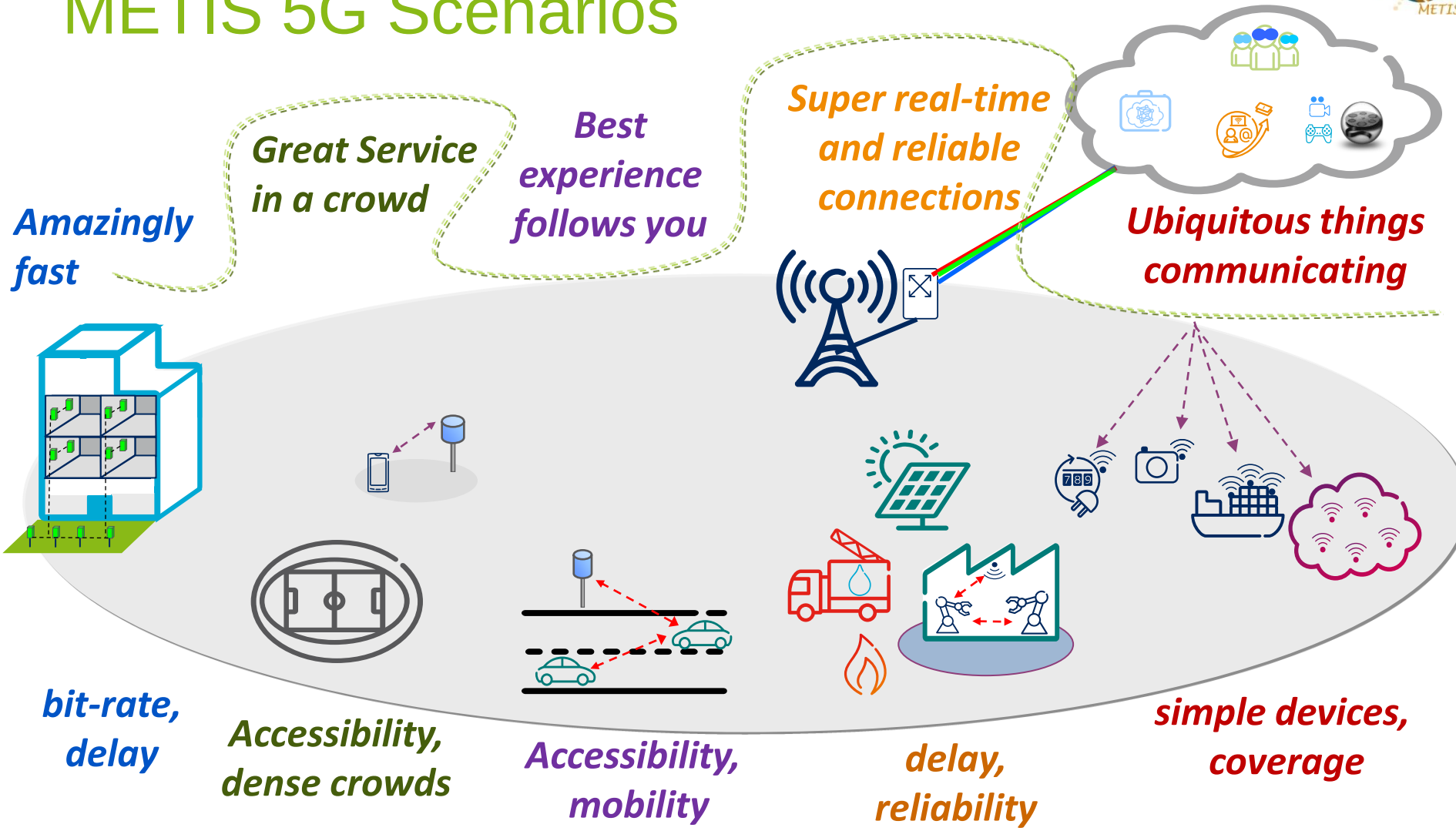
Beyond Mobile Broadband

&

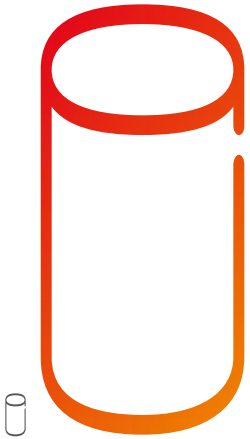
The ICT sector

# METIS 5G Scenarios



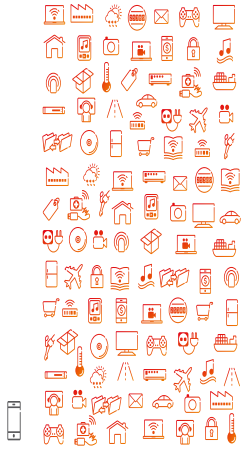
# METIS Technical Objectives

**1000x data volume**



1000x
higher mobile data volumes

**50/500 B devices**



10-100x
higher number of connected devices

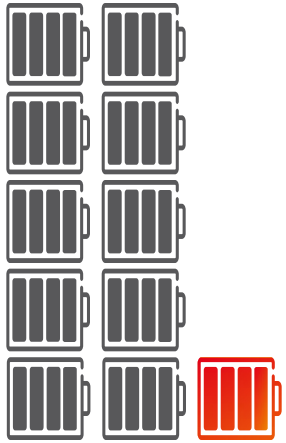
**Up to 10Gbps**

10-100x
typical end-user data rates

**Few ms E2E**

5x
lower latency

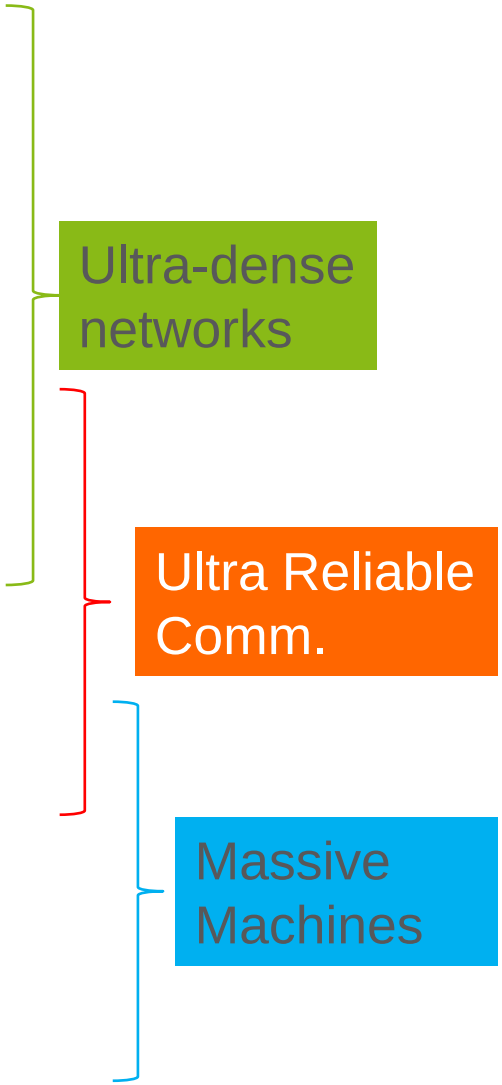
**10 years**



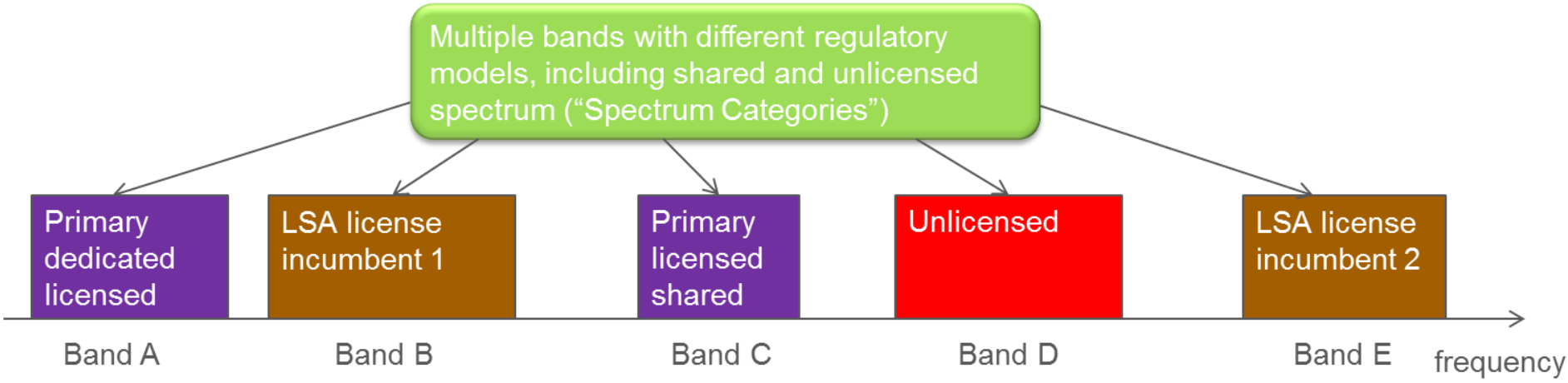
10x
longer battery life for low-power devices

# METIS 5G Requirements

| | |
|---|---|
| Data rates | 1-10Gbps (resp.100s of Mbps) |
| Capacity | 36TB/month/user (resp. 500 GB) |
| Spectrum | Higher frequencies & flexibility |
| Energy | ~10% of today's consumption |
| Latency reduction | ~ 1ms (e.g. tactile internet) |
| D2D capabilities | NSPS, ITS, resilience, … |
| Reliability | 99.999% within time budget |
| Coverage | >20 dB of LTE (e.g. sensors) |
| Battery | ~10 years |
| Devices per area | 300.000 per access node |



# Spectrum Scenario: Future Landscape




› Dedicated licensed spectrum complemented with various forms of shared spectrum

“Toolbox” of different sharing enablers required

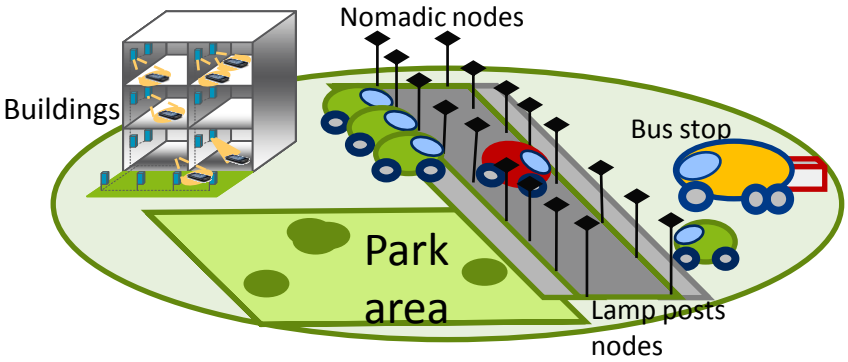
In order for 5G system to work under such scenarios

# 5G Technology Components

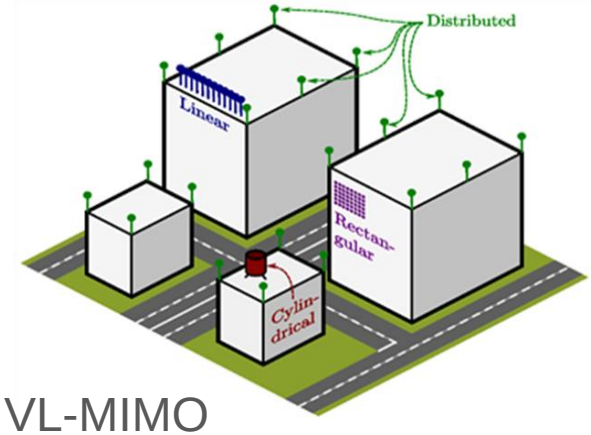
Examples

# Some 5G Technology Components


New spectrum bands and access methods

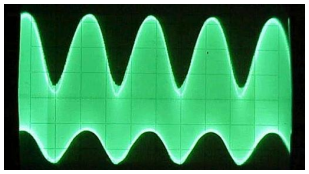



Dense and moving networks
Multi-hop wireless backhaul




VL-MIMO
Massive multi-antenna systems

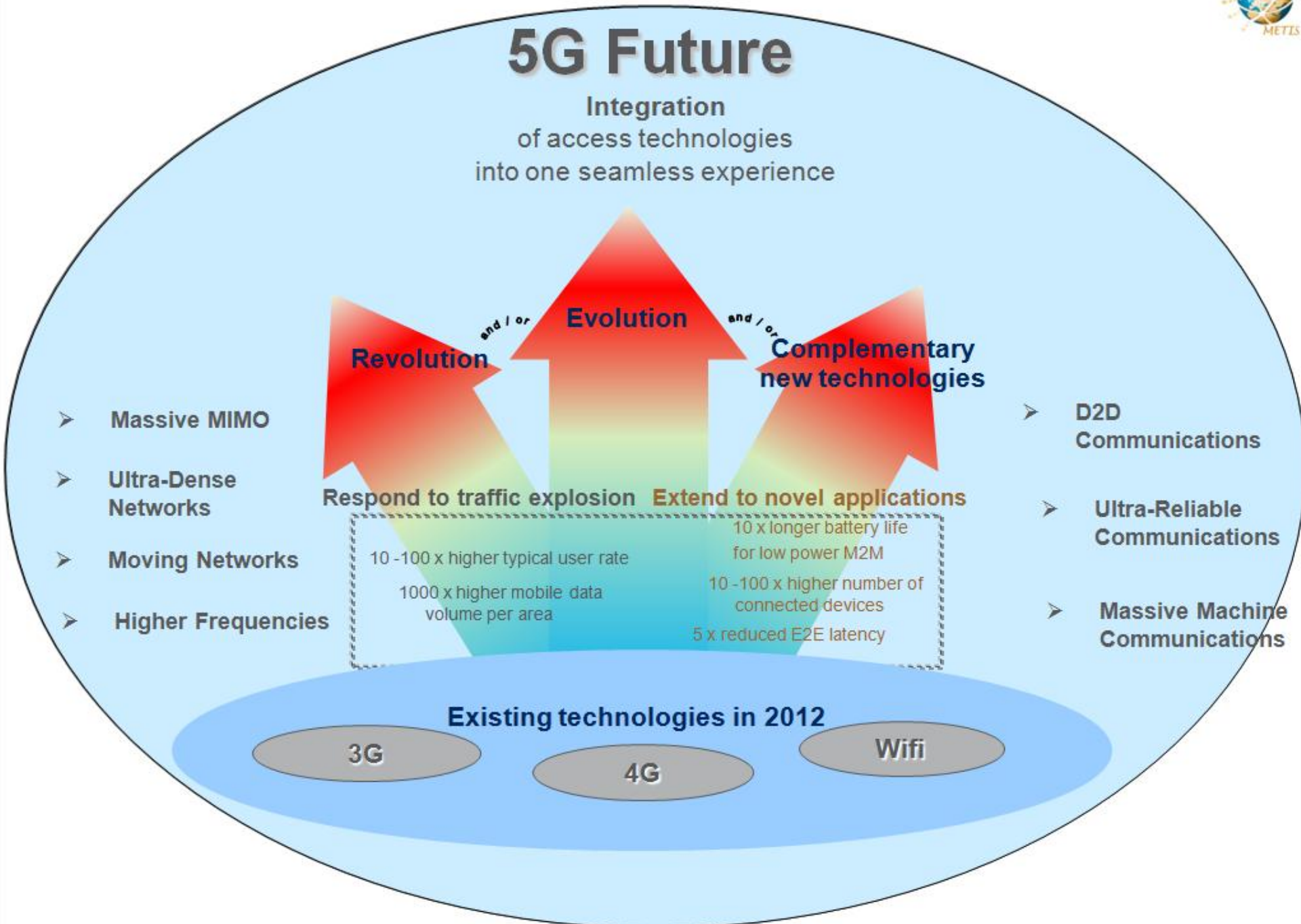
Context-aware interference and mobility management



Air interfaces for new applications and reduced signaling

Device-to-device

# Conclusion: Next Step


5G Future
Integration
of access technologies
into one seamless experience
Revolution
and / or
Evolution
and / or
Complementary
new technologies
Massive MIMO
Ultra-Dense
Networks
Moving Networks
Higher Frequencies
D2D
Communications
Ultra-Reliable
Communications
Massive Machine
Communications
Respond to traffic explosion
Extend to novel applications
10 -100 x higher typical user rate
1000 x higher mobile data
volume per area
10 x longer battery life
for low power M2M
10 -100 x higher number of
connected devices
5 x reduced E2E latency
Existing technologies in 2012
3G
4G
Wifi

# Useful Links

- A. Osseiran et al, Scenarios for the 5G Mobile and Wireless Communications: the Vision of the METIS Project, IEEE Comm. Mag., May, 2014 --To appear on https://www.metis2020.com/documents/publications/

- **Deliverable D1.1**, “Scenarios, requirements and KPIs for 5G mobile and wireless system”, June 2013
- **Deliverable D2.1**, “Requirement analysis and design approaches for 5G air interface”, Sept. 2013
- **Deliverable D3.1**, “Positioning of multi-node/multi-antenna transmission technologies”, Aug. 2013
- **Deliverable D5.1**, “Intermediate description of the spectrum needs and usage principles”, Sep. 2013
- **Deliverable D4.1**,“Summary on preliminary trade-off investigations and first set of potential network-level solutions”, Nov. 2013
- **Deliverable D6.1**,“Simulation guidelines”, Nov. 2013

All deliverables can be downloaded from https://www.metis2020.com/documents/deliverables/

# Thank You

# Cám ơn