

**5GAIner: Portugal 5G+IA Networks Reliability Center**

Leading in Europe



30 minute workout

Rui L Aguiar

Director, 5GAIner

Professor, Universidade de Aveiro

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## Outline

- Review of 5G
- Phasing of 5G
- European Research in 5G
- The road to commercial 5G
- 5G in Portugal
- The future -> last presentation of the webinars

## What is 5G

“just” the new generation of mobile networks...

1G..... Mobile telephony

2G..... Digital mobile telephony

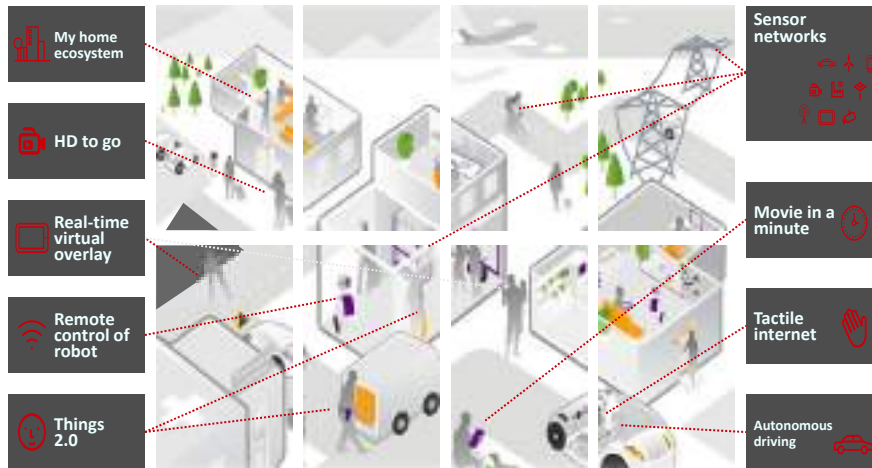
3G..... Mobile Internet

4G..... Mobile Broadband

**5G..... Networked society on the move**

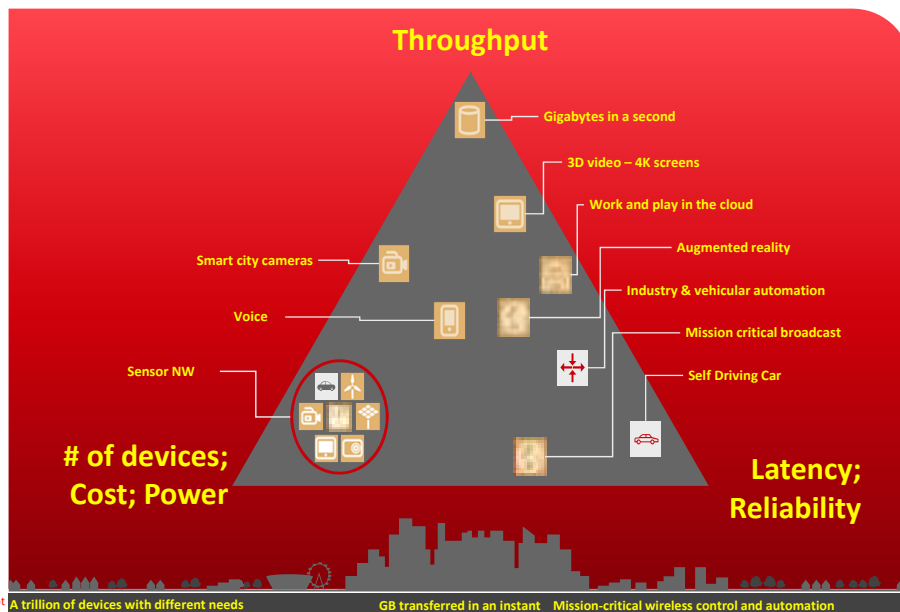
**The business of 5G is not the end-user, but the economic ecosystem**

# 5G is many dreams



5 **SCAI**ner - not for distribution

# 5G is many things



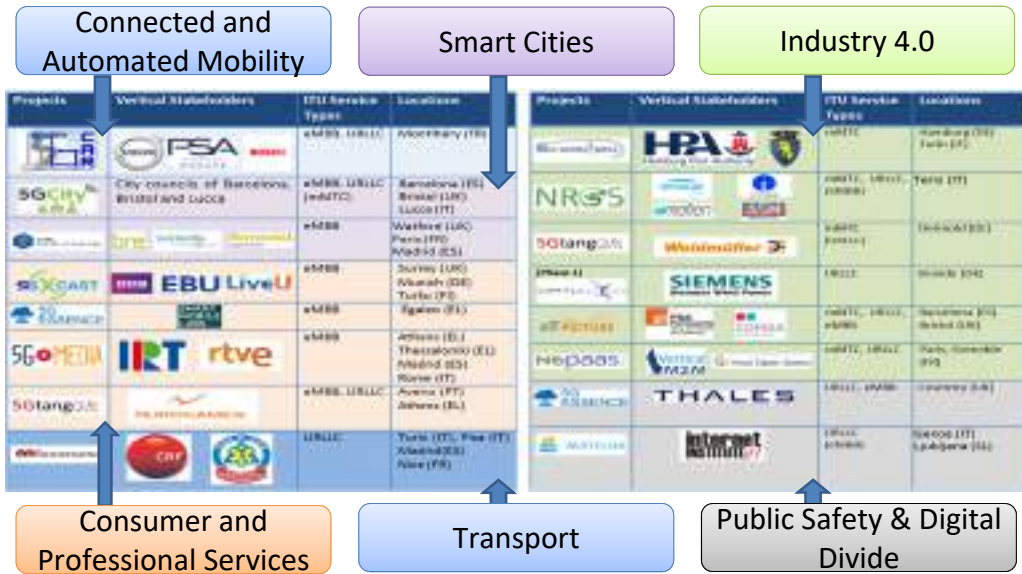
6 **SCAI**ner - not for distribution A trillion of devices with different needs GB transferred in an instant Mission-critical wireless control and automation

# 5G is phased: you do not get it all now



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## Phase II – Vertical Trials & Pilots



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CMM, October 8<sup>th</sup> 2019

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## Mapping SMEs to Verticals

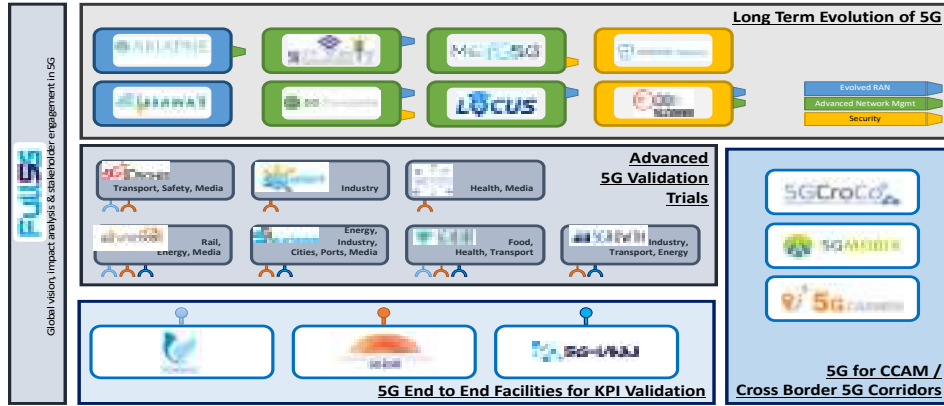


SMEs shown in alphabetical order

- Main Facility that offers Services to ICT-BWAs with defined SLAs
- Experimentation Facility for advanced Experimentation and Testing
- Moving Experimentation Facility Site
- E** SC-5G-E: 5G-Experiments for end users
- V** SC-5G-V: 5G-Experiments for verticals
- G** SC-5G-G: 5G-Experiments for general
- Additional 5G PPP Projects: Mathematics & Nodes; Aachen; Auto; Berlin; Frankfurt; Göttingen; Hamburg; Köln; Leoben; Linz; and Toulouse



## Phase III – Active projects



- new projects as a continuation of Phase 3:
- 5G for Connected and Automated Mobility
  - 5G core Technology Innovations
  - 5G Innovations for Verticals with Third Party Services
  - Smart Connectivity beyond 5G

## Phase III – Services for verticals

	Manufacturing	AgriSmart	Automotive	Healthcare	Smart Cities	Public Safety	Smart Buildings	Smart Grids	Smart Ports	Smart Factories
5G EVE	✓		✓		✓	✓			✓	✓
5G ENESS				✓	✓	✓				✓
5G VMM	✓			✓		✓			✓	
5G OONES				✓		✓				✓
5G HEART		✓	✓	✓						✓
5G RWITH	✓			✓					✓	
5G SMART	✓									
5G SOLUTIONS	✓				✓		✓	✓		✓
5G TOURS				✓	✓		✓		✓	✓
5G VICTOR	✓			✓					✓	✓

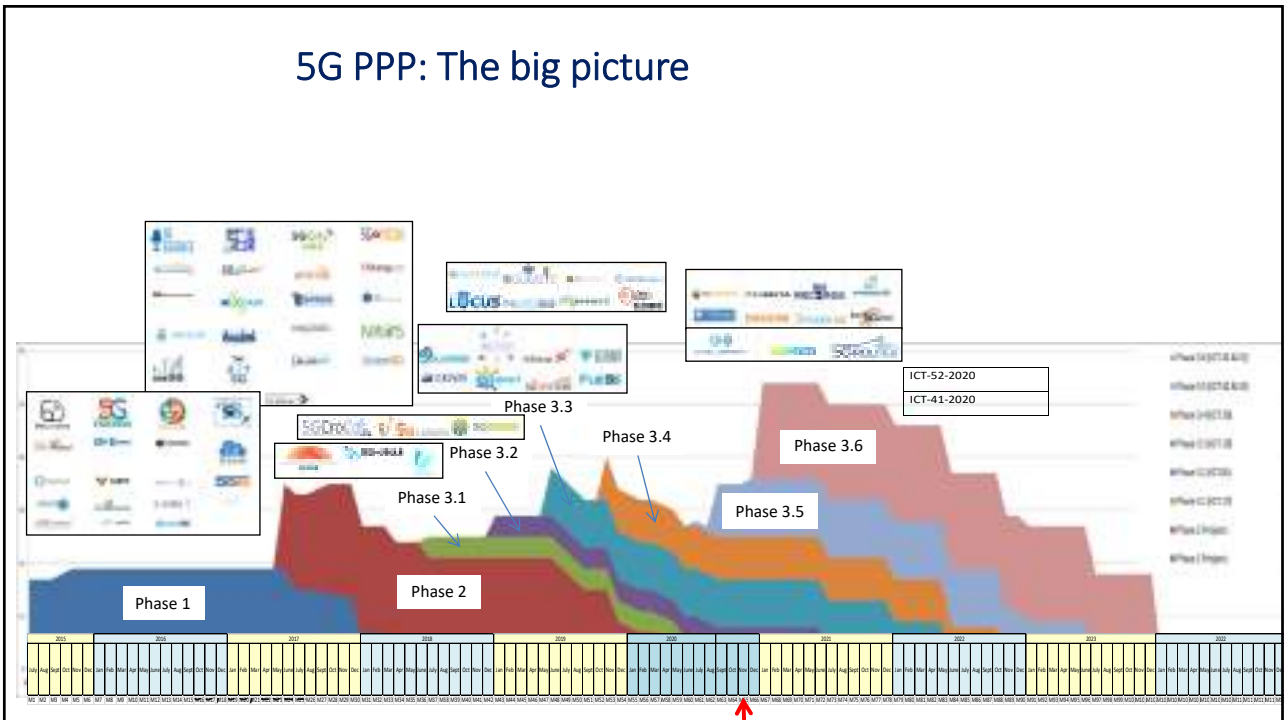
## 5G PPP: Key achievement version 3.0 (June 2020)

**Phase 3 Key Achievements** from the 5G PPP include **Over 80 highlighted results** from projects in phase 3 under **20 program level achievements** as shown by the symbols here. **Please click on the symbols to see the relevant results.**

- 5G Performance Evaluation
- Cellular Systems: Functional, Logical & Physical Architecture
- Radio Access Networks
- 5G Fronthaul: Functional and Multicast
- Technology Enablers
- Network Management and Orchestration of Services
- Software Networks
- Security: Privacy and Assurance
- 5G Service: Architecture and Programming Tools for Networks
- 5G Business: 5G Business and Regulation
- 5G Verticals 1: Industry 4.0
- 5G Verticals 2: Agriculture and Ag-Road
- 5G Verticals 3: Automated Car
- 5G Verticals 4: Transport and Logistics
- 5G Verticals 5: Smart Cities and Utilities
- 5G Verticals 6: Public Safety
- 5G Verticals 7: Smart and Smart Cities
- 5G Verticals 8: Energy
- 5G Verticals 9: Health and Wellness
- 5G Verticals 10: Media, Entertainment and Tourism

13 SCAI ner-not for distri

## 5G PPP: The big picture



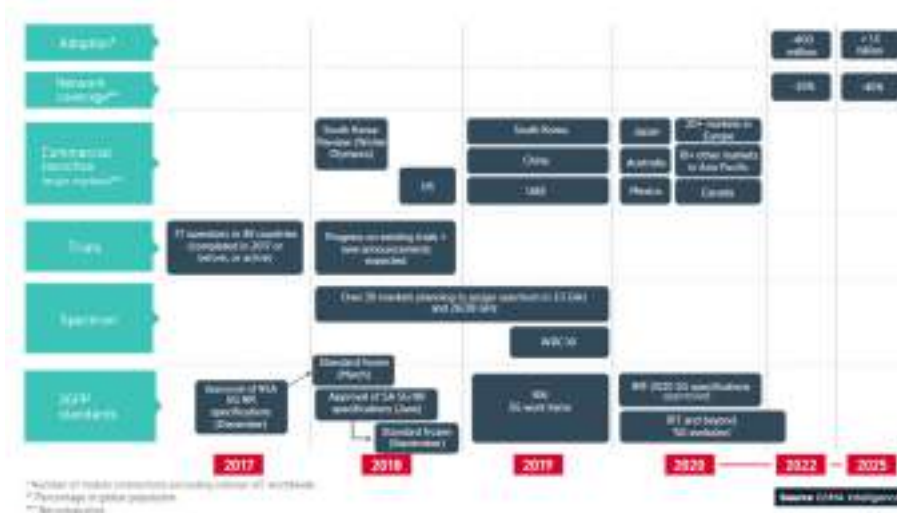
## Where is H2020 today?



Autonomous driving – Cross corridor projects



## Road to commercial 5G





# 5G Spectrum



700 MHz, 3.6GHz, 26GHz for 5G in Europe

# Where is 5G now?



**NOW** means:  
 4G++ better Internet access  
 Slightly better IoT capabilities  
 Worse geographic coverage

## 3GPP Roadmap



# Spectrum discussions



• Spectrum is re

- 700 MHz (694-790 MHz)
- 800 MHz (780-862 MHz)
- 900 MHz (890-910 MHz / 925-960 MHz)
- 1400-1430 MHz
- 1.8 GHz (1710-1785 MHz / 1805-1880 MHz)
- 2 GHz (1920-1980 MHz / 213-2170 MHz)
- 3.3-3.6 GHz
- 3.8 GHz (3500-3690 MHz)
- 3.4-3.6 GHz

OMA	1.400-1.430 MHz	1.430-1.450 MHz	1.450-1.470 MHz	1.470-1.490 MHz	1.490-1.510 MHz	1.510-1.530 MHz	1.530-1.550 MHz
1	1.400-1.430 MHz	1.430-1.450 MHz	1.450-1.470 MHz	1.470-1.490 MHz	1.490-1.510 MHz	1.510-1.530 MHz	1.530-1.550 MHz
2	1.400-1.430 MHz	1.430-1.450 MHz	1.450-1.470 MHz	1.470-1.490 MHz	1.490-1.510 MHz	1.510-1.530 MHz	1.530-1.550 MHz
3	1.400-1.430 MHz	1.430-1.450 MHz	1.450-1.470 MHz	1.470-1.490 MHz	1.490-1.510 MHz	1.510-1.530 MHz	1.530-1.550 MHz
4	1.400-1.430 MHz	1.430-1.450 MHz	1.450-1.470 MHz	1.470-1.490 MHz	1.490-1.510 MHz	1.510-1.530 MHz	1.530-1.550 MHz
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rope  
links

19 SCAI 480 Total : 1210 MHz 200 DEC/11/06

## What about Portugal?

- Spectrum issues
  - > TDT reformed
  - > DUF auction ongoing
- Three incumbent operators with trials and commercial
- One new operator to enter
- One old new operator with a different business model



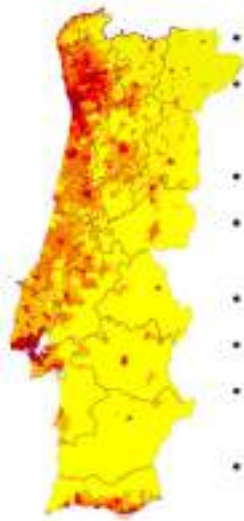
- Many activities in terms of innovation
  - > Several projects, both academia, industry and mixed
  - > Both national and european
  - > One key national project:



- Initiatives starting on economic impact (2nd phase of 5G):
  - > Digital Innovation Hubs, Trial platforms (inc. smart cities), Innovation Zones, etc...



## Regional Asymmetries



- Portugal is economically and demographically asymmetric
- What can 5G do for this?
- **The danger**
  - Business considerations will lead to early (or even only) deployment on privileged areas
  - 5G may increase regional asymmetries
- **The opportunity**
  - 5G can be used to decrease or at least attenuate these asymmetry trends
  - Operator business view will not lead to this situation naturally

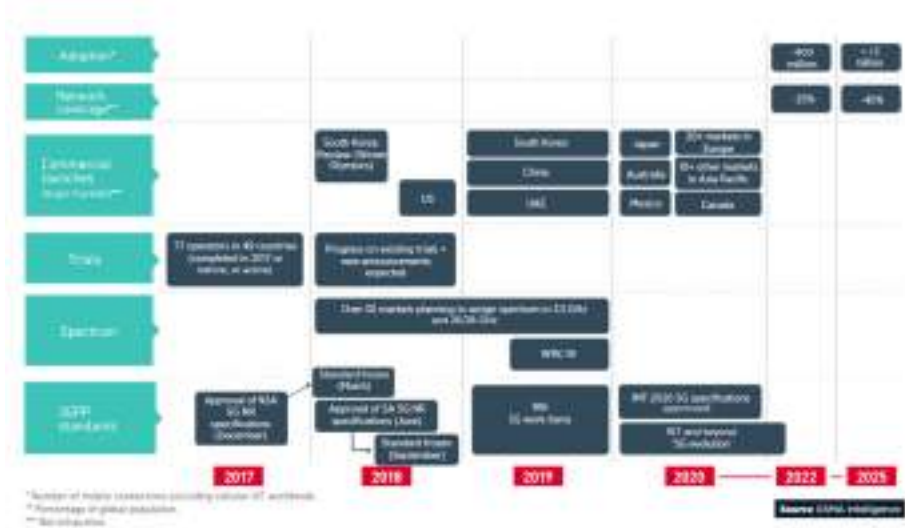
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## Back to Portugal - FAQ

- Where does this leaves me, as a consumer, in practice?
  - > Should I run to buy my 5G phone?
  - > Does it matter where I live?
  - > Will I get IoT if I want?
  - > Should I be worried with my health?
- I have my own company. And now?
  - > Should I rush to the operators?
  - > What do I need to explore 5G?
  - > Can I profit by using 5G?
  - > Is there a place for my company to be involved in 5G?
  - > Are there security challenges that I should be afraid?

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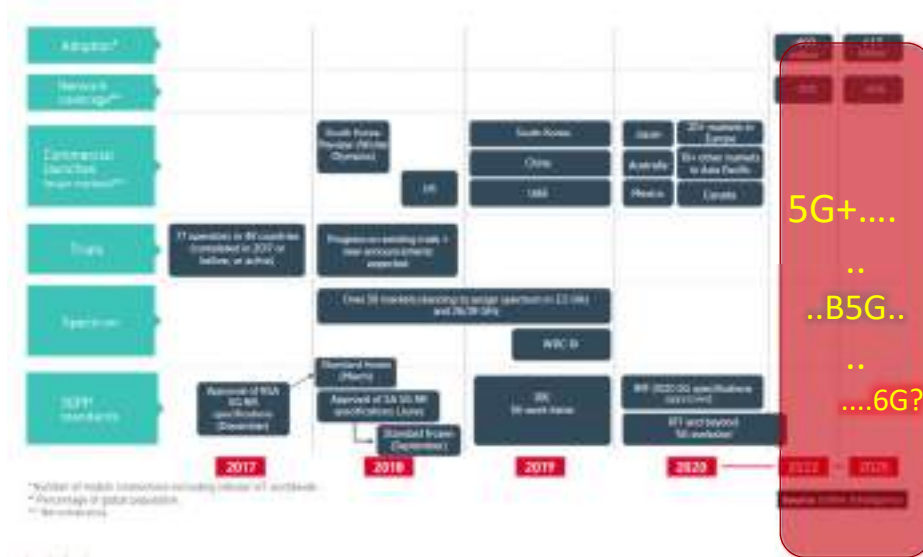
# 5G: the end of the beginning



# 5G: the end of the beginning



# 5G: the end of the beginning



# 6G: the beginning of the beginning

Lesson from the past

It takes a huge amount of time to reach technology maturity.

But large pressures to speed the development.

## Strategic Research and Innovation Agenda

- Updated ~2-3 years
- Used by EC community to frame future research funding
  - Influencing industry
  - Influencing governments' agenda
- Process triggered by the Networld2020 Steering Board
- Early draft build with resource to an Expert group
  - ~150 contributors, ~90 institutions
- Open consultation to the whole community

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