

**URSI** Aveiro, December 2015

#### 5G - How (And where) to reach there

Rui L. Aguiar ruilaa@ua.pt Professor, Uni.Aveiro/DETI, Instituto de Telecomunicações Pesquisador Visitante, FACOM, Uni. Fed. Uberlândia



#### **5G - When did this started?**

Several initiatives across the world now. Europe was piooneer, discussing this from 2011.

**Objective**: trying to catch up lost leadership in mobile communications

Early drive from EU:

- Setting a workprogramme inside H2020
- Last calls of FP7 already pushing in this direction
- Setting up the ETP (Networld2020) and the PPP (5G IA)



#### So, 5G?

INSTIT

Long term discussion on the future of cellular systems

Being pursued across the whole world

#### Cooperative research



#### **5G Time Frame - Standardization**



#### **Standards/Industry Organisations with 5G-related activities**

	Category	Organisation		Category	Organisation
	Industry Alignment & Adoption	NGMN		Architecture	3GPP
		GSMA			ETSI ISG NFV
		ITU-R			ETSI ISG MEC
	Access	3GPP			Small Cell Forum
16	Technology	IEEE 802.11		OPNFV	
		IETF			ITU-T SG13
		ETSI ISG mWT ETSI ISG ORI			IMT2020 FG
				Network Management	TMF
		ETSI RRS			
				Web Innovation	W3C

Note: although not listed, 5GPPP is an important organisation expected to make contributions to standards organisations.

universidade de aveiro

ETSI/BOARD5GCOM(15)004\_003

5

ATNOG

#### **Research? Innovation?**

5G is an economic vision
(it does not stop in 2020, though)
Communications are not the focus: they are simply the enablers

• And without IT, is not really very serious anymore

# Economic and societal value is the key guideline.



6





URSI



## Socio-technical evolution requirements for beyond 2020



7

#### **China flower**



Korea 5G Forum



#### **Europe 5G PPP IA**



INSTITUIÇÕES ASSOCIADAS:



#### In a nutshell:

Different visions, but somewhat aligned

- In general, "more" (capacity, density, data rates) and "less" (energy, latency)
- Addressing multiple real life scenarios: focus is different according to the scenarios that are preferred in different areas.

Intelligent networking are common in all of them.

- What impact will system integration have as an enabling role of this?
- What challenges will (re)appear from different "vertical" sectors?



#### What changes with "Real Life"? The "verticals" discussion



telecomunicações

universidade

#### **Expected Technology**

- Integration of different technologies (not only physical layer)
  - Following the current trends....
- Complex radio environment
  - CRAN, HCRAN, microcells, as now but device # explosion
- Separation between infrastructure, network, computation and service
  - Reconfigurable network and service provision (SDN, NFV, virtualization, cloud...)
- Multitenant environment
  - Different types of providers, different types of interrelations



#### **Overview of key organisation timescales**



#### How wide can 5G be?



Source: AIOTI WG3 (IoT Standardisation) - Release 2.0



#### 5**G** is...

- NOT a communications network, but a large distributed system
  - With real-time constrains
  - With an arbitrary complexity
  - Multi-tenant
  - With dimensions unseen until now
  - With integrated HW and SW components
  - With fast service automation

URSI

December 2015

- Stable
- The "real definition" of 5G will be the result from different power balances between economical sectors and geographical blocks.

ATN



16

INSTITUIÇÕES ASSOCIADAS



81<sup>st</sup> Tech Day PT-Inovação

Aveiro, December 2015

#### 5G - How (And where) to reach there

Rui L. Aguiar ruilaa@ua.pt

### Questions?

INSTITUIÇÕES ASSOCIADAS:



SUPERIOR TÉCNICO









instituto de telecomunicações

creating and sharing knowledge for telecommunications

© 2005, it - instituto de telecomunicações. Todos os direitos reservados.