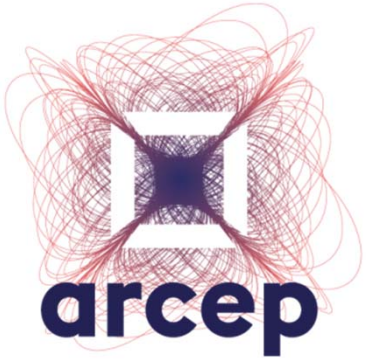


French perspective on spectrum issues

Pierre-Jean Benghozi

Spectrum 5.0 : New Directions in Spectrum Award for 5G

Paris, 5 october 2018

Looking back to the past awards

Spectrum award objectives

How national objectives have been taken into account in past spectrum awards

	2001 to 2010	*2010*	*2011*	*2012*	*2015*	*2018*
	3G 2.1 GHz (4 awards)	3G 2.1 GHz additional blocks	4G 2,6 GHz FDD	800 MHz	4G 700 MHz	900 MHz, 1800 MHz and 2.1 GHz
MONETISING THE STATE'S INTANGIBLE ASSETS	Fees fixed *ex ante*	sealed-bid auction	sealed-bid auction	sealed-bid auction	Multi round auction	
DIGITAL DEVELOPMENT				Coverage: ✓ Nationwide ✓ Priority rollout zone ✓ Departmental area	Coverage: ✓ Same as 800 MHz ✓ on-board coverage of everyday trains	Coverage obligations
COMPETITION ISSUES	Room for a 4th entrant with conditions favouring its expected arrival	MVNO access criteria	MVNO access criteria	MVNO access criteria	Multi band spectrum caps	
INNOVA-TION			Minimum data rate registered in the licences	Minimum data rate registered in the licences		
OTHER OBJECTIVES	14 technical and economic criteria, including : network quality, service offering and corresponding price, rollout speed...					

800 MHz and 2.6 GHz auctions

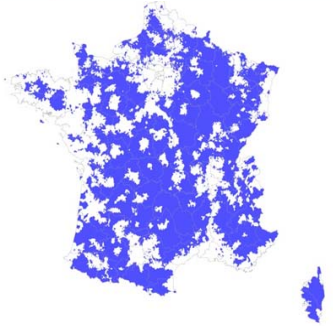
2011-2012

Three core objectives

Digital development of the territory = primary – ambitious - objective of the digital dividend

	T + 12 years	T + 15 years
Overall metropolitan coverage	98%	99,6%
Departmental coverage	90%	95% (*)

+ “priority rollout zone" corresponding to the sparsely populated areas



Competition in the mobile market : a balanced portfolio

Equitable access to spectrum by mobile operators

- Limits on the **maximum amounts of frequencies** that can be granted:
- guarantee of a **minimum amount of spectrum** in the 2.6 GHz band if four players or less are qualified
- **Roaming access** to the 800 MHz network in the “priority rollout zone”

On the other hand, provisions in favour to the **MVNO access**

Maximizing income

This result was among the upper range of European 4G award.

one-turn combinatorial seal-bid auction

bids rated on several criteria, including the candidate pricing:

A score taking into account all the criteria, as the product of the price proposed by the corresponding multipliers

700 MHz auctions

2015

Objectives

Monetizing intangible State assets

Reserve price of 2.5 billion euros for the entire band.

Effective and fair competition

Transparent procedure that allows mobile operators to manage their outcome.

to prevent a squeeze-out strategy by the 3 MNO granted with 800 MHz frequencies

Spectrum caps + whole 30 MHz granted in a unique procedure open to the 4 MNO

Stimulating investment and regional development

Coverage obligations as strong as those attached to the 800 MHz band

New obligations pertaining to on-board coverage of everyday trains.

The procedure

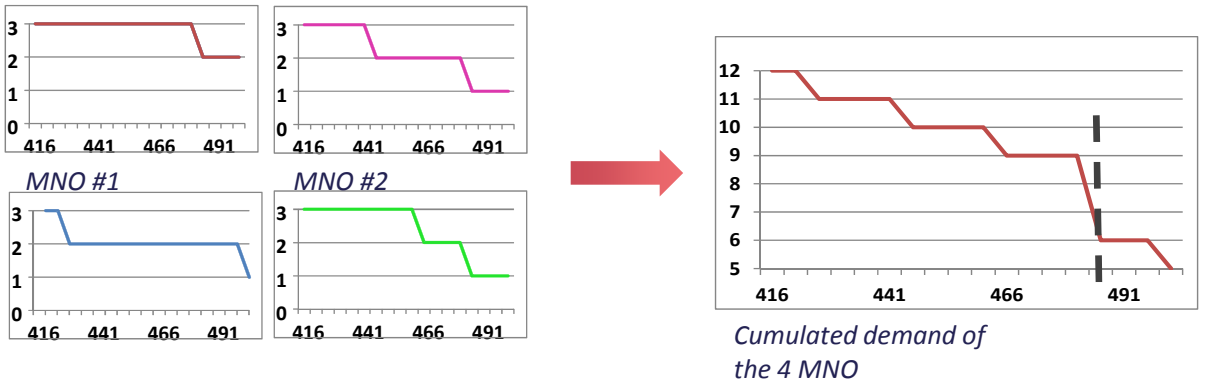
Spectrum Cap

700 MHz spectrum cap : Maximum 2×15 MHz (3 blocs) per candidate in the 700 MHz band.

< 1 GHz spectrum cap : Maximum 2×30 MHz per candidate in the 700 MHz, 800 MHz and 900 MHz bands (2×95 MHz in total).

Process :a combinatorial clock auction (CCA) to determine the quantity of frequencies allocated to MNOs

End of the auction : when the total demand reaches 6 blocs.



Total : 466 M€ per bloc of 2×5 MHz **=2,8 G€**

900 MHz, 1800 MHz and 2.1 GHz renewal

2018 - New deal for mobile coverage : Historic agreement between the Government and mobile operators that aims to ensure the availability of high standard mobile coverage for everyone in France

Context of the mobile coverage : why a “New deal” ?

Context of renewal of the 900, 1800 and 2100 MHz band frequency licences expiring between 2021 and 2024 with a 2018 reassignment procedure conducted by Arcep

- **1. Mobile coverage situation**

Regarding the population, good mobile coverage for 2G,3G and 4G

Regarding the geographical area, unsatisfying mobile coverage expecially for 4G technology

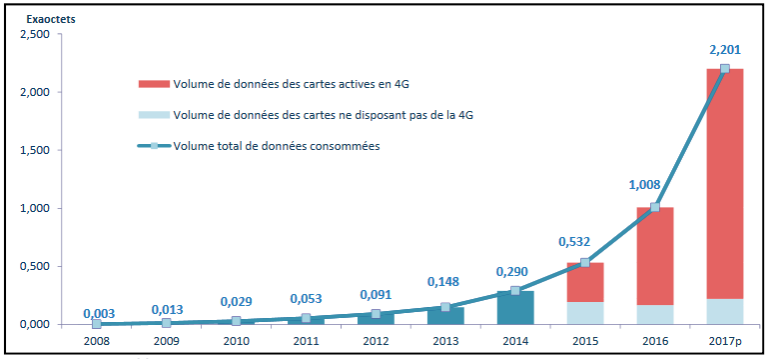
	Population	Area
Orange	92%	65%
SFR	91%	65%
Bouygues	90%	61%
Free	82%	48%

4G Mobile coverage in July 2017

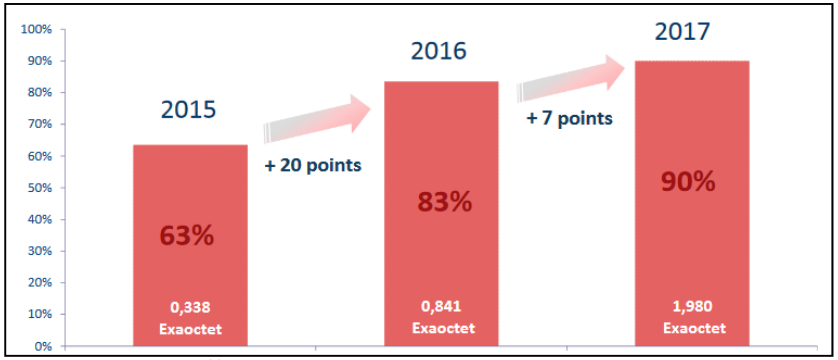
- **2. Mobile traffic explosion**

Data traffic consumption in 2017, in France, has doubled comparing with 2016 (+118,3%)

--> the consumer needs more data everywhere!



Traffic generated by using all the mobile technologies

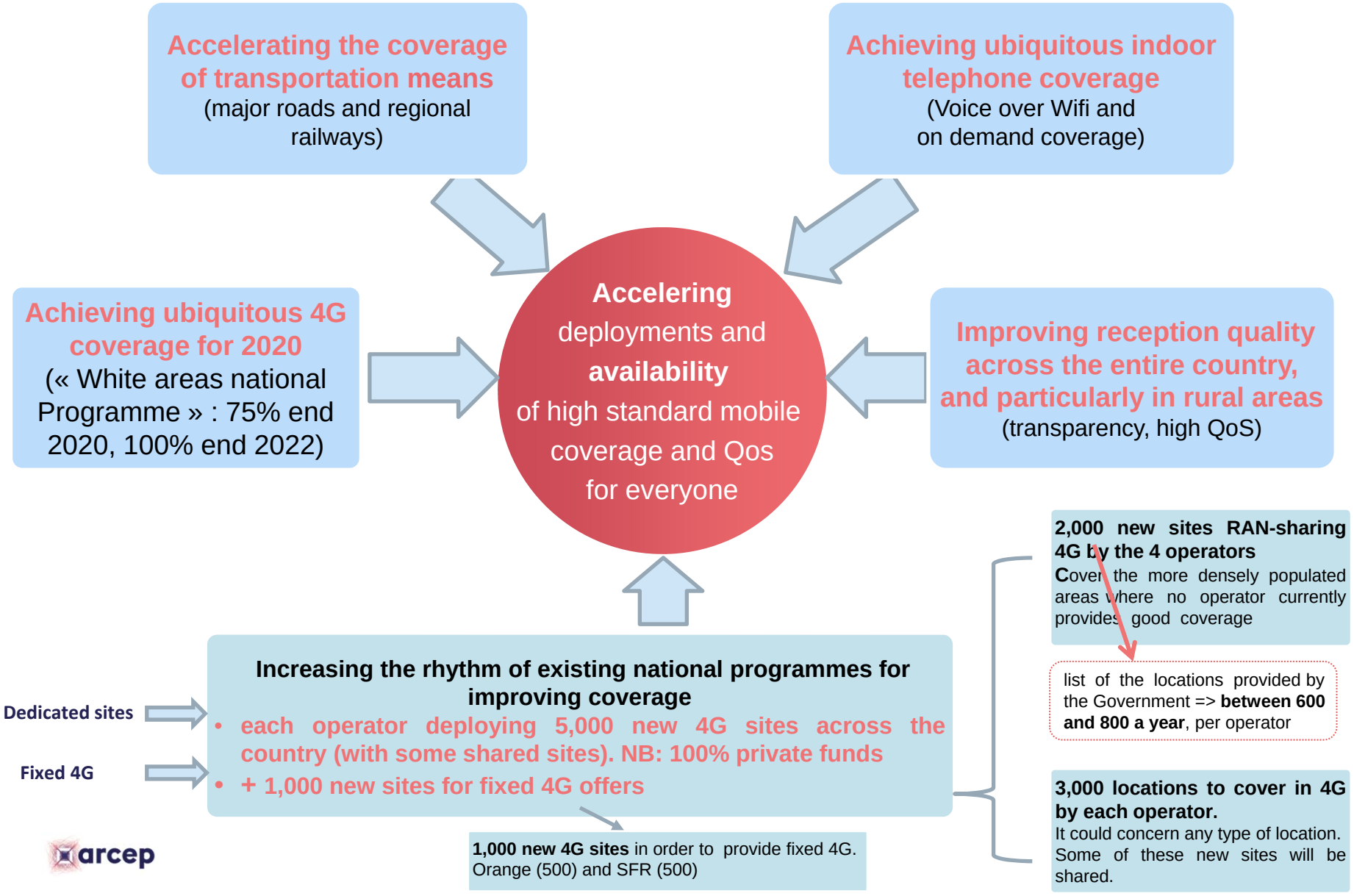


Traffic generated by usign 4G technology

Implementing 4 new principles to generalize a good quality mobile coverage for all

1. Change of paradigm for the State	For the first time in a frequency allocation, the digital coverage of the territory takes precedence
2. Operators' commitments for a gradual improvement of mobile coverage in the daily life of the people	Generalization of 4G coverage, coverage of major roads, indoor coverage, no more obligation of coverage expressed in terms of a % of the population
3. A solution for challenge areas	Operators will use their own funds where the authorities have identified coverage needs
4. Acceleration of digital coverage throughout the country	The Government will implement measures to simplify deployments under the Housing Bill; other regulatory measures will follow.

Intended - legally binding and controllable - new commitments for mobile operators



Looking forward for the future
5G bands… and new challenges

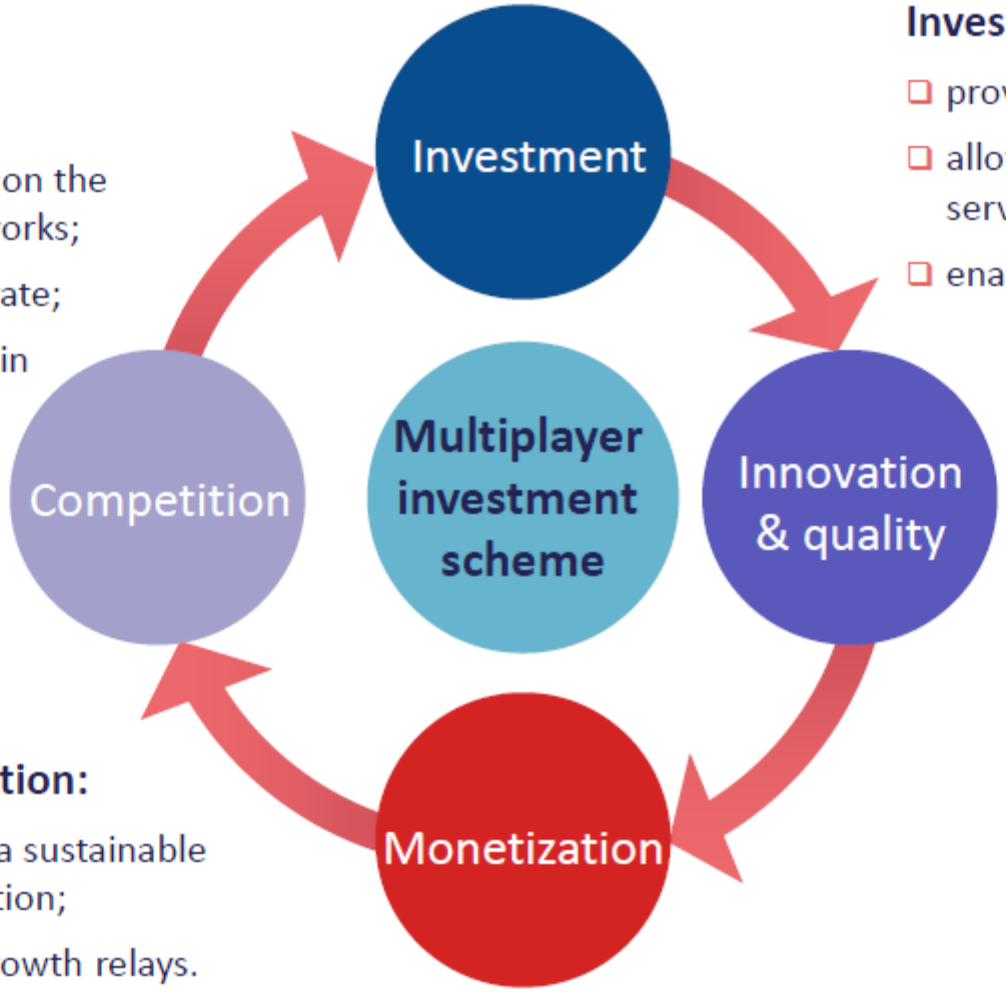
The ultimate goal : a sustainable multiplayers scheme

Investment:

- provides coverage and services;
- allows for bandwidth consuming services;
- enables innovation.

Competition:

- pressures operators on the quality of their networks;
- incentivizes to innovate;
- leads to investment in the networks.



Innovation and quality:

- improve user experience;
- allow for monetization.

Monetization:

- enables a sustainable competition;
- brings growth relays.

Spectrum issues

- Spectrum management/ harmonization
  - Availability of frequencies and technological neutrality
  - A spectrum review ; introduction of new bands and multi carrier aggregation
    - 3,5 (3.4-3.8) : core of the 5G, the 1st deployed in Europe / up to 400 Mhz blocs / for telco or specialized service providers ?
      - Currently Internal Affairs/ THD radio
    - 2,6 : Professional Mobile Radio (currently Defence)
    - 700 : Golden frequency
    - 1.4 (L band) : Supplemental down link + Pb of radio relays and Defence use
    - 26 Ghz : Pioneer band, millimeter, Width + 3Ghz . But problem with radio links and observation satellites
    - Free bands
      - around 900 MHz for IoT
      - around 5.9 GHz, for connected vehicles (ITS or Intelligent Transport Systems) and connected trains (CBTC train autopilot system, already used for example on line 1 of the Paris metro) which are very large objects.
    - Satellite connections for specific needs
  - Frequency refurbishment
  - Coverage requirements
  - How to address verticals and industrial users demand

- the impacts of the multiplication and transformation of numerous small cells
  - Regulation, mutualization, investments and roll out...
  - Street furniture access
  - Sharing of physical infrastructure among multiple providers
    - Need to change network sharing guidelines?
    - Sharing everywhere or in town ,
    - Roaming and coverage
  - The backhaul
    - How much does it cost and who pays
- Timeframe
  - 2018 : year of the pilots
  - 2019-2020 : allotments of frequencies
  - Frequency release and refurbishment
  - Allocation

Economic challenges

- Financing infrastructure investments
  - Avoiding the winner takes all and first mover advantage
  - Who will pay? Operator / transport operators / civil engineering or road infrastructure ?
- Value sharing
  - Data monetization
  - Customer control
- A form of paradox
  - Commoditization risk
    - « Neutral small cell as a service" ?
    - Wholesale operators ?
  - Emergence of intermediaries, platforms, consortia to capture value
    - Who will capture value: manufacturers, telcos, OTT, service providers
    - Competition between different ecosystems
- Pricing models to be designed
  - applied to micro communications

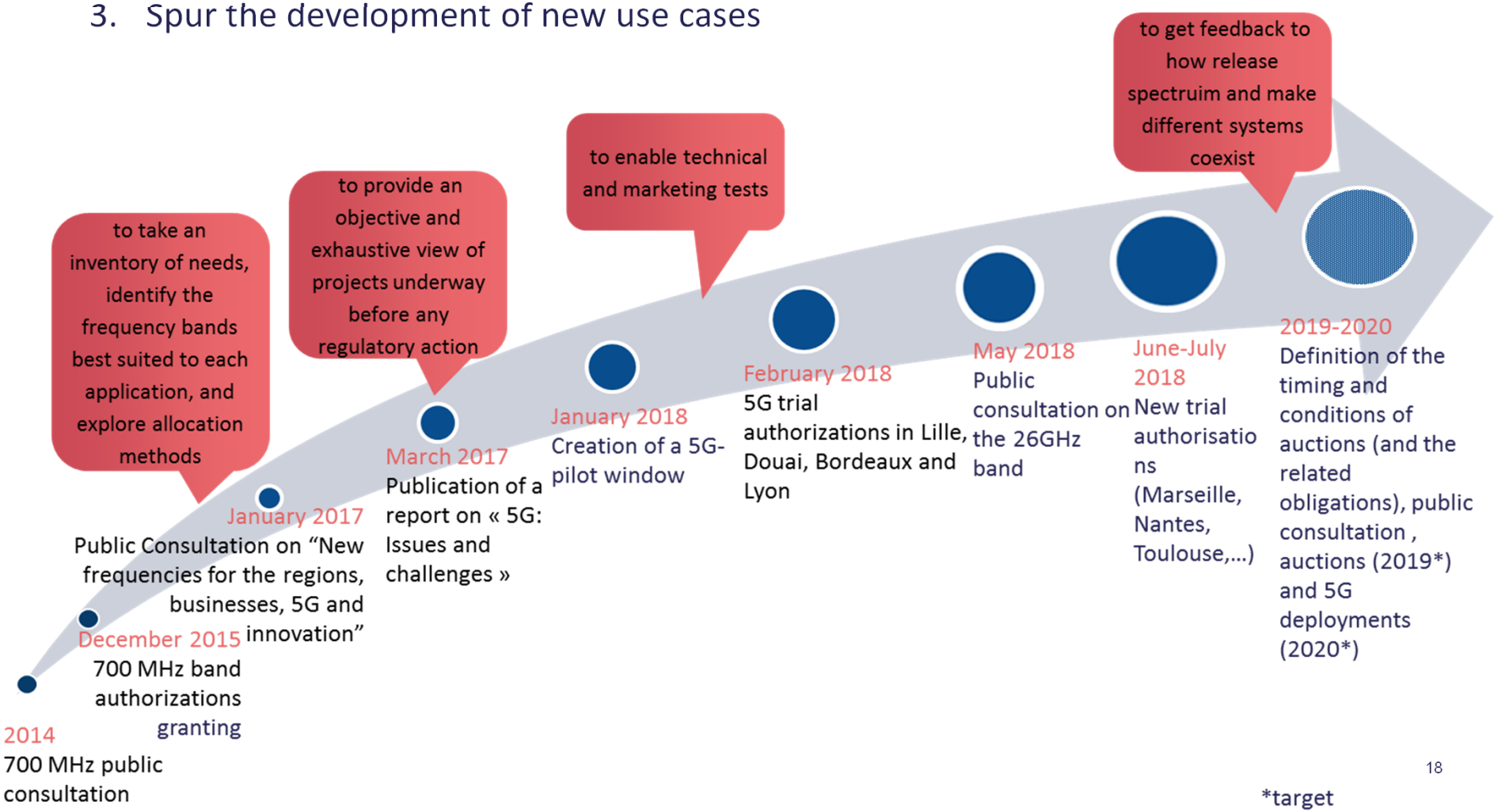
Other regulatory challenges

- Data-based regulation and control
  - Coverage
  - Variability of QoS (latency, energy, flow, symmetry)
- Net neutrality (network/service link, traffic differentiation)
  - "network slicing", used in future 5G deployments, a priori to comply with BEREC recommendations.
  - The subject of net neutrality applied to future 5G networks is still open:
    - new analyses to be carried out, in parallel with the 5G definition.
- Specific scopes of intervention
  - Infrastructure economics v. Data economics
  - Privacy
  - Social acceptance of waves
    - Anses, same framework for wave exposure

Arcep's spectrum work on 5G since 2014

Action plan:

1. Release and allocate spectrum
2. Support the improvement and simplifications of the rollout conditions
3. Spur the development of new use cases



*target

Thank you for your attention

Pierre-Jean BENGHOZI

Arcep Board member

pierre-jean.benghozi@arcep.fr