



Regulation Development on Licensed Shared access and TV white Spaces

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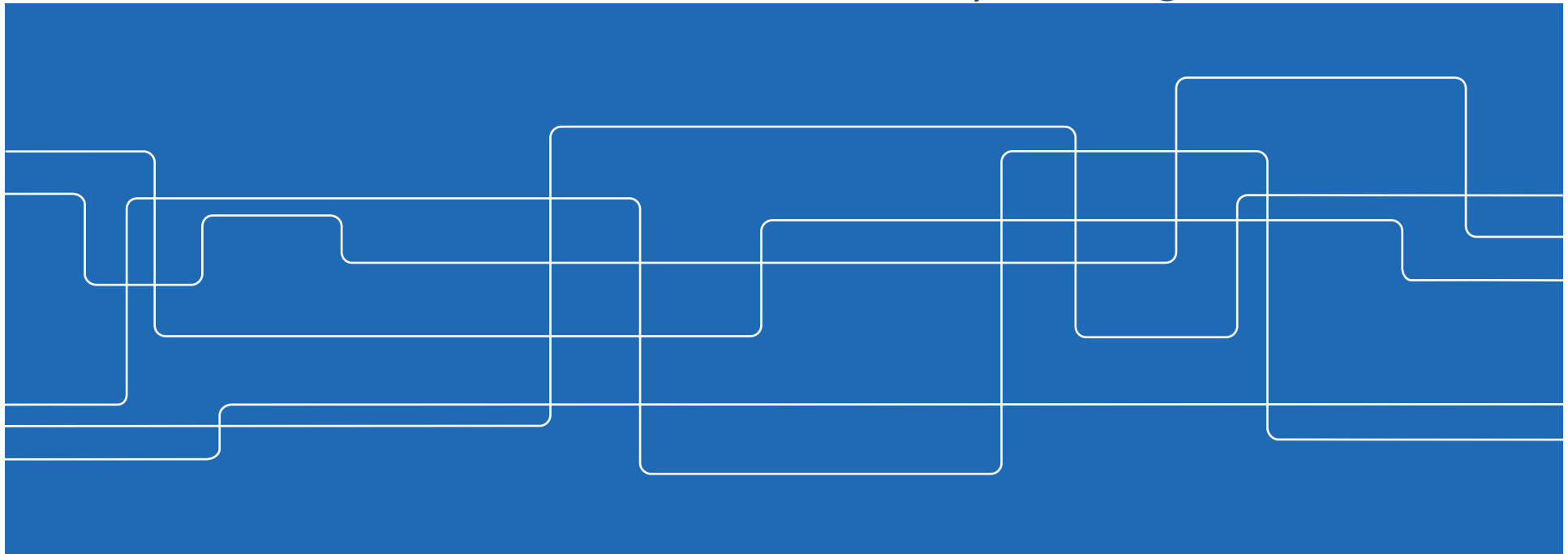
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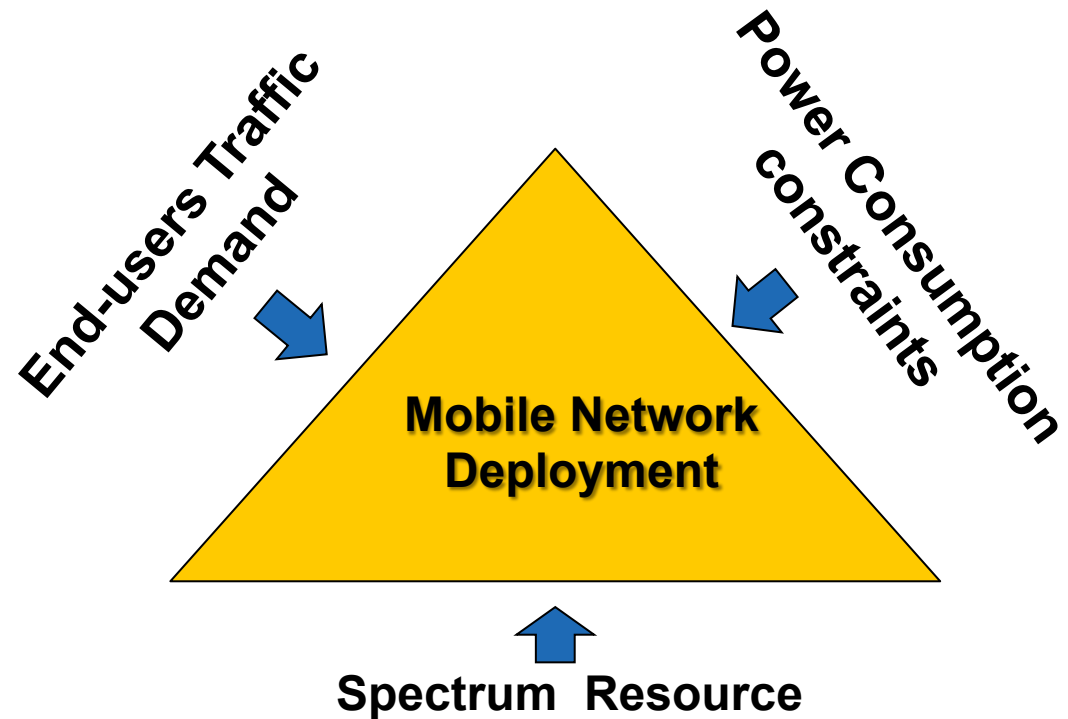


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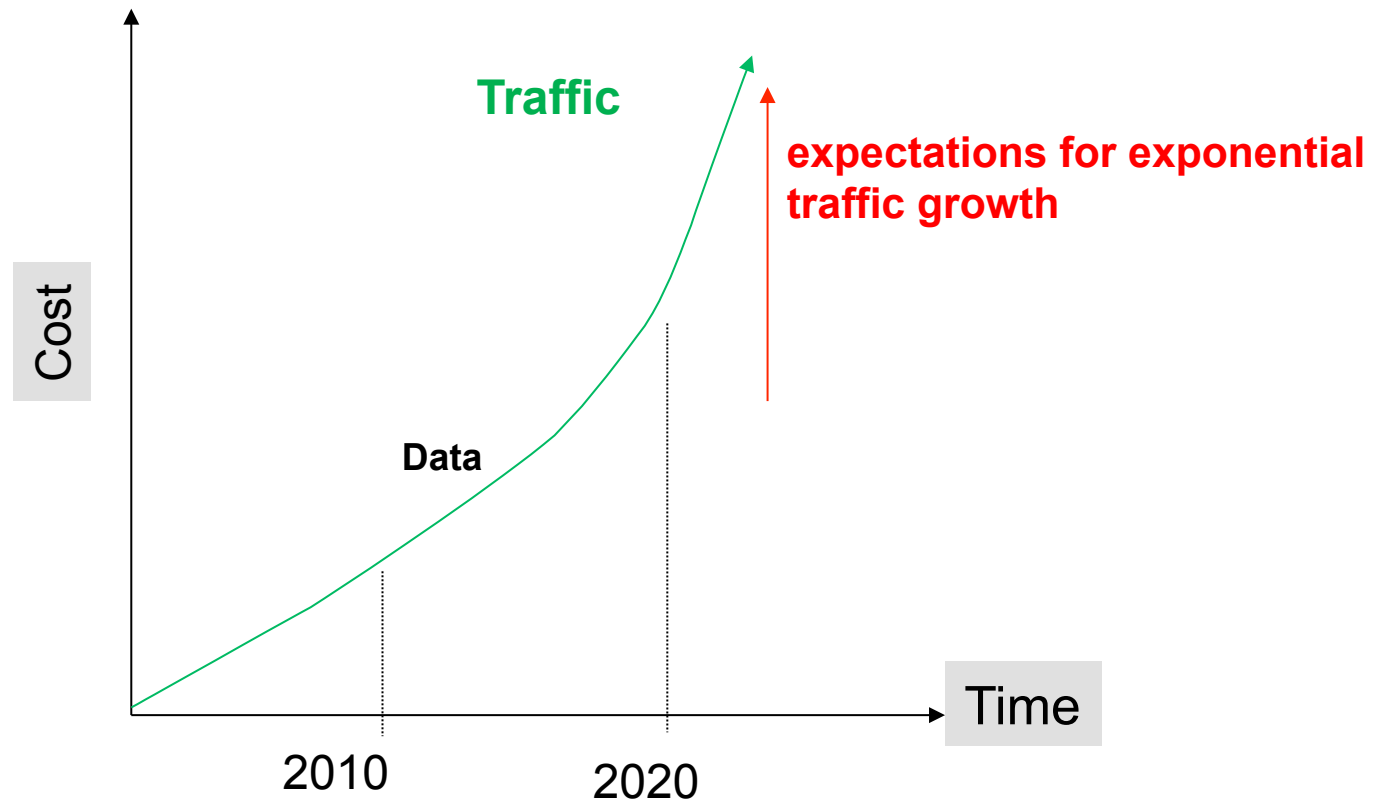
- Motivation and Background
- Research Questions
- Regulation Development on TVWS and LSA
- Impacts of regulatory choices on telecom ecosystem
- Conclusion



Demand, Spectrum Shortage, Cost and Power Consumption

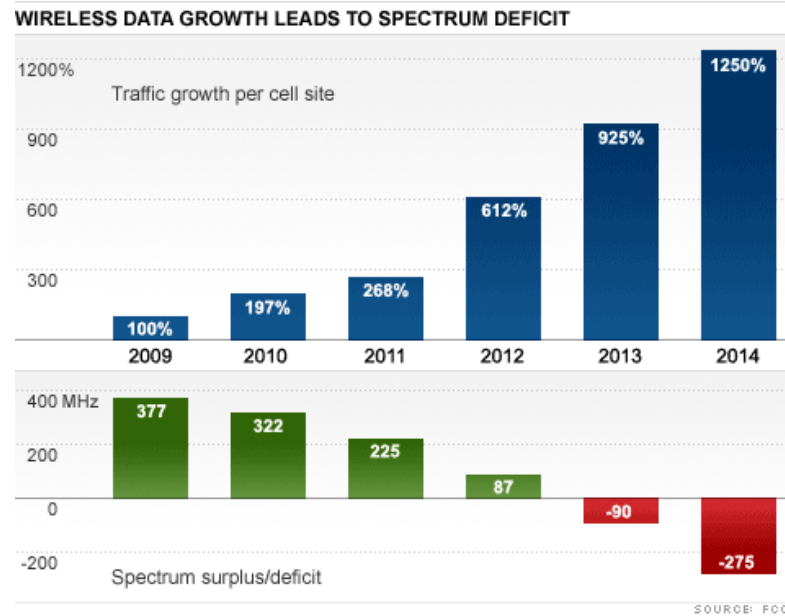


Demand Trend

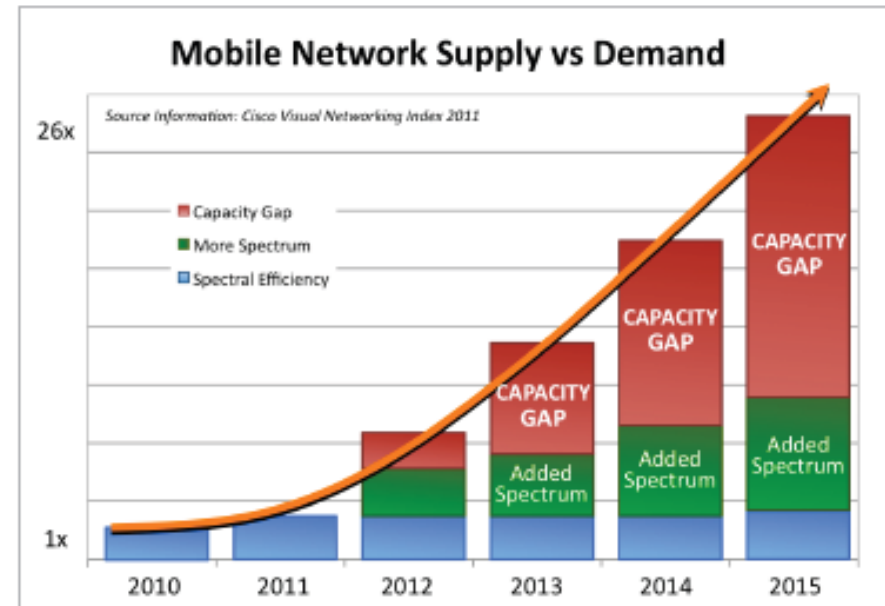




Spectrum Shortage



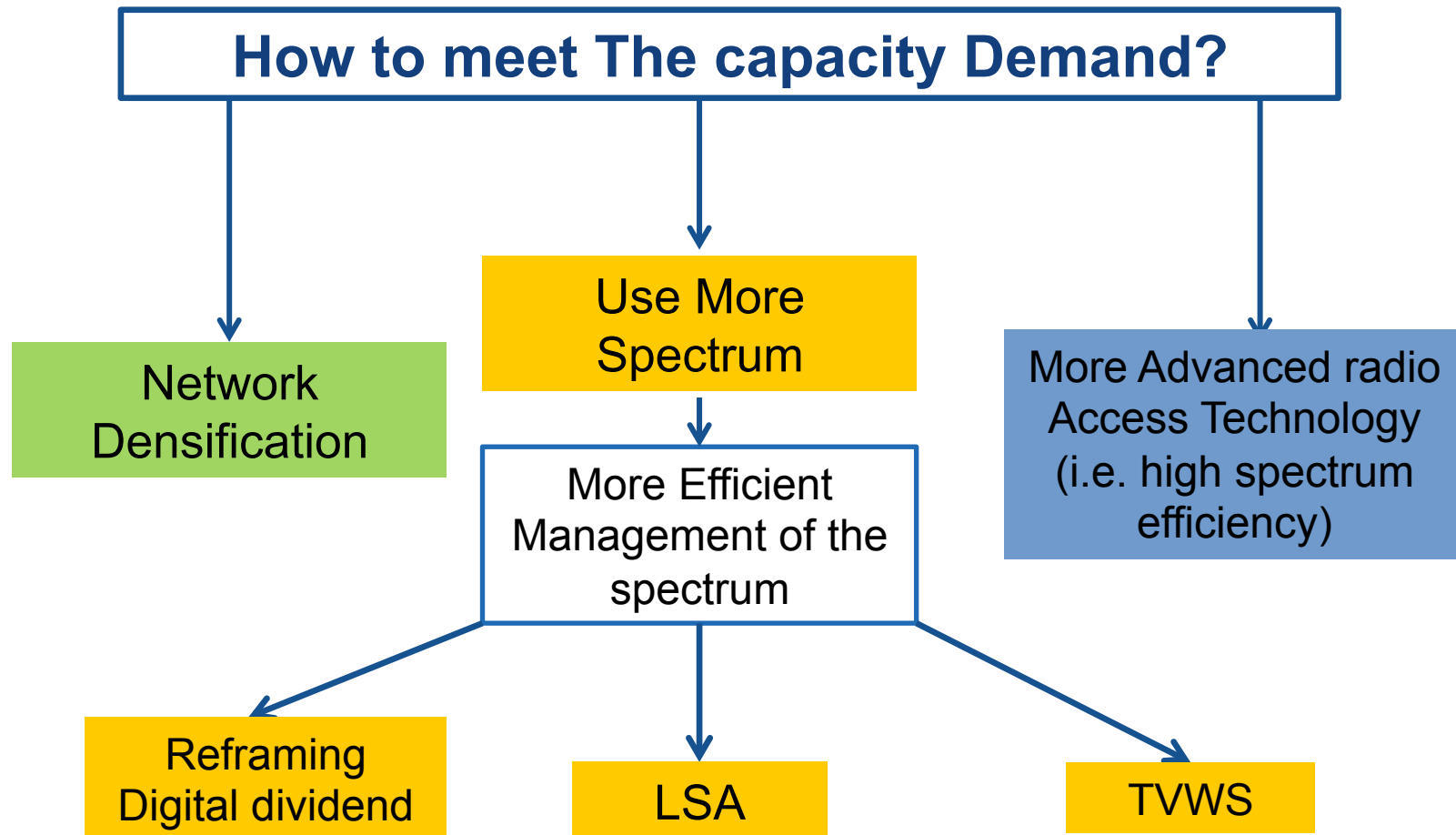
Source: FCC



Source: Cisco

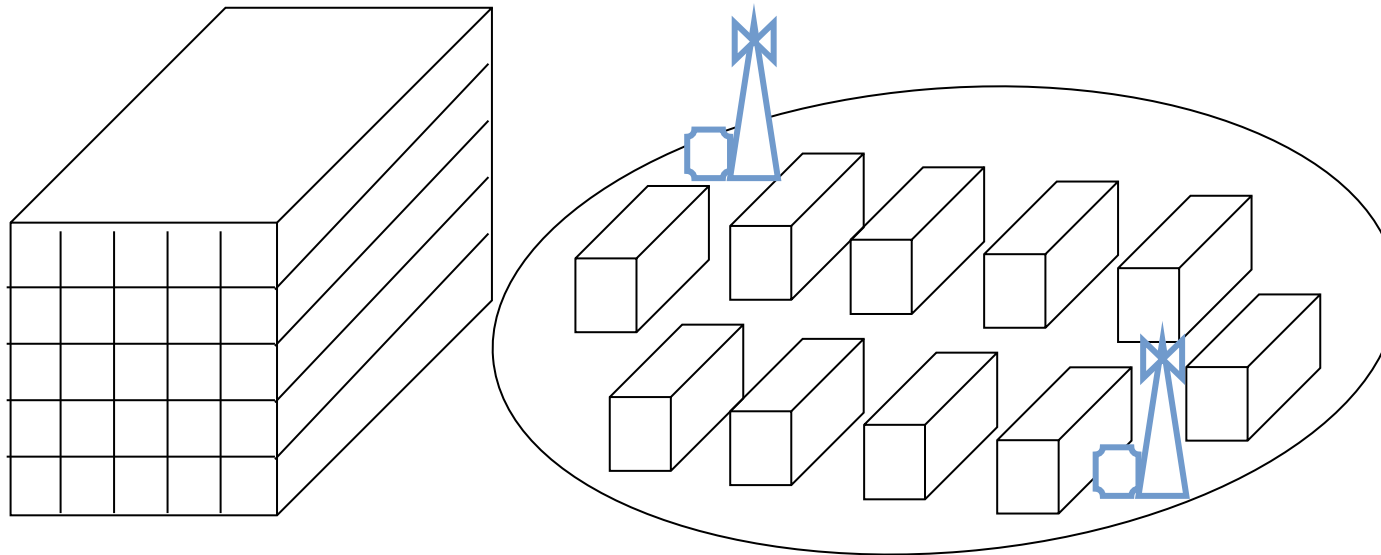


How to Increase the Mobile Network Capacity?



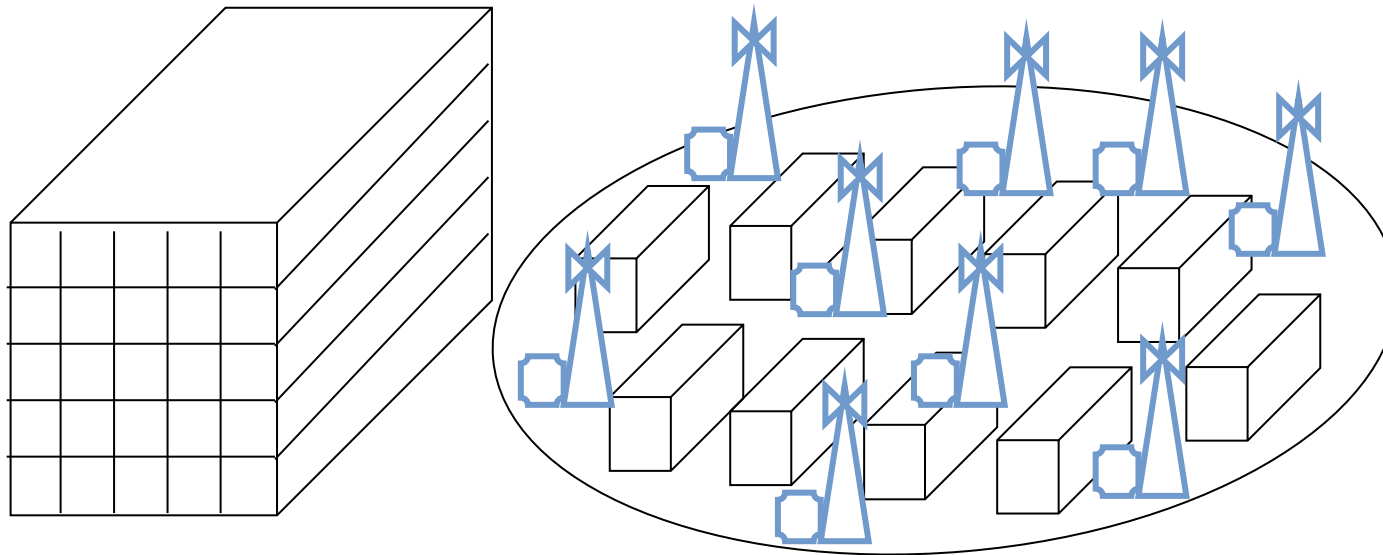
Deployment Scenario (1/2)

Abundant Spectrum Resources



Deployment Scenario (2/2)

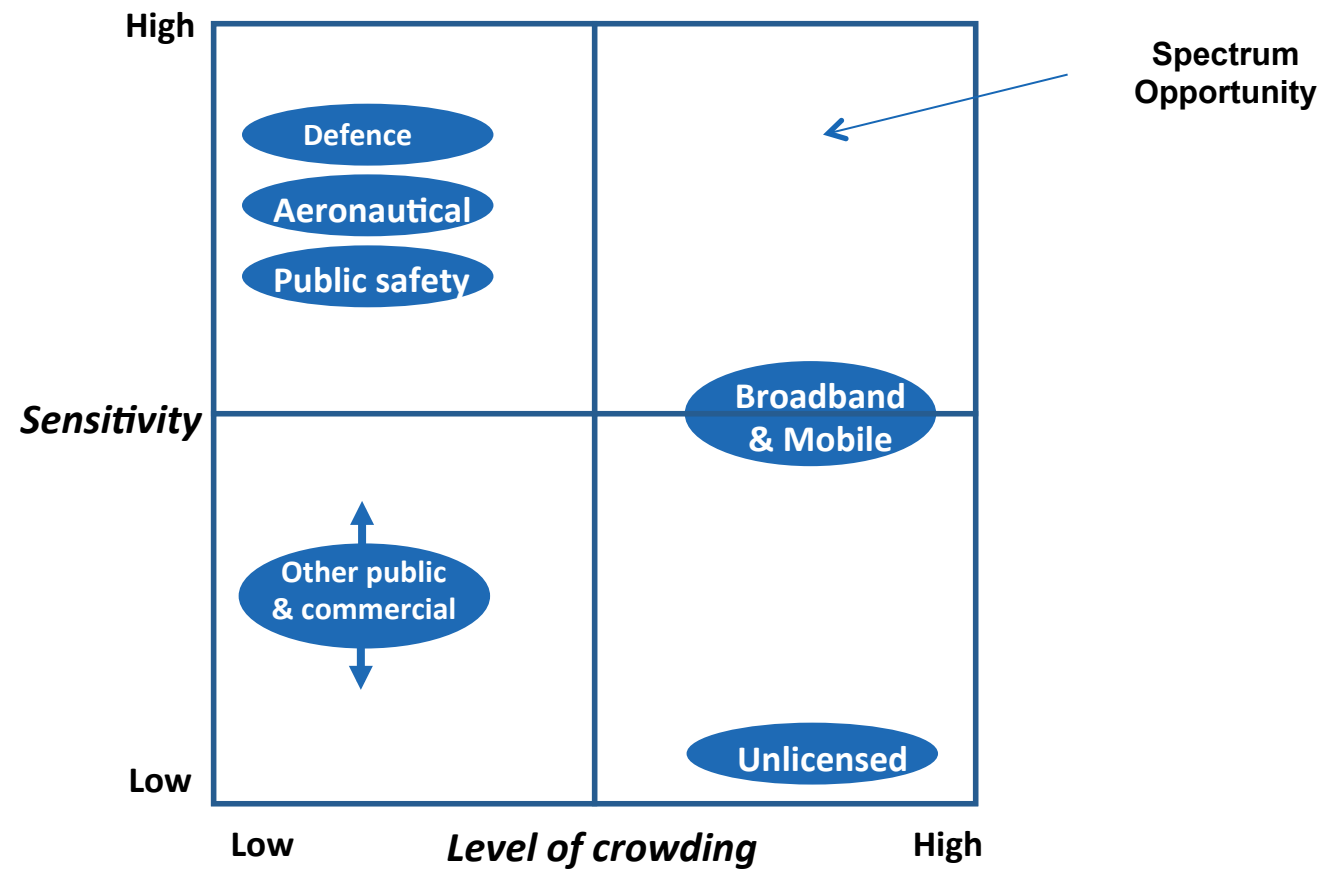
Shortage on the Spectrum Resources



How dense we can go ?

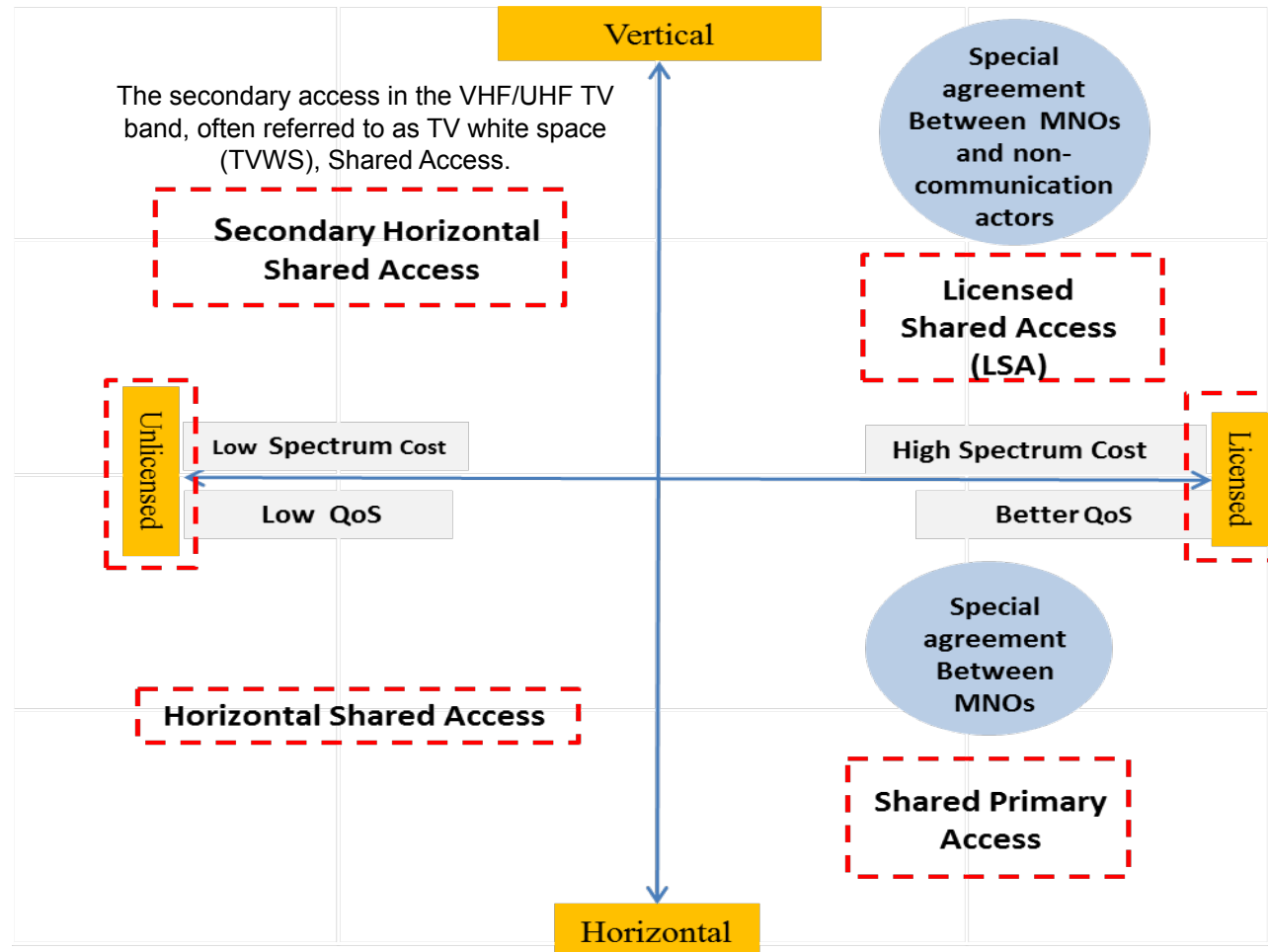


Radio Spectrum is not Efficiently Utilized !



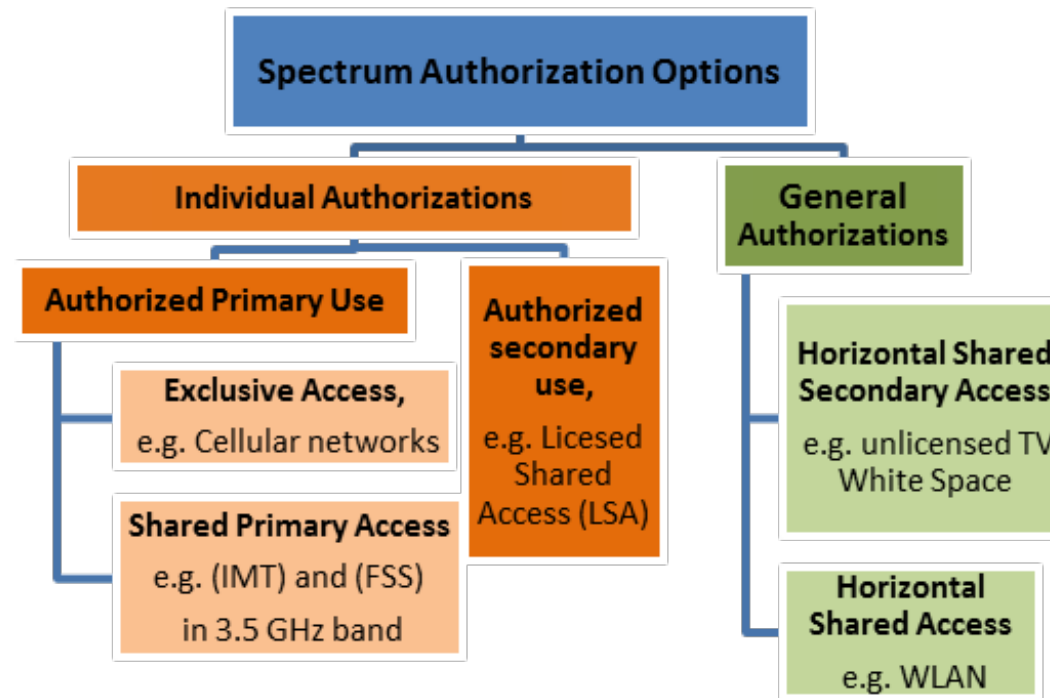
Source :An evolutionary spectrum authorisation scheme for sustainable economic growth and consumer benefit, Presentation at the WG FM – 17th May 2011

Traditional And Emerging Spectrum Access Options





Possible New Spectrum Resources, where to find it?



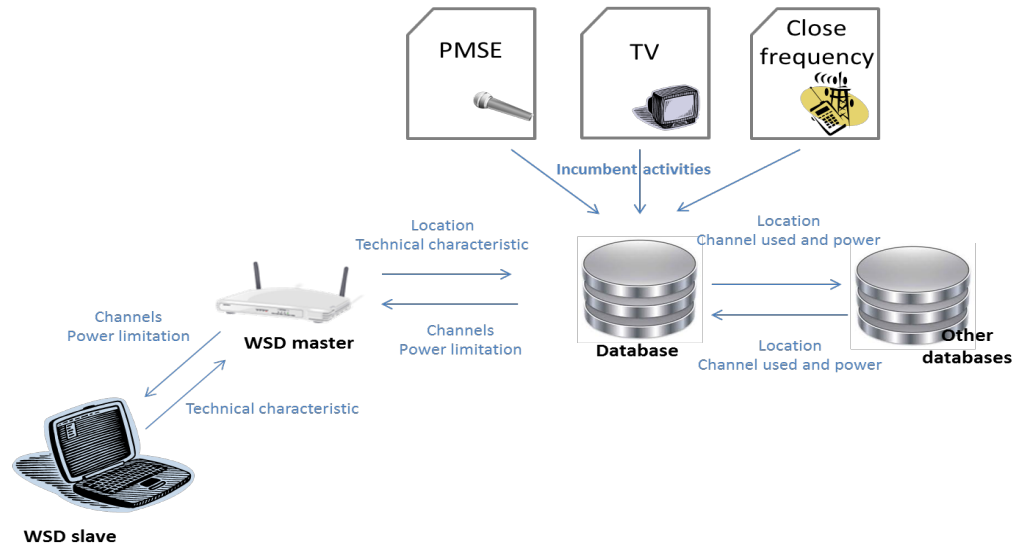
800 MHz	900 MHz	1800 MHz	2.1 GHz
Licensed IMT/ IMT-A Bands (in Sweden 5 MHz block is unlicensed in 1.8 GHz)			
2.3 GHz	2.4 GHz	2.6 GHz	3.6 GHz
LSA (Military Band)	Unlicensed Band (Wi-Fi)	Licensed IMT Bands	
3.8 GHz		5 GHz	
LSA with in Satellite Bands		Unlicensed Band (Wi-Fi)	



Emerging Access Options: What is TV White Space (TVWS)?

- TV White Spaces (TVWS) are vacant frequencies made available for unlicensed use at locations where spectrum is not being used by licensed services in broadcasting spectrum band.
- In TVWS's models, the secondary users are allowed to access the spectrum so long as they do not cause interference to the primary licensee.

Possible (TVWS) implementation



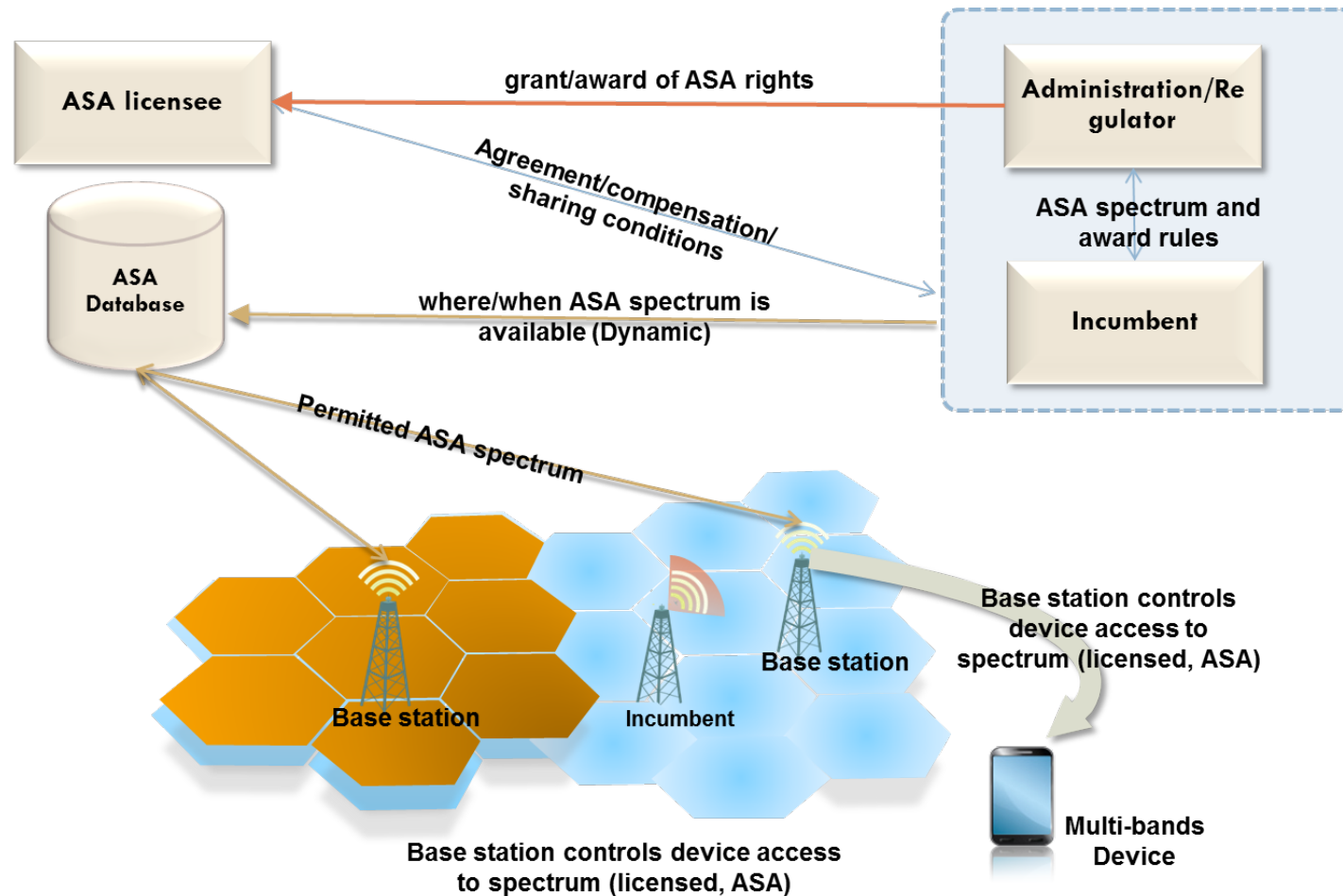
- Even though there are some differences in the way to implement the incumbent protection system, almost all regulators chose the geographical data base system.
- A database is informed on a regular basis of the frequencies used by the incumbents (TV broadcasters, PMSE, adjacent users) for each geographical position.



What is Authorized/ Licensed Share Access (ASA/LSA)?

- Authorized Shared Access (ASA), Licensed Shared Access (LSA), or Priority Access (PA) is a novel spectrum sharing approach that is being discussed in regulatory, industry, and standards forums in the U.S., Europe, and elsewhere
 - Under the ASA/LSA/PA regime, spectrum rights are granted to licensees subject to the terms defined by the relevant authority (government, regulator) and in addition to compensation paid to existing incumbent users (agreement with incumbent is required).
 - Based on the reached agreement, both the incumbent and ASA/LSA/PA licensee should have interference-protected access rights to the spectrum (QoS).

Possible (ASA/LSA) implementation



Source :An evolutionary spectrum authorisation scheme for sustainable economic growth and consumer benefit, Presentation at the WG FM – 17th May 2011



Research Questions

RQ1: How the regulation on TVWS and LSA is developing in different countries?

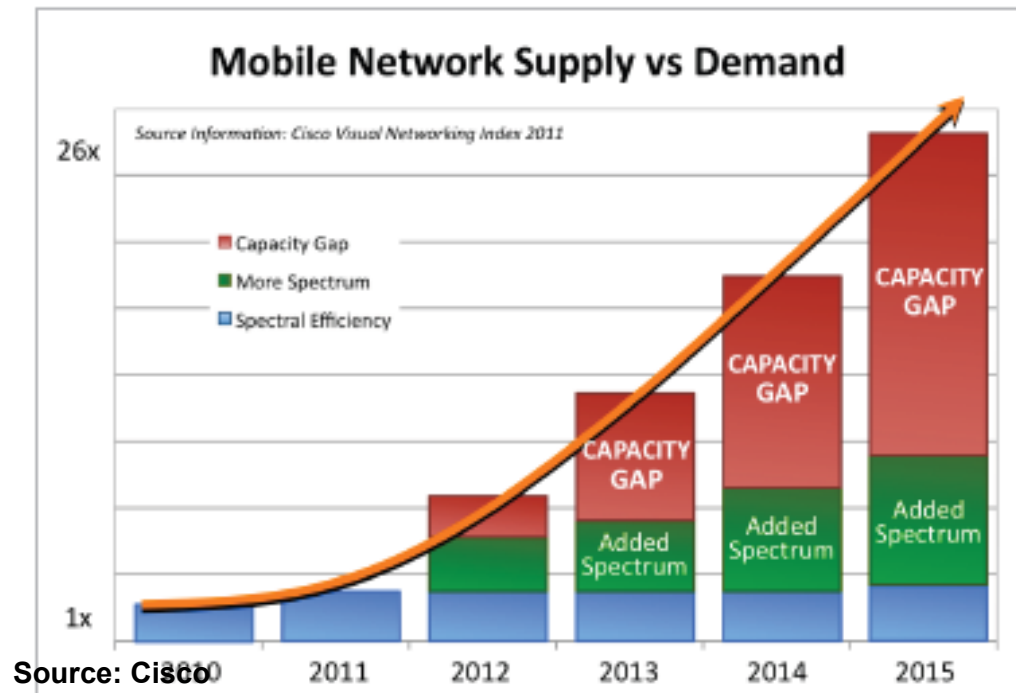
RQ2: How the regulatory choices on TVWS and LSA could affect the telecom ecosystem?



Regulation Development on TVWS and LSA



Reframing: A case From the Broadcasting Spectrum



- ITU in year 2007 (WRC-07), has already allocate the upper part of the UHF band (790–862 MHz)
- Furthermore the WRC-12 concluded with a decision to create a new mobile allocation in the band 694-790 MHz (Subject to final decision in 2015).



LSA Regulation Trend

International regulation:

- A common understanding
- On the agenda of ITU WR15

Regional regulations:

- EU actively developing it
- US considering it

Technical side:

- Standardization is an on-going process

Incumbents:

- Incentive will enable LSA development

Demand side:

- LSA is not the first choice, but is considered since it ensures QoS



LSA Regulation Trends : A Technical viewpoint

Databases:

- Provided standardization, databases could be used for any band
- Already developed for TVWS

Frequency Bands:

- **2.3GHz:** (European band for LSA)
 - Already used in Asia for LTE-TDD
 - T-mobile US will launch LTE-TDD with aggregation in this band
- **3.5GHz:** (US band for LSA)
 - ZTE converts WiMax antennas into LTE-TDD antennas
 - WiMax manufacturers make their antennas compatible with LTE-TDD
 - The UK intends to release 150MHz in that band for LTE-TDD

Handset:

- **2.3GHz:**
 - As of July 2013, 137 TD-LTE commercial devices support use in the 2300 MHz, but do not support 2G/3G in Europe (Asian product)
 - Only iPhone 5C/5S support LTE-TDD and European 2G/3G
- **3.5GHz:**
 - No handset on the market



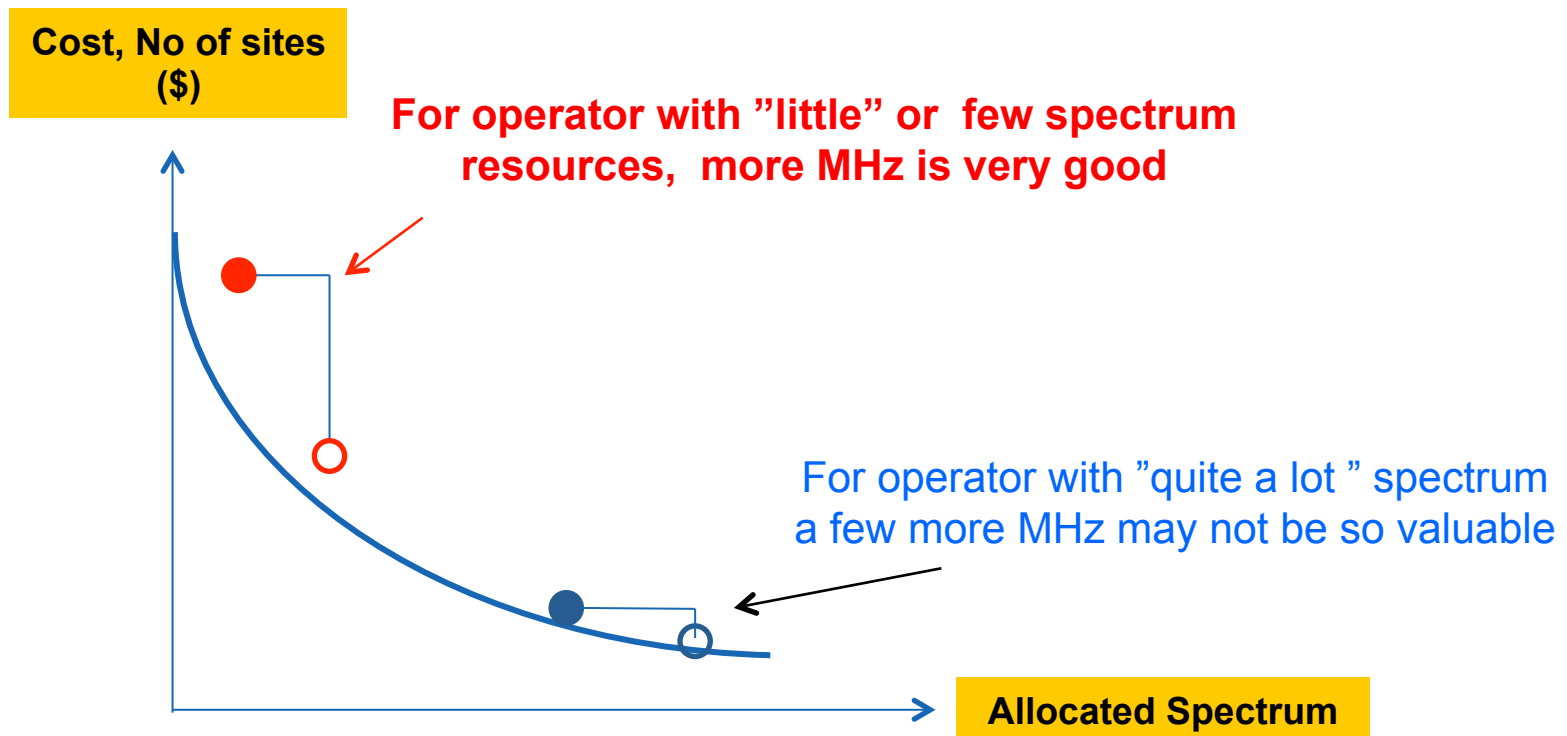
LSA Regulation Trends : Incumbent's viewpoint

- The Ministry of Defense in the UK should pay for the use of their bandwidth (annual fee: £155 millions – 0,5% of their budget)
 - In 2013, it release 140MHz. (reframing)
 - Once reframing every possible bandwidth, LSA will become a suitable option.
- MNOs, NEMs (e.g. Ericsson) are in favor of reframing. If not possible LSA is a good solution.

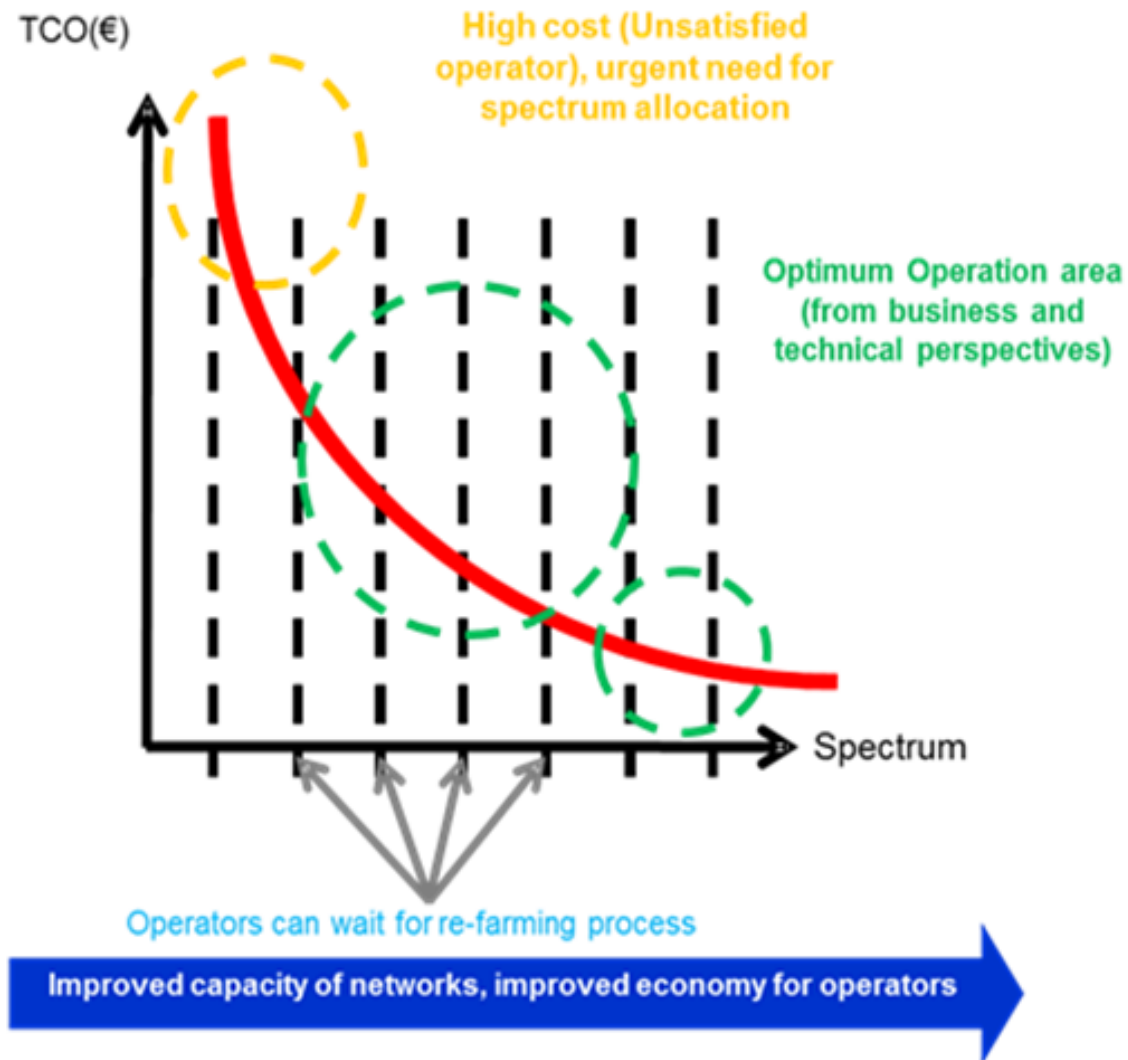


Spectrum Value (From Traditional MNO Perspective)

- Taking into account the anticipated upgrade cost.
- Operators with limited spectrum resources has more incentive to look for new spectrum access options (such as LSA, TVWS).



Spectrum Value (From Traditional MNO Perspective)





Understanding the TVWS and LSA Adoption Trends

Licensed Shared Access

Regulatory



- **The US** is about to authorize LSA in the **3.5GHz band (100MHz)**
- **The EU** is about to authorize LSA in the **2.3GHz band (100MHz)**

Uses

- Exmample ofPotentiel use: 4G small cells

Development

- Only one test has been lead so far. It was in Finland last year.

TV white spaces

- TV frequencies: 700MHz.
- Uncertainty on the balancing between TVWS and reframing
- Standardization of the data transmission protocol.
- M2M, Internet of Things (IoT), rural connectivity, urban hot spot, backhaul, location based services...
- Tests have been led in the UK, the US or Africa.
- Commercialization: rural connectivity (the UK) and M2M in a remote area in the US.



Conclusion: Common issues for LSA and TVWS

- Differences in technical implementation might lead to the development of different sub-technologies and standards



- Endanger economy of scale and render investment less profitable.

- Few estimates of the spectrum available for TVWS or LSA and there are no schedules associated.



- might impede investment in these technologies.





Conclusion: Some issues for TVWS

- The largest uncertainty for TVWS is the regulator's position on frequencies space freed up in the TV-band. Two options

TVWS is widely authorized



Economy of scale



make TVWS technologies attractive.

some TV-band are reframed



TV broadcasting is concentrated on a narrower band



make TVWS technologies less attractive.





Conclusion: Some issues for LSA

Main challenge for LSA is to make first user share their frequencies.

Potential solutions:

- 1. Develop LSA awareness**, assure first users of the technology reliabilities and present them opportunities in sharing.
- 2. Create Incentives, the British example** Ofcom make the Ministry of Defence pay fees for its uses of spectrum. Thus, the first thing that the Army did was to free up some frequencies and ask Ofcom to sell them. We can easily imagine that the second move will be to set up LSA agreement to offset the annual fees.



Thanks ..