INSTITUTO FEDERAL DE TELECOMUNICACIONES

Canadian Spectrum Summit 2017

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Mexico(s)

- 120 million people in 32 States
- Mexico City with 22 million people
- Low density states in places such as Baja California Sur with 637, 026 inhabitants
- Telecom GDP grew 4 times more than national GDP

Source: INEGI, 2014 National Survey of Households Income and Expenditure

Mexicos

- **22% Rural population scattered in more than 185,000 locations**
- **Significant socio-economic inequalities: on average urban households have income 7.6 times larger than rural households**
- **61% mobile broadband penetration nationally**

Source: INEGI, 2014 National Survey of Households Income and Expenditure

Some thoughts about Spectrum

- **Spectrum is a scarce, public resource, an essential facility to digital economy, yet it is a means not a goal.**

- **How do we improve the lives, productivity, equality of Mexican people and boost the digital economy, maximizing social welfare and competition through efficient spectrum policy?**

- **Should we still look at spectrum as a parcel (Noam 95) or can we start looking at it as a platform that can be shared? or both?**

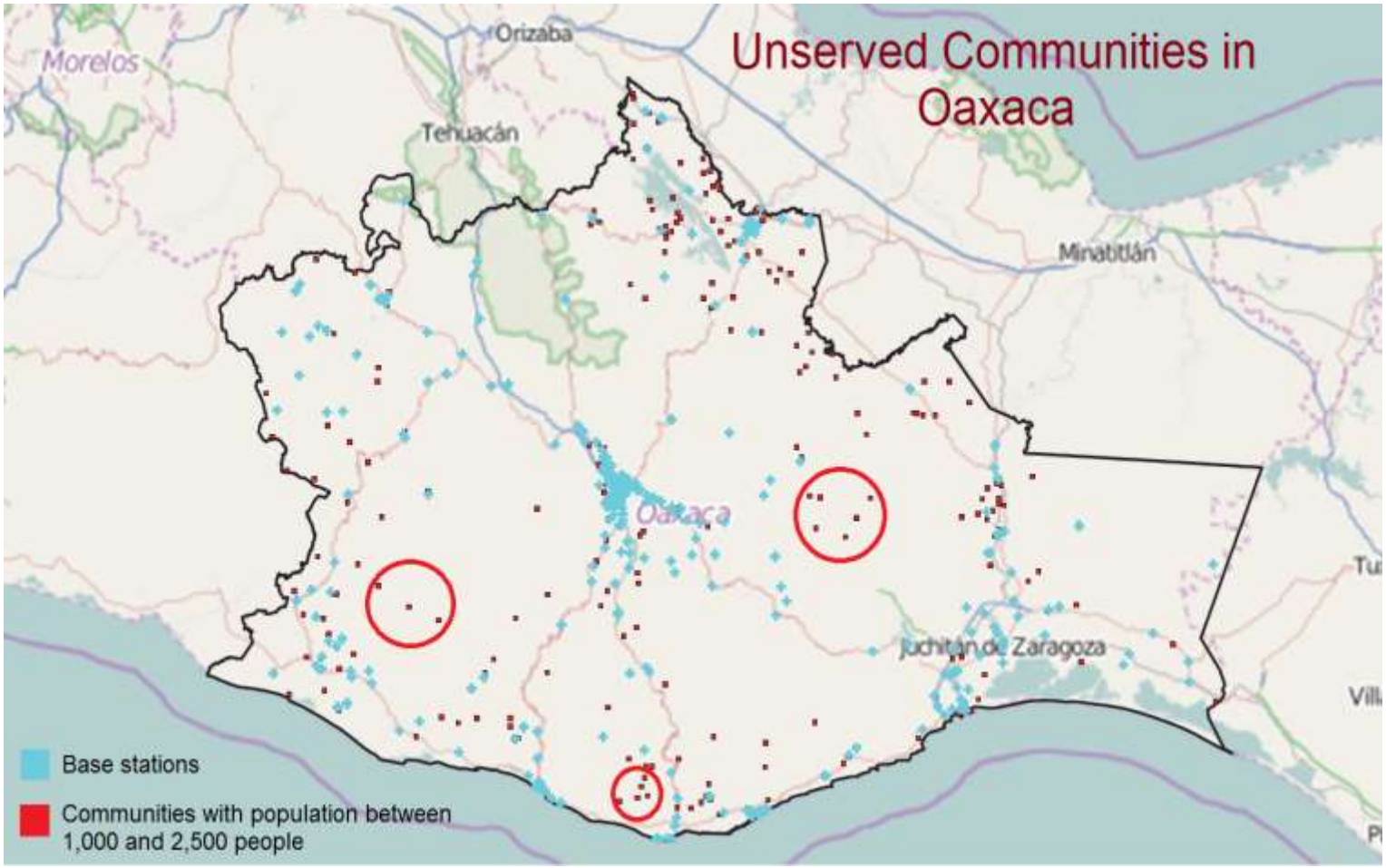
- **When is it better to grant exclusive licenses vs. shared or unlicensed? Secondary use is allowed under new Act.**
- **Is avoiding interference the only reason for exclusive licensing?**

Principles about Spectrum under Mexican law

- **There are commercial, public, private and social (community and indigenous) uses of spectrum.**
- **Commercial and private licenses on a primary basis must be assigned through a bidding process. 20 yr licenses.**
- **IFT annually publishes a radiofrequencies licensing program for all uses based on petitions & availability.**
- **Public and social licenses are granted based on availability, merits of the proposal, etc. Federal government has preference over state entities for spectrum, it does pay fees.**
- **Public and social don't pay for license but annual fees for use except in broadcasting**
- **Experimental, amateur radio although private use, is not allocated thru bids.**
- **Winner of a bidding procedure is not determined exclusively by highest bid, other non-monetary criteria apply too.**

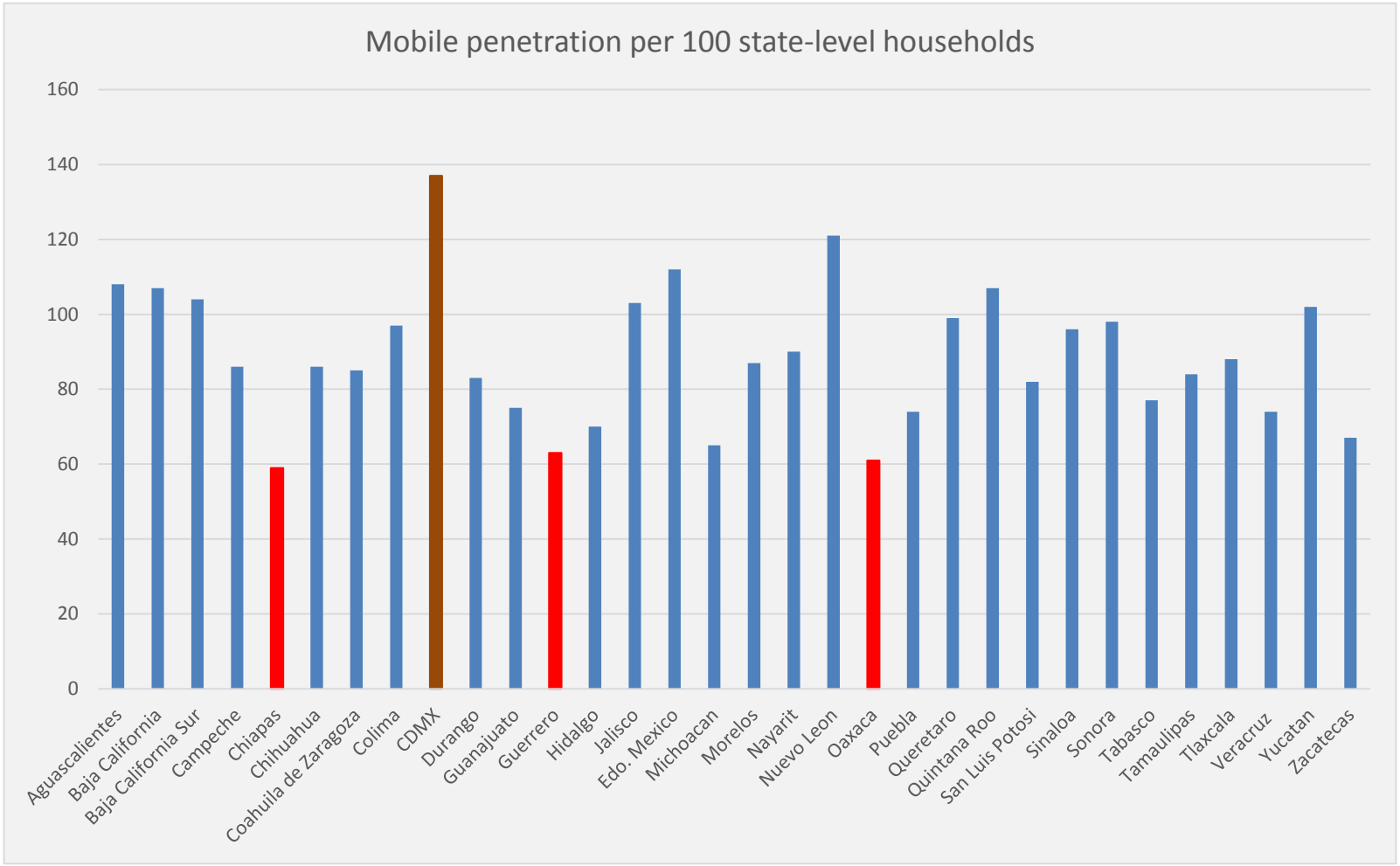
Unserved locations and population

In Mexico there are unserved regions due to market failure perhaps? But 3 operators have national licenses



Source: IFT

Unserved locations and population



Source IFT: https://bit.ift.org.mx/

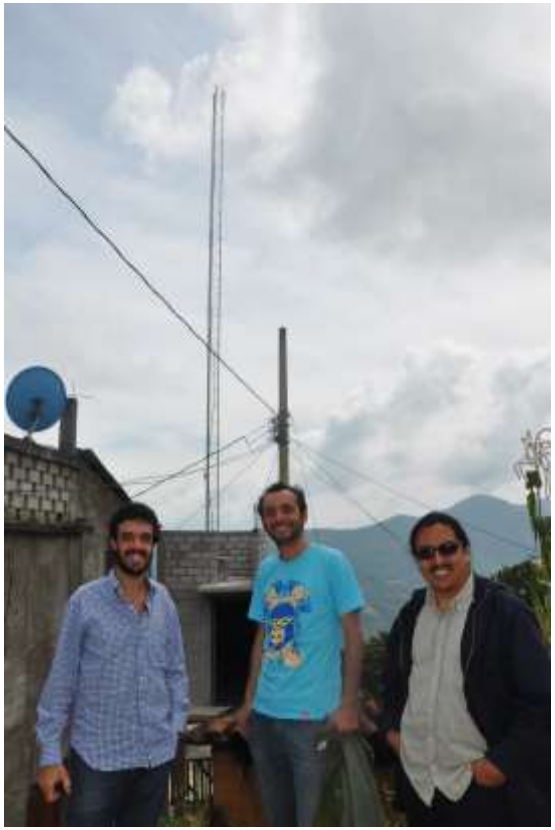
NOT ALL LICENSES ARE COMMERCIAL: SOCIAL LICENSES

First rural wireless access license

Telecomunicaciones Indígenas Comunitarias:

- Software Defined Radio technology
- GSM network
- Frequency band: 847 – 849/892 – 894 MHz (GSM)
- Carrier of: 2 + 2 MHz
- Current operation in 22 rural communities in Oaxaca
- Average of 3000 users
- COMMUNITY OWNED

NOT ALL LICENSES ARE COMMERCIAL: SOCIAL LICENSES



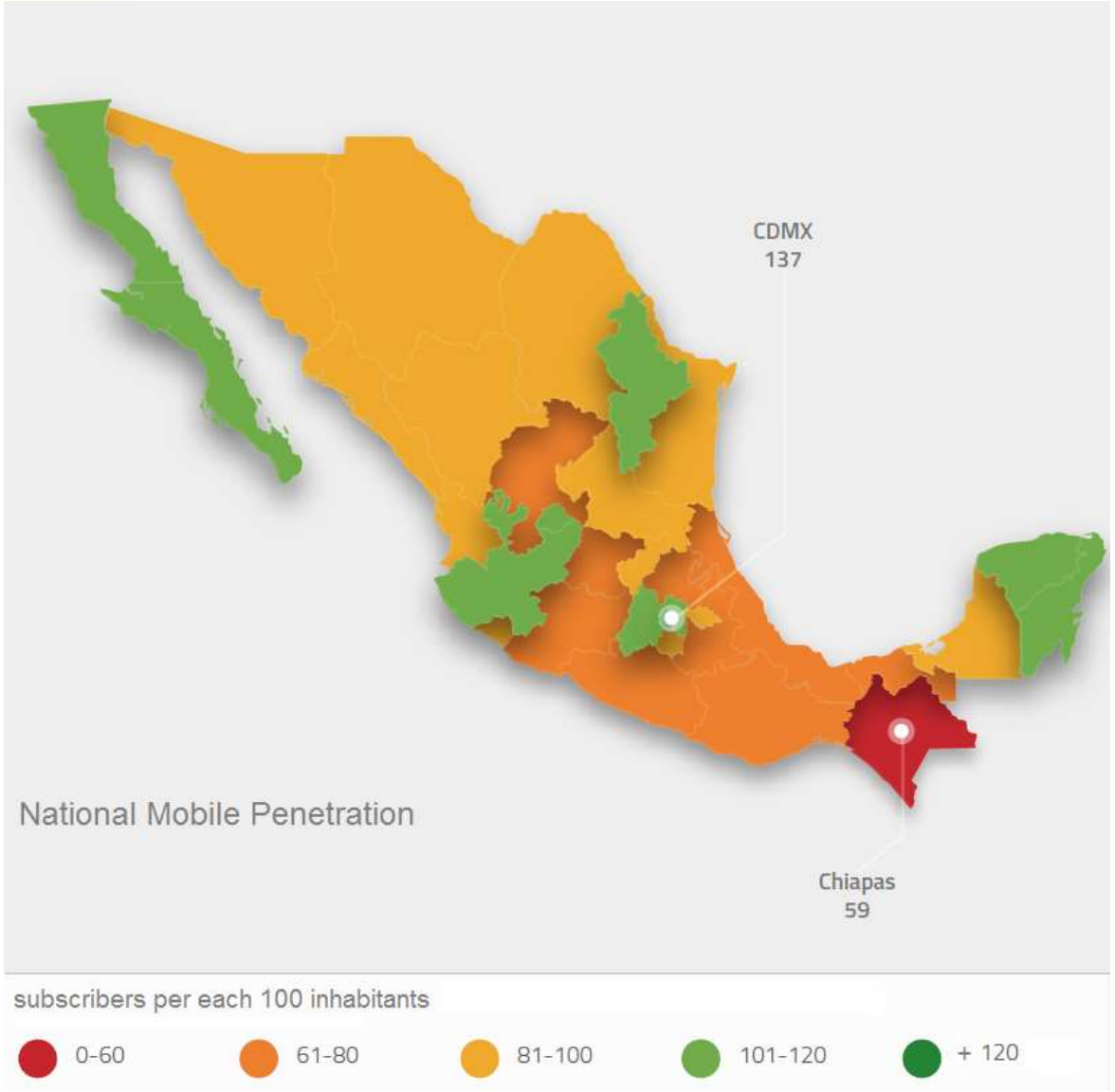
Want wireless? Prepare the Fiber.

- 50% of the population live in areas where there is more than one fibre optic network
- Fibre to the Home (FTTH) represents 16.09% of the total broadband subscriptions.
- National fibre optic of around 19,457 km
- FTTH subscriptions have grown 159.5% from 2014 to 2016
- INCREASING internet wireless access networks have emerged on unlicensed frequencies 2.4 and 5 GHz
- xDSL subscriptions have decreased 28.5% from 2014 to 2016

Source: IFT and CFE: http://www.cfe.gob.mx/inversionistas/SiteCollectionDocuments/PlandeNegocios.pdf

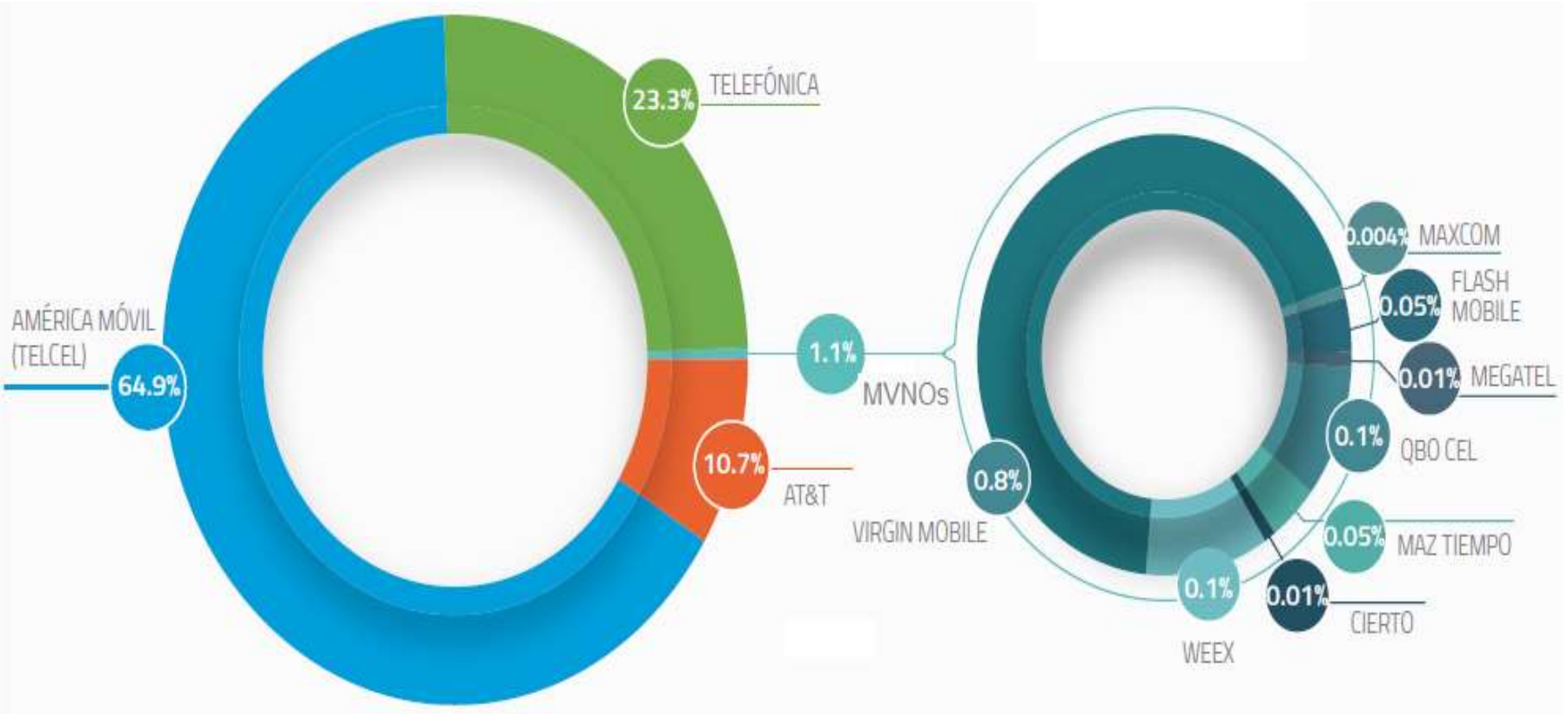
National mobile penetration

- 111.7 millions SIMS
- 91 /100 people
- 74.5 millions BB subscriptions
- 61 mobile broadband/ 100 people



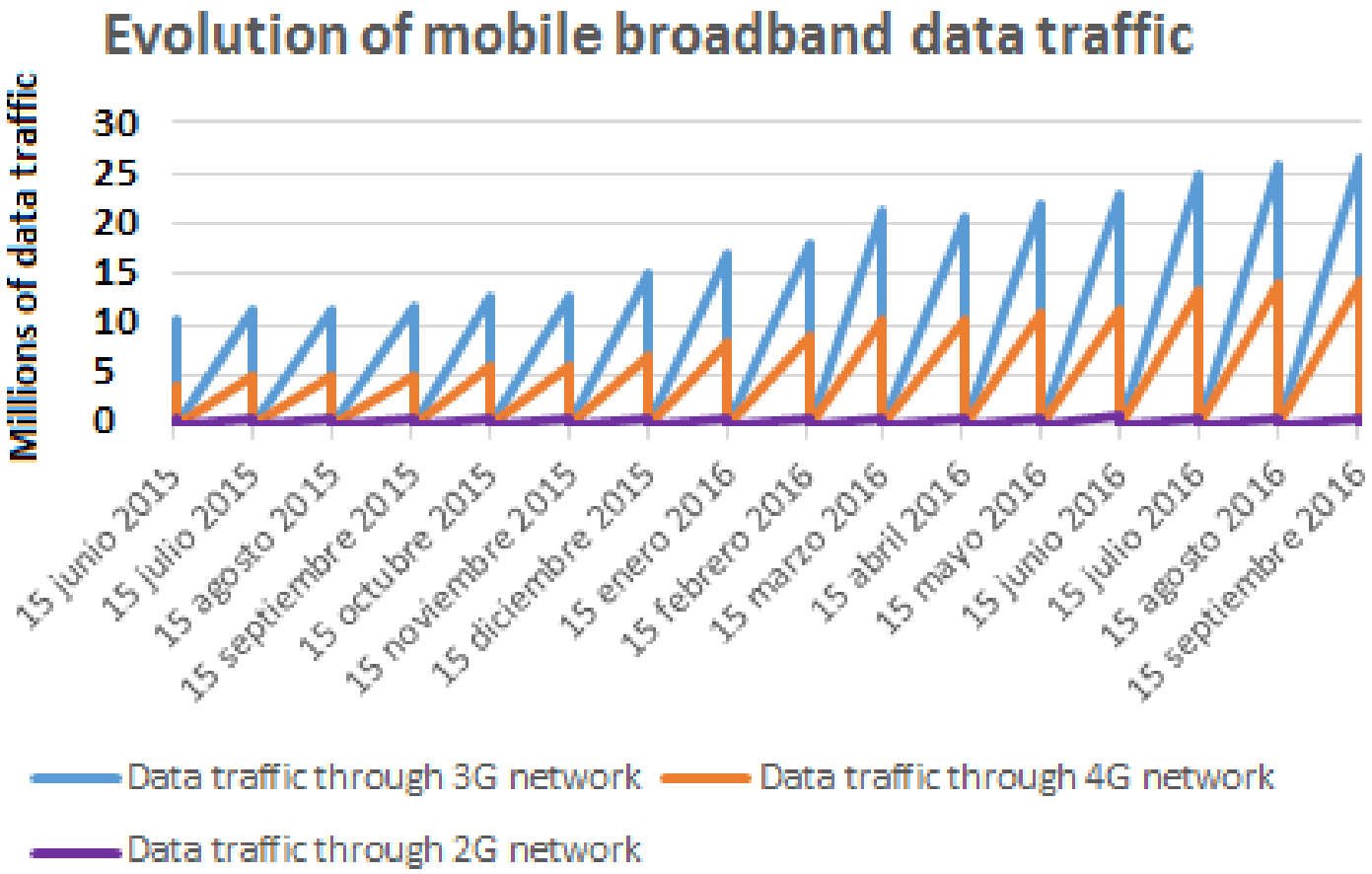
Source IFT: https://bit.ift.org.mx/

Mobile market share/ carrier (4th trimester 2016)



Source IFT: https://bit.ift.org.mx/

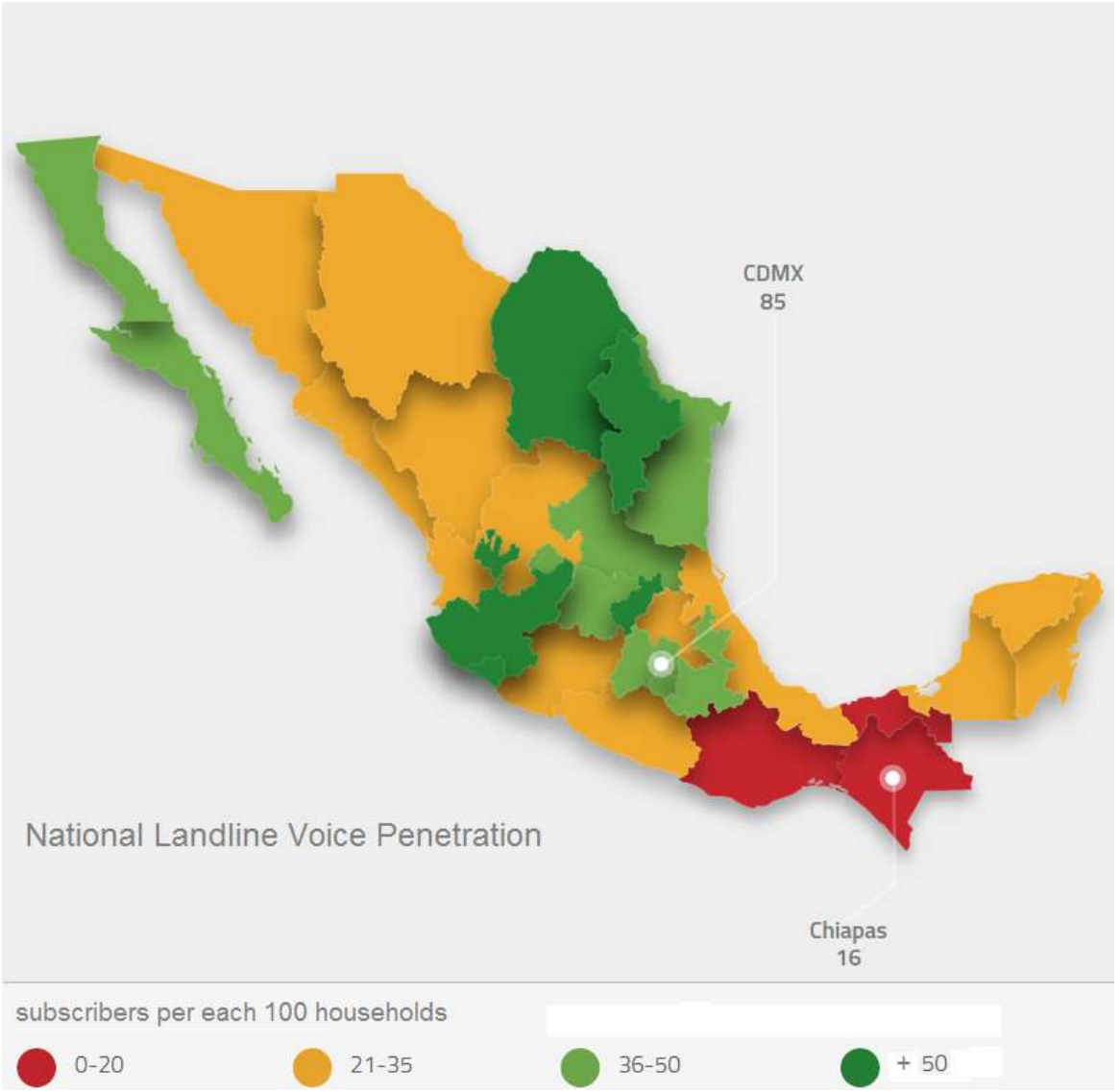
National mobile traffic evolution



Source IFT: https://bit.ift.org.mx/

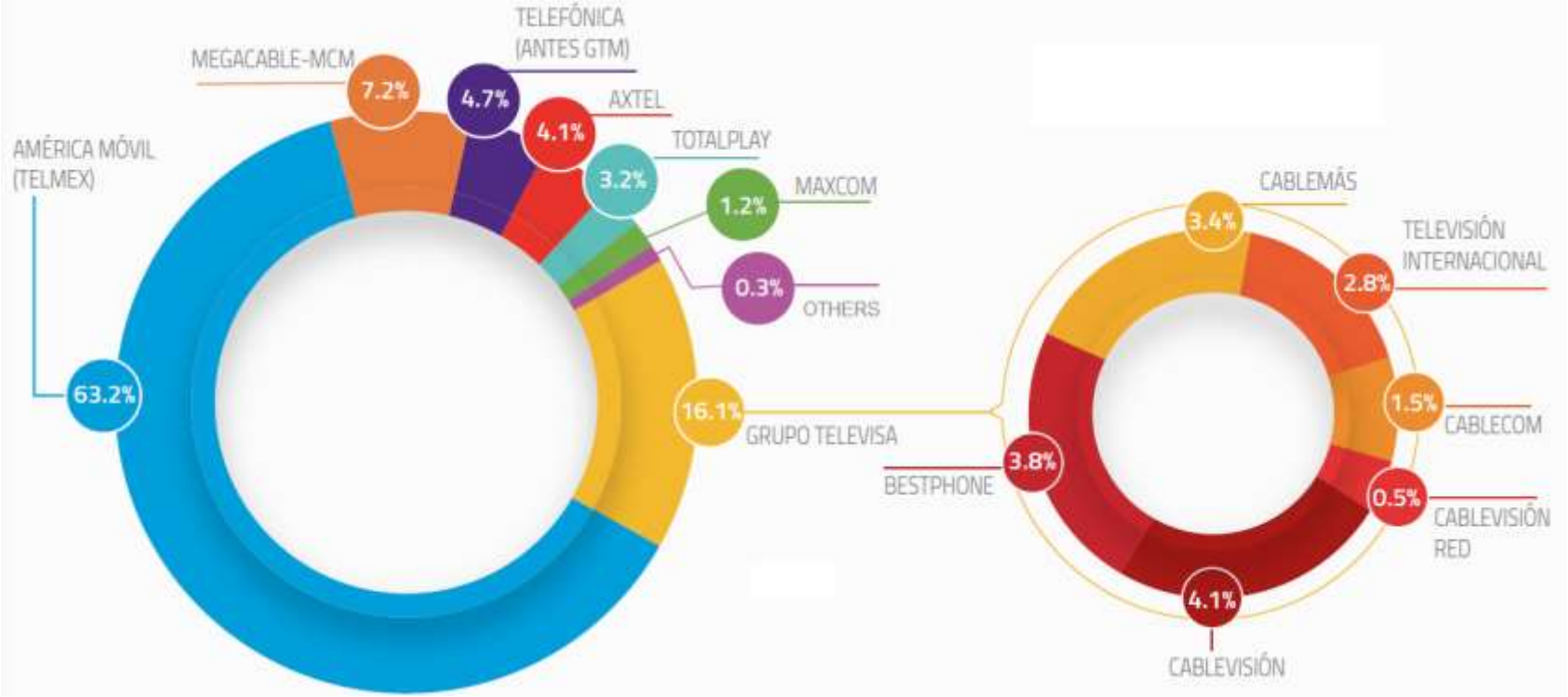
National landline penetration

- 19.6 million landlines
- 59 per 100
- 48 broadband subscriptions per 100
- 79% have at least 10Mbps



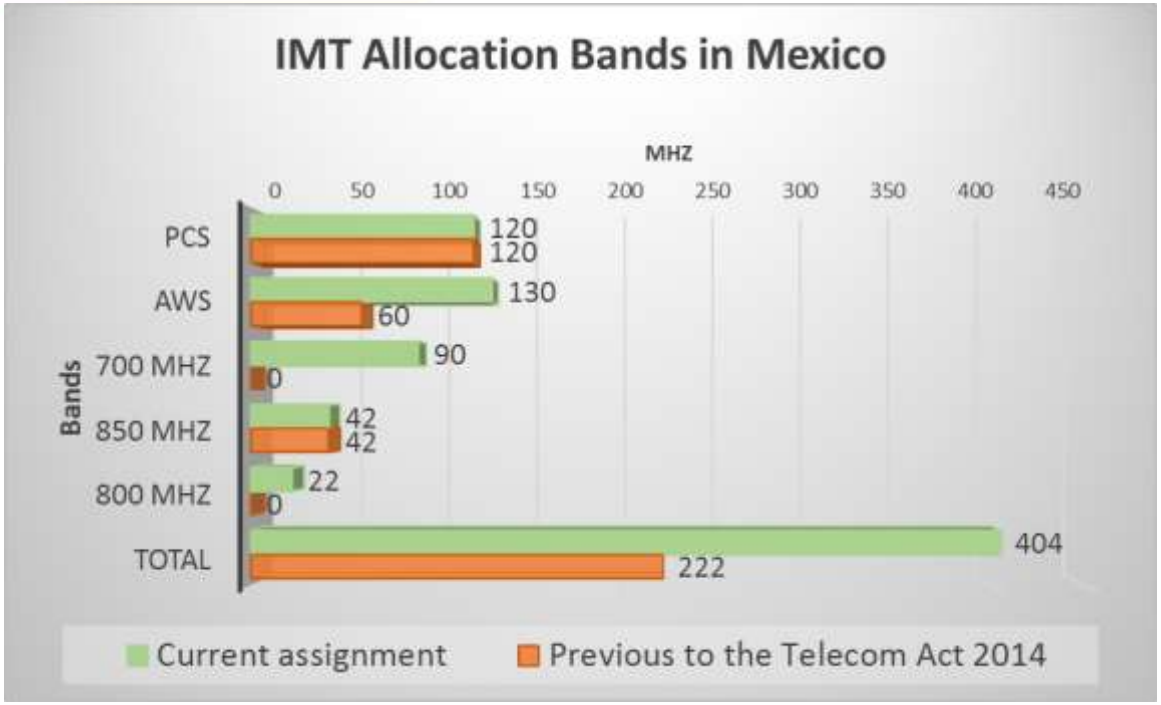
Source IFT: https://bit.ift.org.mx/

Landline market share (4th trimester 2016)



Source IFT: https://bit.ift.org.mx/

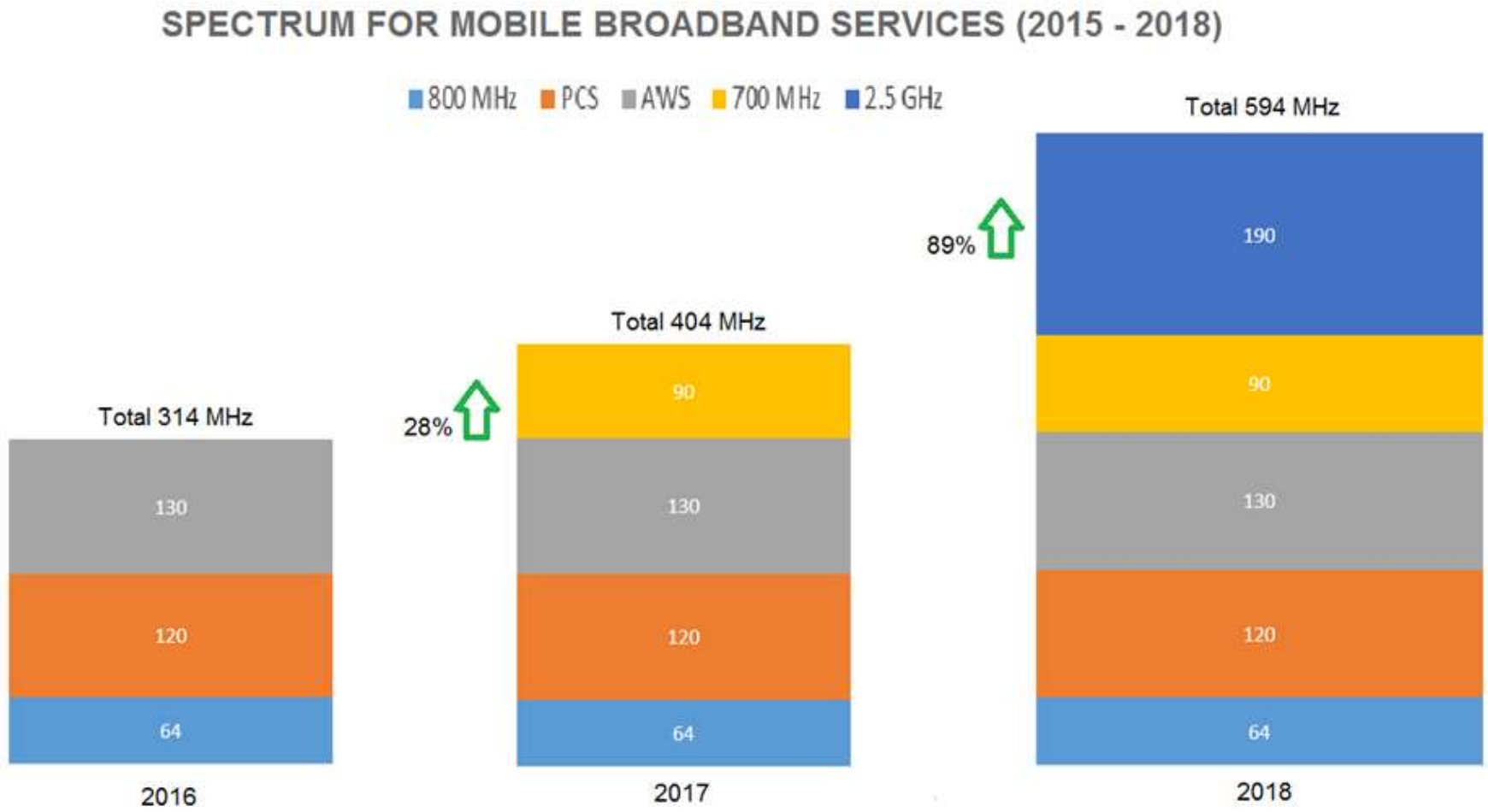
IMT - current spectrum allocation



Frequency bands	Bandwidth assigned
800 MHz band (824-849/869-894 MHz) (806-824/851-869 MHz)	64 MHz
AWS band (1710-1780/2110-2180 MHz)	130 MHz
PCS band (1850-1910/1930-1990 MHz)	120 MHz
700 MHz Band (703 – 748/ 758 – 803 MHz)	90 MHz
TOTAL	**404 MHz**

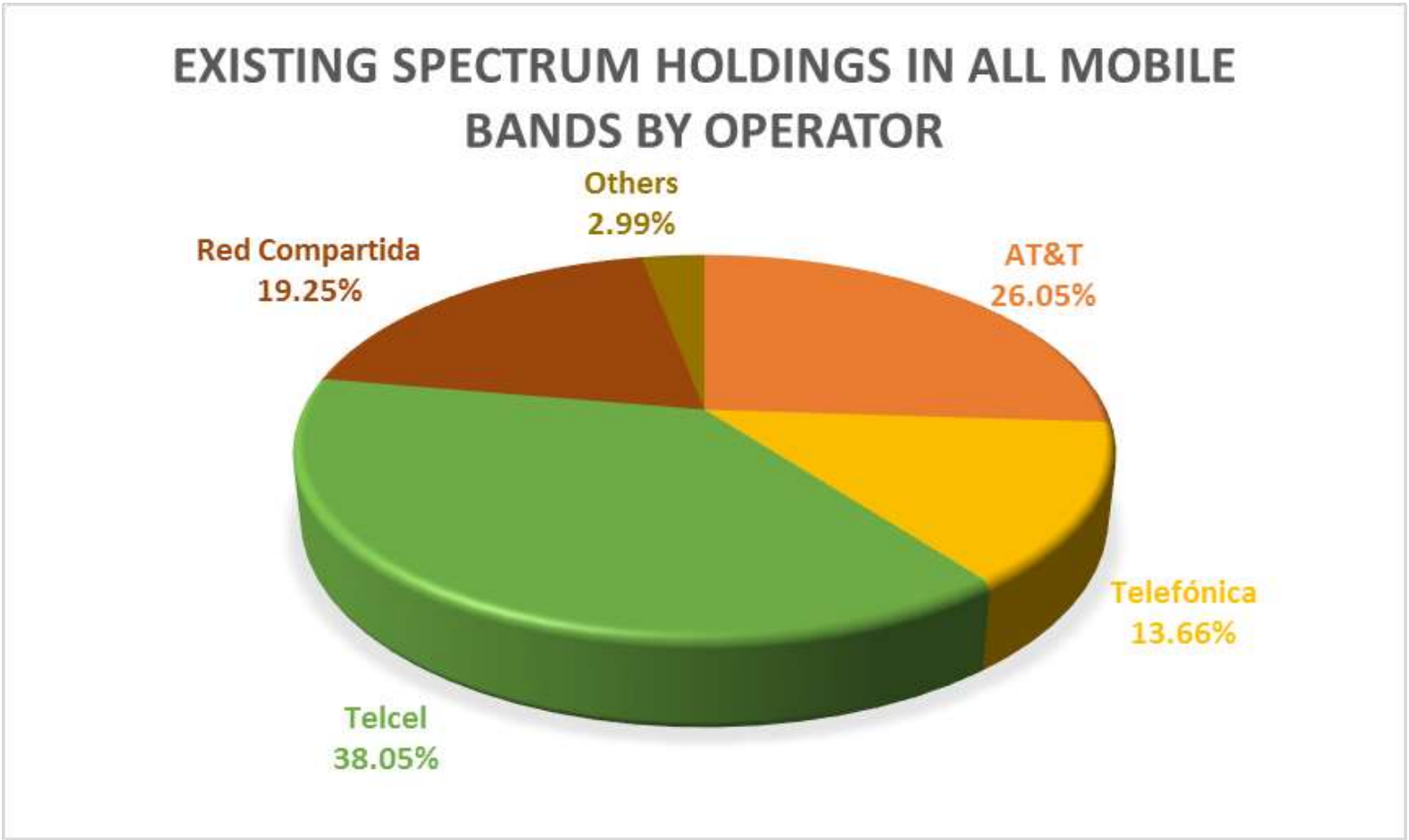
Source: IFT

Short-term plan for IMT bands



Source: IFT

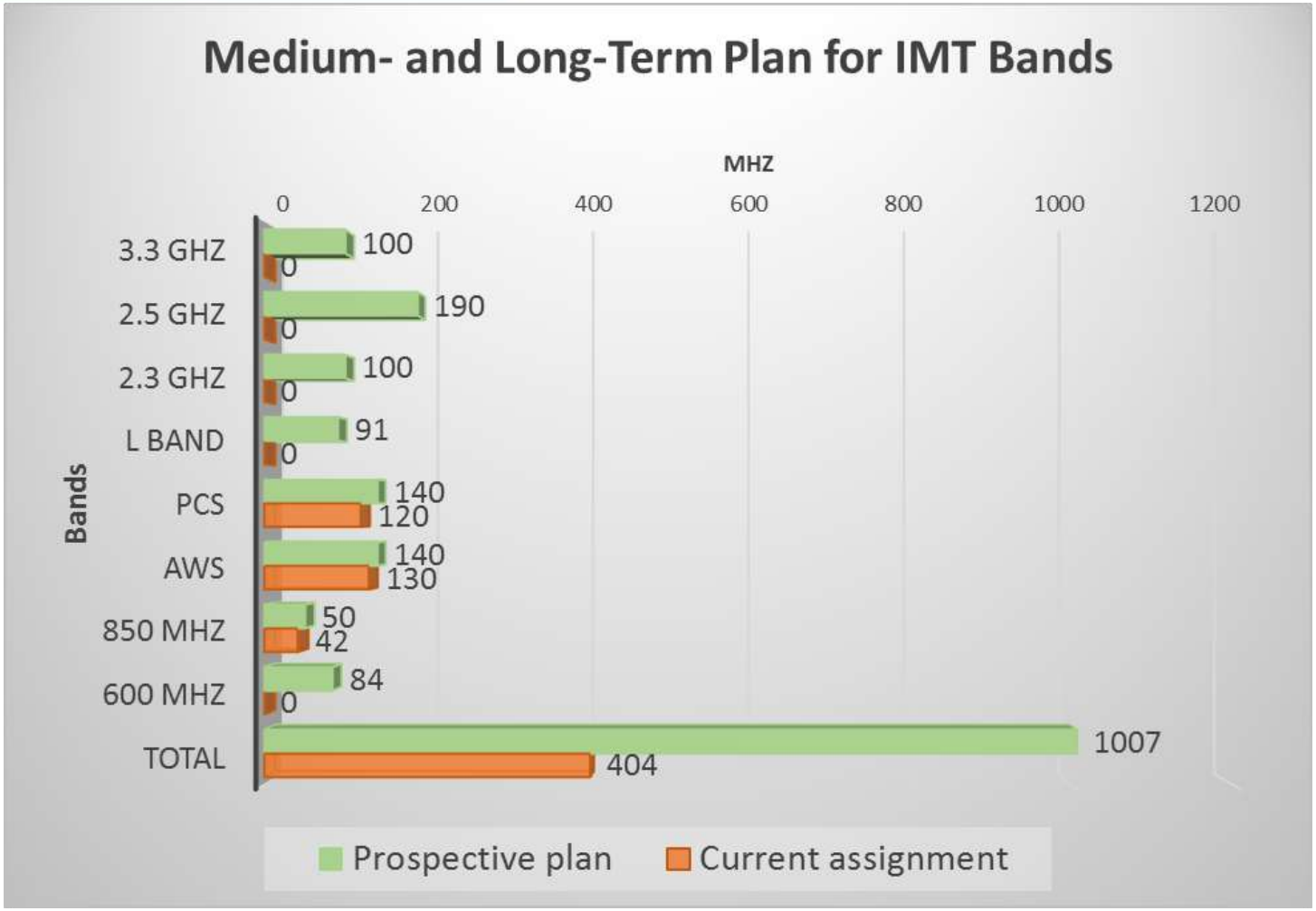
Existing spectrum holdings



IMT spectrum holdings by operator, taking into account the recent 60 MHz acquisition of Telcel in the 2.5 GHz band.

Source: IFT

Medium- and long-term plan for IMT bands



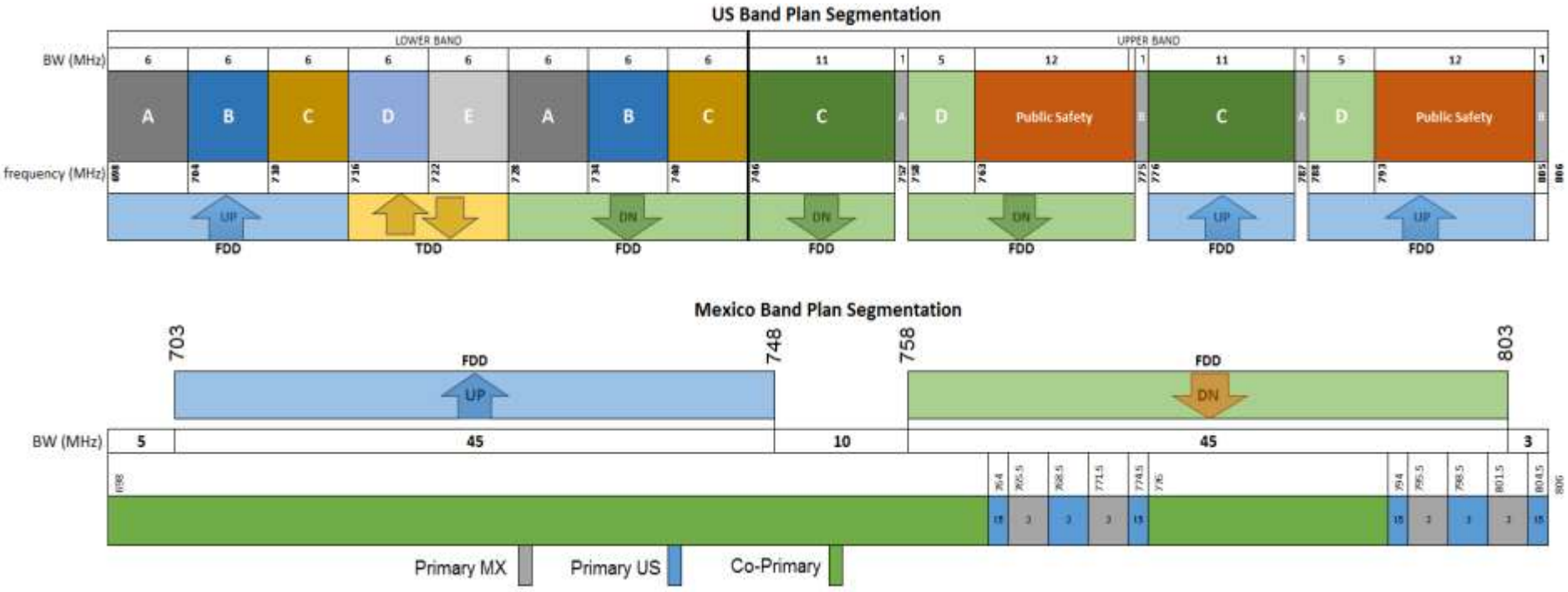
Future spectrum allocation in different bands such as the 3.3 GHz, 2.3 GHz, L band and 600 MHz band depend on the availability of technology for these frequencies.

Source: IFT

700 MHz band plan adopted by Mexico

Mexico and the US have different band plan schemes for the 700 MHz band. Mexico has adopted the APT700 band plan:

- **Available contiguous spectrum** in two FDD blocks 45 + 45 MHz;
- **Adopted worldwide**, particularly in Asia and Latin-America;
- **Encourages the economies of scale** of the networks.



Source: IFT

Red Compartida - rationale

In 2012 when this project was conceived out of a stagnant sector, rationale was:

- linfrastructure sharing to overcome entry barriers
- Need for bridge the digital divide in underserved locations
- Incumbent had no access obligations before 2014, huge barriers to competition
- Competitors struggling to survive and deploy to compete with the incumbent
- Bet on niche markets for MVNOs
- At least 2 Operators would demand capacity

Red Compartida - conformation

The 4G National Shared Wholesale Network will only provide wholesale services using 90 MHz in the 700 MHz band, according to the 3GPP class band 28.

Main Characteristics	Main obligations and rights	Spectrum
Constitutional mandate	92.2% of national coverage by the seventh year of operation	Wide bandwidth for broadband services: 90MHz (45 + 45 MHz)
Public-Private Partnership (PPP)	Availability to use a national fibre pair of the Red Troncal	Wide area coverage: out-door and in-door penetration capabilities
20 years of license (renewable)	Availability to use mobile infrastructure	Economies of scale: 3GPP band class 28
No mobile operator can have influence in the operation of the network	For every 1% of population covered in localities with more than 10K, at least 0.15% on localities less than 10K	Multiband configuration possibility: multiple carrier configurations
Main clients: MNO,FNO, MVNO, MVNA	Possibility of contracting incumbent services	

Red Compartida – International public tender

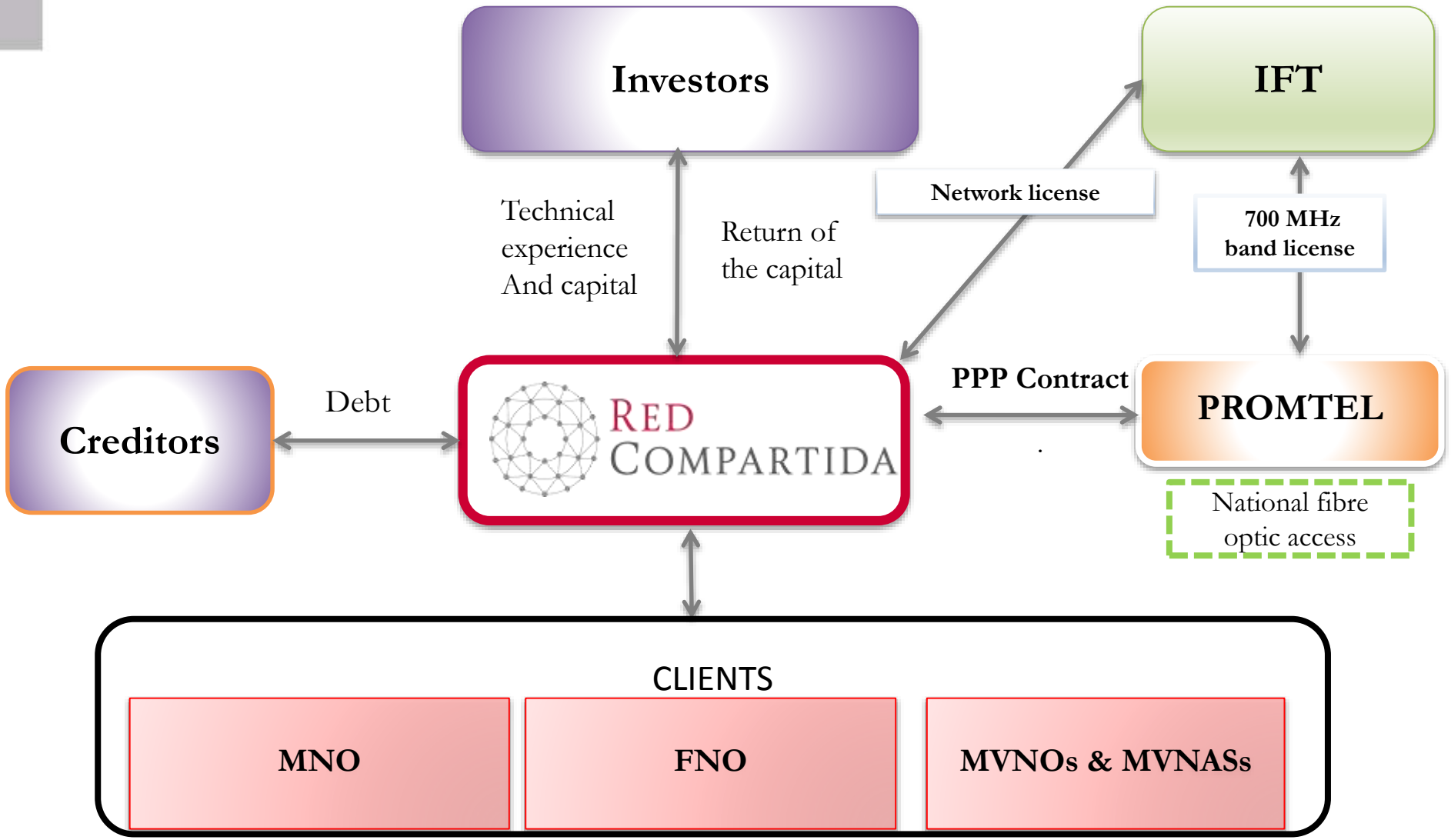
Process:

- Auction process carried out by the SCT
- The right to exploit a national optical fiber pair of the *Red Troncal*
- The IFT carried out an economic analysis on each of the parties to prevent economic concentrations
- The IFT extended the spectrum and network licenses
- The winner was the one that offered the highest economic bid and national coverage.

Result:

- **The winner was ALTAN which bid highest geographic coverage of 92.2%** of the national populations
- **Spectrum cost: $0.06 USD/MHz/pop**
- The other party was disqualified as it did not file the required letter of credit.

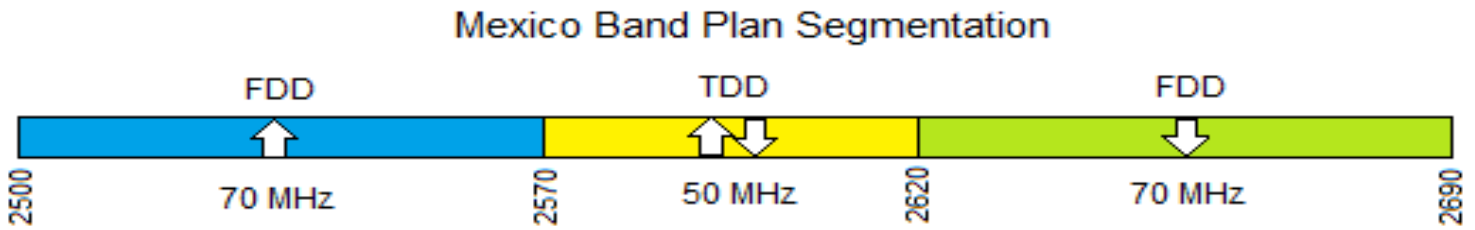
Red Compartida – business case

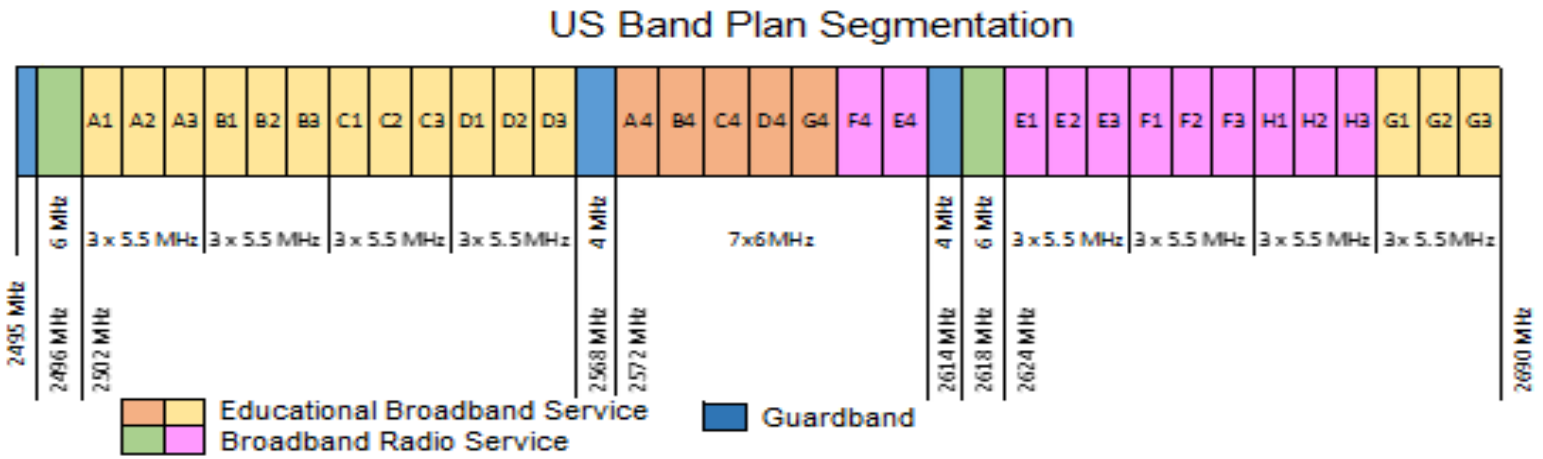


2.5 GHz band plan adopted by Mexico

Mexico has adopted the C1 band plan according to the ITU-R M.1036.:

- Available **contiguous spectrum**;
- Availability to deploy **both FDD and TDD technologies**;
- **Adopted worldwide**: 3GGP class LTE bands;
- **Encourages the economies of scale**;
- **High availability of cell phones**.



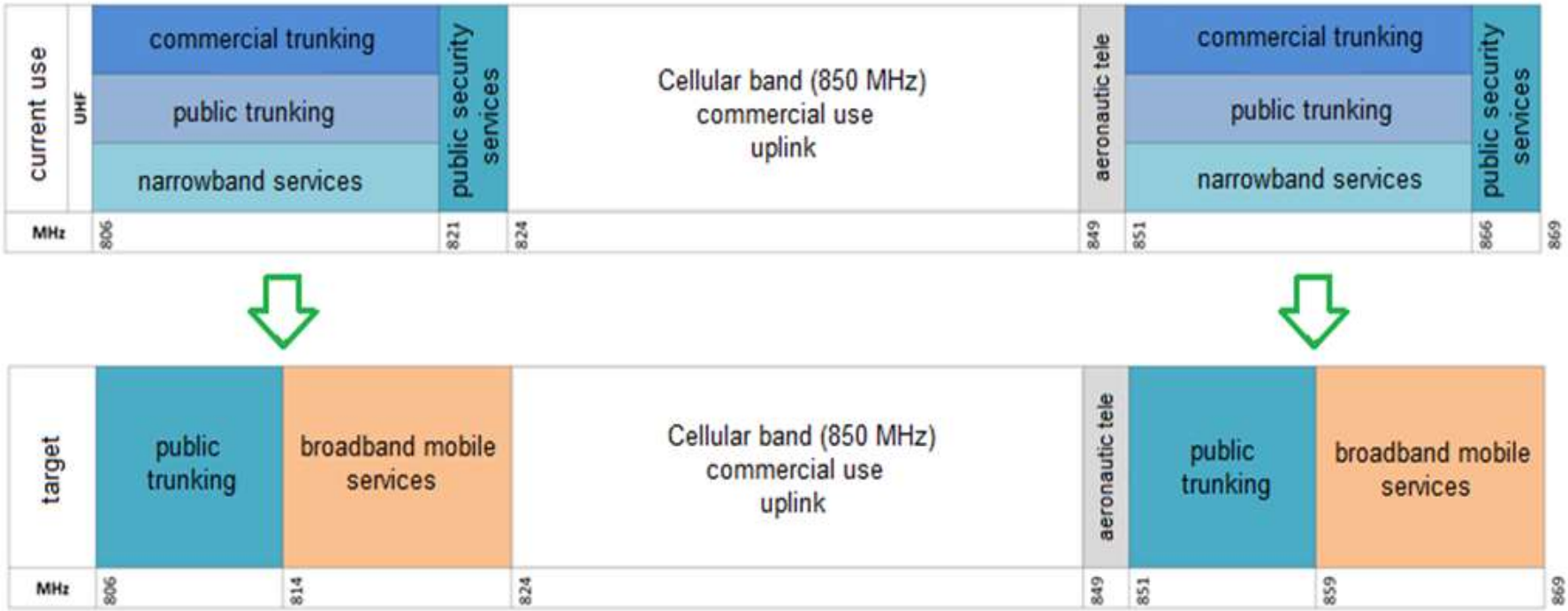


Source: IFT

Spectrum rebanding: 800 MHz band

Identified for IMT by ITU and Mexico has been preparing this band for mobile broadband services.

IFT has reallocated the current narrow band services, such as trunking and government security services:



Source: IFT

Second digital dividend - 600 MHz band

The main reasons for clearing the 600 MHz band are:

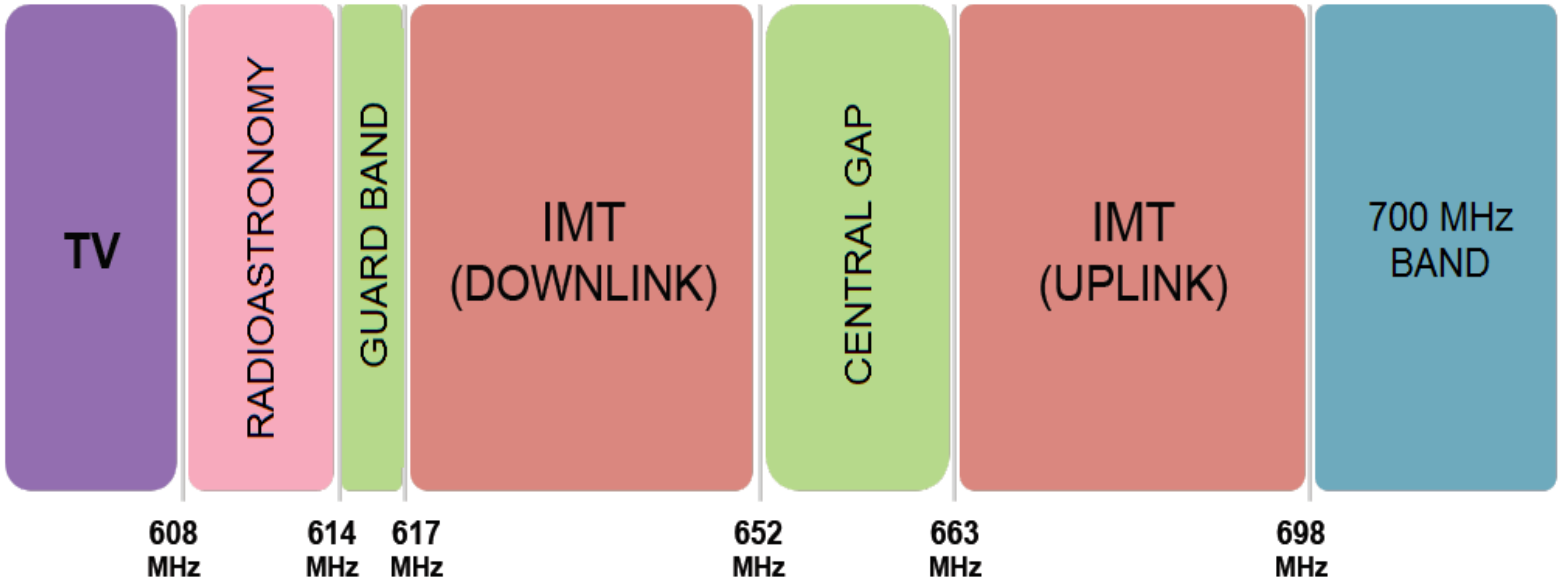
- **The rising demand for high speed broadband services**
- **The propagation characteristics and the in-door penetration capabilities**
- **The transition to the Digital Terrestrial Television**
- **Bridging the digital divide**
- **The improvement of spectrum efficiency**

The main steps to achieve this are:

- To **relocate** the current services in the band to reorganize the 470 – 512MHz band for the DTT service.
- To **optimize** the use of the spectrum allocated for broadcast television in the band 470 – 608MHz.
- To **coordinate** the use of this band along the U.S. border area
- To **develop** strategies to promote the relocation of DTT channels in the VHF band.

Second digital dividend – proposed 600 MHz segmentation band plan

Mexico is an active member in various groups of ITU. As part of the 5D group, both **Mexico and New Zealand have proposed a segmentation plan** for the 600 MHz to be included on the ITU-R Recommendation M.1036 as follows:



The deadline to clear the 600 MHz band is the third trimester of 2018.

Source: IFT

Unlicensed bands – 60 GHz band

In Mexico there are several unlicensed bands identified in the National Frequency Allocation Chart. The most common bands used for Telecom services are:

- **900 MHz band** (902 – 928 MHz)
- Digital Enhanced Cordless Telecommunications **(DECT) frequencies** (1920 – 1930 MHz)
- **Wi-Fi** (2400 – 2483.5 MHz)
- **Wi-Fi** in the 5 GHz frequencies (5.15 – 5.25 GHz, 5.25 – 5.35 GHz, 5.47 – 5.6 GHz, 5.65 – 5.725 GHz, 5.725 – 5.85 GHz)

Unlicensed bands – 60 GHz band

We recently identified the **60 GHz band** (57 – 64GHz) as **unlicensed spectrum**, mainly to satisfy two primary types of equipment serving different markets:

1) **outdoor** short-range point-to-point systems to provide broadband backhaul links or extend the reach of optic-fiber networks;

1) **indoors** wireless personal area networking (WPAN) for devices designed to share uncompressed HD data signals, entertainment devices, HD Television, laptop, smartphones and tablets.

Spectrum auctions – AWS

Purpose:

- Bidding up to 80MHz;
- To obtain contiguous spectrum;
- To satisfy capacity requirements.

Process:

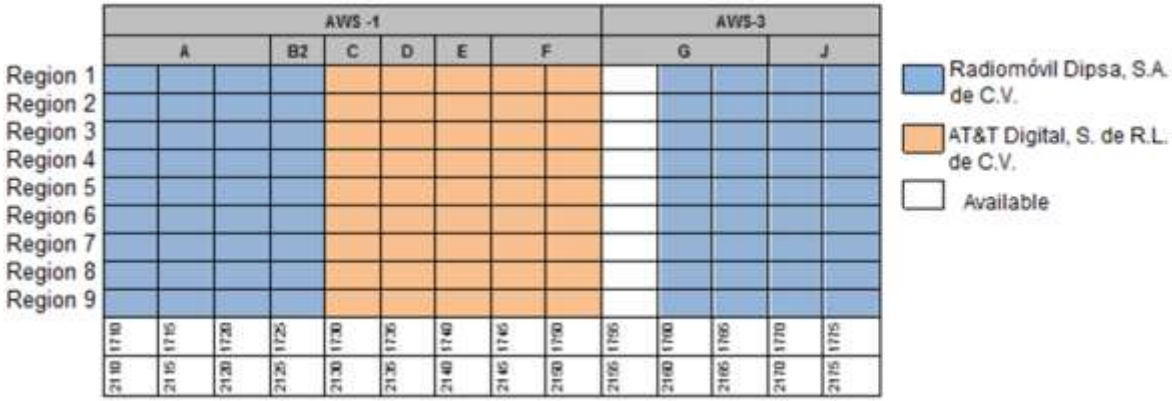
- Combinatorial clock auction;
- 8 national blocks;
- Caps of 5 + 5 MHz;
- no bidder could accumulate more than 80MHz, nor could more than 50MHz in AWS-1.

Result:

- **$0.18USD/MHz/pop**
- Radiomóvil Dipsa (AMX): 4 national blocks in AWS-1 and 4 in AWS-3;
- AT&T: 5 national blocks in AWS-1.

AWS spectrum allocation **before** the auctioning process:

AWS spectrum allocation **after** the auctioning process:



There is still available one national block of 10MHz

Rethinking auctions

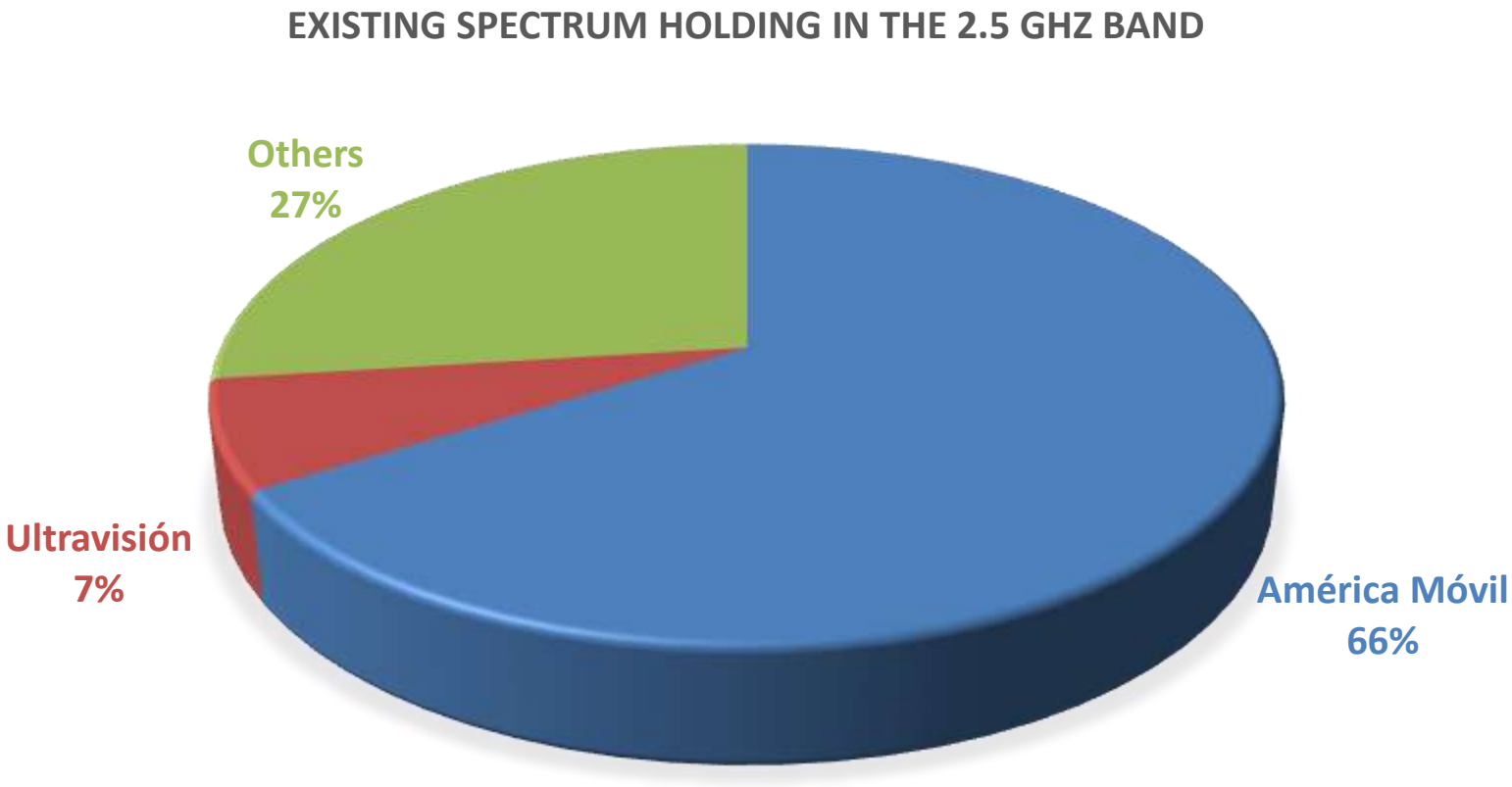
AWS auction:

- Spectrum use: **$0.18 USD/MHz/pop** (auction + annual fees for 15 years)
- $1.7K USD for 70 MHz paid by AT&T and América Móvil
- Total average time of the auction process: 1 year 2 months
- Network investment: It depends on each operator
- No coverage obligations

Red Compartida (700 MHz band):

- Spectrum use: **$0.06USD/MHz/pop** (annual fees for 20 years)
- Access to national fibre optic
- 92.2% population

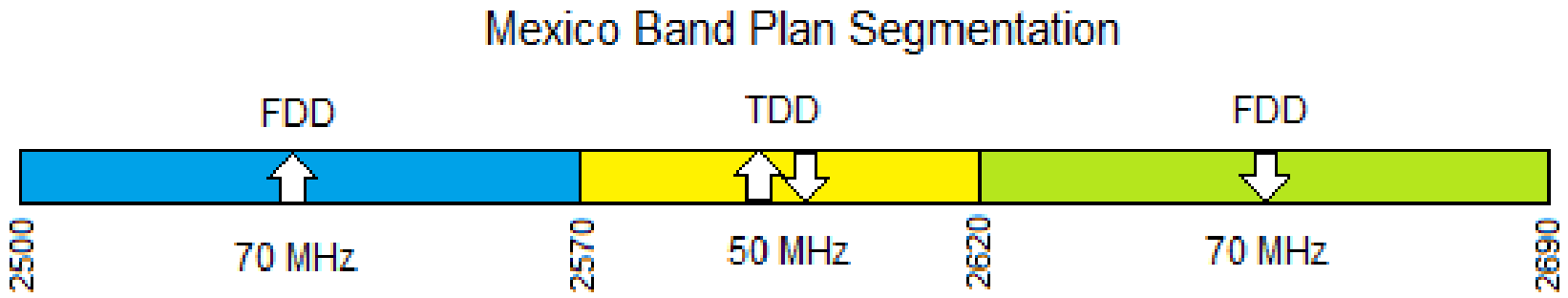
2.5 GHz band existing holding of 60 MHz



There are still 130 MHz available for auctioning

2.5 GHz band auction

Mexico band plan comprised by two FDD segments of 70 MHz and one TDD segment of 50 MHz:



The Federal Telecommunications Institute is currently working on:

- The spectrum packaging
- The reserve price
- The auction format and key rules

The aim of this auction is:

- To **maximize usable spectrum**
- To provide **sufficient flexibility to gain contiguous spectrum** blocks;
- To **avoid outcomes** that might be **detrimental to downstream competition**
- To **avoid harmful interference** between FDD and TDD technologies
- To provide the required **spectrum for high-capacity and good-quality** of services for the users

Dynamic use of the spectrum

Much of the licensed spectrum is underused or even not used at all in some regions of Mexico. However, greater and more intense **spectrum sharing is becoming possible** because of more sophisticated technologies and new authorizations approaches:

Technologies:

- RAN sharing
- TV White Spaces
- Spatial/Geographical Sharing
- Simultaneous use of specific frequencies
- Low Power Radio Technologies
- Cognitive Radios
- Licensed + Unlicensed frequencies

Authorizations:

- Licensed Shared Access
- Authorised Shared Access
- Licensed Assisted Access (LTE + unlicensed spectrum at 5 GHz)
- Priority Sharing
- Secondary Market of the Spectrum (leasing and sub-leasing frequencies bands)

Dynamic use of the spectrum

In order to develop a better spectrum sharing policy, the following questions could be good starting points:

- **What kind of systems or networks can we share?**
- **What would be the market for such shared systems?**
- **Do we already have the technical specifications and standards to allow sharing, including spectrum coordination systems?**
- **Is it necessary to integrate new sharing architectures with the existing networks?**
- **What type of authorization or rights would be suitable for the dynamic use of the spectrum?**
- **WHO should own the databases?**
- **How to get started? Martin and Michael have given wonderful guidance**

5G: Beyond connecting cars, dogs, cities.
What ecosystem should be considered before assigning New bands

ift
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5G: Internet of Things

5G technology not only represents the evolution of the 4G technology but also the revolution of connectivity. **It will allow** the development of the **Internet of Things, autonomous vehicles, remote virtual health care, broadband access in dense regions, higher mobility, low latency, and ultra-reliable communications**.

IoT requires a wide range of frequencies for all types of services, according to their specific applications and operational environment:

- Short range systems and devices (wearables, smart homes)
- Wide coverage systems (smart metering)
- Narrowband devices (monitor sensors)
- Broadband devices (CCTV, Big Data)
- Mission critical services (surveillance)
- Different Levels of Service

E**xploiting technologies such as Wi-Fi, Near Field Communications (NFC), Radio Frequency identification (RFID),** among others, **on both licensed and unlicensed frequencies.**

5G: Internet of Things

It is important that 5G spectrum bands are harmonised globally. Therefore, the World Radiocommunication Conference recognised that particular frequencies could be best suited to 5G:

Band	Technology	Region
600 MHz	LTE/5G	North America
700 MHz	LTE/5G	APAC, Europe Middle East, Africa, LatAm

Full coverage with < 1GHz

Band	Technology	Region
3.3 – 3.4 GHz	LTE/5G	APAC, Africa, LatAm
3.4 – 3.6 GHz	LTE/5G	Global
3.55 – 4.2 GHz	LTE/5G	USA
3.6 – 3.8 GHz	5G	Europe
4.5 GHz	5G	Japan, China

Dense urban high data rates

Band	Technology	Region
24.25 – 27.5 GHz	5G	For discussion at WRC-19
31.8 – 33.4 GHz	5G	For discussion at WRC-19
37 – 43.5 GHz	5G	For discussion at WRC-19
45.5 – 50.2 GHz	5G	For discussion at WRC-19
50.4 – 52.6 GHz	5G	For discussion at WRC-19
66 – 76 GHz	5G	For discussion at WRC-19
81 – 86 GHz	5G	For discussion at WRC-19

Future mm wave bands

Will exclusive rights on spectrum bands satisfy the 5G requirements?

For many years, the preferred and traditional approach for regulators that auction spectrum has **been to clear the bands and then auction them with individual or exclusive licenses**. However, many questions have been raised since traditionally licensed spectrum may not satisfy the spectrum requirements for the next applications.

Efficient allocation of spectrum somehow has been in conflict with equality and inclusion in Mexico.

- ***Will Mexico achieve both goals?***
- ***Are bids and high fees for a 20 year exclusive license, with no coverage or QoS obligations, the best strategy towards the digital economy and sustainable development goals for an unequal nation?***
- ***Will competition only do the job?***
- ***Will there be new players demanding spectrum other than MNOs?***

Will exclusive rights on spectrum bands satisfy the 5G requirements?

I personally fear that **conventional systems for auctioning spectrum may no longer satisfy the requirements for 5G applications**, and thus should be revisited.

I consider that **it would be worth exploring flexible non-exclusive licenses and far more intensive and efficient use of the spectrum.**

In order to bridge the digital divide, it is necessary:

1) **to address low inclusion of remote areas;**
2) **to encourage the full and efficient use of the spectrum;**
3) **to increase the access of high speed broadband across the country;**
4) **relevant content, relevant applications and services to BOP**

Wars in the digital economy

- Access to big data
- **Access to spectrum**
- Access to water rights

Will we use old weapons and tools?

Thank you!

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