

# Acelerando o 5G A Era da Invenção

Francisco Giacomini Soares

Diretor Sênior de Relações Governamentais, America Latina  
Qualcomm





5G

#5GisHere

Transferring data

327

Transferring power

POWER OUTAGE!

POWER TRANSFER LEVELS

220 V

!



Canada



USA



Sweden

# 5G is here

and it's moving fast

Comparison of Year 1 announcements



4 Operators launched  
3 OEMs launched



Sub-6



Sub-6 + mmWave (launched or scheduled)

# 5G commercialization happening faster than 4G

## Comparison of Year 1 announcements



4 Operators launched  
3 OEMs launched



30+ Operators launched  
40+ OEMs announced

Operator and OEM public announcements

## 5G smartphones



Lenovo  
Z6 Pro 5G



LG  
V50 ThinQ 5G



Motorola  
moto z<sup>4</sup>/z<sup>3</sup>  
+ 5G moto mod



Nubia  
Mini 5G



OnePlus  
7 Pro 5G



OPPO  
Reno 5G



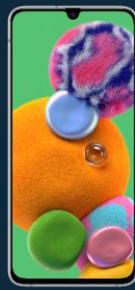
Samsung  
Galaxy  
S10 5G



Samsung Galaxy  
Fold



Samsung  
Galaxy Note10+  
5G



Samsung  
A90 5G



Vivo  
iQOO  
5G Edition



Vivo  
NEX 3 5G



Xiaomi  
Mi MIX 5G



ZTE  
Axon 10 Pro  
5G

## Hotspots and CPEs



Askey

Inseego

HTC

Netcomm

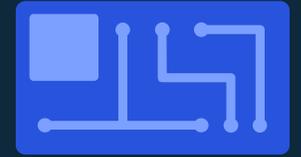
Netgear

Nokia

WNC

ZTE

## 5G modules



Compal

Fibocom

Longsung

Quectel

Sierra

Wireless

SIMcom

Telit

The device ecosystem is delivering 5G  
**150+** 5G devices launched or in development

Qualcomm  
snapdragon





Browsing  
Gaming  
Social  
Video and music streaming



Premium tier



Mid tier



Entry tier



4K / VR video, Multi-player cloud gaming,  
Cloud-based collaboration, AR shopping,  
Real-time translation, GB downloads in seconds

HD video streaming, HD video calling, AR search, Cloud sync

Browsing, Gaming, Social, Video and music streaming



Premium tier



Mid tier



Entry tier

# Bringing the full 5G experience

to other tiers requires rapid scaling



Browsing  
Gaming  
Social  
Video and music streaming



Premium tier



Mid tier



Entry tier



4K / VR video, Multi-player cloud gaming,  
Cloud-based collaboration, AR shopping,  
Real-time translation, GB downloads in seconds

HD video streaming, HD video calling, AR search, Cloud sync

Browsing, Gaming, Social, Video and music streaming



Premium tier



Mid tier



Entry tier

# Bringing the full 5G experience

to other tiers requires rapid scaling



Browsing  
Gaming  
Social  
Video and music streaming



Premium tier



Mid tier



Entry tier



4K / VR video, Multi-player cloud gaming,  
Cloud-based collaboration, AR shopping,  
Real-time translation, GB downloads in seconds

HD video streaming, HD video calling, AR search, Cloud sync

Browsing, Gaming, Social, Video and music streaming



Premium tier



Mid tier



Entry tier

# Bringing the full 5G experience

to other tiers requires rapid scaling

# Redefining

mobile computing



Extreme performance

Extreme battery life<sup>1</sup>

Extreme connectivity<sup>2</sup>

## Always On, Always Connected PC



Samsung Galaxy Book



Microsoft Surface Pro X



Lenovo Project Limitless

<sup>1</sup> Battery life varies significantly with settings, usage, and other factors. <sup>2</sup> Requires network connectivity.



Instant access to  
cloud compute and  
storage



Beyond laptops:  
Augmented and virtual  
reality (XR)



Immersive virtual  
telepresence with  
wireless flexibility



Create with  
real-time  
collaboration

Powering the office  
of the future with

# enterprise 5G networks

# 5G will significantly enhance the mobile experience over 4G



## Download latency

**3x** Improvement up to a **20x** Improvement

## Content download speed

(offline access)

**3x** Improvement up to a **10x** Improvement

## Streaming video performance

**4%** 4G playback at max bitrate vs. **95%** 5G playback at max bitrate<sup>1</sup>

Lower-end improvements for sub-6 GHz, upper-end for mmWave

<sup>1</sup> Across sub-6 GHz and mmWave

# 5G driving global economic growth

Both broadband availability and speed contribute to gains

Annual economic value created\*

~\$100B

~\$3T

~\$12T

3G

4G

5G

Average data rates

100's of Kbps

10's to 100's of Mbps

100's of Mbps to Gbps

Every 10% increase in broadband penetration, GDP increases by

1%

Additional doubling of speed can yield GDP growth in excess of

0.3%

Note: \* Based on global economic value created approx. 5-15 years after initial deployment

Sources: 5G: IHS—The 5G Economy, January 2017; 4G: GSMA Intelligence—The Mobile Economy, 2018—estimated through 2018; 3G: GSMA and Deloitte—What is the impact of mobile telephony on economic growth?, November 2012; GDP impact -- Ericsson, Arthur D. Little, 2011

## Enhanced network communication

Faster cloud access for in-vehicle experiences



V2N



V2N

## New direct communication

V2V, V2I, and V2P communications



Road hazard warning

V2I



RSU

Speed harmonization



V2V

## Massive Internet of Things

Deeper coverage to connect road infrastructure



Smart city



Sensors



Utilities

# Shaping the future of transportation

# Redefining enterprise and industrial connectivity

Reliable robotic control

Real-time inventory

- Lumber
- Manufacturing
- Earth/Soil
- Hardware
- Produce
- Retail
- Technology
- Automotive

AR-guided execution

5G NR  
Private network

Seamless interworking with public network

On-premise compute and storage  
Updating

UHD surveillance

Reliable, autonomous AGVs

### Real-time tracking

Level: 3

Location: [Map]

Capacity: [Table]

Item	Q1	Q2	Q3	Q4	YTD
Item 1	100	120	110	130	460
Item 2	80	90	70	100	340
Item 3	60	70	50	80	260
Item 4	40	50	30	60	180
Item 5	20	30	10	40	100

On-device intelligence



# Powering the factory of the future

 Surveillance

 Ultra reliable,  
Low-latency wireless  
connection

 Predictive maintenance

 XR Guided  
execution

 Precise  
positioning

 Dynamic factory  
reconfigurability



## 5G



On-premise  
edge cloud

Local control for  
ultra-low latency

Sensitive data  
stays on site,  
local analytics

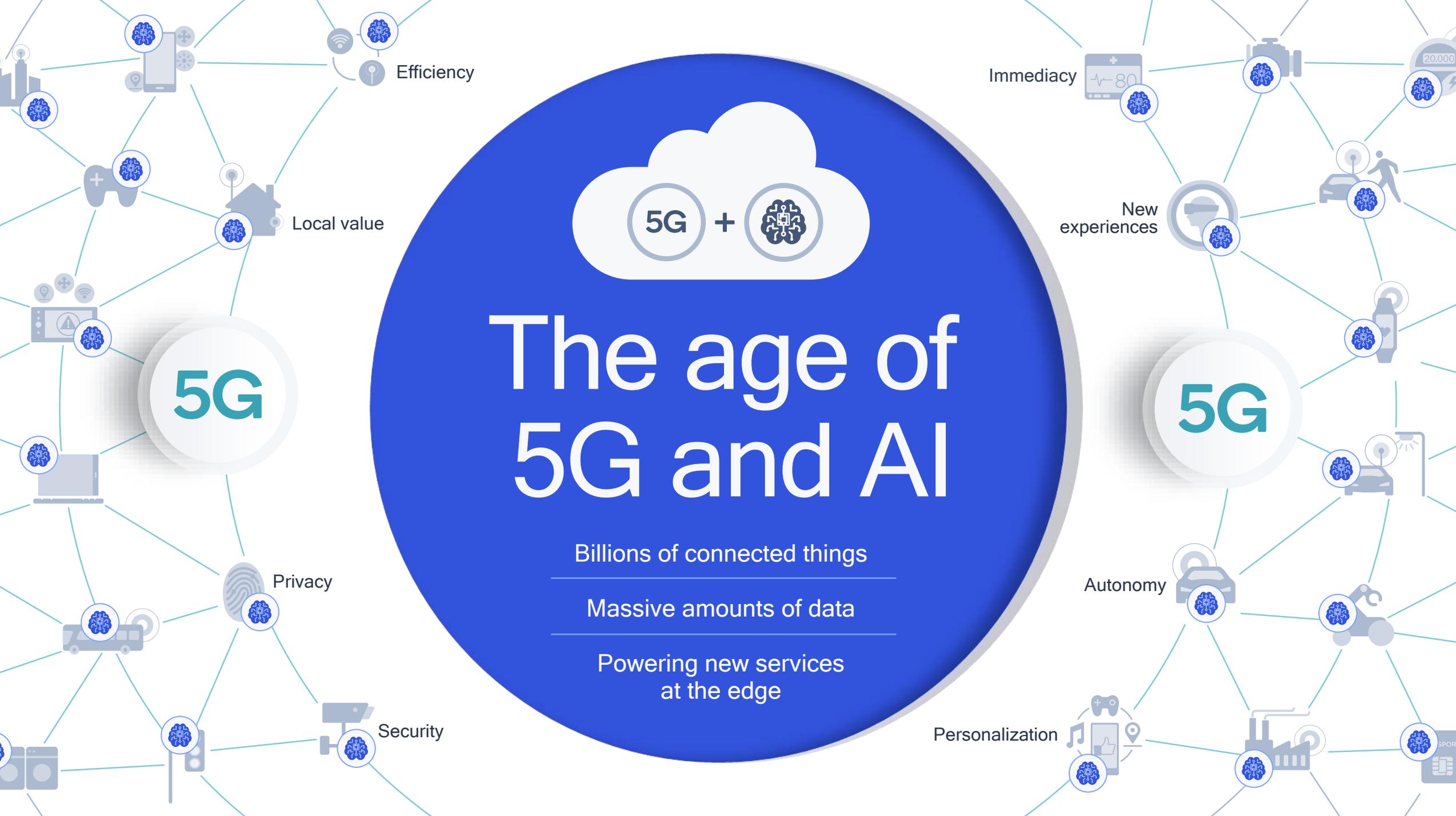
# 5G enhanced mobile broadband is required to take VR/AR experiences to the next level

- Extreme throughput – with Multi-Gbps
- Ultra-low latency – down to 1 ms
- Uniform experience – even at cell edge

Gigabit LTE

Ubiquitous coverage with Wi-Fi and Gigabit LTE, the anchor of the 5G broadband experience





# The age of 5G and AI

Billions of connected things

Massive amounts of data

Powering new services  
at the edge

5G

5G

Efficiency

Local value

Privacy

Security

Immediacy

New experiences

Autonomy

Personalization

# Devices, machines, and things are becoming more intelligent



IoT



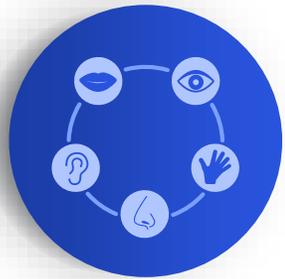
Mobile



Automotive

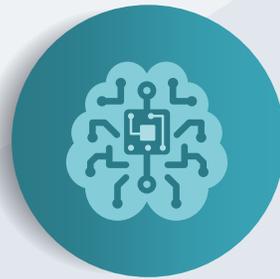


Cloud



## Perception

Object detection, speech recognition, contextual fusion



## Reasoning

Scene understanding, language understanding, behavior prediction



## Action

Reinforcement learning for decision making



Power efficiency



Personalization



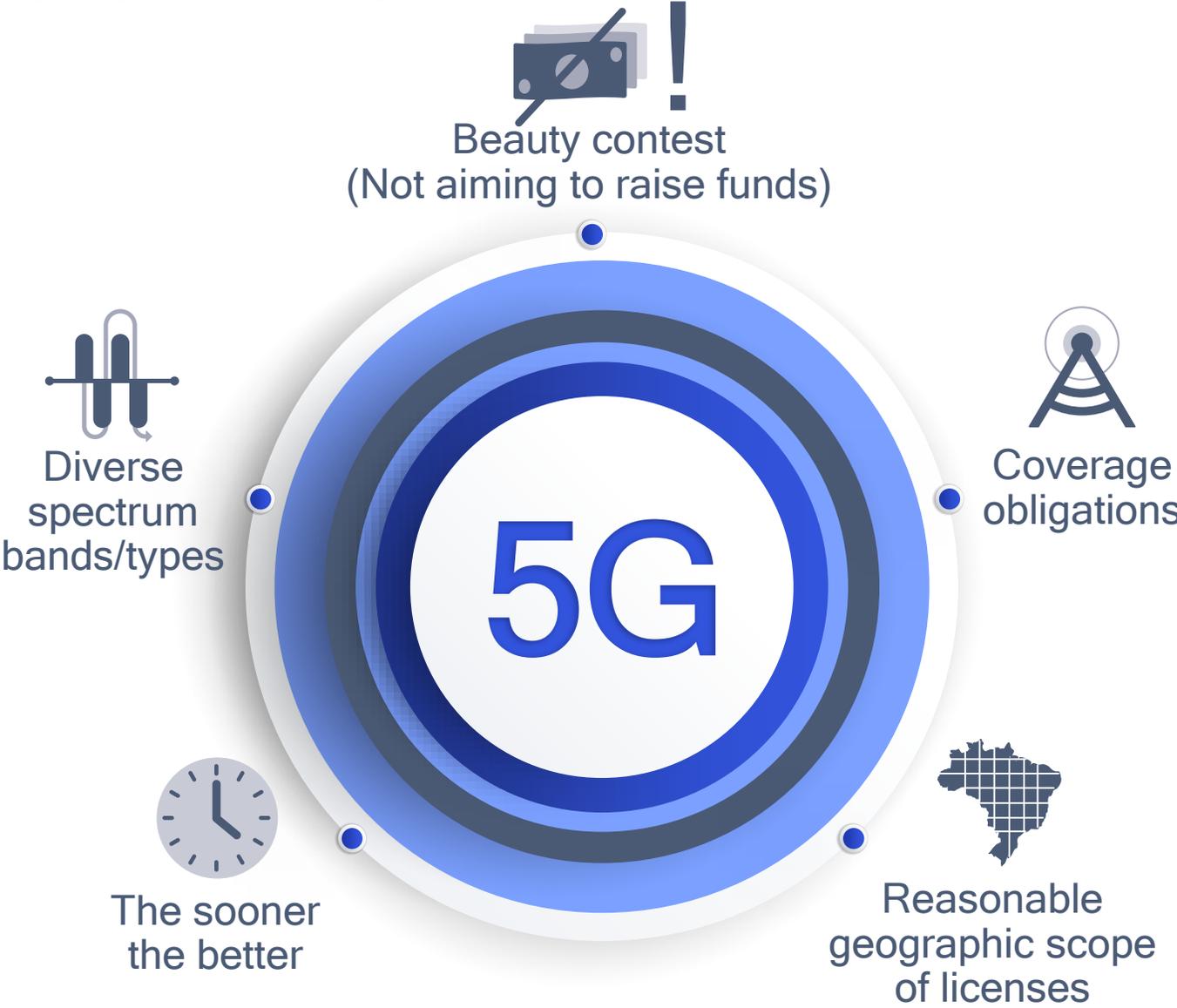
Efficient learning

# Government has an important role in different aspects

Some of them are covered in this presentation



# Spectrum Auction Model



Beauty contest  
(Not aiming to raise funds)



Diverse  
spectrum  
bands/types



Coverage  
obligations



The sooner  
the better



Reasonable  
geographic scope  
of licenses

# Worldwide 5G bands

Spectrum is critical for 5G success

Using all spectrum types and bands



5G

## Licensed spectrum

Exclusive use

Over 40 bands globally for LTE, remains the industry's top priority

## Shared spectrum

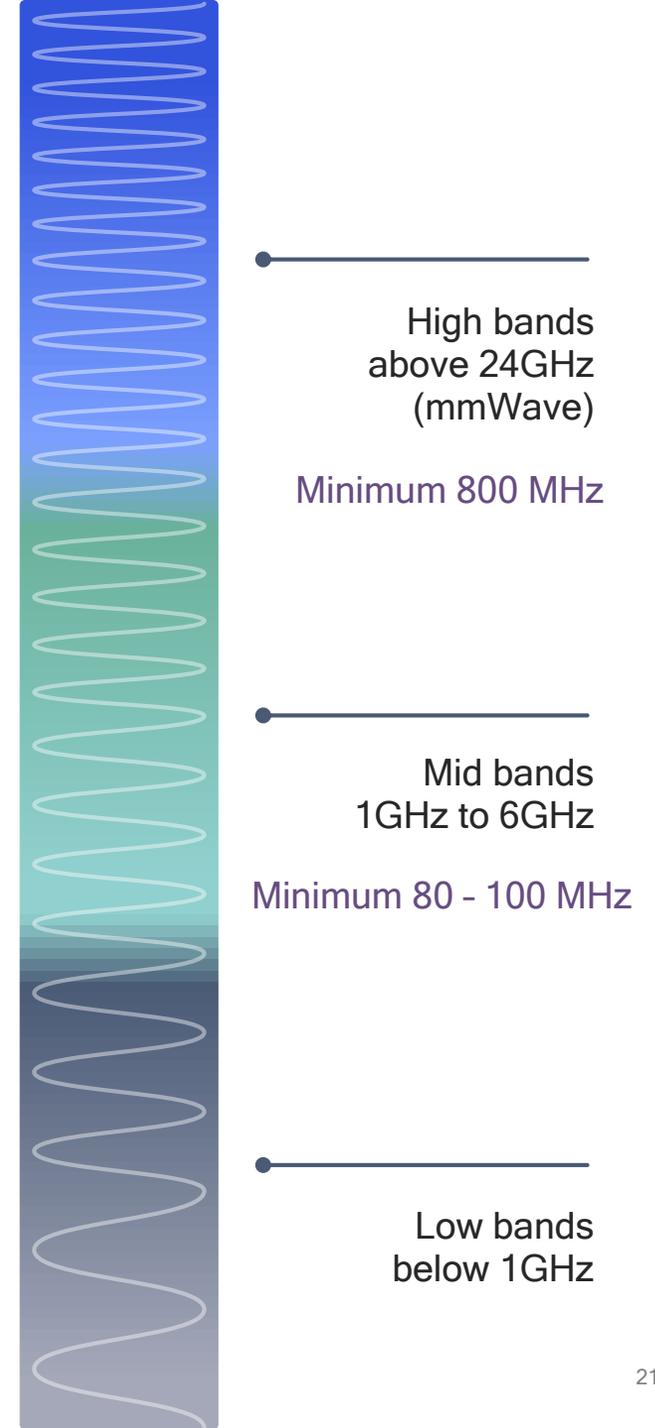
New shared spectrum paradigms

Ex: 2.3 GHz Europe / 3.5 GHz USA

## Unlicensed spectrum

Shared use

Ex: 2.4 GHz / 5.9-7.1 GHz / 57-71 GHz global





# Designed for diverse spectrum bands/types

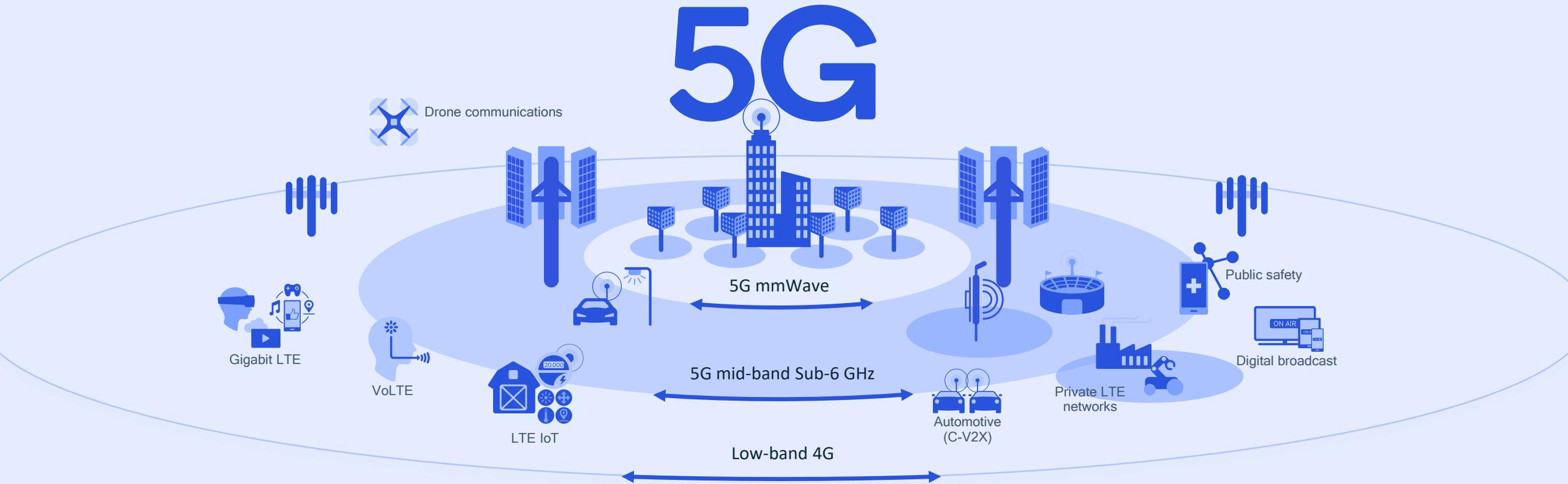
Global snapshot of 5G spectrum bands allocated or targeted

New 5G band



# Sub-6 + mmWave is real 5G

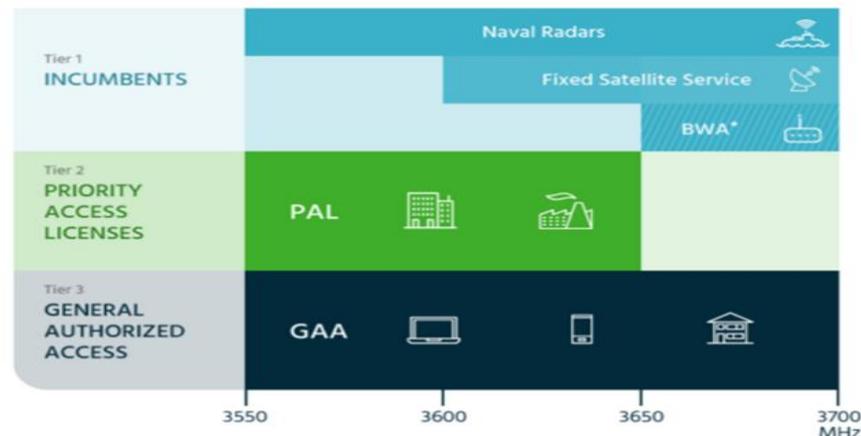
Combining coverage and capacity benefits



# CBRS - Citizen Broadband Radio System

Frequency range established in 2015 for shared broadband use at 3550-3700 MHz, in USA

- **Three-tier spectrum use authorization** framework to accommodate commercial use shared with incumbent federal and non-federal users.
- Managed by an automatic frequency coordination system called the **Spectrum Access System (SAS)**.
  - It incorporates ESC (Environmental Sensor Capability) sensor information, which detects radar transmission and informs SAS. Both SAS and ESC must be certified.
- **Three tiers:** Incumbent Access, Priority Access, and Authorized General Access
- **Incumbent Access:** Federal Users, FSS Earth Stations, at 3650-3700 MHz
- **Priority Access:** licenses (Priority Access Licenses PALs) assigned through competitive access within 3550-3650 MHz. Each PAL is a renewable license for 10 MHz use in one location for 10 years. Up to 7 licenses can be given locally, and up to 4 PALs for one company.
- **General Authorized Access (GAA):** allows flexible bandwidth access on non-incumbent channels and opportunistic access to PALs channels.





# 5G soon in Brazil

And Brazil must be ready

---

- Do not wait for the experience of other countries
- Spectrum caps: should be extinguished, in competitive markets.
- Provide mobile coverage on roads
- Make spectrum available now
- Do not carry out the auction aiming to raise funds
- Carry out the auction for both sub 6 GHz and mmWave, at the same time
- Evaluate spectrum for private mobile networks



# Thank you!

Follow us on:   

For more information, visit us at:

[www.qualcomm.com](http://www.qualcomm.com) & [www.qualcomm.com/blog](http://www.qualcomm.com/blog)

Nothing in these materials is an offer to sell any of the components or devices referenced herein.

©2018 Qualcomm Technologies, Inc. and/or its affiliated companies. All Rights Reserved.

Qualcomm is a trademark of Qualcomm Incorporated, registered in the United States and other countries. Other products and brand names may be trademarks or registered trademarks of their respective owners.

References in this presentation to “Qualcomm” may mean Qualcomm Incorporated, Qualcomm Technologies, Inc., and/or other subsidiaries or business units within the Qualcomm corporate structure, as applicable. Qualcomm Incorporated includes Qualcomm’s licensing business, QTL, and the vast majority of its patent portfolio. Qualcomm Technologies, Inc., a wholly-owned subsidiary of Qualcomm Incorporated, operates, along with its subsidiaries, substantially all of Qualcomm’s engineering, research and development functions, and substantially all of its product and services businesses, including its semiconductor business, QCT.