

# 5G & Digital Divide Challenges and Opportunities

Pakistan Telecomm

Pakistan Telecommunication Authority

Licensing Division

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### Various Milestones of Cellular Industry



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### **Cellular Mobile Subscribers**

Total Teledensity : 74.1 % (Cellular, FLL and WLL)

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### Mobile Broadband Subscribers (Quarter wise)

Mobile Broadband Subscribers (3G/4G): 56.1 Million

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## What is 5G

5G is the **fifth generation of cellular mobile communications.** It succeeds the 4G (LTE/WiMax), 3G (UMTS) and 2G (GSM) systems.

5G performance targets include high data rate, reduced latency, energy saving, cost reduction, higher system capacity and massive device connectivity.

The telecom industry as a whole – service providers, vendors, academia and standards-setting bodies – are working to define exactly what 5G will be. The International Telecommunication Union (ITU) has set a timeline that calls for the standard to be finished in 2020.

A term **IMT-2020** was coined in 2012 by the International Telecommunication Union (ITU) Radio-communication Sector and means International Mobile Telecommunication system with a target date set for 2020.

Additionally, the name IMT-2020 (5G) follows the same naming structure as IMT-2000 (3G) and IMT-Advanced (4G).

(https://en.wikipedia.org/wiki/5G)



# **Technology Evolution**



### Features of 5G

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# **5G Requirements**



# 5G Performance Gap w.r.t. 4G



### 5G Use Case Model



### **5G Network Slicing**

In the case of 5G, a single physical network will be sliced into **multiple virtual networks** that can support **different radio access networks (RANs)**, or **different service types** running across a single RAN.



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# 5G –Spectrum to fulfill Different Needs



# Proposed 5G Spectrum

Primary Objective	Frequency Band	Typical Applications	Benefit
Coverage Layer	Low Frequency (Below	URLLC	Wide-area & deep indoor
	2 GHz)		coverage
Coverage &	Medium Frequencies		Best compromise between
<b>Capacity Layer</b>	(2 - 6 GHz)	IIIVIIC	capacity and coverage
Super Data Layer	High Frequencies (Above 6 GHz)	eMBB	Addressing specific use
			cases requiring extremely
			high data rates.

URLLC = Ultra-Reliable and Low Latency Communications mMTC = Massive Machine Type Communications eMBB = Enhanced Mobile Broadband

### Future Spectrum Roadmap

Frequency Band (MHz)	Bandwidth (MHz)	Status
700	703-748/758-803	Under Refarming
800	791-821/832-862	Subject to adoption of band in 700 MHz and current assignment in 850
850	824-849/869-894	10 MHz assigned to Telenor in 2016. Remaining under discussion for refarming during license renewals
1800	1710-1785/1805-1880 MHz	Under discussion for refarming during license renewals and Top up
2100	1950-1980/2140-2170	1960-1980 MHz under refarmation from Worldcall and Telecard
2300	2300-2400	Under Refarming
2600	2500-2570/2620-2690	Under Refarming
3500	-	Becoming important for fixed/mobile and 5G

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### Future Spectrum Roadmap (continued..)

Bandwidth	Status	
(MHz)	Status	
3800 – 5000 MHz		
5925 – 7100 MHz		
7425 – 9000 MHz		
10.15 – 10.65 GHz		
10.7 – 11.7 GHz		
12.75 – 13.25 GHz 14.4 – 15.35 GHz 17.7 – 19.0 GHz 21.2 – 23.6 GHz	<b>Point-to-point Microwave.</b> These bands used by commercial	
		telecommunications operators mainly for
		24.5 – 26.5 GHz
	27.5 – 29.5 GHz	government users in these bands.
31.8 – 33.4 GHz		
37.0 – 39.5 GHz		
51.4 – 52.6 GHz		
55.78 – 57.0 GHz		
71 – 76 / 81 – 86 GHz (E Band)		

# **Digital Divide**

- It is a term that refers to the gap between demographics and regions that have access to modern information and communications technology, and those that don't or have restricted access. This technology can include the telephone, television, personal computers, mobile coverage and the Internet.
- At present, there are 800 million people in rural areas around the world with no access to network coverage. Network connections can serve as a catalyst to promote economic equality by improving access information, services, and opportunities. For example, in rural China, young people are now able to improve their income via a live broadcast platform that would have been impossible for his parent's generation. In Kenya, villagers can now receive financial remittance from their partners working in cities far away. In Mongolia, children can enjoy online learning over mobile networks while the family maintain their traditional nomadic lifestyles and herd their cattle across vast remote areas.
  - (https://www.huawei.com/en/industry-insights/outlook/mobile-broadband/wireless-for-sustainability/feature-stories/extend-networkcoverage-to-100-million-rural-users)

# 5G - Opportunities

### • Fixed Wireless:

One of the top 5G use cases will be fixed wireless access. Some experts believe that mobile 5G will be several years out. Fixed wireless will provide Internet access to homes using wireless network technology rather than fixed lines. It will use 5G concepts such as millimeter wave (mmWave) spectrum and beamforming to bolster wireless broadband services.

### Enhanced Mobile Broadband:

The 5G standard promises to usher in the next era of immersive and cloud-connected experiences with faster, more uniform data rates at lower latency and lower cost per bit. The 5G standard will take mobile computing performance to the next level with high-speed, always-on, always-connected Internet links with real-time responsiveness. The goal is to reach up to 10 G/ps peak throughput and 1 G/ps throughput in high mobility. This category includes virtual reality (VR) and augmented reality (AR) experiences.

### • Massive IoT (or Massive Machine-Type-Communications):

One of the most anticipated 5G use cases is the ability to seamlessly connect embedded sensors in virtually everything. The industry foresees huge numbers — as many as 50 billion — of potential IoT devices in service by 2020. Industrial IoT is one area where 5G will play a major role, from smart cities to asset tracking, to smart utilities, to agriculture.

# 5G - Opportunities

### Ultra-Reliable Low-Latency Communications:

This category includes new services that will transform industries with ultra-reliable/available low-latency links, such as remote control of critical infrastructure, and (popularly) **self-driving vehicles. The level of reliability and latency will be vital to smart-grid control, industrial automation, robotics, drone control and coordination, and so on.** 

### Digital Farming Example:

With the use of **Precision Farming and Digital Techniques**, the farmers in Belgium have already seen **productivity gains of up to 20%** 

By giving farmers access to cutting edge digital technology, the European Commission's grand ambition is to make farming more competitive, reduce its environmental impact, cut food prices and better inform consumers about the food they eat.



### 5G - Challenges

### • 5G Business Model:

Capital Intensive, Change in Network Components, Stand-alone or Non-Stand Alone.

- Spectrum Harmonization
- Spectrum Cost
- Availability of Cloud Infrastructure
- Security
- Development of Content, Applications, Use Cases
- **Right of Way Issues** *Fiber Deployment, Cell Densification*
- IPv6 and Massive IoT
- Uniform User Experience & Performance Challenges

# PAKISTAN – Government Policy

- Government Policy for Test and Trials for future Networks in place since Oct 2017.
- Possible identification of spectrum in 2.6 GHz, 3.5 GHz and millimeter wave Band.
- Working Group Telecom Operators, Vendors, manufacturers, Academia, R&D Organizations, Regulator (Pakistan Telecom Authority - PTA), GoP (Ministry of Information Technology & Telecommunications – MoIT&T) and Spectrum Management Body (Frequency Allocation Board - FAB).

https://www.pta.gov.pk/assets/media/policy\_directive\_281217.pdf

A PTA- FAB – MoIT&T - Operator – Vendor- Academia based
Working Group is being established. Consultations to be started soon.

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- Pakistan to participate with Standardization bodies especially in WRC-19
- 5G Trials will be offered. Test & Trial Framework in progress
- Permission for trials will be granted as per applications received.

# Pre 5G Trial - A Practical Scenario

- 4.5G LTE-Advanced (Rel. 12 and above) can be utilized as a bridge towards 5G Networks.
- For conducting Pre-5G trial, Hot Spots can be set-up using Fixed Broadband Network based on TDD-LTE technology (Rel 12 at least)
- Trial conditions can be better met in an Indoor Network because it allows better control on SINR conditions thus resulting in utilization of higher modulation schemes (64 & 256 QAM) and support high order MIMO (4x4 and above)
- User Equipment (UE) of Category 16 or above to be used to ensure Gbps DL speed is supported.

# How to achieve Gbps-level DL Throughput

### **Customer Premises Equipment / Modem**

1.6 Gbps

2.0 Gbps

4CC

5CC

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+	4x4 MIMO
+	4x4 MIMO

256QAM

256QAM

PTA

# THANKS