

Road to 5G in India

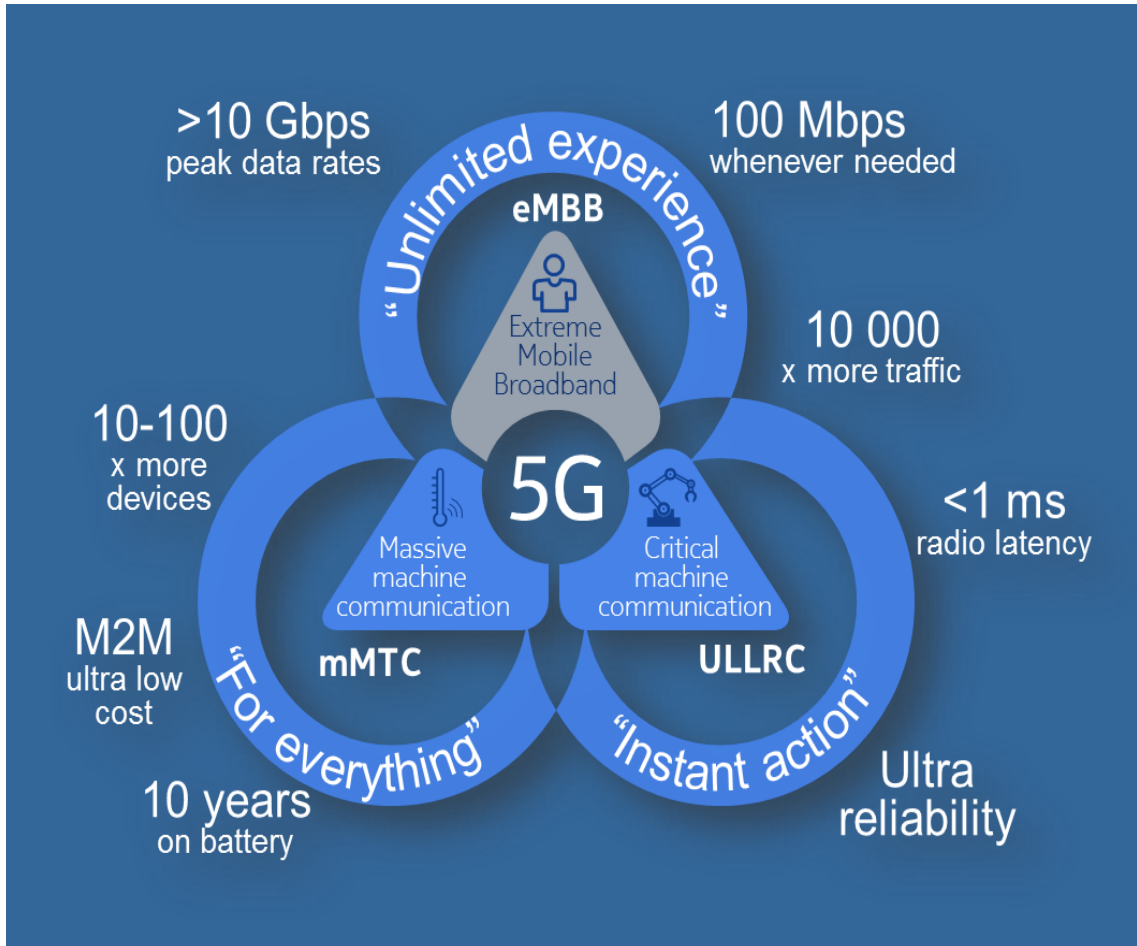
Unlocking new wave of digital

May 2018

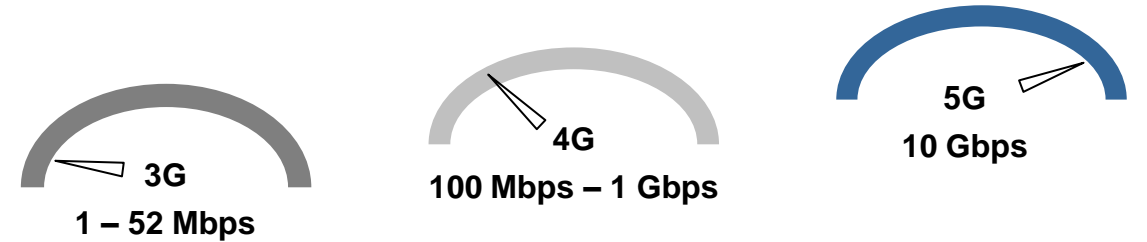
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Why 5G?

Addressing challenges of the future

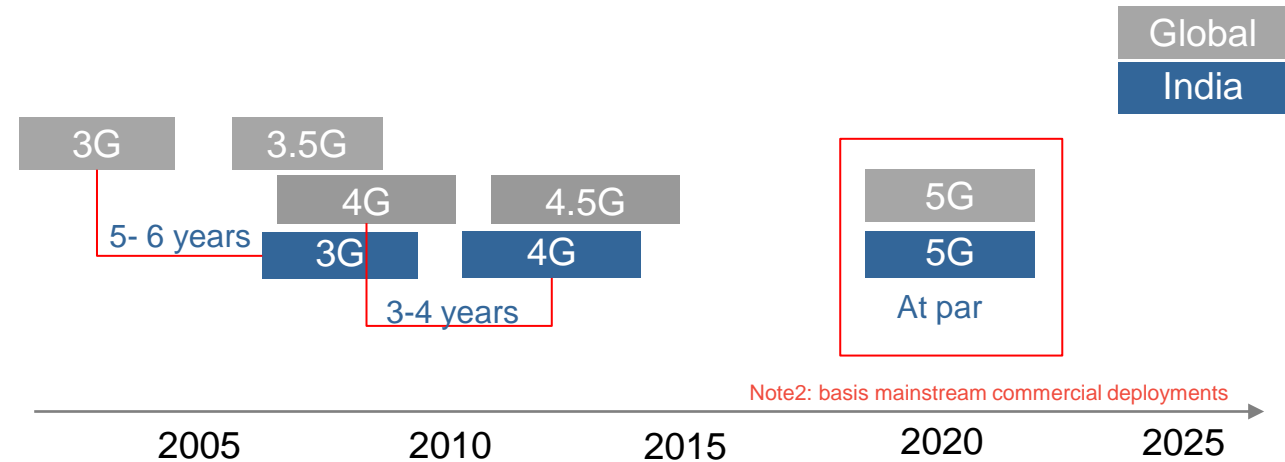


Enhanced broadband user experience¹



Note1: Maximum theoretical downlink speed

India - late entry for 3G, 4G; poised to catch up for 5G²



Note2: basis mainstream commercial deployments

Sept'16: Jio launched 4G

Jan'18: BSNL launched 4G

Progress on 5G globally

Large scale 5G commercial launch expected by 2020

Proposed 5G launch year

2018



2019



2020



5G rollout plans

Verizon to launch 5G residential broadband services in 5 markets by 2018

AT&T aims to launch mobile 5G services in 12 US markets by late 2018

BSNL signed MoUs with Nokia, Coriant and ZTE for 5G ecosystem and with NTT for 5G test bed

KT Corp launched trial 5G network during the 2018 Olympic Games in February 2018, with commercial launch slated for 2019.

China Mobile to develop end-to-end commercial products and pre-commercial 5G network by 2018; deploy 10,000 5G base stations for commercial launch of 5G services by 2020

Telenor and Tele2 to build a joint 5G network in Sweden, with full commercial launch expected in 2020

India – #1 globally in mobile data usage



Data

Per day

76PB

India

69PB

China

53PB

USA

77%

digital media consumption is on mobile devices

200 min

per day spent by Indians on mobile apps

40%

Time spent by mobile internet user on social media; 30% on entertainment

3.9GB

Average data consumed per Smartphone

93%

of time spent on videos in Hindi and other regional languages

250m

people viewed videos online in 2017, a growth of 64% over 2016

79%

web traffic highest on mobile, #2 globally after Nigeria

11m

Global app downloads, at #2 after China at 85m

2022, India to continue to be the largest data consumer

650m

2.2x rise in smartphone users

18GB

5.1x rise in average data on smartphone

44.5m

2.2x rise in applications downloaded

420m+

M2M connections to grow at 37% CAGR

500m

Largest online video users globally

75%

Video consumption of the total mobile traffic

Potential to transform lives of 130 crore+ Indians

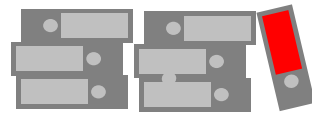
Healthcare

- ▶ Remote monitoring
- ▶ Telemedicine
- ▶ Remote surgery



Education

- ▶ Track objects, students, staff
- ▶ Instructional design



Agriculture

- ▶ Monitoring crop yields, rainfall, pesticide, soil, etc.
- ▶ Environmental control



Safety

- ▶ Women and child safety
- ▶ Alarms and surveillance
- ▶ Connected cameras



Logistics

- ▶ Fleet management and optimization
- ▶ Navigation and fuel management



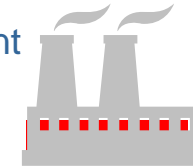
Financial Service

- ▶ Remote sales management
- ▶ Mobile point of sales



Power & Utilities

- ▶ Smart Meter, Smart Grid
- ▶ Facilities Management
- ▶ Equipment management



Automotive

- ▶ Infotainment and positioning services
- ▶ In-car emergency systems
- ▶ Remote diagnostics



BSNL to:

Revolutionize broadband in India

Address digital divide

Accelerate Digital India vision

Telcos adopting use cases for 5G

5G use cases: operator announcements; partnerships play critical role

Connected vehicles

- ▶ SK Telecom, BMW and Ericsson successfully tested 5G network for connected vehicles
- ▶ Able to send and receive data at 3.6 Gbps while running at a speed of 170 km/h.

Self-driving car

- ▶ KT and Hyundai developed 5G self-driving cars
- ▶ Communication between cars and big data analytics
- ▶ Driver only for lead vehicle/truck
- ▶ Followed by platoon of 4-5 self-driven trucks at a fixed distance from lead vehicle

Remote driving

- ▶ Telefonica and Ericsson demonstration remote driving using 5G networks

Truck caravan

Virtual reality applications

- ▶ BT and Nokia are collaborating on 5G can be used to maximise the experience of customers watching fully-immersive live sport or entertainment in future HD VR.

Augmented reality glasses

- ▶ DT and ZEISS partnered to explore the potential applications and the future of smart glasses using 5G.

Robotics

- ▶ DT demonstrated an industrial robot in MWC 2017, with response time at exactly 8 milliseconds, controlled in real time using 5G technology.

VR and Robotics

- ▶ Controlled robot sent in hazardous environment
- ▶ Remote 360 degree view and control through VR headset



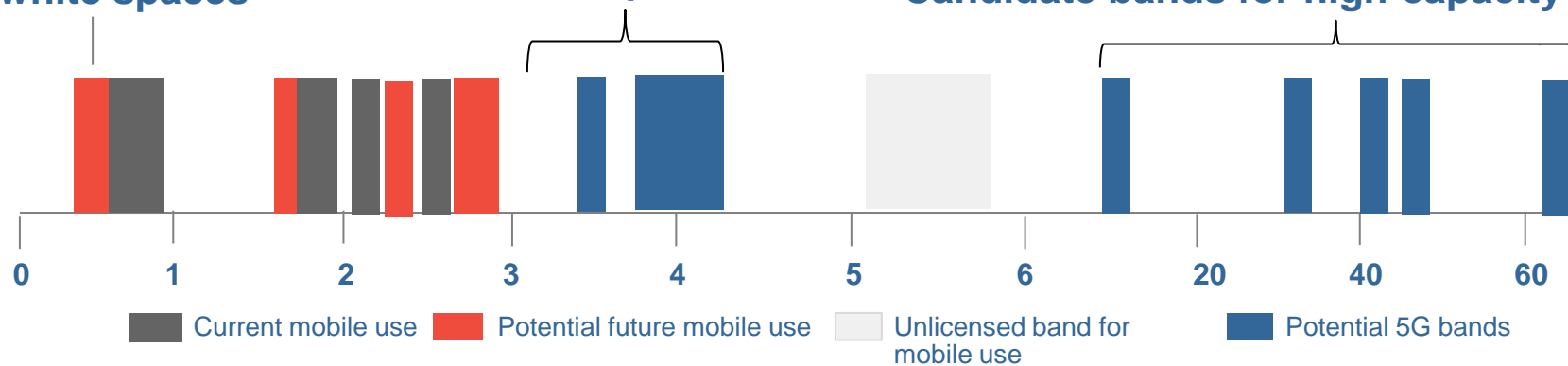
India's journey to 5G

Global spectrum band

TV white spaces

C-band spectrum

Candidate bands for high-capacity 5G

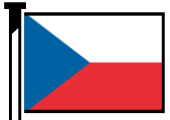


TRAI identified 3.4 GHz and 3.6 GHz for 5G, inline with global practices

Three 5G spectrum auctions have taken place so far



In May'17, **Ireland** conducted 5G spectrum auctions in the **3.6 GHz band**, raising **€78m**, allocating **350 MHz** of the available spectrum to five operators



In Jul'17, **Czech Republic** conducted 5G spectrum auction in the **3.7 GHz band**. Two existing and two new operators awarded frequencies. Each of the **five auctioned blocks** sold for **US\$8.9m – 7x the reserve price**.



In Nov'17, the **Australian** telecoms regulator conducted spectrum auction in the 2 GHz, 2.3 GHz and 3.4 GHz bands. Three operators acquired **62.5 MHz** of spectrum in the **3.4 GHz band** for a total consideration of **A\$58.3m**

Other key considerations

Dearth of fibre backhaul - requisite for 5G

Current levels: 20%-25% towers fiberized, expected to reach 70% by 2020

Financial constraints

Capex is a challenge in India, with high sector debt (>\$70b) and ongoing financial woes of operators.

Right-of-way

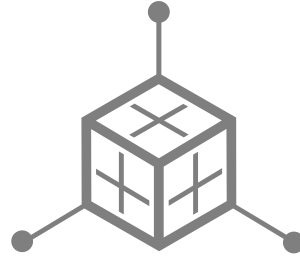
Simplify RoW policy and have a single window clearance, through centre and states

What next?



Clear regulatory roadmap

A conducive policy environment to support 5G in India



Enabling infrastructure

Investments in fibre network and leveraging BharatNet



Not about Gs, but GBs

Data ecosystem and **experience matters** –technology (2G/3G/4G/5G) is just an enabler



To address digital divide and enhance experience for under-connected



Thank you