



5G Opportunity

- Benefits, Use cases, Global and India Perspective”

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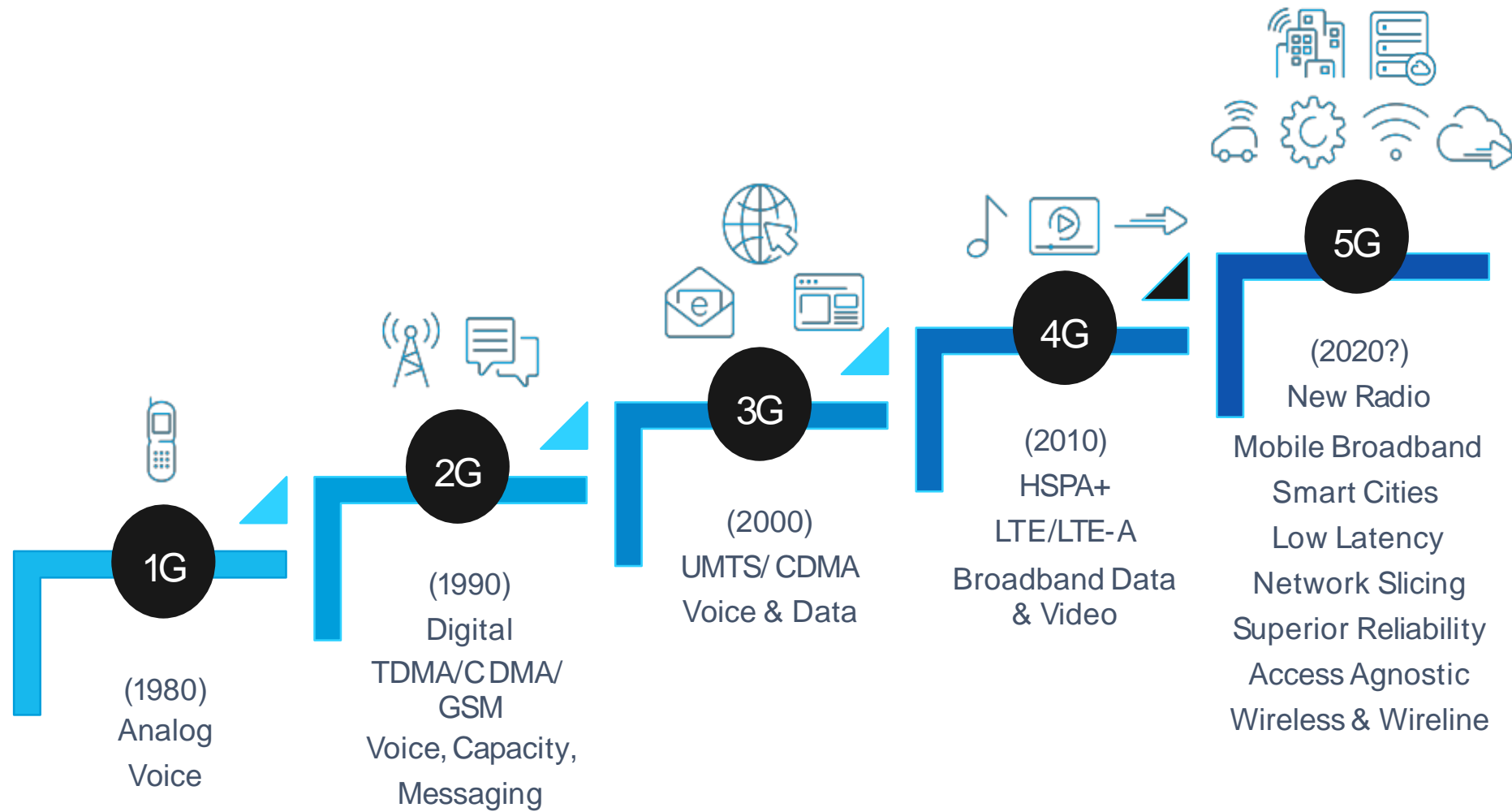
AT&T Global Network Services India Pvt Ltd

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The Network Evolution



“5G” is More than just 5G

- A realistic 5G network will consist of five key technology areas



Access (5G NR)

Delivery of the **5G New Radio (NR)** and advanced radio link protocols to support multi-gigabit speeds, Ultra-Low Latency/ High Reliability and massive densification.

True integration of multiple access methods (Wi-Fi, LTE, NR) for common network experience



Network

Control Plane/User Plane separation, enabling flexible deployment models

Network slicing to dedicate RAN, Core Network and/ or Application resources to verticals/subscribers

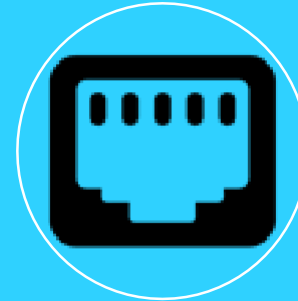
NFV/ SDN



Edge Computing

Provide the ability to run services at the network edge closer to the user equipment - lowering e2e latency

Deliver compute and storage capabilities to the edge to enable service chaining and new product innovation



Transport

New standards to support more flexible transport schemes (front-haul, mid-haul, backhaul)

Support for next generation capabilities like self-backhauling



Device

Support for new and smarter connected devices such as security cameras and connected cars and providing longer battery life

5G will offer...



Massive Device Connectivity

Handle *over 30 billion devices* connected globally by 2030

The graphic features a circular arrangement of blue dots. Various icons are placed around the circle: a laptop, a desktop monitor, a lightbulb, a smartphone, a tablet, a drone, and a mobile phone.

Ultra-Reliability

Help *first responders* and *telemedicine*, as well as industries using robotics like healthcare and manufacturing



Ultra-Low Latency

Support *real-time applications* used for gaming and connected cars



Better Capacity & Coverage

Provide a *better customer experience* with more capacity through more connection points in smaller areas.



The Case for Change – 5G Drivers



- **Lower Cost Structure**

- From hardware to software focus
- Efficiency via resource pooling
- Workforce evolution



- **Advent of IoT**

- Diversification of devices
- High connection density
- Unique ecosystem requirements



- **Enterprise-Grade Experience**

- Extremely Low latency
- 9's Reliability
- Ultra-fast speeds (spectrum)

5G ENABLES NEW IOT USE CASES



Massive IoT

Critical IoT



LOW COST, LOW ENERGY
SMALL DATA VOLUMES
MASSIVE NUMBERS

ULTRA RELIABLE
VERY LOW LATENCY
VERY HIGH AVAILABILITY

Enhanced MBB
MORE CAPACITY, LOW LATENCY

Future AT&T *5G* Use cases

V2X

Transportation

Customer Objective

- Enable vehicles to share and ingest just-in-time, context relevant data to navigate the environment more safely and optimally
- Trend toward vehicle autonomy

AT&T solution – Connected vehicle

- Vehicle communication to road-side units (RSU's), RSU to network edge
- Use ultimate 5G networks and network edge processing to provide ultra-reliable, low latency V2X communication

Customer Value

- Increased safety: Intersection and around corner awareness
- Efficiently delivered content: HD mapping, infotainment
- Eventual vehicle autonomy



Drones

Industrial, Public Safety, Insurance

Customer Objective

- Enable highly secure, reliable, high-quality data transfer from drones for remote operation, increased security, compliance, and safety workflows.

AT&T Solution – Enhanced Video – Uplink bandwidth

- 5G RAN technology helps to provide stable, reliable, high-bandwidth uplink communication for drone workflows
- Cell tower, oil rig, and pipeline inspections
- Public Safety applications and missions
- Edge processing manages latency and backhaul cost

Customer Value

- Reliable, high bandwidth uplink and downlink communication over licensed spectrum
- Beyond line-of-sight applications*

* Where and when regulatory guidelines allow



Video Surveillance

Enterprises, Cities, Retail

Customer Objectives

- Use HD video streams for near real-time analytics
- Need reliable uplink bandwidth and reduced backhaul cost
- Drive cost out of the business without compromising security, compliance, and operations tracking needs

AT&T solution – Enhanced video – Uplink bandwidth, edge processing allows for:

- HD uplink video streams captured over high bandwidth 5G air interface and processed at the RAN or network edge
- City planning, event detection/root cause analysis, surveillance
- Retail floor-planning, people counting
- Enterprise anomaly detection, greater security, safety compliance

Customer Value

- Scalable video surveillance with potential to reduce installation and operation costs





Entertainment

Concept focused on proving 5G technology can deliver greater flexibility and mobility for LIVE broadcasting.

4K HDR video from 7th hole streamed over 5G to network broadcast command center, broadcast over DirecTV.

Heavy uplink bandwidth use case
~60 mbps.



AT&T Retail

Ultra-fast point of sale

Robust platform for video-centric environment, enhanced content distribution and AR/VR

Significant reduction in hardware costs with Multi-Access Edge Computing (MEC)

AT&T 5G is mmWave first, followed by sub-6

5G+

First standards-based mobile 5G network in U.S.
2018: mmWave¹ in parts of 12 cities and continued growth in 2019



First device in 2018: Netgear Nighthawk 5G Mobile Hotspot.
Planned launch 1H19: Samsung smartphone for mmWave.
Future sub-6 ghz model

5G

Sub-6 ghz spectrum deployment 5G planned.
Initial 5G, 5G+ will integrate with 4G RAN/Core

Continuous investment in 4G LTE →

- 5G Evolution in nearly 400 markets by EOY 2018
- LTE License assisted access in 24 cities
- Process for adding 10,000+ FirstNet sites underway
- U.S. & Mexico LTE-M today, NB-IoT in early 2019²

Will 5G replace everything?

The road to standards-based 5G is through 4G LTE-Advanced. Initial deployments of 5G radios will reside on the LTE network core. **Ultimately, standalone 5G will use a new network core that is separate from, but still interworks with, today's LTE network.** So, the continued deployment of our 4G LTE-Advanced network remains essential to laying the foundation for our evolution to 5G.

4G networks aren't going away anytime soon. Research firm Ovum forecasts that by 2020, 3.62 billion people will subscribe to services delivered via **4G LTE networks**, up from 1.05 billion in 2015. **We continue to evolve our 4G LTE network via things like LTE-Advanced to deliver higher capacity, speeds and the best experience for our customers.**

In addition, the path to standards-based **5G initially uses the non-standalone option**, which means 5G radios ride on the existing LTE network core. **Non-standalone 5G adds new, advanced features onto an already solid set of equipment – LTE – to provide customers with faster speeds, lower latency and a better overall experience.**



5G ADOPTION – GLOBAL UPDATE

- US Mobile Network Operators have made a head start
- European Mobile Network operators lagging behind in deployment
- In Asia , Mobile Network operators in China , South Korea , Japan and Australia have taken the lead .
- 5G Smart phones launch in the first quarter of 2019 –Xiaomi launched the first 5G Smart Phones in MWC 2019 for \$679 . Samsung launched its 5G Smart Phone last week



India 5G status and roadmap

- 5G High level Forum set up by Govt in Sep 2017
- Govt launched a program titled “ Building an End to End 5G Test Bed”
- Budget of Rs 2,240 million awarded to IIT Madras, Delhi, Kanpur, IISc etc
- Ericsson installed the first public access 5G test bed at IIT Delhi in Jul 18
- Govt wants full scale deployment of 5G networks by late 2019 or early to mid 2022

IS INDIA READY FOR 5G ?

