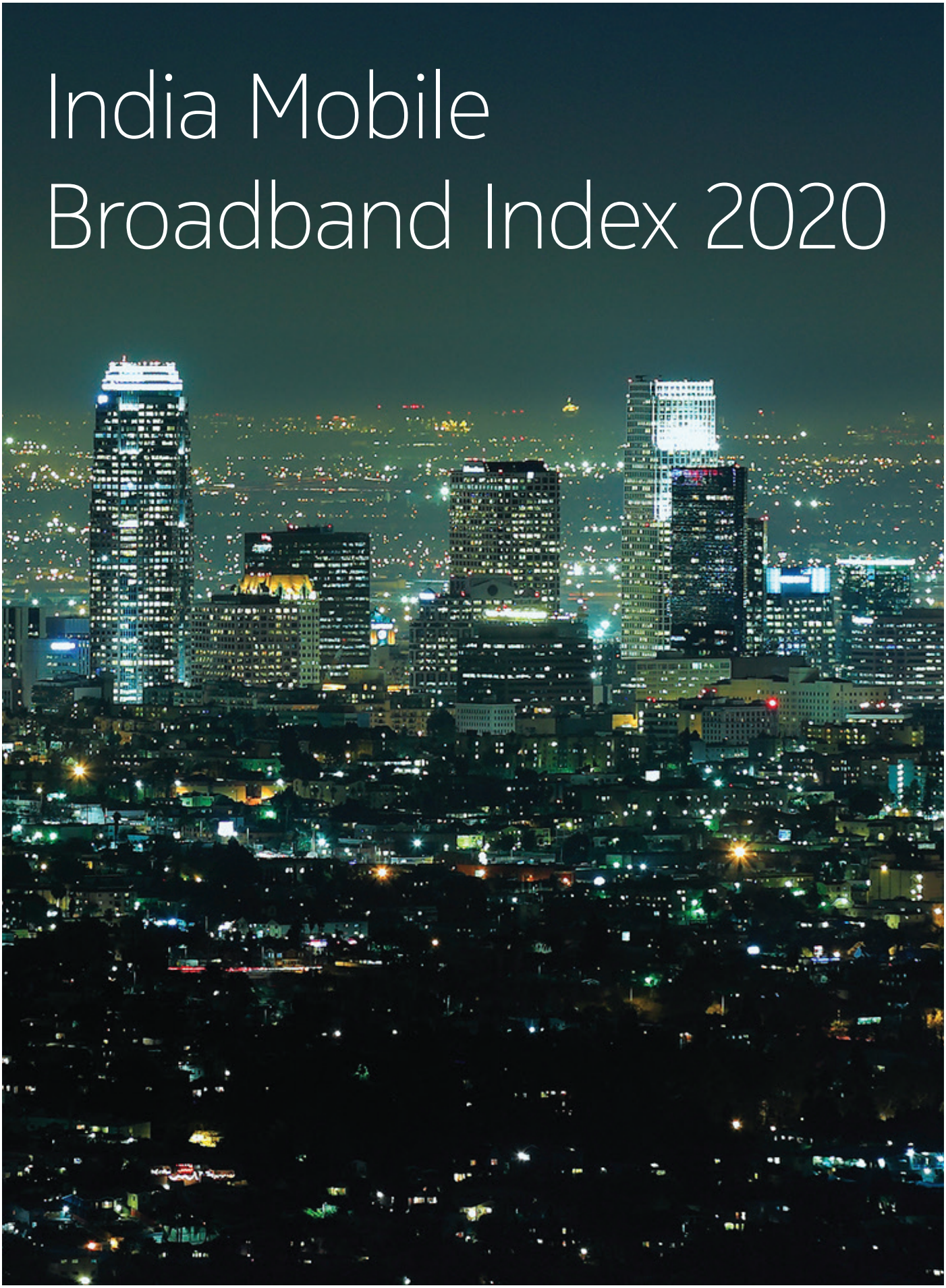
NOKIA | MBiT Index

India Mobile Broadband Index 2020



About Nokia MBiT Index

Nokia MBiT Index is a report on mobile broadband performance in India. It aims to provide valuable insight, data and analysis on mobile broadband and data traffic growth in India, by co-relating these trends with various demand and supply-side drivers of the connectivity ecosystem such as handsets and devices, content, subscriber usage patterns and network investments by mobile operators.

This edition of the MBiT Index evaluates 3G, 4G and overall data traffic growth trends at a pan-India and circle category level, and data consumption per user on 3G and 4G for 2019. It highlights the current device ecosystem for 3G, 4G and VoLTE devices in India as well as users' data usage patterns in terms of type of content being consumed. Key developments on the content and OTT side of the market are covered. The document also covers how Private LTE networks are likely to evolve in India complemented with insights from interviews with the country's top CIOs and CTOs. Finally, key use cases and future roadmap for Private LTE are also highlighted.

MBiT Index has been created based on Nokia's analysis of data obtained from various sources. It analyses mobile broadband traffic trends only at a consolidated level and does not intend to provide a comparative analysis of data growth for different operators.

Total data traffic increased by 44 times over last four years; 2019 saw total broadband subscribers surpassing 600 MN

Massive increase in OTT consumption fueled by rising smartphone users and falling data tariffs led to increase in 4G data traffic

01 Overall data traffic increased by 47% in 2019 due to continued 4G consumption, while 3G data traffic registered its highest ever decline of 30%

02 4G constituted 96% of total data traffic consumed across the country; bulk of the increase in 4G payload came from categories A, B and C

03 Overall average data usage per month registered a CAGR of 93% from 2015-2019 with average data usage per month surpassing 11 GB in December 2019

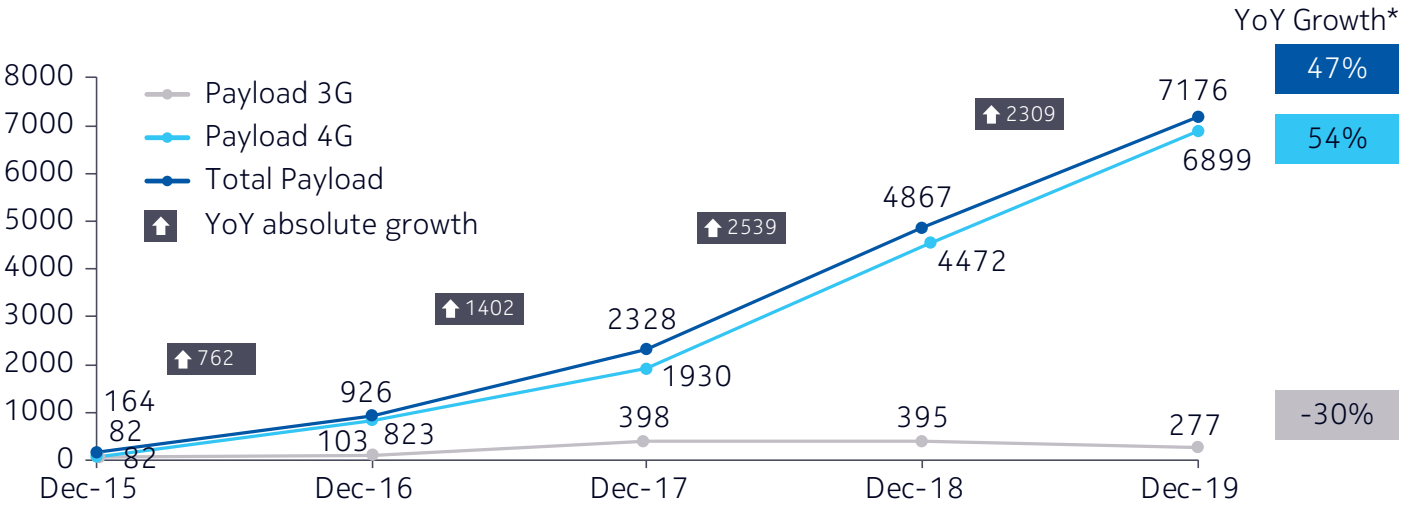
04 4G device base grew by 1.5x driven by launch of variety of models by brands at aggressive pricing; VoLTE handsets grew to 432 Million

05 Video consumption has surged due to an aggressive distribution strategy and innovations like sachet pricing and mobile only packs by OTT players

06 Growing requirement for more reliable, secure & higher capacity connectivity is driving the demand for advanced solutions

Total data traffic grew more than three times over the last two years

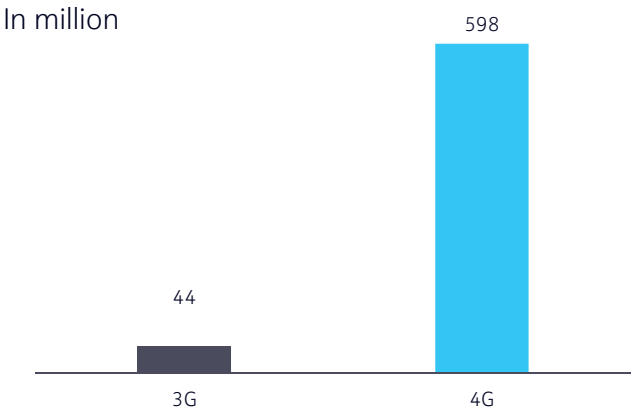
Pan-India mobile data usage – in Petabytes (PB) per month, December[1]**



Continued upgradation to 4G, low data prices, affordable smartphones and increased video viewership have driven higher data consumption

- Post introduction of 4G services in 2016, total data traffic increased by 44 times (2015-2019) which is one of the highest in the world.
- Majority of the data traffic in 2019 was driven through 4G as a result of new 4G users and movement of data traffic from 3G to 4G due to network upgradations.
- Video viewership has been fueled by growth in number of OTT platforms, increased streaming of regional language content and cheaper subscription plans.

Data subscribers by technology, December 2019[2]



- 4G data users have increased by 38% YoY with the 4G penetration in the country reaching 44%.
- 3G subscribers exhibited a steep decline of 41% in 2019.

Source: 1. Nokia Analysis; 2. Operator Quarterly Reports, TRAI Nov data, KPMG Analysis

* Represents Y-o-Y growth for Dec-18 to Dec-19 ; ** 1PB=1000 TB

4G constitutes over 95% of total data traffic across all categories

3G | 4G | 3G contribution% | 4G contribution% | YoY Growth[2]

Metro payload[1] (contributed to 11% of overall 4G payload)

Category A payload[1] (contributed to 36% of overall 4G payload)

Category B payload[1] (contributed to 39% of overall 4G payload)

Category C payload[1] (contributed to 14% of overall 4G payload)

- Circle categories A , B and C saw growth rate of approximately 50% in 2019 due to operator focus on 4G in these circles.
- Broadband penetration has increased as operators have rolled out 4G network in various circles like Bihar, Haryana, Kerala, J&K, Madhya Pradesh etc.

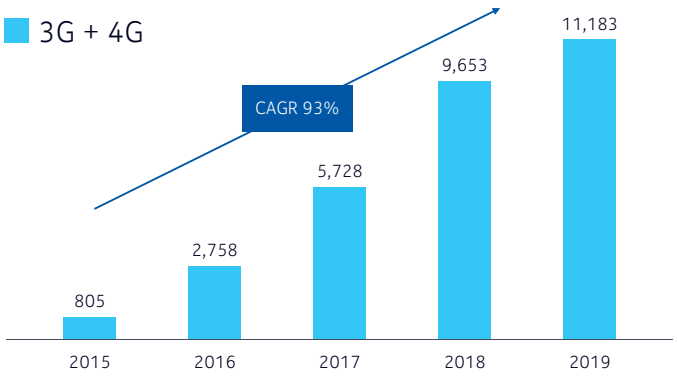
1. Payload in PB/ Month; 2. Represents YoY growth for Dec-18 to Dec-19

Source: Nokia Analysis

Monthly data usage per user has increased almost 14 times over last four years

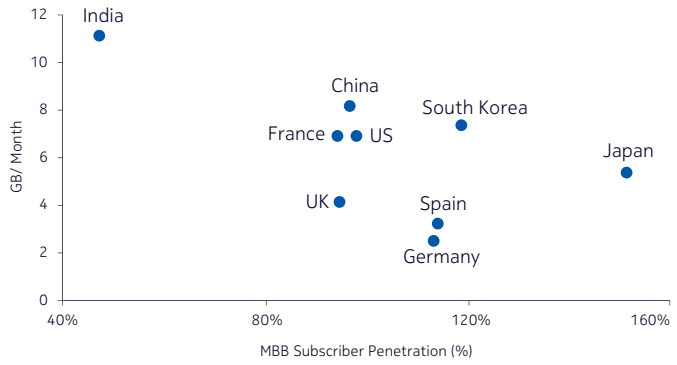
Average monthly data traffic per user increased by 16% annually in 2019 driven by increase in data subscribers and mobile video consumption

Average data per user /month (MB)[1]



- Continuous increase in data traffic has resulted in average data usage per month to grow exponentially at CAGR 93% over the last four years
- The 4G average data usage per month is at 11.7 GB
- Availability of regional content at affordable prices have continued to drive monthly data usage in India

Average Mobile Data per user (excludes Wi-Fi)/ month vs Mobile Broadband Subscriber Penetration[2]



Mobile data usage in India can increase further as broadband penetration approaches the level of similar developed geographies.

- Broadband penetration in India is at around 47%, which is significantly lower compared to China at 95%, and other European nations at around 95-115%.
- In spite of having low average throughput[3], India has a high average data usage. Increase in mobile network speed will further propel the data usage in the country.

Source: 1. Nokia, KPMG Analysis...2. GSMA intelligence country markets data, OECD Broadband Statistics, Tefficient Industry Analysis H1, Cisco, VATM, News reports, Nokia KPMG Analysis...3. Ookla

4G devices grew by 1.5 times in 2019

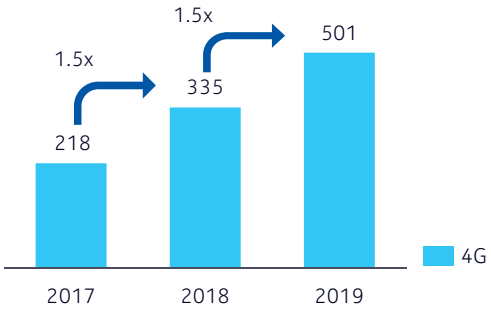
Growth drivers

- Growth of the mid-tier segment where all device manufacturers introduced variety of models with many flagship-grade features and capabilities coupled with users looking to upgrade from their existing smartphones
- Most of the phones sold were in mid-tier smartphone segment with almost 80% of the consumer opting for phones below INR 15000[1]

4G capable unique devices in India

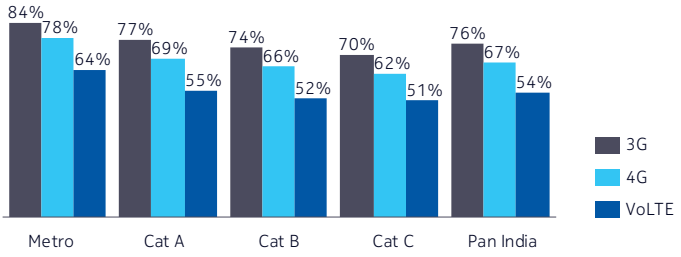
- India surpassed USA in annual smartphone shipments for the first time with 158 million shipments[2]
- 2G phone shipments saw a steep decline of ~25% in 2019[3],however, there are around **400 million** 2G users[3]

432 Million VoLTE capable devices
(86% of Total LTE capable device base)



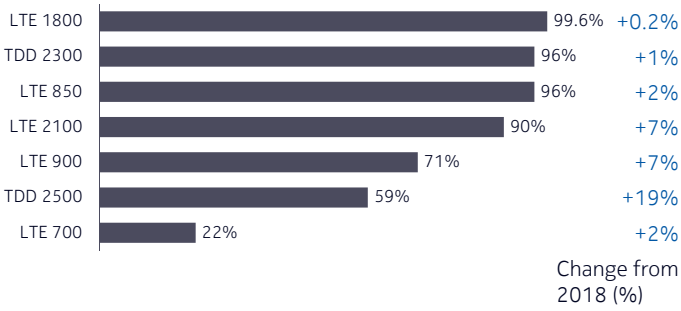
3G/4G capable device penetration by circle category[3]

- 67% of subscriber base in India are equipped with 4G capable devices
- Metros reported the highest 4G device penetration at 78% of subscriber base



LTE band ecosystem (% LTE-capable devices)[3]

- Majority of the LTE devices are across spectrum bands of 1800, 2300, 850 and 2100 MHz
- TDD 2500 showed the highest annual growth among all bands



Source: 1. IDC; 2. Counterpoint Research; 3. Nokia, KPMG Analysis

Video consumption is the key driver of data growth

Factors influencing the growth of online video in India

Cheapest mobile data in the world INR 7/GB (2015- INR 226/GB)[1]

Growth in rural internet penetration to 27.6% in 2019 (2016 – 13%)[1]

Increase in avg mobile data download speed to 11.5 Mbps in Dec' 19 (Dec'17- 8.9 Mbps)[2]

Rise in smartphone users in India to 374 Mn in 2019 (2015- 200 Mn)[3]

Increase in number of OTT platforms in India to 30+ in 2019 (2012 – 9)

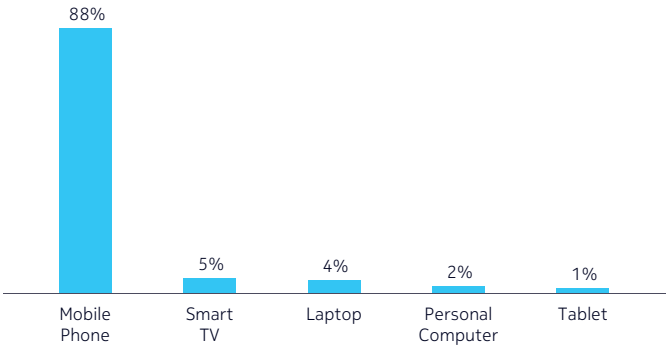
Increase in investment in creation of original content by OTT players

OTT consumption trends in India[4]

Average Time Spent on OTT Platforms	Average Frequency of Access	Average Single Session Duration
70 **minutes/day**	12.5 **times/week**	40 **minutes**

The online video platforms are truly going mass in terms of frequency and duration of consumption

% of daily online video watching time (Overall)[4]



Mobile phones have become the dominant medium of online video consumption in India with widespread freedom of access

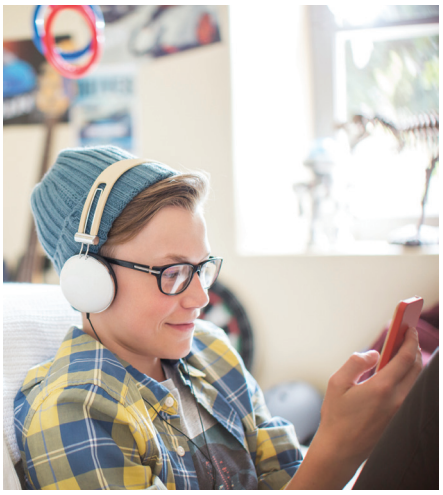
OTT players have increased their user base substantially by adopting different distribution models like partnering with operators, DTH players, OEMs, and other OTT players while also introducing innovations like sachet pricing and mobile only packs.

Source: 1. TRAI; 2. Ookla; 3. Statista; 4. KPMG Report 'Unravelling the digital video consumer' Sep 2019

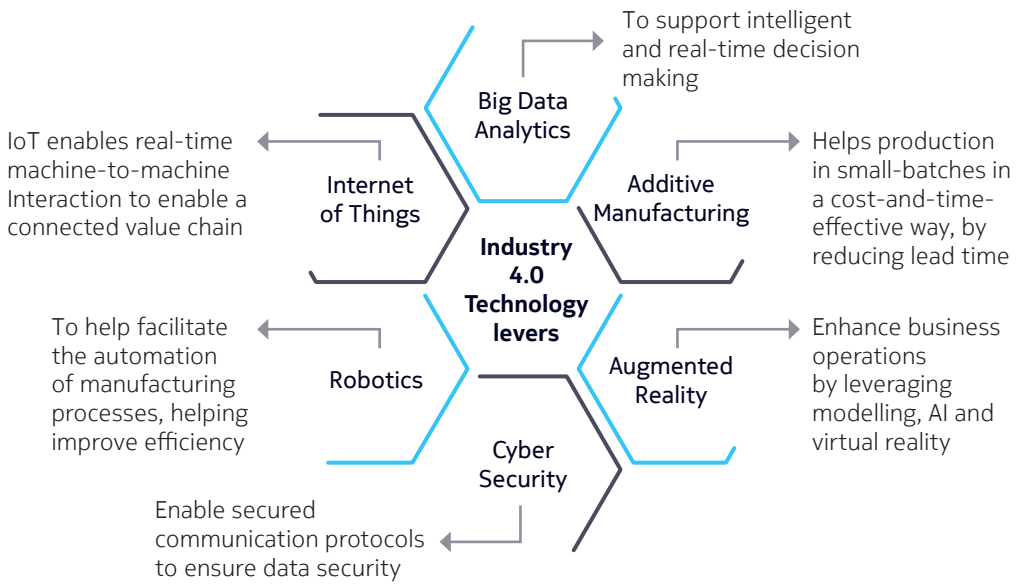
India is gearing for Industry 4.0

Industrial Revolutions

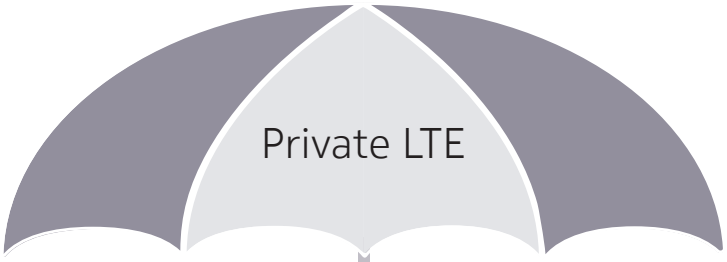
First	Second	Third



Industry 4.0 is bringing together the different silos in a production system via a network, allowing real-time data sharing and facilitating machine-to-machine and human-to machine interactions of unprecedented speed and scale



Advanced technologies like Private LTE will drive Industry 4.0



Enablers

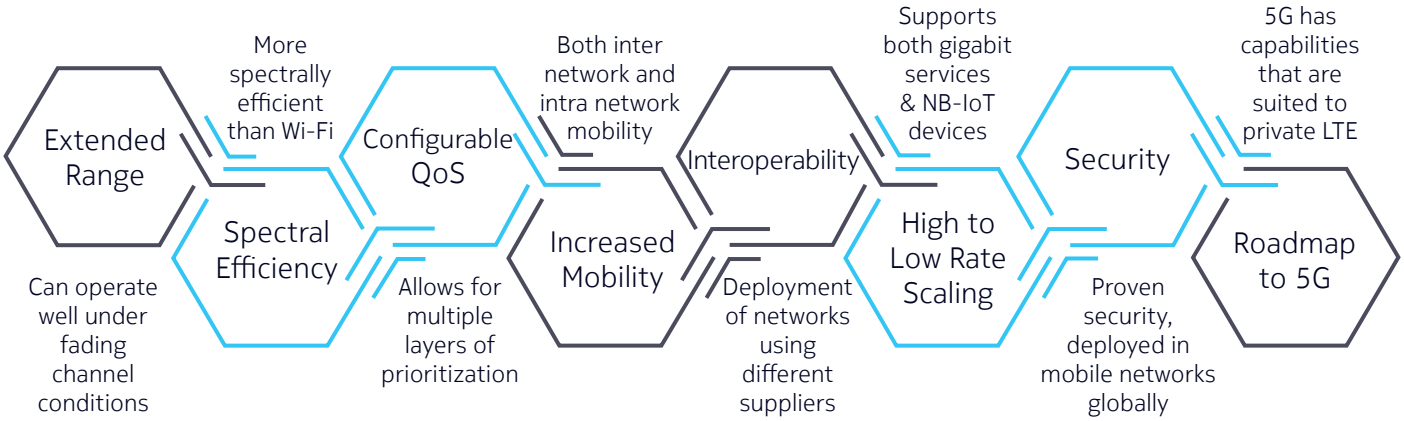
- Sensors, actuators, valves, gateways to gather all kind of data
- Carrier grade technology to meet manufacturing requirements
- Device management and data collection platform
- Applications to derive telemetry information out of data

- Edge processing to meet latency requirements
- Self learning, artificial intelligence to understand health status of assets and root causes
- AR / VR for training and simulations
- Video Surveillance & Analytics for safety and security, and quality assurance

How it works

A Private LTE network leverages micro towers and small cells, similar to a WiFi access point, on-site to replicate the larger public network. Private LTE can be based on licensed, unlicensed, or shared spectrum.

Benefits of Private LTE Network



Private LTE can help in supporting Industry 4.0 use cases

Remote Monitoring

Enables predictive maintenance in machines to increase their efficiency, improve process transparency, lower maintenance costs and reduce downtime. It can be useful in manufacturing & mining

---

Robotics

Robots can be extremely influential on the shop floor by optimizing production efficiency, ensuring quality, limiting human work in hazardous environments thereby improving overall profitability of the company

---

Improving OEE*

Analytics driven insights allowing focus on real-time availability of equipment, performance levels and quality of output. Companies can monitor process parameters, calibration, temperature, speed and production time

---

Material Handling

AR in warehouses can support picking operations by suggesting the most efficient route and providing a digital checklist of work orders. AR can also help the operators load the goods in the best possible sequence in order to optimize the truck capacity

---

VR and Smart Security

Processing huge volume of footage in real time allows manufacturers and warehouse operators to have worker safety alerts and actively monitor the shop floor. Also VR simulations allow workers to participate in on the job trainings

*OEE – Overall Equipment Efficiency

India is expected to follow global examples in adopting Private LTE across industries

Manufacturing | Warehousing | Logistics | Mining

- There are about 7 million global macro base stations delivering connectivity today, however there are around 14 million global industrial sites that stand to be connected. (Source: Harbour Research)
- Nokia has already deployed Private LTE Networks for organizations globally. Some of the examples include Konecrane, Nokia Oulu Factory, Sandvik, Sempra Renewables.
- In India, Nokia's Chennai network equipment manufacturing facility is successfully running Industry 4.0 applications on Private LTE network.

Source: Industry Interactions

Way Forward

Growing data traffic and increasing demand for high bandwidth connectivity will enable a smart ecosystem that's ready to ignite new innovations and highly customized services

The migration of subscribers to 4G will continue to enhance the broadband penetration in India.

There remains scope for 4G penetration to increase further, however, exponential data growth will drive operators to consider other advanced connectivity solutions.

Increase in connected devices and requirement of massive machine-to-machine communication will result in new paradigms in connectivity management with advanced security norms.

Industry interactions reveal that key stakeholders recognize the need to implement Industry 4.0 use cases which will drive demand for Private LTE network.

The growing OTT consumption and the content shifting from SD to HD, and soon to 4k/8k videos, will make high speed and ultra-low latency a prerequisite.

Deploying Private LTE will enable digital transformation across industries and pave the way for 5G mobile technology.

Notes

Nokia India
7th Floor, Building 9A, DLF Cyber city Phase III
Gurgaon – 122 002, Haryana, India
Tel. +91 124 4504000 / +91 124 4504000

Document code: SR2002041565EN (February) CID207210

About Nokia

We create the technology to connect the world. Only Nokia offers a comprehensive portfolio of network equipment, software, services and licensing opportunities across the globe. With our commitment to innovation, driven by the award-winning Nokia Bell Labs, we are a leader in the development and deployment of 5G networks.

Our communications service provider customers support more than 6.1 billion subscriptions with our radio networks, and our enterprise customers have deployed over 1000 industrial networks worldwide. Adhering to the highest ethical standards, we transform how people live, work and communicate. For our latest updates, please visit us online www.nokia.com and follow us on Twitter nokia.com

Nokia is a registered trademark of Nokia Corporation. Other product and company names mentioned herein may be trademarks or trade names of their respective owners.

© 2020 Nokia