

Road to 5G, Built on Fibre

June 14, 2018

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Today's Presenters

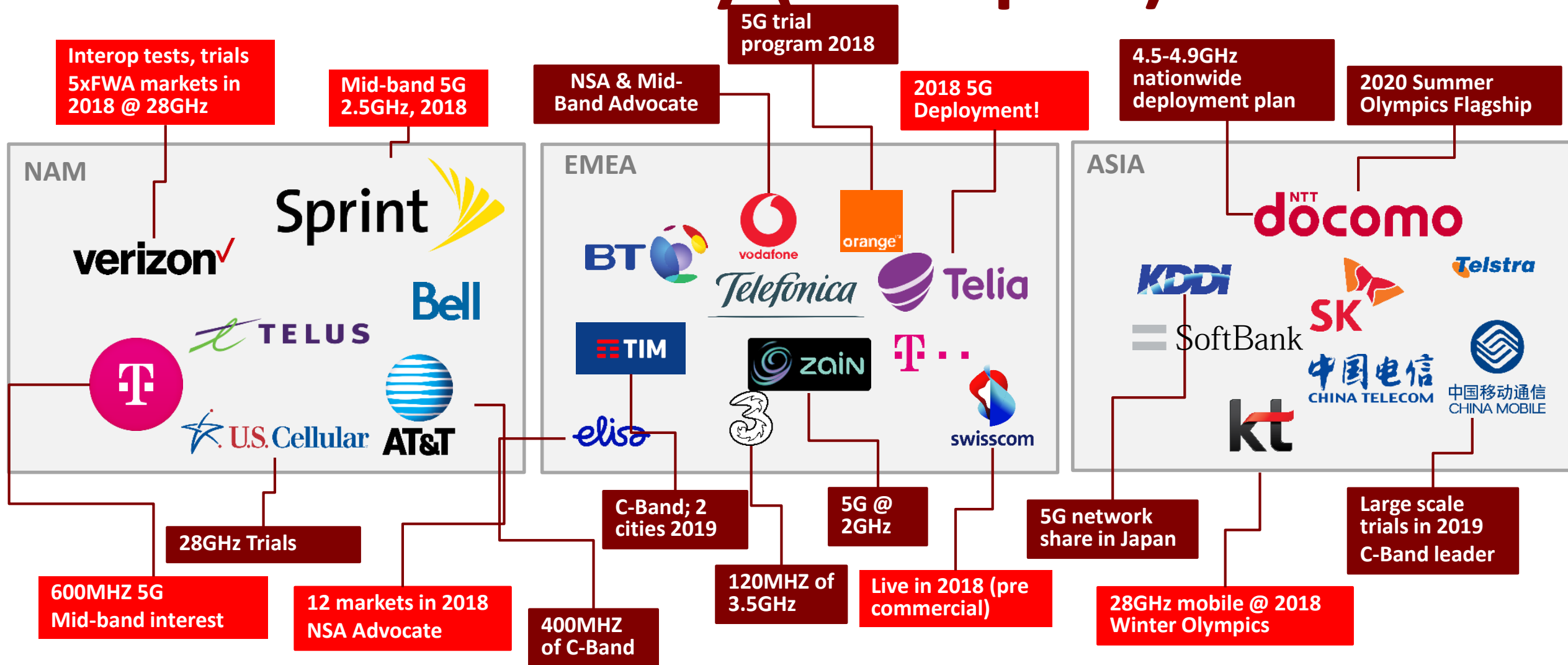


Gabriel Brown
Principal Analyst, Heavy
Reading

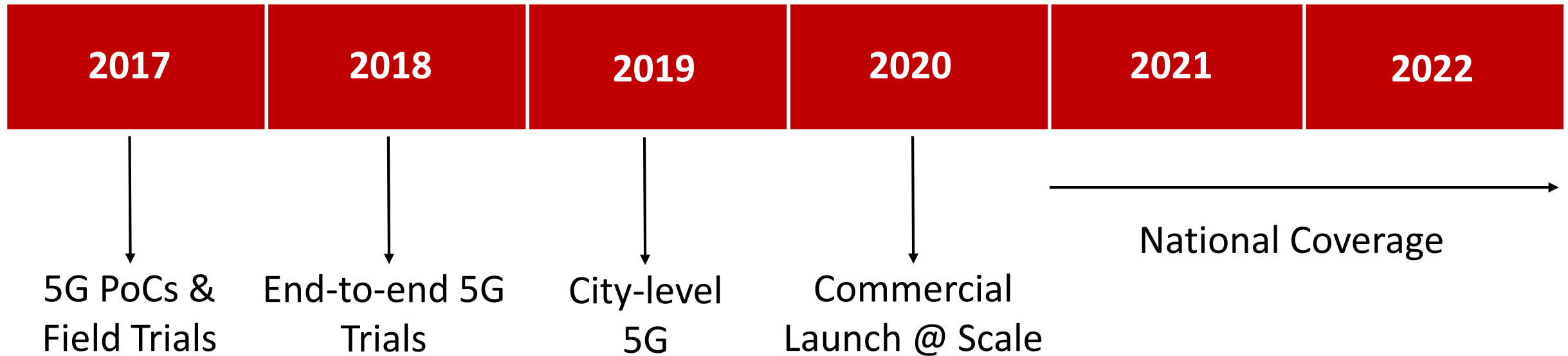


Ankit Agarwal
Director Telecom Products
Business, Sterlite Tech

Global 5G Activity (examples)



Timeline to 5G @Scale



Ultra Dense 5G Networks

3G

4-5 BTS/KM2*

4G

8-10 BTS/KM2*

5G

40-50 BTS/KM2*

A plausible grid-based urban deployment could see BTS density increase 3-5X, decreasing the inter site distance from 170 meters to 85 meters and increasing the cell-edge rate to 1.3 Gbit/s from 25 Mbit/s.**

Poll Question #1

- What percentage of 5G small cell and macro cell sites do you expect to be connected by fiber in your network
 - More than 90%
 - More than 80%
 - More than 70%
 - More than 60%
 - 60% or less



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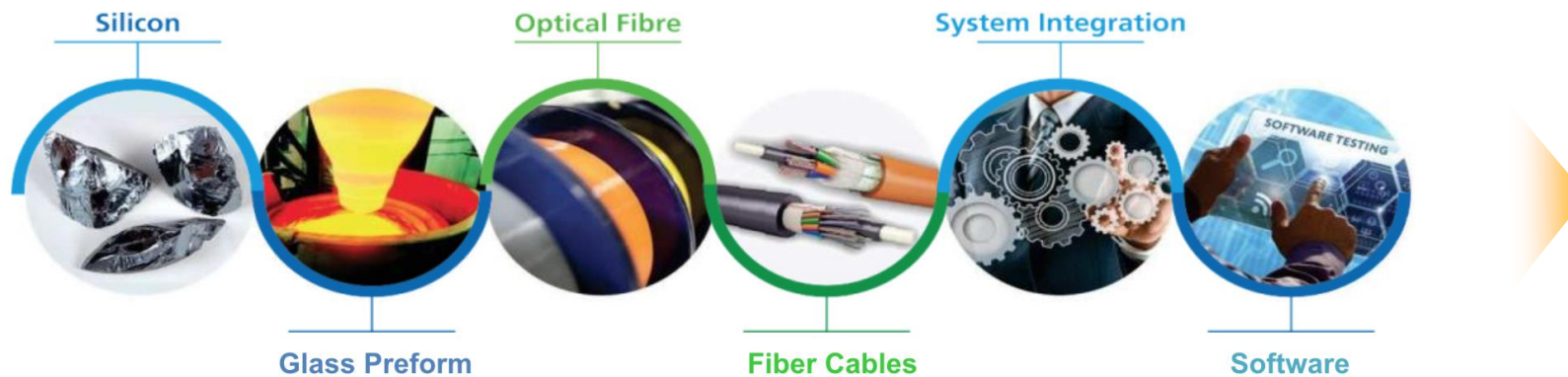
www.sterlitetech.com

Agenda

- Data Explosion and 5G
- 5G Rollout – Network Requirements and Role of Fibre
- Why Fibre is Best Deployed by Experts
- Reliance Jio- Case Study

Only company in the world to have integrated silicon to software offerings

We deliver excellence across the technology stack to help CSPs in every step of their network creation



Presence in over
100 Countries

Partnering with 8 of
top 10 Global Telcos

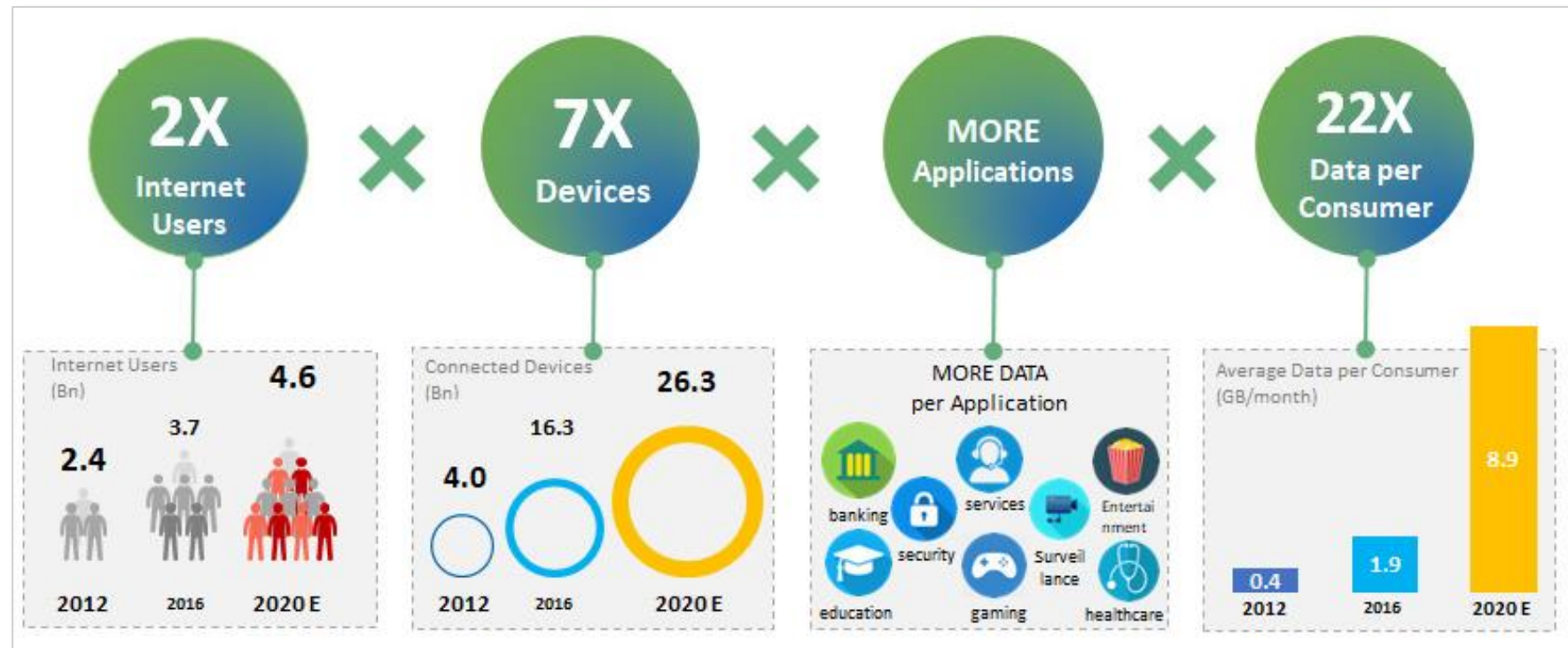
40% of India's Data
runs on Sterlite Fibre

Group contributes 1%
of India's GDP

With 7 Facilities, across 4 locations and unique end-to-end capability, Sterlite Tech leads in designing, building and managing smarter networks

Data Consumption is Exploding – The Age of More

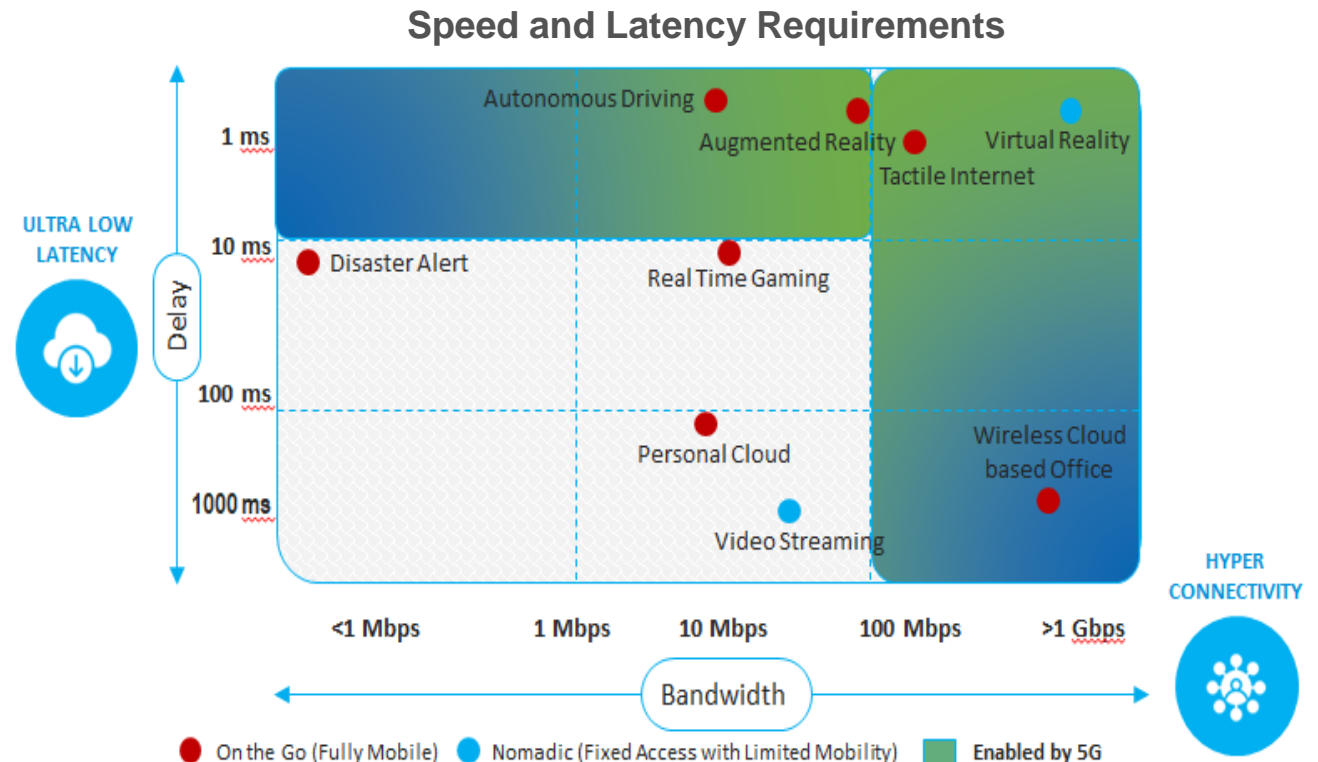
- The world is transforming at a fast pace and data transmission is at the core of this transformation
- We now have MORE USERS, MORE DEVICES per user, MORE GB's per user and MORE CONTENT per device
- By 2020, **more than half** of the world's population will be connected & data will move **beyond mobiles to a world of connected devices**



Source: www.internetworldstats.com, statista Source: Cisco, Gemalto Source: BGR, Cisco, "The Zettabyte Era-Trends and Analysis" July 2016

- The future possibilities are endless. We are likely to see **MORE USE CASES** for data
- Currently people own only one smart device on an average – a smartphone. 5G will enable a **connected devices ecosystem** – connected home appliances, vehicles, medical devices, machines and equipment

Driverless cars
Wireless cloud office
VR enabled events
Virtual classrooms
Connected Devices
Connected cars
5G use cases
Real time gaming
AR-Shopping/Visualisation
VR enabled meetings
Smart cities
Extensive city surveillance
Smart Retail Stores
Connected Homes



Leading Telcos say – Fibre Imperative for a Successful 5G Rollout



“We view **fibre as the cornerstone building block for the network**; the next generation network, and that network is going to look very different than what we have built in the past.

If you look at 2G and third generation and fourth generation wireless, it was about capacity and throughput. **Fifth generation is about those things where we are going to see a 100 times faster throughput**, but we are going to see things like latency of a network, that a network will go out and come back and respond in less than the time it takes to blink your eye.

We are going to see 10 times the battery life that we’ve seen in the past. That opens up a **whole new set of applications for consumers and enterprises**, but you can’t do it if you don’t have fibre deep into the network compared to what we’ve done in the past.”

Lowell McAdam, Verizon Chairman & CEO
18th April 2017

Source: <https://www.cnbc.com/2017/04/18/verizon-agrees-to-1-05-billion-fiber-optic-cable-deal-to-grow-its-fios-platform.html>



“**It all starts with fibre.**

Fibre accelerates everything that businesses need to digitally transform. **Without fibre, innovative solutions like highly secure networking, cloud computing, and 5G wouldn't be possible.**

As we continue to expand our national fibre network, we want businesses to take full advantage of our fibre highway that is essentially right to their doorstep.”

Mo Katibeh, CMO
5th February 2018

Source: <https://www.lightwaveonline.com/articles/2018/02/at-t-plans-fiber-optic-network-expansion-to-deliver-improved-technology-to-businesses.html>



“Telefonica Germany is not yet prepared for 5G given that it still needs to upgrade its mobile antenna sites across the country with fibre

Instead, Telefonica Germany’s plan is to upgrade all of its mobile sites with fibre over the next five years so that they are equipped for the high data transmission rates and low latency 5G requires

While the new 5G technology will be “disruptive”, it will not be a “revolution”. Telefonica will begin a broader rollout of 5G in 2020 and 2021 following tests in 2019, with applications of the new mobile standard to come later when the network is completed”

Martin Cayetano Carbajo, CTO
4th May 2018

Source: <https://www.telecompaper.com/news/telefonica-germany-to-upgrade-mobile-sites-with-fibre-over-next-5-years-for-5g--1243019>

World's biggest economies are gearing up for 5G launch

Committing significant resources towards network transformation



China

Chinese telecom operators expect to spend on 5G networks by 2030

\$400 Billion



USA

Investment in Fiber infrastructure is required over the next 5 to 7 years

\$130 - 150 Billion



India

Expected investment needed for 5G

\$60 - 70 Billion



Japan

Japanese CP's to invest for delivering nationwide 5G coverage by 2023

\$46 Billion



South Korea

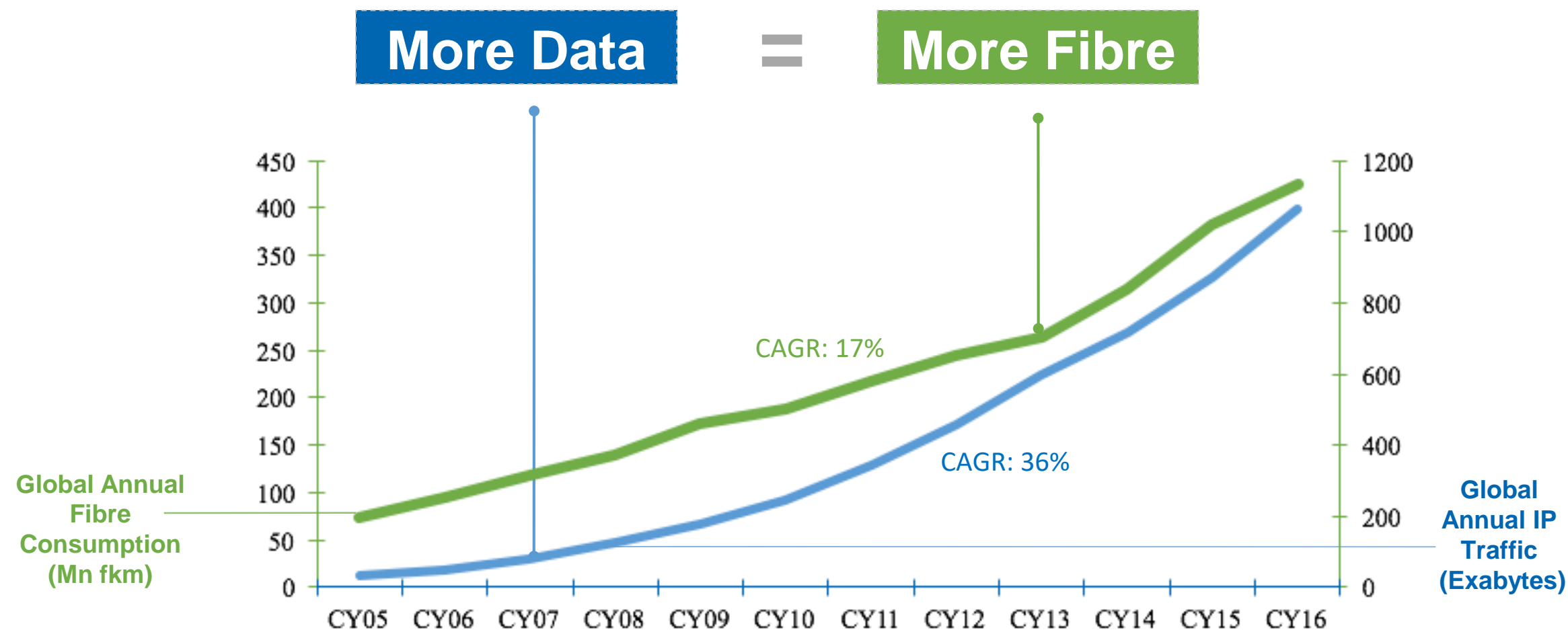
South Korea will invest to build 5G network by 2020

\$1.5 Billion

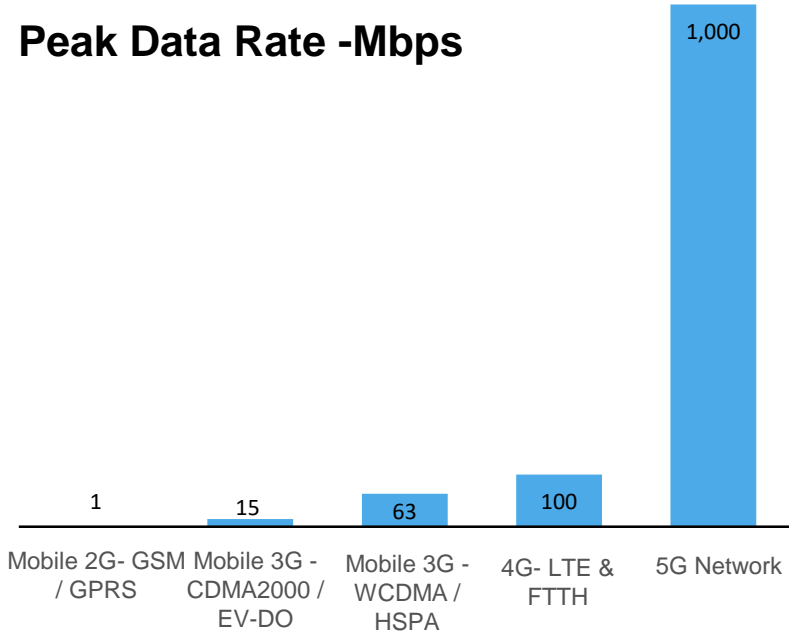
- **Globally Fibre Demand is Increasing**
- **Historically 80% of Global Fibre demand is driven by these 5 countries**

Source: Industry Reports & company research

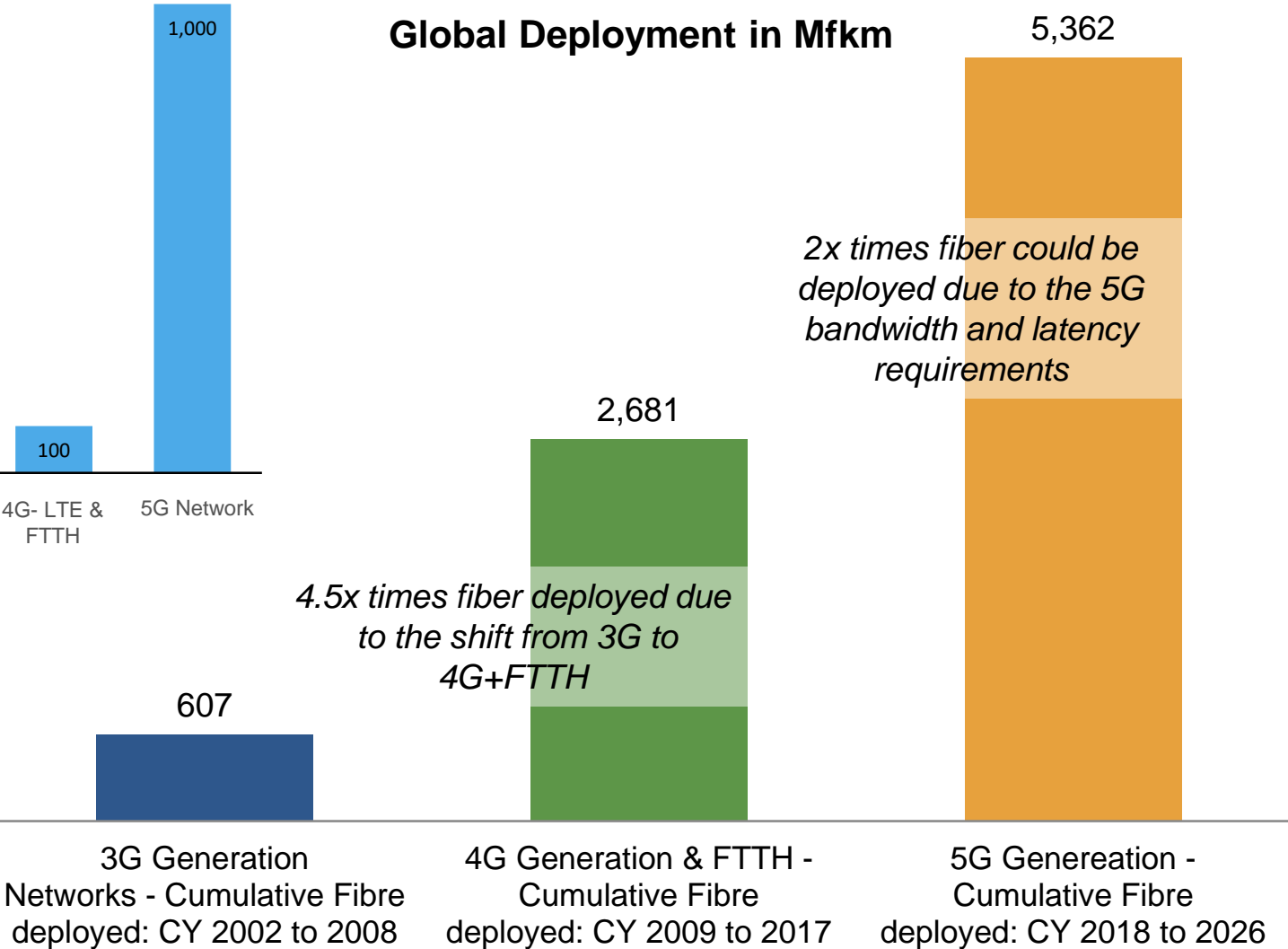
Historically, there has been a **strong correlation** between data consumption & Fibre demand



Peak Data Rate -Mbps



Global Deployment in Mfkm



Data consumption is expected to grow along with rapid evolution of technologies, such as 5G

Surge in data traffic propels growth of Optical Fibre

Fibre is the best & most efficient medium to support exponential data demand growth

Fibre is Getting Closer to the Point of Consumption

Fibre has played a key role in 2G, 3G and 4G roll outs

5G is all set to bring Fibre closer to the end user



2G Era



3G Era

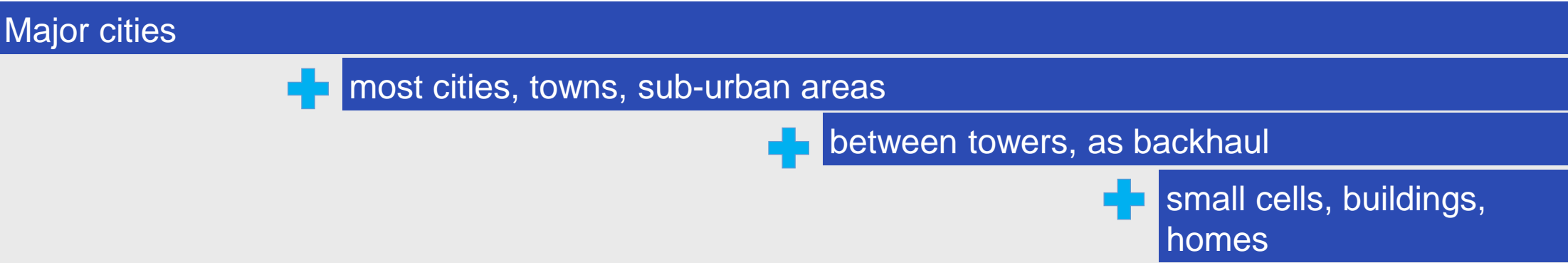


4G Era



5G + FTTH

Fibre is connecting:



Being deployed by:



1 More end points & Edge networks

Significantly more endpoints in the access network

- Deep fibre in the access network for mobile and fixed networks. Each 5G front haul will require 1 fiber pair
- Increase of uploading will require symmetric speeds: 1 to 10 Gbps and latency of 1ms
- Increase AFC to reduce need for optical splitters (reduce losses during splitting)

Proximity data centers and Edge networks

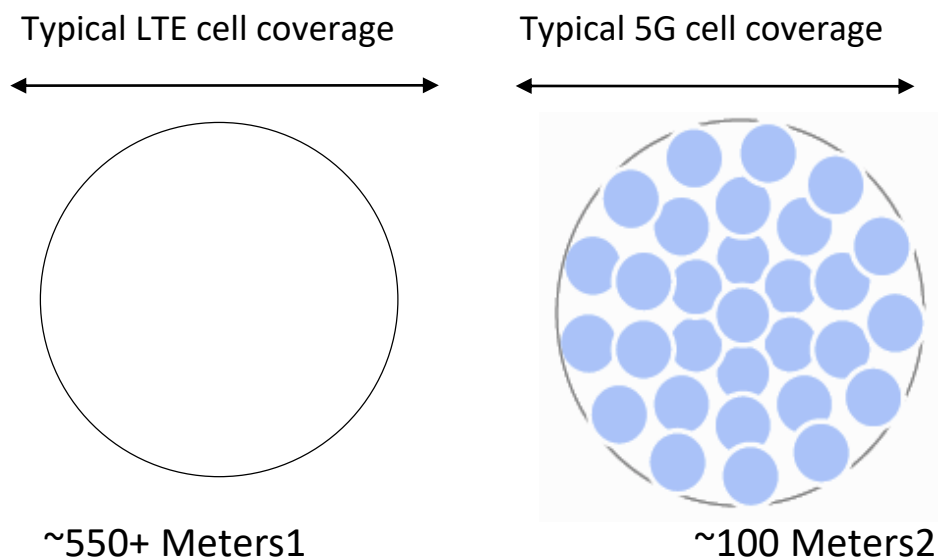
- Proximity data centers- content moving closer to user to improve QoE
- Move IP layer 3 management to edge of the network

Future proofing and cost reduction

- Fibre is only ~10% of overall deployment costs
- Deploy higher fibre count cable to reduce installation costs per fibre
- Imperative to deploy enough capacity for future expansion

2 More number of cells

5G will require 20-30x the number of cells of a conventional cellular network



¹ For typical 2.1 GHz LTE base station in urban area

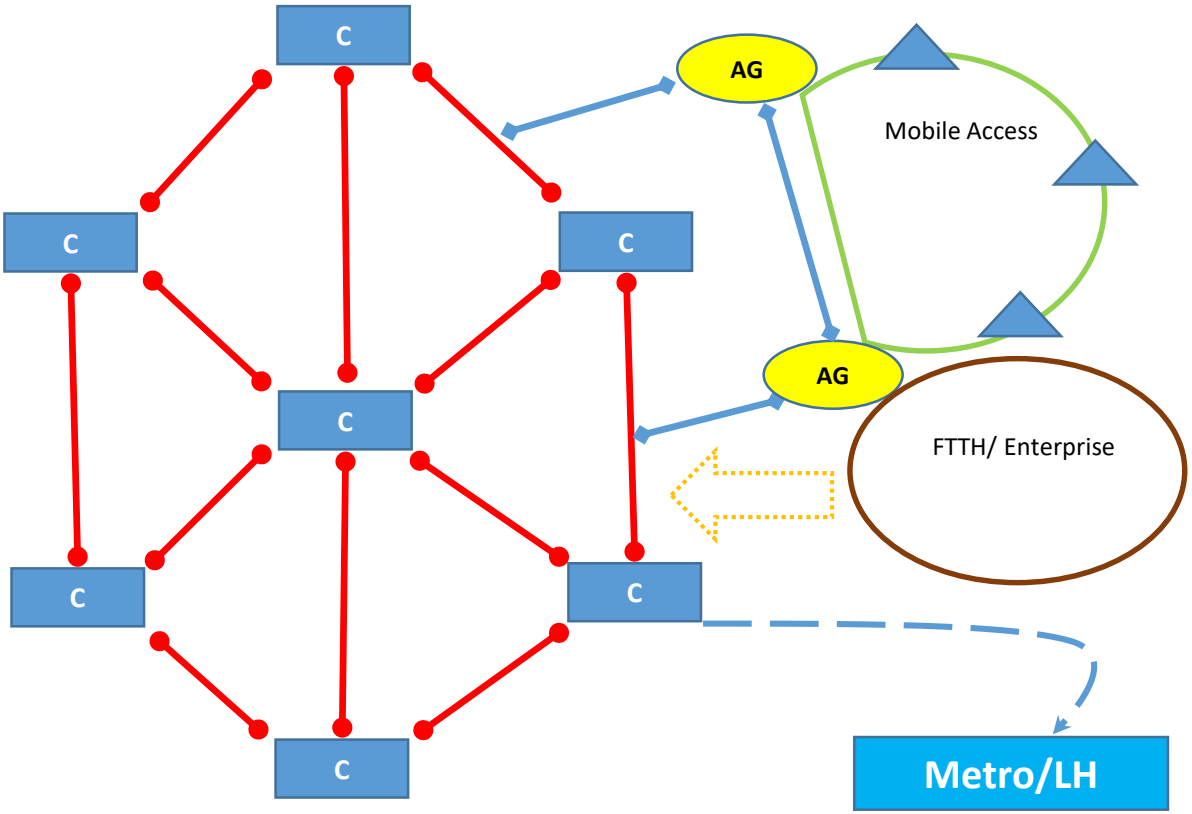
² For 5G small cell based on >5GHz+ spectrum in urban area

Implications on Fibre Requirements

- 5G deployments will require fiber for backhaul: backhaul will constitute **15-30% of 5G deployment costs**
- Fiber requirements for 5G likely to be **3-5X** for same coverage for 4G in the massive MIMO mode
- Governments will need to play a critical role in providing incentives for enabling the same

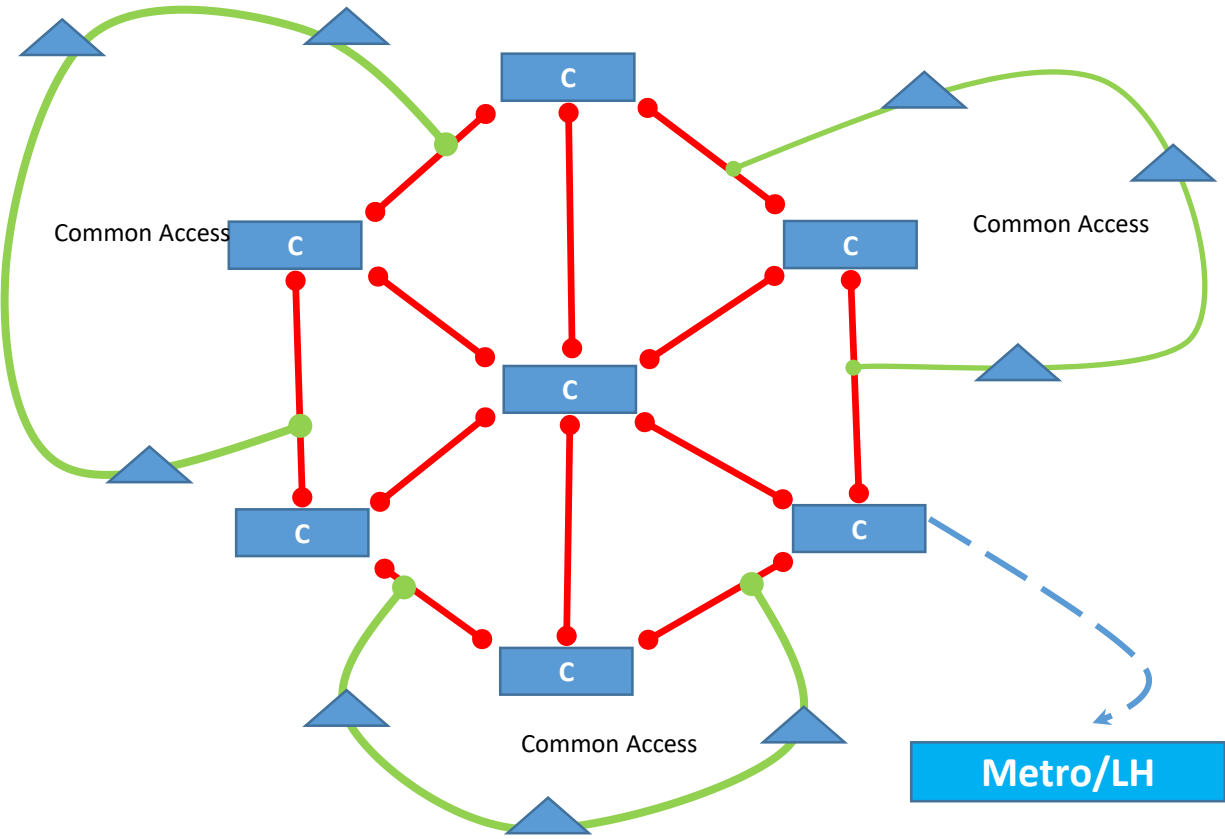
Designing a High Capacity Centralized Fibre Grid

Today's Network Fabric



Distributed Architecture (Hybrid)

Tomorrow's Network Fabric



Centralised Architecture

Fibre deployment by experts can add more value to CSPs, while enabling them to focus on their core competency

It will enable capex & opex optimization hence deliver more site efficiency

Capex Optimization

Improved design

- Efficient routing through a holistic city-wide approach

Increased Fibre Life-Time

- World class execution minimizes the need for Fibre replacement

Reduced Opex

Reduced O&M costs

- World class execution leading to less outages

More efficient O&M

- Clear inventory combined with world class design allows more efficient repairs

Revenue Uplift

Faster execution

- Use of state-of-the-art roll out machinery (e.g., German HDD)

Lower downtime

- Reduce revenue leakage
- Increase customer experience (lower churn)

Disrupting the Indian Market – Partnering with Reliance Jio

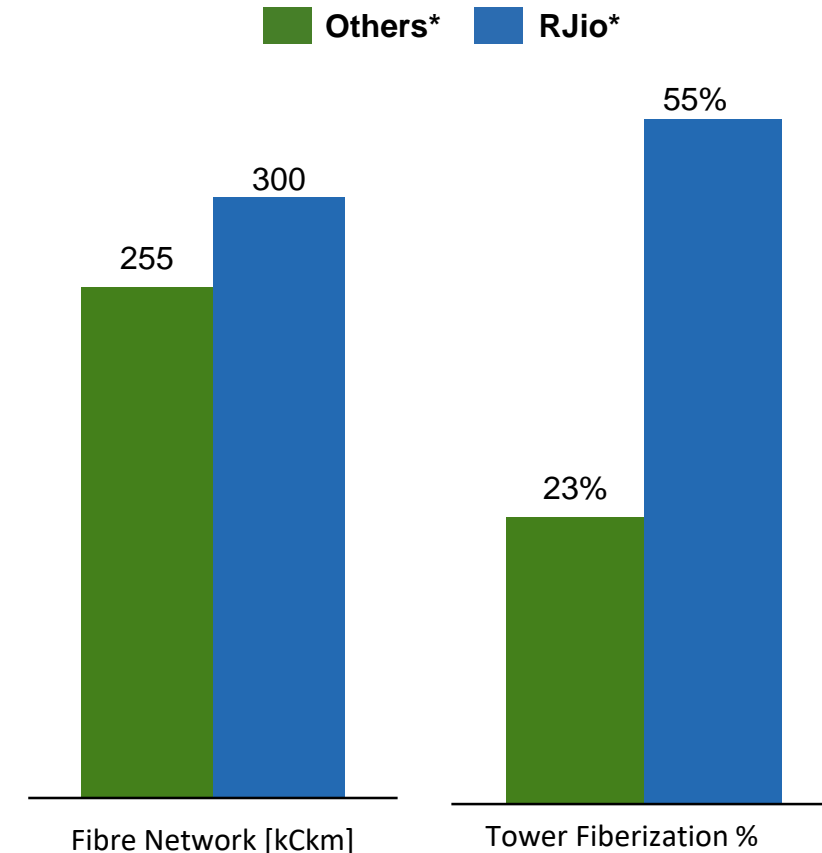
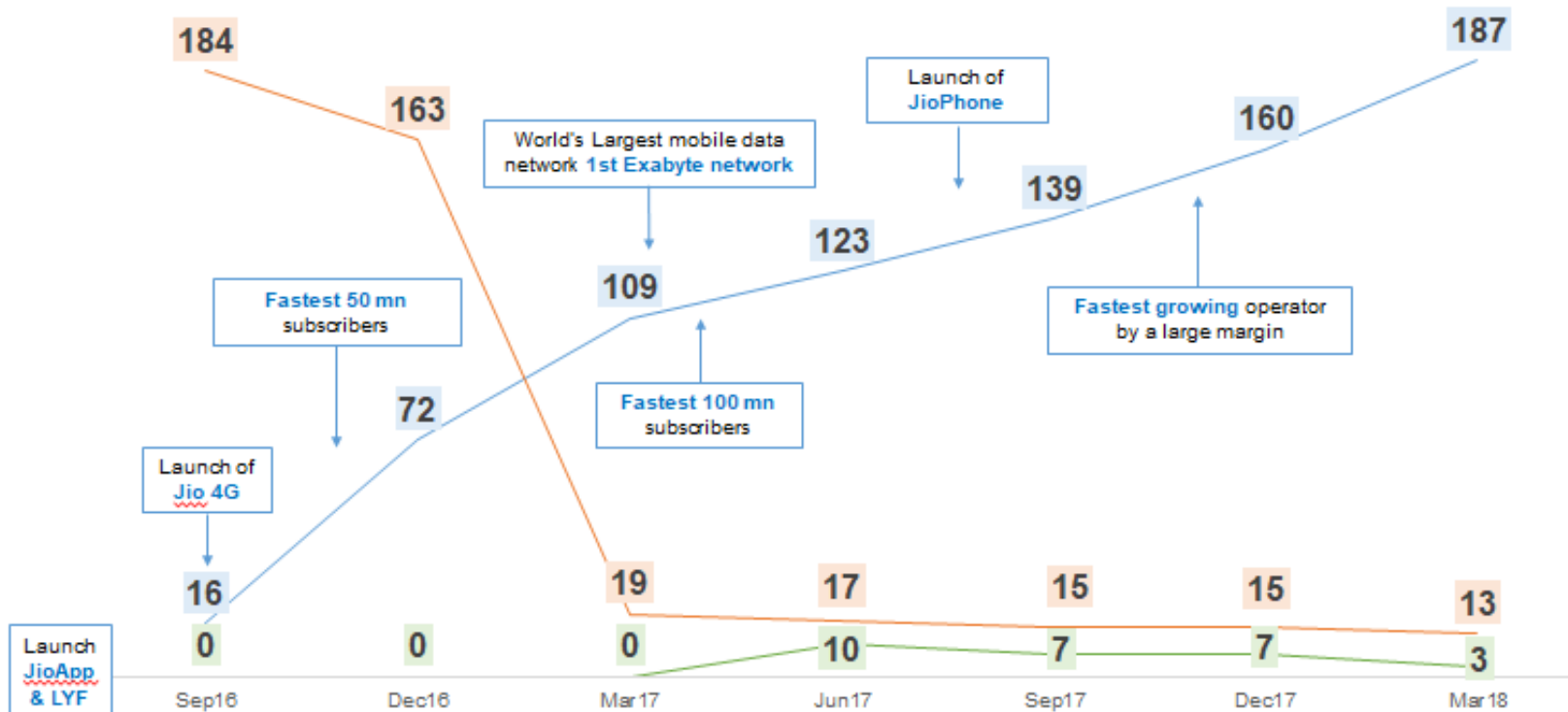


Fastest Subscriber acquisition in the world

World's first Exabyte (Bn GB) Network

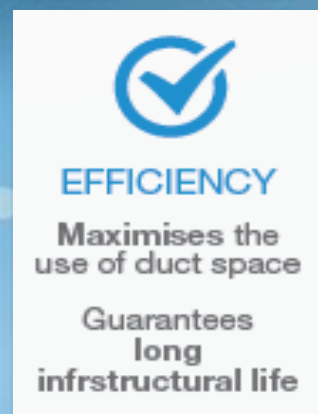
Role of Fiberization

— Subscribers (Mn) — Other Telco* Price (INR/GB) — Jio* Data Price (INR/GB)



*Sterlite Tech Estimates

Sterlite Tech's FUTURE READY 5G cables



Q&A