Road to 5G, Built on Fibre

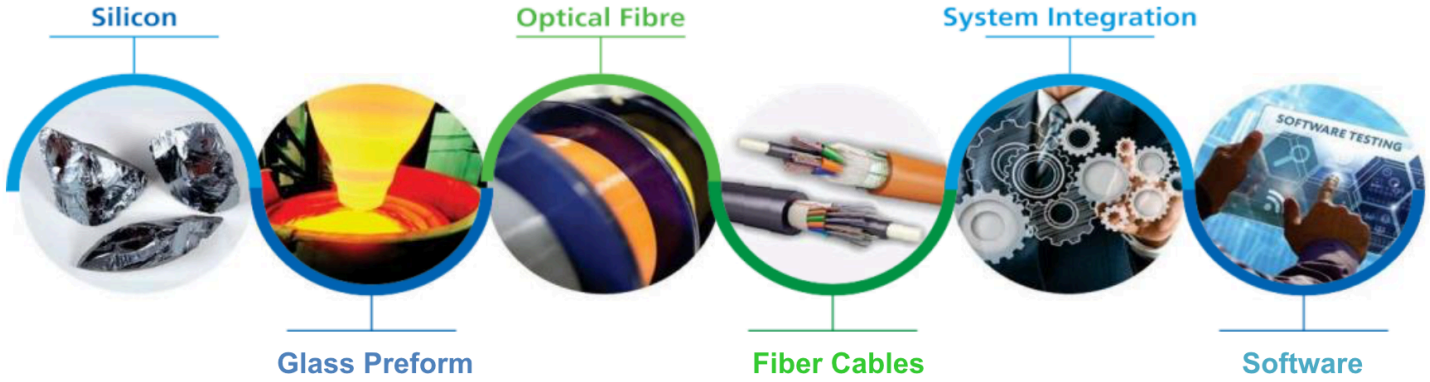
Agenda

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

Sterlite Tech is Present Across the Value Chain

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

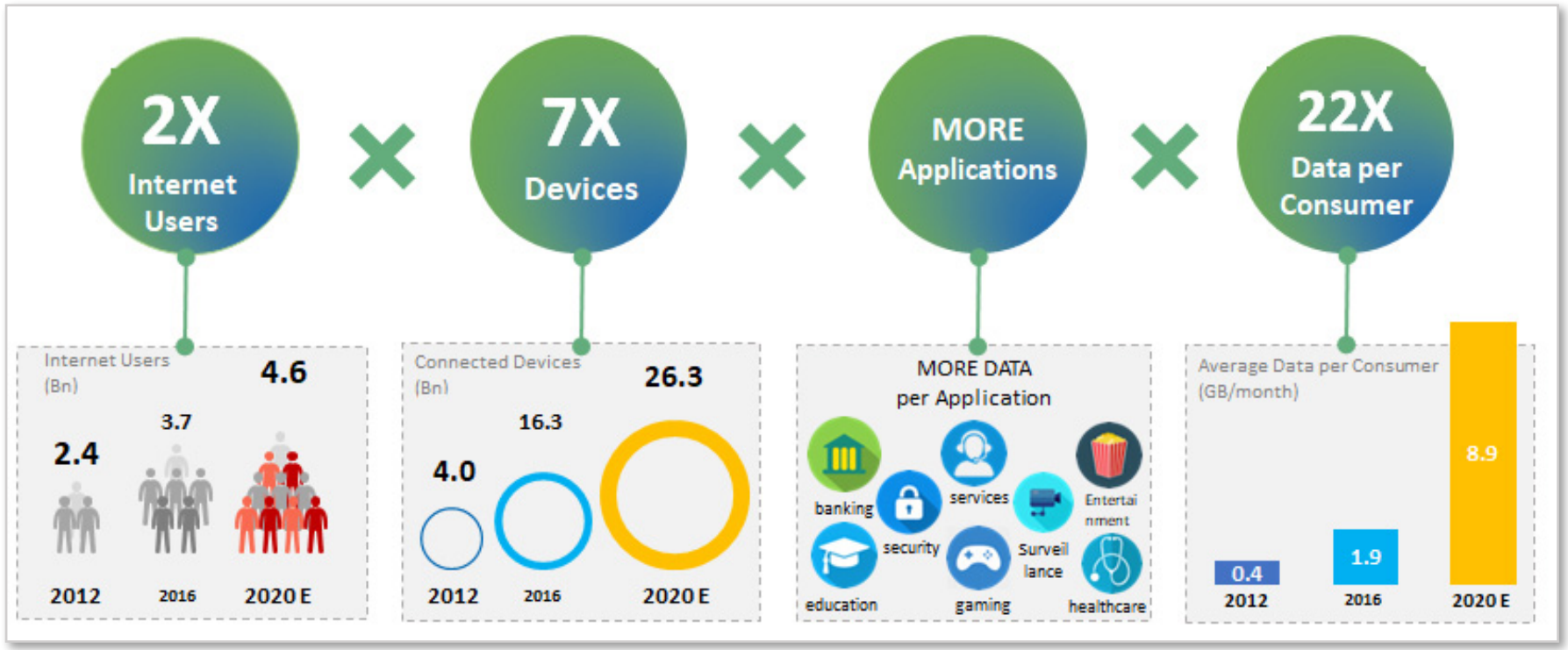


- Presence in over 100 Countries
- Partnering with 8 of top 10 Global Telcos
- 40% of India's Data runs on Sterlite Fibre
- Group contributes 1% of India's GDP

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

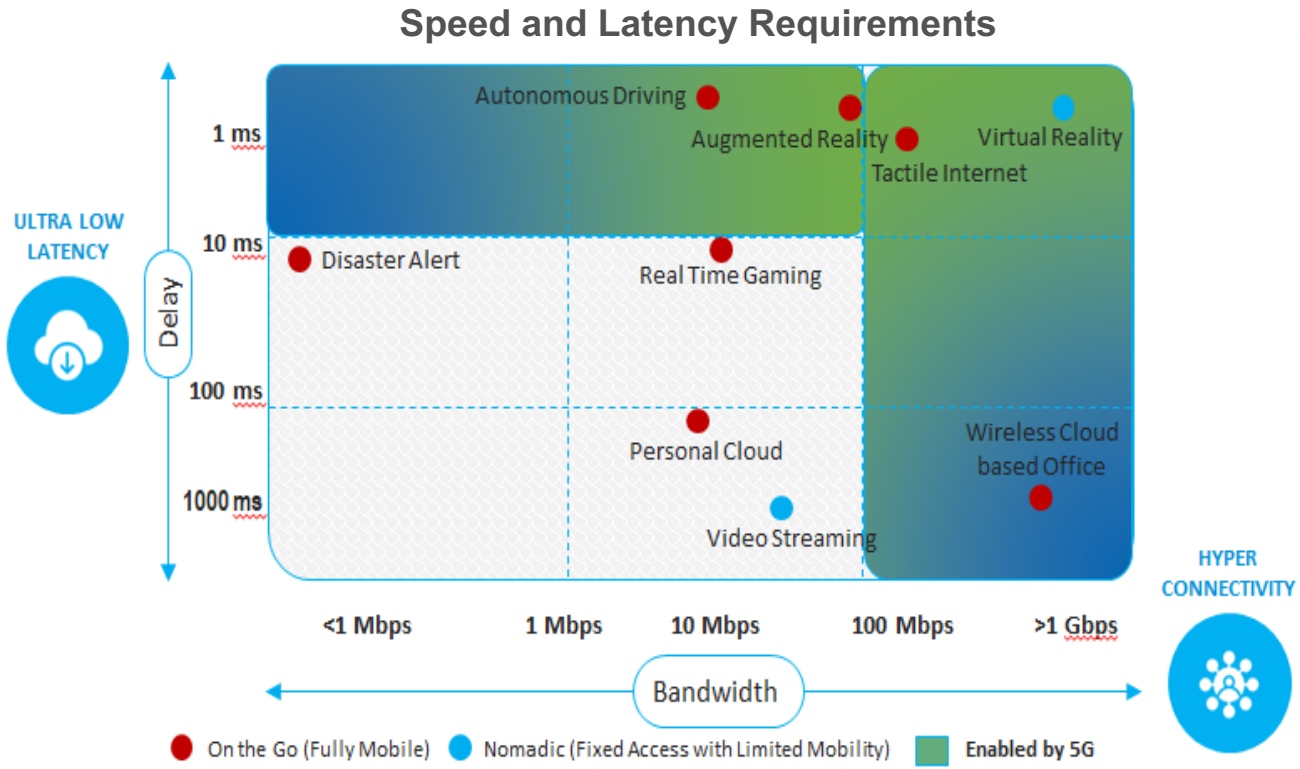
- The world is transforming at a fast pace and data transmission is at the core of this transformation
- We now have MORE USERS, MORE DEVICES per user, MORE GB's per user and MORE CONTENT per device
- By 2020, **more than half** of the world's population will be connected & data will move **beyond mobiles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

Applications of Tomorrow – Data Guzzlers

- 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



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

verizon

"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

AT&T

"**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

Telefónica

"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

Industry Investment on Network Up-gradation including Fibre

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

Fibre Consumption is Directly Proportional to Data Growth

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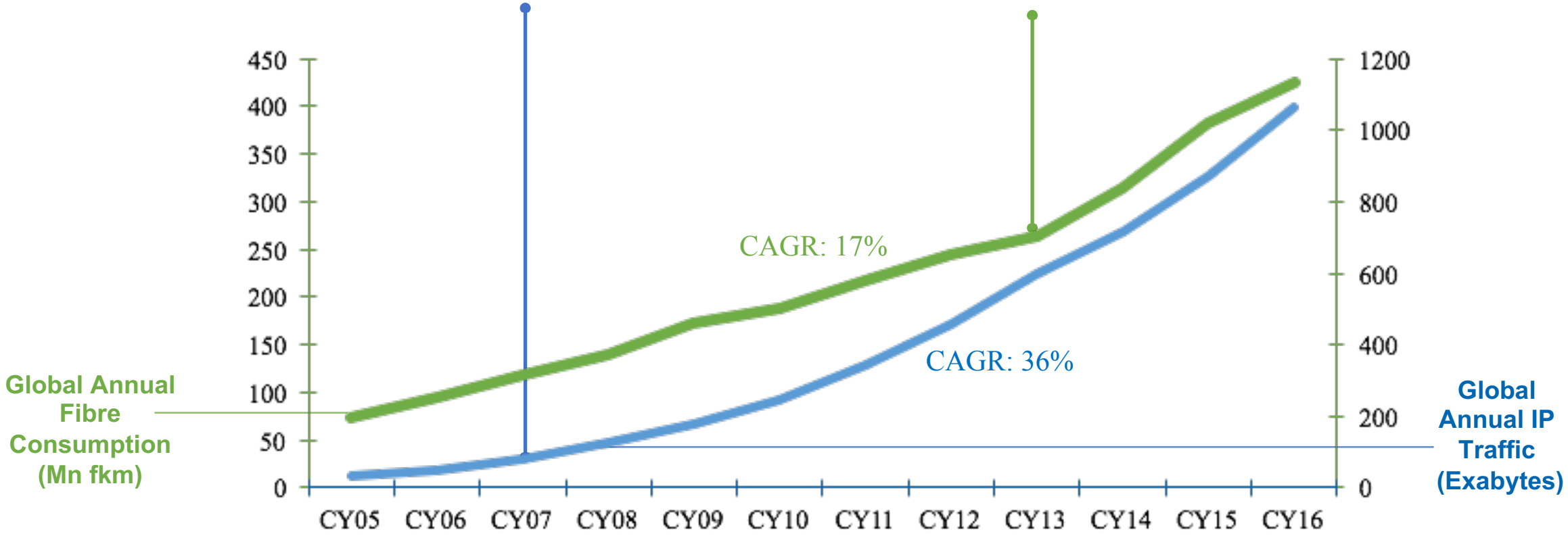
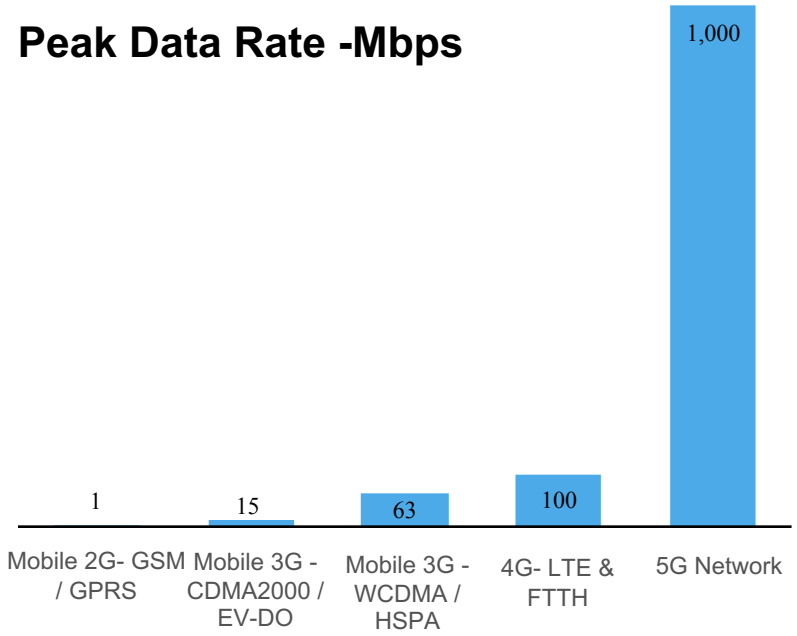
Historically, there has been a **strong correlation between data consumption & Fibre demand**

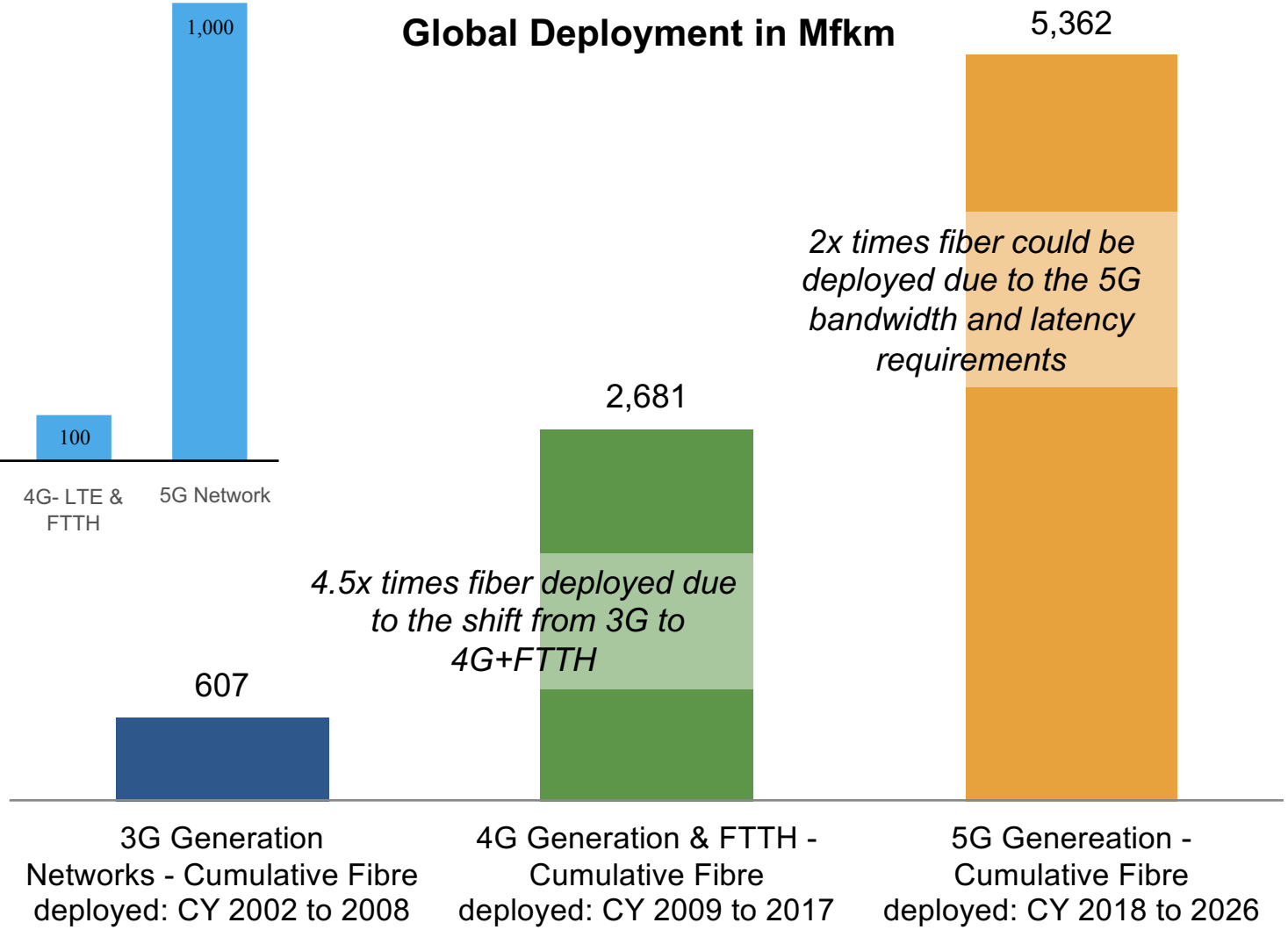
More Data = **More Fibre**



Source: CRU & Cisco

Fiberized Infrastructure- Key to Sustainable Future





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

Source: Qualcomm & CRU

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:

- Major cities
- most cities, towns, sub-urban areas
- between towers, as backhaul
- small cells, buildings, homes

Being deployed by: Conventional Telcos + CSPs / DSPs + OTTs and Content Players

5G Infrastructure Requirements for Roll Out

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

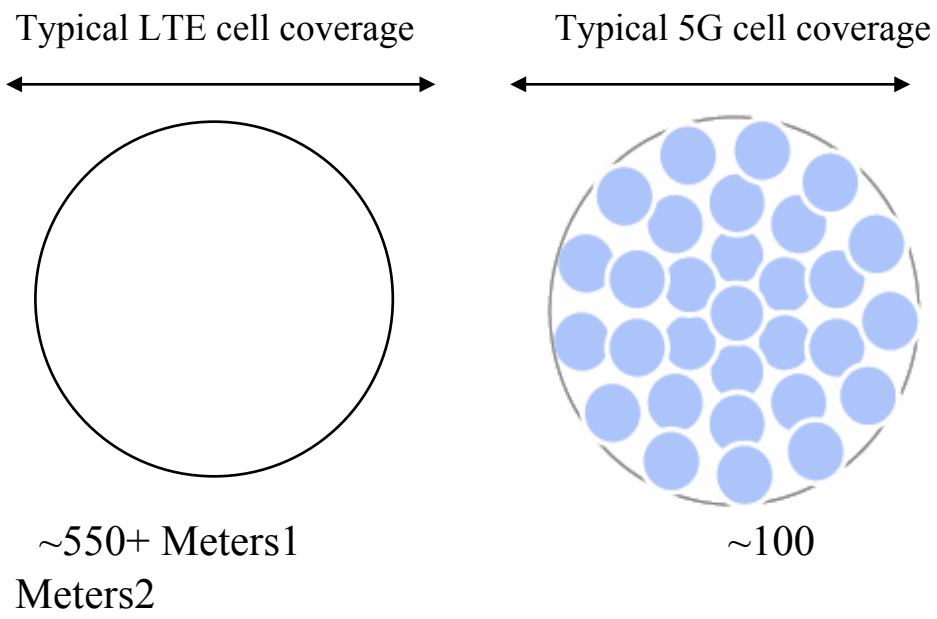
Future proofing and cost reduction

- 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

5G Infrastructure Requirements for Roll-out

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

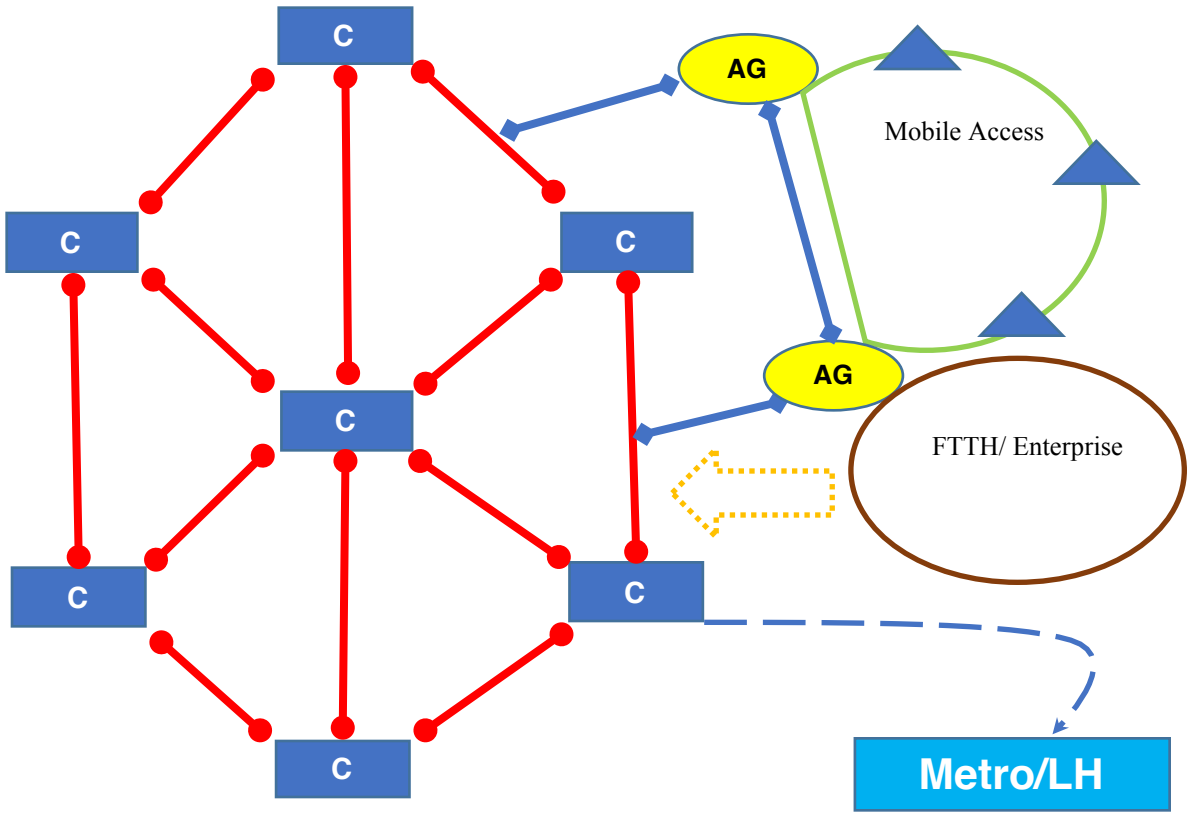
Implications on Fibre Requirements

- 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

Source: McKinsey

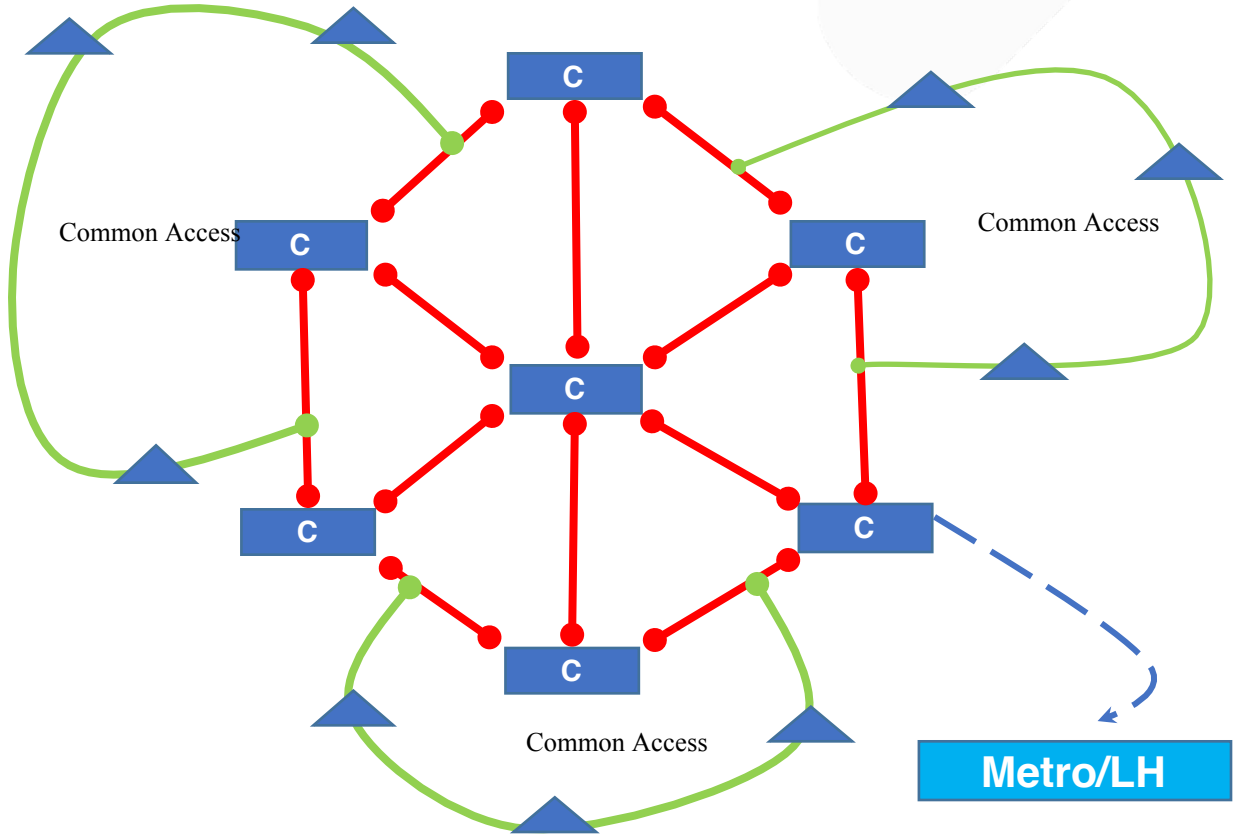
Designing a High Capacity Centralized Fibre Grid

Today's Network Fabric



Distributed Architecture (Hybrid)

Tomorrow's Network Fabric



Centralised Architecture

Why Fibre should be Deployed by Experts

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 word class design allows more efficient repairs

Revenue Uplift

Faster execution

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

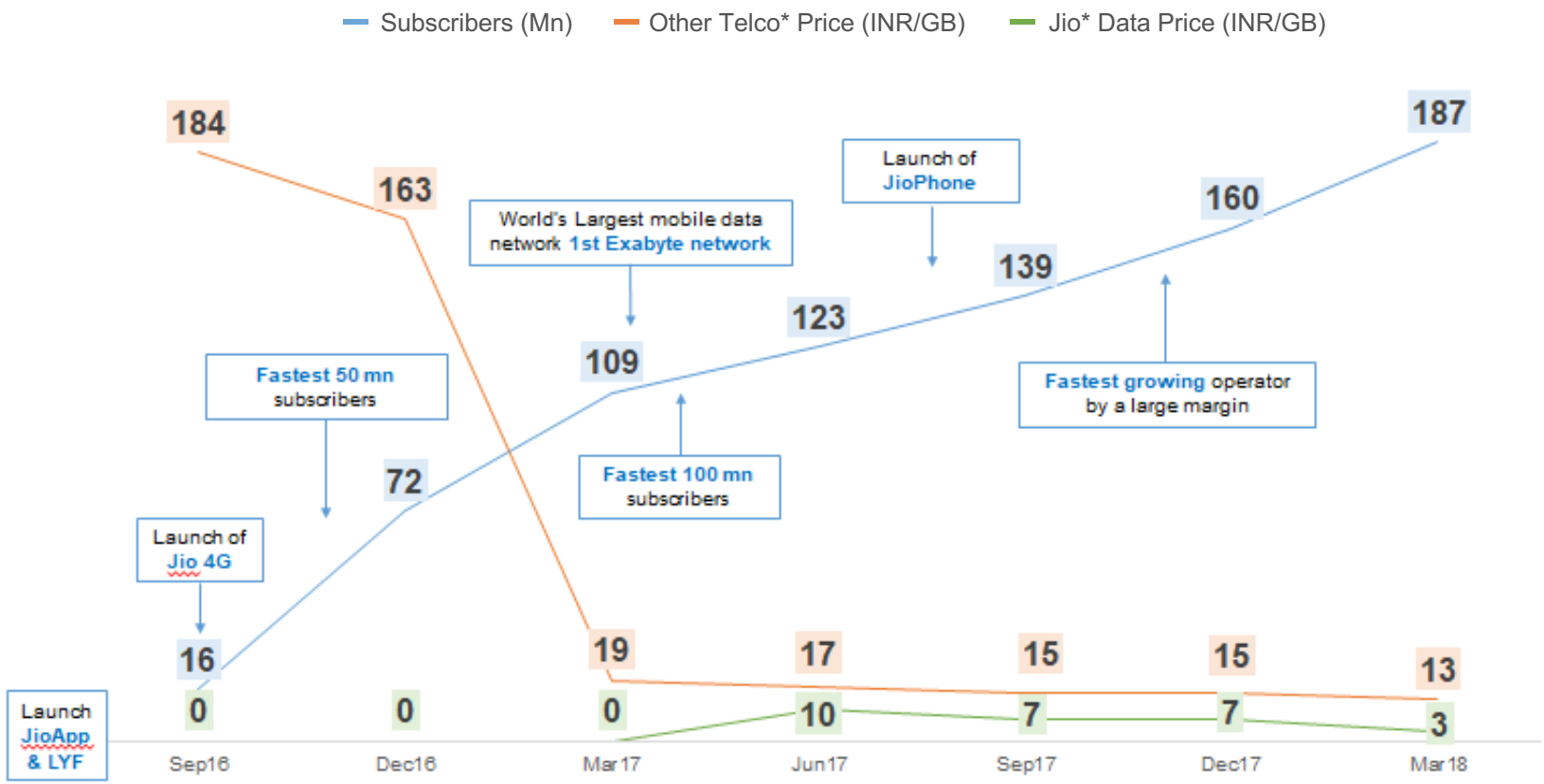
Lower downtime

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

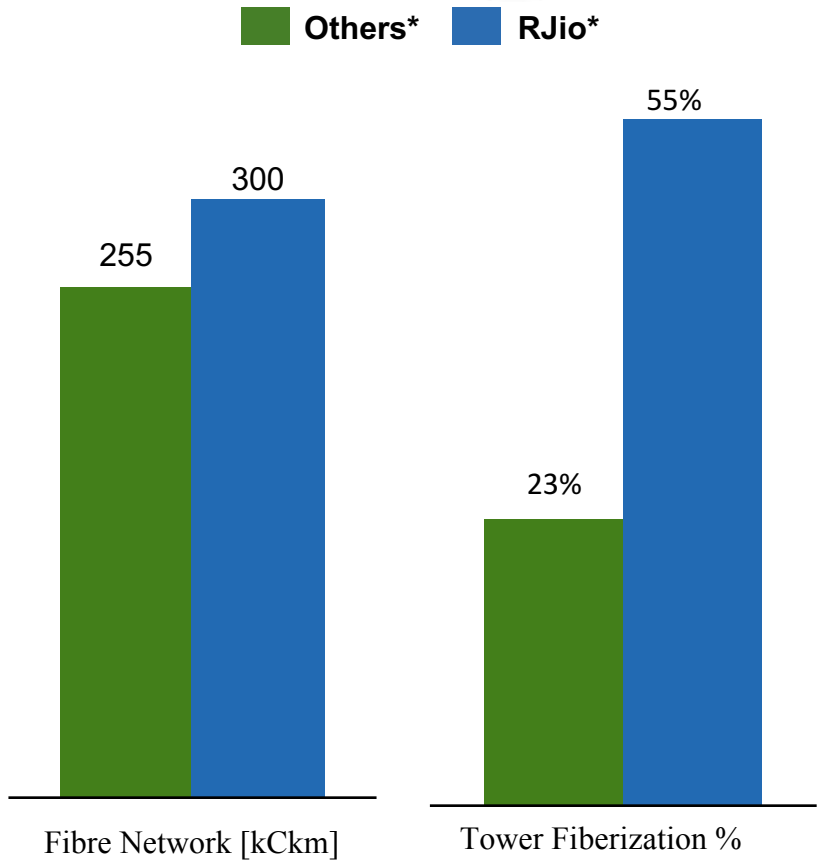
Disrupting the Indian Market – Partnering with Reliance Jio

Fastest Subscriber acquisition in the world

World's first Exabyte (Bn GB) Network



Role of Fiberization



*Sterlite Tech Estimates

Optical Fibre Cables for 5G Future Ready Networks

Sterlite Tech's FUTURE READY 5G cables

INNOVATIVE & ECO FRIENDLY

Dry water-blocking technology with quickest end preparation

Extremely **low-bend-sensitivity**

EASE

High-count mass **fusion splicing** leading to fast **cable** termination

Easy **identification** of each fibre ribbion

EFFICIENCY

Maximises the use of duct space

Guarantees **long infrstructural life**

PROTECTION

High tensile and crush resistant

UV protection enabling all weather conditions

Fully armored

Sterlite Tech

beyond tomorrow