Whitepaper

New approach for accelerated FTTx deployment for the new normal

Abstract

Data is the new 'fuel'. With millions of people working from home and family members spending more time streaming TV shows and movies, doing live video chats and watching live news, a new situation of internet overload has emerged. Residential environments have emerged as the new hubs of data consumption. Consequentially, there has been a shift in peak hours of consumption along with an increase in demand variability.

This has brought the urgent need for hyperscale fibre connectivity and more importantly, FTTx to the fore. In this paper, we dive deep into the challenges of deploying FTTx and explore solutions to achieve the desired scale while focusing on cost and time efficiencies.

1. FTTx and the need for accelerated deployment

Internet usage has seen a dramatic increase ~70% surge in global internet usage with at least a 12% surge in streaming. Regulatory frameworks and public incentives have been constantly promoting FTTH deployments as the preferred technology to provide high bandwidth and low latency to end points. Countries such as France, Germany, UK and India have already announced fibre as the preferred medium for Broadband Internet. Globally China, Japan, Russia, South Korea and the US are the top FTTH markets. In 2019 alone, U.S. broadband services providers and network operators have rolled out enough fibre to the home (FTTH) infrastructure to pass 6.5 million homes. The top drivers for rapid adoption of FTTx networks.

1.1 New use cases to be operationalized very fast

As more and more people around the world become reliant on the internet to communicate, work, learn and stay entertained, critical services such as digital healthcare and e-Education at scale, which were thought of as possibilities of the next ten years have become necessities of today. Millions of hours' worth of academic schedules and medical consultation & treatment would be possible seamlessly if the recipients have the required access to the necessary bandwidth, and availability of data, possible only over an FTTx network.

1.1 The ante on customer experience has gone up

While our earlier selves were content with occurrences such as buffering, sub-optimal quality services, frequent call drops and internet outages when we weren't consuming critical services digitally, we are no ready to compromise on the quality of service that is provided to us. Services such as healthcare, education and business are carried out over broadband networks which have to be ready to serve their consumers as and when required.

Future Market Insights (FMI) forecasts the global fibre to the home (FTTH) market's value will grow to more than $37 billion by the end of 2027, a 14.4% compound annual growth rate (CAGR). In India, leading telecom operators had planned as many as 100 million home-passes by 2023 but today, our country has only 1.3 million households with FTTH connections, a very slow progress rate given the target. However, new technologies such as xPON and cheaper components have made building and maintaining FTTx networks cheaper.

We need our telecom operators and broadband service providers to develop capacity to make at least 33 million home-passes per year to achieve their preset target of a 100 million home-passes by 2023 and then further expand to cover all of 250 million households as soon as possible.

2. What is a robust FTTx Network?

Understanding an FTTx network requires one to understand the individual layers that make up such a network as well as to understand its implementation lifecycle.

2.1 A Layered representation of any FTTx Network

An FTTH network typically consists of a number of different layers:

Passive infrastructure includes the optical fibre, trenches, ducts and poles on which it is deployed, fibre enclosures, optical distribution frames, patch panels, splicing shelves and so on.
Active network refers to the electronic network equipment needed to bring the passive infrastructure alive, as well as the operational support systems required to commercialize the fibre connectivity.
Retail services provide internet connectivity and managed services, such as IPTV, packaged and presented to consumers and businesses – the user layer.

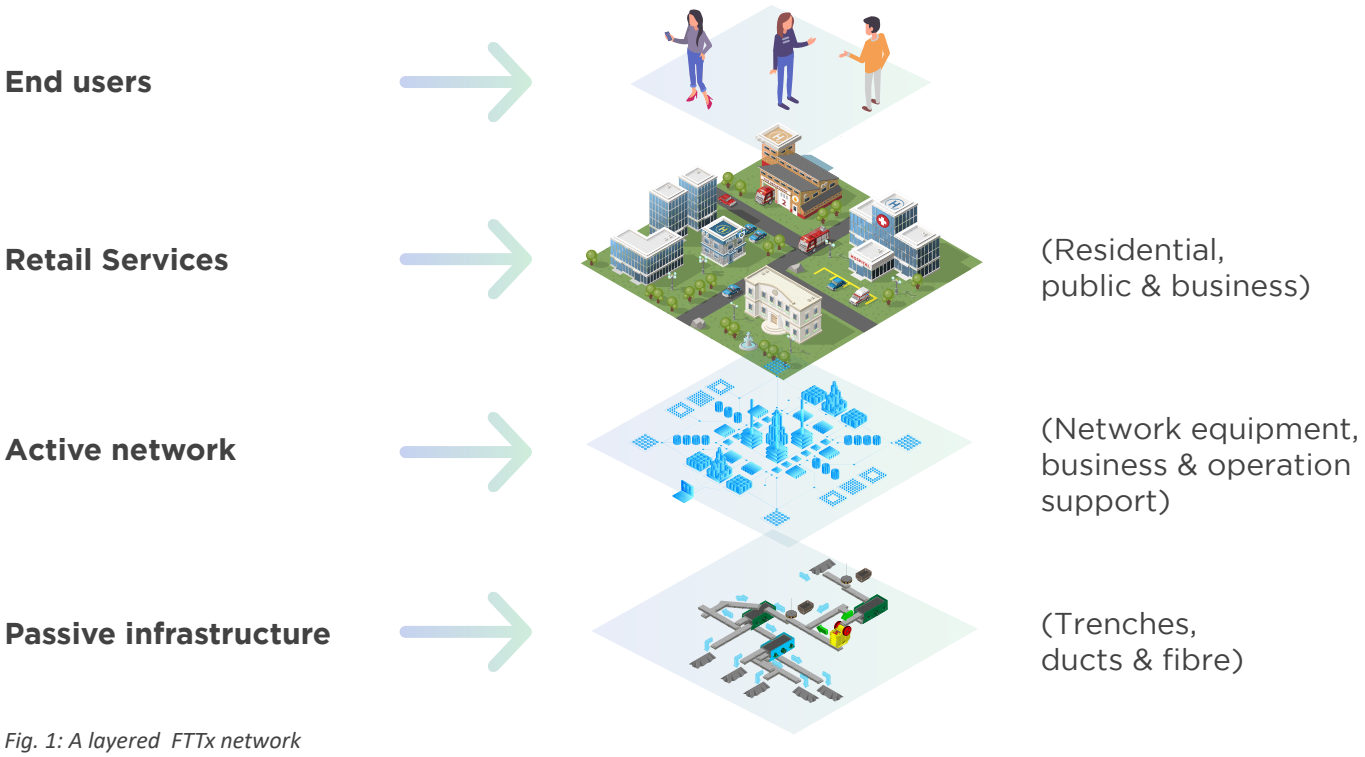


Fig. 1: A layered FTTx network

2.2 FTTx Implementation Lifecycle

FTTx essentially provides the local loop used for last mile telecommunications. It includes several configurations of fibre deployment including FTTH/P/B (Fibre to the Home, Premise, Building) or FTTC/N (Fibre to the Cabinet, Node). In all these configurations, there is a highly nuanced implementation process at play:

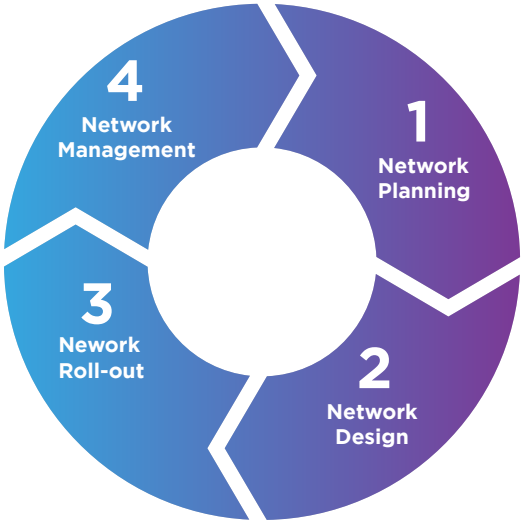


Fig. 2: FTTx implementation lifecycle

2.2.1 Network Planning

The Planning team ensures feasibility check, business case validation, planning for equipment and bandwidth, requirement analysis, route survey, network and site diagrams, civil engineering drawings, project planning, and provides overall project time lines, execution plans,

2.2.2 Network Design

The Network Design function prepares the high -level design (HLD) and low-level design (LLD) documentation for various FTTx configurations. This function works in close collaboration with various internal/external stakeholders to attend to details such as existing network analysis, feasibility checks, network & system architectures, implementation schedules and pre-execution readiness for the installation & commissioning team to kick-start execution.

2.2.3 Network Roll-Out

Network roll out includes physical installation of assets as per design and completing activities like digging and laying conduits, pipes, joints, man holes, etc. This involves installation of active network elements and nodes in field. Some of the most preferred technologies deployed here are Ethernet, IP transmission, GPoN, and xDSL. Some of the other key responsibilities of the roll-out team include end to end project management, network roll-out on the ground, monitoring & control, learning records update, user acceptance testing.

2.2.4 Network Management

Network Management includes activities such as monitoring, fault management, configuration management, front office & back office operations, SLA maintenance along with inventory management. This function is one of the most instrumental in delivering continued value to the customers.

3. Key challenges to deploying hyperscale FTTx networks

3.1 Design/architecture challenges

Choosing the right design and architecture for the FTTx network use case is one of the most pertinent challenges as this drives costs in an FTTx network. In most of the developing world as well as in some developed countries, cities have evolved over a period with MDUs (Multi-Dwelling Units) and SDUs (Single Dwelling Units) coming up in an unplanned manner. Such establishments require very specific design considerations. Most of the dwellings are not standardized in terms of number of homes per square kilometre. This varia -tion of home density and irregular distribution makes every cluster unique in terms of creating the most optimized design. Some of the most pertinent design challenges are:

3.1.1 Non-standard in-building space & unavailability of utility ducts

One of the most challenging stages of FTTx deployments is the lead time for initial design, which can take months to complete. A major contributor to this is the number of stakeholders who are involved in the properties to be connected over FTTx technology. For example, in a Multi-Dwelling Unit, site surveys must be coordinated between building managers, city administration, engineers and occupants to ensure minimum disruption.

3.1.2 Fragmentation in design practices

Another major challenge of FTTx deployments is the fragmentation that exists in the world of FTTx design and installation. Operators around that globe have been using their own suite of tools and methods to design FTTx networks, leading to complex processes for critical activities such as site surveys, documentat -ions, etc. Limited use of survey and design tools for design automation of FTTH inhibits agility and adaptability.

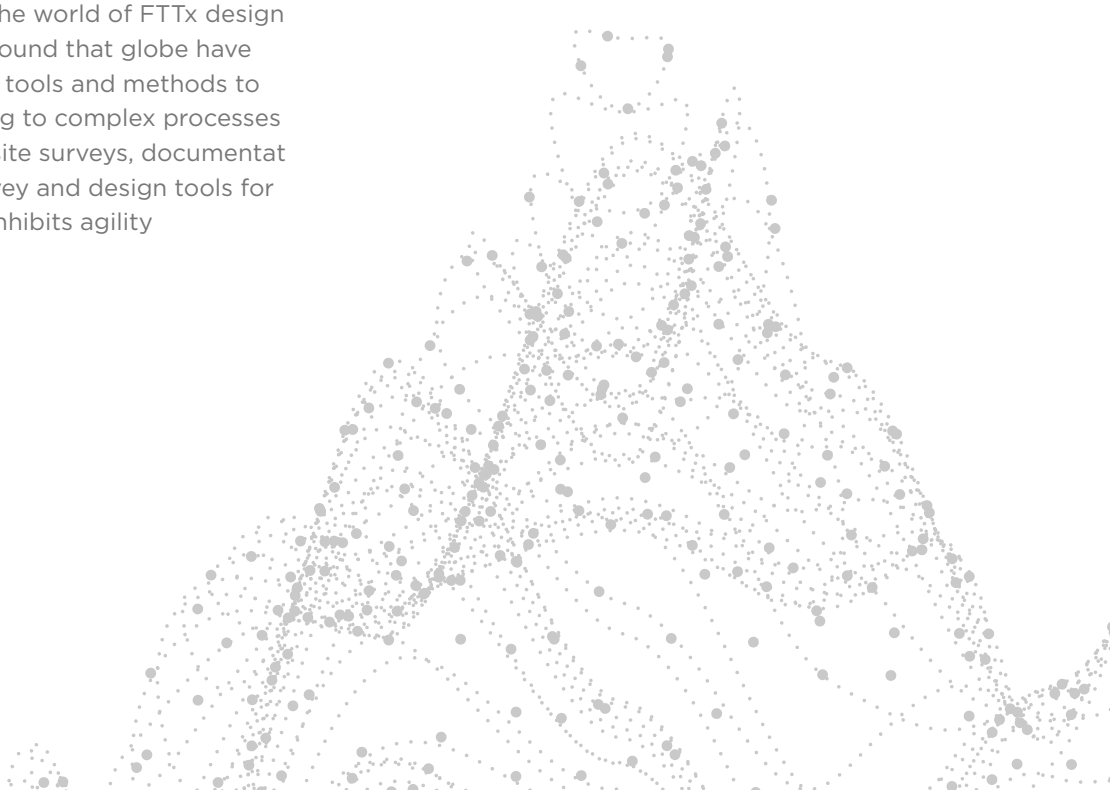
3.1.3 Requirements for highly skilled design engineering

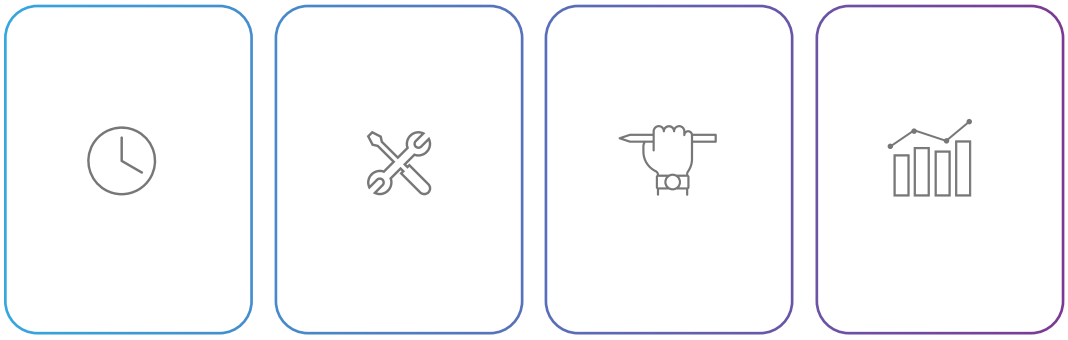
A design engineer is responsible for all elements of preparing from the ground up and playing an active role in maintaining the FTTx network. Choosing the right connectivity solution for a particular deployment situation is a daunting task one that rests with a qualified design engineer. Failed connections lead to service outages and expensive service calls. With most of the world undertaking FTTx deployment as a key enabler of digital economy, finding the right talent for FTTx networks is of paramount importance.

3.1.4 Passive Optical Network (PON)vsActive Optical Network (AON)

The choice between PON and AON is a critical design consideration in large scale projects. While the former implements a point to multipoint architecture, it can serve multiple endpoints from a single optical fibre through the use of unpowered splitters; the latter uses electrically powered switching equipment to manage signal distribution and direct signals to specific customers. PON uses passive splitters and couplers to divide up the bandwidth among the end users typically 32 over a maximum distance of 10–20km. Active networks can serve a virtually unlimited number of subscribers over an 80km distance.

The choice between the two determines performance in terms of operational costs, installation costs, network energy costs, as well as a consumption of network infrastructure.





Non-standard in-building space & unavailability of utility ducts

Fragmentation in design practices

Requirements for highly skilled design engineering

Passive Optical Network (PON) vs Active Optical Network (AON)

Fig. 3: Design/Architecture challenges

When it comes to FTTx networks, the planning horizon can easily be as long as 20 - 30 years which means every choice has long-term implications. Some of the questions that builders & providers of such networks should answer before deciding are:

- What is our network monetization model?
- A residential-service-only model?
- A residential-plus-business network?
- A business-plus-wholesale network?
- Do we create a multi-purpose network?
- Have we considered the total cost of ownership of building and managing such a network?

3.2 Fibre deployment challenges

3.2.1 Complicated field deployments in FTTx networks

One of the most critical activities in FTTx deployment is the drop-cable connectivity an extremely sensitive and critical activity that must mandatorily be performed by experts. It is one of the earliest considerations to be taken before deployment begins. The unavailability of optimized passive kits solutions as well quality splicers for large scale FTTx deployment leads to severe hindrances and in elasticity such as mandates to procure cables of a specific length only to match the FTTx deployment distance. The sheer scale of FTTx deployments requirements warrants customised execution solutions to be adopted. Their absence significantly impacts delivery timelines of such large scale deployment projects. Apart from this, the unavailability of skilled workforce and quality training infrastructure for FTTx technicians limits the development of a capable labour ecosystem and increases the risk of faulty deployments.

3.2.2 Policy level challenges

Many infrastructure and service providers have challenges at the policy level securing approvals and permissions. There are no industry standardised rules in terms of rights of way, permits and access to private poles and underground facilities. Most implementations are thus restricted by the local rules and regulations which are often built without a buy-in,making this a time-consuming and costly process. Multiple RoW challenges emerge in the absence of a single window approval system. This further increases the burden of RoW charges per kilometre of Optical Fibre on the operator.

3.2.3 High cost per homepass

FTTx implementationshave historically been expensive usually combined with scale reliability issues, missed installation targets, and out of control deployment costs. The high cost of OFC deployment is one of the major hindrances for CapEX constrained telecom operators who already reeling under existing burden of debts from financing spectrum acquisitions.

3.2.4 Uncoordinated utilities ecosystem

Infrastructure belonging to other utilities, such as the sewer system, gas main or water pipes, is part of the existing ecosystem that already serves the feeder part of the network and the final drop to homes. However, lack of permission to leverage existing utility infrastructure coupled with the lack of synergy with utility companies like water, gas, electricity, sewer, etc. present the expensive challenge of building new underground or aerial corridors. Space is one of the most pertinent pain points in major cities and most do not have any concept of telecom utility corridors which further deters providers from taking up FTTx deployment.

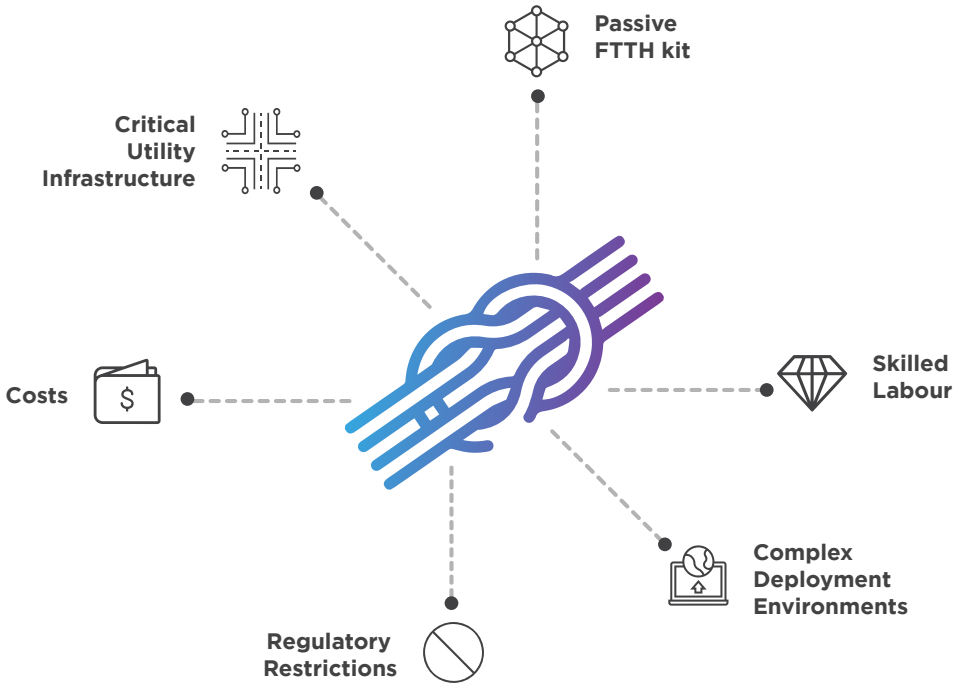


Fig. 4: Fibre deployment challenges

4. Some key strategic interventions for deploying FTTx at a fast pace

Establishing an FTTx network rapidly in India has its own peculiar challenges in the form of capacity planning, unplanned civic infrastructure, and uncoordinated developments by various utility providers, out-dated approval mechanisms and availability of skilled manpower. Uncertainty around the number of forecasted subscribers is also a major challenge, especially in India where competitive intensity is high and users have limited budgets. In spite of the challenges to envision and deploy an FTTX network, there are technology-led ways to convert these challenges into opportunities and fast-track fibre deployment. While multiple solutions can be devised to solve the above challenges, we believe in following a structured and specific approach that will help deploy large scale FTTx network rapidly.

4.1 Ecosystem development mind-set and design focus:

A new approach is required to realise fast paced and cost optimised FTTx network roll-outs. With an ecosystem development mindset, telecom operators can view the entire network from a holistic standpoint spanning different network layers and different technologies used, and can build networks and industry services that support the larger objective of democratisation of FTTx.

Another key aspect is integrated designing of the network that is secure, robust and available to its end users. It helps understand the existing network, if any, from a neutral standpoint, identify gaps from a holistic angle and helps prepare solutions accordingly. Pro-active engagements with Utility companies help leverage existing civil infrastructure build-up to plan fibre infrastructure. E.g. Typical Gas, Water and Electricity distribution networks follow FTTH design as every utility needs to reach household. Synergies with these companies could bring huge benefits and reduce the time and cost of FTTx. During execution, this helps drive efficien -cies in cost and time because all the constituent segments of the network have been designed and planned to collaborate with one another thereby nullif-ying the possibilities of siloed work. From a design perspective for an FTTx network, one of the biggest considerations in choosing architecture should be the density of customer base. Typically, multi-stage splitter architectures are best for urban environments where might need rapid scaling to meet demand. In rural areas single-stage splitter architectures tend to be the most cost effective.

4.2 Standardised models of execution:

While dealing with executing complex fibre networks in both, hyperscale fibre networks as well as FTTx deployments, standardised models of execution are an efficient way to ensure timely completion of work without exceeding budgets. These include measures to pre-arrange approvals from concerned authorities, for example – blanket approvals for all work related to fibre deployment in a particular section; along with the use of technology in the form of drones and sensor-enabled equipment to carry out activities such as surveying, trenching, ducting and cable-blowing. Mandates for new buildings, commercial spaces and community centres to provide civil duct space for OFC infrastructure can solve the problem of time and cost implications of designing and deploying FTTx as well as cable slack management problems across SDUs and MDUs. Standardising execution in FTTx ensures uniform tools and technology for better management of large-scale projects.

Pre-arranged centrally held guidelines for deployment of fundamental infrastructure can help synergise with other utilities and avoid red-tapes around critical activities such as digging and trenching. Telecom operators and ISPs should make concerted efforts in this direction so that the industry, as a whole matures over time.

4.3 Technology-led execution:

Digitisation and various technologies can be used to orchestrate the execution of a project right from its design stage to project planning and real-time progress monitoring through a single window application to give the user a complete picture of the project as well as prepare modules to educate/up -skill the labour-force on the right way of handling and deploying fibre networks. Use of Systems tools and Techniques can automate repetitive tasks in Design, Deployment and Documentation stage. Much of the labour spend depends on the skill set of technicians and the design of the FTTx network. It is absolutely important that field technicians have the knowledge and skills necessary to execute a deployment strategy. A trained labour-force is known to unlock up to 50% more productivity in on-ground fibre laying activities.

Another important benefit of technology is its ability to offer solutions that can deskill various field tasks, for example the pre-connectorized cable which eliminates the need of time & cost expensive fusion splicing. A good pre-connectorized cable can eliminate approximately 60% fusion splicing required during field termination.

It offers the advantage of high-quality factory terminated connector delivering highest reflectance and lowest optical losses while being relatively simple to deploy without requiring expert skill.

Deploying FTTH means reaching those final few hundred meters to the private detached home or building MDU complex from the nearest node where fibre is present. With plug and play FTTx kits that include compact, modular and, re-configurable Passive Enclosures, namely Main Distribution Box (MDB), Basement Distribution Box (BDB), and Fibre Access Termination-8 (FAT-8), home Pass readiness at scale can be ensured in the shortest possible deployment time in high-rise and medium rise building scenarios.

Other similar technological innovations include Zero touch provisioning AR & VR based online technical support among many others. Micro-trenching is another emerging trend that offers significant benefits of time and cost-over traditional trenching practices. Overall, technology combined with standardised execution models such as the introduction of innovative passive ducts, programmable FTTx as well as automation can reduce service costs, TCO as well as CapEX constraints respectively.

4.4 New Funding Models to help strike the right balance between risk and benefit

Government funding plays a very important role in enabling development of network infrastructure and it is tightly connected to GDP growth. Encouraging private investments in creation of Neutral civil infrastructure for OFC laying across major cities is an option that has been adopted in many countries and it is certainly worth looking at in India. Emerging public-private partnership (PPP) models arealso a promising alternative to the traditional “municipal broadband” models for many markets that lack the capital or expertise to deploy and operate FTTx networks or to act as ISPs on their own. By taking on the risk of fibre construction and finding a partner to lighten the network work, a locality can increase the potential for a universal fibre build-out to every location – however, this kind of partnership can be complicated as the two parties have different goals.

Additionally, it should be mandated by government that in case of any road where PCC or RCC work is being done, Duct for OFC infrastructure should be laid and maintained by agency the way it isdone for Government funding plays a very important role in enabling development of network infrastructure and it is tightly connected to GDP growth.

5. Conclusion

As enterprises adopt new technologies such as IoT, AI, machine learning, big data and blockchain, the consumption of data is only going to increase. Given the massive shift in the points of data consumption, it is very much the need of the hour to have FTTH networks planned and rolled-out in mission mode. Among other things, it is also critical that the FTTH network and connect subscribers quickly.

Competition across markets will continue to increase with rising internet demands. Therefore, being able to scale efficiently is the key to success and generating cash flow early. A relevant FTTx network is forward looking in terms of how it will integrate with future technologies. Not only should it enable services that are relevant today, but you also need to be ready innovations that come with time. The sooner FTTH technology becomes more mature, the better it is for operators, consumers and countries.

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