REPORT ON : FTTH

(FIBER TO THE HOME)

What is FTTH ?(Fibre to the Home)

Fiber to the home (FTTH) is the delivery of a communications signal over optical fiber from the operator's switching equipment all the way to a home or business, thereby replacing existing copper infrastructure such as telephone wires and coaxial cable.

It is the installation and **use of optical fiber from a central point directly to individual buildings such as residences, apartment buildings and businesses** to provide unprecedented high-speed Internet access.

FTTH is a relatively new and fast growing method of providing vastly higher bandwidth and connection speeds to consumers and businesses, and thereby enabling more robust video, internet and voice services which known as VoIP, with technologies now used in most places.

Why use FTTH?

- Almost 3 million consumers now use direct fiber optic connections in the America, more than 10 million in Japan, and about 15 million worldwide. Has become a reality which is,used by other countries ,soon,the world.

- FTTH is the only technology that will deliver enough bandwidth, reliably and at a low enough cost, to meet the consumer demands of the next decade.

- FTTH is desirable because it can carry highspeed broadband services integrating voice, data and video, and runs directly to the junction box at the home or building.
    - For better network speed, for browsing streaming or donwloading videos,sending important information in a second, for VoIP function.

- Used by bussiness companies and other organisation to meet their bussiness needs. Ex: Webcam Conference.

- Example, companies like Netflix are preparing to offer feature length movies for download. More people(customers/users) are looking to upload their own home movies into emails or web pages. Consumer electronics companies are coming out

with devices that connect televisions to the Internet. Ex: Android TV (for devices) and apps is (Google TV).

Pro's and Con's of FTTH

Pro's:

1. Bandwidth Capacity:

Optical signals can carry much more information than electrical ones. The most advanced copper cables **can theoretically carry 1 Gigabit/second**. Optical fibers, on the other hand, have a theoretical capacity of **350 Terabits/second or 350.000 Gigabits/second**.

Current optical core networks (the backbone of telecom carriers) can already pack over 1 Terabit/second into a single optical fiber. The twisted copper pair (the cable that arrives to telephone plug), instead, can transmit a maximum of 50 Megabits/second using the latest DSL technologies.

2. Signal reliability:

Optical signals do not suffer electromagnetic interference and present a much smaller bit error rate compared to electrical systems. The signal loss (the amount of energy lost as the signal travels a medium) is also much lower in optical systems, meaning they can travel longer distances. DSL technology over the copper cable can cover up to 5 kilometers (18000 feet) before it needs a regeneration while an optical network can reach over 200 kilometers.

3. Size and weight:

The core of an optical fiber goes from 10 to 50 micrometers (1/5 the diameter of a human hair) while some coaxial cables have diameters of half an inch. The weight of 1 kilometer of optical fiber is about 6 kilograms while the same length of coaxial cable could weight as much as 1000 kilograms.

Cons:

1. Cost per user:

Optical networks are the rule for carrier's backbone because the huge amount of traffic justify the economic investments. Deploying fiber to the home, however, is a different story. Telecom operators spend more money (around $ 1000) per fiber subscriber. Eventhough the current network connections can send data up to 50 Megabits/second (a reasonable bandwidth even for coming years) at a fraction of that cost you get andi t is the reason why FTTH is advancing slowly.

2. Physical Constraints:

Optical fibers can not be bended too much or they lose some light reflecting properties. Additionally optical fibers can be damaged much more easily than copper cables, and the cost and complexity of the repair is significantly higher:

- Needing special tools to repair the damaged fibre optic.
- Make sure that fibre optic surface is in good condition

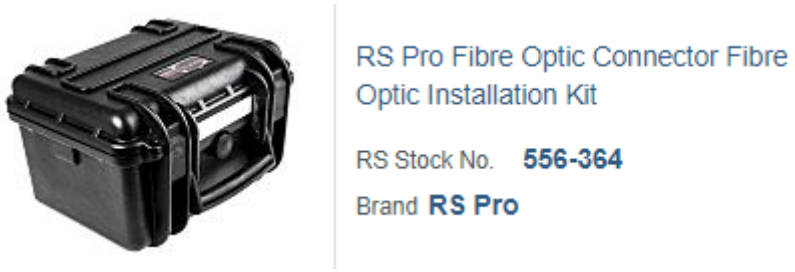


Figure 1

*The picture above is the connector tool for fibre optic. There are many tools available to repair fibre optic cable.

3. Switching:

Current optical technology is very efficient for point-to-point data transmission. Unfortunately the same can not be said for traffic switching. Optical switching technology is advancing fast but it still can not match the flexibility and cost-efficiency of electrical switching solutions.

Active and non active equipment

There are two important types of systems that make fiber-to-the-home broadband connections possible. These are **active optical networks** and **passive optical networks**. Each technology offers ways to separate data and route it to the proper place, and each has advantages and disadvantages as compared to the other.

An active optical system uses electrically powered switching equipment, such as a router or a switch aggregator, to manage signal distribution and direct signals to specific customers. This switch opens and closes in various ways to direct the incoming and outgoing signals to the proper place. In such a system, a customer may have a dedicated fiber running to his or her house.

A passive optical network, on the other hand, does not include electrically powered switching equipment and instead uses optical splitters to separate and collect optical signals as they move through the network. A passive optical network shares fiber optic strands for portions of the network. Powered equipment is required only at the source and receiving ends of the signal. In some cases, FTTH systems may combine elements of both passive and active architectures to form a hybrid system. Passive Optical Networks, or PONs, have some distinct advantages. They're efficient, in that each fiber optic strand 19 can serve up to 32 users. PONs has a low building cost relative to active optical networks along with lower maintenance costs.

*More likely to have a PoE (Power Over Ethernet) conecpt.

Disadvantage of AON and PON

AON

Active Optical Networks also have some disadvantages:

- They require at least one switch aggregator for every 48 subscribers. Because it requires power, an active optical network inherently is less reliable than a passive optical network.

PON

Passive Optical Networks also have some disadvantages:

- They have less range than an active optical network, meaning subscribers must be geographically closer to the central source of the data.
- PONs also makes it difficult to isolate a failure when they occur. Also, because the bandwidth in a PON is not dedicated to individual subscribers, data transmission speed may slow down during peak usage times in an effect known as latency.
- Latency quickly degrades services such as audio and video, which need a smooth rate to maintain quality.

Architecture of FTTH

FTTH can be installed as a point-to-point architecture, or as a passive optical network (PON). The former requires that the provider have an optical receiver for each customer in the field. PON FTTH utilizes a central transceiver and splitter to accommodate up to 32 clients. Optical electric converters, or OECs, are used to convert the signals to interface with copper wiring where necessary.

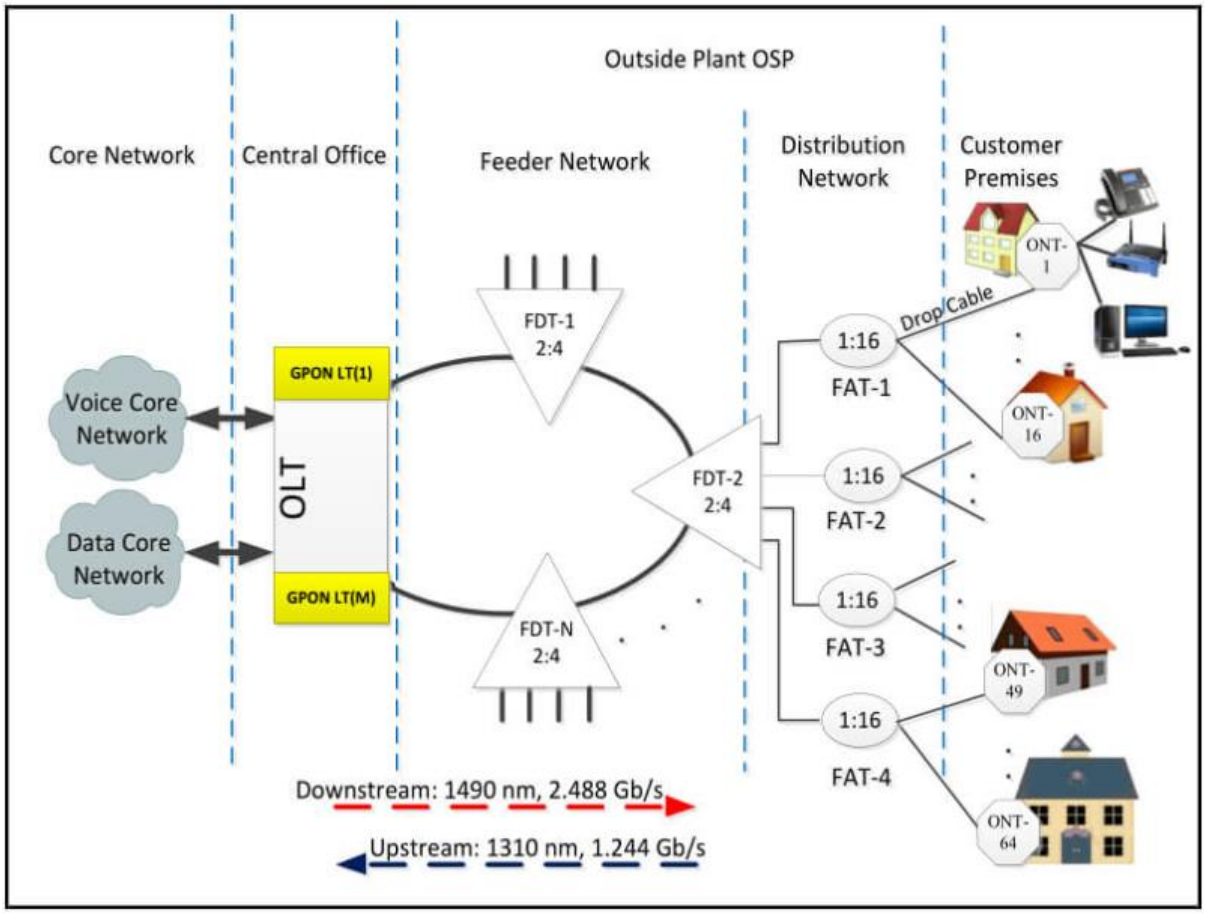


Figure 2

*Architecture of FTTH.

FTTH Architectures

The major deployment consideration for telecom service provider is to decide on FTTH architecture. There are two categories of architectures. They are active optical network(AON) and passive optical network (PON). These AON and PON have been explained below.

AON vs PON

Active Optical Network

AON is a point to point FTTH architecture. This type uses active devices and connects OLT (Optical Line Terminal) placed at central office with ONT (Optical Network Terminal) placed at user premises using dedicated cable. Distance can be about 80 Km and the fibre cable provides full bi-directional communication.

Passive Optical Network

PON is a point to multipoint FTTH architecture. This configuration is used for various applications. It includes voice, video, data etc. This configuration uses optical splitter to connect OLT located at service provider side with multiple ONUs located at user premises.

*Optical Splinters.

Optical splitters are available in different configurations viz. 1:4, 1:8, 1:16, 1:32, 1:64 etc. As the name suggests this architecture uses all the passive components between OLT and ONUs. No electronic or electrical active components are used. There are two benefits to this type of architecture; easy maintanance and lower cost. Typical distance between OLT and ONU is about 35Km.

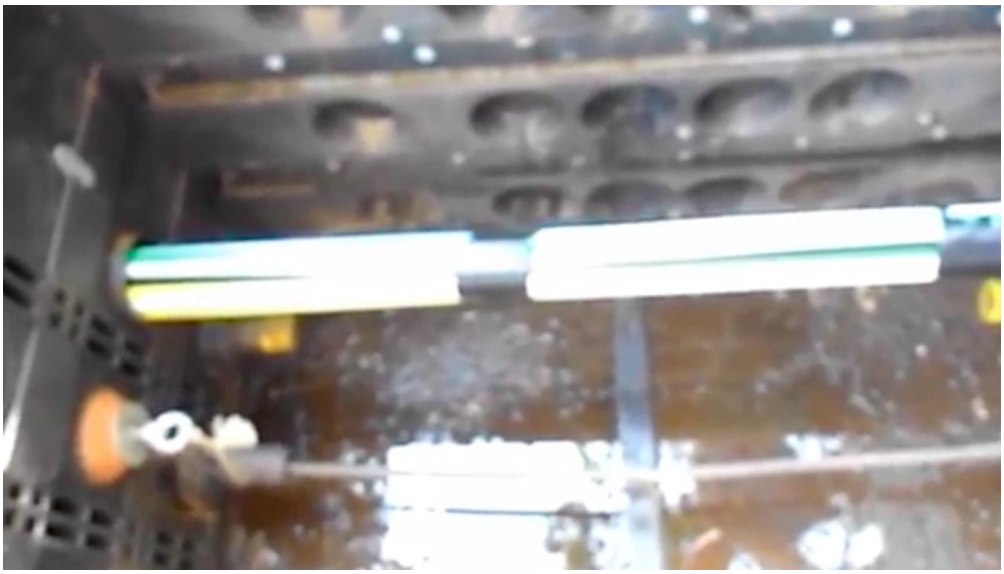
How to install?

There are three basic steps in providing FTTH services: building a backbone network, installing fibre to each block, and connecting homes to the fibre network.

- Backbone network – The backbone network is typically a fibre ring which feeds the fibre from a distribution node to every block.
- Fibre in each block – After the backbone network is installed, each block in the neighbourhood starts to get fibre. This is where everyone's pavements are dug up to put in the fibre.
- Connecting homes – Fibre is taken from the distribution box on the boundary wall into the home.

This installation of fibre is based on the viewed video in Youtube.

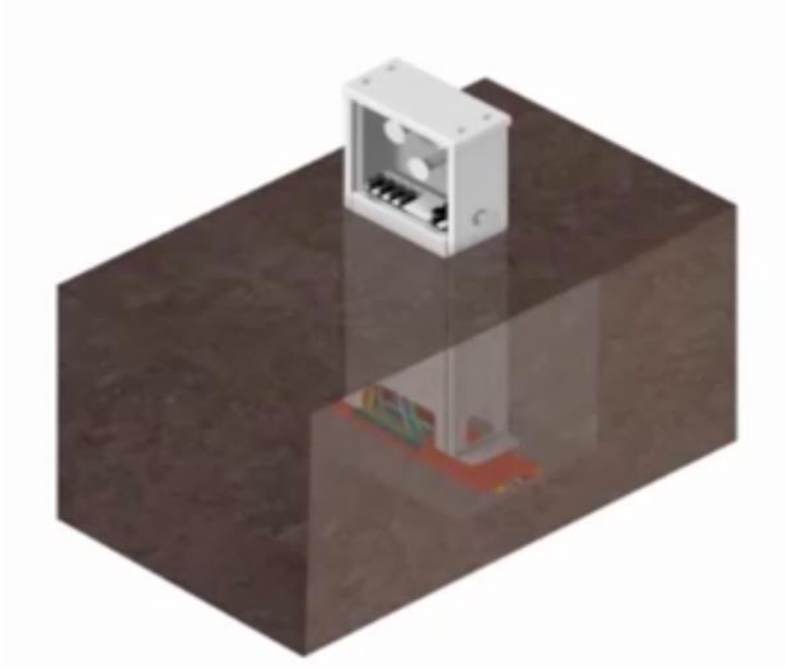
Figure 2 and 3 below.



1. The fibre cable will be installed in the topsoil or manhole. There will be rollers (fibre rollers) from starting point of fibre installation to the end point.

- The fibre cable will be rolled based on the project requirements, ex: rolled for 1.2 km, from one point to another.
- Contractors will be using specific machines to drill the topsoil to install the fibre.

Figure 5 and 6 below.



2. The fibre cable then will be connected to the wiring cabinet (in Malaysia, known as Telekom Malaysia Cabinet)

- Here, the contractor will install the cabinet in the ground, so that the top based cabinet can be accessed by the splicer team.

Figure 7 below.

3. When the cabinet is ready, the splice team (the Service Provider team) will do the configuration for the fibre cable in the cabinet.

- Splicing for fibre will be done here.
- Easier access from manhole.
- Better cable management.

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