

# FTTx Solution White Paper

Talking  
to the  
Future

# 1 Introduction of FTTx

## 1.1 Technology of FTTx

Fiber access is one of the most important technologies in the next generation network. It increases the access layer bandwidth and builds a sustainable-development access layer network. OAN (Optical Access Network) adopts 2 technologies: active point-to-point (P2P) Ethernet and passive optical network (PON).

At the earlier stage, P2P adopted dual Tx and Rx fibers to the user. The fiber layout in pairs was difficult. With the development of wavelength division multiplexing (WDM), now in the PON technology, one fiber to the user has been realized. In the downstream direction, the wavelength is 1490 nm, and in the upstream direction, the wavelength is 1310 nm. PON is the optical access technology developed to support P2MP (Point-to-Multi-Point) applications. PON Topology Architecture is refer to Figure 1

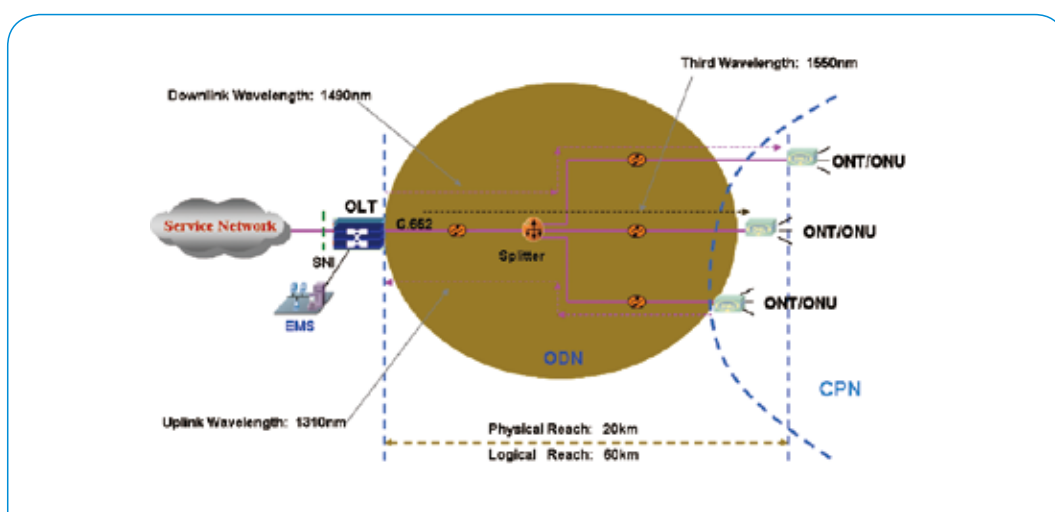


Figure 1 PON Topology Architecture

PON realizes P2MP transmission through the POS (Passive Optical Splitter). The fiber connected to the OLT port is split through by the Splitter into multiple channels to the ONUs of different users. The distance between OLT and ONU is longer i.e. 20km. With the PON technology, the ODN (Optical Distribution Network) does not have active nodes. The feature of passiveness makes the network deployment flexible, because the equipment room and power supply are not needed. The following lists the advantages of PON:

- Reduced cost. The equipment and fiber at the CO are shared by users, so the cost is lower than of P2P. Because equipment room and power supply are not needed, the capital construction cost is greatly reduced. The cable distribution at the CO is easy.
- Easy maintenance. The active equipment is removed from the access network, so the effect from electromagnetic interference, thunder and lightning is reduced. Thus, the failure rate of the line and the external equipment is reduced. Therefore, the operation and maintenance cost is reduced.

PON is most widely accepted by main Operators in the world. It is first technology choice and the trend of OAN. So we analyze the FTTx networking models that based on the fiber cable and PON technology in this document.

## 1.2 FTTx network model

OAN (Optical Access Network) have several applications model: FTTC (Fiber to The Curb), FTTB (Fiber to The Building), FTTH (Fiber to The Home) and FTTO (Fiber to The Office). Please refer to Figure 2.

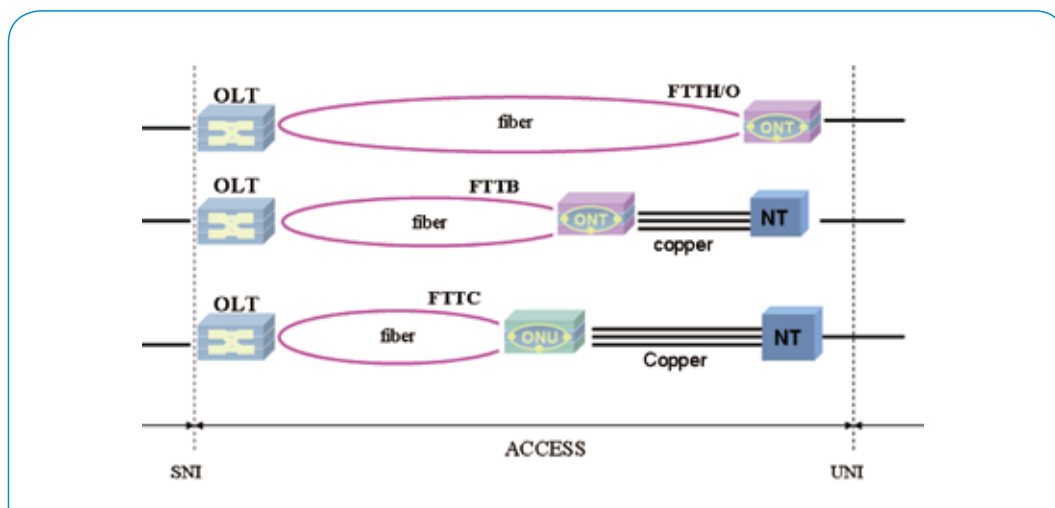


Figure 2 FTTx application model in PON

Different FTTx application model is based on the ONU location and the fiber length.

In FTTH/FTTO, ONU is deployed in the home or office indoor, which is the nearest position to user. The fiber Length is the longest.

In FTTB, ONU is deployed in the building or corridor.

In FTTC, ONU is deployed Curb, which is the farthest position to user, The fiber Length is the shortest.

Table 1 list all kinds of FTTx application models main features.

Table 1 FTTx Features

Application Mode	FTTC	FTTB	FTTO	FTTH
ONU capability	Hundreds	Tens	Single Enterprise /Office	Single Family
Distance between OLT and ONU	5Km~100Km	< 20km	< 20km	< 20km
Distance Between ONU and User	1~3Km	<500m	0 ~ 50 m	0 ~ 20 m
Bandwidth Per User	2 to 25Mbps	50/100Mbps	100M to GE	>=100M
ONU Interface	POTS, ADSL/ADSL2+, VDSL2	FE,POTS,VDSL2 /TDM	FE/GE, TDM, Wifi	FE,POTS, Wifi,RF
ONU Type	ONU (Large Capability)	MDU /MTU	SBU	SFU
International Abbreviation	FTTN FTTZ	FTTK	FTTP FTTBusiness	FTTP FTTU

## 2 FTTx Solution

### 2.1 Introduction of FTTx solution

PON access system should be an all-optical solution in response to the continuously growing bandwidth requirements in the last-mile (access) domain. PON-based access network follows the trend of delivery of triple-play services to end subscribers, aggregating three types of services over a single delivery platform. This in turns is the next step in the evolution of the core networks to IP-based NGN. In order to build the new generation of optical access networks, this solution draws on the technologies of different maturity extents such as EPON, GPON, Ethernet and xDSL, ranging from local exchange devices of various capacities to serialized user-side devices. It can be deployed in various application scenarios, such as FTTC, FTTB, FTTO and FTTH, enabling operators to deliver services in a simple and straightforward manner, providing cost-effective high-bandwidth and multi-service support capabilities. This allows operators to become more competitive and adapt services to ever changing customer demands. The total FTTx solution please refer to Figure 3.

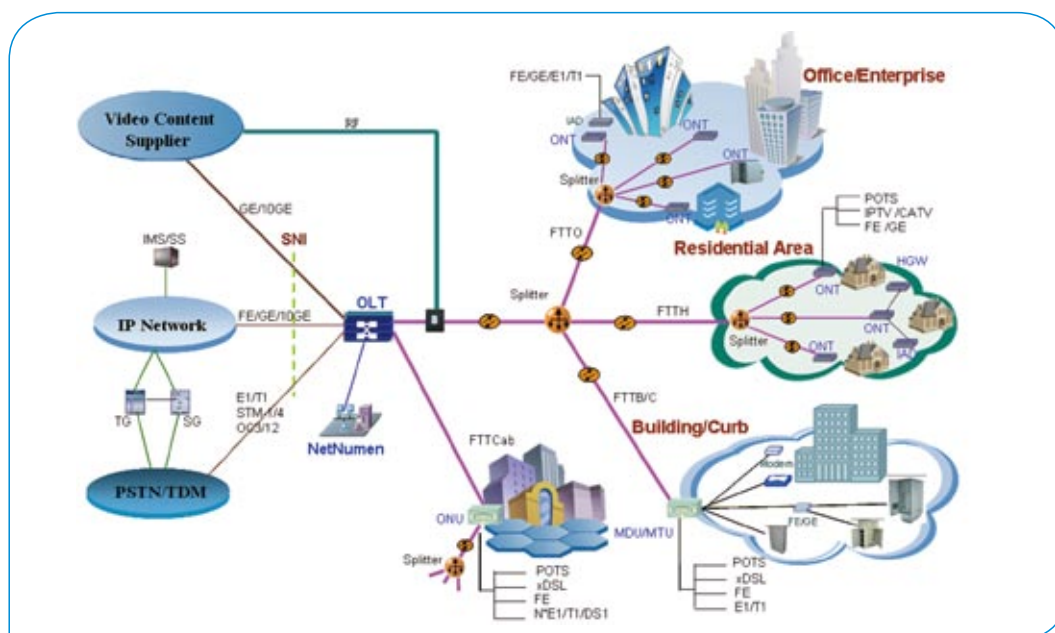


Figure 3 total FTTx solution

## 2.2 Typical Application and Suggestions

### 2.2.1 FTTH

FTTH network topology is refer to Figure 4

1 Equipment arrangement

- PON OLT is placed in the Central Office or in the equipment room of the residential area
- Splitter is placed outside of the building, mounted on the wall or in the outdoor cabinet. For multi-layer residential building, one splitter can be shared by several residential building. Generally splitter is placed in the middle of the buildings to save fiber
- Fiber is inter-connected in the connecting cabinet, and then enters into the room of subscribers via pig-tail
- ONU is placed on the desk or mounted on the wall at every home.

2 Providing Service

- VoIP, IPTV, Monitor, HSIA, CATV, etc.

3 ONU interface

- POTS, FE/GE, WIFI, RF, etc.

4 Access bandwidth

- The bandwidth of each subscriber is relative to the number of ONUs. Generally, it can be up to 10~100Mbps per subscriber.

5 Typical application

- Villa
- New buildings

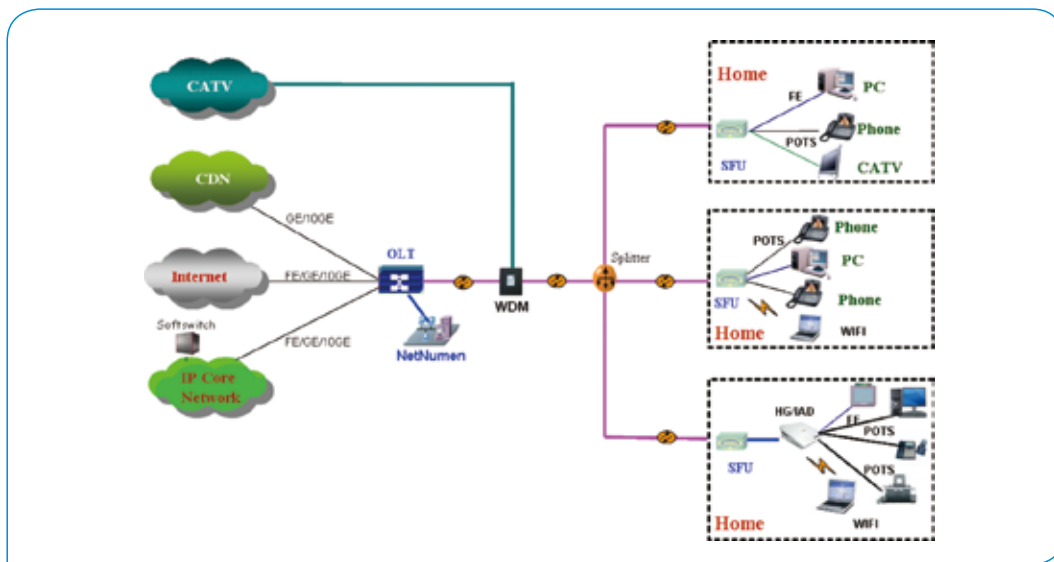


Figure 4 Solution for FTTH

2.2.2 FTTO

For office application it is similar to that of FTTH, but the distance between ONU and user is generally < 50 meters. In this case, SBU (Single Business Unit) is used for few interfaces providing and MTU (Multi-Tenant Unit) is used for more interfaces providing.

The service providing includes TDM and IP service. Such as ONU need provides E1/T1 interface to connect PBX.

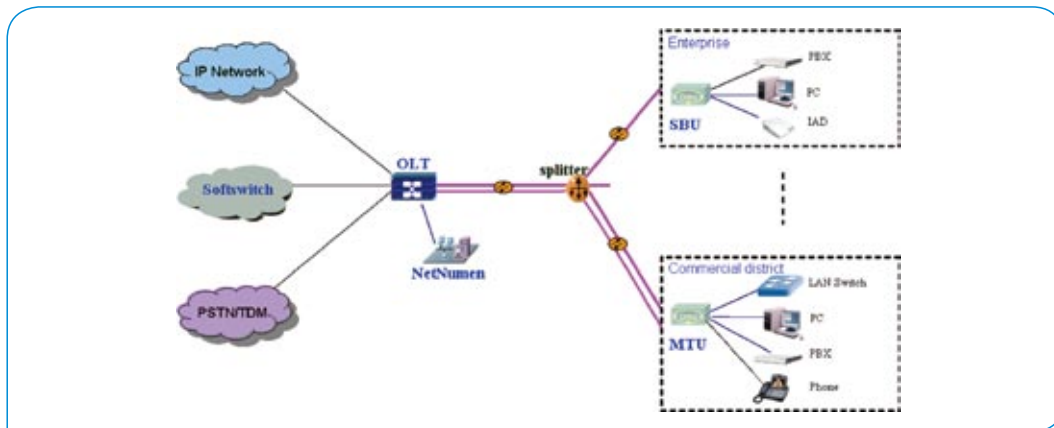


Figure 5 Solution for FTTO

### 2.2.3 FTTB

#### 1 Equipment arrangement

- PON OLT is placed in the Central Office, basement or equipment room of the building;
- Splitter is placed in the low voltage room of each floor of the building;
- Fiber end at ONU
- ONU is placed in the basement of the building or in the low voltage room of each floor (FTTB+LAN), in the basement of the building or outdoor cabinet (FTTB+DSL).

#### 2 Providing Service

- VoIP, IPTV, HSIA, TDM leased line, VPN, Monitor, etc.

#### 3 ONU interface type

- POTS, FE/GE,E1/T1, ADSL/ADSL2/ADSL2+,VDSL2,SHDSL,etc.

#### 4 Access bandwidth

The bandwidth of each subscriber is relative to the split ratio. Generally, it can be up to 50M~100Mbps per subscriber.

#### 5 Typical application

Self-governed enterprises or companies in commercial building, family subscriber in the apartment building;

The solution of fiber redundancy protection is for some important subscribers.

- PON+LAN mode

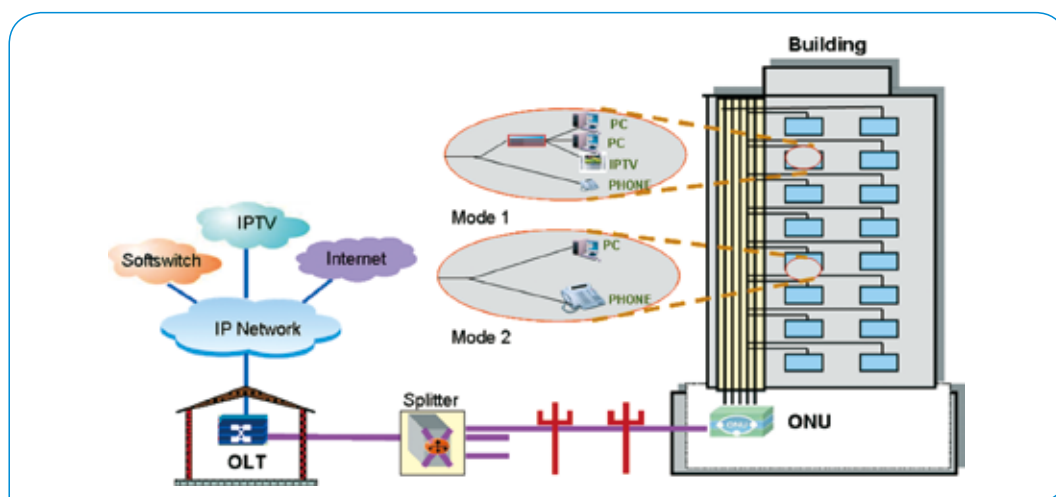


Figure 6 Solution for FTTB with PON+LAN

i ONU module

PON MTU

ii User interface type

E1/POTS/10/100Base\_T

iii Uplink interface type

EPON or GPON

The existing UTP-5 in the building can be used to save the cost of networking, for higher building, cable box can be used in certain layer to make it easy for cable planning.

- PON+DSL mode

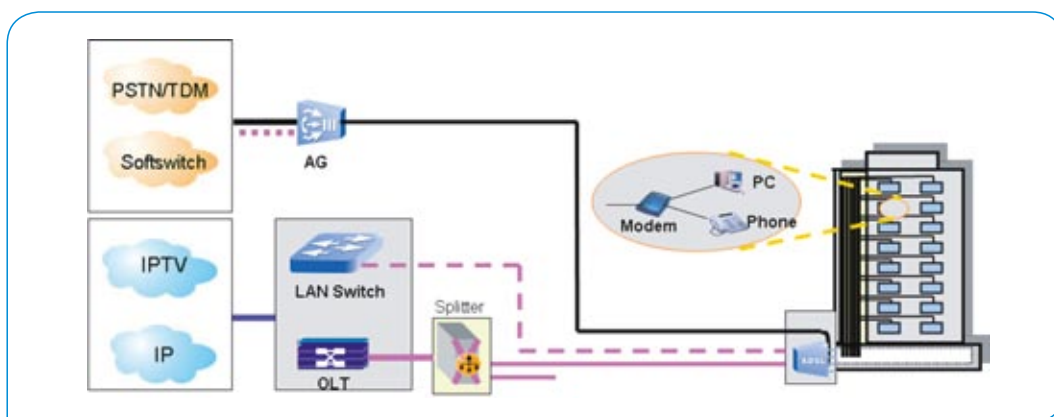


Figure 7 Solution for FTTB with PON+DSL

i ONU module

PON MDU

ii User interface type

ADSL/ADSL2/ ADSL2+/SHDSL, VDSL2, POTS

iii Uplink interface type

EPON or GPON

The existing twisted-pair in the building can be used to save the cost of networking, for higher building, cable box can be used in certain layer to make it easy for cable planning.



### 2.2.4 FTTC

#### 1 Equipment arrangement

- PON OLT is placed in the Central Office
- Fiber end at ONU
- ONU is placed in the building or curb, hanging on the pole or in the outdoor cabinet at the central of residence area.

#### 2 Providing Service

- VoIP, IPTV, HSIA, etc.

#### 3 ONU interface type

- POTS, FE/GE, ADSL/ADSL2/ADSL2+,VDSL2,SHDSL,etc.

#### 4 Access bandwidth

The bandwidth of each subscriber is relative to the split ratio. Generally, it can be up to 100K~100Mbps per subscriber.

#### 5 Typical application

PON+ADSL2+, PON+VDSL2

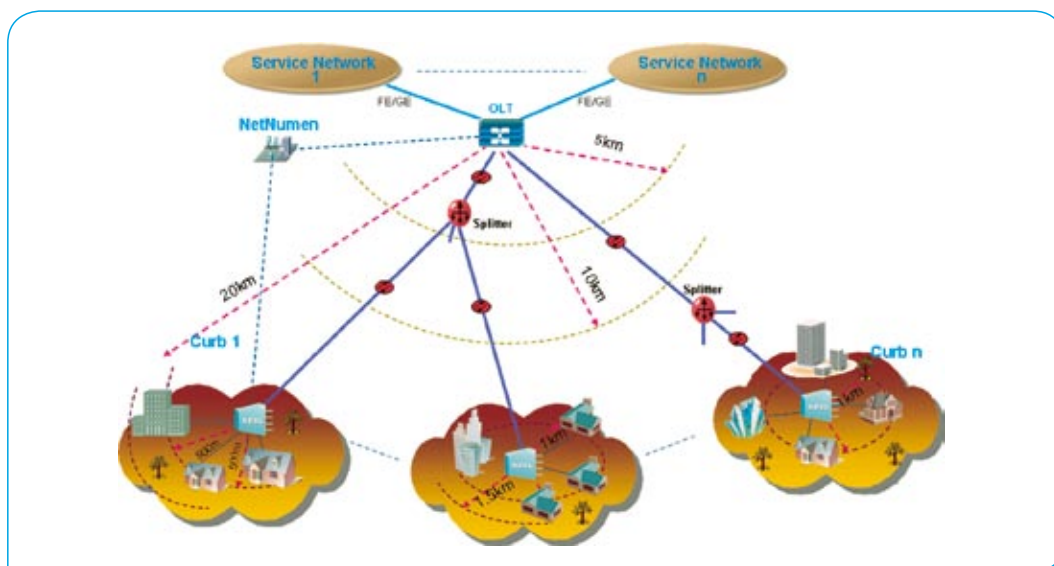


Figure 8 Solution for FTTC

## 2.3 FTTx application in the world

According to the view of point-topic, till the end of Q3, 2008, FTTx subscribers in world wide had increased a lot, to 49 millions. Among them Asia-Pacific was the biggest region with 43.5% market share.

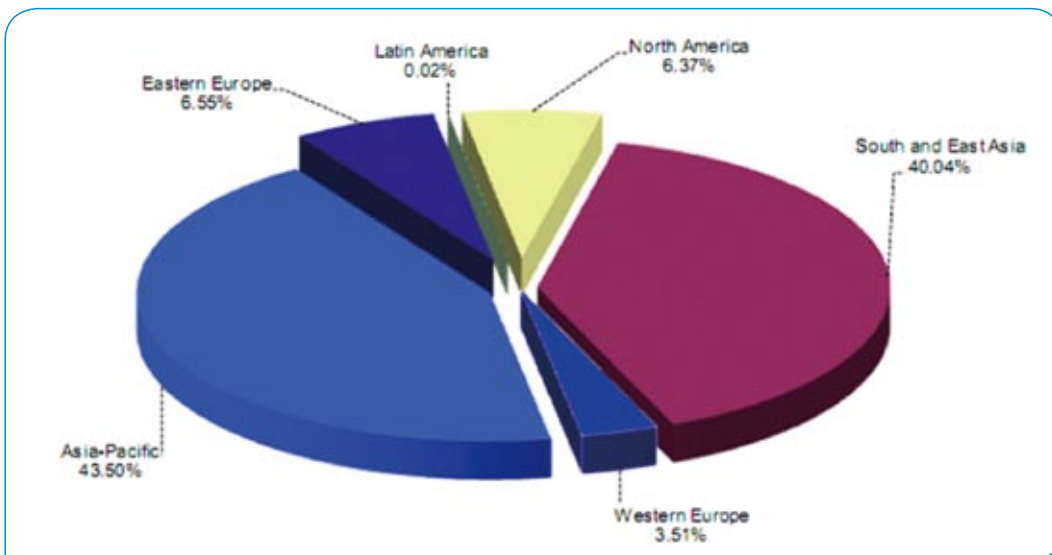
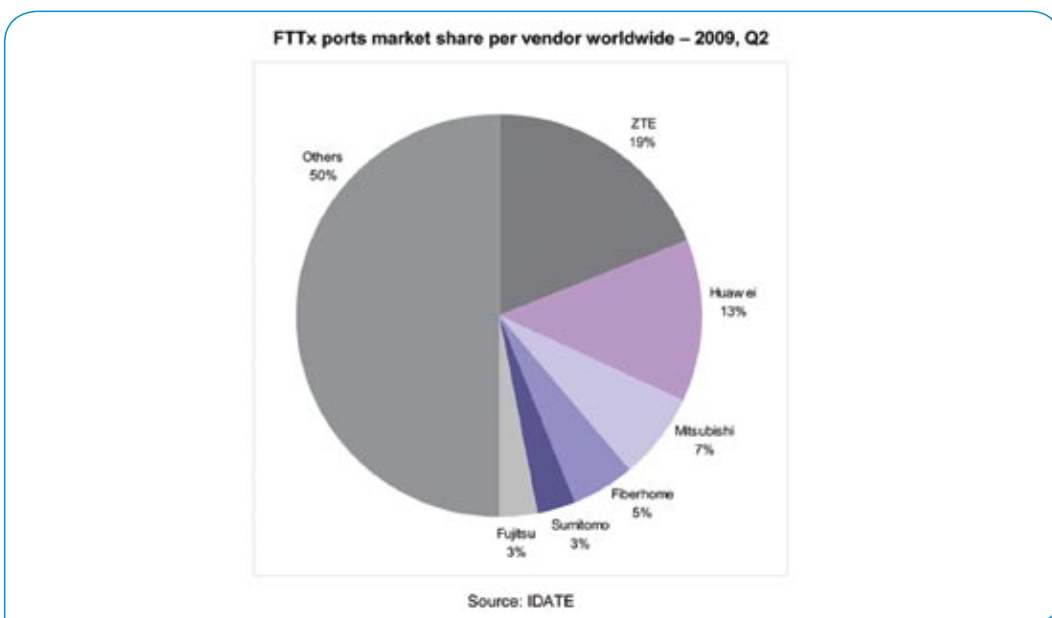


Figure 9 43.50% of FTTx Subscribers are in Asia-Pacific

The installed FTTx ports are estimated worldwide at 83.3 million at end of 2008.

The first estimate of the vendors global market shares at 2009,Q2. In a very fragmented FTTx market, the global top six vendors is composed of Asian equipment vendors, ZTE being the market leader with 19% of market share. Huawei came in second position with 13%, followed by the Japanese manufacturer Mitsubishi in the third position at 7%.



**ZTE中兴** 中兴通讯股份有限公司  
ZTE CORPORATION

地址：深圳市高新技术产业园科技南路中兴通讯大厦

邮政编码：518057

网址：[www.zte.com.cn](http://www.zte.com.cn)

电话：86-755-26770000

传真：86-755-26771999