

White paper

FTTX Technology & Market Outlook From 2008



LES-2400-RPS



LGS-2207C



LGS-2300-RPS



LGS-2404



CM-216



CM-011

Full Gigabit / 100M Fiber Modular Switch or
Converter chassis with remote access switch and converter



Transportation



Maritime area



Power station



Oil platform



Airport



FTTX



Surveillance

FTTX Technology & Market Outlook from 2008

Technology :

FTTX (Fiber to the Home/Curb/Node) is the ultimate broadband architecture for many ISPs and Telecoms. It is the technology recognized as future-proof for any advanced applications – IPTV, Triple Play, Surveillance, Medical Care, etc. There are two major deploy technologies for FTTX–PON (Passive Optical Network) & P2P (Active Ethernet Network). The current latest technology for PON is GPON while P2P is 10G. Here are the Pros & Cons for these two technologies:

| Type | Pros | Cons |
|------|--|--|
| P2P | <ul style="list-style-type: none"> -Lower Cost CPE -Higher Upstream Bandwidth -Dedicated Bandwidth -Distance -Greater Flexibility to Evolve -Off the Shelf Equipment | <ul style="list-style-type: none"> -Active Components increase OPEX -Require Large Amounts of Fiber -Require per subscriber fiber termination |
| PON | <ul style="list-style-type: none"> -Passive OSP, Lower OPEX -Shared Infrastructure -Dynamic Bandwidth Allocation(GPON) | <ul style="list-style-type: none"> -Lack of Interoperability -Higher cost CPE -Shorter Distance -Optical Budget |

Source: FTTH Council

Many companies in the 1980's and 1990's went to PON because it could split the fiber signal into dedicated bandwidth (like a switch) while the old Ethernet only shared bandwidth (like a hub). Other devices were then added to the network for redundancy and reliability. The fiber goes from the PON to an optical network transport device (OLT, Optical Line Terminal), then from the OLT into a modem, then out of the modem via Ethernet into the gateway/router.

Now that Ethernet P2P can do GBE rings, as bandwidth usage increases, the P2P technology becomes more appealing. The ability to add PoE (Power-over-Ethernet) and reduce the need for back up batteries at the CPE device is another practical feature for P2P Ethernet. This gives the service provider the ability to remotely manage the network from a central location all the way down to the CPE device, and remotely reset the device if need be.

In current FTTX infrastructures, PON technology is mostly widely deployed by RBOCs (Regional Bell Operating Companies) like AT&T and Verizon for IPTV services, while P2P are mainly implemented by Municipalities, Power Utility Companies and CLECs (Competitive Local Exchange Carriers). The biggest challenge for PON is the problem of interoperability and the need to plan the network precisely at the initial installation of the infrastructure to avoid losing money as the network grows. On the contrary, P2P uses the Ethernet standard which has been in use for decades. Ethernet is cost-effective and has the ability to scale as the network needs grow. To cope with the large amount of fiber cable used in P2P FTTX, WDM technology is a good solution that is commonly used in Asia, mainly Japan, Korea and Taiwan.

Market Outlook :

Today's FTTH market only accounts for 11% of the broadband markets in the world, yet Internet traffic demand is growing at a 33.4% CAGR. Every ISP and Telecom service provider are adapting FTTH as a competitive "weapon" to gain broadband service market share according to a 2008 report of the Institute of Information Industry of Taiwan.

North America is the fastest growing market in the world since 2007 because of Verizon's success with their FiOS IPTV service, which is quickly taking competitive cable TV subscribers. Other competitors are aggressively launching Triple Play services through FTTH.

Europe's infrastructure is mainly controlled by Municipalities and Power Utility Companies resulting in a slower development of FTTH due to the lack of mass-deployment. Currently, with municipalities and power utility companies continually investing in and supporting major telecom carriers, FTTH deployment is expected to ramp in the next few years.

Asia is the market leader for FTTH deployments with the highest penetration rate in the world. The leading countries are Japan, South Korea and Taiwan.

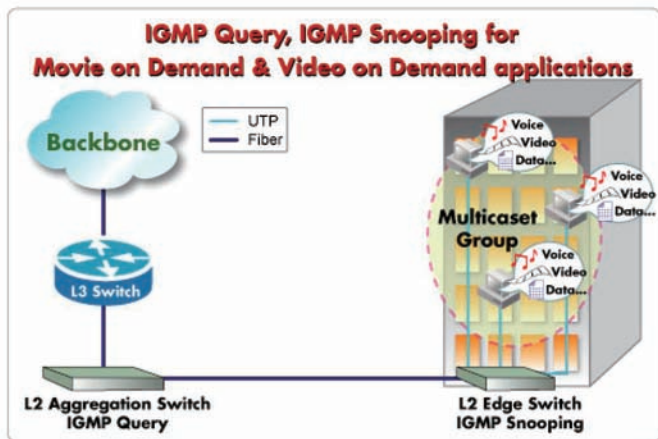
Please see the following table at a glance for FTTH in each region.

| Region | N. America | Europe | Asia |
|-------------------------|---|---|---|
| Major Conductor | RBOC | CLEC, Muni/Utility | ILEC, CLEC |
| Development Environment | Confronted by CableTVs, Carriers are planning FTTH service to increase competitiveness and raise ARPU | Municipality and Power Utility construct fiber network to let CLEC lease the fiber network in which penetrates ILEC broadband markets | To strength countries' competitiveness, each government strategically develops FTTH infrastructure. With ILEC strong cooperation, Asia has become the booming market for FTTH |
| Development Status | RBOC strong promotion makes US as quickest growing country for FTTH | ILEC is speeding up FTTH infrastructure | xDSL becomes saturated and is replacing by FTTH |
| Leading Countries | US | France, Italy, Netherlands, Sweden, Denmark | Japan, South Korea, Taiwan |
| Leading Players | Verizon, AT&T | Muni/Utility, Free, KPN, FastWeb | NIT, KT, CHT |
| Technology | BPON, GPON | Ethernet P2P, GPON | EPON |

Lantech's Solution :

Lantech has been developing Ethernet Switch solutions for the past two decades. In order to offer complete FTTH P2P solutions, we are enhancing our product offering to meet the coming challenges in metro networks. These include the following features: Gigabit Ethernet Ring topologies that can self heal in less than 10ms by proprietary RSTP, IGMP Query and Snooping, VLAN QinQ (SuperVLAN), VLAN translation and VLAN matching, MSTP(Multiple Spanning Tree), ACL, IP source guard, and OAM (Operations, Administration and Maintenance) for large network demand.

Most of the FTTH applications are to provide Triple-Play or IPTV service for Digital Homes. IGMP Query and Snooping is very important for "Video on Demand" or "Movie on Demand" applications in big Metro-networks to release the heavy network utilization causing by the large video streams. In today's trends in the Digital Home, HD video could easily take 8MB bandwidth to provide 864x480 resolution with 5.1CH and Dolby sound effects, so to provide IGMP Query and Snooping functionality is essential to avoid video lag for home users. In today's Metro networks, L2 switches are aggregated to handle IGMP query and snooping functions to ease the burden on the L3 core switches.

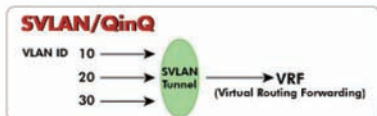


Super VLAN is another feature utilized in Metro LANs in which it can save IP v4 addresses by grouping sub-VLANs (customer port) in a Super VLAN(Host) and utilizing the default gateway IP address of the Super VLAN sharing the same IP subnet mask. Super VLANs in L2 switches provide enhanced security between customers (each home), by not allowing communication between the sub-VLANs, even they are located in the same LAN and have the same IP subnet mask. The configuration is simple as you assign each VLAN as a port based VLAN to each home (customer).

The ability to add another tag type on top of an 802.1q tag type is a desirable feature in L2 switches for Metro networks, especially for Triple-play services. The outer tag can be set for VoIP, Video or Data in each Super VLAN and Customer VLAN (sub-VLAN). The QoS bits are automatically copied from the edge switch to the tag set by the core switch, which helps the edge switch prioritize SAV traffic that is transmitted through the Core network.

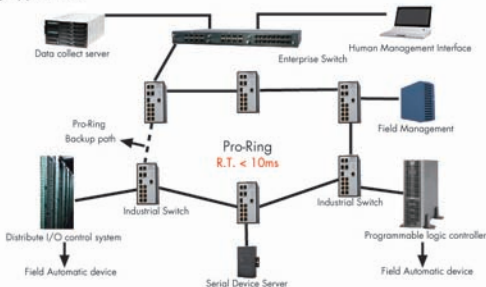
Outer Tag

| SVLAN | 1P | CVLAN | 1P |
|-------|----|-------|----|
| 100 | 1 | 1 | 1 |
| 200 | 2 | 1 | 2 |

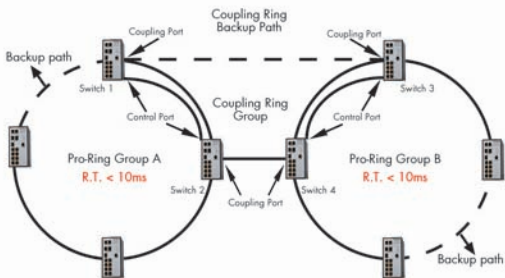


VLAN Mapping and Translation allows ISPs to deliver multiple services on separate customer interfaces or on a single customer interface. This isolates each of the services so that the ISP can troubleshoot CPE problems without affecting other services.

Pro-Ring or Auto Fast Recovery Ring Proprietary Topologies can help the network to recover from network connection failures within 10ms or less, and can also make the network system more reliable. The Pro-Ring algorithm is similar to the Spanning Tree Protocol (STP) and the Rapid STP (RSTP) algorithm but the recovery time is less than STP/RSTP. The picture below is a sample of the Pro-Ring application.

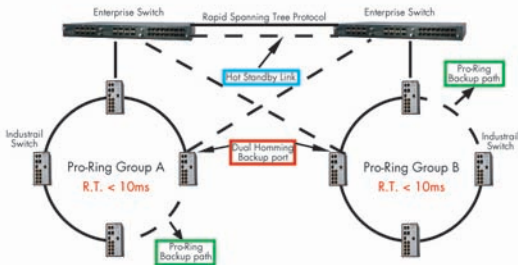


Coupling Ring is used to connect multiple Ring groups for more secure redundant backup paths. It can ensure the transmissions between two ring groups do not fail. The following figure is a sample of a coupling ring application.



The Dual Homing function prevents connection loss between the Pro-Ring group and the upper level/core switch. You assign two ports to be the Dual Homing ports that are the backup ports in the Pro-Ring group. The Dual Homing function only works when the Pro-Ring function is active. Each Pro-Ring group only has only one Dual Homing port.

Auto provisioning can allow ISPs to manage "End-to-End" IP services through the auto-detection and upgrading of firmware for CPE devices. This allows ISPs to quickly troubleshoot and provide quality assure services to consumers.



OAM :

OAM (Operations, Administration and Maintenance) is used in the Telecom/ISP link path monitoring and administration, which is now defined in the METRO Ethernet network with 802.1ah and 802.1ag. 802.1ah OAM is usually used in access networks while 802.1ag is used in aggregation and edge networks for connectivity OAM.

Lantech Product Matrix for FTTH

| Model Name | Description | Highlight Features | Application |
|------------|-------------|--------------------|-------------|
|------------|-------------|--------------------|-------------|

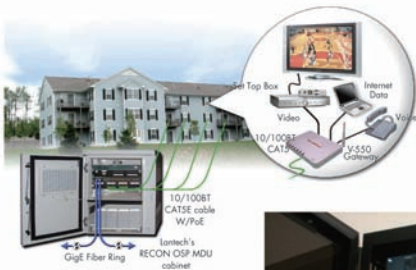
Ethernet – Fiber Converter

| | | | |
|-----------------------------|---------------------------|----------------------------------|-------------------------------|
| CM-011-SC | 10/100TX to 100M FX | LLF, LFP, Duplex mode DIP switch | FTTB, FTTH, MTU |
| CM-021-GB | 10/100/1000T to 1000M SFP | LLF, LFP | FTTB, FTTH, MTU |
| CM-011 OAM-SC (2009) | 10/100TX to 100M FX | LLF, LFP, OAM | FTTB, FTTH, MTU |
| CM-021 OAM-GB (2009) | 10/100/1000T to 1000SFP | LLF, LFP, Jumbo Frame, OAM | FTTB, FTTH, MTU |
| MC-216 Chassis | 16-slot converter chassis | SNMP, 10/100/1000M | Central, Distribution, Access |
| MC-316 Chassis w/OAM (2009) | 16-slot converter chassis | SNMP, OAM, 10/100/1000M | Central, Distribution |

| Model Name | Description | Highlight Features | Application |
|------------|-------------|--------------------|-------------|
|------------|-------------|--------------------|-------------|

Access Switch / Distribution Switch

| | | | |
|---------------|---|--|---------------------------|
| LES-2224C-SFP | 24x100M SFP SNMP L2 Switch | SNMP, RSTP, VLAN | FTTB, Access |
| LES-2400-RPS | 3-slot 100M FX/SFP/UTP SNMP L2 Plus Switch | SNMP, RSTP, Pro-Ring, IGMP Query, Snooping | FTTB, Aggregation, Access |
| LGS-2300-RPS | 3-slot 1000M SX/SFP/UTP SNMP L2 Plus Switch | SNMP, RSTP, Ring Pro-Ring, IGMP Query, Snooping | FTTB, Aggregation, Access |
| LGS-2207C | 7 x GigaT + 2 GigaSFP/T combo SNMP L2 Plus Switch | SNMP, RSTP, Pro-Ring, IGMP Query, Snooping | FTTB, Aggregation, Access |
| IGS-2206C | 6 x GigaT + 2 GigaSFP/T combo SNMP L2 Industrial Switch | Harden, SNMP, RSTP, Pro-Ring, IGMP Query, Snooping, Lantech-View | Aggregation |
| IGS-2408 | 8 x GigaT w/ 4 Giga SFP/T combo SNMP L2 Industrial Switch | Harden, SNMP, RSTP, Pro-Ring, IGMP Query, Snooping, Lantech-View | Aggregation |



- Lantech's RECON cabinet at each apartment complex
- Giga fiber ring to each cabinet
- Lantech's IPES-2224C-24 POE Ethernet switch at each cabinet - Includes Lantech's fiber and patch panel equipment
- CAT5E cable from cabinet to each apartment unit
- Support for 24 to 48 apartment units per cabinet
- Lantech's power and battery equipment at each cabinet
- Power over Ethernet (PoE) to each apartment unit
- Lantech's V-550 Gateway at apartment unit

