

# Equipos de acceso

Area de Ingeniería Telemática  
<http://www.tlm.unavarra.es>

Redes de Banda Ancha  
5º Ingeniería de Telecomunicación

# Modem ADSL



# D-Link DSL-2320B

## HIGH PERFORMANCE DSL MODEM

The D-Link ADSL2/2+ Ethernet/USB Modem (DSL-2320B) enables you to access a high-speed DSL Internet connection. The DSL-2320B supports the latest ADSL2/2+ standards to provide higher performance (up to 24Mbps<sup>1</sup> downstream and 3.5Mbps<sup>1</sup> upstream) and longer reach from your Internet Service Provider's (ISP) Digital Subscriber Line Access Multiplexer (DSLAM). The DSL-2320B is also backward compatible with standard ADSL. To create a home or office network, simply add a multi-port router<sup>2</sup>.

## ALWAYS ON, ALWAYS CONNECTED

Unlike a dial-up Internet service, a DSL Internet connection is always on so that you do not have to wait to access the Web. The DSL-2320B supports TR-067 standards ensuring compatibility with your ISP's infrastructure. This modem automatically detects your DSL settings to quickly establish a connection to the Internet. The DSL-2320B includes a simple configuration tool and a Web-based Graphic User Interface (GUI) that enables you to easily modify settings to connect to a DSL Internet service. The conveniently located LED indicators let you quickly check the modem's status and activity.

## CHOICE OF CONNECTIVITY

The DSL-2320B offers both Ethernet and USB ports for flexible connectivity. The RJ-45 port enables you to connect an Ethernet device such a multiple-port router or an Ethernet-enabled computer. If the Ethernet port is not being utilized, then you can use the USB port to connect a USB-enabled computer and vice versa<sup>3</sup>.

The D-Link ADSL2/2+ Ethernet/USB Modem (DSL-2320B) is a great all-around high-speed DSL Internet access solution, whether you are a home user who requires a high-speed Internet access for faster file downloads, or a business user that relies on the Internet to conduct daily business.

## GREATER COMPATIBILITY

The D-Link DSL-2320B is TR-067 compliant, ensuring that this device will work with your Internet Service Provider's infrastructure. The DSL-2320B also offers both Ethernet and USB ports, allowing for flexible connectivity with various networking devices.



# D-Link DSL-2320B

## TECHNICAL SPECIFICATIONS

### DATA RATES'

- + Downstream: Up to 24Mbps
- + Upstream: Up to 3.5Mbps

### COMPLIANCE

TR-067 Interop Performance

### ADSL STANDARDS

- + Multi-mode
- + Full-rate ANSI T1.413 Issue 2
- + ITU-T G.992.1 (G.dmt) Annex A/C/I
- + ITU-T G.992.2 (G.lite) Annex A/C
- + ITU-T G.994.1 (G.hs)

### ADSL2 STANDARDS

- + ITU-T G.992.3 (G.dmt.bis) Annex A/J/K/L/M
- + ITU-T G.992.4 (G.lite.bis) Annex A

### ADSL2+ STANDARDS

ITU-T G.992.5 Annex A/L/M

### ATM/PPP PROTOCOLS

- + ATM Forum UNI3.1/4.0 PVC - Up to 8
- + PVCs
- + PPP over ATM
- + PPP over Ethernet

### NETWORK PROTOCOLS AND FEATURES

- + Ethernet to ADSL Self-Learning Transparent Bridging
- + Internet Control Message Protocol (ICMP)

### FIREWALL

- + MAC Filtering
- + Packet Filtering
- + Stateful Packet Inspection (SPI)
- + User Authentication PAP
- + User Authentication CHAP

### VPN

Multiple IPSec/PPTP/L2TP Pass-through

### CONFIGURATION AND MANAGEMENT

- + Web-based GUI Configuration
- + ADSL/ADSL2/ADSL2+ Manual Selection and Auto Fallback
- + Auto VPI/VCI Detection
- + Configuration Backup and Restore

### PORTS

- + ADSL Port (RJ-11)
- + 10/100 Ethernet Port (RJ-45)
- + USB 1.1 Port

### LEDs

- |         |            |
|---------|------------|
| + Power | + Status   |
| + DSL   | + LAN      |
| + USB   | + Internet |

### OPERATING TEMPERATURE

32°F to 104°F (0°C to 40°C)

### STORAGE

-4°F to 149°F (-20°C to 65°C)

### HUMIDITY

5% to 95% Non-condensing

### CERTIFICATIONS

- |               |       |
|---------------|-------|
| + FCC Class B | + CE  |
| + RoHS        | + CSA |

### DIMENSIONS

- + Item (WxDxH): 5.7" x 4.3" x 1.3"
- + Packaging (WxDxH): 10.8" x 8.2" x 2.7"





# Router xDSL



# D-Link DSL-2540B

## 2-IN-1 DEVICE

The D-Link ADSL2/2+ Modem with 4-Port Ethernet Router (DSL-2540B) is a 2-in-1 device that combines the function of a DSL modem and 4-port 10/100 Ethernet router. The DSL-2540B supports the latest ADSL2/2+ standards to provide higher performance (up to 24Mbps' downstream and 3.5Mbps' upstream) and longer reach from your Internet Service Provider's (ISP) Digital Subscriber Line Access Multiplexer (DSLAM). You can also create a wired network to share your high-speed Internet connection, documents, photos, music, videos, printers, and Network Attached Storage (NAS).

## ACCESS HIGH-SPEED INTERNET

Unlike a dial-up Internet service, a DSL Internet connection is always on so that you do not have to wait to access the Web. Setting up the DSL-2540B is simple since it automatically detects your DSL settings to quickly establish a connection to the Internet. With support for TR-067, compatibility with your ISP's infrastructure is ensured. This device also supports TR-069, which automatically updates the firmware and other settings when they become available from your ISP.

## ADVANCED NETWORKING

The DSL-2540B includes a built-in QoS engine that helps prioritize Internet traffic to enable smooth Internet phone calls (VoIP) and lag-free online gaming. In addition, this device includes Dual Active Firewalls (SPI and NAT) to help protect your network from potential attacks from across the Internet. With a built-in 4-port 10/100 Ethernet router, up to four network-ready computers or devices can simultaneously be connected to the DSL-2540B.

Whether it is for a home user who wants to share high-speed Internet access or for a small office that needs Internet access for conducting essential business activities, the DSL-2540B ADSL2/2+ Modem with 4-Port Ethernet Router (DSL-2540B) is the ideal all-in-one broadband and wired networking solution.

# D-Link DSL-2540B

## TECHNICAL SPECIFICATIONS

### DATA RATES<sup>1</sup>

- + Downstream: Up to 24Mbps
- + Upstream: Up to 3.5Mbps

### COMPLIANCE

- + TR-067 Interop Performance
- + TR-069 Compliant with ACS

### ADSL STANDARDS

- + Multi-mode
- + Full-rate ANSI T1.413 Issue 2
- + ITU-T G.992.1 (G.dmt) Annex A/C/I
- + ITU-T G.992.2 (G.lite) Annex A/C
- + ITU-T G.994.1 (G.hs)

### ADSL2 STANDARDS

- + ITU-T G.992.3 (G.dmt.bis) Annex A/J/K/L/M
- + ITU-T G.992.4 (G.lite.bis) Annex A

### ADSL2+ STANDARDS

- + ITU-T G.992.5 Annex A/L/M

### ATM/PPP PROTOCOLS

- + ATM Forum UNI3.1/4.0 PVC - Up to 8
- + PVCs
- + PPP over ATM
- + PPP over Ethernet

### NETWORK PROTOCOLS AND FEATURES

- + Ethernet to ADSL Self-Learning Transparent Bridging
- + Internet Control Message Protocol (ICMP)
- + IP Static Routing
- + Routing Information Protocol (RIP, RIPv2)
- + Network Address Translation (NAT)
- + Virtual Server, Port Forwarding
- + NAT ALGs: MSN Messenger, FTP, CUSEEME, H323\_Q931 (Netmeeting etc.), H323\_RAS, ICQ, etc.
- + Dynamic Host Configuration Protocol (DHCP)

- + DNS Relay, DDNS
- + IGMP Proxy
- + Simple Network Time Protocol (SNTP)

### FIREWALL

- + Built-in NAT
- + MAC Filtering
- + Packet Filtering
- + Stateful Packet Inspection (SPI)
- + Denial of Service Prevention (DoS)
- + DMZ

### VPN

- + Multiple IPSec/PPTP/L2TP Pass-through

### QoS

- + Port-based Priority
- + 802.1p (0~7) Priority

### CONFIGURATION AND MANAGEMENT

- + Web-based GUI Configuration
- + ADSL/ADSL2/ADSL2+ Manual Selection and Auto Fallback
- + Auto VPI/VCI Detection
- + Configuration Backup and Restore

### PORTS

- + ADSL Port (RJ-11)
- + 4 10/100 Ethernet Port (RJ-45)

### LEDs

- + Power
- + DSL
- + Internet
- + Status
- + LAN

### OPERATING TEMPERATURE

- + 32°F to 104°F (0°C to 40°C)

## Broadband Forum TR-68 ?

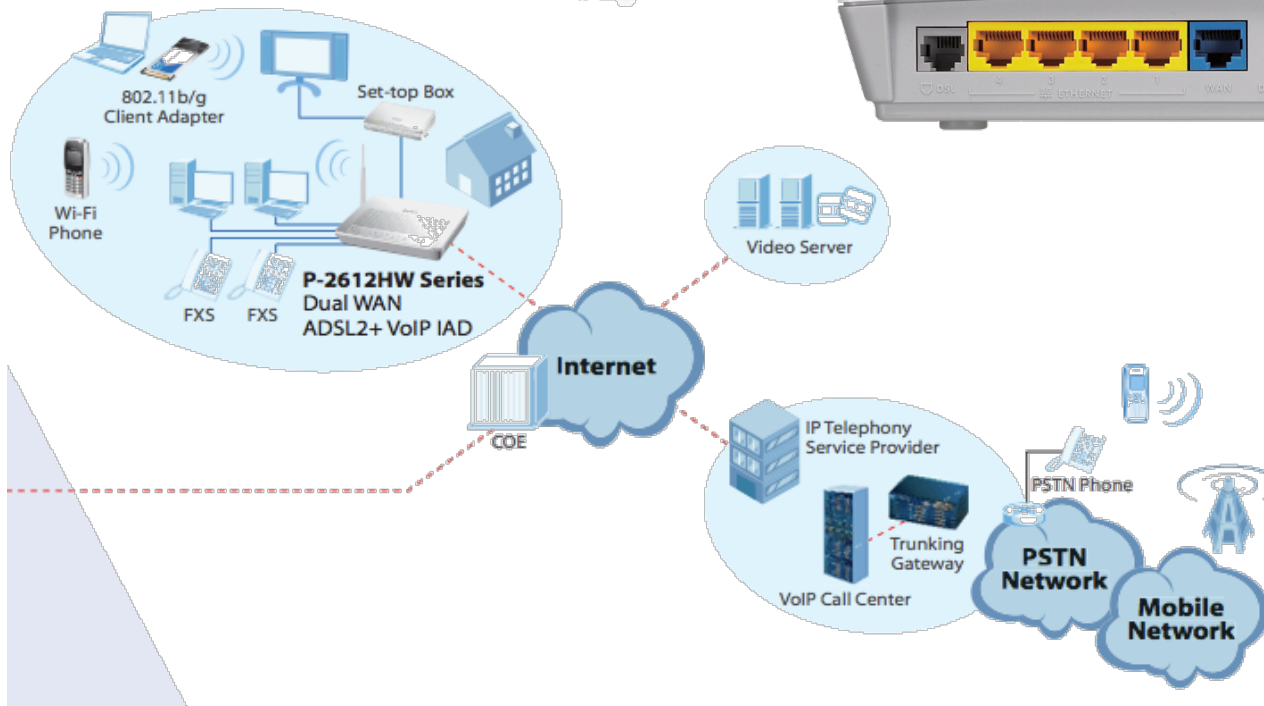
- I-87 The device **MUST** support 0/35 as the default VPI/VCI for the first PVC.
- I-88 The device **MUST** be able to perform an auto search for the VPI/VCI settings for the first PVC. This search **MUST** be the following VPI/VCI's in sequence looking for a first- success: 0/35, 8/35, 0/43, 0/51, 0/59, 8/43, 8/51, 8/59.

The default VPI/VCI identified in I - 87 is searched prior to this auto search list.



# Router ADSL

- Zyxel P-2612HW





# Router ADSL

## DSL Features

- ADSL compliance/ITU-T G.992.1/ITU-T G.992.2 Annex A, B (G.lite)/ITU-T G.994.1 (G.hs)
- ADSL2 compliance/ITU-T G.992.3 (G.dmt.bis)/ITU-T G.992.4 (G.lite.bis)
- ADSL2+ compliance/ITU-T G.992.5

## Router Features

- NAT (includes multi-to-multi NAT)/SUA, 4096 NAT sessions
- Full cone NAT
- NAT server (port forwarding)
- NAT ALGs
- PPTP/L2TP/IPSec VPN pass through
- PPPoE
- DHCP client/server/relay
- DHCP options (option 42, 43, 60, 61, and 125)\*
- DNS proxy
- Dynamic DNS support
- IGMP snooping and proxy
- IGMP fast leave
- IP multicasting, IGMP v1, v2, v3\*
- IP alias
- RIP I/RIP II supported
- Support 16 IP static route
- IP policy routing
- UPnP support
- Adjustable MTU size (Max 1518 byte)

## VLAN/QoS

- Support 802.1Q port/tag based VLAN
- Support 802.1P priority bit
- TOS/DiffServ
- Support flexible traffic classification
- Support 4 priority queue
- Freely assign the classified traffic to queues, VLAN, or PVC
- Per VLAN IPR (IP routing), (Max 4)
- Per VLAN PPPoE (Max 4)
- Media Bandwidth Management (MBM) for 3-play

## Wireless LAN

- IEEE 802.11g compliance
- Button/PIN mode WPS (Wi-Fi Protected Setup)
- Wi-Fi Protected Access support (WPA, WPA PSK, WPA2 (IEEE 802.11i), WPA2-PSK, WPA EAP)
- 802.11e (WMM)
- WLAN bridge to LAN
- MAC address filter
- Support IEEE 802.1x
- Multiple SSID (up to 4)
- Random WPA key
- Time scheduling for wireless on/off
- SSID VLAN-tagging (guest access)\*

# Router ADSL

## Voice Functionality

- SIP version 2 (RFP 3261)
- Codec: G.711, G.729a/b
- Wideband voice (G.722)\*
- Echo cancellation: G.168, VAD, silence suppression, CNG, dynamic jitter buffer
- DTMF detection and generation
- DTMF: in-band and out-of-band (RFC 2833), (SIP INFO)
- Modem and fax tone detection and pass-through
- T.38 FAX relay
- DNS SRV

## Phone Features

- Message waiting indicator (RFC 3842)
- Flexible dial plan (RFC3525 section 7.1.14)
- Caller ID
- FAX relay: transparent fax relay over G.711
- IVR (Interactive Voice Response)
- Call waiting
- Call hold
- Early media
- Flash hook timer
- Call transferring (blind and attended transfer)
- Call forwarding
- Three way conference
- Abbreviated dialing (speed dialing)

- Shuttle enquiry call (second call)
- DND (Do NOT Disturb)
- Call block
- CLIP (Calling Line Identification Presentation)
- CLIR (Calling Line Identification Restriction)
- COLP (Connected Line Identification Presentation)
- COLR (Connected Line Identification Restriction)
- Conference call w/media server
- Caller ID generation/detection w/DTMF & FSK format
- Internal call
- Speed dial (phone book)



- RJ-11 DSL port for ADSL Annex A and RJ-45 DSL port for ADSL Annex B and U-R2
- 4-port auto MDI/MDI-X 10/100M Ethernet LAN ports
- 1-port auto MDI/MDI-X 10/100M Ethernet WAN port
- Wi-Fi IEEE 802.11b/g
- One external dipole antenna, non-detachable
- Restore factory defaults button
- 2 FXS POTS interface
- A hardware switch for DSL/Ethernet WAN
- WLAN button on top side for WLAN On/Off and WPS
- Restore factory reset button
- Power consumption: 18 W

# Router SHDSL





# Zyxel P-791Rv2

- **G.SHDSL.bis Compliance**
- **Symmetric Data Rate of up to 5.69 Mbps**
- **Auto Fail-over and Fall-back WAN Backup Solution**
- **Web Based Configuration for Easy Deployment**

## Benefits

### High Speed Symmetric Data Transmission

The P-791R v2 is a high performance SHDSL.bis router for small/medium office to have Internet access and LAN-to-LAN application over the existing copper line. The P-791R v2 makes full use of the advanced G.SHDSL.bis technology, its symmetric transmission data rate can be up to 5.69 Mbps.

### UPnP Support

The P-791R v2 supports UPnP discovery and UPnP NAT traversal. By using the standard TCP/IP protocol, the P-791R v2 can dynamically join a network and obtain an IP address as well as convey its capabilities and learn about other devices on a network.

### Auto Fail-over and Fall-back WAN Backup Solution

The P-791R v2 features a fail-over and fall-back WAN backup solution for complete reliability. When the DSL connection fails, traffic is forwarded to either a backup ISDN or analog modem to maintain data exchange. When the DSL connection is re-established, traffic will be fully restored. The P-791R v2 also performs backup functions by redirecting traffic to a specific gateway to ensure availability of the Internet connection. The WAN backup solution saves device maintenance cost and reduces loss from daily operation.

## System Specifications

### G.SHDSL Compliance

- ITU-T 991.2 G.SHDSL and G.SHDSL.bis
- Symmetric data transmission speed up to 5.69 Mbps
- Auto-negotiation rate adaptation and manually rate configuration
- Server/Client mode selectable

### ATM Protocol

- ATM Forum UNI 3.1/4.0 PVC
- Support up to 8 PVCs
- RFC 1483/2684 Multiple Protocol over AAL5
- RFC 2364 PPP over AAL5
- RFC 2516 PPP over Ethernet
- LLC and VC Multiplexing
- ITU-T1.610 OAM F4/F5
- ATM QoS CBR, UBR, VBR-nrt

### Firewall Security

- Packet Filtering
- User Authentication (PAP, CHAP) with PPP (RFC 1334, RFC 1994)
- Microsoft CHAP



# Zyxel P-791Rv2

## Network Protocol

- IEEE 802.1d Transparent Bridging
- IP Routing: TCP, UDP, ICMP, ARP
- RIP v1 and RIP v2
- IP Multicast IGMP v1/v2

## IP Management

- SUA/Multi-NAT Internet Sharing
- NAT server (Port forwarding)
- VPN (IPSec, PPTP) Pass-through
- SIP ALG Pass-through
- Multimedia Applications Support
- DHCP Server/Relay/Client
- DNS Proxy
- Dynamic DNS
- UPnP Support

## Network Management

- Web-based Configuration
- FTP/TFTP for Firmware and Configuration Upgrade/Backup
- Telnet Management
- SNMP Support
- Built-in Diagnostic Tools

## Advanced Features

- Dial Backup
- Traffic redirect

## Hardware Specifications

- DSL interface: RJ-11 Connector for G.SHDSL Connection
- LAN interface: One Ethernet port, 10/100M Auto MDI/MDIX
- Reset Button
- Console/Aux: RJ-45 Connector for Local Management and Dial Backup
- Status LED Indicator: POWER, ETHERNET, CON/AUX, DSL, INTERNET
- Power: 12V 1A

## Physical Specifications

- Dimensions: 180 (W) x 127 (D) x 36 (H) mm
- Weight: 286.5 g

## Environmental Specifications

### Operation Environment

- Temperature: 0C ~ 40C
- Humidity: 20% ~ 85%

### Storage Environment

- Temperature: -20C ~ 60C
- Humidity: 20% ~ 90%



# Dual ADSL2+ Bonded router



# Comtrend NexusLink 5630u

## Bonded ADSL2+

Dual ADSL2/2+ bonded ports carry WAN traffic at speeds of up to 48 Mbps, while its Ethernet and USB ports support LAN traffic at 100 Mbps speeds. The TR-068 compliant rear panel and LED indicators also simplify installation and improve ease-of-use. Additionally, the USB host port connects to printers.



## Networking Protocols

- RFC2684 VC-MUX, LLC/SNAP encapsulations for bridged or routed packet
- RFC2364 PPP over AAL5
- IPoA, PPPoA, PPPoE, Multiple PPPoE sessions on single PVC, PPPoE pass-through, PPPoE filtering of on-PPPoE packets between WAN and LAN
- Transparent bridging between all LAN and WAN interfaces
- 802.1p/802.1q VLAN support
- Spanning Tree Algorithm
- IGMP Proxy V1/V2/V3, IGMP Snooping V1/V2/V3, Fast leave
- Static route, RIP v1/v2,
- DHCP Server/Client/Relay,
- DNS Relay, Dynamic DNS,
- ARP, RARP

## Hardware

- RJ-14 X1 for ADSL2+ bonded
- RJ-45 X 4 for LAN
- Reset Button X 1,
- Power switch X 1
- USB host

## WAN

- Comply with ITU-T G.992.5, ITU-T G.992.3, ITU-T G.992.1, ANSI T1.413 Issue 2 AnnexM
- G.998.1 (ADSL2+ Bonded):  
Downstream : 48 Mbps Upstream : 2.6 Mbps
- G.992.5 (ADSL2+ non-Bonded):  
Downstream : 24 Mbps Upstream : 1.3 Mbps
- G.992.3 (ADSL2 non-Bonded)  
Downstream : 12 Mbps Upstream : 1.3 Mbps
- G.DMT  
Downstream : 8Mbps Upstream : 832kbps
- AnnexM

## LAN

- IEEE 802.3, IEEE 802.3u
- 10/100 BaseT auto-sense
- Support MDI/MDX

## ATM Attributes

- RFC 2364 (PPPoA), RFC 2684 (RFC 1483) Bridge/Route; RFC 2516 (PPPoE); RFC 1577 (IPoA)
- Support up to 16 PVCs
- AAL5
- UBR/CBR/VBR-rt/VBR-nrt
- UNI 3.1/4.0
- OAM F4/F5

# VDSL2 Switch Router





# Zyxel P-870H-51a

## VDSL2 High-speed and High-performance Internet Access

ZyXEL P-870H-51a v2 provides 5-band VDSL2 up to profile 17a with data rates up to 100 Mbps in downstream direction and 45 Mbps in upstream direction. The VDSL2 technology can support the wide deployment of Triple Play services such as voice, video, data, high definition television (HDTV) and interactive gaming. It also enables operators and carriers to gradually, flexibly, and cost-effectively upgrade existing xDSL interface.

## QoS Support

The P-870H-51a v2 enables network administrators to allocate network resources while guaranteeing Quality of Service (QoS). QoS can be achieved by classifying packets by their ether type or source IP and then assign them with different 802.1p priority value or directly forward them to different queue or added by VLAN ID. It provides the capability to provide better service to select network traffic over VDSL technology. For example, it can help end users to enjoy the triple play service with high quality performance in the household.

## TR-069 Remote Management

The P-870H-51a v2 provides DSL Forum compliant TR-069 remote management function, it could speed up your deployment with the default Auto-Configuration Server (ACS) for auto-configuration and dynamic service provisioning. It can also help VDSL service provider reduce operation effort as well as enhance customer satisfaction.

# Zyxel P-870H-51a

## System Specifications

### VDSL Compliance

- ITU.T G.993.1 VDSL1
- ITU.T G.993.2 VDSL2 (Profile 8a, 8b, 8c, 8d, 12a, 12b and 17a support)
- Support VDSL band plan, Annex A, Annex B, 997, 998
- Support up to 100 Mbps downstream and 45 Mbps upstream
- Rate adaption
- SRA (Seamless Rate Adaption)
- UPBO (Upstream Power Back-Off)
- VDSL OAM communication channels
- Dual latency support in VDSL mode
- INP value up to 16
- Trellis coding
- PhyR PHY level retransmission technology
- PTM mode
- PPPoE (RFC2516)

### LAN Switch

- IEEE 802.3 10Base-T Ethernet
- IEEE 802.3u 100Base-Tx Ethernet
- Flow control in full duplex mode
- Back pressure in half duplex mode

### QoS

- Support flexible packet classification
- Support 4 priority queues with strict priority scheme
- Support tag processing

- Queuing and scheduling
- Traffic shaping
- Auto priority mapping
- Queue management

### Management

- Web
- CLI (Command Line Interpreter)
- SSH (Secure Shell function)
- Remote management for Web/Telnet/FTP
- Access control for remote management
- Firmware upgrade via Web/FTP/TFTP
- Text based configuration
- DSL forum TR-069
- DSL forum TR-064
- DSL forum TR-111\*
- 802.1ag (Connectivity fault management)

### Security

- PAP/CHAP
- Protocol and generic packet filtering
- Prevent DoS attack
- Stateful packet inspection firewall

## Physical Specifications

- Item dimensions:  
189 (W) x 132 (D) x 40 (H) mm
- Item weight: 328 g
- Package dimensions:  
238 (W) x 203 (D) x 60.5 (H) mm
- Item and package weight: 711 g



# DSLAM



# Mini DSLAM



# Versa VX1000LD

**VX1000LD** offers lowest port count DSLAM available in the market place. It provides the least initial investment solution for Service Provider who want to start providing Broadband service in a low subscriber density location. The unit features maximum downstream rate up to 24 Mbps and maximum reach distance over 6.5 Km. It is most suitable for use on existing copper twisted pair telephone lines to provide high speed Internet access.

This 8-port interface module is compliant with ITU G.992.5, G.992.3, G.992.1, and features the Link Status LED indicators in front panel. When LED turns steady green that means the line connection is valid and operational. Versa Technology's ADSL2+ technology is also backwards compatible with early version of ADSL. This ADSL2+ technology is an enhanced version of the ADSL technology which provides cross-talk free deployment. The ADSL2+ DSLAM is ideal solution for Triple-play requirements.

## Features:

- 8 ADSL2+ Ports
- Supports ANSI T1.413 Issue 2, ITU G.992.5, G.992.3, G.992.1 (G.dmt), ITU-T G.992.2 (G.lite)
- Multimode (automatic modulation detection)
- Supports packets transmit and receive statistics report.
- Provides optimal rate/reach performance
- Higher rates by limiting reach (up to 24.0 Mbps)
- Longer reach by reducing rate (distance up to 7.0 Km)
- Bandwidth Management control on each port at 32kbps interval.
- Build-in Data/Voice Splitter

## Network Configuration Modes

- Bridge

## ADSL2+ Line Card Overview:

The ADSL2+ Line Card interface module provides **Maximum Downstream Rate up to 24 Mbps and Maximum Reach Distance over 6.5 Km**. It is most suitable for local ISPs to



use existing copper twisted pair telephone lines to provide high speed Internet access.

This 8-port interface module is ITU G.ADSL2+ (G.992.5), G.992.3, G.span Standard ADSL II 992.2, 992.1, hot swappable and features the LED indicators in front of the Line Card panel. Link status LED indicates each connection status. When LED turns green means the line connection is valid and operational. Versa Technology's ADSL2 / 2+ Line Card is also backwards compatible with early version of ADSL and it is enhanced version of the ADSL2 improvement technology with the cross-talk free features.

## System & Management Features:

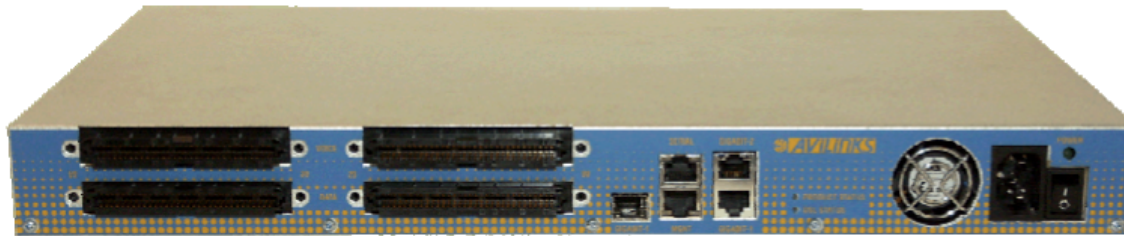
- 10/100 BASE-TX ports for uplink and downlink using cross cable
- Support Mixed voice-data networks
- Special power saving mode for inactive ports
- Each port can be individually enabled or disabled
- TFTP
- BOOTP Client, Boot Server
- IEEE 802.1 P/Q
- Support IGMP Snooping
- Support multiple PVC QoS configuration



## Interface

- 1 RJ45 for Uplink
- 1 RJ21 for Phone Line Connection
- 1 DB9 male (Null Modem) for Local Management

# Ejercicio





# DSLAM AVivid S-A60

## Architecture

- Scalable, non-blocking IP fabric
- Multi Gbps switching
- IGMP v1 & v2 & v3
- 1000 Multicast
- Internal power supply
- Four fans and status LED
- Stackable
- Internal POTS Splitter feature
- Max port density: 60 ADSL2++ ports

## IP Capabilities

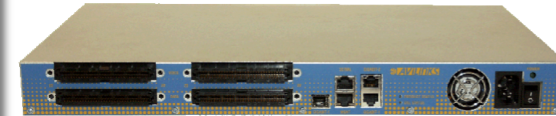
- Multi Gbps switching, non-blocking
- Bridging and routing
- Support for IPV4, IPV6@
- Bridging Ethernet to Ethernet and Ethernet to ATM
- Routing and forwarding over ATM, RFC 1483/2684
- 496 VLANs
- 496 Virtual Circuits
- 15,000 MAC addresses
- VLAN 802.1P/Q
- IGMP v1 & v2 & v3 snooping or proxy
- Broadcast and Multicast with internal agent AVIcast™ for IP Multicast management in Video broadcast application
- PPPoE: 120 clients
- DHCP server / relay@ (option 82)
- Per flow WFQ

## Subscriber Links

- 60 ADSL2++ ports DMT cell relay
- Annex A (optional Annexes B & M)
- Two 64-pin CHAMP connectors
- Long Reach ADSL2: rates of 128 kbps up to 21 kft
- ADSL data rates (ITU-T G.992.1)
  - Downstream: 32 kbps to 10 Mbps
  - Upstream: 32 kbps to 1 Mbps
- ADSL G.lite data rates (ITU-T G.992.2)
  - Downstream: 32 kbps to 4 Mbps
  - Upstream: 32 kbps to 1 Mbps
- ADSL2+ data rates (ITU-T G.992.5)
  - Downstream: 32 kbps to 26 Mbps
  - Upstream: 32 kbps to 3 Mbps
- ADSL2++ data rates (optional)
  - Downstream: 32 kbps to 50 Mbps
  - Upstream: 32 kbps to 6 Mbps

## ATM Capabilities

- ATM PVC support per ATM UNI 3.1 and 4.0 signalling
- ATM Shaping, support for CBR, VBR-rt, VBR-nrt, GFR & UBR traffic types
- AAL5 data & management transparency
- Configurable VPI/VCI range, up to 480 connections per system
- 8 VP/VC per ADSL port
- Early and partial packet discard
- Intelligent dynamic buffering architecture with per VP/VC queuing



## Management and Services

- 1 Ethernet 100BASE-T port
- 1 Serial port for local craft interface (RJ-45)
- Support for Private and Public MIBs (RFC 1213, 1493, 2933, 3635,3636)
- CLI through Serial port or Telnet
- Embedded HTTP server for configuration and management from standard Web browser
- SNMP V.1 and V.2 agent
- SSL/SSH encryption for secure management access
- Dual bank Flash memory for software upgrade
- Local and remote self-diagnostic testing

## POTS Splitters (option)

- Fully integrated ADSL POTS splitters
- Annex A (optional Annexes B & M)
- Two 64-pin CHAMP connectors for PBX connections
- Meets DC requirements in Annex 1.2 of T.413 Issue 2
- Meets Voice band requirements in Annex 1.3 of T.413 Issue 2
- Meets ADSL band requirements in Annex 1.4 of T.413 Issue 2

# IP DSLAM



# Zyxel IES-6000

## Future Proof Architecture

As the flagship of ZyXEL's IP DSLAM product portfolio, the IES-6000 is equipped with a non-blocking Gigabit backplane, failover-enabled Management Switch Cards (MSC), dual input power modules and various high-port density multi-purpose line cards. With comprehensive IP-centric firmware features, the IES-6000 is a high-capacity system that facilitates Telco/ISP to deliver high-quality residential or business user services experience at competitive CAPEX/OPEX as well as satisfying its current and future infrastructural requirements of reliability, flexibility and scalability.

## Easy & Reused Logistics

The IES-6000 is a 12.5 U-height, 17-slot chassis-based multi-service access node capable of adopting the same line cards as those for IES-5005/5000 systems. The MSC1024G control card with eight 1G uplinks is designed to plug into slot 8 and/or slot 9, while the remaining slots are available for equipping various line cards. The new MSC1224G control card is with two 10G and six 1G Ethernet uplinks to support even larger bandwidth requirement. The variety of line cards are including 48-port or 72-port ADSL2+ line cards that provide subscribers with asymmetric transmission bandwidth up to 25 Mbps/2.4 Mbps; 48-port SHDSL.bis line cards with symmetric transmission bandwidth of 5.69 Mbps per port; 24-port and 48-port VDSL2 line cards that offer up profile 17a (100 Mbps/45 Mbps) high-speed connectivity per port over copper wires; 48-port VoIP line card that supports either H.248 or SIP protocol and 20-port fiber-based Fast Ethernet line card that supports 100 Mbps transmission speed per port. The primary designed concept of IES 6000M is also taking account of the further technology evolution such as PON.

## Advanced Triple Play and Mass Deployment Functionality

The IES-6000 inherits all the Layer 2 and Layer 3 QoS, security and multicast functionalities from the IES-5000/5005, while the following new features are added to satisfy the requirements for massive field deployments: (1) IP bridge functionality that alleviates the Layer 2 access network deployment restrictions resulted from MAC address table limitation and security attack issues; (2) ARP Proxy which minimizes the ARP broadcast requests to all subscribers; (3) TACACS+ mechanism to support remote authentication with TACACS+ servers; (4) VLAN-aware DHCP snooping which adds VLAN information into DHCP snooping tables; (5) DHCP option82 sub-option2 for providing remote client ID information to DHCP servers for flexible IP address assignment. (6) Cluster management feature that is able to reduce the OPEX of multiple DSLAM maintenance.

- 768/1152 ports, 17 Vertical Slots with a Maximum Configuration of 1 MSC Card and 16 Line Cards
- Multi-service interfaces including ADSL2/2+, G.SHDSL.BIS, VDSL2 and VOIP (SIP & H.248)
- 10G Ethernet Uplinks to Provide Non-blocking Network Interfaces
- Comprehensive QoS to Enhance Triple Play Users' Experience (SR, WRR)
- Field Proven IGMP v1, v2 Snooping and Proxy for IPTV Deployment (512 Multicast Groups)
- Flexible ACL, VLAN-aware DHCP and Anti-IP/MAC Address Spoofing to Prevent Malicious Attack
- DHCP Option 82 and PPPoE IA Features Support Versatile IP Address Assignment



## IES-6000M

- 17-slot rack mountable enclosure, 19" or 23" chassis
- Maximum 16 slots for DSL line cards (slot 1 ~ 7, 8 or 9, 10 ~ 17)
- 2 slots for management and switch cards (slot 8 & 9)
- 2 DC power input module and filter
- One FAN and dust filter module
- One Alarm Module



# Zyxel IES-6000

## System Specifications

### DSL Compliant

- ADSL:
  - G.992.1 Annex A, G.992.3 Annex A, G.992.5 Annex A
  - G.992.1 Annex B, G.992.3 Annex B, G.992.5 Annex B
    - Support G.992.3 and G.992.5 Spectral Mask
    - Support Annex M and Annex L in G.992.3 and G.992.5
    - Support EOC and Overhead Channel Access
    - Support the latency path function
    - Support loop diagnostic function specified
    - Support the power management capability
    - Support the capability of the Seamless Rate Adaptation (SRA) on-line configuration
    - Single and Dual end loop test
    - G.998.1 port bonding
- SHDSL: G.991.2, G.991.2.bis, G.998.1
- VDSL2: G.993.2, G.994.1, G.997.1

### ATM Traffic Management

- Support 8 PVC per DSL port
- Support UBR, CBR, rt-VBR, nrt-VBR, QoS Mechanisms
- Support ATM Forum TM 4.0 peak cell rate traffic parameter
- Support downstream traffic shaping function per ATM PVC
- Support ATM F5 OAM cells for End-to-End Loop back test (ITU-T Rec. I.610)

### Performance

- Eight queues with packet priority scheduling (SPQ, WRR)
- Support 512 IGMP multicast groups
- The maximum channel zapping processing time is 250 ms
- DSCP to 802.1p mapping

- Rule-based packet filtering (L2 ~ L4 ACL)
- MAC count limiting
- ARP broadcast filtering
- DHCP broadcast filtering
- VLAN aware DHCP snooping
- NetBIOS filtering
- IGMP filtering
- Anti IP/MAC address spoofing
- Support TACACS+ remote authentication

### VLAN

- 4094 IEEE 802.1Q compliant VLAN tagging
- VLAN stacking (Q-in-Q)
- VLAN Bridge Function (multiple PVCs to one VLAN)(N:1)
- PVC and VLAN one to one mapping (1:1)
- VLAN Trunking (Single PVC join Multiple VLAN)(1:N)
- Support GVRP function

### Traffic Management

- Bandwidth control and Broadcast/Multicast/Unknown Unicast control on Gigabit Ethernet ports
- RSTP: IEEE 802.1d, IEEE 802.1w, IEEE 802.1s
- IP Bridge
- IEEE 802.3ad (Link Aggregation Control Protocol)
- IP multicast forwarding
- IGMP v1, v2 snooping/proxy
- IGMP multicasting channel limiting
- VLAN aware DHCP snooping
- DHCP Relay Option 82 with Sub-option 1 & 2
- TR-101 compliant PPPoE intermediate Agent
- Multicast bandwidth control
- L2 ~ L4 ACL
- IGMP group count/filtering profile

### VoIP Features

- Codes: G.711, G.726, G.729a/b, G.723.1

- RTCP (RFC 1890)
- FAX/Modem pass through (T.38) via RTP
- Tone detection and generation (bi-directional)-RFC2833 RTP Payload for DTMF
- Echo cancellation and auto gain control (G.165, G.168)
- VAD (voice activity detection)
- CNG (comfort noise generation)
- Caller ID generation and detection
- Supplementary services
- Local dial available
- Emergency call local route\*
- Do not Disturb
- Selective/Anonymous call rejection
- Call waiting
- Call transfer (blind and attended transfer)
- Call return and call back on busy
- Off hook warning tone

### Network Management

- Local management through a craft terminal
- Web-based Management Interface
- Cluster Management (Up to 8 cluster members)
- View-based Network Management
- Support XML-based North Bound Interface NetAtlas Access EMS
- In-band and out-of-band IP interface for management (SSH, SFTP)
- SNMP Management (through ZyXEL NetAtlas Access EMS)
  - SNMPv1/v2c/v3 agent/traps
  - Standard MIBs
    - RFC 1213 MIB II
    - ADSL Line MIB (RFC2662)/Extension Line MIB (RFC 3440)
    - SHDSL Line MIB (RFC 3276)
    - VDSL line MIB (RF3728)
    - Bridge MIB/Extension MIB
    - RMON MIB (RFC 1757)
  - Vendor specific MIBs e.g.

# Zyxel IES-6000 line cards

## ALC1248G-51/ALC1272G-51

- Hot swappable 48-port/72-port ADSL2/ADSL2+ Annex A line card
- Maximum transmission rate up to 25 Mbps/ 2.4 Mbps for ADSL2+
- One mini-RJ11 console port
- One gigabit backplane
- Support G.992.3 and G.992.5 Spectral Mask
- Support EOC and Overhead Channel Access defined in G.992.3 and Rec.G.997.1
- Support the latency path function specified in G.992.3 and G.992.5
- Support Annex L and Annex M specified in G.992.3 and G.992.5
- Support loop diagnostic function specified in G.992.3 and G.992.5
- Support the power management capability specified in G.992.3 and G.992.5
- Support the capability of the Seamless Rate Adaptation (SRA) on-line configuration specified in G.992.3 and G.992.5
- Support ADSL2+ 2-port bonding (G.998.1)



**ALC1248G-51**



**ALC1272G-51**

# Zyxel IES-6000 line cards



**ALC1248G-53**

## **ALC1248G-53**

- Hot swappable 48-port ADSL2/ADSL+ Annex B line card
- Support Annex M and Annex L specified in G.992.3 and G.992.5
- Maximum transmission rate up to 25 Mbps/ 2.4 Mbps for ADSL2+
- One mini-RJ11 console port
- One gigabit backplane

# Zyxel IES-6000 line cards

## VLC1324G-51/VLC1324G-53

- Hot swappable 24-port VDSL2 line card over POTS and over ISDN
- Support G.993.2, G.994.1, G.997.1
- Maximum transmission rate up to 100 Mbps/45 Mbps
- One mini-RJ11 console port
- Two gigabit backplane
- Support VDSL2 profiles 8a, 8b, 8c, 8d, 12a, 12b and 17a
- Support frequency allocation bandplan 998 and 997
- Support U0 band, customer PSD, RFI notch, single latency in PTM mode and INP
- Support UPBO and DPBO, Reed Solomon and Trellis coding
- Support ADSL fall back with ADSL/ADSL2/ADSL2+ CPE in Annex A, M, L modes
- Support IEEE 802.1ag Connectivity Fault Management (CFM)



VLC1324G-51



VLC1324G-53

# Zyxel IES-6000 line cards



**ELC1220G-55**

## **ELC1220G-55**

- Support 20 open slots for Fast Ethernet SFP (100BASE-FX/BX/LX/EX)
- One mini-RJ-11 console
- Aggregates layer-2 traffic from Fast Ethernet subscribers to the chassis system
- Support Multicast VLAN, IGMP Snooping, IGMP Filter and Static Multicast functions for MoD services
- Support DHCP Relay, Option82 and Snooping functions
- Support ACL, Anti-IP Address Spoofing and Anti-MAC Address Spoofing security functions

# Zyxel IES-6000 line cards



**MSC1024G**



**MSC1224G**

## **MSC1024G/MSC1224G**

- Failover-enabled Network Termination Card
- Embedded 48G, non-blocking full duplex switching fabric
- MSC1024G supports eight 1G Ethernet uplink & subtending ports:
  - 4 optical fiber port (SFP modules) for uplink traffic aggregation
  - 2 100/1000Base-Tx interface module for subtending
  - 2 1000 Mbps interface modules (combo design, SFP + copper) for dynamic adjustment about subtending and uplink aggregation, depending on the practical deployment requirement
- MSC1224G supports two 10G (XFP) and six 1G uplink/subtending interfaces:
  - 2 optical fiber port (SFP modules) for uplink traffic aggregation
  - 2 100/1000Base-Tx interface module for subtending
  - 2 1000 Mbps interface modules (combo design, SFP + copper) for dynamic adjustment about subtending and uplink aggregation, depending on the practical deployment requirement
- One RS232 (DB-9) serial console port
- One 10/100M out-of-band Mgmt interface
- 16 Gigabit Ethernet (SerDes) backplane interface
- 16K MAC addresses
- 512 L2 multicast groups (1K scalability)
- 4K VLANs



# Zyxel IES-6000 line cards



**VOP1248G-61**

## **VOP1248G-61**

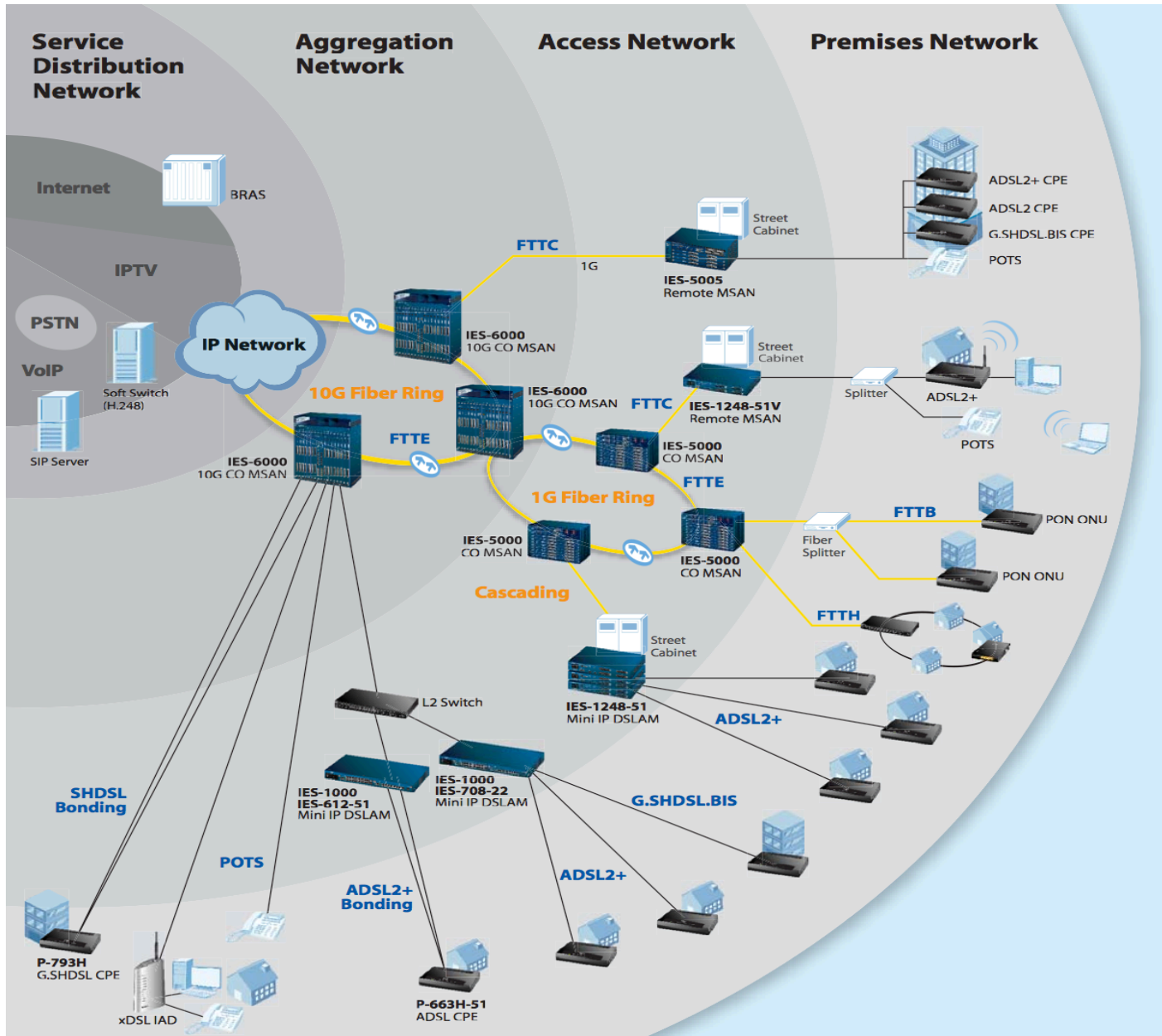
- 48-port VoIP line card
- Support H.248 version 2 or SIP signaling protocol
- Compatible CPE including POTS phone, Fax, Analog Modem and Pay phone
- Support G.711 a/μ, G.726, G.729 a/b G.723.1
- 20K Business Hour Call Attempts (BHCA)
- Configurable jitter buffer
- Support the generation of dial tone, second dial tone, ringing tone (ring-back tone), busy tone, off-hook warning tone
- Support call waiting, call hold, call transfer, return and call back on busy



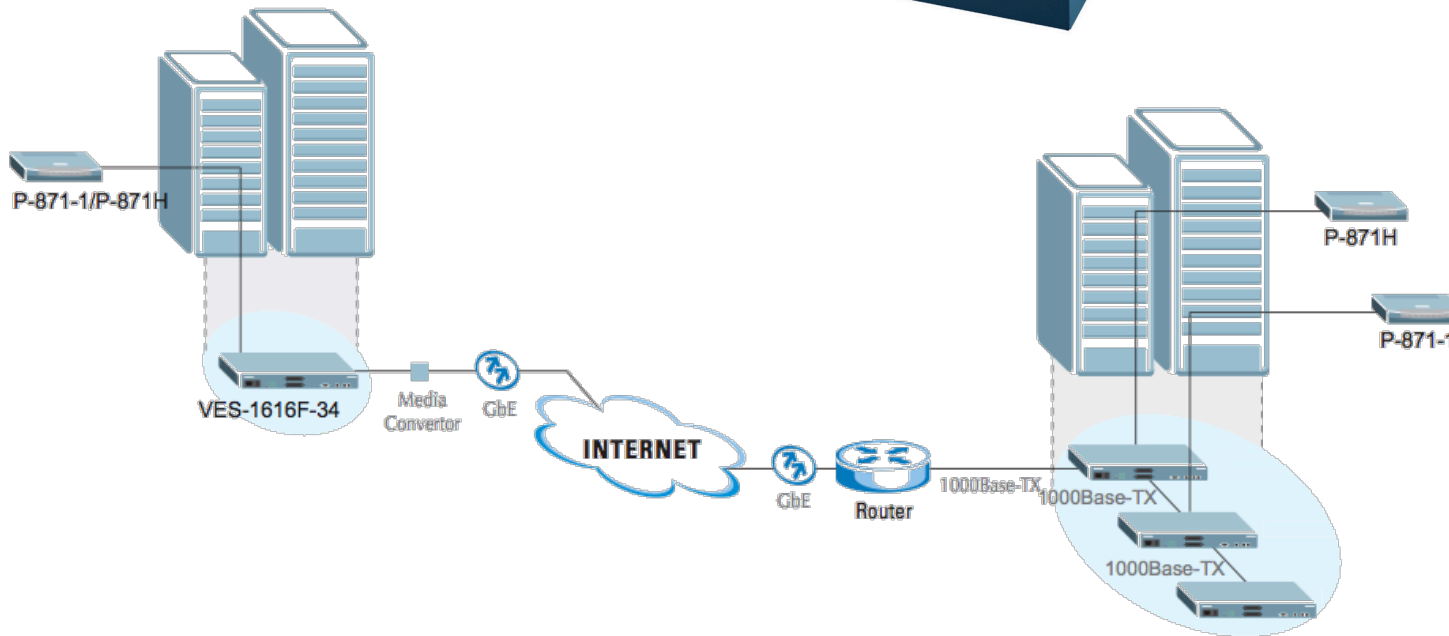
# Feature Matrix

Model	IES-612-51	IES-708-22	IES-1000	IES-1248-51	IES-1248-51V	IES-5005	IES-5000	IES-6000
<b>System Overview</b>								
Category	IP DSLAM for Outside Plant (ADSL2+ only)	IP DSLAM for Outside Plant (G.SHDSL.bis only)	IP DSLAM for Outside Plant (Both ADSL2+ & G.SHDSL.bis)	IP DSLAM for Outside Plant (ADSL2+ only)	MSAN for Outside Plant (Both ADSL2+ & VoIP)	MSAN for Outside Plant (ADSL2+, VoIP, G.SHDSL.bis, VDSL2, Active Fiber-based Ethernet)	MSAN for Central Office (ADSL2+, VoIP, G.SHDSL.bis, VDSL2, Active Fiber-based Ethernet)	MSAN for Central Office (ADSL2+, VoIP, G.SHDSL.bis, VDSL2, Active Fiber-based Ethernet)
Dimensions W x D x H (mm)	270 x 350 x 44.45	270 x 350 x 44.45	440 x 320 x 44.5	270 x 350 x 44.45	440 x 251 x 66	440 x 250 x 152	440 x 289 x 249	440 x 281 x 544
Splitter	Built in		Built in		Built in	Separated, IES-5005ST	Separated, IES-5000ST	Separated, IES-3016ST
Rack Mountable	19" 1U	19" 1U	19" 1U	19" 1U	19" 1.5U	19" 4U	19" 6.5U	19" 12.5U
Total Slots	Standalone	Standalone	2	Standalone	Standalone	5	10	17
Max. xDSL Slots	Standalone	Standalone	2	Standalone	Standalone	4	8	16
Max. xDSL Ports	12 (ADSL2+)	8 (ADSL2+)	24	48	48	192/288	384/576	786/1152
Management & Switching Card Redundancy							•	•
Power Input	AC or DC	AC or DC	AC or DC	AC or DC	AC or DC	DC	DC	DC
Power Redundancy						•	•	•
Hot Swappable			•			•	•	•
<b>Interfaces</b>								
Uplink	2FE	2FE	2FE	2 100/1000Base-T or 2 Mini GBIC	2 100/1000Base-T or 2 Mini GBIC	4GE	4GE	8GE or 2 x 10G + 6 x GE
Subtending	•	•	•	•	•	•	•	•
ADSL2/2+ Line Card	•		•	•	•	•	•	•
G.SHDSL.bis Line Card		•	•			•	•	•
VDSL2 Line Card			• (Future)			•	•	•
VoIP Line Card			• (Future)		Build in	•	•	•
Ethernet Line Card						•	•	•
<b>ADSL2/2+</b>								
Annex M	•		•	•	•	•	•	•
SRA	•		•	•	•	•	•	•
INP (Min=2)	•		•	•	•	•	•	•
SELT	•		•	•	•	•	•	•
DELT	•		•	•	•	•	•	•
ADSL2+ Bonding	•		•	•	• (Future)	•	•	•
<b>G.SHDSL</b>								
N-wire Bonding (G.991.2)		•	•			•	•	•
ATM-based Multi-Pair Bonding (G.998.1)		•				•	•	•
<b>VDSL2</b>								
DS/US Speed (Mbps)						100/45	100/45	100/45
Max. ports						24/48	24/48	24/48

# Network Topology



# IP DSLAM VDSL2



# VES-1616F-34

Recently, Ethernet has been used for access applications, transport, and backbone infrastructure. Today, more service providers are adopting Ethernet as the First Mile (EFM) in their FTTB/C deployment as they discover the convenience of the technology. One such convenience is EFM over copper wire, which fills the bandwidth gap between high-speed, Metro fiber networks and low-bandwidth, copper-based services. It utilizes the existing copper wires, offering a cost-effective solution to service providers for today, tomorrow and beyond. Furthermore, mature Ethernet technology allows EFM to provide seamless connectivity between the enterprise Ethernet LAN and the WAN.

Ethernet over VDSL has changed the fundamental economics of broadband services for the last mile and the MTU market. It allows small to medium size corporations to use high bandwidth services similar to those of larger companies.

Residential users can now enjoy video, data and voice services simultaneously through VDSL, without having to suffer from limited bandwidth. VDSL delivers cost-effective, high-bandwidth broadband access to enterprise campuses, hotels, commercial and residential buildings without the cost and effort of installing additional wires.

ZyXEL's VES-1616F-34 is a 16-port 5-band VDSL switch based on Discrete Multi Tone (DMT) modulation and the latest Ethernet technologies. It aggregates traffic from ZyXEL P-871-1/P-871H, DMT-based VDSL CPE.

The VES-1616F-34 has two Giga-bit fiber and two 100/1000Base-TX for either uplink connection to any third-party Ethernet switch or WAN router, or cascading multiple VES switches to service increasing subscribers. The built-in POTS/ISDN splitter splits and sends voice traffic to the PSTN. The VES-1616F-34 supports downstream speeds of up to 100Mbps and upstream speeds of up to 50Mbps while extending Ethernet service up to 1.5km.

The IEEE 802 standard-based firmware provides a rich set of features and ensures interoperability with equipment from other vendors. Additionally, the firmware includes advanced features such as IGMP snooping, broadcast storm control, and MAC address filtering that enhance security and bandwidth utilization.

With a broad array of advanced, fully integrated technologies, the VES-1616F-34 together with the P-871-1/P-871H enable service providers and system administrators to build a cost-effective, full service network that makes all kinds of media-rich applications possible.



# VES-1616F-34

## General

### Uplink/Cascade Interface

- Two Giga-bit fiber module
- Two 100/1000Base-TX module

### VDSL Interface

- 16-port VDSL
- One Telco-50 connector to CPE
- Ethernet over VDSL
- Maximum downstream: 100Mbps
- Maximum upstream: 50Mbps
- Power back-off algorithm
- Rate adaptation at 64 Kbps
- Support resynchronization
- Support RFI configuration
- Support VDSL profile setup

### POTS/ISDN Interface

- Built-in POTS/ISDN splitter
- 16-port POTS/ISDN
- One Telco-50 connector to PBX or CO

## Performance & Management

### Bridging

- 16K MAC addresses
- Static MAC address filtering/forwarding
- Limited max. number of MAC addresses per port

### Switching

- Switching fabric: 12.8Gbps, non-blocking
- Frame size: 1522 bytes
- Forwarding frame: 802.3, 802.1q, Ethernet II, PPPoE

## STP

- 802.1d spanning tree protocol
- 802.1w rapid spanning tree protocol

## VLAN

- Port-based VLAN
- IEEE 802.1Q tag-based VLAN
- No. of VLAN ID: 4K  
No. of static VLAN entries: 256
- Support automatic member registration; GVRP

## QoS

- 802.1P
- 8 queues

## Port Trunking

- IEEE802.3ad port trunking and static port trunking

## Access Control

- 802.1x

## Multicasting

- IGMP snooping
- IGMP filtering

## Rate Limiting

- At 1 Mbps increment

## Broadcast Storm Control

- Support

## Multicast Storm Control

- Support

## Port Mirroring

- All ports support port mirroring

## IP Forwarding

## System Control

- Alarm/status surveillance
- OAM&P
  - Trouble management
  - Configuration management
  - Performance management
  - Status management
  - Security management
- Software upgrade via console, web, FTP
- Configuration backup
- Self diagnostic
- Temperature monitoring

## Network Management

- Local console
    - RS-232
    - 10/100 Base-TX
  - SNMPv2
  - Telnet
  - Web-based management
  - RMON group 1, 2, 3, 9
  - Single IP management
- ## MIBs
- SNMP MIB II (RFC1213)
  - Bridge MIB (RFC1493, 2674)
  - RMON MIB (RFC1757, group 1, 2, 3, 9)
  - Private MIB (Set/Get/trap, etc)



# Alcatel-Lucent 7330 ISAM FTTN



## FEATURES

- Non-blocking architecture with distributed processing
- Compact 19inch access node with 10 slots for a mix of LTs, voice cards, and splitters
- New line cards, including 48p VDSL2 (8/12/17 profiles and ADSL/ADSL2+ backwards compatibility) and 16p Active Ethernet
- Integrated VoIP Access Gateway on ISAM with the ISAM Voice Package
- High-stability clock and clock synchronization support with BITS and NTR
- NT, link, and voice gateway redundancy
- Extensive Dynamic Line Management and Line Diagnostics capabilities
- 2.5 Gbit backplane with front cabling for LTs

# Alcatel-Lucent 7330 ISAM FTTN

## Full-Service Platform

- Multiservice access support
  - 48-port VDSL2 (very high speed DSL2) LT card for POTS and ISDN
  - 48-port multi-ADSL line cards: ADSL, ADSL2, ADSL2plus, reach extended ADSL2 (READSL2)
  - 24-port SHDSL LT cards
  - 48-port POTS LT cards
  - 24-port ISDN LT cards
- Network connectivity
  - Up to eight electrical or optical Gigabit/Fast Ethernet uplinks; ECNT-A: 7GE/FE, ECNT-C: 3GE + 5GE/FE
  - 4,095 VLAN IDs, VLAN stacking (Q in Q), 16,000 MAC addresses
  - Rapid spanning tree protocol support
  - 802.3ad trunking (link aggregation control protocol [LACP])
  - Ethernet ring connectivity
  - PPP connectivity to single or multiple systems
  - Optical connection through small form-factor pluggable (SFP) standards
  - Uplink redundancy
  - Network termination (NT) redundancy
  - ISAM Voice Packet Server (IVPS) 1+1 redundancy
  - Routing information protocol (RIP) version 2 and open shortest path first (OSPF) support for IP routing

## Service intelligence

- Multicast, high-performance, distributed multistage IGMP processing, IGMP proxy, immediate leave
- IP-aware bridging
- Protocol-aware cross-connect
- IP and MAC anti-spoofing
- Malicious MAC-move protection
- Protocol-based VLAN selection
- IP QoS
- IP operations, administration and maintenance (OAM)
- Intelligent bridging with protocol handling
- VLAN cross-connect forwarding
- VLAN stacking for residential and business access
- Protocol-based VLAN selection
- DHCP relay with option 82
- Ethernet 802.1x authentication

- PPP line identification: PPP relay

- Virtual broadband access server (VBAS) authentication

- PPP over ATM (PPPoA) to PPP over Ethernet (PPPoE) translation with auto-detect

- Support for central broadband remote access server (BRAS) and distributed service-edge models

- Billing and accounting support

- Up to eight permanent virtual circuits (PVCs) per line

- Network processor-based line cards

- H.248 (Megaco) for voice traffic signaling

## • Hubbing support

- Up to 16,000 subscribers per system

- Up to 5,000 subscribers per IVPS

- Subtending Alcatel-Lucent 7330 ISAM FTTN

- Subtending Alcatel-Lucent 7330 ISAM FTTN REMs

- Subtending RUs:

- Alcatel-Lucent 7324 RU

- Alcatel-Lucent 7300 ASAM compact unit (ASAM-c)

- Alcatel-Lucent 7300 -ASAM outdoor cabinet (ASAM-o-c)

- Subtending other ISAMs and ASAMs via standard FE/GigE connections

## Network Services

- High-speed Internet access (HSIA)
  - Cross-connect access model
  - PPPoE access based on intelligent bridging
  - PPPoA to PPPoE translation
  - PPPoE termination
  - IP over Ethernet (IPoE) and IP over ATM (IPoA) access model
- Business access
  - PPP-VPN service to one remote LAN (cross-connect); support for any Layer 3 protocol (e.g., IP, Internet protocol exchange [IPX], Appletalk)
  - Point-to-multipoint VPN service to one remote LAN (port-based VLAN)
  - Transparent VLAN service to virtual private LAN service (VPLS)/virtual leased line (VLL) aggregation

# Alcatel-Lucent 7330 ISAM FTTN

- Multimedia service
  - Video multicast (near VoD, broadcast TV)
  - Internet multicast (PC-oriented multicast)
  - Interactive real-time video conference, voice over IP (VoIP), gaming
  - Video on demand (VoD)
  - Applications
    - Instant zapping (<200ms)
    - Picture-in-Picture (PiP)
    - Multi-Angle
    - Mosaic
    - Pay-per-View with preview mode
  - Management & Operations:
    - Service profiles (access to channel packages, bandwidth)
    - Call data records (CDR) track viewing behaviour
    - Call admission control for guaranteed QoE
    - Channel package management
- Voice
  - VoIP support (PSTN and ISDN line termination on ISAM) with ISAM voice package
  - Support of Telephony Supplementary Services:
    - Hold for inquiry and Call Hold
    - Call Waiting
    - Call Forwarding
    - Explicit Call Transfer
  - POTS splitters (DSL)
  - ISDN splitters (DSL)

## Network Interfaces

- First-mile interfaces
  - 24 ports with VDSL Ethernet-in-the-first-mile (EFM) line card, POTS and ISDN (ETSI)
  - 48 ports with multi-ADSL line cards, POTS and ISDN
  - ADSL2plus (G.selt)
  - ADSL2plus Annex M
  - ADSL2plus chip-level bonding, configurable INP
  - 24-port SHDSL LT cards
  - 48-port POTS cards
  - 24-port ISDN cards
- Optical interfaces
  - FE 100Base-FX multimode and single mode, full duplex
  - FE 100Base-FX optical SFP module with 29 dB optical link budget (40 km)
  - GigE 1000Base-SX SFP LC full duplex 850 nm (500 m)
  - GigE 1000Base-LX SFP LC full duplex 1,310 nm (10 km)
  - GigE 1000Base-EX SFP LC full duplex 1,310 nm (40 km)
  - GigE 1000Base-ZX SFP LC full duplex 1,550 nm (80 km)
  - GigE, coarse wavelength division multiplexing (CWDM) SFP
- Electrical interfaces
  - FE 100Base-TX RJ-45 10/100 full duplex and adaptive duplex
  - GigE 1000Base-T RJ-45 full duplex
- Ethernet-uplink capabilities
  - Fully compliant with standards-based Ethernet equipment according to IEEE 802.3 (optical and electrical)
  - VLAN according to IEEE 802.1q
  - VLAN bridging/cross-connect
  - ISP and other service identification based on VLAN

## Packet Processing

- ATM over DSL connection
  - ATM adaptation Layer 5 (AAL-5) support
  - Logical link control (LLC)/subnetwork access protocol (SNAP) bridged (RFC 2684)
  - RFC 2684-rt
  - PPPoA encapsulation
- Auto configuration on DSL connection
  - Access Layer 1 signaling (DSL overhead) with embedded operations channel (CPE type and serial number)
- Layer 2 intelligent bridge mode
  - Up to 128 instances
  - PVC bridging with port-based VLAN
  - Broadcast storm control
  - MAC anti-spoofing
  - Port-based VLAN tagging mode (frames from DSL port without any VLAN tag)
  - MAC address learning and configuration
- IP-aware bridge mode
  - Up to 128 instances
  - MAC concentration



# Alcatel-Lucent 7330 ISAM FTTN

- IP-based service and VLAN selection
- Layer 3 QoS
- IP and MAC anti-spoofing
- Malicious MAC move protection
- Address resolution protocol (ARP) proxy
- IPoE and IPoA encapsulation support
- Layer 2 cross-connect mode
  - PVC-to-VLAN mapping
  - Port-based VLAN tagging mode (frames from DSL port without any VLAN tag)
  - VLAN stacking
- DHCP handling
  - DHCP relay (compliant with RFC 2131)
  - Option 82 support (RFC 3046)
  - Configurable option 82
  - Support of MAC unicast DHCP offer
  - Support of broadcast DHCP offer
  - VLAN-based DHCP server selection
  - DSL subscriber linerate info in DHCP
- IP routing
  - RIP and OSPF
  - RIPv2 toward the subscriber

- PPPoE termination
  - Authentication: both local and via remote authentication dial-in user service (RADIUS)
  - Redundant RADIUS server support
  - Dynamic IP-address assignment (local pool or RADIUS based)
  - Password authentication protocol (PAP) and challenge handshake authentication protocol (CHAP) support for user authentication
  - Billing and accounting support
  - User-traffic shaping per PPP session
  - DSL subscriber linerate info in PPPoE
- Multicast handling
  - Static and dynamic multicast root
  - Cross-VLAN multicast
  - IGMPv2
  - Multicast connection admission control (CAC):
    - controls number of streams and available bandwidth on user line
    - Immediate leave
    - controls selected multicast IP addresses against subscriber profile

- IGMP proxy:
  - 200-ms maximum zapping delay
  - 5 zaps/s per subscriber
  - 1,024 simultaneous channels
- Security
  - Upstream filtering: block control protocols from the user side
    - pause frame
    - spanning tree protocol (STP) (802.1q, 802.1w)
    - GARP multicast registration protocol (GMRP) (802.1d)
    - generic attribute registration protocol (GARP) (802.1d)
    - link aggregation control protocol (LACP) (802.3ad)
  - MAC address filtering
  - IP anti-spoofing
  - MAC anti-spoofing
    - Configurable maximum number of MAC addresses per PVC (up to 64)
    - Configurable MAC address filters
  - VBAS protocol for line identification
  - System security logs for all management interfaces
  - Alarm for uplink removal or breakdown

## Layer 2 Ethernet Protocol Handling

- 802.1q support
- Auto-detection of half/full duplex for electrical interfaces
- Auto-detection of line speed for electrical FE/GigE
- 802.1p support for QoS
- 802.3ad link aggregation (trunking)
- 802.3x duplex flow control:
- back pressure half-duplex flow-control support on reception
- 802.1d spanning tree support
- 802.1w rapid spanning tree per trunk port

## Voice Signaling and Call Control

- Megaco (RFC 3525)/H.248.1 (Version 2)
- Real-time transport protocol (RTP) and real time conferencing protocol (RTCP) (RFC 1889)
- RTP profile for audio (RFC 1890)
- RTP payload for dual-tone multifrequency (DTMF) digits, tones and signals (RFC 2833)
- ISDN user adaptation (IUA) (RFC 3057)
- Stream control transmission protocol (SCTP) (RFC 2960)

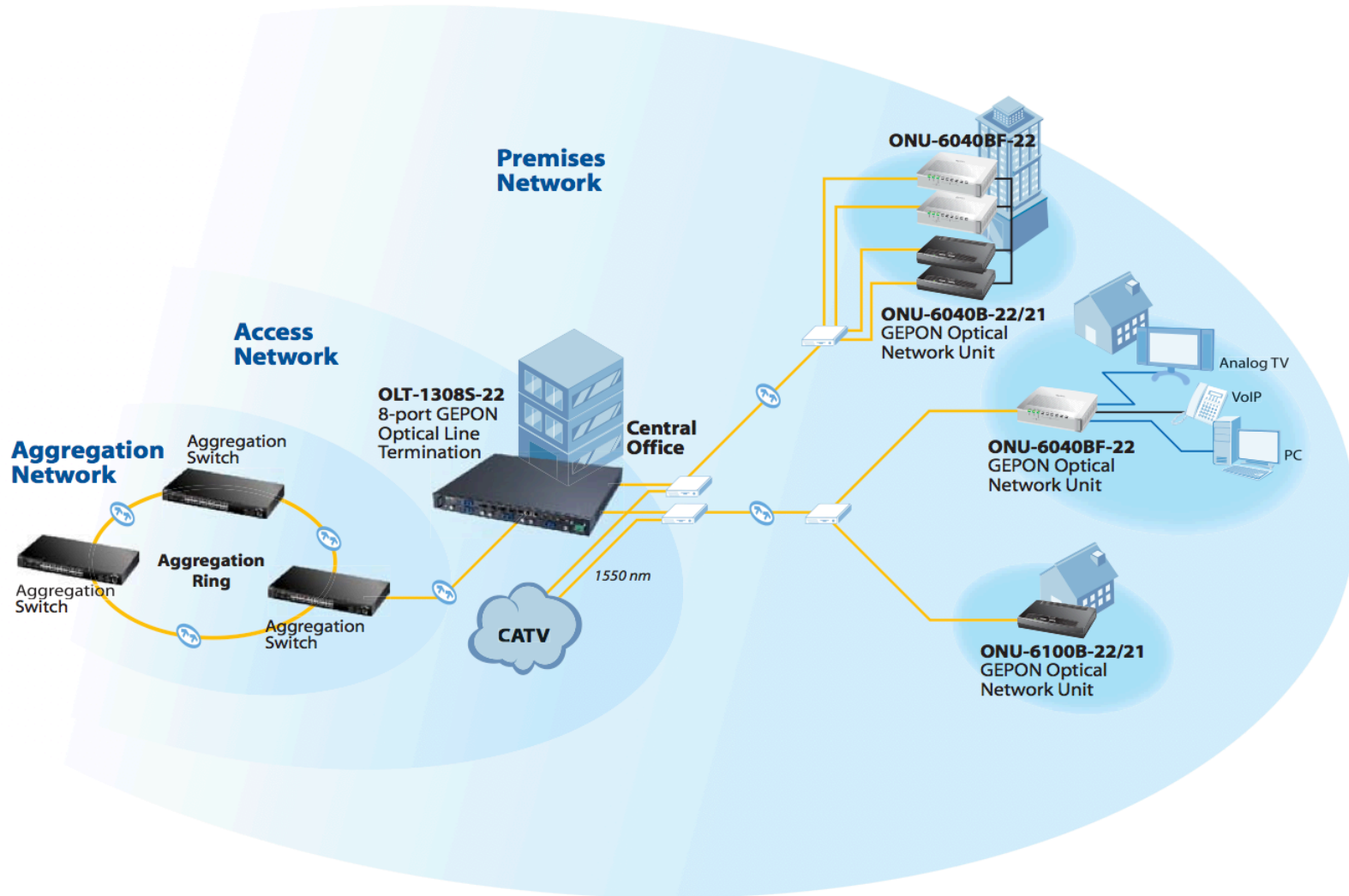
# Alcatel-Lucent 7330 ISAM FTTN

## Quality of Service

- Per-subscriber, per-service queuing, scheduling, marking and policing
  - IP-based traffic filtering via access control lists (Layer 2, 3 and/or 4)
  - IP DiffServ Code Point (DFCP) marking
  - IP flow-based ingress and egress policing
  - IP type of service (ToS)
  - Session profile support with RADIUS interface
  - Upstream and downstream DSL traffic rate limiting
  - Upstream and downstream policing per PVC
- Intelligent traffic handling per DSL port and traffic aggregate for:
    - VoIP
    - VoD and broadcast video
    - HSIA or best-effort mode
    - control management traffic on network level
  - DSL connection upstream traffic handling per DSL:
    - Priority bit (p-bit) marking configurable per PVC or VLAN in upstream
    - DSCP marking
    - DSCP onto p-bit mapping
    - prioritization of voice and video traffic over HSIA traffic
    - configure eight priorities mapped to four queues
  - DSL connection downstream QoS per DSL
    - prioritization of traffic (real-time and critical traffic over best-effort traffic)
    - scheduling techniques on packet level
  - Ethernet uplink and hubbing traffic handling per interface:
    - classification and queue mapping based on p-bits
    - strict priority (SP) scheduling for delay-sensitive remote terminal (RT) traffic
    - weighted fair queuing (WFQ) scheduling
    - head-of-line (HOL) blocking prevention
  - Fair share of resources between different DSL service subscribers
  - Ethernet uplink downstream and upstream traffic shaping per interface:
    - 1 Mb/s bandwidth granularity
    - dynamic modification of parameters



# OLT/ONU EPON



# Zyxel OLT-1308S-22

## Broadband Passive Optical Network

ZyXEL's OLT-1308S-22 GEAPON system (Optical Line Termination, OLT) is located in the operator's central office and different types of ONU (Optical Network Unit, ONU) are located at customer premises for FTTH/H connections. The OLT-1308S-22 is connected by a single fiber to an optical power splitter that supplies the optical signal to as many as 256 sets of ONUs (each OLT PON port supports up to 32 ONU sets). The OLT-1308S-22 is a mini chassis with a Layer-2 GEAPON switch featuring 8 GEAPON ports (including 3 PON modules), 4 Gigabit uplink ports (2 copper and 2 combo ports) and one 10/100 Mbps Ethernet port for out-of-band management. For CPE compatibility, ZyXEL provides several models for different network architecture needs.

## High Bandwidth

As demand for broadband services such as high-definition TV (HDTV), media-on-demand (MoD), voice over IP (VoIP) and online gaming increases continuously, GEAPON technology emerges to provide astounding 1.25 Gbps bandwidth for both upstream and downstream, giving a 30 Mbps bi-directional bandwidth to up to 32 subscribers each. It is a cost-effective access technology with a reliable and scalable carrier-grade Ethernet infrastructure that really addresses Triply-play service needs.

## Cost-Effective Operations beyond Initial Fiber Deployment

Construction of the fiber access network is the most labor-intensive task in FTTH projects and thus the most expensive. However, PON architecture requires less cost since it requires less fiber. PON networks use splitters to allow minimal fiber deployment in local loops. In addition, it requires no power between CO and network's termination that lead to lower maintenance costs.



# Zyxel OLT-1308S-22

## 20 km Long Distance Coverage

On a PON network, subscribers must be within 10 to 20 km from the CO, depending on the total number of splits (distance decreases as splits increase). The OLT-1308S-22 supports a maximum distance of up to 20 km, and users can choose the different distances ONU type for 10 km or 20 km deployment to adapt to the existing network structure.

### Standard Compliance

- IEEE 802.3ah
- IEEE 802.3ab
- IEEE 802.3 Ethernet
- IEEE 802.3u Fast Ethernet
- IEEE 802.3z Gigabit Ethernet
- IEEE 802.3x flow control
- IEEE 802.3ad LACP aggregation
- IEEE 802.1d spanning tree protocol
- IEEE 802.1w rapid spanning tree protocol
- IEEE 802.1Q VLAN tagging
- IEEE 802.1p QoS
- IEEE 802.1x port authentication
- IEEE 802.11 MIB

### MAC and Packet Buffer

- 16K MAC entries

### Traffic Management and QoS

- IEEE 802.1p QoS with 8 priority queues per port
- IEEE 802.1Q tag-based VLAN
- 2K static VLAN, up to 4K dynamic VLAN
- VLAN trunking
- Supports to GVRP, automatic VLAN member registration
- IGMP v1, v2 & v3

### Hardware Specifications

- 2 embedded GEAPON ports
- 3 open slots for GEAPON modules, each module supports 2 PON ports
- Wavelength: 1.31 um for upstream and 1.49 um for downstream
- Distance: 1000Base-PX20 for distances up to 20 km
- 4 GE uplinks with 2-port RJ-45 1000Base-T and 2 combo ports
- One 10/100Base-T for out-band management
- 1 DB9 RS-232 for craft interface
- 1 alarm input port



# Zyxel EPON ONU



**ONU-6100B-22/21**  
**ONU-6040B-22/21**



**ONU-6040BF-22**

# Zyxel EPON ONU

## Wall-Mountable

- 1 GEPON interface with SC type connector (IEEE 802.3ah)
- LAN interface:
  - ONU-6100B-22/21: 1 auto MDI/MDI-X 10/100/1000 Mbps port
  - ONU-6040B-22/21: 4 auto MDI/MDI-X 10/100 Mbps ports
  - ONU-6040BF-22: 4 auto MDI/MDI-X 10/100 Mbps ports
- Wavelength: 1310 nm for upstream & 1490 nm for downstream
- Wavelength: 1550 nm for RF overlay (ONU-6040BF-22)
- Transmission distance:
  - 20 km (PX-20): ONU-6100B-22, ONU-6040B-22, ONU-6040BF-22
  - 10 km (PX-10): ONU-6100B-21, ONU-6040B-21
- Power: 12 VDC @1.5 A
- RF overlay (ONU-6040BF-22)
- Fiber tray supported (ONU-6040BF-22)

## Support

- IEEE 802.3ah
- IEEE 802.3/u/ab
- IEEE 802.1x port authentication
- IEEE 802.1Q VLAN
- IEEE 802.1q VLAN, tag-based and port-based
- IEEE 802.1p QoS
- IGMP snooping
- Broadcast control
- Multicast drop/flooding

## Security Function

- IEEE 802.1x: AES algorithm with 128-bit encryption key
- Triple churing encryption



ONU-6100B-22/21  
ONU-6040B-22/21



ONU-6040BF-22