# ZyXEL



- 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



**12.5U High Capacity Multi-Service Access Node**

**IES-6000**

# Future Proof Next Generation Multi-Service IP Access Solution

## Benefits

### Future Proof Architecture

As the flagship of ZyXEL's IP DSLAM product portfolio, the IES-6000 is equipped with 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.

## Robust Physical Safety Design

The IES-6000 supports 1+1 MSC redundancy with a failover switch time less than 1 second. In addition, voltage, temperature and FAN speed sensors are fitted into the system. When an abnormal condition is detected, the LED displays and/or the corresponding alarms will alert administrators of the situation. In case the system temperature rises over the preset threshold, thermal cutoff protection will kick in to shut down the system automatically.

## Sophisticated OAM&P Features

The IES-6000 provides various management methods: local console port, Web-based configuration, Telnet and SNMP v1/v2/v3-based EMS (NetAtlas Access EMS). The management functions include Alarm and Status Surveillance, Configuration management, Performance management and Fault management. The IES-6000 allows multiple administrative accounts with 3-level access privileges. Accounts with the first-level privilege have full access to all management objects on the Management Information Base (MIB). Second-level accounts have similar access rights except creating new administrative accounts, while the third-level accounts are granted read-only access rights to the MIB objects. NetAtlas Access EMS also provides view-based MIB management that partial MIB objects can be defined and accessed for customization and security reasons. In addition, Cluster Management enables multiple DSLAM administration with single/master IP address, XML-based northbound interface is equipped to interoperate with external OSS systems.

# Specifications

## 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

### Security
- Per Port and Per VLAN isolation
- IEEE 802.1x (Authentication)

- 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
- Network signaling protocols: ITU-T H.248 v2, SIP v2 (RFC3261)
- RTP (RFC 1889)

- 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.,
    - Chassis Management MIB (Fan Speed, Voltage, Temperature)

## Hardware Specifications

### 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

### 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-53
- Hot swappable 48-port ADSL2/ADSL2+ 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

### SLC1248G-22
- Hot swappable 48-port SHDSL/SHDSL.bis line card
- Support ETSI TS 101 524 V 1.2.1, ITU-T G.991.2, ITU-T G.991.2.bis
- ATM-based multi-pair bonding (G.998.1) up to 8 ports
- Symmetric transmission rate of 5.69 Mbps/port
- One mini-RJ11 console port
- One gigabit backplane

### 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)

### 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

### 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

### VOP1248G-61
- 48-port VoIP line card
- Support H.248 version 2 or SIP singling 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

- Emergency call local route*
- Local dial available*
- MLT (Metallic loop testing for subscriber lines) and GR-909 loop diagnostic

## Physical Specifications

### IES-6000M
- Dimensions: 439.2 (W) x 280.5 (D) x 543.3 (H) mm
- Weight: 15 Kg

### ALC1272G-51
- Dimensions: 390.6 (W) x 240 (D) x 13.8 (H) mm
- Weight: 0.7 Kg

### ALC1248G-51
- Dimensions: 390.6 (W) x 240 (D) x 13.8 (H) mm
- Weight: 0.5 Kg

### ALC1248G-53
- Dimensions: 390.6 (W) x 240 (D) x 13.8 (H) mm
- Weight: 0.5 Kg

### SLC1248G-22
- Dimensions: 390.6 (W) x 240 (D) x 13.8 (H) mm
- Weight: 0.5 Kg

### VLC1324G-51/VLC1324G-53
- Dimensions: 390.6 (W) x 240 (D) x 13.8 (H) mm
- Weight: 1 Kg

### ELC1220G-55
- Dimensions: 390.6 (W) x 240 (D) x 13.8 (H) mm
- Weight: 0.5 kg

### MSC1024G
- Dimensions: 390.6 (W) x 240 (D) x 13.8 (H) mm
- Weight: 0.6 Kg

### MSC1224G
- Dimensions: 390.6 (W) x 240 (D) x 13.8 (H) mm
- Weight: 0.8 Kg

### VOP1248G-61
- Dimensions: 390.6 (W) x 240 (D) x 13.8 (H) mm
- Weight: 0.5 Kg

## Environmental Specifications
- Operating temperature: 0°C ~ 50°C
- Storage temperature: -40°C ~ 70°C
- Humidity: 10% ~ 95% (non-condensing)
- Power Supply: -48 VDC
- Full Load Power Consumption:
  - IES-6000M: 70 W
  - ALC1272G-51: 95 W
  - ALC1248G-51/53: 69 W
  - SLC1248G-22: 47 W
  - VLC1324G-51/VLC1324G-53: 47.5 W
  - ELC1220G-55: 40 W
  - MSC1024G: 20 W
  - MSC1224G: 33 W
  - VOP1248G-61: 84 W

## Certification
- CE
- UL 60950, CSA 60950
- FCC part 15 class A
- ITU-T K.20
- ETSI 300 019
- EN55022 class A
- EN55024 class A
- ETSI 300 386
- NEBS

*Firmware upgradeable for future enhancement.*

# MSAN Feature Matrix

| Model | IES-612-51 | IES-708-22 | IES-1000 | IES-1248-51 | IES-1248-51V | IES-5005 | IES-5000 | IES-6000 |
|---|---|---|---|---|---|---|---|---|
| **System Overview** | | | | | | | | |
| 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-base 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 | | | • | | | • | • | • |
| **Interfaces** | | | | | | | | |
| 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 | | | | | | • | • | • |
| **ADSL2/2+** | | | | | | | | |
| Annex M | • | | • | • | • | • | • | • |
| SRA | • | | • | • | • | • | • | • |
| INP (Min=2) | • | | • | • | • | • | • | • |
| SELT | • | | • | • | • | • | • | • |
| DELT | • | | • | • | • | • | • | • |
| ADSL2+ Bonding | • | | • | • | • (Future) | • | • | • |
| **G.SHDSL** | | | | | | | | |
| N-wire Bonding (G.991.2) | | • | • | | | • | • | • |
| ATM-based Multi-Pair Bonding (G.998.1) | | • | | | | • | • | • |
| **VDSL2** | | | | | | | | |
| DS/US Speed (Mbps) | | | | | | 100/45 | 100/45 | 100/45 |
| Max. ports | | | | | | 24/48 | 24/48 | 24/48 |
| ADSL2+ Fallback | | | | | | • | • | • |
| CFM (802.1ag) | | | | | | • | • | • |
| SELT | | | | | | • | • | • |
| DELT | | | | | | • | • | • |
| **VoIP** | | | | | | | | |
| Signaling Protocol | | | SIP/H.248 (Future) | | SIP, H.248 (Future) | SIP/H.248 | SIP/H.248 | SIP/H.248 |
| Voice Codec (G.711a/u, G.723, G.726, G.729ab) | | | • | | • | • | • | • |
| Metallic Line Test (MLT) | | | | | • | • | • | • |
| DTMF | | | • | | • | • | • | • |
| Fax/Modem (T.38) | | | • | | • | • | • | • |
| Call Waiting/Hold/Transfer | | | • | | • | • | • | • |
| Dial Tone, Ringing Tone, Busy Tone | | | • | | • | • | • | • |
| **QoS** | | | | | | | | |
| 802.1p | 4 queue | 4 queue | 4 queue | 4 queue | 4 queue | 8 queue | 8 queue | 8 queue |
| 802.1q (VLAN#) | 256 | 256 | 256 | 1024 | 1024 | 4K | 4K | 4K |
| SPQ/WRR | SPQ | SPQ | SPQ | SPQ | SPQ | SPQ, WRR | SPQ, WRR | SPQ, WRR |
| **Security** | | | | | | | | |
| IEEE 802.1x | • | • | • | • | • | • | • | • |
| Multiple PVC | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Q in Q (VLAN Stacking) | • | • | • | • | • | • | • | • |
| DHCP Snooping | • | • | • | • | • | • | • | • |
| DHCP Relay option 82 | • | • | • | • | • | • | • | • |
| MAC/Packet Filtering | • | • | • | • | • | • | • | • |
| MAC Count Filtering | • | • | • | • | • | • | • | • |
| 802.3ad Link Aggregation | | | | | | • | • | • |
| IP Bridge | | | | • | • | • | • | • |
| **Multicast Function** | | | | | | | | |
| IGMP v1/v2/v3 — Snooping | • (no v3) | • (no v3) | • | • | • | • | • | • |
| IGMP v1/v2/v3 — Proxy | • (no v3) | • (no v3) | • | • | • | • | • | • |
| IGMP v1/v2/v3 — Multicast Group | 256 | 256 | 256 | 512 | 512 | 256 | 256 | 512 |
| Multicast VLAN — Static Multicast | • | • | • | • | • | • | • | • |
| Multicast VLAN — Multicast VLAN | • | • | • | • | • | • | • | • |
| **Network Management** | | | | | | | | |
| SNMP v1, v2 | • | • | • | • | • | • | • | • |
| SNMP v3 | | | | | | • | • | • |
| Web Management | • | • | • | • | • | • | • | • |
| CLI Management | • | • | • | • | • | • | • | • |
| EMS Management | NetAtlas Access | NetAtlas Access | NetAtlas Access | NetAtlas Access | NetAtlas Access | NetAtlas Access | NetAtlas Access | NetAtlas Access |

* Future release

# System Architecture



**IES-6000M**

## Control Card



**MSC1024G**



**MSC1224G**

## ADSL Line Card



**ALC1248G-51**



**ALC1248G-53**



**ALC1272G-51**

## VDSL2 Line Card



**VLC1324G-51**



**VLC1324G-53**

## VoIP Line Card
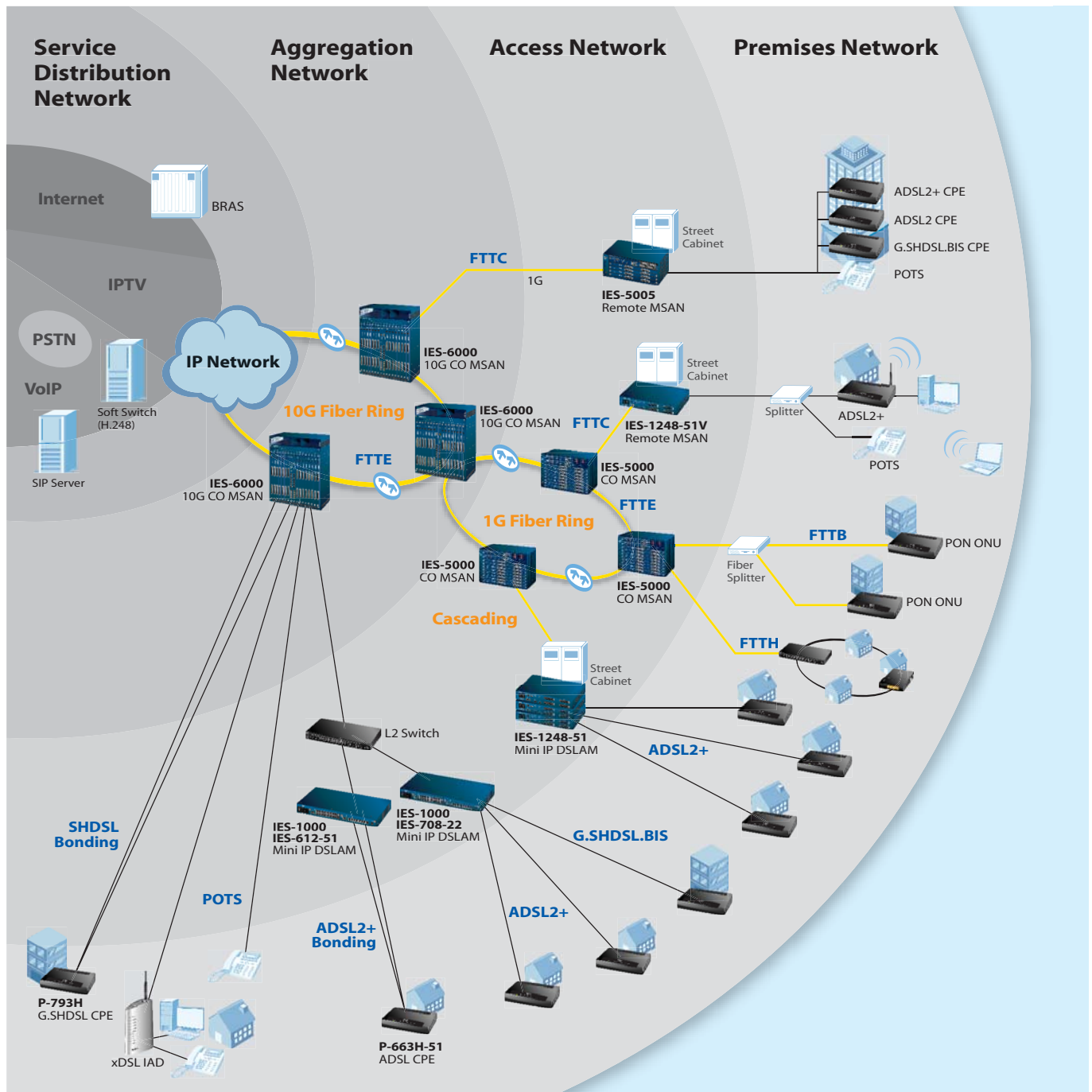


**VOP1248G-61**

## G.SHDSL Line Card



**SLC1248G-22**

## Ethernet Line Card



**ELC1220G-55**

# Application Diagram

## Network Topology for MSAN DSLAM Products



**Service Distribution Network**

Internet

BRAS

IPTV

PSTN

VoIP

Soft Switch (H.248)

SIP Server

**Aggregation Network**

IP Network

IES-6000 10G CO MSAN

10G Fiber Ring

IES-6000 10G CO MSAN

FTTE

IES-6000 10G CO MSAN

1G Fiber Ring

IES-5000 CO MSAN

Cascading

L2 Switch

IES-1000 IES-612-51 Mini IP DSLAM

IES-1000 IES-708-22 Mini IP DSLAM

SHDSL Bonding

POTS

ADSL2+ Bonding

P-793H G.SHDSL CPE

xDSL IAD

P-663H-51 ADSL CPE

ADSL2+

G.SHDSL.BIS

**Access Network**

FTTC

1G

Street Cabinet

IES-5005 Remote MSAN

Street Cabinet

IES-1248-51V Remote MSAN

FTTC

IES-5000 CO MSAN

FTTE

IES-5000 CO MSAN

Fiber Splitter

FTTB

FTTH

Street Cabinet

IES-1248-51 Mini IP DSLAM

ADSL2+

**Premises Network**

ADSL2+ CPE

ADSL2 CPE

G.SHDSL.BIS CPE

POTS

Splitter

ADSL2+

POTS

PON ONU

PON ONU