COE IPv6 Roadmap Planning

ZyXEL

COE Product Offering with IPv6

- **Dual Stack Lite / Translation & Dual Stack, IPv6 Core**

Phase I

- **Chassis MSAN FW Rel. 3.96.1**
  - MSC1000G, MSC1024G, MSC1224G, ALC12xxG-5x, VLC13xxG-5x (not include SLC & ELC)
  - IPv6 Pass Through
- **Box MSAN FW Rel. 3.53.x**
  - 3.53.2 for IES-1248-5xx, AAM1212-5x, 3.53.1 for SAM1x16-22, 3.53.3 for VES-1624FT-55A
  - IPv6 Pass Through

MSAN FW Rel. 3.98/4.0

- **MSC1000G/MSC1024G/MSC1224G**
  - LDRA (Lightweight DHCPv6 Relay Agent; RFC3315) with no v6 DHCP snooping
  - VLC1424G-56/VLC13XX/ALC1372G-51

Phase II

- **Chassis MSAN FW Rel. 4.0**
  - MSC1x24GB, VLC1424G-56, ALC1372G-51
  - IPv6 host
  - Neighbor Discovery Protocol (NDP, neighbor cache, prefix cache, default router, destination cache, routing table)
  - Ping (Internet Control Message Protocol Version 6, ICMPv6)
  - Telnet server, HTTP / HTTPs Server, Syslog server, TFTP server, SSH, SFTP
  - NTP over IPv6
  - SNMP Agent
  - MLDv1 & MLDv2 snooping, MLDv2 proxy
  - IPv6 Access Control List profile
  - IPv6 Subnet-Based VLAN Translation

Phase III

- **Chassis MSAN FW Rel. 4.1 (Q1/2013)**
  - MSC1x24GB, VLC1424G-56, ALC1372G-51
  - RA guard for IPv6 stateless scenario (RFC6105)
  - DHCP Snooping / IP Source guard for IPv6 stateful DHCP-PD scenario
  - DHCP Snooping / IP Source guard for IPv6 stateful DHCP scenario.
  - SEND (RFC3971) for MSC management interface.

Phase IV

- **Chassis MSAN FW Rel. 4.2 (Q4/2013)**
  - MSC1x24GB, VLC1424G-56, ALC1372G-51
  - IPv6 Anycast Addressing
  - IPv6 over Ethernet
  - RADIUS Client
  - IPv6 stack
  - Stateless Address Autoconfiguration
  - Path Maximum Transmission Unit (PMTU) Discovery
  - Default Address Selection for IPv6

To discuss upon request

- DHCPv6 Client / DHCPv6 Server / Relay
- Stateful Address Autoconfiguration
- IPv6 over PPPoE/PPPoA/ATM
- DNS Client / Proxy
- DNS and IPv6 Prefix Delegation (DHCPv6-PD)

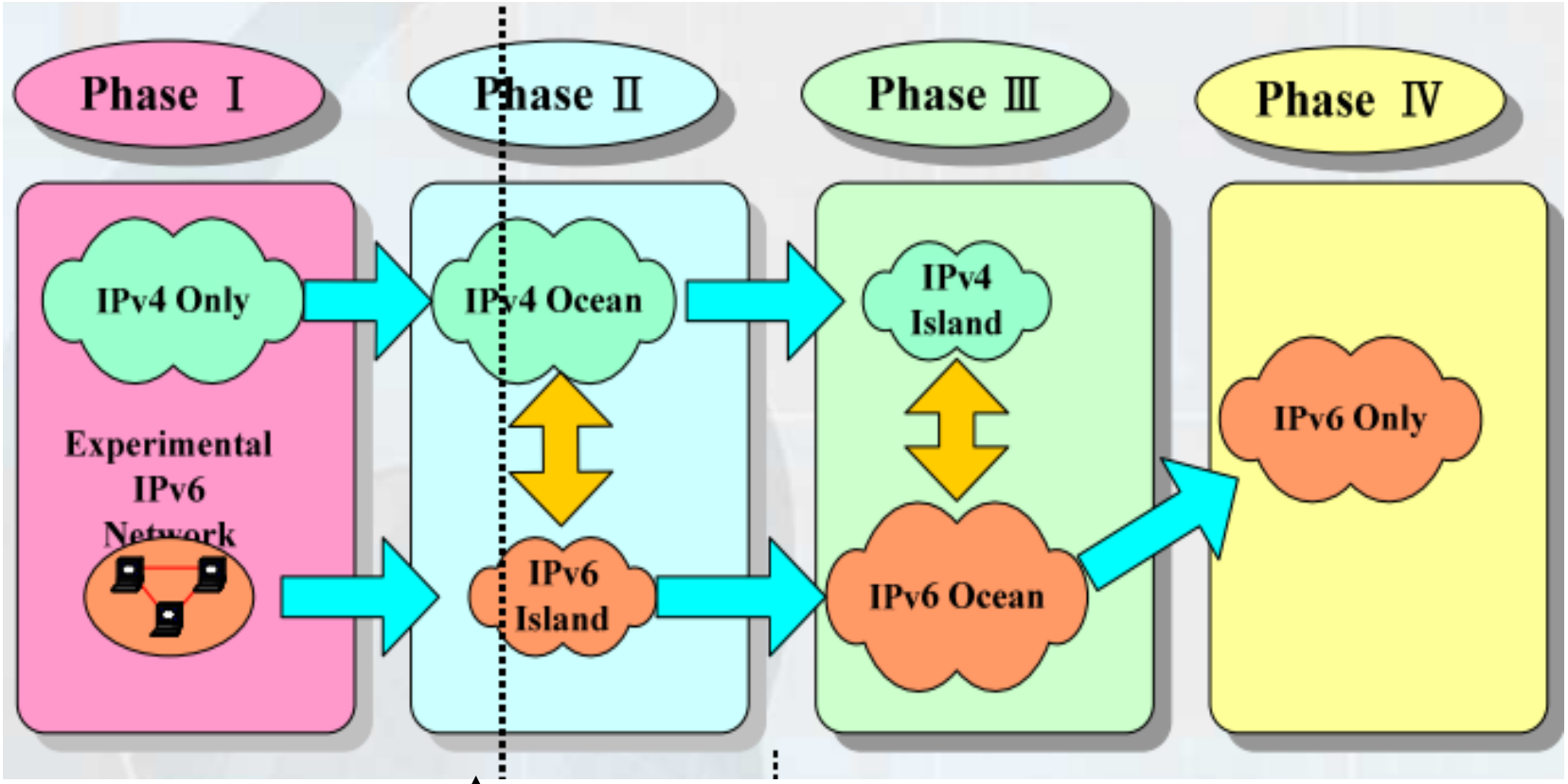
DSLAM FW Rel. 3.80

- **VES-1608FE-57/VES1724-56**
  - IPv6 (RFC2460)
  - IPv6 Anycast Addressing (RFC3513)
  - Internet Control Message Protocol Version 6 (ICMPv6, RFC2463)
  - Neighbor Discovery Protocol (NDP, RFC2461)
  - Stateless Address Autoconfiguration (RFC2462)
  - Path Maximum Transmission Unit (PMTU) Discovery (RFC1981)
  - Protocol-based VLAN for IPv6 (ether type select for ipv6)
  - IPv6 Access Control List profile (classifier and policy)
  - MLDv1 & MLDv2 snooping, MLDv2 proxy
  - NTP over IPv6
  - RADIUS/TACACS over IPv6
  - Ping (Internet Control Message Protocol Version 6, ICMPv6)
  - FTP server, Telnet server, HTTP / HTTPs server, Syslog server
  - SNMP Agent

Carrier Switch IPv6 Management

- IPv6 over Ethernet (RFC 2464)
- IPv6 Addressing Architecture (RFC 4291)
- Dual stack (RFC4213)
- ICMPv6 (RFC4884)
- Path MTU (RFC 1981)
- Minimum Path MTU size of 1280 (RFC 5905)
- Encapsulation for minimum PMTU of 1500
- Neighbor Discovery (RFC4861)
- DHCPv6 Relay

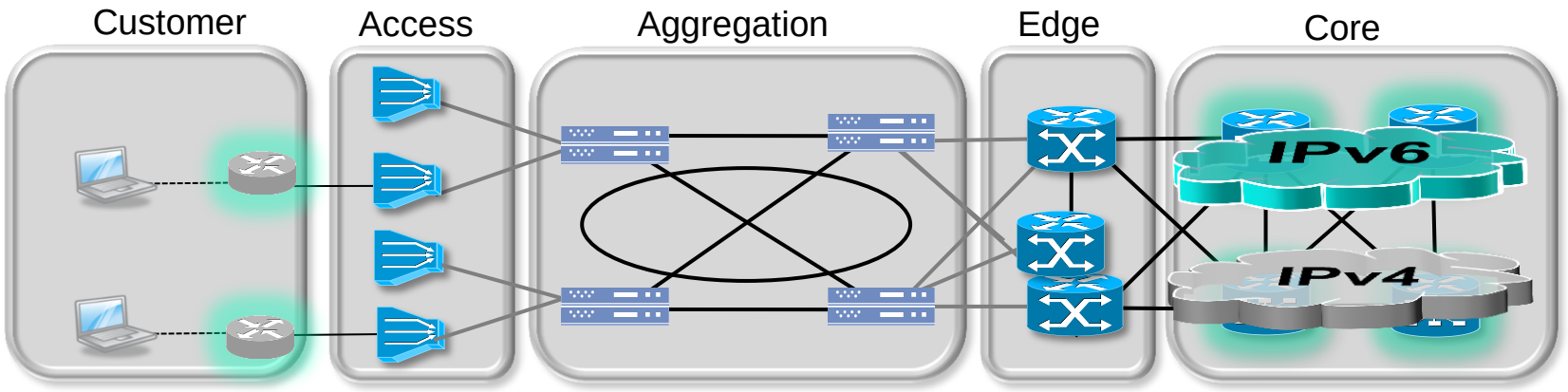
IPv6 transition path



Three Possible ways of Transition

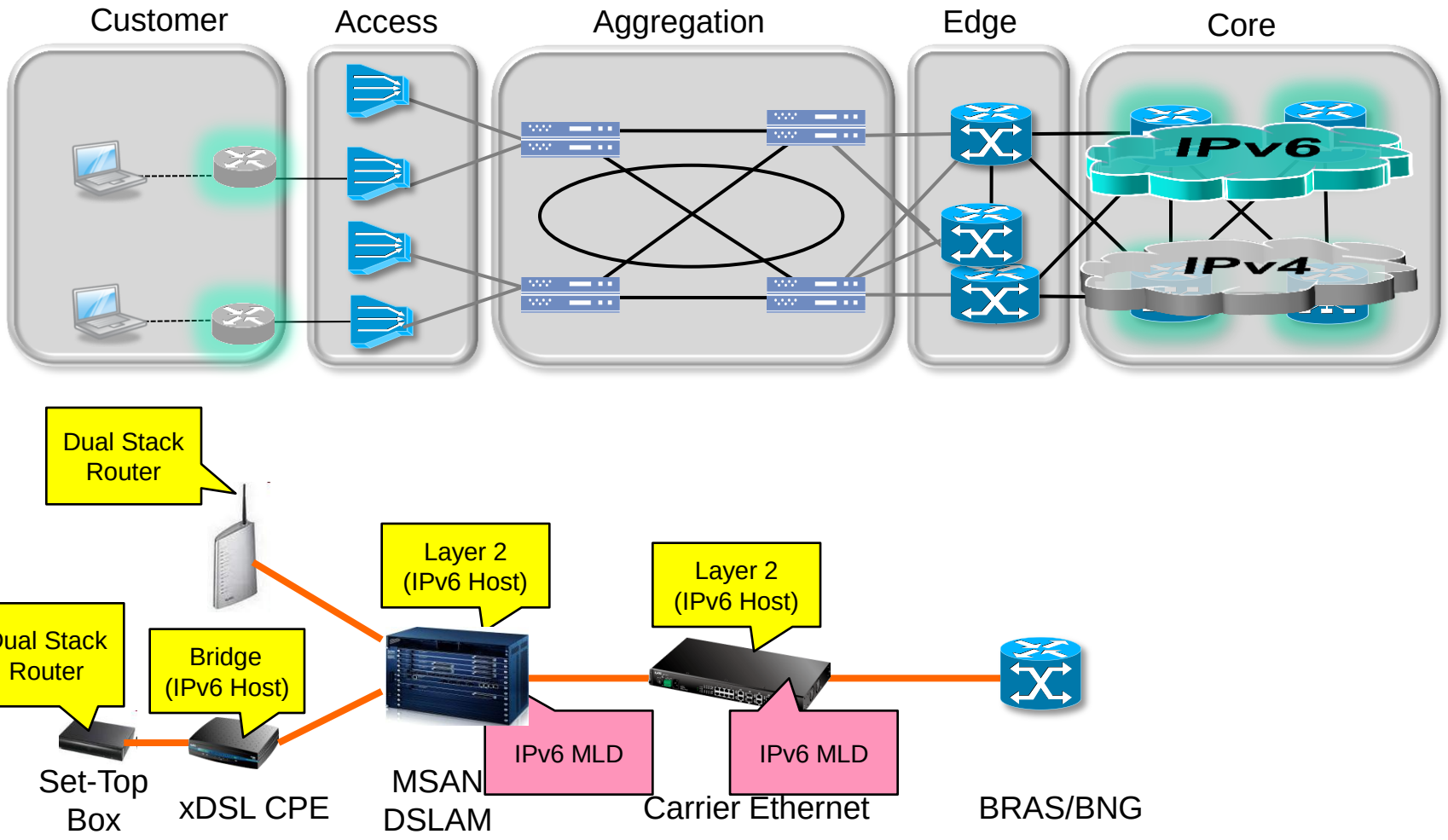
- **Dual – Stack**
  - Allow IPv4 and IPv6 to co-exist in the same devices and networks.
- **Tunneling**
  - Enable network edge devices to interconnect over incompatible network.
- **Translation**
  - Allow IPv6-Only devices to communicate with IPv4-Only devices

Future network types



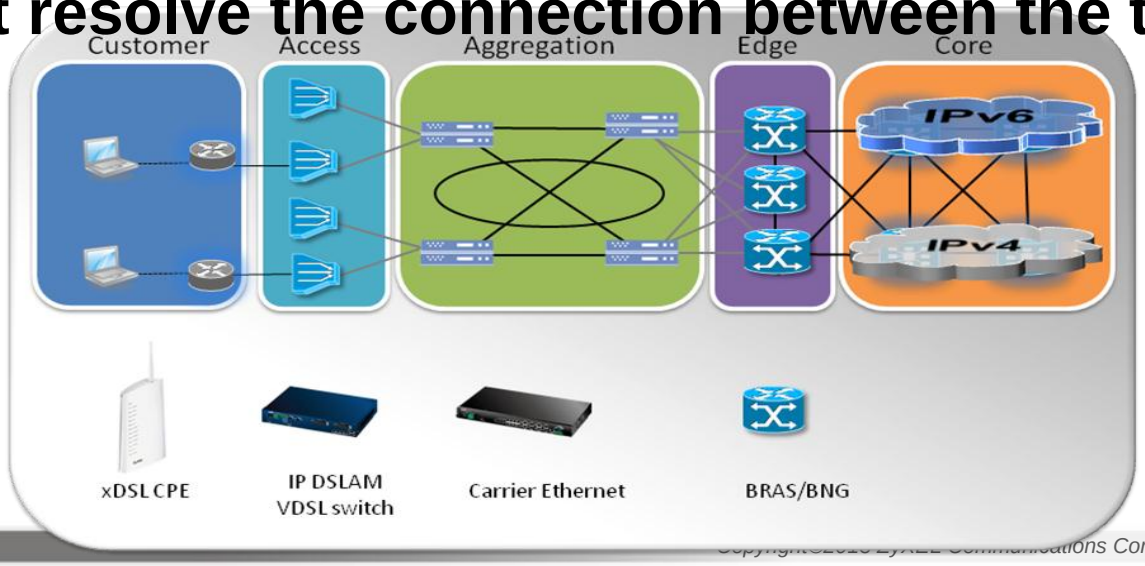
	Customer		Access & Aggregate		Edge	Core		
Device / **Network**	Set-Top Box	xDSL CPE IAD	MSAN DSLAM	L2 Switch	BRAS	IPTV Server	VoIP SSW	DHCP PPPoE server
Dual Stack	v4 or v6	v4 & v6	v4+v6 pass thru		v4 & v6	v4 or v6	v4	v4 & v6
Dual Stack Lite	v6	B4	v6 pass thru+MLD		v6	v6	v4	v4
6rd (tunneling)	v4	6rd CE	v4+v6 pass thru		v4	v4	v4	v4

Dual Stack


Customer
Access
Aggregation
Edge
Core
IPv6
IPv4
Dual Stack Router
Layer 2 (IPv6 Host)
Layer 2 (IPv6 Host)
Dual Stack Router
Bridge (IPv6 Host)
IPv6 MLD
IPv6 MLD
Set-Top Box
xDSL CPE
MSAN DSLAM
Carrier Ethernet
BRAS/BNG

Dual Stack

- **Service provider must maintain existing infrastructure for existing subscribers during transition**
- **Service provider must build IPv6 Core network if current Core network cannot support IPv6 and must resolve the connection between the two**



Dual Stack

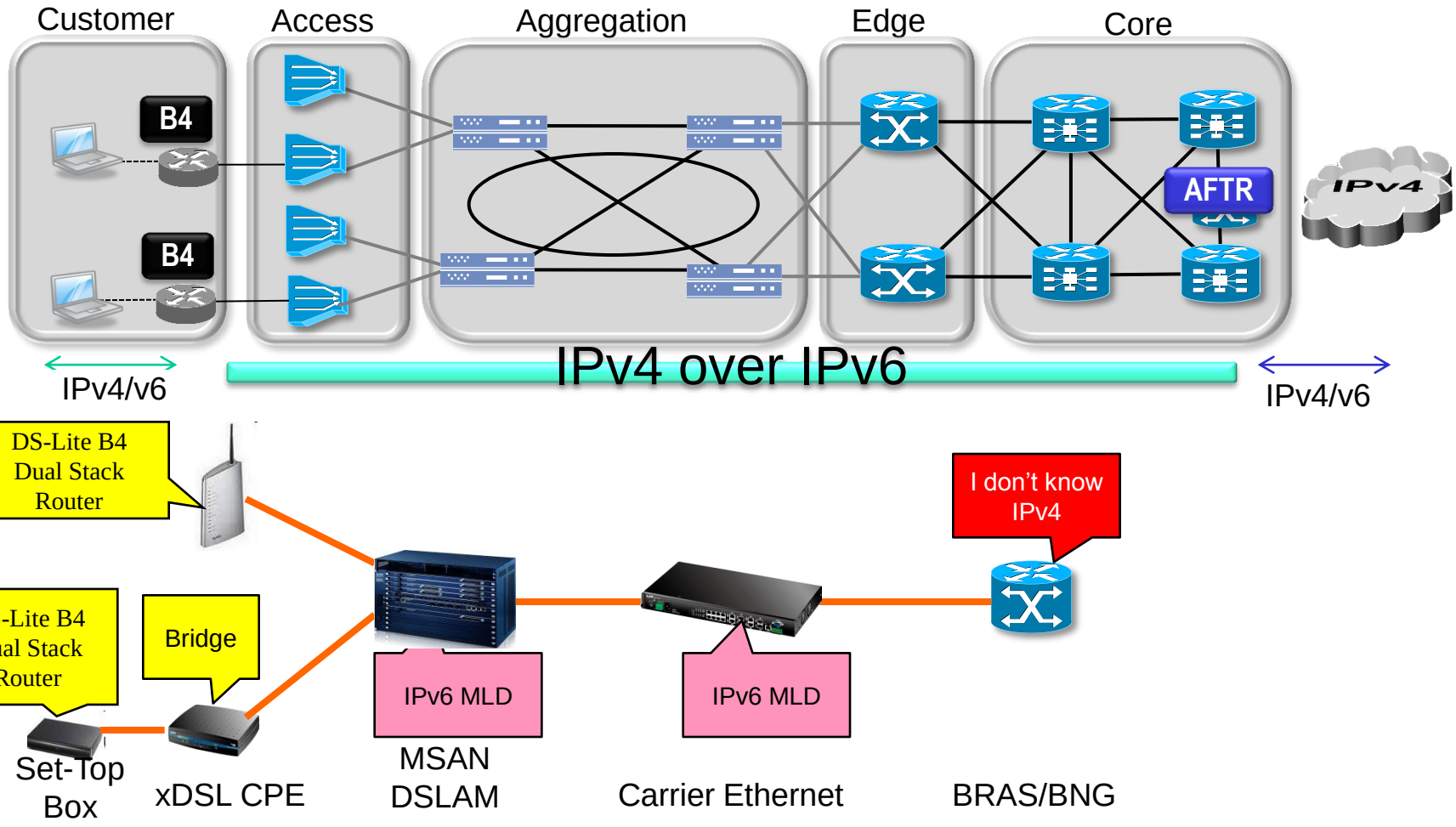
Pro

- Easy to config
- End-to-end connection model remains

Con

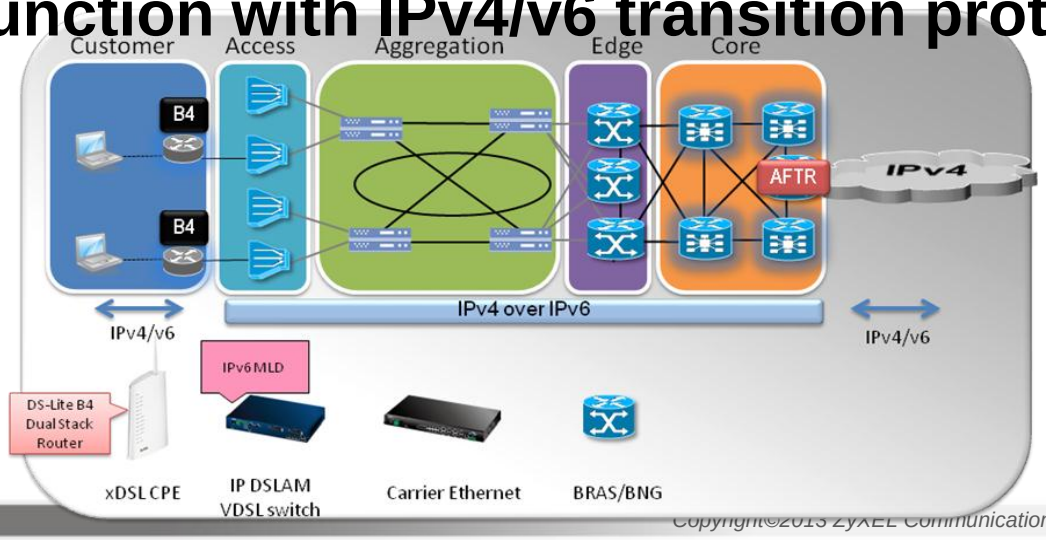
- Each node requires two IP address (one for v4 & one for v6), scalability suffers
- Extra effort in maintain routing table for both v4 & v6

Dual Stack Lite / Translation



Dual Stack Lite / Translation

- **Dual-Stack lite encapsulates IPv4 packets over IPv6 in the Access Network to allow a single public IPv4 address to be shared by many**
- **xDSL CPE must be an IPv6 aware CPE with a B4 interface to create a tunnel to the AFTR. AFTR (Address Family Transition Router) will perform NAT function with IPv4/v6 transition protocol.**



Dual Stack Lite / Translation

Pro

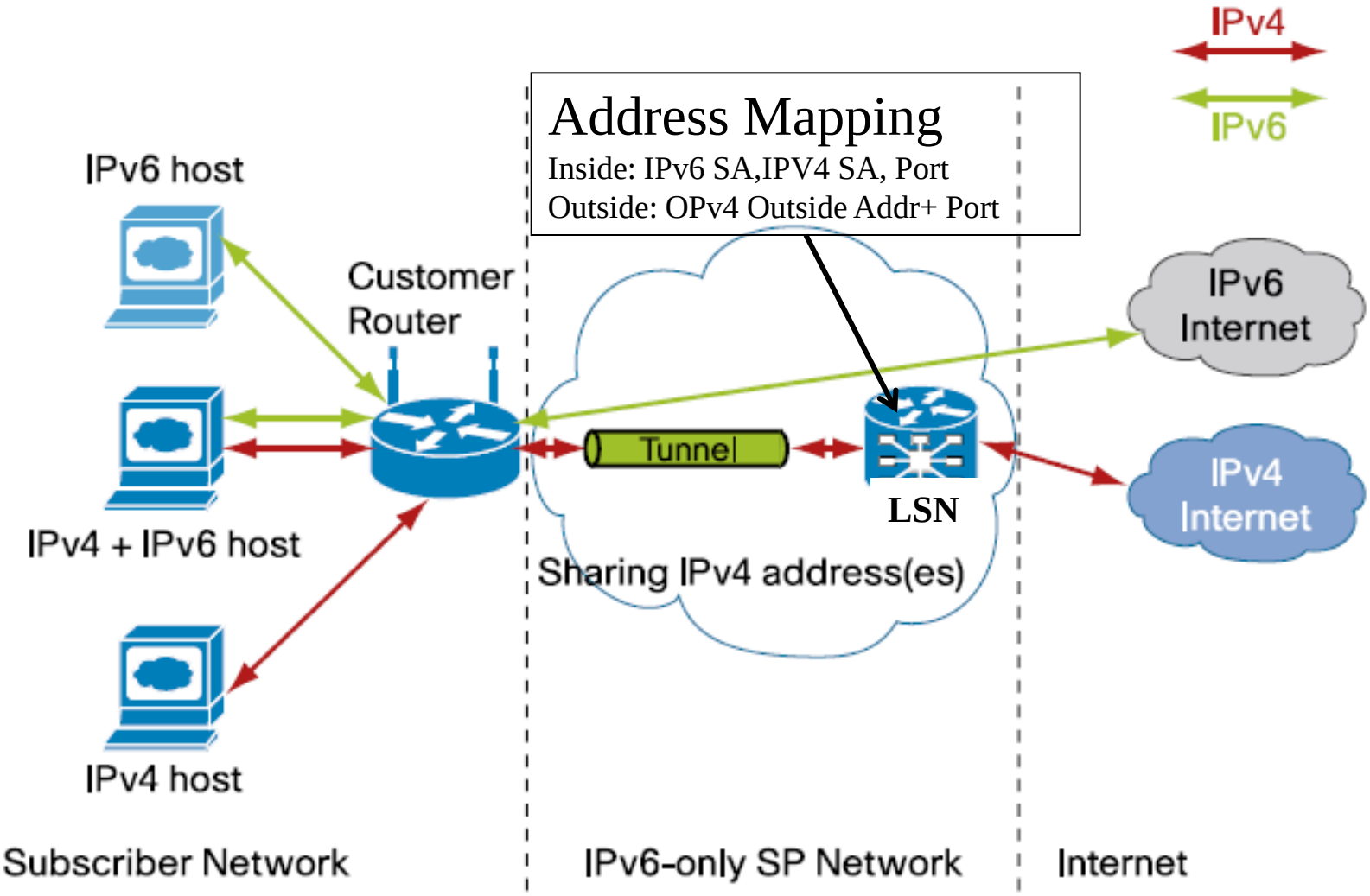
- Need only AFTR (Address Family Transition Router) at the edge of the network for v4 & v6 network interconnection
- Extend existing v4 device life cycle

Con

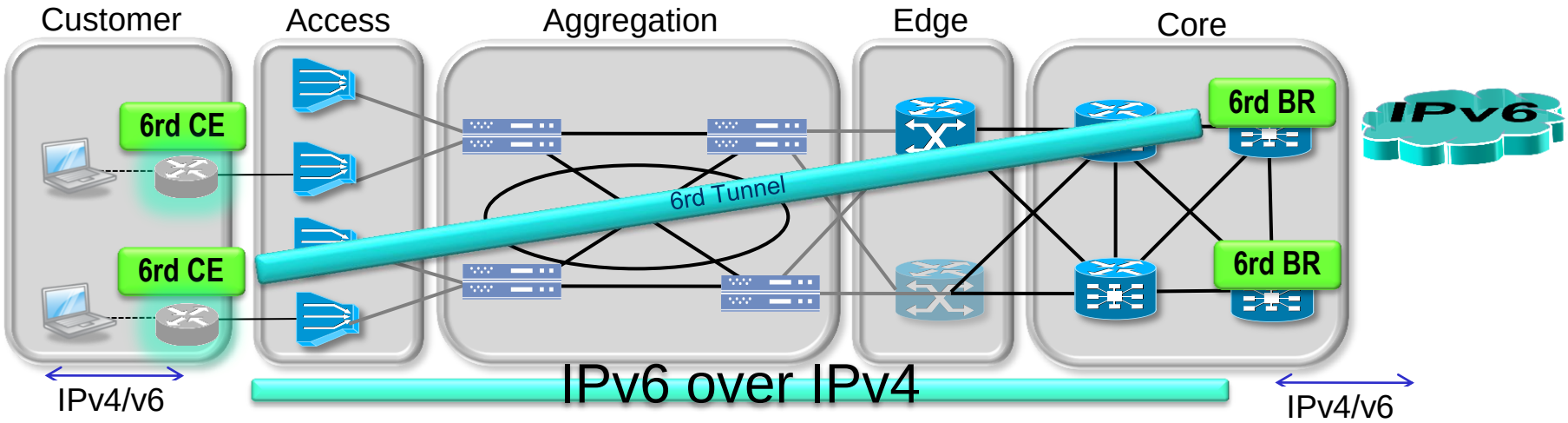
- AFTR can easily become traffic bottle-neck
- Application like DNS, FTP, etc requires ALG (application layer gateway)

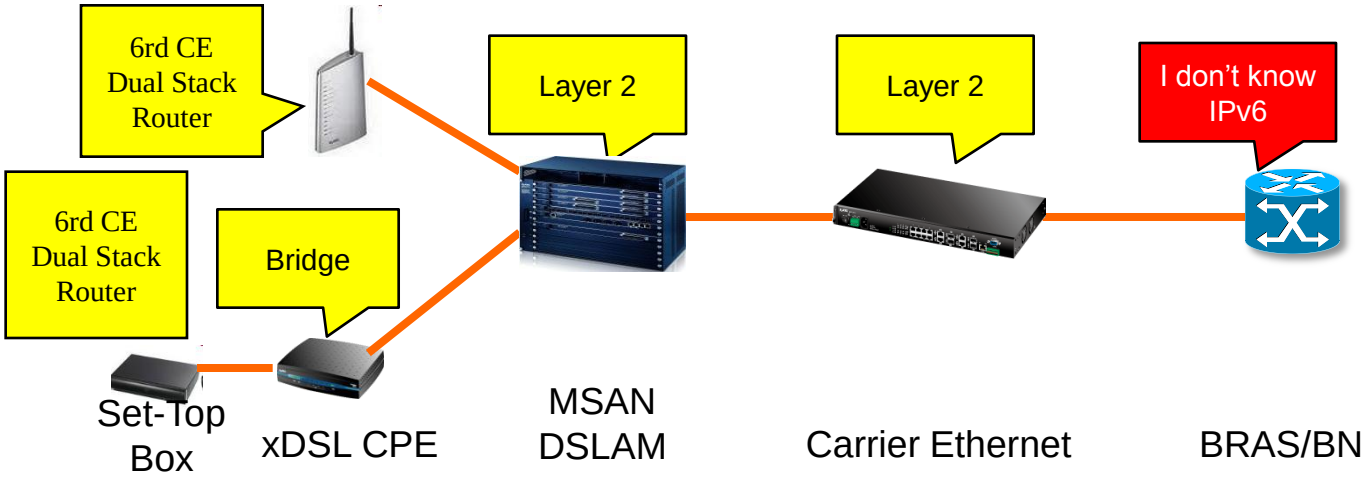
IPv6 Deployment- Dual-Stack Lite

- **On 25 Feb ‘10, gogo6 starts DS-Lite beta to Freenet6**



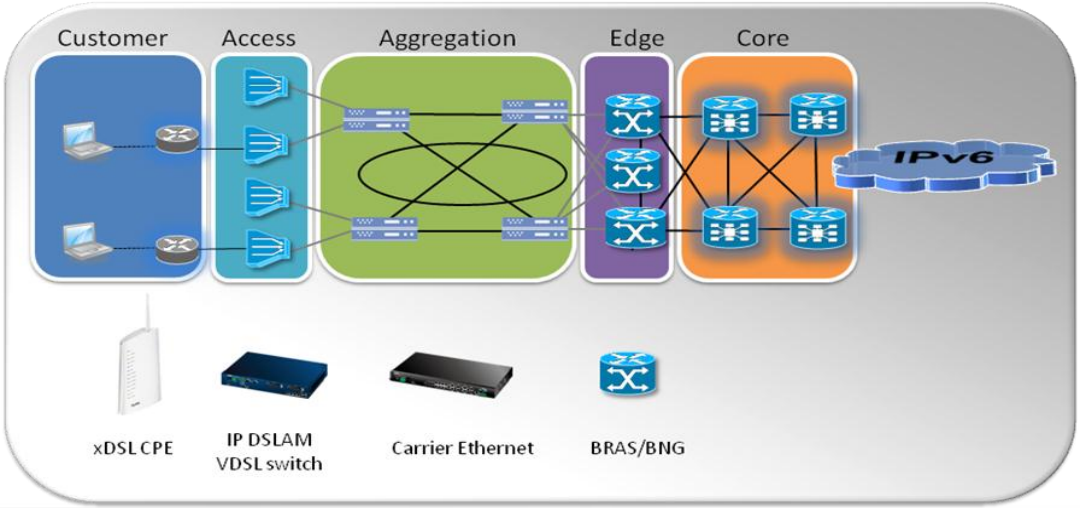
6rd / Tunneling





6rd / Tunneling

- **Service provider deploys 6rd BR (Border Relay) router at the edge of the core network and 6rd CE (Customer Edge) at customer network to offer IPv6 Internet access. BR acts as BR router at the core network layer.**



6rd / Tunneling

Pro

- End-to-end connection model remains
- Extend existing v4 network life cycle

Con

- Effort to maintain v4 network architecture & 6rd border relay router
- No solution for lack of v4 IP address
- Extra overhead compromises Network performance

Pro & Con summary

	Method 1 Dual Stack	Method 4 6RD	Method 5 DS-Lite
IPv4 Depletion Countermeasures	No	No（must be combined with other method）	Yes
Scalability	Depends on the number of IPv4 addresses	Yes	Yes
IPv6 Support	Yes	Yes	Yes
Coexistence with IPv6	Yes	Yes	Yes
Operational complexity	Low	Low	Moderate
Troubleshooting complexity	Low	Moderate	High
IPv4 NAT when connecting to server scalability concerns	No	No	Yes
IPv6 NAT when connecting to server scalability concerns	No	No	No
CPE Changes	IPv6 Support	Yes	Yes
Protocol conversion in CPE (AFT)	No	Yes	No
PE Side NAT	No	No	Yes
SP Protocol conversion (AFT)	No	Yes	No
Phase-in (for the existing IPv4 infrastructure)	Entire transition will be long	Can be easy	IPv6 access network is required

Security considerations

- Tunneling IPv6 through IPv4 Networks May Break IPv4 Network Security Assumptions
- Avoiding the Trap of Insecure IPv6 Service Piloting
- Addressing Schemes and Securing Routers
- Consequences of Multiple Addresses in IPv6
- Operational Factors when Enabling IPv6 in the Network
- Security Issues Due to Neighbor Discovery Proxies

IPv6 deployment suggestions

- **Network:** Dual Stack where you can, Tunneling where you must, Translation where you have no other solutions.
- **Service:** Dual stack where you can, isolate each other where you must , Translation where you have no other solutions.

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