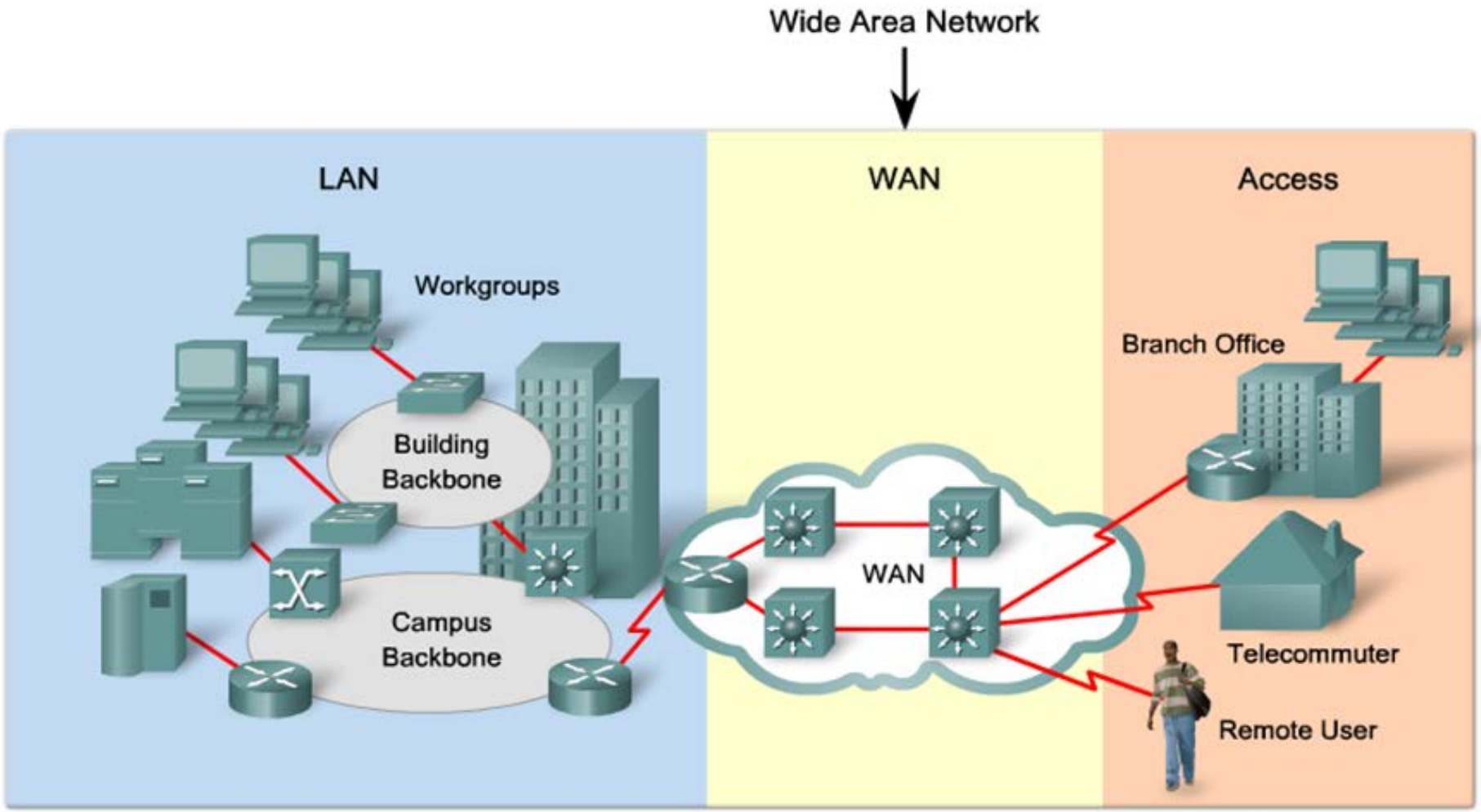
WAN INTRODUCTION

What is WAN ?

- **A WAN is a data communications network that operates beyond the geographic scope of a LAN.**
- **WANs are different from LANs in several ways. While a LAN connects computers, peripherals, and other devices in a single building or other small geographic area, a WAN allows the transmission of data across greater geographic distances.**
- **In addition, an enterprise must subscribe to a WAN service provider to use WAN carrier network services. LANs are typically owned by the company or organization that uses them.**

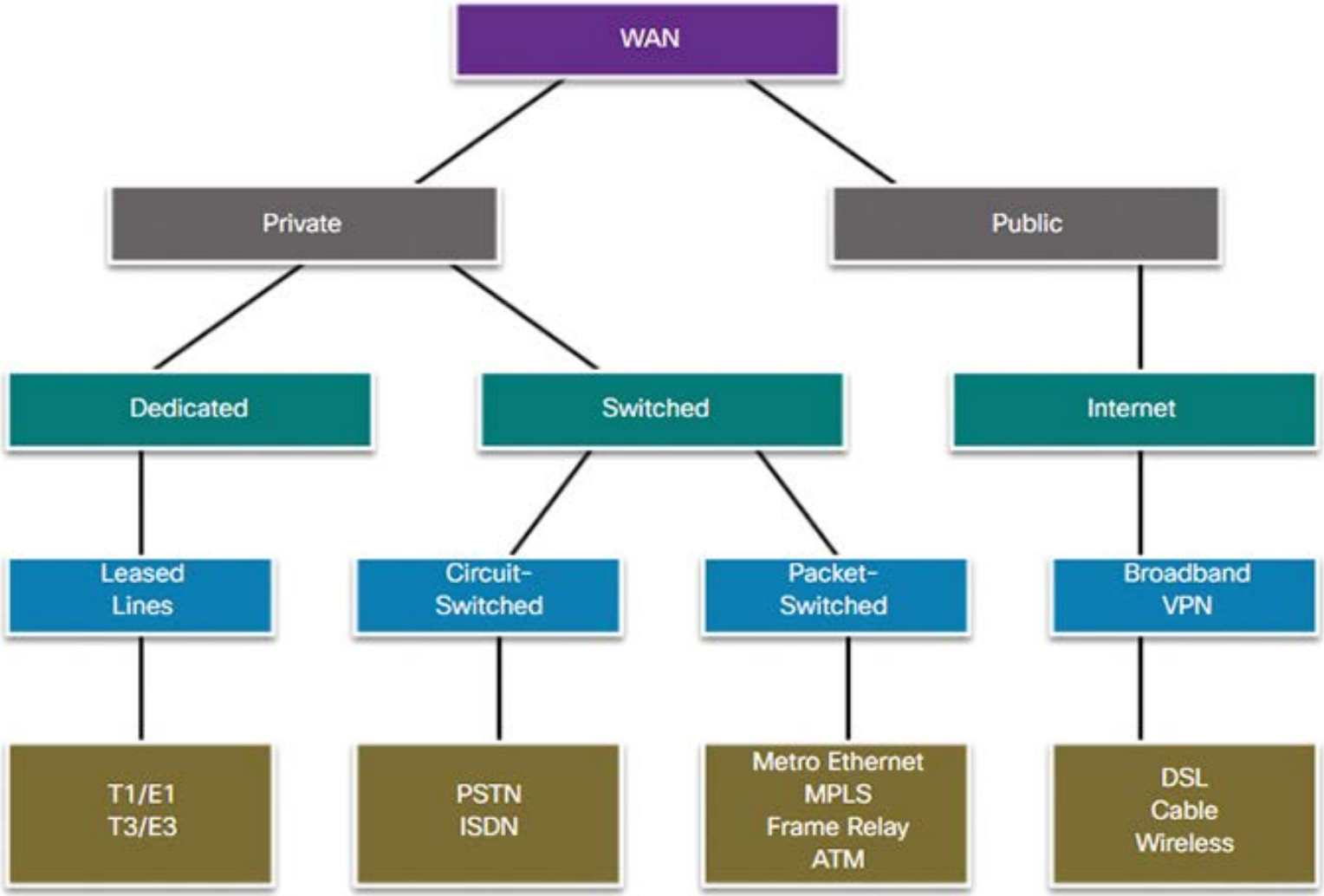
What is WAN ?


Wide Area Network
LAN
WAN
Access
Workgroups
Building
Backbone
Campus
Backbone
WAN
Branch Office
Telecommuter
Remote User

WANs vs. LANs

	WANs	LANs
Area	Wide geographic area	Single building or small geographic area
Ownership	Subscription to outside service provider	Owned by Organization

WAN Acess Options



Layer 2 Encapsulation Protocols

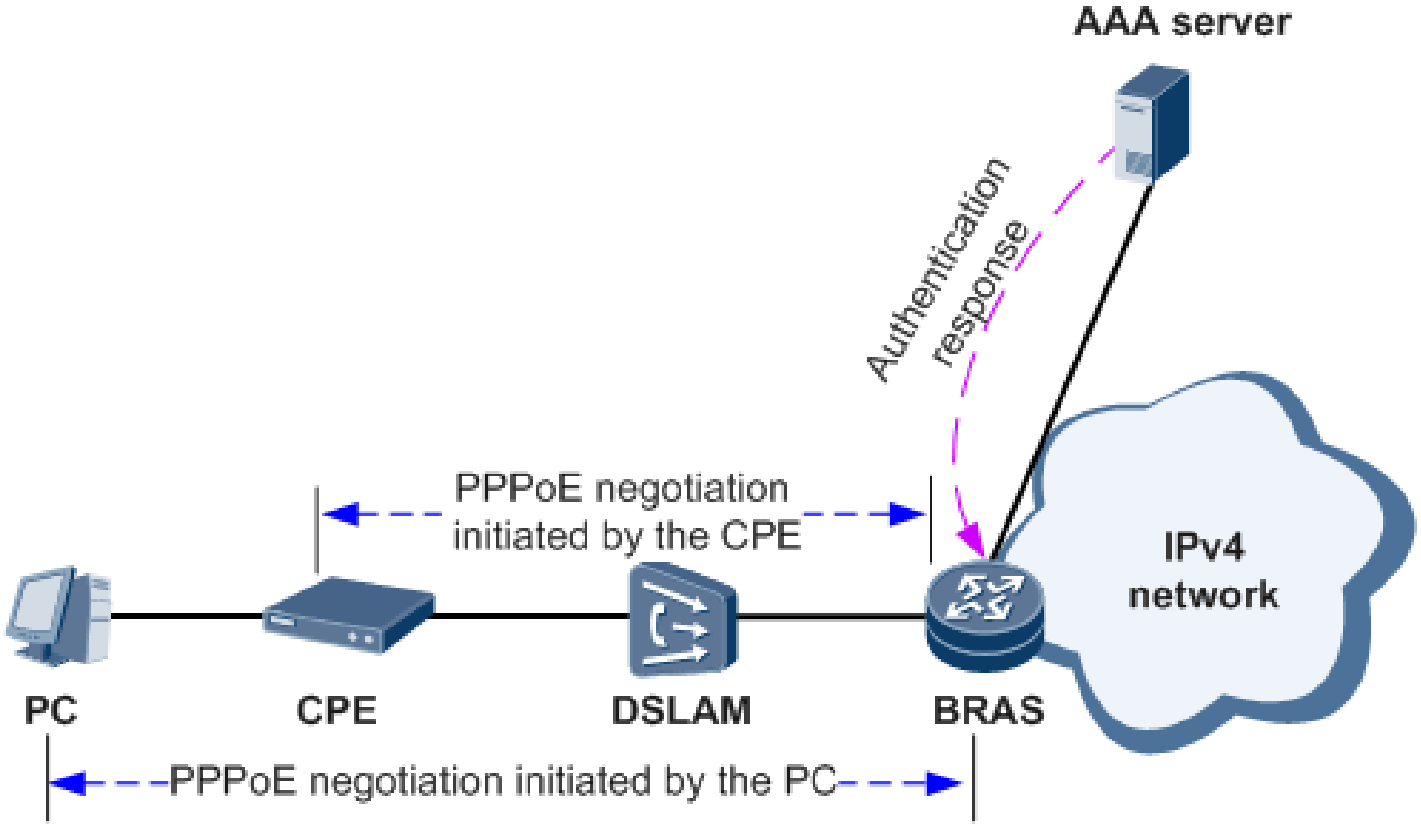
- **High-level data link control (HDLC) is the default encapsulation type on point-to-point dedicated links and circuit switched connections. HDLC should be used for communication between Cisco devices.**
- **Point-to-Point Protocol (PPP) provides connections between devices over several types of physical interfaces. PPP uses PAP and CHAP for basic security.**
- **Frame Relay is the industry-standard switched data link layer protocol. Frame Relay (based on X.25) can handle multiple virtual circuits.**
- **Asynchronous Transfer Mode (ATM) is the international standard for cell relay using fixed-length (53-byte) cells for multiple service types.**

PPP over Ethernet (PPPoE)

PPP over Ethernet

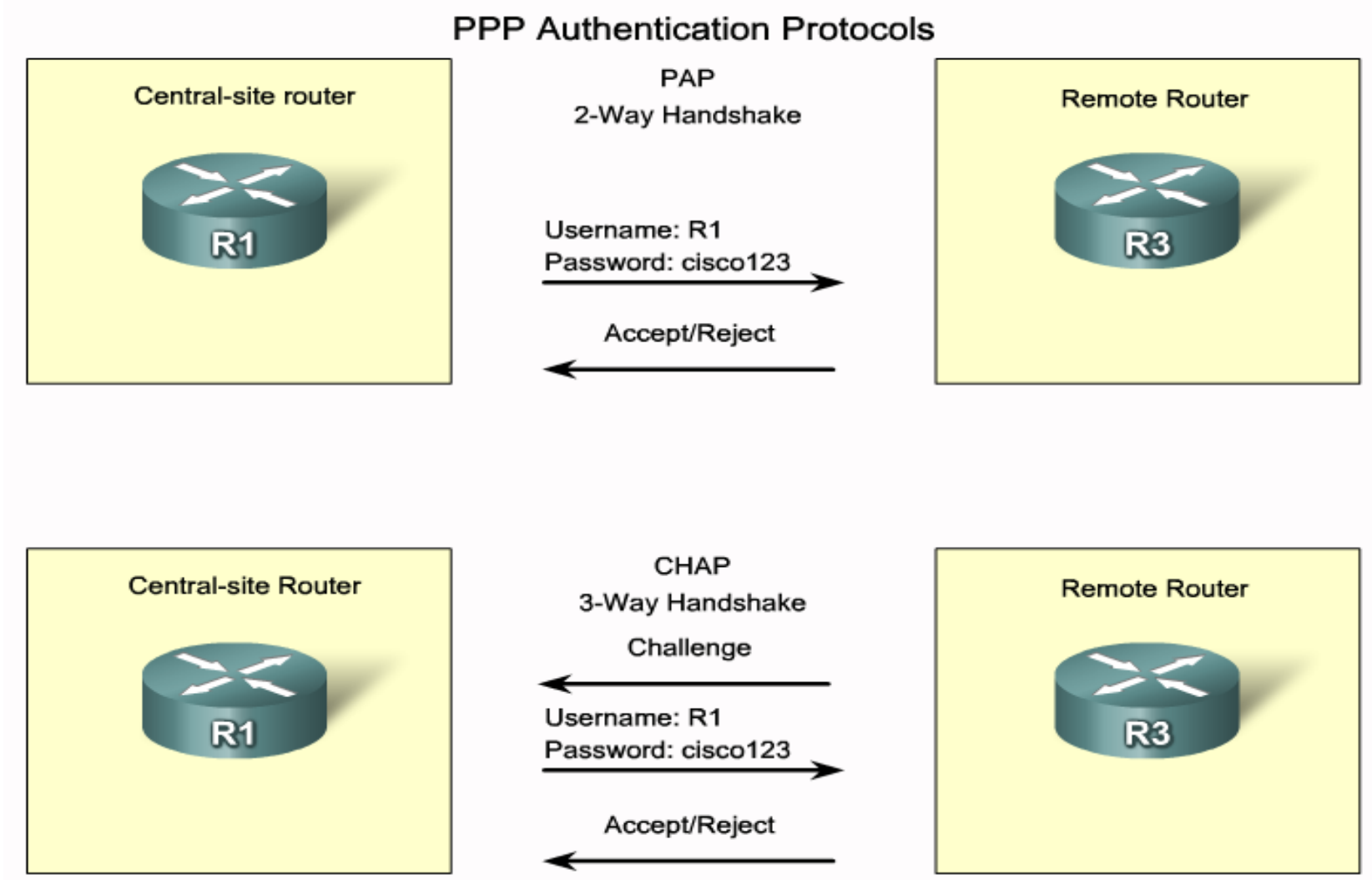
- Ethernet frame carrying PPP frame
- Service provider end:
  - DSLAM for DSL connection termination
  - Aggregation router for PPP session termination
- Subscriber end:
  - DSL modem for DSL connection termination
  - PPPoE client for PPP session termination
- The client device is the PC or the router at the CPE

PPPoE Session Establishment



- **PPP session is from PPPoE client to the aggregation router.**
- **Subscriber IP address is assigned by the aggregation router via IPCP.**

PPP AUTHENTICATION



PPPoE Client Configuration

PPPoE Client:

```
Client(config)#interface dialer 0
Client(config-if)#encapsulation ppp
Client(config-if)#ip address negotiated
Client(config-if)#ppp pap sent-username user1 password cisco
Client(config-if)#dialer pool 1

Client(config)#interface g1
Client(config-if)#pppoe-client dial-pool-number 1
```

PPPoE Verification

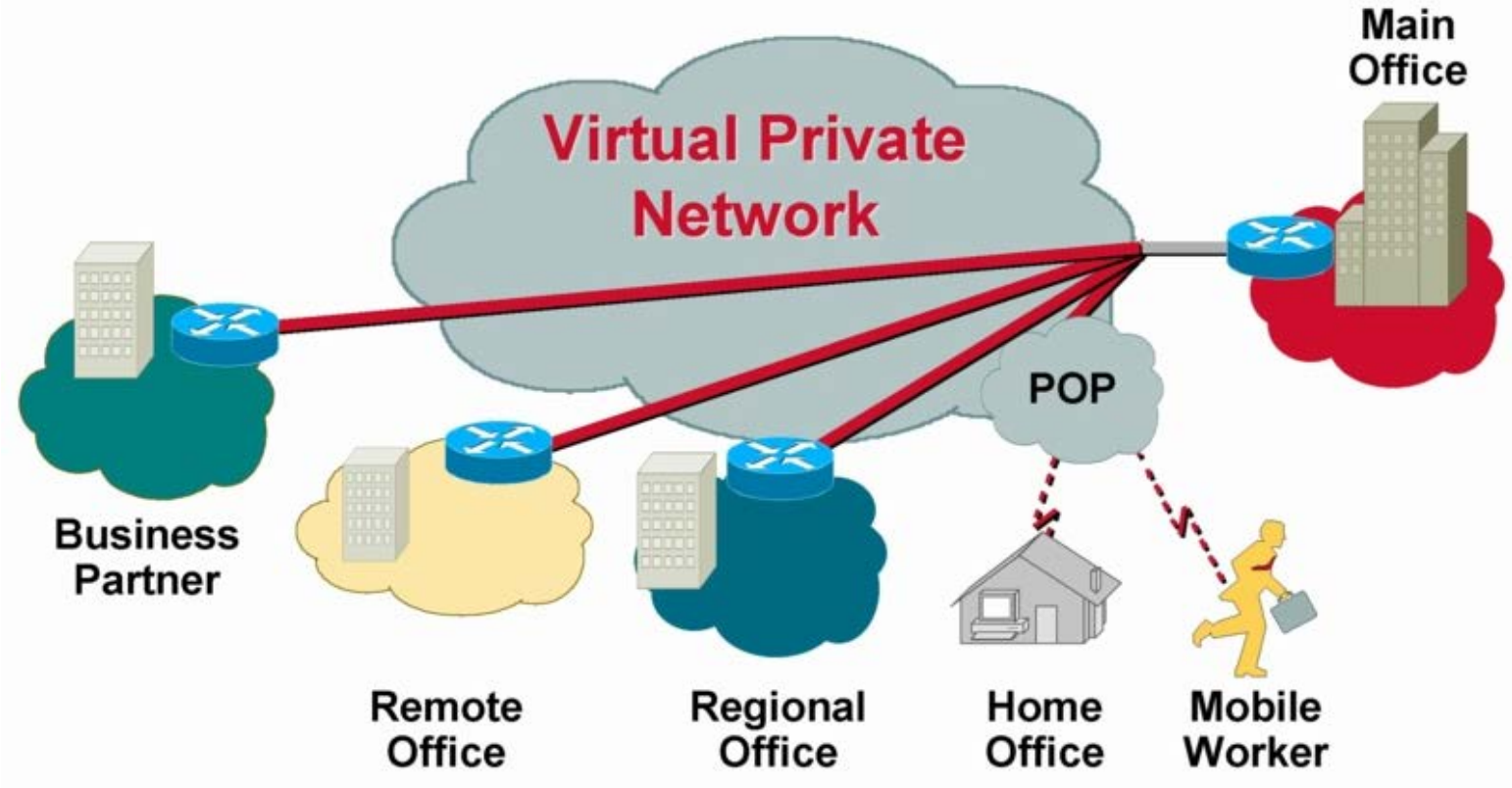
```
Client#show pppoe session
     1 client session

Uniq ID   PPPoE   RemMAC           Port                VT   VA          State
            SID   LocMAC                                    VA-st
    N/A      18   000c.297c.c044   G1                  Di0  Vi1         UP
                  000c.297c.d19e                            UP
```

```
Client#sh ip int brief
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet1       unassigned      YES unset  up                    up
Dialer0                113.1.1.2       YES IPCP   up                    up
```

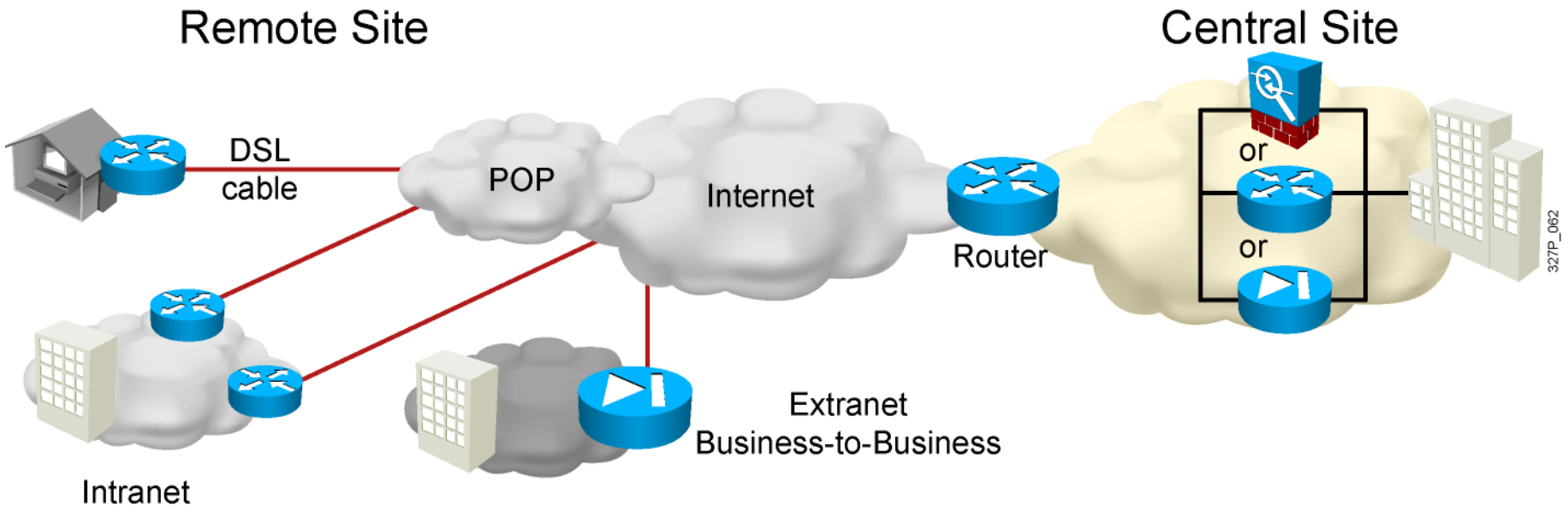
Introducing VPN Solutions

What Is a VPN?



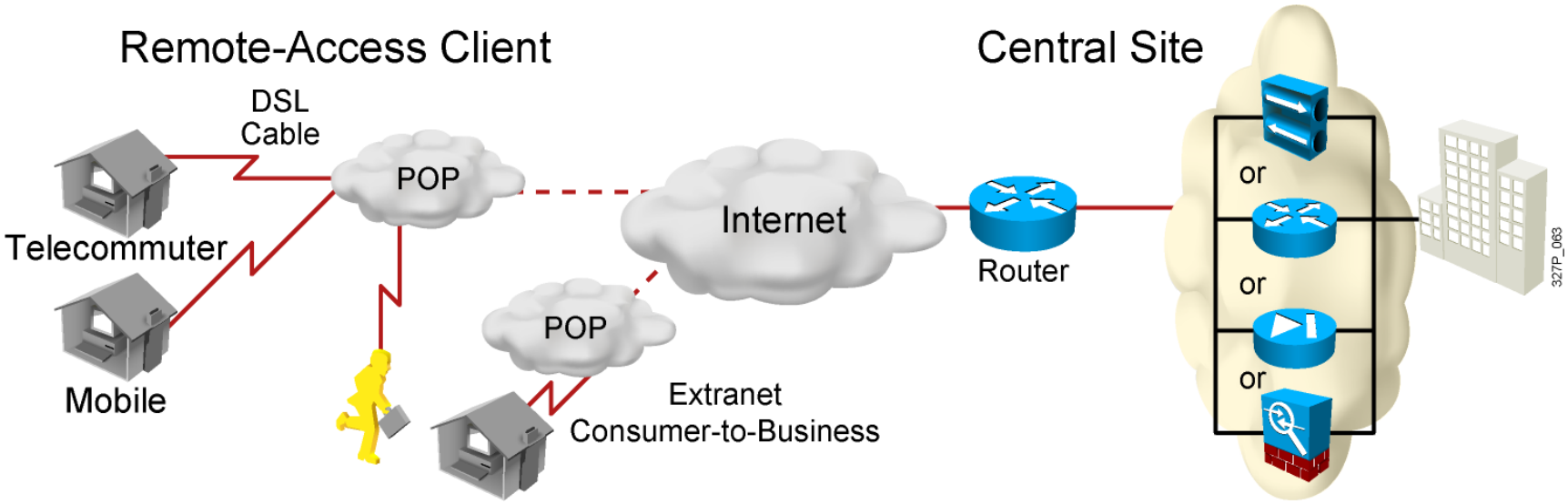
Information within a private network is transported over a public network as a private network

Site-to-Site VPNs



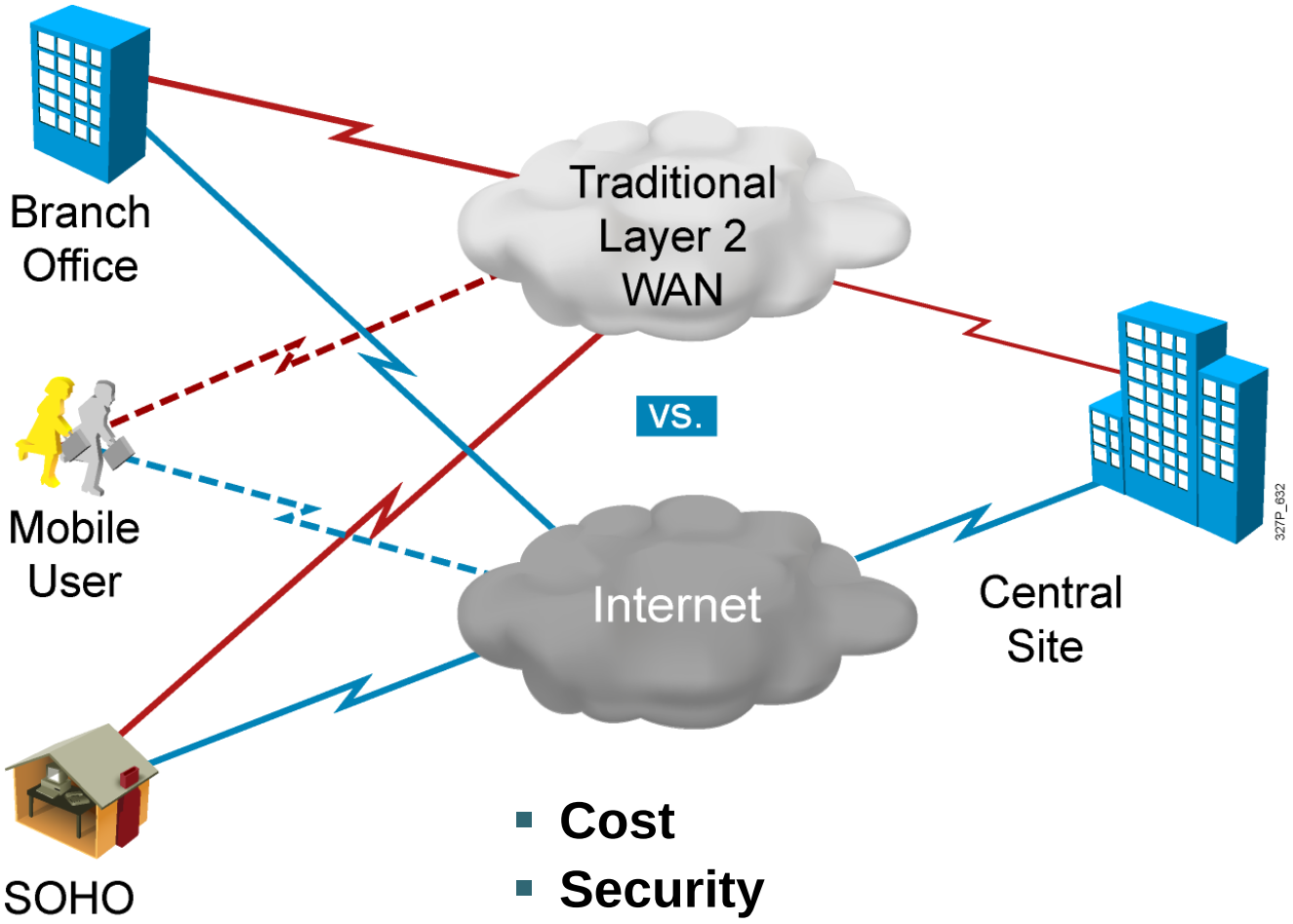
Site-to-site VPN: extension of classic WAN

Remote-Access VPNs



Remote-access VPN: connection allows an individual user to connect to a private network from a remote location using a laptop or desktop computer connected to the internet.

Benefits of VPN



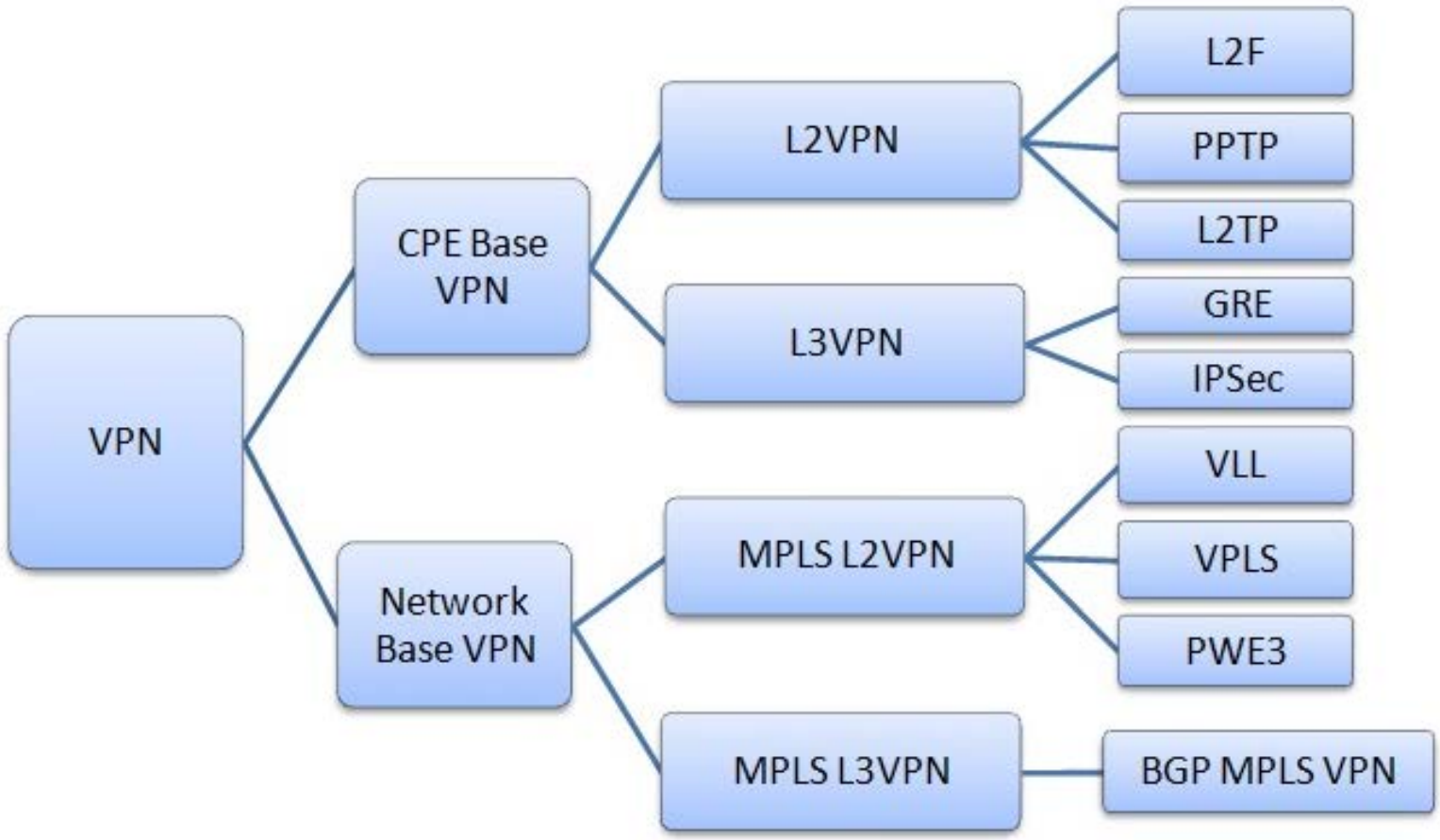
- **Cost**
- **Security**
- **Scalability**

VPN Models

VPN services can be offered based on two major models:

- **Overlay VPNs, in which the service provider provides virtual point-to-point links between customer sites**
  - **Layer 2: X.25, Frame Relay, ATM**
  - **Layer 3: GRE, DMVPN, IPSec, SSLVPN**
- **Peer-to-peer VPNs, in which the service provider participates in the customer routing**
  - **ACLs (Shared Router), Split Routing (Dedicated Router), GETVPN, MPLS.**

VPN Taxonomy

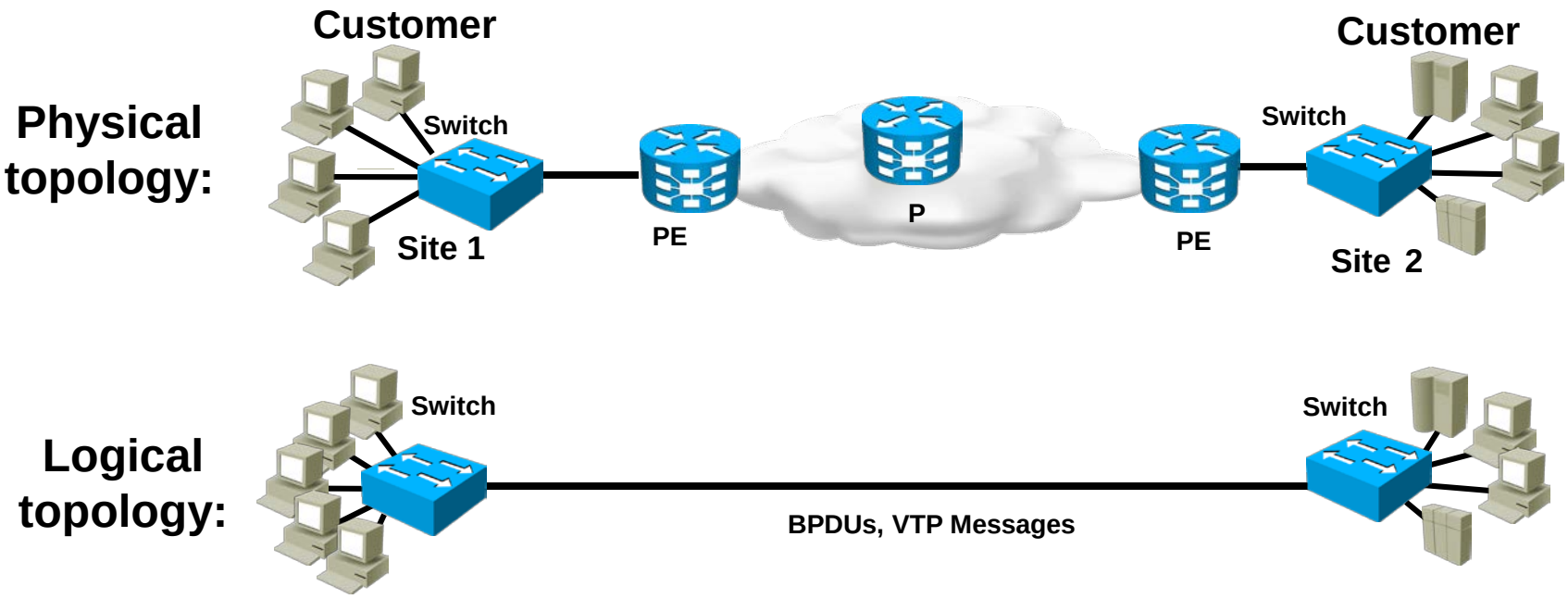


Layer 2 VPN

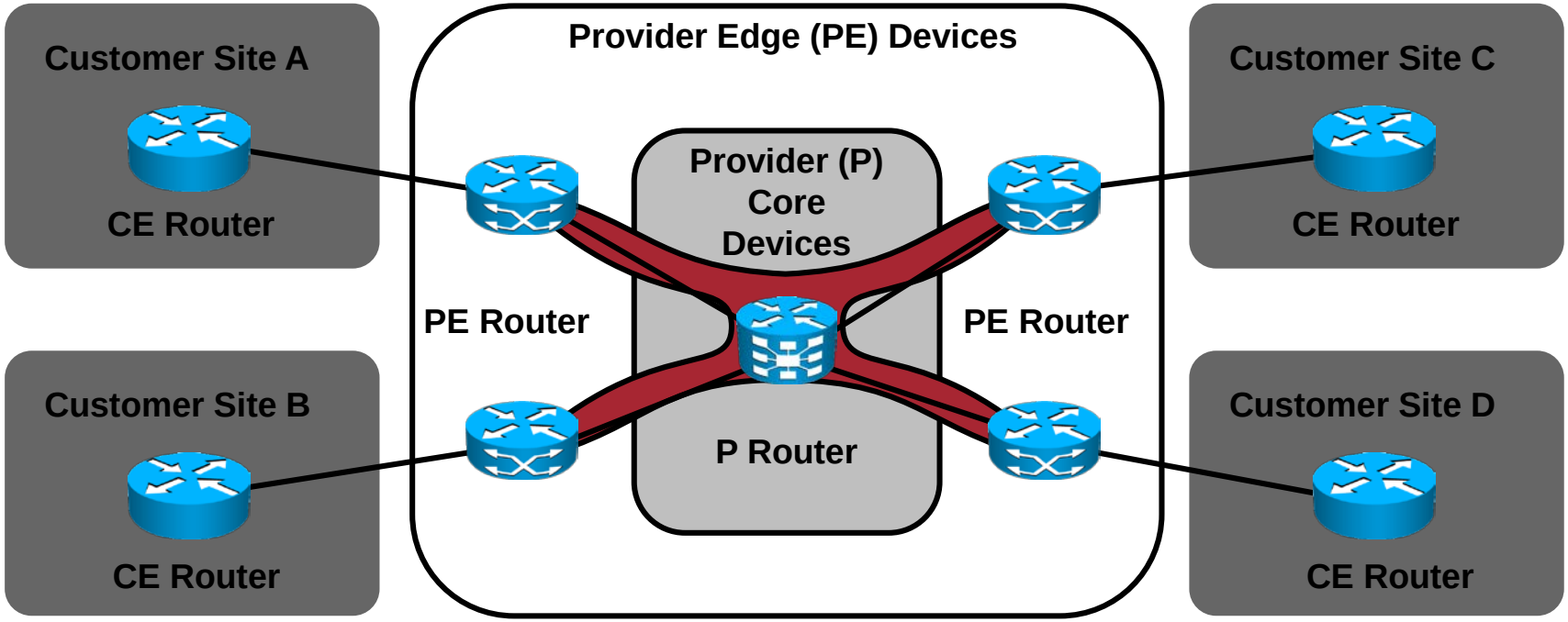
- **Single infrastructure for both IP and traditional services**
  - **Service providers:**
    - **Move legacy ATM and Frame Relay traffic to the MPLS or IP core without service interruption**
  - **Enterprises:**
    - **Optimize data center solution with WAN or MPLS transport**
    - **Improve high availability**
- **New Layer 2 tunneling services**
  - **Customer can have its own routing, QoS policy, and so on**
- **A migration step toward IP and MPLS VPN**

Metro Ethernet

- **Service provider emulates an IEEE Ethernet bridge network**



MPLS VPN



- CE routers route traffic to PE routers.
- Each customer has its own isolated routing table instance on PE router.
- P routers do not have customer route information.
- Label switching is enabled in service provider core.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