



# Introduction to WAN



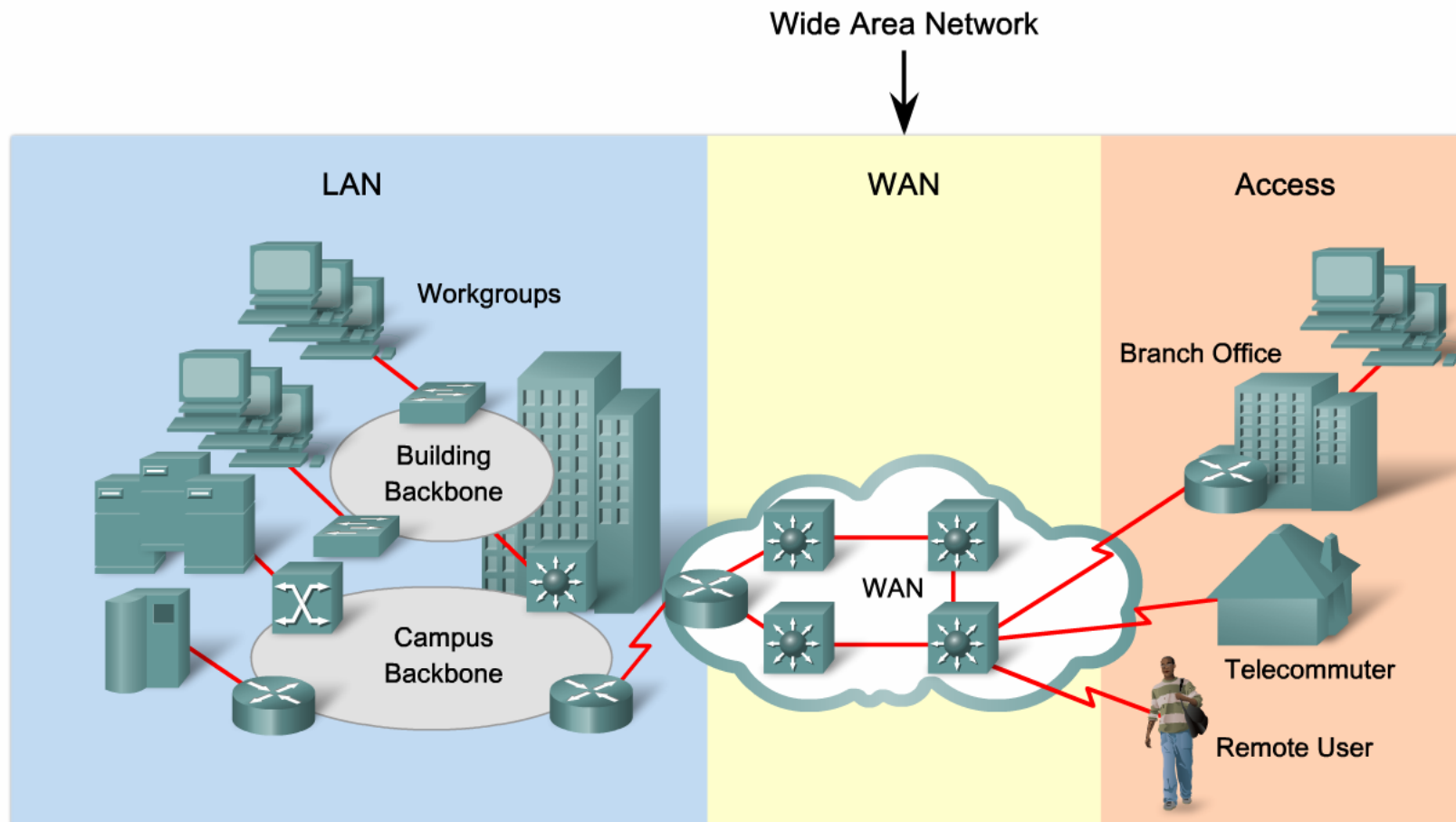
## Accessing the WAN – Chapter 1

# Objectives

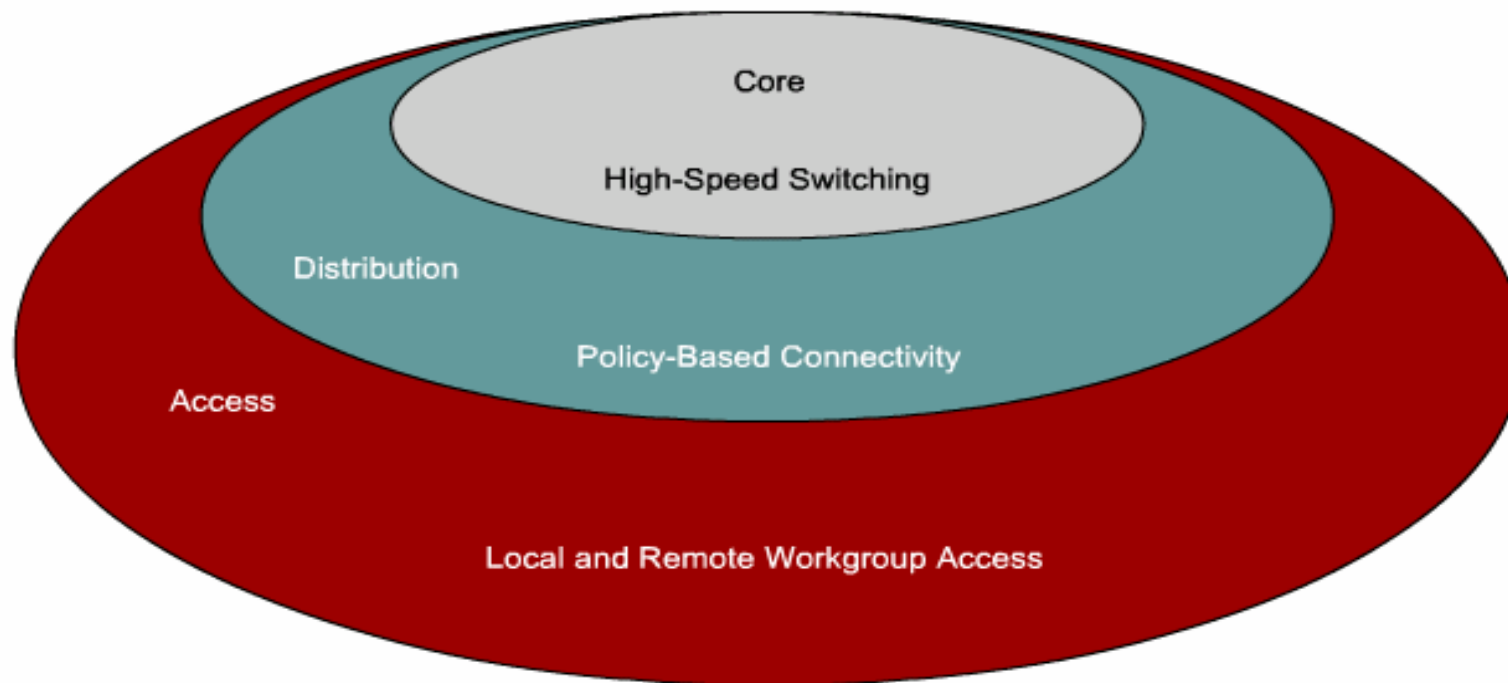
- Introduction to WAN
- WAN technology concepts
- Internet connection options

# The purpose and function of WANs

What is a WAN?



# The Hierarchical Design Model



**Access layer** - Grants user access to network devices.

**Distribution layer** - aggregates WAN connections at the edge of the campus and provides policy-based connectivity.

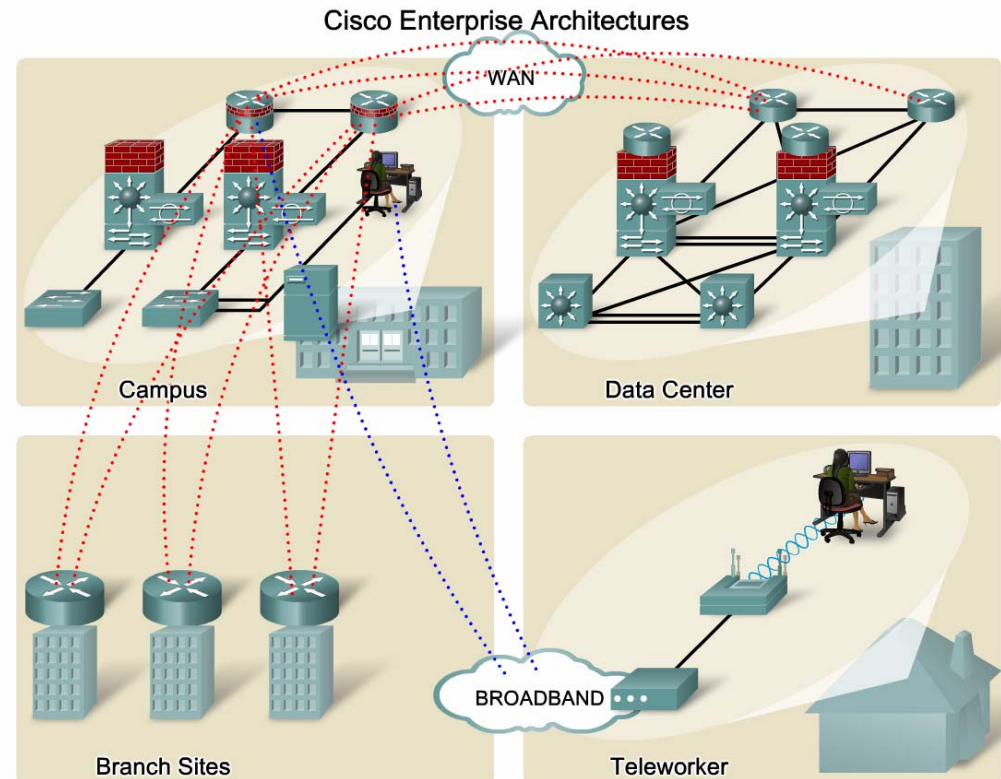
**Core layer** - high-speed backbone that is designed to switch packets as fast as possible.

# The Enterprise Architecture

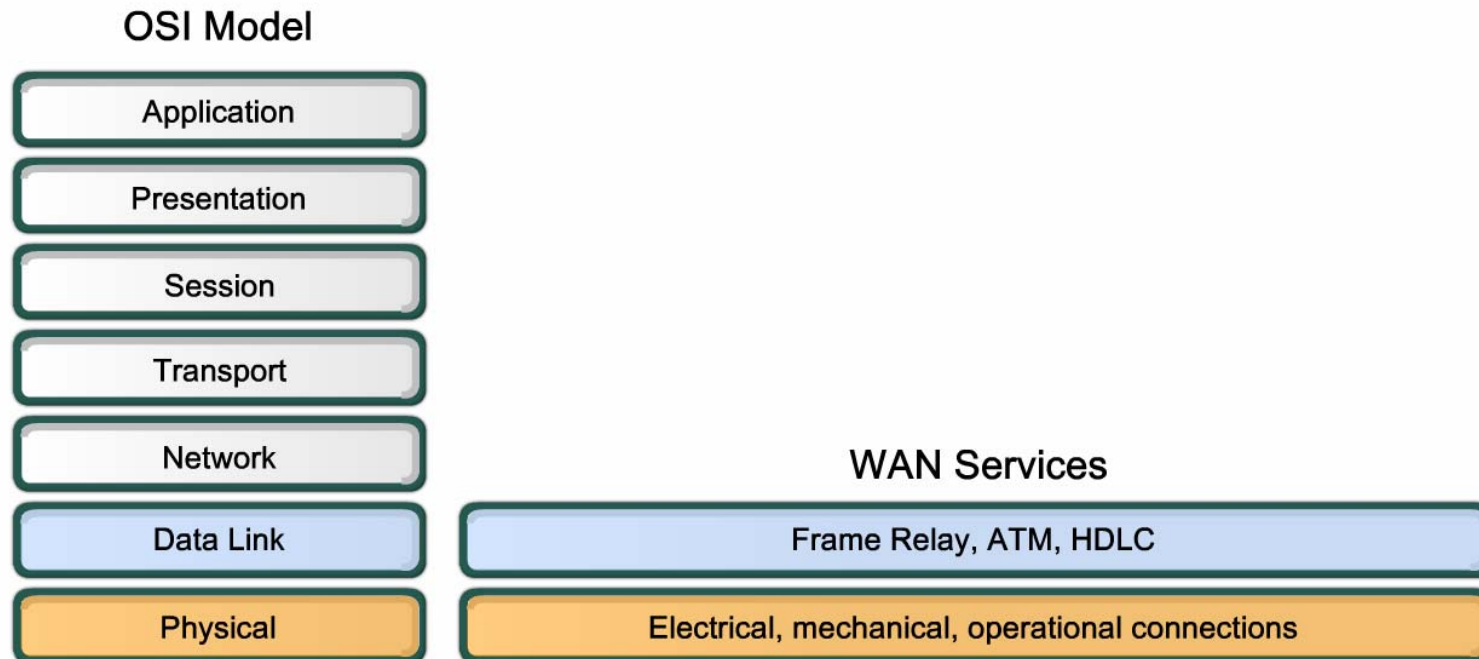
Different businesses need different types of networks.

Some examples of the modules:

- Enterprise Campus Architecture**
- Enterprise Branch Architecture**
- Enterprise Data Center Architecture**
- Enterprise Teleworker Architecture**

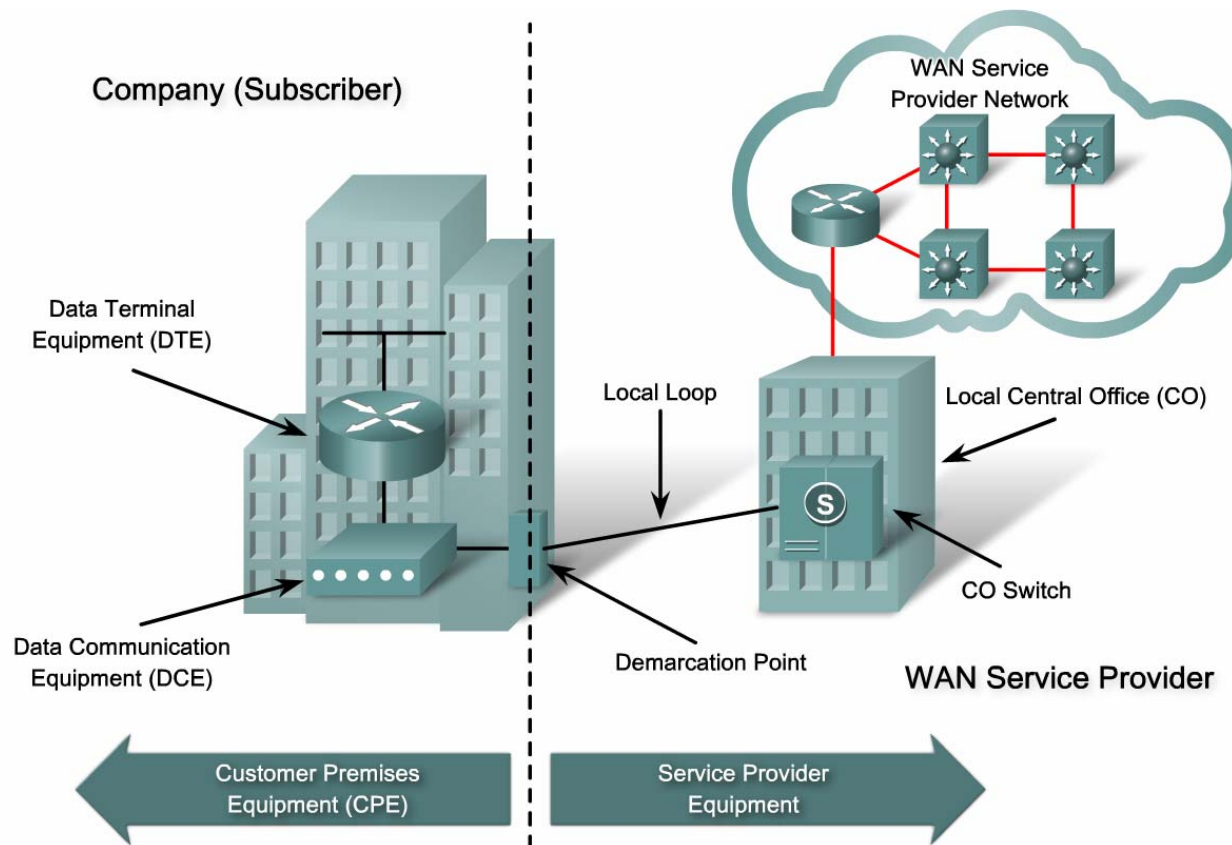


# Describe the Key WAN Technology Concepts



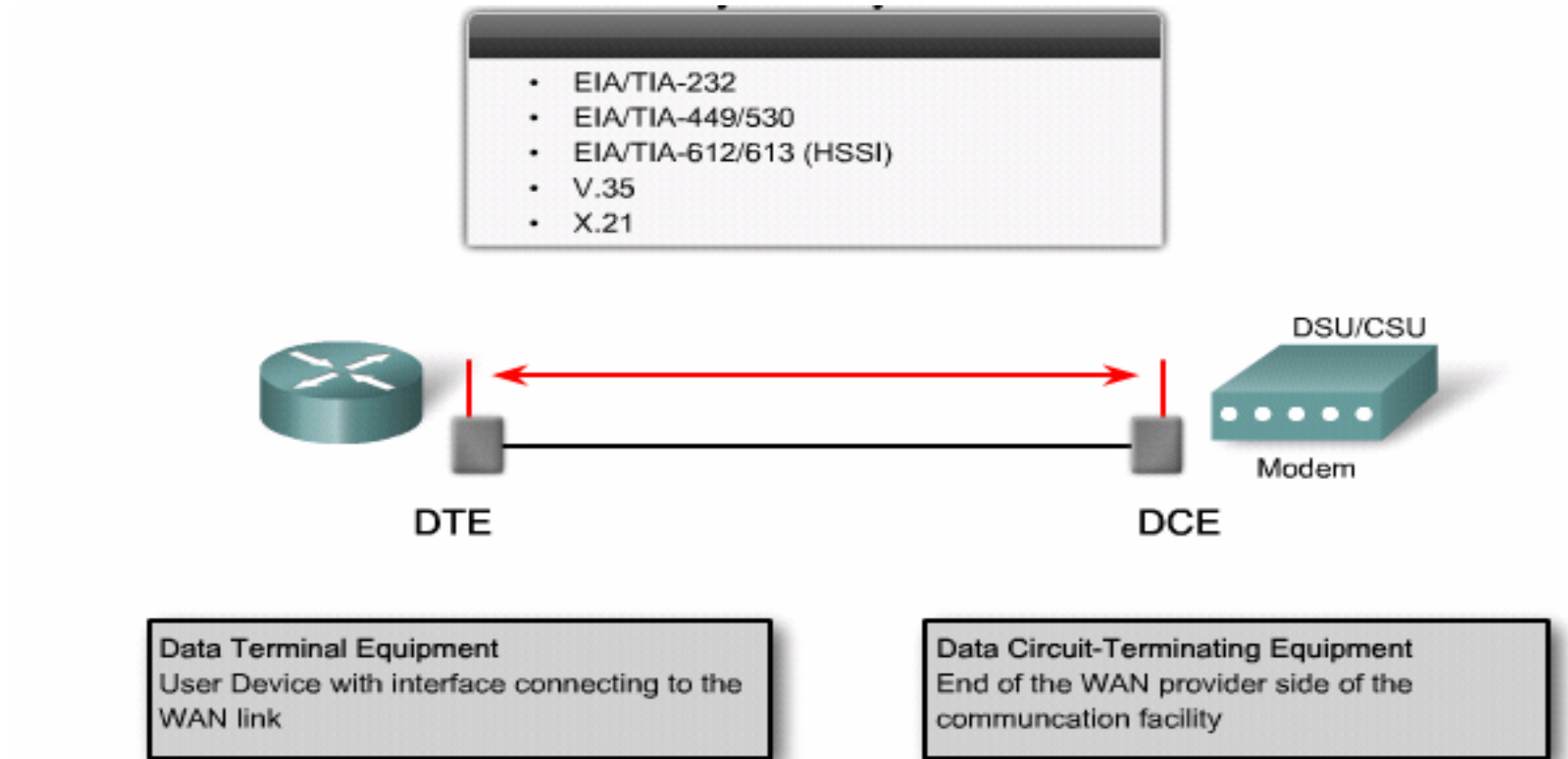
WAN operations focus primarily on Layer 1 and Layer 2.

# WAN Physical Layer Terminology



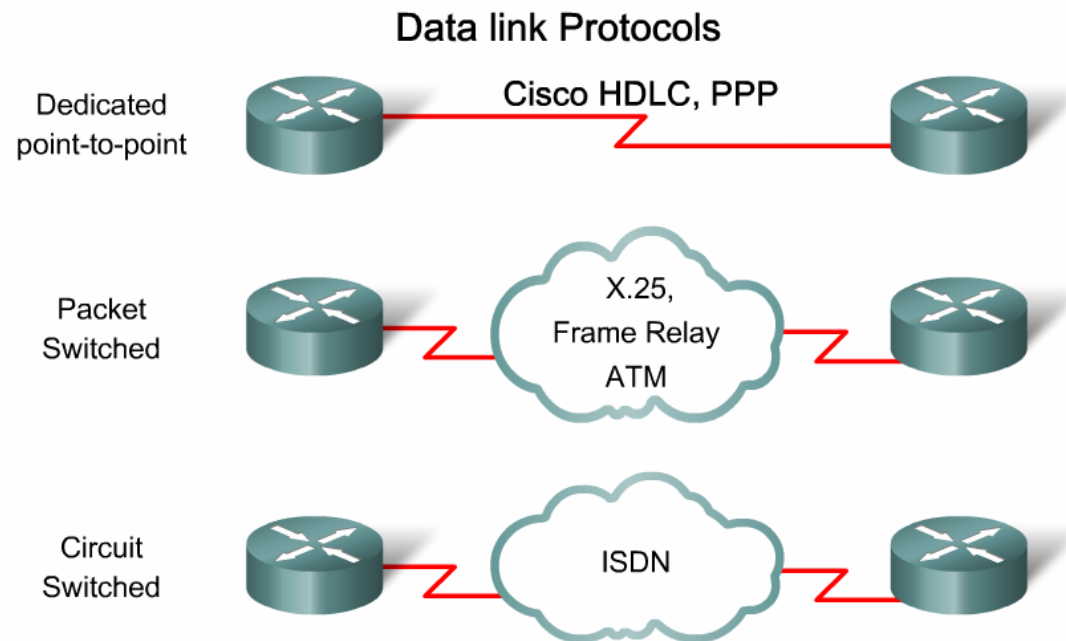
- Customer Premises Equipment
- Data Communications Equipment
- Data Terminal Equipment
- Demarcation Point

# WAN Physical Layer Standards



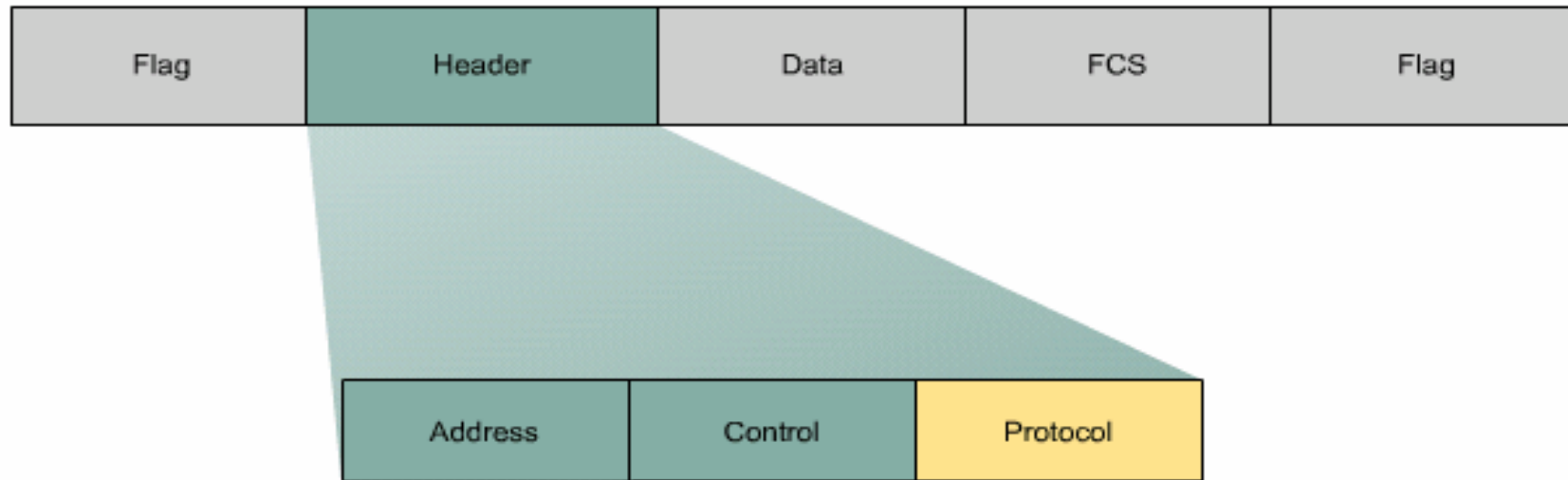


# WAN Data Link Layer Standards



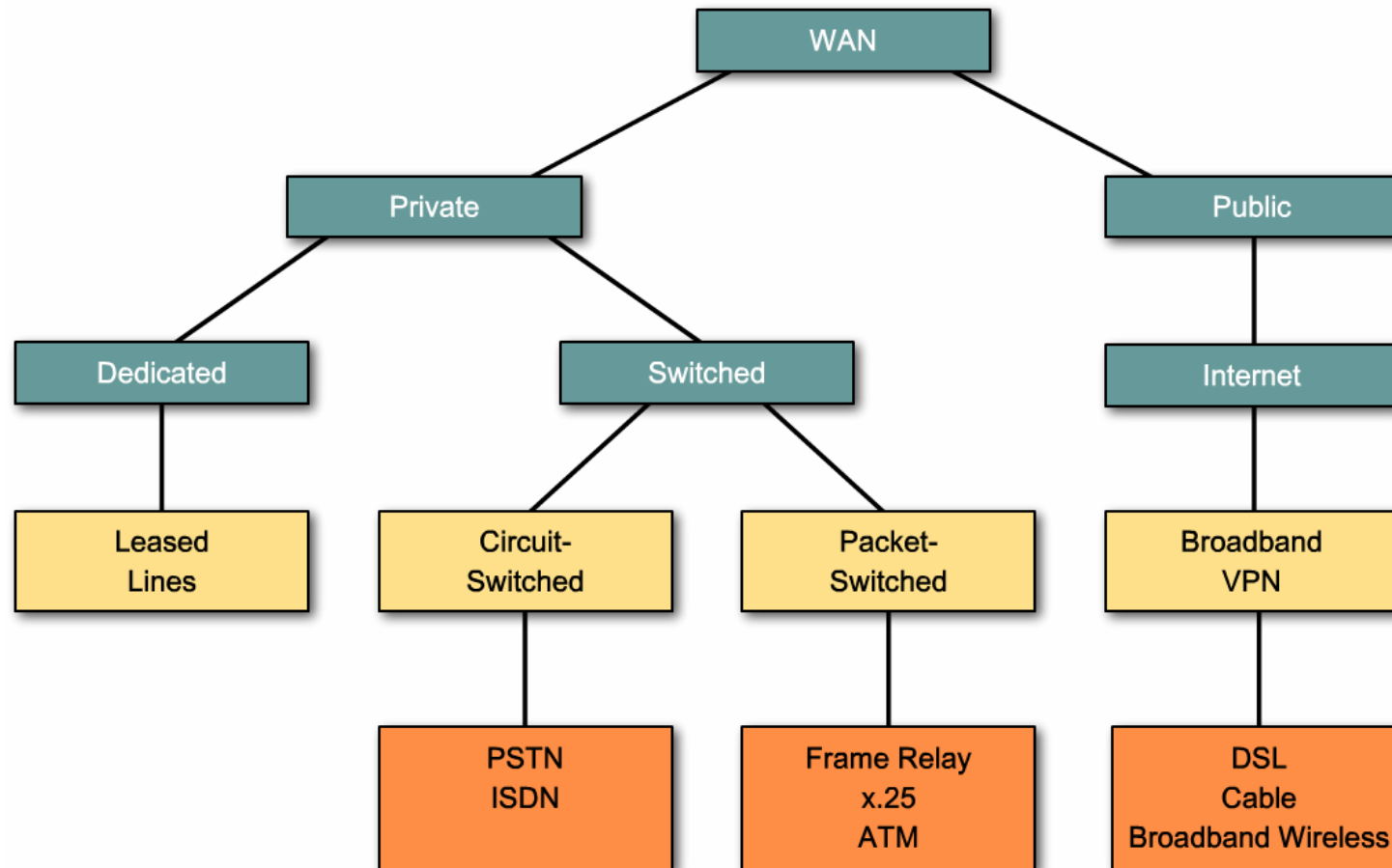
Protocol	Usage
Link Access Procedure Balanced (LAPB)	X.25
Link Access Procedure D Channel (LAPD)	ISDN D channel
Link Access Procedure Frame (LAPF)	Frame Relay
High-Level Data Link Control (HDLC)	Cisco default
Point-to-Point Protocol (PPP)	Serial WAN switched connections

# WAN Frame Encapsulation Formats

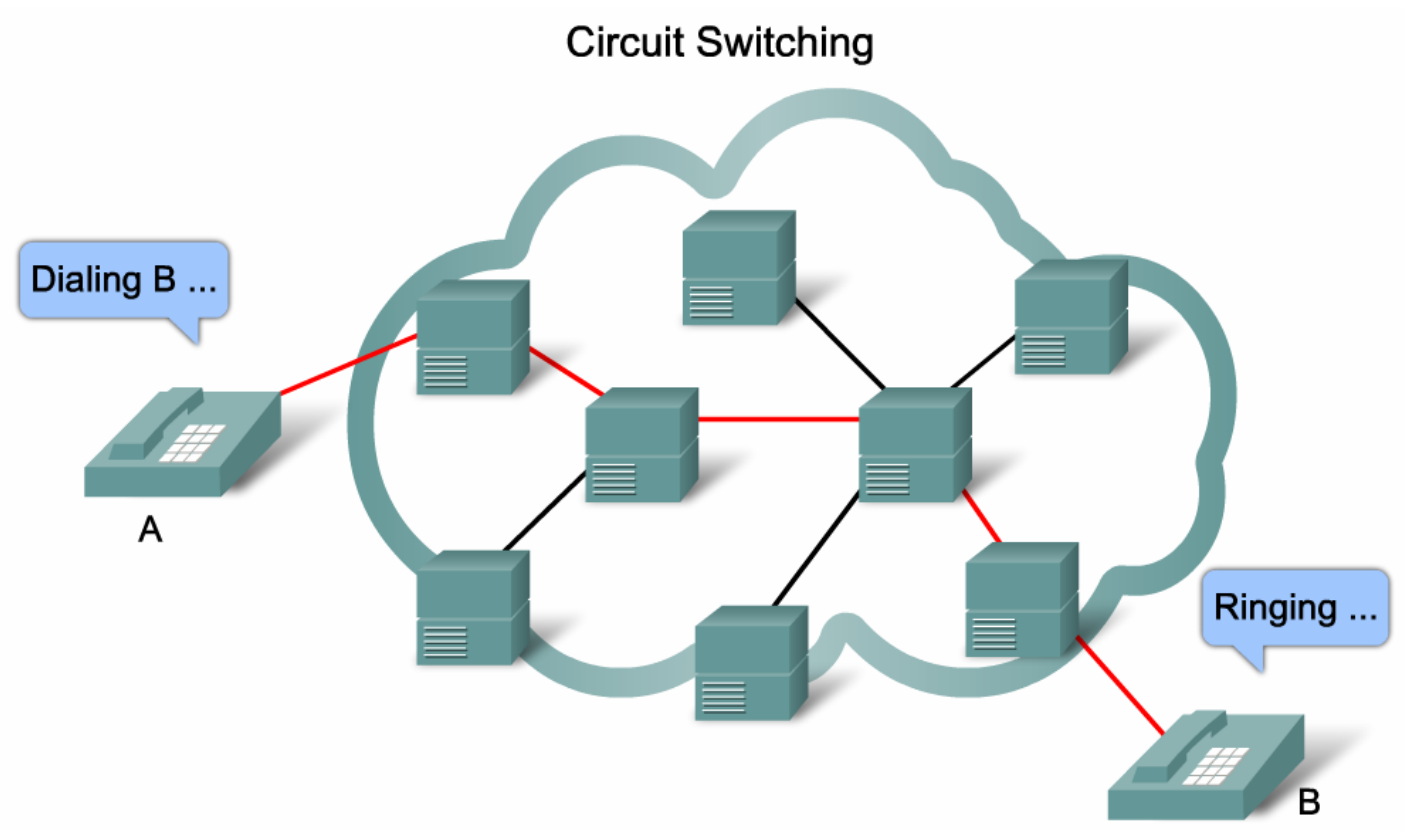


A WAN header address field is usually a broadcast address on a point-to-point link. The control field identifies the data portion as either information or control. The protocol field identifies the intended layer 3 protocol (e.g., IP, IPX).

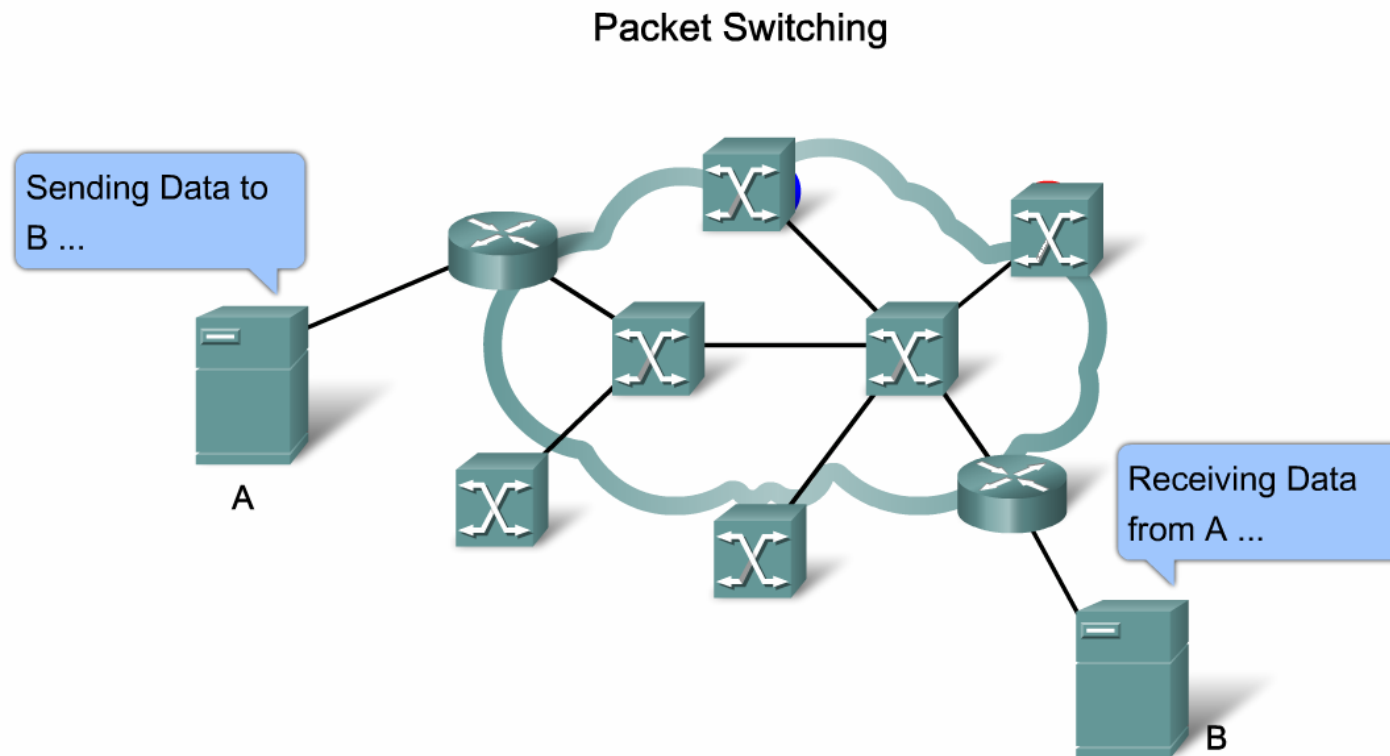
## Various options for connecting subscribers to the WAN



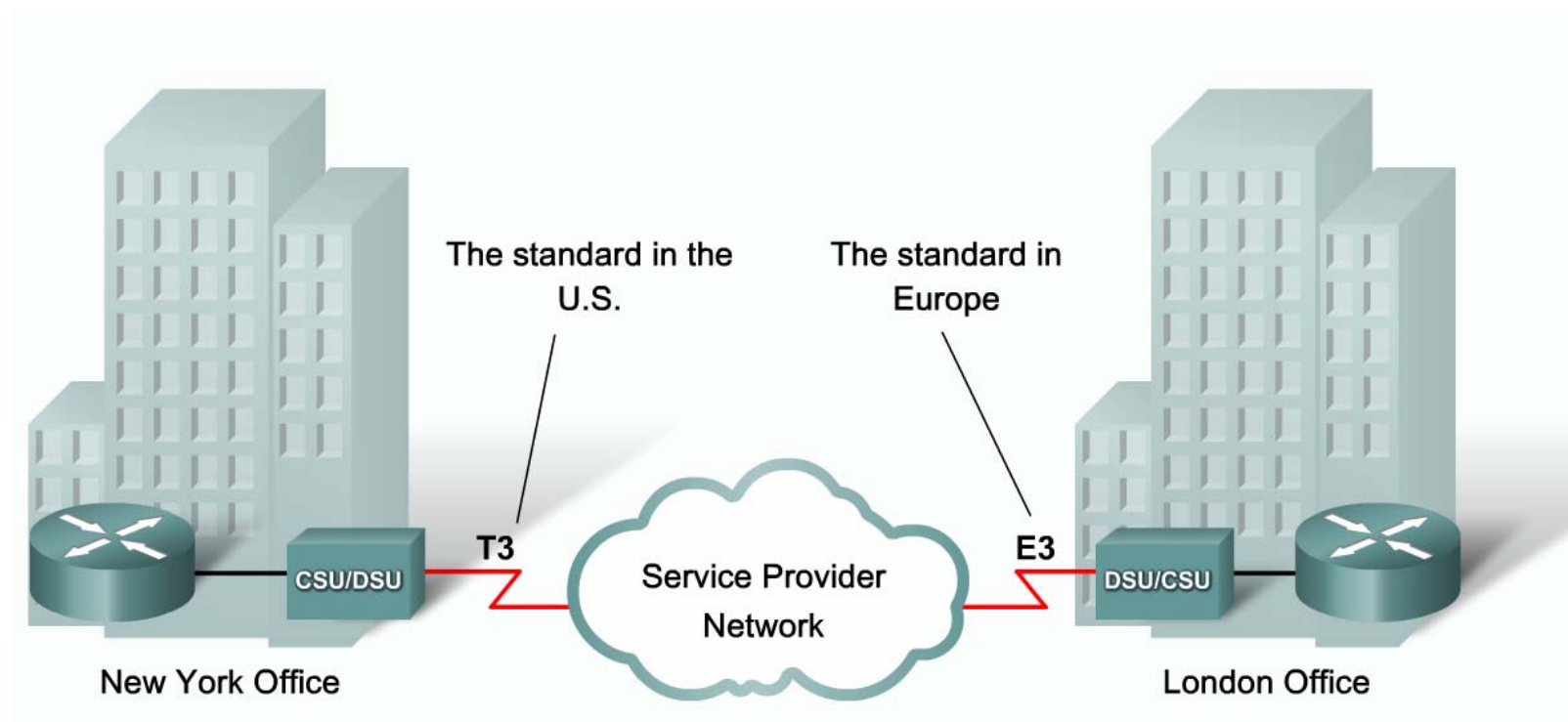
# Circuit Switching



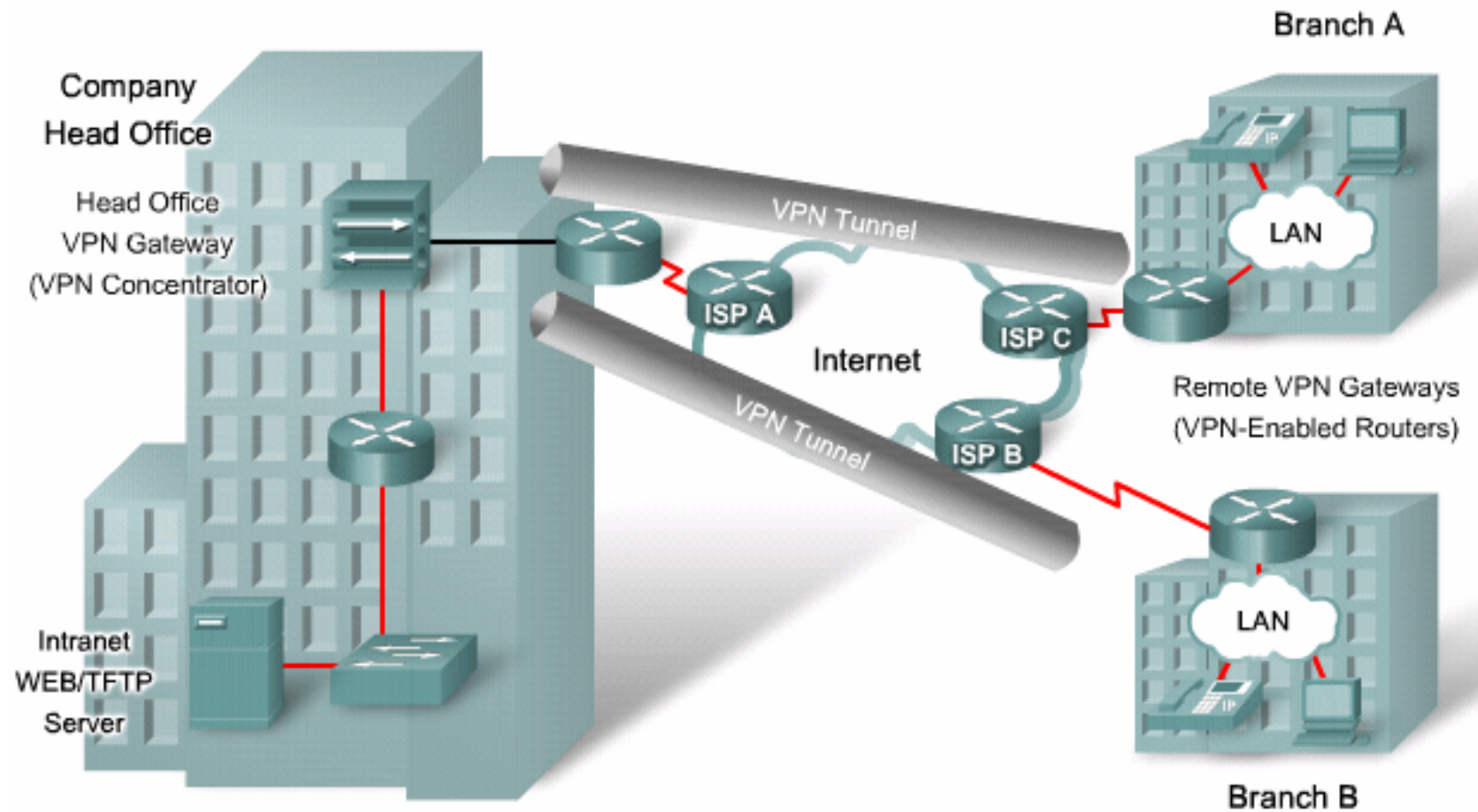
# Packet Switching



# Leased line



# VPN Technology



# Factors to consider when selecting a WAN connection

Option	Description	Advantages	Disadvantages	Sample protocols used
Leased line	Point-to-Point connection between two computers or Local Area Networks (LANs).	Most secure	Expensive	PPP, HDLC, SDLC, HNAS
Circuit switching	A dedicated circuit path is created between endpoints. Best example is dialup connections.	Less expensive	Call setup	PPP, ISDN
Packet switching	Devices transport packets via a shared single point-to-point or point-to-multipoint link across a carrier interwork. Variable length packets are transmitted over permanent virtual circuits (PVCs) or switched virtual circuits.(SVCs)		Shared media across link	X.25, Frame Relay



# Factors to consider when selecting a WAN connection (cont.)

Option	Description	Advantages	Disadvantages	Sample protocols used
Cell relay	Similar to packet switching, but uses fixed length cells instead of variable length packets. Data is divided into fixed-length cells and then transported across virtual circuits	best for simulated use of voice and data	Overhead can be considerable.	ATM
Internet	Connectionless packet switching using the Internet as the WAN infrastructure, uses network addressing to deliver packets. Because of security issues, VPN technology must be used.	Least expensive Globally available	Least secure	VPN, DSL, Cable-Modem, Wireless

# Summary

- A WAN is defined as
  - A data communications network that operates beyond the geographic scope of a LAN
- WAN primarily operate on layer 1 & 2 of the OSI model
- WAN technologies include
  - Leased line
  - ISDN
  - Frame relay
  - X.25
  - ATM

# Summary

- Cisco Enterprise Architecture
  - This is an expansion of the hierarchical model that further divides the enterprise network into
    - Physical areas
    - Logical areas
    - Functional areas
- Selecting the appropriate WAN technology requires considering some of the following:
  - WAN's purpose
  - Geographic scope of WAN
  - Traffic requirements
  - If WAN uses a public or private infrastructure

