

WAN Connection Options



- Multiple options are available for connecting geographically dispersed offices together.
- Not all options are available in all locations.
- What is commonly used in one region may be considered legacy in another.
- Different providers may use different terminology. I'll use the terminology used by Cisco for the CCNA exam.

Primary WAN Connectivity Options

- Leased Line
- MPLS Multi Protocol Label Switching
- Satellite

- The service provider will typically provide an SLA (Service Level Agreement) with guarantees for uptime and traffic delay and loss on the link.

Primary WAN Connectivity Options



- Leased lines and Satellite can be used for connectivity to the Internet, for direct connectivity between offices, and/or connectivity between offices over VPN.
- MPLS uses a shared core infrastructure at the service provider. It can be used for connectivity to the Internet and/or connectivity between offices over VPN.

Optical Fiber



- Optical fiber is more suitable for long distances than copper wire
- It is commonly used for service provider backhaul connections, but can also be offered to their customers
- FTTx services:
 - Fiber to the Home
 - Fiber to the Premises
 - Fiber to the Building
 - Fiber to the Neighborhood

SONET and SDH



- SONET (in North America) and SDH (rest of the world) are the standards used in service provider optical fiber networks

SONET STS	SONET OC	SDH STM	Bit Rate Mbps
STS-1	OC-1		51.84
STS-3	OC-3	STM-1	155.52
STS-12	OC-12	STM-4	622.08
STS-48	OC-48	STM-16	2488.32
STS-192	OC-192	STM-64	9953.28

DWDM Dense Wavelength Division Multiplexing

- DWDM combines ('multiplexes') multiple optical signals into one optical signal transmitted over a single fiber strand
- Each signal is assigned a different wavelength
- DWDM allows more capacity to be added to existing infrastructure without expensive upgrades
- DWDM is used in all modern long haul optical connections

Dark Fiber



- Many service providers laid optical fiber cabling in the past and then found they didn't require it
- DWDM was a major reason for this
- The unused cabling can be offered to customers as 'Dark fiber'

WAN Backup and Small Office Solutions

- Less expensive options often aimed at home user Internet access can be used as Internet VPN WAN backup options in corporate environments
- There will typically be no corporate level SLA with these services
- These can be used as the primary WAN connection method to the corporate network from smaller offices and for home users
 - DSL Digital Subscriber Line
 - Cable
 - Wireless eg 4G

Legacy WAN Connectivity Options



- PSTN Public Switched Telephone Network
- ISDN Integrated Services Digital Network
- Frame Relay
- ATM Asynchronous Transfer Mode
- X.25

Interface Cards



- Routers will typically come with on-board Ethernet ports. Additional Ethernet interface cards can be added
- Ethernet is often used for WAN connections today
- Other WAN interfaces are modular and fit into a spare slot on the router
- There are many different types of WAN interface card
- Part numbers for different cards can be very similar
- Different cards are compatible with different router platforms
- Be careful when selecting your card!

Interface Card Examples



WIC-2T Serial
1700 and 2600



HWIC-2T Serial
1800, 1900, 2800,
2900, 3800, 3900 ISR



NIM-2MFT-T1/E1
4000 ISR
TDM Data & Voice



NIM-VAB-A
4000 ISR
DSL