



# Describing FTP, TFTP, Telnet, SSH and Ping

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CCIE Routing & Switching



# Video Overview

- Describe what FTP does
- Describe what TFTP does
- Describe what Telnet does
- Describe what SSH does
- Describe what Ping does

# Protocols Functionality Overview

▶ These five protocols can be broadly categorized as:

- Protocols designed to upload/download files
  - ✓ FTP
  - ✓ TFTP
- Protocols designed to allow a user to login to the CLI of a device.
  - ✓ Telnet
  - ✓ SSH
- Protocols designed to verify IP reachability to a device
  - ✓ Ping

# File Transfer Protocol (FTP)

- ▶ Used to transfer files between devices on a network.
- ▶ Resides at Layer-7 (Application-Layer) of OSI Model
- ▶ Utilizes **TCP** at Layer-4 of OSI Model.
- ▶ Built-into many web browsers.
- ▶ Client/Server Architecture
  - Logging-in
  - Anonymous FTP

# TCP and FTP

## ▶ FTP utilizes two TCP connections

- Control Connection
- Data Connection

## ▶ Control Connection

- TCP connection that is created when an FTP session is established.
- Used only for passing control information, such as FTP commands and replies.
- FTP Server passively listens for Control Connections on **TCP port 21**

## ▶ Data Connection

- A distinct TCP data connection established between server and client to transfer data.
  - ❑ “Active” FTP: Server initiates TCP Data Connection using (source) **TCP port 20.**
  - ❑ “Passive” FTP: Client initiates TCP Data Connection, ephemeral ports used in both directions.

# Trivial File Transfer Protocol (TFTP)

- ▶ Used to transfer small files between devices on a network.
- ▶ Resides at Layer-7 (Application-Layer) of OSI Model
- ▶ Utilizes **UDP** at Layer-4 of OSI Model (**Port-69**).

```
Router-3#copy tftp flash:
Address or name of remote host [1.1.1.2]?
Source filename [c1841-advipservicesk9-mz.124-24.T6.bin]?
Destination filename [c1841-advipservicesk9-mz.124-24.T6.bin]?
Accessing tftp://1.1.1.2/c1841-advipservicesk9-mz.124-24.T6.bin...
Loading c1841-advipservicesk9-mz.124-24.T6.bin from 1.1.1.2 (via FastEthernet0/0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

# TFTP and FTP Compared

- ▶ FTP includes a rich set of commands to allow files to be sent, received, renamed, deleted and so forth.
- ▶ TFTP only allows files to be sent and received.
- ▶ FTP allows many data representation options.
- ▶ TFTP allows only simple ASCII or binary file transfers.
- ▶ TFTP allows no login or authentication mechanisms.



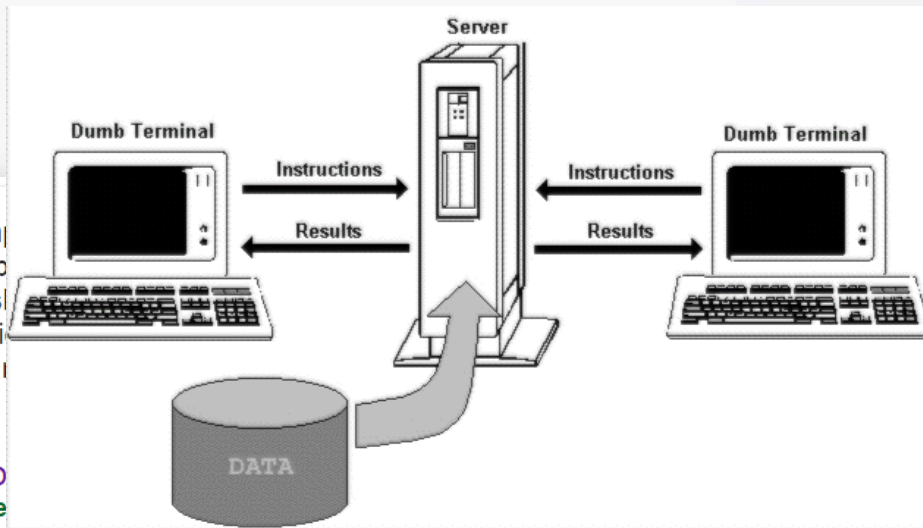
# What is Telnet?

► Prior to Telnet: Dumb terminals were used to connect to the Shell of a device.

- What is a “Shell”?

**Shell (computing)** ... In computing, a shell is a user interface for access to an operating system's general-purpose command line interface (CLI) or graphical user interface (GUI), depending on a computer's architecture.

Shell (computing) - Wikipedia  
[https://en.wikipedia.org/wiki/Shell\\_\(computing\)](https://en.wikipedia.org/wiki/Shell_(computing))



**Telnet was the answer to this question: How can we provide a user the same ability to interact with the Shell, if their terminal is not directly-connected to the Computer Periphery but instead only reachable remotely over an IP connection?**

# Telnet Facts

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- ▶ Telnet defined in RFC 854
- ▶ TCP-based (Port-23)
- ▶ Used to access the CLI of remote devices over an IP connection.
- ▶ Typically creates small packets
- ▶ Data in IP packets sent in clear-text

# How does it actually work?

- ▶ When Telnet is invoked in a system, both sides (Host and Process within a Server) of the connection are “assumed to originate and terminate at a “Network Virtual Terminal”, or NVT
- ▶ Telnet sends/receives two things:
  - Data (either stuff you type or output from the process Shell)
  - Negotiated Options (things that dictate how the NVT will be displayed and act)

# SSH

- ▶ Secure Shell
- ▶ Same objective as Telnet but encrypted (secure)
- ▶ Authenticates using passwords or SSH keys.
  - Matching set of cryptographic keys which can be used for authentication.
- ▶ Uses **TCP port-22**
- ▶ SSH requires IOS images that support IPsec DES (SSH version-1) or 3DES (SSH version-2)
  - Typically look for a “k9” in IOS image name.

# Ping

- ▶ Packet Internet Groper (PING)
- ▶ Used to test IP reachability to remote devices
- ▶ Utilizes ICMP (Internet Control Messaging Protocol)
- ▶ Ping utilizes two ICMP Message Types:
  - Echo Request
  - Echo Reply