FTP & TFTP

file/trivial file transfer protocol: industry standard protocols used to transfer files over a network, use a client-server model, Can be used in the process of upgrading OS of a network device to download a newer version of IOS from a server and then reboot the device with the new IOS image.

TFTP: allows a client to copy a file to or from a server, no authentication (username/pass), no encryption, used in a controlled environment to transfer small files quickly, TFTP servers listen on UDP port 69, TFTP has connection and reliability features within the protocol itself.
Every TFTP message is acked, if client is transferring a file to a server, the server will ack and if the server is transferring to the client, the client will ack.
Timers are used if the expected message is not received in time to re-send its previous message.
Lock-step communication: the client and server send a message and then wait for a reply + retransmissions are sent as needed.
TFTP has 3 phases: 1- connection → client sends request to a server and the server responds back initiating connection.
2- data transfer: the client and server exchange TFTP messages, one sends data and the other sends acks.
Connection termination: after the last data message has been sent a final ack is sent to terminate the connection.
TFTP first message to server use dest port of 69, then both client and server use random ports.
TID → Transfer ID (the random ports tftp use).

FTP: uses TCP ports 20 and 21, usernames and passwords ar used for authentication with no encryption, for greater security FTPS (FTPover SSL/TLS)/ FTP secure is used, SFTP/SSHFTP can also be used for greater security.
FTP is more complex allowing clients to navigate file directories and remove directories, list file,..etc using FTP commands.
FTP uses 2 types of connections: FTP control using TCP 21 to send FTP commands and replies, FTP data connections using TCP 20.
FTP active mode data connections: the server initiates the TCP data connection which is default.
In FTP passive mode: the client initiates the data connection, if the client is behind a firewall, the firewall won't permit outside devices to initiate connections.

IOS file-systems: it's a way of how data is stored and retrieved, use
Disk: storage devices as flash memory, where IOS itself is stored.
Opaque: for internal functions: used for specific internal functions, logical internal systems not actual separate storage devices.
NVRAM: startup-config.
Network: external file systems as ftp/tftp servers.
The client always initiates the control connection.
Copying a file into NVRAM completely overrides it while to DRAM merges it.

Command: show file systems. **Command: show flash. Command: tftp: flash:. Command: ftp: flash:.**
Command: boot system <filepath> if this command is not used the router will boot using the first IOS it finds on flash.
Command: reload. To restart the device. **Command: delete <filepath>.**
Command: ip ftp username <username>. Command: ip ftp password <pass>.
Command:copy running-config tftp.
Command:copy tftp startup config.