10.5.9 NTP Facts

The Network Time Protocol (NTP) is used to synchronize system time between computers over a network connection.

This lesson covers the following topics:

- How NTP works
- NTP files and utilities
- General considerations

How NTP Works

NTP uses a hierarchy of clocks and computers for synchronizing the current time. NTP:

- Gradually synchronizes time in increments.
- Allows computers to be a time consumer and a time provider simultaneously, allowing computers to synchronize time hierarchically.
- Runs on IP port 123.
- Uses strata to define time providers in a hierarchy (levels of time providers):
    - Stratum 0 devices are accurate clocks (such as atomic clocks) that provide the official UTC time.
    - Stratum 1 devices get their time from Stratum 0 devices.
    - Stratum 2 devices receive their time from stratum 1 devices, and can also provide time to other devices.
- Supports up to 256 strata, with lower devices getting time from higher devices and providing time to devices in a lower stratum.
- Can be configured to use a pool of time servers at **pool.ntp.org**.
- Uses stepping to quickly make large adjustments to close wide time discrepancies; usually about once every 60 seconds.
- Uses slewing to make smaller incremental time adjustments at a rate of about every 15 - 17 minutes. Slewing occurs when time discrepancies are under 128ms.
- Does not adjust time when time discrepancies are larger than 17 minutes. This is known as insane time.
- Logs time synchronization events in:
    - The **/var/log/ntp** file on init-based distributions.
    - In the system journal on systemd distributions.

NTP Files and Utilities

Use the following files and utilities to manage time using the NTP:

Command or File	Function	Examples
/etc/ntp.conf	Configures the time providers where the ntpd daemon should get its time from. - Each entry in the file begins with **server** followed by the address of the time provider. - The **server 127.127.1.0** entry identifies the local host address and sets the system time to the hardware clock if no other time providers are available.	**server 0.fedora.pool.ntp.org** synchronizes the time with the Fedora time server pool. **server 192.168.1.10** synchronizes the time with a computer at the specified IP address. **server 127.127.1.0** synchronizes the time with the hardware clock on the local computer.
ntpdate	Updates the current time on a computer. **ntpdate** must be run as root; it will not function if the ntpd daemon is currently running. **ntpdate** is deprecated; use **ntpd** in its place.	**ntpdate 0.pool.ntp.org** updates the system time using a time provider from the NTP pool.
ntpd	Manages the NTP daemon from the command line. Options include: - **-q** does a one-time synchronization with a time provider. It is similar to **ntpdate**. - **-g** allows the NTP daemon to ignore insane time restrictions for the first synchronization. - **-c** specifies the name and path of the configuration file. The default is **/etc/ntp.conf**.	**ntpd -qg** updates the current time on the computer and ignores insane time restrictions. **ntpd -c ~/ntp/ntpconfig.txt** changes the configuration file that NTP uses to *~/ntp/ntpconfig.txt*.
rcntp start (init) or **systemctl start ntpd** (systemd)	Starts the NTP daemon.	**systemctl start ntpd** starts the NTP daemon.

insserv ntp (init) or **systemctl enable ntpd** (systemd)	Configures the NTP daemon to start at boot time (BSD systems only.)	**systemctl enable ntpd** starts the NTP daemon automatically on system boot.
ntpq -p	Queries the status of the NTP daemon. The output displays the following information for each time provider: • **remote** specifies the IP address of the current time provider. • **refid** specifies the type of the time provider. • **st** shows the stratum of the time provider. • **when** shows the last synchronization time. • **poll** shows the synchronization interval. • **reach** lists the last time NTP queried the time provider. • **delay** displays the network lag time between the time provider and the client (in milliseconds). • **offset** specifies the time difference between the local system clock and the time provider (in milliseconds). • **jitter** specifies the size of time discrepancies (in milliseconds).	**ntpq -p** displays the status of the ntpd daemon.
ntptrace	Traces how the time consumer receives time from the provider. It lists the time provider's name, its stratum, and its time offset from the system clock on the local system.	**ntptrace** traces how the time consumer is receiving time from the provider.

General Considerations

Keep the following in mind when working with NTP:

- To view events as the NTP daemon starts:
  - Use one terminal to start the daemon, and use another terminal with the **tail** command to view the daemon log at **/var/log/ntp** on init-based distributions.
  - Use one terminal to start the daemon, and use another terminal with the **journalctl -f** command running on systemd-based distributions.
- The time used by the computer is adjusted to account for network delay and other inaccuracies detected in the received time. The amount of error that the algorithm identifies is called the drift. The drift is calculated over time and typically saved on the computer to quickly identify accurate time, compensated by the drift amount.
- The computer continues to poll the time servers to ensure that the system time remains synchronized.
- If configuration changes are made to the **/etc/ntp.conf** file, those changes won't take effect until the NTP daemon is restarted using the **systemctl restart ntpd** command.