# **37. NTP**

## **Why is Time Important for Network Devices?**

* All devices (routers, switches, PCs, etc.) have an **internal clock**.
* In Cisco IOS, you can view the time with the show clock command.
* Use the show clock detail command to see the **time source**.
* The **internal hardware clock** of a device will drift over time, making it **not an ideal time source**.
* Accurate time is crucial for **troubleshooting logs**.
* **Syslog**, the protocol for keeping logs, will be covered later.
* Command: show logging
* Example: R3’s timestamp is different from R2’s.

## **Manual Time Configuration**

* Configure time manually with the clock set command.
* The **hardware clock** (built-in) and **software clock** are separate and can be configured independently.

### **Hardware Clock (Calendar) Configuration**

* Manually configure the **hardware clock** with the calendar set command.
* Synchronize the clock and calendar:
  + clock update-calendar (syncs calendar to clock)
  + clock read-calendar (syncs clock to calendar)

## **Configuring the Time Zone**

* Configure the time zone using the clock timezone command.

### **Daylight Saving Time (Summer Time)**

Example command:  
 R1(config)# clock summer-time EDT recurring 2 Sunday March 02:00 1 Sunday November 02:00

* 2 Sunday March 02:00 -> Start of DST 1 Sunday November 02:00 -> End of DST
* Specifies the start and end of daylight savings.

## **Summary of Commands**

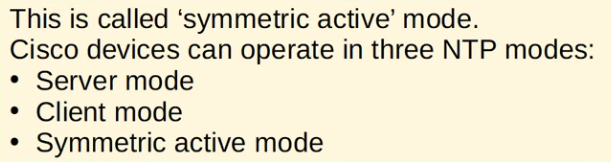
* Commands for checking, setting, and syncing time are available.

## **NTP Basics**

* **Manual time configuration is not scalable**.
* Clocks will drift, leading to **inaccurate time**.
* **NTP (Network Time Protocol)** allows automatic synchronization of time over a network.
* **NTP clients** request time from **NTP servers**.
* A device can function as both an **NTP client and an NTP server**.
* Accuracy:
  + **~1ms** if the NTP server is in the same LAN.
  + **~50ms** over a WAN or the Internet.
* **NTP servers are ranked by stratum levels**.
* **NTP uses UDP port 123** for communication.

### **Reference Clock**

* A **Reference Clock** is a highly accurate time source (e.g., Atomic Clock, GPS Clock).
* **Stratum 0**: Reference Clocks.
* **Stratum 1**: NTP servers directly connected to Reference Clocks.
* **Stratum 2-15**: Get their time from the servers one stratum level above



* NTP clients can sync to multiple servers.

## **NTP Configuration**

Configure an NTP client/server:  
 R1(config)# ntp server <server-ip>

R1(config)# ntp peer <peer-ip>

* Use prefer to set a **preferred NTP server**.

Show configured servers:  
 R1# show ntp associations

* **sys.peer** indicates the currently synchronized server.
* **st** (Stratum Tier) shows the server’s stratum level.

Show NTP status:  
 R1# show ntp status

* Synchronizing with **Google (Stratum 1)** results in a **Stratum 2** status.

Sync the hardware clock with NTP:  
 R1(config)# ntp update-calendar

* The hardware clock retains time even if the device restarts.

## **Configure a Loopback Interface for NTP**

* Why use a **Loopback Interface**?
  + If a physical interface goes down, the NTP server is still accessible.

Example:  
 R1(config)# interface Loopback0

R1(config-if)# ip address 192.168.1.1 255.255.255.0

Set R2’s NTP server as R1’s **loopback interface**:  
 R2(config)# ntp server 192.168.1.1

* Set R3’s NTP sources as R1 and R2.
* **R1 has preference because it is a lower stratum level than R2 (Closer to the source)**.

## **Configuring NTP Server Mode**

Convert a device into an **NTP Server**:  
 R1(config)# ntp master 2

* + 2 represents **Stratum 2**.
  + Lower stratum numbers indicate a more accurate time source.
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## **Configuring NTP Symmetric Active Mode**

Command:  
 R2(config)# ntp peer <peer-ip>

* **Peering allows two devices to synchronize with each other**.

## **Configuring NTP Authentication**

* **NTP Authentication is optional but enhances security**.

Steps to configure authentication:  
 R1(config)# ntp authenticate

R1(config)# ntp authentication-key 1 md5 MySecureKey

R1(config)# ntp trusted-key 1

R1(config)# ntp server <server-ip> key 1