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**Welcome  
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Network for you  
NTP**



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## NTP (Network time protocol):

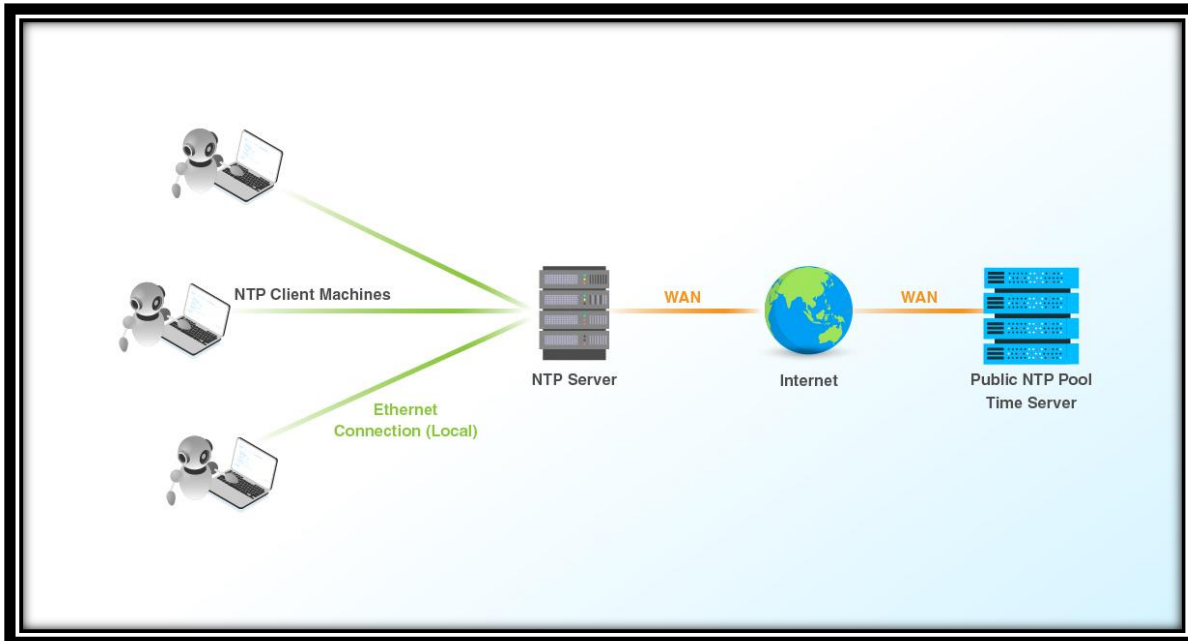
- NTP stand for Network Time Protocol.
- NTP is use to provide time.
- NTP is used to allow network devices to synchronize clocks with central source clock.
- NTP is very important for network devices like routers, switches, server and firewalls.
- NTP make sure logging information and timestamps have the accurate time and date.
- NTP is runs over User Datagram Protocol (UDP).
- NTP is a protocol used on networks to maintain clock time.
- NTP uses a hierarchical system of time sources.
- NTP used client server architecture to work.
- NTP uses UDP port number 123.
- NTP have two version NTP Version 3 and Version 4.
- NTP Server is also called as NTP Master.
- CISCO Router and Switch can be configured in three modes Server, Client and Server/Client Mode.
- By default router works in NTP Server/Client mode.
- Stratum defines the reliability and accuracy of NTP source.
- NTP uses of stratum 0 to Stratum 15 for NTP Sources.
- One (1) is the most reliable and 15 are the worst NTP sources.
- Stratum 0 represents Atomic Clock and not used in CISCO Router or Switch.
- Stratum 1 to 15 are valid levels and used in CISCO Router and Switches.
- Stratum 16 represents NTP is not synchronized.
- Default stratum level of CISCO Router or Switches internal clock is 8.
- Syslog messages timestamp using the Network Time Protocol (NTP).



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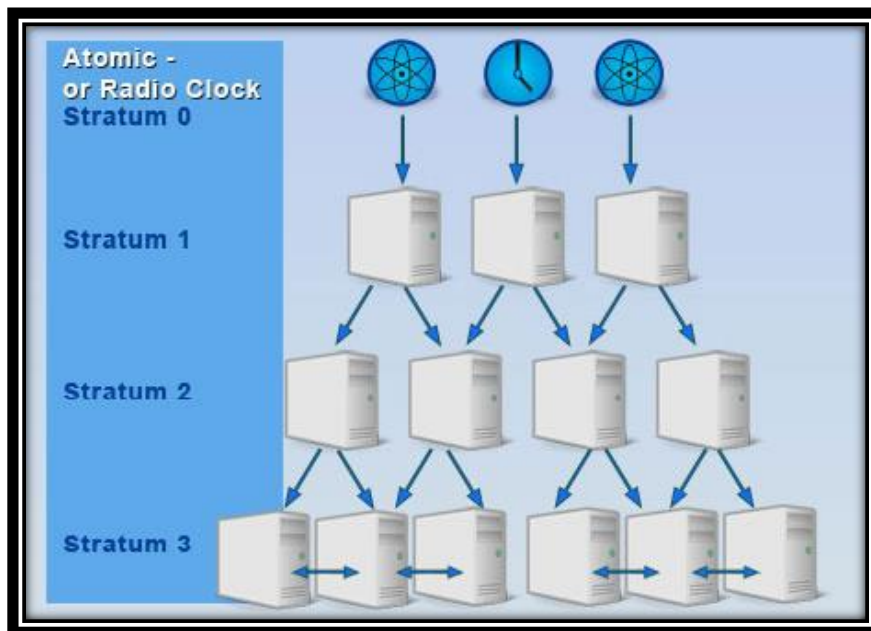
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### NTP Stratum:

- NTP Stratum levels define the distance from the reference clock.
- A Stratum-0 device that is assumed to be most accurate and it has no delay.
- NTP Stratum -0 servers cannot be used on the network.



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## NTP Architecture:

- NTP uses stratum 1 to 16 to define clock accuracy.
- A lower NTP stratum value represents higher accuracy.
- Clocks at NTP stratum 1 through 15 are in synchronized state.
- Clocks at Network Time Protocol stratum 16 are not synchronized.

## NTP Modes:

- CISCO Router and Switches can use four different NTP modes.
  1. NTP Server,
  2. NTP Client,
  3. NTP Server/Client
  4. NTP Peer

## NTP Server Mode:

- NTP Server is a network device, which running NTP service.
- NTP Server is configured to provide Time information to NTP Clients.
- NTP Server never accept time synchronization information from other devices.
- NTP Server mode router reads time from NTP source or uses its own clock as NTP source.

## NTP Client Mode:

- NTP Clients mode Only receives NTP updates.
- NTP Clients does not advertise received updates.
- NTP Clients uses them to synchronize its own clock.

## NTP Server/Clients Mode:

- NTP Server/Clients, Router receives updates from NTP Server.
- NTP Server/Clients also advertises them from its own interfaces.
- CISCO Router and Switch play both role NTP Server and Clients.
- As NTP Clients, it received NTP updates and as NTP Server, it advertises NTP updates.

## NTP Peer Mode:

- In NTP peer modes each device can provide time synchronization to other.
- So, one can synchronize the other in case of failures.

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## NTP Master:

- When we make NTP master then internal devices can synchronize use NTP master command.
- NTP Master command tells router that it is an NTP Server.
- NTP Server is also referred to as an NTP Master.

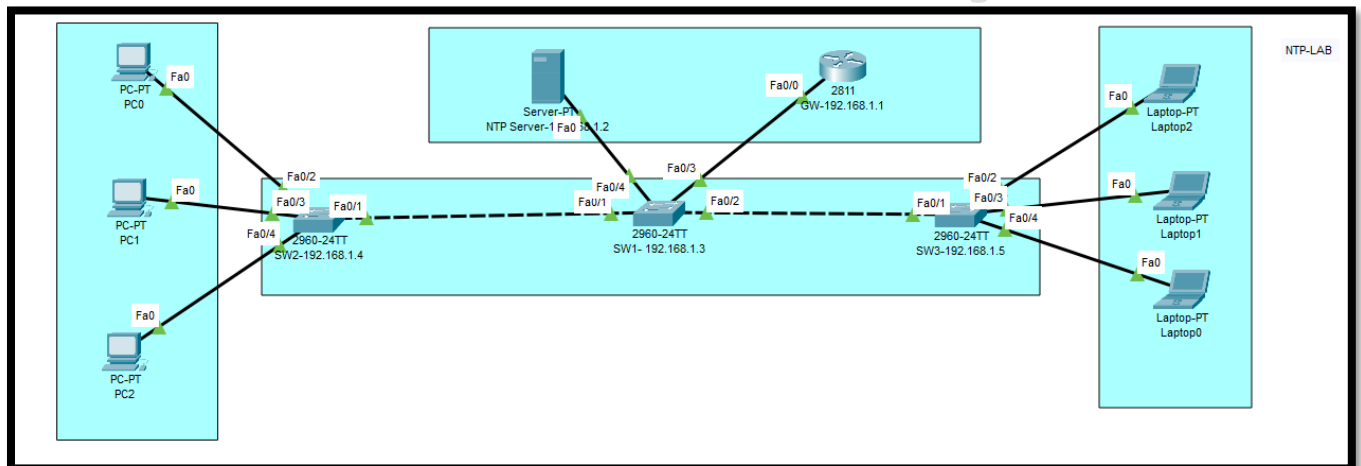
## NTP Versions:

- We have two NTP version that is version 3 and version 4.
- Version 4 supports IPV6 and it backwards compatible with NTP version 3.
- NTP Version 4 also adds DNS support for IPV6.
- NTPv3 use broadcast messages where as NTPV4 use Multicast.
- NTPV4 is more secure compare to NTP V3.

## NTP Security and Authentication:

- NTP can be secured by authentication mechanism that uses MD5 algorithm.
- All NTP packets that can update the clock have to be authenticated.
- The packets will be authenticated using HMAC MD5 which carries a key number.

## NTP Lab in Packet Tracer:



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R1 Configuration:	SW1 Configuration:
<pre>en config t hostname R1 int f0/0 ip add 192.168.1.1 255.255.255.0 no sh  ntp server 192.168.1.2</pre>	<pre>en config t hostname SW1  int vlan 1 ip add 192.168.1.3 255.255.255.0 no sh  ip default-gateway 192.168.1.1  ntp server 192.168.1.2</pre>
SW2 Configuration:	SW3 Configuration:
<pre>en config t hostname SW2  int vlan 1 ip add 192.168.1.4 255.255.255.0 no sh  ip default-gateway 192.168.1.1  ntp server 192.168.1.2</pre>	<pre>en config t hostname SW3  int vlan 1 ip add 192.168.1.5 255.255.255.0 no sh ip default-gateway 192.168.1.1  ntp server 192.168.1.2</pre>
<p><b>Output:</b></p> <p><b>Sh ntp status</b></p> <p><b>Sh clock</b></p>	<pre>R1#sh clock 12:18:16.312 UTC Sun Jan 17 2021 R1#sh ntp status Clock is synchronized, stratum 16, reference is 192.168.1.2 nominal freq is 250.0000 Hz, actual freq is 249.9990 Hz, precision is 2**24 reference time is 17EB4FF2.000002C1 (21:58:10.705 UTC Sat Dec 5 2048) clock offset is 0.00 msec, root delay is 0.00 msec root dispersion is 10.00 msec, peer dispersion is 0.12 msec. loopfilter state is 'CTRL' (Normal Controlled Loop), drift is - 0.000001193 s/s system poll interval is 4, last update was 11 sec ago.</pre>

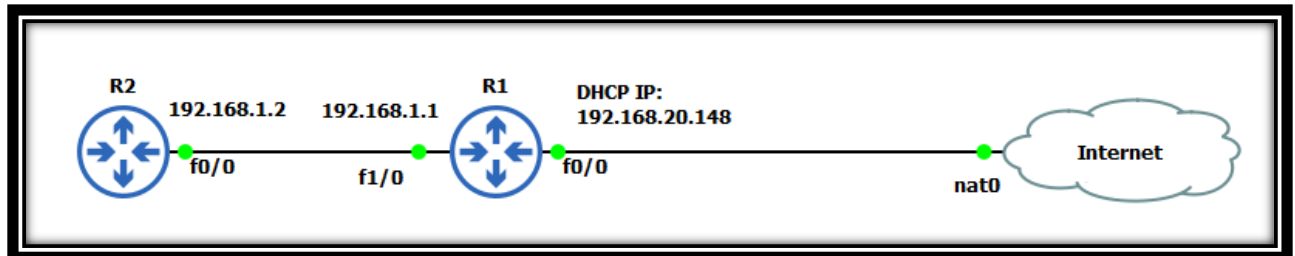
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## Lab Time:



R1 Configuration	R2 Configuration
<pre>en config t hostname R1  int f0/0 ip add dhcp no sh exit  ip name-server 8.8.8.8 ip domain-lookup  int f1/0 ip add 192.168.1.1 255.255.255.0 no sh ip domain-lookup</pre>	<pre>en config t hostname R2  int f0/0 ip add 192.168.1.2 255.255.255.0 no sh</pre>

Adjust Router Clock (R1)
<pre>Sh clock Sh clock detail Clock set 22:36:00 Oct 20 2020 Config t: Clock timezone UTC+3 Show clock Config t: ntp server sa.pool.ntp.org Sh ntp status Sh ntp associations</pre>

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