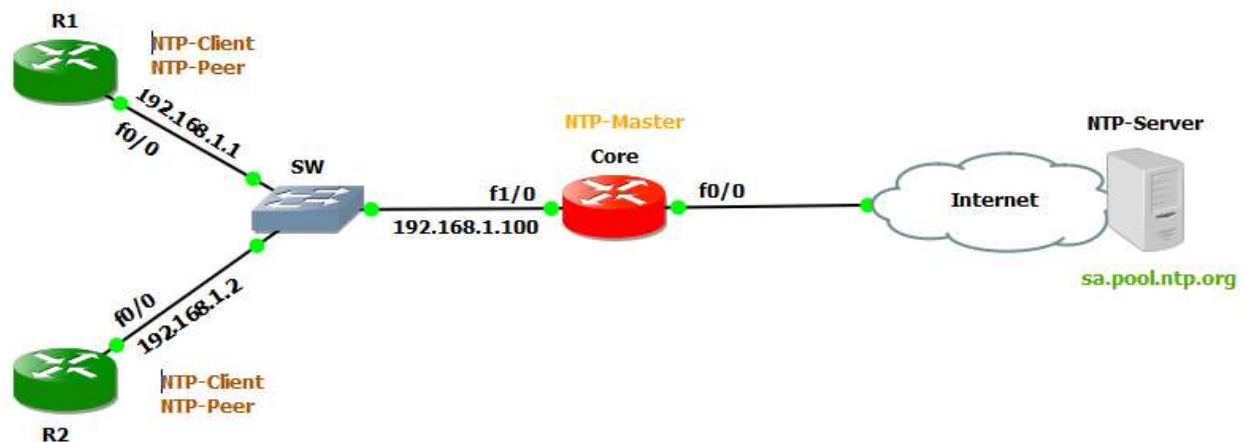


## NTP Security & Authentication:

- o NTP communications can be secured using an Access Control List.
- o NTP can be secured by authentication mechanism that uses MD5 algorithm.
- o All NTP packets that can update the clock have to be authenticated.
- o The packets will be authenticated using HMAC MD5, which carries a key number.
- o To use ACL, write ACL to allow certain IP addresses or a range then apply to NTP.
- o Access-group command has these options, ordered from least restrictive to most restrictive.



### Routers Basic Configuration

```
Core(config)# interface f0/0
```

```
Core(config-if)# ip address dhcp
```

```
Core(config-if)# no shutdown
```

```
Core(config)# interface f1/0
```

```
Core(config-if)# ip address 192.168.1.100 255.255.255.0
```

```
Core(config-if)# no shutdown
```

```
Core(config)# ip name-server 8.8.8.8
```

```
Core(config)# ip domain-lookup
```

```
R1(config)# interface f0/0
```

```
R1(config-if)# ip address 192.168.1.1 255.255.255.0
```

```
R1(config-if)# no shutdown
```

```
R2(config)# interface f0/0
```

```
R2(config-if)# ip address 192.168.1.2 255.255.255.0
```

```
R2(config-if)# no shutdown
```

<b>Adjust Router Clock</b>
Core# show calendar
Core# show clock
Core# show clock detail
Core# clock set 4:14:1 Jan 1 2019
Core(config)# clock timezone UTC + 3
Core# show clock

<b>Configure NTP Server</b>
Core(config)# ntp master
Core(config)# ntp master 3
Core(config)# ntp source loopback 1
Core(config)# interface f1/0
Core(config-if)# ntp broadcast
Core# show clock
Core# show clock detail

<b>Configure NTP Server/Client</b>
R1(config)#ntp server 192.168.1.100
R1(config)#ntp server 192.168.1.100 version 3
R1# show clock
R1# show clock detail

<b>Configure NTP Client</b>
R2(config)#ntp server 192.168.1.1
R2(config)#ntp server 192.168.1.1 version 3
R2(config)# interface f0/0
R2(config)# ntp broadcast client
R2# show clock
R2# show clock detail

<b>Configure NTP Peer</b>
R1(config)# ntp peer 192.168.1.2
R2(config)# ntp peer 192.168.1.1
R1(config)# ntp peer 192.168.1.2 version 3
R2(config)# ntp peer 192.168.1.1 version 3
R1#show ntp associations

### Configure Authentication on NTP Server

```
Core(config)# ntp master 5
```

```
Core (config)# ntp authenticate
```

```
Core (config)# ntp trusted-key 1
```

```
Core (config)# ntp authentication-key 1 md5 test
```

### Configure Authentication on NTP Client

```
R1(config)# ntp server 192.168.1.100 key 1
```

```
R1(config)# ntp authenticate
```

```
R1(config)# ntp trusted-key 1
```

```
R1(config)# ntp authentication-key 1 md5 test
```

### Configure Authentication on NTP Peer

```
R2(config)# ntp peer 192.168.1.1 key 1
```

```
R2(config)# ntp authenticate
```

```
R2(config)# ntp trusted-key 1
```

```
R2(config)# ntp authentication-key 1 md5 test
```

```
R2# debug ntp packet
```

```
R2# debug ntp auth
```

### Configure ACL on NTP Server

```
Core (config)# access-list 1 permit public-IP
```

```
Core (config)# ntp access-group peer 1
```

```
Core (config)# access-list 11 permit 192.168.1.1
```

```
Core (config)# access-list 11 permit 192.168.1.2
```

```
Core (config)# ntp access-group serve-only 11
```

### Configure ACL on NTP Client

```
R1 (config)# access-list 3 permit 192.168.1.100
```

```
R1 (config)# ntp access-group peer 3
```

## Troubleshoot and Verify NTP:

To verify NTP there many commands to use some of them are the following:

show ntp status

show ntp associations

show ntp associations detail

debug ntp packet

debug ntp events

debug ntp authentication

```
R1#show ntp associations
```

```
address      ref clock    st  when  poll reach  delay  offset  disp
*~192.168.1.100 127.127.7.1 8    0    64  377   56.0  49.01  45.7
* master (syncd), # master (unsyncd), + selected, - candidate, ~ configured
```

Field	Description
characters in display lines	* —Synchronized to this peer # —Almost synchronized to this peer + —Peer selected for possible synchronization - —Peer is a candidate for selection ~ —Peer is statically configured
Address	Address of peer.
ref clock	Address of reference clock of peer.
St	Stratum of peer.
When	Time since last NTP packet was received from peer.
Poll	Polling interval (in seconds).
Reach	Peer reachability (bit string, in octal).
Delay	Round-trip delay to peer (in milliseconds).
Offset	Relative time of peer clock to local clock (in milliseconds).
Disp	Dispersion

```

R1#show ntp status
Clock is synchronized, stratum 9, reference is 192.168.1.100
nominal freq is 250.0000 Hz, actual freq is 250.0000 Hz, precision is 2**18
reference time is C029435B.BAE5C0C0 (00:01:31.730 UTC Fri Mar 1 2002)
clock offset is 51.8989 msec, root delay is 27.94 msec
root dispersion is 1934.72 msec, peer dispersion is 1882.80 msec

```

Field	Description
Synchronized	System is synchronized to an NTP peer.
Unsynchronized	System is not synchronized to any NTP peer.
Stratum	NTP stratum of this system.
Reference	Address of peer the system is synchronized to.
nominal freq	Nominal frequency of system hardware clock.
actual freq	Measured frequency of system hardware clock.
Precision	Precision of the clock of this system (in Hertz).
reference time	Reference time stamp.
clock offset	Offset of the system clock to synchronized peer.
root delay	Total delay along path to root clock.
root dispersion	Dispersion of root path.
peer dispersion	Dispersion of synchronized peer.

