

## Chapter 23

# Configuring Time

This chapter discusses the following topics related to configuring time:

Setting the Time Zone on page 392

Configuring the Network Time Protocol on page 393

For more information about configuring time, see “Setting the Current Date and Time” on page 180. For more information about setting the date and time for Network Time Protocol (NTP) servers, see “Setting the Date and Time from NTP Servers” on page 180.

## Setting the Time Zone

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The default local time zone on the router is UTC (Coordinated Universal Time, formerly known as Greenwich Mean Time). To modify the local time zone, include the `time-zone` statement at the `[edit system]` hierarchy level:

```
[edit system]
time-zone time-zone;
```

You specify *time-zone* using the continent and major city. For the time zone change to take effect for all processes running on the router, you must reboot the router.

For information about setting the time on the router, see “Setting the Current Date and Time” on page 180.

### Examples: Setting the Time Zone

Set the time zone for New York:

```
[edit]
user@host# set system time-zone America/New_York
[edit]
user@host# show
system {
    time-zone America/New_York;
}
```

Set the time zone for Pacific Time:

```
[edit]
user@host# set system time-zone America/Los_Angeles
[edit]
user@host# show
system {
    time-zone America/Los_Angeles;
}
```

For information about what time zones are available, see `time-zone` on page 526.

## Configuring the Network Time Protocol

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NTP provides the mechanisms to synchronize time and coordinate time distribution in a large, diverse network. NTP uses a returnable-time design in which a distributed subnet of time servers operating in a self-organizing, hierarchical master-slave configuration synchronizes local clocks within the subnet and to national time standards by means of wire or radio. The servers also can redistribute reference time using local routing algorithms and time daemons.

NTP is defined in RFC 1305, *Network Time Protocol (Version 3) Specification, Implementation and Analysis*.

To configure NTP on the router, include the `ntp` statement at the [edit system] hierarchy level:

```
[edit system]
ntp {
  authentication-key number type type value password;
  boot-server address;
  broadcast <address> <key key-number> <version value> <ttl value>;
  broadcast-client;
  multicast-client <address>;
  peer address <key key-number> <version value> <prefer>;
  server address <key key-number> <version value> <prefer>;
  source-address source-address;
  trusted-key [ key-numbers ];
}
```

To configure NTP properties, you can do one or more of the following:

Configuring the NTP Boot Server on page 394

Specifying a Source Address for an NTP Server on page 394

Configuring the NTP Time Server and Time Services on page 395

Configuring NTP Authentication Keys on page 399

Configuring the Router to Listen for Broadcast Messages on page 399

Configuring the Router to Listen for Multicast Messages on page 400

When configuring NTP, you do not actively configure time servers. Rather, all clients also are servers. An NTP server is not believed unless it, in turn, is synchronized to another NTP server—which itself must be synchronized to something upstream, eventually terminating in a high-precision clock.

If the time difference between the local router clock and the NTP server clock is more than 128 milliseconds, but less than 128 seconds, the clocks are slowly stepped into synchronization. However, if the difference is more than 128 seconds, the clocks are not synchronized. You must set the time on the local router so that the difference is less than 128 seconds to start the synchronization process. On the local router, you set the date and time using the `set date` command. To set the time automatically, use the `boot-server` statement at the [edit system ntp] hierarchy level, specifying the address of an NTP server.

## Configuring the NTP Boot Server

When you boot the router, it issues an ntpdate request, which polls a network server to determine the local date and time. You need to configure a server that the router uses to determine the time when the router boots. Otherwise, NTP will not be able to synchronize to a time server if the server's time appears to be very far off of the local router's time.

To configure the NTP boot server, include the boot-server statement at the [edit system ntp] hierarchy level:

```
[edit system ntp]
boot-server address;
```

Specify the address of the network server. You must specify an address, not a hostname.

## Specifying a Source Address for an NTP Server

For IP version 4 (IPv4), you can specify that if the NTP server configured at the [edit system ntp] hierarchy level is contacted on one of the loopback interface addresses, then the reply will always use a specific source address. This is useful for controlling which source address NTP will use to access your network when it is either responding to an NTP client request from your network or when it itself is sending NTP requests to your network.

To configure the specific source address that the reply will always use, and the source address that requests initiated by NTP server will use, include the source-address statement at the [edit system ntp] hierarchy level:

```
[edit system ntp]
source-address source-address;
```

*source-address* is a valid IP address configured on one of the router interfaces.

## Configuring the NTP Time Server and Time Services

When configuring NTP, you can specify which system on the network is the authoritative time source, or time server, and how time is synchronized between systems on the network. To do this, you configure the router to operate in one of the following modes:

**Client mode**—In this mode, the local router can be synchronized to the remote system, but the remote system can never be synchronized to the local router.

**Symmetric active mode**—In this mode, the local router and the remote system can synchronize each other. You use this mode in a network in which either the local router or the remote system might be a better source of time.



**NOTE:** Symmetric active mode can be initiated by either the local or remote system. Only one system needs to be configured to do so. This means that the local system can synchronize to any system that offers symmetric active mode without any configuration whatsoever. However, we strongly encourage you to configure authentication to ensure that the local system synchronizes only to known time servers.

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**Broadcast mode**—In this mode, the local router sends periodic broadcast messages to a client population at the specified broadcast or multicast *address*. Normally, you include this statement only when the local router is operating as a transmitter.

**Server mode**—In this mode, the local router operates as an NTP server.



**NOTE:** In NTP server mode, the JUNOS software does not support authentication.

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The following sections describe how to configure these modes of operation:

Configuring the Router to Operate in Client Mode on page 396

Configuring the Router to Operate in Symmetric Active Mode on page 397

Configuring the Router to Operate in Broadcast Mode on page 397

Configuring the Router to Operate in Server Mode on page 398

### Configuring the Router to Operate in Client Mode

To configure the local router to operate in client mode, include the server statement and other optional statements at the [edit system ntp] hierarchy level:

```
[edit system ntp]
server address <key key-number> <version value> <prefer>;
authentication-key key-number type type value password;
boot-server address;
trusted-key [ key-numbers ];
```

Specify the address of the system acting as the time server. You must specify an address, not a hostname.

To include an authentication key in all messages sent to the time server, include the key option. The key corresponds to the key number you specify in the authentication-key statement, as described in “Configuring NTP Authentication Keys” on page 399.

By default, the router sends NTP version 3 packets to the time server. To set the NTP version level to 1 or 2, include the version option.

If you configure more than one time server, you can mark one server as being preferred by including the prefer option.

For information about how to configure trusted keys, see “Configuring NTP Authentication Keys” on page 399. For information about how to configure an NTP boot server, see “Configuring the NTP Boot Server” on page 394. For information about how to configure the router to operate in server mode, see “Configuring the Router to Operate in Server Mode” on page 398.

#### **Example: Configuring Client Mode**

Configure the router to operate in client mode:

```
[edit system ntp]
authentication-key 1 type md5 value "$9$EgfcrvX7VY4ZEcwgoHjkP5Q3CuREyv87";
boot-server 10.1.1.1;
server 10.1.1.1 key 1 prefer;
trusted-key 1;
```

### Configuring the Router to Operate in Symmetric Active Mode

To configure the local router to operate in symmetric active mode, include the peer statement at the [edit system ntp] hierarchy level:

```
[edit system ntp]
peer address <key key-number> <version value> <prefer>;
```

Specify the address of the remote system. You must specify an address, not a hostname.

To include an authentication key in all messages sent to the remote system, include the key option. The key corresponds to the key number you specify in the authentication-key statement, as described in “Configuring NTP Authentication Keys” on page 399.

By default, the router sends NTP version 3 packets to the remote system. To set the NTP version level to 1 or 2, include the version option.

If you configure more than one remote system, you can mark one system as being preferred by including the prefer option:

```
peer address <key key-number> <version value> prefer;
```

### Configuring the Router to Operate in Broadcast Mode

To configure the local router to operate in broadcast mode, include the broadcast statement at the [edit system ntp] hierarchy level:

```
[edit system ntp]
broadcast address <key key-number> <version value> <tll value>;
```

Specify the broadcast address on one of the local networks or a multicast address assigned to NTP. You must specify an address, not a hostname. Currently, the multicast address must be 224.0.1.1.

To include an authentication key in all messages sent to the remote system, include the key option. The key corresponds to the key number you specify in the authentication-key statement, as described in “Configuring NTP Authentication Keys” on page 399.

By default, the router sends NTP version 3 packets to the remote system. To set the NTP version level to 1 or 2, include the version option.

### Configuring the Router to Operate in Server Mode

In server mode, the router acts as an NTP server for clients when the clients are configured appropriately. The only prerequisite for “server mode” is that the router must be receiving time from another NTP peer or server. No other configuration is necessary on the router.

To configure the local router to operate as an NTP server, include the following statements at the [edit system ntp] hierarchy level:

```
[edit system ntp]
authentication-key key-number type type value password;
server address <key key-number> <version value> <prefer>;
trusted-key [ key-numbers ];
```

Specify the address of the system acting as the time server. You must specify an address, not a hostname.

To include an authentication key in all messages sent to the time server, include the key option. The key corresponds to the key number you specify in the authentication-key statement, as described in “Configuring NTP Authentication Keys” on page 399.

By default, the router sends NTP version 3 packets to the time server. To set the NTP version level to 1 or 2, include the version option.

If you configure more than one time server, you can mark one server as being preferred by including the prefer option.

For information about how to configure trusted keys, see “Configuring NTP Authentication Keys” on page 399. For information about how to configure the router to operate in client mode, see “Configuring the Router to Operate in Client Mode” on page 396.

#### **Example: Configuring Server Mode**

Configure the router to operate in server mode:

```
[edit system ntp]
authentication-key 1 type md5 value "$9$tXERuBEreWx-wtuLNdboaUjH.T3AtOESe";
server 172.17.17.27.46 prefer;
trusted-key 1;
```

## Configuring NTP Authentication Keys

Time synchronization can be authenticated to ensure that the local router obtains its time services only from known sources. By default, network time synchronization is unauthenticated. The system will synchronize to whatever system appears to have the most accurate time. We strongly encourage you to configure authentication of network time services.

To authenticate other time servers, include the `trusted-key` statement at the `[edit system ntp]` hierarchy level. Only time servers transmitting network time packets that contain one of the specified key numbers and whose key matches the value configured for that key number are eligible to be synchronized to. Other systems can synchronize to the local router without being authenticated.

```
[edit system ntp]
trusted-key [ key-numbers ];
```

Each key can be any 32-bit unsigned integer except 0. Include the `key` option in the `peer`, `server`, or `broadcast` statements to transmit the specified authentication key when transmitting packets. The key is necessary if the remote system has authentication enabled so that it can synchronize to the local system.

To define the authentication keys, include the `authentication-key` statement at the `[edit system ntp]` hierarchy level:

```
[edit system ntp]
authentication-key key-number type value password;
```

*number* is the key number, *type* is the authentication type (either Message Digest 5 [MD5] or DES), and *password* is the password for this key. The key number, type, and password must match on all systems using that particular key for authentication.

## Configuring the Router to Listen for Broadcast Messages

When you are using NTP, you can configure the local router to listen for broadcast messages on the local network to discover other servers on the same subnet by including the `broadcast-client` statement at the `[edit system ntp]` hierarchy level:

```
[edit system ntp]
broadcast-client;
```

When the router hears a broadcast message for the first time, it measures the nominal network delay using a brief client-server exchange with the remote server. It then enters *broadcast client* mode, in which it listens for, and synchronizes to, succeeding broadcast messages.

To avoid accidental or malicious disruption in this mode, both the local and remote systems must use authentication and the same trusted key and key identifier.

### **Configuring the Router to Listen for Multicast Messages**

When you are using NTP, you can configure the local router to listen for multicast messages on the local network to discover other servers on the same subnet by including the `multicast-client` statement at the `[edit system ntp]` hierarchy level:

```
[edit system ntp]
multicast-client <address>;
```

When the router hears a multicast message for the first time, it measures the nominal network delay using a brief client-server exchange with the remote server. It then enters *multicast client* mode, in which it listens for, and synchronizes to, succeeding multicast messages.

You can specify one or more IP addresses. (You must specify an address, not a hostname.) If you do, the route joins those multicast groups. If you do not specify any addresses, the software uses 224.0.1.1.

To avoid accidental or malicious disruption in this mode, both the local and remote systems must use authentication and the same trusted key and key identifier.