IBM Cloud Object Storage System
Version 3.14.3

Time Synchronization Configuration Guide

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This edition applies to IBM Cloud Object Storage System™ and is valid until replaced by new editions.

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Chapter 1. Describe the IBM Cloud Object Storage System™ NTP functions

The Network Time Protocol (NTP) is a standard protocol for synchronizing clocks between interconnected computer systems. It is used ubiquitously from notebooks to desktop computers to production servers.

NTP uses UDP port 123. The software and associated documentation are available at **NTP: The Network Time Protocol** (http://www.ntp.org/).

In a system, it is assumed that all nodes contain synchronized clocks. The clocks are accurate to within 1 second across the various nodes; however, small clock variations do not pose any functional issues. System clocks can be synchronized to an external time source. Clocks require access to the internet or to an NTP server on the customer's private network. When neither is available, the clocks can still be synchronized to each other, but are inaccurate when compared to the real time.

The following terms are used:

synchronize
In the NTP model:

1. The NTP daemon is properly communicating with the remote clock.
2. The local clock characteristics are identified.

It does not necessarily mean that the times on the two clocks match. Two clocks that are synchronized might still have a significant offset, but the system corrects itself over time. It does not mean that the two clocks have the same exact time.

delay Measured round-trip time for network communication from the local NTP daemon to the remote clock.

offset Calculated difference between the local clock and the remote clock is measured in units of time (typically seconds).

jitter The apparent variation in the remote clock from the perspective of the local clock.

Note: For example, the local clock believes 60 seconds passed while the remote clock indicates 59 seconds passed, but then in a different 60-second period, the remote clock indicates that 61 seconds passed.

drifting
The slow, small adjustments (about one or 2 seconds per hour) that the NTP daemon makes to the local clock to match the remote clock. The daemon adjusts the local clock over a long period so no large gaps in the clock time are perceived by locally running system processes.

Chapter 2. Configure clock synchronization

When the NTP daemon starts, it communicates periodically with the remote clock to keep itself continuously synchronized. Without this periodic synchronization, inexpensive clocks that are often used in commodity hardware can drift apart from each other over time.

Setting the synchronization method

Configure the **NTP** behavior for devices in the system.

About this task

Synchronize the Manager clock to an external NTP server and other system nodes with the Manager clock.

Attention: The **Manager-only** option cannot be used with a manager that is deployed with Docker.

Note: If the system has Vault Protection enabled or contains protected vaults or protected mirrors, then only accounts with the Super User role can configure NTP.

Procedure

1. Select **System NTP Configuration** from the **Administration** page in the Manager Web Interface.
2. Click **Configure** . The **System NTP Configuration** page opens.
3. Select the type of **NTP** behavior you want to configure.
   - Manager NTP Only - all devices synchronize to the manager, and the manager synchronizes to external NTP servers.
   - Manager and External NTP - all devices synchronize to both the manager and external NTP servers.
   - External NTP Only - all devices synchronize to external NTP servers. For external servers, enter **host names** or **IP addresses**. Multiple NTP servers can be entered, separated by commas or spaces.
4. Type the list of NTP Servers in the **External NTP Servers** field (separate each by commas) if **Manager And External NTP** or **External NTP Only** were selected.
5. Click **Update** to save the NTP settings and return to the **Administration** page.

Chapter 3. Synchronize the system clocks by using NTP

The **cron** command checks the NTP status every minute:

- If the Manager clock cannot synchronize to an external clock, it generates an error in the **Event Console** .
- If the non-Manager clock is not synchronizing to the Manager clock, it generates an error.
- The Manager Allowed Clock Difference Policy is 11 seconds. The table describes messages that are based on these values.

Table 1. Message and location

Message	**Appears**
System time is not synchronized (difference: xxx).	On the **Monitor Device** page.
Device clock is not synchronized.	On the **Event Console** every minute when the clock is unsynchronized.

Note: If the device clocks are synchronizing, but are off by less than 10 seconds, the clocks drift by using existing NTP logic and no error messages are generated.

Chapter 4. Recognize unusual time synchronization behaviors

The details of the NTP algorithm result in some non-obvious behavior.

- If the remote clock cannot be reached when the NTP daemon first starts, the daemon continues to run and periodically checks the remote clock until it becomes available. When the remote clock becomes available, the daemon begins synchronizing to determine the local clock accuracy.
- When synchronization completes (might take 10 minutes).
  - If the local clock is off by more than 1,000 seconds (~17 minutes), then the local clock immediately adjusts to match the remote clock.
  - If the local clock is determined to be off by less than 1,000 seconds, then the NTP daemon begins adjusting the local clock towards the remote clock by using a drifting model.

Chapter 5. Review the NTP limitations

Ordinarily, the remote clock is external to the system, similar to the root DNS servers. In ClevOS, the remote clock for the system non-manager nodes is the Manager, which is more likely to be powered down, disconnected or unreachable during system setup.

NTP drifting can take a long time to complete. To adjust a clock by 5 minutes by using drifting, it takes about one week. To dramatically reduce the duration to synchronize the clocks, ClevOS introduces a mechanism to expedite the clock adjustment.

CAUTION: Any software that uses time stamps in file names might encounter issues if the clock suddenly changes backwards in time.

The greater the adjustment, the more risk there are in errors. Backwards-in-time adjustments are especially risky.

CAUTION: NTP is very much “devil is in the details”. The algorithms are complex and meant to handle a wide variety of network conditions and clock types. Do not tweak the behavior of these algorithms.

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