Computing Resources
The Lister Hill National Center for Biomedical Communications

Network Time Synchronization User Guide

Version History

Version	Date	Description	Author
6.00	10/26/2007	Incorporated users feedback	Dengfeng Liu
5.00	10/24/2007	Changed to unicast configuration	Dengfeng Liu
4.00	03/20/2006	Reorganized the document	Howard Lu/ Dengfeng Liu
1.00	03/16/2006	Revision after NTP representation and comments from	Dengfeng Liu
1.00_A	03/02/2006	This is the proposed instructions for LHC network time synchronization	Dengfeng Liu

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A Purpose

This manual is used as an instruction to setup time synchronization with the central time server at LHC using multicast mode to accommodate all computing resources.

B Scope

This document targets the end-users at LHC who want to use network time protocol based synchronization. It is also a technical reference for LHC staff to practice/testing the time server setups.

C Applicable References

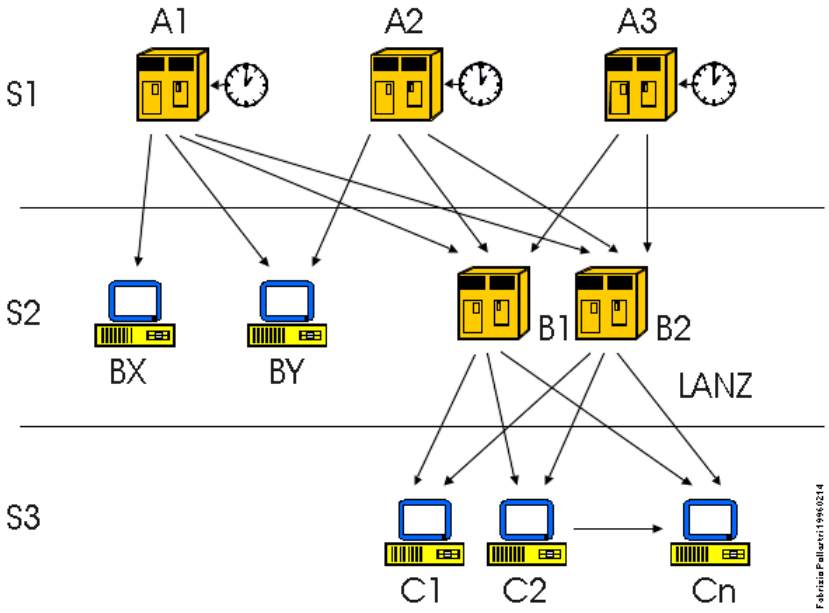
1. http://ntp.isc.org
2. Network Time Protocol Server Configuration Procedure, LHC draft

D Overview

Time is inherently important to the function of routers and networks. It provides the only frame of reference between all devices on the network. This makes synchronized time extremely important. Without synchronized time, accurately correlating information between devices becomes difficult, if not impossible. When it comes to security, if you cannot successfully compare logs between each of your routers and all your network servers, you will find it very hard to develop a reliable picture of an incident. Finally, even if you are able to put the pieces together, unsynchronized times, especially between log files, may give an attacker with a good attorney enough wiggle room to escape prosecution.

A NTP primary server, also called of stratum 1, is a computer connected to a high precision reference clock and equipped with NTP software. Other computers, called of stratum 2, equipped with similar software, automatically query the primary server to synchronize their system clocks (THIS IS LHC TIME SERVER). The stratum 2 computers can synchronize other computers, called of stratum 3, and so on until 16 stratums. Going away from stratum 1 toward lower stratums, the synchronization accuracy lowers. In such a framework, each computer can be at the same time a server for the computers belonging to the lower stratum and a client for the computers belonging to the upper stratum. Each server can have some hundreds of clients, so the number of computers that can be indirectly synchronized by one primary server is virtually unlimited. To make the system more reliable, each client can have more than one server in the upper stratum. In this case, the NTP software monitors continuously the figures of stability and

accuracy of all configured servers, switching dynamically to the server with the best information. A typical NTP server structure is showed below:



E Requirements

- Fully automatic, keeps continuous synchronization
- Minimize client installation and software configuration
- Suitable to synchronize one computer as well as a whole computer network.
- Available for almost every type of computer.
- Fault tolerant and dynamically configuring.
- Synchronization accuracy up to 1 millisecond.

F Implementation

F.1 NTP running modes

There are 4 modes in which NTP client can operate in:

- **unicast** (Client/Server) mode - NTP client connects to specified NTP server. IP address of NTP server must be set in ntp-server and/or second-ntp-server parameters.

- **broadcast** mode - NTP client listens for broadcast messages sent by NTP server. After receiving first broadcast message, client synchronizes local clock using unicast mode, and afterwards does not send any packets to that NTP server. It uses received broadcast messages to adjust local clock.

- **multicast** mode - acts the same as broadcast mode, only instead of broadcast messages to group. Multicast messages are received (IP address 224.0.1.1), whenever the client received a multicast, it use unicast mode to communicate with the server.

- **manycast** mode(V4 only) - actually is unicast mode only with unknown IP address of NTP server. To discover NTP server, client sends multicast message (IP 239.192.1.1). If NTP server is configured to listen for these multicast messages (manycast mode is enabled), it replies. After client receives reply, it enters unicast mode and synchronizes to that NTP server.

At LHC, to satisfy the requirements (see section E), we use unicast mode. Currently lhcntp.nlm.nih.gov is the time server.

F.2 NTP security

We use standard MD-5 (Message Digest v5) for the client to trust our server; keys are shared with clients (15715) to verify the source of our broadcast.

F.3 Client Setups

The section below illustrates the setup for the different types of operating systems. If you need help in setting these up, please open a ticket under the CRTC Unix queue.
Note: The update of the local time can vary between 64s to 1024s to get updated, you can use minpool and maxpoll to control it, please talk to your SA for help.
(SA: append minpoll xxx maxpoll xxx to the end of the server lhcntp.nlm.nih.gov lines, replace xxx with the seconds your want to update the local host)

F.3.1 For Linux/Solaris machines

Edit /etc/ntp.conf if you are running Linux
Edit /etc/inet/ntp.conf if you are running Sun Solaris
>User lines between ##### to replace the existing ntp.conf file:

```
###################
server lhcntp.nlm.nih.gov
driftfile /var/lib/ntp/drift
keys /etc/ntp/keys
trustedkey 15715 65533 65534
###########################
```

create /etc/ntp/keys file with this content:(file permission should set to root readable only)
15715 M lhctimekey
65534 M keyofreq
65533 M keyofcontrol

To make your changes take effect immmediately:(need root priviledges)
/etc/init.d/ntpd restart (linux)
svcadm restart svc:/network/ntp(solaris 10)
/etc/init.d/xntpd stop;/etc/init.d/xntpd start(solaris 9,8)

F.3.2 For MacOS

Replace /etc/ntp.conf with this config:
############
driftfile /var/run/ntp.drift
server lhcntp.nlm.nih.gov
keys /etc/ntp.keys
trustedkey 15715 65535 65534
requestkey 65534
controlkey 65535
################
Create /var/run/ntp.drift as an empty file by this command:
touch /var/run/ntp.drift

User text editors, create /etc/ntp.keys file with this content:(file permission should set to root readable only)
15715 M lhctimekey
65534 M keyofreq
65533 M keyofcontrol

To check the synchronization, issue ntpq –p to check if it's already received a server package for time synchronization. If not, try these steps:
Remove /var/run/NetworkTime.StartupItem
SystemStarter restart "Network Time"

More questions, please issue a ticket to the RT server.

F.3.3 For Windows 2000/XP

If the windows machine already joined the NIH/NLM domain, it's getting time synchronization from the domain controller. If not, you can set the time synchronization for Windows under the command line, type:

Net time /setsntp:lhcntp.nlm.nih.gov
Net start "Windows Time"

F.3.4 Network devices

Use the time server name as the time server: lhcntp.nlm.nih.gov or 130.14.49.33