

Using an SEL-2401, SEL-2404, or SEL-2407[®] to Create a Stratum 1 Linux[®] NTP Server

Kim Yauchzee, Brian Pickering, and Barry Grussling

INTRODUCTION

Network Time Protocol (NTP) is a common protocol used for Ethernet time synchronization in applications requiring 1- to 50-millisecond time accuracy, such as IT (information technology), SCADA (supervisory control and data acquisition), and public safety networks. Stratum levels define the distance of a device from a reference clock. Reference clocks with GPS (Global Positioning System) lock reside at Stratum 0. Devices directly connected to reference clocks reside at Stratum 1, while clients connecting to those devices reside at Stratum 2, and so on. A Stratum 1 server is the highest server in an NTP hierarchy.

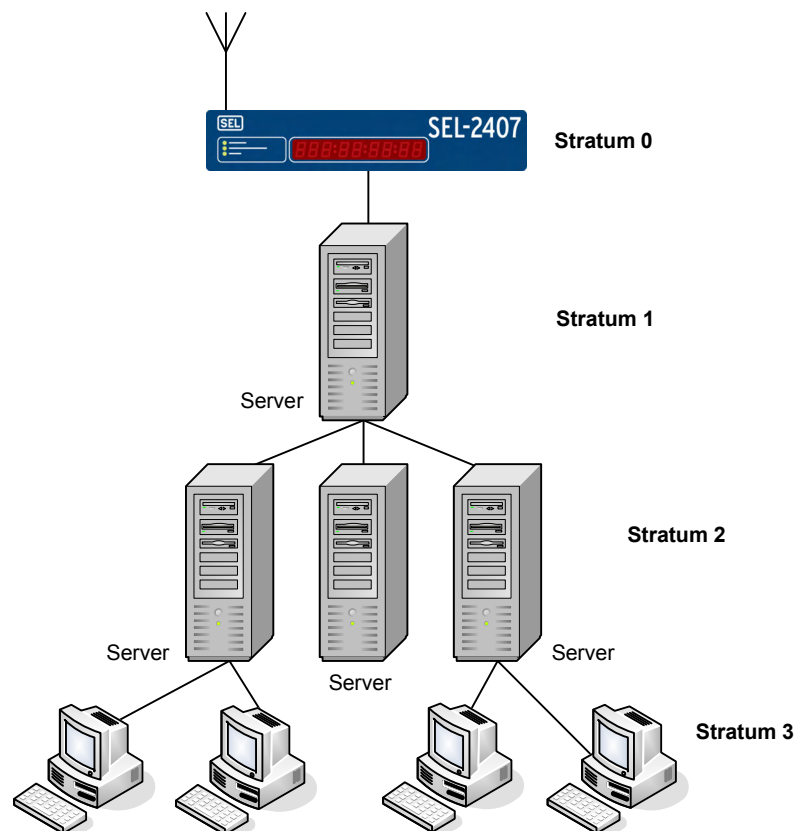


Figure 1 Stratum Levels

This application note provides implementation details and requirements for using the SEL-2401, SEL-2404, or SEL-2407 Satellite-Synchronized Clock with Linux NTP service to create a Linux NTP Stratum 1 server suitable for LAN/WAN (local-area network/wide-area network) applications.

PROBLEM

NTP is an economical way to distribute time over Ethernet for applications that are not time-critical. Traditionally, an SEL clock connects to SEL computing products and communications processors that convert high-accuracy IRIG-B to NTP to provide robust time with reliable computing.

However, users running standard computer hardware without an IRIG-B input can also benefit from using an SEL clock.

SEL SOLUTION

The following equipment is required:

- Linux computer with NTP service installed (included by default in Red Hat[®] and Debian[®] distributions)
- SEL-2407, SEL-2404, or SEL-2401
 - Serial cable (C234A or C260)
 - Antenna and antenna cabling (C960 or C961)

Note: This application note is intended for readers who have prior experience with Linux system administration and NTP server configuration. For additional guidance on driver configuration for reference clocks, please refer to the documentation at <http://www.ntp.org/documentation.html>.

SEL Clock Configuration

Two configurations are available, depending on which SEL clock is selected. SEL clocks support serial broadcast commands that can be parsed by a Linux driver for output via NTP. The clock must be configured to output broadcast ASCII (BX commands) from the rear serial port, sending time in the B8, UTC (Coordinated Universal Time) format. This configuration is shown in Figure 2 and can be used with an SEL-2401, SEL-2404, or SEL-2407 clock.

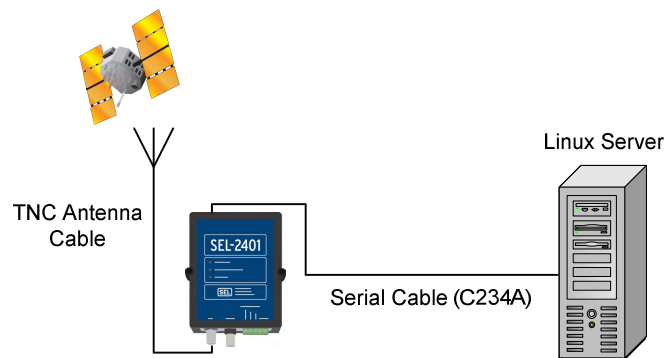


Figure 2 Basic Configuration

Alternatively, the SEL-2407 clock has the added capability of sending a 1 pps (pulse per second) signal on a BNC output port. Using a different cable, you can combine this 1 pps signal with the serial broadcast commands for added accuracy. This configuration is shown in Figure 3.

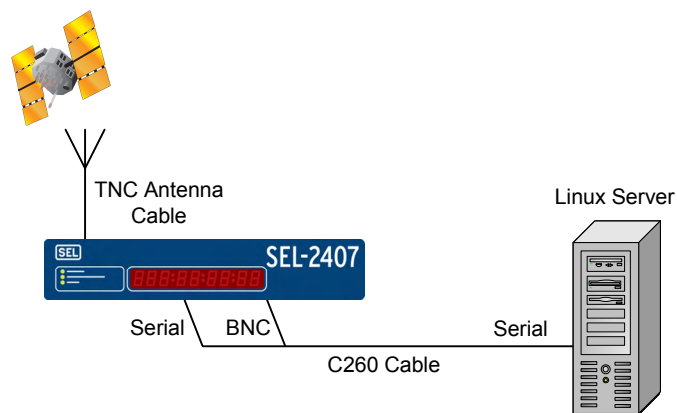


Figure 3 Advanced Configuration

You may need to review if your current Linux distribution has kernel support for pps signal interpretation. Support for pps signal interpretation has been included since Linux kernel Revision 2.6.38. For details on setup and configuration of the output ports, see your SEL clock instruction manual, available at <http://www.selinc.com>.

Linux Server Configuration

The NTP software installed with the NTP service provides a large number of reference clock drivers. The SEL clock driver is a Type 8 (PARSE) driver running in Mode 24 from the list of available drivers in the NTP service documentation available at <http://www.eecis.udel.edu/~mills/ntp/html/refclock.html>.

Note: The SEL clock driver has been included in the NTP source since Version 4.2.8. A full copy of the SEL clock driver is also available at <http://www.selinc.com/timedriver>.

NTP uses the Linux device file `/dev/refclock-x`, where $x = 0$ to 3. This device file is not created automatically but can be a symbolic link created by the user or `udev` to the serial port attached to the clock.

When configuring NTP via `ntp.conf`, specify the server line as `server 127.127.8.x mode 24`, where $x = 0$ to 3 and matches the `refclock` device filename.

© 2010, 2012 by Schweitzer Engineering Laboratories, Inc.
All rights reserved.



SCHWEITZER ENGINEERING LABORATORIES, INC.

2350 NE Hopkins Court • Pullman, WA 99163-5603 USA
Tel: +1.509.332.1890 • Fax: +1.509.332.7990
www.selinc.com • info@selinc.com