Need for time distribution

Each machine running applications uses a local clock. Even if they are synchronized to start, they will each change at a slightly different rate with errors that accumulate over time so number of milliseconds before the hour won't be identical

Even worse: Each individual processor in each rack has its own clock and those clocks can drift away from each other

What you want to be able to do

NTP – network time protocol. A "time server" connected to some authoritative clock – like the one from the GPS satellites – sends periodic corrections to each cluster asking the clusters to re-synchronize.

Just the first of many problems

The network delivery delays on update messages are variable because of congestion, routing etc.

So the machine getting the update has to estimate the delay before it can adjust its own clock

Send update
At time T0

Update arrives
At time T0+D6

Update arrives
At time T0+D1

Timekeeping Error Accumulation

Server loses sync with GPS clock or lurches to recover

WAN/LAN Latencies

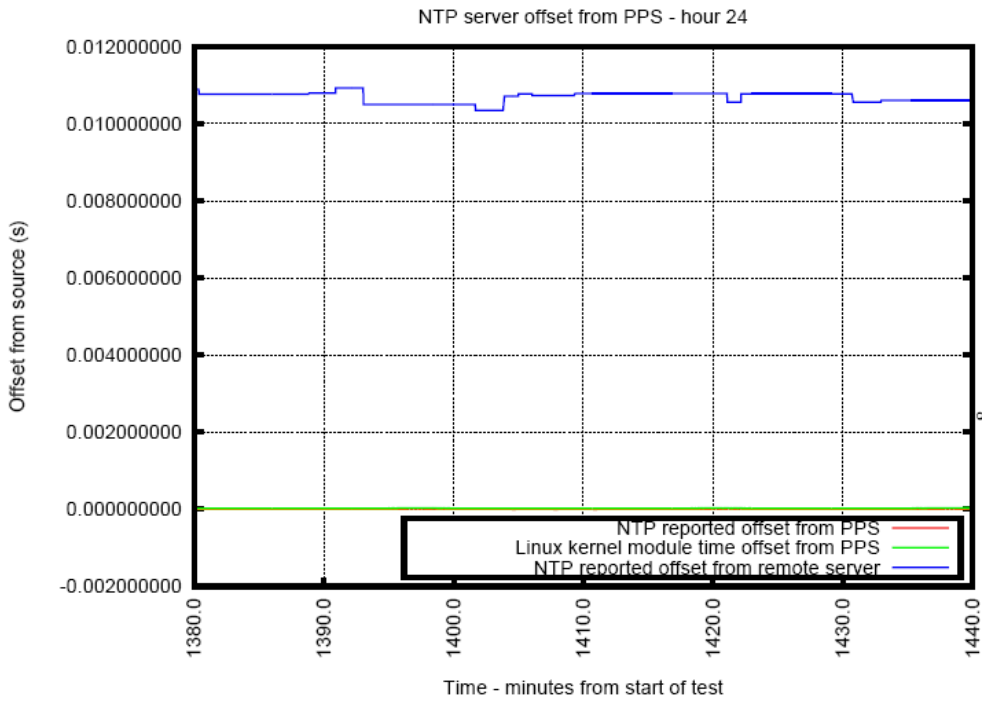
Blade clocks lose sync with time reference

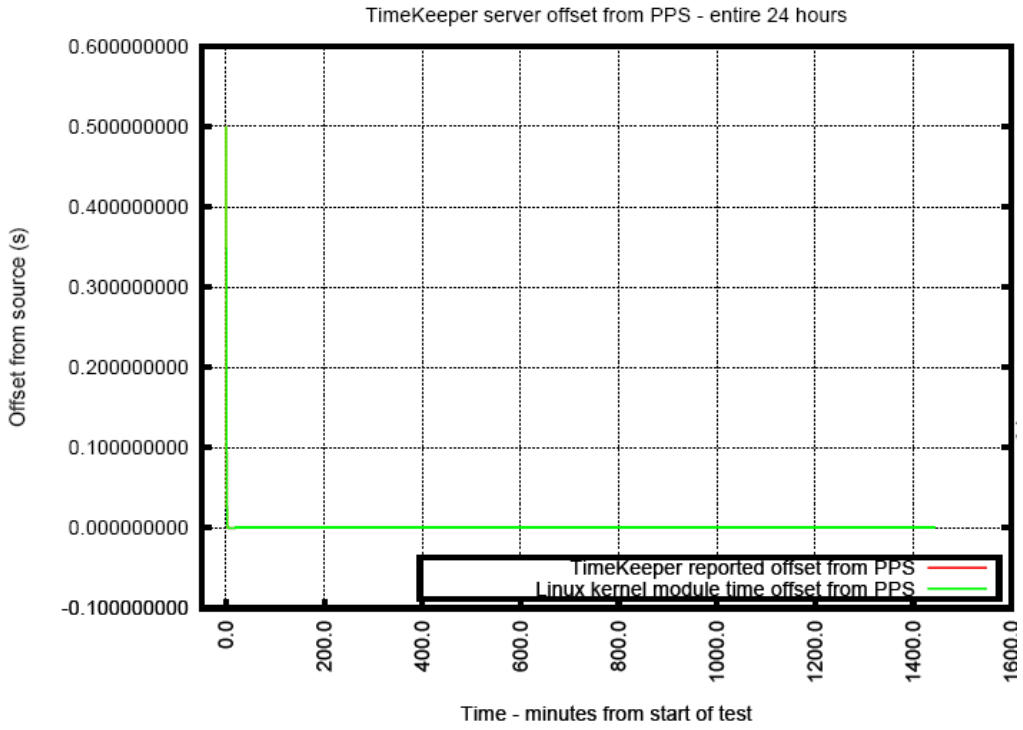
Lagging OS drivers

Time received / maintained by application off by multiple seconds

Comparing NTP and TimeKeeper Servers

NTP Server Time vs. PPS

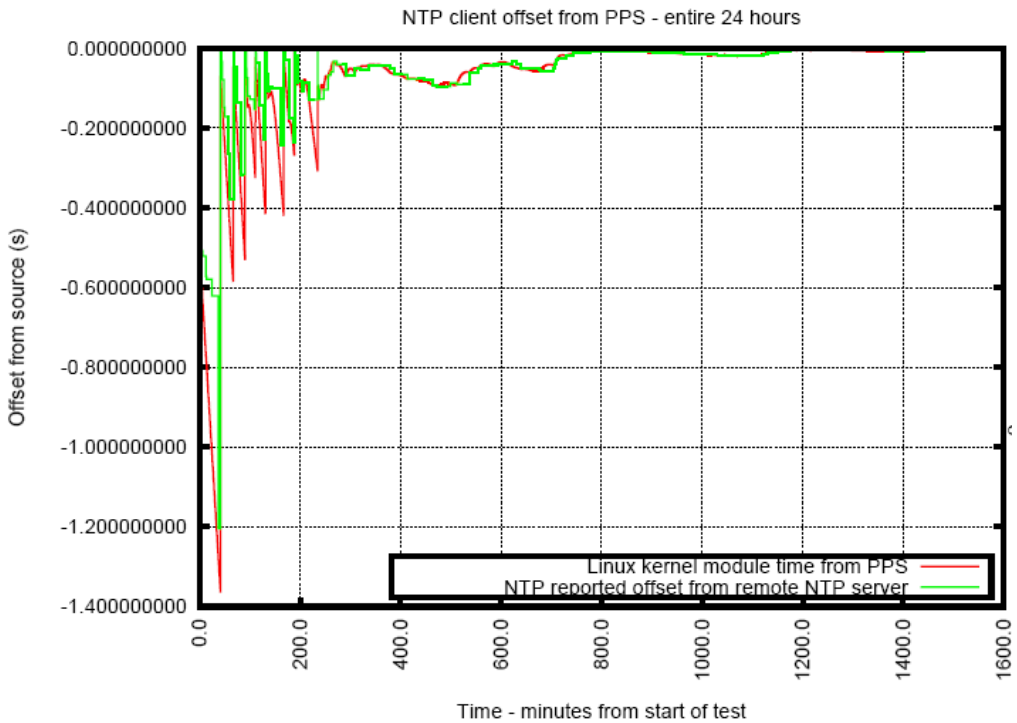


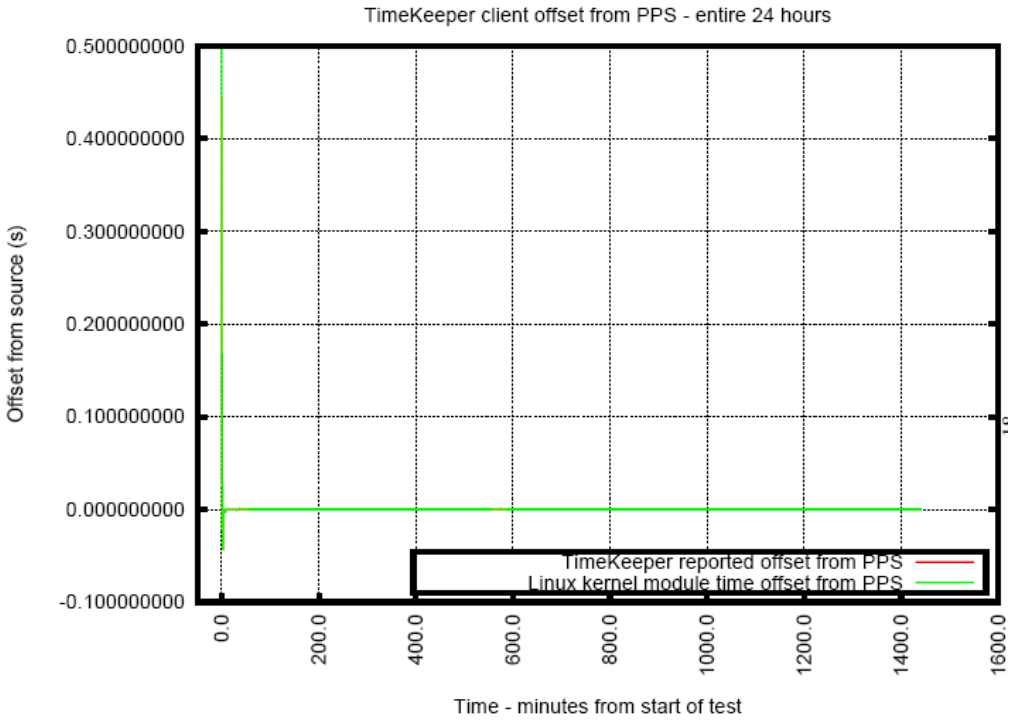


TimeKeeper Server Time vs. PPS

Comparing NTP and TimeKeeper Clients

NTP Client Time vs. PPS





TimeKeeper Client Time vs. PPS

TimeKeeper™ : Simple to Implement

- Pure software blade/cluster time solution
- Zero additional hardware
- Nanosecond accuracy
- No configuration
- End to end solution
- NTP compatible

Enterprise and Global Operation

- TimeKeeper Server can be connected to a reference time like GPS
- Accurate, synchronized time served to all clusters and blades at all client sites
- TimeKeeper accurate to <10 microseconds
  - Even more accurate with superior networks and blade hardware.

Plug in Cluster Installation

Blades sync quickly to TimeKeeper reference time with no OS changes

Turn-key TimeKeeper Server for cluster

Applications time queries via local OS receive accurate reference time – no code changes needed

FSMLabs

Tighter Timekeeping Faster Convergence

- TimeKeeper Builds on NTP and existing APIs
  - Builds on industry-standard infrastructure for UNIX, Linux, Windows and MacOS
- Uses Network Time Protocol messages but
  - more stringent timing
  - zero configuration
  - rapid convergence