

A close-up photograph of a mechanical watch movement, showing various gears of different sizes and colors (brass, steel, and blue-tinted metal). The gears are intricately meshed together, and the background is a dark, textured metal surface. A semi-transparent blue banner is overlaid across the middle of the image, containing the text 'TimeKeeper Time Synchronization'.

TimeKeeper Time Synchronization

TimeKeeper Compliance for regulatory reporting

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About FSM Labs

Who We Are

- Independent, self-financed, specialist system and operating system software development, integration and support firm
- Focused on adapting “off the shelf” technology to high-performance and critical response-time applications
- 16-year record of success in building mission critical real-time acceleration for standard software
- Clients on every continent except Antarctica

TimeKeeper

Who We Serve

- Exchanges
- Banks
- Brokerage Firms
- Proprietary Trading Firms



VIRTU FINANCIAL



KCG



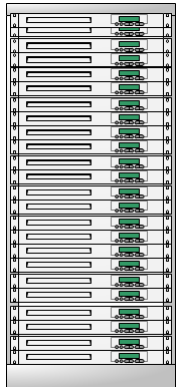
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TECHNOLOGIES



FSMLabs
Enterprise Real-Time®

TimeKeeper Compliance eases FINRA, MiFID, etc. time sync monitoring and reporting burden

- Monitors/records every time sync transaction and measurement
- Tracks track primary time source (normally local GPS) and cross-check NIST (as per FINRA)
- Able to alert immediately when any system is out of certain bounds
- GUI for high level view of compliance/non-compliance
- Produces PDFs for long-term storage of monitoring/reporting
- Consolidates logs over standard PTP/NTP protocols between hosts
 - Even between datacenters



Reporting via the GUI

Choose Reports

Compliance Finished Report at Mon, 30 Jan 2017 22:32:04 GMT

Report Report Type Year Month Day

All MIFID2 FINRA .192 net FINRA amazon hosts

All Monthly Daily Weekly Yearly

All 2017

All January

All 14 15 16 17 18

Show All Detail

Synchronization Report for 2017-01-15 to 2017-01-16

Report Start: Sun, 15 Jan 2017 00:00:00 GMT
Report End: Mon, 16 Jan 2017 00:00:00 GMT
Gap Breaches: 11
Max Offset: 0.001 100 199
Max Gap: 0h 16m 57s
Clientset: 10*
Warning Threshold: .000050
Breach Threshold: .000100

Showing all of 1 daily report for the 15th of January 2017

Clients by maximum offset range

Sync'd	Warning	Breach
4	0	1

Daily, weekly, monthly, yearly reports are available

As much detail or as little as needed. Designed to be simple and provide only necessary data for reporting

Quickly see how many hosts exceeded certain time offset thresholds, for how long and how many times

Reporting via PDF files

Logfile Integrity & Traceability

Total Samples: 370,905
 Number of Gaps > 180s: 11
 Total Gaps Time: 11,054
 Max Gap: 0h 16m 44s

IP Address	Max Offset	Gaps	Max Gap	Samples
10.0.0.3	0.000 007 704	0	0	76602
10.0.0.5	0.000 007 297	0	0	72415
10.0.0.2	0.000 003 254	0	0	77565
10.0.0.1	0.001 100 199	11	0h 16m 44s	67640

Source	Max Offset	Samples	Sample From	Key
10.0.0.1_0	0.001 100 199	67,640	NTP(1.2.3.4:5.6.7.8)	471b38a9b710e5ed9b619f4e10973168ec8b77d675d716b6aabeb481b13502ce

Breaches & Gaps

Bucket	Breach Start	Breach End	Duration
0.000100000	0.000000000	1485561600.280002428	1485561600.280002428
0.000050000	0.000000000	1485561600.280002428	1485561600.280002428
0.050000000	0.000000000	1485561600.280002428	1485561600.280002428
0.010000000	0.000000000	1485561600.280002428	1485561600.280002428
0.050000000	0.000000000	1485561600.280002428	1485561600.280002428
0.010000000	0.000000000	1485561600.280002428	1485561600.280002428
0.000100000	1485565200.771200020	1485565537.229400022	336.458200002
0.000050000	1485565200.771200020	1485565537.229400022	336.458200002
0.000100000	1485568801.542400040	1485569138.000600042	336.458200002
0.000050000	1485568801.542400040	1485569138.000600042	336.458200002
GAP	1485569200.390200042	1485570205.308400047	1004.918200005
0.000100000	1485572402.313600060	1485572738.771800061	336.458200001
0.000050000	1485572402.313600060	1485572738.771800061	336.458200001
0.000100000	1485572402.313600060	1485572738.771800061	336.458200001

Similar to GUI reports but in PDF form – with all selections expanded

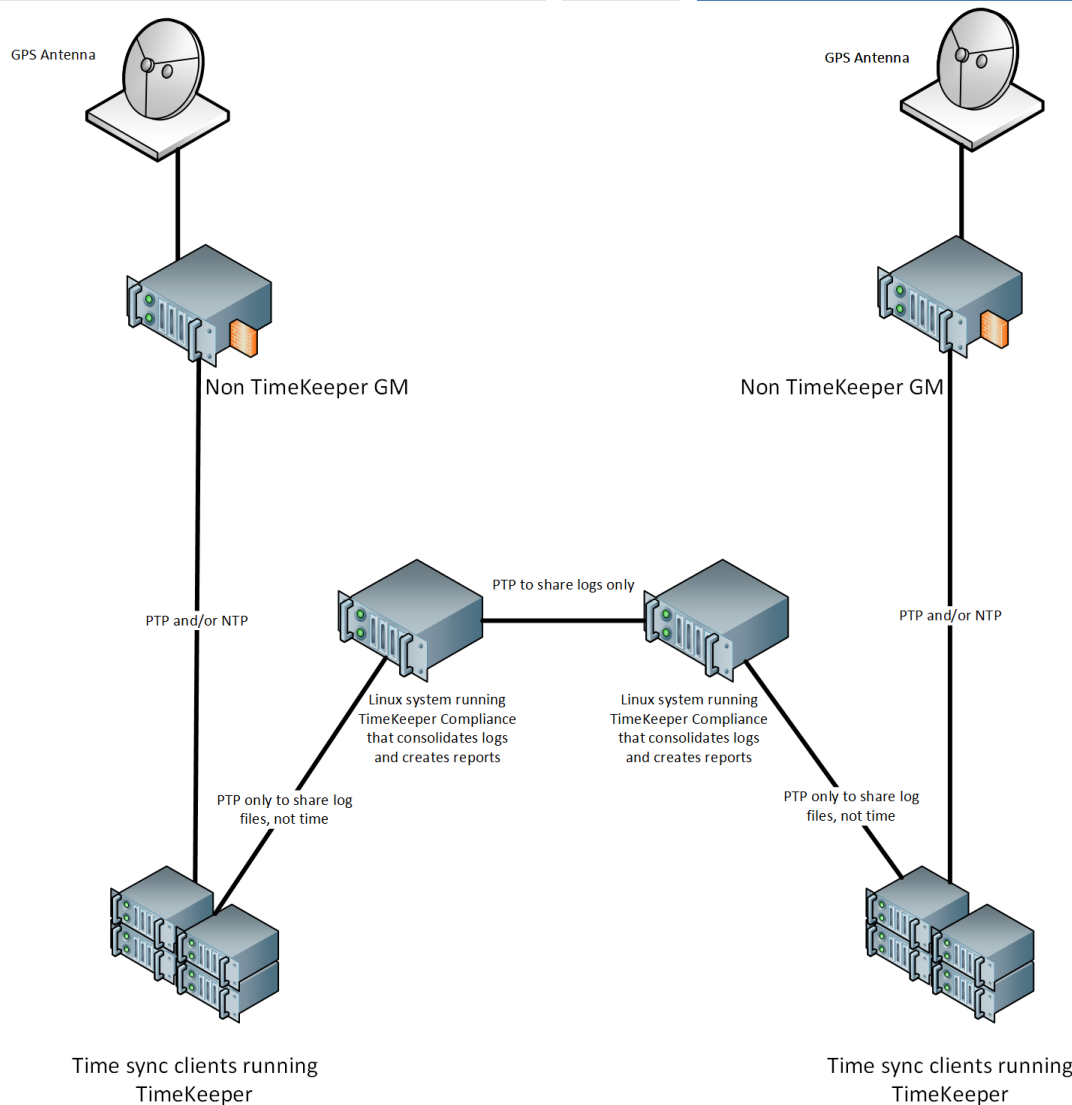
Ease to archive for long-term record keeping

Simple to include in other reports

How TimeKeeper Compliance works

- TimeKeeper setup to serve/receive time sync
- TimeKeeper clients start recording data
- Every 15 seconds (configurable) TimeKeeper shares sync data with servers/clients/other network nodes
- Data is stored in `/var/log/timekeeperclients/`
- User configures a given TimeKeeper instance to generate Compliance reports with stored data

Deployment: Software-only architecture

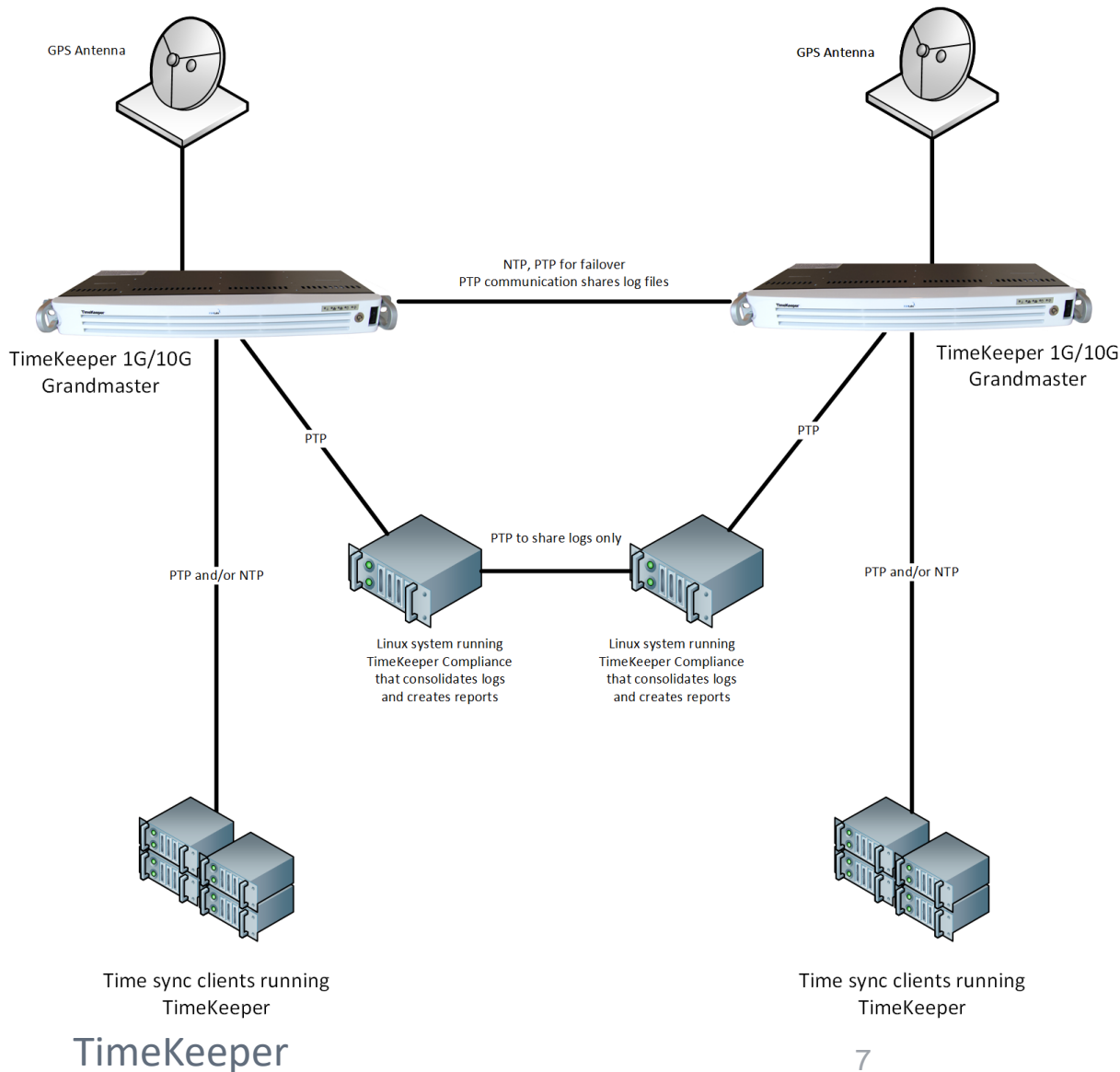


TimeKeeper Clients get time via PTP or NTP from non TimeKeeper grandmasters

TimeKeeper Compliance runs on your own hardware to collect client logs and generate reports, gets data directly from clients

Compliance instances communicate to share data between data centers and/or duplicate records for disaster recovery

Deployment: TimeKeeper-based time appliance



TimeKeeper Clients get time via PTP or NTP from TimeKeeper grandmasters

TimeKeeper Compliance runs on your own hardware to collect client logs and generate reports, gets data from grandmasters

Compliance instances communicate to share data between data centers and/or duplicate records for disaster recovery

Installation/setup is easy

- Install TimeKeeper 7.2.0 or newer
- Use a “compliance enabled” license
- Turn on Compliance
 - Add `ENABLE_COMPLIANCE=1` to `/etc/timekeeper.conf`, refer to TimeKeeper documentation for all options
- Confirm clients are providing data
 - `/var/log/timekeeperclients` should be populating
 - GUI will show ‘clients’ in timing quality tab
- Wait ~24 hours for first day of reports to appear

Data retention requirements (disk space)

- Varies by protocol, sync rate, etc.
- Typical/default values would be 1 update/second, NTP/PTP and thus ~2.7MB per client/source/day
- This would be ~985MB/year
- For 20k clients: ~20TB/year

Compliance performance

- Compliance reports are generated every 24 hours
- Processing all client data can be slow and require up to 24 hours to generate
- Disk speed is the limiting factor
 - SSDs speed up the process tremendously
 - Running on virtual hardware can be very slow
- Generally recommended to not run Compliance on systems also serving time

For more information, contact us!

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