

A decorative graphic on the left side of the slide, consisting of several blue triangles of varying sizes and orientations, some overlapping each other, creating a dynamic, abstract shape.

# Assisting Regulatory Compliance in Time Synchronization for Finance

FSMLabs Inc.  
TimeKeeper.  
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# MiFID II in the EU and FINRA/CATS in USA require clock sync in financial trading firms



- The requirement involves a lot of “documentation”
- This puts clock sync records in the same basket as other trading records.

# MiFidII



## MiFID II/MiFIR

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“Operators of trading venues and their members or participants shall be able to evidence that their systems meet the requirements. They shall be able to do so by documenting the system design, its functioning and specifications.”

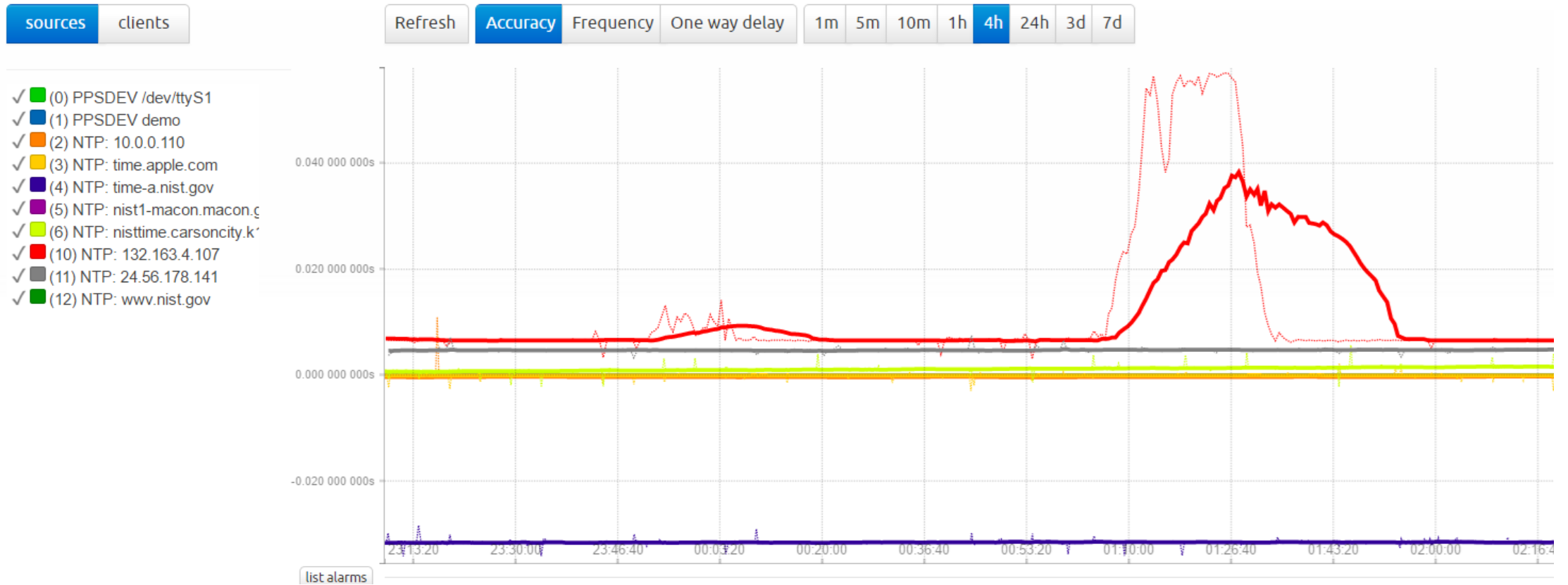
# One underlying purpose is to document books are not being manipulated.

- Is the order flow consistent with market regulations? (need consistent timestamps to determine sequence of events)
- Are trades anticipating release of supposedly confidential data?
- Are risk limits being always enforced?
- ...

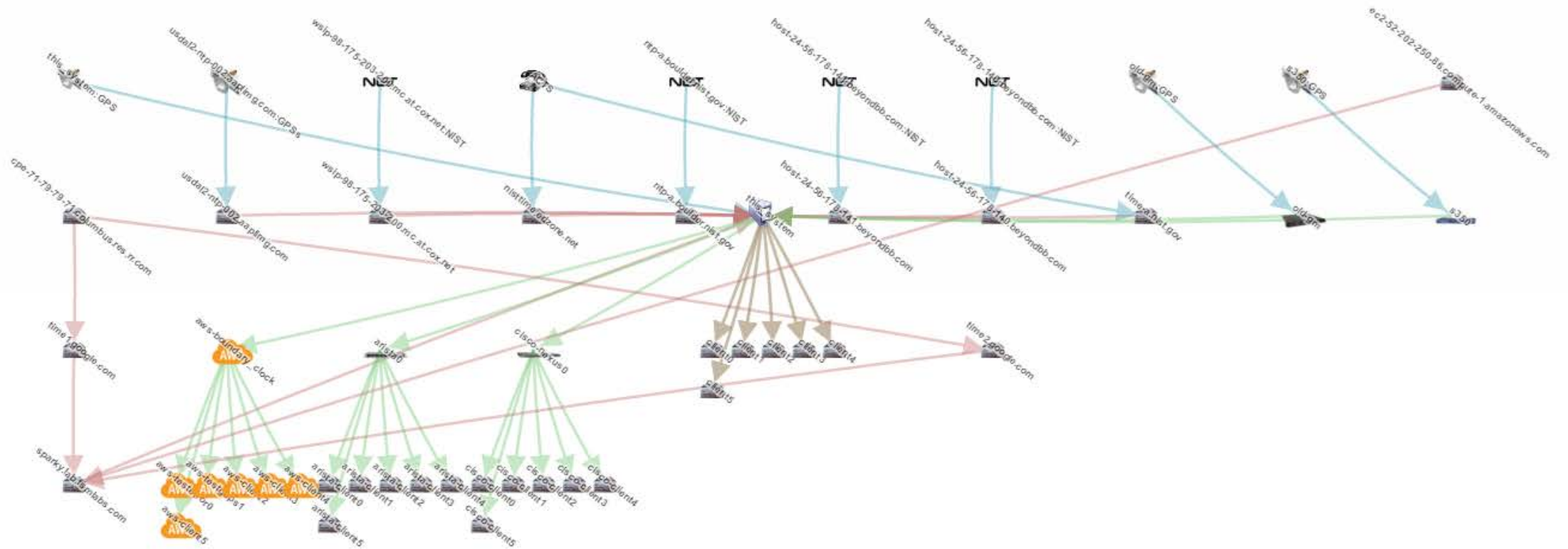
When transactions are 50 microseconds, then timestamps are essential for data integrity



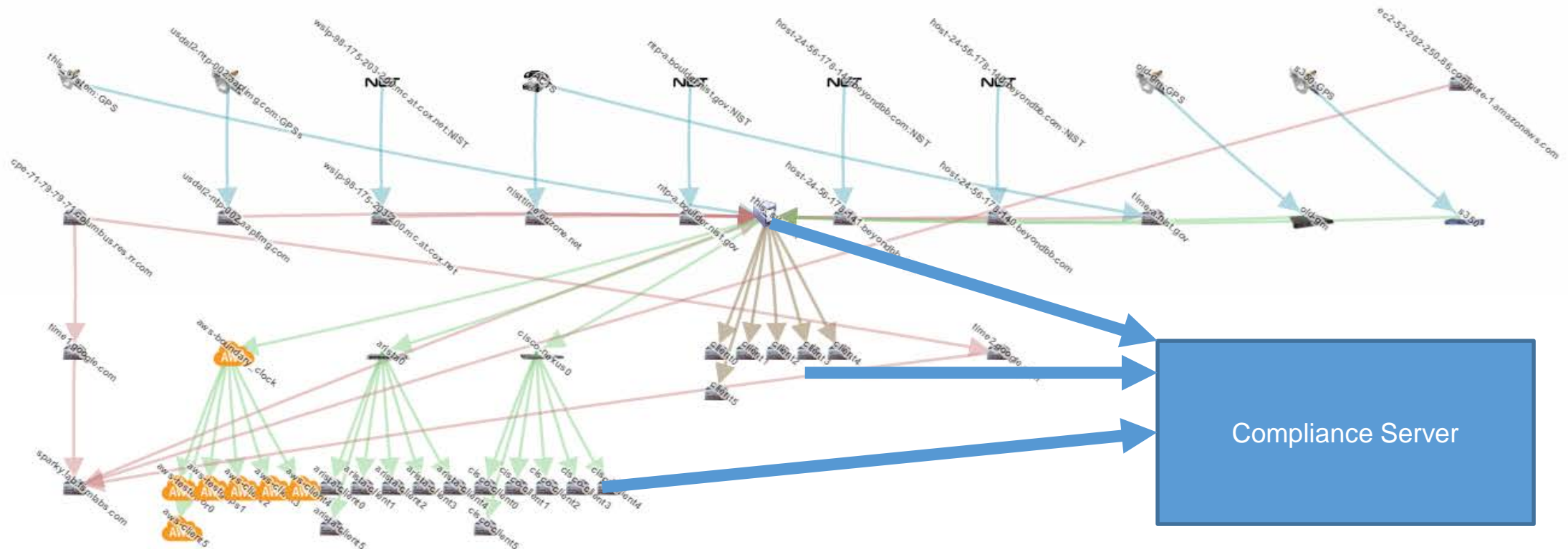
# Monitoring multiple time sources is essential if the reference time can fail.



# Goal is to show a chain of evidence from client to source.

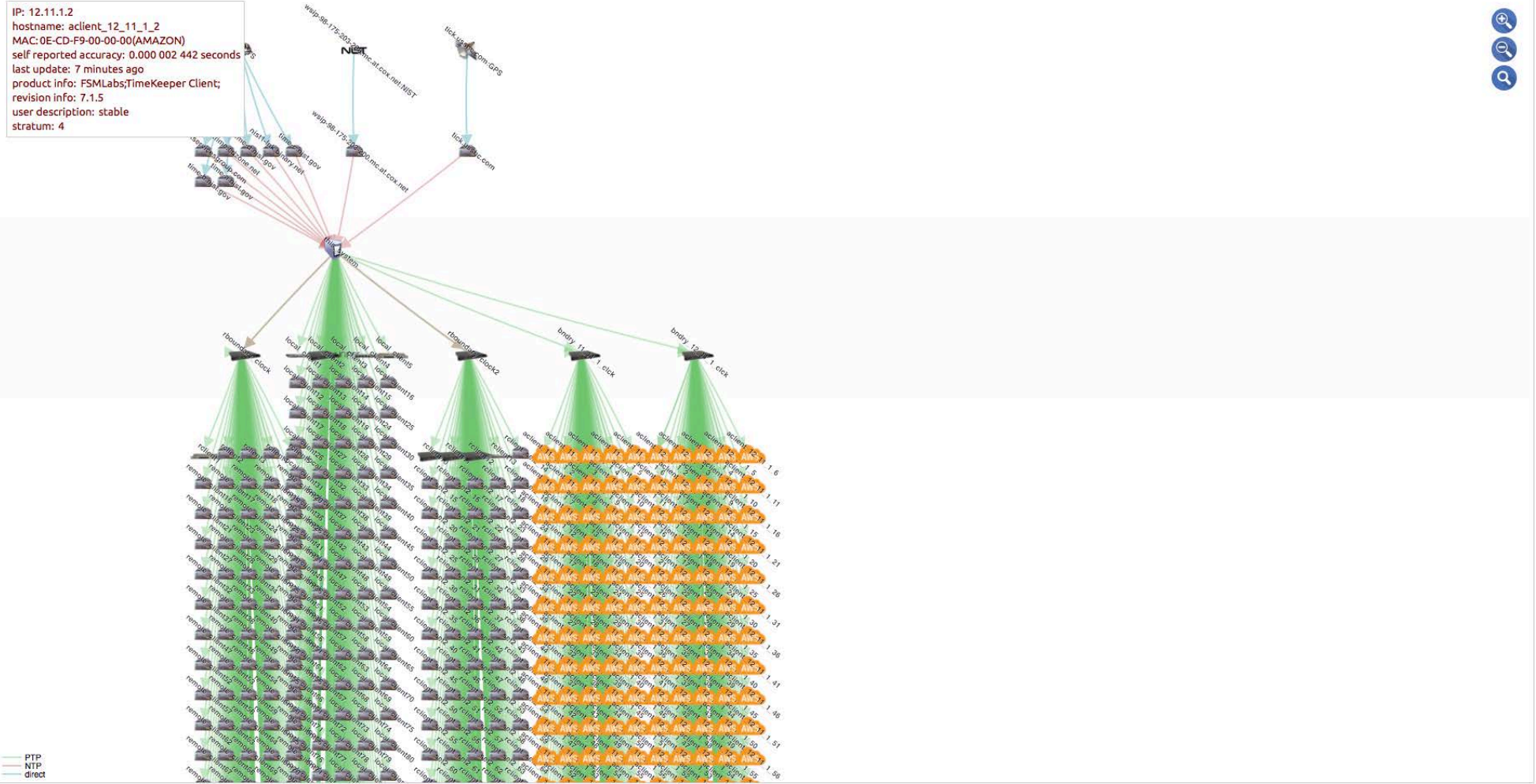


# Compliance servers should be able to collect data from all participants in clock sync



# More realistic map

Below is the current timing network as of: 19:08:49(UTC) as discovered by TimeKeeper.

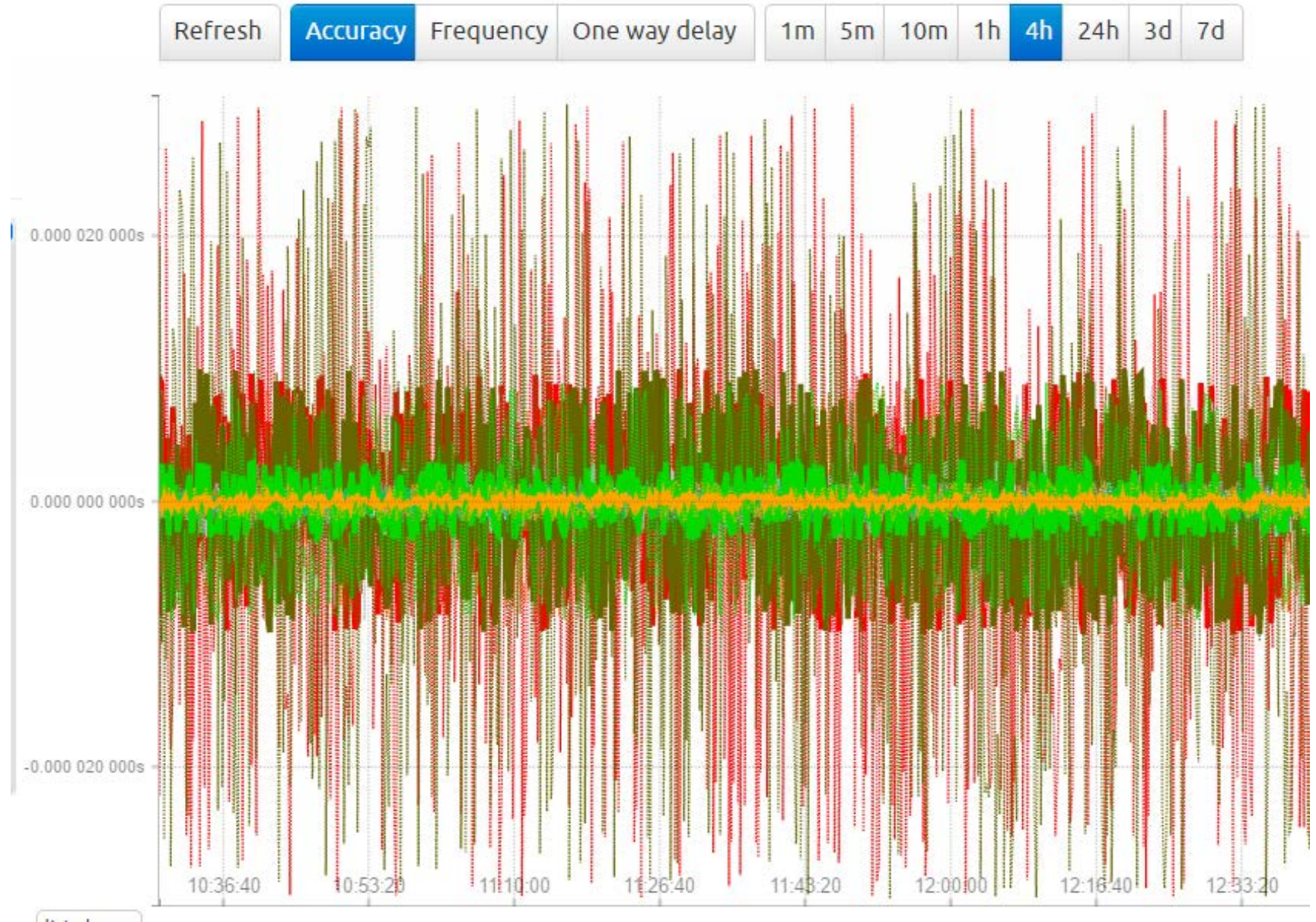




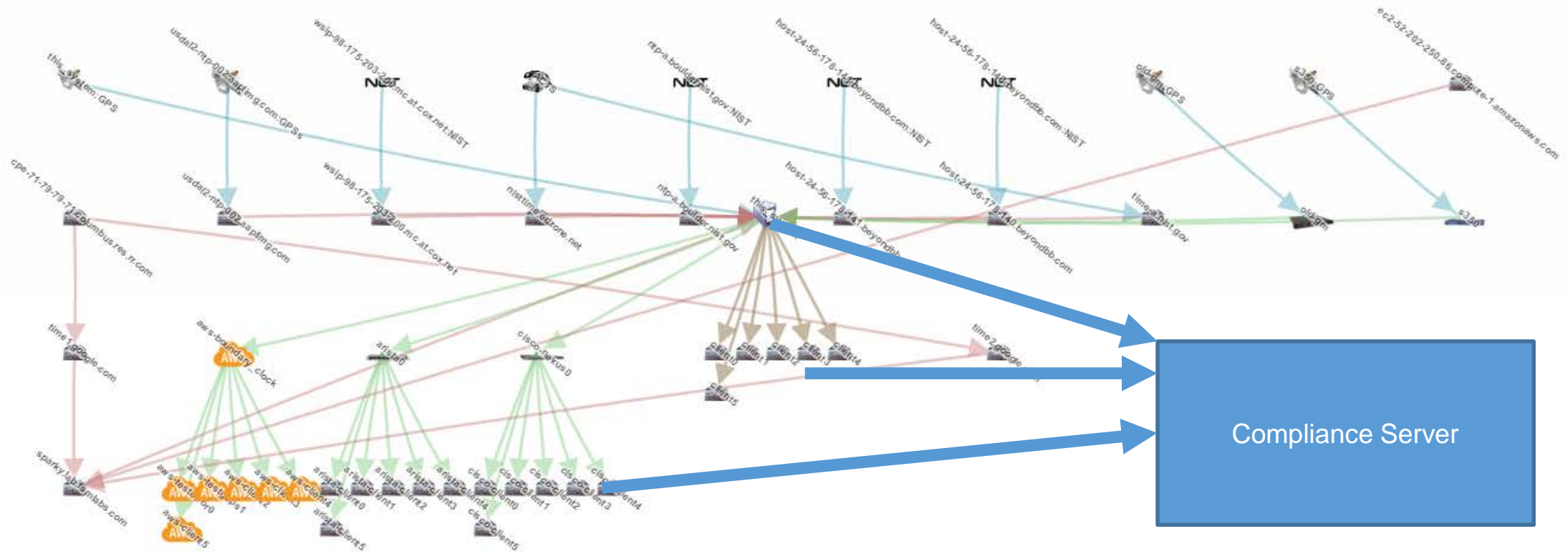
# The server monitors its clients



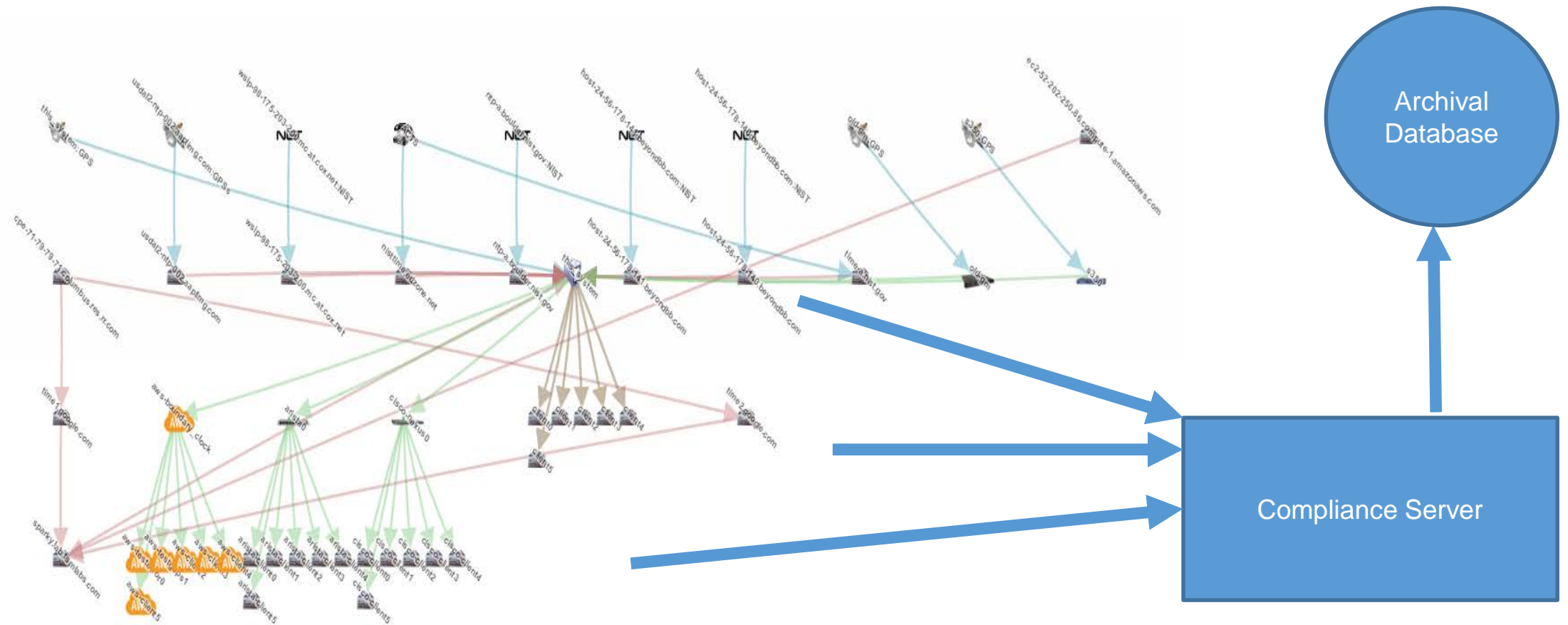
Without  
the outlier  
– most  
look good.



# Goal is to show a chain of evidence from client to source.



# Compliance Servers also need to build a searchable archival database



The clock data is presented in a form to flag compliance and failure

Time Intelligence Platform **FSMLabs**  
Sign out

Status Configuration Timing Quality Time Map Compliance Logs Support

Choose Reports *Compliance report finished*

Report	Report Type	Year	Month	Day
All	Monthly	2014	January	1
MiFID II	Daily	2015	February	2
FINRA	Weekly	2016	March	3
Host .4 MiFID II	Yearly	2017	April	4
			May	5
			June	6

**Synchronization Report for 2015-01-01 to 2017-03-13**

Report Start: Thu, 01 Jan 2015 00:00:00 GMT  
Report End: Mon, 13 Mar 2017 00:00:00 GMT  
Clientset: ALL  
Warning Threshold: 0.001  
Alert Threshold: 0.05

Clients by maximum offset range

Sync'd	Warning	Alert
141	39	22

(daily report) Tue, 08 Nov 2016 00:00:00 GMT - Wed, 09 Nov 2016 00:00:00 GMT(1478563200 - 1478649600)(download ALL)

Clients by maximum offset range

Sync'd	Warning	Alert
141	39	22

**Synchronization and Quality**

Report Date: 2016-11-08




IP Address	Max Offset	YYYY-MM-DD
192.168.1.16	0.059 602 536	2016-11-08
10.0.0.11	0.015 912 353	2016-11-08
10.0.0.197	0.000 577 233	2016-11-08
10.0.0.196	0.072 870 718	2016-11-08
10.0.0.92	0.000 371 203	2016-11-08
10.0.0.160	0.000 149 594	2016-11-08

Reporting has to be able to filter on different sets of machines; tolerances; and dates.

Choose Reports Compliance report finished

Report	Report Type	Year	Month	Day
All	Monthly	2014	January	1
MiFID II	Daily	2015	February	2
FINRA	Weekly	2016	March	3
Host .4 MiFID II	Yearly	2017	April	4
			May	5
			June	6

# A report, a range, a tolerance, and a tolerance

▶	<b>REPORT 0 : MIFID2</b>	
▼	<b>REPORT 1 : FINRA .192 net</b>	
Report Title	<input type="text" value="FINRA .192 net"/>	
Client Set	<input type="text" value="192*"/>	
Warning Threshold	<input type="text" value=".000500"/>	
Alert Threshold	<input type="text" value=".001"/>	
▶	<b>REPORT 2 : FINRA amazon hosts</b>	
▶	<b>Add a new compliance report</b>	

# Drill down to specific machine (IP number)

10.0.0.147	0.056 631 078	2	0h 12m 43s	3515
Source	Max Offset	Samples	Sample From	
Source 0	0.056 631 078	3,515	undefined	
Alerts, Warnings & Gaps				
Bucket	Start	End	Duration	
0.050000000	1478605508.621463299	1478606108.176355839	599.554892540	
<b>GAP</b>	1478623886.773636341	1478624624.595240116	737.821603775	
<b>GAP</b>	1478635254.819823265	1478636018.757485867	763.937662601	



# A report summary

## Synchronization Report for 2015-01-01 to 2017-03-13

Report Start: Thu, 01 Jan 2015 00:00:00 GMT

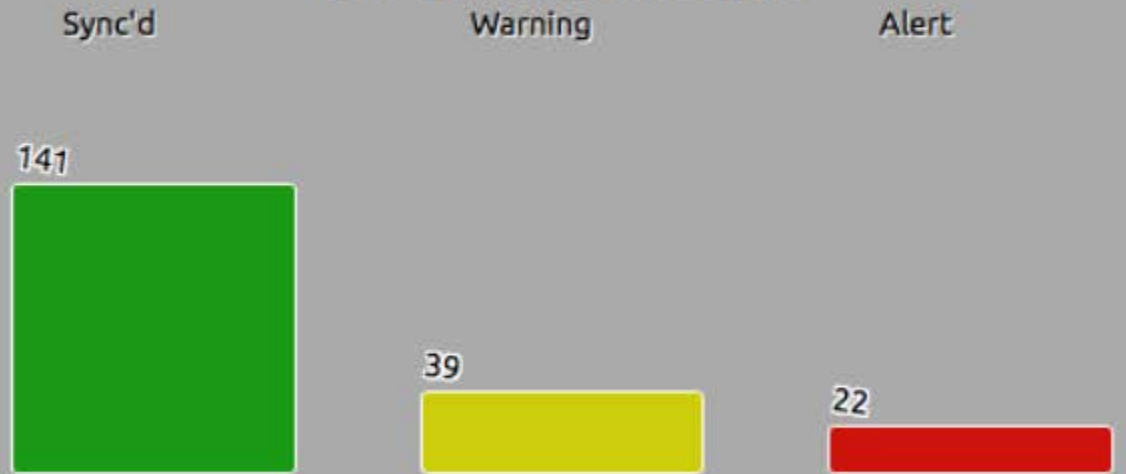
Report End: Mon, 13 Mar 2017 00:00:00 GMT

Clientset: ALL

Warning Threshold: 0.001

Alert Threshold: 0.05

## Clients by maximum offset range



# A daily report

Report Date: 2015-01-01

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<b>IP Address</b>	<b>Max Offset</b>	<b>YYYY-MM-DD</b>
192.168.1.16	0.086 436 813	2015-01-05
10.0.0.11	0.054 932 932	2015-01-05
10.0.0.197	0.087 477 597	2015-01-05
10.0.0.196	0.094 905 984	2015-01-05
10.0.0.92	0.001 843 796	2015-01-05
10.0.0.160	0.000 927 441	2015-01-05

# MiFID II imposes a requirement to store significant amounts of data

- Rough order of magnitude is 1 terabyte of data per year per 1000 clients (more with more sources)
- Data needs to be searchable
- Data needs to be checksummed and validated
- Each financial institution and each regulatory framework involves different reporting forms and requirements (which are evolving)
- Regular automatic report generation and “real-time” data query are both necessary functions.

# Contact info

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