



**Here come the time cops**



**But first...**



## **STAC Update on STAC-TS**

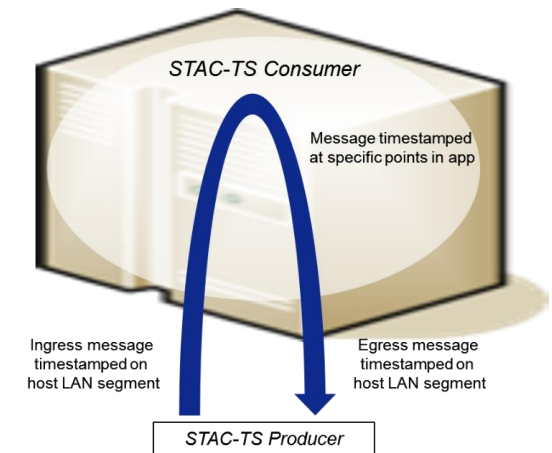
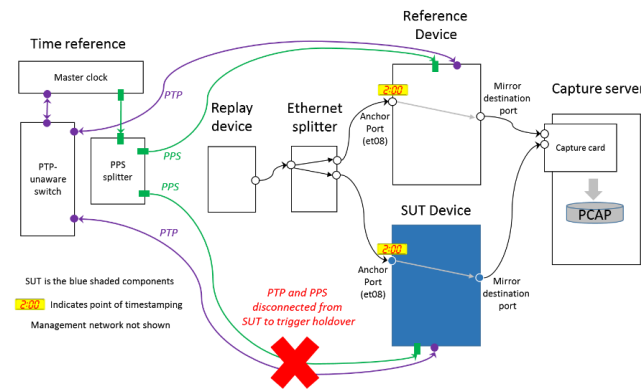
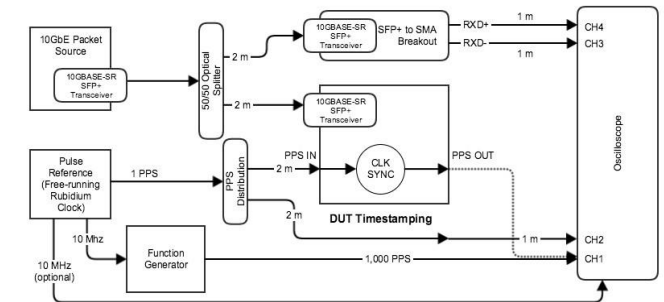
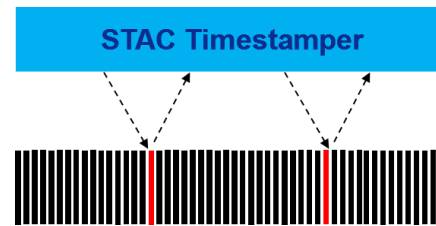
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The views in this presentation are mine and do not necessarily represent those of any other STAC Benchmark Council member.

# Refresh on what STAC-TS is

- A Working Group in the STAC Benchmark Council
  - Vendors in the time sync / timestamping / capture businesses
  - HFT shops, banks, exchanges
- A set of benchmark specs
  - Application timestamping
  - Network timestamping
  - Enterprise time distribution
  - Time distribution to site
- A set of software tools
- A process for delivering and improving these



# Purposes of STAC-TS

- Help firms demonstrate compliance with regulations

- Provide information helpful for product evaluation

**STAC Traceability Report** Generated by: Firm XYZ Report date: 15 May 2018

**INTERVAL ANALYSIS**

Time Interval  
2018-04-17T08:00:00Z to 2018-04-19T16:30:00Z

Timestamping Point ID: 384  
Accuracy with respect to: APPLICATION EVENTS

Timestamping Point Class: 62  
clock\_gettime(CLOCK\_REALTIME)  
C++ 11  
06 build 274  
Server build 736  
PTP client x.y.z  
PTP LAN: Segment A22

Highest Error Magnitude (microseconds)		
99%	99.99%	Max
2	5	81

Error Range (microseconds)		
99%	99.99%	Max
0 +/- 1	3 +/- 3	40 +/- 41

Traceability Decomposition (microseconds)					
Component	99%	99.99%	Max	Exceptions	Source/Hyperlink
Platform type X.Y - Application-level error	1 +/- 1	3 +/- 3	40 +/- 40	None	<a href="#">STAC-TS.ALE results</a>
Platform type X.Y, PTP solution A, network segment A22 - Host clock error	0 +/- 0	0 +/- 0	0 +/- 1	None	<a href="#">Loop stats (host daemon)</a>
Acme PTP boundary clock model 82m	0 +/- 0	0 +/- 0	0 +/- 0	None	<a href="#">STAC-TS.CE1 results</a>
Acme Grand Master Clock v2.4 as PTP master	0 +/- 0	0 +/- 0	0 +/- 0	None	<a href="#">STAC-TS.CE4 results</a>
GPS signal	0 +/- 0	0 +/- 0	0 +/- 0	None	<a href="#">GPS bulletin</a>

**STAC Report** STAC-TS / MetaWatch 0.5.2 / MetaApp32 rev A5A / MOS-0.14.0alpha3

Two Metamako MetaApp32 rev A5A running MetaWatch 0.5.2 firmware on MOS-0.14.0alpha3 with Finisar FTLX8574D3BCV SFP+ and PPS discipline via a TimeTech Pulse Distribution Unit 10535  
SUT ID: MMK170530

**STAC-TS™ BENCHMARKS**

Scope of report: Accuracy of network timestamping

Test dates: 30 May 2017 to 2 Sep 2017

Draft 1.0, 15 October 2017

**Stack under test**

- 2 x MetaWatch 0.5.2 / MetaApp32 rev A5A / MOS-0.14.0alpha3
- Finisar FTLX8574D3BCV Transceivers
- TimeTech Pulse Distribution Unit 10535
- 2 x 1.8m Yuebit 80 Ohm SMA to SMA Coaxial Cables

**Benchmark specs: STAC-TS (network timestamping subset)**

THESE TESTS FOLLOWED STAC BENCHMARK SPECIFICATIONS PROPOSED OR APPROVED BY THE STAC BENCHMARK COUNCIL. (SEE [WWW.STACRESEARCH.COM](http://WWW.STACRESEARCH.COM)). BE SURE TO CHECK THE VERSION OF ANY SPECIFICATION USED IN A REPORT. DIFFERENT VERSIONS MAY NOT YIELD RESULTS THAT CAN BE COMPARED TO ONE ANOTHER.

# First official STAC Report released (today)

- Metamako MetaApp32 rev A5A + MetaWatch 0.5.2 firmware
  - And other components
- We previewed some results at the last STAC Summits
- Additional results



# Highlights

- STAC-TS.NTE2 = -0.5 +/- 5.5 nanoseconds
  - Worst case absolute accuracy with respect to the PPS source, for timestamps obtained from any port on a single device
- STAC-TS.PSE1.TOTAL = -1.5 +/- 4.5 nanoseconds
  - Worst case error between any two ports on a single device
- STAC-TS.PSE2.TOTAL = 1.5 +/- 8.5 nanoseconds
  - Worst case error between any port on one device and any port on the other device
- STAC-TS.PSE1.RAND.BEST = +/- 1 nanosecond
  - Best case random error between two ports on a single device (error that cannot be calibrated out)

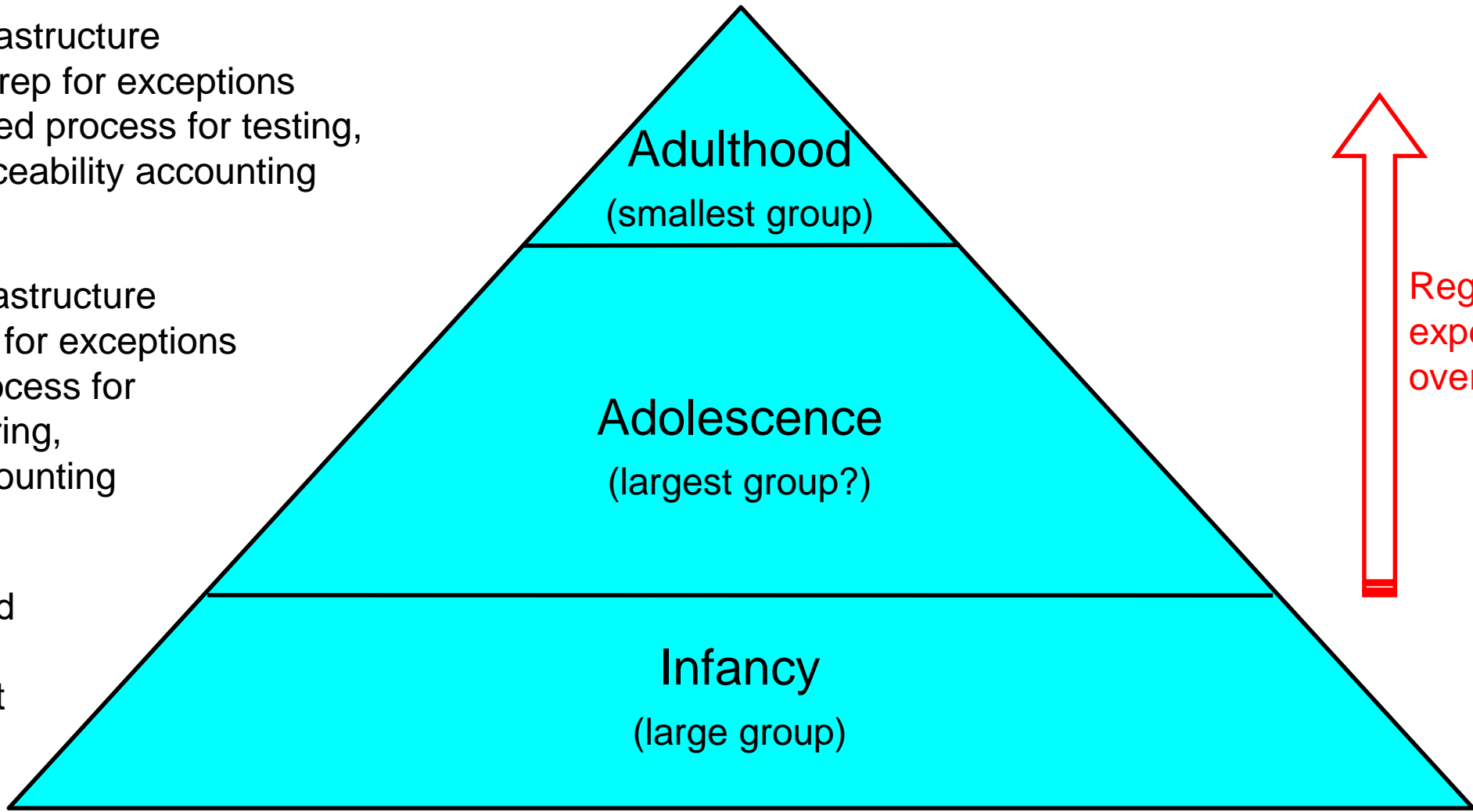


# How is MiFID 2/RTS 25 enforcement looking?

- By many reports, ESMA does not expect full compliance with MiFID 2 by Jan 3, 2018
  - That applies to broadly to all of MiFID 2 (which is massive)
- Key phrase from the FCA on RTS 25:
  - By Jan 3, 2018, expect firms to have taken “every reasonable effort”
- Expect “thematic reviews” of RTS 25 compliance (audits not tied to an investigation)

# How is MiFID 2/RTS 25 readiness looking?

- Have good infrastructure
  - Best practice prep for exceptions
  - Standards-based process for testing, monitoring, traceability accounting
- 
- Have good infrastructure
  - Semi-prepared for exceptions
  - No rigorous process for testing, monitoring, traceability accounting
- 
- Don't have good infrastructure
  - Haven't thought about anything else



*The Time Compliance Maturity Pyramid*

# The key to demonstrating compliance

- The key is not a checklist of technologies
  - “We use GPS in every location with PTP to every server” (or whatever)
- There are many ways that great technologies can yield bad results
  - Trust me, we see it every day!
- The key is:
  - Testing
  - Monitoring
- These tell you how things actually work
- That’s why ESMA explicitly clarified that they expect testing and monitoring

## A Tale of Two Audits

# Consider the following scenario

- Regulator asks Firm A to submit RTS 6 events for a 3-day interval
  - Including evidence that timestamps comply with RTS25
- Inside Firm A: Fire drill to pull together relevant info for those dates
- Network group provides loop stats for all hosts during that period
- App dev group provides test results from early 2017 showing mean application jitter < 100 ns, std dev ~ 3 usec
- Firm A dresses up the info, declares compliance, and sends to regulator

# What happens next

- Regulator can't judge the information. Uses Sec 166 to bring in an independent auditor at Firm A's expense.
- Auditor asks for more data (second fire drill)
  - Test plans, results, network layouts, logs. Questions, questions....
- Auditor finds gaps in loop stats and no holdover data
- Auditor rejects the firm's application-test data
  - Points out that there was an OS upgrade since then
  - Says firm's statistics not relevant to RTS 25 anyway
- Auditor finds other issues

# What happens next

- Auditor's report to regulator:
  - Firm A cannot demonstrate compliance
  - Quite likely that some hosts were non-compliant
  - Firm A's testing and monitoring is not best practice
- Regulator concludes Firm A violated RTS 25
  - Also believes the firm is not taking RTS 25 seriously
- **Regulator issues a juicy fine**

# The costs to Firm A

- Multiple fire drills \$\$
- External auditor \$\$
- Adopting a new process going forward \$
- Fines \$\$\$...?



# What could make it even worse...

- Suppose Firm A were suspected of market abuse
  - Spoofing
  - Front-running
  - Or whatever
- It would be pretty hard for Firm A to use data with non-compliant timestamps to justify trades
  - Remember: the burden of proof is on the firm
- Result could be an even bigger financial impact

**\$ \$ \$ \$ ++**

# Things to note

- The regulator didn't have to prove any particular timestamps were wrong
  - Usually they can't (that's the whole reason for RTS 25)
  - Which is why they will focus on how the firm ensures accuracy
- Firm A couldn't justify the validity of its timestamps
- Nor could it show its processes were industry best practices

# Another way that first scenario could go

- Regulator asks Firm A to submit trade records for 3-day interval
  - Including evidence that timestamps comply with RTS25
- Firm A provides a STAC Traceability Survey for relevant timestamping points for those dates
  - With embedded hyperlinks to test and monitoring data
- STAC Traceability Survey shows all nodes in compliance during the interval except one
  - Clicking on the exception brings up a STAC Traceability Report

# What happens next

- Firm A provides an explanation for the exception
  - Host daemon accidentally killed. Not remedied in time.
  - Actually, 3 hosts had the problem, but holdover test data showed 2 were too short to cause non-compliance
- Firm A documents improved operational procedures to ensure Unix team can meet its SLA
- Firm A shows it performs comprehensive testing
  - Following industry best practices (STAC-TS)
  - Infrastructure and app platforms, foreseeable exceptions
  - Including holdover tests based on Unix team's remedy window

# What happens next

- **Regulator issues a stern letter**

# Summary

- You've got time to do it right
- Standards can help
- See [www.STACresearch.com/TS](http://www.STACresearch.com/TS)