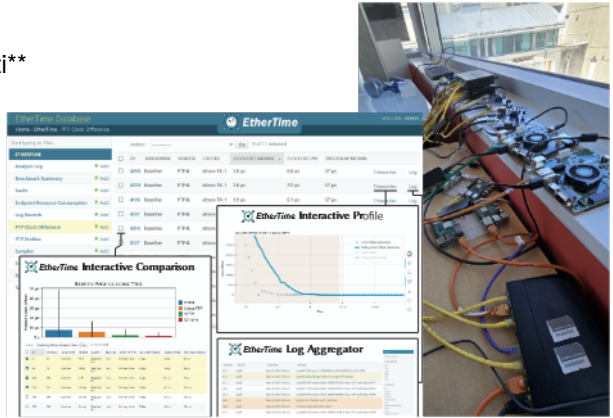
EtherTime: Cross-vendor Evaluation of PTP/NTP on Ethernet-based COTS Embedded Platforms

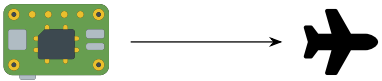
*Vincent Bode**, William Shen**, Arpan Gujarati**
Visiting International Research Student Project at UBC

* Chair for Computer Architecture and Parallel Systems
Technical University of Munich

** Systopia Lab
Department of Computer Science
University of British Columbia



Time in Distributed Systems



Time in Distributed Systems

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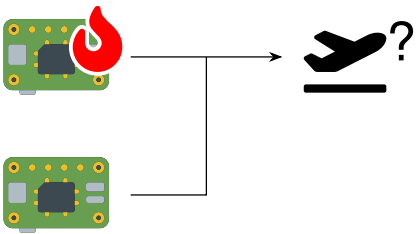
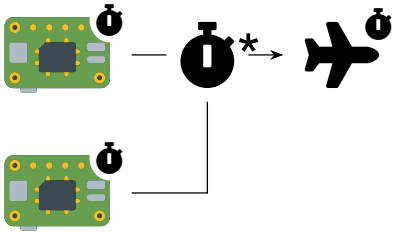
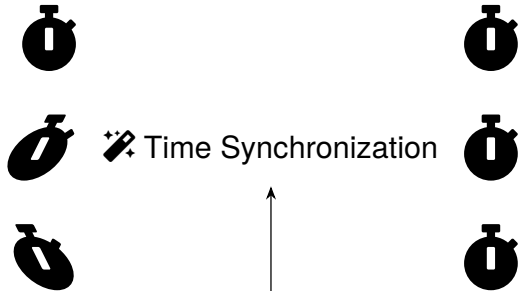
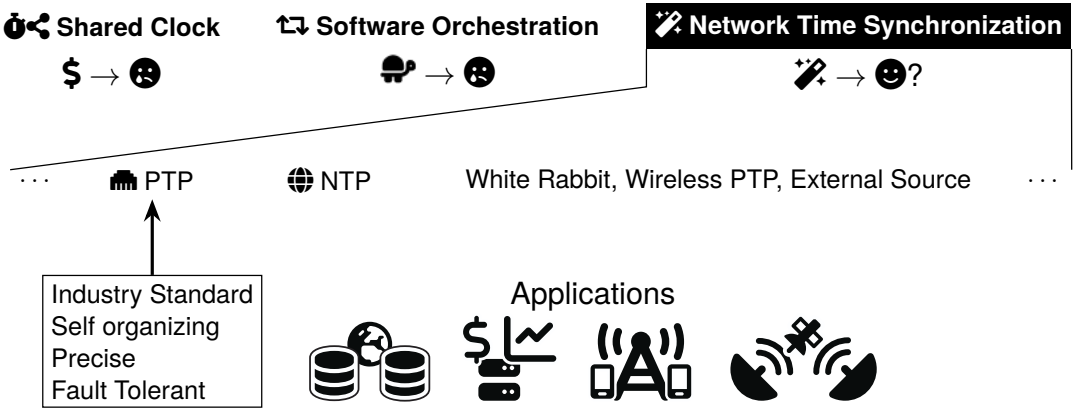


Time in Distributed Systems

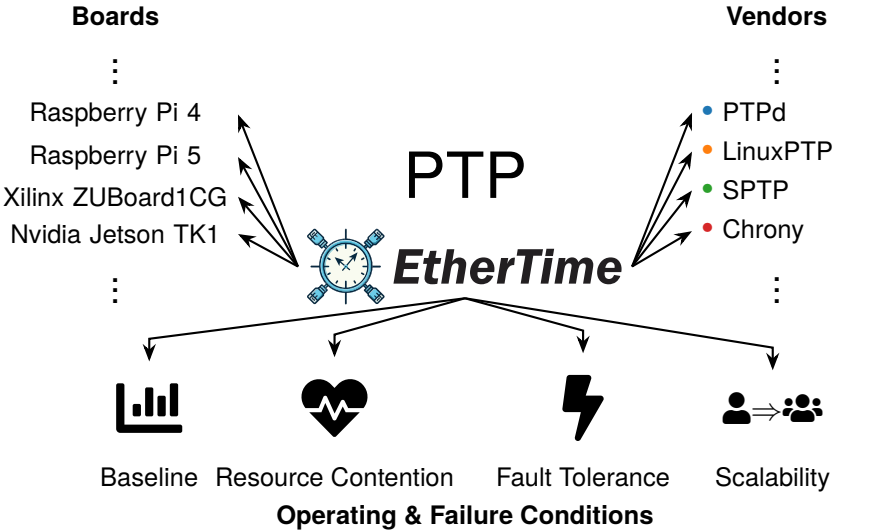


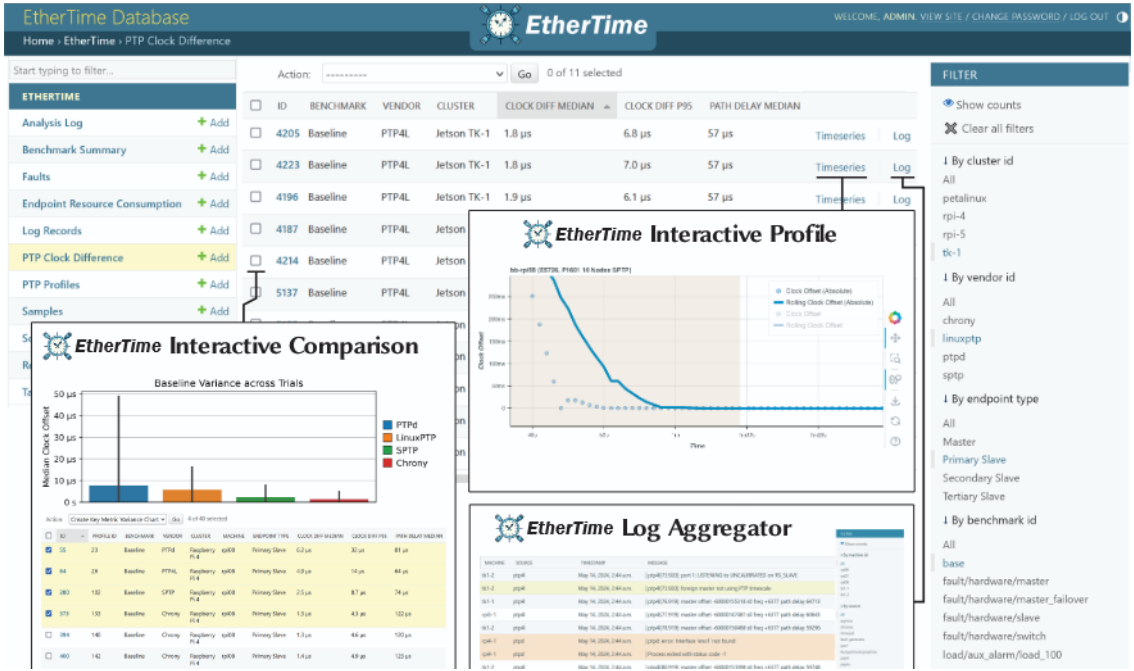


Distributed Synchronized Time

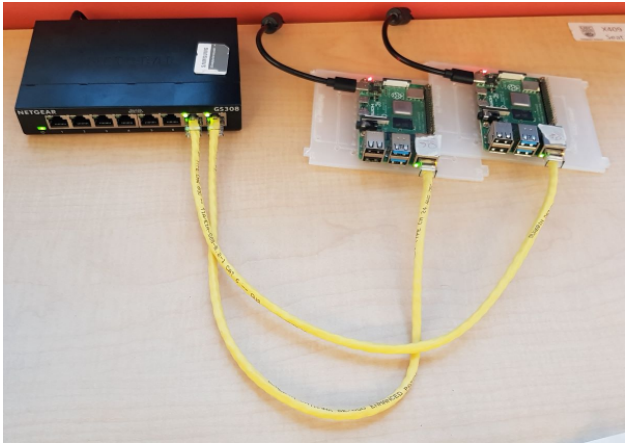


Precision Time Protocol

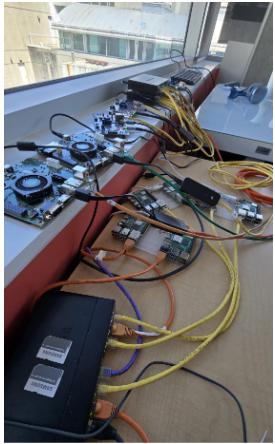



EtherTime Database
Home › EtherTime › PTP Clock Difference
EtherTime
WELCOME, ADMIN. VIEW SITE / CHANGE PASSWORD / LOG OUT
Start typing to filter...
ETHERTIME
Analysis Log + Add
Benchmark Summary + Add
Faults + Add
Endpoint Resource Consumption + Add
Log Records + Add
PTP Clock Difference + Add
PTP Profiles + Add
Samples + Add
Action: ---------
Go
0 of 11 selected
ID BENCHMARK VENDOR CLUSTER CLOCK DIFF MEDIAN CLOCK DIFF P95 PATH DELAY MEDIAN
4205 Baseline PTP4L Jetson TK-1 1.8 µs 6.8 µs 57 µs Timeseries Log
4223 Baseline PTP4L Jetson TK-1 1.8 µs 7.0 µs 57 µs Timeseries Log
4196 Baseline PTP4L Jetson TK-1 1.9 µs 6.1 µs 57 µs Timeseries Log
4187 Baseline PTP4L Jetson
4214 Baseline PTP4L Jetson
5137 Baseline PTP4L Jetson
EtherTime Interactive Comparison
Baseline Variance across Trials
Median Clock Offset
50 µs
40 µs
30 µs
20 µs
10 µs
0 s
PTPd
LinuxPTP
SPTP
Chrony
EtherTime Interactive Profile
Clock Offset (Absolute)
Rolling Clock Offset (Absolute)
Clock Offset
Rolling Clock Offset
Time
EtherTime Log Aggregator
FILTER
Show counts
Clear all filters
By cluster id
All
petalinux
rpi-4
rpi-5
tk-1
By vendor id
All
chrony
linuxptp
ptpd
sptp
By endpoint type
All
Master
Primary Slave
Secondary Slave
Tertiary Slave
By benchmark id
All
base
fault/hardware/master
fault/hardware/master_failover
fault/hardware/slave
fault/hardware/switch
load/aux_alarm/load_100

Hardware Setup

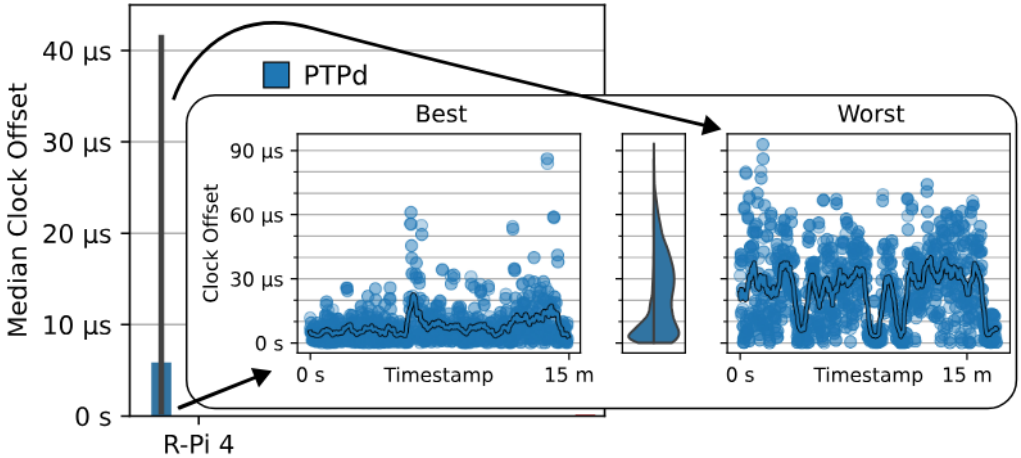


Hardware Setup

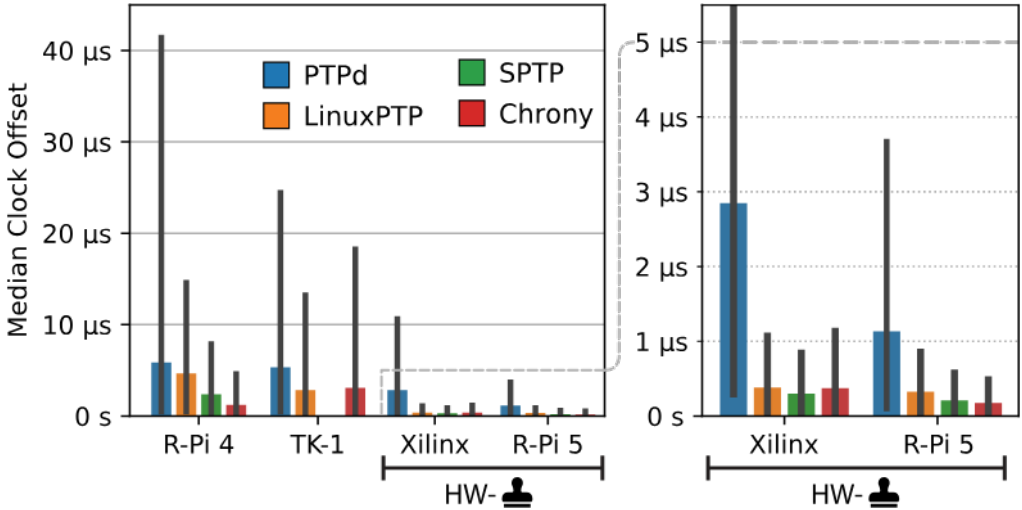


	Purpose	HW-⏚	RTC
Raspberry Pi 4 	General	✗	✗
Raspberry Pi 5 	Next-Gen	✓	✓
Xilinx ZUBoard 1CG 	Real-time	✓	✓
NVIDIA Jetson TK-1 	GPU	✗	✗

Baseline


Median Clock Offset
40 µs
30 µs
20 µs
10 µs
0 s
R-Pi 4
PTPd
Best
Worst
Clock Offset
90 µs
60 µs
30 µs
0 s
0 s
Timestamp
15 m
0 s
Timestamp
15 m

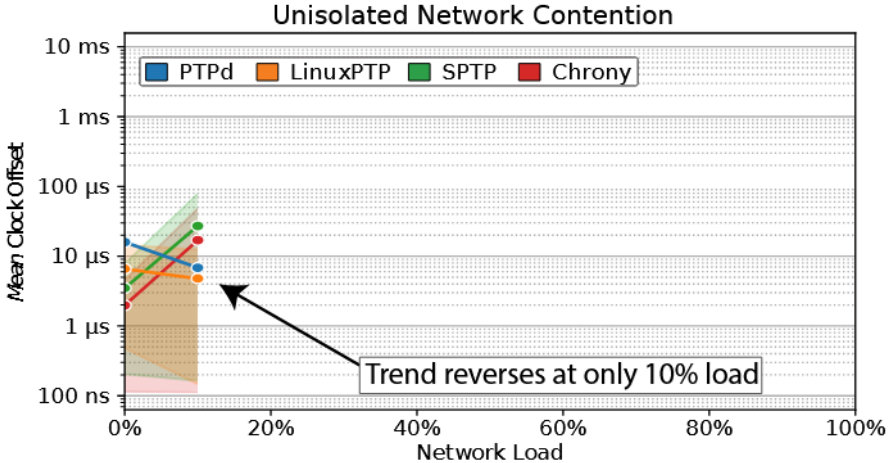
Baseline


Median Clock Offset
40 µs
30 µs
20 µs
10 µs
0 s
PTPd
LinuxPTP
SPTP
Chrony
R-Pi 4
TK-1
Xilinx
R-Pi 5
HW-
5 µs
4 µs
3 µs
2 µs
1 µs
0 s
Xilinx
R-Pi 5
HW-

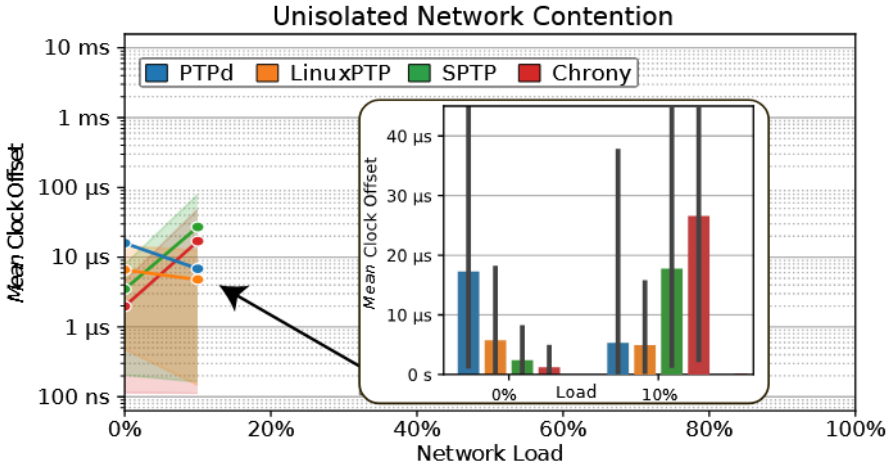
Evaluation

	• PTPd	• LinuxPTP	• SPTP	• Chrony
Base Metrics				
Accuracy				
Stability				

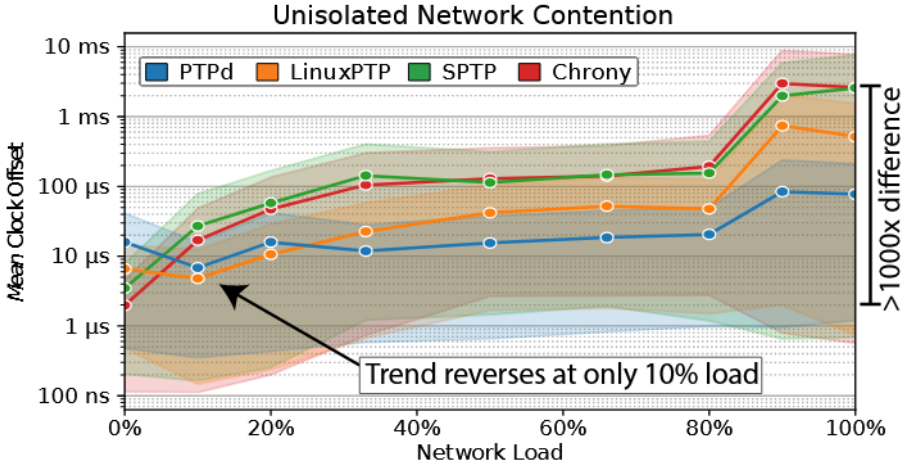
Resource Contention (Network)



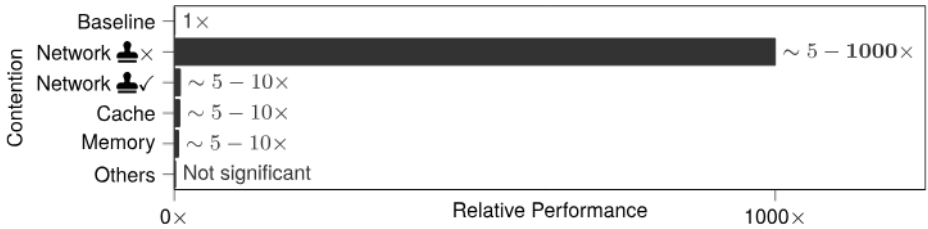
Resource Contention (Network)



Resource Contention (Network)



Resource Contention (All)



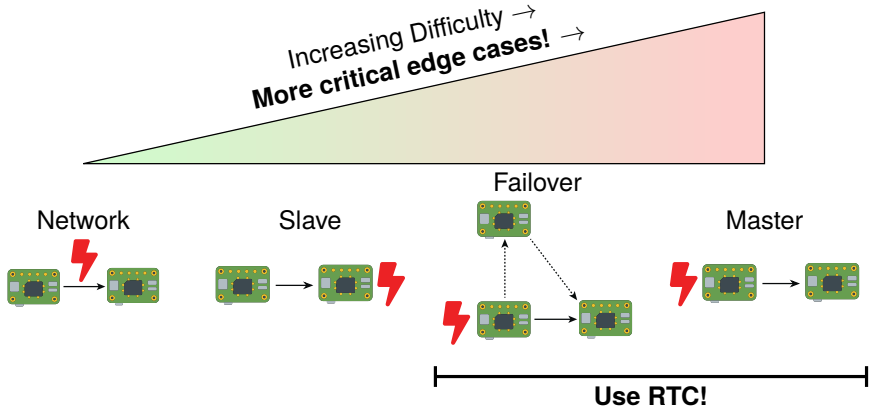
Potential Solutions:

Hardware Isolation ✓ Traffic Prioritization ⚠

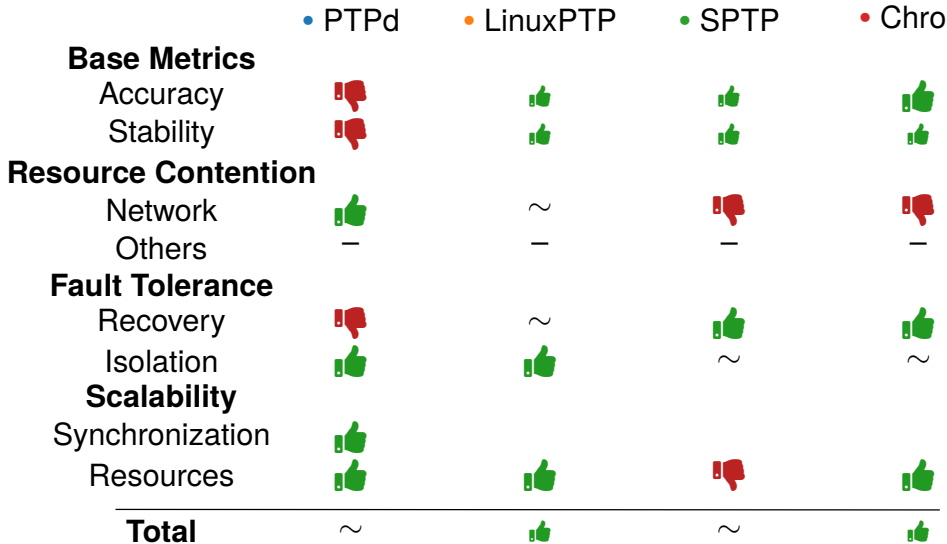
Evaluation

	• PTPd	• LinuxPTP	• SPTP	• Chrony
Base Metrics				
Accuracy	👎	👍	👍	👍
Stability	👎	👍	👍	👍
Resource Contention				
Network	👍	∼	👎	👎
Others	–	–	–	–

Fault Tolerance



Evaluation


• PTPd
• LinuxPTP
• SPTP
• Chrony
Base Metrics
Accuracy
Stability
Resource Contention
Network
Others
Fault Tolerance
Recovery
Isolation
Scalability
Synchronization
Resources
Total

Conclusion – State of PTP Implementations

1. Accuracy? 
2. Dependability? ~
3. Features? HW-  +
4. Vendor? LinuxPTP/*Chrony* ~~PTPd~~

More performance results in paper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Vincent Bode (vincent.bode@tum.de)
Chair for Computer Architecture and Parallel Systems
Technical University Munich

THE UNIVERSITY OF BRITISH COLUMBIA