Global STAC Live, Fall 2021

Data Center Precise Time

Dan Biederman and Dave Cohen

Notices & Disclaimers

Intel technologies may require enabled hardware, software or service activation.

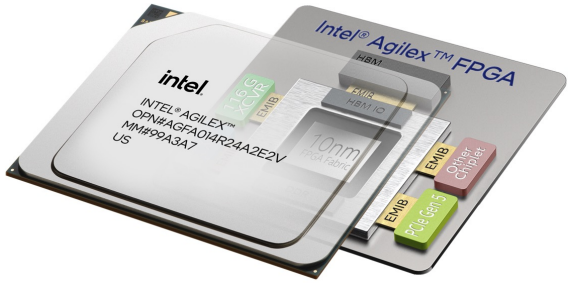
No product or component can be absolutely secure.

Your costs and results may vary.

Intel does not control or audit third-party data. You should consult other sources to evaluate accuracy.

© Intel Corporation. Intel, the Intel logo, and other Intel marks are trademarks of Intel Corporation or its subsidiaries. Other names and brands may be claimed as the property of others.

Time Sync Trends and Silicon Implementations



Cellular Industry Precise Time requirements

- Example: ITU-T 8273.2 Class D - 5ns Total Error per node.

Silicon vendors have implemented these technologies for Cellular customers

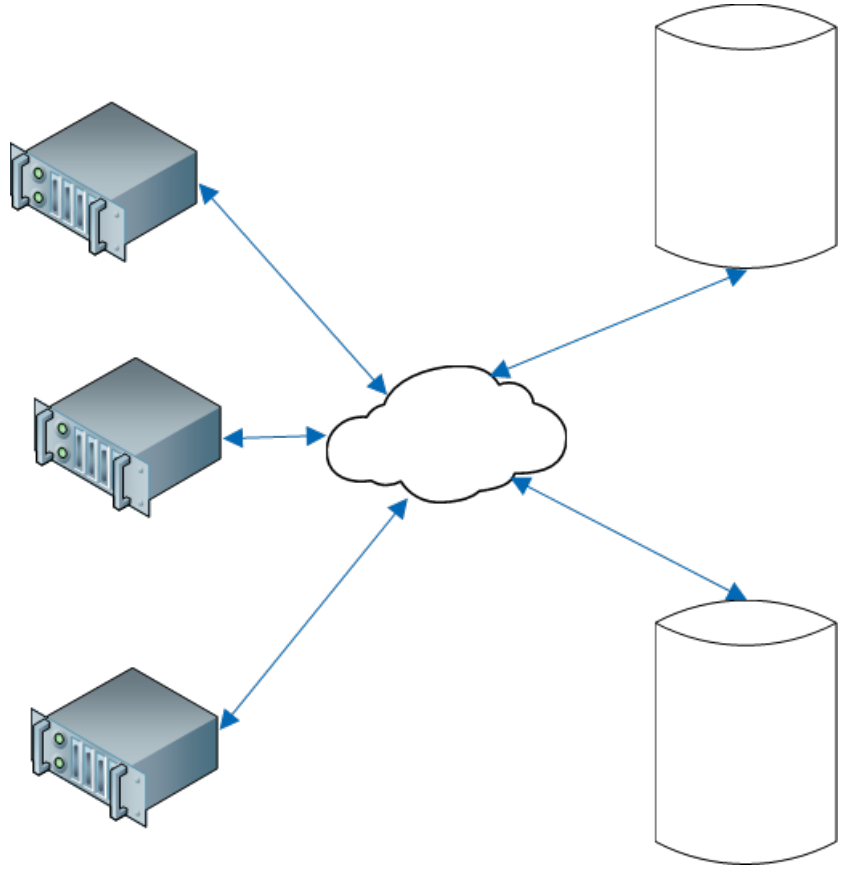
- Servers like Intel® Atom™ P5900
- FPGAs like Agilex™ and Stratix® 10
- NICs (E810-XXVDA4T)

Precise Time in the data center seems to be following that of the Cellular Industry, just a few years behind

Data Centers will use and improve on these cellular technologies (i.e., OCP-TAP)

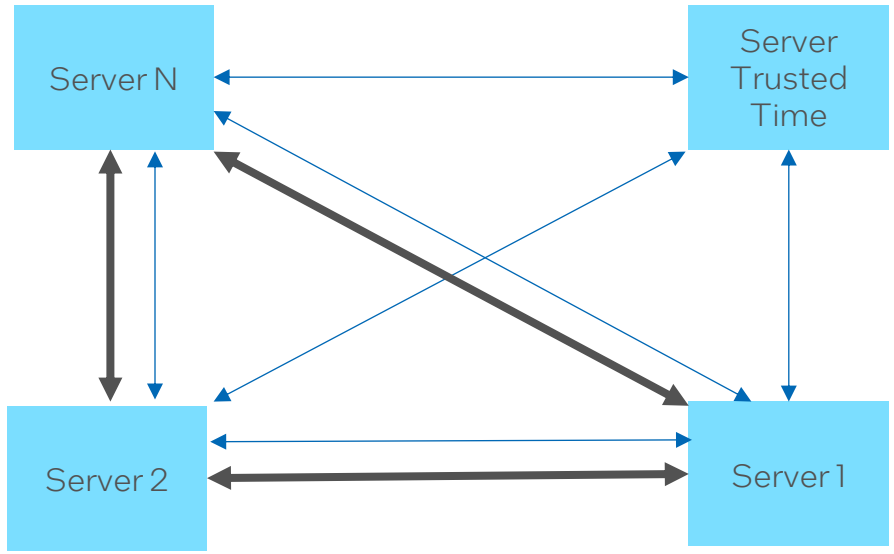
Use Case: Shared Database, Storage, Cache, etc.

- OCP-TAP presentation on CockroachDB by Nathan VanBenschoten
  - Fewer Transaction Retries
  - Less Transaction Waiting
  - Strict Transaction Serialize-ability
- End-to-End Precision Give Amazing results
- “as the clock uncertainty T was reduced from 1 ms to 10 us and then to 100 ns, the retry rate fell from 99.30% to 4.74% and to 0.08% in an experiment with 10,000 reads for each value of T.” Geng*



* Reference: “Exploiting a Natural Network Effect for Scalable, Fine-grained Clock Synchronization,” Geng, et.al., Proceedings of the 15th USENIX Symposium on Networked Systems Design and Implementation (NSDI ’18). April 9–11, 2018 ▪ Renton, WA, USA.

Use Case: Trusted Time at the Edge



Must be authenticated

Must be verify-able

- Kicked off if hacked
- Kicked off is intercepted

Valid time-stamper at the edge

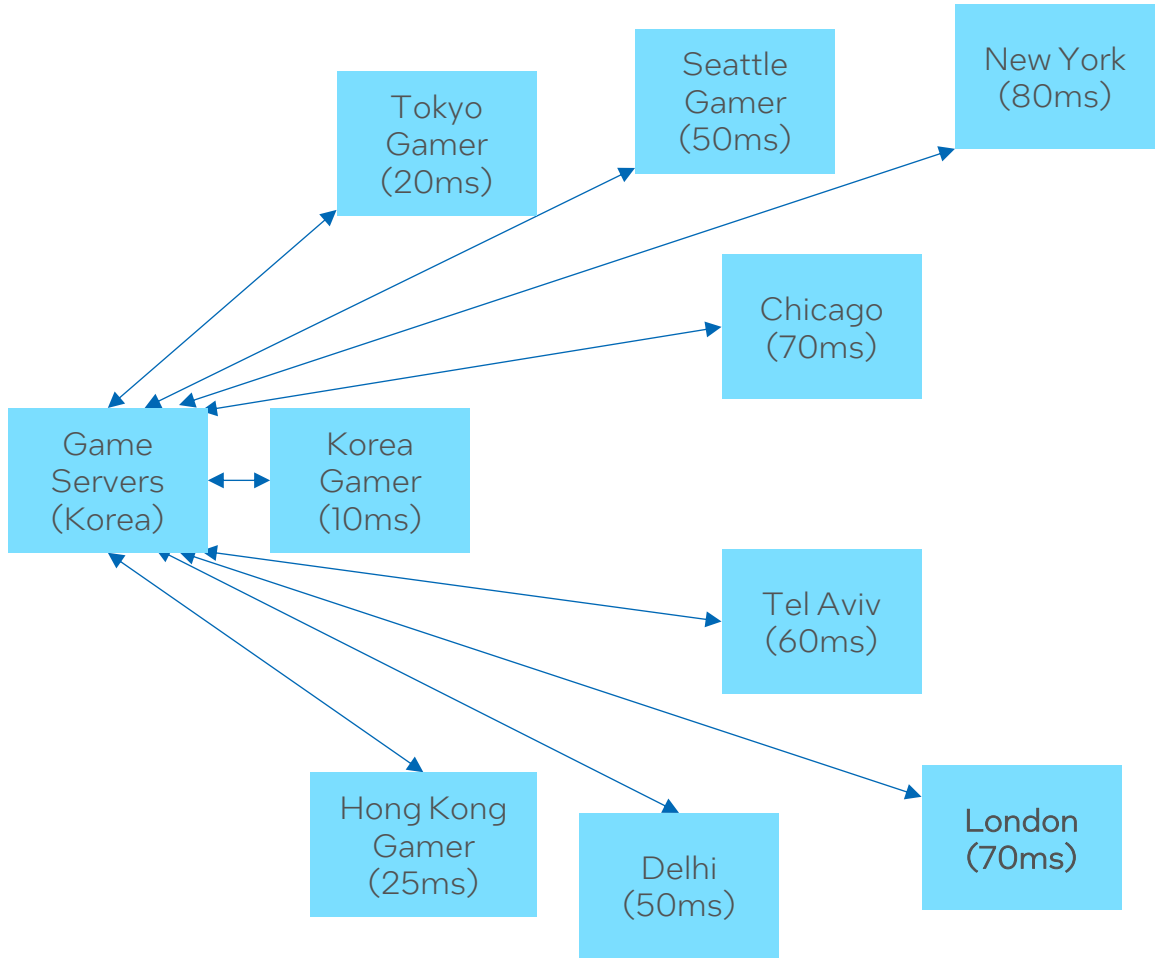
Time-As-A-Serivce

End-to-End Precision:

- Depends on application

Use Case: Mass Online Platforms (Games)

- Lower latency gives an advantage
- People will move closer to the server
- Instead, time stamp action at the customer then delay a decision for 100ms.
- End-to-End Precision: <1 microsecond (globally)



Use Case: Stock Exchange

Current Stock Exchange

Contract on the table

One place for all transactions (the table)

Distributed Stock Exchange

If there was a precise time known, it could be based on Time Stamps

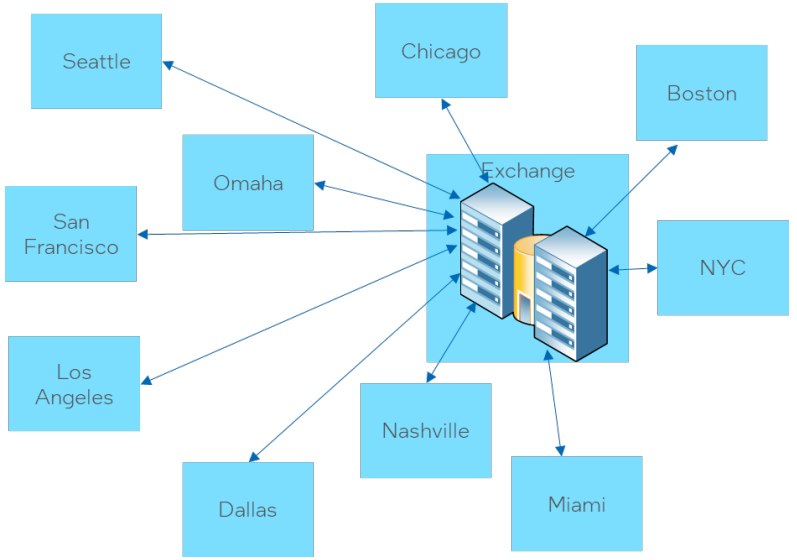
Must be trusted time

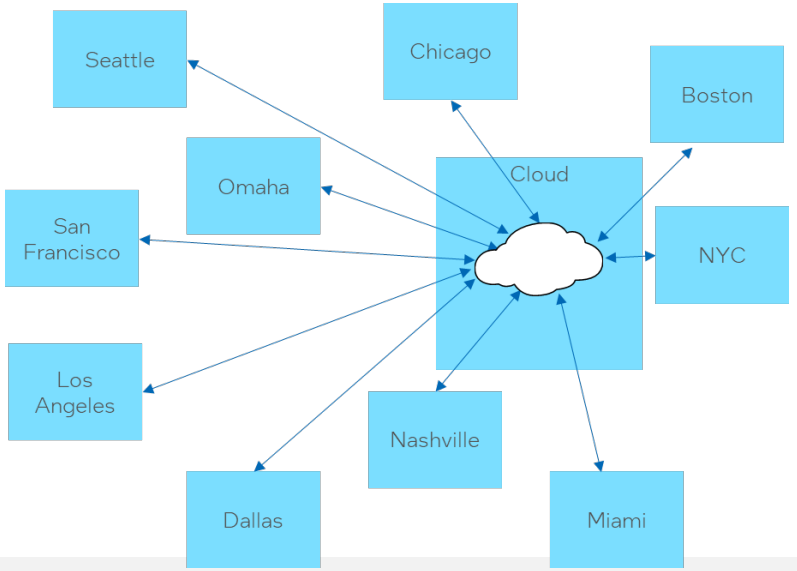
Must be verifiable and traceable

End-to-End Precision

Skewness of clocks must be less than the latency of the network

Usually in the nanoseconds





Conclusion

- Time is important to data center application
- Cloud Service Providers are trending to:
  - Reuse precise time technologies from the Cellular Industry
  - Develop new technologies for the Data Center (OCP-TAP)
- Data Centers and Financial Services Companies can adapt Precise Time technologies with amazing results!

"What will you do with Precise Time in your business?"

intel