STAC Update:
Fast Data

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Overview

- FPGA Special Interest Group

- Cloud connectivity benchmark development

- STAC-N1 (full network stack)

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FPGA SIG Background

- Founded with 7 financial firms

- Goal:
  - Work together on non-proprietary challenges in FPGA development that all firms would benefit from solving

- Initial objectives
  - Facilitate dialog regarding common challenges in FGPA design, development, testing and deployment
  - Articulate industry requirements for FPGA hardware and toolchains where commonalities exist

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What's happening now

- The group is meeting every 4 to 6 weeks

- Grown to
  - 16 financial firms
    - Exchanges, hedge funds, prop shops, and banks
  - 7 vendors
    - board, chip, development tools, and IP providers
    - vendors who leverage FPGA for their own projects

- Expanding on initial objectives, with focuses on:
  - Joint initiatives that allow for collaboration across financial firms and vendors
  - Exploring open source and open-source friendly projects
  - Deeper dives with vendors on critical tool chain components

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Current collaborations: 3 main projects

- RapidWright / RapidStream improvements, including
  - Common requirements, requests, and prioritized bugs
  - Collaborating with developers at AMD at a deeper level

- Language support
  - Jointly contribute to VHDL and SystemVerilog projects that check canonical language feature support in other tools
  - Use to convey of critical features to vendors

- Joint development of open-source Switch and/or NIC reference implementation
  - Exploring currently existing projects as starting points
  - Focus on the primary needs of trading firms

Education

- ## Previously

  - Financial firms FPGA developers presented different build, test, and deploy pipelines
  - RapidWright project deep dive led by project engineers from AMD

- ## Upcoming

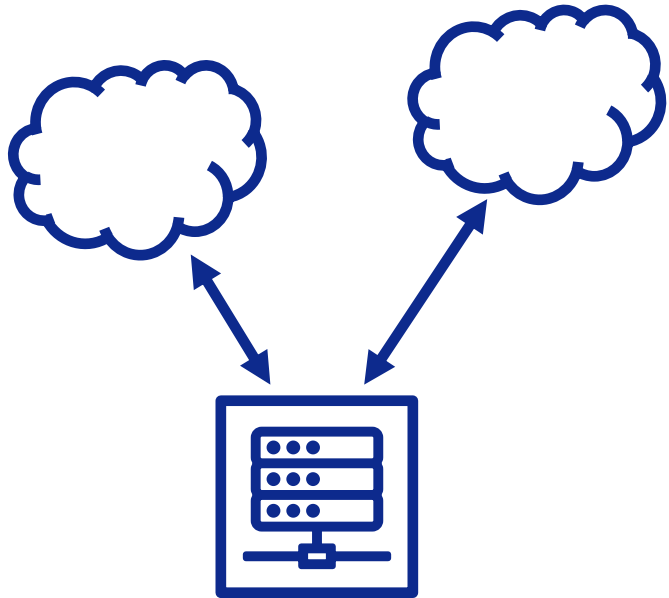 - Tutorial for CXL for FPGA to CPU communication and impact on development from Intel

FPGA SIG update

- Topics and projects are driven by interests of financial firms

- You too can join us

www.STACresearch.com/fpga

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- Have had increasing interest in understanding:
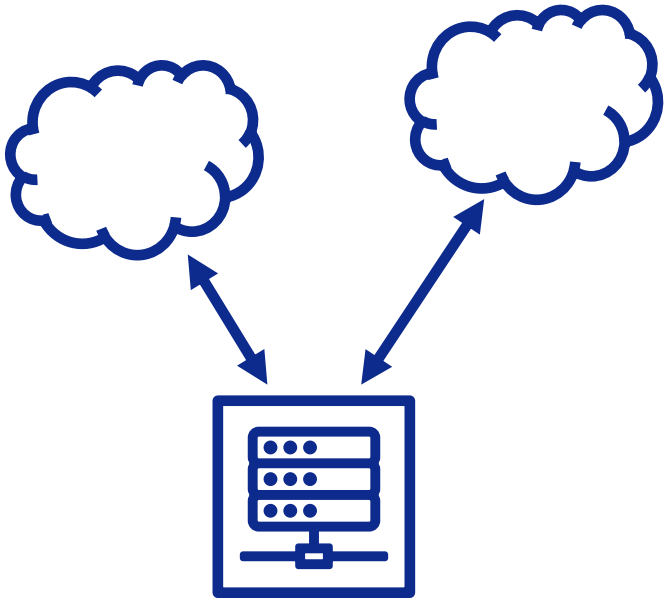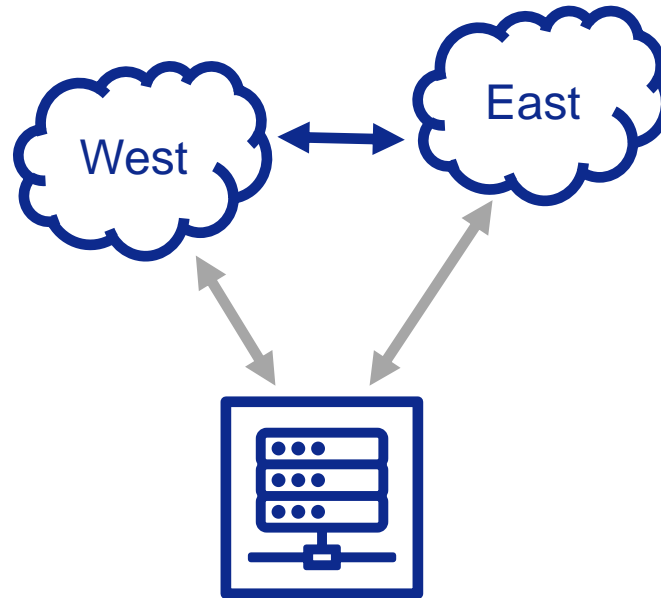 - Latency
  - Determinism

**On-prem
to Cloud**

Cloud connectivity latencies

- Have had increasing interest in understanding:
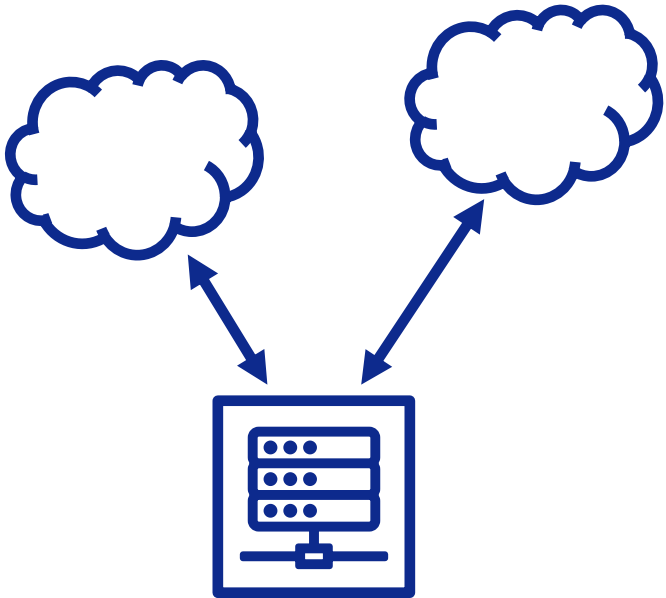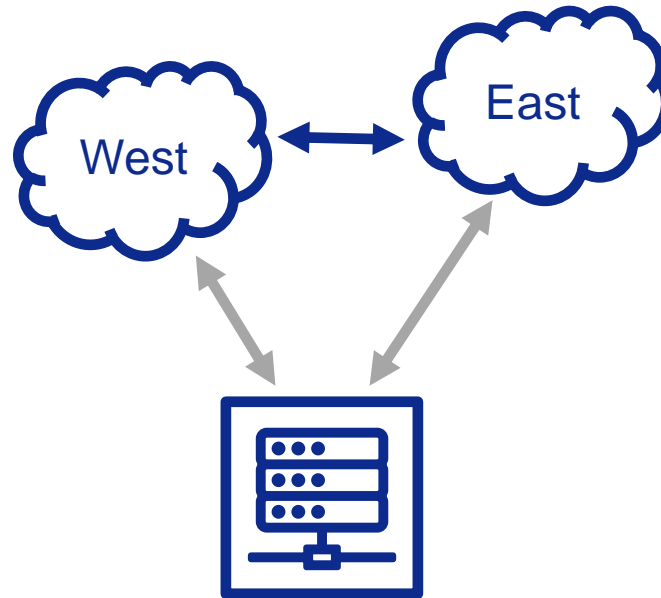 - Latency
  - Determinism

**On-prem
to Cloud**

West ⟷ East

**Cloud Region
to Cloud Region**

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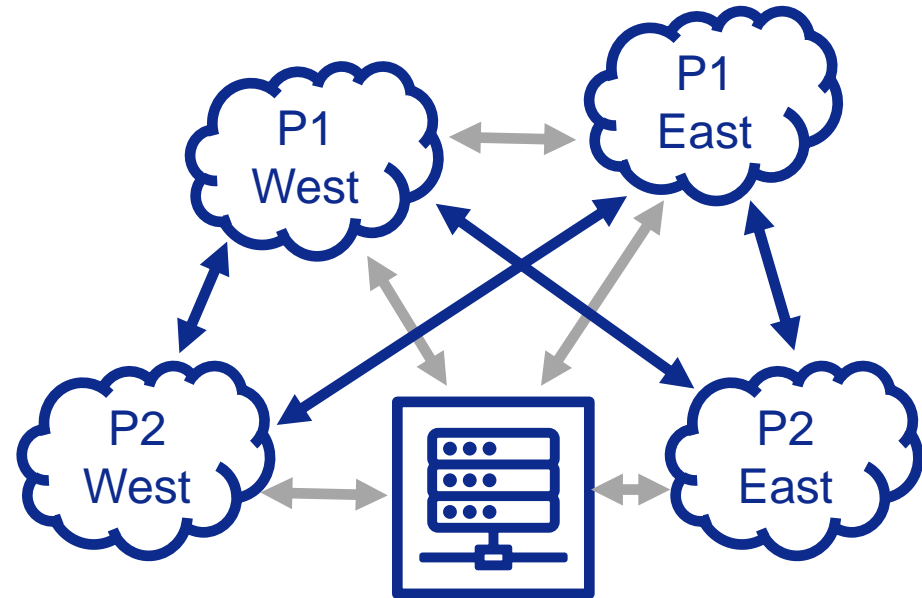# Cloud connectivity latencies

- Have had increasing interest in understanding:
  - Latency
  - Determinism


On-prem to Cloud

Cloud Region to Cloud Region

Cloud Provider to Cloud Provider

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Issues with measuring cloud networks

- Opaque network infrastructures

- Dynamic network infrastructures

- Noisy neighbors

- No line capture

- Time synchronization?
  - What should be required for time synchronization?
  - What sub tests are needed to prove the accuracy of this?

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High-level diagram: on-prem to cloud
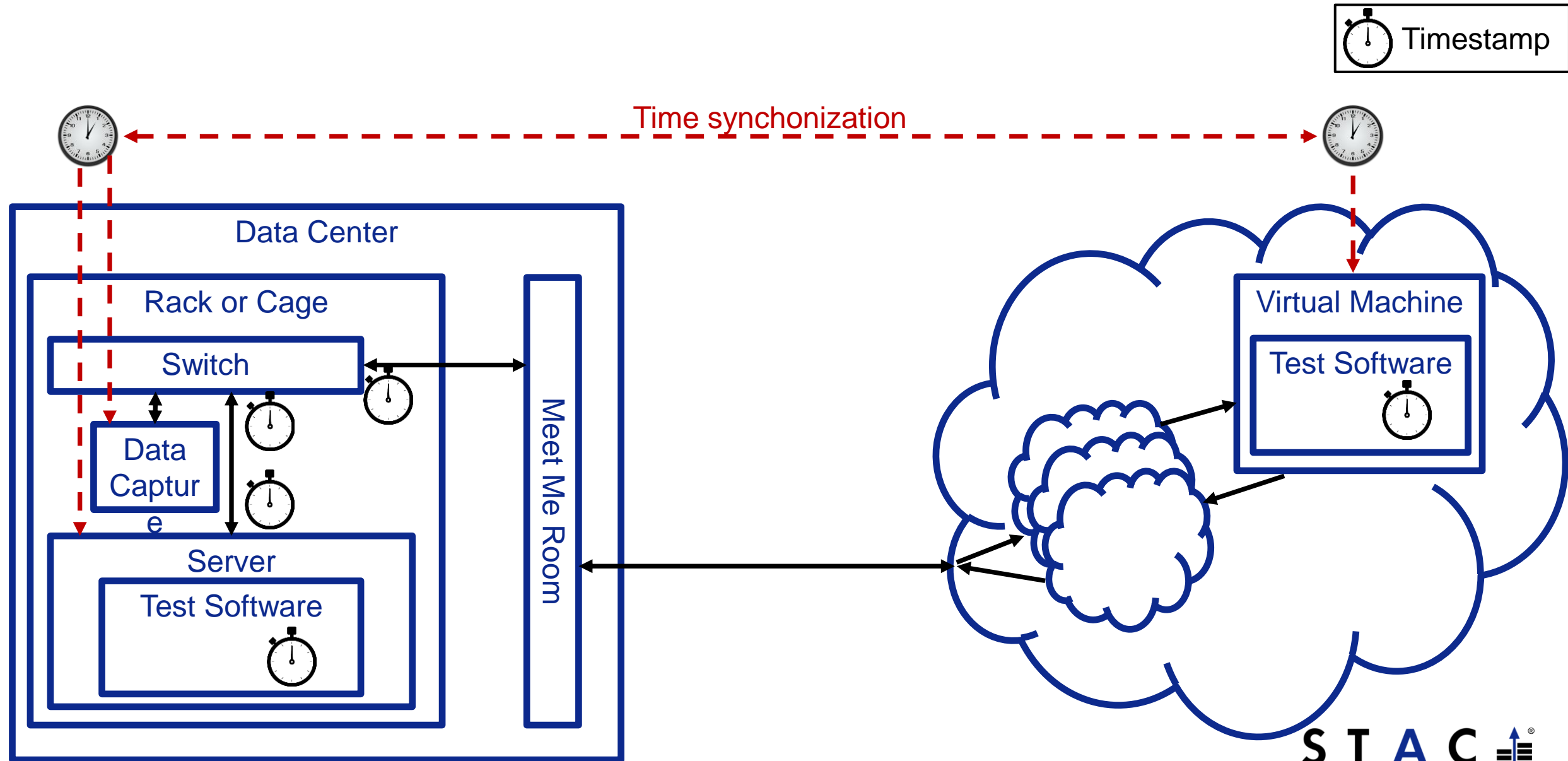
Open questions on measuring cloud systems

- How long and when should we measure?
  - Time of day and time of month can impact performance due to noisy neighbors

- How many instances should we measure?
  - Different instances will have different paths to get to them
  - How many do we run in parallel vs how many total?

- Time synchronization?
  - What should be required for time synchronization?
 - What sub tests are needed to prove the accuracy of this?

STAC-N1

- Measures the performance of a host network stack (server, OS, drivers, host adapter)

- Round-trip software timestamping

- Market data style workload

- Network API to network API
  - No middleware, feed handlers, etc.
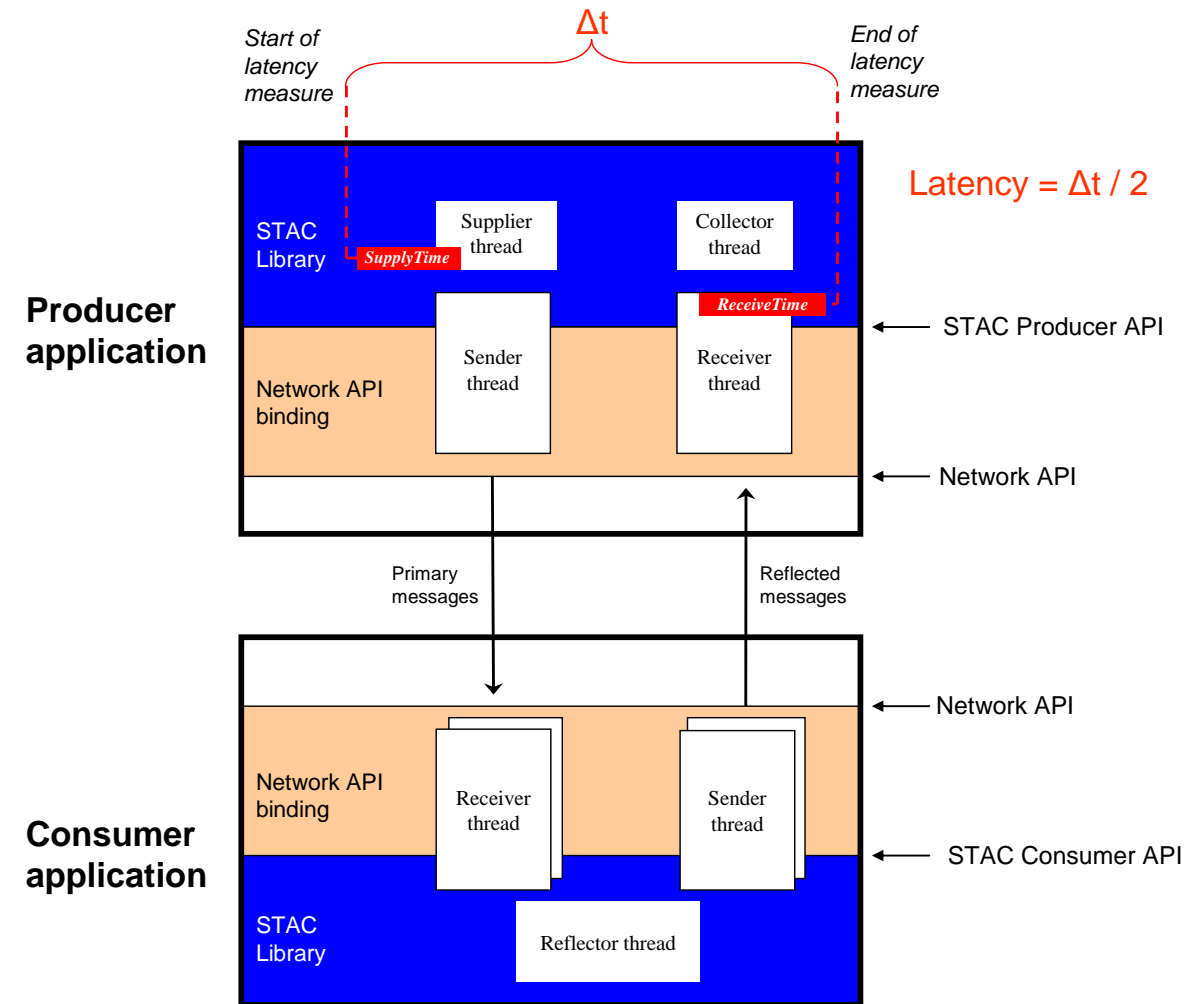
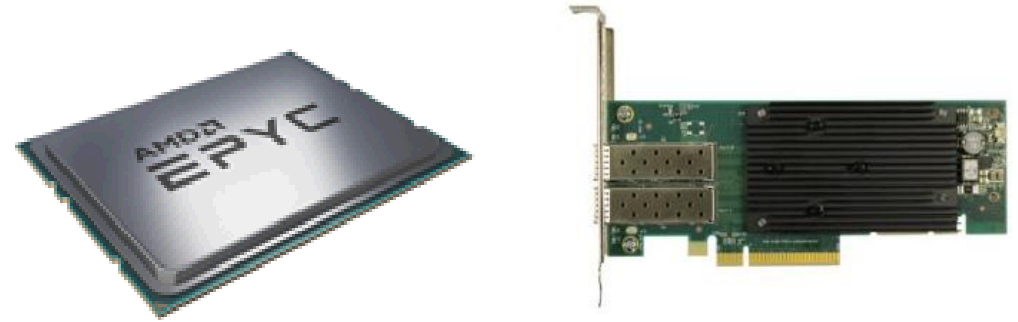# STAC-N1 / UDP / AMD / HPE / XtremeScale / OpenOnload

- First STAC software latency benchmarks with AMD EPYC

- Stack
  - STAC-N1 UDP-TCP binding
  - 2 x HPE ProLiant DL345 Gen10 Plus Servers
    - 1 x 32-core AMD EPYC™ 75F3 @ 2.95Ghz (4 GHz Boost)
    - AMD Xilinx XtremeScale™ X2522-25G-PLUS Adapter
    - Red Hat Enterprise Linux 8.4
  - 25Gb (via cross-over cable, FEC off)

www.STACresearch.com/AMD221001
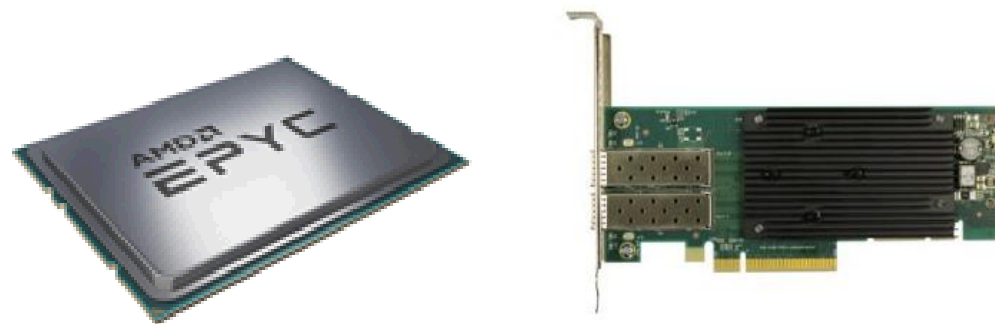
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Vs. all public results for UDP on non-overclocked servers

- The lowest maximum latency for the base rate of 100k messages per second
  - STAC.N1.β1.PINGPONG.LAT1

- The highest maximum throughput tested of 1.2 million messages per second
  - STAC.N1.β1.PINGPONG.TPUT1

- The lowest 99p and max latency at the highest rate tested. Both:
  - STAC.N1.β1.PINGPONG.LAT2
  - STAC.N1.β1.PINGPONG.LAT3

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