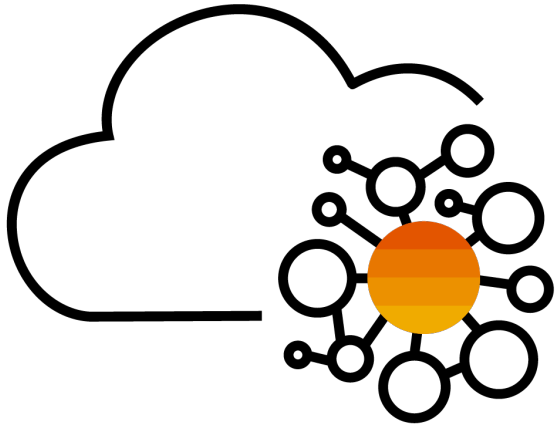

Live in the Express Lane

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Crucial challenges of coordination tasks

- Transition in the last decade
  - Conceived as distributed (cloud-based) application
  - Data center (DC) interferences prevent predictability
  - Weak synchrony assumptions to guarantee safe execution
- Mitigation of interference in DC to accelerate distributed systems (DS)
  - Awareness of timely sensitive interactions
  - Tight upper bounds required
  - Foundation to increase performance of DS coordination tasks

Related work

- Low latency [1, 2, 3, 4]
  - Generic approaches
  - 99th percentile
  - No process response time
- In network processing [5, 6]
  - Specific to particular service
  - Specific hardware required
  - No process response time

Communication links are reliable but asynchronous [7]

[1] M. P. Grosvenor, M. Schwarzkopf, I. Gog, R. N. M. Watson, A. W. Moore, S. Hand, and J. Crowcroft. *Queues Don'T Matter when You Can JUMP Them!* In: USENIX NSDI. 2015, pp. 1–14.

[2] B. Montazeri, Y. Li, M. Alizadeh, and J. K. Ousterhout. *Homa: a receiver-driven low-latency transport protocol using network priorities*. In: ACM SIGCOMM. 2018, pp. 221–235.

[3] J. Perry, A. Ousterhout, H. Balakrishnan, D. Shah, and H. Fugal. *Fastpass: A Centralized "Zero-queue" Datacenter Network*. In: ACM SIGCOMM. 2014, pp. 307– 318.

[4] G. Prekas, M. Kogias, and E. Bugnion. *ZygOS: Achieving Low Tail Latency for Microsecond-Scale Networked Tasks*. In: ACM SOSP. 2017, pp. 325–341.

[5] H. T. Dang, D. Sciascia, M. Canini, F. Pedone, and R. Soulé. *NetPaxos: Consensusat Network Speed*. In: SIGCOMM SOSR. 2015, pp 5:1–5:7.

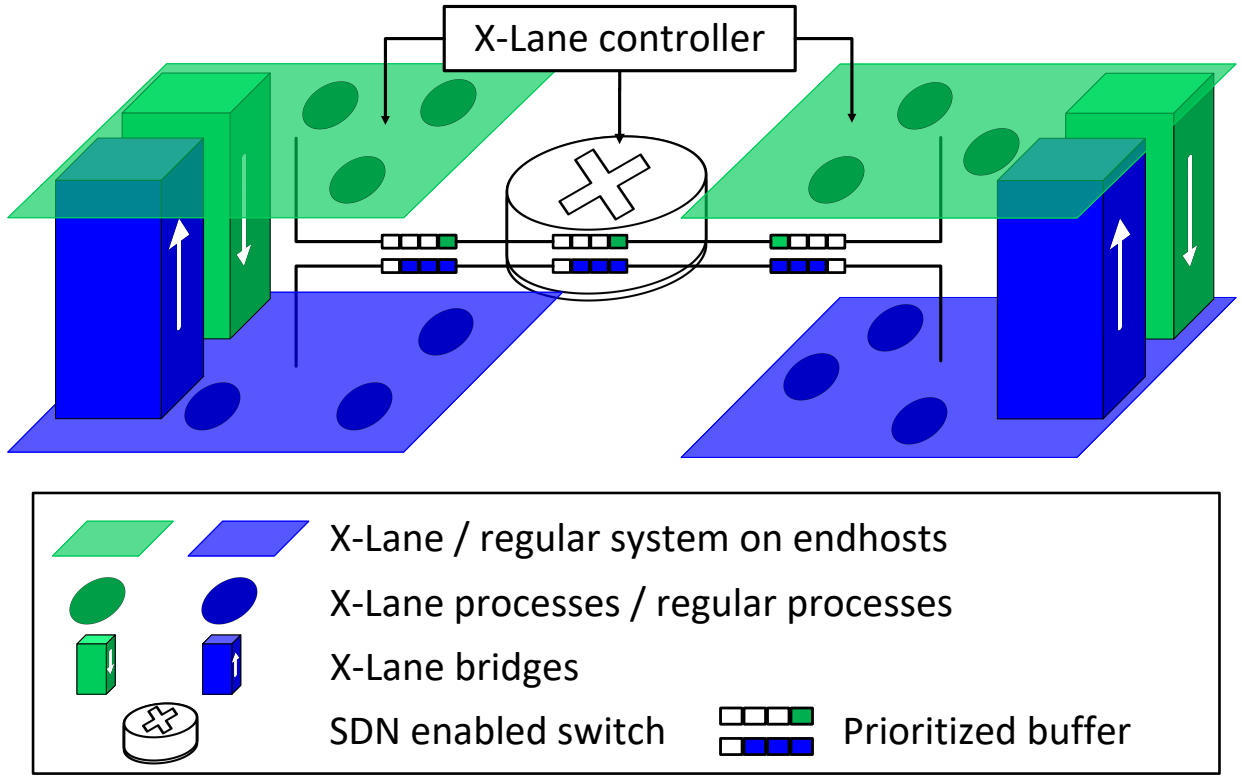
[6] Z. István, D. Sidler, G. Alonso, and M. Vukolic. *Consensus in a Box: Inexpensive Coordination in Hardware*. In: USENIX NSDI. 2016, pp 425–438.

[7] A. Basu, B. Charron-Bost, and S. Toueg. *Simulating reliable links with unreliable links in the presence of process crashes*. In: Springer. 1996, pp 105-122.

Features of X-Lane

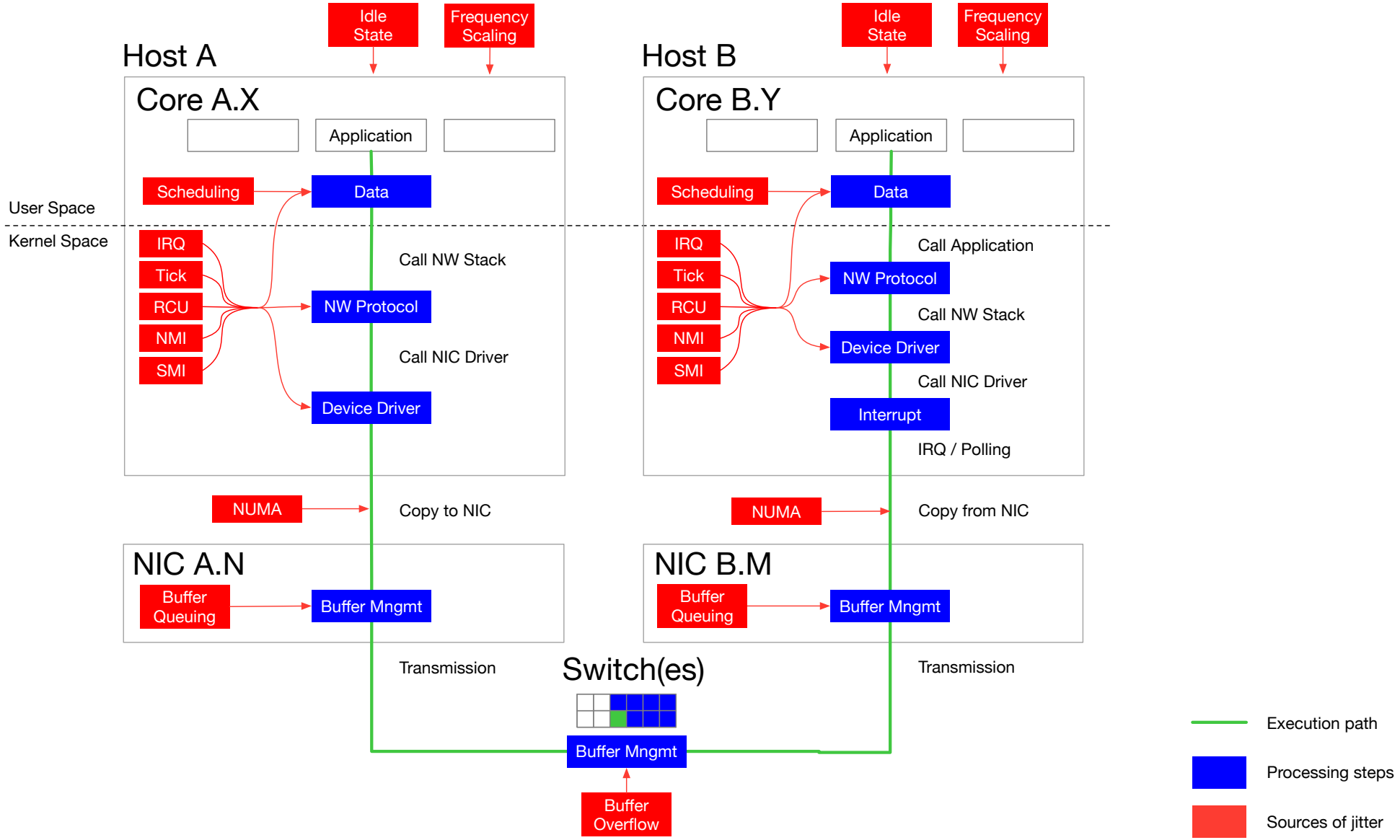
- Interference free environment
  - Bounded communication latency / jitter
  - Bounded processing latency
- Generic design
  - Supports multiple coordination protocol
  - Commodity and specialized hardware

Separation between X-Lane & the regular system

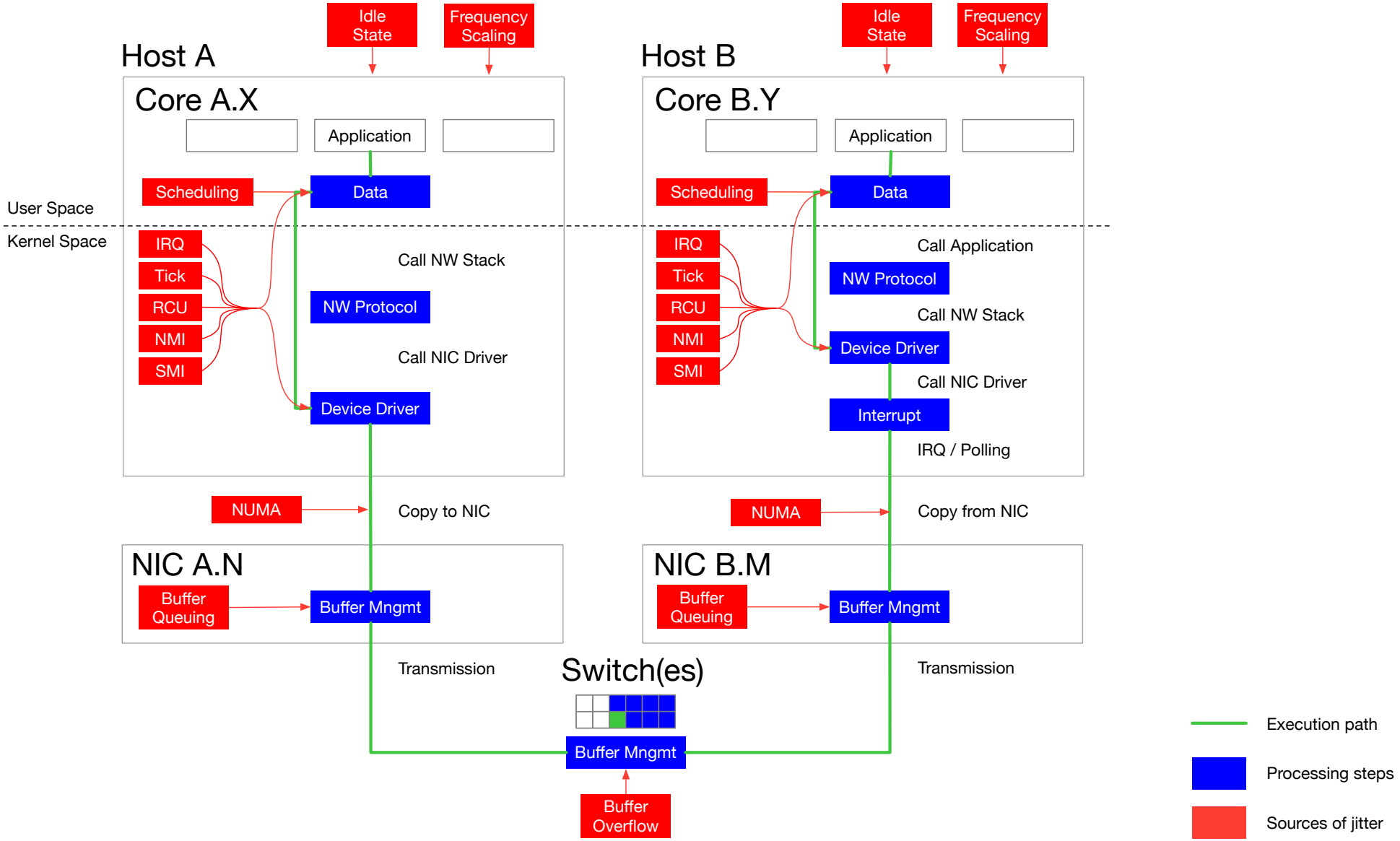


- X-Lane isolated from “regular system”
- Prioritize X-Lane packets to prevent losses
- Process communication over bridges

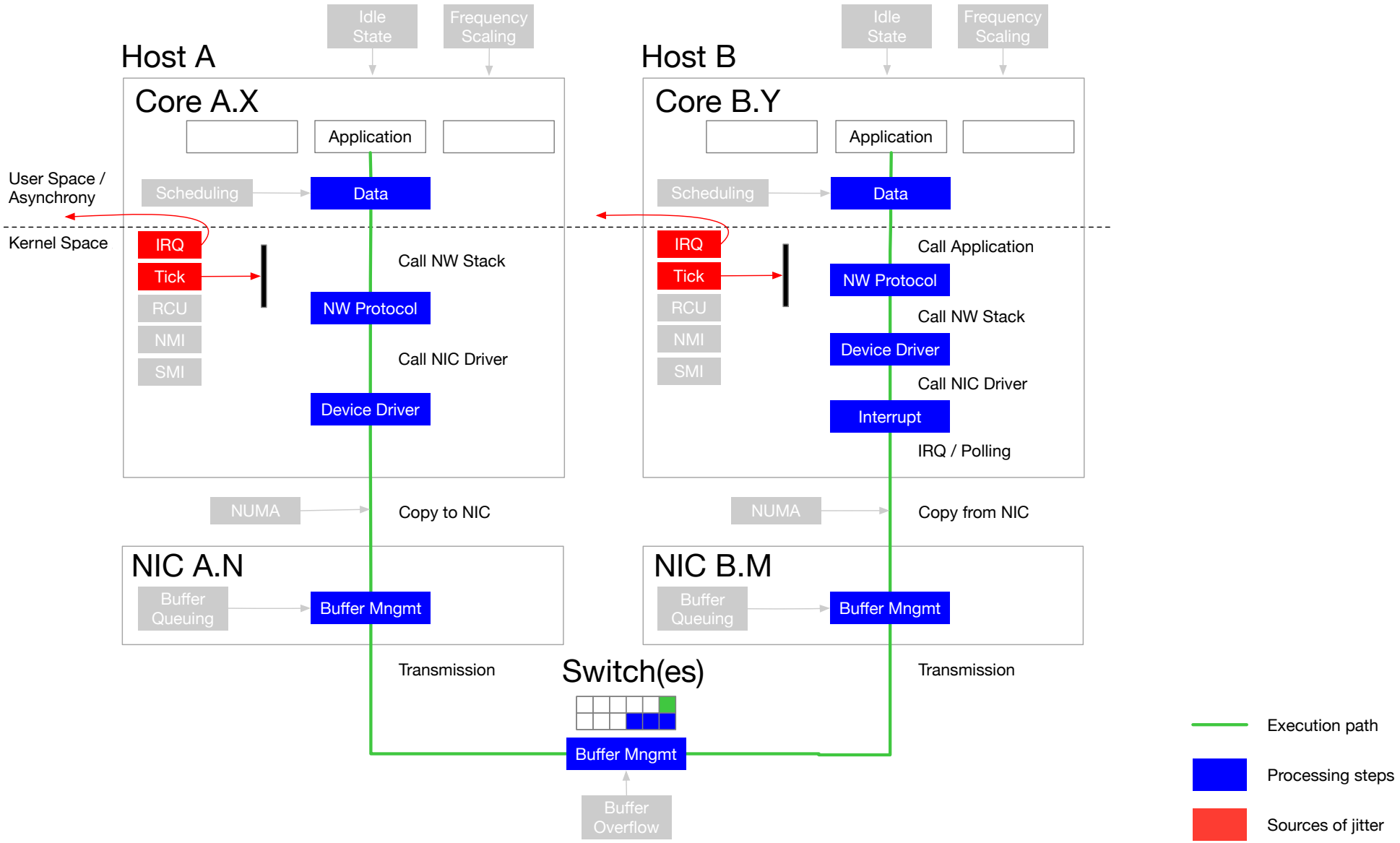
Usual workflow for a packet



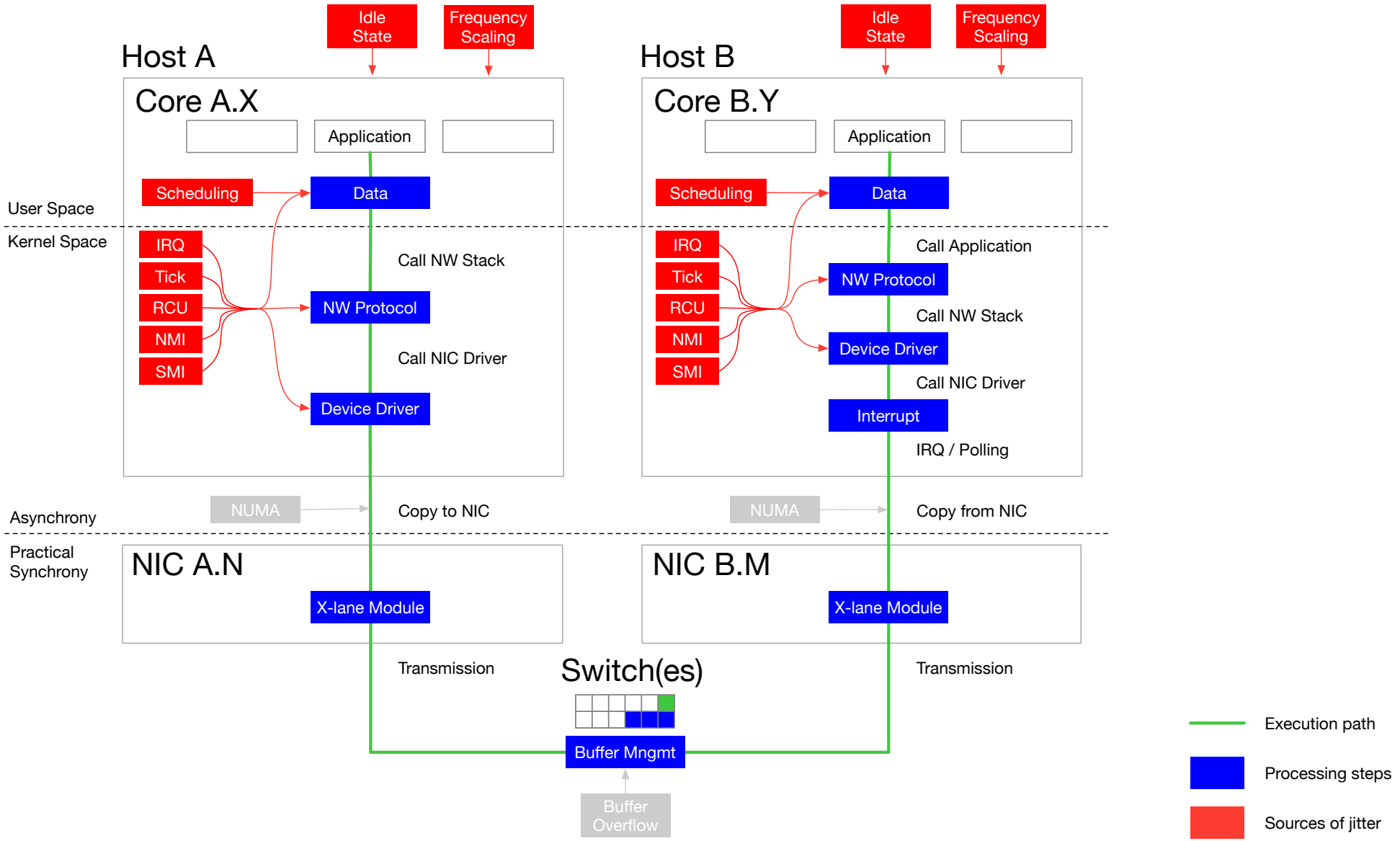
Usual workflow for a packet



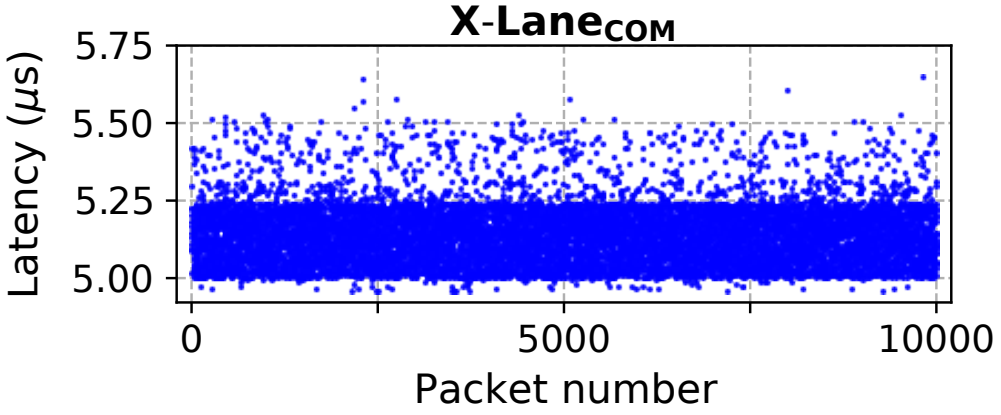
X-Lane workflow for commodity hardware

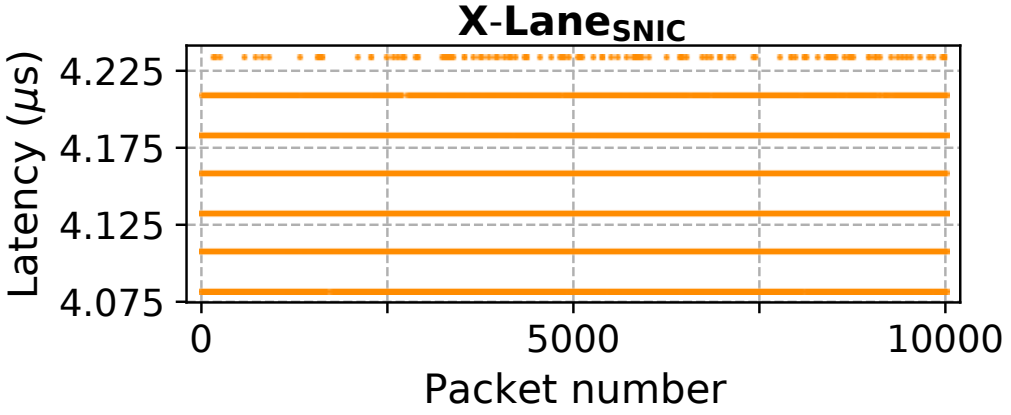


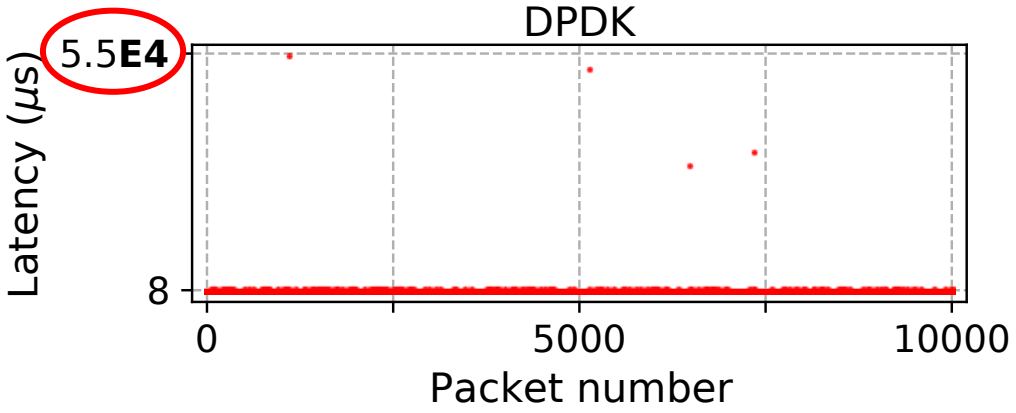
X-Lane workflow with smartNICs

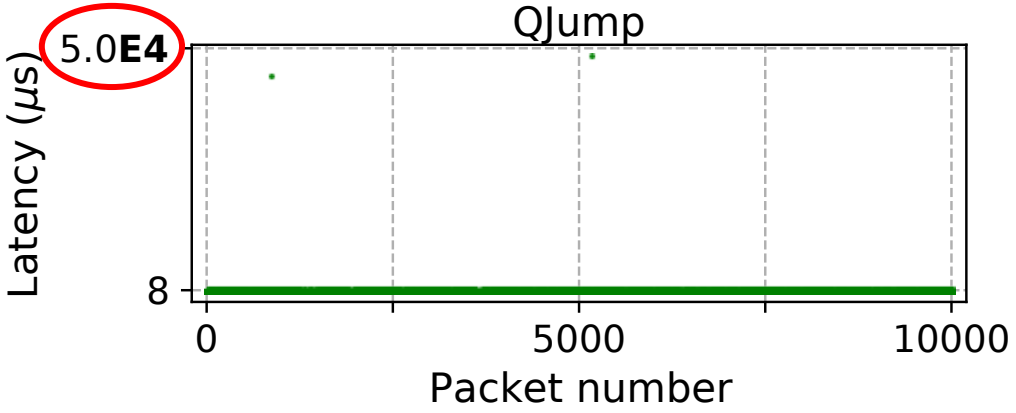


Latency and jitter for DPDK, QJump and X-Lane

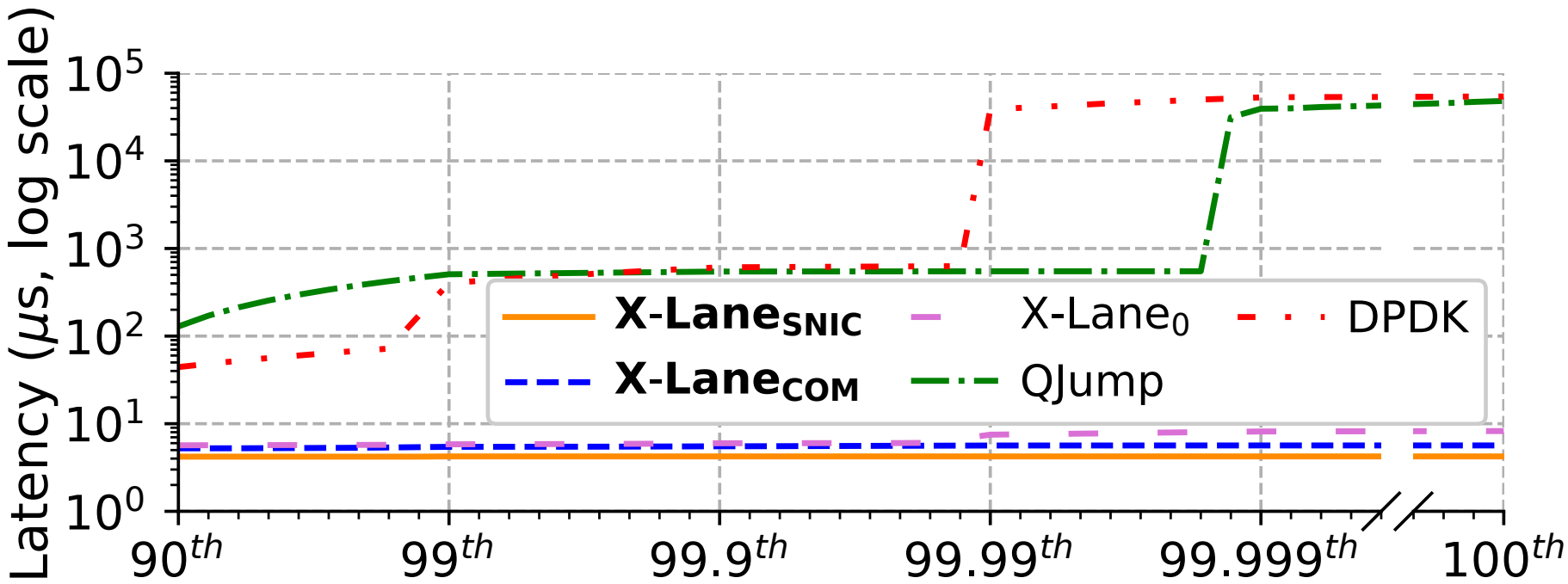




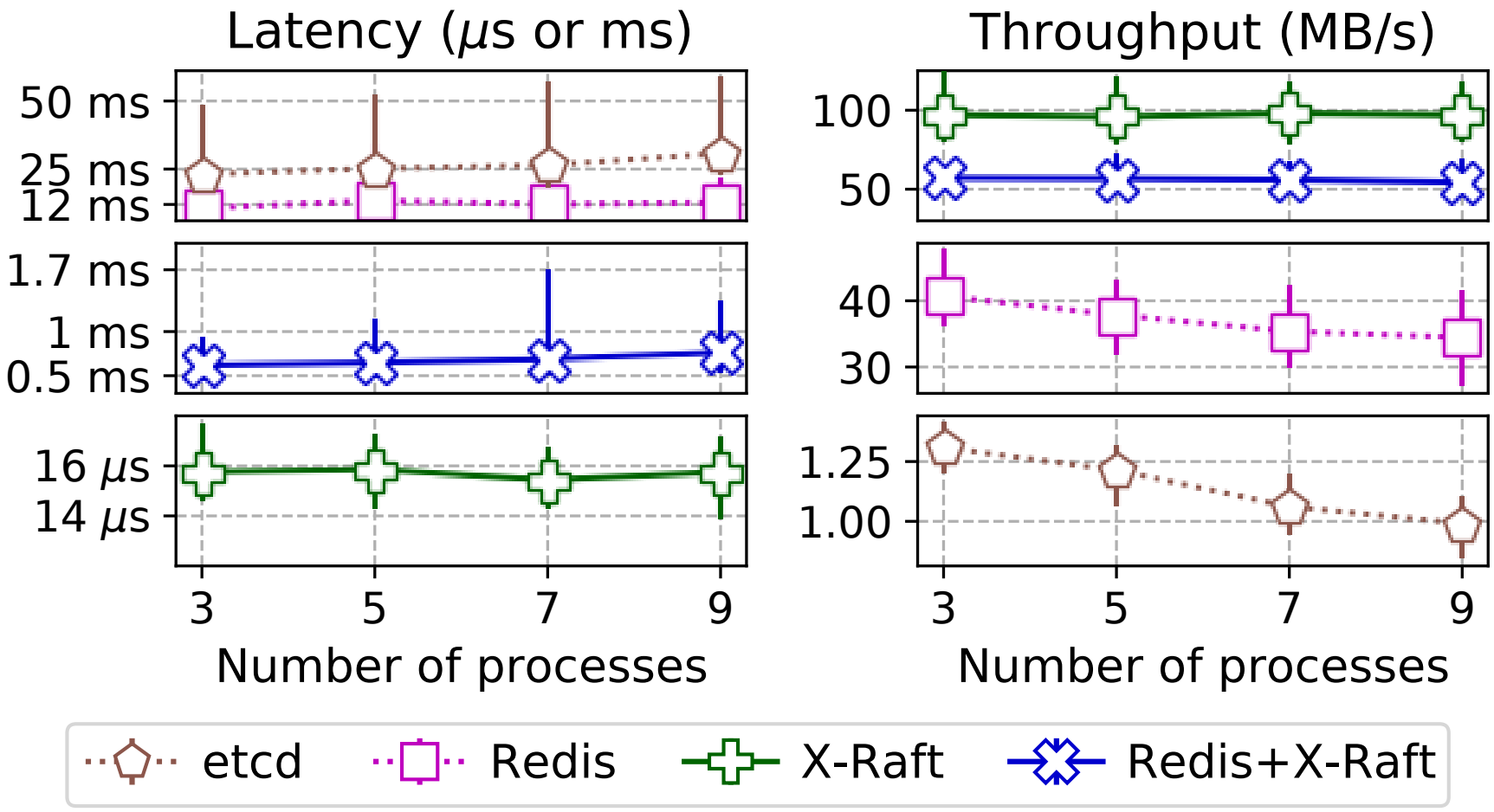




Tail latency over 21 days



Latency and throughput results for Raft implementations



Conclusion

- Low latency and jitter for coordination interaction
- X-Lane isolated from regular system
- Generic system design
- Commodity software / hardware and smartNIC support

Interested?

Questions?

thank You!