



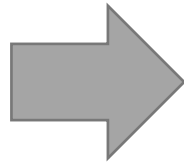
The Case For In-network Computing On-demand

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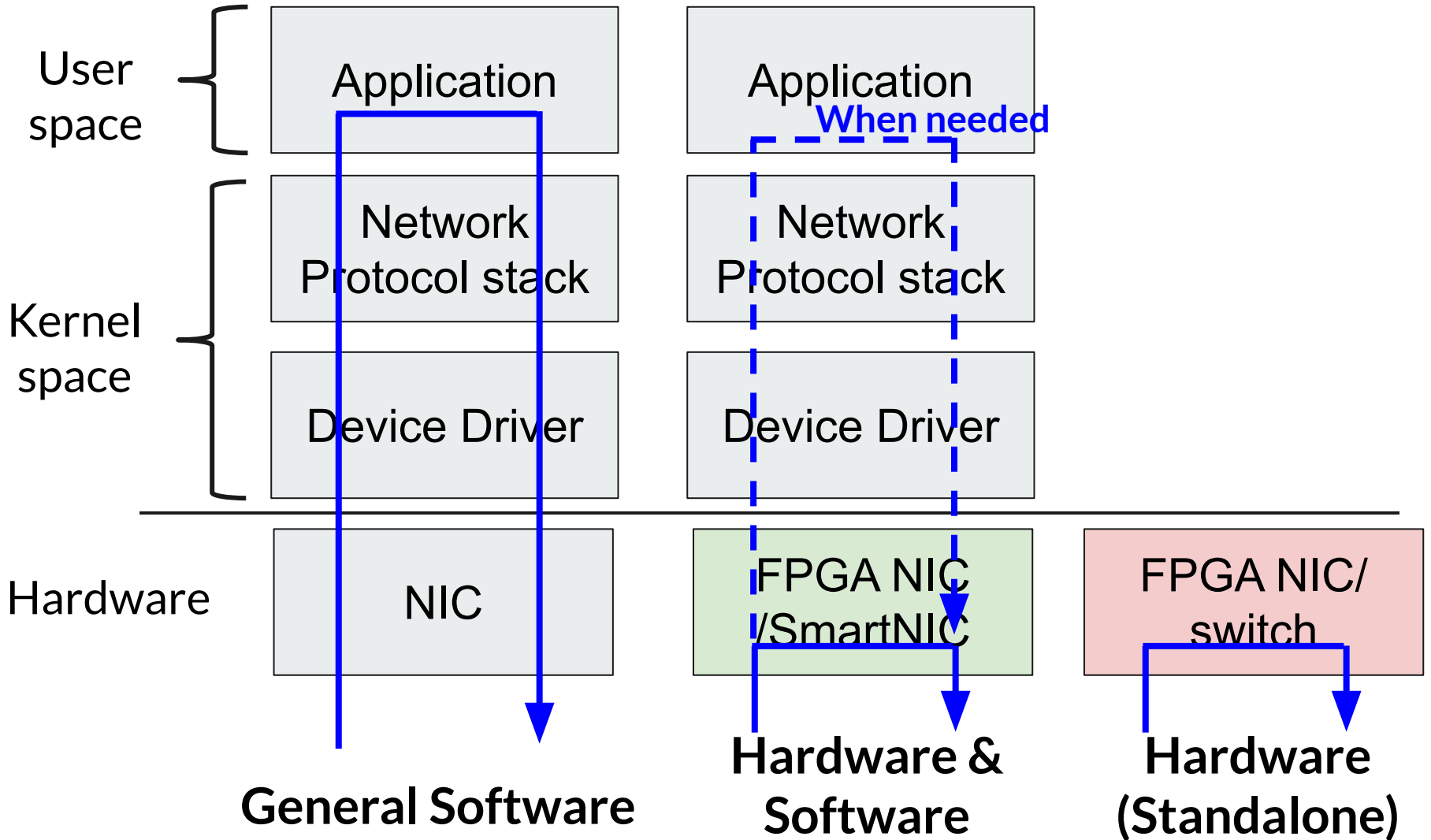
Joint work with Tu Dang, Fernando Pedone, Robert Soulé and Noa Zilberman,

In-network Computing

- ❑ The execution of native host applications within the network using standard network devices:
 - ❑ network interface cards (NIC)
 - ❑ switches



What is in-network computing?





Goal

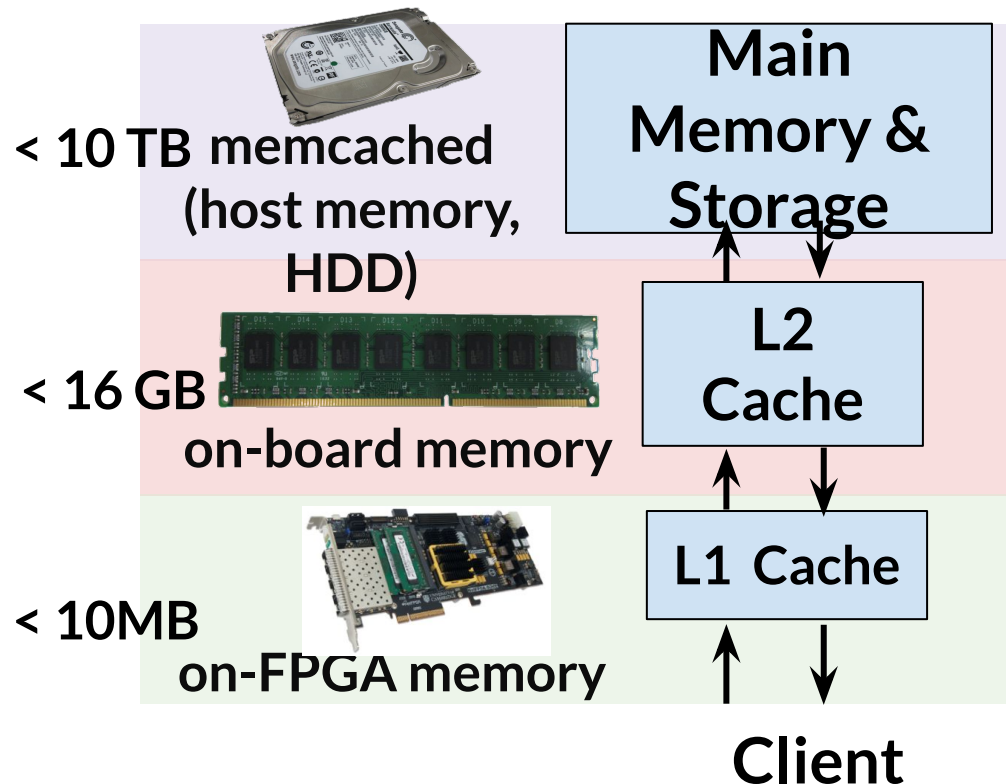
Research Question:

Can we improve the power-efficiency for datacenter by using in-network computing ?

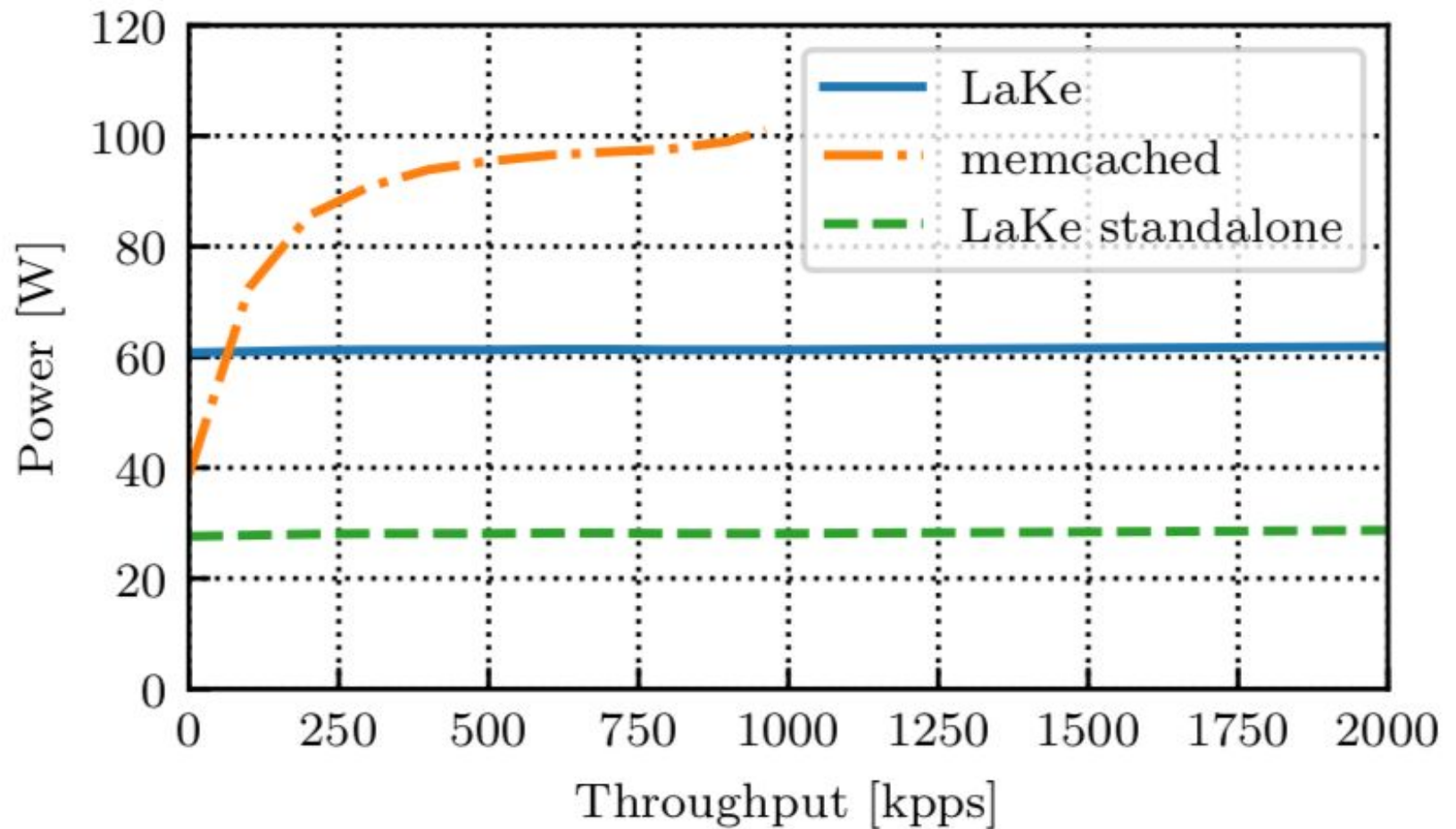
- ❑ Adding devices costs power
- ❑ FPGA accelerators (in-network computing) have been researched to improve power efficiency of the specific application

LaKe - Layered Key-value Store

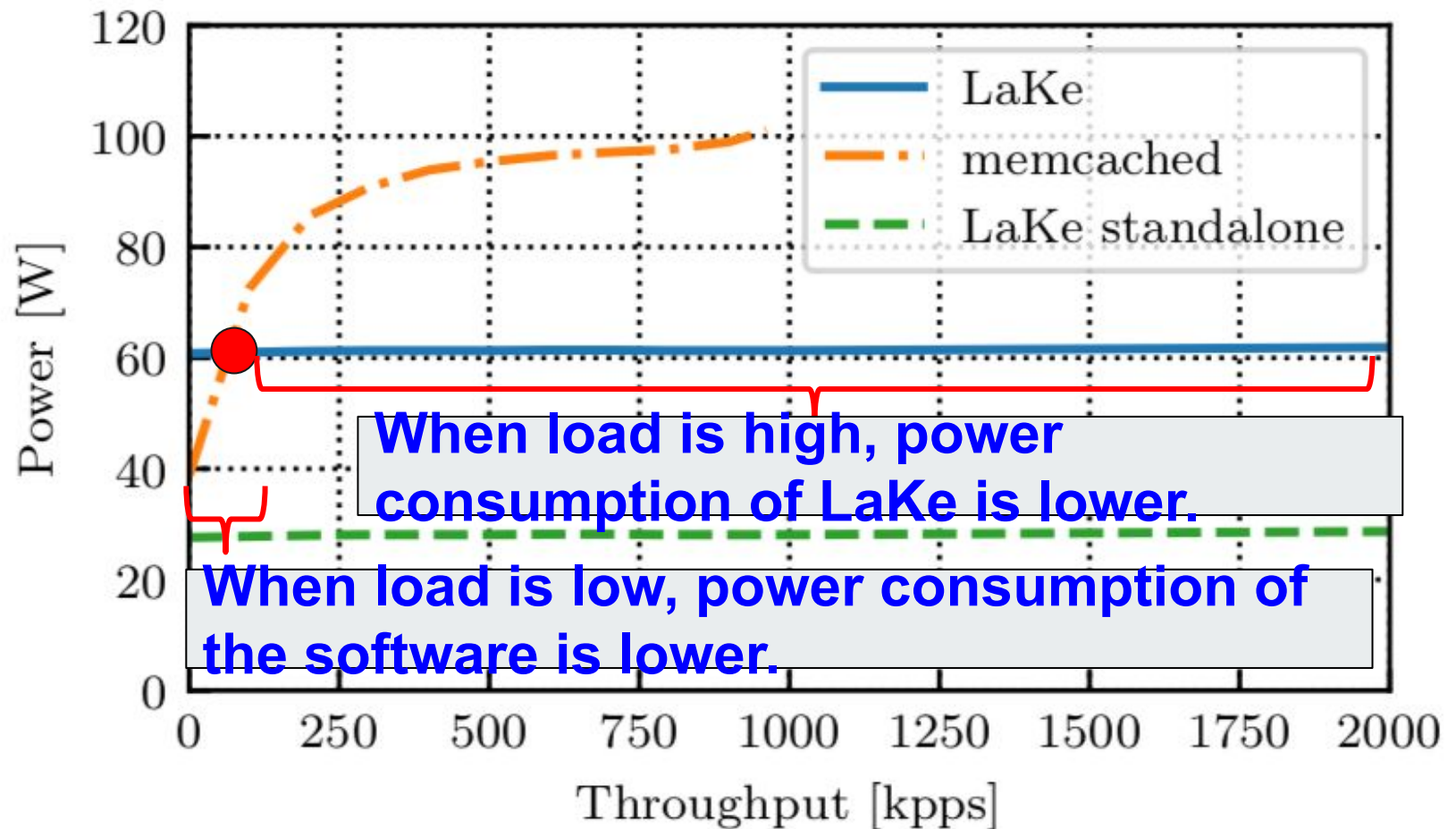
- ❑ Memcached compatible hardware
- ❑ Adding a layer of cache on FPGA-NIC
 - ❑ In case of cache miss, the query is sent to host
 - ❑ In case of cache hit, the query is processed in NIC



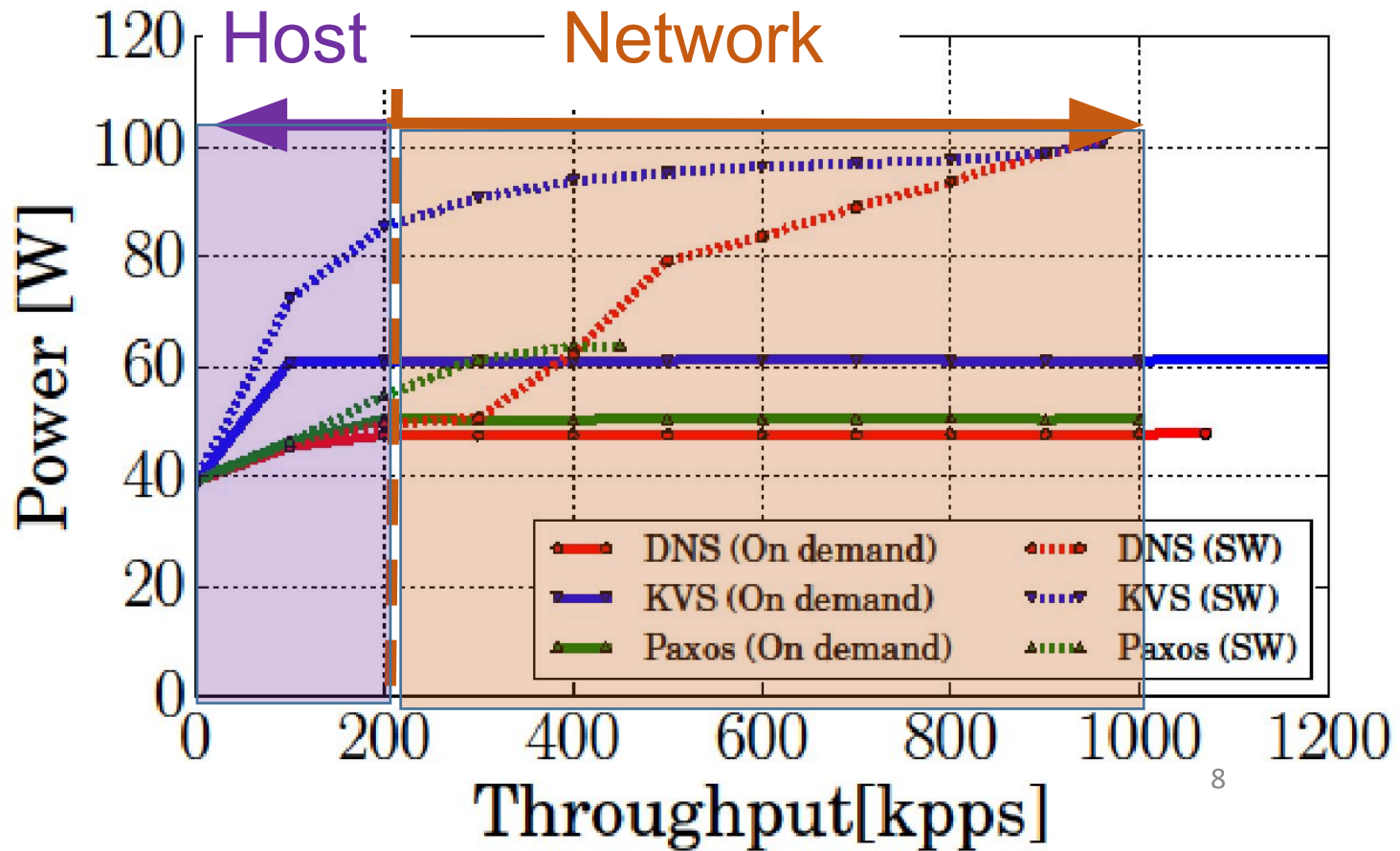
Measurement: Key-value store



Measurement: Key-value store



Ideal power-efficiency

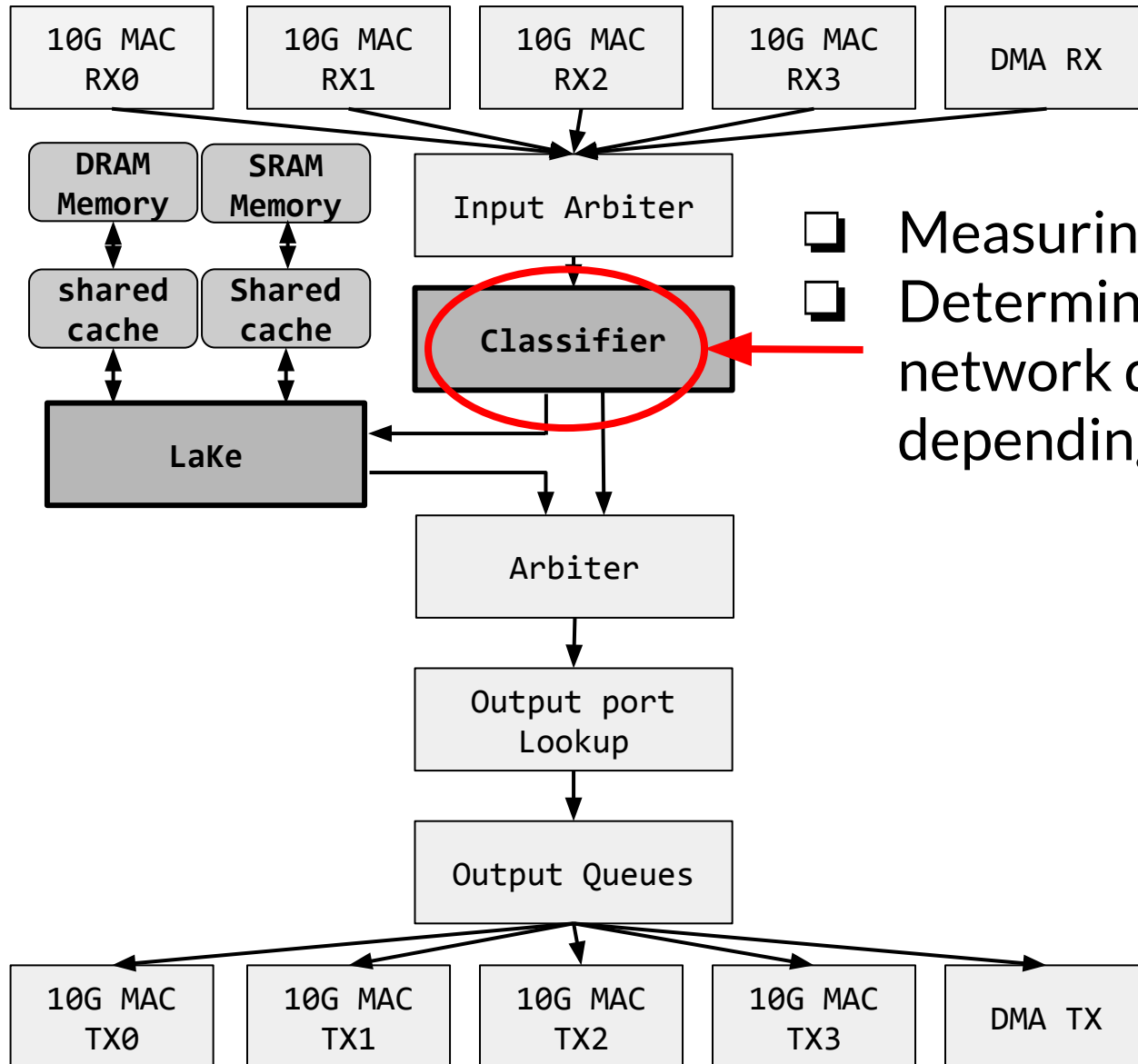




In-network Computing On-demand

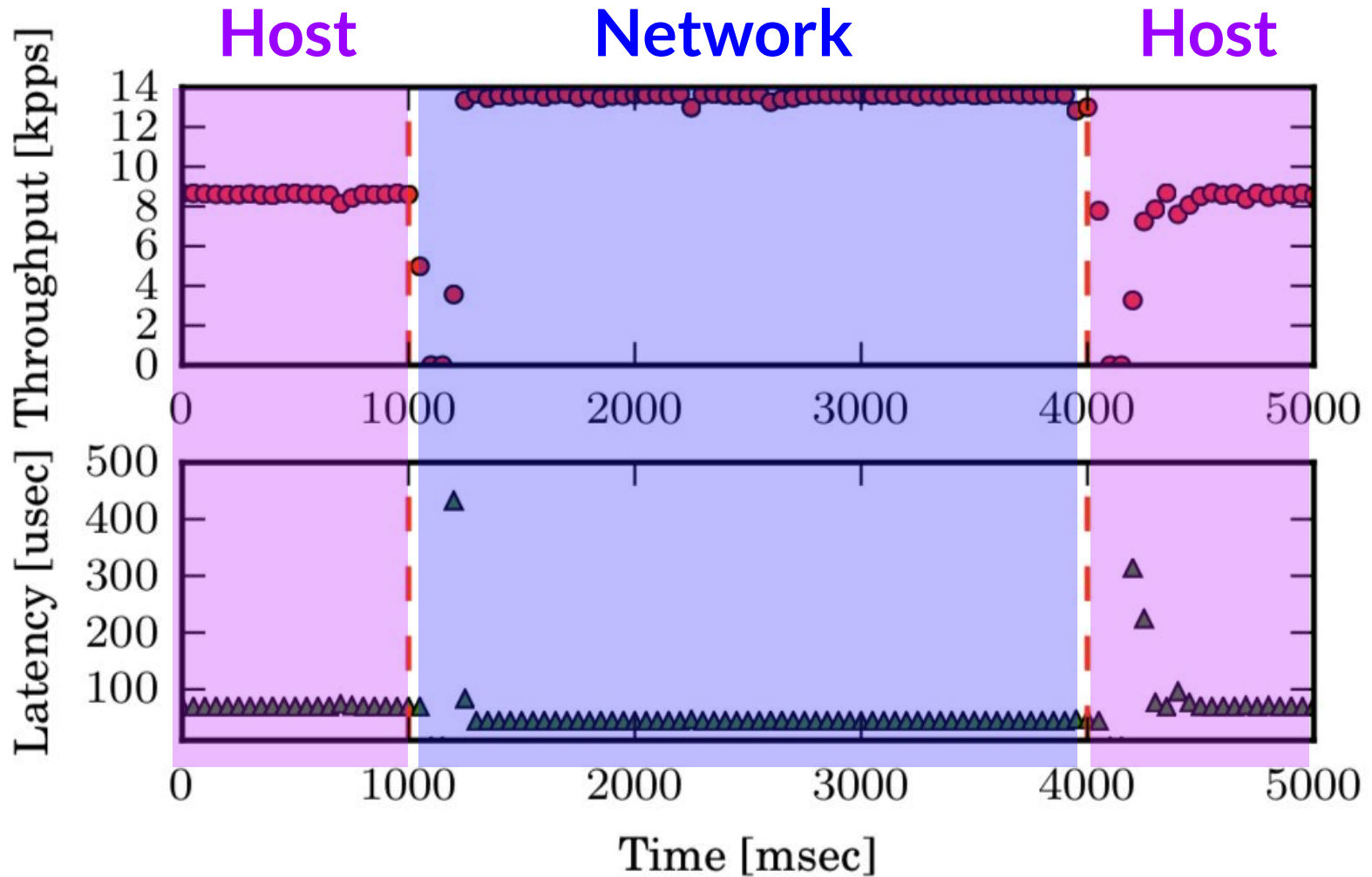
- ❑ Power-aware scheduling
 - ❑ Measuring power consumption provided by RAPL
 - ❑ Scheduling
 - ❑ In-network computing when power is high
 - ❑ Software processing when power is low
- ❑ Traffic-aware scheduling
 - ❑ Measuring traffic on NIC
 - ❑ Scheduling
 - ❑ In-network computing when traffic is high
 - ❑ Software processing when traffic is low

In-network Computing On-demand



- Measuring traffic
- Determining LaKe or network datapath, depending on traffic

Demonstration: Paxos





When to use INC on-demand ?

- ❑ Can all applications be applied to in-network computing?
 - ❑ No: In-network computing is good for network intensive applications.
- ❑ To determine whether the application can be applied to in-network computing on-demand, we must understand relation between throughput and power.
- ❑ In-network Computing(ASIC) can save power x1000 than the server!

Summary

- In our observation,
 - When load is low, host is good for power!
 - When load is high, in-network computing is good
- We developed dynamic scheduling for in-network computing based on our observation.

