Agenda for Today

• Reminders
• Introduction to RDMA and RPCs
• FaRM discussion
• Where do research ideas come from?
Reminders

• Leading a discussion
  • See notes on Canvas
• First Day Survey #FinAid
  • Due Friday 10/7
• Warm-up assignment
  • Due Tuesday 10/11 at 11:59 pm
RDMA and RPCs
The Shift Towards Storing Data in Memory

- Disk is a poor fit for modern datacenter applications
  - Disk is much slower to access than memory (10 ms vs. 100 ns)
  - Datacenter workloads require random access
- RAM is becoming much cheaper
- Feasible to store a significant fraction (or all of) your app’s data in memory, distributed across a cluster

- 500 GB disk
- 800 Mbps
- 10 ms latency

20 machines, each with:
- 128 GB DRAM
- 40 Gbps
- 10 μs latency
How Should Programs Access Remote Memory?

- Access data one word at a time, similar to local memory
  - `movl remote_addr %eax`
- Access a chunk of data at once (e.g., 64 bytes, 1 KB)
  - FaRM
- Access multiple dependent chunks of data at once
  - PRISM
- Execute a function on the remote server via RPC
  - eRPC
CPU-Based Memory Access vs. RDMA

- Remote Direct Memory Access
  - Access memory directly from the NIC

  - CPU
  - NIC

  **interrupts the CPU**

  **read data using TCP**
  (e.g., Linux, IX, XDP)

  "RPC" or "two-sided RDMA"

  **doesn't involve the CPU!**

  **read data using RDMA**

  "one-sided RDMA"
RDMA – An Old Technology

- First proposed in 1993
- Used in super computers (HPC) for many years
- Relied on Infiniband in the 2000s
  - Lossless network
  - Expensive
- RoCE (~2010)
  - RDMA over Converged Ethernet, pronounced “rocky”
  - Provides a reliable network and enables RDMA over regular Ethernet
  - Cheaper than Infiniband
  - Made it easier to adopt RDMA in datacenters
FaRM Discussion
Where Do Research Ideas Come From?

- How do researchers come up with the problems, solutions, or observations in their papers?
- Why does this matter?
  - Helps to understand the perspective of authors
  - Inspiration for coming up with your own research ideas