Two types of RDMA operations:

- **Two-sided** involves the remote CPU, as in socket-based communication
- **One-sided** directly accesses remote memory, bypassing the remote CPU

### Two-sided vs One-sided

**Two-sided (Send/Receive)**

1. Client sends a GET request to the NIC.
2. NIC reads the hash entry and sends the value to the CPU.
3. CPU reads the value.

**One-sided (Direct Access)**

1. Client reads the hash entry.
2. Compare keys.
3. Read value.

- Single round trip
- Simple client-server model
- Remote CPU involved
- Remote CPU not involved
- At least 2 RTs necessary
- Handling of misses costly

### StRoM: Smart Remote Memory

- Deployment of acceleration kernels on the NIC
  - Invoke one-sided RPCs on the remote NIC
  - On-the-fly data processing when transmitting/receiving

### Accelerating Data Access: Consistent Object Retrieval

- Atomictiy on x86 at cache-line granularity. When retrieving large objects over one-sided RDMA, consistency not guaranteed.

- Offload consistency check to remote StRoM kernel

### Accelerating Data Processing: Gathering Statistics

- HyperLogLog (HLL) kernel to estimate cardinality of the incoming data set
  - Cardinality estimation can augment the optimizer in data processing systems
  - On-the-fly statistics gathering

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