

# Network File System (NFS) in High Performance Networks

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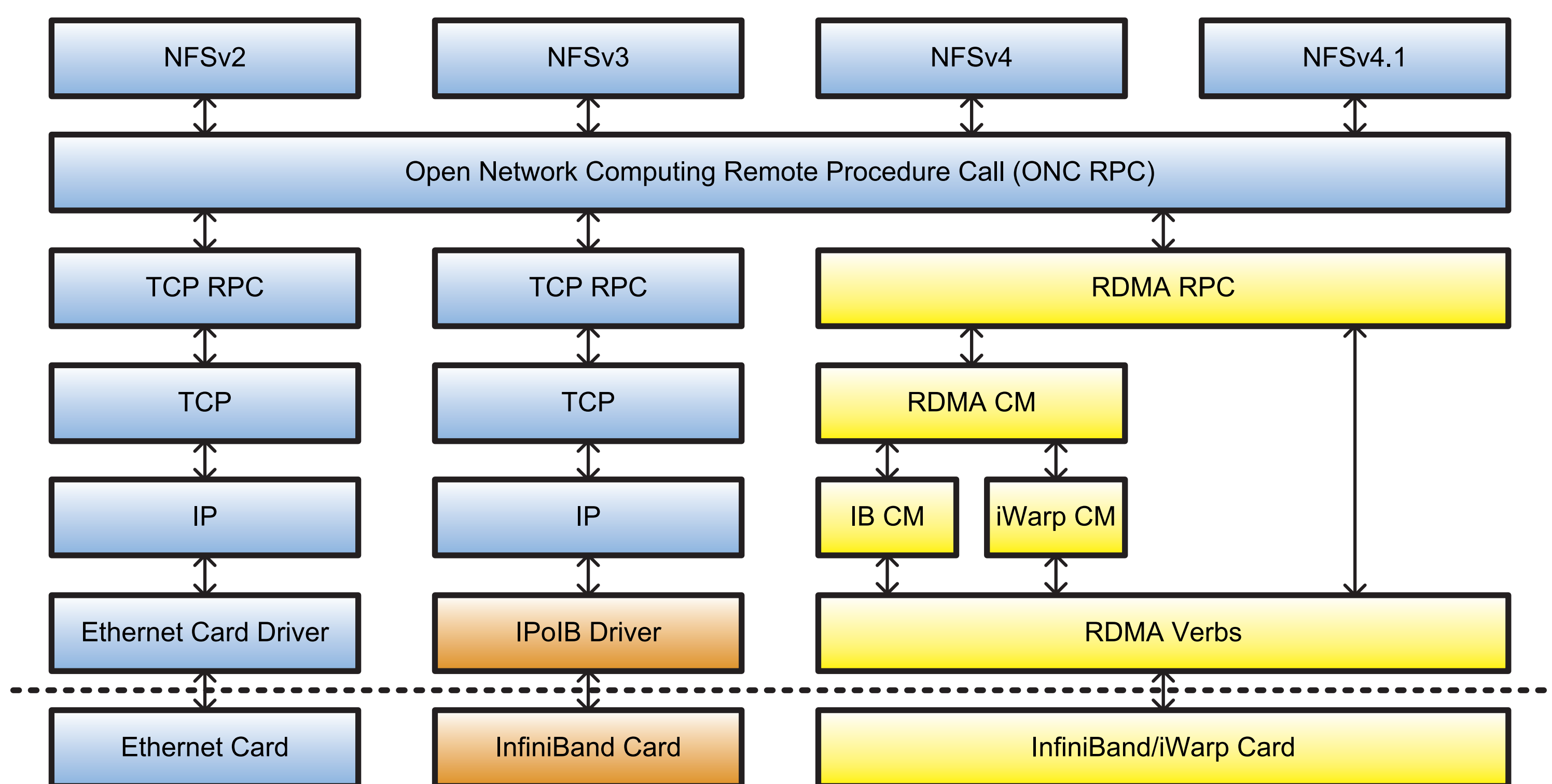
## Overview

- NFS over RDMA was recently released in February 2008
- What is the value of RDMA to storage users?
- Competing networks
  - General purpose network (e.g. Ethernet)
  - High-performance network with RDMA (e.g. InfiniBand)

Type	Bandwidth (Gbps)	~Latency ( $\mu$ s)	~Price per NIC+Port (\$)
Gigabit Ethernet	1	40	40
10 Gigabit Ethernet	10	40	1,350
Infiniband 4X SDR	8	4	600
Infiniband 4X SDR	16	4	720
Infiniband 4X SDR	32	4	1,200

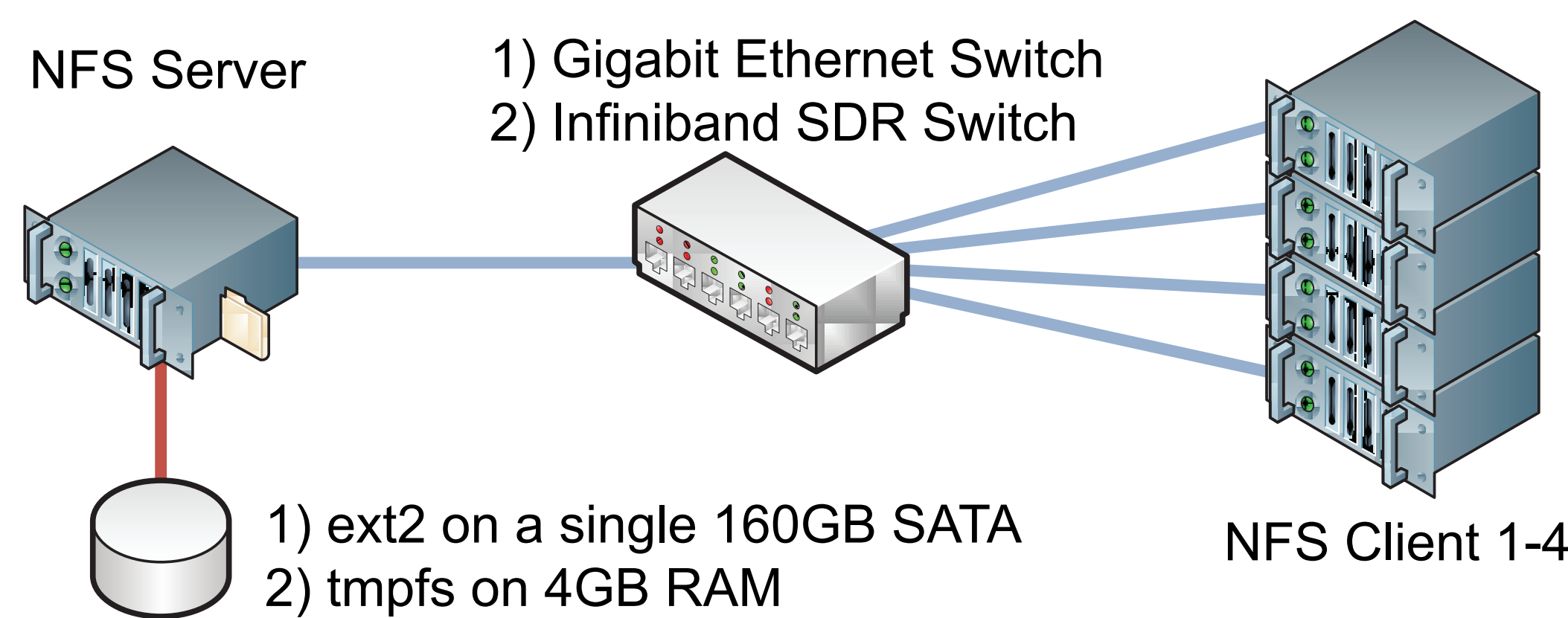
Source: High-Performance Systems Integration group, Los Alamos National Laboratory (HPC-5, LANL)

## NFS over IPoIB / NFS over RDMA

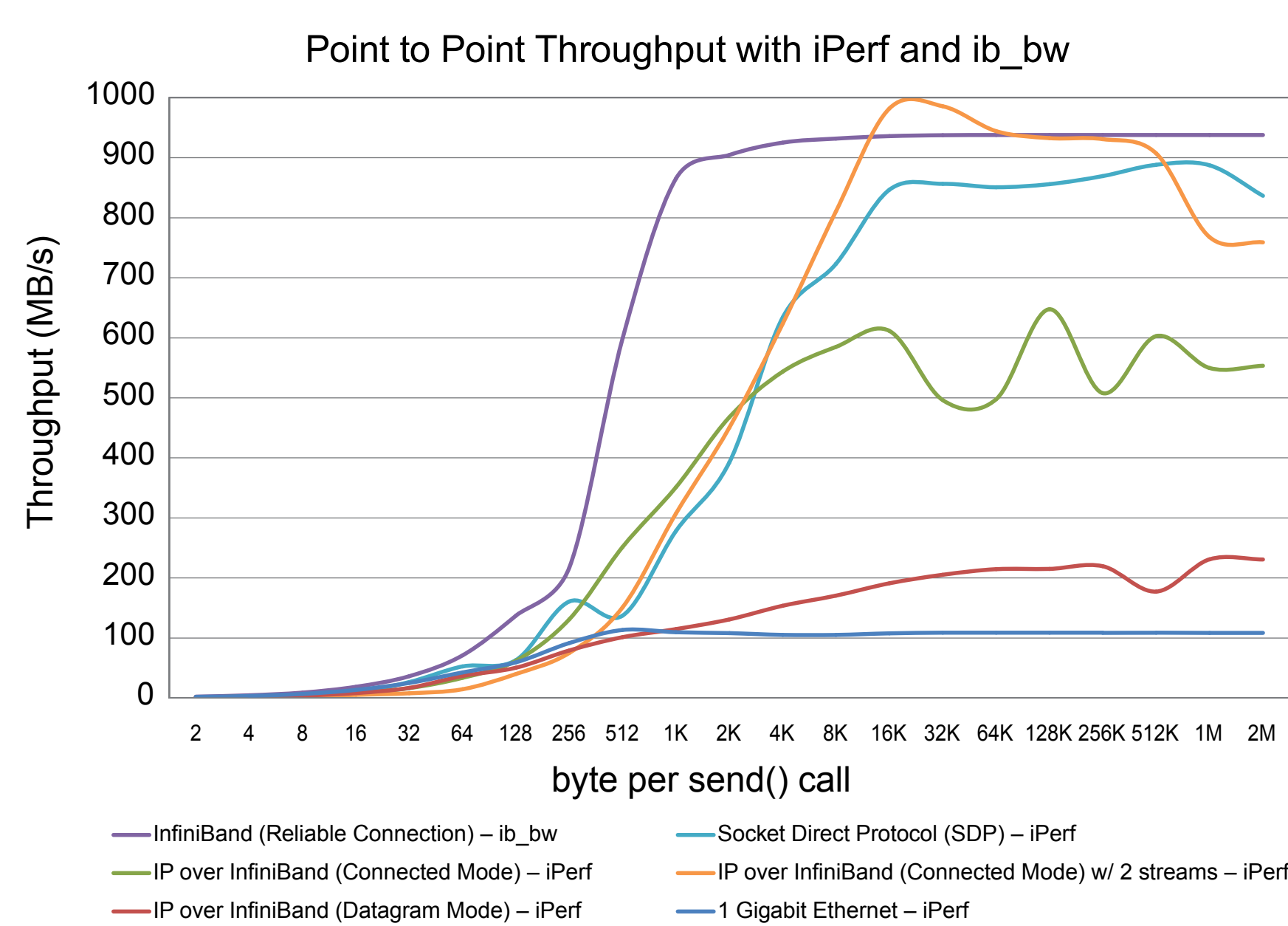


- IPoIB: Implemented as a standard network driver
- RDMA: Implemented as a new RPC type

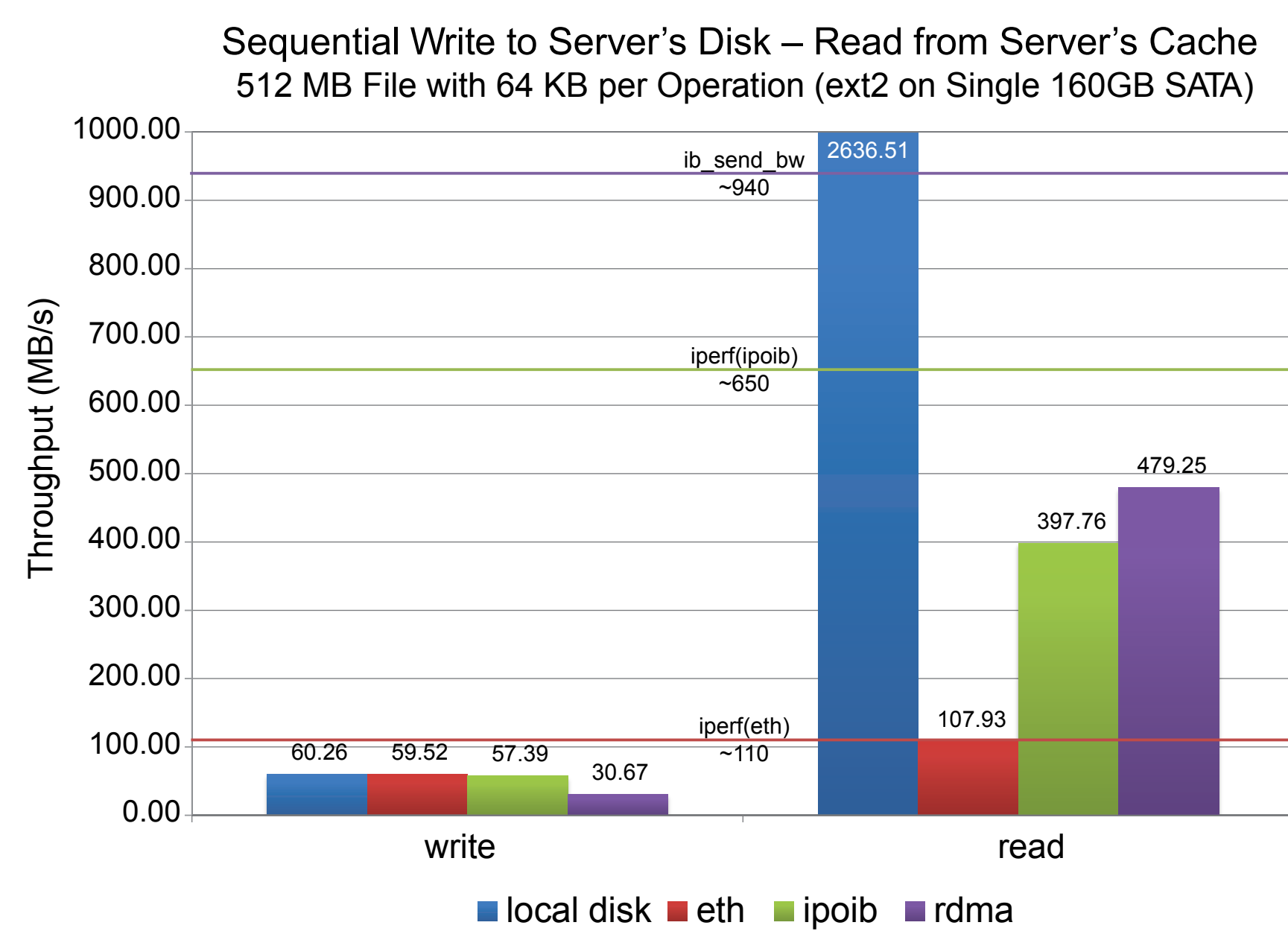
## Experiment Setup



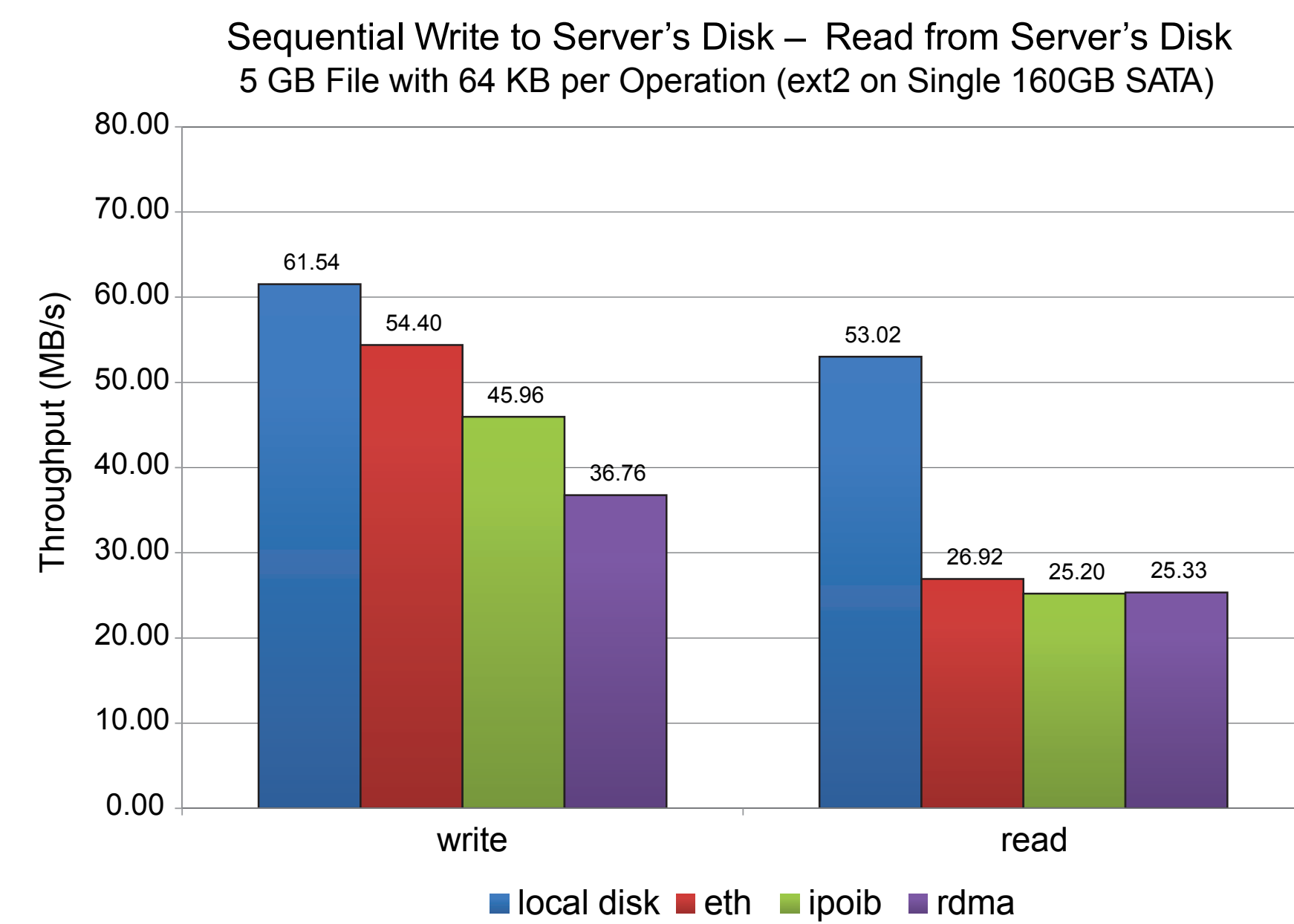
## Experimental Results



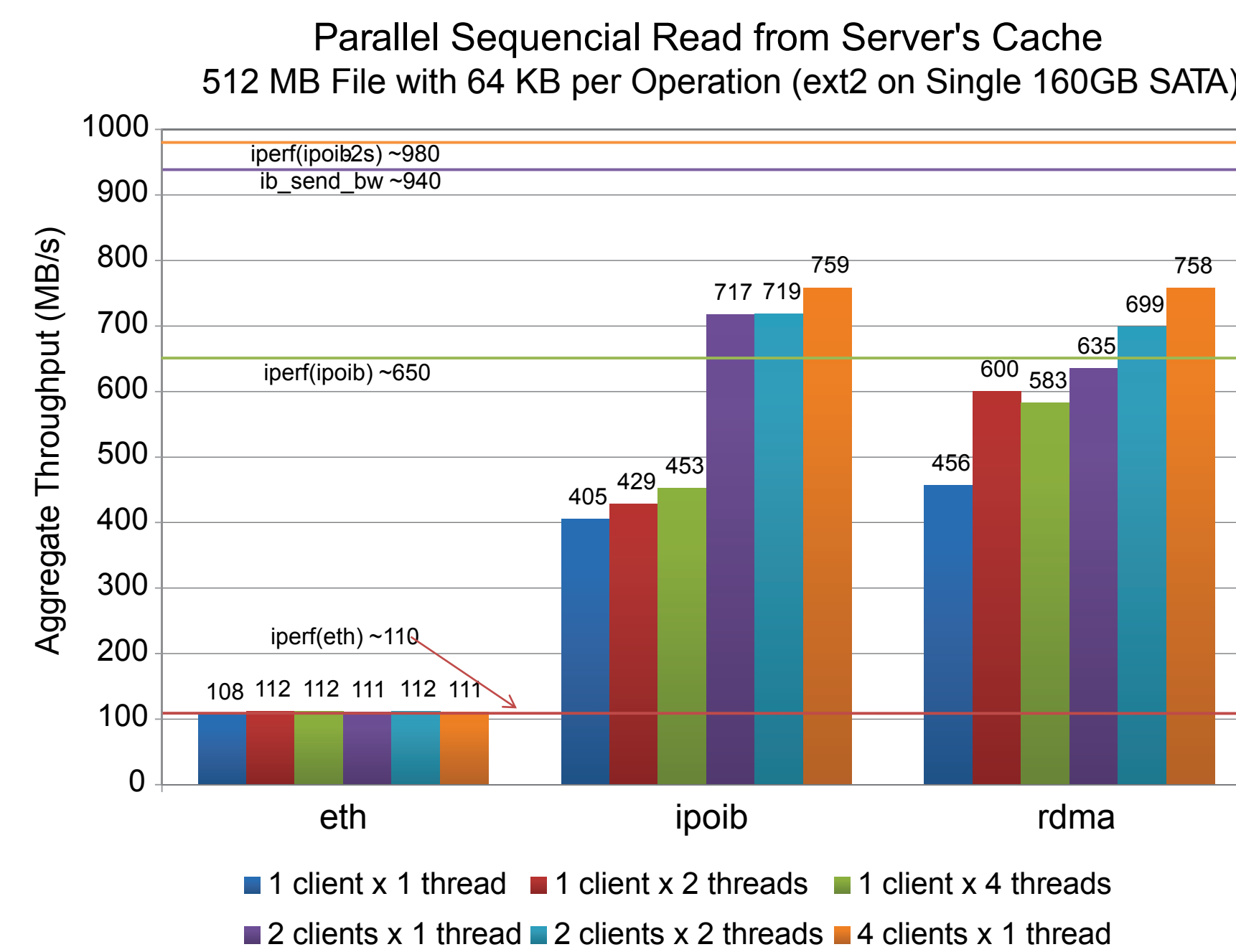
- For point-to-point throughput, IP over InfiniBand (Connected Mode) is comparable to a native InfiniBand



- When a disk is not a bottleneck, NFS benefits significantly from both IPoIB and RDMA
- RDMA is better than IPoIB by ~20%



- When a disk is a bottleneck, NFS can benefit from neither IPoIB nor RDMA



- As the number of concurrent read operations increases, aggregate throughputs achieved for both IPoIB and RDMA significantly improve with no disadvantage for IPoIB