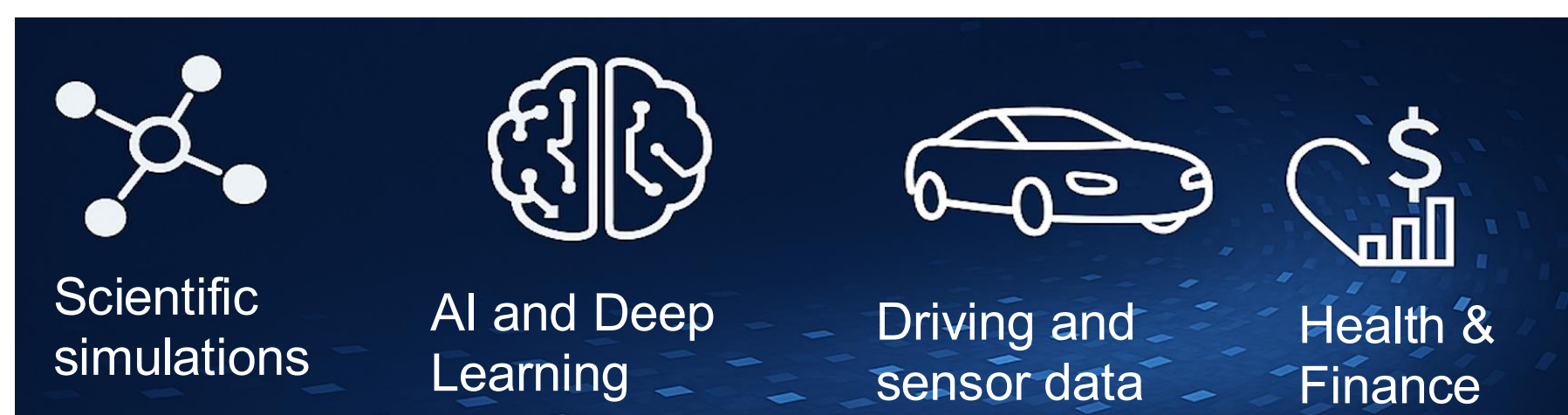


Accelerating AI Workloads with GPUs and RDMA-Enabled S3 and NFS Data Access

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1. AI and HPC applications generate massive amounts of data !

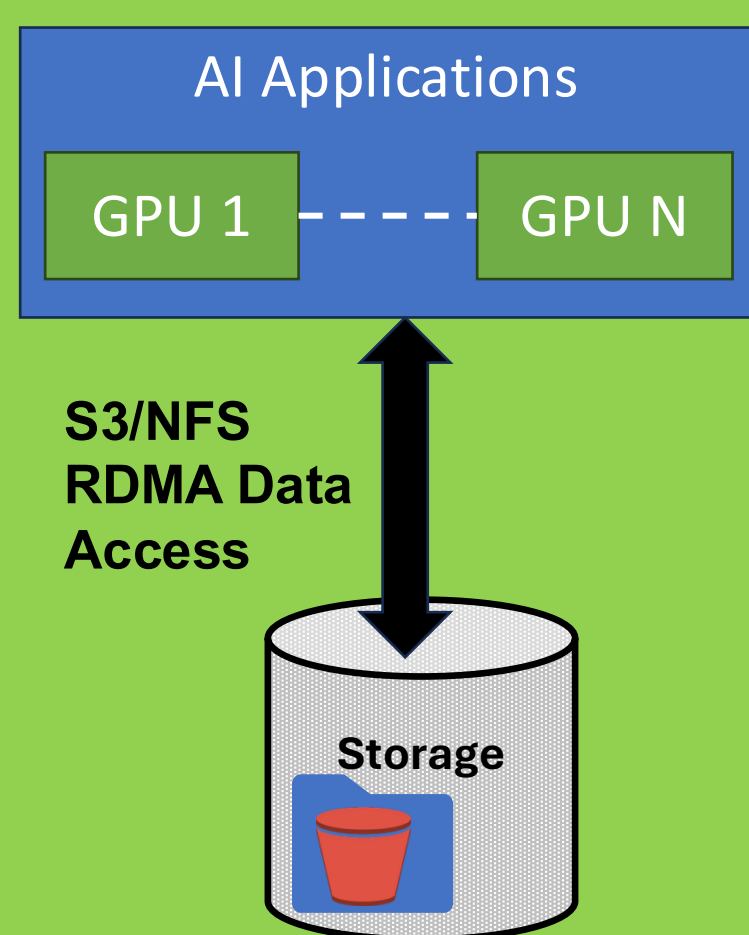


Need & Benefits of RDMA access for High-Performance Storage

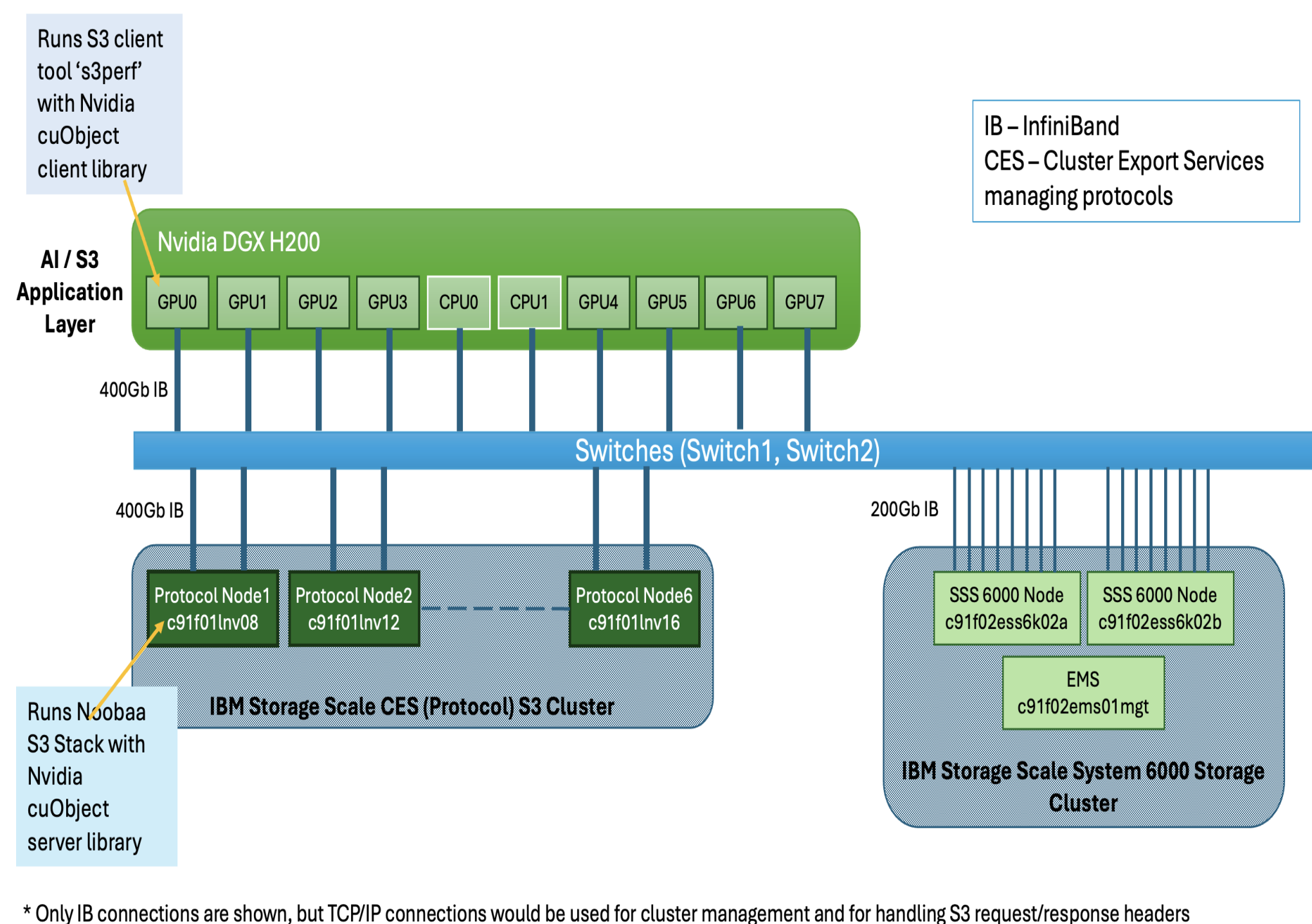
AI applications processing uses GPUs and requires fast data access through protocols like S3, NFS to access backend storage.

Benefits of RDMA Data Access to Storage

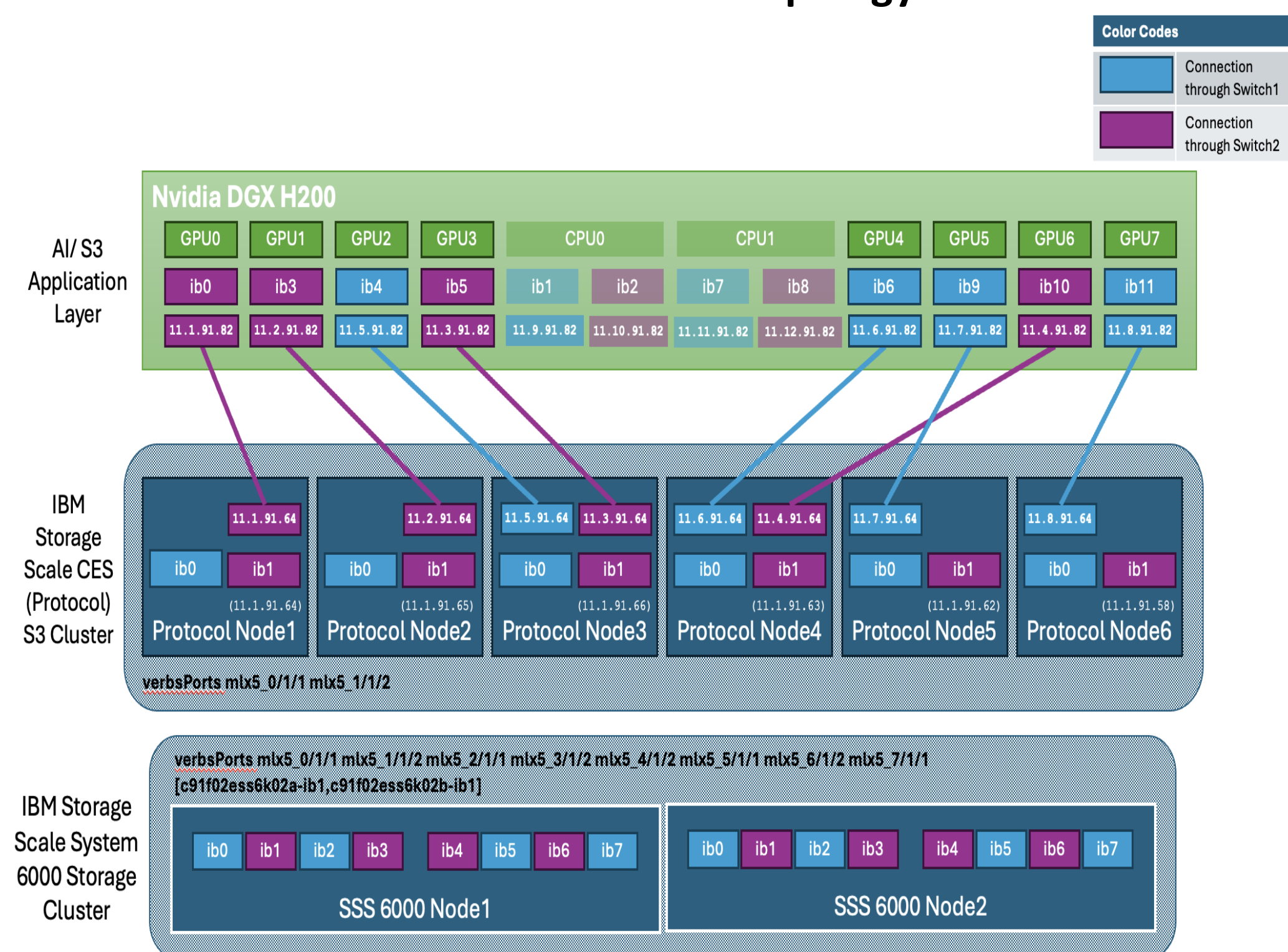
- Reduced CPU resource overhead by enabling memory to memory data movement and zero-copy transfers.
- Higher throughput with lower latency.
- Control path and data path can be separated which helps boost the AI data access performance.



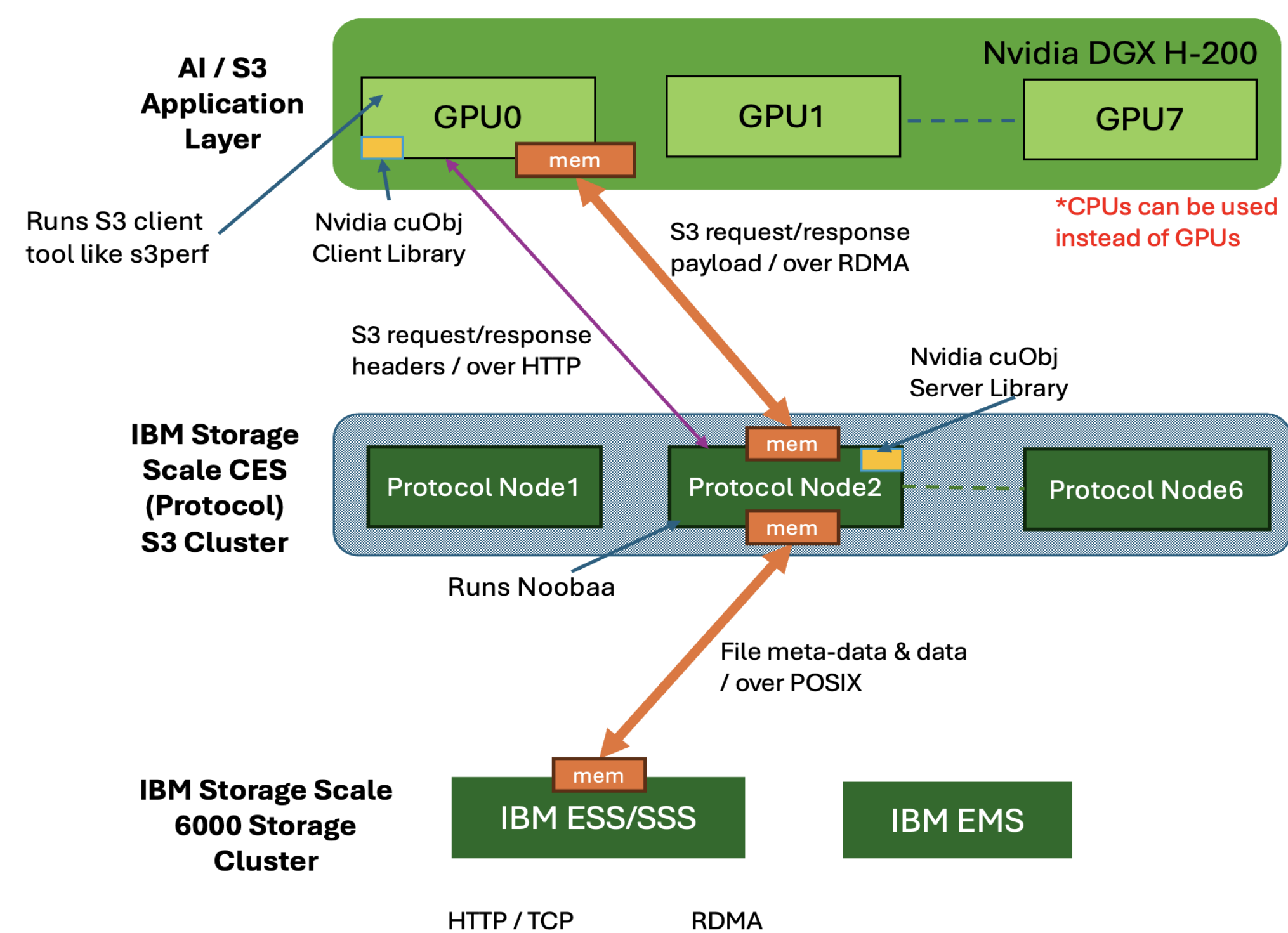
2. Method: Testbed - Lab Infrastructure Setup for measuring performance for RDMA-enabled S3 protocol data access



3. Method: Testbed - RDMA Network Topology



4. Performance Benchmark Reference Data Flow Architecture for RDMA-enabled S3 protocol data access



5. Results: Performance Benchmark Results for S3 over RDMA with GPUs and IBM Storage Scale System 6000

Large Objects:

| Object Size | READ Bandwidth | WRITE Bandwidth |
|-------------|----------------|-----------------|
| 1 GB | ~297 GB/s | ~153 GB/s |
| 128 MB | ~308 GB/s | ~149 GB/s |
| 64 MB | ~308 GB/s | ~140 GB/s |

Small Objects:

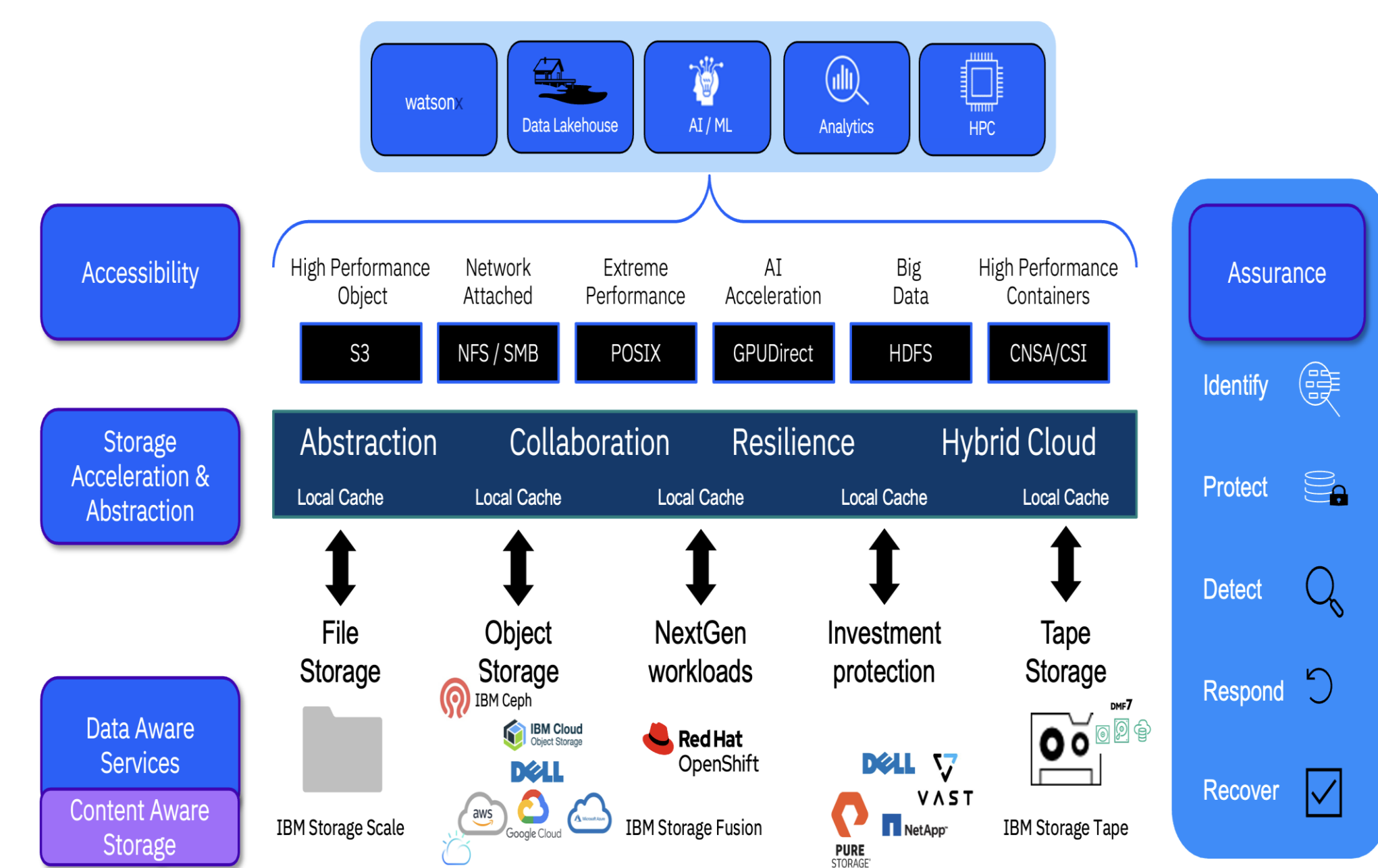
| Object Size | READ Ops/sec | WRITE Ops/sec |
|-------------|--------------|---------------|
| 16 MB | ~17K ops/s | ~4.6K ops/s |
| 1 MB | ~23.5K ops/s | ~4.6K ops/s |

* Performance was measured with single IBM Storage Scale 6000 cluster with 2 nodes

Performance with POSIX for 1GB files: ~320 GB/s read, ~155 GB/s write

Conclusion: Despite protocol overhead, S3 over RDMA achieved 90%+ of POSIX performance, showing its suitability for high-throughput AI workloads which prefer S3 access. Similarly, NFS over RDMA can provide high-performance data access for AI workloads.

6. Global Data Platform to provide Multi-site, Large Scale Enterprise Infrastructure for AI applications based on IBM Storage Scale supporting GDS based access



References:

- [1] IBM Storage Scale Document <https://www.ibm.com/docs/en/storage-scale>
- [2] IBM Storage Scale S3 Support Document <https://www.ibm.com/docs/en/storage-scale/6.0.0?topic=reference-s3-protocol>