Lessons from Post-processing Climate Data on Modern Flash-based HPC Systems

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Flash devices are a plausible solution to accelerate I/O bound applications. However, the tradeoffs associated with different flash architectures is unclear. We quantitatively assess tradeoffs associated with different flash devices to accelerate I/O bound applications. However, the Flash devices are a plausible solution to some applications.

• Each compute node has access to a single solid state drive (SSD).
• Remote direct memory access via Infiniband.
• Can cause accesses to become queued.

1) Single SSD cannot handle rate of parallel accesses and interconnect causes latency.

2) Benefits of flash decreases at intermediate scale and relatively small request sizes.

Comparison of I/O Architectures

Multiple flash devices per compute node are needed to accommodate rate of parallel accesses issued by post-processing applications.

Lessons Learned

• An incorrect matching between storage architecture and I/O workload can hide the benefits of flash devices by increasing runtime by 2x.
• Hybrid I/O decreases flash storage consumption by half while decreasing runtime by 6x.
• Local flash could be a cheaper alternative to a pooled architecture if scalability and interconnect bottlenecks are alleviated.
• Three main criteria which determine performance on flash systems. 1) Number of flash devices in job. 2) Interconnect 3) Data availability of data stored on flash.
• Three years of more advanced hardware without flash devices provides more speedup than flash devices for some datasets, lessening the need for flash.

Acknowledgements

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