**PARALLEL GRAPH REDUCE ALGORITHM FOR SCALABLE FILE SYSTEM STRUCTURE DETERMINATION**

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High performance computing (HPC) is integral to continued advancement in almost all scientific disciplines. Fields such as atomic physics, biology, and genetics rely heavily on supercomputers for fast and accurate data processing. To meet the growing demand, HPC centers have increased their data processing and storage capabilities. However, backup algorithms employed by these facilities to prevent data loss cannot scale to efficiently back up the massive file systems at most HPC facilities. This problem is further exacerbated by the increased number of error-prone storage devices composing modern file systems; the high failure rates of these large systems requires more frequent backups, limiting productivity and continued scientific growth. In this project, a computationally efficient and scalable algorithm was developed to speed up a necessary component of the backup procedure: file system structure determination. By comparison, many widely used algorithms determine file system structures with linear time complexity, achieving good performance on small file systems; however, most do not scale to multiple compute nodes, thus are limited by system clock speeds and the latency of random file system access. This presentation describes the theory, implementation, and benchmarking results of this project’s scalable, graph reducing algorithm. Results obtained at the National Energy Research Scientific Computing Center (NERSC) in Berkeley, California show this algorithm can be massively parallelized, achieving logarithmic time complexity when sufficiently scaled. The significant speedup gained from this algorithm has enabled NERSC and other HPC facilities to provide researchers with the maximum potential of their facility’s resources.