OpenSFS Application I/O kernel creation effort
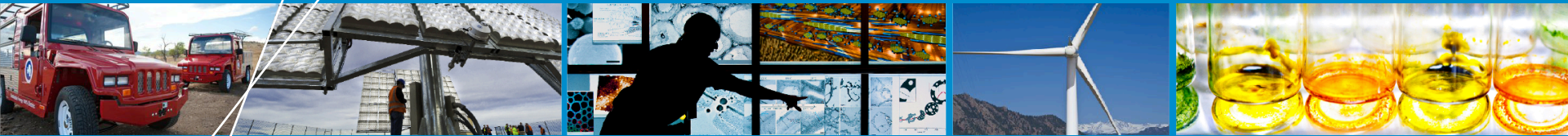
Salishan 2015 Random Access Session

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OpenSFS (Open Scalable File Systems) BWG

Application I/O kernel extraction task group

- What Application I/O kernels exist?

- What patterns are not represented?

- Develop application kernels to complement those that already exist, to allow evaluation of file system performance and scalability for specific application workloads.

What already exists?

The I/O associated with the class of applications that use MPI at large scale is well studied.

- Several previous efforts resulted in creation of application I/O benchmarks:
    - MADbench2, Chombo I/O, S3D-IO
    - Most of the I/O is associated with writing history files (results) or checkpoints.
    - Several layers of middleware are important for improving the I/O performance so (application + middleware) is the entity to benchmark.
- Many of the application I/O benchmark codes are **not supported or available** outside of the group that created them.

What patterns are not represented?

- I/O from applications that don't use MPI IO, HDF5, netCDF, etc.

- I/O from non-traditional HPC applications for which source code is not available

- I/O from applications that use many files of different types, often with small I/O accesses, especially those that run many instances simultaneously on different data.

Examples:

- High throughput computational screening studies

- Parameter sweeps with serial or modestly parallel codes

- Genomic codes (ex. BLAST)

- Financial modeling codes

Challenges

- Often proprietary applications
- Uncoordinated POSIX I/O from different instances of the application running simultaneously.

Plan

- Develop application kernels to complement those that already exist, to allow evaluation of file system performance and scalability for specific application workloads.

- Use trace based methods to create surrogate applications.

Current status

- In 2014, came across an interesting paper by Babak Behzad (then a student of Marc Snir) about creation of surrogate applications that display the same I/O patterns as a traced application.

- Began discussions to see whether the tools he developed could be extended to cover any of the cases we're interested in.

- Using Pynamic benchmark as a test case.

OpenSFS BWG

- **http://opensfs.org/get-involved/ benchmarking-working-group/**
- **Co-Chairs: Devesh Tiwari (tiwari@ornl.gov), and Andrew Uselton, (andrew.c.uselton@intel.com)**
- **GET INVOLVED!**