Cyber-infrastructure Working Group: Pagoda

Status and Future

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Parallel Analysis of Geodesic Data

- ▶ a.k.a Parallel Analysis of Geoscience Data
- ▶ C++ API for developing custom analysis
  - ■ Most similar to Java NetCDF API
- ▶ Data-parallel command-line tools
  - ■ Mimics the NetCDF Operators (NCO)

NCO	pagoda
ncks	pgsub
ncra	pgra
ncea	pgea
ncbo	pgbo
ncflint	<soon>
ncwa	<soon>
ncrcat	
ncrename	
ncatted	
ncpdq	

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Pagoda Design

- ► Focus on parallel IO and large variables
  - ■ Do what NCO does but when your data is too large for your workstation
- ► Handles regular and geodesic grids
  - ■ Geodesic grids are described using an explicit topology
  - ■ Explicit topology needed for analysis/visualization e.g. VisIt
- ► Reads and writes classic NetCDF via Parallel NetCDF
- ► Reads and writes NetCDF4
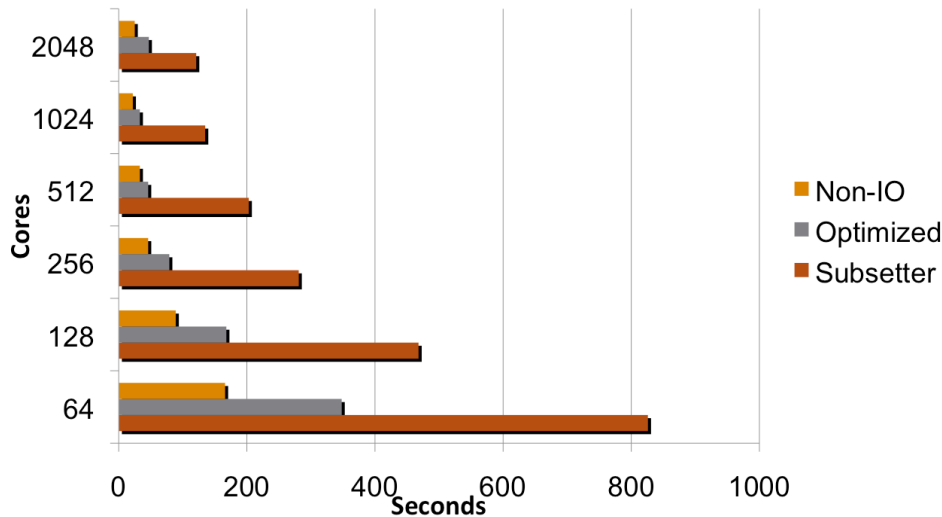- ► Runs on workstations, clusters, HPC systems e.g. hopper

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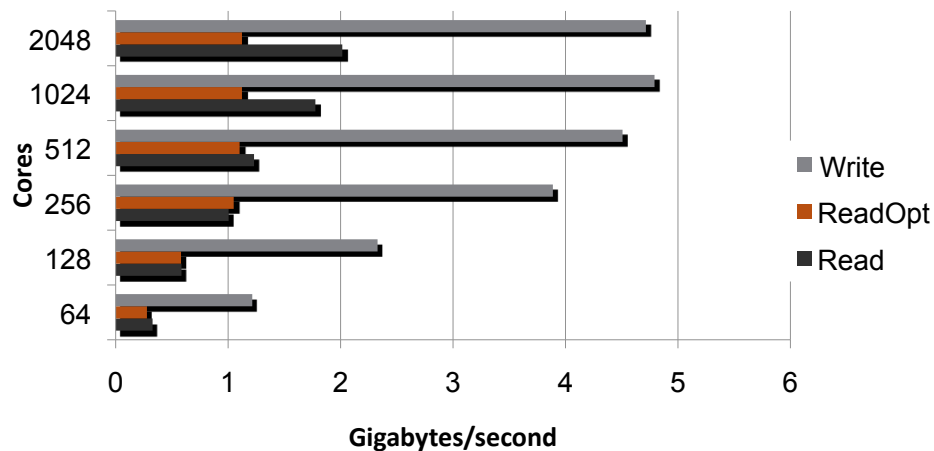NATIONAL LABORATORY

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pgsub Strong Scaling

Strong Scaling - Wall Time

Cores (vertical axis): 2048, 1024, 512, 256, 128, 64
Seconds (horizontal axis): 0, 200, 400, 600, 800, 1000

Legend:
- Non-IO
- Optimized
- Subsetter

Strong Scaling - IO Bandwidth

Cores (vertical axis): 2048, 1024, 512, 256, 128, 64
Gigabytes/second (horizontal axis): 0, 1, 2, 3, 4, 5, 6

Legend:
- Write
- ReadOpt
- Read

▶ Shown to scale up to 2K cores

▶ Shows that IO is a major bottleneck

▶ Write bandwidth nearly 5GB/s on franklin

▶ Our first optimization shows importance of efficient use of IO

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Future Directions

► "make it easy" – A higher level API

► New language bindings? Python? Fortran?

► Handle additional conventions e.g. missing_value

► Finish pgflint (ncflint), pgwa (ncwa)

► Grid interpolation

► Other operators?

  ■ What if header isn't big enough and data is too large?

  ■ What if pnetcdf's "CDF5" format is used?

► We need more users and user input on what's needed

  ■ Already in use/testing by CSU, ANL, NCAR

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Thanks

► http://svn.pnl.gov/gcrm/wiki/pagoda

► pagoda-dev@googlegroups.com

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