PetaApps: Ultra-High Resolution Climate

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July 1, 2010
PetaApps Project

NSF PetaApps project: Interactive Ensemble
- Kinter, Stan (COLA)
- Kirtman (U of Miami)
- Collins, Yelick (Berkley)
- Bryan, Dennis, Loft, Vertenstein (NCAR)
- Bitz (U of Washington)

Ultra-High resolution Climate Computing
- ~99,000 core Cray XT5 system at NICS [Kraken]
- Large TG allocation: 35M CPU hours
Other Ultra-High resolution CCSM efforts

- LLNL Grand Challenge Project
  - 0.25° ATM, LND + 0.1° OCN, ICE
  - Bader, McClean, Bryan, Jones, Dennis, Ivanova, Vertenstein, Craig, Norton, Worley, Boyle, Norton, Jones, Mirin, Maltrud, Jacob
  - 20 year run

- Upcoming DOE runs
  - 0.25° ATM, LND + 0.1° OCN, ICE (FV,HOMME)
  - T341 ATM, LND + 0.1°deg OCN,ICE (spectral)
Funding Sources

Department of Energy: CCPP Program Grants
- DE-FC03-97ER62402 [SciDAC]
- DE-PS02-07ER07-06 [SciDAC]

National Science Foundation:
- OCI-0749206 [PetaApps]
- CCF-0937939 [HECURA]
- OCE-0825754
- Cooperative Grant NSF01
Large scale PetaApps run

155 year control run
- 0.1° Ocean model [3600 x 2400 x 42]
- 0.1° Sea-ice model [3600 x 2400 x 20]
- 0.5° Atmosphere [576 x 384 x 26]
- 0.5° Land [576 x 384]

Statistics
- ~18M CPU hours
- 5844 cores for 4-5 months
- ~100 TB of data generated
- 0.5 to 1 TB per wall clock day generated

100x current production
4x current production

CCSM Workshop
Large scale PetaApps run (con’t)

Work flow

- Run on Kraken (NICS)
- Transfer output from NICS to NCAR (100 – 180 MB/sec sustained)
  - Caused noticeable spikes in TG network traffic
- Archive on HPSS
- Data analysis using 55 TB project space at NCAR
Issues/challenges with runs

- Reduced cost of simulation by 20%
  - code changes
  - system upgrades

- Very large variability with job run times (MPI message passing)
  - Interference with other jobs
  - 25% of jobs terminated abnormally
Execution time for non-I/O CCSM day
Issues/challenges with runs (con’t)

- Very large variability with I/O performance
  - 2-10x slowdown common
  - 300x slowdown was observed
- Interference with other jobs?
Write bandwidth for CCSM

I/O day

*Write Bandwidth for CCSM I/O day*

- phase A
- phase B
- phase C
- phase D

Date:
- 01-Apr-09
- 01-Jul-09
- 01-Oct-09
- 01-Jan-10

Sustained Bandwidth (Mbytes/sec)
Acknowledgements

NCAR:
- D. Bailey
- F. Bryan
- T. Craig
- B. Eaton
- J. Edwards [IBM]
- N. Hearn
- K. Lindsay
- N. Norton
- M. Vertenstein

COLA:
- J. Kinter
- C. Stan

U. Miami
- B. Kirtman

U.C. Berkeley
- W. Collins
- K. Yelick (NERSC)

U. Washington
- C. Bitz

NICS:
- M. Fahey
- P. Kovatch

ANL:
- R. Jacob
- R. Loy

LANL:
- E. Hunke
- P. Jones
- M. Maltrud

LLNL
- D. Bader
- D. Ivanova
- J. McClean (Scripps)
- A. Mirin

ORNL:
- P. Worley

Grant Support:
- DOE
  - DE-FC03-97ER62402 [SciDAC]
  - DE-PS02-07ER07-06 [SciDAC]
- NSF
  - Cooperative Grant NSF01
  - OCI-0749206 [PetaApps]
  - CNS-0421498
  - CNS-0420873
  - CNS-0420985

Computer Allocations:
- TeraGrid TRAC @ NICS
- DOE INCITE @ NERSC
- LLNL Grand Challenge

Thanks for Assistance:
- Cray, NICS, and NERSC

and many more...
Questions

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