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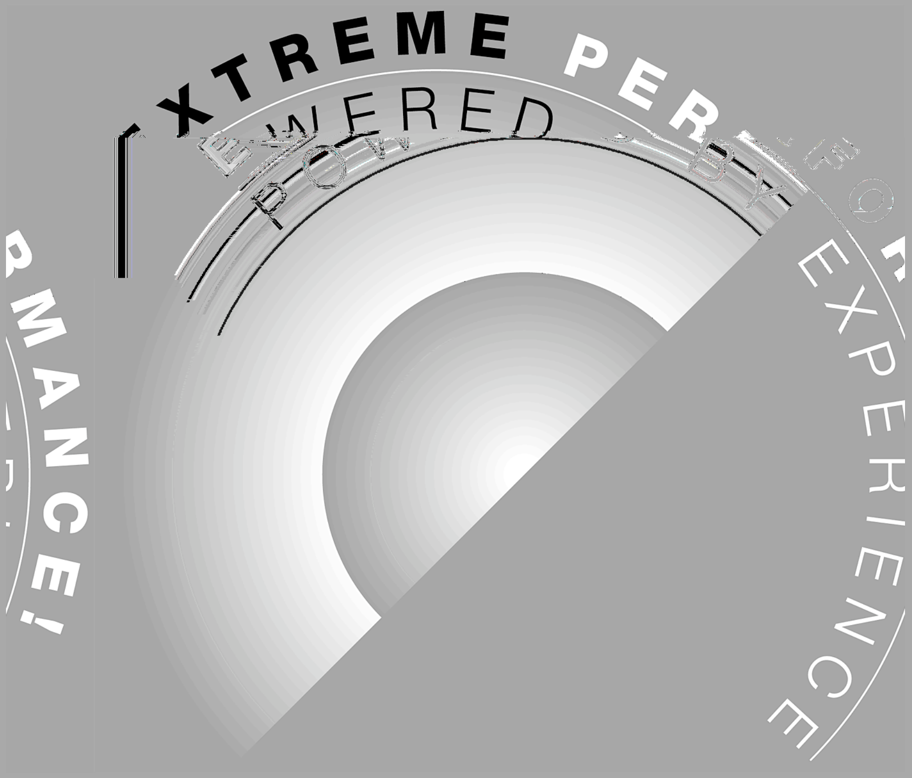

Porting and Optimization of CAM/CLM on the Cray X1

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Porting and Optimization of CAM

- Porting of single MSP version.
- Optimization of single MSP version.
- Future plans.

Porting and Optimization of CAM

- Obtained CAM v 2.0.1 source code from NCAR.
- Obtained T42/gx1v3 input data set.
- Obtained X1 port of netCDF
- Compiled under Programming Environment v4.2 using FORTRAN compiler (ftn) v4.2.0.1
  - Options:
    - -s real64 (promotes R4 -> R8)
    - -DDISABLE_TIMERS (get better statistics)
    - -UCRAY (disable CRAY macro)

Porting and Optimization of CAM

- ESMF
  - Created new UNICOS macro and directory
  - #define ESMC_HAVE_FORTRAN_UNDERSCORE
- CAM
  - Insert UNICOS macros where relevant
    - system() -> ishell()
    - getenv() -> pxfgetenv()

Porting and Optimization of CAM

- Optimization
  - Concentrate on single MSP performance first
    - Identify areas where we can vectorize and multistream.
    - MPI version works
  - CAM timings and CrayPat analysis showed that 25% of run-time spent doing radiative transfer:
    - radcswmx()
    - radclwmx()

Porting and Optimization of CAM

- Optimization
  - Concentrate on radcswmx()
    - Inserted compiler directives:
      - !DIR$ PREFERVECTOR
      - !DIR$ PREFERSTREAM
      - !DIR$ CONCURRENT
    - Inlined several function/subroutine calls
    - Changed some array ranks to allow vectorization

Porting and Optimization of CAM

- Optimization
  - radcswmx()
    - Optimizing initialization loops did not give much of a performance gain.
    - Vectorized over spectral intervals in major work loop

```
DO n =1,ndayc
   …sorting…
   DO n = 1, nspint
                do l=0,p1
                …
                end do
                do j = p2,0,-1
                …
                end do
   END DO
END DO
```

```
DO n =1,ndayc
   …sorting…
                do l=0,p1
                    DO n = 1, nspint
                    END DO
                end do
                do j = p2,0,-1
                    DO n = 1, nspint
                    END DO
                end do
   END DO
END DO
```

Porting and Optimization of CAM

- Optimization
  - Result:
    - Reduced run time by 35%
    - radcswmx() now accounts for only 7% of total run-time, rather than 25%.
      - Now #3 contributor to overall CPU time.

Porting and Optimization of CAM

- Future plans:
  - Believe we can further multi-stream radcswmx().
  - Analyze other routines for optimization
    - e.g. radclwmx(), pcond(), outfld(), radcswmx() may come back
  - Analyze MPI performance.
  - Analyze performance for different chunk sizes
    - e.g. chunksize = 256, 512, ...
  - Run longer models with different dynamics (e.g. FV rather than Euler).

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END • FIN • FINALE • FINE