CSCS
Centro Svizzero di Calcolo Scientifico
Swiss National Supercomputing Centre

ETH zürich

Summer School 2015

MPI Profiling
http://github.com/eth-cscs/SummerSchool2015/wiki - DAY4
July 2015

Summary

- Parallel performance
- Profiling the MPI mini app
  - with Cray's perftools-lite

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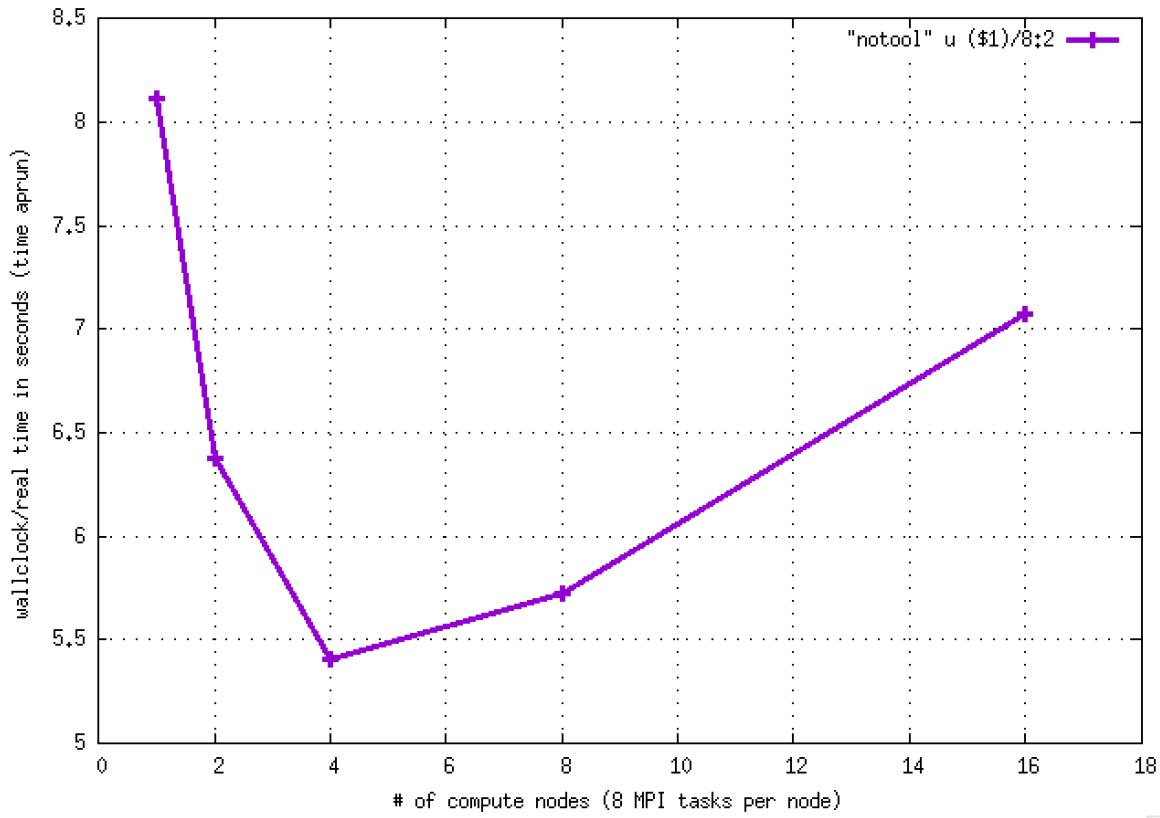
Parallel Performance

Scalability results (C++/MPI miniapp)



Getting timings

```
course51@daint103:~ /usr/bin/time -p aprun -n 32 256 256 400 0.1
==========================================================
                      Welcome to mini-stencil!
version   :: with MPI : 32 MPI ranks
mesh      :: 256 * 256 dx = 0.00392157
time      :: 400 time steps from 0 .. 0.1
...  ----------------------------------------- Goodbye!
     real 5.41          <================ real time in seconds
```

WHY ?

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Perftools

MPI miniapp + perftools: compiling

Compiling with the tool

- Cray's perftools supports all 4 compilers
- module load `perftools-lite`; man `perftools-lite`
- make clean; make

Recompile with optimisation flags on

```
course51@daint103:~ make
CC -O3  -c stats.cpp -o stats.o
CC -O3  -c data.cpp -o data.o
CC -O3  -c operators.cpp -o operators.o
CC -O3  -c linalg.cpp -o linalg.o
CC -O3 *.o main.cpp -o main.exe

INFO: creating the CrayPat-instrumented exec 'main.exe'
                          (sample_profile) ...OK

INFO: A maximum of 53 functions from group 'io' will be traced.
INFO: A maximum of 292 functions from group 'mpi' will be traced.
INFO: A maximum of 22 func. from group 'realtime' will be traced.
INFO: A maximum of 54 func. from group 'syscall' will be traced.
```

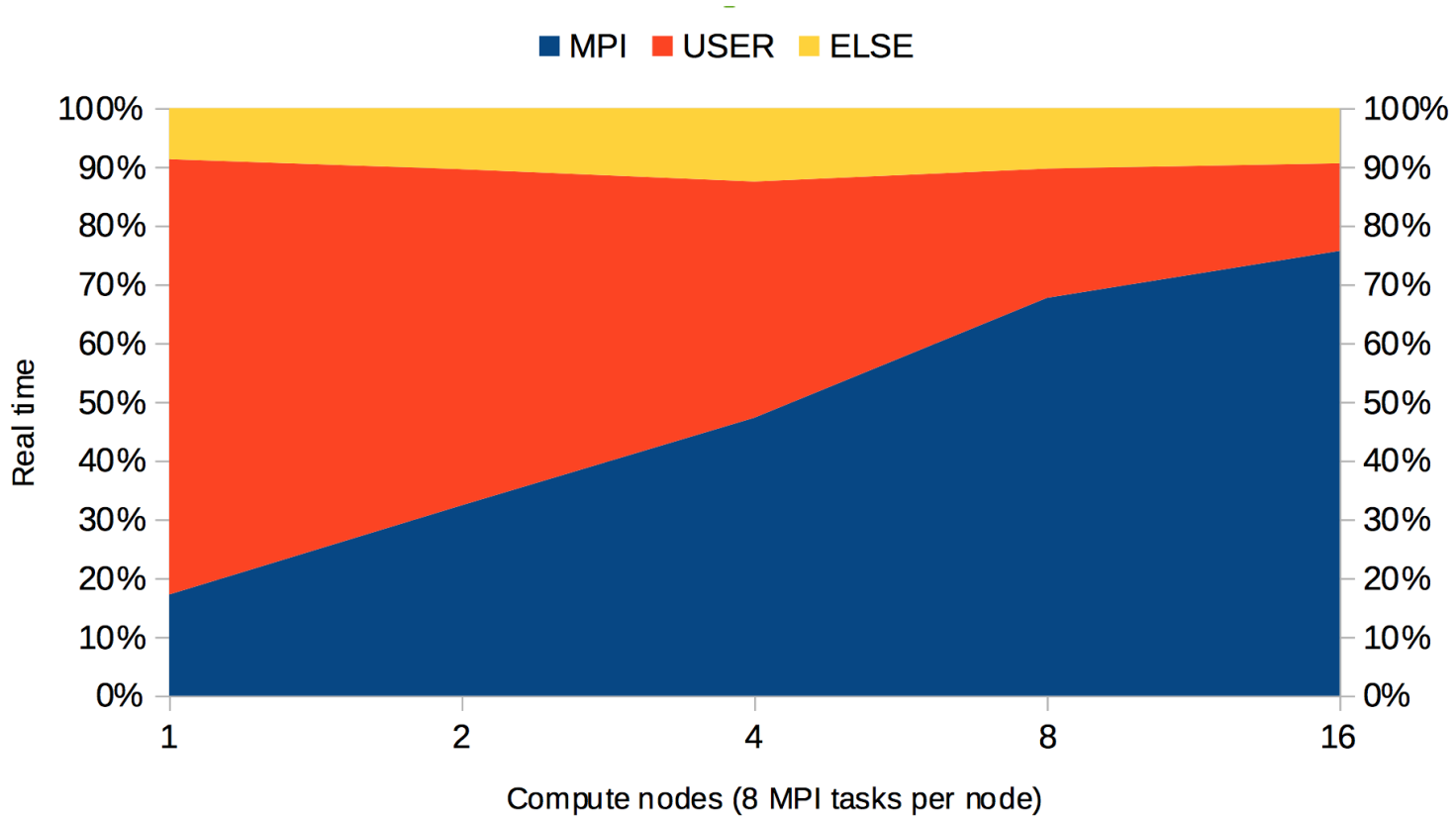
MPI miniapp + perftools: running

Run to get the performance report (4 CN here)

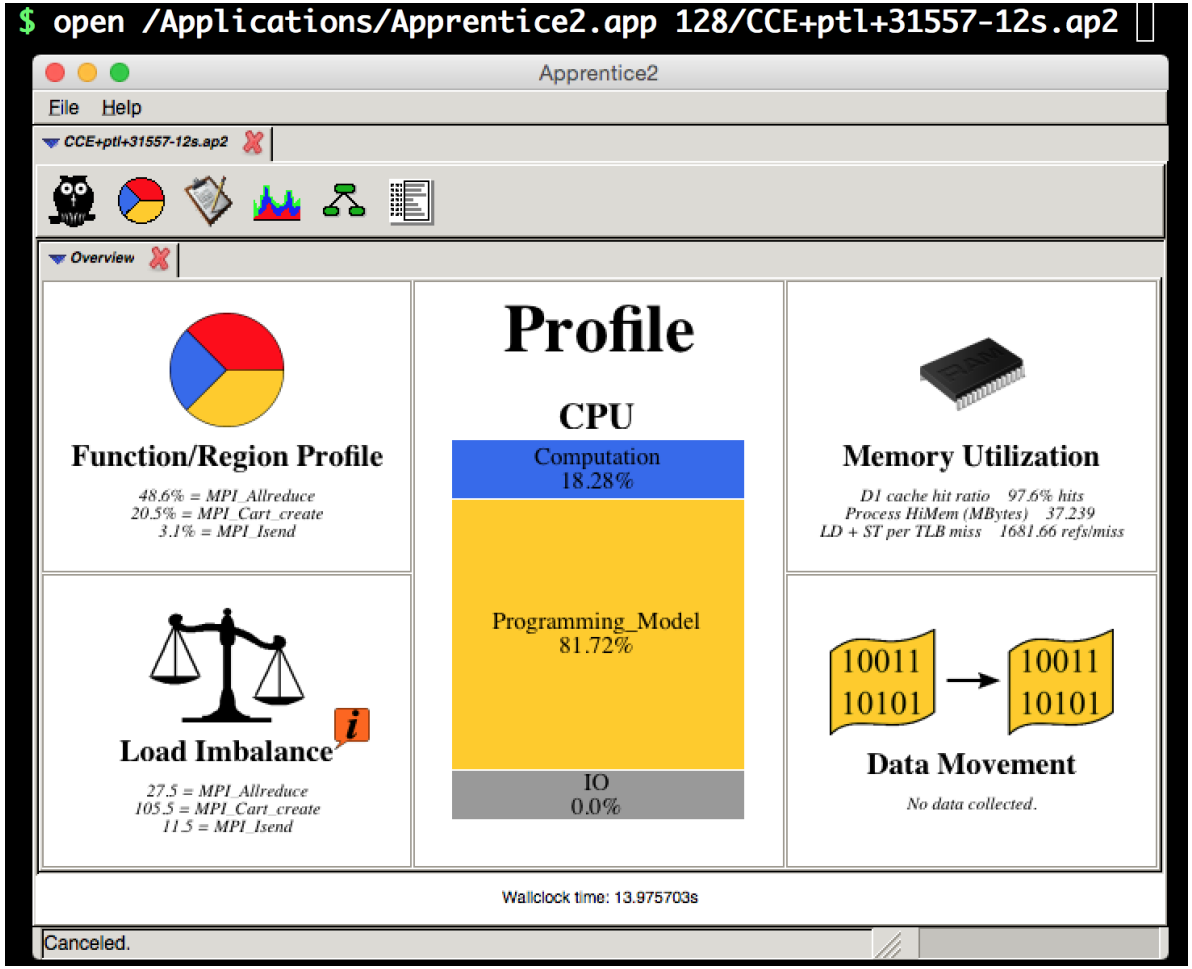
```
course51@daint103:~ aprun -n 32 256 256 400 0.1

=================================================
                    Welcome to mini-stencil!
...
------------------------------------------------- Goodbye!
Table 1:  Profile by Function Group and Function
          (top 10 functions shown)
  Samp% |   Samp | Imb. |  Imb. |Group
        |        | Samp | Samp% | Function
        |        |      |       |  PE=HIDE

 100.0% | 444.3 |   -- |    -- |Total
|---------------------------------------
|  47.3% | 210.2 |   -- |    -- |MPI
||--------------------------------------
||  34.2% | 151.9 | 29.1 | 16.6% |MPI_Allreduce
||   6.1% |  27.1 | 17.9 | 41.1% |MPI_Cart_create
||   3.2% |  14.4 | 14.6 | 51.8% |MPI_Isend
||   3.0% |  13.4 | 10.6 | 45.4% |MPI_Waitall
||======================================
|  40.2% | 178.8 |   -- |    -- |USER
|   7.7% |  34.1 |   -- |    -- |OMP
|   4.8% |  21.2 |   -- |    -- |ETC
```

MPI miniapp + perftools: Because !

Scalability results (C++/MPI miniapp): 256x256



MPI miniapp + perftools: apprentice2

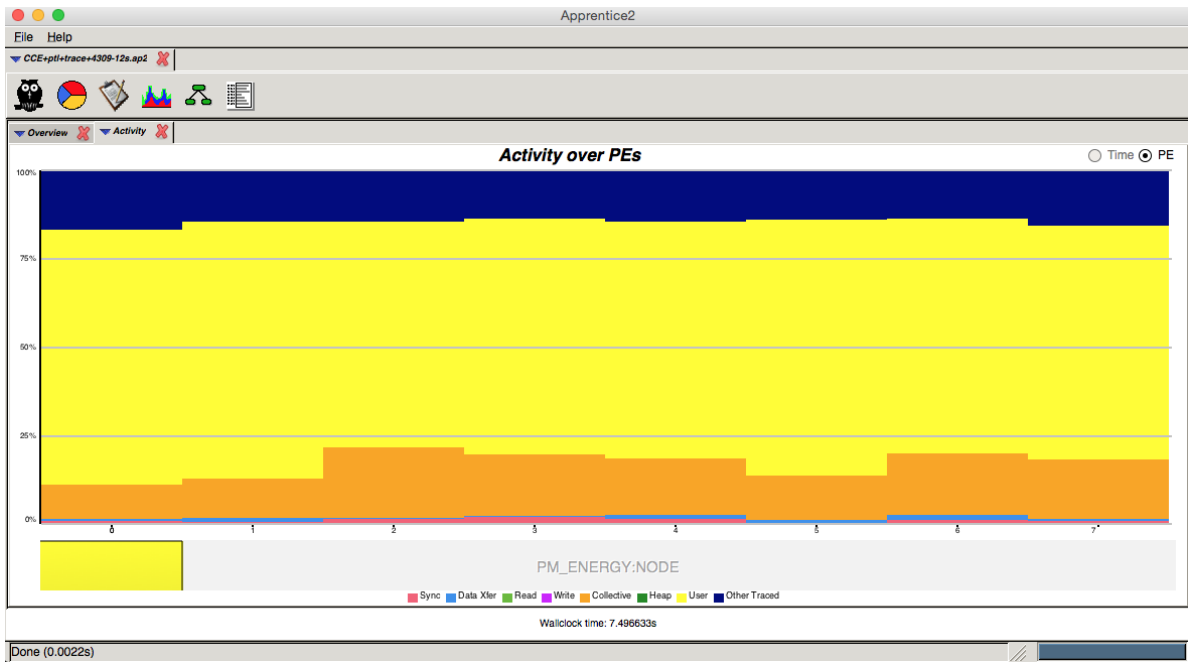


- You can install app2 on your laptop: `/opt/cray/perftools/default/share/desktop_installers/`

MPI miniapp + perftools: tracing

app2

- module load `perftools-lite`; man `perftools-lite`
- export CRAYPAT_LITE=event_profile
- make clean; make; aprun ...



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Scorep

MPI miniapp + scorep: compiling

Compiling with the tool

- module rm perftools-lite
- module load scorep; module help scorep
- make clean; make CXX=’`scorep --mpp=mpi` CC’

Recompile with optimisation flags on

```
course51@daint103:~ make CXX="scorep --mpp=mpi CC" CXXFLAGS="-O3 -h
      noomp"
         scorep --mpp=mpi CC -O3 -h noomp  -c stats.cpp
         scorep --mpp=mpi CC -O3 -h noomp  -c data.cpp
         scorep --mpp=mpi CC -O3 -h noomp  -c operators.cpp
         scorep --mpp=mpi CC -O3 -h noomp  -c linalg.cpp
         scorep --mpp=mpi CC -O3 -h noomp *.o main.cpp -o main
```

MPI miniapp + scorep: running

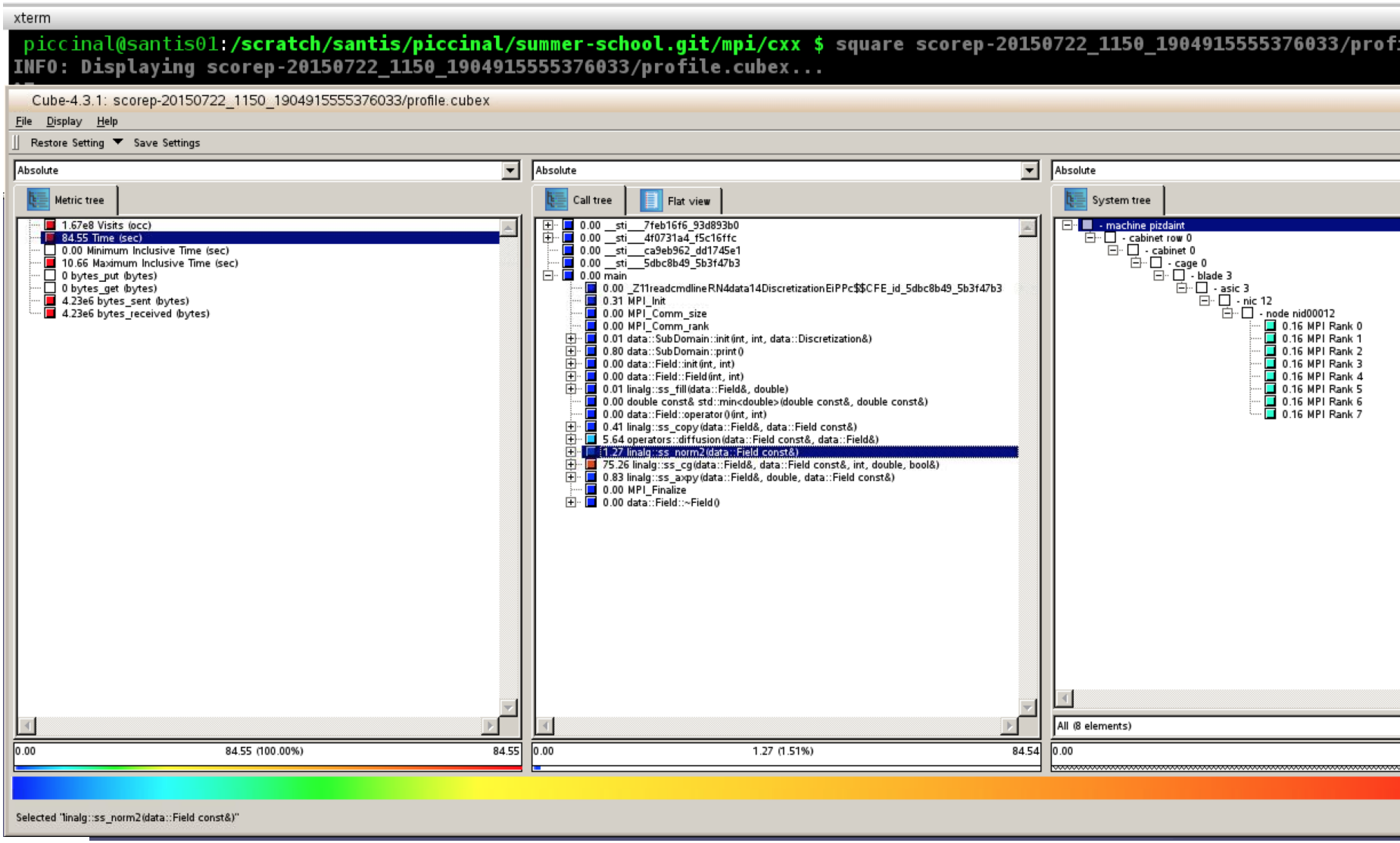
Run to get the performance report dir

```
course51@daint103:~ aprun -n 8 CCE+sc141 128 128 25 0.0001

=================================================
Welcome to mini-stencil!
...
------------------------------------------------- Goodbye!

New dir ==> scorep-20150722_1150_1904915555376033/
```

View the text performance report

```
course51@daint103:~ scorep-score \
   scorep-20150722_1150_1904915555376033/profile.cubex

 type   max_buf[B]       visits time[s] time[%] time/visit[us]
      region
  ALL 501,600,399 166,898,392   84.55   100.0           0.51   ALL
  USR 501,322,776 166,859,984   60.97    72.1           0.37   USR
  MPI     247,839      28,480    0.72     0.9          25.31   MPI
  COM      29,784       9,928   22.85    27.0        2301.87   COM
```

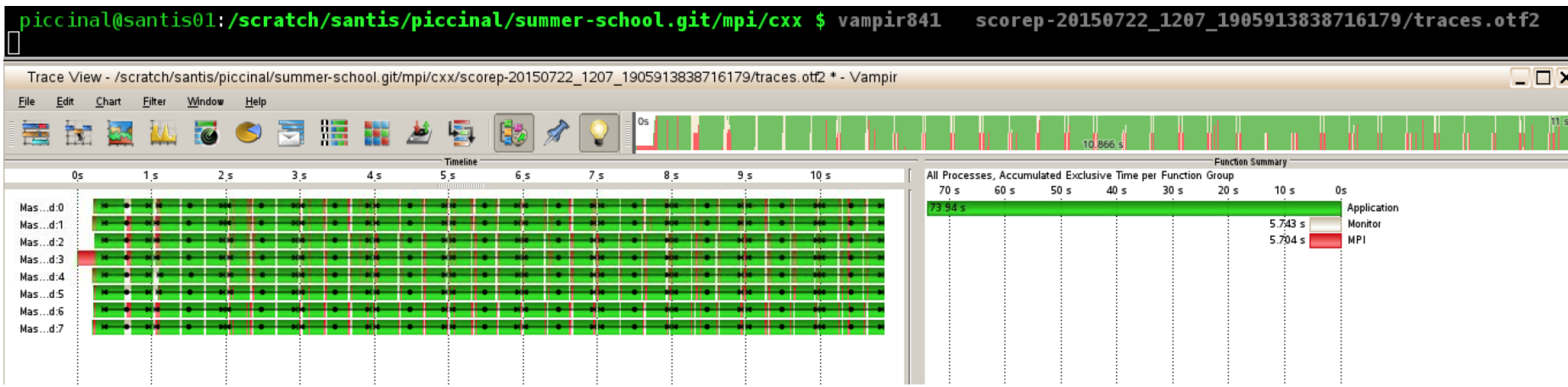
MPI miniapp + scorep: scalasca



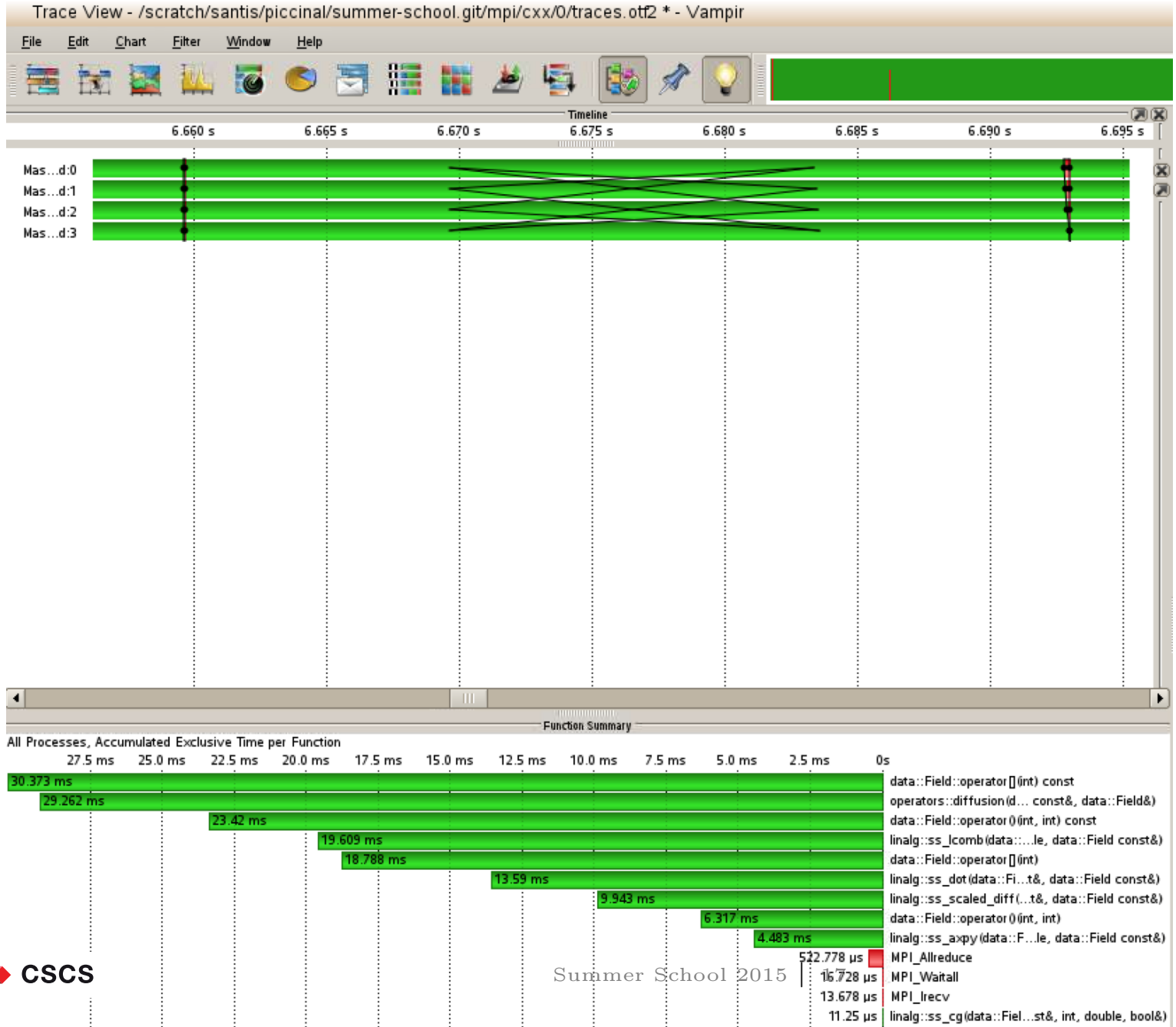
MPI miniapp + scorep: vampir (1)

vampir

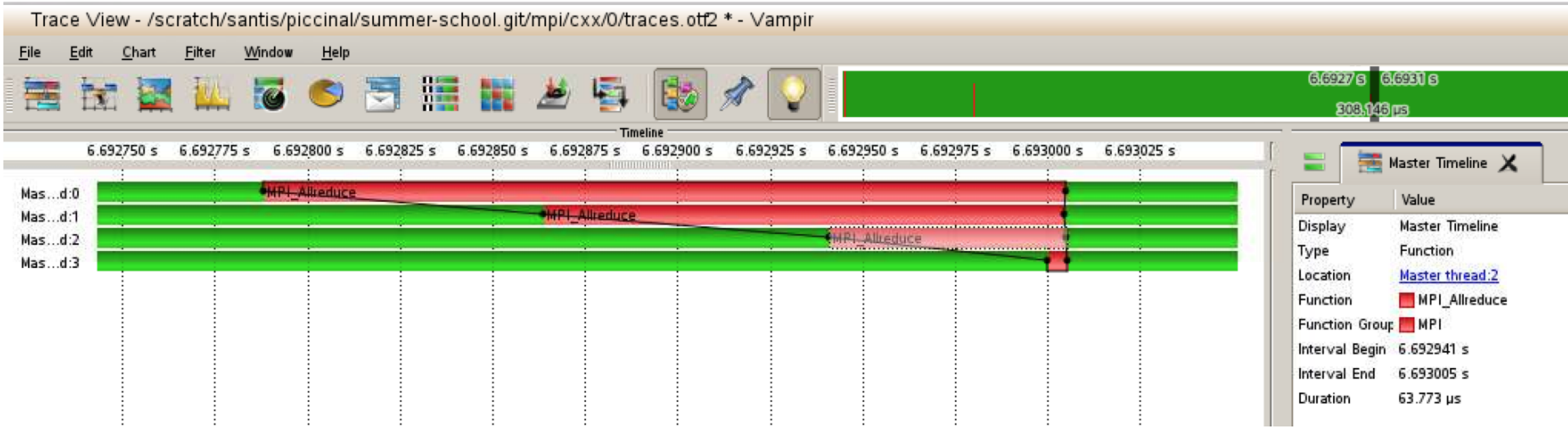
- module rm perftools-lite
- module load scorep; module help scorep
- make clean; make;
- export SCOREP_ENABLE_TRACING=true; aprun ...

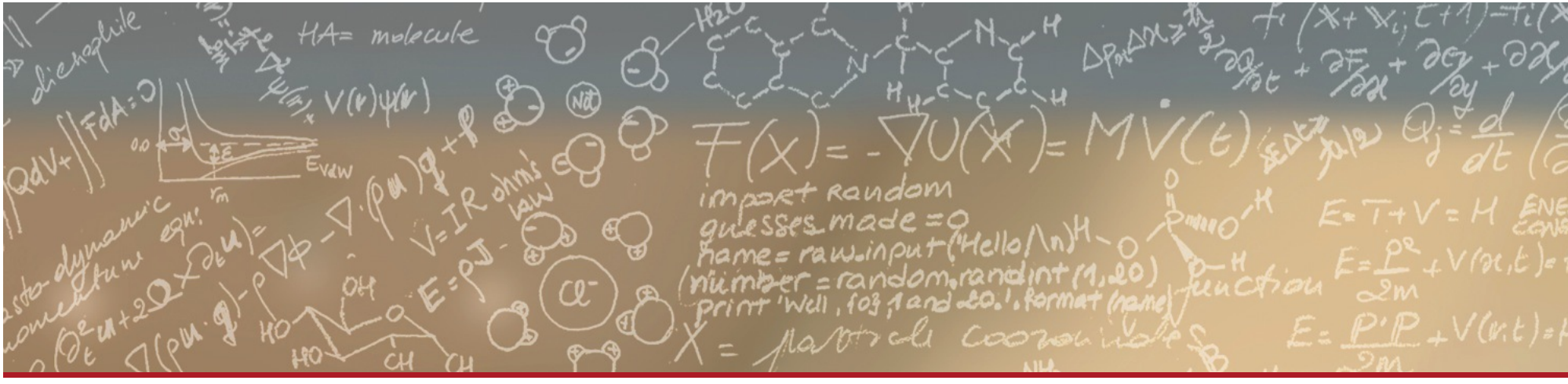


MPI miniapp + perftools: vampir (2)



MPI miniapp + perftools: vampir (3)





Thank you for your attention.