Enabling HPC software productivity with the TAU performance system

Hands-on

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Sourcing TAU

Guidelines to Load TAU Modules

Initial HOWTO

```
# Add TAU to MODULE PATH
. ~besnard2/TAU/tau.sh
# You now have two flavors of TAU

# Cray
module load TAU/2.32.1-cray

# AMD
module load TAU/2.32.1-amd

# Get some examples

cd && tar xf $TAU_TARBALL
export WORK=$HOME/pdc_tau
```

Tour of Supported Configurations

Cray Compilers and AMD ones

module load TAU/2.32.1-amd

On GPU due to ROCM dep

```
cc --version
AMD clang version 14.0.0 (https://github.com/RadeonOpenCompute/llvm-project roc-5.0.2 22065 030a405a181176f1a7749819092f4ef8ea5f0758)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/rocm-5.0.2/llvm/bin
```

module load TAU/2.32.1-cray

On GPU and Main

```
cc --version
Cray clang version 14.0.1  (3a8780657c742829e80f36338fb6ec6578642bb7)
Target: x86_64-unknown-linux-gnu
Thread model: posix
InstalledDir: /opt/cray/pe/cce/14.0.1/cce-clang/x86_64/share/../bin
```

Sampling

Running with Event-Based Sampling

Flat Event-Based Sampling

```
# Setup Env
module load TAU/2.23.1-cray
# Go to sources
cd $WORK/CoMD/src-mpi/
# Compile without instrumentation
make CC=cc

#Now run
cd ../bin/
sh ./run-mpi.sh

# Show profile
paraprof
```

... tau_exec **-ebs** ...

Event Based Sampling

Paraprof Output

File Options Windows Help

Name △	Exclusive TIME	Inclusive TIME	Calls	Child Calls
.TAU application	0,002	4,015	1	1
MPI Collective Sync	0,005	0,005	34	0
MPI_Allreduce()	0	0,004	33	33
MPI_Barrier()	0,002	0,002	5	0
MPI_Bcast()	0	0,001	1	1
MPI_Comm_rank()	0	0	1	0
MPI_Comm_size()	0	0	1	0
MPI_Finalize()	0,023	0,023	1	0
MPI_Get_count()	0	0	606	0
MPI_Init()	0,063	0,063	1	0
MPI_Sendrecv()	0,076	0,076	606	0
[CONTEXT] MPI_Sendrecv()	0	0,15	3	0
int taupreload_main(int, char **, char **)	3,844	4,013	1	1 255
[CONTEXT] int taupreload_main(int, char **, char **)	0	3,65	73	0
[SAMPLE] getBoxFromTuple [{/cfs/klemming/home/b/besnard2/pdt_tau_workshop/CoMD/src	0,05	0,05	1	0
[SUMMARY] ljForce [{/cfs/klemming/home/b/besnard2/pdt_tau_workshop/CoMD/src-mpi/ljFc	3,5	3,5	70	0
[SAMPLE] ljForce [{/cfs/klemming/home/b/besnard2/pdt_tau_workshop/CoMD/src-mpi/ljf	0,3	0,3	6	0
[SAMPLE] ljForce [{/cfs/klemming/home/b/besnard2/pdt_tau_workshop/CoMD/src-mpi/ljf	0,05	0,05	1	0
[SAMPLE] ljForce [{/cfs/klemming/home/b/besnard2/pdt_tau_workshop/CoMD/src-mpi/ljf	0,05	0,05	1	0
[SAMPLE] ljForce [{/cfs/klemming/home/b/besnard2/pdt_tau_workshop/CoMD/src-mpi/ljf	0,75	0,75	15	0
[SAMPLE] ljForce [{/cfs/klemming/home/b/besnard2/pdt_tau_workshop/CoMD/src-mpi/ljf	0,25	0,25	5	0
[SAMPLE] ljForce [{/cfs/klemming/home/b/besnard2/pdt_tau_workshop/CoMD/src-mpi/ljf	0,4	0,4	8	0
[SAMPLE] ljForce [{/cfs/klemming/home/b/besnard2/pdt_tau_workshop/CoMD/src-mpi/ljf	0,15	0,15	3	0
[SAMPLE] ljForce [{/cfs/klemming/home/b/besnard2/pdt_tau_workshop/CoMD/src-mpi/ljf	0,2	0,2	4	0
[SAMPLE] ljForce [{/cfs/klemming/home/b/besnard2/pdt_tau_workshop/CoMD/src-mpi/ljf	0,05	0,05	1	0
[SAMPLE] ljForce [{/cfs/klemming/home/b/besnard2/pdt_tau_workshop/CoMD/src-mpi/ljf	0,2	0,2	4	0
[SAMPLE] ljForce [{/cfs/klemming/home/b/besnard2/pdt_tau_workshop/CoMD/src-mpi/ljf	0,2	0,2	4	0
[SAMPLE] ljForce [{/cfs/klemming/home/b/besnard2/pdt_tau_workshop/CoMD/src-mpi/ljf	0,8	0,8	16	0
[SAMPLE] ljForce [{/cfs/klemming/home/b/besnard2/pdt_tau_workshop/CoMD/src-mpi/ljf	0,05	0,05	1	0
[SAMPLE] ljForce [{/cfs/klemming/home/b/besnard2/pdt_tau_workshop/CoMD/src-mpi/ljf	0,05	0,05	1	0
[SUMMARY] loadAtomsBuffer [{/cfs/klemming/home/b/besnard2/pdt_tau_workshop/CoMD/s	0,05	0,05	1	0
[SAMPLE] loadAtomsBuffer [{/cfs/klemming/home/b/besnard2/pdt_tau_workshop/CoMD/	0,05	0,05	1	0
[SUMMARY] sortAtomsInCell [{/cfs/klemming/home/b/besnard2/pdt_tau_workshop/CoMD/sr	0,05	0,05	1	0
[SAMPLE] sortAtomsInCell [{/cfs/klemming/home/b/besnard2/pdt_tau_workshop/CoMD/s	0,05	0,05	1	0

Running with Event-Based Sampling

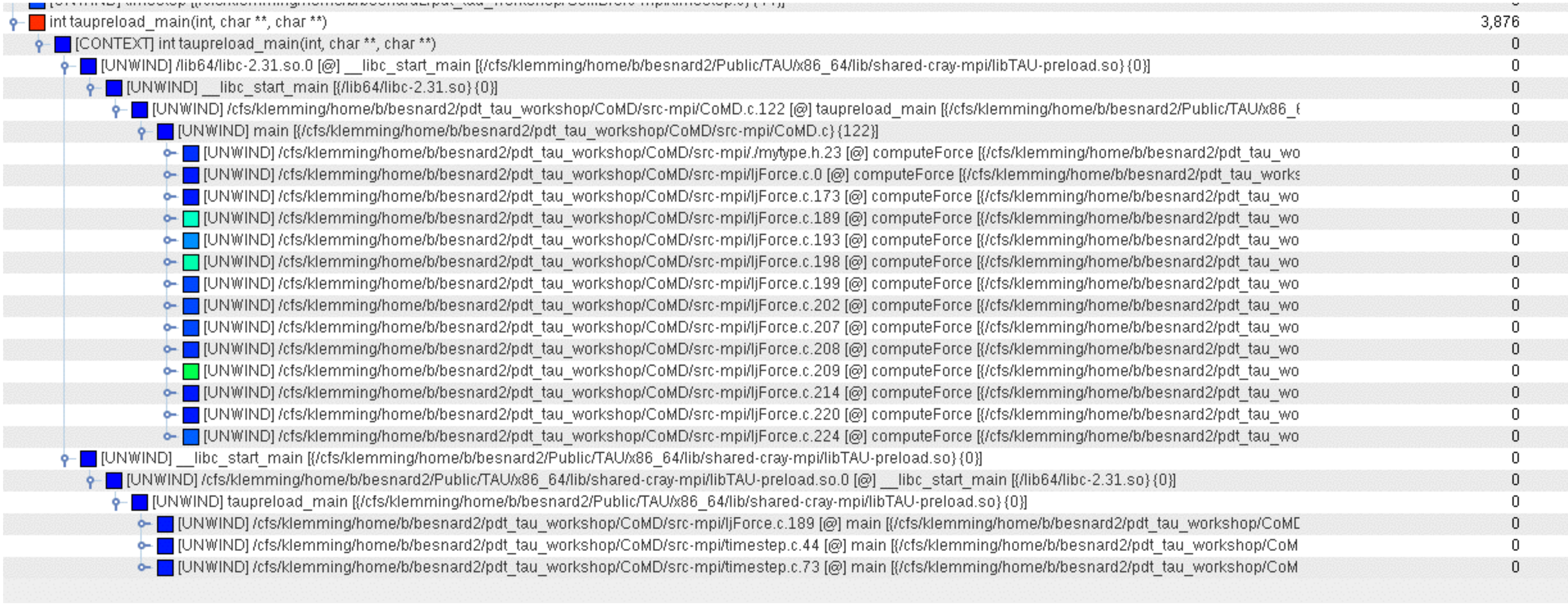
Add Stack Unwinding

```
# Setup Env
module load TAU/2.23.1-cray
# Go to sources
cd $WORK/CoMD/src-mpi/
# Compile without instrumentation
make CC=cc

#Now run
cd ../bin/
TAU_EBS_UNWIND=1 ./run-mpi.sh

# Show profile
paraprof
```

... tau_exec **-ebs** ...

Event Based Sampling + Unwind

Paraprof Output



Callsite Profiling

Callsites

Flat Profile with MPI events

```
# Setup Env
module load TAU/2.23.1-cray
# Go to sources
cd $WORK/CoMD/src-mpi/
# Compile without instrumentation
make CC=cc
#Now run
cd ../bin/
# Edit run-mpi.sh and remove -ebs
./run-mpi.sh
# Show profile
paraprof
```

... tau_exec ...

MPI Flat Profile

Paraprof Output

.TAU application	0,002
MPI Collective Sync	0,013
MPI_Allreduce()	0
MPI_Barrier()	0,002
MPI_Bcast()	0,001
MPI_Comm_rank()	0
MPI_Comm_size()	0
MPI_Finalize()	0,006
MPI_Get_count()	0
MPI_Init()	0,061
MPI_Sendrecv()	0,08
int taupreload_main(int, char **, char **)	3,798

Callsites with Stacks

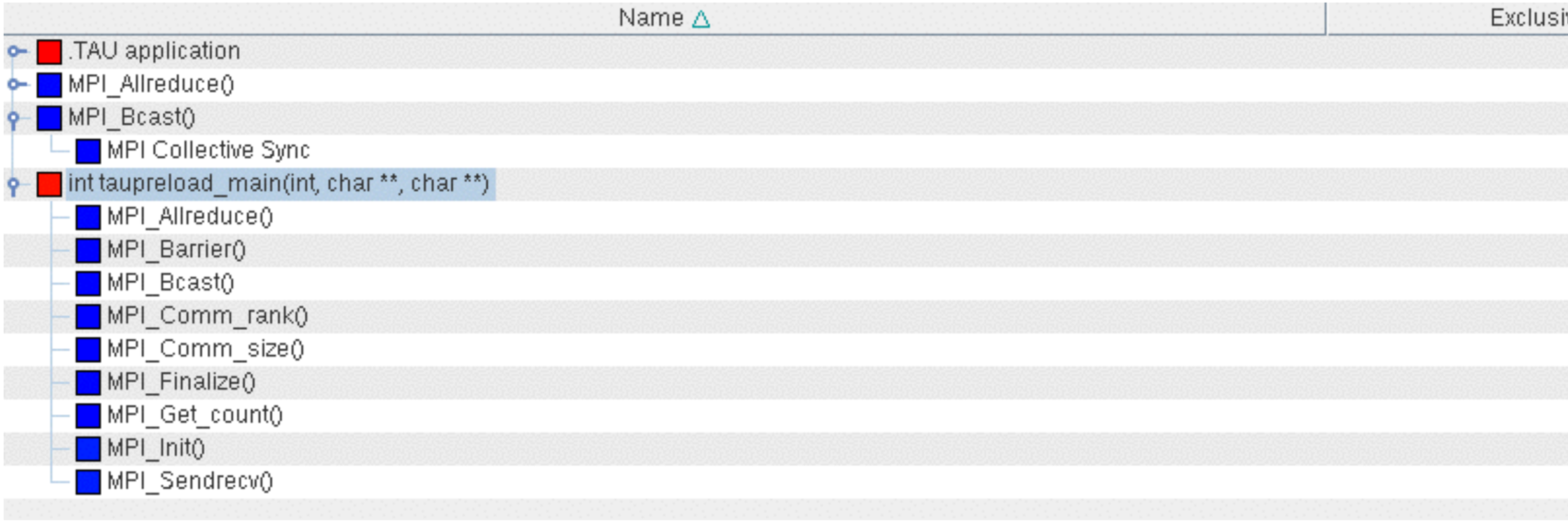
Add location of the calls

```
# Setup Env
module load TAU/2.23.1-cray
# Go to sources
cd $WORK/CoMD/src-mpi/
# Compile without instrumentation
make CC=cc
#Now run
cd ../bin/
# Edit run-mpi.sh and remove -ebs
TAU_CALLPATH=1 ./run-mpi.sh
# Show profile
paraprof
```

… tau_exec … (-mpi is by default)

MPI Flat Profile + Callpath

Paraprof Output



Looking at MPI Traces

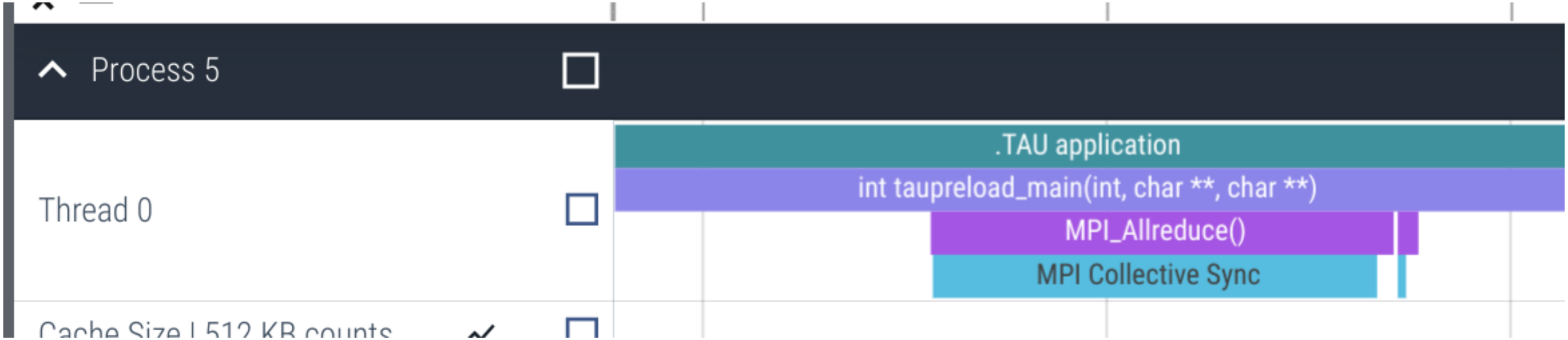
How to understand temporal behavior

```
# Setup Env
module load TAU/2.23.1-cray
# Go to sources
cd $WORK/CoMD/src-mpi/
# Compile without instrumentation
make CC=cc
#Now run
cd ../bin/
TAU_TRACE=1 ./run-mpi.sh
# Merge per process traces
tau_treemerge.pl
# Generate CHROME trace
tau_trace2json ./tau.trc ./tau.edf -o ./out.json -chrome [-ignoreatomic]
# Copy traces to your machine
# Load in https://ui.perfetto.dev/
```

… tau_exec … (-mpi is by default)

MPI Trace

Perfetto UI Output



Profiling I/O

Capturing I/O Calls

How to look at atomic events

```
# Setup Env
module load TAU/2.23.1-cray
# Go to sources
cd $WORK/mpiposix/
# Compile without instrumentation
make CC=cc
#Now run
sh ./run-mpi.sh
# Show profile
paraprof
```

Go to Window/Thread/User Event Statistics

… tau_exec -T cray,mpi -io …

IO Atomic Events

Paraprof Output

Max	Min	Mean	Std. Dev	Name
40000	2	39749,78	3152,478	Bytes Written
1904,762	0,01	1379,365	206,721	Write Bandwidth (MB/s)
1904,762	220,994	1387,329	178,836	Write Bandwidth (MB/s) : int taupreload_m
40000	40000	40000	0	Bytes Written : int taupreload_main(int,
1904,762	220,994	1387,329	178,836	Write Bandwidth (MB/s) <file=out.0.dat>
40000	40000	40000	0	Bytes Written <file=out.0.dat>
1904,762	220,994	1387,329	178,836	Write Bandwidth (MB/s) <file=out.0.dat> :
40000	40000	40000	0	Bytes Written <file=out.0.dat> : int taup
39,429	0,167	0,829	3,163	Read Bandwidth (MB/s)
276	1	2,821	22,305	Bytes Read
1	0,167	0,572	0,267	Read Bandwidth (MB/s) : int taupreload_ma
1	1	1	0	Bytes Read : int taupreload_main(int, cha
32	0,01	6,351	7,712	Write Bandwidth (MB/s) <file=/dev/cxi0>
88	8	35,228	29,853	Bytes Written <file=/dev/cxi0>
32	0,043	7,569	7,815	Write Bandwidth (MB/s) : int taupreload_m
88	8	53,935	28,735	Bytes Written : int taupreload_main(int,
32	0,043	7,569	7,815	Write Bandwidth (MB/s) <file=/dev/cxi0> :

Tracing I/O Calls

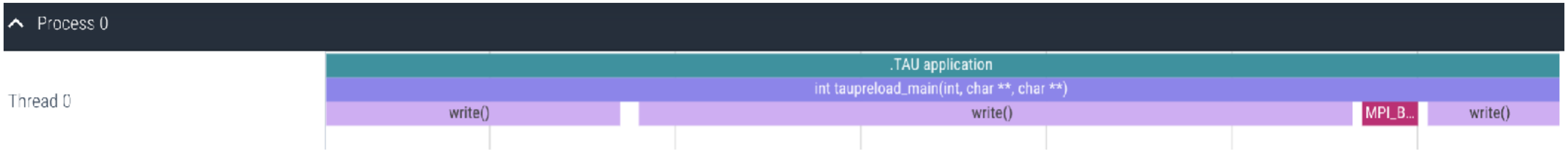
How to look at atomic events

```
# Setup Env
module load TAU/2.23.1-cray
# Go to sources
cd $WORK/mpiposix/
# Compile without instrumentation
make CC=cc
#Now run
TAU_TRACE=1 sh ./run-mpi.sh
# Merge per process traces
tau_treemerge.pl
# Generate CHROME trace
tau_trace2json ./tau.trc ./tau.edf -o ./out.json -chrome [-ignoreatomic]
# Copy traces to your machine
# Load in https://ui.perfetto.dev/
```

… tau_exec -T cray,mpi -io …

MPI Trace

Perfetto UI Output



Instrumenting OpenMP

OpenMP via OMPT

Requires LLVM's OMP runtime

```
# Setup Env
module load TAU/2.23.1-amd
# Go to sources
cd $WORK/CoMD/src-openmp/
# Compile without instrumentation
make CC=cc
#Now run
cd ../bin/
export TAU_OMPT_SUPPORT_LEVEL=full
./run-omp.sh
# Show profile
paraprof
```

… tau_exec -T amd,ompt -ompt -ebs …

MPI Flat Profile + Callpath

Paraprof Output

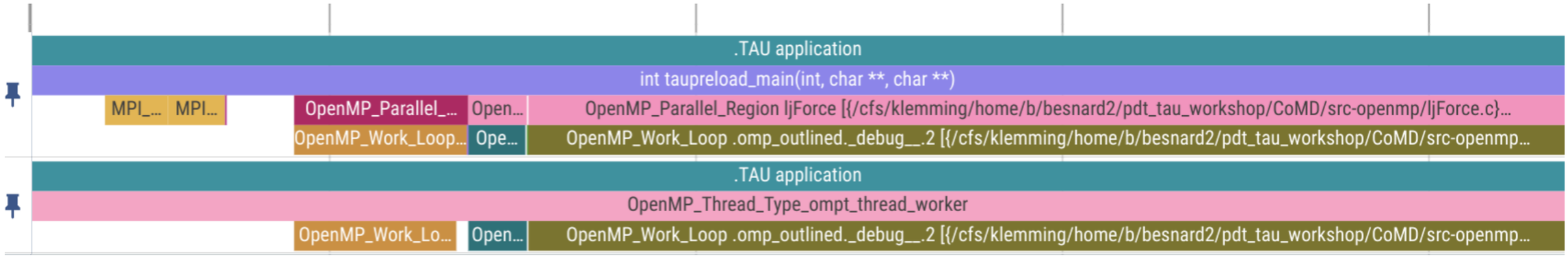
Looking at OpenMP Traces

How to understand temporal behavior

```
# Setup Env
module load TAU/2.23.1-amd
# Go to sources
cd $WORK/CoMD/src-openmp/
# Compile without instrumentation
make CC=cc
#Now run
cd ../bin/
export TAU_OMPT_SUPPORT_LEVEL=full
TAU_TRACE=1 ./run-omp.sh
# Merge per process traces
tau_treemerge.pl
# Generate CHROME trace
tau_trace2json ./tau.trc ./tau.edf -o ./out.json -chrome [-ignoreatomic]
# Copy traces to your machine
# Load in https://ui.perfetto.dev/
```

MPI Trace

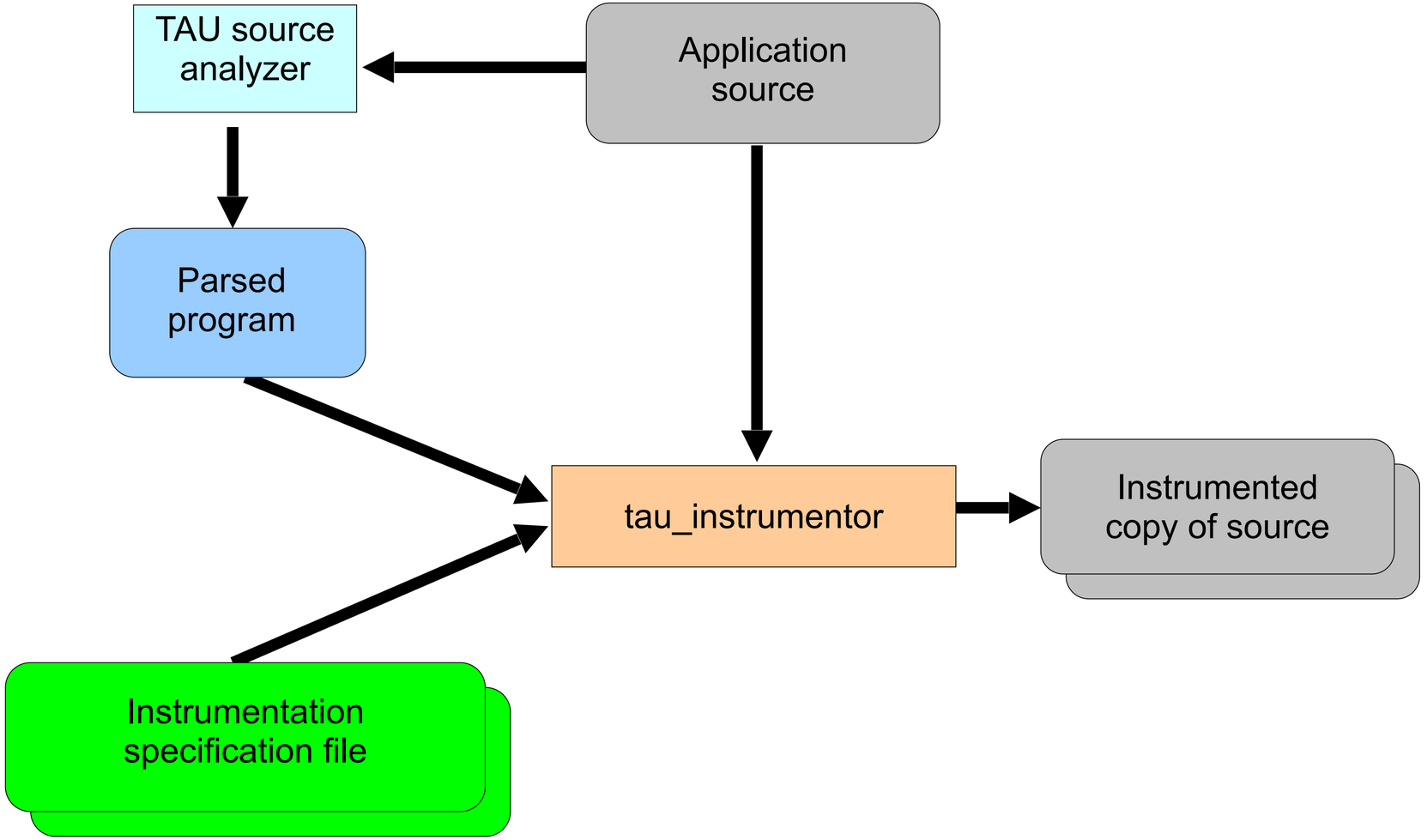
Perfetto UI Output



Compiler Based Instrumentation

Tracking More at Compile Time

Using PDT (source to source)



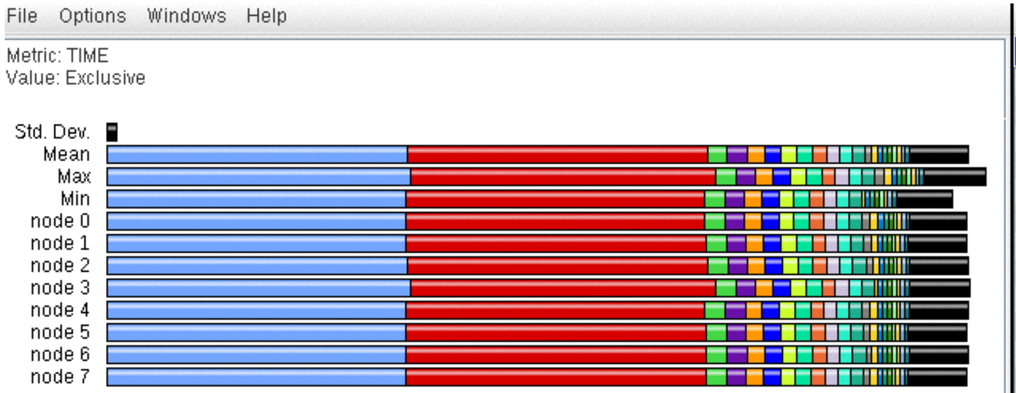
Tracking More at Compile Time

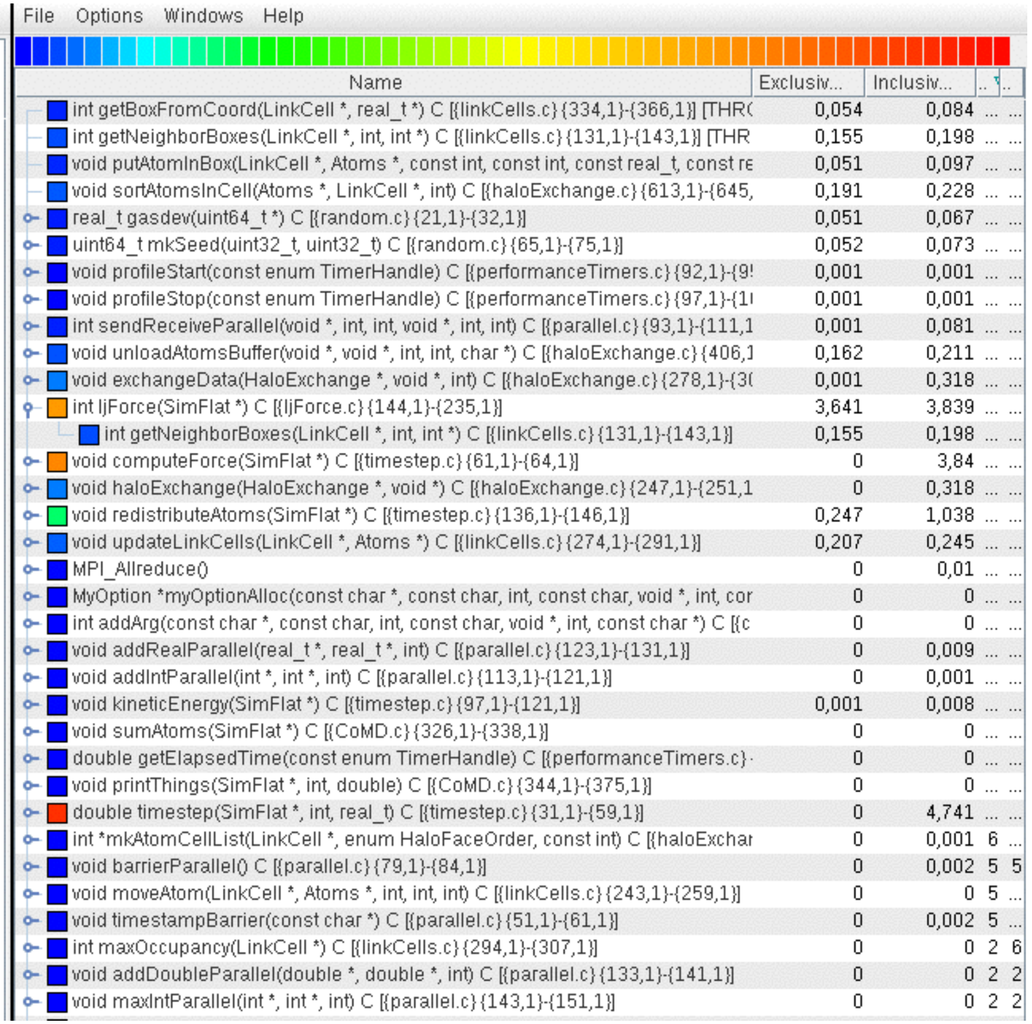
Using PDT

```
# Setup Env
module load TAU/2.23.1-amd
# Go to sources
cd $WORK/CoMD/src-mpi/
# Set the TAU Makefile
export TAU_MAKEFILE=$TAU/Makefile.tau-cray-mpi-pdt
# Compile with clang instrumentation
unset TAU_OPTION
make CC=tau_cc.sh
#Now run
cd ../bin/
# We add call path not to get a flat profile
TAU_CALLPATH=1 ./run-mpi-bare.sh
# Show profile
paraprof
```

Looking at The Output

A look in Paraprof





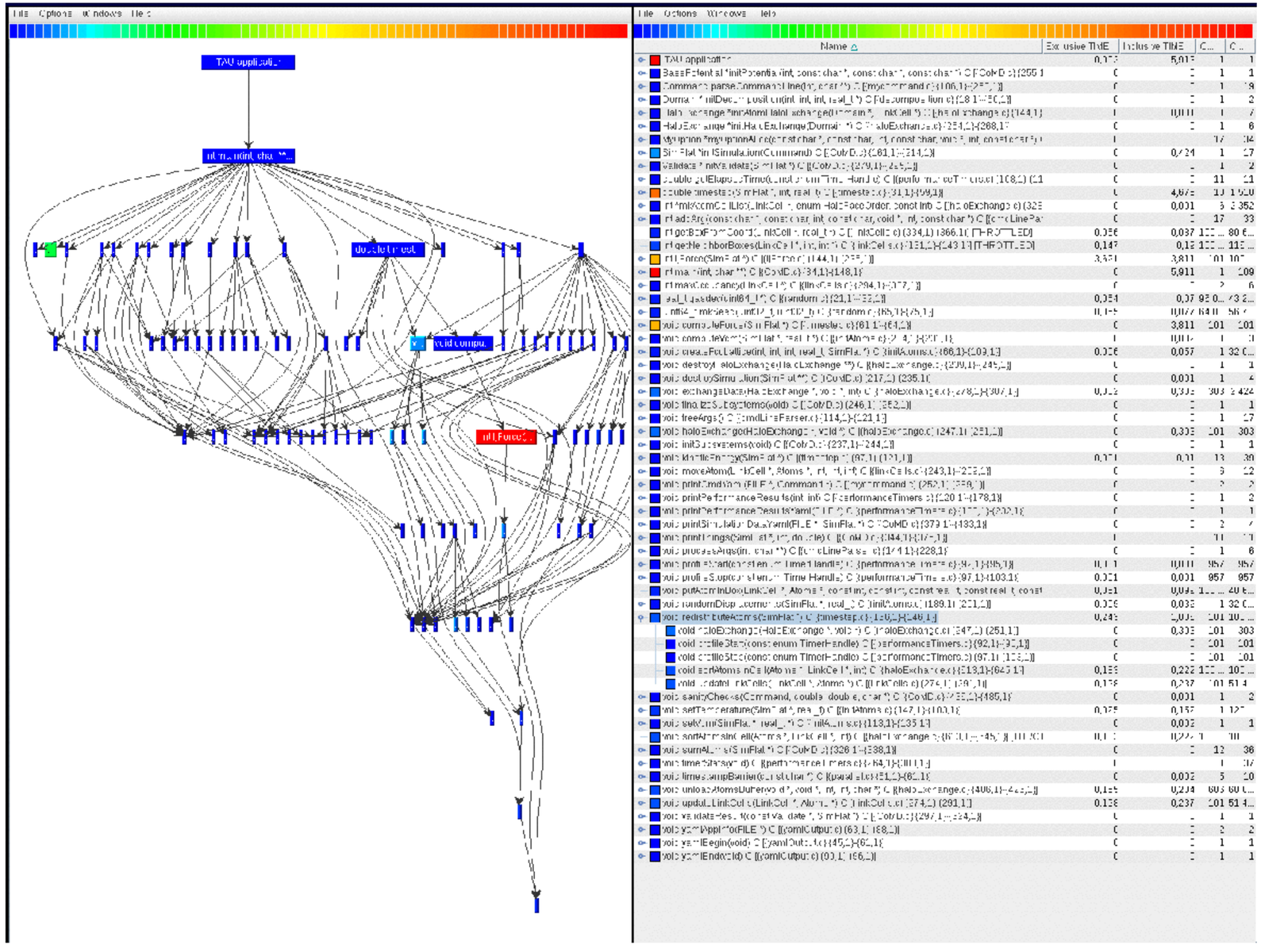
Tracking More at Compile Time

Using LLVM Plugin (preview !)

```
# Setup Env
module load TAU/2.23.1-amd
# Go to sources
cd $WORK/CoMD/src-mpi/
# Set the TAU Makefile
export TAU_MAKEFILE=$TAU/Makefile.tau-amd-clang-mpi
export TAU_OPTION="-optCompInst -optVerbose"
export TAU_COMPILER_MIN_INSTRUCTION_COUNT=1
# Compile with PDT instrumentation
make CC=tau_cc.sh
#Now run
cd ../bin/
# We add call path not to get a flat profile
TAU_CALLPATH=1 ./run-mpi-bare.sh
# Show profile
paraprof
```

Looking at The Output

A look in Paraprof



Looking at The Output

Similar to LLVM (less verbose)

Create a filter file « select.tau » :

```
BEGIN_INCLUDE_LIST
int timestep#
int MPI_#
END_INCLUDE_LIST
```

Sample syntax:

```
BEGIN_INCLUDE_LIST
int main#
int dgemm#
END_INCLUDE_LIST
BEGIN_FILE_INCLUDE_LIST
Main.c
Blas/*.f77
END_FILE_INCLUDE_LIST
# replace include with exclude list
```

Selective Instrumentation for Tracing

Starting from the PDT case ..

```
# Setup Env
module load TAU/2.23.1-cray
# Go to sources
cd $WORK/CoMD/src-mpi/
# Set the TAU Makefile
export TAU_MAKEFILE=$TAU/Makefile.tau-cray-mpi-pdt
# Compile with selective instrumentation
export TAU_OPTION="-optTauSelectFile=select.tau"
make CC=tau_cc.sh
#Now run
cd ../bin/
# We add call path not to get a flat profile
TAU_TRACE=1 ./run-mpi-bare.sh
# Merge per process traces
tau_treemerge.pl
# Generate CHROME trace
tau_trace2json ./tau.trc ./tau.edf -o ./out.json -chrome [-ignoreatomic]
# Copy traces to your machine
# Load in https://ui.perfetto.dev/
```

Looking at The Output

A look in Perfetto

GPU Instrumentation (AMD/ROCM)

GPU Instrumentation (AMD)

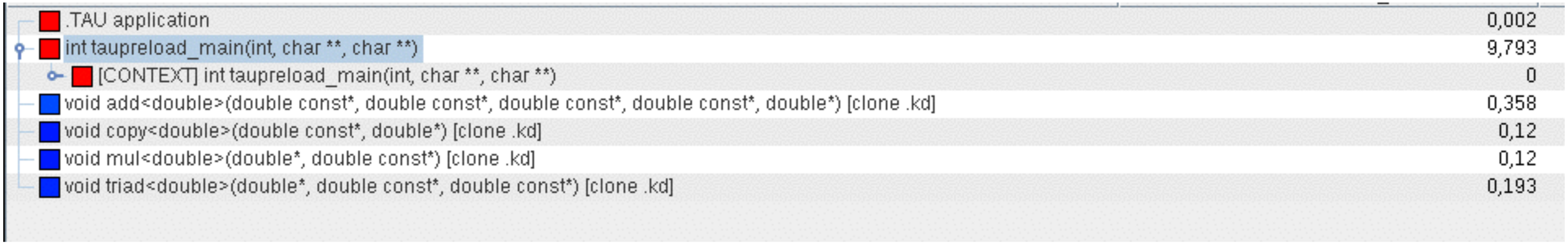
Track ROCM Events

```
# Setup Env
module load TAU/2.23.1-amd
# Go to sources
cd $WORK/hip_add4/
# Look at content just makes on the nodes
./compile.sh
#Now run
./run.sh
# Show profile
paraprof
```

… tau_exec **-T rocm,serial -rocm -ebs** …

Looking at The Output

A look in Paraprof



GPU Instrumentation (AMD)

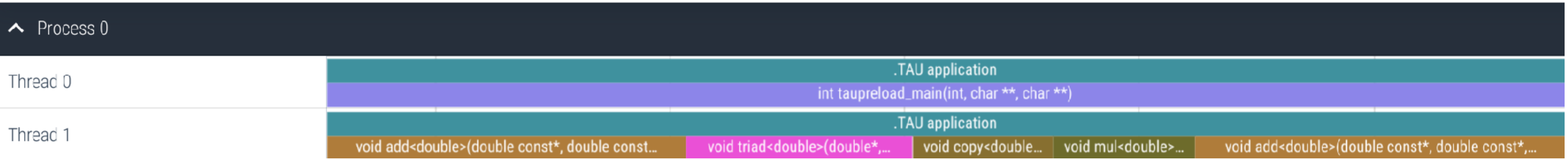
Trace ROCM Events

```
# Setup Env
module load TAU/2.23.1-amd
# Go to sources
cd $WORK/hip_add4/
# Look at content just makes on the nodes
./compile.sh
#Now run
TAU_TRACE=1 ./run.sh
# Merge per process traces
tau_treemerge.pl
# Generate CHROME trace
tau_trace2json ./tau.trc ./tau.edf -o ./out.json -chrome [-ignoreatomic]
# Copy traces to your machine
# Load in https://ui.perfetto.dev/
```

… tau_exec **-T rocm,serial -rocm -ebs** …

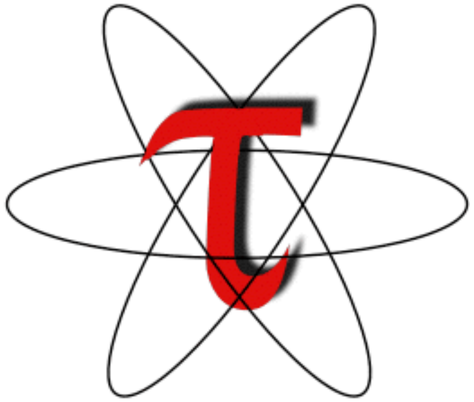
Looking at The Output

A look in Perfetto



Cheat-Sheet

Download TAU from U. Oregon



http://tau.uoregon.edu

http://taucommander.com

http://www.hpclinux.com [OVA for VirtualBox]

https://e4s.io [Extreme-Scale Scientific Software Stack, Containers for HPC]

Free download, open source, BSD license

Setup: Installing TAU on Laptops

Prerequisites: Java in your path

Microsoft Windows

- Install Java from Oracle.com
  - http://tau.uoregon.edu/tau.exe
  - Install, click on a ppk file to launch paraprof

macOS (x86_64)

- Install Java 11.0.3:
  - Download and install http://tau.uoregon.edu/java.dmg
  - If you have multiple Java installations, add to your ~/.zshrc (or ~/.bashrc as appropriate):
  - export PATH=/Library/Java/JavaVirtualMachines/jdk-11.0.3.jdk/Contents/Home/bin:$PATH
  - java -version
- Download and install TAU (copy to /Applications from dmg):
  - http://tau.uoregon.edu/tau.dmg
  - export PATH=/Applications/TAU/tau/apple/bin:$PATH
  - paraprof app.ppk &

macOS (arm64, M1,M2)

  - http://tau.uoregon.edu/java_arm64.dmg
  - http://tau.uoregon.edu/tau_arm64.dmg

Linux (http://tau.uoregon.edu/tau.tgz)

- ./configure -mpi -bfd=download -iowrapper -dwarf=download -unwind=download -otf=download ; make install

Installing and Configuring TAU

- Installing PDT:
  - wget tau.uoregon.edu/pdt_lite.tgz
  - ./configure; make ; make install
- Installing TAU:
  - wget tau.uoregon.edu/tau.tgz; tar zxf tau.tgz; cd tau-2.<ver>
  - wget http://tau.uoregon.edu/ext.tgz ; tar xf ext.tgz
  - ./configure -bfd=download -pdt=<dir> -papi=<dir> -mpi –pthread –c++=mpicxx –cc=mpicc –fortran=mpif90 –dwarf=download –unwind=download –otf=download –iowrapper –papi=<dir>
  - make install
- Using TAU:
  - export TAU_MAKEFILE=<taudir>/x86_64/lib/Makefile.tau-<TAGS>
  - make CC=tau_cc.sh CXX=tau_cxx.sh F90=tau_f90.sh

Compile-Time Options

Optional parameters for the TAU_OPTIONS environment variable:
% tau_compiler.sh

-optVerbose Turn on verbose debugging messages
-optCompInst Use compiler based instrumentation
-optNoCompInst Do not revert to compiler instrumentation if source instrumentation fails.
-optTrackIO Wrap POSIX I/O call and calculates vol/bw of I/O operations (Requires TAU to be configured with *–iowrapper*)
-optTrackGOMP Enable tracking GNU OpenMP runtime layer (used without –opari)
-optMemDbg Enable runtime bounds checking (see TAU_MEMDBG_* env vars)
-optKeepFiles Does not remove intermediate .pdb and .inst.* files
-optPreProcess Preprocess sources (OpenMP, Fortran) before instrumentation
-optTauSelectFile=”<file>" Specify selective instrumentation file for *tau_instrumentor*
-optTauWrapFile=”<file>" Specify path to *link_options.tau* generated by *tau_gen_wrapper*
-optHeaderInst Enable Instrumentation of headers
-optTrackUPCR Track UPC runtime layer routines (used with tau_upc.sh)
-optLinking="" Options passed to the linker. Typically $(TAU_MPI_FLIBS) $(TAU_LIBS) $(TAU_CXXLIBS)
-optCompile="" Options passed to the compiler. Typically $(TAU_MPI_INCLUDE) $(TAU_INCLUDE) $(TAU_DEFS)
-optPdtF95Opts="" Add options for Fortran parser in PDT (f95parse/gfparse) …

Compile-Time Options (contd.)

Optional parameters for the TAU_OPTIONS environment variable:
% tau_compiler.sh

-optShared	Use TAU's shared library (libTAU.so) instead of static library (default)
-optPdtCxxOpts=""	Options for C++ parser in PDT (cxxparse).
-optPdtF90Parser=""	Specify a different Fortran parser
-optPdtCleanscapeParser	Specify the Cleanscape Fortran parser instead of GNU gfparser
-optTau=""	Specify options to the tau_instrumentor
-optTrackDMAPP	Enable instrumentation of low-level DMAPP API calls on Cray
-optTrackPthread	Enable instrumentation of pthread calls

See tau_compiler.sh for a full list of TAU_OPTIONS.

…

TAU's Runtime Environment Variables

Environment Variable	Default	Description
TAU_TRACE	0	Setting to 1 turns on tracing
TAU_CALLPATH	0	Setting to 1 turns on callpath profiling
TAU_TRACK_MEMORY_FOOTPRINT	0	Setting to 1 turns on tracking memory usage by sampling periodically the resident set size and high water mark of memory usage
TAU_TRACK_POWER	0	Tracks power usage by sampling periodically.
TAU_CALLPATH_DEPTH	2	Specifies depth of callpath. Setting to 0 generates no callpath or routine information, setting to 1 generates flat profile and context events have just parent information (e.g., Heap Entry: foo)
TAU_SAMPLING	1	Setting to 1 enables event-based sampling.
TAU_TRACK_SIGNALS	0	Setting to 1 generate debugging callstack info when a program crashes
TAU_COMM_MATRIX	0	Setting to 1 generates communication matrix display using context events
TAU_THROTTLE	1	Setting to 0 turns off throttling. Throttles instrumentation in lightweight routines that are called frequently
TAU_THROTTLE_NUMCALLS	100000	Specifies the number of calls before testing for throttling
TAU_THROTTLE_PERCALL	10	Specifies value in microseconds. Throttle a routine if it is called over 100000 times and takes less than 10 usec of inclusive time per call
TAU_CALLSITE	0	Setting to 1 enables callsite profiling that shows where an instrumented function was called. Also compatible with tracing.
TAU_PROFILE_FORMAT	Profile	Setting to "merged" generates a single file. "snapshot" generates xml format
TAU_METRICS	TIME	Setting to a comma separated list generates other metrics. (e.g., ENERGY,TIME,P_VIRTUAL_TIME,PAPI_FP_INS,PAPI_NATIVE_<event>:<subevent>)

Runtime Environment Variables

Environment Variable	Default	Description
TAU_TRACE	0	Setting to 1 turns on tracing
TAU_TRACE_FORMAT	Default	Setting to “otf2” turns on TAU’s native OTF2 trace generation (configure with –otf=download)
TAU_EBS_UNWIND	0	Setting to 1 turns on unwinding the callstack during sampling (use with tau_exec –ebs or TAU_SAMPLING=1)
TAU_EBS_RESOLUTION	line	Setting to “function” or “file” changes the sampling resolution to function or file level respectively.
TAU_TRACK_LOAD	0	Setting to 1 tracks system load on the node
TAU_SELECT_FILE	Default	Setting to a file name, enables selective instrumentation based on exclude/include lists specified in the file.
TAU_OMPT_SUPPORT_LEVEL	basic	Setting to “full” improves resolution of OMPT TR6 regions on threads 1.. N-1. Also, “lowoverhead” option is available.
TAU_OMPT_RESOLVE_ADDRESS_EAGERLY	1	Setting to 1 is necessary for event based sampling to resolve addresses with OMPT. Setting to 0 allows the user to do offline address translation.

Runtime Environment Variables

Environment Variable	Default	Description
TAU_TRACK_MEMORY_LEAKS	0	Tracks allocates that were not de-allocated (needs –optMemDbg or tau_exec –memory)
TAU_EBS_SOURCE	TIME	Allows using PAPI hardware counters for periodic interrupts for EBS (e.g., TAU_EBS_SOURCE=PAPI_TOT_INS when TAU_SAMPLING=1)
TAU_EBS_PERIOD	100000	Specifies the overflow count for interrupts
TAU_MEMDBG_ALLOC_MIN/MAX	0	Byte size minimum and maximum subject to bounds checking (used with TAU_MEMDBG_PROTECT_*)
TAU_MEMDBG_OVERHEAD	0	Specifies the number of bytes for TAU's memory overhead for memory debugging.
TAU_MEMDBG_PROTECT_BELOW/ ABOVE	0	Setting to 1 enables tracking runtime bounds checking below or above the array bounds (requires –optMemDbg while building or tau_exec –memory)
TAU_MEMDBG_ZERO_MALLOC	0	Setting to 1 enables tracking zero byte allocations as invalid memory allocations.
TAU_MEMDBG_PROTECT_FREE	0	Setting to 1 detects invalid accesses to deallocated memory that should not be referenced until it is reallocated (requires –optMemDbg or tau_exec –memory)
TAU_MEMDBG_ATTEMPT_CONTINUE	0	Setting to 1 allows TAU to record and continue execution when a memory error occurs at runtime.
TAU_MEMDBG_FILL_GAP	Undefined	Initial value for gap bytes
TAU_MEMDBG_ALINGMENT	Sizeof(int)	Byte alignment for memory allocations
TAU_EVENT_THRESHOLD	0.5	Define a threshold value (e.g., .25 is 25%) to trigger marker events for min/max