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Title: Performance Analysis Tools Alinea MAP: Use & Functionality

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Performance Analysis Tools

Allinea MAP: Use & Functionality

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LANL IC User Group Meeting

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HPC Performance Analysis Tools

- <http://hpc.lanl.gov/perftools>
 - Open Speed Shop
 - TAU: Tuning and Analysis Utilities
 - Darshan: A Scalable HPC I/O Characterization Tool
 - HPC Toolkit Quickstart Guide
 - Score-P
 - Vampir / VampirTrace
 - Intel suite (vTune Amplifier, Trace, Inspector)
 - **MAP**
- Profiling/performance analysis is an iterative process and requires multiple tools

MAP

- A high-level profiler that provides a view of your application's behavior (memory usage, CPU vectorization, I/O, MPI, and threading) over time (not just aggregate)
 - MPI, OpenMP, pThreads
 - Source code profiling
 - Can profile large jobs (many nodes) and long running jobs in batch
- Benefits
 - Low overhead; easy-to-use
- What it doesn't do
 - Cache miss, hit specifics
 - Identify where the compiler failed to optimize & how/why

MAP metrics: CPU Instructions

- Preset: Default
- Preset: Activity Timelines
- Preset: CPU Instructions
- Preset: CPU Time
- Preset: IO
- Preset: MPI
- Preset: Memory**
- Activity Timelines >
- CPU Instructions >
- CPU Time >
- IO >
- MPI >
- Memory >

MAP metrics: MPI

MAP Stack View

MAP: Zoom in time to isolate critical regions

MAP Tidbits

- Mouse over graphs at any time to see the min, max, average, std. dev. for that metric
- Mouse over metric name for definitions
- Help
 - Get more complete descriptions of the metrics, along with hints about how to use it for optimizations

Getting MAP running with your application

- Set your environment
 - `module load friendly-testing`
 - `module load allinea-MAP/5.0`
- At compile
 - Add `-g` to compile (keep your optimizations on)
- At run
 - Invoke GUI and run job through GUI
 - `map &`
 - In your batch script (use `map` instead of `mpirun`)
 - `map -n 16 -profile ./executable.x input.in`
 - A `.map` file will be generated with your analysis (can reload for later enjoyment)

Using MAP remotely (and keeping your sanity)

- Download and install Alinea-Forge Client Tools for your workstation
 - (<https://www.allinea.com/products/downloads/download-allinea-ddt-and-allinea-map>)

Remote clients

Platform	Versions
Mac OS/X	Mountain Lion+ 64-bit (AMD/Intel)
Windows	XP+ 32-bit (AMD/Intel) XP+ 64-bit (AMD/Intel)
Linux	See the Downloads section above. All Linux builds may be used as remote clients.

Figure 6: Connecting to a Remote System

Configure your client...

- Launch Client App on your workstation
- Choose “Configure” > Add
- specify user@hostname, name the session and the path to the Allinea installation
- (Note, client and cluster versions must match!)
- Run “Test Remote Launch”

Testing Cluster Connection via Workstation Client

Cluster Connection Success!

Getting a Remote License

- The client doesn't require a subscription (i.e. license) to run, as it will make use of the Cluster's license

```
-bash-4.1$ cat /usr/projects/hpcsoft/toss2/common/allinea/5.0/remote-init  
export DDT_LICENSE_FILE=/usr/projects/hpcsoft/toss2/common/allinea/Licence/licence
```

- A “remote-init” license definition file should be in the installation directory of IC or ASC clusters. If not, notify ptools@change.lanl.gov
- The client will look for this for defining the license file upon connecting to the cluster

```
[jgreen@darwin-login2 ~]$ vi ~/remote-init  
[jgreen@darwin-login2 ~]$ cat ~/remote-init  
export DDT_LICENSE_FILE=/projects/opt/allinea/forged/./license  
~ [jgreen@darwin-login2 ~]$
```


Client-Side Script to handle ssh-ing to cluster

```
if type printf >/dev/null && [ "$(printf '%q' 'test' 2>/dev/null)" = test ]; then
case "$1" in
-*)
;; High Performance Computing Systems
*)
Los Alamos National Laboratory
host="$1"
shift
args=""
for arg in "$@"; do
quotedArg="$(printf '%q' "$arg")"
if [ -z "$args" ]; then
args="$quotedArg"
else
args="$args $quotedArg"
fi
done
exec ssh "$host" "$args"
esac
fi
exec ssh "$@"
exit 127
fi
```

Server Side Job Submit Script

Tags are employed to communicate runtime job submit parameters to the cluster scheduler- Savvy user can create powerful submission scripts via this feature

```
#!/bin/sh
#
# NOTE: if using with srun then you should select "generic (SLURM)" as the MPI
#       implementation on the System Settings page of the Options window.
#
# WARNING: If you install a new version of Allinea Forge to the same
#          directory as this installation, then this file will be overwritten.
#          If you customize this script at all, please rename it.
#
# Name: SLURM [green@lanl.gov]
#
# submit: sbatch
# display: queue [owner-ptools@maillist.lanl.gov [owner-ptools@maillist.lanl.gov] on behalf of Green, Jennifer Kathleen ([green@lanl.gov]
# job regexp: (\d+) [owner-ptools@maillist.lanl.gov] [owner-ptools@maillist.lanl.gov] [owner-ptools@maillist.lanl.gov] [owner-ptools@maillist.lanl.gov]
# cancel: scancel JOB_ID_TAG [owner-ptools@maillist.lanl.gov] [owner-ptools@maillist.lanl.gov] [owner-ptools@maillist.lanl.gov] [owner-ptools@maillist.lanl.gov]
# show num_nodes: no
#
# WALL_CLOCK_LIMIT_TAG: {type=text,label="Wall Clock Limit",default="00:30:00",mask="09:09:09"}
#
# Install mpi/S.L.P on lightshow, else include this as an exclusion in the announcement. CETA
#SBATCH --nodes=NUM_NODES_TAG
#SBATCH --time=WALL_CLOCK_LIMIT_TAG
#SBATCH --job-name="ddt"
#SBATCH --output=allinea.stdout
#SBATCH --error=allinea.stdout
#
# [owner-ptools@maillist.lanl.gov] [owner-ptools@maillist.lanl.gov] [owner-ptools@maillist.lanl.gov] [owner-ptools@maillist.lanl.gov] [owner-ptools@maillist.lanl.gov]
#
# High Performance Computing Systems
# Los Alamos National Laboratory
#
# AUTO_LAUNCH_TAG
```

Job Queued and Waiting to Start... (polls scheduler)

Documentation and Full Programming Env. Support Coming Soon...

- Remote Connection Configuration and Ease of Use Scripting on a Per-Cluster Basis is in the Works
- When the Capability is Fully Developed / Documented, HPC-3 Will Send a Link and Provide the Tools
- From a Developer's Perspective, the Client – Server mode of Running A GUI Based Application on a Cluster is Much Less Problematic- Once Configurations Are in Place
- This is Especially True With Off-Site Multi-Hop Connections

Now What?

- A profiler will identify areas of code where **YOU** need to work to improve performance
 - Increase CPU vectorization
 - Enough computational work?
 - Reduce areas that inhibit vectorization
 - memory thrashing
 - branching
- Try it out
 - DDT & MAP user guides (we have)
<https://www.allinea.com/user-guide/forgel/userguide.html>
 - Performance reports: (we don't have)
<https://www.allinea.com/user-guide/reports/userguide.html>