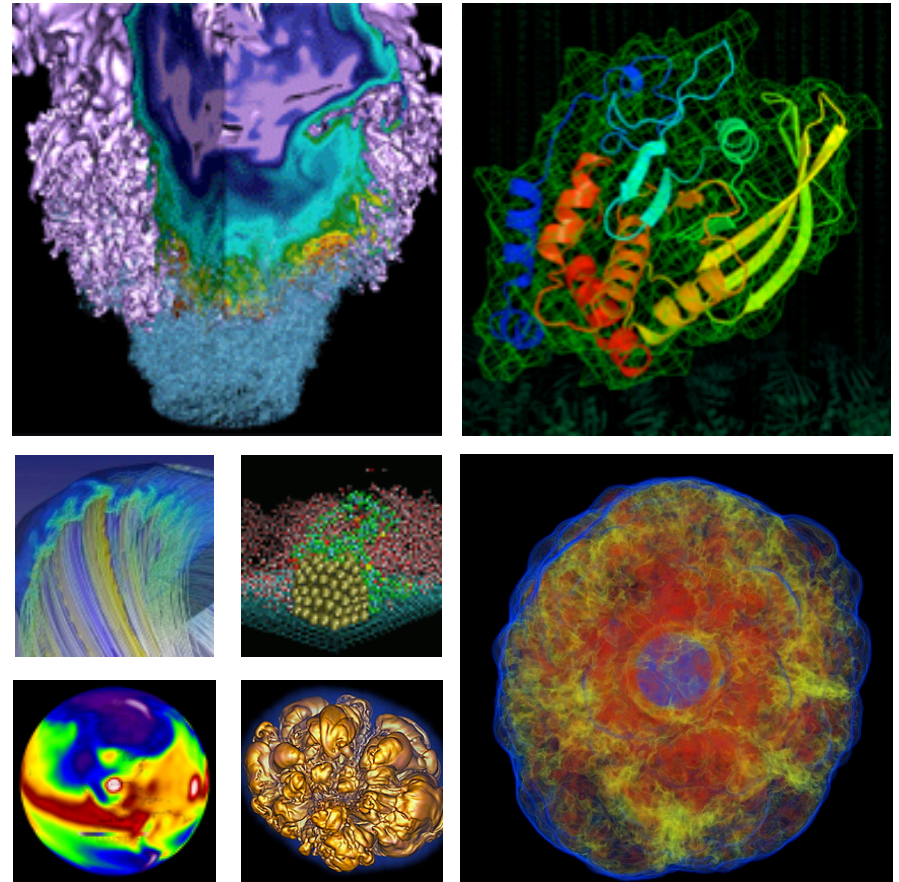


# Starting DDT and MAP at NERSC



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NERSC User Services Group

Allinea DDT and MAP Training  
May 14, 2015

# Overview of today's training

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- **Training on Allinea's DDT (parallel debugger) and MAP (parallel profiler)**
- **Lectures and demo sessions**
  - Beau Paisley, Allinea Software
- **Hands-on session in the afternoon**
  - You can use your own code

- Use the ‘training’ module to get training materials that Beau prepared:

```
$ module load training
$ echo $EXAMPLES          # example code directory name
/project/projectdirs/training/2015/allinea_ddt_map

$ cp -R $EXAMPLES .      # copy the entire directory
$ cd allinea_ddt_map
$ ls
```

- We will primarily use Edison for today’s demos

# Allinea DDT and MAP



- **DDT (Distributed Debugging Tool)**
  - Graphical parallel debugger
  - Can be used for debugging serial, MPI, OpenMP, CAF, UPC, CUDA codes
  - Intuitive and simple to use
  - 8192 license tokens ( $\approx$ MPI tasks)
- **MAP**
  - Source-level parallel code performance profiler
  - Measures floating point operations, memory usage, floating point vector instructions, CPU time, I/O, MPI communication, load balancing etc.
  - OpenMP threading support added lately
  - 512 license tokens ( $\approx$ MPI tasks)
- **DDT and MAP on**
  - Edison
  - Hopper
  - sl6carver: Carver with Scientific Linux 6
  - sl5carver: Carver with Scientific Linux 5
  - Babbage (Xeon Phi)

- Mostly run in an interactive batch session

```
$ qsub -I -v DISPLAY -lmpwidth=24,walltime=30:00 -q debug  
...  
$ cd $PBS_O_WORKDIR  
$ module load allineatools  
$ ddt ./a.out  
$ map ./a.out
```

- Can run in non-interactive mode, too (“off-line” mode with DDT and command line mode with MAP)
- See

<https://www.nersc.gov/users/software/debugging-and-profiling/ddt/#toc-anchor-3>

# One “environment” called Allinea Forge, starting 5.0



File Edit View Control Tools Window Help

allinea FORGE

allinea DDT

allinea MAP

Support  
Tutorials  
allinea.com

Licence Serial: 3027 ?

**Running DDT**

**RUN**  
Run and debug a program.

**ATTACH**  
Attach to an already running program.

**OPEN CORE**  
Open a core file from a previous run.

**MANUAL LAUNCH (ADVANCED)**  
Manually launch the backend yourself.

**OPTIONS**

Remote Launch:

**QUIT**

File Edit View Window Help

allinea FORGE

allinea DDT

allinea MAP

**Running MAP**

**PROFILE**  
Profile a program.

**LOAD PROFILE DATA FILE**  
Load a profile data file from a previous run.

**OPTIONS**

Remote Launch:

**QUIT**

# If you are far away from NERSC



- **Remote X window application (GUI) over network: slow response**
- **Two solutions**
  - Use NX to improve the speed
    - Works with any X window applications
    - <https://www.nersc.gov/users/network-connections/using-nx/> (general)
    - [http://portal.nersc.gov/project/mpccc/nx/NX\\_Tutorial/Start\\_Over.html](http://portal.nersc.gov/project/mpccc/nx/NX_Tutorial/Start_Over.html) (installation and quick user guide)
  - Use Alinea Forge remote client
    - Runs on your desktop/laptop
    - Connects to NERSC machine and submits a batch job
    - Displays results in real time
    - No license file required on your local desktop/laptop
    - <http://www.allinea.com/products/downloads/download-allinea-ddt-and-allinea-map> (downloading clients)

# Using NX



The screenshot displays the Allinea DDT - Allinea Forge 5.0.1 IDE interface. The main window shows the source code for `jacobi_mpi.f90` with the following visible lines:

```
41 allocate(u(0:n,js-1:je+1), newu(0:n,js-1:je+1),
42
43 ! Initialize f, u(0,*), u(n:*), u(*,0), and u(*,n)
44
45 call init_fields(u,f,n,js,je)
46
47 ! Main solver loop.
48
49 h = 1.0 / n
50
51 do k=1,maxiter
```

The interface includes a terminal window on the left showing shell commands and output, a project tree on the left, a stack window at the bottom, and a variable watch window on the right. The status bar at the bottom indicates the current process is `jacobi_mpi (jacobi_mpi.f90:45)`.



# First, set up the remote client for login and using Alinea tools



**(1) Select 'Configure' to create a configuration for a NERSC machine**

The screenshot shows the Alinea Forge 5.0.1 application window. On the left is a sidebar with logos for allinea FORGE, allinea DDT, and allinea MAP. The main area contains a menu with options: RUN, ATTACH, OPEN CORE, MANUAL LAUNCH (ADVANCED), and OPTIONS. The OPTIONS menu is open, showing 'Remote Launch:' with sub-options 'Off' (checked) and 'Configure...'. A 'Remote Client' status indicator is visible at the bottom left.

**(2) Create a configuration**

The screenshot shows the 'Remote Launch Settings' dialog box. It contains the following fields and options:

- Connection Name: edison
- Host Name: wyang@edison.nersc.gov
- Remote Installation Directory: /usr/common/usg/allineatools/5.0.1
- Remote Script: /usr/common/usg/allineatools/remote-init
- Always look for source files locally
- Buttons: Help, Test Remote Launch, OK, Cancel

# Then, connect to a machine using remote client



## (1) Select a machine

### RUN

Run and debug a program.

### ATTACH

Attach to an already running program.

### OPEN CORE

Open a core file from a previous run.

### MANUAL LAUNCH (ADVANCED)

Manually launch the backend yourself.

### OPTIONS

#### Remote Launch:

✓ Off  
Configure...

edison

hopper

carver

## (2) Enter the passphrase for your ssh key



Enter your password for the SSH key "id\_rsa".

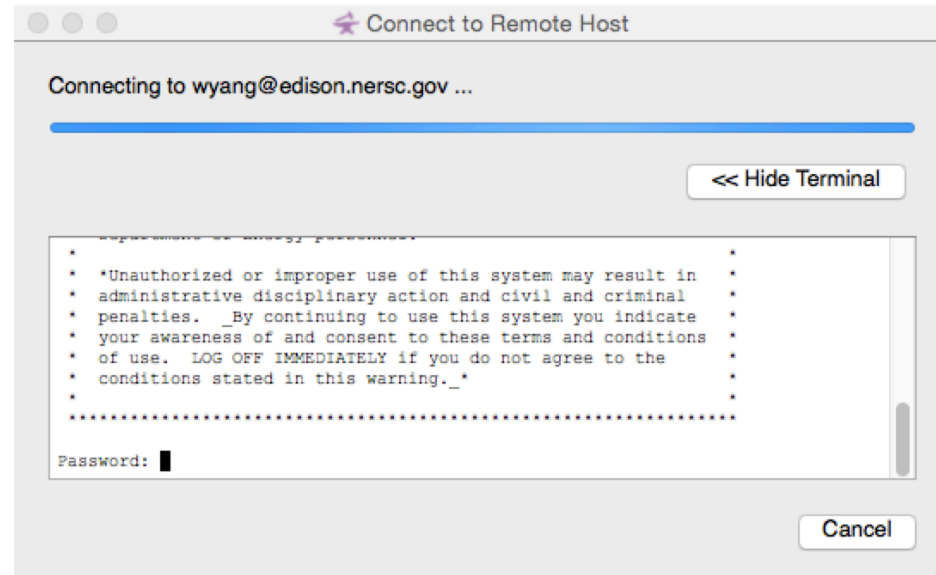
Password:

Remember password in my keychain

Cancel

OK

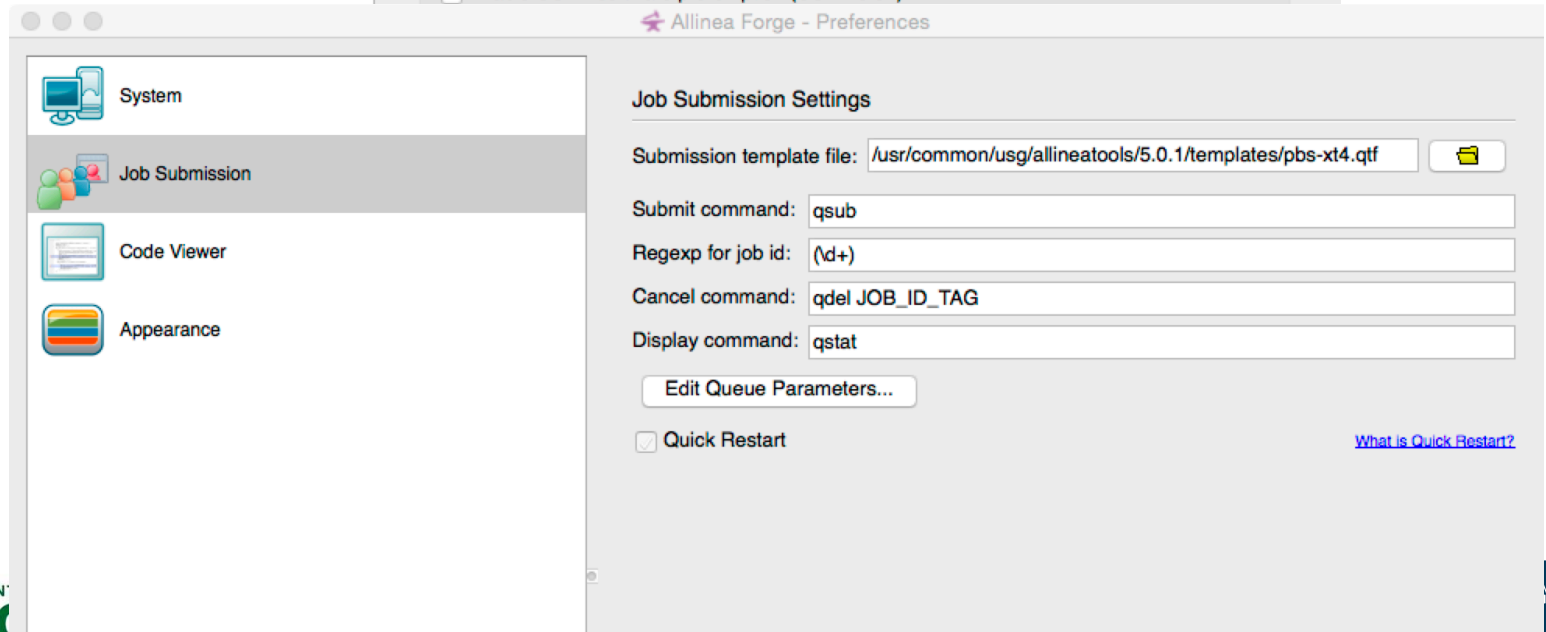
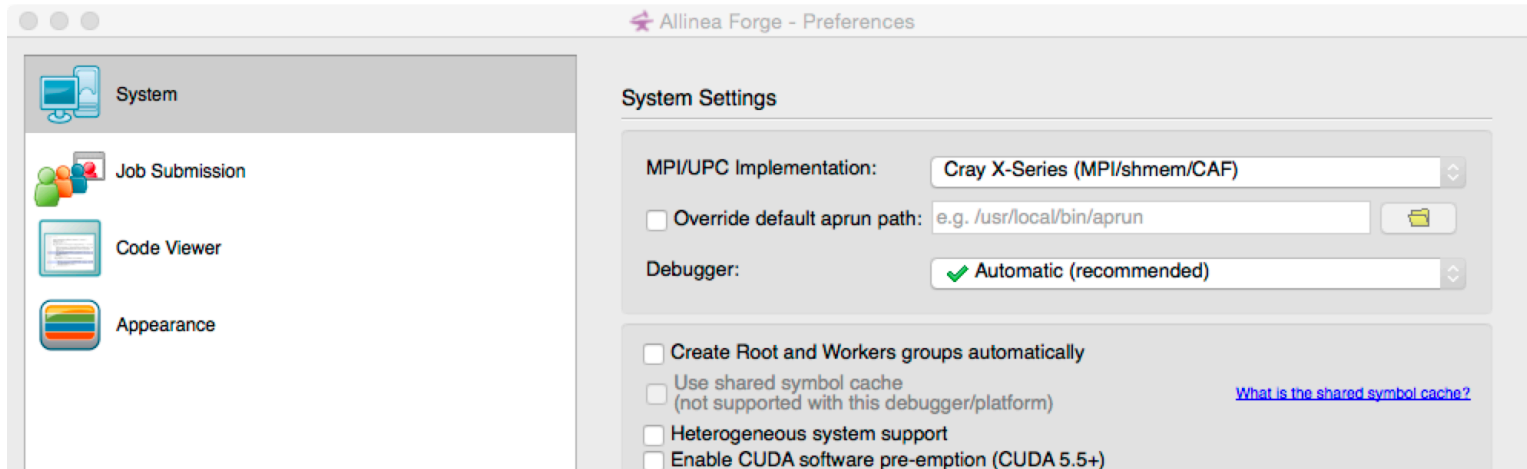
## or enter the NIM password



# Set up for batch job submission (for Edison, Hopper)



After clicking the 'OPTIONS' button...



# Then, submit a job from the remote client



**Application:** /global/scratch2/sd/wyang/debugging/jacobi\_mpi Details

Application: /global/scratch2/sd/wyang/debugging/jacobi\_mpi ▼ 📁

Arguments: ▼

stdin file: ▼ 📁

Working Directory: /global/scratch2/sd/wyang/debugging ▼ 📁

**MPI: 24 processes, 24 ppn, Cray X-Series (MPI/shmem/CAF)** Details

Number of Processes: 24 ▼

Processes per Node 24 ▼

Implementation: Cray X-Series (MPI/shmem/CAF) Change...

aprun arguments ▼

**OpenMP** Details

**CUDA** Details

**Memory Debugging** Details...

**Submit to Queue: Wall Clock Limit=00:30:00, Que** Configure... Parameters...

**Environment Variables:** none Details

**Plugins:** none Details

Help Options Submit Cancel

Working Directory needs to be set correctly

'Submit to Queue' must be selected; queue parameters can be adjusted

- If things go wrong (e.g., DDT using mpirun instead of aprun on Edison, Hopper), do `'rm -rf ~/.allinea'` and start from beginning
- See
  - <https://www.allinea.com/user-guide/forge/userguide.html>
  - <https://www.nersc.gov/users/software/debugging-and-profiling/ddt/>
  - <https://www.nersc.gov/users/software/debugging-and-profiling/MAP/>



**National Energy Research Scientific Computing Center**