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TEXAS
The University of Texas at Austin

Tutorial on Parallel Debugging

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TACC

Compiling for debug

Enable debug mode

```
mpicc -g -O2 yourprogram
```

Debug option can be used with any optimization level, but use

```
mpicc -g -O0 yourprogram
```

to prevent confusion.
(Compiler ‘optimizes away’ code at higher levels.)

Your minimal debugger

```
mpirun -np 4 xterm -e gdb yourprogram
```

Pops up 4 xterms.

Great for debugging on your laptop.

Not great at scale.

The DDT debugger

Load the module:

```
module load ddt
```

Call the debugger:

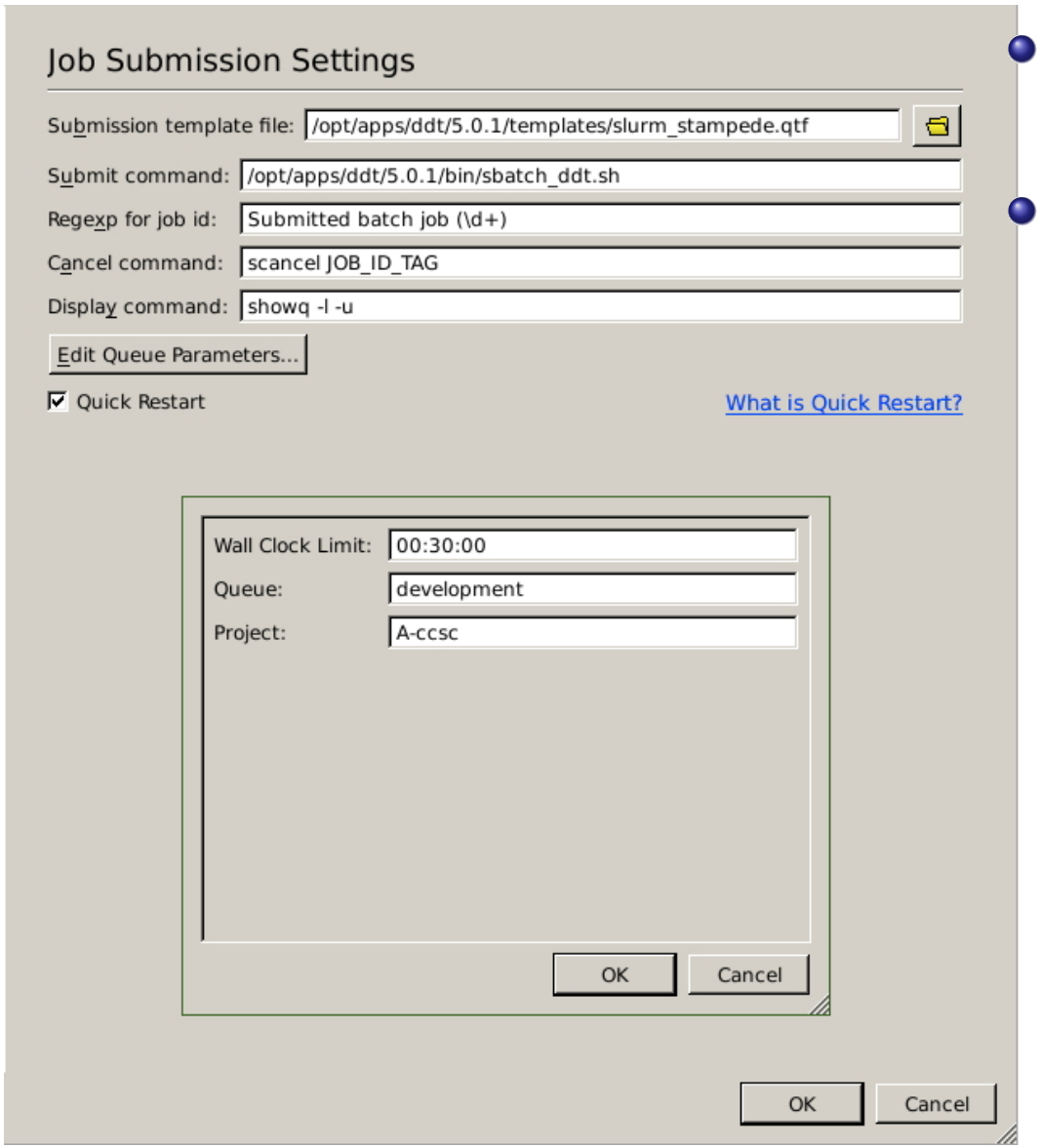
```
ddt yourprogram
```

Make sure you have an X forwarding connection:

```
ssh -X you@stampede.tacc.utexas.edu
```

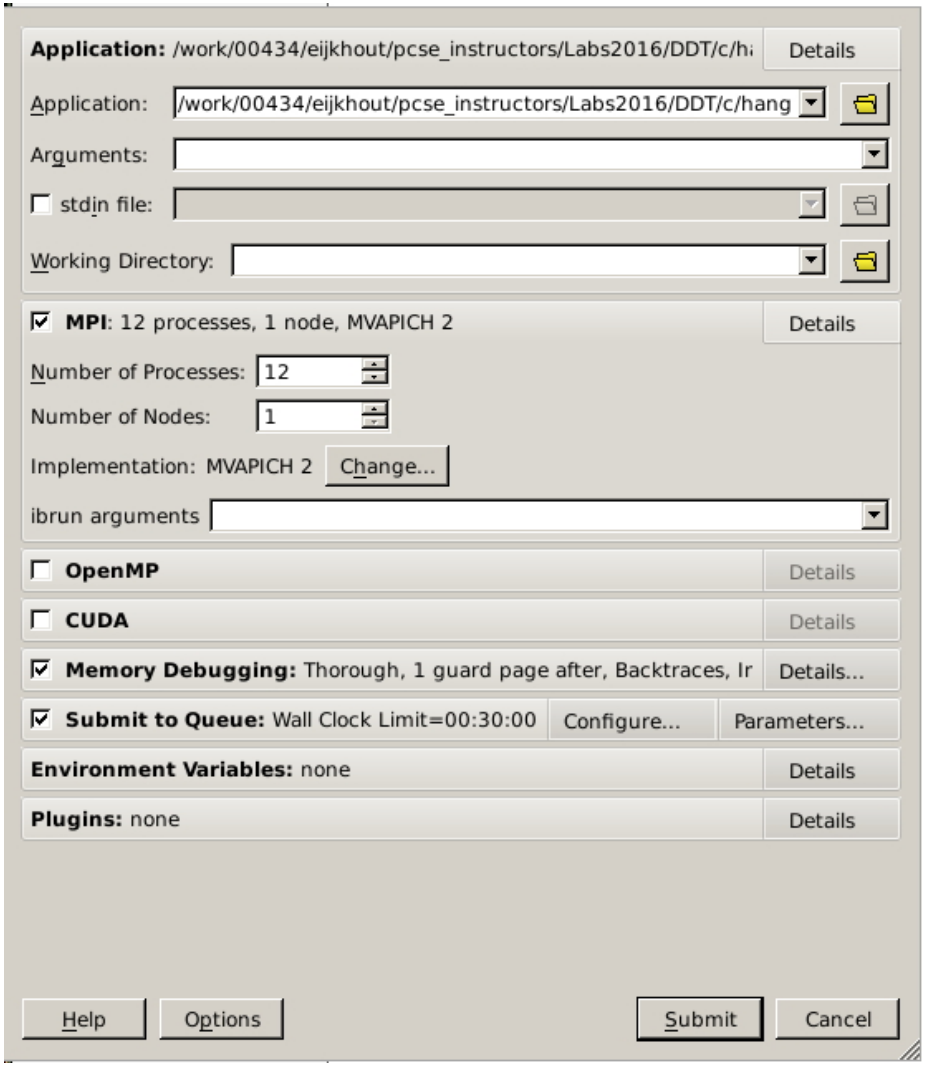
or use VNC.

Setup



- Project: for this class, but later of your own
- Queue: development often quickest

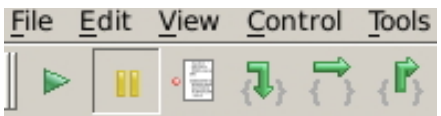
Run parameters



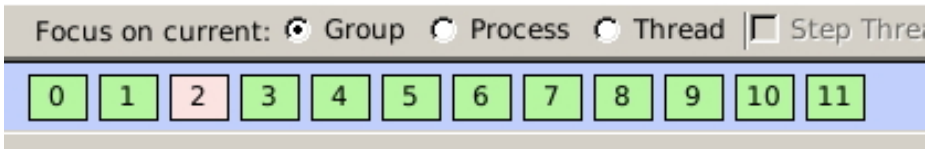
- MPI or OpenMP? Processes, nodes, threads.
- Memory debugging
- Commandline arguments

```
37 int main(int argc,char **argv) {
38   MPI_Comm comm;
39
40   MPI_Init(&argc,&argv);
41   comm = MPI_COMM_WORLD;
42
43   loop_for_awhile(comm);
44
45   MPI_Finalize();
46   return 0;
47 }
48
```

- Program starts at `MPI_Init`
- Use run controls



Hanging processes

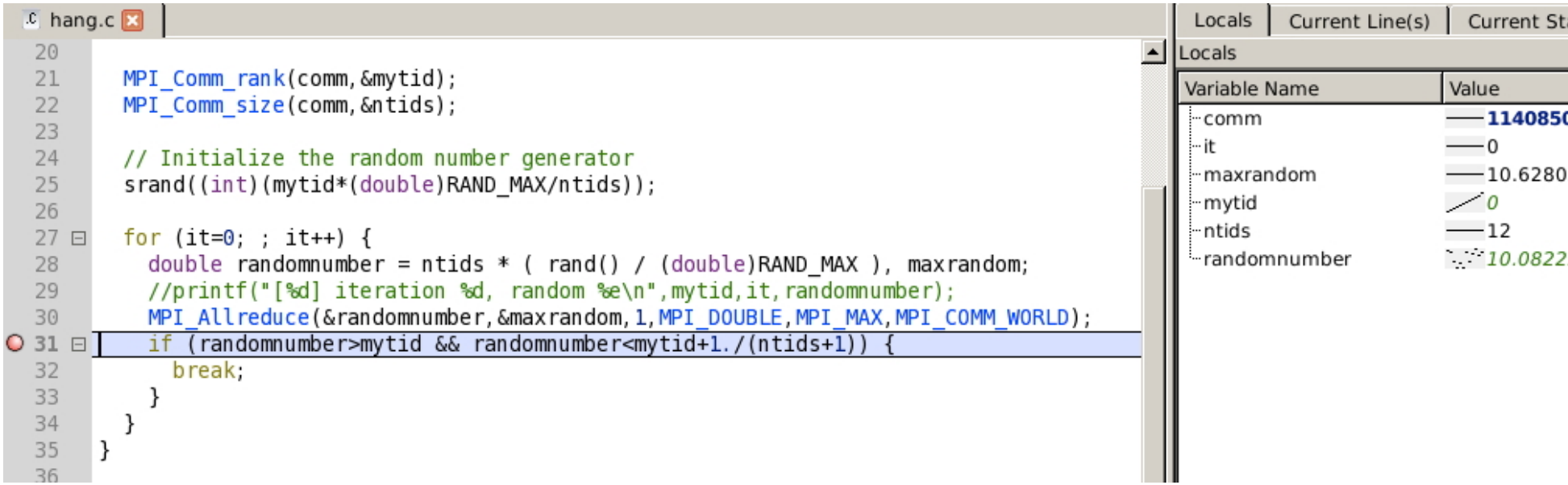


- Red: stopped at an interrupt or breakpoint
- Green: still running.
  All green but ‘nothing happening’: probably hanging program.
- Combination: some processes are not getting to the breakpoint: probably deadlocked.

Call stacks

- Hit the pause button, go to ‘stacks’ panel.
- Not every process is in the same source line.
- Click on process number to see what it’s doing.

Breakpoints



- Values display: everyone the same `it`
- value of `mytid` linearly increasing
- value of `randomnumber` all over the place.

Exercise 1 (`hang0`)

1. `make hang0`
2. `ddt hang0`
3. Every process outputs a different value. Why?
4. Use stepping or breakpoints

Exercise 2 (`hang1`)

1. the author of `hang0.c` has attempted to fix the program
2. `make hang1`
3. in DDT: `File > New Session`
4. run the program: only one process prints output.
   what are the others doing?
5. fix the program

Exercise 3 (`broadcast`)

The author of `broadcast.c` was confused about the SPMD model.

1. The program as is will abort. Find the reason and fix.
2. Now the program will hang. Find out why and fix it.