# CS633 Project: Parallel Debugger

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# Motivation

```
===================================================================================
=   BAD TERMINATION OF ONE OF YOUR APPLICATION PROCESSES
=   PID 21523 RUNNING AT hostname
=   EXIT CODE: 6
=   CLEANING UP REMAINING PROCESSES
=   YOU CAN IGNORE THE BELOW CLEANUP MESSAGES
===================================================================================
YOUR APPLICATION TERMINATED WITH THE EXIT STRING: Aborted (signal 6)
This typically refers to a problem with your application.
Please see the FAQ page for debugging suggestions
```

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# Allinea DDT and Totalview

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- Both have a rich feature set and GUIs.
- However, both are proprietary, commercial software.
- Restrictive licenses (locked to one node, or four processes etc) and high cost (a few hundred dollars).
- Can't be extended any further.

# Using XTerm and GDB

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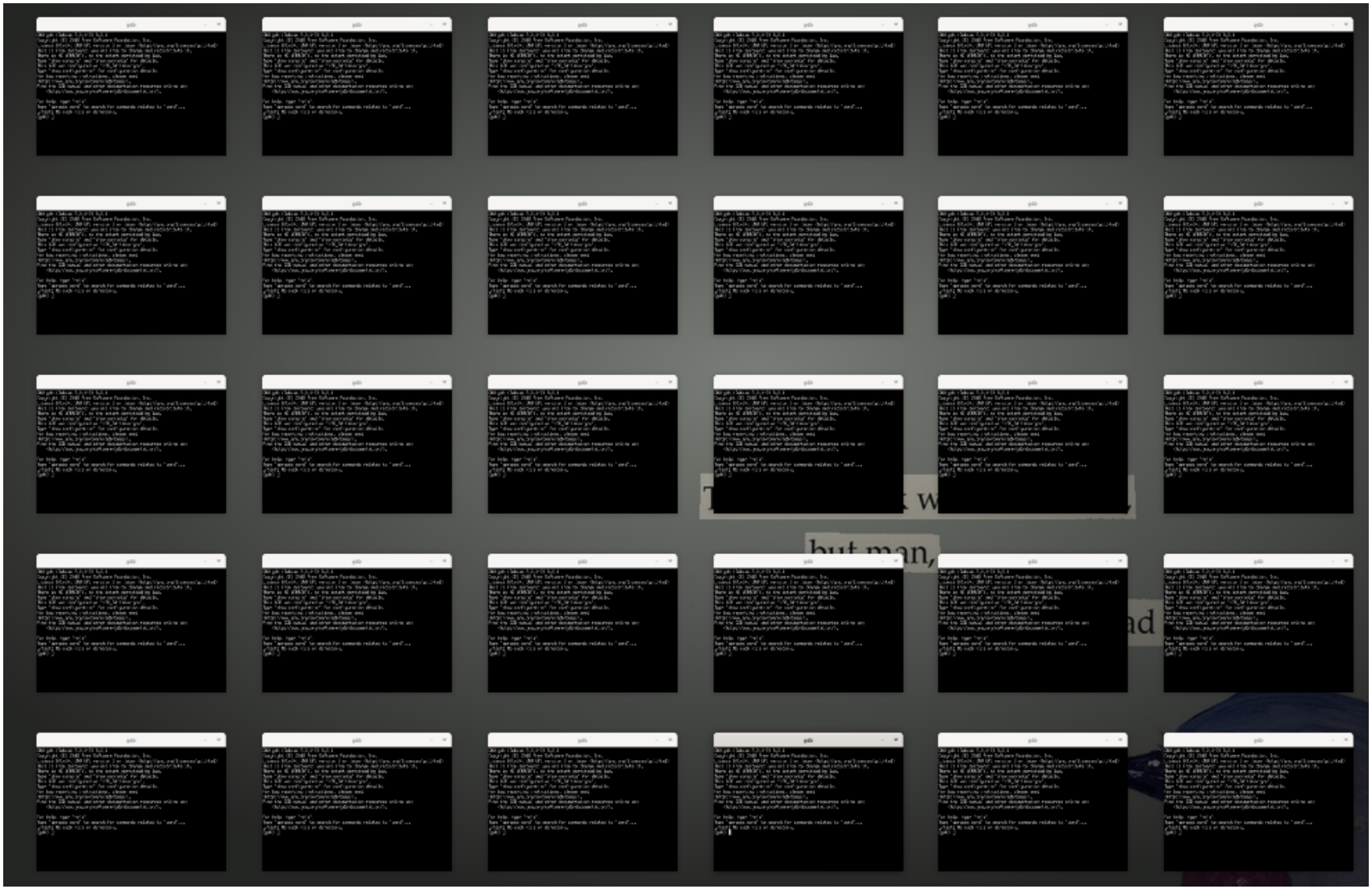
- `mpiexec -n 4 xterm -e gdb ./test`

# Problems with XTerm + GDB

```
mpiexec -n 30 xterm -e gdb ./test
```



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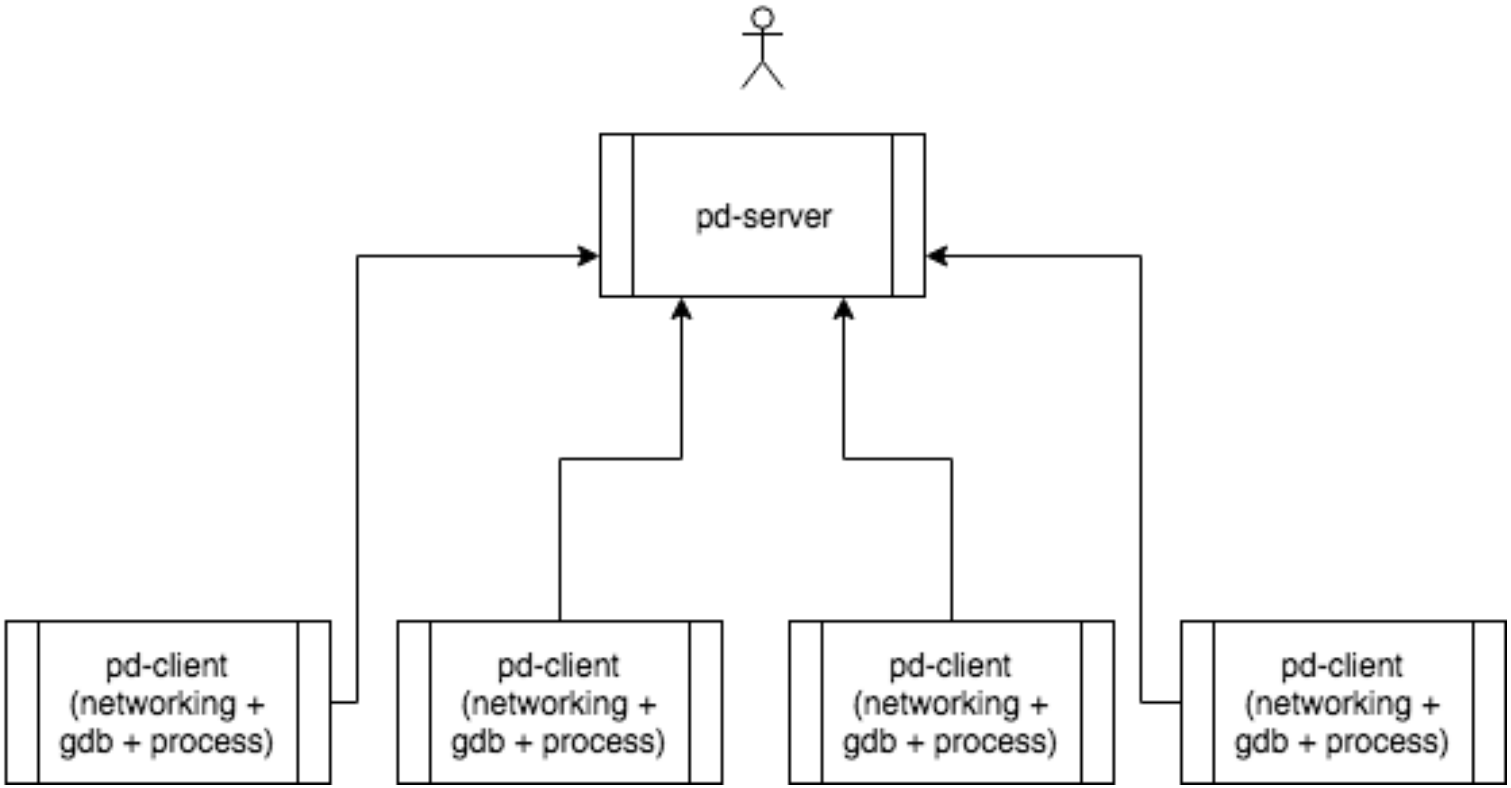
- Each client instance will run a `gdb` instance with the program to be debugged.
- All the instances of `gdb` are controlled using a single, centralized interface.

# Basic Idea


pd-server
pd-client (networking + gdb + process)
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  - Sends request to the server using **TCP sockets**.
- Loads the target binary `./test` and instrument it using LD preload.
- Acts as a frontend to the GDB interpreter `mi2`.
  - Conveys the instructions from the server to individual clients.

# Machine Interface (mi)

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- **mi2** is a line based machine oriented text interface to GDB
- The default interpreter is the **Console Interpreter**. For a different interpreter user can use
- `gdb .test --interpreter=(console|mi|mi2)`

# mi2 vs console

**mi2**

- `-file-exec-and-symbols ./test`

**console**

- `file ./test`

# mi2 vs console

**mi2**

- `-file-exec-and-symbols ./test`
- `-break-insert main`

**console**

- `file ./test`
- `break main`

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- `-file-exec-and-symbols ./test`
- `-break-insert main`
- `-exec-run`

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- `file ./test`
- `break main`
- `run`

# mi2 vs console

**mi2**

- `-file-exec-and-symbols ./test`
- `-break-insert main`
- `-exec-run`
- `-exec-continue`

**console**

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- Maintains a in-memory `map[rank int]conn *net.Conn` to store the clients that are already connected.

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- `(pdb) break MPI_Allgather`
- Example: Selectively print `argc` in processes with rank 4, 5, 6 (with respect to MPI_COMM_WORLD).
- `(pdb) pdb_print argc [r=4,5,6]`

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- Example: Selectively set breakpoint in processes in communicator 4.
- `(pdb) pdb_break MPI_Allgather [c=4]`

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- We can use this to maintain a list of collectives pending on a process.
- Example: Listing all pending collectives.
- `(pdb) pdb_listcoll`

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- We can track buffer writes using watchpoints.
- Hence, we can give feedback for any invalid write.

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- Communicate with `gdb/mi`. DONE
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- Allow commands from server to all clients, and echo client console on server. DONE

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- Track asynchronous call buffers. IFPOSSIBLE
- Make a nice GUI. IFANYONEVOLUNTEERS

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# References


- GDB/MI2 Documentation
- Go library for talking to GDB/MI - Our modified version of the library.
- Allinea DDT, TotalView
- OpenMPI FAQ for Parallel Debugging
- Common MPI Programming Errors