GDB & Multi-target

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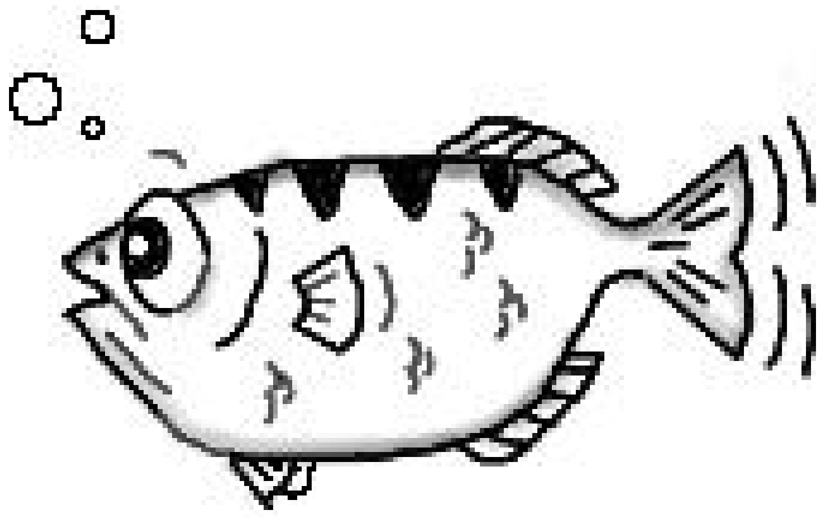
Pedro Alves <palves@redhat.com>

GNU Cauldron 2017



Outline

- Multi target

Why?

- Combined host/accelerator|coprocessor debugging
    - GPGPU debugging? (CPU target + GPU target)
- Debug multiple embedded boards as multiple inferiors
    - requested on the gdb@ list a couple days ago!
- Combined Client+Server debugging
- Distributed computing (HPC debugging)
    - debug multiple nodes, potentially different archs
- Valgrind follow-fork/follow-exec
- Because it's cool?

GDB's evolution

- GDB starts single-process debugging only (1734)
  - Multi-threading (1830)
    - Multi-process (2010)
      - Multi-target (2017)

GDB's little brain

- inferior list is a global list
- thread list is a global list
- ptid_t is pervasive
- there's only one target stack
    - historical "current_target" squashed target
    - each target_ops instance has "beneath" pointer
    - targets > process_stratum skip "wrong" inferiors

GDB's little brain, after

- target_ops -> C++ class hierarchy + virtual methods
- inferior list is still a global list
- each inferior has its own thread list
- target stack is now an array of target_ops pointers
- each inferior has its own target stack array
- squashed "current_target" is gone -> inf->m_stack.top ();
- "target_ops::beneath" pointer is gone -> inf->m_stack.beneath (target);
- ptid_t remains the same
- ptid_t => thread_info * in many places
- ptid_t => 'target_ops *' + ptid_t in other places

target stack, after

```
class target_stack
{
public:
  void push_target (struct target_ops *);
  int unpush_target (struct target_ops *);

  target_ops *at (enum strata stratum) { return m_stack[stratum]; }
  target_ops *top () { return at (m_top); }
  target_ops *find_target_beneath (const target_ops *t);

private:
  enum strata m_top {};
  target_ops *m_stack[(int) debug_stratum] {};
};
```

Status

- Requires target_async-capable targets
- Non-stop native + gdbserver works
- Non-stop gdbserver (1) + gdbserver (2) works
- All-stop works, as long as all target backends are non-stop:
  - "maint set target-non-stop on"
- native + gdbserver + core works too, for fun
- all-stop without all-stop-on-top-of-non-stop not attempted
- Testsuite not regression-free
- Several hacks in place...

Demo!

User interface, threads

```
(gdb) info threads
  Id   Target Id                                 Frame
  1.1  Thread 8284.8284 "server"                 main () at server.c:70
* 2.1  Thread 8287.8287 "client"                 main () at client.c:66
```

User interface, inferiors

```
(gdb) info inferiors
  Num  Description       Connection                  Executable
  1    process 8284      1 (extended-remote :20000) /tmp/server
* 2    process 8287      2 (extended-remote :20001) /tmp/client
  3    process 11617     3 (core)                   /tmp/threaded-core
  4    <null>            2 (extended-remote :20001)
```

User interface, "info connections"

```
(gdb) info connections
  Num  Description
  1     1 (extended-remote :20000)
* 2     2 (extended-remote :20001)
  3     3 (core)
```

User interface, new "connections"

```
(gdb) info inferiors
  Num  Description       Connection                     Executable
* 1    process 8284      1 native                       /tmp/server
  2    process 8287      2 (extended-remote :20001) /tmp/client
(gdb) add-inferior
Added inferior 3 on target 1 (native)
(gdb) inferior 2
[Switching to inferior 2 [process 8287] (/tmp/client)]
(gdb) add-inferior
Added inferior 4 on target 2 (extended-remote :20001)
```

User interface, the new "connections"

```
(gdb) info inferiors
  Num  Description       Connection                          Executable
  1    process 8284      1 (extended-remote :20000) /tmp/server
* 2    process 8287      2 (extended-remote :20001) /tmp/client
  3    <null>            4 (native)
  4    <null>            2 (extended-remote :20001)
(gdb)
```