LLDB LLVM debugger

START HERE

`lldb -- <prog> <args>`
Debug a program with arguments

`b <func>`
Stop at a function

`run`
Start the program

`n / s`
Over / into the next line

`bt`
Show the call stack

`frame variable`
Show locals and arguments

`p <expr>`
Evaluate an expression

`c`
Resume until the next stop

CONCEPTS

Compile with -g (and -O0 for sane stepping), otherwise LLDB has no source lines or local variables.

Debugger settings, aliases
Target executable, breakpoints
Process running program
Thread bt, step
Frame variables, registers

Commands are noun verb (breakpoint set, frame select); most have short aliases such as b, n, s, c, bt, p, f.

Abbreviate any word to a unique prefix, and use help <cmd> or apropos <word> to explore.

START AND ATTACH

`lldb <prog>`
Load a program

`lldb -- <prog> <args>`
Load a program with arguments

`lldb -p <pid>`
Attach to a running process
Often needs root or ptrace permission (kernel.yama.ptrace_scope)

`lldb -c <core> <prog>`
Inspect a core dump

`lldb -b -o run -o bt -- <prog>`
Non-interactive: run, print a backtrace, exit

`run [args]`
Start the program

`process attach --name <name>`
Attach by process name

`settings set target.run-args <args>`
Set arguments for later runs

`settings set target.env-vars <VAR>=<val>`
Set an environment variable

`process detach`
Release the process and keep it running

`process kill`
Kill the program being debugged

`quit`
Leave LLDB

BREAKPOINTS

`b <func>`
Break at a function

`b <file>:<line>`
Break at a line of a file

BREAKPOINTS (cont.)

`breakpoint set --name <func> --condition '<cond>'`
Break only when the condition holds

`breakpoint list`
List breakpoints and hit counts

`breakpoint delete <n>`
Delete a breakpoint

`breakpoint disable <n>`
Disable a breakpoint

`breakpoint enable <n>`
Re-enable a breakpoint

`breakpoint set --func-regex <regex>`
Break on every function matching a regex

`breakpoint set --method <name>`
Break on a C++ method by base name

`breakpoint modify --condition '<cond>' <n>`
Add or change a condition

`breakpoint modify --ignore-count <count> <n>`
Skip the next hits

`breakpoint command add <n>`
Run commands when it hits

WATCHPOINTS

`watchpoint set variable <var>`
Stop when a variable changes

`watchpoint set expression -- <addr>`
Watch the memory at an address

`watchpoint list`
List watchpoints

`watchpoint delete <n>`
Delete a watchpoint

RUN CONTROL

`c`
Continue until the next stop

`n`
Step over the next line

`s`
Step into the next line

`finish`
Run until the current function returns

`thread until <line>`
Run to a line in this frame

`thread step-in -r <regex>`
Step into, skipping functions matching a regex

`settings set target.process.thread.step-avoid-regexp <regex>`
Never step into matching functions

RUN CONTROL (cont.)

`si`
Step one instruction

`ni`
Step over one instruction (calls too)

`process status`
Show the process state and stop reason

STACK AND THREADS

`bt`
Backtrace of the current thread

`bt all`
Backtrace of every thread

`frame select <n>`
Switch to frame n

`up`
Go to the caller frame

`down`
Go back toward the callee frame

`frame info`
Show the current frame

`thread list`
List threads

`thread select <n>`
Switch to thread n

INSPECT DATA

`frame variable`
Show arguments and locals

`frame variable <var>`
Show one variable

`frame variable --format x <var>`
Show a variable in hex

`target variable <var>`
Show a global or static variable

`p <expr>`
Evaluate a C/C++ expression

`expr -- <expr>`
Evaluate, with options before the --

`parray <count> <ptr>`
Print count elements behind a pointer

`target stop-hook add -o "frame variable <var>"`
Show a variable on every stop

MEMORY AND REGISTERS

`memory read --size 4 --format x --count 4 <addr>`
Dump four 32-bit words in hex

`x/4xw <addr>`
Same, in GDB shorthand

`memory read --outfile <file> --binary <start> <end>`
Save a raw binary range

MEMORY AND REGISTERS (cont.)

`register read`
Show general registers

`register read <reg>`
Show one register

SOURCE AND SYMBOLS

`disassemble --frame`
Disassemble the current function

`disassemble --name <func>`
Disassemble a function by name

`image list`
List loaded executables and shared libraries

`image lookup --address <addr>`
Which symbol is at this address?

`image lookup -r -n <regex>`
Find functions with debug info by regex

`image lookup --type <type>`
Show a type's layout

FROM GDB

GDB to LLDB

GDB	LLDB
`break foo`	b foo
`rbreak <re>`	breakpoint set -r <re>
`info locals`	frame variable
`info break`	breakpoint list
`watch <var>`	watchpoint set variable <var>
`info threads`	thread list
`disassemble`	disassemble --frame
`info registers`	register read

RECIPES

Crash post-mortem

```
ulimit -c unlimited
./<prog>            # crashes, writes core
lldb -c <core> <prog>
(lldb) bt
```

Stop in a loop on a condition

```
(lldb) b <file>:<line>
(lldb) breakpoint modify -c 'i == 99' 1
(lldb) run
(lldb) frame variable
```

Who changes this variable?

```
(lldb) b main
(lldb) run
(lldb) watchpoint set variable <var>
(lldb) c    # stops at the writing line
(lldb) bt
```

Log and go on

```
(lldb) b <func>
(lldb) breakpoint command add 1
> frame variable <var>
> continue
> DONE
```