GNU GDB Debugger Command Cheat Sh

GDB Command cheat sheet: Command summaries.

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GDB Command Line Arguments:

Starting GDB:

- `gdb` *`name-of-executable`*
- `gdb -e` *`name-of-executable`* `-c` *`name-of-core-file`*
- `gdb` *`name-of-executable`* `-pid` *`process-id`*
  (Use `ps -auxw` to list process id's.)

Command line options: (version 6. Older versions use a single "-")

Option	Descript
--help -h	List command line arguments
--exec=*fi le-name* -e *fi le-name*	Identify executable associated with core file.
--core=*name-of-core-file* -c *name-of-core-file*	Specify core file.
--command=*command-file* -x *command-file*	File listing GDB commands to perform. Good for automa
--directory=*directory* -d *directory*	Add directory to the path to search for source files.
--cd=*directory*	Run GDB using specified directory as the current workin
--nx -n	Do not execute commands from `~/.gdbinit` initialization list of commands.
--batch -x *command-file*	Run in batch (not interactive) mode. Execute commands
--symbols=*fi le-name* -s *fi le-name*	Read symbol table from file file.
--write	Enable writing into executable and core files.
--quiet -q	Do not print the introductory and copyright messages.
--tty=*device*	Specify *device* for running program's standard input and

--pid=*process-id* -p *process-id* -c *process-id*	Specify process ID number to attach to.

GDB Commands:

Commands used within GDB:

Command	Descr
help	List gdb command topics.
help *topic-classes*	List gdb command within class.
help *command*	Command description.
apropos *search-word*	Search for commands and command topics contai
info args i args	List program command line arguments
info breakpoints	List breakpoints
info break	List breakpoint numbers.
info break *breakpoint-number*	List info about specific breakpoint.
info watchpoints	List breakpoints
info registers	List registers in use
info threads	List threads in use
info set	List set-able option
Break and Watch	
break *funtion-name* break *line-number*	Suspend program at specified function of line num `break ClassName::functionName`
break +*offset* break -*offset*	Set a breakpoint specified number of lines forward stopped.
break *filename:function*	Don't specify path, just the file name and function
break *fi lename:line-number*	Don't specify path, just the file name and line numl `break Directory/Path/filename.cpp:62`
break **address*	Suspend processing at an instruction address. Us
break *line-number* if *condition*	Where condition is an expression. i.e. `x > 5` Suspend when boolean expression is true.
break *line* thread *thread-number*	Break in thread at specified line number. Use `info`
tbreak	Temporary break. Break once only. Break is then r
watch *condition*	Suspend processing when condition is met. i.e. `x`
clear clear *function* clear *line-number*	Delete breakpoints as identified by command optic
delete d	Delete all breakpoints, watchpoints, or catchpoints
delete *breakpoint-number* delete *range*	Delete the breakpoints, watchpoints, or catchpoint arguments.
disable *breakpoint-number-or-range* enable *breakpoint-number-or-range*	Does not delete breakpoints. Just enables/disable Example: Show breakpoints: `info break` Disable: `disable 2-9`
enable *breakpoint-number* once	Enables once

continue c	Continue executing until next break point/watchpo
continue *number*	Continue but ignore current breakpoint *number* tim
finish	Continue to end of function.
Line Execution	
step s step *number-of-steps-to-perform*	Step to next line of code. Will step into a function.
next n next *number*	Execute next line of code. Will not enter functions.
until until *line-number*	Continue processing until you reacha aspecified li filename:function or filename:line-number.
stepi si nexti ni	step/next assembly/processor instruction.
info signals info handle handle *SIGNAL-NAME option*	Perform the following option when signal recieved: nopass/ignore
where	Shows current line number and which function you
Stack	
backtrace bt bt *inner-function-nesting-depth* bt *-outer-function-nesting-depth*	Show trace of where you are currently. Which func
backtrace full	Print values of local variables.
frame *number* f *number*	Select frame number.
up *number* down *number*	Move up/down the specified number of frames in t
info frame	List address, language, address of arguments/loca frame.
info args info locals info catch	Info arguments of selected frame, local variables a
Source Code	
list l list *line-number* list *function* list - list *start#,end#* list *filename:function*	List source code.
set listsize *count* show listsize	Number of lines listed when `list command given.`
directory *directory-name* dir *directory-name* show directories	Add specified directory to front of source code pat
directory	Clear sourcepath when nothing specified.
Examine Variables	

print *variable-name* p *variable-name* p *file-name*::*variable-name* p '*fi le-name*':*variable-name*	Print value stored in variable.
p **array-variable*@*length*	Print first # values of array specified by *length*. Go
p/x *variable*	Print as integer variable in hex.
p/d *variable*	Print variable as a signed integer.
p/u *variable*	Print variable as a un-signed integer.
p/o *variable*	Print variable as a octal.
p/t *variable* x/b *address* x/b &*variable*	Print as integer value in binary. (1 byte/8bits)
p/c *variable*	Print integer as character.
p/f *variable*	Print variable as floating point number.
p/a *variable*	Print as a hex address.
x/w *address* x/4b &*variable*	Print binary representation of 4 bytes (1 32 bit wor
GDB Modes	
set *gdb-option value*	Set a GDB option
set logging on set logging off show logging set logging file *log-file*	Turn on/off logging. Default name of file is `gdb.txt`
set print array on set print array off show print array	Default is off. Convient readable format for arrays
set print array-indexes on set print array-indexes off show print array-indexes	Default off. Print index of array elements.
set print pretty on set print pretty off show print pretty	Format printing of C structures.
set print union on set print union off show print union	Default is on. Print C unions.
set print demangle on set print demangle off show print demangle	Default on. Controls printing of C++ names.
Start and Stop	
run r run *command-line-arguments* run < *infile* > *outfile*	Start program execution from the beginning of the started. Also allows basic I/O redirection.
continue c	Continue execution to next break point.
kill	Stop program execution.
quit q	Exit GDB debugger.

GDB Operation:

- Compile with the "-g" option (for most GNU and Intel compilers) which generates add can match a line of source code with the step of execution.
- Do not use compiler optimization directive such as "-O" or "-O2" which rearrange con will not match the order of execution in the source code and it may be impossible to f
- control+c: Stop execution. It can stop program anywhere, in your source or a C librar
- To execute a shell command: `! command`
  or `shell command`
- GDB command completion: Use TAB key
  `info bre` + TAB will complete the command resulting in `info breakpoints`
  Press TAB twice to see all available options if more than one option is available or ty
- GDB command abreviation:
  `info bre` + RETURN will work as `bre` is a valid abreviation for `breakpoints`

De-Referencing STL Containers:

Displaying STL container classes using the GDB "`p variable-name`" results in an cryptic displ following `~/.gdbinit` file (V1.03 09/15/08). Now works with GDB 4.3+.
(Archived versions: [V1.01 GDB 6.4+ only])
Thanks to Dr. Eng. Dan C. Marinescu for permission to post this script.

Use the following commands provided by the script:

Data type	GDB command
std::vector<T>	pvector *stl_variable*
std::list<T>	plist *stl_variable* T
std::map<T,T>	pmap *stl_variable*
std::multimap<T,T>	pmap *stl_variable*
std::set<T>	pset *stl_variable* T
std::multiset<T>	pset *stl_variable*
std::deque<T>	pdequeue *stl_variable*
std::stack<T>	pstack *stl_variable*
std::queue<T>	pqueue *stl_variable*
std::priority_queue<T>	ppqueue *stl_variable*
std::bitset<n>td>	pbitset *stl_variable*
std::string	pstring *stl_variable*
std::widestring	pwstring *stl_variable*

Where T refers to native C++ data types. While classes and other STL data types wil de-reference tool may not handle non-native types.

Also see the YoLinux.com STL string class tutorial and debugging with GDB.

De-Referencing a vector:

Example: `STL_vector_int.cpp`

```
#include <iostream>
#include <vector>
#include <string>

using namespace std;

main()
{
   vector<int> II;
```

```
   II.push_back(10);
   II.push_back(20);
   II.push_back(30);

   cout << II.size() << endl;

}
```

Compile: `g++ -g STL_vector_int.cpp`

Debug in GDB: `gdb a.out`

```
(gdb) l
1       #include <iostream>
2       #include <vector>
3       #include <string>
4
5       using namespace std;
6
7       main()
8       {
9          vector<int> II;
10
(gdb) l
11         II.push_back(10);
12         II.push_back(20);
13         II.push_back(30);
14
15         cout << II.size() << endl;
16
17      }
(gdb) break 15
Breakpoint 1 at 0x8048848: file STL_vector_int.cpp, line 15.
(gdb) r
Starting program: /home/userx/a.out

Breakpoint 1, main () at STL_vector_int.cpp:15
15         cout << II.size() << endl;
(gdb) p II
$1 = {
  <std::_Vector_base<int,std::allocator<int> >> = {
    _M_impl = {
      <std::allocator<int>> = {
        <__gnu_cxx::new_allocator<int>> = {<No data fields>}, <No data fields>},
      members of std::_Vector_base<int,std::allocator<int> >::_Vector_impl:
      _M_start = 0x804b028,
      _M_finish = 0x804b034,
      _M_end_of_storage = 0x804b038
    }
  }, <No data fields>}
(gdb) pvector II
elem[0]: $2 = 10
elem[1]: $3 = 20
elem[2]: $4 = 30
Vector size = 3
Vector capacity = 4
Element type = int *
(gdb) c
Continuing.
3

Program exited normally.
(gdb) quit
```

Notice the native GDB print "p" results in an cryptic display while the "pvector" routine decipherable display of your data.

De-Referencing a 2-D vector of vectors:

Example: `STL_vector_int_2.cpp`

```
#include <iostream>
#include <vector>

using namespace std;
```

```
main()
{
   vector< vector<int> > vI2Matrix(3, vector<int>(2,0));

   vI2Matrix[0][0] = 0;
   vI2Matrix[0][1] = 1;
   vI2Matrix[1][0] = 10;
   vI2Matrix[1][1] = 11;
   vI2Matrix[2][0] = 20;
   vI2Matrix[2][1] = 21;

   cout << "Loop by index:" << endl;

   int ii, jj;
   for(ii=0; ii < 3; ii++)
   {
      for(jj=0; jj < 2; jj++)
      {
         cout << vI2Matrix[ii][jj] << endl;
      }
   }
}
```

Compile: `g++ -g STL_vector_int_2.cpp`

Debug in GDB: `gdb a.out`

```
(gdb) l
1       #include <iostream>
2       #include <vector>
3
4       using namespace std;
5
6       main()
7       {
8          vector< vector<int> > vI2Matrix(3, vector<int>(2,0));
9
10         vI2Matrix[0][0] = 0;
(gdb) l
11         vI2Matrix[0][1] = 1;
12         vI2Matrix[1][0] = 10;
13         vI2Matrix[1][1] = 11;
14         vI2Matrix[2][0] = 20;
15         vI2Matrix[2][1] = 21;
16
17         cout << "Loop by index:" << endl;
18
19         int ii, jj;
20         for(ii=0; ii < 3; ii++)
(gdb) break 17
Breakpoint 1 at 0x8048a19: file STL_vector_2.cpp, line 17.
(gdb) r
Starting program: /home/userx/a.out

Breakpoint 1, main () at STL_vector_2.cpp:17
17         cout << "Loop by index:" << endl;
(gdb) pvector vI2Matrix
elem[0]: $1 = {
  <std::_Vector_base<int,std::allocator<int> >> = {
    _M_impl = {
      <std::allocator<int>> = {
        <__gnu_cxx::new_allocator<int>> = {<No data fields>}, <No data fields>
      members of std::_Vector_base<int,std::allocator<int> >::_Vector_impl:
      _M_start = 0x804b040,
      _M_finish = 0x804b048,
      _M_end_of_storage = 0x804b048
    }
  }, <No data fields>}
elem[1]: $2 = {
  <std::_Vector_base<int,std::allocator<int> >> = {
    _M_impl = {
      <std::allocator<int>> = {
        <__gnu_cxx::new_allocator<int>> = {<No data fields>}, <No data fields>
      members of std::_Vector_base<int,std::allocator<int> >::_Vector_impl:
      _M_start = 0x804b050,
      _M_finish = 0x804b058,
      _M_end_of_storage = 0x804b058
    }
  }, <No data fields>}
elem[2]: $3 = {
  <std::_Vector_base<int,std::allocator<int> >> = {
    _M_impl = {
      <std::allocator<int>> = {
        <__gnu_cxx::new_allocator<int>> = {<No data fields>}, <No data fields>
      members of std::_Vector_base<int,std::allocator<int> >::_Vector_impl:
      _M_start = 0x804b060,
      _M_finish = 0x804b068,
      _M_end_of_storage = 0x804b068
---Type <return> to continue, or q <return> to quit---
    }
  }, <No data fields>}
Vector size = 3
Vector capacity = 3
Element type = class std::vector<int,std::allocator<int> > *
(gdb) pvector $1
elem[0]: $4 = 0
elem[1]: $5 = 1
Vector size = 2
Vector capacity = 2
Element type = int *
(gdb) pvector $2
elem[0]: $6 = 10
elem[1]: $7 = 11
Vector size = 2
Vector capacity = 2
Element type = int *
(gdb) pvector $3
elem[0]: $8 = 20
elem[1]: $9 = 21
Vector size = 2
Vector capacity = 2
```

Note "pvector" does not de-reference the entire vector of vectors all at once but retur
then helps us traverse the information by examining the contents of each element in
native gdb "p vI2Matrix" (last command) was much less informative.

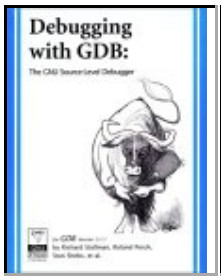
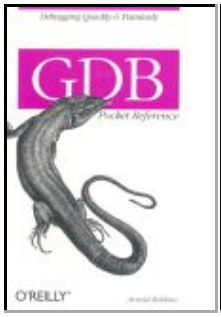
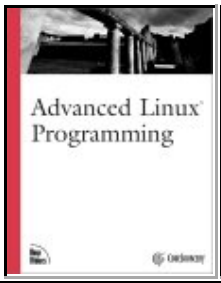
Man Pages:

- gdb - GNU debugger
- ld - Linker
- gcc/g++ - GNU project C and C++ compiler

Links:

- Gnu.org: GDB manual
- Postscript file: GDB: Quick reference

Books:

	"Debugging with GDB: The GNU Source-Level Debugger" by Richard Stallman, Roland H. Pesch, Stan Shebs ISBN # 1882114884, Free Software Foundation; 9th edition (Ja
	"GDB Pocket Reference" by Arnold Robbins ISBN # 0596100272, O'Reilly
	"Advanced Linux Programming" by Mark Mitchell, Jeffrey Oldham, Alex Samuel, Jeffery Oldham ISBN # 0735710430, New Riders Good book for programmers who already know how to program specifics. Covers a variety of Linux tools, libraries, API's and tec to program, start with a book on C.