Debugging

(or where you'll spend 90% of your time)

The first step in effective debugging is
understanding the tools in your bag

Some tools...

Print statements
Logging frameworks (strategies)
Debuggers

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Logging frameworks (strategies)

Debuggers ← Today

Print statements

There exist many breeds...

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printf(“**here**”);

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printf(“**here**”);

printf(“**here2**”);

Print statements

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printf(“**Shouldn’t be here.....**”);

Print statements
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printf(“**Shouldn’t be here.....**”);

printf(“**WTF!!!!**”);

Print statements

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Program Flow:

printf(“**here**”);

printf(“**here2**”);

printf(“**Shouldn’t be here.....**”);

printf(“**WTF!!!!**”);

Print statements

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Program Flow:

printf(“**here**”);

printf(“**here2**”);

printf(“**Shouldn’t be here.....**”);

printf(“**WTF!!!!**”);

Value checking:

printf(“value = %d”, some_value);

extremely important for numerical errors

Logging
Printing on steroids

```
Logger Log;

// ...

Matrix** Invert(Matrix** myMatrix) {
  Log("Invert()",Log::Arguments, myMatrix);


  Matrix** InvMatrix;
  //... Code to invert matrix ... //


  Log("Invert()",Log::Return, InvMatrix);
  return InvMatrix;
}
```

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Some open-source logging frameworks I found:

https://github.com/easylogging/easyloggingpp
http://www.drdobbs.com/cpp/a-lightweight-logger-for-c/240147505
http://www.codeproject.com/Articles/584794/Simple-logger-for-Cplusplus
https://github.com/gabime/spdlog (fast, header only)

Debuggers

Programs that assist in the detection of errors in other programs

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All platforms
https://www.gnu.org/software/gdb/

Windows
https://www.visualstudio.com/en-us/products/visual-studio-community-vs.aspx

Terminal based

passpointer.c

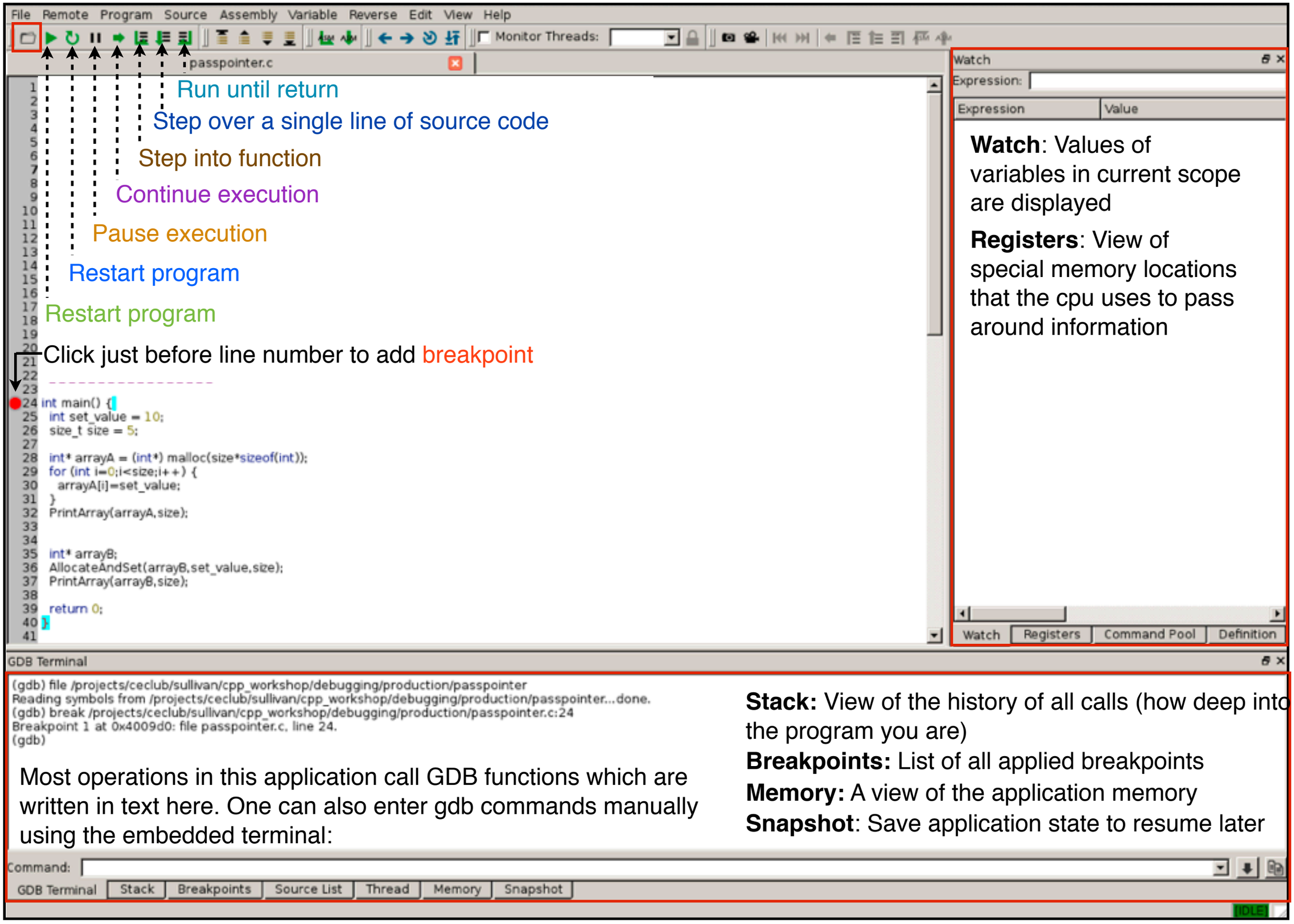
```
1       #include <iostream>
2       #include <cstdlib>
3       #include <string.h>
4
5       using namespace std;
6
7       //-------------------------------------------------------------------------------
8       void PrintArray(int* array, size_t size) {
9         for(int i=0; i<size; i++) {
10          cout << array[i] << " ";
11        } cout << endl;
12      }
13      //-------------------------------------------------------------------------------
14      void AllocateAndSet(int* array, int val, size_t size) {
15        array = (int*)malloc(size*sizeof(int));
16        for (int i=0;i<size;i++) {
17          array[i] = val;
18        }
19      }
20      //-------------------------------------------------------------------------------
21
22      //_-_-_-_-_-_-_-_-_-_-_-_-_-_-_-_-_-_-_-_-_-_-_-_
23
24      int main() {
25        int set_value = 10;
26        size_t size = 5;
27
28        int* arrayA = (int*) malloc(size*sizeof(int));
29        for (int i=0;i<size;i++) {
30          arrayA[i]=set_value;
31        }
32        PrintArray(arrayA,size);
33
```

(gdb)

GDB with a graphic front end

Chris Sullivan

Open program (compiled with -g)



Watch: Values of variables in current scope are displayed

Registers: View of special memory locations that the cpu uses to pass around information

Most operations in this application call GDB functions which are written in text here. One can also enter gdb commands manually using the embedded terminal:

Stack: View of the history of all calls (how deep into the program you are)

Breakpoints: List of all applied breakpoints

Memory: A view of the application memory

Snapshot: Save application state to resume later