Software Testing

Other Debugging Tools

Log Files

- Log files are simply files containing text and values written out by programs as they execute.
- information can be gathered whether the programmer is actually sitting there or not.
- can be gathered over a long period of time
- can be triggered to gather output only when specific erroneous conditions arise.
- Can gather information in a production system.
- Good for working with distributed programs

Log4c

- Our own logging system
- Has 3 levels of logging severity
  - Error – very important
  - Warning – you should read this
  - Info – information you might want to see (most debugging info)
- Can be
  - Filtered to write only messages of higher than a given severity
  - Can be enabled and disabled
  - Can auto flush to make sure output or not to increase efficiency

Log4c Functions

Function	Description
l4cOpen	Open a log file for overwriting or appending
l4cClose	Close an open log file
l4cError l4cWarning l4cInfo	Write a message to the log with a specific severity level.
l4cPrintf	Write a formatted message to the log file.
l4cEnable l4cDisable l4cIsEnabled	Enable or disable log file.
l4cFilter l4cGetFilter	Set filter level or get filter level.

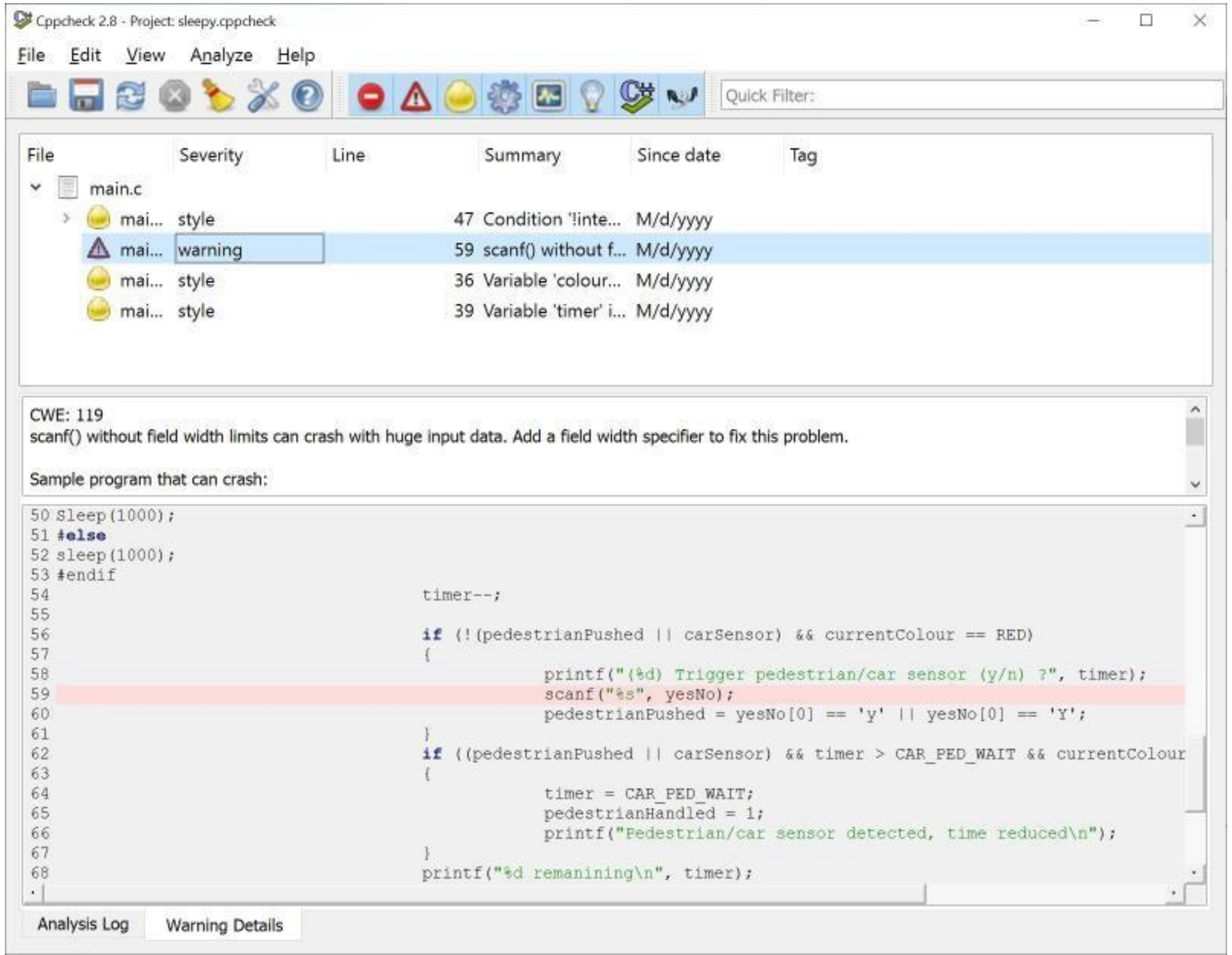
Assertions

- #include <assert.h>
- Added to production systems to stop program when something goes very wrong
- Tells the programmer the impossible happened and needs to be fixed
- assert(logical condition)
  - If the condition is triggered, the assert fires.
- E.g. assert(length > 0);

Lint

- A program which checks code for many possible errors
- Can give clues about the source of a bug
- Available for many languages
- CPPcheck for windows
  - https://github.com/danmar/cppcheck/releases/tag/2.8

CPPcheck


Cppcheck 2.8 - Project: sleepy.cppcheck
File Edit View Analyze Help
Quick Filter:

File	Severity	Line	Summary	Since date	Tag
main.c					
mai...	style	47	Condition '!inte...	M/d/yyyy	
mai...	warning	59	scanf() without f...	M/d/yyyy	
mai...	style	36	Variable 'colour...	M/d/yyyy	
mai...	style	39	Variable 'timer' i...	M/d/yyyy	

CWE: 119
scanf() without field width limits can crash with huge input data. Add a field width specifier to fix this problem.

Sample program that can crash:

```
50 Sleep(1000);
51 #else
52 sleep(1000);
53 #endif
54                         timer--;
55
56                         if (!(pedestrianPushed || carSensor) && currentColour == RED)
57                         {
58                                 printf("(%d) Trigger pedestrian/car sensor (y/n) ?", timer);
59                                 scanf("%s", yesNo);
60                                 pedestrianPushed = yesNo[0] == 'y' || yesNo[0] == 'Y';
61                         }
62                         if ((pedestrianPushed || carSensor) && timer > CAR_PED_WAIT && currentColour
63                         {
64                                 timer = CAR_PED_WAIT;
65                                 pedestrianHandled = 1;
66                                 printf("Pedestrian/car sensor detected, time reduced\n");
67                         }
68                         printf("%d remanining\n", timer);
```

Core Dumps

- a much older debugging technique which are rarely used nowadays.
- A copy of the memory allocated for program written it to a file.
- in binary and is very laborious to go through by hand.
- automatic dumped readers which can allow you to explore these files in a more human readable way.

Conditional Compilation

- We can turn debugging on an off with

```
#define DEBUG 1

...

if(DEBUG) printf("%s (%d): z=%d\n", __FILE__, __LINE__, z);
```

- This does a check of the condition during runtime, slowing program
- Conditional compilation is more efficient

```
#define DEBUG

...
#ifdef DEBUG
printf("%s (%d): z=%d\n", __FILE__, __LINE__, z);
#endif
```

Debug and Release Builds

- Debug builds do more checking of error conditions
- Slow your program
- Release builds are faster but do not checking

Debugging Other Languages

- Languages differ
    - Complied vs interpreted
    - Strongly typed vs weakly typed

- These differences affect how to approach testing and debugging

Compiled vs. Interpreted

- Compiled
  - A compiler goes through the whole program at once before it runs
  - Detects problems before the program ever runs

- Interpreted
  - Program is run line by line
  - Program is parsed only just before line is executed
  - Problems are not detected until line is executed
  - Rarely executed lines can make it to production with bugs in them because they were never executed

Strongly vs. Weakly Typed

- Strongly typed
  - All assignments and function calls are check to make sure the right types are used
  - Errors detected at compilation time

- Weakly typed
  - Variables and parameters can accept any type
  - Sending the wrong variable by mistake is not detected until the line is executed
  - Rarely executed lines can have errors in them that are not detected until months later.