

”For those in peril on the Sea” - Main Mission CS23710 2013

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1 Introduction

This document describes my design decisions for the Main Mission. It also contains screenshots showing output of my netbeans project. As well as a sample of the logfile produced.

2 Design decisions.

2.1 Data structures

In order for my program to store the data loaded from the text files, I decided to use C structures. Each set of data, that I thought should be grouped together, was put in a structure. I used the keyword `typedef` to define structures with fields, matching those from the datafiles. I have defined the following structures:

- `ship`
- `time`
- `rescue_asset`
- `mayday_call`

Once I had defined the datatypes, I had to decide how and where to store multiple structures of `ship`, `rescue_asset` and `mayday_call`. In order to be able to determine which lifeboat and helicopter to send for each mayday call, I had to be able to easily loop through all of the rescue assets. I realized that I had to have them grouped in some kind of list. One of the requirements was that we should not assume that there are specific numbers of ships, mayday calls or rescue assets. My first idea was to try and build a dynamic array. After some research on the internet, I realized that memory reallocation is dangerous. I gave up on that idea and decided to go with another strategy. I decided I would count the number of lines in each file, and based on that, create a fixed size array, big enough to hold all the data records I would read. I stuck with that decision, and built my program around arrays. I acknowledge the fact that my design has one big flaw - adding further records to my arrays would be impossible (unless memory reallocation is used). Now I realize that another simple solution would be using linked list, as the one I have produced in our practicals. But my rescue

asset matching algorithm was already built to work with arrays and it would take great amount of time to refactor my code.

2.2 File loading

Loading from a file wasn't that hard to do. I started off with the example on the Blackboard, the loading league tables(first case study). I also used the man pages from the Linux Mint terminal. Since my design decision to first count the lines in each file, I had to open each file twice.

My loading algorithm is the following:

The first time I open the file, validate the format, and if it is correct, I return the number of lines as an integer. If the file doesn't have the required format I return a negative value, so the second opening of the file doesn't happen.

Provided the file was OK, I allocate enough memory for all the ships. Having created enough memory for all of them, I start reading the file again. I read a line, store all the data read into the corresponding ship. I repeat this until I load all the ships. I perform various checks in order to be sure that the file has the expected format and also that my file is not NULL. In case loading fails while in the middle of loading a ship, I do free the memory occupied for my array. I am not sure if this makes any difference, but to my understanding any memory allocated with malloc will persist even after the function finishes executing. That's why if a loading fails, and I decide to exit the function, I must make sure the memory is given back to the system.

Having all the files loaded,I had to start responding to each mayday call. To do that I had to be able to calculate following things:

- Calculate time passed
- Calculate ship's new location

2.3 Calculate time passed

In order to calculate the difference between two given times, I wrote a function that takes as parameters two pointers to time structs. They do contain a time represented by 6 integer fields. The best approach was to sum up all the time in minutes and subtract the first from the second. But decision proved to be bad, since I had to create a very complex function that checks for leap years, for the number of days in the month and many other things. That's why I decided to use only days, hours and minutes. My calculation will indeed give wrong results if the mayday call and the initial time of when I have the ship's position span across a month. For example if the initial time is 28th of June , and the mayday call is issued on 1st of July. My functions will probably show some weird results.

I want also to note that there might be +/-1 minute deviation because of the fact that I ignore seconds.

2.4 Calculate ship's new location

Being able to calculate the time passed, I had now to find a ship's new location. To do so I wrote a function that takes a location, a time in minutes, course

over the ground and a speed. Then I use the formula provided to us from the assignment sheet. Having the new coordinates I return them as a location struct.

2.5 Finding closest asset

Having all the data and functions to manipulate it, I was ready to start building my algorithm. The function that finds closest asset takes various parameters including the array of assets, and then it determines which asset is closest and can arrive first, but in the same time be able to return safely to it's base. Once the function determines which ship and boat to send, it prints out the result and writes the output to a log file.

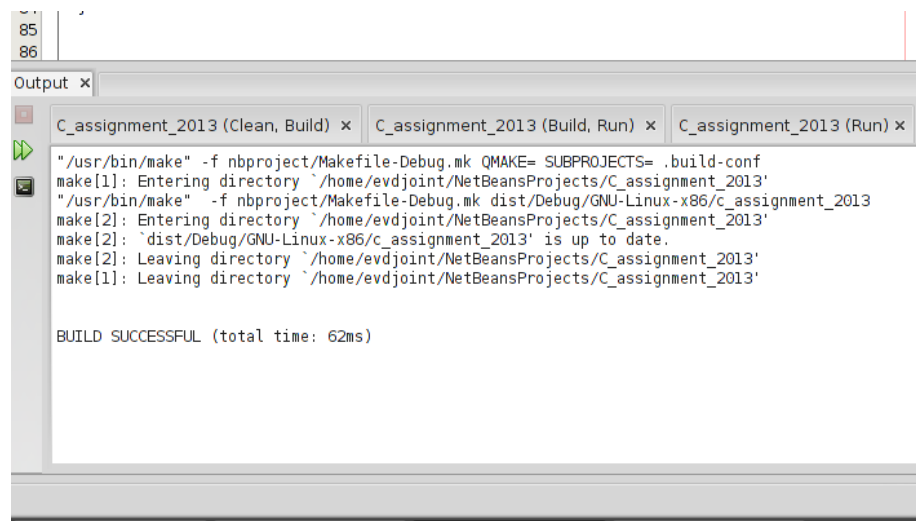
2.6 Various events

There are cases when there is a ship that issues a mayday call, but is not in the ships file. In that case, we cannot calculate it's position, and sadly cannot help the ship that is in peril.

There is also a case is when a ship is not in our borders. There is possibility that it was in our zone, but left after sometime. Or it never was in our zone, and it is not in the moment of issuing the mayday call. In both cases we ignore the mayday call, as it's another organization's responsibility to help them.

3 NetBeans output

3.1 Build project



```
85 |
86 |
Output x
C_assignment_2013 (Clean, Build) x C_assignment_2013 (Build, Run) x C_assignment_2013 (Run) x
"/usr/bin/make" -f nbproject/Makefile-Debug.mk QMAKE= SUBPROJECTS= .build-conf
make[1]: Entering directory `/home/evdjjoint/NetBeansProjects/C_assignment_2013'
"/usr/bin/make" -f nbproject/Makefile-Debug.mk dist/Debug/GNU-Linux-x86/c_assignment_2013
make[2]: Entering directory `/home/evdjjoint/NetBeansProjects/C_assignment_2013'
make[2]: `dist/Debug/GNU-Linux-x86/c_assignment_2013' is up to date.
make[2]: Leaving directory `/home/evdjjoint/NetBeansProjects/C_assignment_2013'
make[1]: Leaving directory `/home/evdjjoint/NetBeansProjects/C_assignment_2013'

BUILD SUCCESSFUL (total time: 62ms)
```

3.2 Data files 1

```
C_assignment_2013 (Clean, Build) x C_assignment_2013 (Build) x C_assignment_2013 (Build, Run) x C_assignment_2013 (Run) x
Enter the rescue assets file :
/home/evdjoint/rescue_assets.txt
Enter the ships file :
/home/evdjoint/ships_1.txt
Enter the mayday calls file :
/home/evdjoint/mayday_1.txt

Time: 13/11/2011 13:10:0 *** Ship in trouble! "GS452" sent mayday call.***
Estimated coordinates of "GS452" are 51.767 LAT , -4.298 LNG
Best H to send : Rescue_169, 41.18 miles away. Approx. arrive time 13:32
Best L to send : Cardigan_Lifeboat, 24.21 miles away. Approx. arrive time 13:51

Time: 13/11/2011 15:14:23 *** Ship in trouble! "EI597" sent mayday call.***
Estimated coordinates of "EI597" are 52.100 LAT , -5.295 LNG
Best H to send : Rescue_117, 66.25 miles away. Approx. arrive time 15:47
Best L to send : Fishguard_ILB, 12.88 miles away. Approx. arrive time 15:44

Time: 13/11/2011 15:34:35 *** Ship in trouble! "EI600" sent mayday call.***
Estimated coordinates of "EI600" are 52.616 LAT , -5.724 LNG
Best H to send : Rescue_116, 52.23 miles away. Approx. arrive time 16:00
Best L to send : Courtown_ILB, 18.20 miles away. Approx. arrive time 16:17

RUN FINISHED; exit value 0; real time: 36s; user: 0ms; system: 0ms
```

3.3 Data files 2

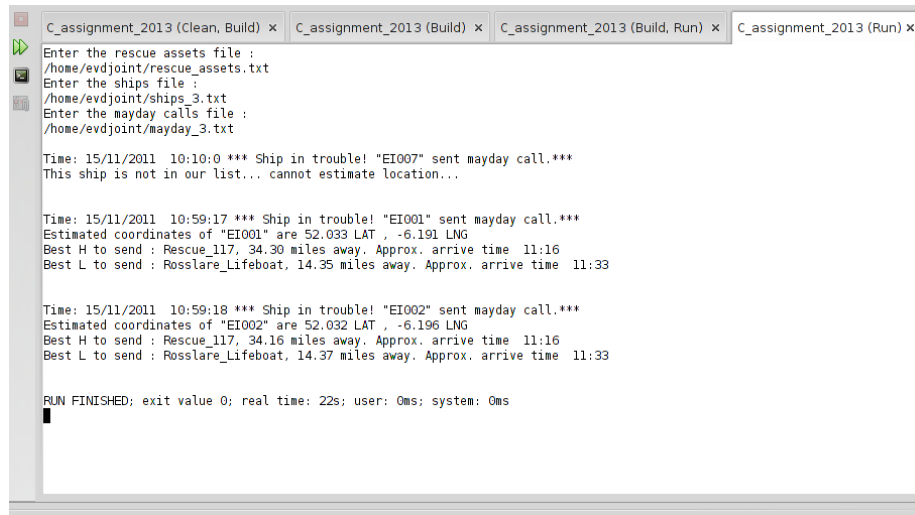
```
C_assignment_2013 (Clean, Build) x C_assignment_2013 (Build) x C_assignment_2013 (Build, Run) x C_assignment_2013 (Run) x
Enter the rescue assets file :
/home/evdjoint/rescue_assets.txt
Enter the ships file :
/home/evdjoint/ships_2.txt
Enter the mayday calls file :
/home/evdjoint/mayday_2.txt

Time: 14/11/2011 18:0:0 *** Ship in trouble! "Tanker01" sent mayday call.***
Estimated coordinates of "Tanker01" are 51.523 LAT , -6.074 LNG
The ship is out of our borders. As it is some other organisation's responsibility to help them we will ignore it !

Time: 14/11/2011 23:0:0 *** Ship in trouble! "Tanker03" sent mayday call.***
Estimated coordinates of "Tanker03" are 52.744 LAT , -5.337 LNG
Best H to send : Rescue_122, 41.90 miles away. Approx. arrive time 23:22
Best L to send : Abersoch_Lifeboat, 30.83 miles away. Approx. arrive time 23:52

RUN FINISHED; exit value 0; real time: 22s; user: 0ms; system: 0ms
```

3.4 Data files 3



```
C_assignment_2013 (Clean, Build) x C_assignment_2013 (Build) x C_assignment_2013 (Build, Run) x C_assignment_2013 (Run) x
Enter the rescue assets file :
/home/evdjoint/rescue_assets.txt
Enter the ships file :
/home/evdjoint/ships_3.txt
Enter the mayday calls file :
/home/evdjoint/mayday_3.txt

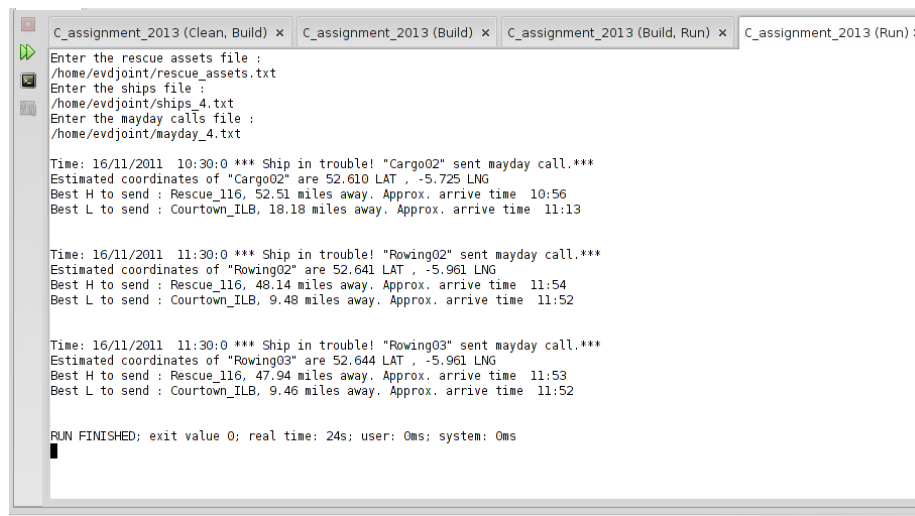
Time: 15/11/2011 10:10:0 *** Ship in trouble! "EI007" sent mayday call.***
This ship is not in our list... cannot estimate location...

Time: 15/11/2011 10:59:17 *** Ship in trouble! "EI001" sent mayday call.***
Estimated coordinates of "EI001" are 52.033 LAT , -6.191 LNG
Best H to send : Rescue_117, 34.30 miles away. Approx. arrive time 11:16
Best L to send : Rosslare_Lifeboat, 14.35 miles away. Approx. arrive time 11:33

Time: 15/11/2011 10:59:18 *** Ship in trouble! "EI002" sent mayday call.***
Estimated coordinates of "EI002" are 52.032 LAT , -6.196 LNG
Best H to send : Rescue_117, 34.16 miles away. Approx. arrive time 11:16
Best L to send : Rosslare_Lifeboat, 14.37 miles away. Approx. arrive time 11:33

RUN FINISHED; exit value 0; real time: 22s; user: 0ms; system: 0ms
```

3.5 Data files 4



```
C_assignment_2013 (Clean, Build) x C_assignment_2013 (Build) x C_assignment_2013 (Build, Run) x C_assignment_2013 (Run) x
Enter the rescue assets file :
/home/evdjoint/rescue_assets.txt
Enter the ships file :
/home/evdjoint/ships_4.txt
Enter the mayday calls file :
/home/evdjoint/mayday_4.txt

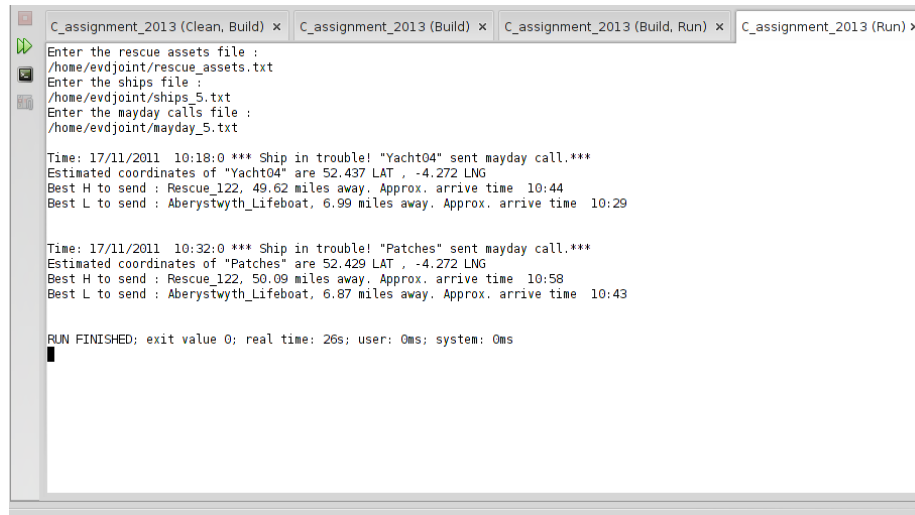
Time: 16/11/2011 10:30:0 *** Ship in trouble! "Cargo02" sent mayday call.***
Estimated coordinates of "Cargo02" are 52.610 LAT , -5.725 LNG
Best H to send : Rescue_116, 52.51 miles away. Approx. arrive time 10:56
Best L to send : Courtown_ILB, 18.18 miles away. Approx. arrive time 11:13

Time: 16/11/2011 11:30:0 *** Ship in trouble! "Rowing02" sent mayday call.***
Estimated coordinates of "Rowing02" are 52.641 LAT , -5.961 LNG
Best H to send : Rescue_116, 48.14 miles away. Approx. arrive time 11:54
Best L to send : Courtown_ILB, 9.48 miles away. Approx. arrive time 11:52

Time: 16/11/2011 11:30:0 *** Ship in trouble! "Rowing03" sent mayday call.***
Estimated coordinates of "Rowing03" are 52.644 LAT , -5.961 LNG
Best H to send : Rescue_116, 47.94 miles away. Approx. arrive time 11:53
Best L to send : Courtown_ILB, 9.46 miles away. Approx. arrive time 11:52

RUN FINISHED; exit value 0; real time: 24s; user: 0ms; system: 0ms
```

3.6 Data files 5



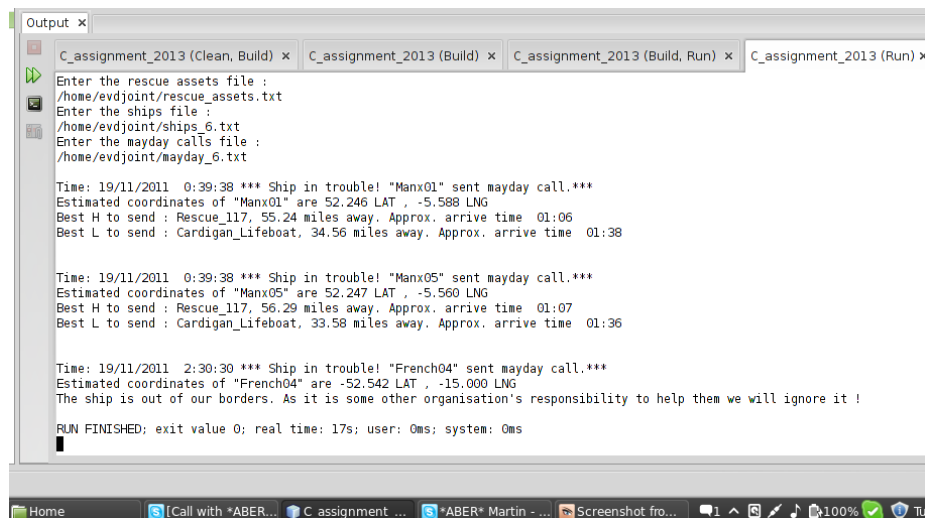
```
C_assignment_2013 (Clean, Build) x C_assignment_2013 (Build) x C_assignment_2013 (Build, Run) x C_assignment_2013 (Run) x
Enter the rescue assets file :
/home/evdjoint/rescue_assets.txt
Enter the ships file :
/home/evdjoint/ships_5.txt
Enter the mayday calls file :
/home/evdjoint/mayday_5.txt

Time: 17/11/2011 10:18:0 *** Ship in trouble! "Yacht04" sent mayday call.***
Estimated coordinates of "Yacht04" are 52.437 LAT , -4.272 LNG
Best H to send : Rescue_122, 49.62 miles away. Approx. arrive time 10:44
Best L to send : Aberystwyth_Lifeboat, 6.99 miles away. Approx. arrive time 10:29

Time: 17/11/2011 10:32:0 *** Ship in trouble! "Patches" sent mayday call.***
Estimated coordinates of "Patches" are 52.429 LAT , -4.272 LNG
Best H to send : Rescue_122, 50.09 miles away. Approx. arrive time 10:58
Best L to send : Aberystwyth_Lifeboat, 6.87 miles away. Approx. arrive time 10:43

RUN FINISHED; exit value 0; real time: 26s; user: 0ms; system: 0ms
```

3.7 Data files 6



```
Output x
C_assignment_2013 (Clean, Build) x C_assignment_2013 (Build) x C_assignment_2013 (Build, Run) x C_assignment_2013 (Run) x
Enter the rescue assets file :
/home/evdjoint/rescue_assets.txt
Enter the ships file :
/home/evdjoint/ships_6.txt
Enter the mayday calls file :
/home/evdjoint/mayday_6.txt

Time: 19/11/2011 0:39:38 *** Ship in trouble! "Manx01" sent mayday call.***
Estimated coordinates of "Manx01" are 52.246 LAT , -5.588 LNG
Best H to send : Rescue_117, 55.24 miles away. Approx. arrive time 01:06
Best L to send : Cardigan_Lifeboat, 34.56 miles away. Approx. arrive time 01:38

Time: 19/11/2011 0:39:38 *** Ship in trouble! "Manx05" sent mayday call.***
Estimated coordinates of "Manx05" are 52.247 LAT , -5.560 LNG
Best H to send : Rescue_117, 56.29 miles away. Approx. arrive time 01:07
Best L to send : Cardigan_Lifeboat, 33.58 miles away. Approx. arrive time 01:36

Time: 19/11/2011 2:30:30 *** Ship in trouble! "French04" sent mayday call.***
Estimated coordinates of "French04" are -52.542 LAT , -15.000 LNG
The ship is out of our borders. As it is some other organisation's responsibility to help them we will ignore it !

RUN FINISHED; exit value 0; real time: 17s; user: 0ms; system: 0ms
```

3.8 Log file sample

Time: 19/11/2011 0:39:38 *** Ship in trouble! "Manx01" sent mayday call.***
Estimated coordinates of "Manx01" are 52.245694 LAT , -5.588304 LNG
Best H to send : Rescue.117, 55.24 miles away. Approx. arrive time 01:06
Best L to send : Cardigan_Lifeboat, 34.56 miles away. Approx. arrive time 01:38

Time: 19/11/2011 0:39:38 *** Ship in trouble! "Manx05" sent mayday call.***
Estimated coordinates of "Manx05" are 52.247347 LAT , -5.559927 LNG
Best H to send : Rescue.117, 56.29 miles away. Approx. arrive time 01:07

Best L to send : Cardigan_Lifeboat, 33.58 miles away. Approx. arrive time 01:36

Time: 19/11/2011 2:30:30 *** Ship in trouble! "French04" sent mayday call.***
Estimated coordinates of "French04" are -52.542000 LAT , -15.000000 LNG
The ship is out of our borders. As it is some other organisation's responsibility
to help them we will ignore it !

Time: 15/11/2011 10:10:0 *** Ship in trouble! "EI007" sent mayday call.***
This ship is not in our list... cannot estimate location...

Time: 15/11/2011 10:59:17 *** Ship in trouble! "EI001" sent mayday call.***
Estimated coordinates of "EI001" are 52.033199 LAT , -6.191132 LNG
Best H to send : Rescue_117, 34.30 miles away. Approx. arrive time 11:16
Best L to send : Rosslare_Lifeboat, 14.35 miles away. Approx. arrive time 11:33

Time: 15/11/2011 10:59:18 *** Ship in trouble! "EI002" sent mayday call.***
Estimated coordinates of "EI002" are 52.031631 LAT , -6.195721 LNG
Best H to send : Rescue_117, 34.16 miles away. Approx. arrive time 11:16
Best L to send : Rosslare_Lifeboat, 14.37 miles away. Approx. arrive time 11:33