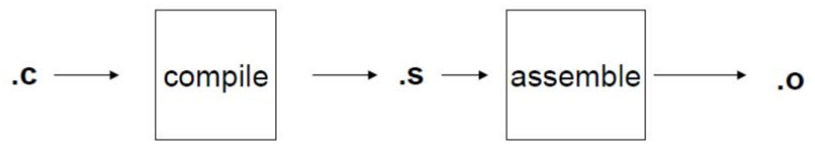
WEEK 1: The make utility

Date: 27/08/2020

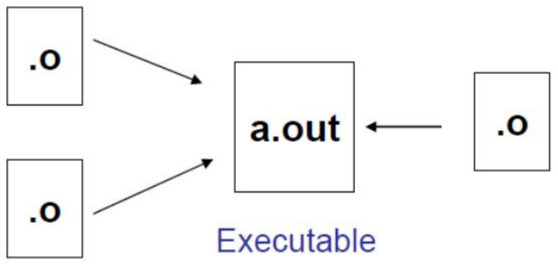
Compiling

- High level $\longrightarrow$ Machine level



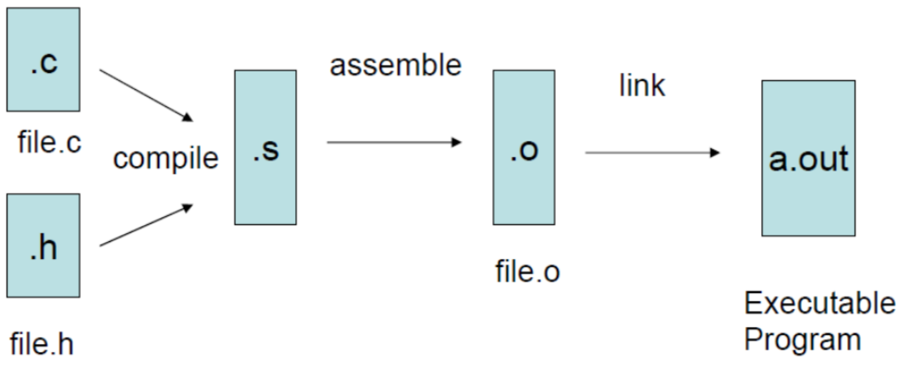
- Looks one file at a time
- Function calls not resolved
- gcc –c file.c

Linking



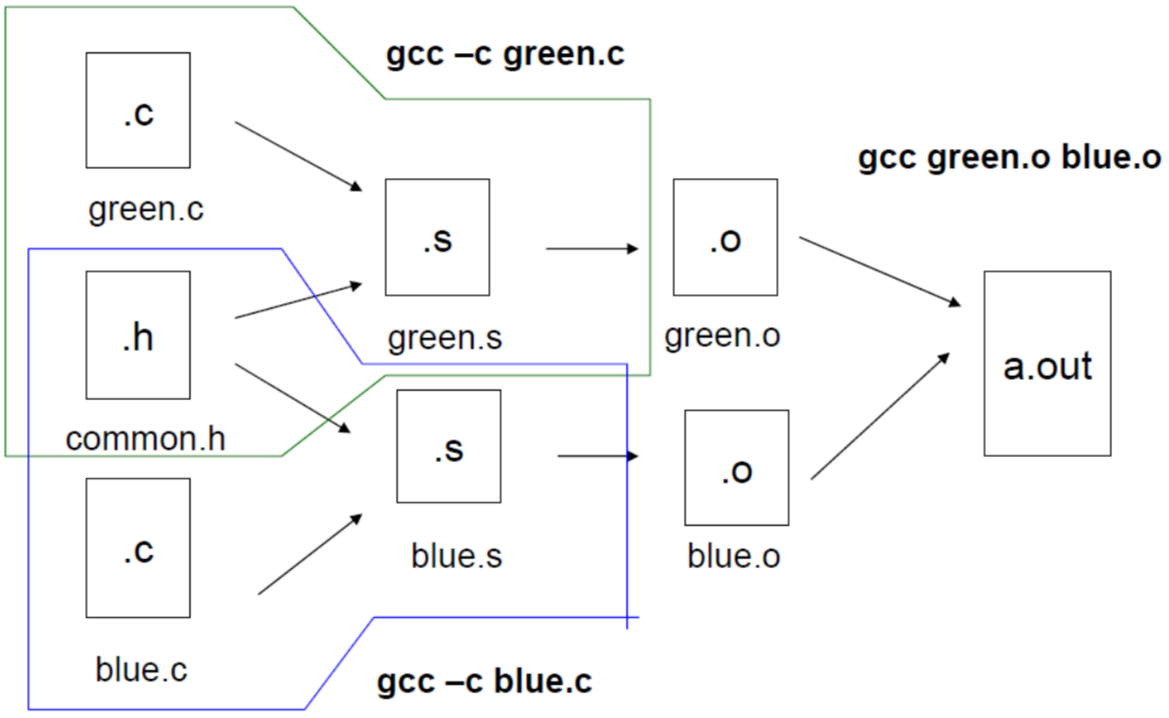
- Many files at a time
- Resolves all cross – references
- gcc <file1.o> <file2.o> –o <output>

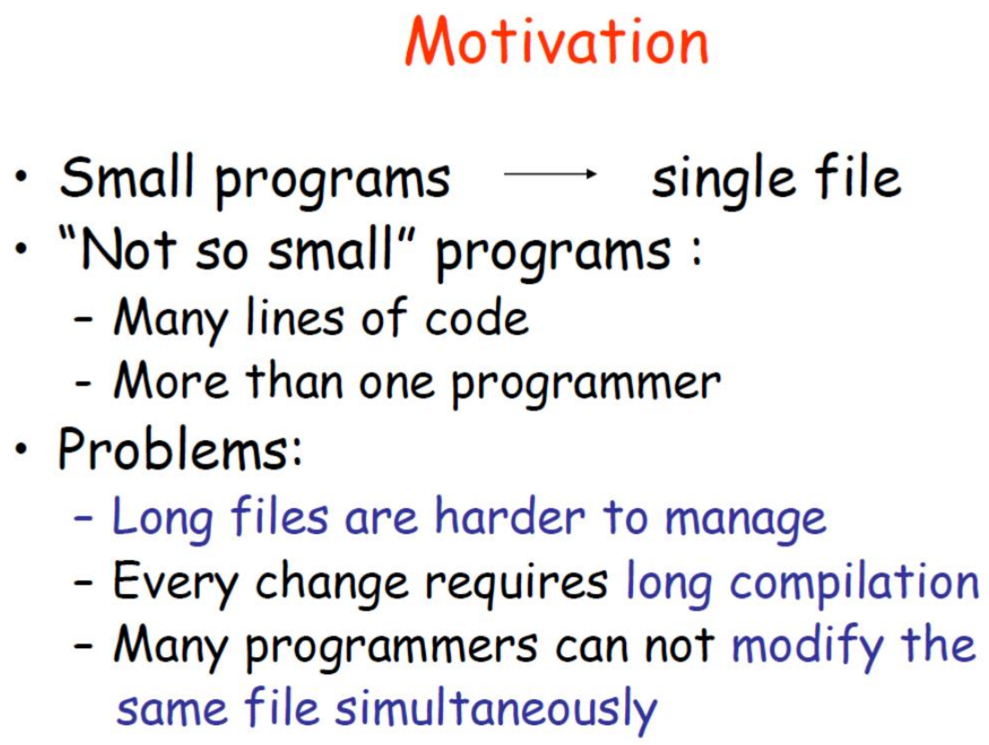
A simple compilation



Command – gcc file.c

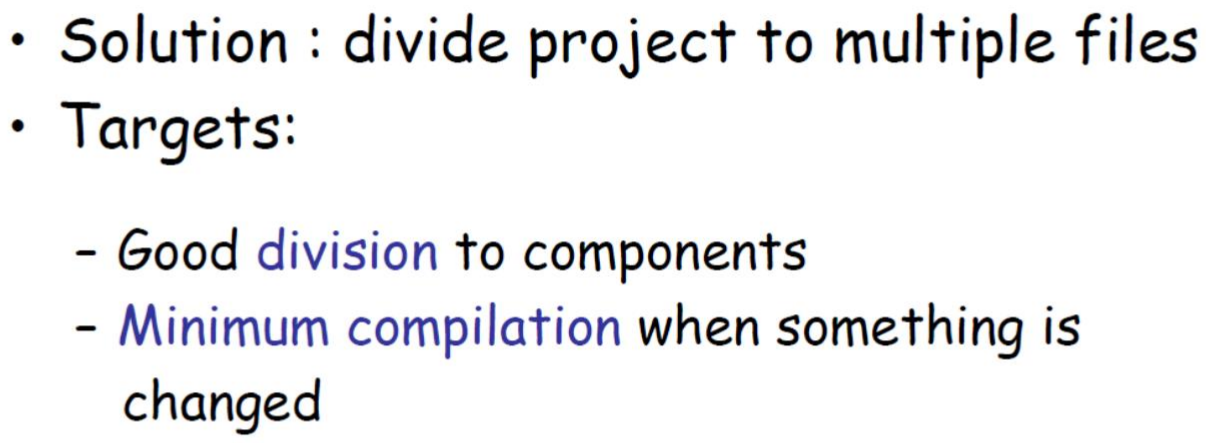
Compiling with several files



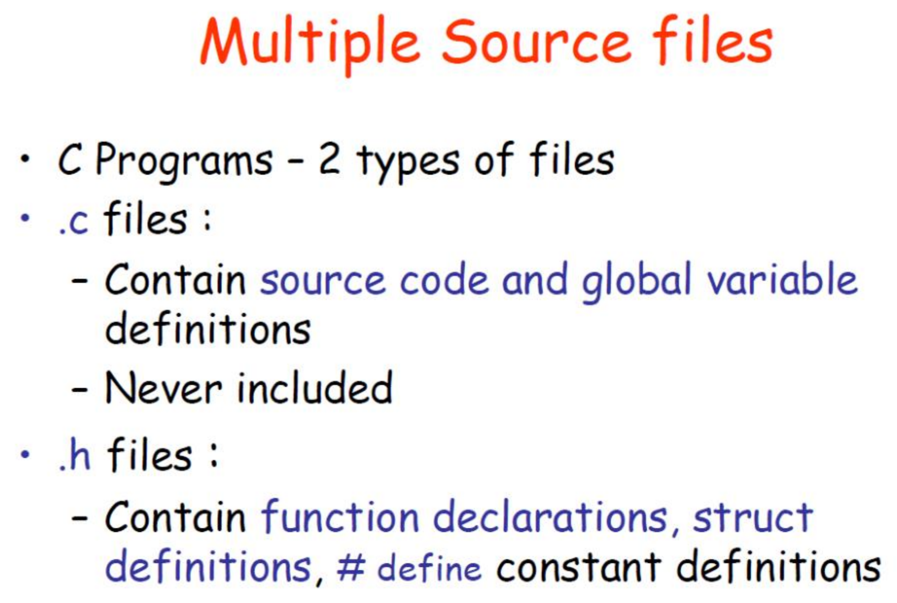


Motivation

- Small programs $\longrightarrow$ single file
- "Not so small" programs :
  - Many lines of code
  - More than one programmer
- Problems:
  - Long files are harder to manage
  - Every change requires long compilation
  - Many programmers can not modify the same file simultaneously

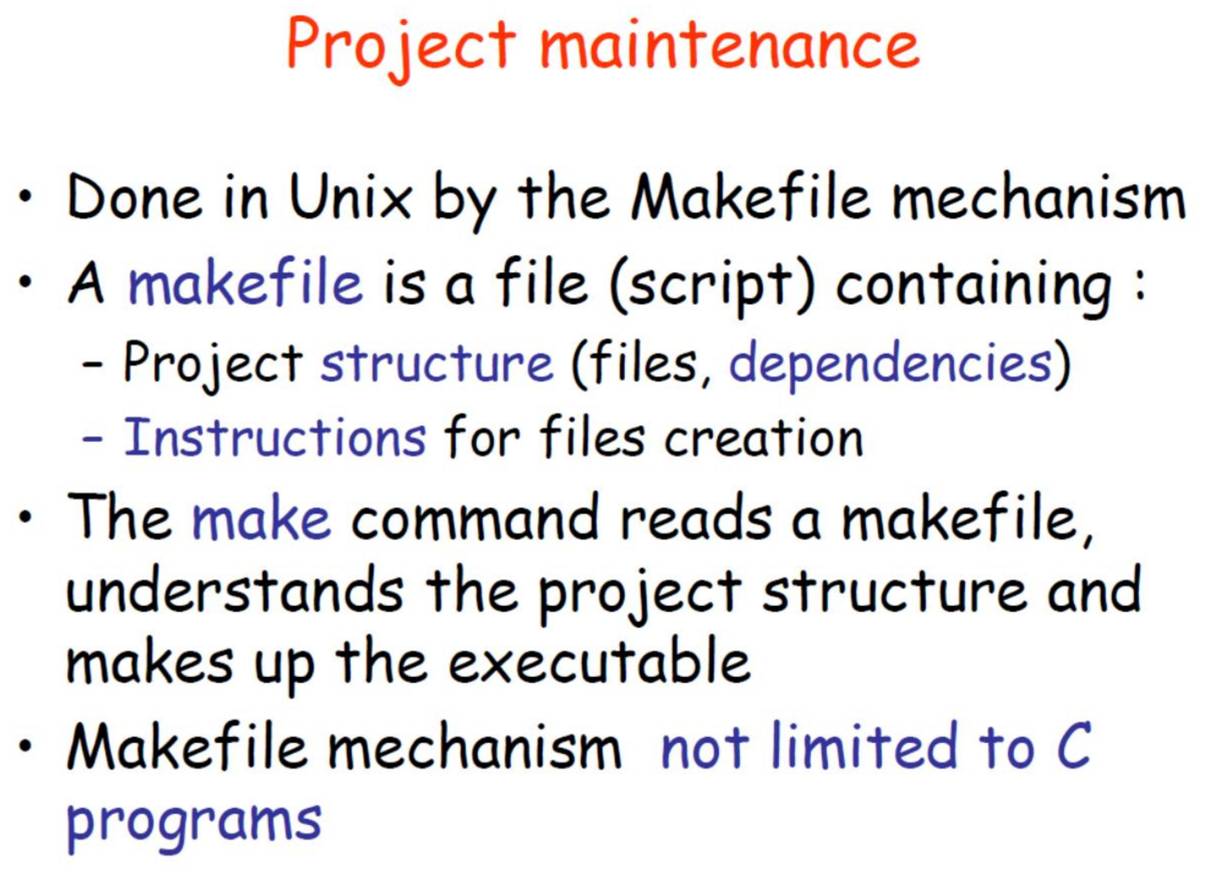


- Solution : divide project to multiple files
- Targets:
  - Good division to components
  - Minimum compilation when something is changed



Multiple Source files

- C Programs – 2 types of files
- .c files :
  - Contain source code and global variable definitions
  - Never included
- .h files :
  - Contain function declarations, struct definitions, # define constant definitions

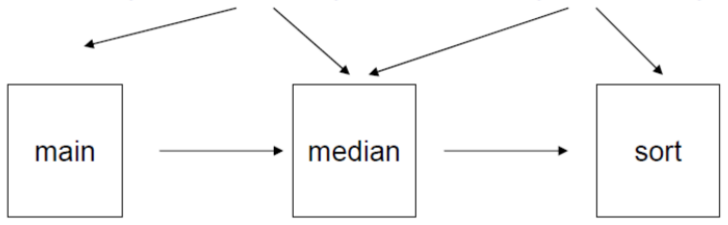


Project maintenance

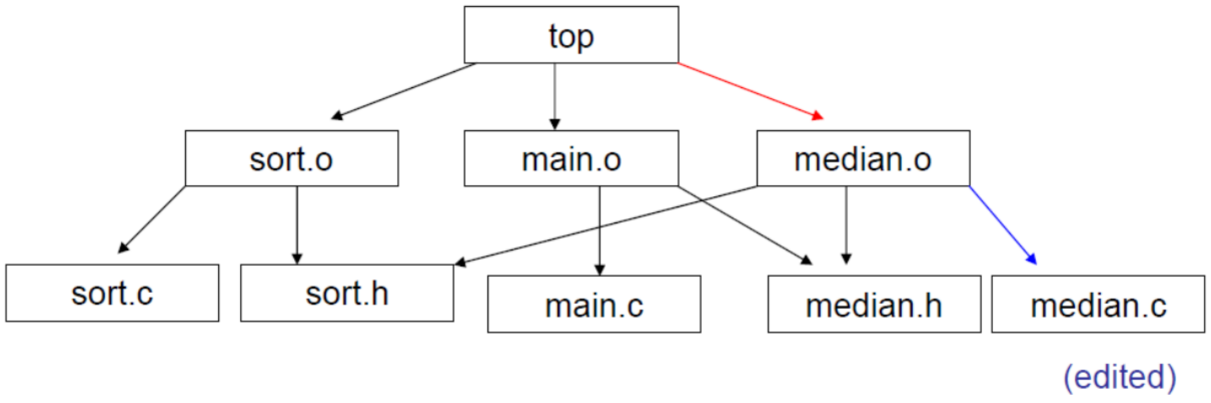
- Done in Unix by the Makefile mechanism
- A makefile is a file (script) containing :
  - Project structure (files, dependencies)
  - Instructions for files creation
- The make command reads a makefile, understands the project structure and makes up the executable
- Makefile mechanism not limited to C programs

Project structure

- Project structure and dependencies can be represented as a graph
- Example given in previous lab session :
  - Program contains 5 files
  - main.c, median.h, median.c, sort.h., sort.c

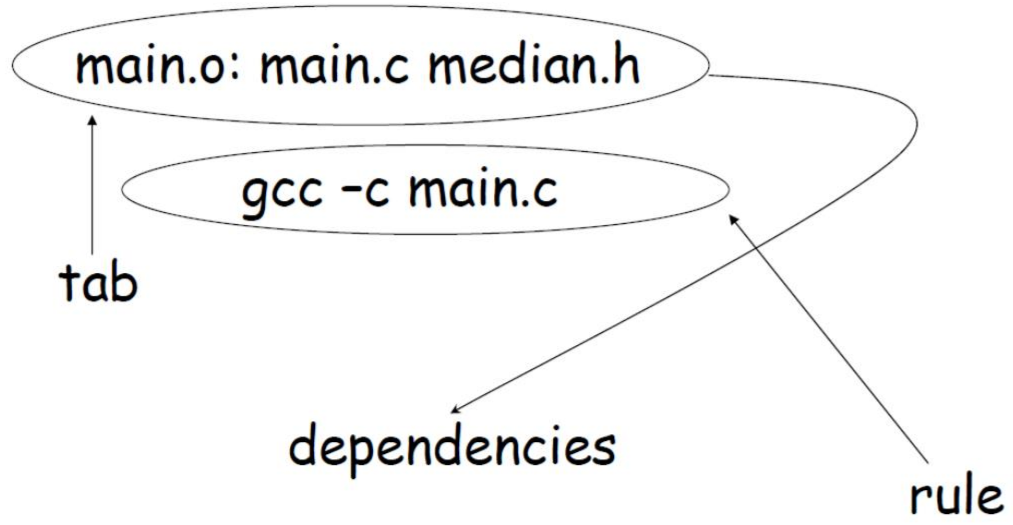


Dependency Graph

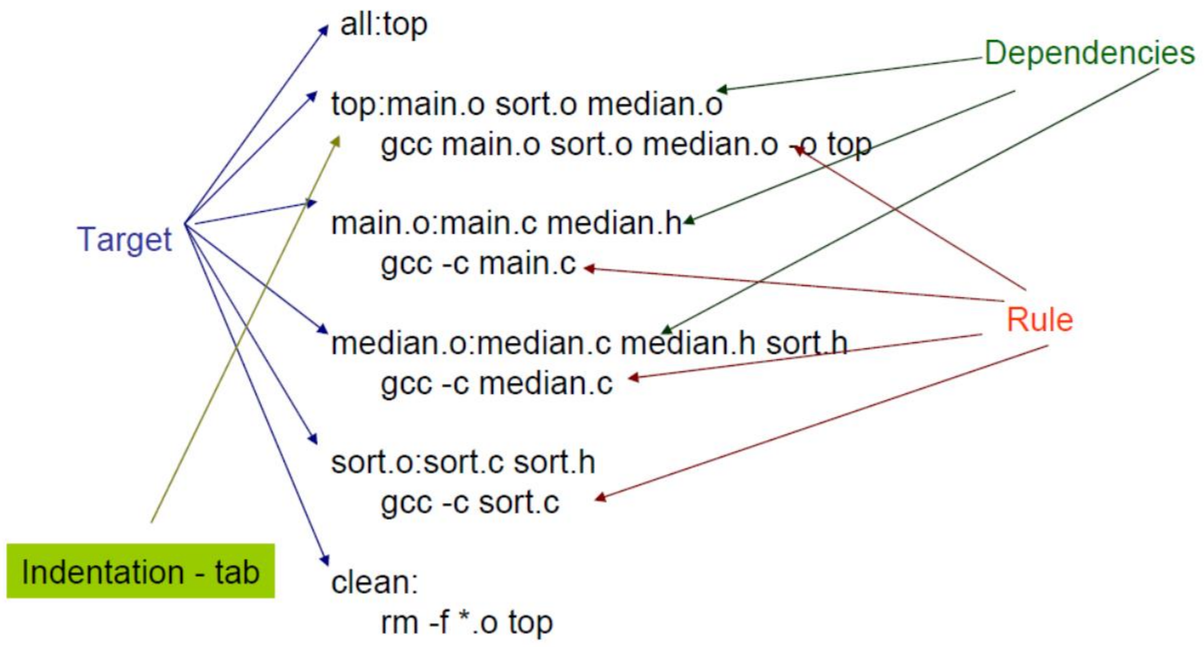


- If median.c is edited
  - gcc -c median.c
  - gcc median.o main.o sort.o -o top

Makefile syntax



Makefile Eg



```
all:top
top:main.o sort.o median.o
	gcc main.o sort.o median.o -o top
main.o:main.c median.h
	gcc -c main.c
median.o:median.c median.h sort.h
	gcc -c median.c
sort.o:sort.c sort.h
	gcc -c sort.c
clean:
	rm -f *.o top
```

Makefile (contd)

```
CC=gcc
CFLAGS=-c -Wall

all:top

top:main.o sort.o median.o
    $(CC) main.o sort.o median.o -o top

main.o:main.c
    $(CC) $(CFLAGS) main.c

sort.o:sort.h sort.c
    $(CC) $(CFLAGS) sort.c

median.o:median.h median.c
    $(CC) $(CFLAGS) median.c

clean:
    rm -f *.o top
```

```
CC=gcc
CFLAGS= -Wall
OBJS=median.o main.o sort.o

all:top

top:$(OBJS)
median.o:median.h sort.h
sort.o:sort.h
main.o:median.h

clean:
    rm -f *.o top
```