

make

# Why make?

- Keeps track of what has changed and what needs to be updated
- Allows us to define commands once so we don't have to remember them each time
- Allows us to create a repeatable process

# Makefile

- The “Makefile” tells the make command what to do
- A Makefile consists of a list of “targets”
  - Each target is something you can make
- Each target contains...
  - A list of dependencies... if these are new, the target needs to be rebuilt
  - A “recipe” to build the target from the dependencies

# Example

- Target... the “filter” command (e.g. project 3)
- Dependencies: the filter.c file
  - If filter.c is new, filter needs to be rebuilt
- “New” means the dependency has a file write time/date stamp newer than the target time/date stamp
  - If filter.c has been edited since the last build, filter needs to be rebuilt
- Recipe: `gcc -Wall -o filter filter.c`
  - Creates the filter command from the filter.c file

In the Makefile...

```
filter : filter.c
```

```
    gcc -Wall -o filter filter.c
```

# In the Makefile...

Dependencies

**filter** : filter.c

**gcc -Wall -o filter filter.c**

Target

Required Tab

Recipe

# “Pseudo” targets

- If a target is not actually a file, it is called a “pseudo” target
- Pseudo targets are always considered as “ancient”... always older than the dependencies
- Therefore, pseudo-targets are always rebuilt

# Examples Pseudo-Target

test : filter

./filter Mary Alice <input.txt

- “test” is always older than filter.
- Whenever we “make test”, the recipe is run.



# Dependencies that are Targets

- If a dependency is also a target in the Makefile, make will try to build the dependency first
- After building the dependency, make checks to see if the target needs to be built as well

# Example with Target Dependencies

test : filter

./test Mary Alice <input.txt

filter : filter.c

gcc -Wall -g -o filter filter.c

# Example with Target Dependencies

test : filter

./test Mary Alice <input.txt

filter : filter.c

gcc -Wall -g -o filter filter.c

- make test
  - filter is a dependency AND a target!
  - make invokes make filter
    - If filter.c is newer than filter
      - runs gcc ...
  - make builds “test” target
    - runs ./test Mary ...

# Typical Targets

- all – build all executable files
- test – test all executable files
- install – build and install executables (usually needs special authority)
- clean – remove all the files created by make
  - If something goes wrong, it can often be fixed by “make clean” “make”

# make default

- make with no arguments...
- If there is an “all” target, does a “make all”
- Otherwise, does a make for the first target in the Makefile

# Resources

- Programming in C, Chapter 14 – The Make Utility
- GNU On-Line Make manual

[http://www.gnu.org/software/make/manual/html\\_node/index.html](http://www.gnu.org/software/make/manual/html_node/index.html)

- Make Tutorial <http://mrbook.org/blog/tutorials/make/>