COMP26020 Programming Languages and Paradigms Part 1: C Programming

# Automated Compilation

# Incremental Build

```
# Initial build:
gcc -c network.c -o network.o
gcc -c parser.c -o parser.o
gcc -c main.c -o main.o
gcc main.o network.o parser.o -o prog

# Assume we update parser.c, to rebuild we don't need to recompile everything:
gcc -c parser.c -o parser.o
gcc main.o network.o parser.o -o prog

# Now we update parser.h, remember it's included in both parser.c and main.c, so:
gcc -c parser.c -o parser.o
gcc -c main.c -o main.o
gcc main.o network.o parser.o -o prog
```
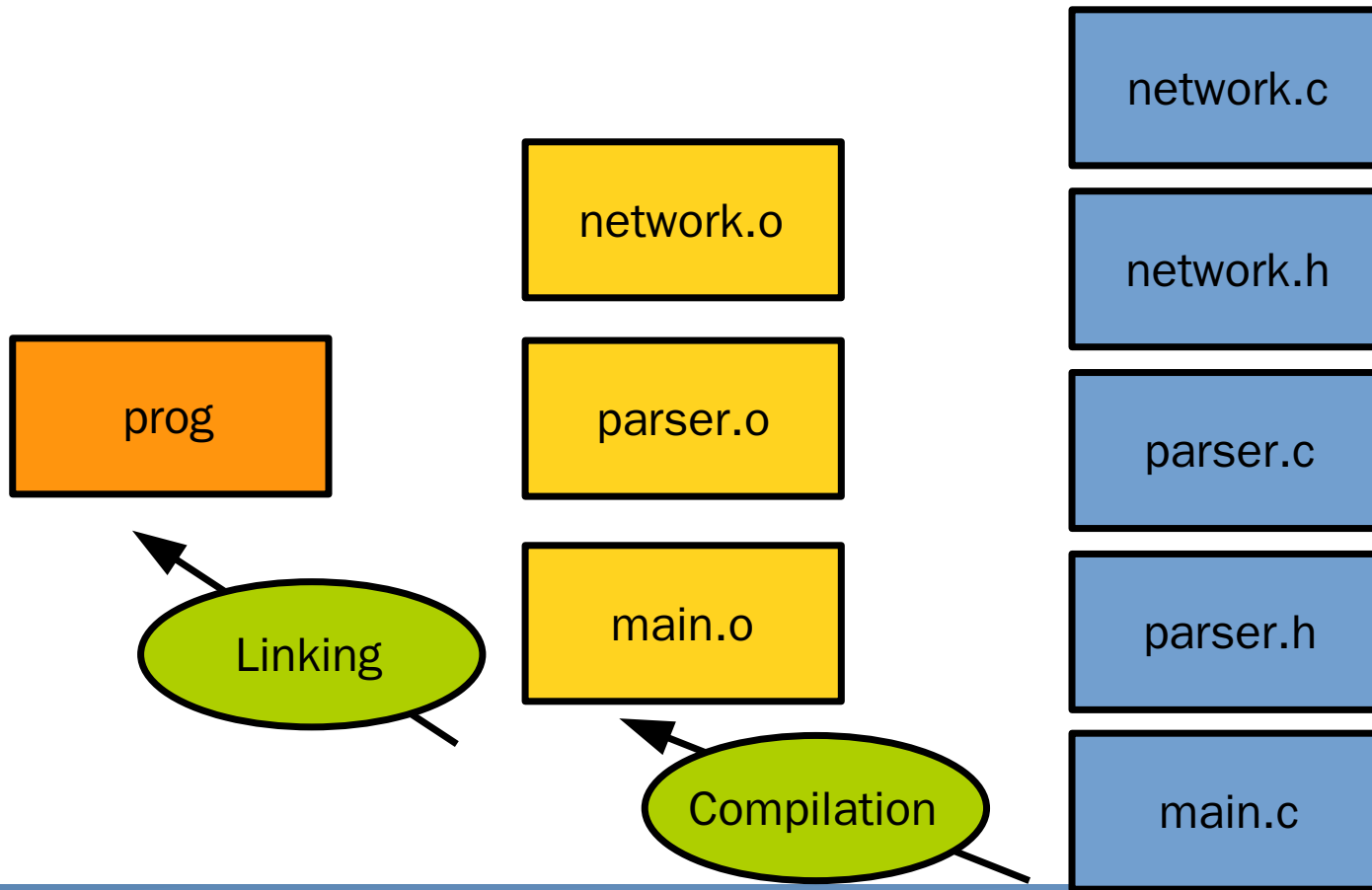
- **How to automate dependency management and the build process itself?**

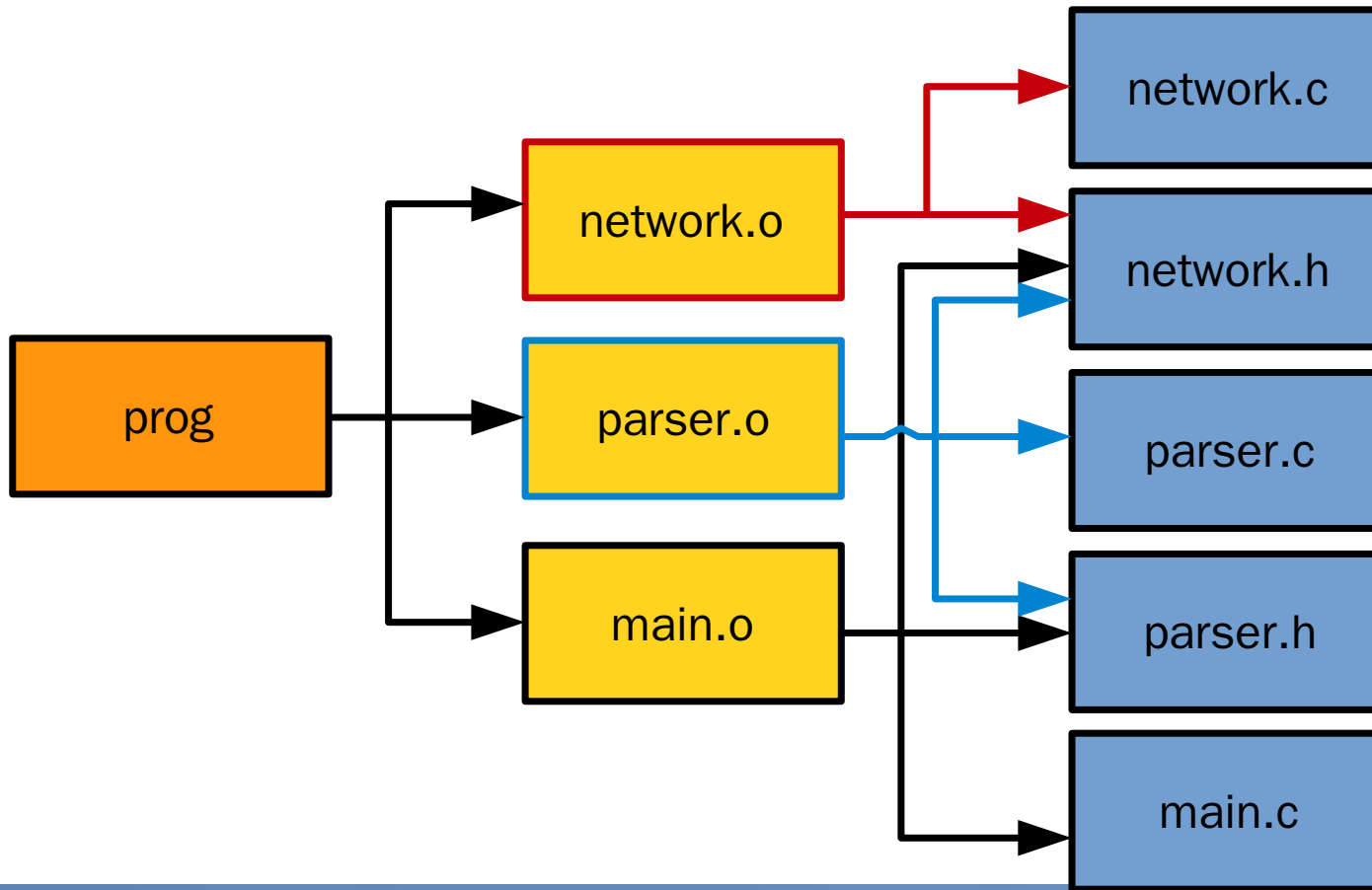# Makefiles: Automated Build and Dependency Management

# Makefiles

- Let's consider the dependencies in our example program

network.c

network.h

parser.c

parser.h

main.c

network.o

parser.o

main.o

prog

Linking

Compilation

# Makefiles

- Let's consider the dependencies in our example program

# Makefiles

- Text file named `Makefile` in the local source directory

```
# The first rule is executed when the
# command make is typed in the local folder:
all: prog

# executable deps and command to buil1d it:
prog: main.o network.o parser.o
    gcc main.o network.o parser.o -o prog

# network.o deps and command to build it:
network.o: network.c network.h
    gcc -c network.c -o network.o

parser.o: parser.c parser.h network.h
    gcc -c parser.c -o parser.o

main.o: main.c network.h parser.h
    gcc -c main.c -o main.o

# Special rule to remove all build files
clean:
    rm -rf *.o prog
#
```
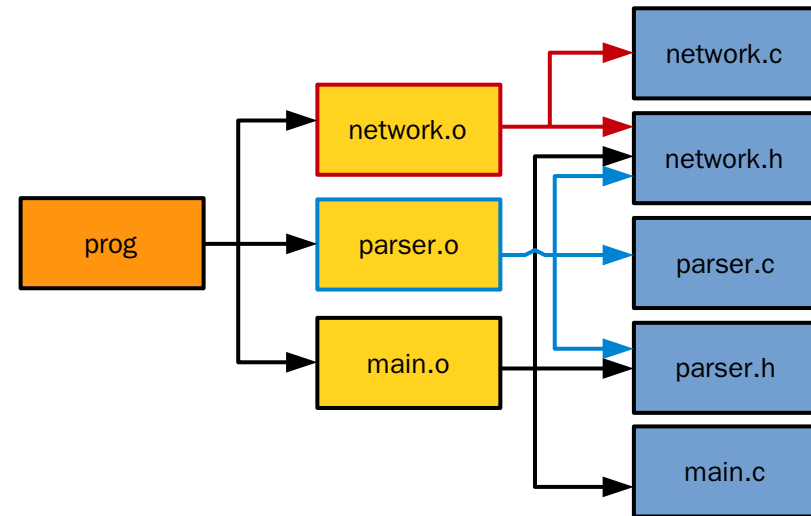
17-automated-compilation/automated-compilation.zip



## Rule syntax:

```
<target>: <dependencies>
[TAB]    <command to build target from deps>
```

# Makefiles

```
$ make
gcc -c main.c -o main.o
gcc -c network.c -o network.o
gcc -c parser.c -o parser.o
gcc main.o network.o parser.o -o prog

$ make                  # try to rebuild without having modified anything
make: Nothing to be done for 'all'.

$ touch network.c     # update network.c
$ make
gcc -c network.c -o network.o
gcc main.o network.o parser.o -o prog

$ touch parser.h      # update parser.h
$ make
gcc -c main.c -o main.o
gcc -c parser.c -o parser.o
gcc main.o network.o parser.o -o prog

make clean
rm -rf *.o prog
```

# Summary

- C/C++ application build automation and dependency management with Makefiles

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Feedback form: https://bit.ly/37uMy09