Advanced Programming in the UNIX Environment

Week 05, Segment 5: Unix Development Tools: The Compiler Chain, Part III

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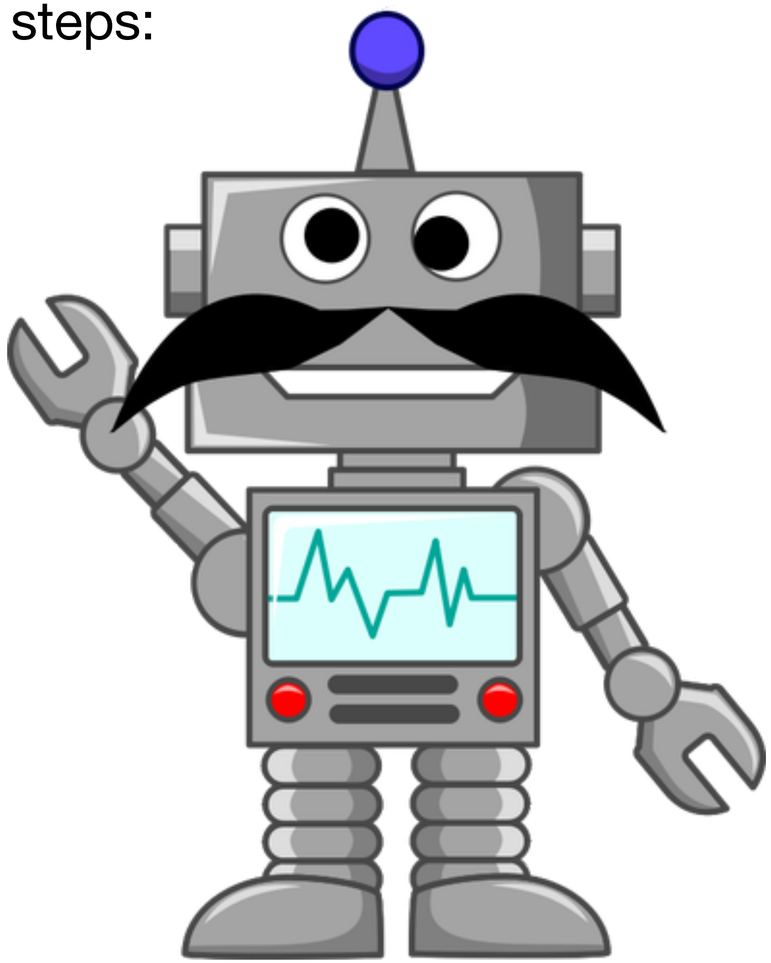
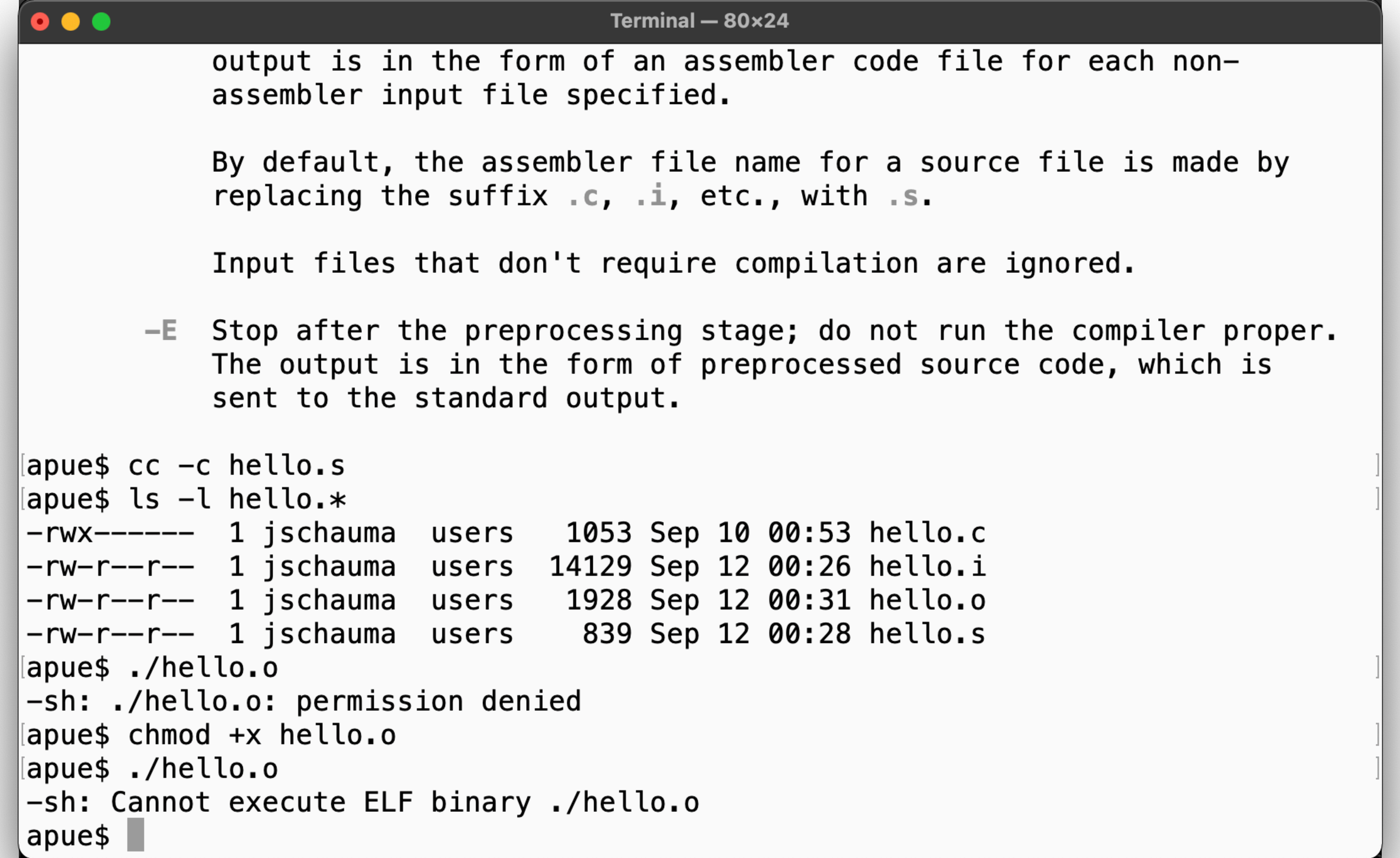
The GNU Compiler Collection

A compiler translates *source code* from a high-level programming language into *machine code* for a given architecture by performing a number of steps:

- preprocessing — `cpp(1)` ✅
- lexical analysis
- syntax analysis
- semantic analysis
- code generation
- code optimization

  (lexical analysis … code optimization — `cc(1)`)
- assembly — `as(1)`
- linking — `ld(1)` ⏩




Terminal — 80×24
output is in the form of an assembler code file for each non-
assembler input file specified.
By default, the assembler file name for a source file is made by
replacing the suffix .c, .i, etc., with .s.
Input files that don't require compilation are ignored.
-E Stop after the preprocessing stage; do not run the compiler proper.
The output is in the form of preprocessed source code, which is
sent to the standard output.
apue$ cc -c hello.s
apue$ ls -l hello.*
-rwx------ 1 jschauma users 1053 Sep 10 00:53 hello.c
-rw-r--r-- 1 jschauma users 14129 Sep 12 00:26 hello.i
-rw-r--r-- 1 jschauma users 1928 Sep 12 00:31 hello.o
-rw-r--r-- 1 jschauma users 839 Sep 12 00:28 hello.s
apue$ ./hello.o
-sh: ./hello.o: permission denied
apue$ chmod +x hello.o
apue$ ./hello.o
-sh: Cannot execute ELF binary ./hello.o
apue$

The GNU Compiler Collection

The compiler chain or driver usually performs preprocessing (*e.g.* via `cpp(1)`), compilation (`cc(1)`), assembly (`as(1)`) and linking (`ld(1)`).

- use `cc(1)` with the "`-S`" flag to stop after compilation
- use the "`-OX`" flags to set optimization
- assemble intermediate code to machine-dependent object files using `as(1)` or "`cc -c`"

To be continued…