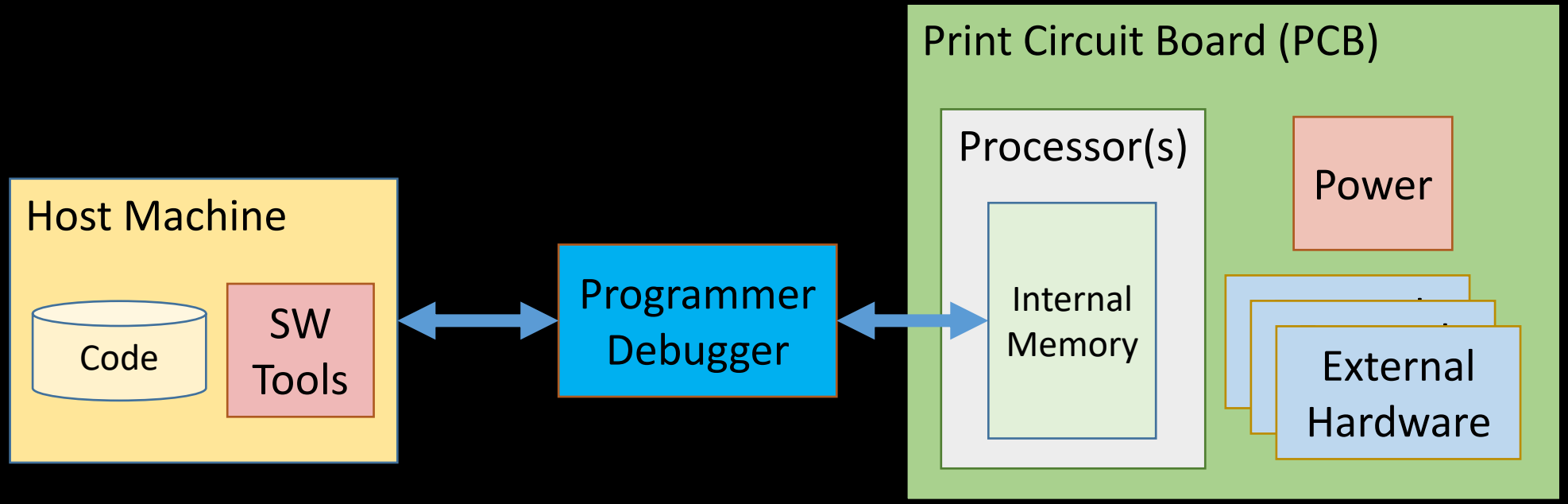
Embedded Software Essentials

Introduction to Build Systems using GNU Toolsets

C1 M2 V1

Copyright

Embedded System Development Platform



The host machine contains our Build Environment

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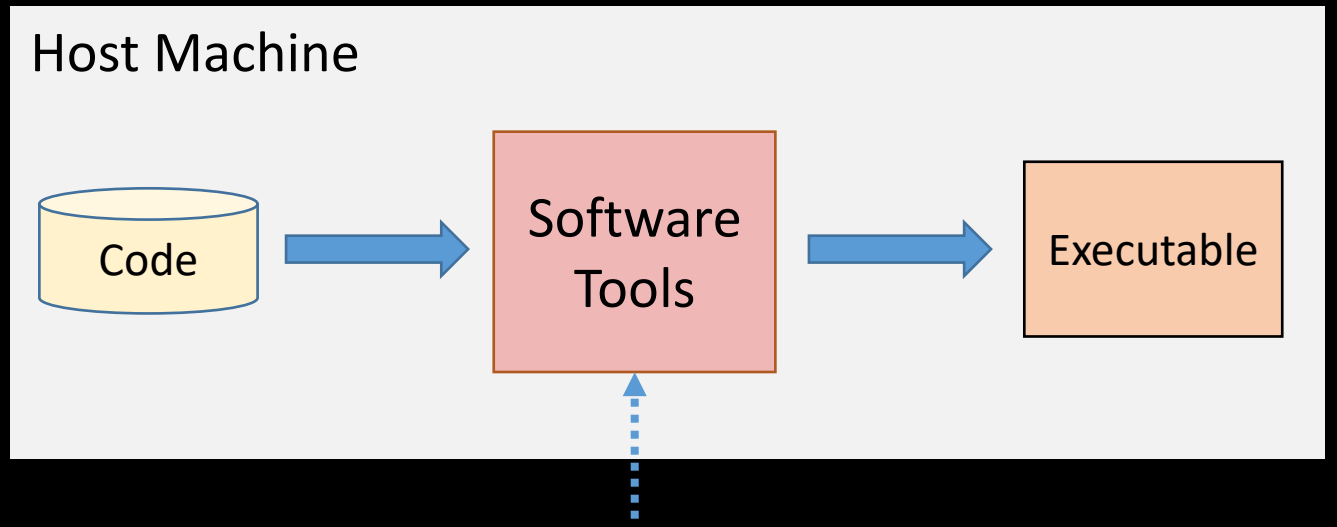
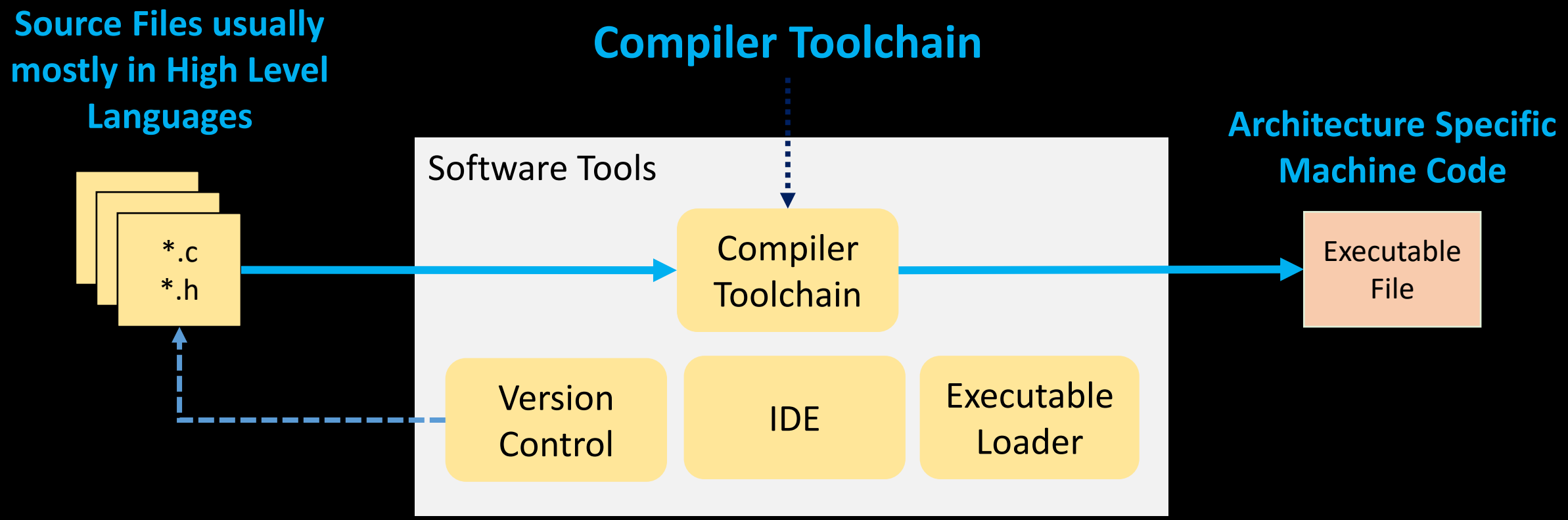


Software Engineer's Tools include Compiler Toolchain

- GCC – GNU's Compiler Collection
- Make

Software Tools



Building a Software Project

C-Programming (High Level Language)

```
int x = 0;
int y = 20;
int z = 5;
    …
while (y >= z) {
  y = y – z;
  x++;
}
```

ARM Assembly Language (Low Level Language)[1]

```
    ldr   r2, (y)
    ldr   r3, (z)
    ldr   r4, (x)
LOOP:
    sub   r2, r3
    inc   r4
    cmp   r2, r3
    bgt   LOOP
    str   r2, (y)
    str   r4, (x)
```

[1] (x),(y),(z) = Pseudocode

Machine Code (Binary encoded Assembly Instructions) [2]

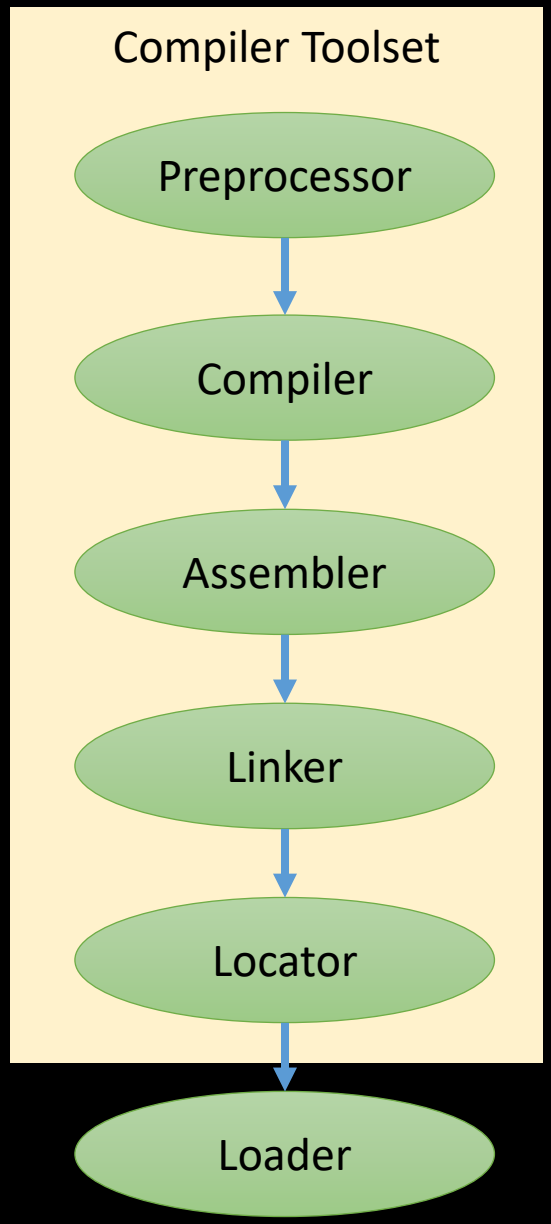
```
0x0c1b
0x7023
0x2302
0x71bb
0x2300
0xf7ff ef24
0xc407
0x8023
0x3402
```

[2] Machine code just an example

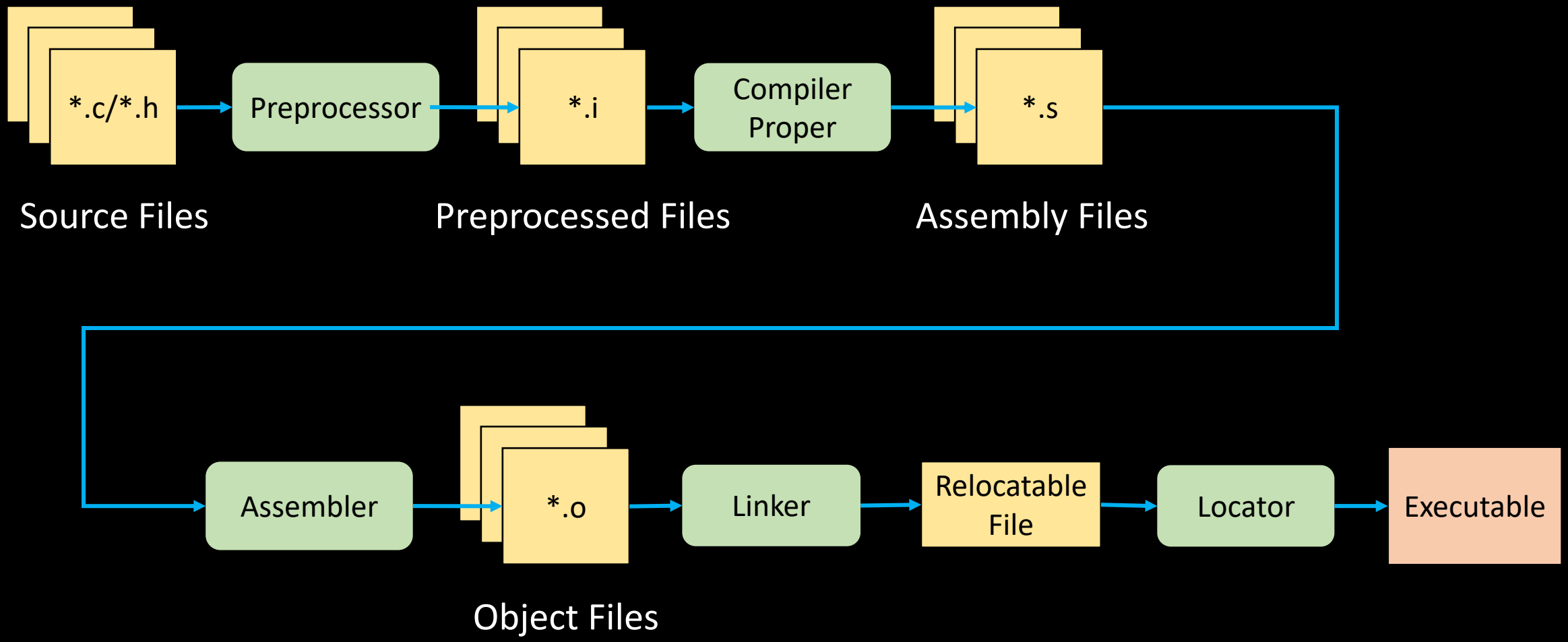
Building a Software Project

- Build and Install Process:
  - Preprocessing
  - Assembling
  - Compiling
  - Linking
  - Locating
  - Installing

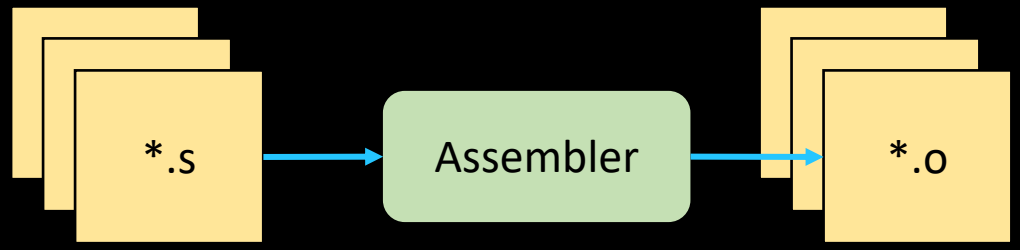
- Installation will require other tools

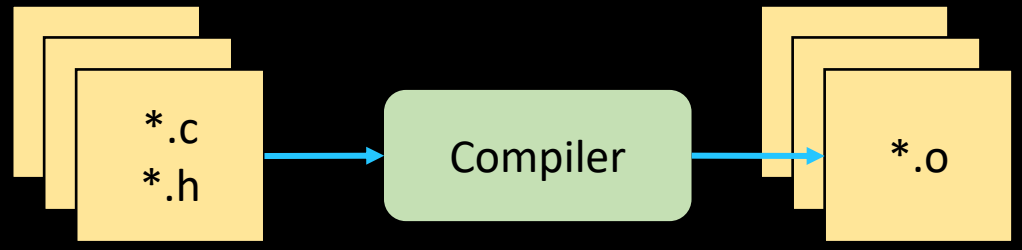


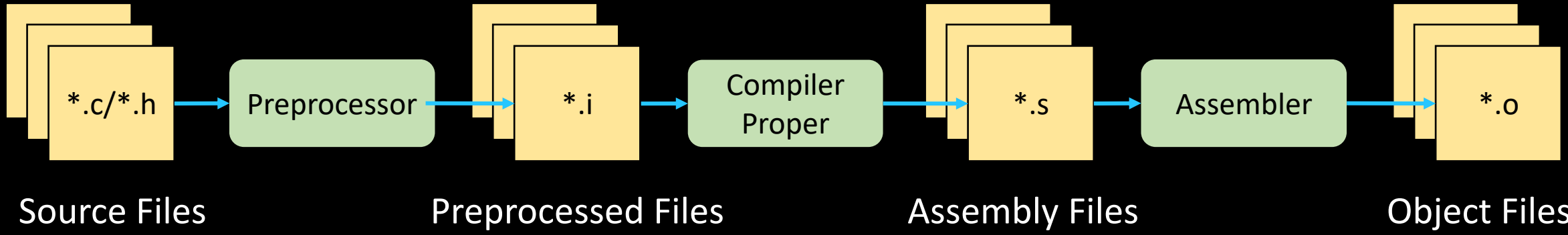
Build Process (linear)



Compilation (No Linking)







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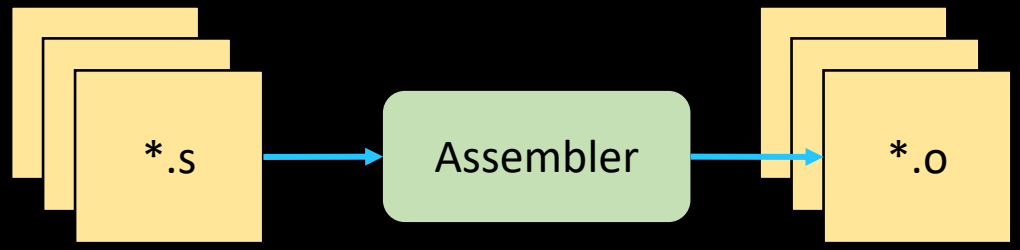
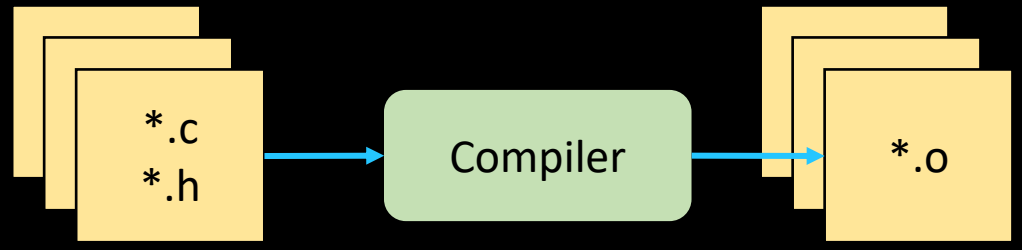
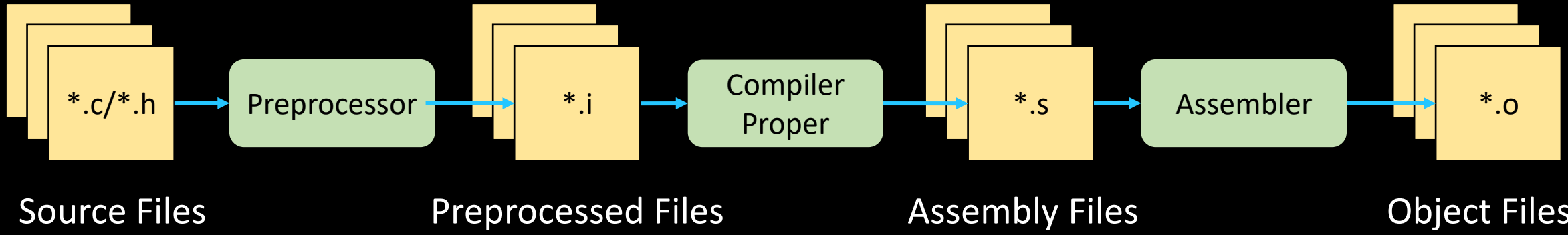
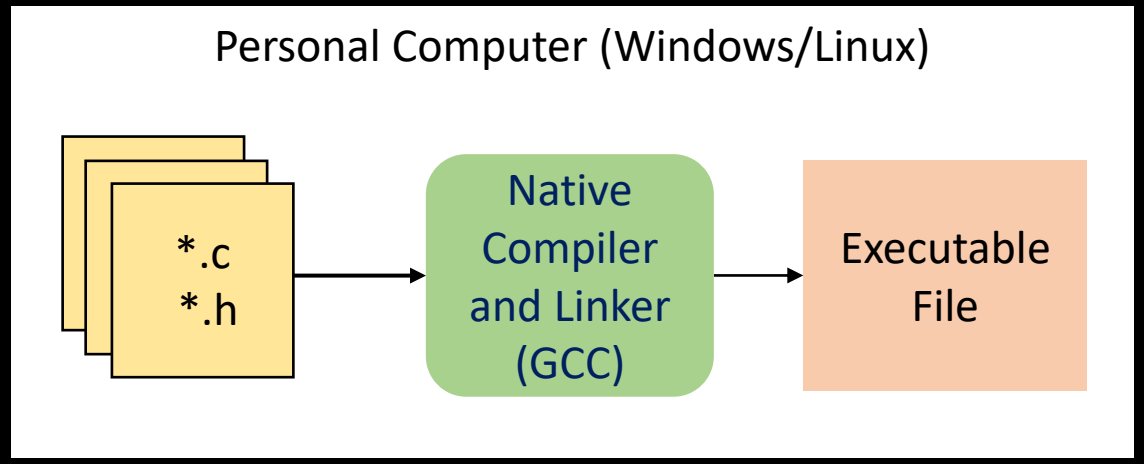






Native Compilation

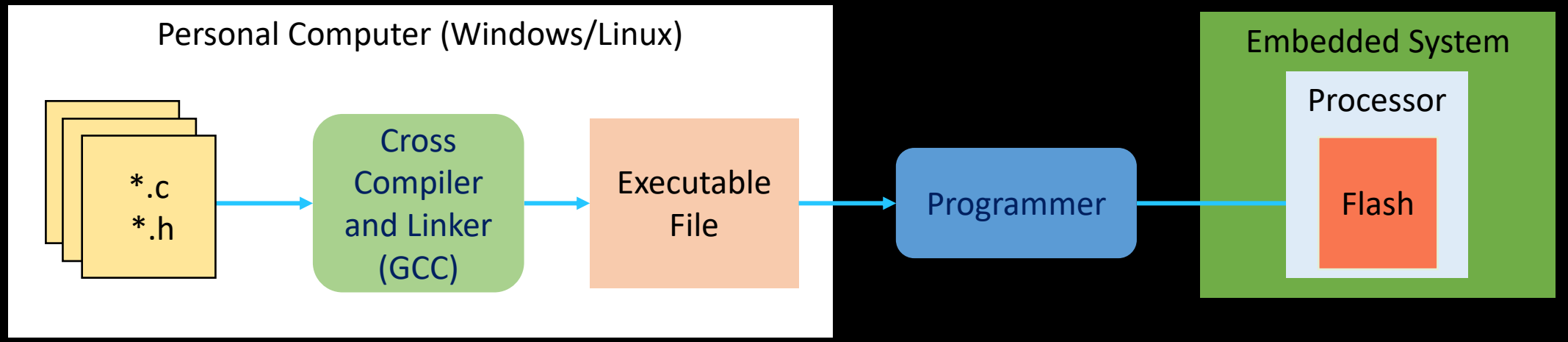
- Compile an executable on one system and it is intended to run on same system



No hardware needed

Cross Compilation

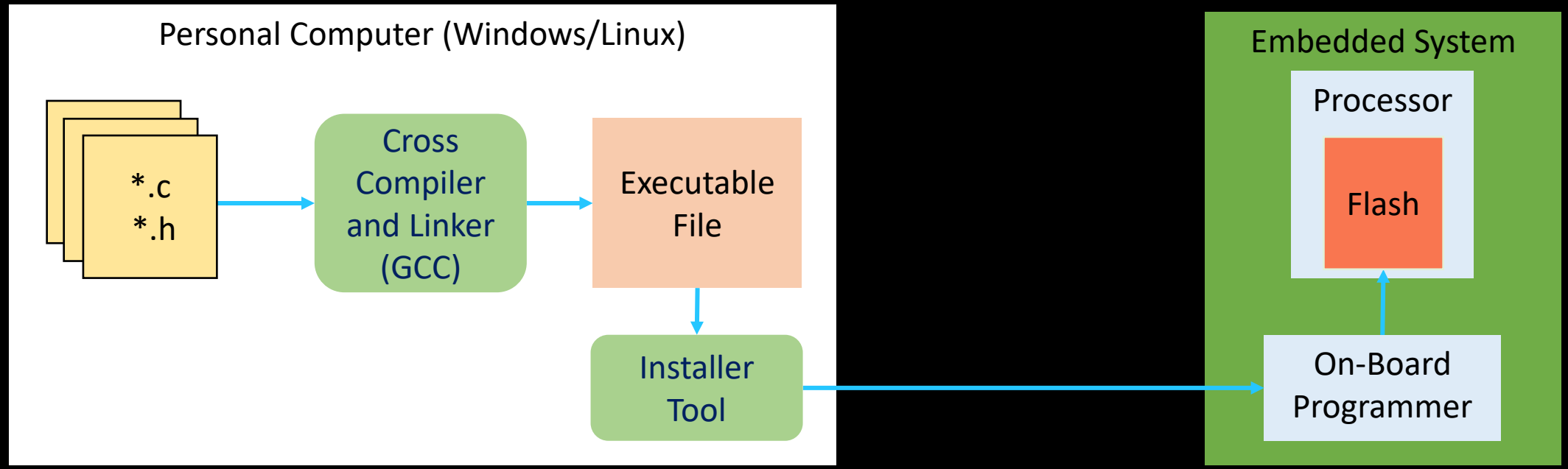
- Compile an executable on one system and it is intended to run on another



Programmer HW needed for Install

Cross Compilation

- Installer tool sends executable to on board programmer
  - No external hardware needed



Compiler Toolchain

- **GCC = GNU's Compiler Collection**
  - Contains many tools (compiler, assembler, linker, etc)
- **GNU Make**
  - "Tool that controls the generation of executables and other non-source files of a program from the program's source files"[2]