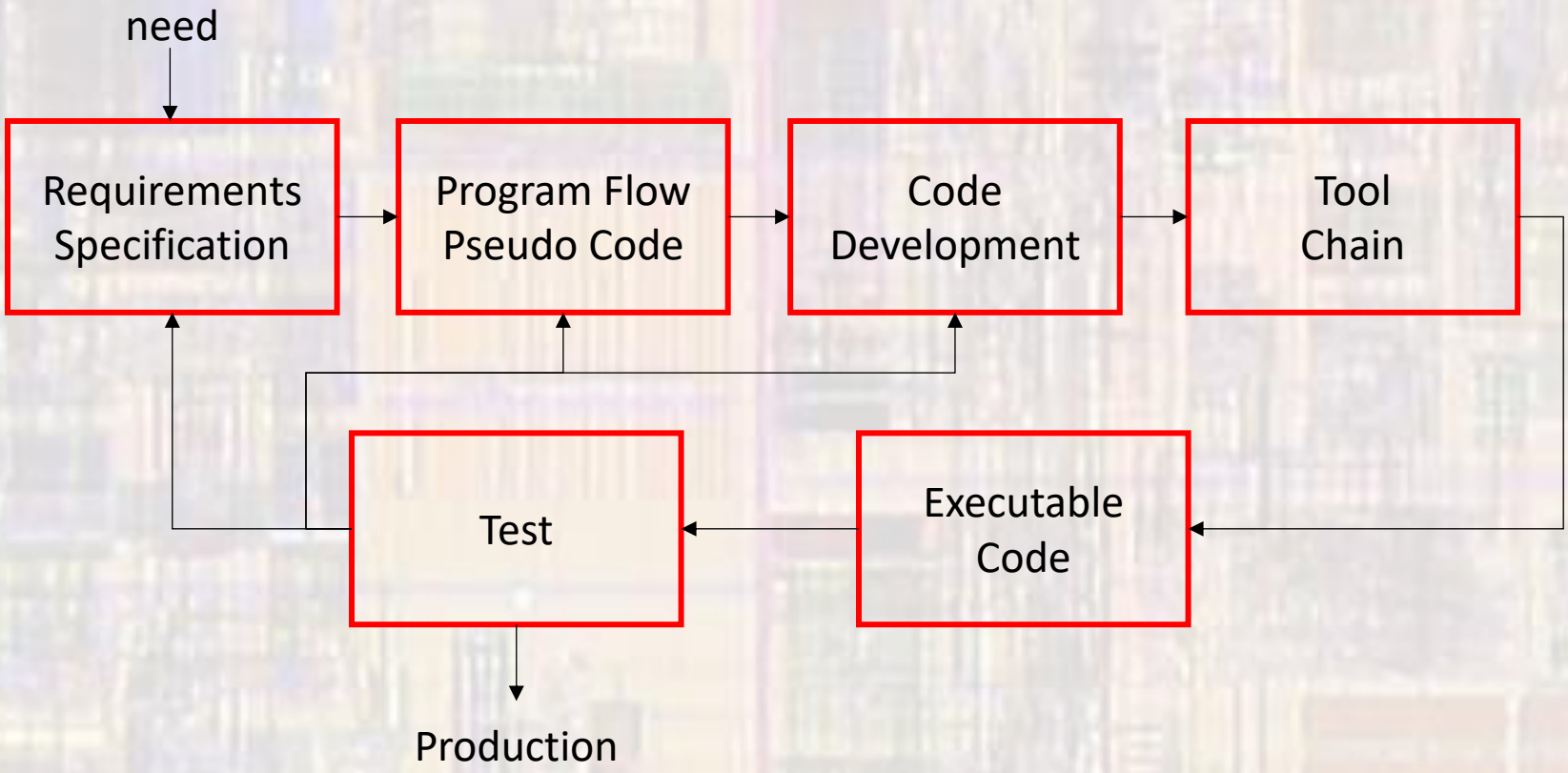
Tool Chain

Last updated 10/8/25

These slides introduce the software development tool chain

Tool Chain

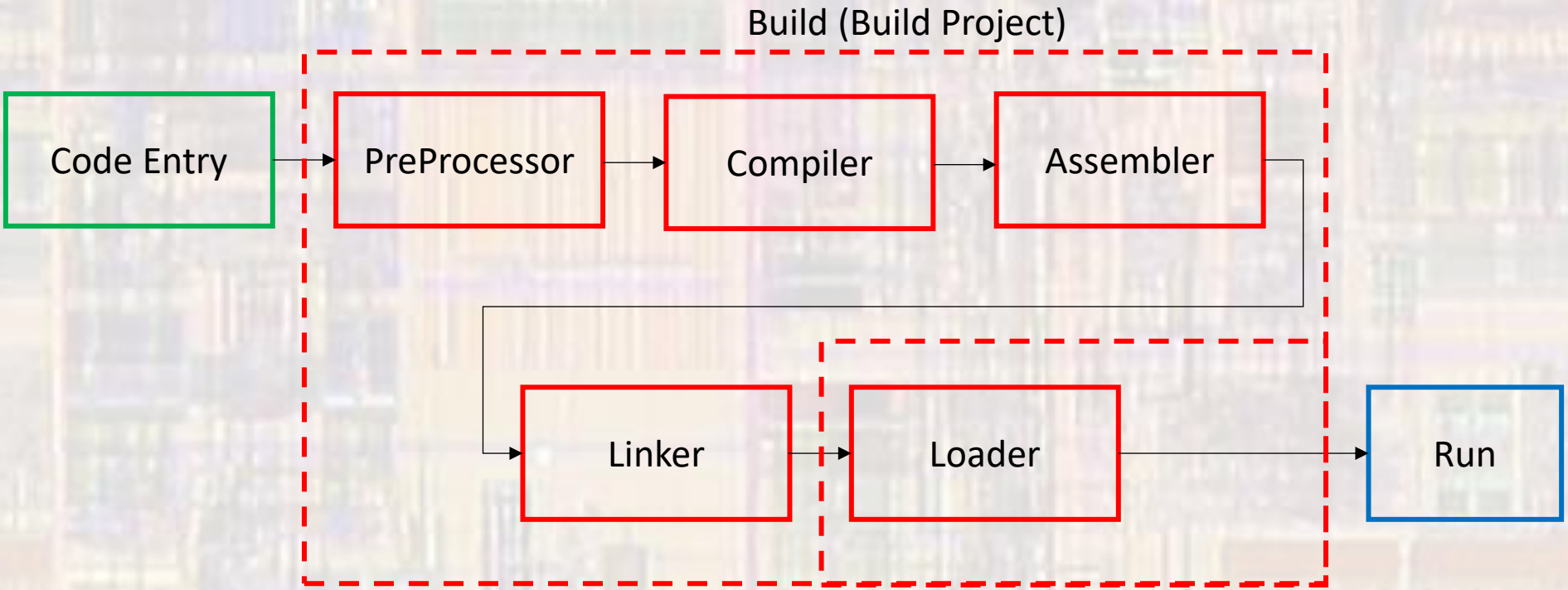
- Development process



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Tool Chain

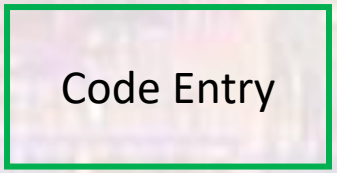
- Tool Chain



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Tool Chain

- Code Entry



  - In C, the code goes into a file with a .c extension
    - filename.c
  - Any text editor can be used to create the code file
  - An Integrated Development Environment (IDE) provides additional features
    - Code checking and hints
    - Color coding
    - Debugging tools
  - We use Eclipse
    - Basis for TI (code composer) and STM (STM Cube) IDEs
  - You may also use Visual Studio (not for this class)
    - Integrated IDE for Windows

Tool Chain

- Preprocessor



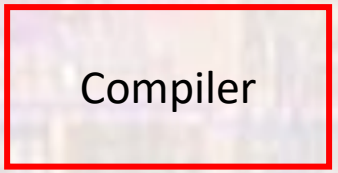
  - Deals with any commands starting with #

  - Tells the tool chain to include additional libraries
  - Replaces any “defines” throughout the code
  - Expands macros throughout the code
  - Manages any conditional defines

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Tool Chain

- Compiler



  - Converts c-code to assembly language

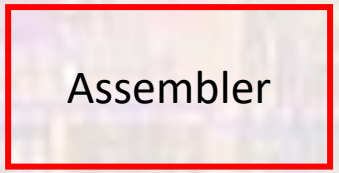
  - Assembly language
    - Architecture specific programming language
      - ARM7, ARM9, RISCV, Intel ix, …
    - Direct access to specific registers, commands, memory

```
ldi RD, 5;          // load register RD with the value 5
sts RD, 0x0200;     // copy the value in RD to mem location 0x0200
add RA,RB,RA;       // add the values of RB and RA and store in RA
```


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Tool Chain

- Assembler



  - Converts assembly language to machine language
  - Result is an object file (file.o)

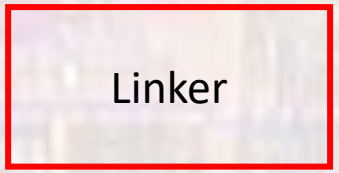
  - Machine language
    - Part specific programming language
      - Arm M3, M4, A7, A15, …
    - Binary representation that the processor understands

```
1000 0000 0100 0101     // load register RB with the value 5
1001 1011 0010 0000     // copy RC to mem location 0x200
0100 0100 0000 0000     // add RB, RA and store in RA
```


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Tool Chain

- Linker

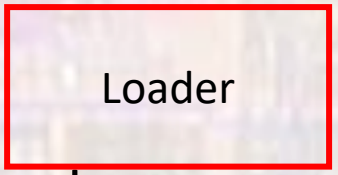


  - Combines the machine language code from your program with all included libraries
  - Configures all the code in memory
    - Aligns code segments
    - Makes connections where necessary (function calls)
    - Assigns variables to locations in memory
  - Creates an executable file
    - file.exe for Windows systems
    - file.out (or no extension) for Linux systems

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Tool Chain

- Loader (programmer)



  - Creates whatever environment is necessary on the executing machine
  - Loads the executable program
  - Starts the program

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