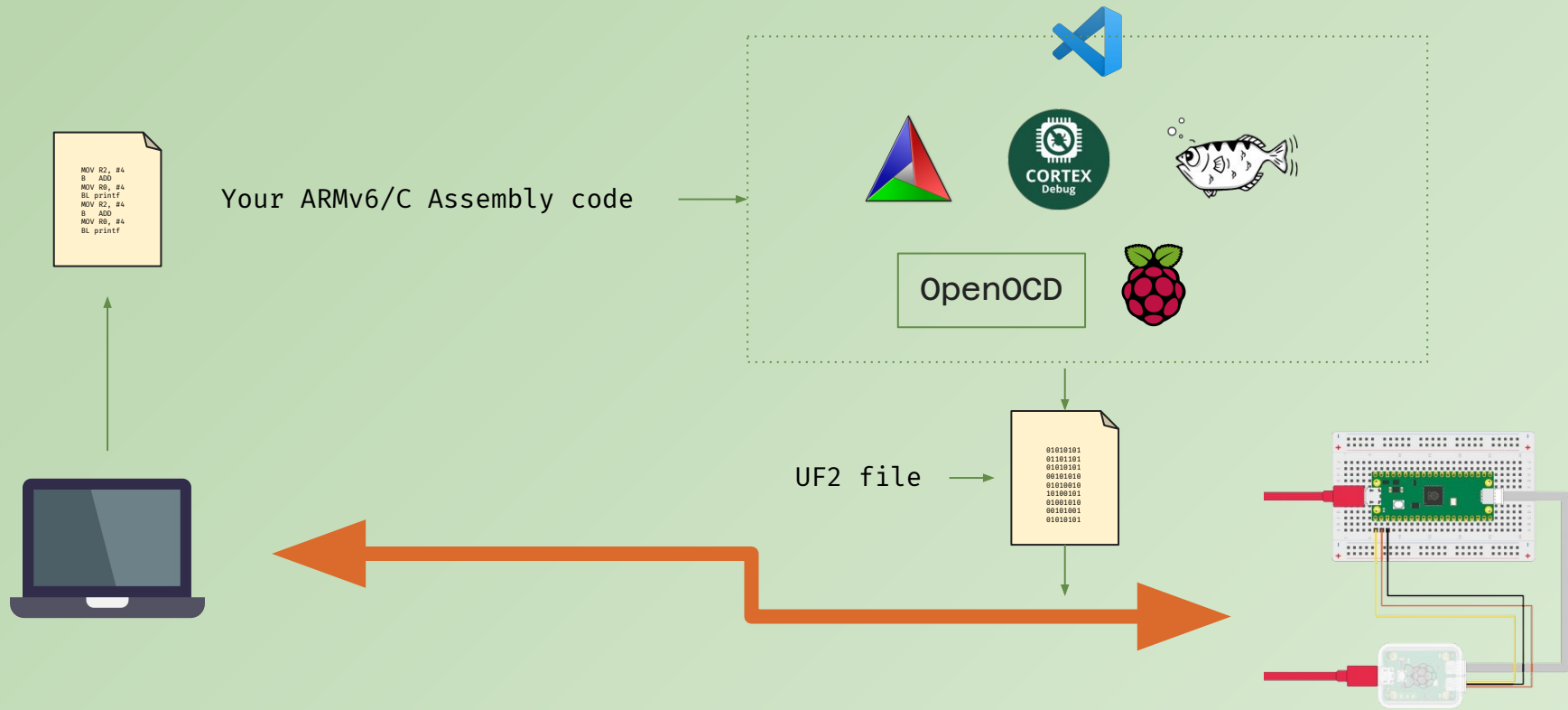


OX **BARE**
CB **METAL**



"Assembly"

**Any language whose
instructions closely
resemble machine-level
operations.**

ARMv6

Instructions

Opcode

MOV

MOV

Destination

R1, R2

Source

R1, [R2]

“Indirect
addressing”

ARMv6

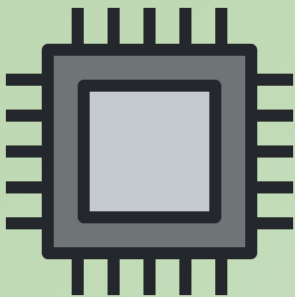
ADDing to our
instruction set

8-bit numbers (#imm8)

3-bit numbers (#imm3)

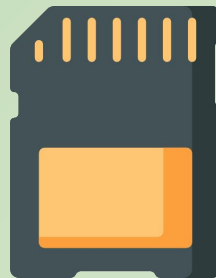
ADD R4, R2, #7
ADD R4, R4, #255
ADD R4, #255
ADD R4, R5
ADD R4, R5, R6

32-bit
numbers



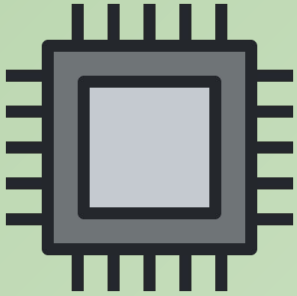
REGISTERS

- On the processor
 - But *are not* the processor
- Called by R[0-12]
- Operates on data
- Limited to 32 bytes of instruction and/or storage



MEMORY

- Outside of processor
- Called by mnemonics like 0x123f
- Cannot be operated on
 - Can only store



R0	
R1	
R2	
R3	
R4	
R5	
R6	
R7	

Data:

- Instruction “word”
- Data “word”
- Memory “word”

Back to basics

Adding two numbers

```
main:
    LDR    R2, =addend1
    LDR    R3, =addend2
    LDRB   R4, [R2]
    LDRB   R5, [R3]
    ADD    R6, R4, R5
    LDR    R0, =output
    MOV    R1, R6
    BL     printf
    B      main

.data
    addend1:    .byte    2
    addend2:    .byte    3
    output:     .asciz    "%d\n"
```


"... [a] most obstinate war ... began upon the following occasion. It is allowed on all hands, that the primitive way of breaking eggs, before we eat them, was upon the larger end; but his present majesty's grandfather, while he was a boy, going to eat an egg, and breaking it according to the ancient practice, happened to cut one of his fingers. Whereupon the emperor his father published an edict, commanding all his subjects, upon great penalties, to break the smaller end of their eggs."

Jonathan Swift, *Gulliver's Travels*

"Endianness"

There are 10 types of people who crack their eggs...

Memory Address Byte Value

X:	AA
X + 1:	BB
X + 2:	CC
X + 3:	DD

(a) Big-Endian

Default Raspberry Pico

Memory Address Byte Value

X:	DD
X + 1:	CC
X + 2:	BB
X + 3:	AA

(b) Little-Endian

Full word Half word

One byte

LDR/LDRB/LDRH

Load contents of
memory into register

STR/STRB/STRH

Store contents of
register in memory

