Identify Instruction Se Architecture

Know a brief history of x86 processors

Understand the lifetime of a program

Name x86 integer registers

Machine Programming

① Instruction Set Architectures

② Machine Programming

Add 5 and 8

011000110101

instructions

instruction set

machine language

words

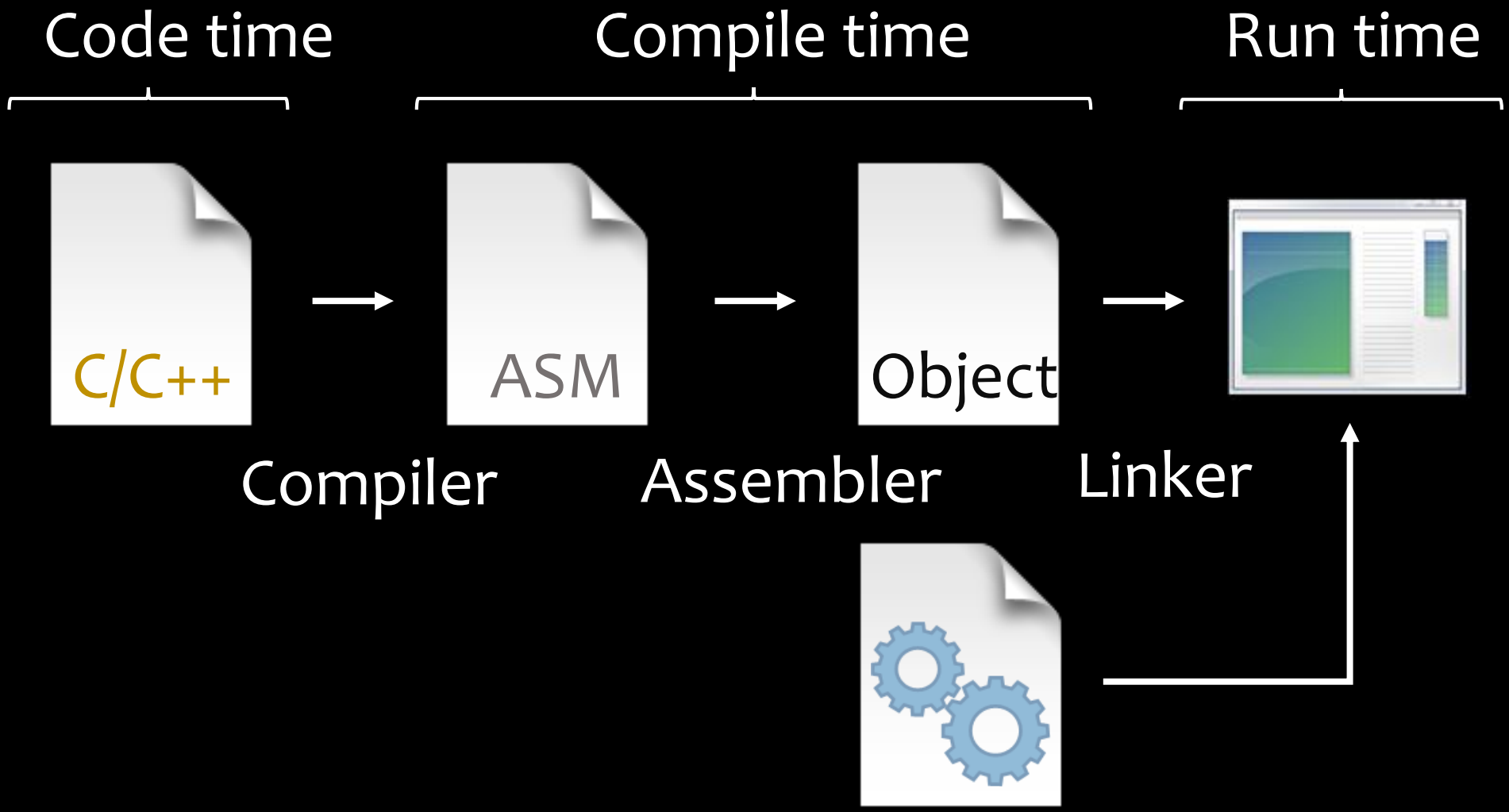
vocabulary

assembly language

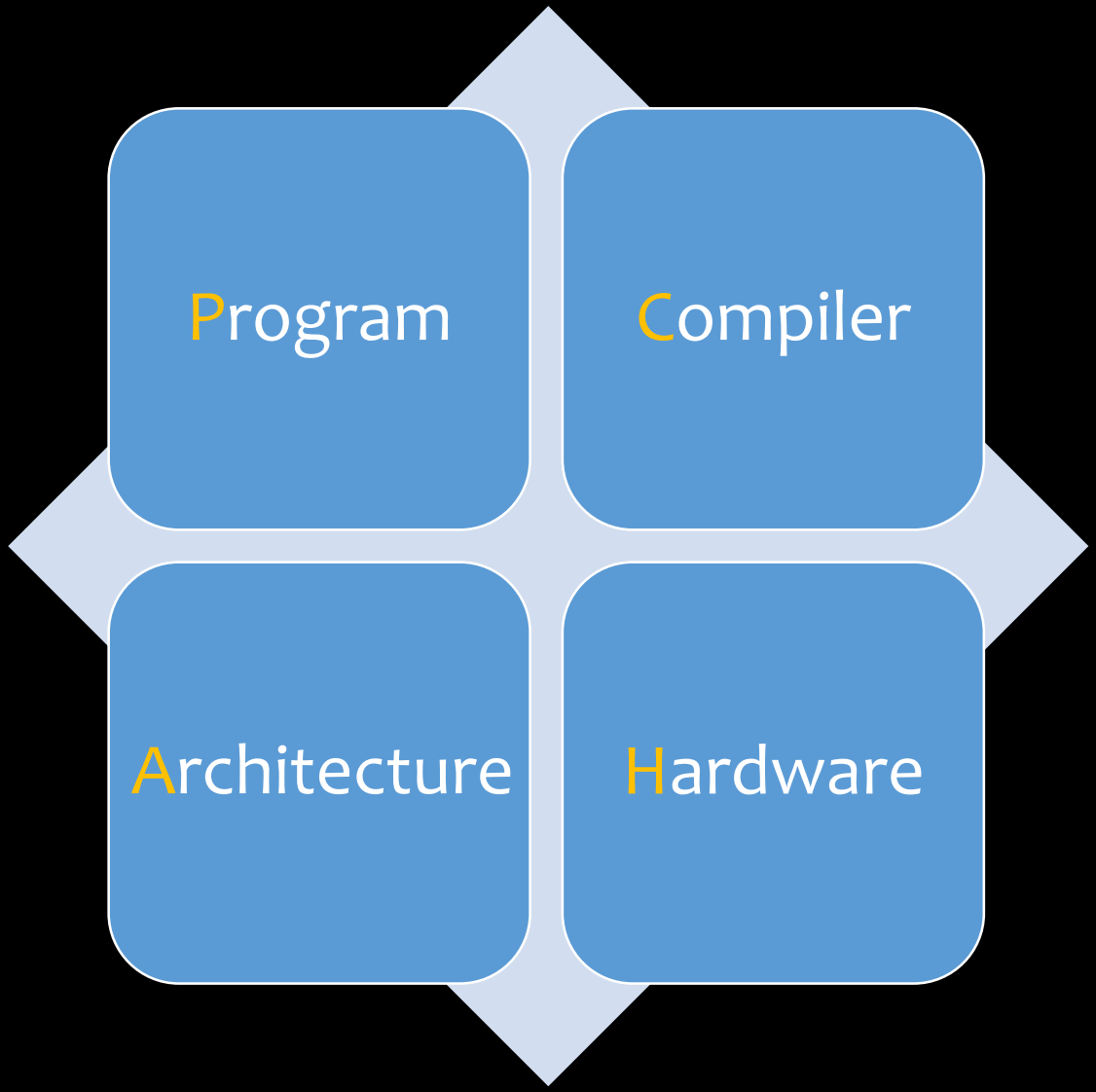
```
55
89 e5
8b 45 0c
03 45 08
89 ec
5d
c3
```

```
push   %ebp
mov    %esp,%ebp
mov    0xc(%ebp),%eax
add    0x8(%ebp),%eax
mov    %ebp,%esp
pop    %ebp
ret
```

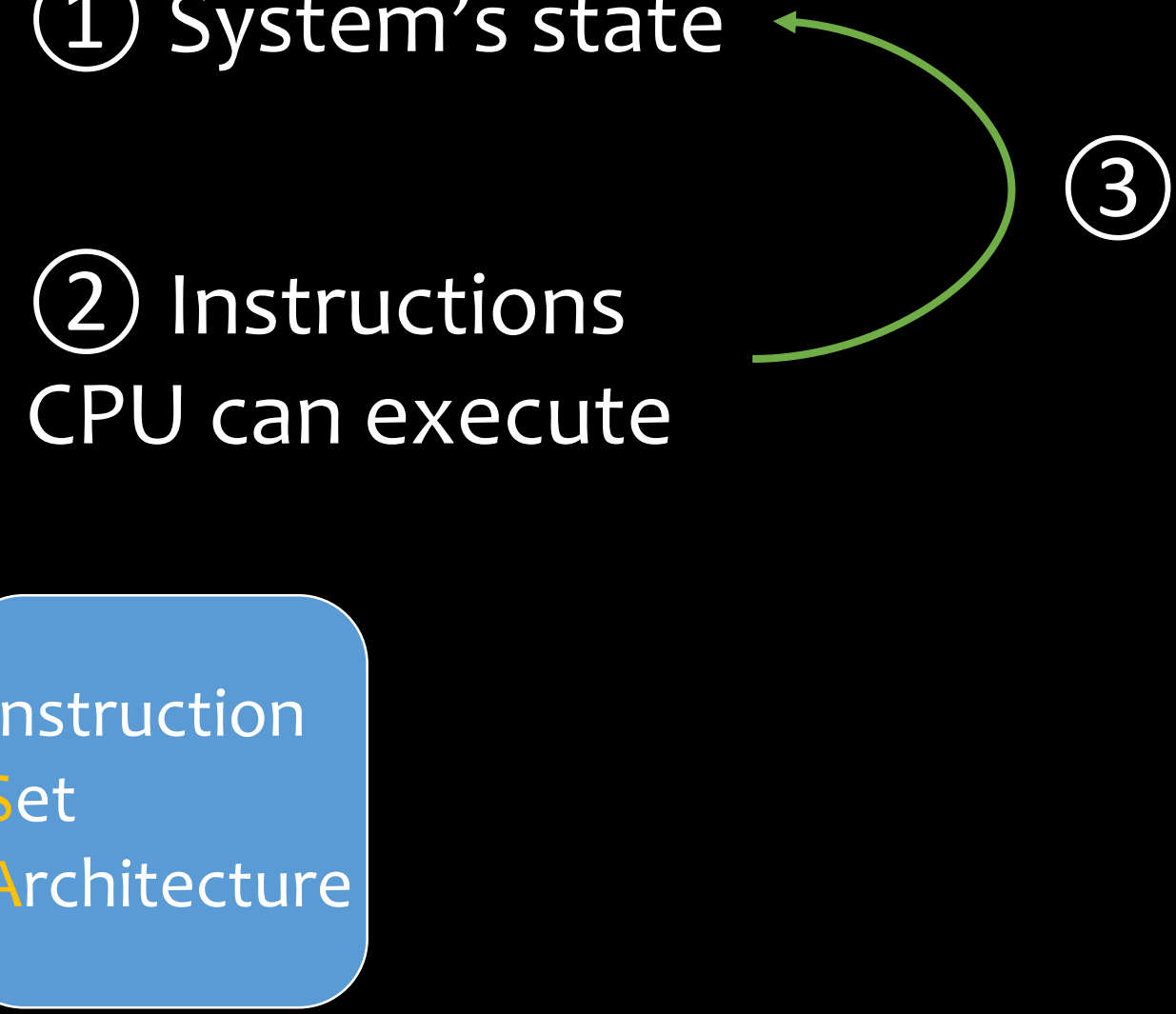
Translation



Program Performance



CHAP


① System's state
③
② Instructions
CPU can execute
Instruction
Set
Architecture

Instruction Set Architectures

x86

MIPS

SPARC

PowerPC

29K

275K

230M

2.6B

1968 → 1978 → 1985 → 2005

Moore's law

Gordon Earle Moore

Co-founder of Intel Corporation

"The number of transistors in a chip will approximately double every two years."

Moore's law


AMD
64
TM


AMD Opteron™
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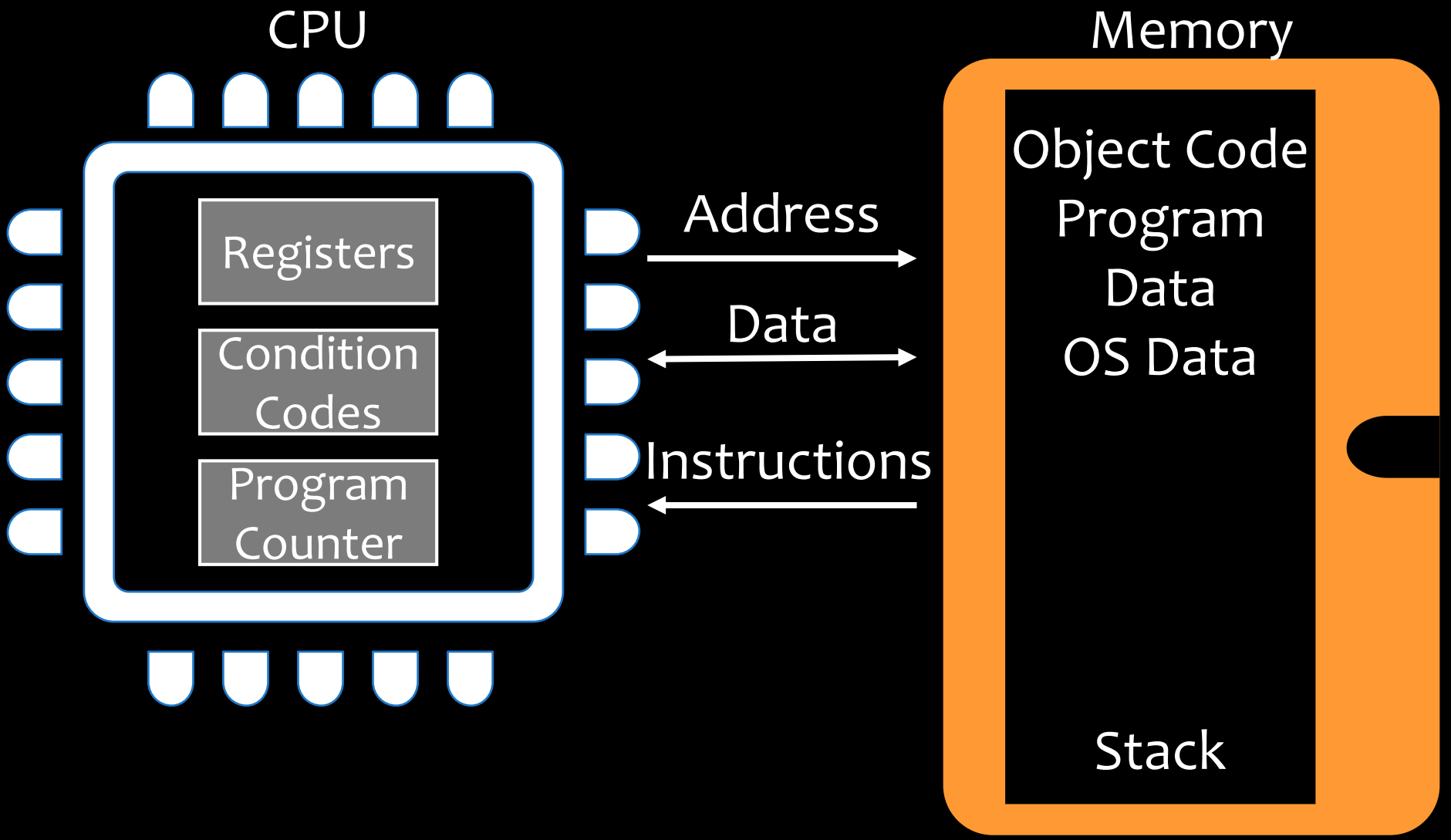
ASSEMBLED IN MALAYSIA

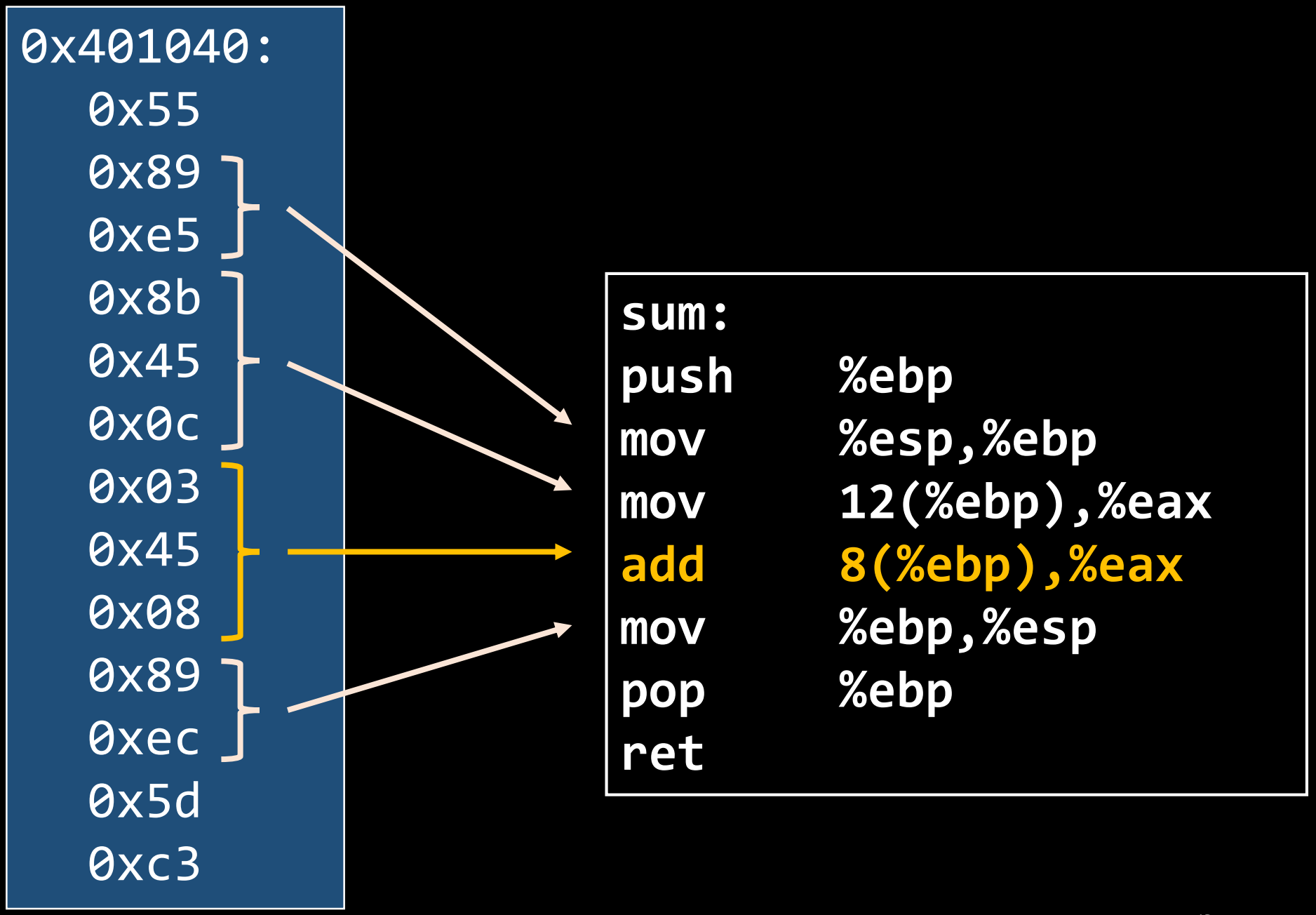
Assembly Programmer's View

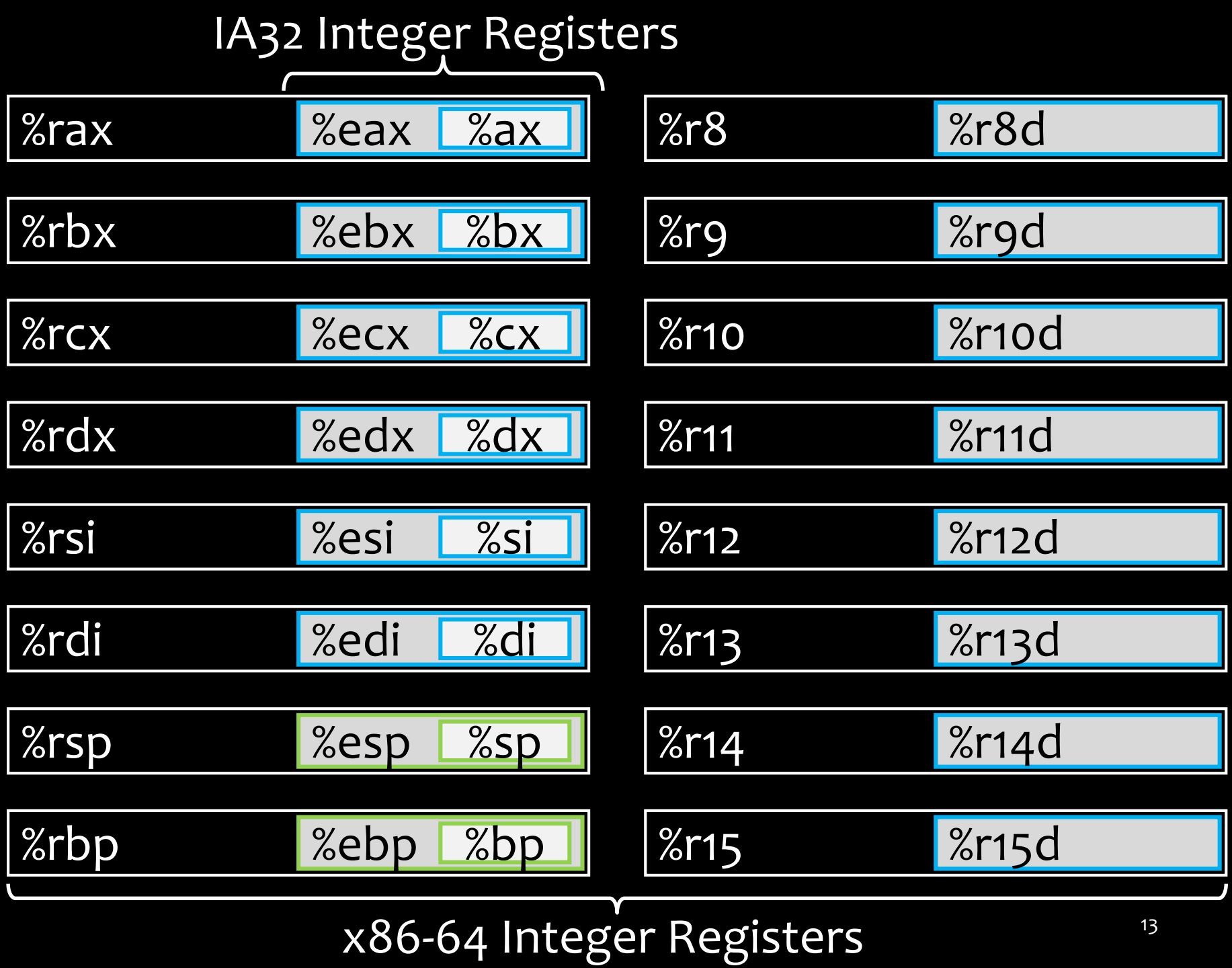


```
int sum(int x, int y)
{
   int t = x+y;
   return t;
}
```

```
gcc -O1 -S code.c
```

```
sum:
push    %ebp
mov     %esp,%ebp
mov     12(%ebp),%eax
add     8(%ebp),%eax
mov     %ebp,%esp
pop     %ebp
ret
```


0x401040:
0x55
0x89
0xe5
0x8b
0x45
0x0c
0x03
0x45
0x08
0x89
0xec
0x5d
0xc3
sum:
push %ebp
mov %esp,%ebp
mov 12(%ebp),%eax
add 8(%ebp),%eax
mov %ebp,%esp
pop %ebp
ret


IA32 Integer Registers
%rax
%eax
%ax
%rbx
%ebx
%bx
%rcx
%ecx
%cx
%rdx
%edx
%dx
%rsi
%esi
%si
%rdi
%edi
%di
%rsp
%esp
%sp
%rbp
%ebp
%bp
%r8
%r8d
%r9
%r9d
%r10
%r10d
%r11
%r11d
%r12
%r12d
%r13
%r13d
%r14
%r14d
%r15
%r15d
x86-64 Integer Registers

Summary

- Instruction Set Architecture
- Program Performance
- Intel x86 Architecture
- x86 Registers

John Carmack

CTO of Oculus VR

> “Because of the nature of Moore's law, anything that an extremely clever graphics programmer can do at one point can be replicated by a merely competent programmer some number of years later.”