X86
An Historical Perspective

Computer Systems: Section 4.1

ISA Compatibility

- It's nice to have the same software run on different hardware
- It's nice to have the apps I wrote for iPhone6 run on iPhoneX
- But different hardware has different capabilities
- I can do more things on an iPhoneX than an iPhone6

- How can we manage this change?

Backward Compatibility

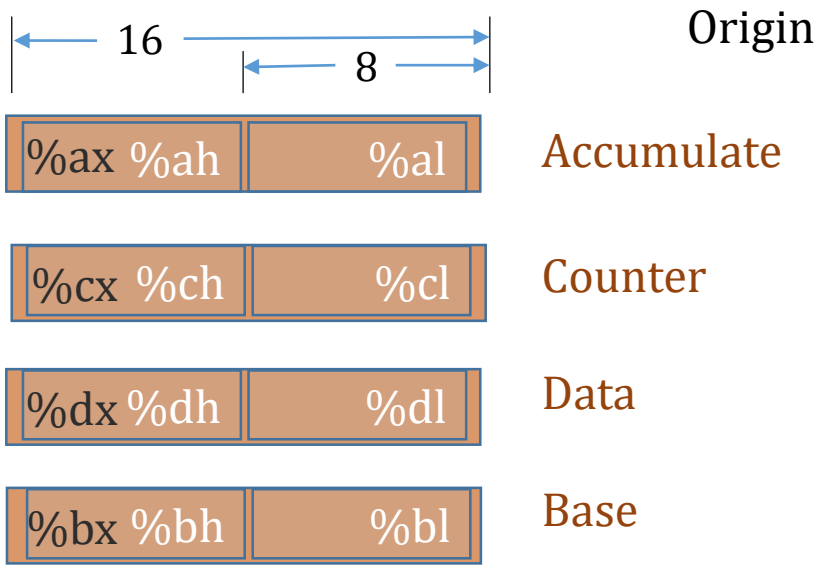
- If something is backward compatible
  - It will do everything it used to do
  - It may be able to do more

- Implications …
  - Things can only get more complex
  - Every “mistake” made early propagates forever
  - Eventually, things get really complicated

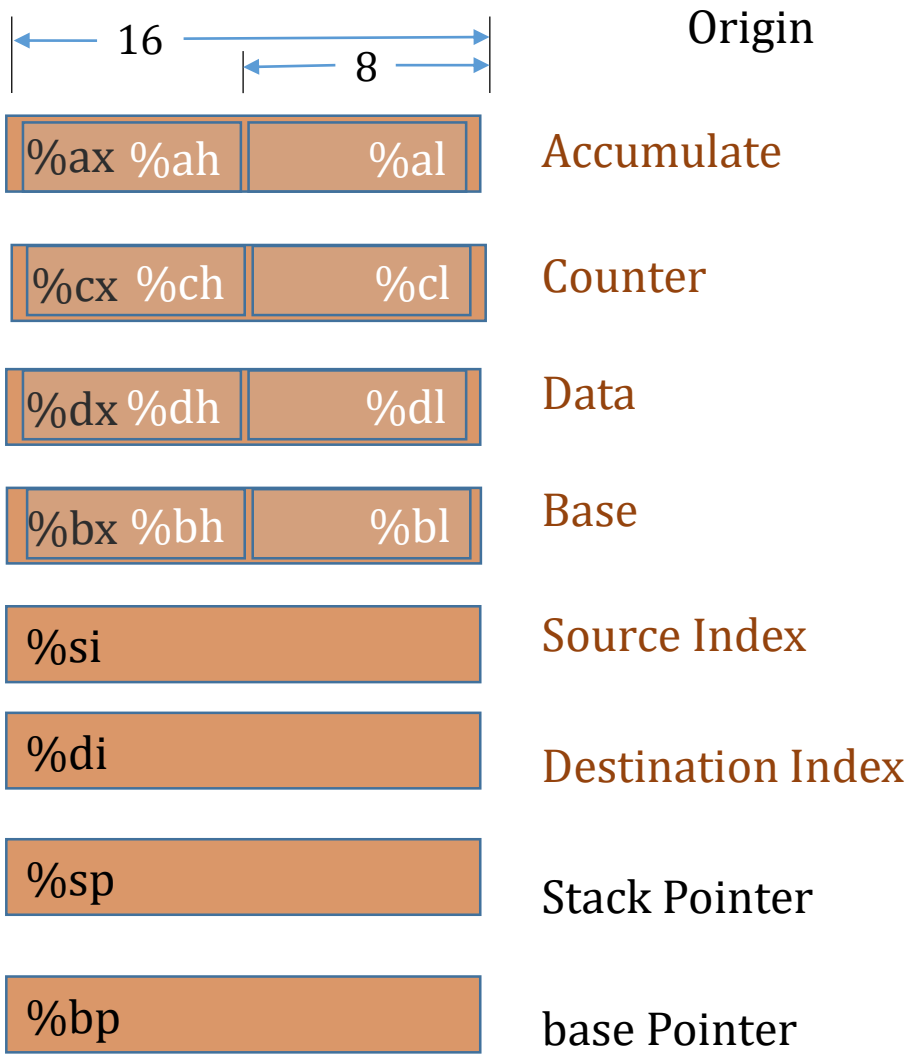
Intel Microprocessor Milestones

Date	Chip	Data Width	Transistors	Clock Rate	Usage
1972	8008	8	3.5K	0.8 MHz	Monitors, Controllers
1974	8080	8 (some 16)	6K	2 MHz	+ Calculators
1978	8086	16	29K	10 MHz	IBM PC/DOS – First x86
1985	80386	32	275K	40 MHz	IBM PC-AT - Windows+Linux
1993	Pentium P5	32	3.1M	66 MHz	IBM Personal Computer
2004	Pentium 4F	64	125M	3.8 GHz	IBM ThinkCenter
2008	Core i7	64	731M	3.33 GHz	Lenovo Thinkpad
2014	Core i7 extreme	64	1.4B	3.5 GHz	Lenovo Ultrabook

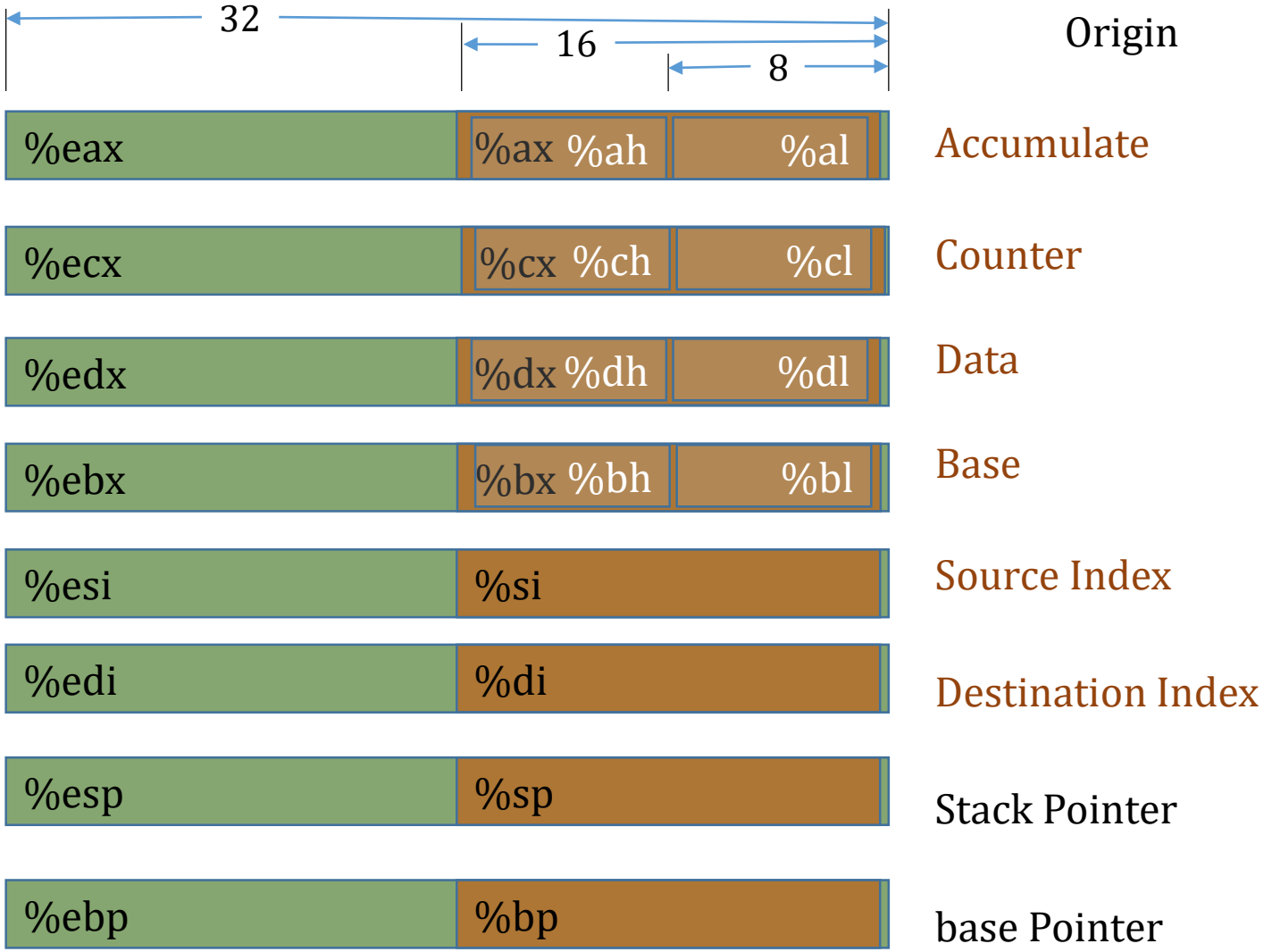
1972 Intel 8008, 8 bit word - Calculators



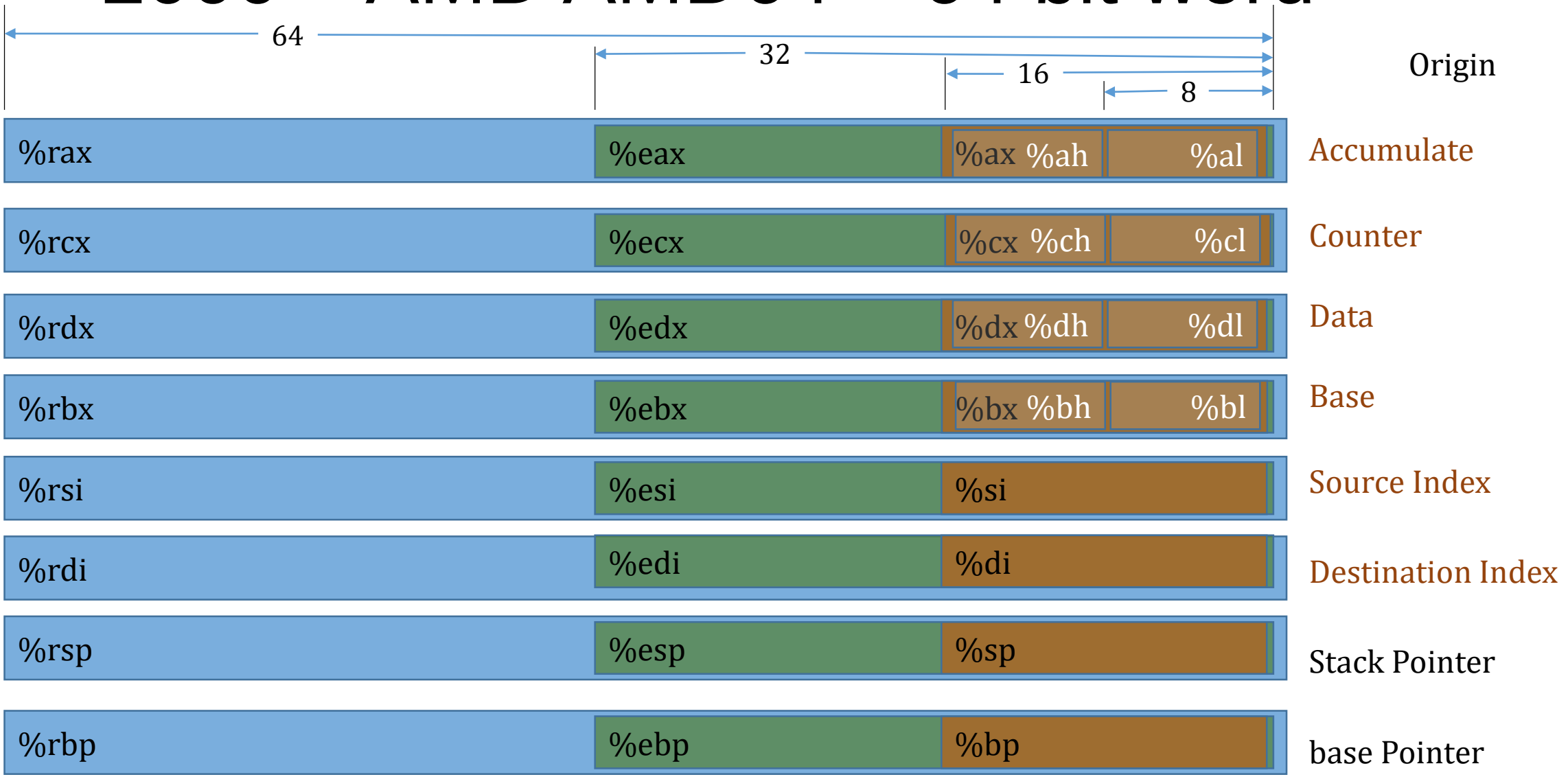
1978 Intel 8086, 16 bit word – Vanilla PC



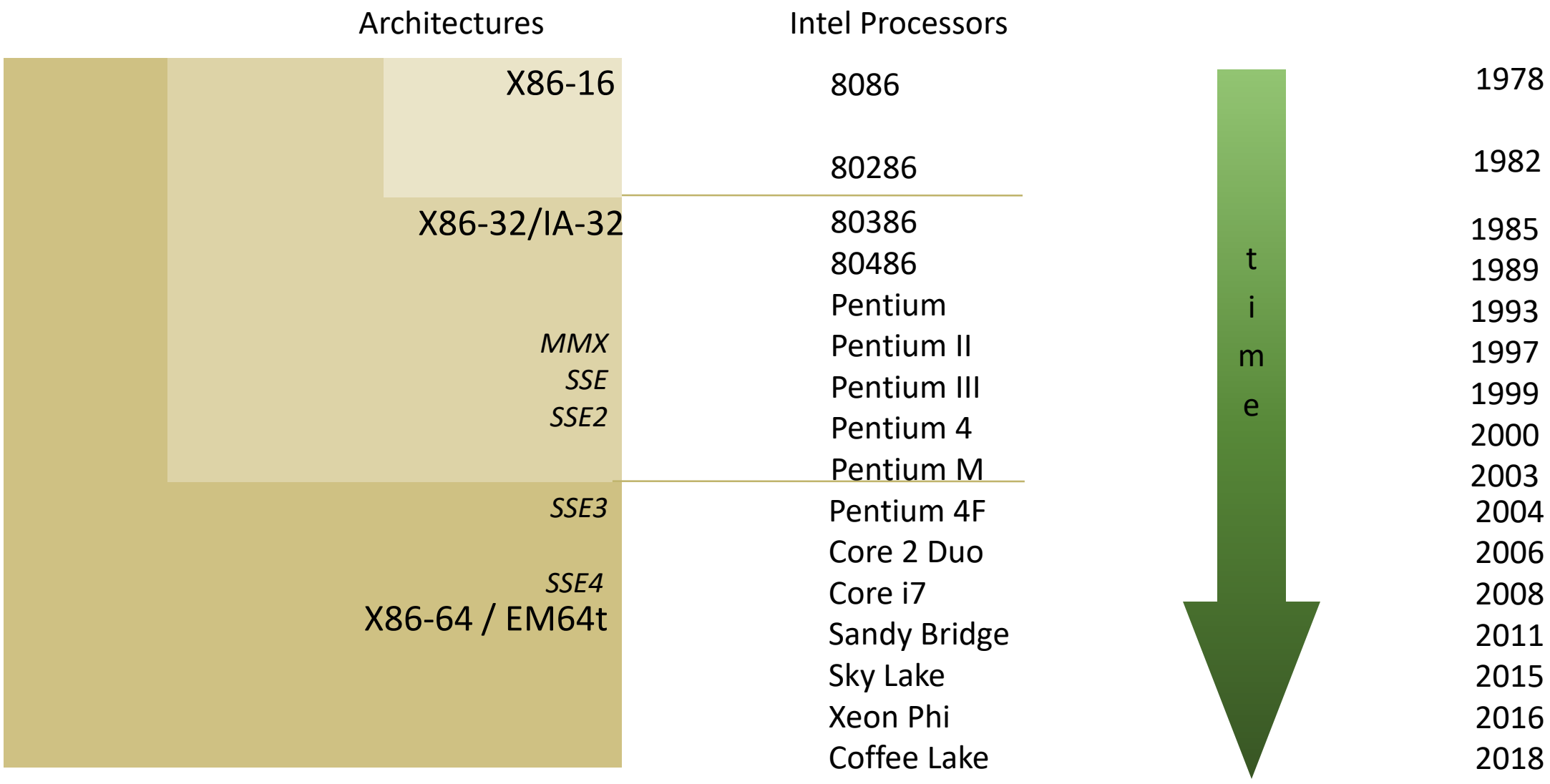
1985 - 80386 32 bit word - PC/XT



~2000 – AMD AMD64 – 64 bit word

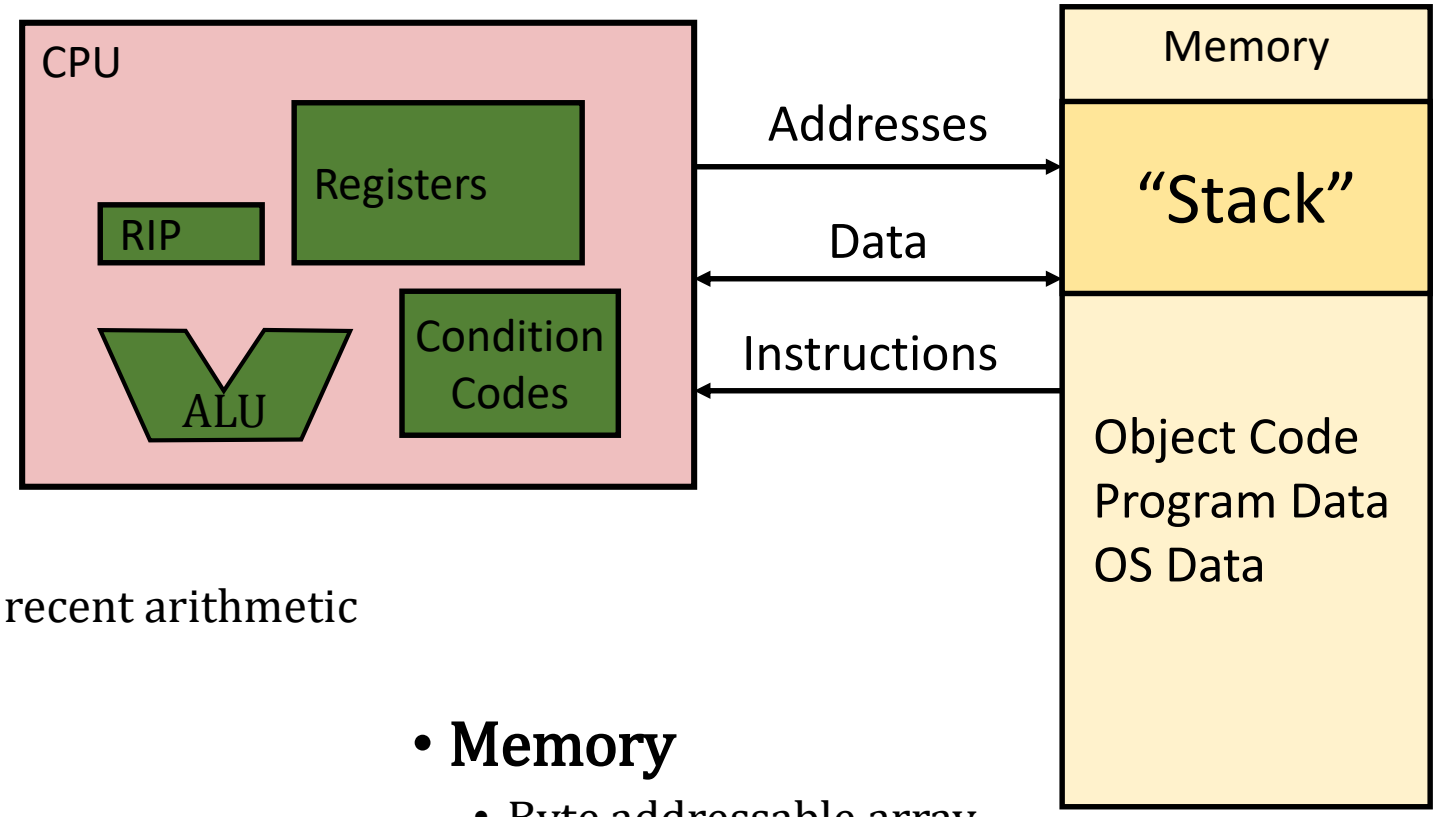


41 Years of Intel x86 Evolution



Assembly Programmer's View of x86

- Programmer-Visible State
  - IP: Instruction Pointer
    - Address of next instruction
    - "%rip" (x86-64)
  - Register file
    - Heavily used program data
  - Condition codes
    - Store status information about most recent arithmetic operation
    - Used for conditional branching
  - Arithmetic/Logic Unit (ALU)
    - Performs Instructions



- **Memory**
  - Byte addressable array
  - Code, user data, (some) OS data
  - Includes stack used to support procedures