COS10004 Computer Systems

Lecture 7.5 ARM Assembly Programming – Littl Endian Memory Addressing
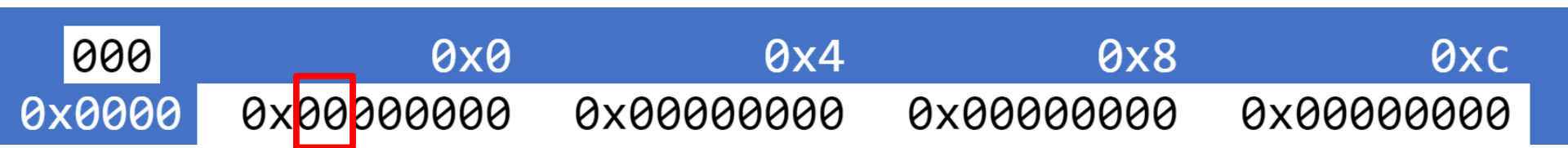
Dr Chris McCarthy

_start:

ARMLITE MEMORY ADDRESSING

ARMlite models "byte" addressable memory

That is – every byte can be indexed individually
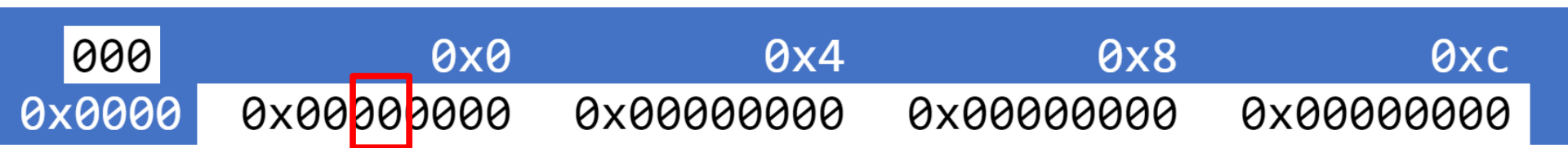
Byte Addressable Memory

	0x0	0x4	0x8	0xc
000				
0x0000	0x00000000	0x00000000	0x00000000	0x00000000

Byte Addressable Memory

000	0x0	0x4	0x8	0xc
0x0000	0x00000000	0x00000000	0x00000000	0x00000000

Address: 0x00000

BYTE ADDRESSABLE MEMORY

000	0x0	0x4	0x8	0xc
0x0000	0x00000000	0x00000000	0x00000000	0x00000000

Address: 0x00001

Byte Addressable Memory

000	0x0	0x4	0x8	0xc
0x0000	0x00000000	0x00000000	0x00000000	0x00000000
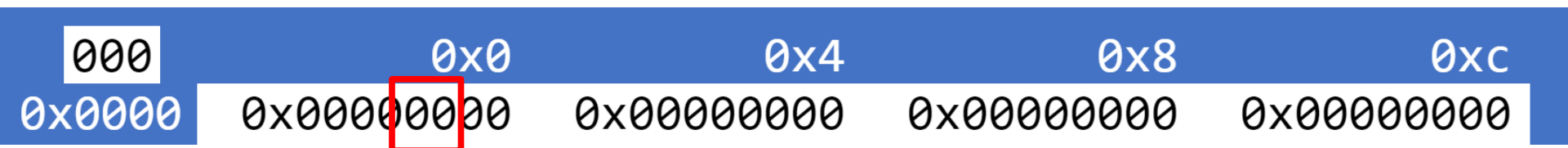
Address: 0x00002

Byte Addressable Memory

000	0x0	0x4	0x8	0xc
0x0000	0x00000000	0x00000000	0x00000000	0x00000000
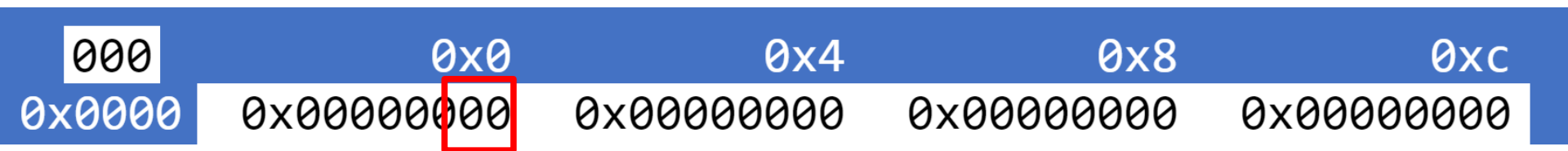
Address: 0x00003

Byte Addressable Memory

000	0x0	0x4	0x8	0xc
0x0000	0x00000000	0x00000000	0x00000000	0x00000000
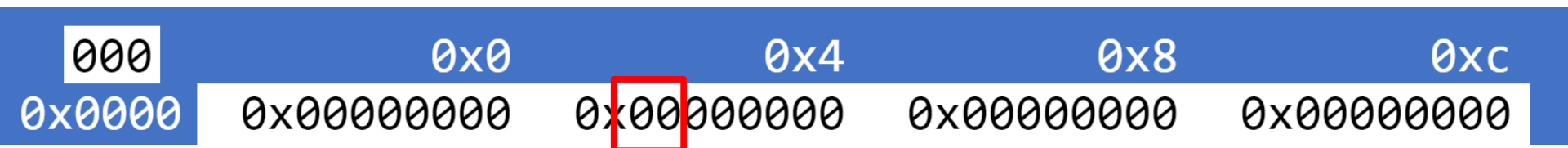
Address: 0x00004

BYTE ADDRESSABLE MEMORY

000	0x0	0x4	0x8	0xc
0x0000	0x00000000	0x00000000	0x00000000	0x00000000
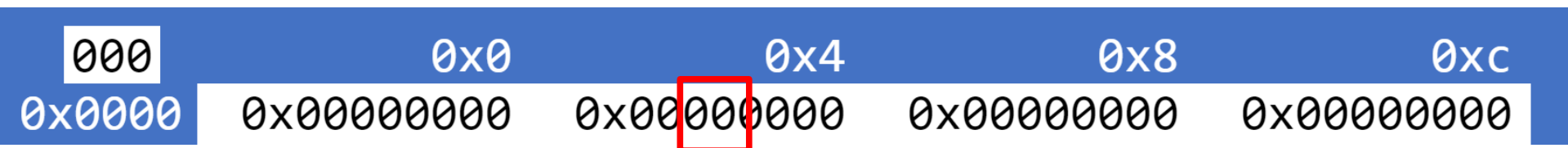
Address: 0x00005

Byte Addressable Memory

000	0x0	0x4	0x8	0xc
0x0000	0x00000000	0x00000000	0x00000000	0x00000000
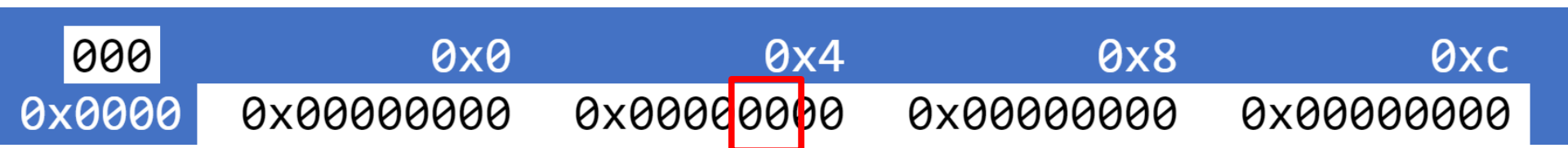
Address: 0x00006

Byte Addressable Memory

000	0x0	0x4	0x8	0xc
0x0000	0x00000000	0x000000[00]	0x00000000	0x00000000
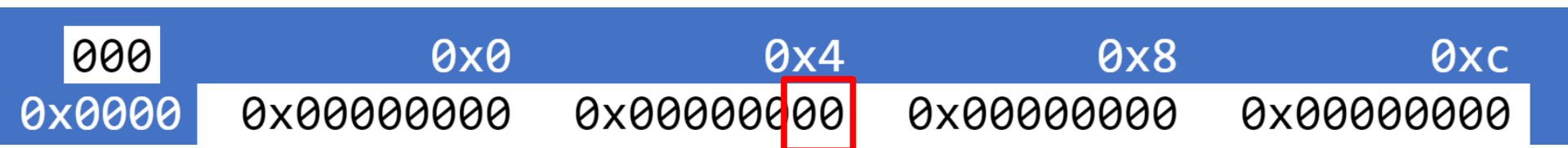
Address: 0x00007

Byte addressable Memory

What I just showed you hopefully made complete sense

The problem is …..

BYTE ADDRESSABLE MEMORY

What I just showed you hopefully made complete sense

The problem is …..

I lied

😬

ARMlite uses Little Endian

- Recall Big Endian versus Little Endian
- Big Endian:
  - The most significant bits are represented first in memory
- Little Endian:
  - The least significant bits are represented first in memory
- ARMlite displays memory values in Big Endian format
- BUT - addresses them using Little Endian
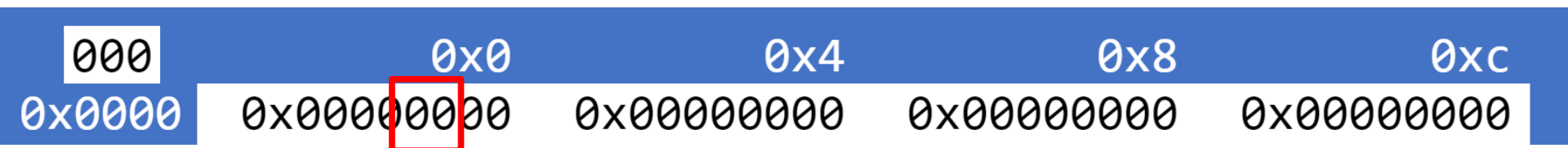
  So …..

Little Endian Byte Addressable Memory

	000	0x0	0x4	0x8	0xc
0x0000		0x00000000	0x00000000	0x00000000	0x00000000

Little Endian Byte Addressable Memory

	0x0	0x4	0x8	0xc
000				
0x0000	0x00000000	0x00000000	0x00000000	0x00000000
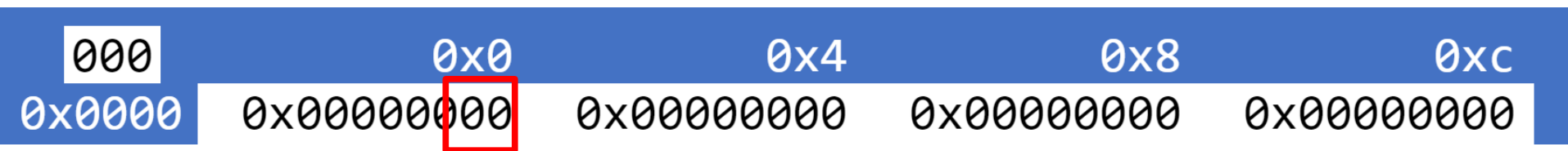
Address: 0x00000

Little Endian Byte Addressable Memory

000	0x0	0x4	0x8	0xc
0x0000	0x00000000	0x00000000	0x00000000	0x00000000

Address: 0x00001

LITTLE ENDIAN BYTE ADDRESSABLE MEMORY

000	0x0	0x4	0x8	0xc
0x0000	0x00000000	0x00000000	0x00000000	0x00000000
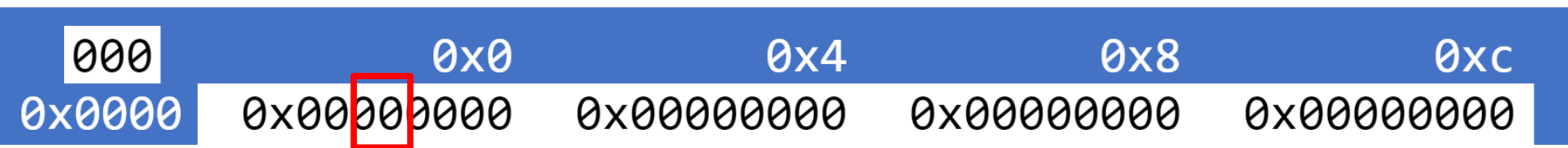
Address: 0x00002

Little Endian Byte Addressable Memory

000	0x0	0x4	0x8	0xc
0x0000	0x00000000	0x00000000	0x00000000	0x00000000
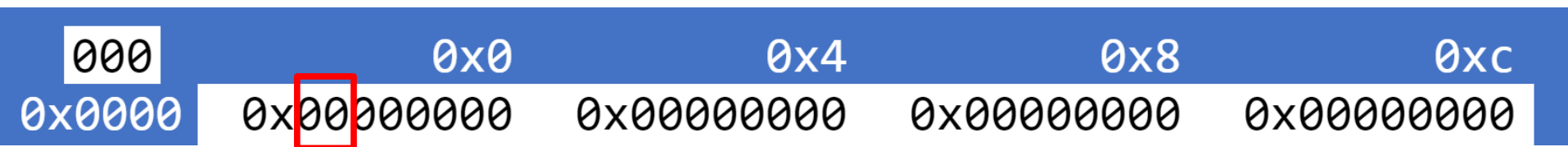
Address: 0x00003

Little Endian Byte Addressable Memory

000	0x0	0x4	0x8	0xc
0x0000	0x00000000	0x00000000	0x00000000	0x00000000
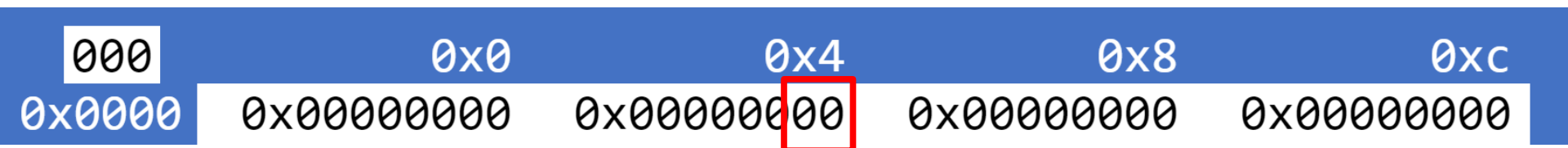
Address: 0x00004

Little Endian Byte Addressable Memory

000	0x0	0x4	0x8	0xc
0x0000	0x00000000	0x00000000	0x00000000	0x00000000
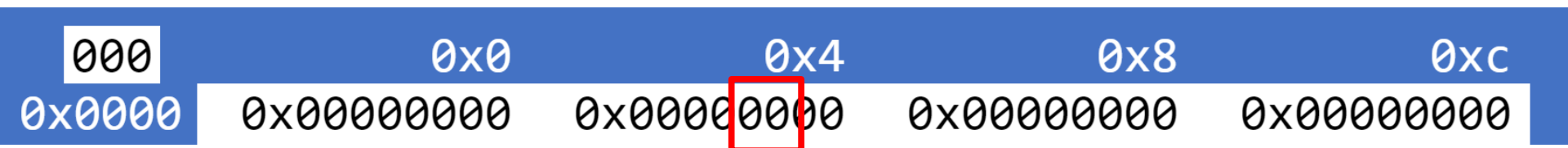
Address: 0x00005

Little Endian Byte Addressable Memory

000	0x0	0x4	0x8	0xc
0x0000	0x00000000	0x00000000	0x00000000	0x00000000
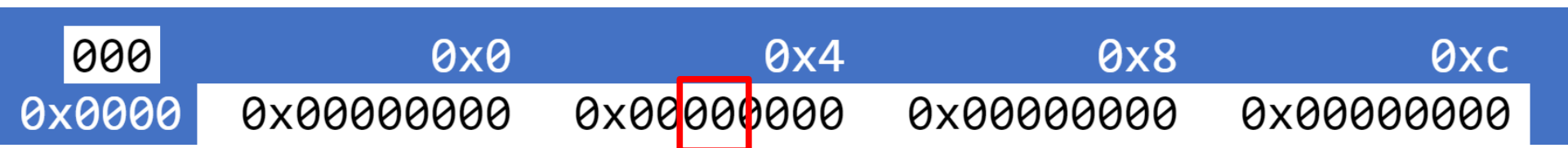
Address: 0x00006

LITTLE ENDIAN BYTE ADDRESSABLE MEMORY

000	0x0	0x4	0x8	0xc
0x0000	0x00000000	0x00000000	0x00000000	0x00000000
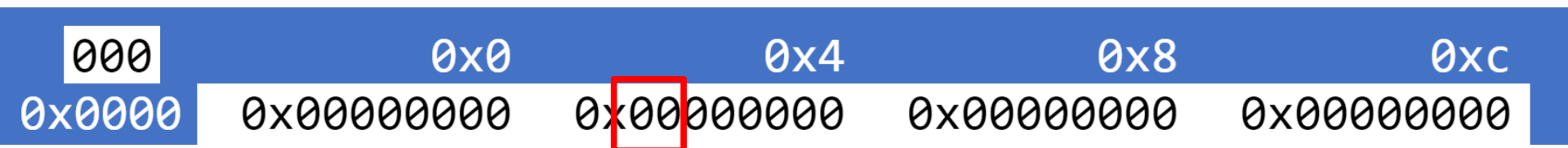
Address: 0x00007

SUMMARY

- When working at the level of bytes and bits, endianness matters a lot.

- In all our ARMlite programming, remember we will be working with bit strings in Little Endian format in memory (despite how they are displayed on the screen!)