Programming in C++

Endianness (Byte-order)

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Objectives

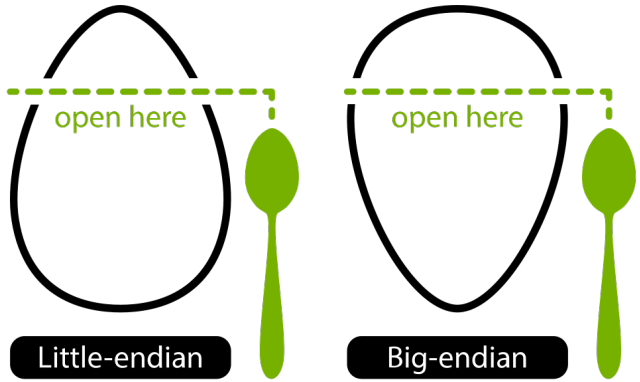
Objectives:

- Understand byte ordering
- Create code that extracts specific bytes
- Create code that writes integers in little endian order
- Create code that writes strings in big endian order

Endian

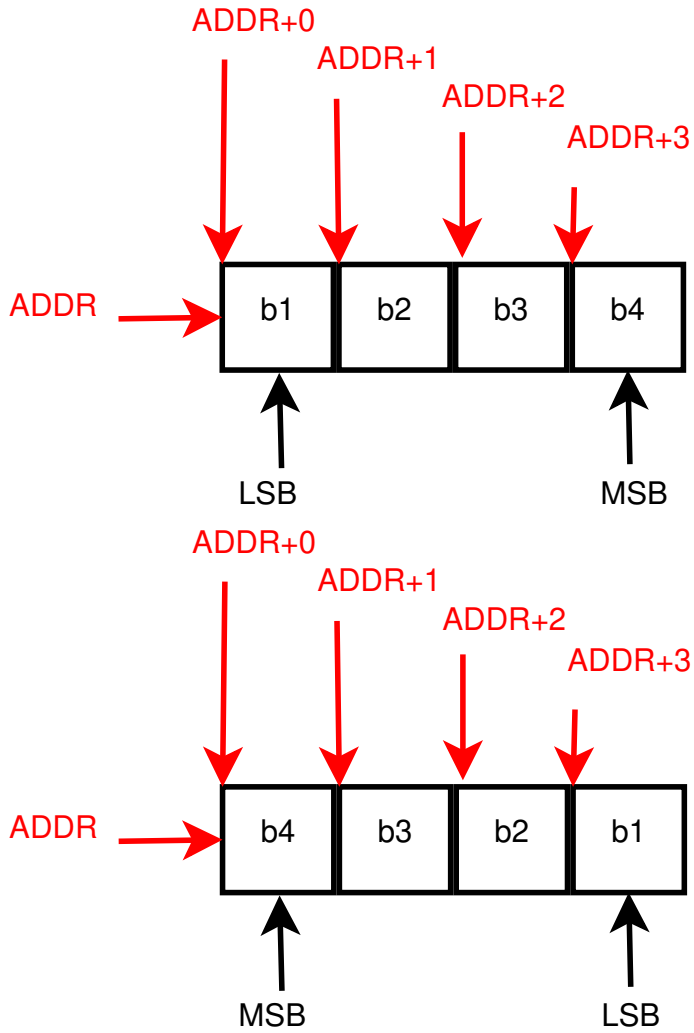
Etymology

- Gulliver's Travels (1726) - Jonathan Swift
- Lilliput vs. Blefuscu war
- Which of boiled egg to open?



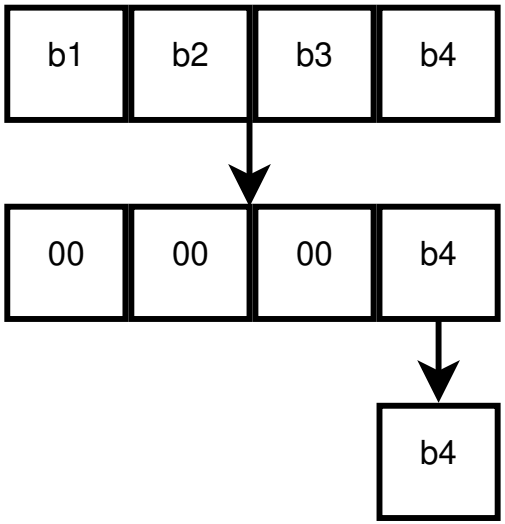
Computing Endianness

- Most Significant Byte (MSB)
- Least Significant Byte (LSB)
- What order are bytes in a computer's memory?
- Little Endian (LSB first)
- Big Endian (MSB first)

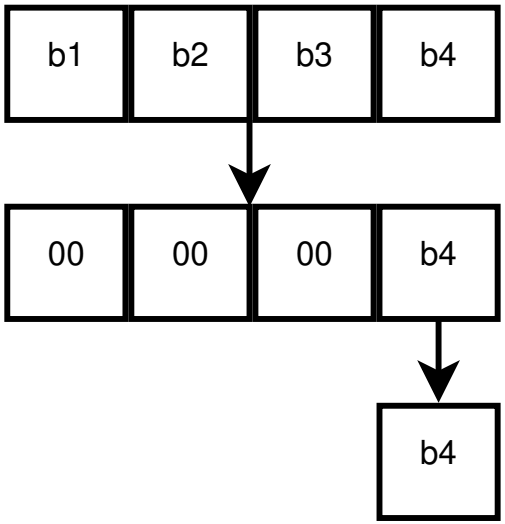


Extracting Bytes

Masking



Masking

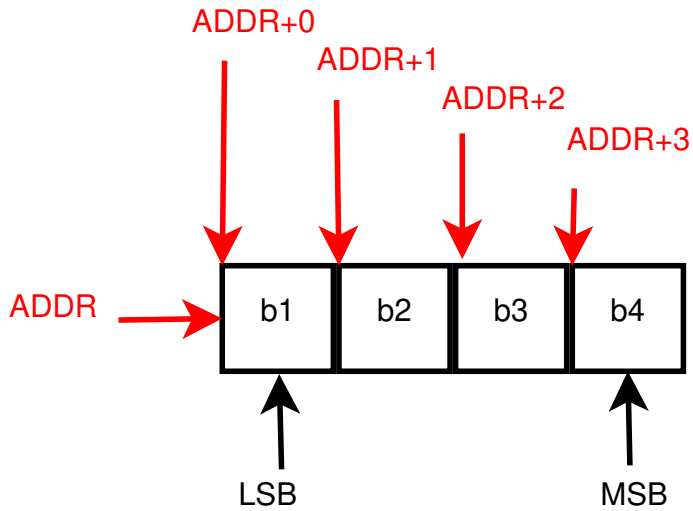


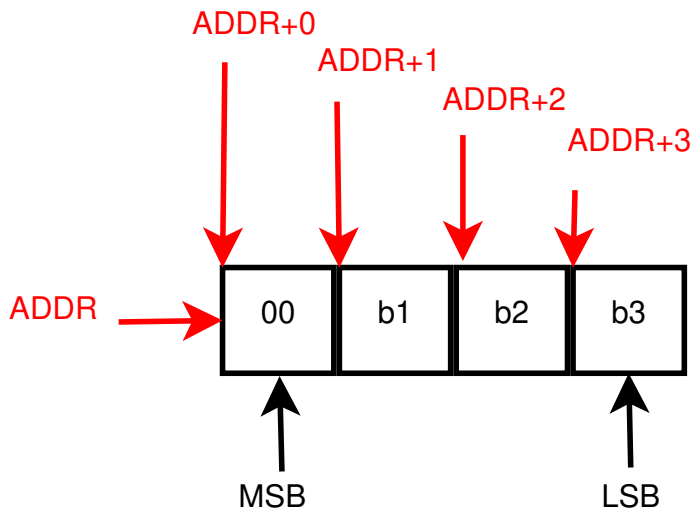

```
// Sample value
unsigned int x = 0xB1B2B3B4;
// Extract LSB, 0 for rest of the bytes
unsigned int y = x & 0x000000FF;
// Assign to 1 byte data type
unsigned char z = y;
```

Discarding Bytes

Shifting

```
// Sample value
unsigned int x = 0xB1B2B3B4;
// Discard LSB
unsigned int y = x >> 8
```





Writing Little Endian

Write Word

- Given: an integer stored in big endian order in memory
- Given: write n bytes to stream in little endian order
- for n times:
- extract LSB into unsigned char
- write unsigned char to stream
- discard the LSB

Writing Big Endian

Write String

- Given: a string stored in big endian order in memory
- Given: write n bytes to stream in big endian order
- for n times:
- write current MSB of string
- move to next byte
-
- `output_stream << string` does this process