Computer Architecture

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Contents

1 Overview

Intel Xeon Processor

$13012

$400

- **Xeon Platinum 8380HL**
  - **28: Cores**
  - **56: Threads**
  - **Base Frequency: 2.9 GHz**
  - **Max Turbo Frequency: 4.3 GHz**
  - **Cache: 38.5MB**
  - **Max Memory Size: 4.5 TB**
  - **Memory Channels: 6**
  - **Max. Memory Speed: 3200MHz**
  - **Package Size: 77.5 x 56.5mm**
- **Intel i9-10850K**
  - **10: Cores**
  - **20: Threads**
  - **Base Frequency: 3.6 GHz**
  - **Max Turbo Frequency: 5.2 GHz**
  - **Cache: 20MB**
  - **Max Memory Size: 128GB**
  - **Memory Channels: 2**
  - **Max. Memory Speed: 3200MHz**
  - **Package Size: 37.5 x 37.5mm**

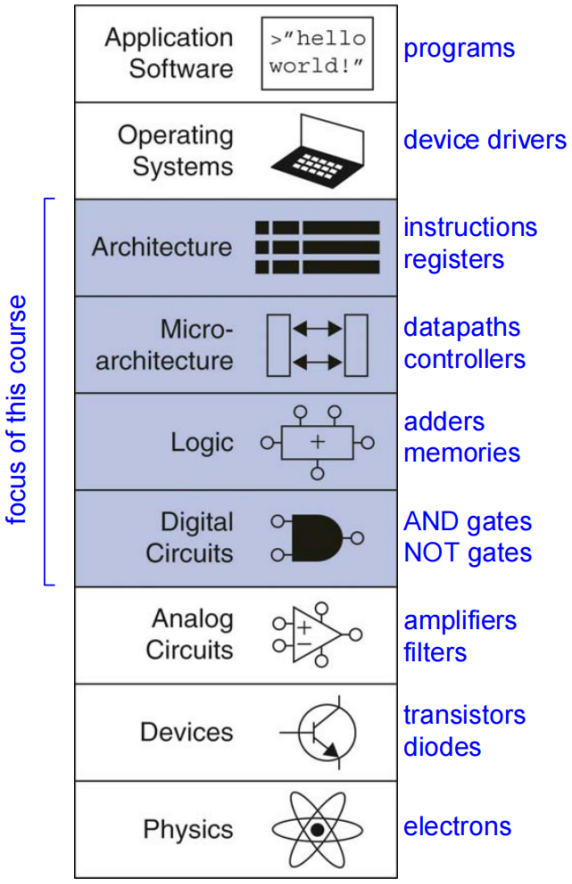
1.1 Why the prices of two processors differs?

1. The prices increase exponentially as the number of Cores and Threads increase. That's because every core has a bad possibility, so the difficult of making a processor with many cores much harder.

2. Significant: The memory Chaneels of XEON is three times by i9, which means it has three times as many pins as i9 has.

2 Digital Design

2.1 Abstraction



2.2 The Digital Abstraction

- Most physical variables are continuous
  - Voltage on a wire
  - Frequency of an oscillation
  - Position of a mass
- Digital abstraction considers discrete subset of values

2.3 Digital Discipline: Binary Values

- Two discrete Values:
  - 1's and 0's
  - 1, true, high
  - 0, false, low
- 1 and 0: voltage levels, rotating gears, fluid levels
- Digital circuits use voltage levels to represent 1 and 0

2.4 Decimal to Binary Conversion

Method: repeatedly divided by 2, remainders goes in next most significant bit

53_{10} =

53/2 = 26 R1
26/2 = 13 R0
13/2 = 6 R1
6/2 = 3 R0
3/2 = 1 R1
1/2 = 0 R1

$= 110101_2$

2.5 Signed Binary Numbers

2.5.1 Sign/Magnitude Numbers

Problems

- Has two 0 values, positive 0 and negative 0
- Addition of a negative and a postive will fail

2.5.2 Two's Complement Numbers

Conversion from positive to negative:

- Invert every bit
- Add 1

2.6 Logic Gates