

CENG 311
Computer Architecture Lecture Notes

Ege Özkan

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Chapter 1

Introduction - October 16, 2020

1.1 Four Key Current Directions

1. Fundementally secure/reliable/safe architectures
2. Fundementally energy-efficient and memory centric architectures
3. Fundementally low latency and predictable architectures
4. Architectures for AI/ML, Genomics, Medicine, etc.

1.2 Transformation Hierarchy

The order travels through different hierarchical levels until it reaches the electrons. From problems to algorithms, through program/language to system software to SW/HW Interface to lower hardware components.

Computer architecture was traditionally limited to SW/HW Interface and to Micro-architecture, but in the present day, computer architecture expands from algorithms to devices. This is because, to achieve the highest energy efficiency and performance, one must take the expanded view therefore co-designing across the hierarchy.

This way, once can specialize most of the components for a specific domain.

1.3 Computer Architecture

Computer architecture is the science and art of designin computing platforms to achibe a set of design goals. Designing a supercomputer is different from designing a smartphone, but many fundamental principles are similiar.

The computer architecture allows better systems to be built by making computer faster, cheaper, smaller and more reliable, it enables new applications and enables better solutions to be found.

Studying computer architecutre allows one to understand why computers work the way they do.

1.3.1 Computer Architecture Today

The present day industry has entered a paradigm shift to novel architectures, as many difficult problems motivate and cause a demand for novel architectures.