

CSC 411

Computer Organization (Spring 2022)

Lecture 1: Introduction, Class Logistics

Prof. Marco Alvarez, University of Rhode Island

Welcome !

‣ Lectures

- TTh 5-6:15p @ Tyler 108

‣ Lab

- W 5-5:50p @ Zoom

‣ Office Hours

- TBA

‣ Team

- Marco Alvarez, Instructor
- Alfred Timperley, TA

‣ Course Website

- <https://homepage.cs.uri.edu/~malvarez/teaching/csc-411/>

From the 2020-21 catalog ...

CSC 411: Computer Organization

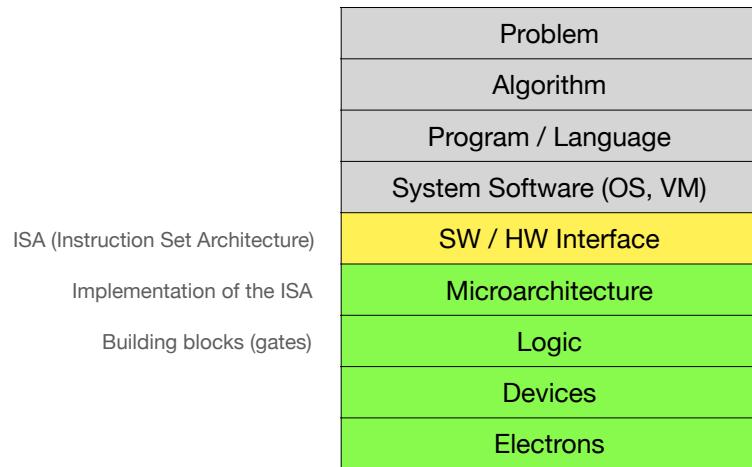
LEC: (4 crs.) Logical structure of computer systems viewed as a hierarchy of levels. Assembly language programming, assemblers, linkers, loaders. Computer architecture including digital logic, processor organization, instruction sets, addressing techniques, virtual memory, microprogramming. (Lec. 3, Project 3) Pre: CSC 212 and student must be admitted to a degree-granting college.

How computers work?

What you will learn?

- How programs are translated into machine language?
 - how the hardware executes them?
- The hardware/software interface
- What determines program performance?
 - how it can be improved?
- How hardware designers improve performance?
- What is parallel processing?

Abstraction layers (computing system)



Why do we care?

Computer architecture

- Science of designing and implementing computing systems
 - HW/SW interface and below
 - expanding to upper layers
- Design goals
 - highest performance
 - optimizing for energy efficiency
 - best performance/cost ratio
- Think about design goals for a supercomputer vs an smartphone
 - fundamental principles are similar

Why study computer architecture?

- Understanding future capabilities of computing systems
- Developing better software
 - best system programmers understand all abstraction levels and the underlying hardware
- Understanding computer performance
 - writing well tuned software requires knowing what's under the hood
- Setting up the fundamentals for further work on hardware design

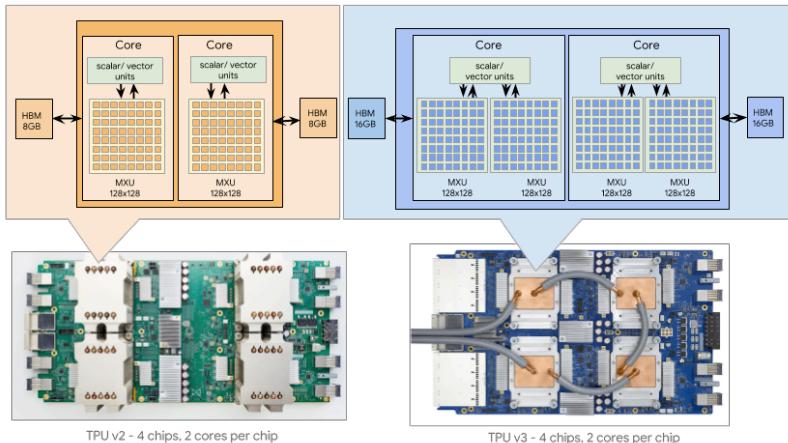
Fugaku



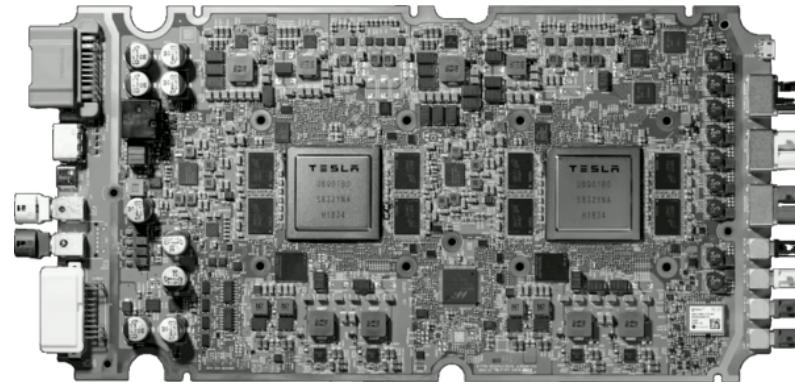
Fugaku remains the No. 1 system. It has 7,630,848 cores which allowed it to achieve an HPL benchmark score of 442 Pflop/s. This puts it 3x ahead of the No. 2 system in the list. Fujitsu RIKEN Center for Computational Science, Japan.

<https://www.top500.org/lists/top500/2021/11/>

TPU (Tensor Processing Unit)

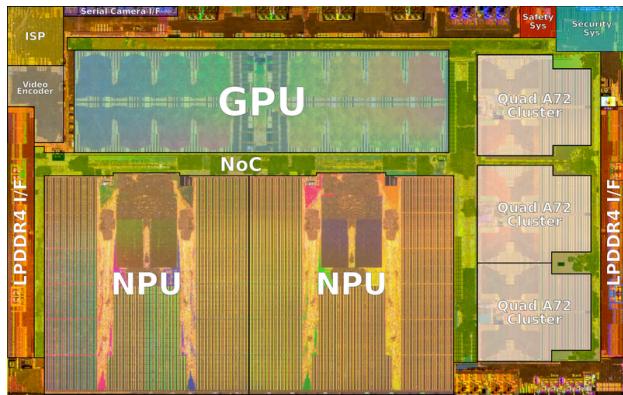


Tesla's Computer



[https://en.wikichip.org/wiki/tesla_\(car_company\)/fsd_chip](https://en.wikichip.org/wiki/tesla_(car_company)/fsd_chip)

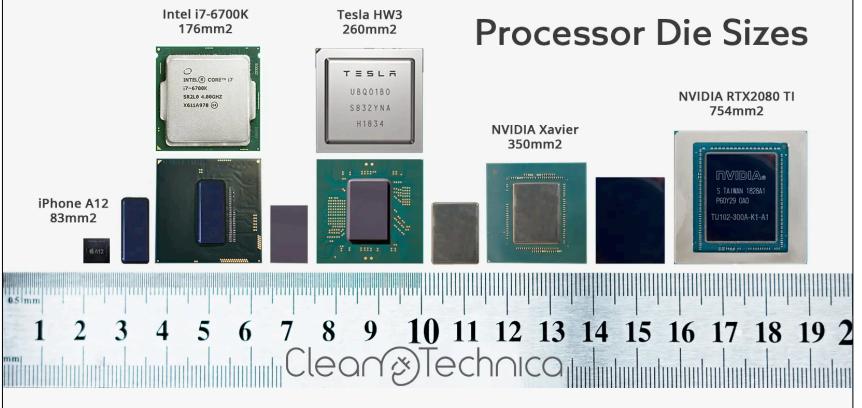
Tesla's Computer (Full Self-Driving Chip)



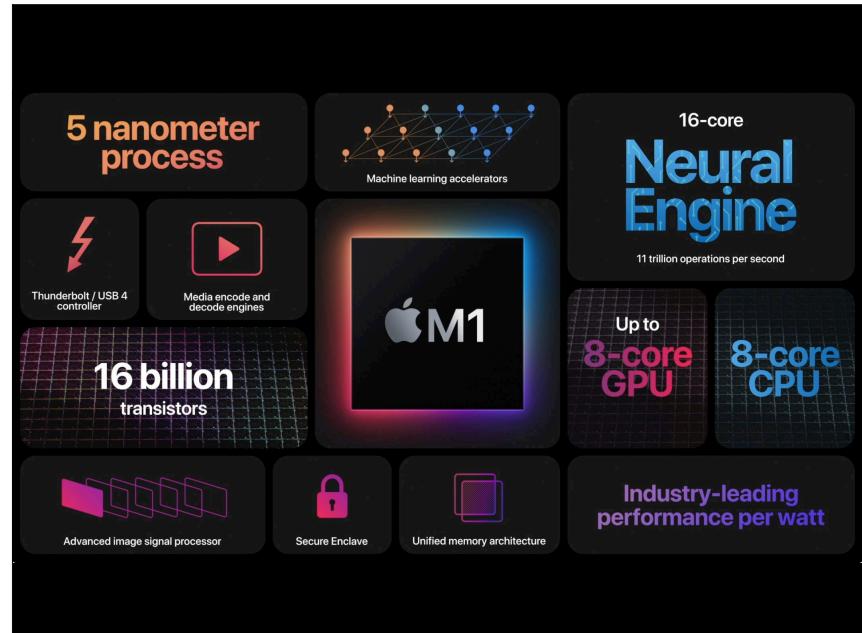
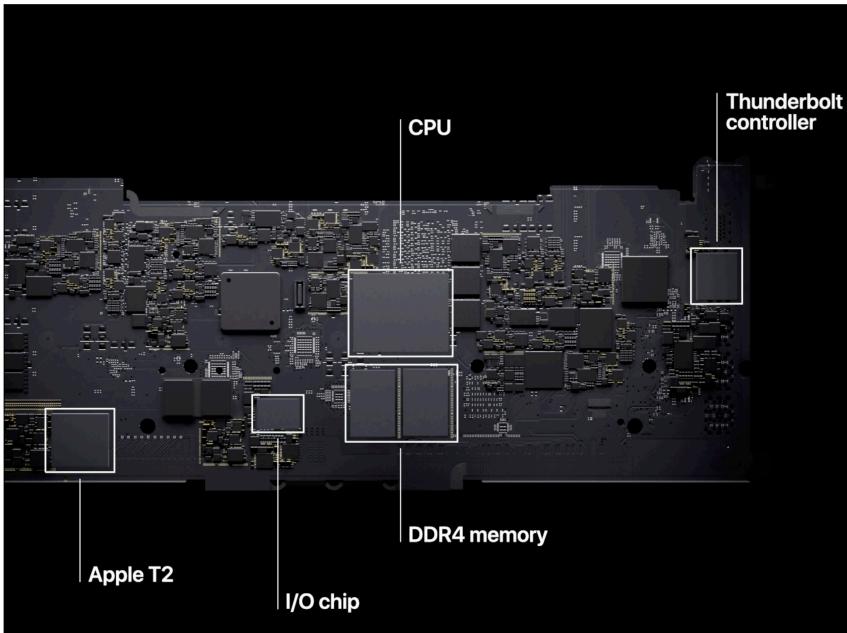
At a high level, the chip is a **full system-on-a-chip** capable of booting a standard operating system. It is manufactured on Samsung's 14-nanometer process at their Austin, Texas fab, packing roughly six billion transistors on a 260 millimeter squared silicon die.

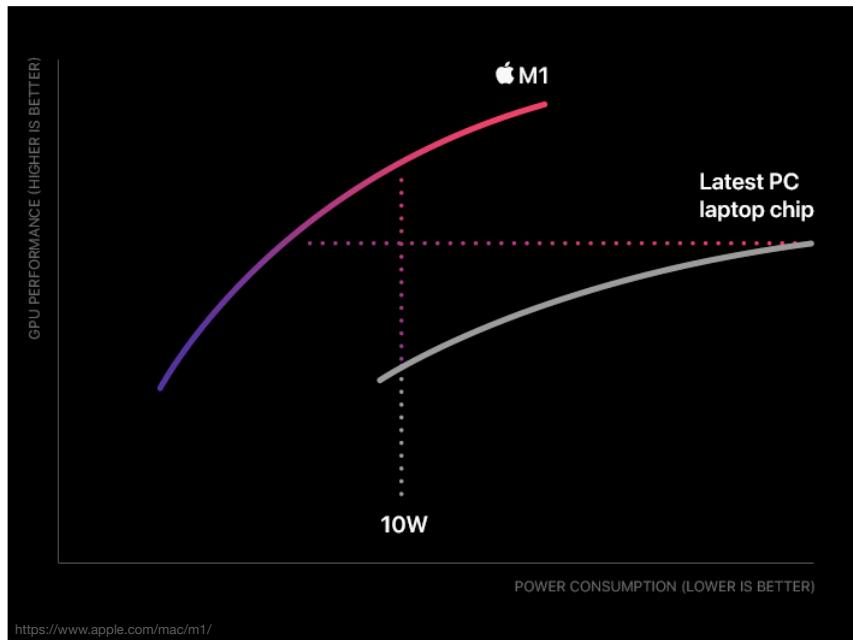
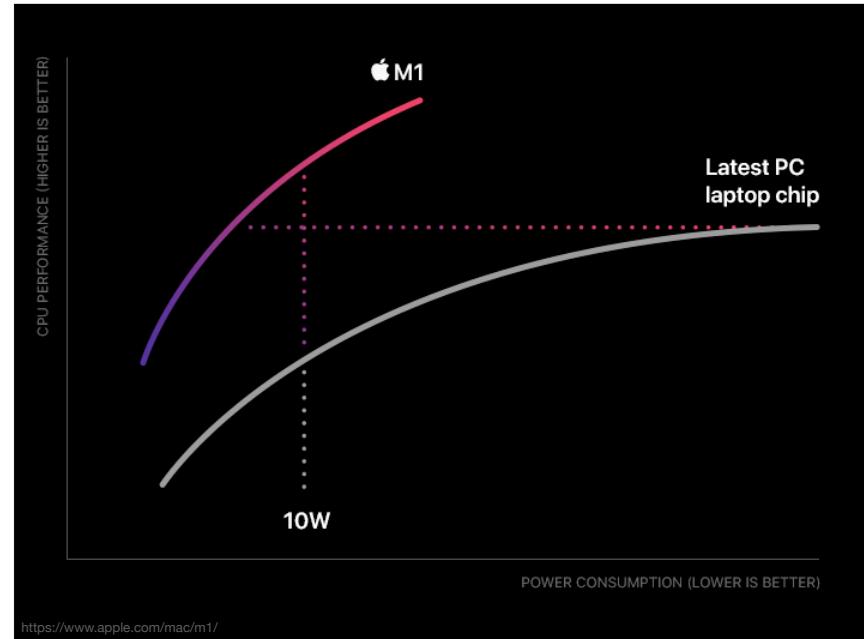
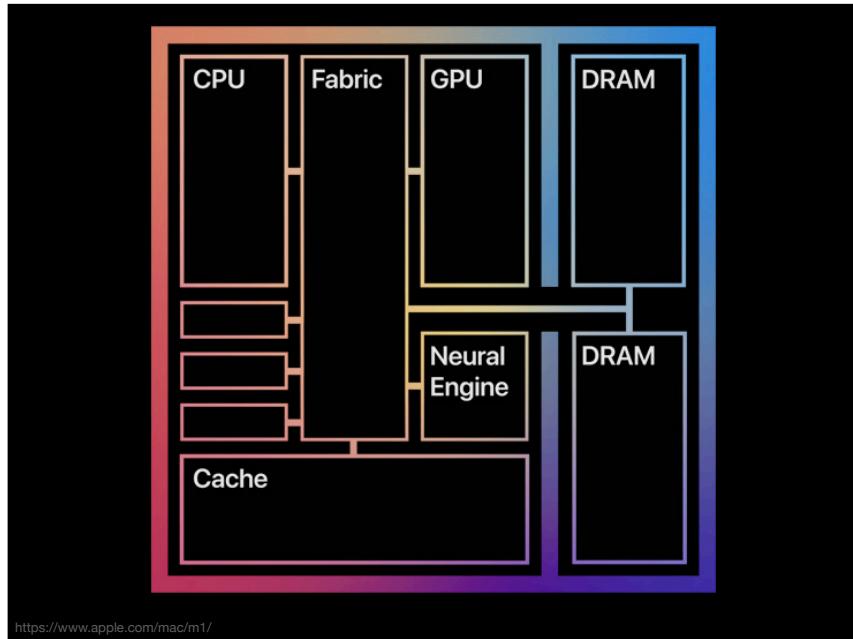
[https://en.wikichip.org/wiki/tesla_\(car_company\)/fsd_chip](https://en.wikichip.org/wiki/tesla_(car_company)/fsd_chip)

Getting a sense of size



<https://cleantechnica.com/2019/06/15/teslas-new-self-driving-computer-its-a-beast-cleantechnica-deep-dive/>



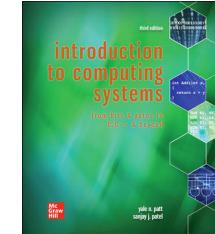
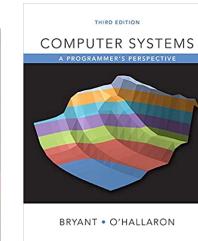
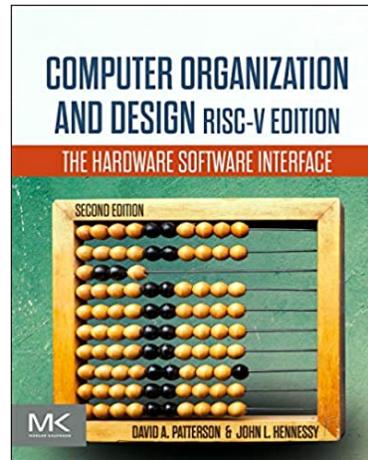


Modern computer architecture

- Achieving higher performance and efficiency
 - co-design across the hierarchy (bring algorithms to devices)
 - specialize as much as possible
- Looking forward ...
 - same basic building blocks and design principles

Course organization

Recommended textbooks



Grading

- Assignments (25%)
 - programming
 - problem sets (mostly from the textbook)
- Technical Presentation (30%)
 - teams of 2
- Exams
 - 1 midterm (20%)
 - 1 final (25%)



Assignments

- Discussions and collaboration are allowed
 - you must write your own code and solutions
- Late submissions **NOT accepted**
 - ample time given for assignments (~9 days)
 - start and submit early, leaving plenty of time for updates
- Plagiarism?
 - just don't do it
 - reports are sent to the chair with copies to your dean, the student's dean, and the office of student life

How to succeed?

- **Attend all lectures/labs**
 - lectures run **synchronously** and are not being recorded
 - attendance usually correlates with higher grades
- **Participate and think critically**
 - turn on your cameras during lectures and feel free to ask questions
 - use the online forum (EdStem)
 - use office hours regularly
- **Start working on assignments early**
 - avoid copying/pasting or google'ing answers