

# **Digital Logic Design + Computer Architecture**

**Sayandeep Saha**

**Assistant Professor  
Department of Computer  
Science and Engineering  
Indian Institute of Technology  
Bombay**



# Introduction

# Who is talking??

- Sayandeep Saha (<https://www.cse.iitb.ac.in/~sayandeepsaha/>)
  - Research Interests: Security and Cryptographic Engineering
  - Office: CC 215
  - Office Hours: Before and after the labs (1:30 PM to 5:30 PM) on **Tuesday**
  - Mailto: [sayandeepsaha@cse.iitb.ac.in](mailto:sayandeepsaha@cse.iitb.ac.in) (must mention [CS230+231] in the subject).

# I am a Computer Scientist...

## CS230 Deep Learning

Deep Learning is one of the most highly sought after skills in AI. In this course, you will learn the foundations of Deep Learning, understand how to build neural networks, and learn how to lead successful machine learning projects. You will learn about Convolutional networks, RNNs, LSTM, Adam, Dropout, BatchNorm, Xavier/He initialization, and more.

[Syllabus](#)[Ed \(link via Canvas\)](#)[Lecture videos \(Canvas\)](#)[Lecture videos \(Fall 2018\)](#)

### Instructors



Andrew Ng  
Instructor

### Time and Location

Wednesday 9:30AM-11:20AM  
Zoom

# Sorry Guys... But this is also about...

- Machine and Learning...Better to say “learning about machines...”

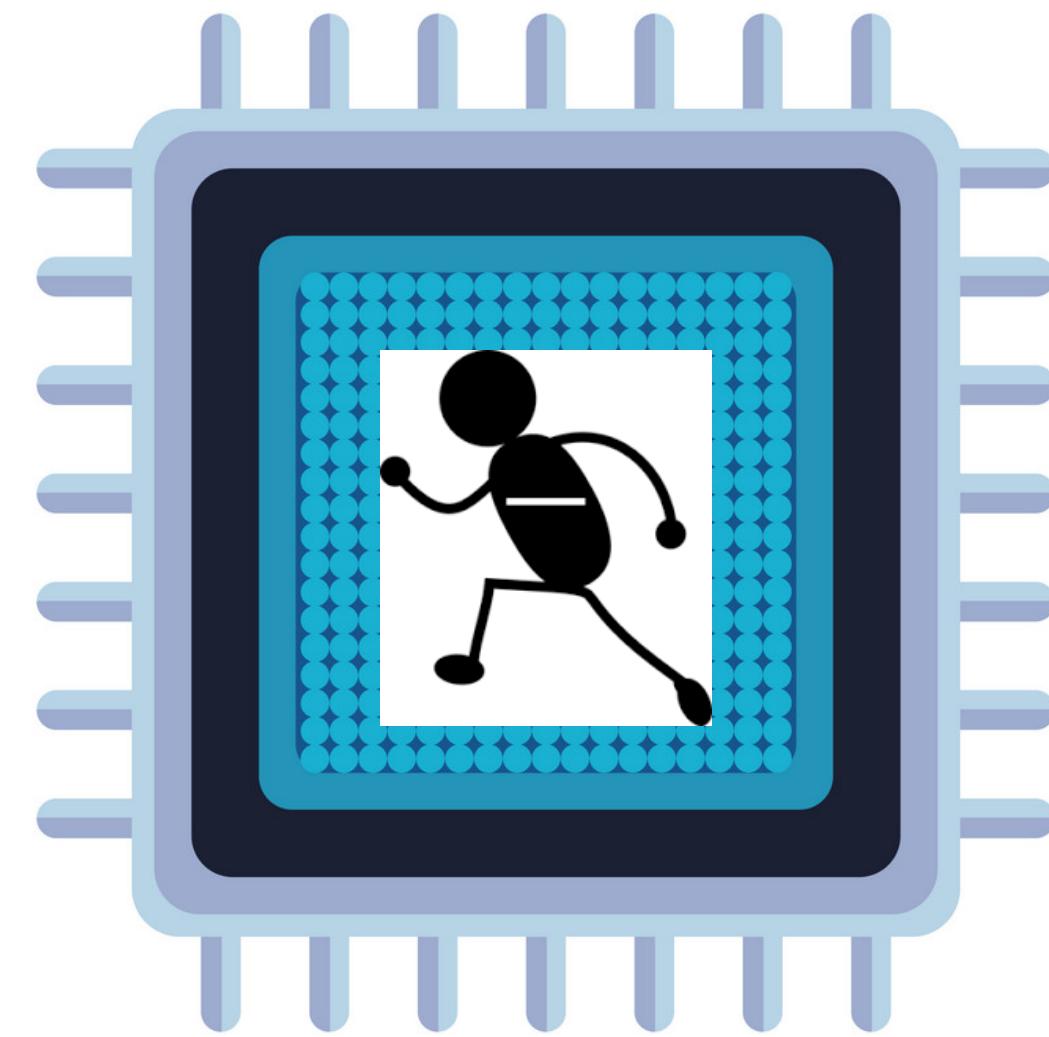


# How is it Related to “Machine Learning”?

- Ever though about where your tensorflow/pytorch runs?
- Machine Learning
  - Concepts were there since 1980's
  - Then why such buzz in 2024??
- Those days we didn't have such powerful machines to train our models

# Why should I bother about chips??

- It is Electronics... :(
- Indeed it is....But then...



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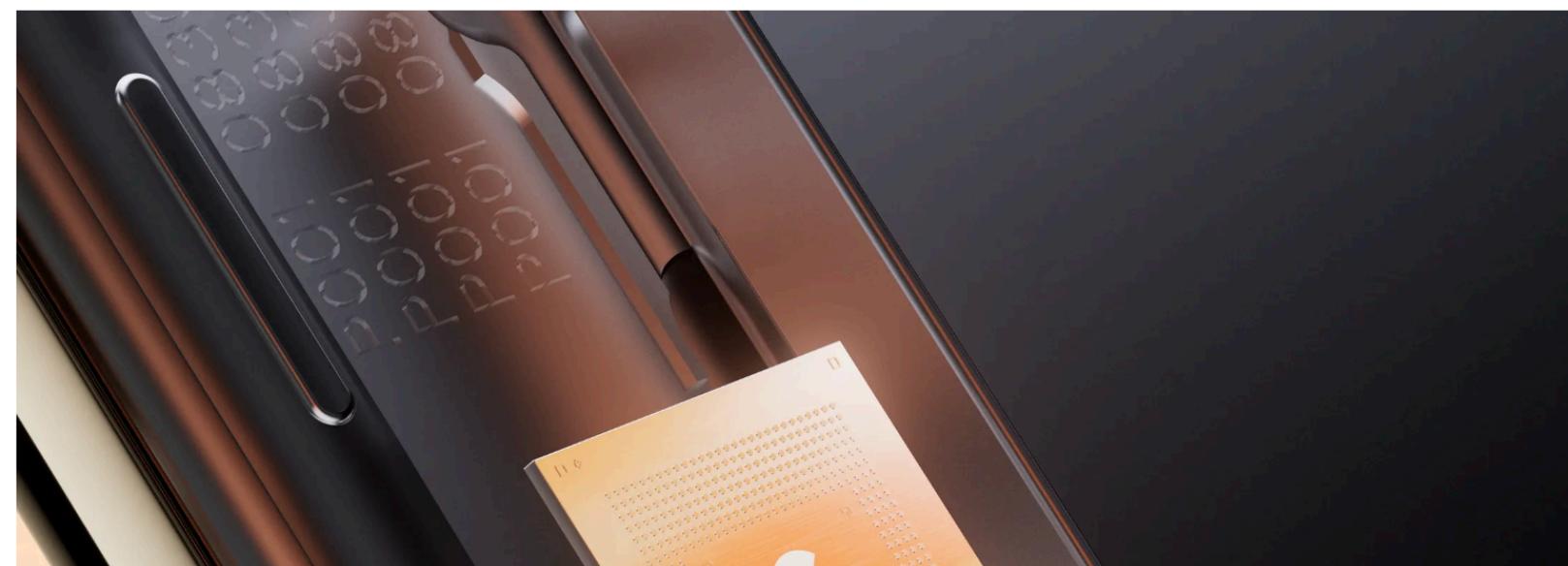
# Why should I bother about chips??

- It is Electronics... :(
- Indeed it is....But then everyone wants their own processor, why???

News / [Technology Science](#)

## Google's Next Pixel Phone Will Be Powered by a Custom Chip

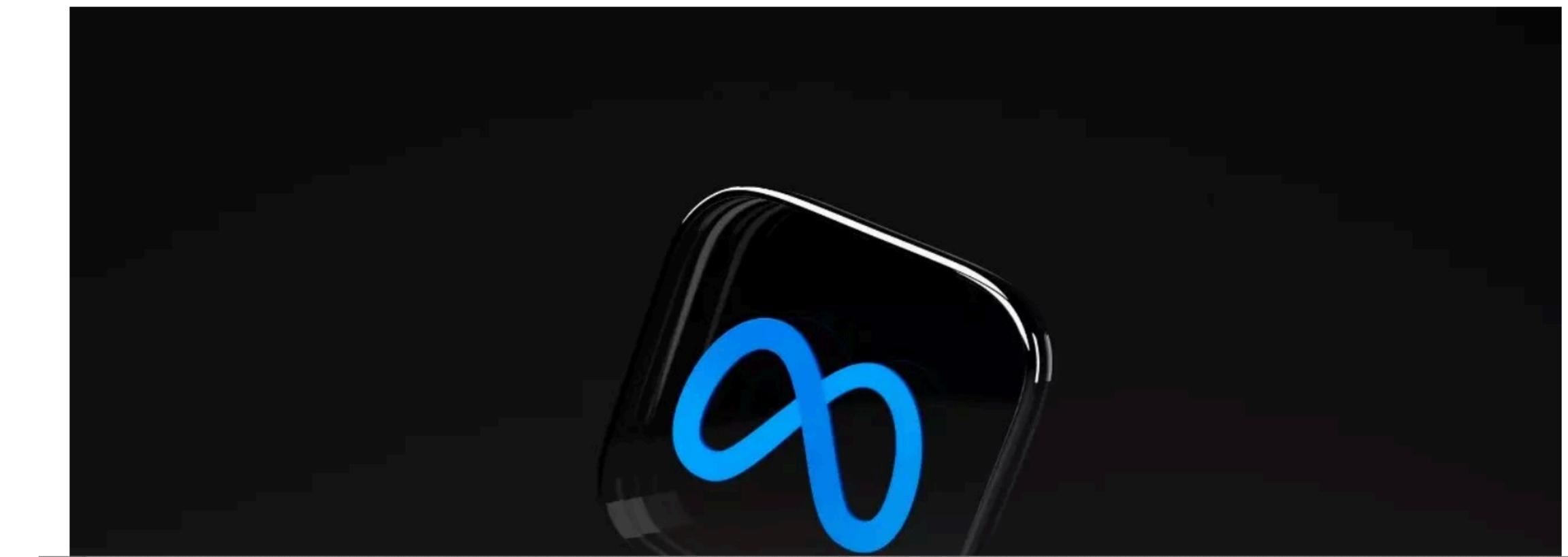
Following the industry trend of tech giants manufacturing their own processors, the company will start putting bespoke silicon in its mobile hardware.



## Meta Launches New AI Chip For Facebook, Instagram And WhatsApp

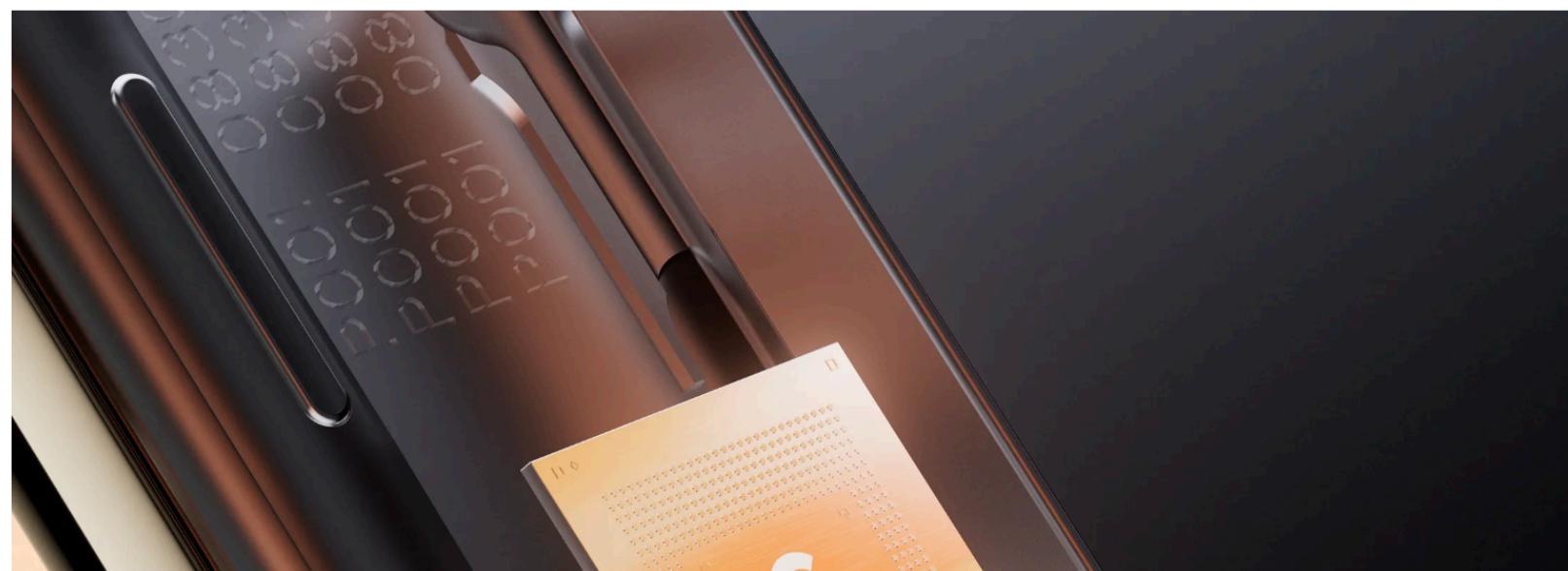
The chip, internally known as "Artemis," signifies Meta's move towards reducing reliance on Nvidia's AI chips and cutting down energy costs.

TIMES NOW Authored by: TN Tech Desk | Updated Apr 11, 2024, 09:50 IST



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- It is Electronics... :(
- Hardware is the new software



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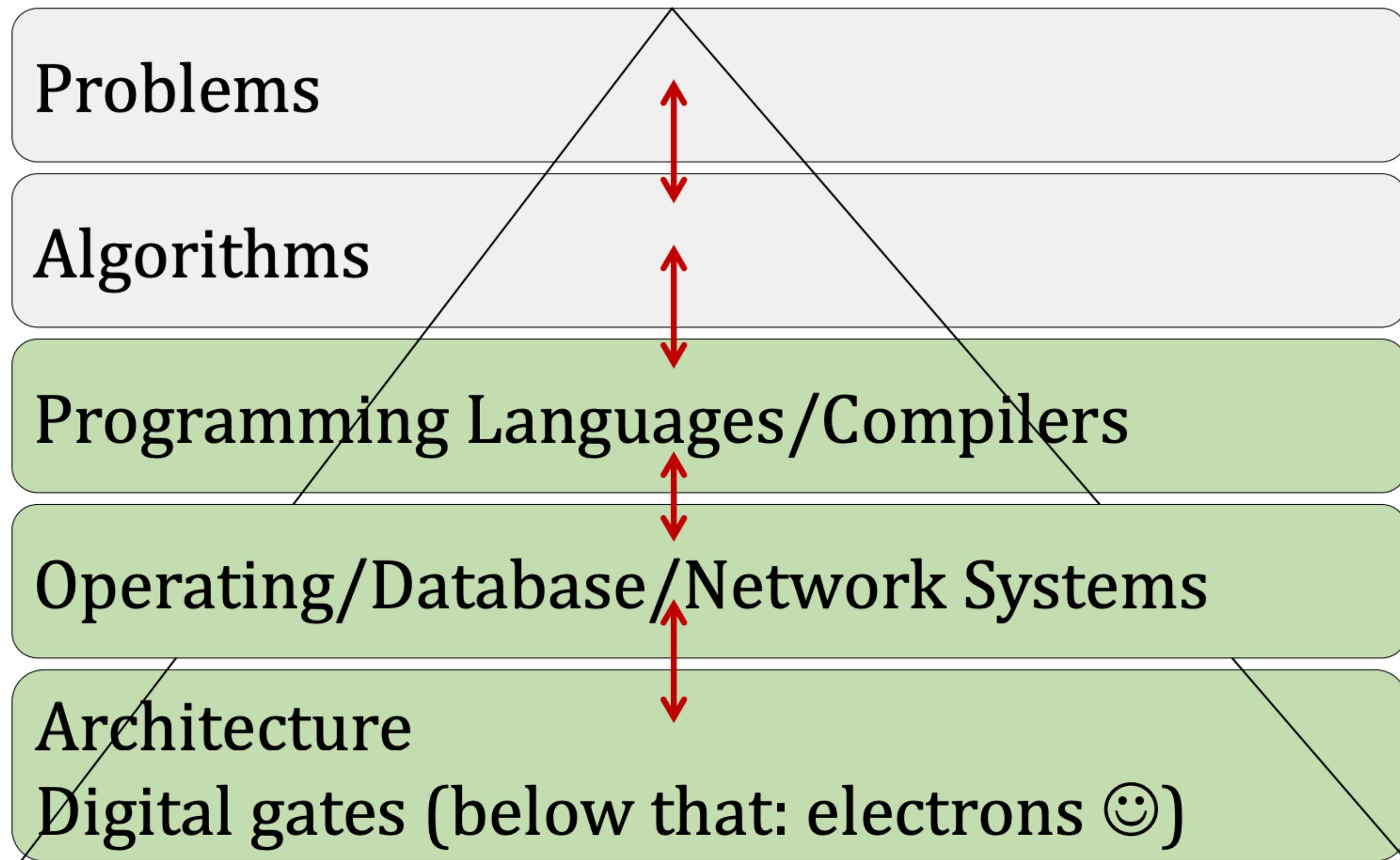


# Abstraction...

- We only use our computers...do not bother what is inside...
  - Don't bother about unnecessary complexity...just use things as black box
  - Can you develop a game while thinking on how your electrons behave??



# Abstraction...



# Abstraction...

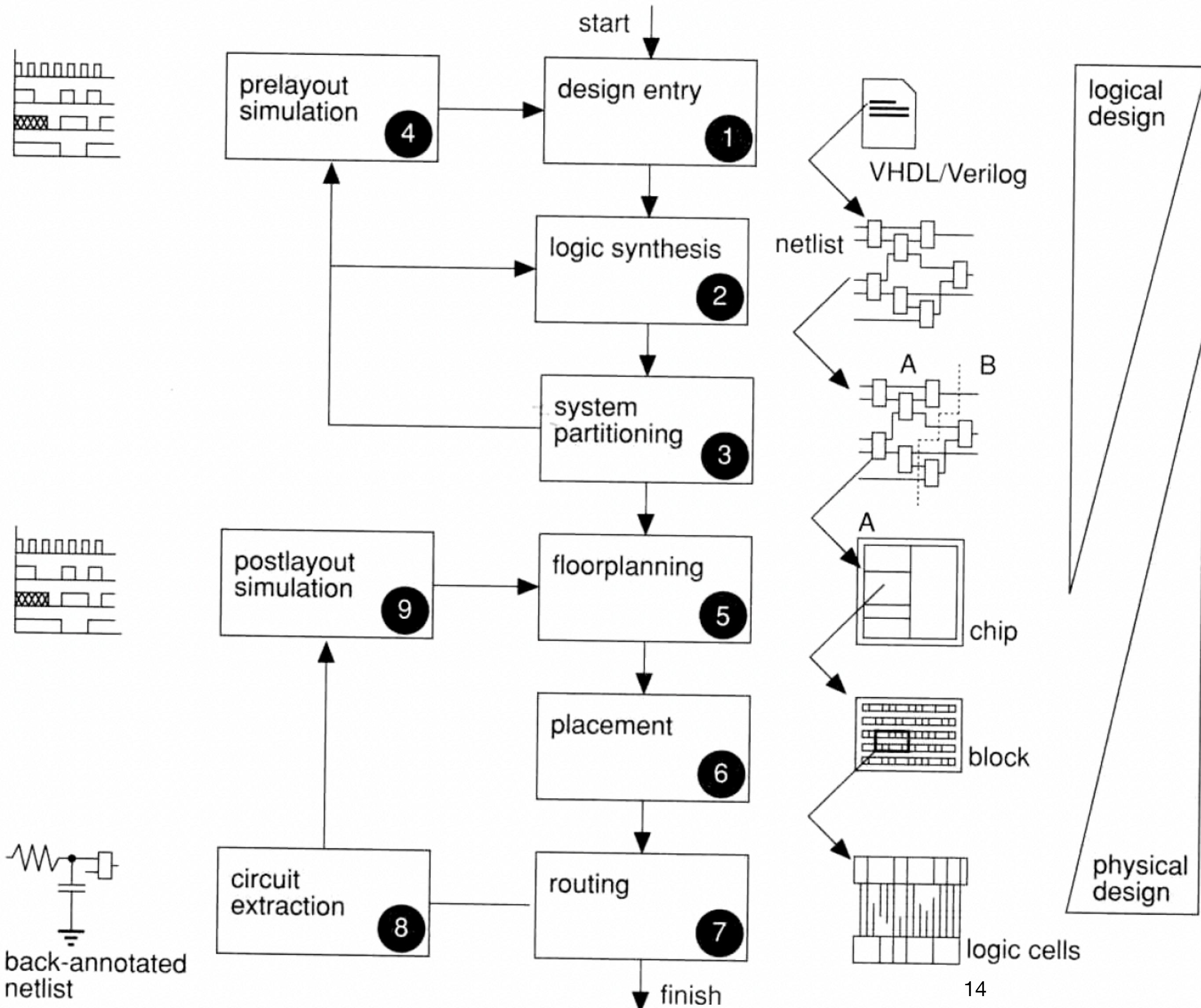
- But then, it only works when you don't care much about performance...
  - Recent trend in industry...
  - Design and optimize everything...
  - Breaking the abstraction barrier..
  - But that's ok, performance gives money



# The Computer Aided Design Industry

- The role of a computer scientist in all this....
- Imagine wiring your latest intel processor by hand ...
  - Note: 10 billion transistors...
  - We do it with computers since 80's.

# The Computer Aided Design Industry



**synopsys®**

**cadence®**

**Mentor Graphics®**  
**SIEMENS**

# And Finally, Security...

- Hardware hacking is the new “cool” thing...

**Crypto Keys Could Be Compromised by Intel and AMD ‘Hertzbleed’ Chip Vulnerability**

⌚ 2 mins

By Martin Young Updated by Geraint Price  
15 June 2022, 07:40 GMT+0000 15 June 2022, 07:40 GMT+0000

**In Brief**

The attack observes power signature of any cryptographic workload.

Modern Intel Core and AMD Ryzen chips are affected.

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## Intel ups protection against physical chip attacks in Alder Lake

Repurposes logic originally used for spotting variations in voltage, timing in older circuits to help performance

by Dan Robinson

Fri 12 Aug 2022 / 15:00 UTC

**BLACK HAT** Intel has disclosed how it may be able to protect systems against some physical threats by repurposing circuitry originally designed to counter variations in voltage and timing that may occur as silicon circuits age.

The research was presented by Intel at the [Black Hat USA 2022](#) cybersecurity conference this week, and details logic inside the system chipset that is intended to complement existing software mitigations for fault injection attacks, the chipmaker said.

It makes use of a Tunable Replica Circuit (TRC), logic developed at Intel Labs to monitor variations such as voltage droop, temperature, and aging in circuits to improve

TRENDING: Maingear MG-1 AMD PC Build GeForce RTX 4070 Radeon RX 7900 XTX Ryzen 7 7800X3D Alienware Area 51m

**HOME NEWS**

### AMD And Intel CPUs Rocked By New Speculative Execution Attack With A Huge Performance Hit

by Zak Killian — Wednesday, July 13, 2022, 05:08 PM EDT

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Technology

## Using just a \$25 device a researcher hacked into Elon Musk's Starlink system

What will the technology mogul have to say about this?



AI power analysis breaks post-quantum security algorithm

Technology News | February 19, 2023

By Nick Flaherty

AUTHENTICATION & ENCRYPTION

One of the key post quantum security algorithms agreed as the latest standard has been broken by Swedish researchers

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- We can just hack a hardware by writing a piece of code

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# Let's Pause

- This is a foundational course for entering...
  - The world on modern computer architecture, AI accelerators...
  - **Byproduct:** It will make you a better coder for sure...
  - CAD tools and algorithms
  - Modern computer security
  - And many more...
- Let's now talk a bit on the course logistics...

# Digital Logic + Computer Architecture

- Logic Part: (First 3 weeks)

- Instructor: Sayandeep
- Traditional Model
  - Class lectures
  - SAFE quiz — every class
  - Traditional quiz — 1
  - Lab on Verilog — 3 labs
  - Resources:
    - **BodhiTree**
    - <https://sites.google.com/view/sayandeepsaha/digital-logic-and-computer-architecture-theory-lab>

- Architecture Part:

- Instructor: Bhaskar
- Flipped Classroom Model



Thank you