

# Verilog HDL: Introduction

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# Outline

- What is VLSI ?
- Evolution of VLSI
- Evolution of Microprocessor
- Major domains of VLSI
- Skills required
- Career in VLSI

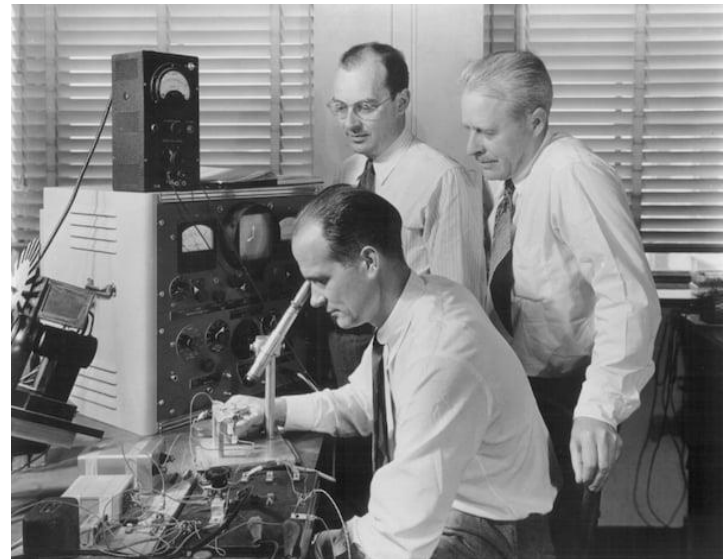
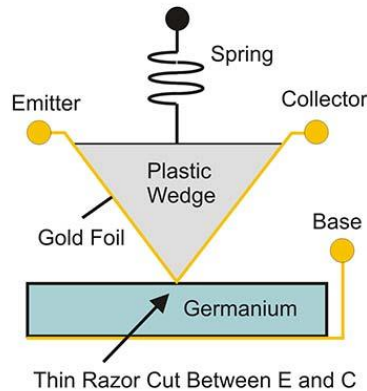
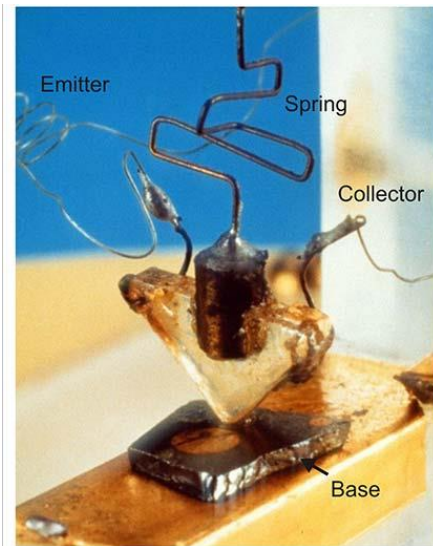
# What is VLSI ?

- Millions and even billions of devices on a single chip
- The scale at which this technology has advanced is unmatched
- The technology has helped the computing community grow

# From Transistor to VLSI Journey

## Transistor Invention

- **Year:** 1947
- **Inventors:** Bardeen, Brattain, Shockley (Bell Labs)
- **Replaced:** Vacuum tubes → Enabled miniaturization
- **Impact:** Birth of modern electronics & computing



# Evolution

- SSI (Small-Scale Integration)
  - Contains only a few logic gates (1 to 10 gates, about 10–100 transistors)
  - Example: basic logic gates (AND, OR, NOT) in separate IC packages (like 7400 NAND gate)
- MSI (Medium-Scale Integration)
  - Integrates tens to hundreds of gates (about 100–1,000 transistors).
  - Example: simple digital circuits like adders, multiplexers, decoders, counters. IC families like 7400 series MSI chips.

# Evolution

- LSI (Large-Scale Integration)
  - Contains thousands of gates (about 1,000–10,000 transistors).
  - Example: 8-bit microprocessors, memory chips, small processors.
  - Used in early microcomputers (1970s).
- VLSI (Very-Large-Scale Integration)
  - Contains tens of thousands to millions (now billions) of transistors.
  - Example: modern microprocessors, DSPs, FPGAs, GPUs, SoCs.
  - Technology from late 1970s onwards, dominating today's IC industry.

# Evolution

- ULSI (Ultra-Large-Scale Integration) (modern usage)
  - Integration of **millions to billions of transistors** on a single chip.
  - Today's processors (e.g., Intel Core, AMD Ryzen, Apple M-series) are ULSI.

# Integration



First Hard Disk 10 MB



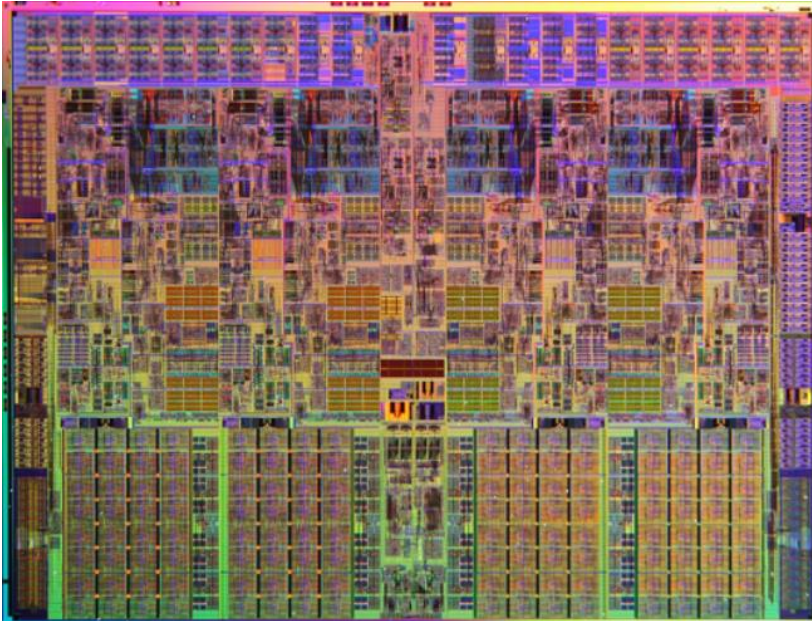
Recent Hard Disk 15 TB



# Evolution of Microprocessors

- First Generation : 4-bit 4004 in 1971
- Second Generation : 8-bit, 8008, in 1974
- Third Generation : 16-bit, 8086 in 1978
- Fourth Generation : 32-bit, 80286 and Pentium, 1986 and 1993
- Fifth Generation : 64-bit, i3, i5 and i7 in 2010

# Modern Digital Designs



- Intel Core i7
- More than 3 billion transistors
- Very expensive to design
- Very expensive to manufacture
- Not viable unless the market is very large

# Major domains of VLSI

## Two main domains

- Frontend :
  - All logical designing verification part is focused
  - Knowledge of digital design and HDL is required
- Backend :
  - Physical design , layout and manufacturing part is focused
  - Knowledge of ASIC flow starting from specification is required
  - Functional simulation, Synthesis and Timing analysis is required

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# Frontend Skills and Focus

- Strong HDL Knowledge:
  - Expertise in VHDL, Verilog, and C Ability to write clean, synthesizable code
- SystemVerilog for Modern Design
  - Popular for advanced verification Supports object-oriented testbenches
- ASIC Verification Techniques
  - Testbench creation & simulation Familiarity with UVM / OVM methodologies
- Passion for Logic & Hardware Coding
  - Inclination towards circuit design & logic building Strong problem-solving mindset

# Backend Skills and Focus

- Deep understanding of CMOS circuits and analog concepts
- Circuit analysis & simulation expertise with SPICE simulations (HSPICE, NGSPICE, Spectre)
- Memory Design Expertise Knowledge of SRAM, DRAM and other memory architectures
- Layout & Physical Design Techniques, Hands-on skills in floor-planning, placement, and routing Parasitic extraction & post-layout simulation
- Automation & Scripting Skills, Proficiency in Python, Tcl, Perl, or Shell scripting
- Automation of design, simulation, and verification flows
- Additional Recommended Skills Familiarity with Knowledge of EDA tools for analog layout

# Career in VLSI

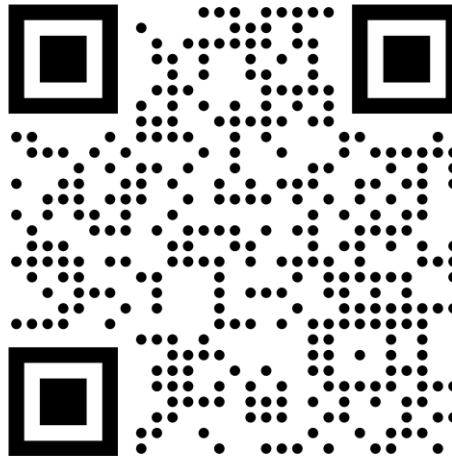
- **Design Engineer** : Frontend/Backend , AMS, DFT, PCB designer
- **Verification Engineer** : Frontend verification, Validation, Modelling
- **CAD Engineer** : Managing license , evaluate Tools , develop workflow
- **Application Engineer** : Field Application Engineer ( Pre-sales ) , Corporate Application Engineer ( Post-Sales ), Application Consultants
- **Marketing and Sales** : Promotes brands, contacting clients, post sales services

# Classroom and Feedback

CDAC Verilog Sept 2025  
WhatsApp group



WhatsApp  
Group



Pre Course  
Delivery  
Feedback



Google  
Classroom





**Thank you !**

**Happy Learning**