VLSI Design (CSE-4411)

INTRODUCTION

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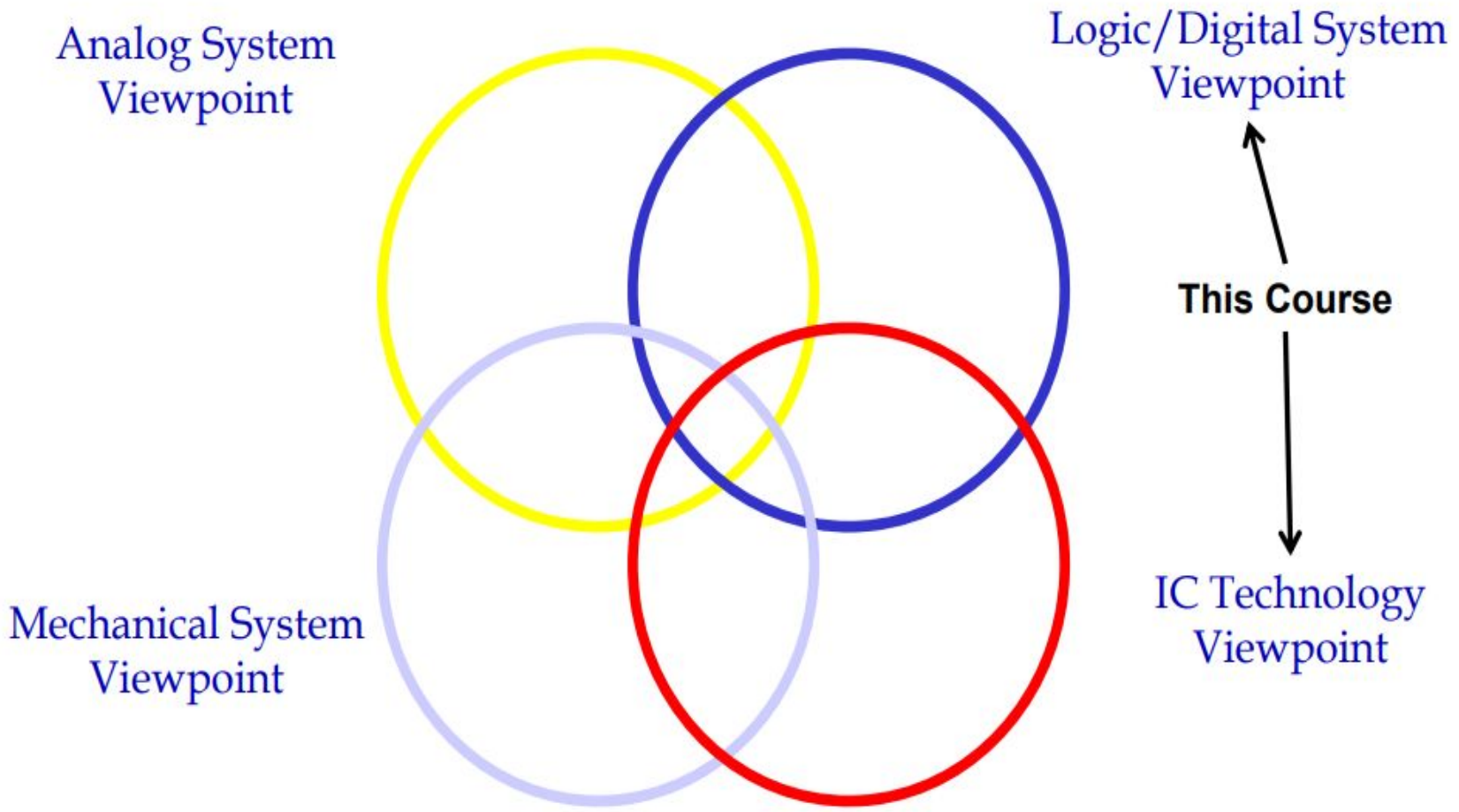
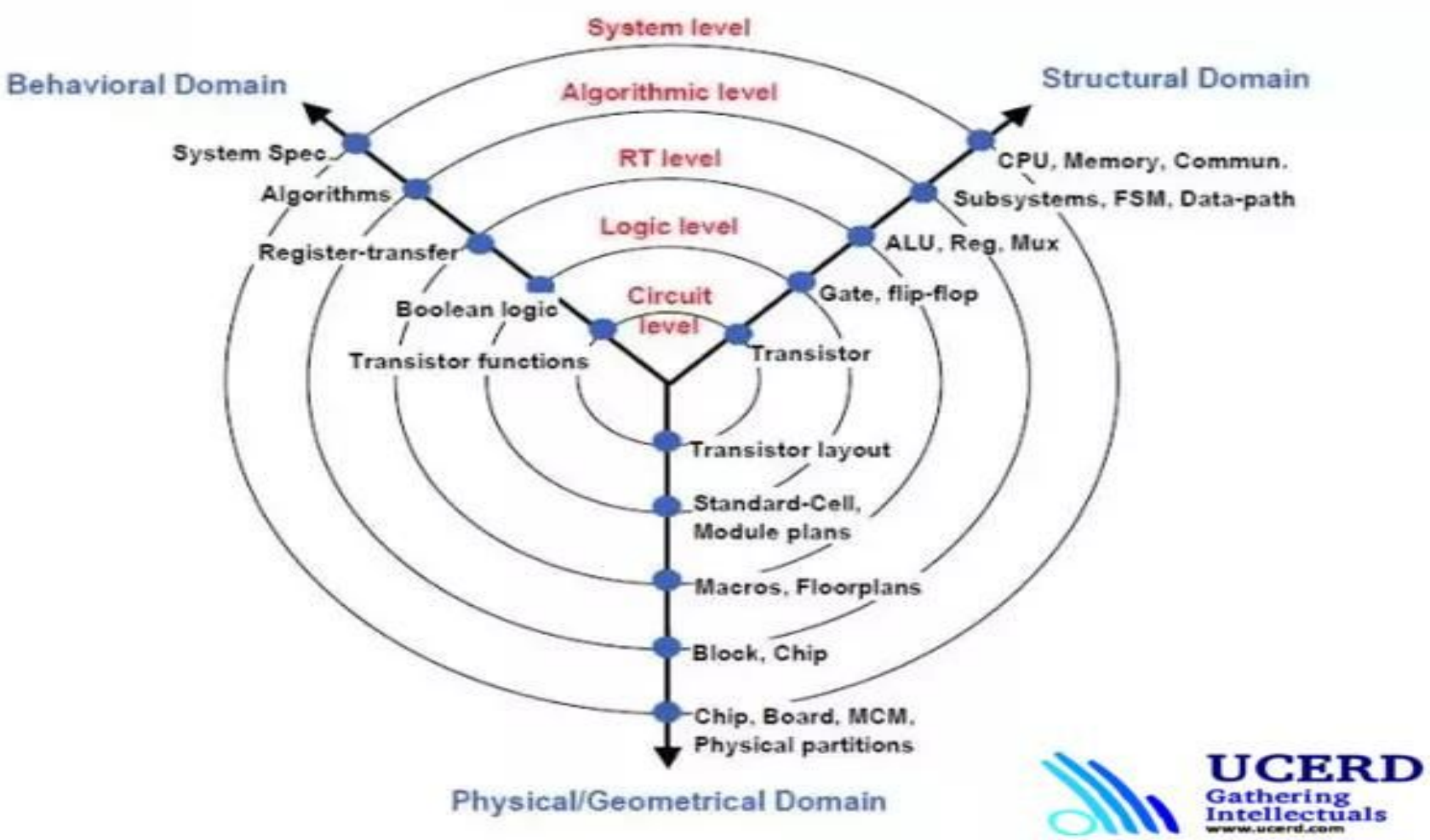
Course Logistics

- **2 Class Tests (15%)**
- **2 Assignments (15%)**
- **Class Participation (5%)**
- **Mid Term (20%)**
- **Final Exam (40%)**

Outline

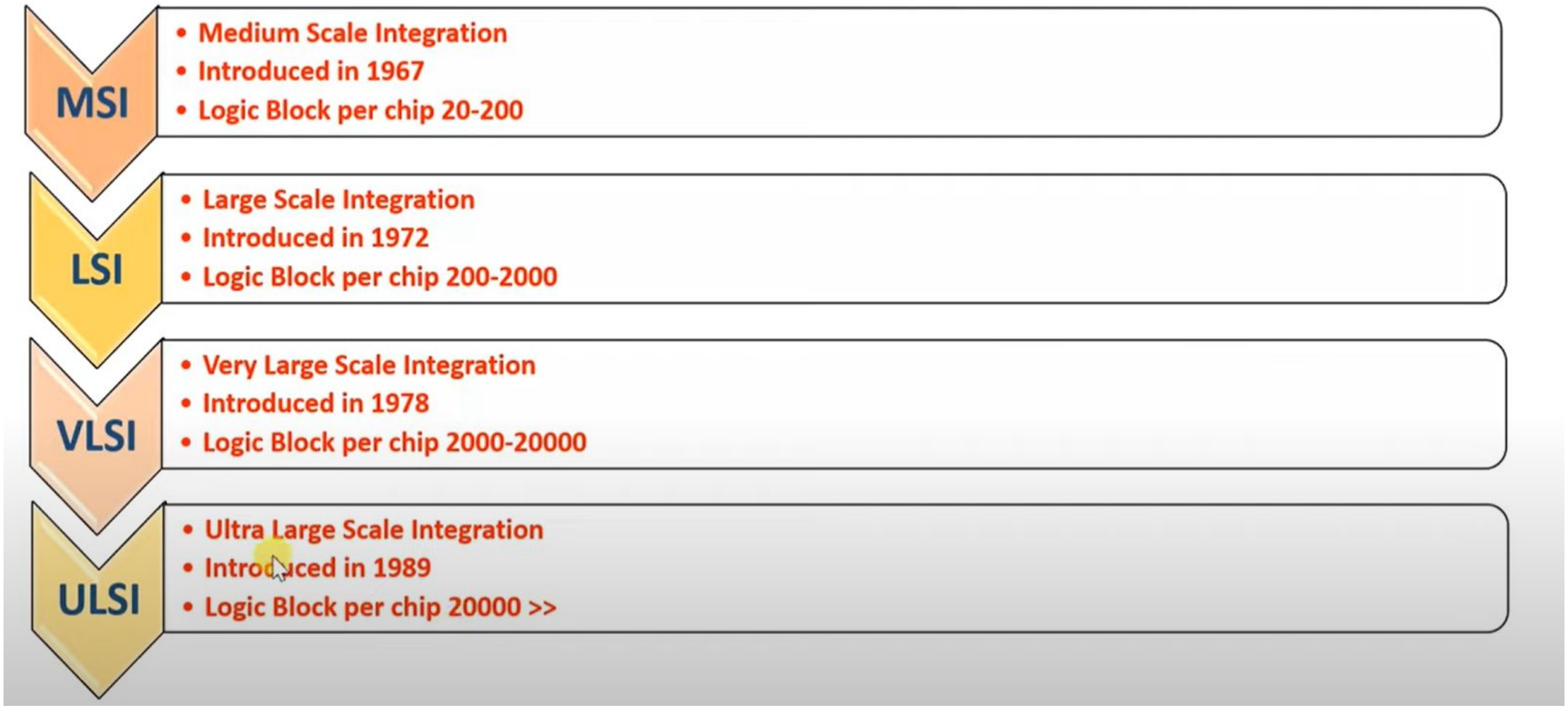

Analog System Viewpoint
Logic/Digital System Viewpoint
This Course
Mechanical System Viewpoint
IC Technology Viewpoint

Outline



UCERD Gathering Intellectuals www.ucerd.com

Evolution in logic complexity in IC’s



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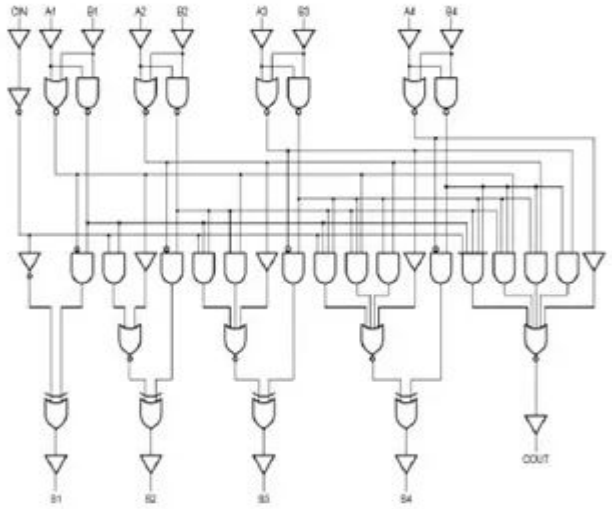
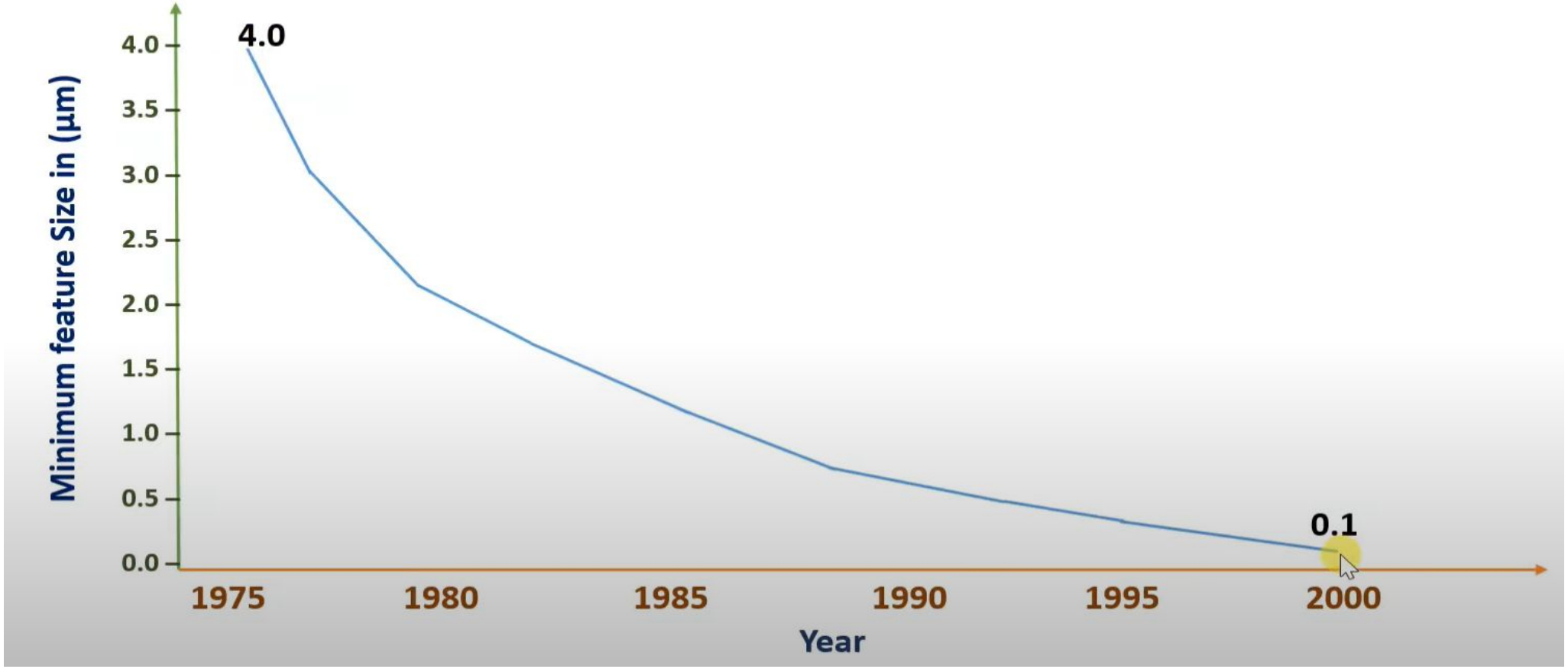
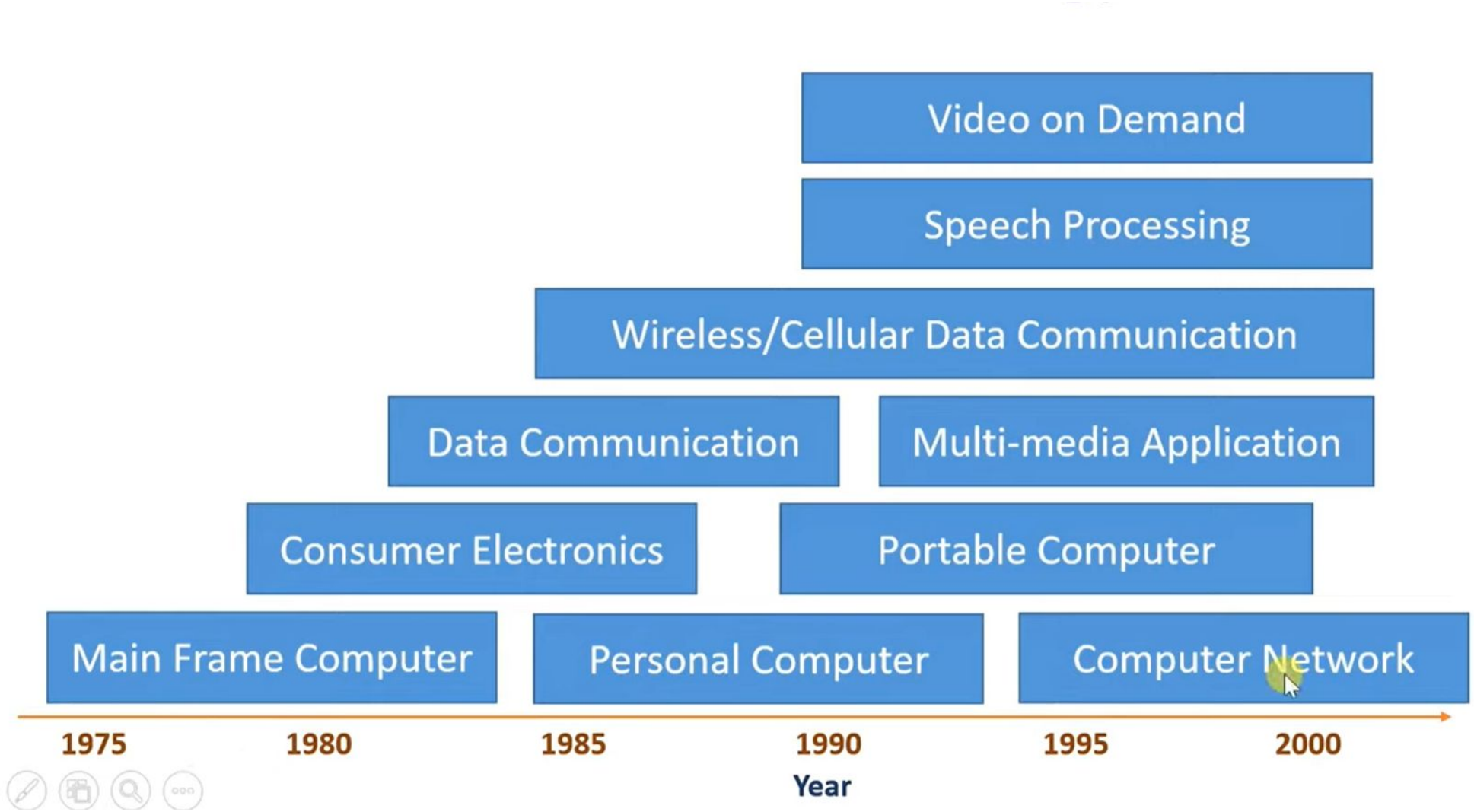


Evolution of Size in Integrated Services



Prominent Information Technology Services

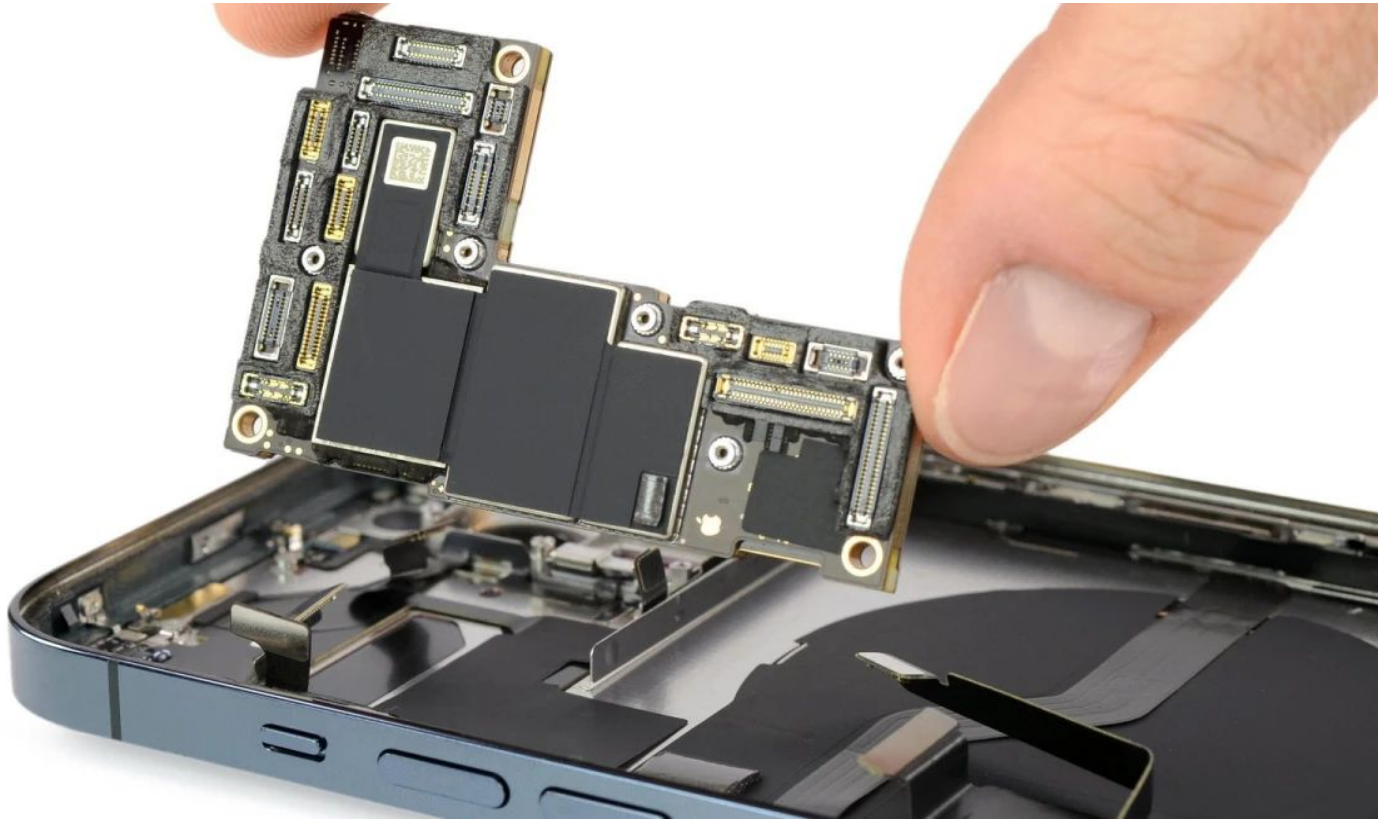


Some Facts

- **1.4 Billion mobile phones & tablets**
  - **About 100 million transistors per phone processor**
  - **About 2 GB per phone/tablet of memory 180 million PCs, laptops, desktops, and servers**
  - **About 1 Billion transistors per processor**
  - **Average memory of 8 GB each**
  - **Total logic transistors ~ 3.2E17**

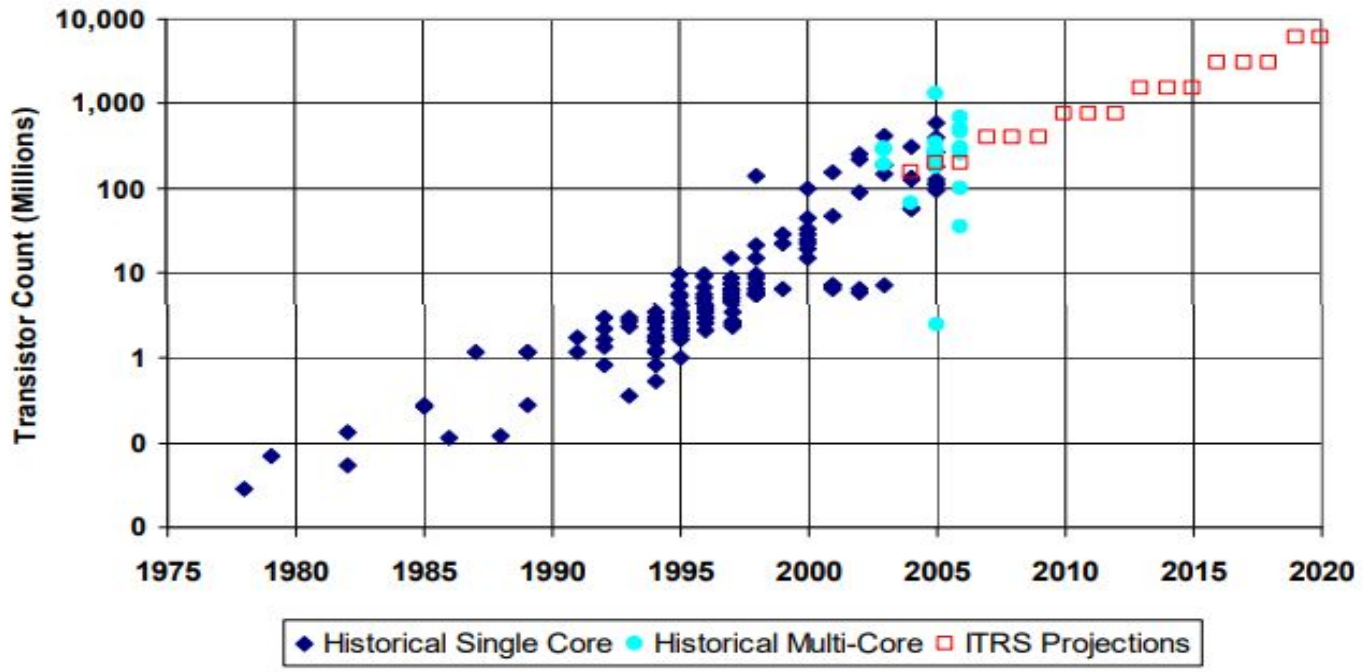
Mobile Parts Breakdown

Mobile Parts Breakdown



Moore's Law

- **1965: Gordon Moore plotted transistor on each chip**
  - **Fit straight line on semilog scale**
  - **Transistor counts have doubled every 26 months**



Integration Levels

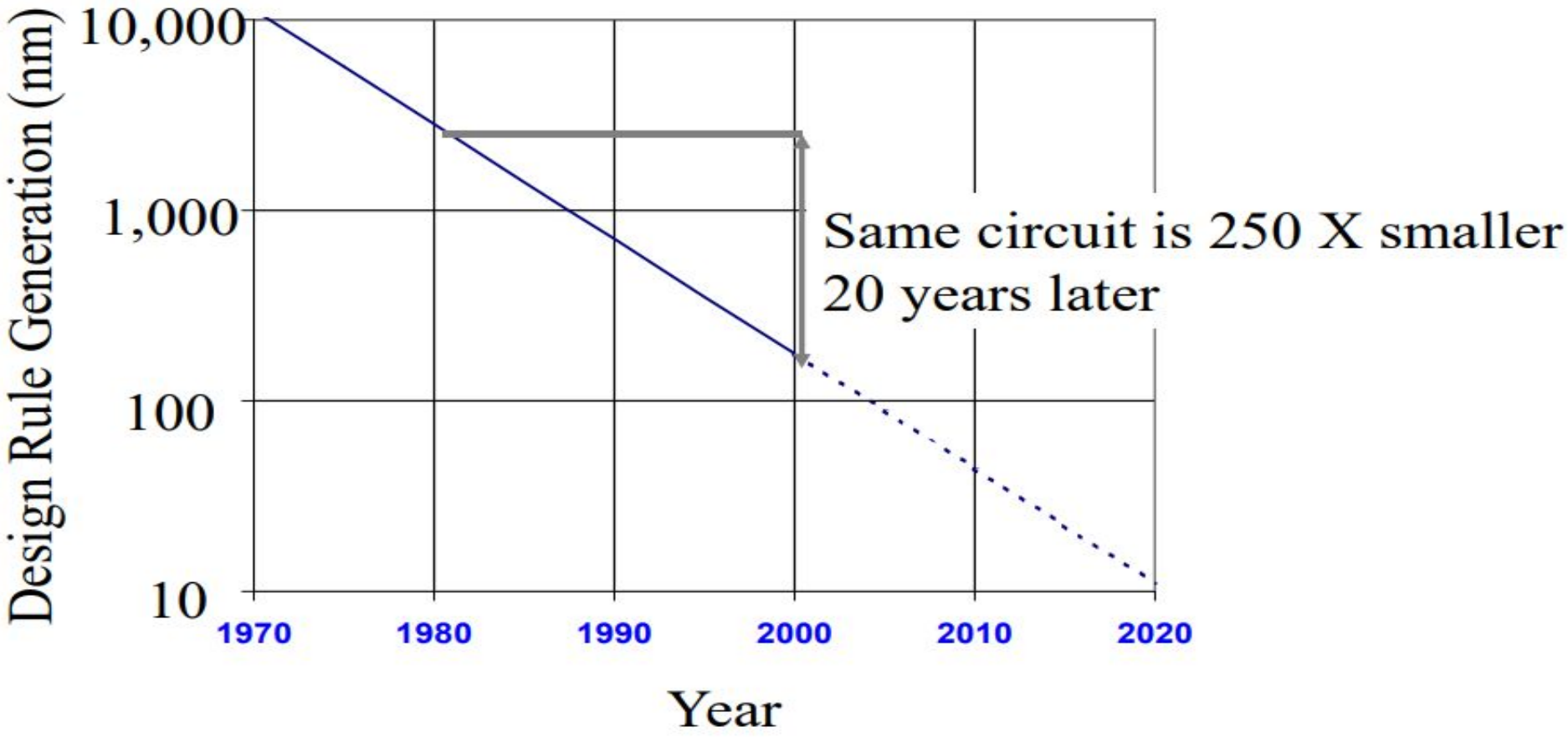
SSI: 10 gates

MSI: 1000 gates

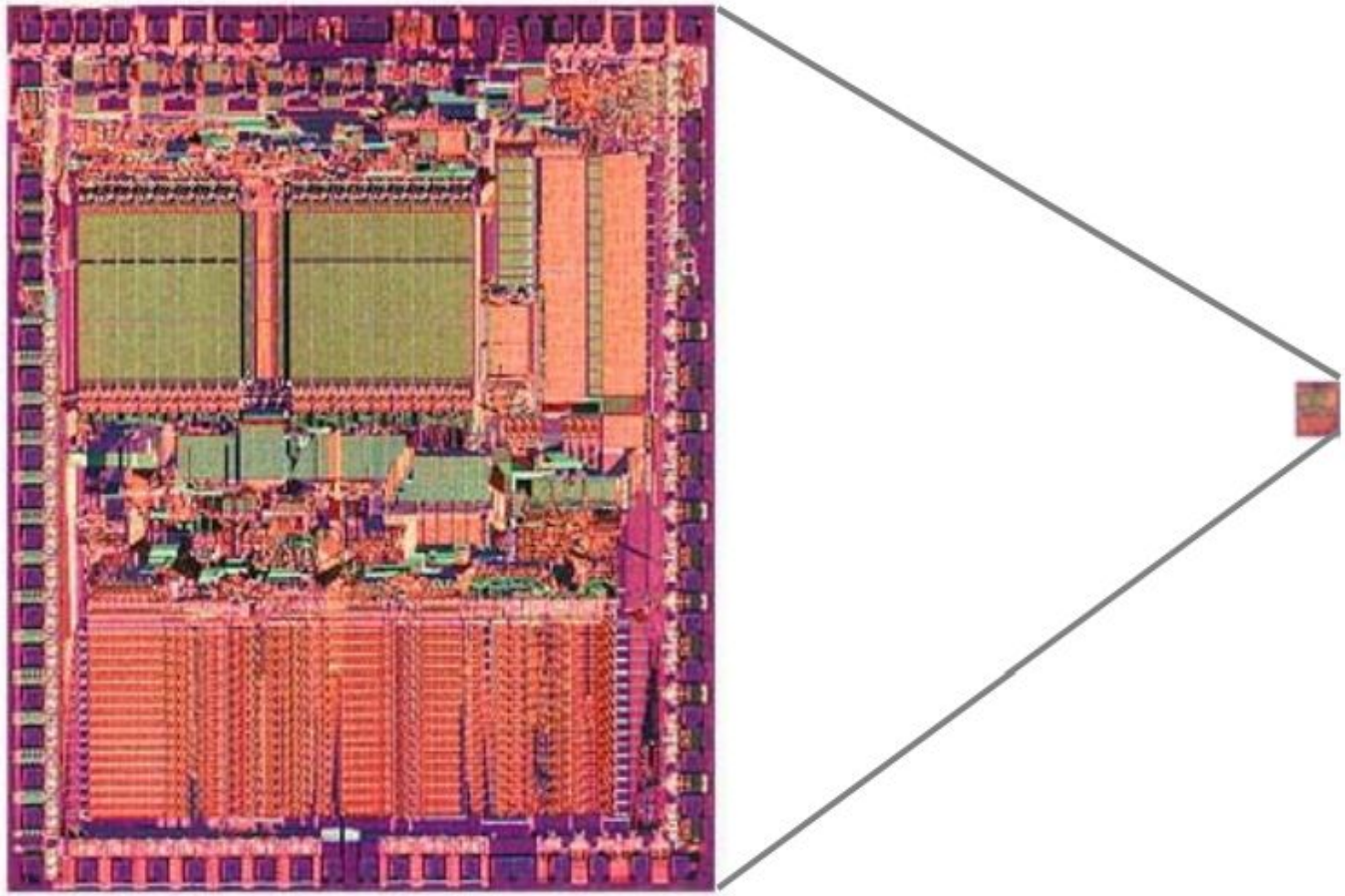
LSI: 10,000 gates

VLSI: > 10k gates

Moore’s Design Rule Scaling Law



20 Years of Progress



Why integrated circuits are preferred

- ➔ **Compact size**
- ➔ **Low power consumption**
- ➔ **Lesser weight**
- ➔ **Reduced cost**
- ➔ **Improved operating speeds**
- ➔ **Increased reliability**

Ref: medium

Fabrication

- Chips are built in huge factories called fabs
- Contain clean rooms as large as football fields

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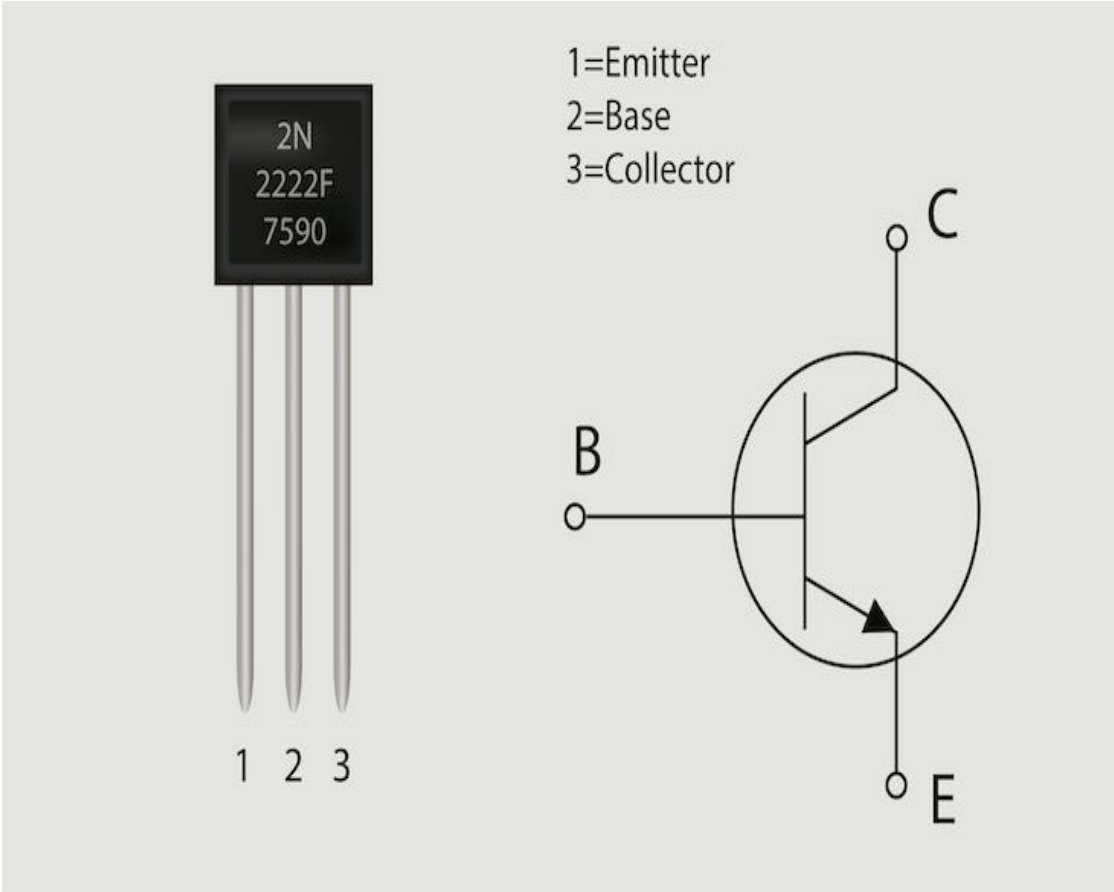
Semiconductor industry: A new possibility for Bangladesh

- **Walton took the first step by establishing the country's first hardware manufacturing plant, followed by Samsung's assembly plant.**
- **only 3 semiconductor companies !!!**
- **worldwide profit from semiconductor sales reached $481 billion in 2018.**
- **current market ~ above $600 billion.**
- **In 2011, the annual electronics sales were $216 billion, reaching a staggering $2.9 trillion in 2020.**
- **Bangladesh ChipMakers:**
  - **Neural Semiconductor Limited office in Uttara.**
  - **PrimeSilicon Limited**
  - **Ulkasemi**
  - **Walton in Bangabandhu Hi-Tech Park**
  - **ACI is going to invest soon**

Ref: link 1, Link 2

Transistor

- **semiconductor that amplifies or switches electronic signals.**
- **basic building blocks of modern electronics.**
- **Applications:**
  - **Computers**
  - **Cell Phones**
  - **Automotive**
  - **Space and Military Applications**



Evolution of IC Technologies

- **1925: J. Lilienfeld proposed the basic principle of MOS FET (Field Effect Transistor).**
- **1935: O. Heil proposed a similar structure.**
- **1962: P.K. Weimer (RCA) first placed pMOS and nMOS transistors on the same substrate.**
- **1963: Frank Wanlass (Fairchild) invented invertor, NOR and NAND CMOS gates.**
- **1965: The first MOS calculator.**
- **1971: Emergence of nMOS-silicon gate technology.**

Textbook and readings

- **CMOS VLSI Design: A Circuits and Systems Perspective**
  - **Book by David Harris and Neil Weste**

THANK YOU