# EECE416 :Microcomputer Fundamentals and Design ("Microcomputer & Microprocessor")

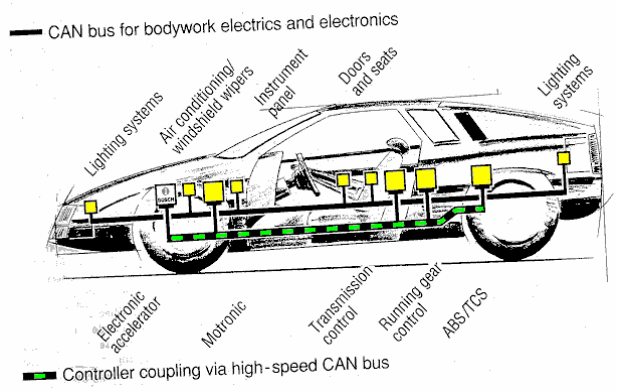
## COMPUTER HISTORY

**Compiled by Charles Kim**

**Howard University**

# Computers Everywhere

- Everywhere
  - PC, VCR, DVD,Toys
  - Phones, Cars, etc
- Hardware and Software
- Embedded Computing
- Mobile Computing
- Computers and Microprocessors
- System on Chip (SoC)



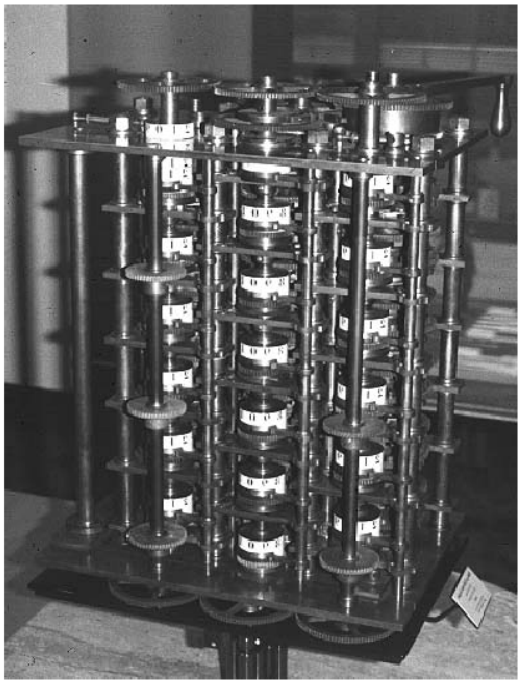
# Evolution of Microprocessor

- First Generation
  - 10s of Vacuum Tubes
- Second Generation
  - Advent of Transistors (solid-state)
- Third Generation
  - Advent of IC (Integrated Circuit)
  - Chips
- Fourth Generation
  - VLSI(Very Large Scale Integration)
- Advent of uP
  - Intel 8080→8086→80186→286→386→486→Pentium
  - Motorola 6800→68000→68020
  - Zilog  Z80 series
- And the rest is, rapidly changing technology history

# Charles Babbage's Differential Engine

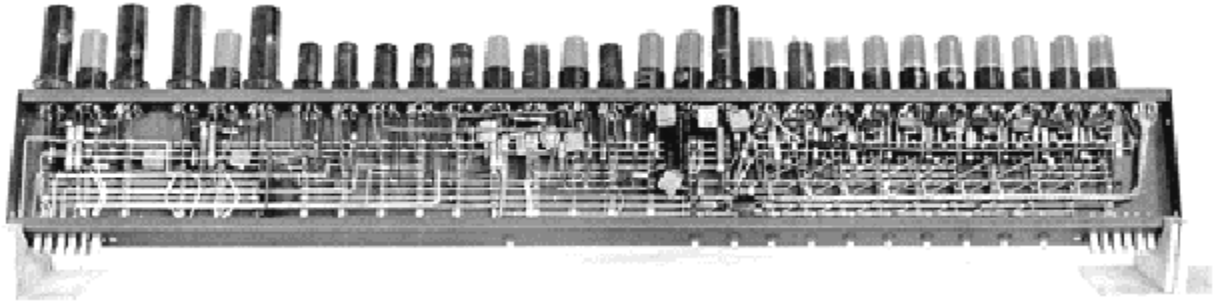
- To solve 6th degree differential equation (1842)
- Incompletion

$$f(x) = \sum_{i=0}^{n} a_i x^i$$

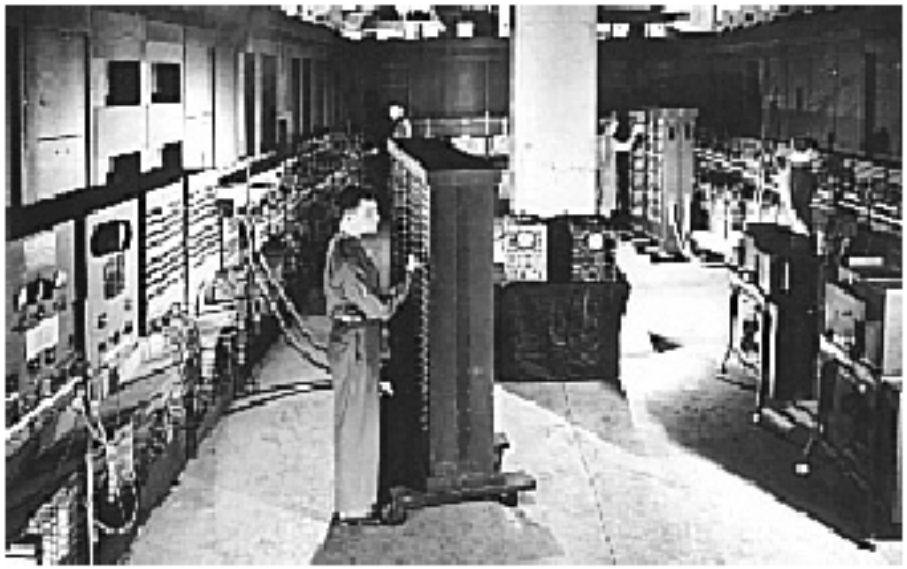


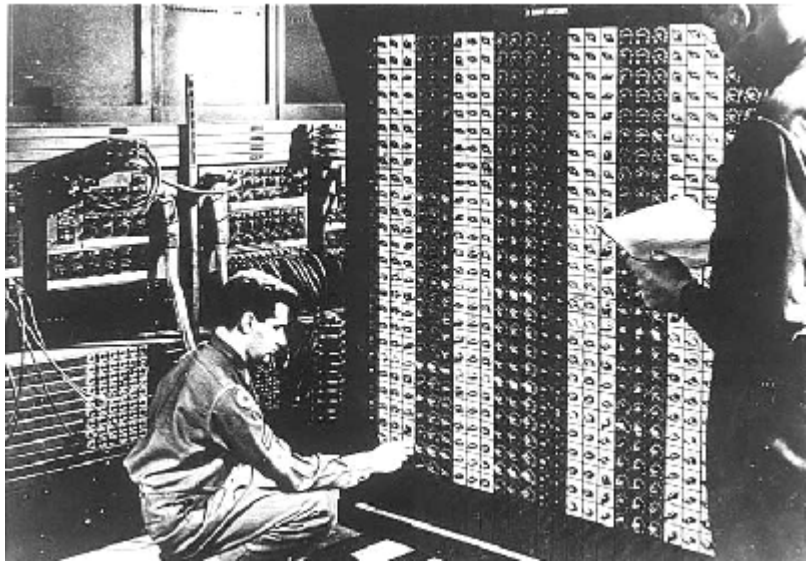
$$\Delta^i y_{j+1} = \Delta^i y_j + \Delta^{i+1} y_j$$

# ENIAC



- Electronic Numerical Integrator and Calculator, 1943-46.
- Designed by John W. Mauchly and J. Presper Eckert (Upenn)
- First general purpose electronic computer – Artillery firing tables for US Army's Ballistic Research Lab
- Smithonian Museum of American History





# IBM

## International Business Machines Corp. (IBM)

1890, Herman Hollerith (1860 - 1926, USA), (1890 Census)

– **Punching Cards, Tabulating Machine**

Electric Tabulating System

⇩

Tabulating Machine Co. (1896)

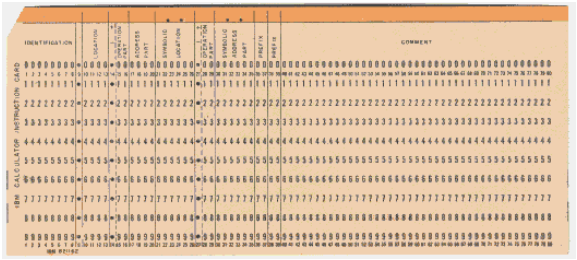
⇩

Computation-Tabulating Recording Co. (1911)

⇩

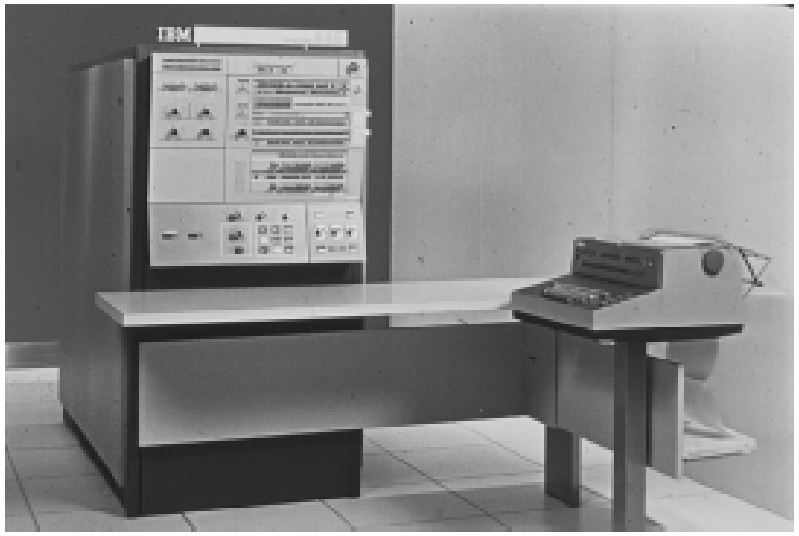
International Business Machines Corp. (IBM) (1924)

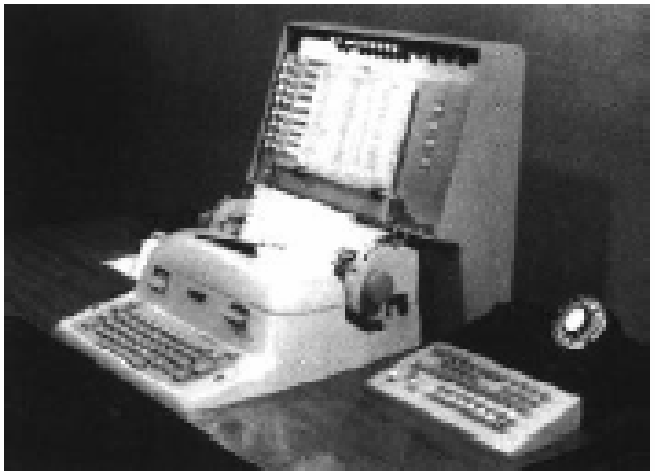
**Tom Watson**

# IBM, 1964

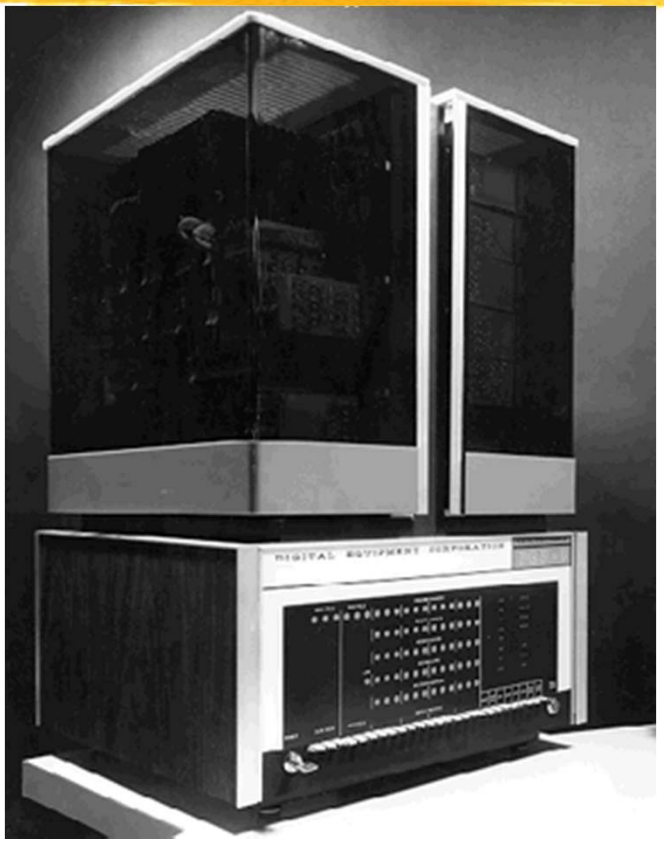
- System/360
  - "third-generation" computer
  - 7 Year long Sabre project for World wide airline reservation – fully implemented



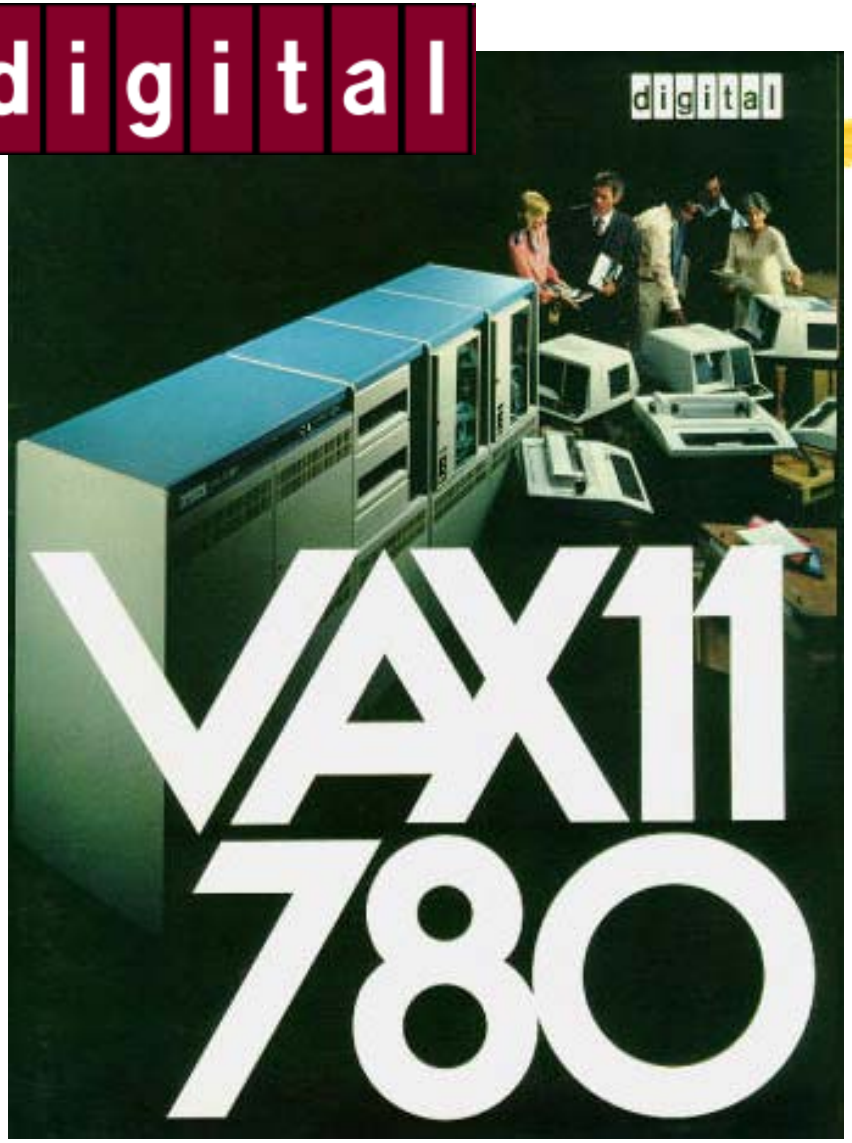


# DEC, 1965

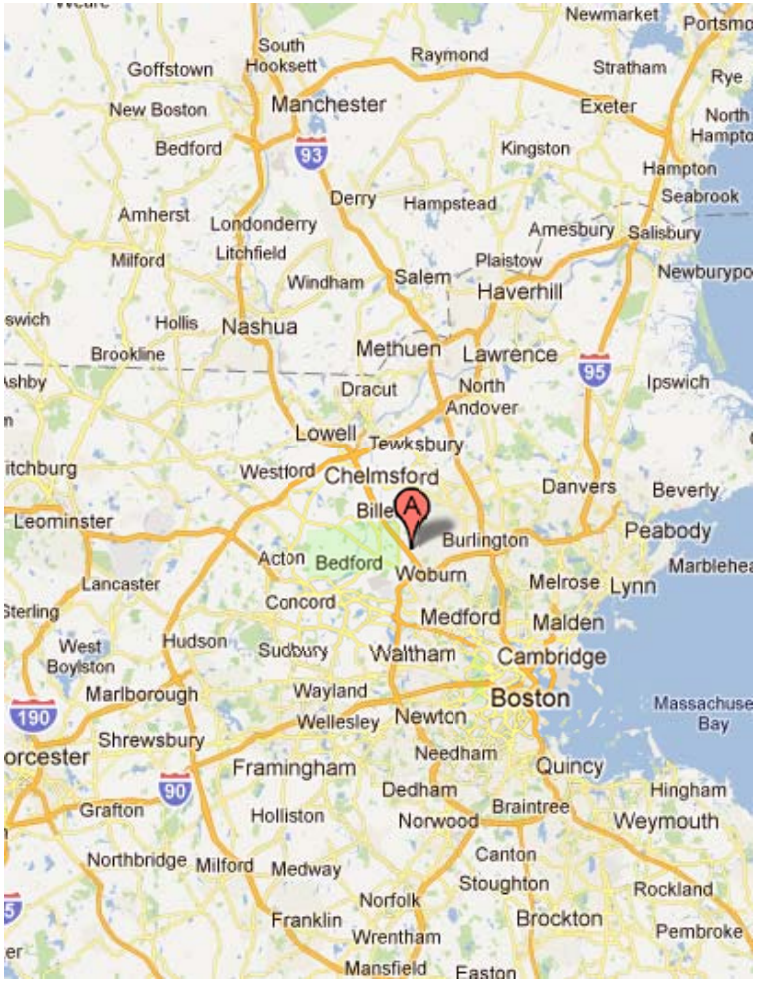
- **Digital Equipment Corp (DEC)**
  - Founded in 1957 by Ken Olsen and Harlan Anderson (both worked for MIT Lincoln Lab)
  - Brain: C. Gordon Bell
  - **Focus: "Interactive Computing" as opposed to the batch-job of IBM**
  - **PDP-8** ("programmed Data Processor")
  - **first commercially** successful minicomputer
  - **$18,000** - one-fifth the price of a small IBM 360 mainframe.
  - **A great success by**
    - Speed
    - small size
    - reasonable cost
  - **Well accepted by**
    - manufacturing plants
    - small businesses
    - scientific laboratories.
- **DEC (1957) → Compaq (1998)→ HP (2002) → No Computer Business (2011?) or Yes? (2013)**



# DEC VAX 11/780 – My Experience in early 1980s

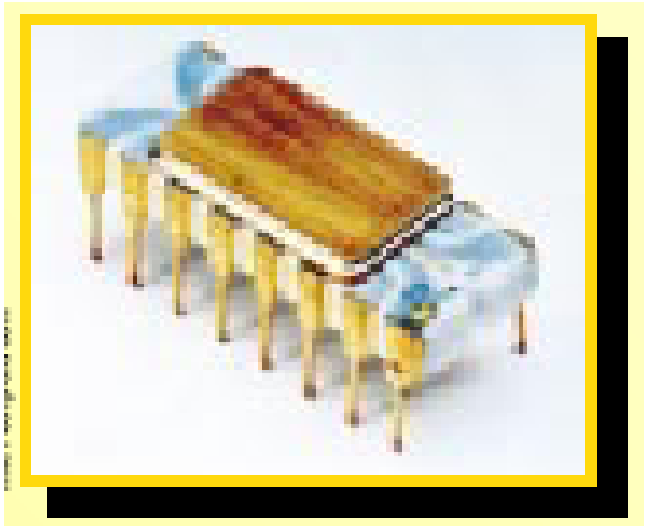



- VAX (Virtual Address eXtension) :16 → 32
- To accommodate 16-bit PDP : backward compatibility



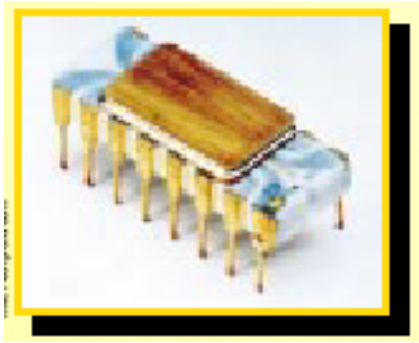
# INTEL, 1971 (“computer in a chip”)

- Intel
  - introduced 4-bit Microprocessor (4004)

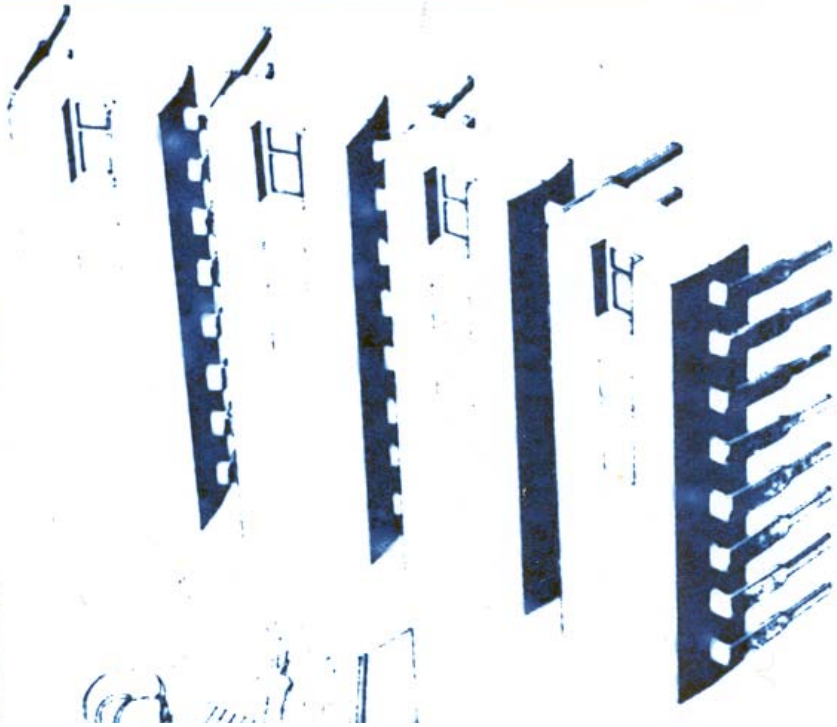


# Intel 4004 (Yr 1971)

*Intel's first advertisement for the 4004 microprocessor appeared in the 15 November 1971 issue of* Electronic News.



**Announcing a new era of integrated electronics**



**A micro-programmable computer on a chip!**

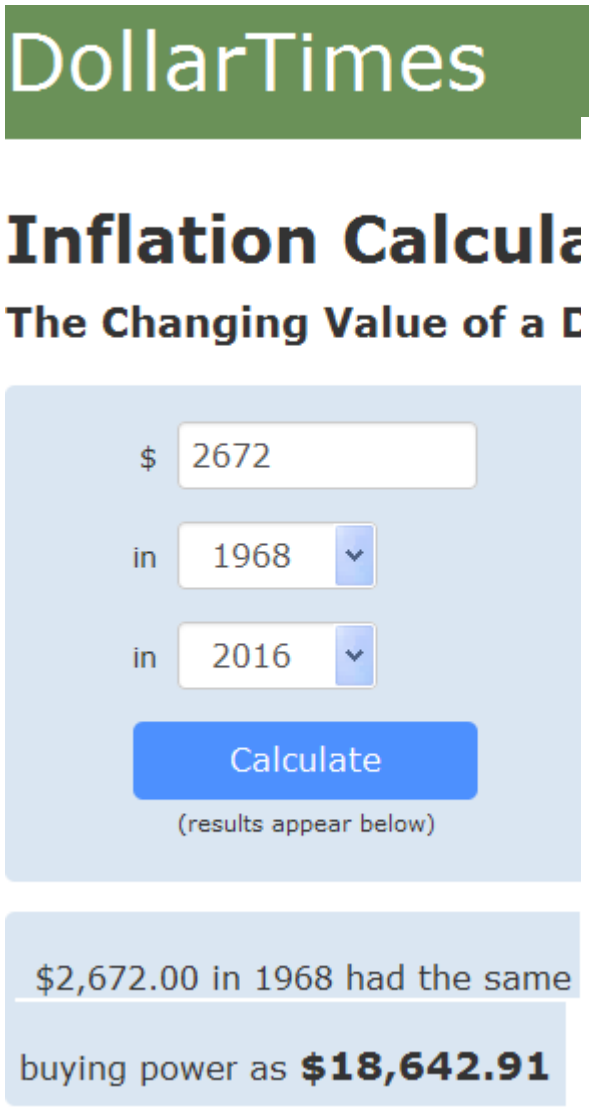
Intel introduces an integrated CPU complete with a 4-bit parallel adder, sixteen 4-bit registers, an accumulator and a push-down stack on one chip. It's one of a family of four new ICs which comprise the MCS-4 micro computer system -- the first system to bring you the power and flexibility of a dedicated general-purpose computer at low cost in as few as two dual in-line packages.

MCS-4 systems provide complete computing and control functions for test systems, data terminals, billing machines, measuring systems, numeric control systems and process control systems.

The heart of any MCS-4 system is a Type 4004 CPU, which includes a powerful set of 45 instructions. Adding one or more Type 4001 ROMs for program storage and data tables gives you a fully functioning micro-programmed computer. To this you may add Type 4002 RAMs for read-write memory and Type 4003 registers to expand the output ports.

Using no circuitry other than ICs from this family of four, you can create a system with 4096 8-bit bytes of ROM storage and 5120 bits of RAM storage. When you require rapid turn-around or need only a few systems, Intel's erasable and re-programmable ROM, Type 1701, may be substituted for the Type 4001 mask-programmed ROM.

# Behind Story of 4004




- Intel
  - **Robert Noyce** and **Gordon Moore** founded Intel in 1968
  - 12 employees
  - First year revenue: $2,672 → 2016 Value? $18,642.
  - Main product: Computer Memory
  - First Product: 3101 (64-bit memory)

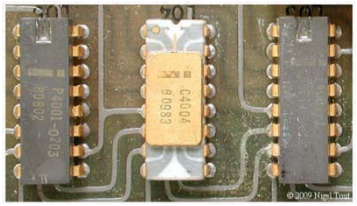
# Story-Continued

- 1969: Busicom (Japanese Co) order “A set of chips for a programmable calculator” with advanced money of $60,000.→ multiple custom chips.


NCM/Busicom *HL21* mechanical pinwheel calculator.

# Story-Continued

- Ted Hoff (designer): “single-chip, general purpose logic device, which would retrieve its instructions from **memory**”
- Result: Intel 4004 Microprocessor
  - 1/8”x 1/6”
  - 2300 transistors



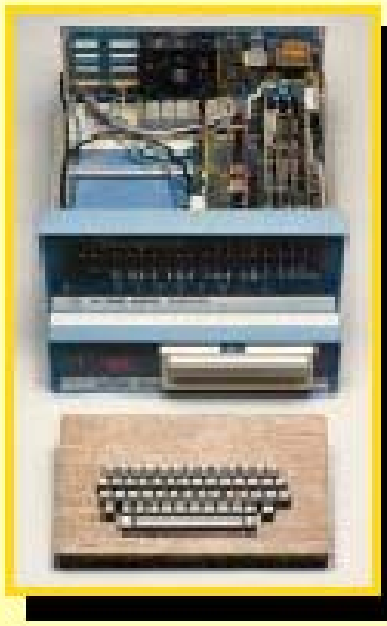
The Busicom 141-PF calculator

- Busicom under financial problem→ Intel bought back the right
- And, the rest is history
- 1971: Intel 4004, $200
- 1972: Intel 8008, 8-bit, $360

# Computer based on 8080

- Altair 8800 Computer
  - Intel 8080
  - Ed Roberts
  - His daughter's name
  - $397
  - Intel supplied the chip for $75 each


*The January 1975 cover of*



***1975*** *The first PC, an Altair 8800, available as a kit, appears on the cover of Popular Electronics in January.*

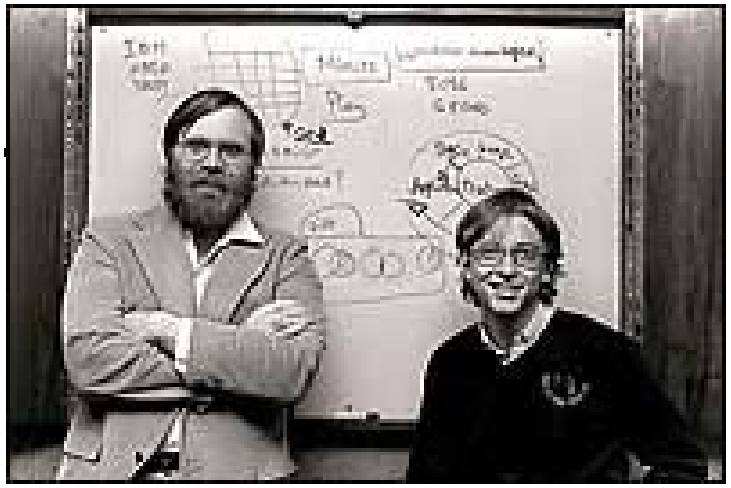
The Computer Museum

# Seattle Connection and "Micro Soft"

- 1968: Mother's group at Lakeside School raised money for Math class project ($3000)
- Arranged to buy some time on a computer for the class ("time-sharing")
- Old teletype machine →Telephone →DEC Minicomputer (owned by General Electric) in downtown Seattle
- 2 gifted students: 10th grader (Paul Allen) and 8th grader (Bill Gates) → computer nerds
- Learned how to program using **Basic** (**b**eginner's **a**ll purpose **s**ymbolic **i**nstruction **c**ode; developed at Dartmouth College in 1964)
- 1971:Paul Allen went to Washington State University, and Bill Gates, later in 1973, to Harvard.
- 1971: Started a part-time company, Traf-O-Data.
- 1972: They bought one of the first Intel 8008 chip for $360. Added some electronics for traffic data collection in digital format

# Altair 8800 and Micro Soft

- Altair8800 needed software
- Ed Roberts received letter from a company: “they already created a version of Basic for Altai 8800”
- Within 30 days they [Gates and Allen] finished the version.
- They also regained the right to market in themselves.
- Formed ***Micro Soft*** in 1977.



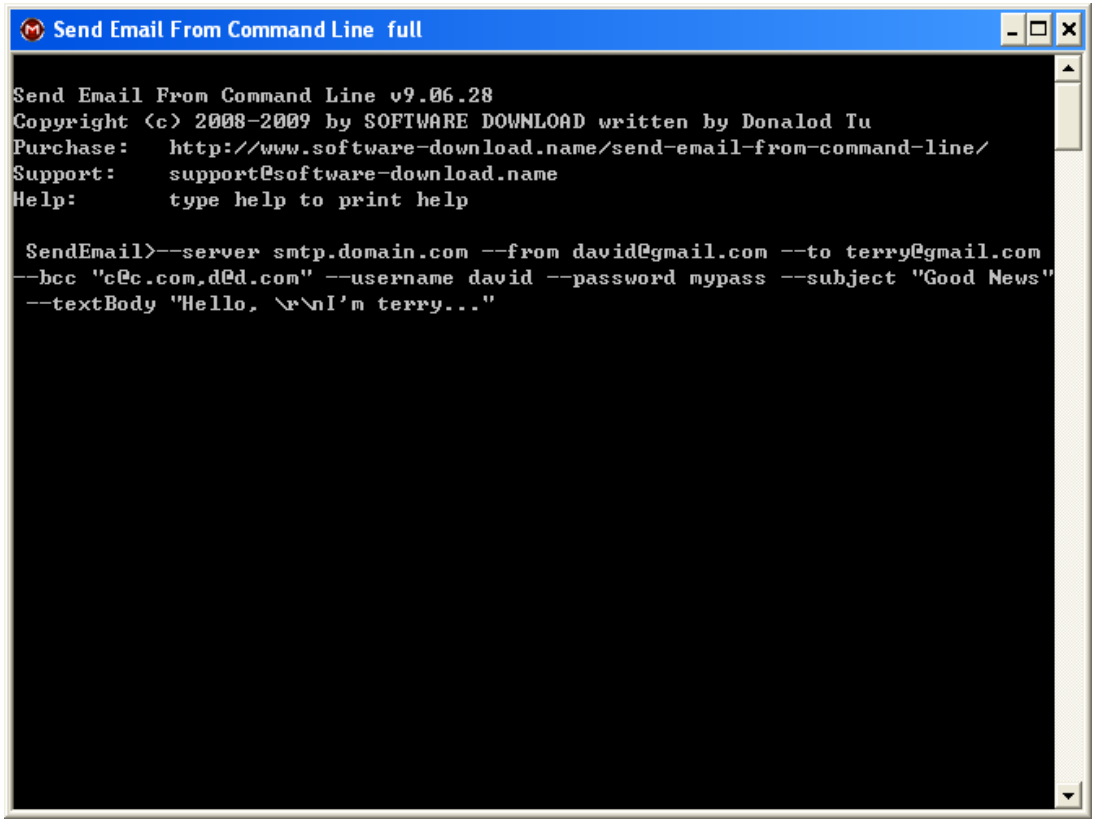
# Behind Story of MS-DOS

- IBM: Manhattan Project for PC
  - Approached Microsoft
  - Intel was 8086 suggested
  - *Basic* for PC project offered
  - Operating System needed
- Bill Gates
  - Contacted Tim Patterson (of Seattle Computer Products): File Allocation for Basic→QDOS(quick and dirty operating system)
  - Deal of the Century
    - Bought QDOS for $50,000.
    - Supplied it to IBM as MS-DOS

# Micro soft - main IBM PC software provider

## MS-DOS

- or Micro soft Disk Operating System
- the basic software for the newly released IBM PC
- Start of a long partnership between IBM and Microsoft



# Commodore, 1977

- The Commodore PET ("Personal Electronic Transactor")
  - first of several **personal computers** released in 1977
  - straightforward to operate.

# 1977: Apple II

- **Steve Jobs + Steve Wozniak**
- **Apple II**
  - instant success when released in 1977
  - printed circuit motherboard
  - Keyboard
  - game paddles
  - cassette tape
  - computer game "Breakout”

# 1977: TRS-80

- **TRS-80**
- **Tandy Radio Shack**
- **company's projected sales for 1 year: 3,000 unitsIn**
- **The first month after its release, sold 10,000 units**

# 1981: IBM PC

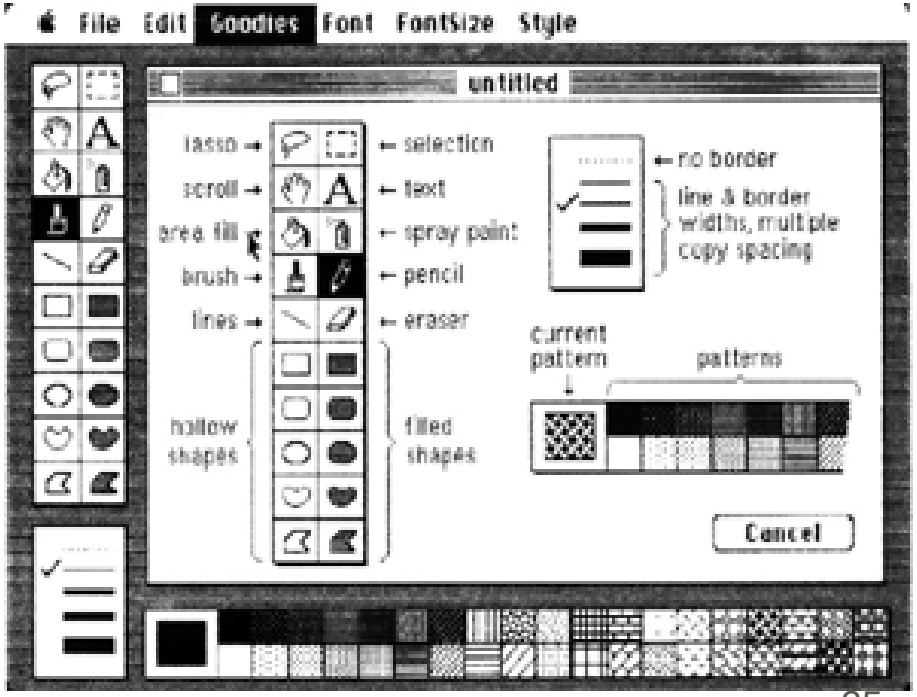
- **IBM 5150 PC Personal Computer**
  - 4.77-MHz Intel 8088 CPU
  - 64KB RAM
  - 40KB ROM
  - one 5.25-inch floppy drive (160KB capacity)
  - PC-DOS 1.0 (Microsoft's MS-DOS)
  - US$3000
  - Microsoft BASIC
  - CP/M-86
  - Easywriter 1.0. A fully loaded version with color graphics costs US$6000.
  - CGA graphics card for the PC, giving 640x200 resolution with 16 colors.

# 1981: big portable

- **Adam Osborne**
- **First portable computer**
- **Osborne I**
  - **weighed 24 pounds**
  - **cost $1,795**
  - **Used Z80**

# 1984: Apple Macintosh

- **Apple Macintosh:**
  - **8-MHz 32-bit Motorola 68000 CPU**
  - **built-in 9-inch B/W screen**
  - **512x342 graphics**
  - **400KB 3.5-inch floppy disk drive**
  - **Mouse**
  - **128KB RAM**
  - **weighs 20 pounds**
  - **Price: $2500.**



# Intel Side --- 8086 to Pentium Pro

**Processor Performance Over Time and Other Key Features of the Intel Architecture**

| Intel Processor | Date of Product Intro-duction | Perfor-mance in MIPs[1] | Max. CPU Frequency at Intro-duction | No. of Transis-tors on the Die | Main CPU Register Size[2] | Extern. Data Bus Size[2] | Max. Extern. Addr. Space |
|---|---|---|---|---|---|---|---|
| 8086 | 1978 | 0.8 | 8 MHz | 29 K | 16 | 16 | 1 MB |
| Intel 286 | 1982 | 2.7 | 12.5 MHz | 134 K | 16 | 16 | 16 MB |
| Intel386™ DX | 1985 | 6.0 | 20 MHz | 275 K | 32 | 32 | 4 GB |
| Intel486™ DX | 1989 | 20 | 25 MHz | 1.2 M | 32 | 32 | 4 GB |
| Pentium® | 1993 | 100 | 60 MHz | 3.1 M | 32 | 64 | 4 GB |
| Pentium Pro | 1995 | 440 | 200 MHz | 5.5 M | 32 | 64 | 64 GB |

# New Intel Atom Board

## DE2i-150 Kit Contents



intel

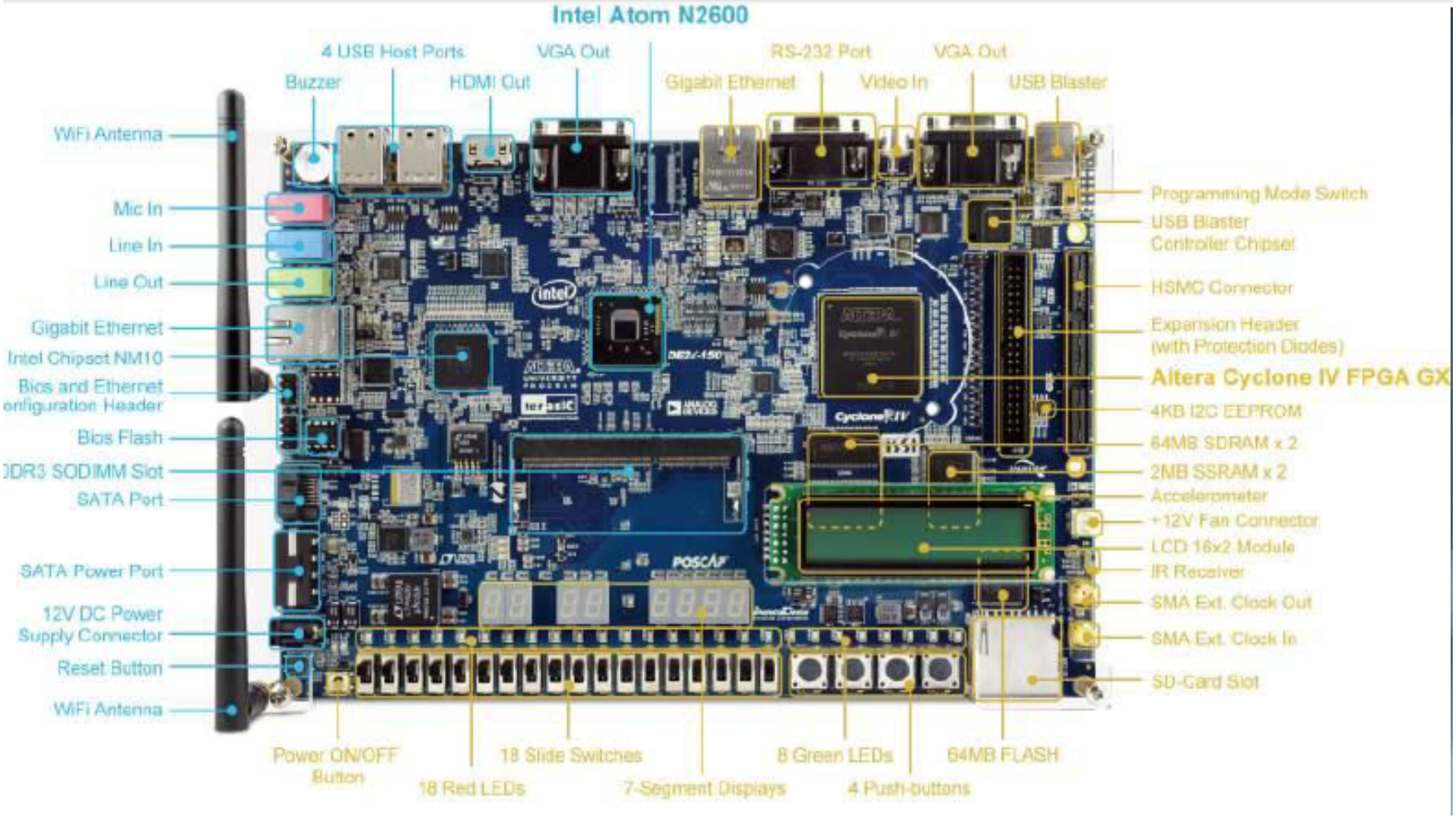
ALTERA UNIVERSITY PROGRAM

terasIC
www.terasic.com

- Development Board
- System CD
- Quartus II CD
- Quick Start Guide
- USB Cable
- Power Cable
- IR Remote
- Loopback Board

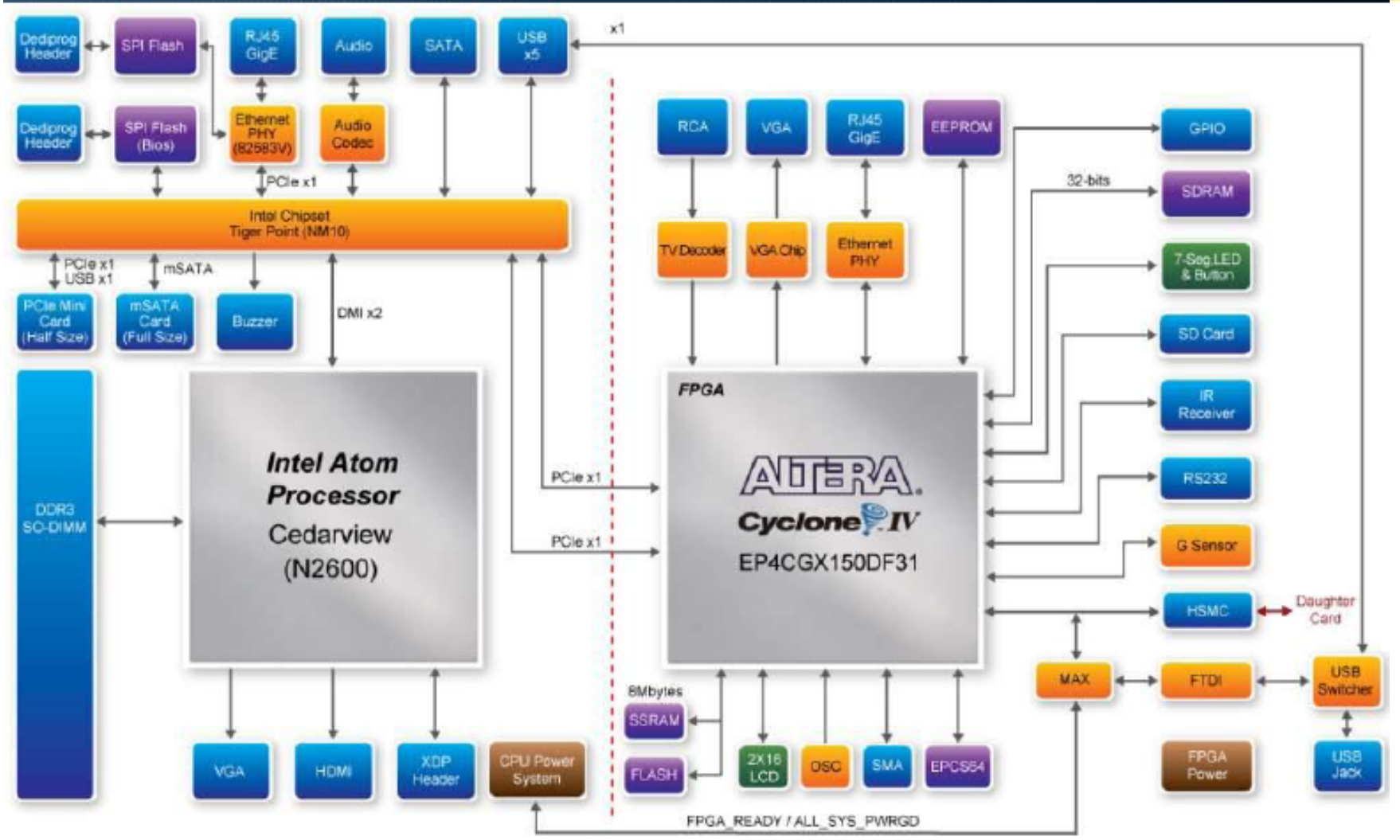
# DE2i-150 Kit

## DE2i-150 Floorplan



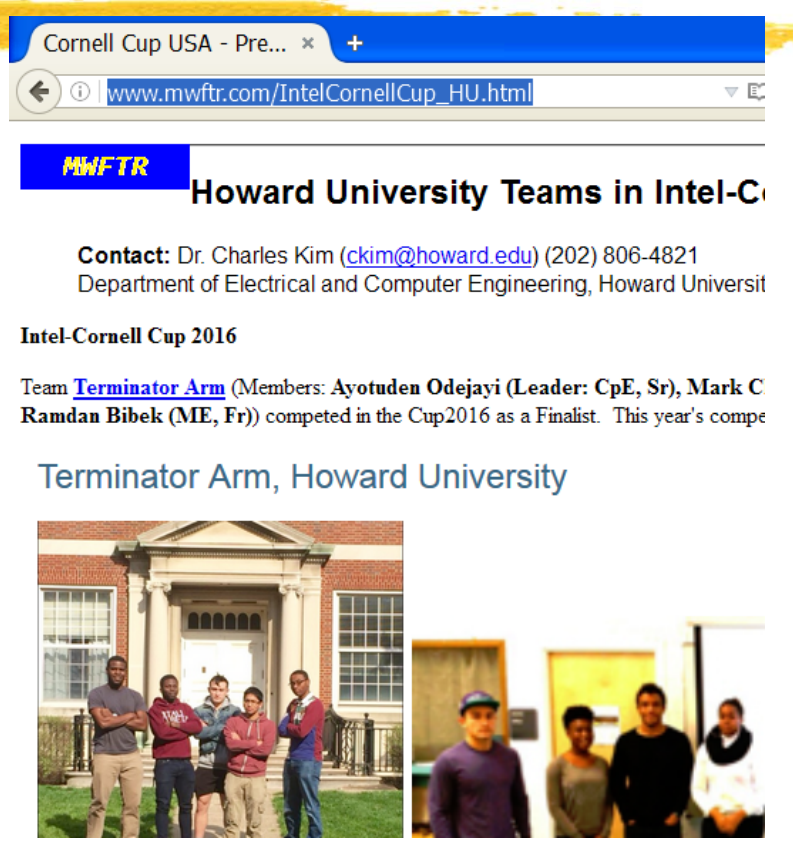
# DE2i-150 Kit

## DE2i-150 Block Diagram



# What/How HU students did?

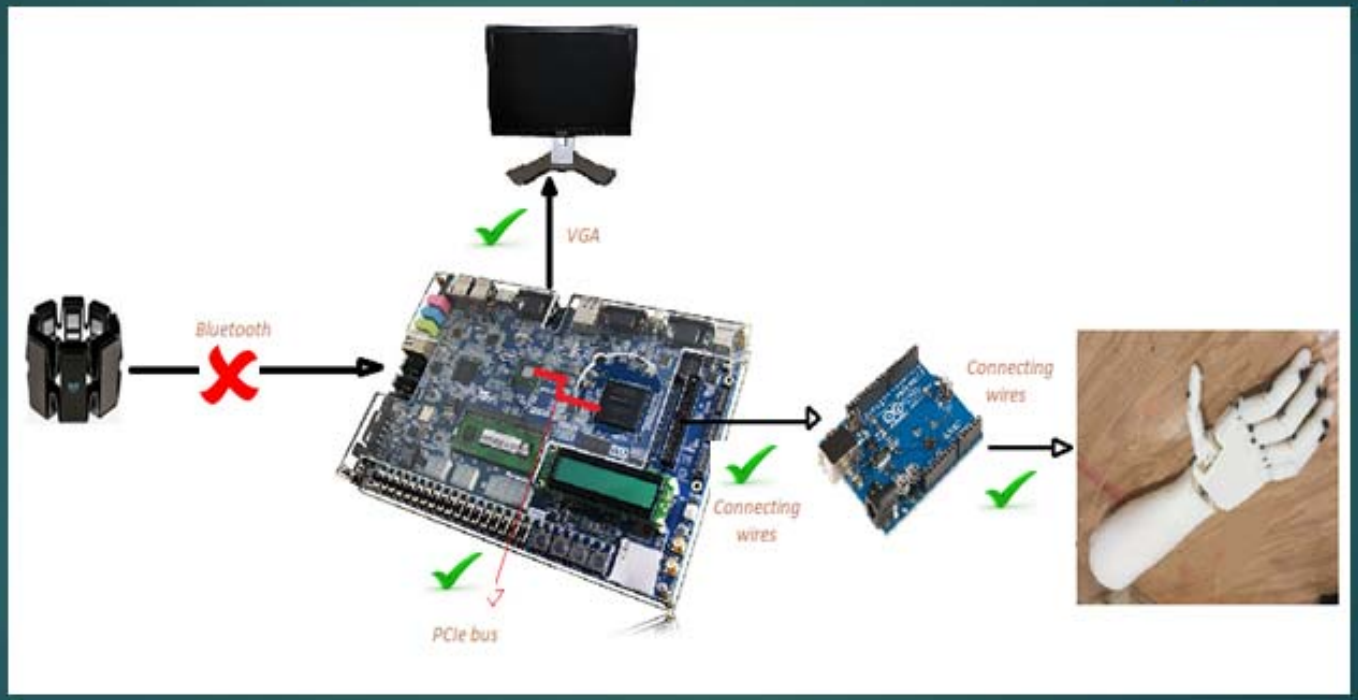
- **History** of Howard student teams in Intel-Cornell Cup Competition.
- Check out: http://www.mwftr.com/IntelCornellCup_HU.html



# What/How HU students did? Intel-Cornell Cup 2016

## Implementation, Test & Evaluation

### Design Architecture



# What/How HU students did? Intel-Cornell Cup 2015

## Implementation


- Intel De2i-150 board
- USB Logitech camera
- 12 V DC Power
- Display Screen

# What/How HU students did? Intel-Cornell Cup 2014