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

COMPUTER HISTORY

Compiled by Charles Kim

Howard University

Computers and Microprocessors
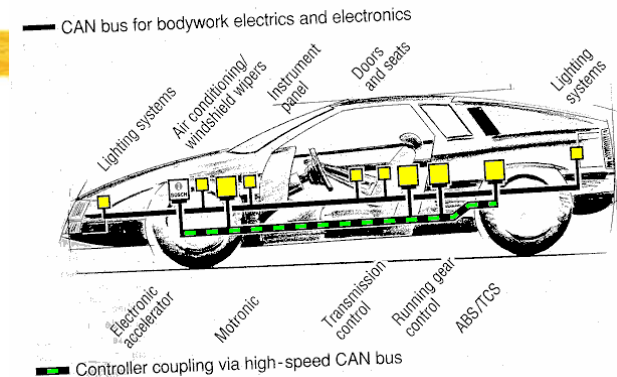
⌘ Everywhere
- ⌃ PC, VCR, DVD,Toys
- ⌃ Phones, Cars, etc

⌘ Hardware and Software

⌘ Embedded Computing

⌘ Mobile Computing

⌘ Computers and Microprocessors

CAN bus for bodywork electrics and electronics

Lighting systems, Air conditioning/windshield wipers, Instrument panel, Doors and seats, Lighting systems, Electronic accelerator, Motronic, Transmission control, Running gear control, ABS/TCS

Controller coupling via high-speed CAN bus

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

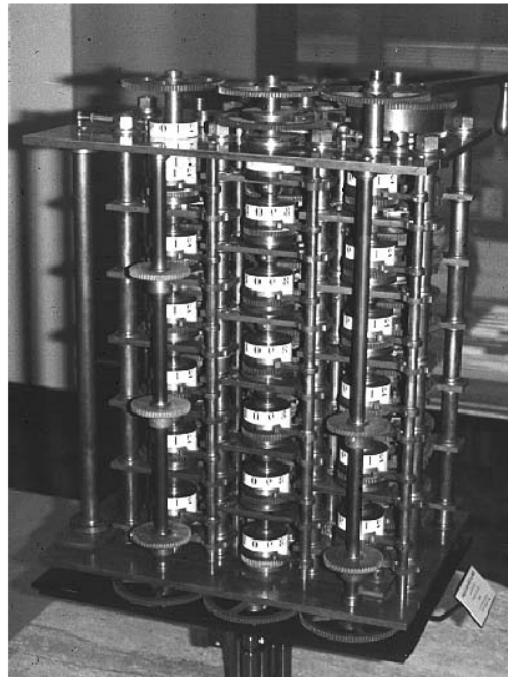To solve 6th degree differential equation (1842)

Incompletion

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

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

International Business Machines Corp. (IBM)

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

– **Punching Cards, Tabulating Machine**
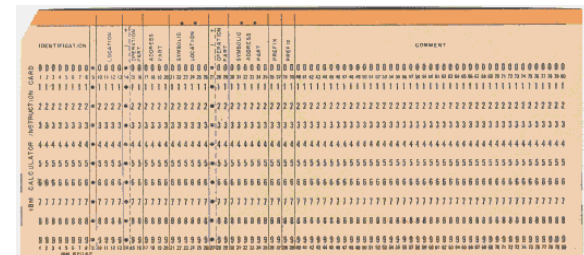
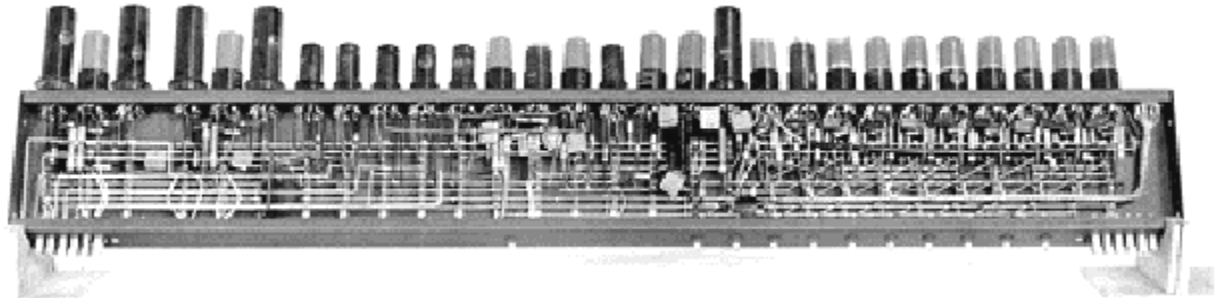Electric Tabulating System

⬇

Tabulating Machine Co. (1896)
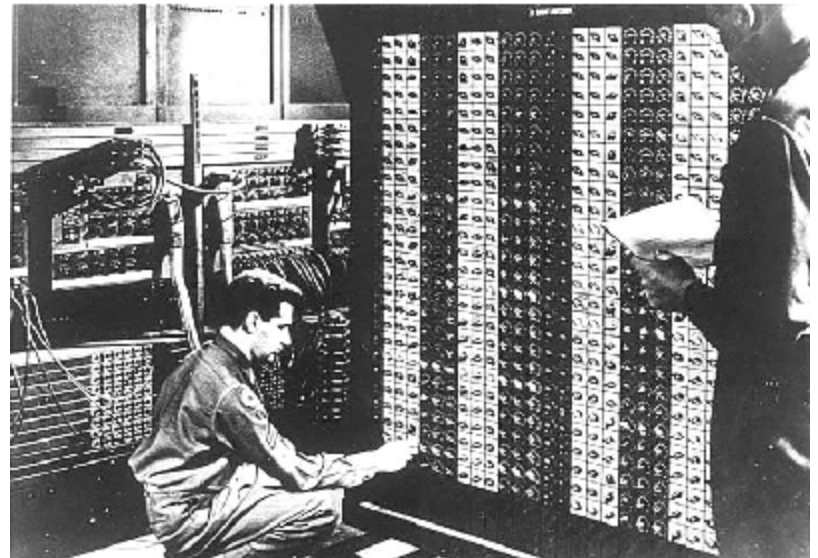
⬇

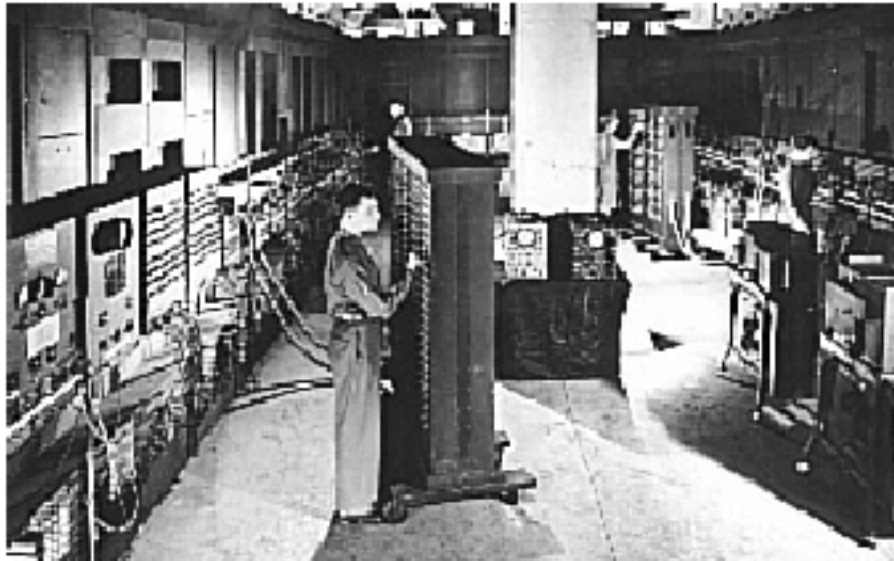Computation-Tabulating Recording Co. (1911)
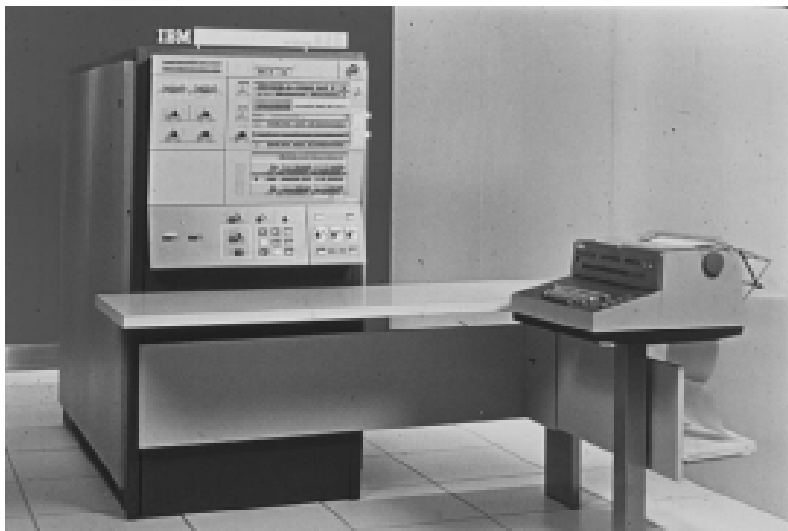
⬇

International Business Machines Corp. (IBM) (1924)

ENIAC

⌘ Electronic Numerical Integrator and Calculator, 1943-46.
⌘ First general purpose electronic computer
⌘ Smithonian Museum of American History

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" than 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)**

digital

8
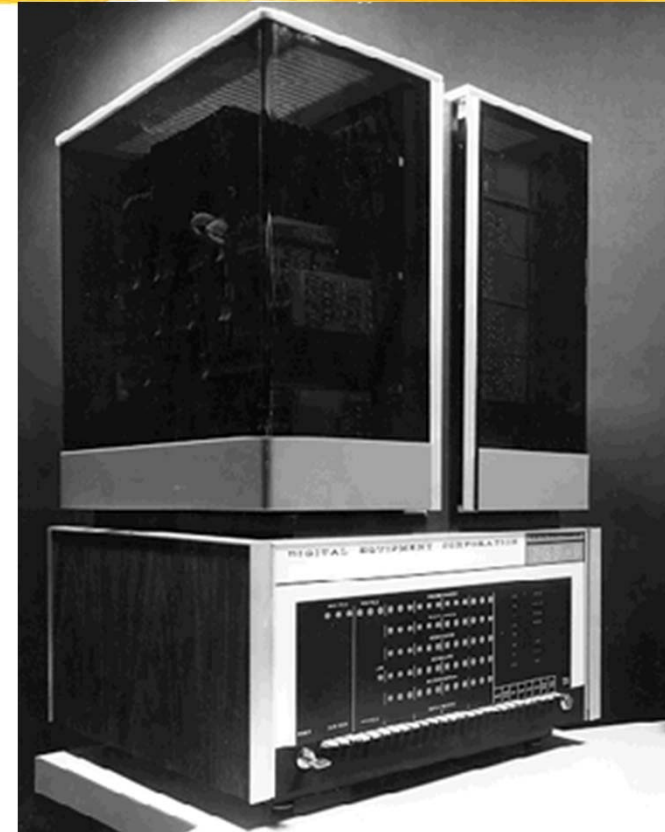
- VAX (Virtual Address eXtension) :16 → 32
- To accommodate 16-bit PDP : backward compatibility

INTEL, 1971 ("computer in a chip")

⌘ Intel

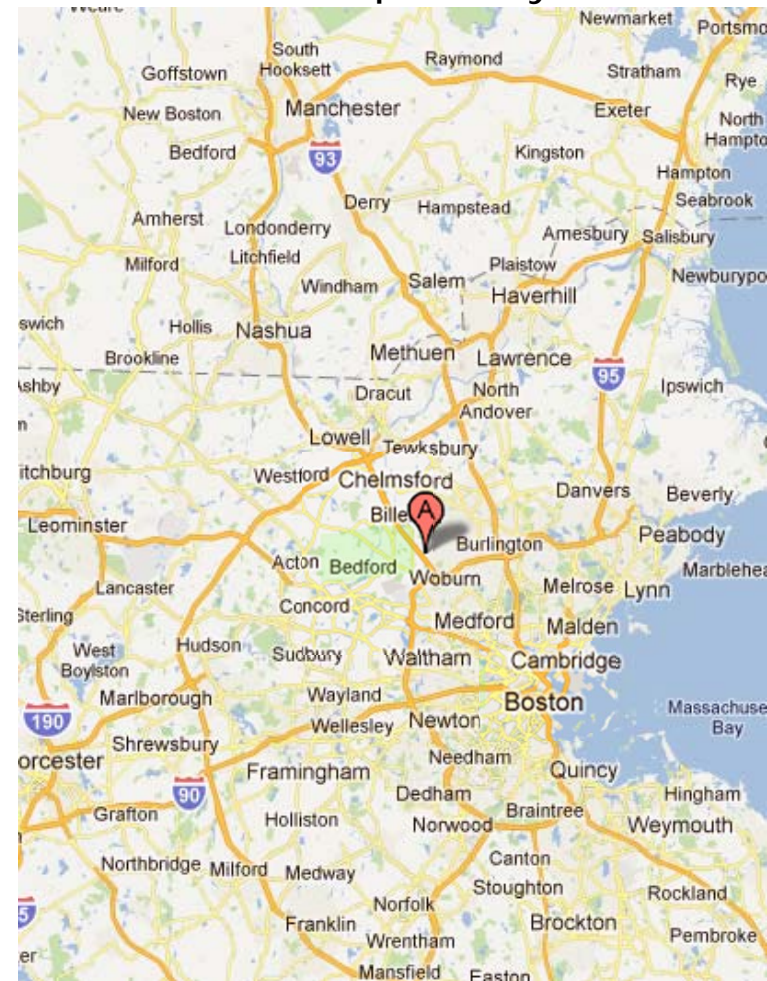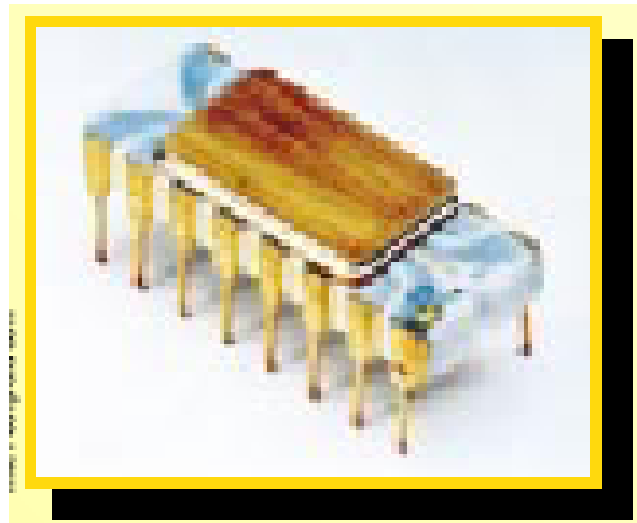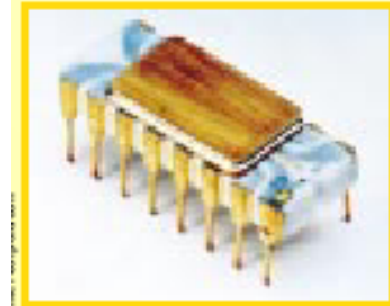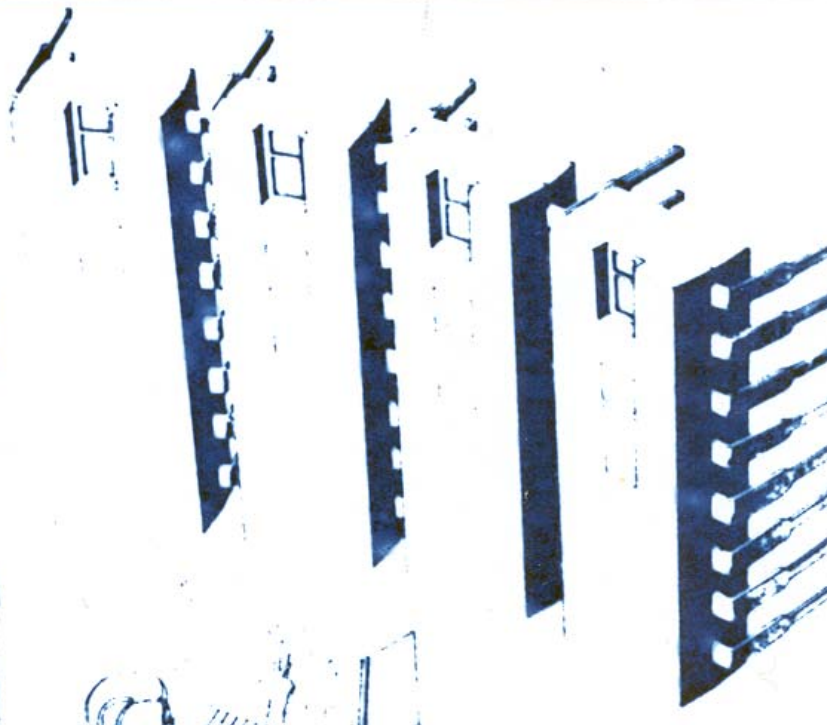☐ introduced 4-bit Microprocessor (4004)

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.

$ DollarTimes

Inflation Calculato[r]

The Changing Value of a[dollar]

$ 2672

In 1968 ▾

A dollar

Our infla[tion]
dollar in

Convert to $:

In 2013 ▾

[Calculate]
(results appear below)

It will al[so]
choose.

We dete[rmine]
from De[cember]
approxim[ately]

Fun fact[s]
than an[y]
the lowe[st]

$2,672.00 in 1968 had the same b[uying power]

Annual inflation over this period wa[s]

⌘ Intel

- Robert Noyce and Gordon Moore founded Intel in 1968
- 12 employees
- First year revenue: $2,672 → 2013 Value? $18,097.
- Main product: Computer Memory
- First Product: 3101 (64-bit memory)

- 1969: Busicom(Japanese Co) order "A set of chips for a programmable calculator" with advanced money of $60,000.→ multiple custom chips.
- 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
- Busicom under financial problem→ Intel bought back the right
- And, the rest is history
- 1971: Intel 4004, $200
- 1972: Intel 8008, 8-bit, $360

⌘ **Altair 8800 Computer**

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

The January 1975 cover of Popular Electronics

1975 The first PC, an Altair 8800, available as a kit, appears on the cover of Popular Electronics in January.
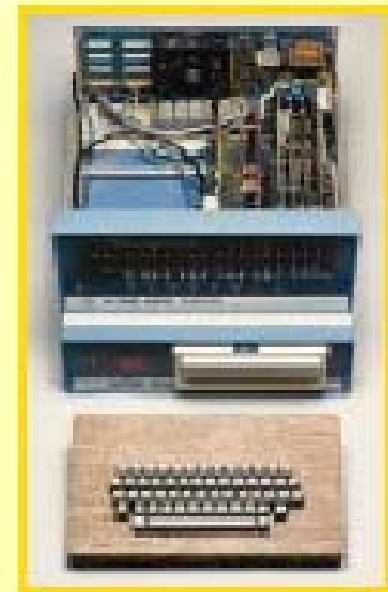
Seattle Connection and "Micro Soft"

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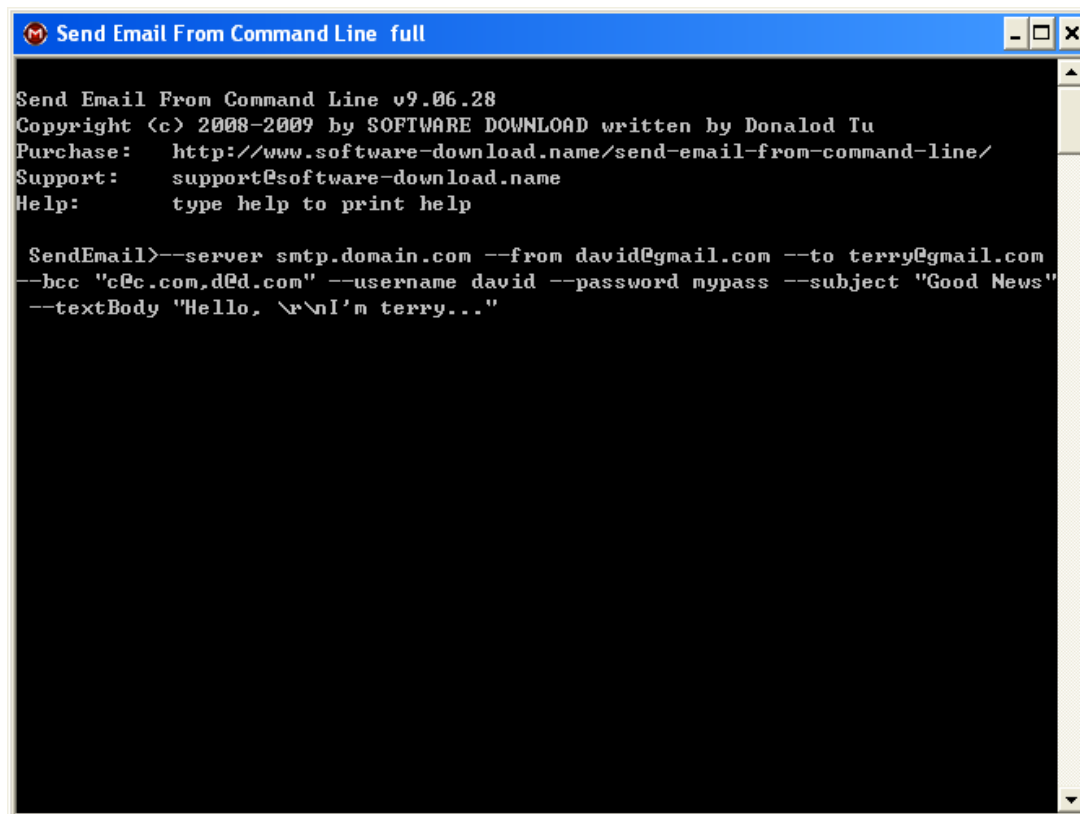
- Altair8800 needed software
- Ed Roberts received letter from a company: "they already created a version of Basic for Altai 8800"
- Within 30 days they [Gates and Allen] finished the version.
- They also regained the right to market in themselves.
- Formed Micro Soft in 1977.
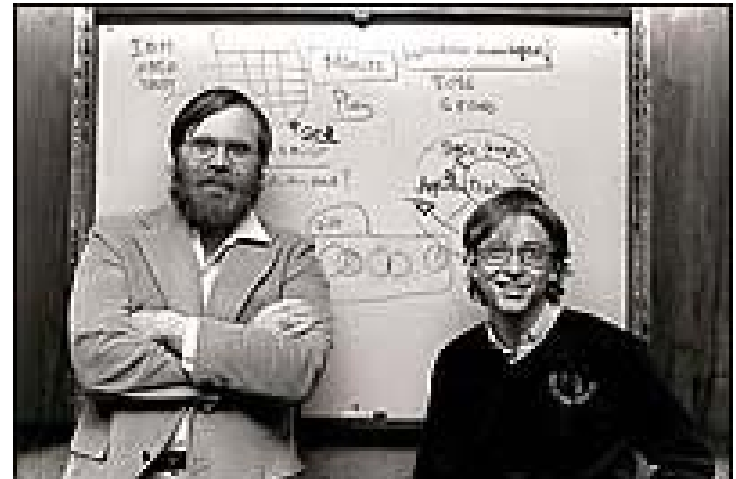
Micro soft - main IBM PC software provider

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

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Behind Story of MS-DOS

- IBM: Manhattan Project for PC
  - Approached Microsoft
  - Intel 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

Commodore, 1977

⌘The Commodore PET ("Personal Electronic Transactor")

- first of several personal computers released in 1977
- straightforward to operate.

1977: Apple II

⌘ **Apple II**
- ⌃ **instant success when released in 1977**
- ⌃ **printed circuit motherboard**
- ⌃ **switching power supply**
- ⌃ **Keyboard**
- ⌃ **case assembly**
- ⌃ **Manual**
- ⌃ **game paddles**
- ⌃ **cassette tape**
- ⌃ **computer game "Breakout"**

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1977: TRS-80

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

⌘ **the Osborne I**
  - ◹ **weighed 24 pounds**
  - ◹ **cost $1,795**
  - ◹ **Used Z80 (NOT IBM-PC clone (yet)!)**

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1981: Apollo - First Workstations

⌘ **Apollo Computer**

  ⌃ **first workstation**

  ⌃ **offering more power than some minicomputers at a fraction of the price.**

1982: SUN Microsystems

⌘ Sun Microsystems is founded in 1982. "SUN" - Stanford University Network.

⌘ Motto: "Network is the computer".

⌘ Four employees.

⌘ The SUN-2 features

  ◁ a Motorola 68010 processor.

  ◁ 4MB of memory

  ◁ 400MB Fujitsu M2351 disk.

1984: Apple Macintosh

- ⌘ **Apple Computer's Steve Jobs**
- ⌘ **Apple Macintosh** at the Flint Center of DeAnza College in Cupertino, California.
- ⌘ **The 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.**
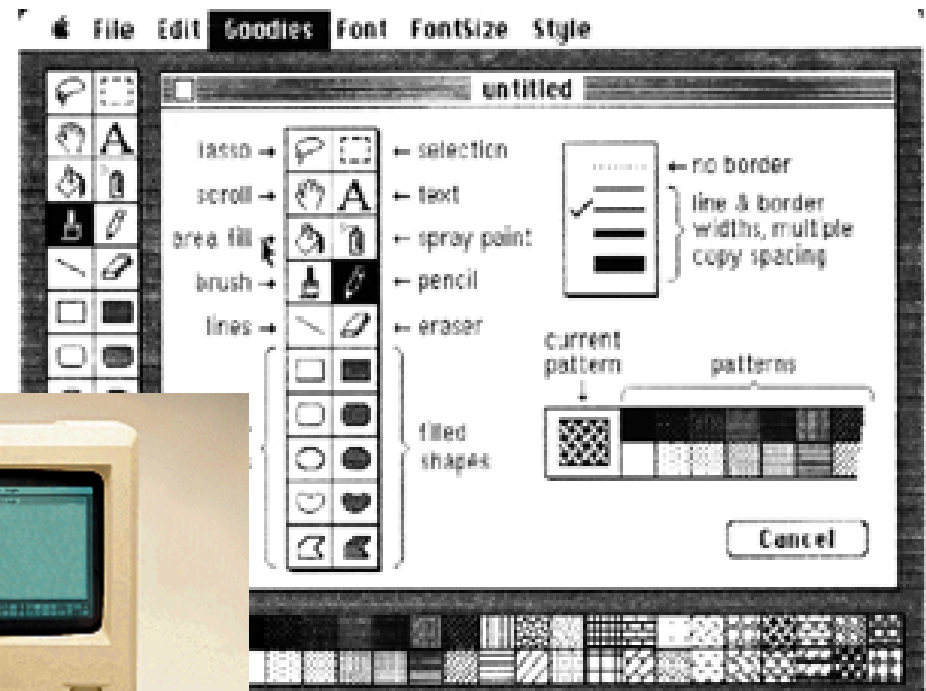
Intel Processor History

P5   P6

4-bit

Embedded
Atom processor

"Tunnel Creek"

Atom Z540
N270
core i7

* "Tunnel Creek"
80632
80618
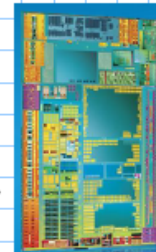
4004

8008
8080
8085
8086
8088
80286/80186
80386
486
Pentium
Pentium Pro
Pentium II
celeron
Pentium III
Pentium+
Itanium
Core Duo

* "Stellarton"
(Tunnel Creek
+
FPGA)

1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2
7   8   9   0   1

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

i386
i386
i386sl
i386dx
i386sx

i486
i486dx
i486sl
i486sx
Overdrive

Pentium - "P5"
P5
P54C
Pentium MMX (P55C)
Mobile Pentium MMX
Mobile Pentium
Overdrive

Legend

Architecture Names
Core Names
Marketing, Box, Board,
Concept, or Chipset
Names

Color Key
32-bit
64-bit

Larrabee
Knight's Corner

Pentium Pro - "P6"
Overdrive

Atom
Silverthorne
Menlow
Atom 300
Atom 200
Poulsbo
US15W

Diamondville
Atom Z Series

Pentium II - "P6"
Klamath
Deschutes
Tonga
Dixon

Mobile Pentium II
Mendocino
Covington
Celeron
Overdrive

Pentium III - "P6M"
Coppermine
Katmai
Tualatin

Celeron
Xeon

Netburst -
"P7" Pentium 4
Willamette
Prescott
Northwood
Cedar Mill

Pentium Extreme Edition
Prescott 2M (Irvindale)
Mobile Pentium 4 M
Mobile Pentium 4
Pentium D
Smithfield Celeron D
Gallatin   Celeron
Presler   Xeon

Atom Gen 2
Lincroft   Pineview   Tunnel Creek
Sodaville   Stellarton

Z6xx   *D4xx*   *E6xx*
N4xx
Oak Trail *D5xx*   *Queens Bay*
Whitney Point *N5xx*   *Crossville*
Briertown   *Top Cliff*

Atom Gen 3
Cedarview

"Stealey"
Dothan
McCaslin
A110
A100

Pentium M
Dothan
Banias
Centrino Sonoma
Centrino Carmel
Celeron

Core (brand)
Yonah
Centrino Napa
Core Solo
Core Duo
Xeon LV

Core Microarchitecture
(=Core2 brand)
Conroe   Merom
Allendale Wolfdale
Kentsfield Yorkfield
Penryn

Centrino Santa Rosa
Centrino2 Montevina
Core2 Quad   Xeon
Celeron   Woodcrest
Core2 Solo Clovertown
Core2 Duo   Tigerton

Nehalem
Beckton   Westmere
Lynnfield Gulftown
Gainestown Clarkdale
Bloomfield Arrandale
Clarksfield

Core i7 Extreme
Centrino2 Calpella
Core i3
Core i5
Core i7
Core i9
Xeon

Sandy Bridge
MB   EP
EN   B2
DT   EX
Ivy Bridge
Gesher
Core i3
Core i5
Core i7
Core i9
Xeon

Haswell
Broadwell

Intel Desktop CPU Roadmap

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Intel 805xx product codes

Intel discontinued the use of part numbers such as 80486 in the marketing of mainstream x86-architecture microprocessors with the introduction of the Pentium brand in 1993. However, numerical codes, in the 805xx range, continued to be assigned to these processors for internal and part numbering uses. The following is a list of such product codes in numerical order:

Product code	Marketing name(s)	Codename(s)
80500	Pentium	P5 (A-step)
80501	Pentium	P5
80502	Pentium	P54C, P54CS
80503	Pentium with MMX Technology	P55C, Tillamook
80521	Pentium Pro	P6
80522	Pentium II	Klamath
80523	Pentium II, Celeron, Pentium II Xeon	Deschutes, Covington, Drake
80524	Pentium II, Celeron	Dixon, Mendocino
80525	Pentium III, Pentium III Xeon	Katmai, Tanner
80526	Pentium III, Celeron, Pentium III Xeon	Coppermine, Cascades
80528	Pentium 4, Xeon	Willamette (Socket 423), Foster
80529	*cancelled*	Timna
80530	Pentium III, Celeron	Tualatin

Intel 805XX Product Codes

80531	Pentium 4, Celeron	Willamette (Socket 478)
80532	Pentium 4, Celeron, Xeon	Northwood, Prestonia, Gallatin
80533	Pentium III	Coppermine (cD0-step)
80534	Pentium 4 SFF	Northwood (small form factor)
80535	Pentium M, Celeron M 310–340	Banias
80536	Pentium M, Celeron M 350–390	Dothan
80537	Core 2 Duo T5xxx, T7xxx, Celeron M 5xx	Merom
80538	Core Solo, Celeron M 4xx	Yonah
80539	Core Duo, Pentium Dual-Core T-series	Yonah
80541	Itanium	Merced
80542	Itanium 2	McKinley
80543	Itanium 2	Madison
80546	Pentium 4, Celeron D, Xeon	Prescott (Socket 478), Nocona, Irwindale, Cranford, Potomac
80547	Pentium 4, Celeron D	Prescott (LGA 775)
80548	*canceled*	Tejas and Jayhawk
80549	Itanium 2 90xx	Montecito

Intel 805XX Product Codes

80550	Dual-Core Xeon 71xx	Tulsa
80551	Pentium D, Pentium EE, Dual-Core Xeon	Smithfield, Paxville DP
80552	Pentium 4, Celeron D	Cedar Mill
80553	Pentium D, Pentium EE	Presler
80554	Celeron 800/900/1000 ULV	Shelton
80555	Dual-Core Xeon 50xx	Dempsey
80556	Dual-Core Xeon 51xx	Woodcrest
80557	Core 2 Duo E4xxx. E6xxx, Dual-Core Xeon 30xx, Pentium Dual-Core E2xxx	Conroe
80560	Dual-Core Xeon 70xx	Paxville MP
80562	Core 2 Quad, Core 2 Extreme QX6xxx, Quad-Core Xeon 32xx	Kentsfield
80563	Quad-Core Xeon 53xx	Clovertown
80564	Xeon 7200	Tigerton-DC
80565	Xeon 7300	Tigerton
80566	Atom Z5xx	Silverthorne
80567	Itanium 91xx	Montvale
80569	Core 2 Quad Q9xxx, Core 2 Extreme QX9xxx, Xeon 33xx	Yorkfield

Intel 805XX Product Codes

80570	Core 2 Duo E8xxx, Xeon 31xx	Wolfdale
80571	Core 2 Duo E7xxx, Pentium Dual-Core E5xxx, Pentium Dual-Core E2210	Wolfdale-3M
80573	Xeon 5200	Wolfdale-DP
80574	Core 2 Extreme QX9775, Xeon 5400	Harpertown
80576	Core 2 Duo P7xxx, T8xxx, P8xxx, T9xxx, P9xxx, SL9xxx, SP9xxx, Core 2 Extreme X9xxx	Penryn
80577	Core 2 Duo P7xxx, P8xxx, SU9xxx, T6xxx, T8xxx	Penryn-3M
80578	LE80578	Vermilion Range
80579	EP80579	Tolapai
80580	Core 2 Quad Q8xxx, Q9xxx, Xeon 33xx	Yorkfield-6M
80581	Core 2 Quad Q9xxx	Penryn-QC
80582	Xeon 74xx	Dunnington
80583	Xeon 74xx	Dunnington-QC
80584	Xeon X33x3 LV	Yorkfield CL
80585	Core 2 Solo SU3xxx, Celeron 7xx, 9xx	Penryn-L
80586	Atom 2xx, N2xx	Diamondville
80587	Atom 3xx	Diamondville DC
80588	Xeon L3014, E3113	Wolfdale-CL

Intel 806XX Product Codes

Intel 806xx product codes

Product code	Marketing name(s)	Codename(s)
80601	Core i7, Xeon 35xx	Bloomfield
80602	Xeon 55xx	Gainestown
80603	Itanium 93xx	Tukwila
80604	Xeon 65xx, Xeon 75xx	Beckton
80605	Core i5-7xx, Core i7-8xx, Xeon 34xx	Lynnfield
80606	*canceled*	Havendale
80607	Core i7-7xx QM, Core i7-8xx QM, Core i7-9xx XM	Clarksfield
80608	*canceled*	Auburndale
80609	Atom	Lincroft
80610	Atom N400, D400, D500	Pineview

Intel 806XX Product Codes

|		
80611	*canceled*	Larrabee
80612	Xeon C35xx, Xeon C55xx	Jasper Forest
80613	Core i7-9xxX, Xeon 36xx	Gulftown
80614	Xeon 56xx	Westmere-EP
80615	Xeon E7-28xx, Xeon E7-48xx	Westmere-EX
80616	Pentium G6xxx, Core i3-5xx, Core i5-6xx	Clarkdale
80617	Core i5-5xx, Core i7-6xxM/UM/LM	Arrandale
80618	Atom	Tunnel Creek
80620	Xeon	Sandy Bridge-EP-8, Sandy Bridge-EP-4
80621	Xeon	Sandy Bridge-EP-8, Sandy Bridge-EP-4
80622	Xeon	Sandy Bridge-EP-8
80623	Xeon E3-xxxx, Core i3/i5/i7-2xxx, Pentium Gxxx	Sandy Bridge-HE-4, Sandry Bridge-M-2
80627	Core i3/i5/i7-2xxxM,, Pentium Bxxx, Celeron Bxxx	Sandy Bridge-HE-4, Sandy Bridge-H-2, Sandy Bridge-M-2
80632	Atom	Tunnel Creek
80640	Atom	Penwell
80641	Atom	Cedar View

New Intel Atom Board

DE2i-150 Kit Contents

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

DE2i-150 Kit

DE2i-150 Floorplan
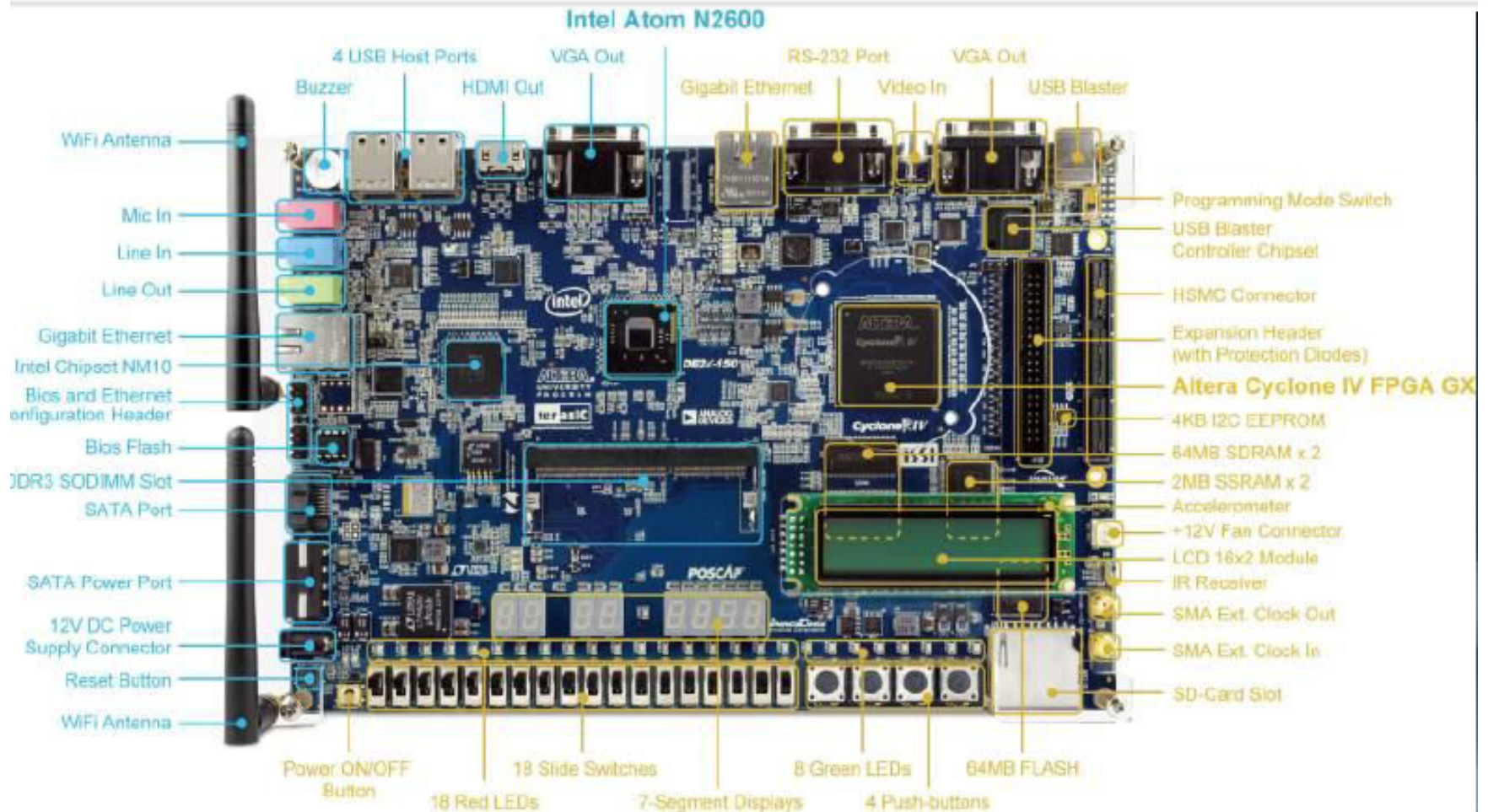
DE2i-150 Kit: Intel Atom-based Features

- Audio Input & Output

- HDMI 1.3a

- VGA

- PCIe Mini Card (Half-Size)

- mSATA Card (Full-Size)

- USB 2.0 Host x4

- 10/100/1000 M Ethernet

- SATA Gen2

- DDR3 SO-DIMM Socket

DE2i-150 Kit: Altera Cyclone 4 GX-based feature

- VGA Display, TV Decoder (Composite Input)
- Gigabit Ethernet
- SD Card Socket
- IR Receiver, RS232
- Accelerometer
- HSMC & GPIO Expansion Connector
- EEPROM, Flash, SSRAM, SDRAM, and EPCS64(for FPGA Configure)
- Two PCIe x1 (Connected to Intel Atom)
- On board Oscillator and SMAx2 for External Clock Input & Output
- LED, 2x16 LCD, Button, Switch & 7-Segment
- On-board USB Blaster

DE2i-150 Kit

DE2i-150 Block Diagram
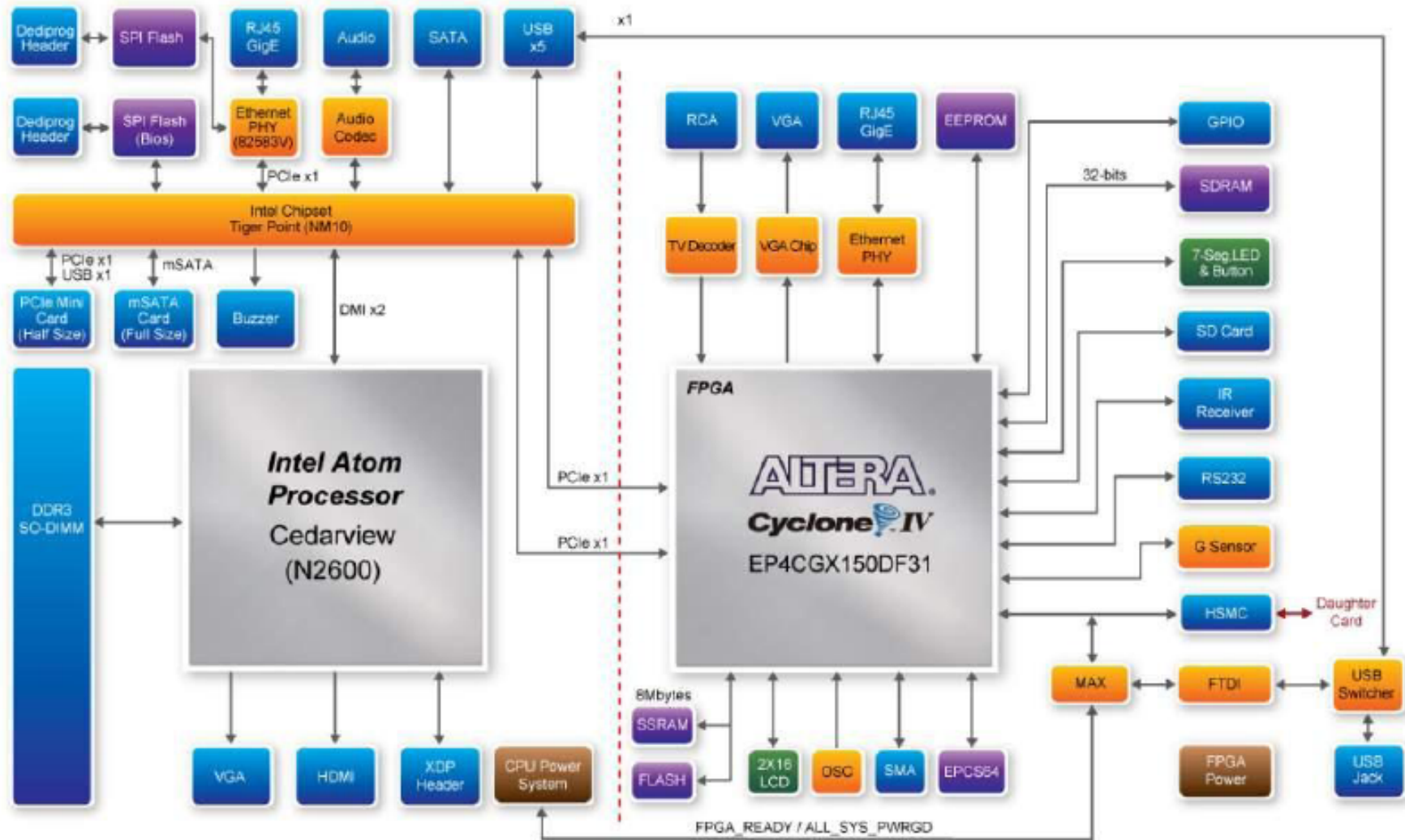
Interfacing

Daughter Card Solutions

Capacitive Touch Screen — **CameraLink Adapter** — **5 Megapixel Camera** — **HDMI Input** — **DVI Input/Output**

Ethernet — **Serial Digital Interface** — **Altera Industrial Communications** — **HDMI Output** — **Aptina Adapter**
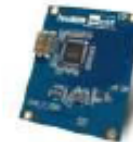
AD/DA — **Mass Storage and Video** — **High Speed AD/DA** — **Communication** — **SATA/SAS**

What/How HU students did? An example