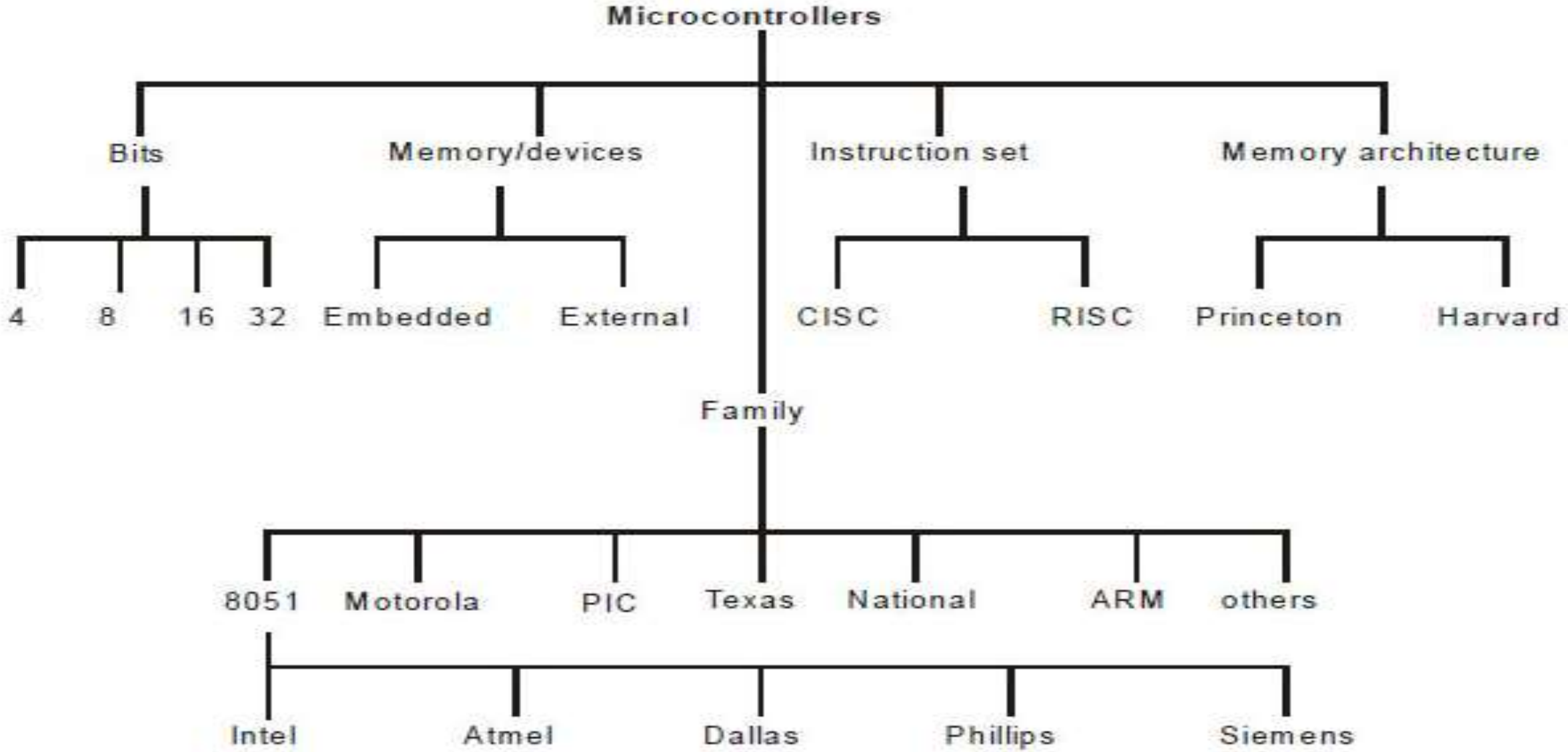
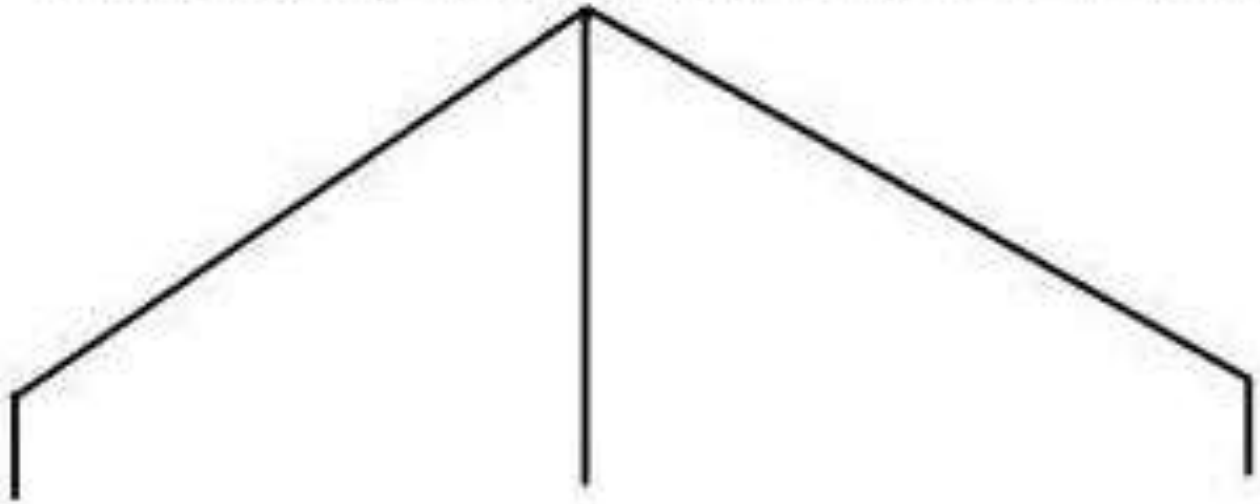
Microcontrollers



Types of microcontrollers

MICROCONTROLLERS



8051

89S52
89S51
89C52
89C51
89V51XX....etc

AVR

ATMEGA16
ATMEGA 8
ATMEGA32
.....etc

PIC

pic 10F XX
pic 12F XX
pic 16F XX...etc

Features of 89C51

Belongs to ATMEL family

- 8 bit CPU
- 128 Byte RAM
- 4KB in system programmable Flash ROM
- Fully static operation 0-24 MHz 32 programmable I/O pins
- Two 16 bit Timer/counters
- Five interrupt sources
- Programmable full duplex Serial port (UART)
- Low power Idle (stops CPU) and Power down modes(stop CPU, Timer, Interrupt)

8051 Applications

- Energy management, Home automation
- Portable Electronics, media players,
- Automobiles: ant braking systems, ignition control
- Medical devices: BP, Glucose, temperature monitor,

PIC Microcontroller

- Developed by Microchip family in 1998
- PIC-Peripheral Interface Controller
- Faster and simple to implement than 8951
- Apart from RAM, Flash ROM, TIMER, COUNTER, INTERRUPT, UART, it contains ADC, DAC, Watch Dog Timer (WDT)
- It supports CAN, SPI, UART
- It uses modified Harvard architecture and RISC architecture
- Supports In Circuit serial programming
- More popular in industry over 8951
- Ex. PIC16F84

PIC Microcontroller Features

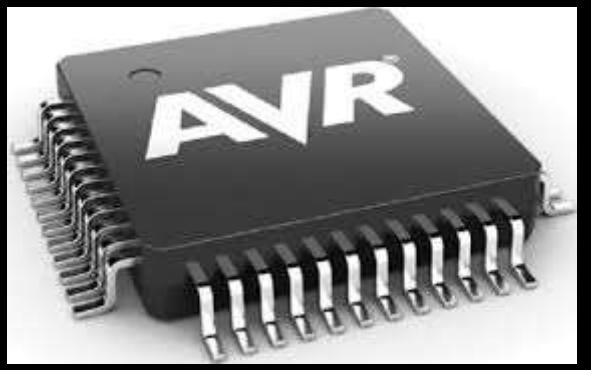
- I/O pins: 13
- Memory: 64bytes data RAM. 1KB Flash ROM
- Watchdog timer: Terminate the program if takes longer time than expected
- Registers: General purpose registers and special purpose registers
- Timer: 8bit
- Sleep mode: low current power down which can be terminated using interrupt, external reset and watchdog timer
- RAM memory banks: 4
- UART

Applications

- Automation, central heating, data loggers, data acquisition using sensors, security systems
- Industrial automation, hobby projects

Advanced Virtual RISC (AVR)Microcontroller

- conceived by two students Alf-Egil Bogen and Vegard Wollan.
- Developed by Atmel in 1996
- Its RISC based microcontroller
- Also known as Advanced Virtual RISC (AVR)
- It has various sleep modes
- Inbuilt DAC, ADC
- Internal oscillator, single cycle execution
- Very fast operation, low power
- Available IN 8 bit, 16 bit, 32 bit configurations



Types of AVR

- Tiny AVR: Less memory, less size, suitable for simple operations
- Mega AVR: medium memory (up to 256KB), higher inbuilt peripherals, suitable for medium to complex applications
- Xmega AVR: Large program memory, high speed. Suitable for very complex applications

Features of AVR Microcontroller ATMEGA328

- 32 Kb flash memory
- 1024 Bytes EEPROM
- 2KB SRAM
- 8 channel, each of 10bit ADC
- 32 general purpose I/O lines and registers
- JTAG interface
- Internal and external interrupts
- Serial programmable USART
- TWI interface
- SPI serial port
- Operating voltage: 4.5 to 5.5 V
- Frequency: 16MHz

Applications of AVR Microcontroller

- Data acquisition
- Signal sensing
- Motion control
- Display devices
- GSM and GPS
- Industrial automation, process control
- Medical instrumentation
- Telephone communication

ARM Controllers

- ARM (Advance RISC Machine)
- Developed by Acorn Computers in 1981
- 32/64 bit controllers, based on RISC instructions and Harvard architecture
- Efficient multicore processing and easier coding
- Mostly single cycle instruction execution
- Enhanced power saving instructions
- Supports memory management unit (MMU) and memory protection unit (MPU)
- Supports digital signal processing algorithms(DSP)

ARM Controllers

- Thumb instructions are available which are suitable for 16 bit instructios
- 65% of all mobiles use ARM controllers
- Popular 32 controller is ARM7TDMI
- Raspberry development board uses ARM controllers
- Supports android and other OS
- ARM is a architecture, sold to various companies like Dallas, NXP, Motorola, STM and other manufacturers

ARM Controllers Applications

- Smart phones
- Multimedia Game consoles
- Digital Camera, Camcorders
- Tablet computers
- Industrial process control
- Wireless networks and sensors
- Automobiles
- Robotics
- Consumer Electronics
- Set top box
- Smart TV, Smart Watch, Smart gadgets
- Bluetooth and Wi-Fi devices,
- Medical, avionics, missiles

Microcontroller Comparison

Parameter	8951	PIC	AVR	ARM
Bus Width	8bit	8/16/32bit	8/32	32/64 bit
Communication protocol	UART,SPI, I2C	UART,SPI, I2C, CAN, Ethernet	UART,SPI, I2C, CAN, Ethernet, USB	UART,SPI, I2C, CAN, Ethernet, USB, IrDA, SAI (Serial Audio Interface
Speed	12 Clock/ Instruction cycle	4 Clock/ Instruction cycle	1 Clock/ Instruction cycle	1 Clock/ Instruction cycle
Architecture	CISC	Some features of RISC	RISC	RISC
Memory Architecture	Harvard	Harvard	Modified Harvard	Modified Harvard
Families	8051 variants	PIC16, PIC17, PIC18,PIC24, PIC32	Tiny, Mega, XMaga, Special purpose AVR	ARM4, 5, 6, 7, 9 etc.
Power Consumption	Average	Low	Low	Low