SATA Connector (x4)

BIOS Flash Chip in PLCC Socket

Southbridge (with heatsink)

Floppy Drive Connector

IDE Connector (x2)

CMOS Backup Battery

24-pin ATX Power Connector

Integrated graphics processor (with heatsink)

Super IO Chip

PCI Slot (×3)

DIMM Memory Slots (×4)

CPU Fan Connector

CPU Fan & Heatsink Mount

Integrated audio codec chip

Integrated Gigabit Ethernet chip

CPU Socket (Socket 939)

PCI Express Slot

Connectors For Integrated Peripherals

PS/2 Keyboard and Mouse, Serial Port, Parallel Port, VGA, Firewire/IEEE 1394a, USB (x4), Ethernet, Audio (x6)
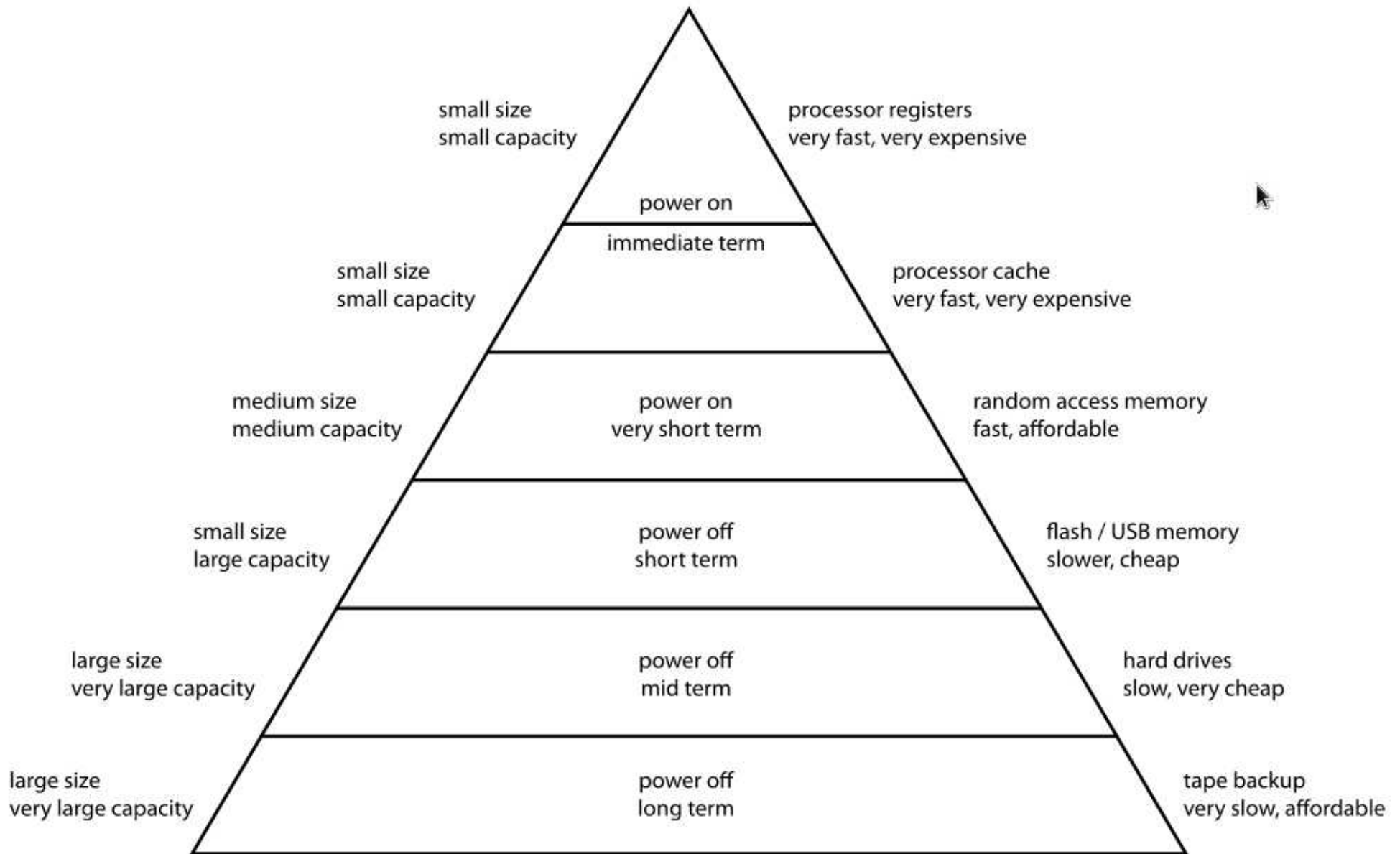
Memory

- Store programs and data

- Primary and Secondary memory (storage)

- Volatile

  - CPU Registers and Cache

  - RAM (Random Access Memory)

- Non- Volatile

  - For firmware

    – ROM (Read Only Memory)

    – PROM (Programmable ROM)

    – EPROM (Erasable PROM – erase using UV light)

    – EEPROM (Electrically EPROM – erase using electricity)

  - Flash memory

Computer Memory Hierarchy

small size small capacity	processor registers very fast, very expensive	
	power on **immediate term**	
small size small capacity	processor cache very fast, very expensive	
medium size medium capacity	power on very short term	random access memory fast, affordable
small size large capacity	power off short term	flash / USB memory slower, cheap
large size very large capacity	power off mid term	hard drives slow, very cheap
large size very large capacity	power off long term	tape backup very slow, affordable

http://en.wikipedia.org/wiki/File:ComputerMemoryHierarchy.svg

Memory

- Memory refers to the physical devices used to store programs or data on a temporary or permanent basis for use in a computer.

- The semiconductor memory is organized into memory cells or bistable flip-flops, each storing one binary bit (0 or 1).

- The memory cells are grouped into words of fix word length, for example 1, 2, 4, 8, 16, 32, 64 or 128 bit.

- Each word can be accessed by a binary address of N bit, making it possible to store 2 raised by N words in the memory.

Memory

- Volatile memory is computer memory that requires power to maintain the stored information.

- Non-volatile memory is computer memory that can retain the stored information even when not powered.

Primary Memory

- Primary storage (or main memory or internal memory), often referred to simply as memory, is the only one directly accessible to the CPU.

- The CPU continuously reads instructions stored there and executes them as required.

- Any data actively operated on is also stored there in uniform manner.

- Usually volatile.

Secondary Memory

- Secondary Memory or Secondary storage (also known as external memory or auxiliary storage), differs from primary storage in that it is not directly accessible by the CPU.

- The computer usually uses its input/output channels to access secondary storage and transfers the desired data using intermediate area in primary storage.

- Non-volatile – data is safe after power down.

CPU Registers

- Processor registers are located inside the processor.

- Stores a word of data (often 32 or 64 bits).

- CPU instructions instruct the arithmetic and logic unit to perform various calculations or other operations on this data (or with its help).

- Registers are the fastest of all forms of computer data storage.

CPU Registers

Architecture	Integer registers	FP registers
x86	8	8
x86-64	16	16
IBM/360	16	4
z/Architecture	16	16
Itanium	128	128
UltraSPARC	32	32
IBM Cell	4~16	1~4
IBM POWER	32	32
Alpha	32	32
6502	3	0
PIC microcontroller	1	0
AVR microcontroller	32	0
ARM 32-bit	16	varies
ARM 64-bit	31	32

CPU Cache

- Processor cache is an intermediate stage between ultra-fast registers and much slower main memory.

- Most actively used information in the main memory is just duplicated in the cache memory, which is faster, but of much lesser capacity.

- Multi-level hierarchical cache setup is also commonly used—primary cache being smallest, fastest and located inside the processor; secondary cache being somewhat larger and slower

CPU Cache
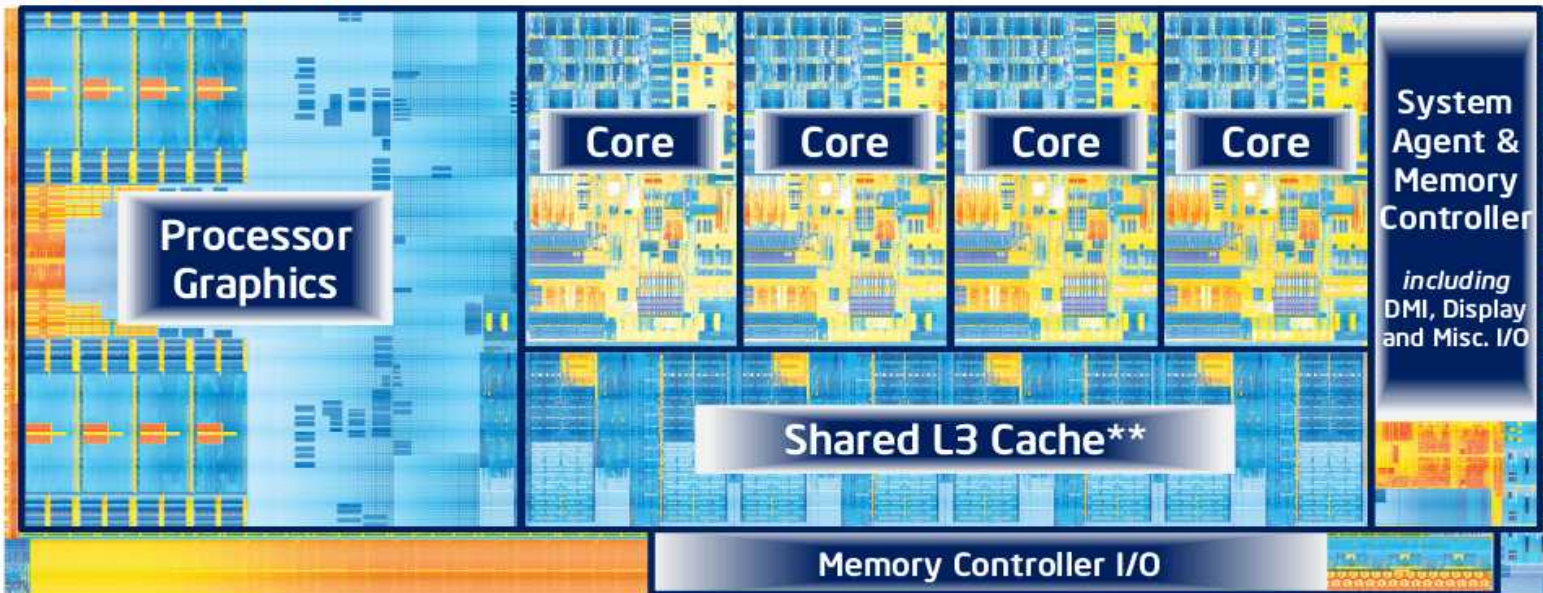
RAM

- The two main forms of modern RAM are static RAM (SRAM) and dynamic RAM (DRAM).

  - In static RAM, a bit of data is stored using the state of a flip-flop.

- This form of RAM is more expensive to produce, but is generally faster and requires less power than DRAM and, in modern computers, is often used as cache memory for the CPU.

RAM

- DRAM stores a bit of data using a transistor and capacitor pair, which together comprise a memory cell.

  - The capacitor holds a high or low charge (1 or 0, respectively), and the transistor acts as a switch that lets the control circuitry on the chip read the capacitor's state of charge or change it.

- As this form of memory is less expensive to produce than static RAM, it is the predominant form of computer memory used in modern computers.

Non-volatile Memory

- Non-volatile memory, nonvolatile memory, NVM or non-volatile storage is computer memory that can retain the stored information even when not powered.

- Non-volatile memory is typically used for the task of secondary storage, or long-term persistent storage.

- Non-volatile data storage can be categorized in electrically addressed systems and mechanically addressed systems.

ROM

- Read-only memory (ROM) is a class of storage medium used in computers and other electronic devices.

- It is used mainly to store firmware.

- Classic mask-programmed ROM chips are integrated circuits that physically encode the data to be stored, and thus it is impossible to change their contents after fabrication.

PROM

- A programmable read-only memory (PROM) or field programmable read-only memory (FPROM) or one-time programmable non-volatile memory (OTP NVM) is a form of digital memory where the setting of each bit is locked by a fuse or antifuse.

- PROMs are manufactured blank and, depending on the technology, can be programmed at wafer, final test, or in system.

EPROM

- An EPROM (rarely EROM), or erasable programmable read only memory, is a type of memory chip that retains its data when its power supply is switched off.

- The memory cells are individually programmed by an electronic device that supplies higher voltages than those normally used in digital circuits.

- Once programmed, an EPROM can be erased by exposing it to strong ultraviolet light source (such as from a mercury-vapor light).

EEPROM

- EEPROM (also written E2PROM) stands for Electrically Erasable Programmable Read-Only Memory.

- It is a type of non-volatile memory used in computers and other electronic devices to store small amounts of data that must be saved when power is removed.

- EEPROM is user-modifiable read-only memory (ROM) that can be erased and reprogrammed (written to) repeatedly through the application of higher than normal electrical voltage.

Flash Memory

- Non volatile storage chip that evolved from EEPROM.

- Data must be erased in fairly large blocks before being re-written.

  - EEPROMs can have data erased in small blocks (bytes).

- NAND Flash – general storage and data transfer.

- NOR Flash – allows direct code execution.

Thank You