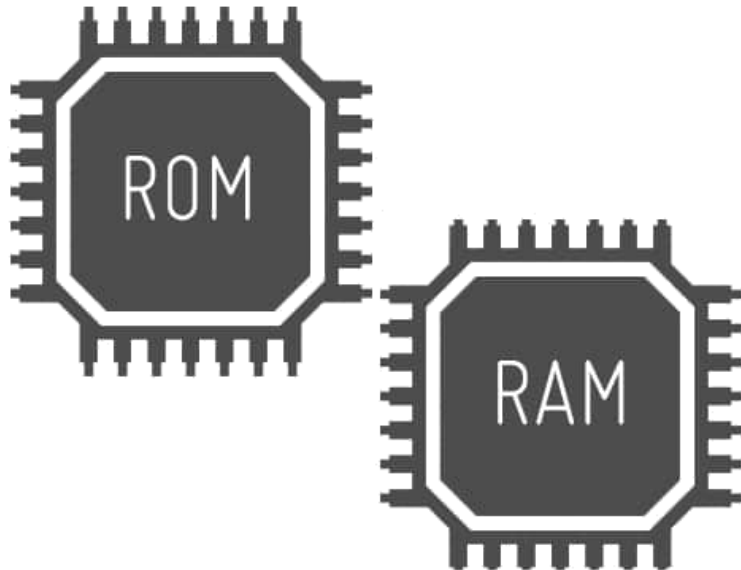
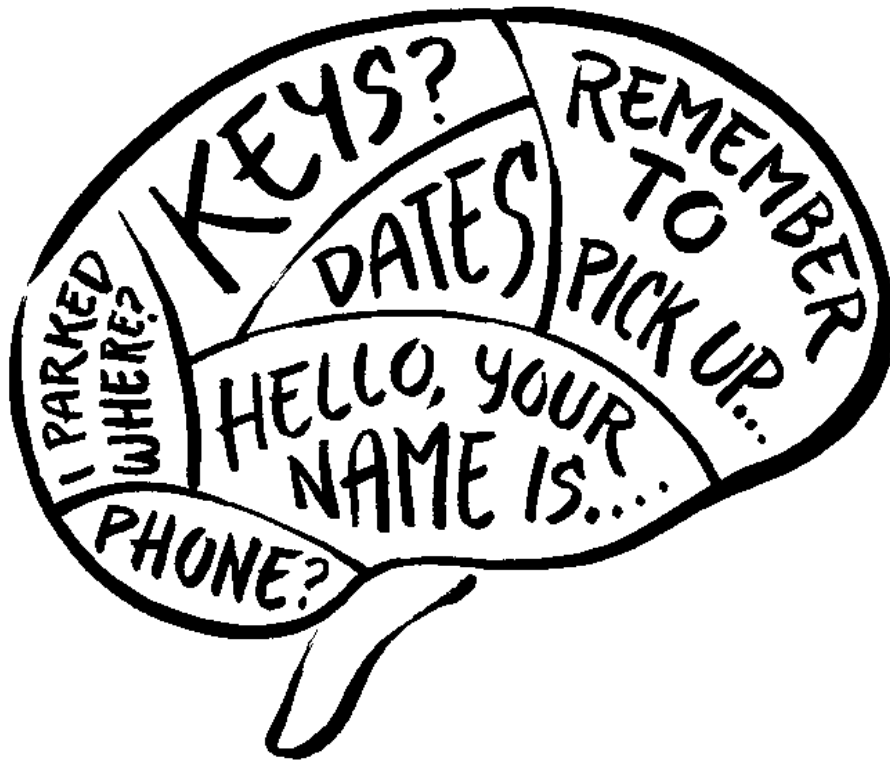


# Memory Systems

**EEE 203: Electronic Devices and  
Circuits & Pulse Techniques**

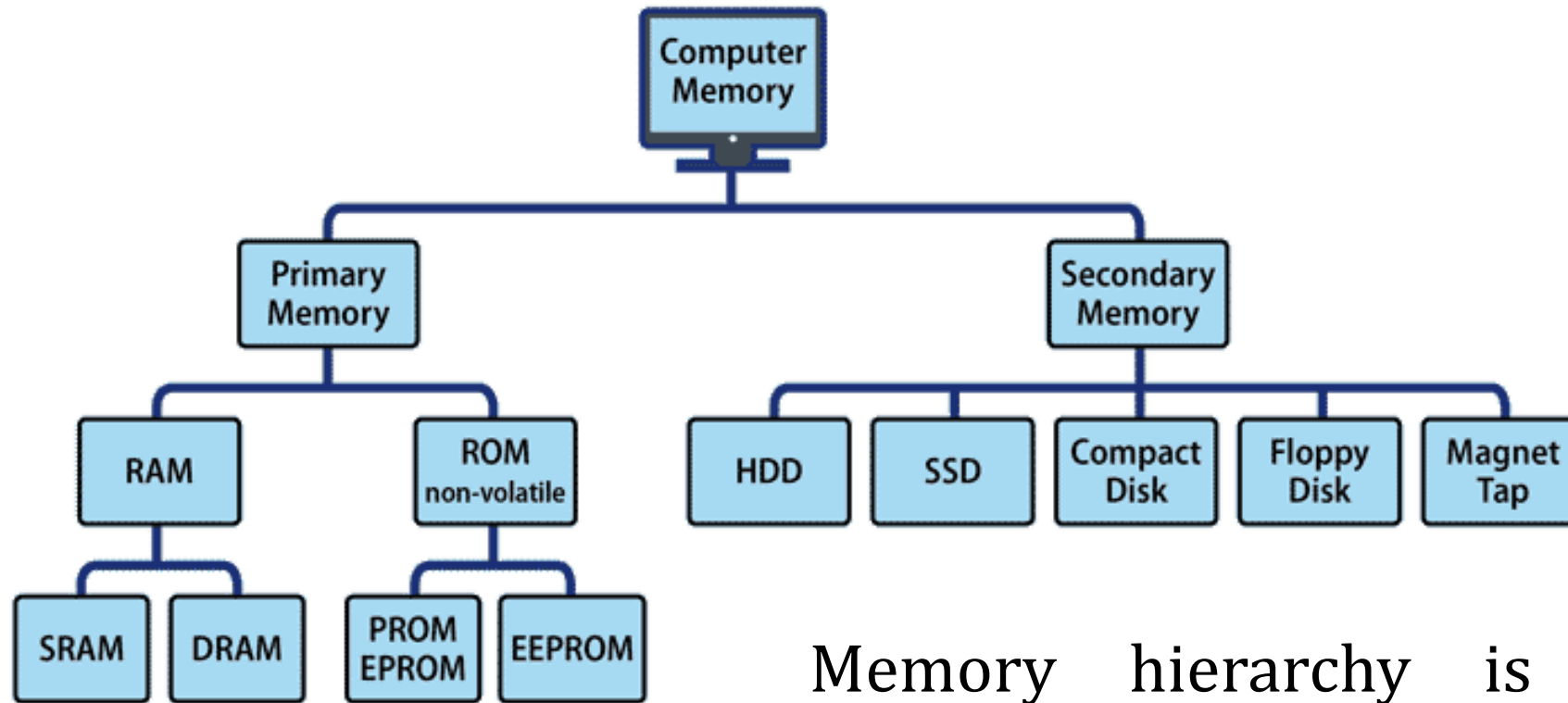


# What is Memory?



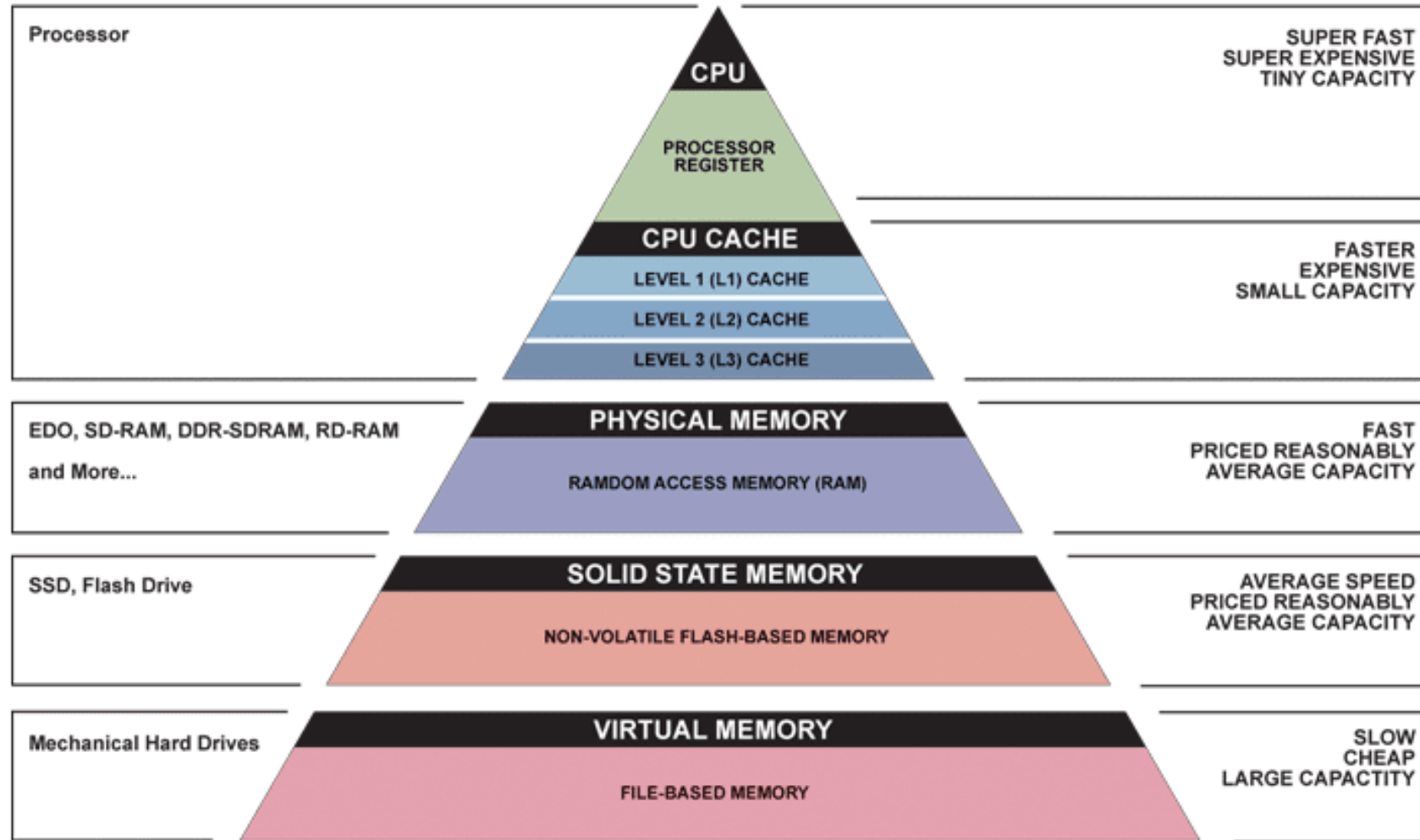
Memory refers to **storages** of **data**. These storings can be **temporary** or **permanent** depending on the design.

# Memory Hierarchy



Memory hierarchy is the **organized sorting** of **total memory capacity** of different components in a computer

# Computer Memory Hierarchy



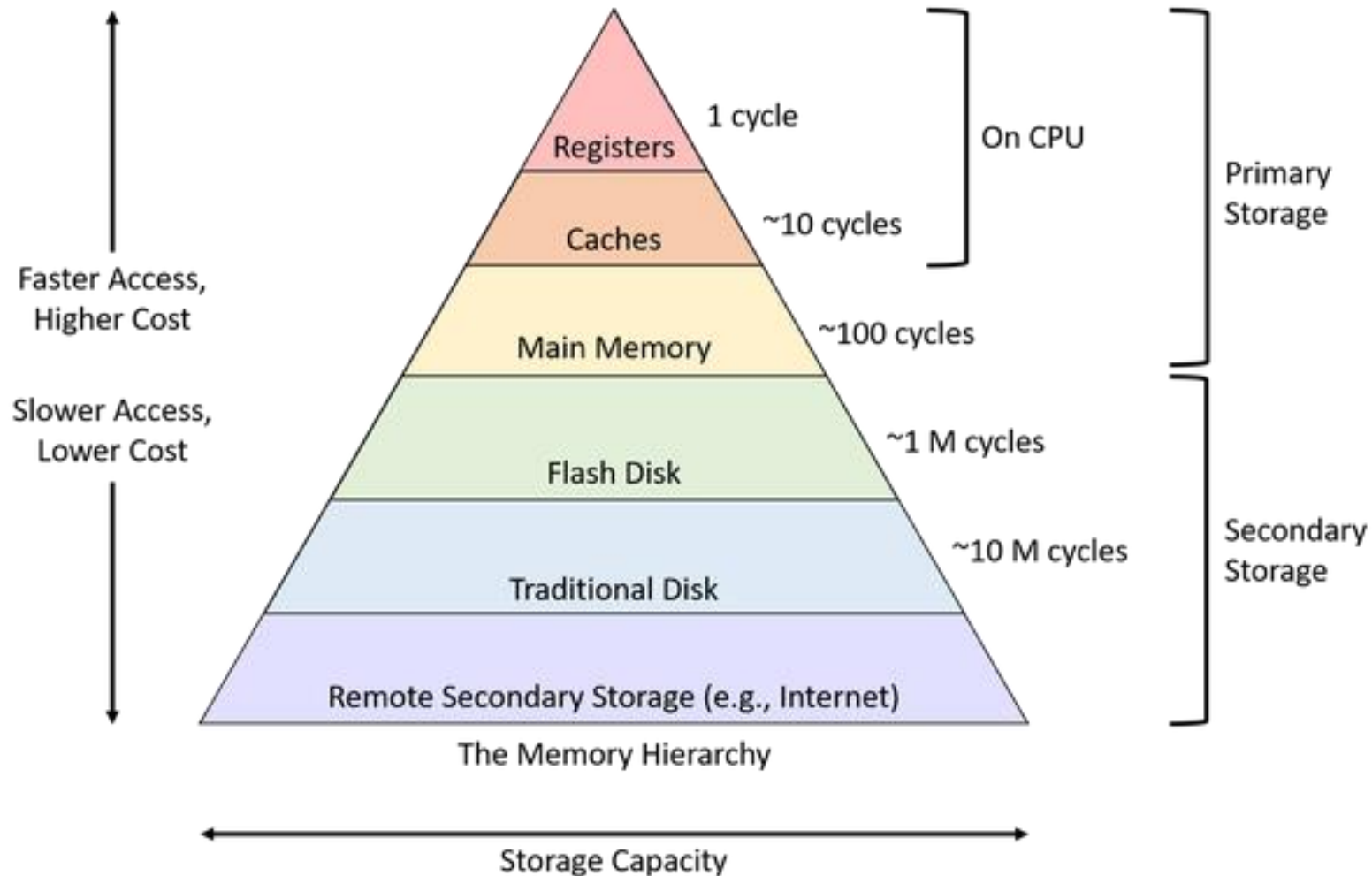
▲ Simplified Computer Memory Hierarchy

Illustration: Ryan J. Leng

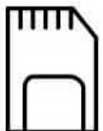
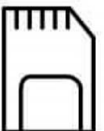
Van. Ustia. Armed, Lecturer, EEE, GUB

# Hierarchy Pyramid



## Characteristics







- Capacity
- Access Time
- Cost/bit
- Performance

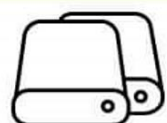
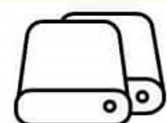
Primary Memory	Secondary Memory
 <p>By volatile and non-volatile memories, the primary memory is categorized.</p>	 <p>The secondary recall is often a non-volatile remembrance.</p>

Primary Memory	Secondary Memory
 <p>Memory devices mainly cost more than storage devices secondary to one.</p>	 <p>Secondary storage devices are cheaper than the main storage devices.</p>

Primary Memory	Secondary Memory
 <p>By data bus, you can access the primary memory.</p>	 <p>By input and output channels, you can access the secondary memory.</p>

Primary Memory	Secondary Memory
 <p>Primary memory data is accessed quicker.</p>	 <p>Secondary memory data is slower to access.</p>

Primary Memory	Secondary Memory
 <p>Processor/CPU accesses directly to the main memory.</p>	 <p>CPU is not directly available to secondary memory.</p>

Primary Memory	Secondary Memory
 <p>It includes data or information that the processing unit currently uses. Power is typically between 16 and 32 GB.</p>	 <p>It stores a large amount of information and data. The terabyte size is normally 200GB.</p>

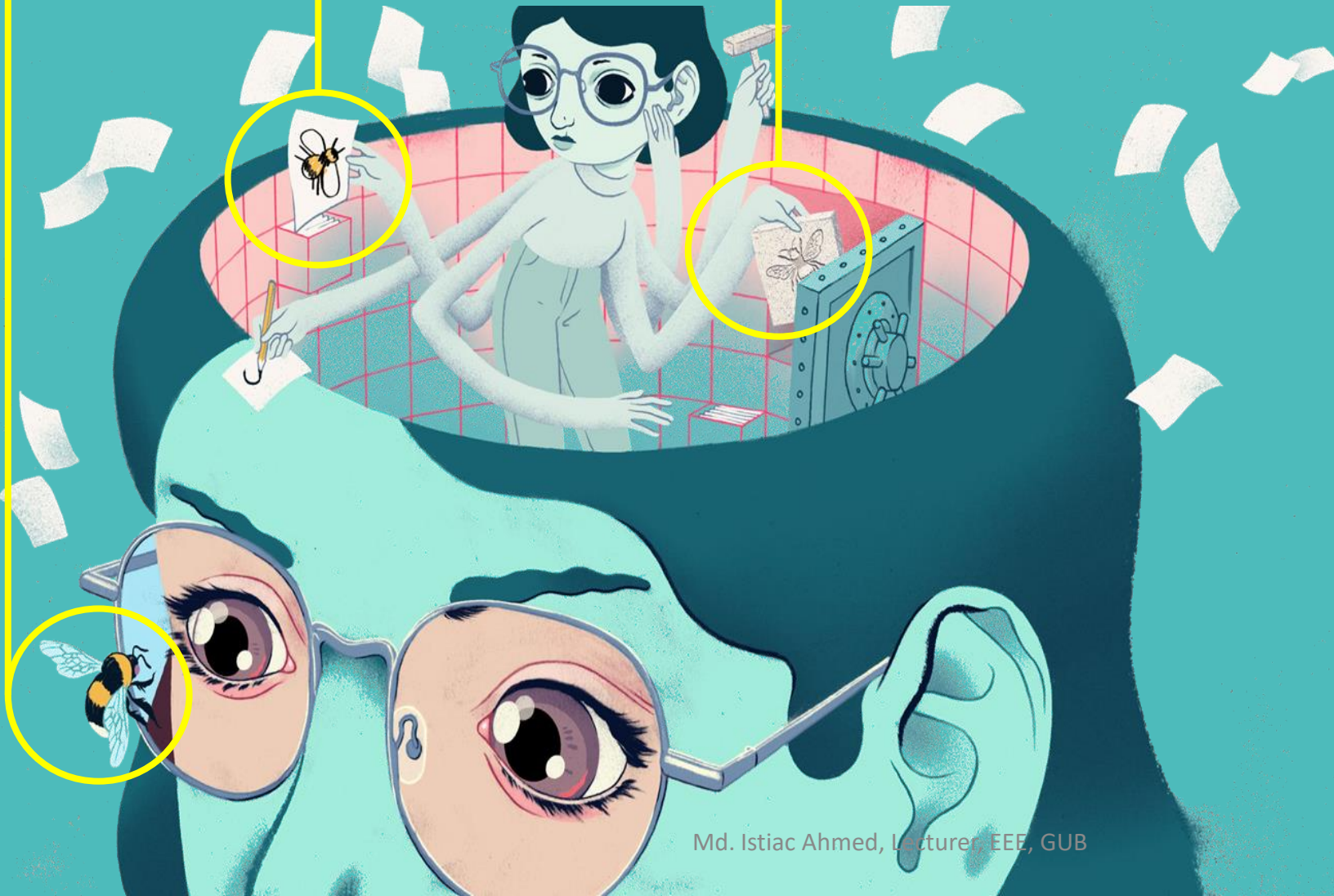


External Stimulus

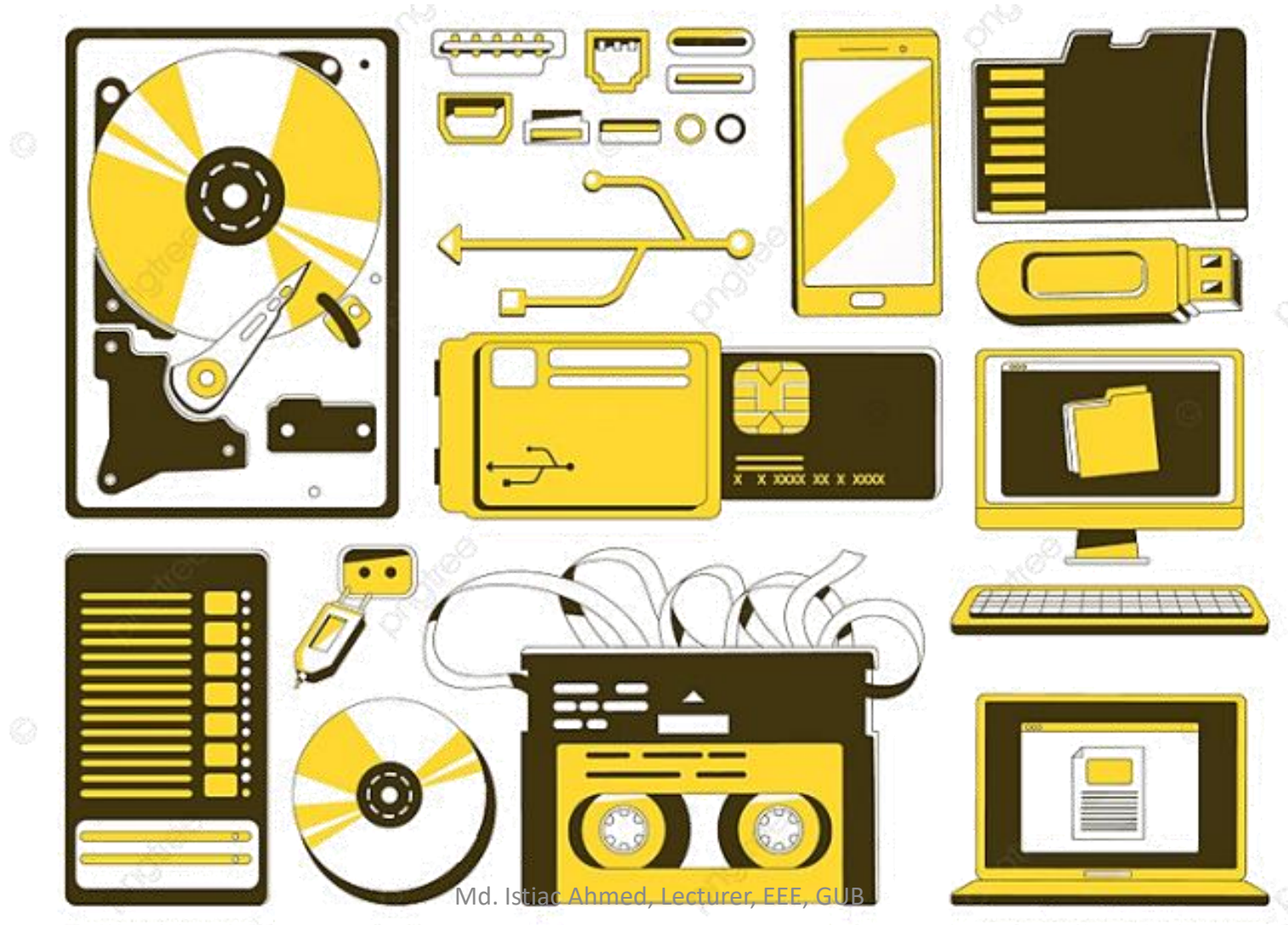
Analyze

Store/Preserve

# Data Acquisition and Preservation in Fauna

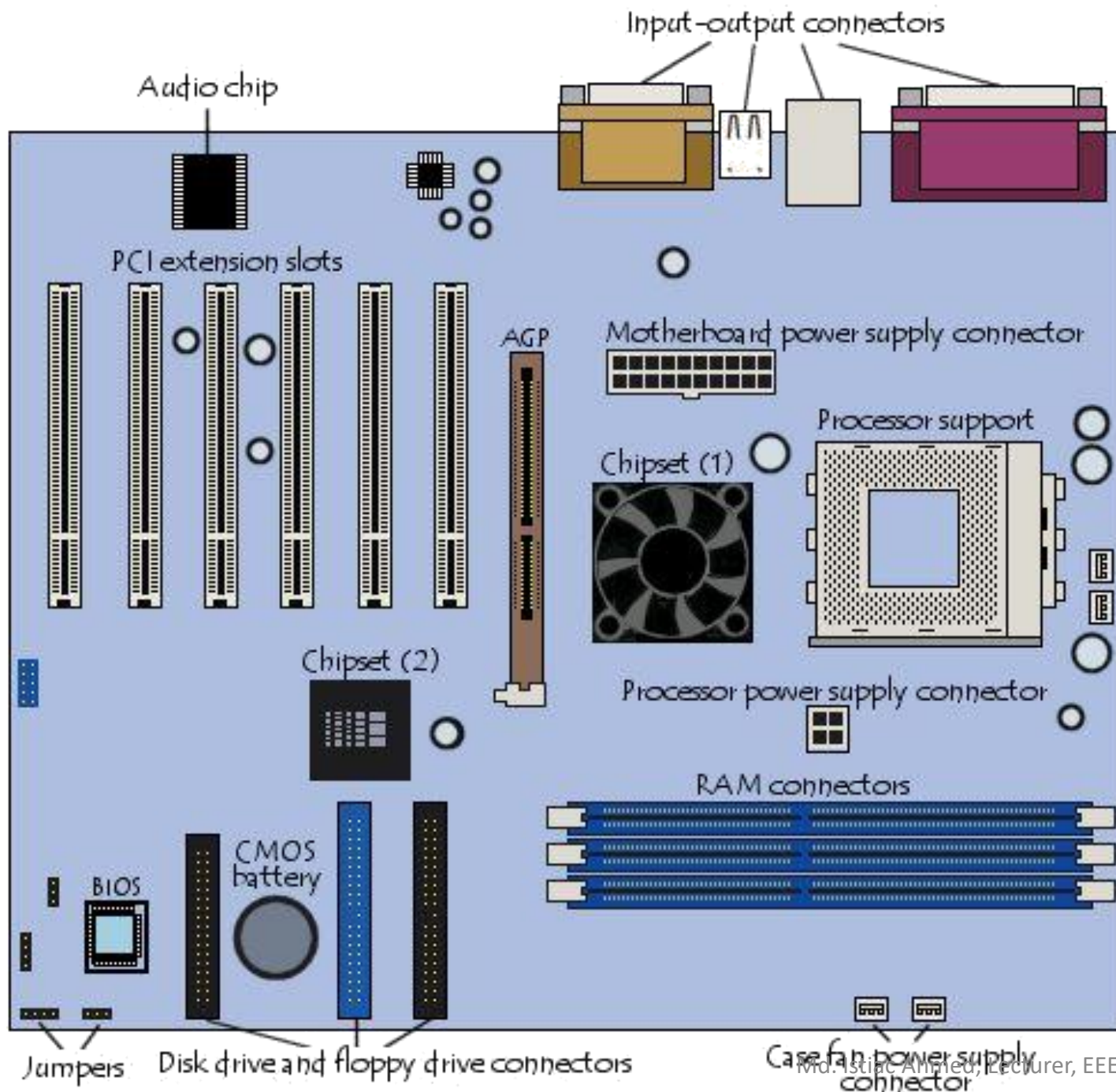


# Digital Memory

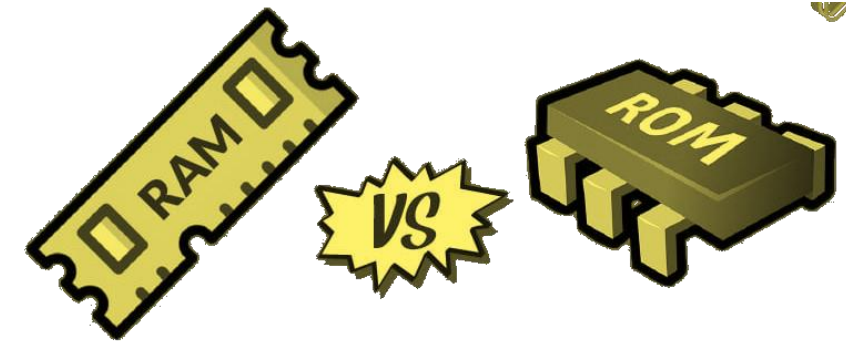


Md. Istiaq Ahmed, Lecturer, EEE, GUB





# Primary Memory



## Difference Between RAM & ROM

# RAM VERSUS ROM

## 2 KEY DIFFERENCES

Data can be both stored and retrieved from RAM (Random-Access Memory)

Data can be only read from ROM (Read-Only Memory)

RAM is a volatile memory, so once the voltage supply is lost, the data is removed from the memory

ROM is a non-volatile memory. If it is not erasable, data remains in storage until the hardware is damaged

[Click here to go to main differences](#)

Visit [www.differencebetween.com](http://www.differencebetween.com)

# Dynamic RAM (DRAM)

- Capacitor-Transistor Model
- Periodic Refreshing

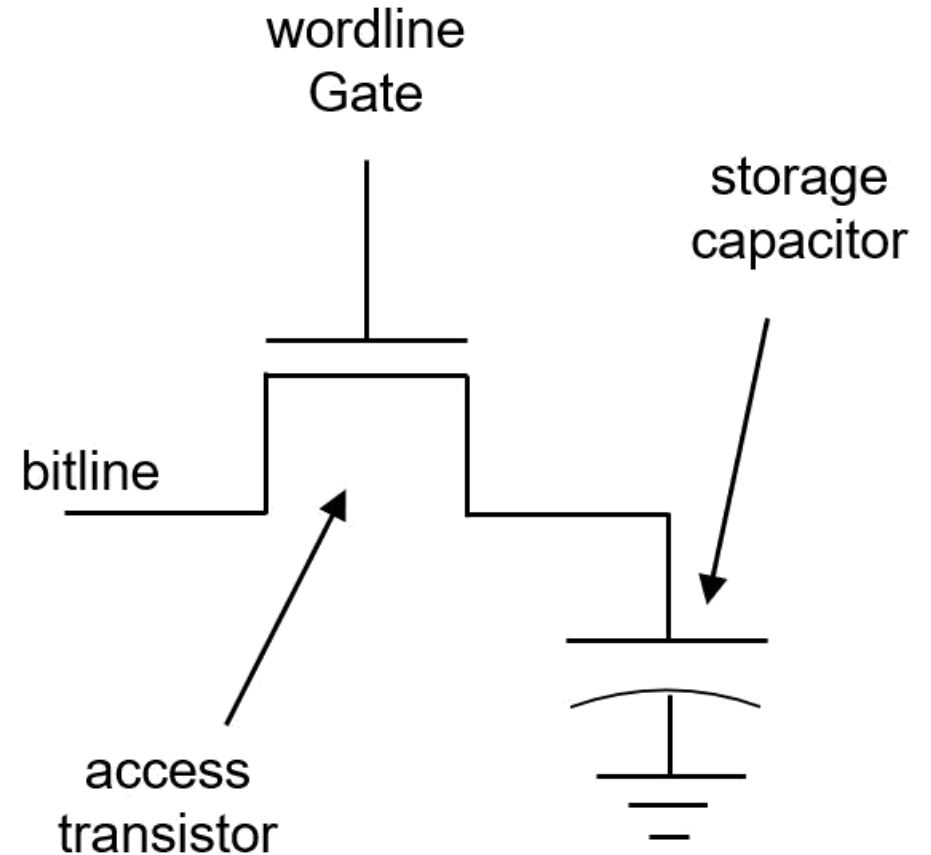
To activate DRAM cell for read/write operation, the access transistor must be turned-on using the WL.

## READ Operation

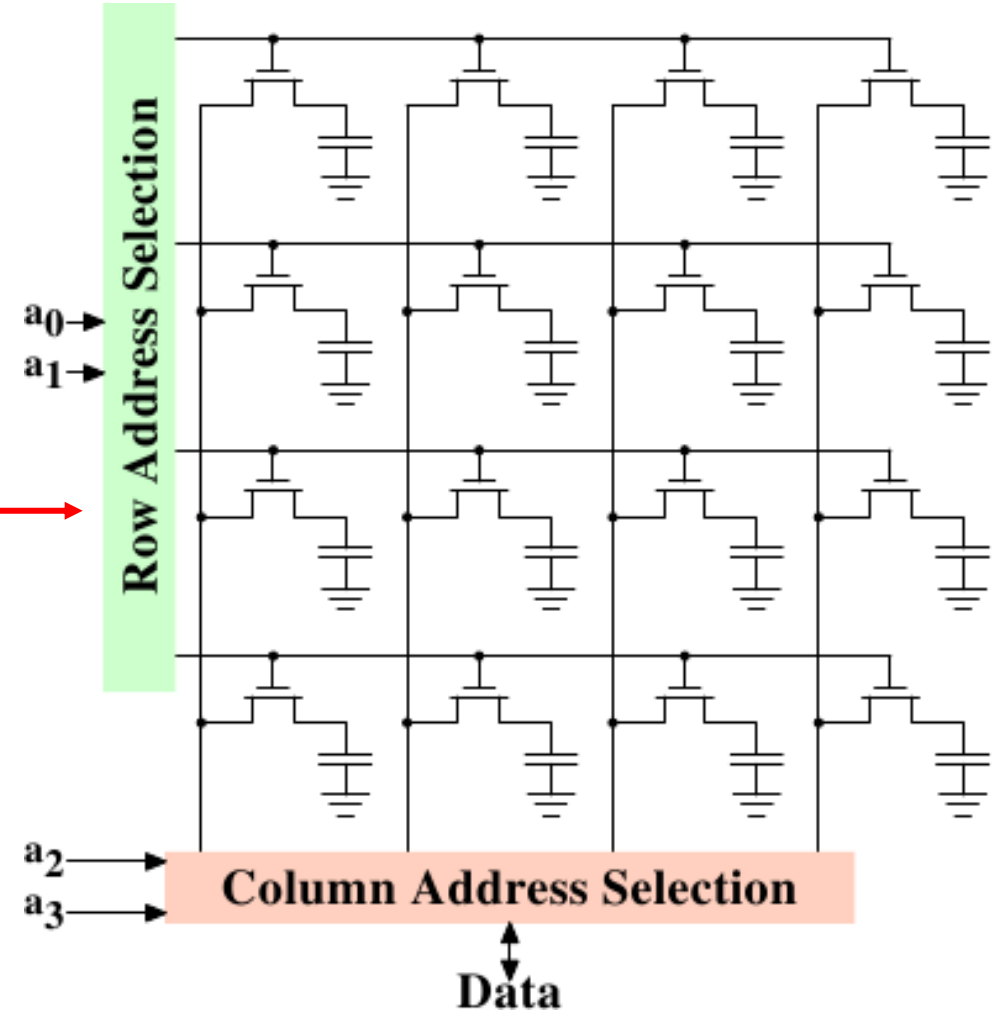
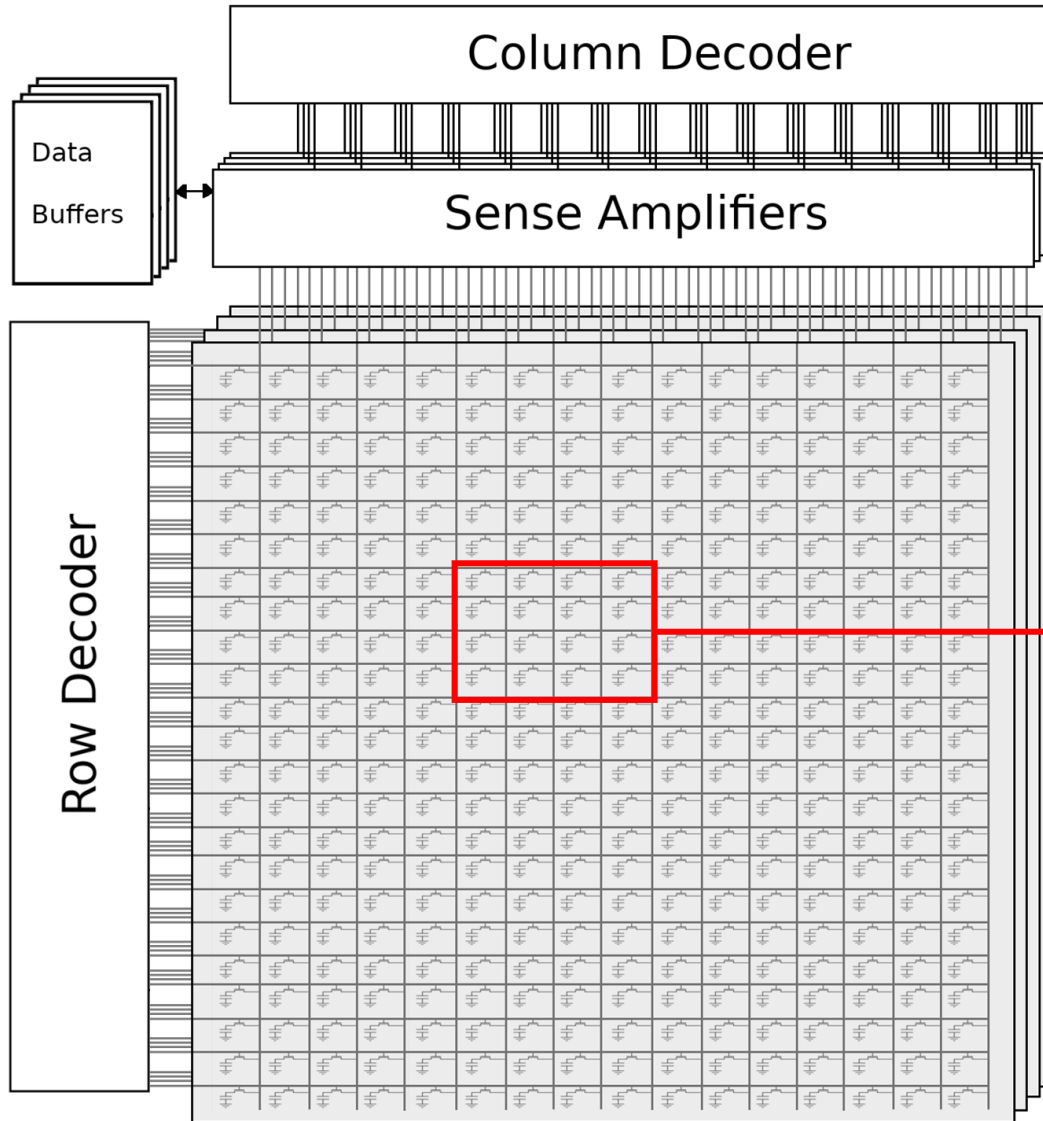
Capacitor voltage is sensed from the BL using the sense amplifier connected to it (not shown in the cell)

## WRITE Operation

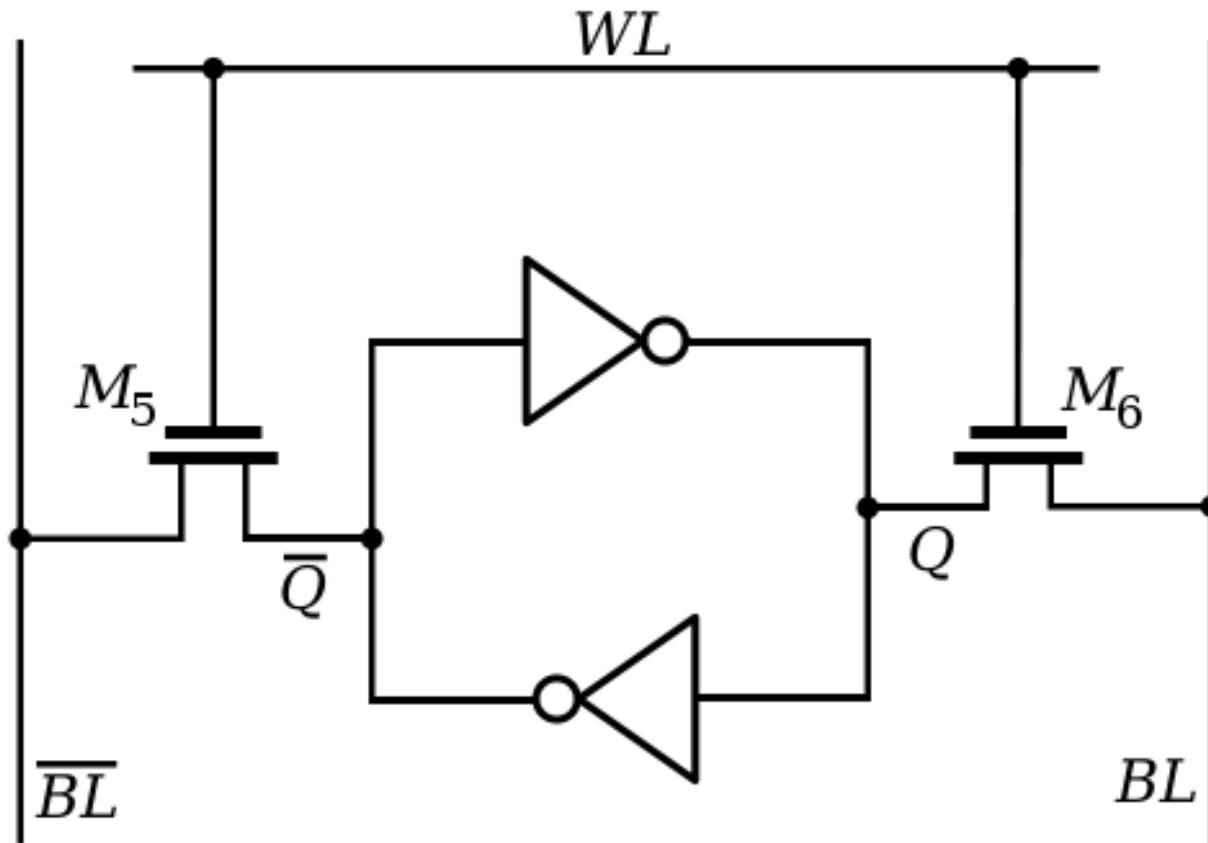
Capacitor is charged to the voltage applied in the BL.



# Dynamic RAM (DRAM)



# Static RAM (SRAM)

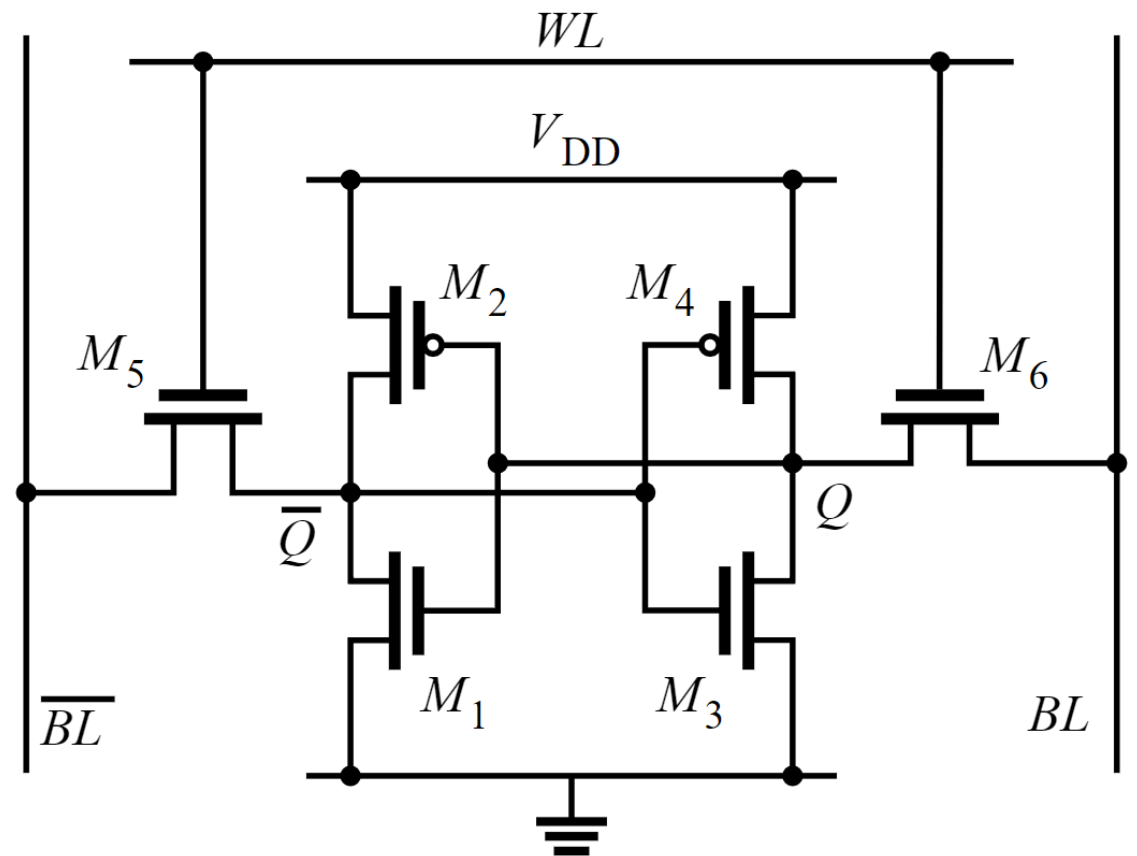
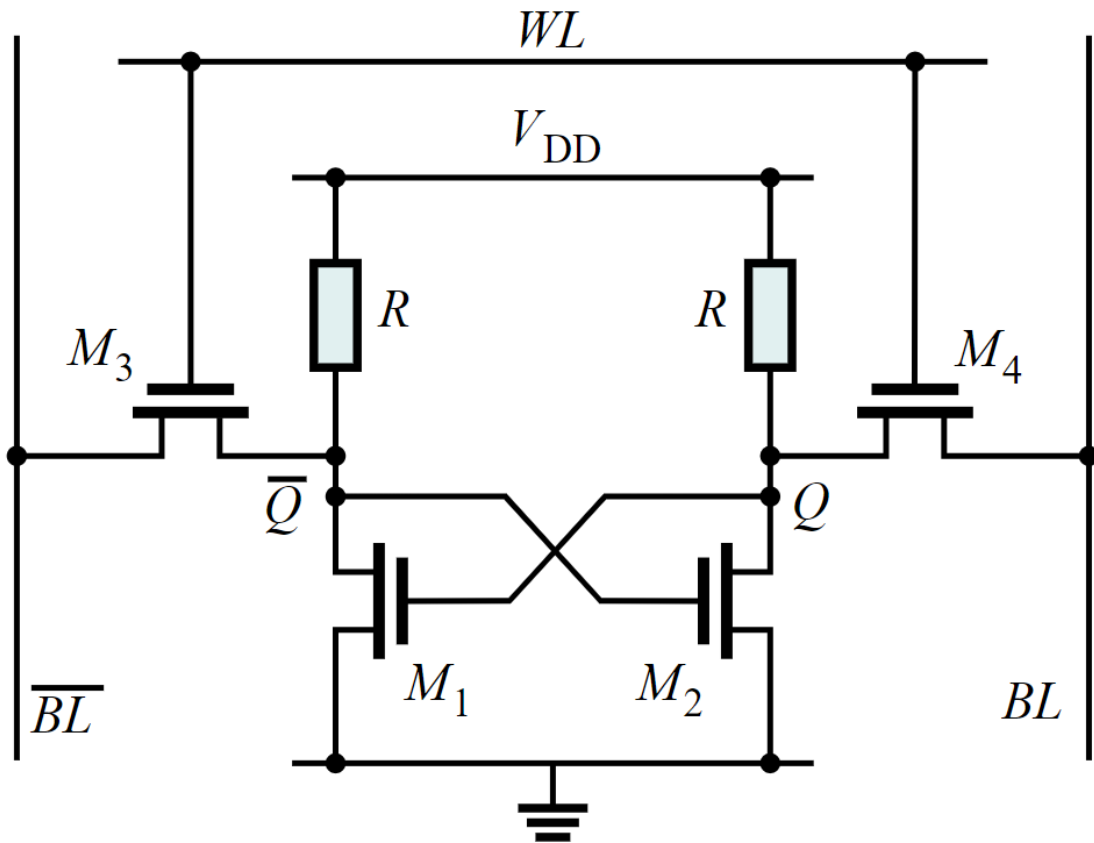


- Transistor Model
- Data is held statically

To activate SRAM cell for read/write operation, the access transistor must be turned-on using the  $WL$ .



# 4T & 6T SRAM Cell



**Faster**

**SRAM**

**No  
Refresh**

**Low  
Power**



**Cheaper**

**DRAM**

**High  
Density**

**Fast**



# ROM Classifications

