

# 15-213

*“The course that gives CMU its Zip!”*

## **The Memory Hierarchy** **Sept 26, 2007**

### **Topics**

- Storage technologies and trends

# Random-Access Memory (RAM)

## Key features

- **RAM** is traditionally packaged as a chip.
- Basic storage unit is normally a **cell** (one bit per cell).
- Multiple RAM chips form a memory.

## Static RAM (**SRAM**)

- Each cell stores a bit with a four or six-transistor circuit.
- Retains value indefinitely, as long as it is kept powered.
- *Relatively* insensitive to electrical noise (EMI), radiation, etc.
- Faster and more expensive than DRAM.

## Dynamic RAM (**DRAM**)

- Each cell stores bit with a capacitor. One transistor is used for access
- Value must be refreshed every 10-100 ms.
- More sensitive to disturbances (EMI, radiation,...) than SRAM.
- Slower and cheaper than SRAM.

# SRAM vs DRAM Summary

	Trans. per bit	Access time	Needs refresh?	Needs EDC?	Cost	Applications
SRAM	4 or 6	1X	No	Maybe	100x	cache memories
DRAM	1	10X	Yes	Yes	1X	Main memories, frame buffers