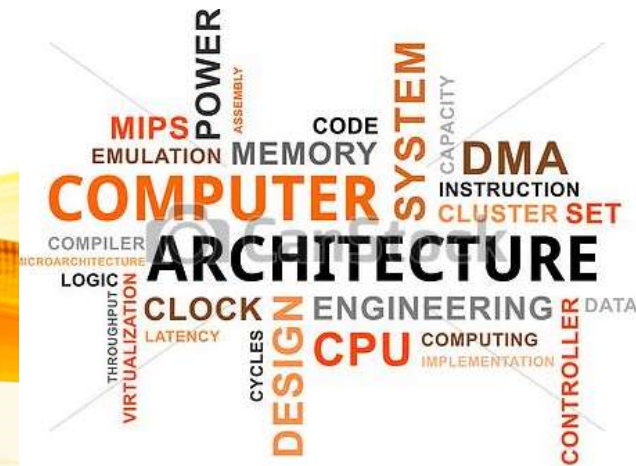


# UNIT III

## PROCESSOR AND PIPELINING

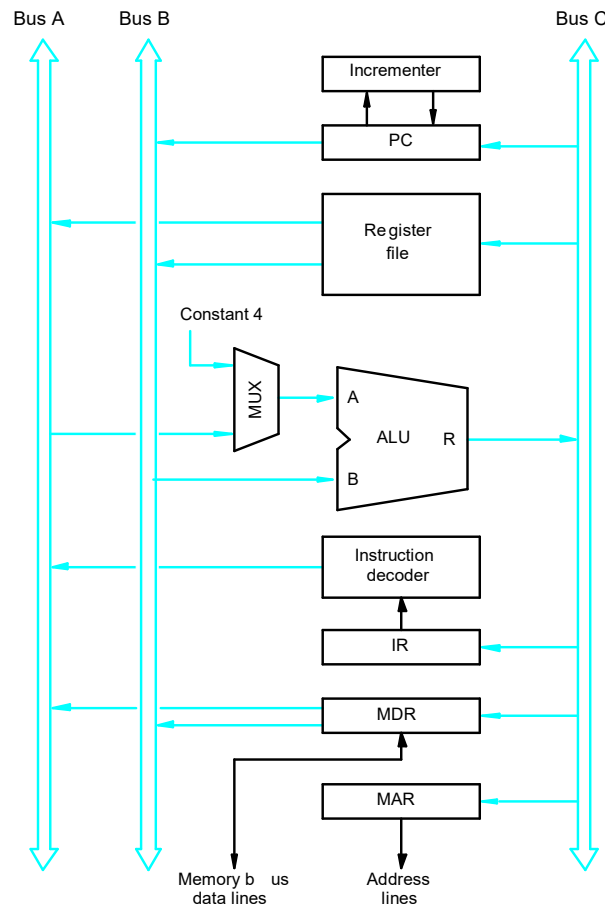
Fundamental concepts – Execution of a complete instruction – **Multiple bus organization** – Hardwired control – Micro programmed control – Pipelining: Basic concepts – Data hazards – Instruction hazards – Influence on Instruction sets – Data path and control consideration.



# Recap the previous Class



# Multiple-Bus Organization



- Allow the contents of two different registers to be accessed simultaneously and have their contents placed on buses A and B.
  - Allow the data on bus C to be loaded into a third register during the same clock cycle.
  - Incrementer unit.
  - ALU simply passes one of its two input operands unmodified to bus C
- control signal:  $R=A$  or  $R=B$



- General purpose registers are combined into a single block called registers.
- 3 ports, 2 output ports – access two different registers and have their contents on buses A and B
- Third port allows data on bus c during same clock cycle.
- Bus A & B are used to transfer the source operands to A & B inputs of the ALU.
- ALU operation is performed.
- The result is transferred to the destination over the bus C.



- ALU may simply pass one of its 2 input operands unmodified to bus C.
- The ALU control signals for such an operation  $R=A$  or  $R=B$ .
- Incrementer unit is used to increment the PC by 4.
- Using the incrementer eliminates the need to add the constant value 4 to the PC using the main ALU.
- The source for the constant 4 at the ALU input multiplexer can be used to increment other address such as load multiple & store multiple

# Multiple-Bus Organization

- Add R4, R5, R6

---

## Step Action

---

- |   |   |
|---|---|
| 1 | $PC_{out}$ , $R=B$ , $MAR_{in}$ , Read, IncPC             |
| 2 | WMFC  |
| 3 | $MDR_{outB}$ , $R=B$ , $IR_{in}$                          |
| 4 | $R4_{outA}$ , $R5_{outB}$ , SelectA, Add, $R6_{in}$ , End |
- 

Figure 7.9. Control sequence for the instruction. Add R4,R5,R6, for the three-bus organization in Figure 7.8.



- Step 1: The contents of PC are passed through the ALU using  $R=B$  control signal & loaded into MAR to start a memory read operation  
At the same time PC is incremented by 4
- Step 2: The processor waits for MFC
- Step 3: Loads the data, received into MDR, then transfers them to IR.
- Step 4: The execution phase of the instruction requires only one control step to complete.



**sns**  
INSTITUTIONS



*Thank You*