Interfacing Display with MPU *without Peripheral Controller*

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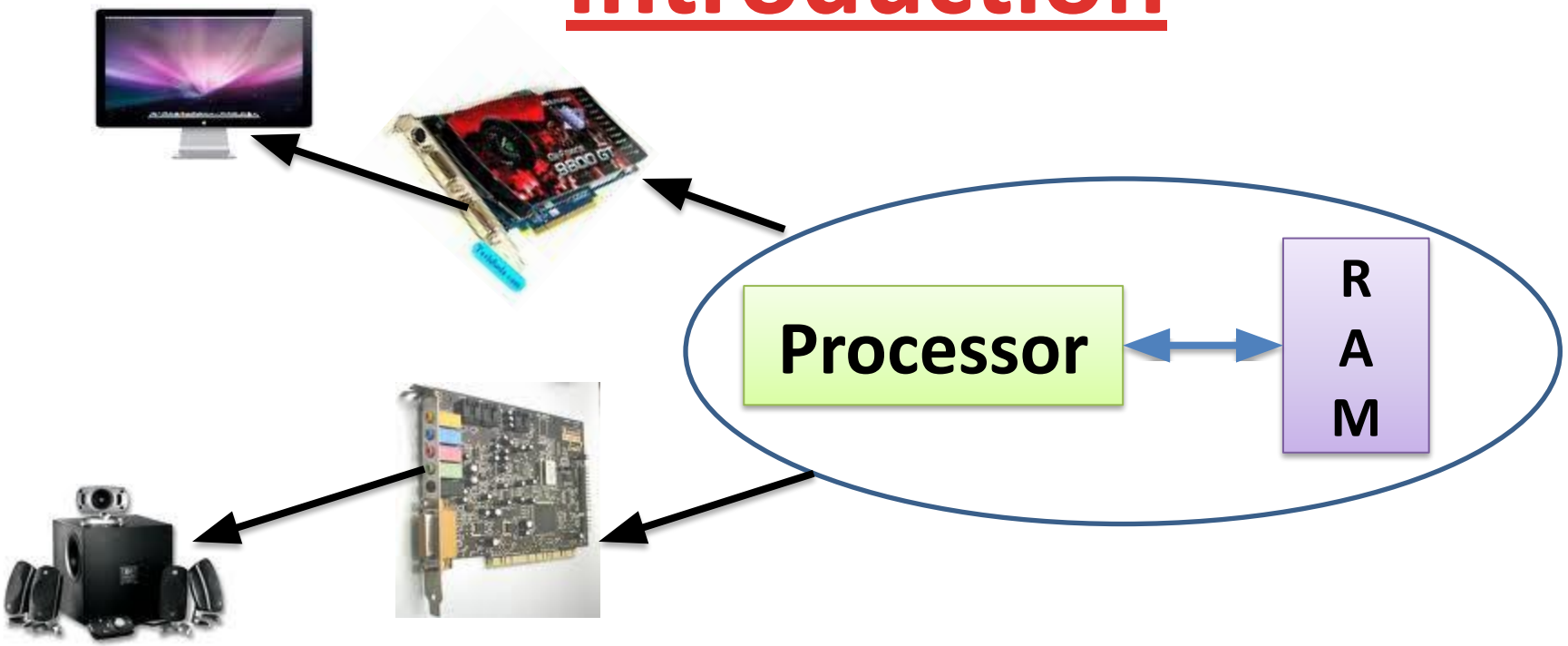
Outline

- Peripheral communications
- Display
- LED Display
  - Decoder
  - Generic model
  - Interfacing
- Character Display Monitor
  - Decoder
  - Generic Model
- Graphics monitor
  - Why graphics? Vector Vs Raster
- Keyboard type and Interfaces

Introduction



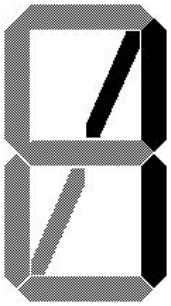
- Peripherals : HD monitor, 5.1 speaker
- **Interfaces : Intermediate Hardware**
  - **Nvidia GPU card, Creative Sound Blaster card**
- Interfaces : Intermediate Software/Program
  - Nvidia GPU driver , Sound Blaster Driver software

Transmission controller

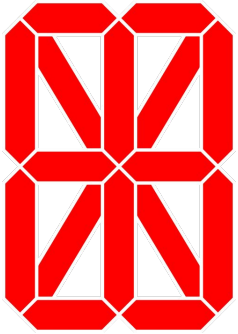
- Transmission Controller:
  - **MPU control**, Device Control (DMA)
- Type of IO mapping
  - **Peripheral (IN/Out**), Memory mapped IO (LD/ST,MV)
- Format of communication
  - **Synchronous** (T & R sync with clock), **Asynchronous**
- Mode of Data Transfer
  - **Parallel**, Serial (UART)
- Condition for data transfer
  - **Uncond.**, Polling, Interrupt, **Ready signal**, Handshake

Display

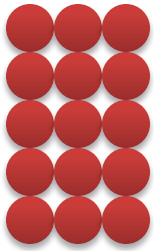
7 Seg



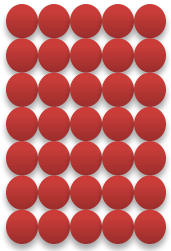
9 Seg



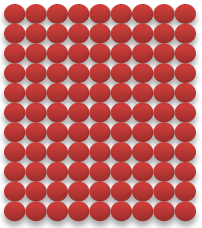
16 Seg



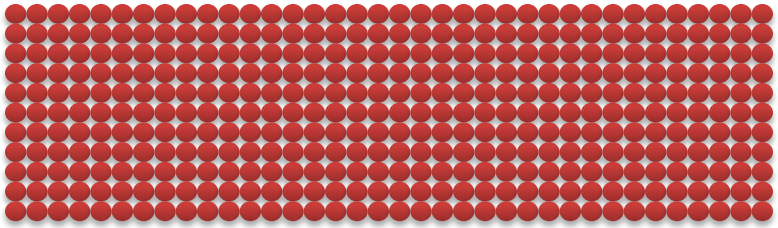
3x5 DotMatix



5x7



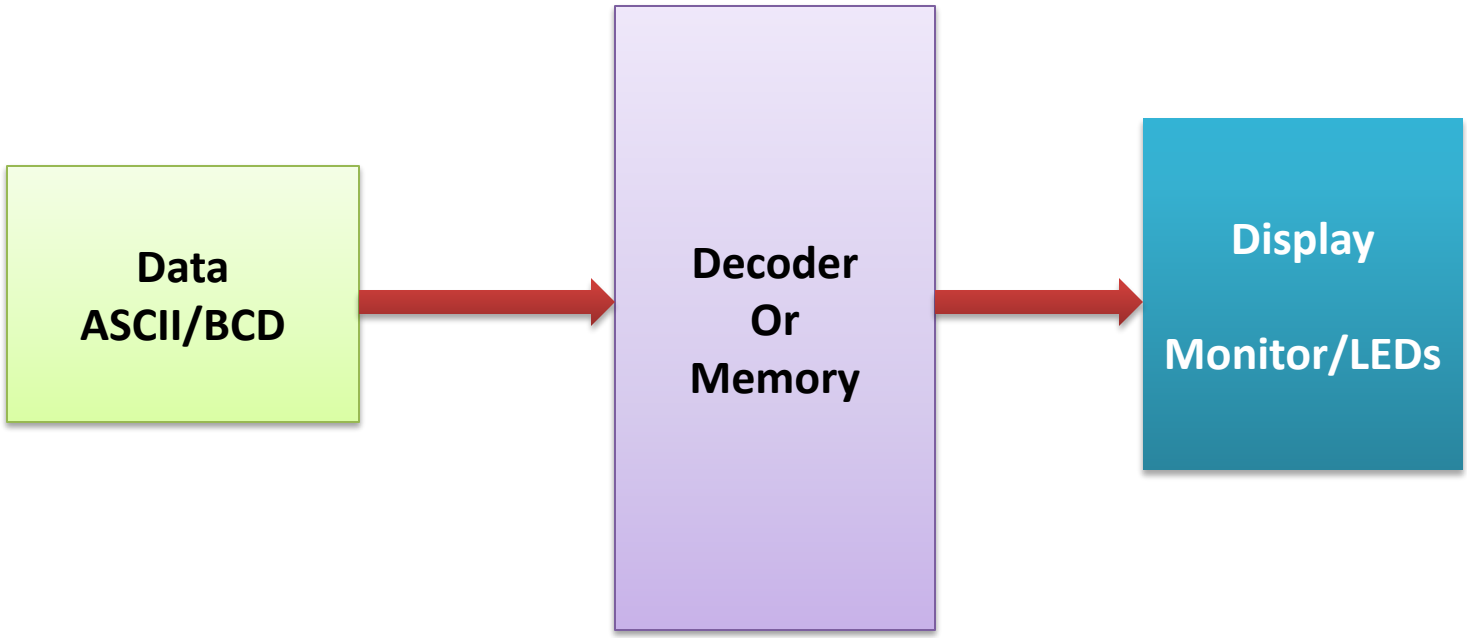
9x11



Dot Matrix Display Panel

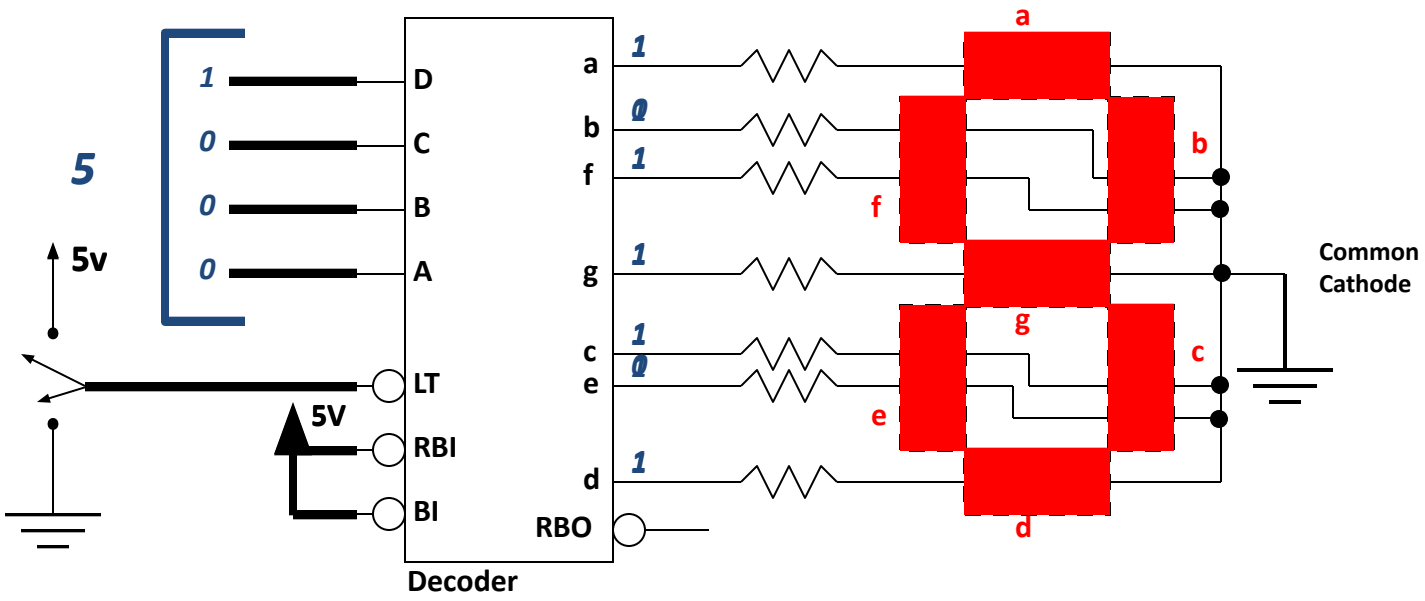
25x80 character monitor

Generic Model (Data) of Display



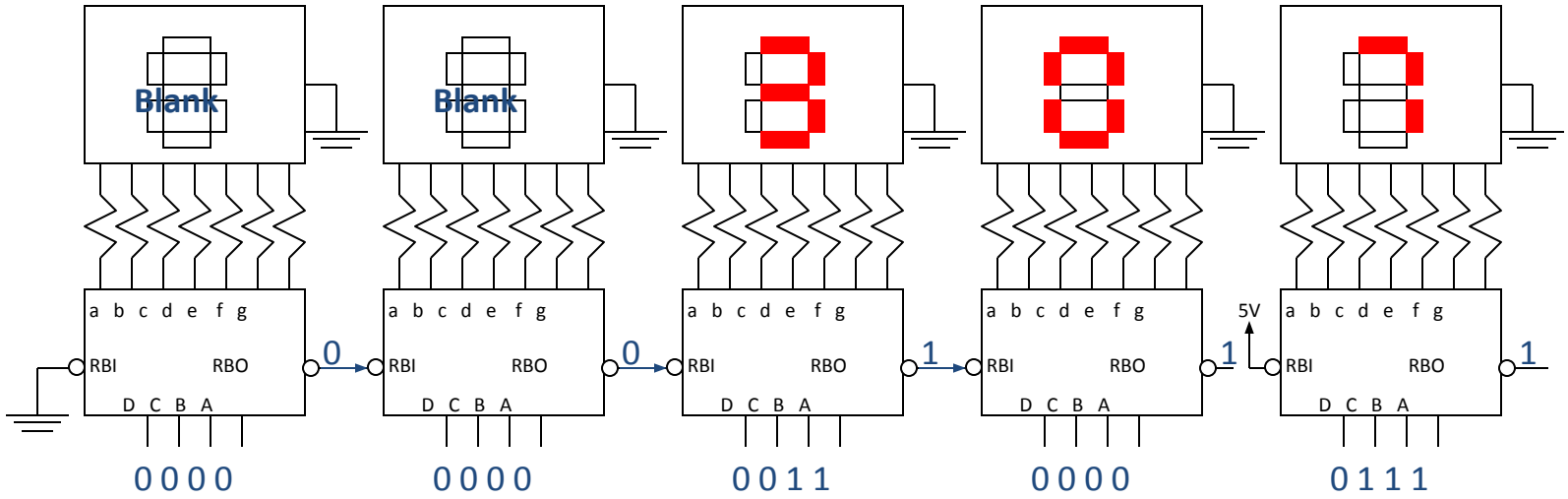
7 Segment LED Interfaces

- Data to 7 Segment Decoder

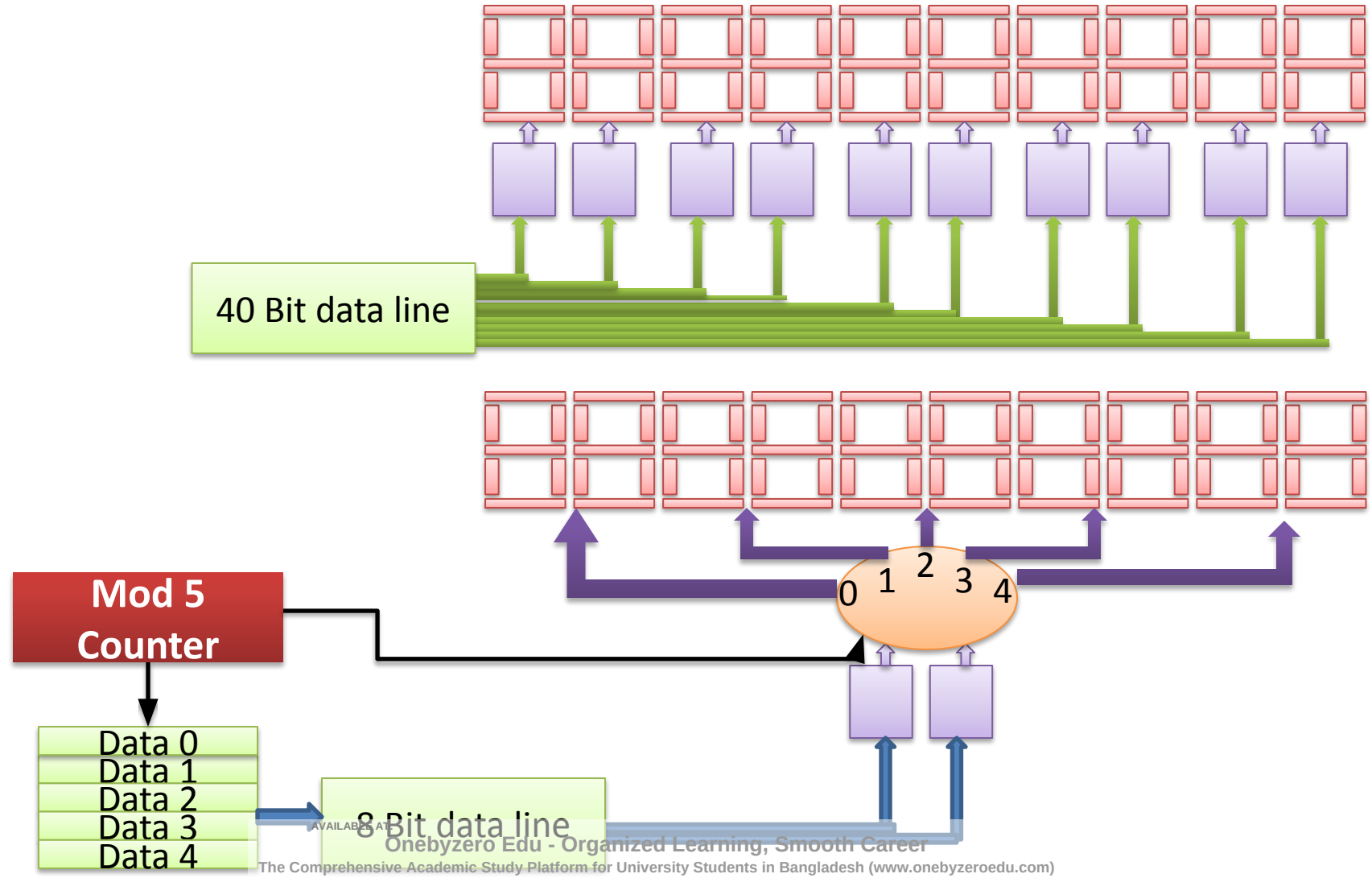


Multiple 7 Segment LED Interfaces

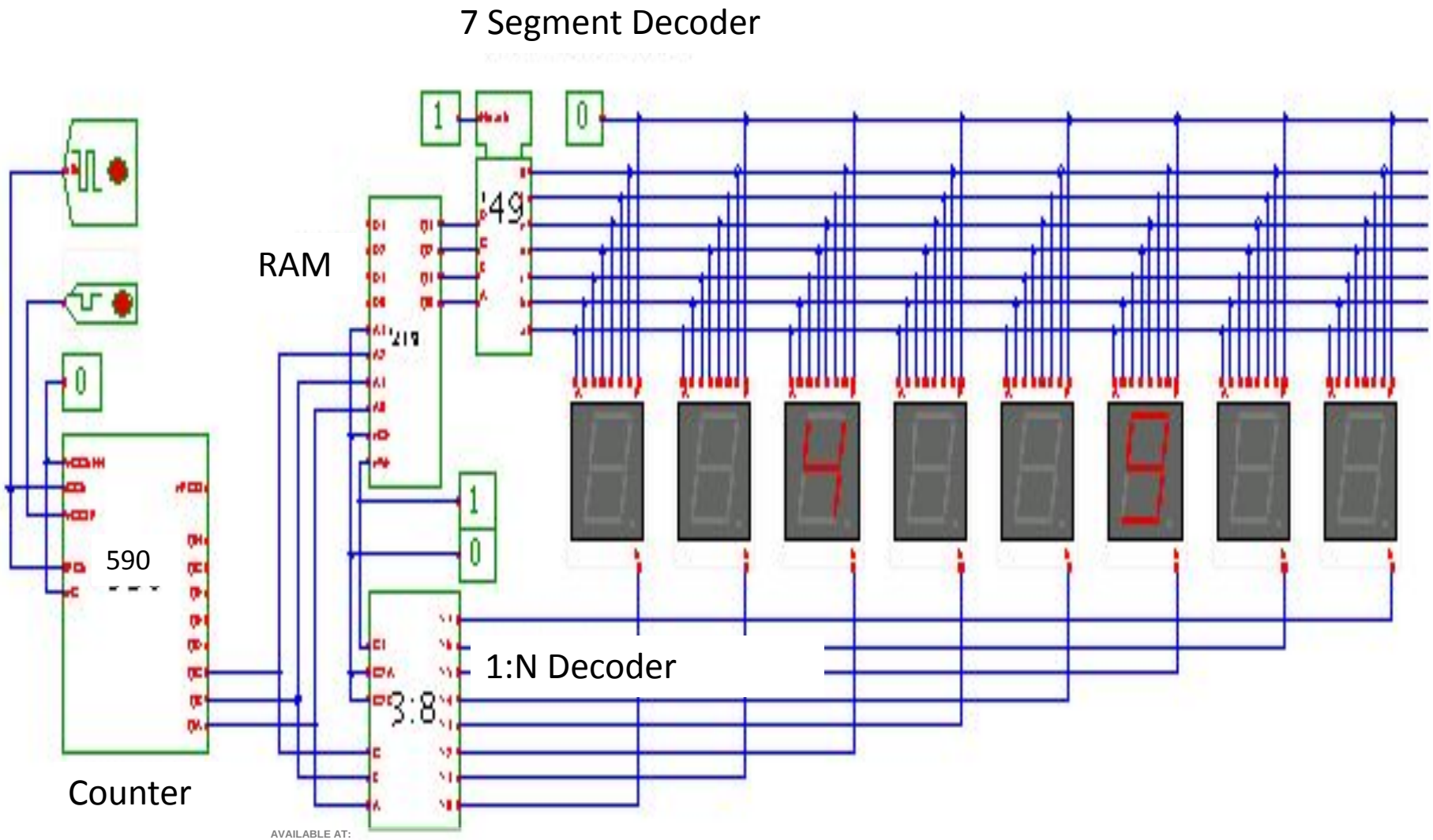
- Data to 7 Segment Decoder



Multiplexed line and Memory use



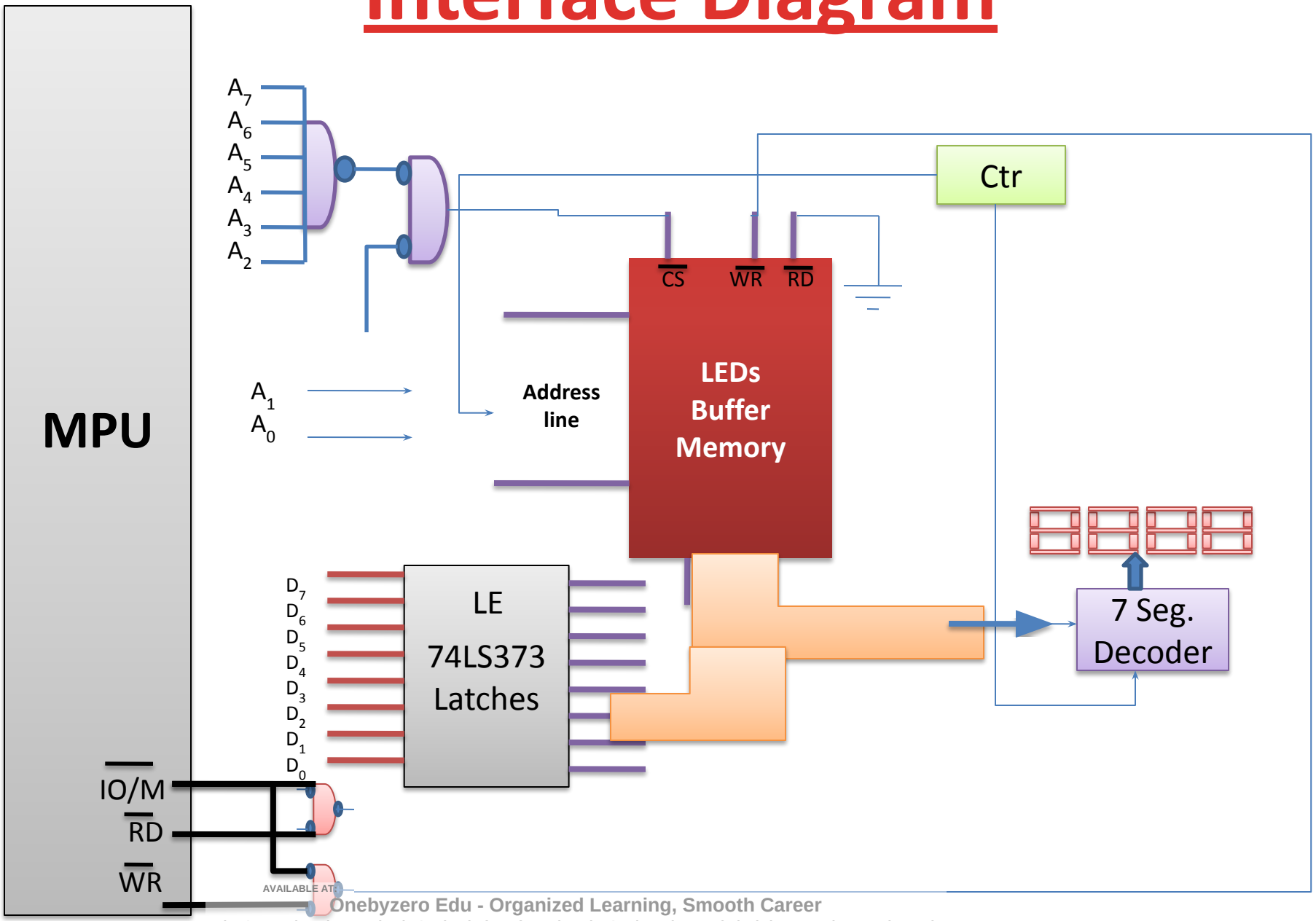
Multiplexed line/Memory used



Interface LED Display Using Delay

- Write a program to display contents of B,C,D and E register to LED display
- Write to buffer memory to display to 7 Seg. LEDs
- Use address FC H,FD H,FE H and FF H to display

Interface Diagram

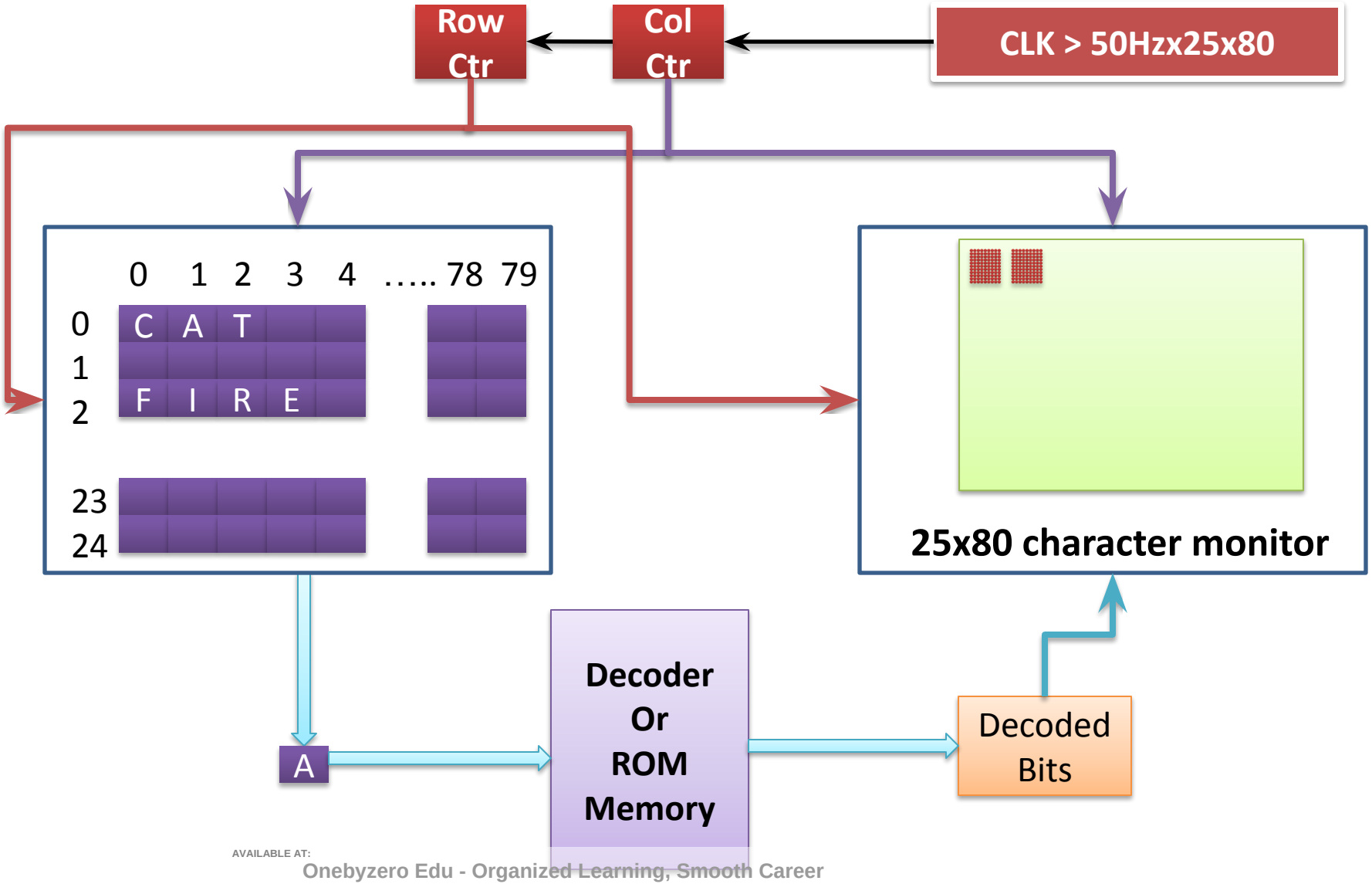


Monitor program

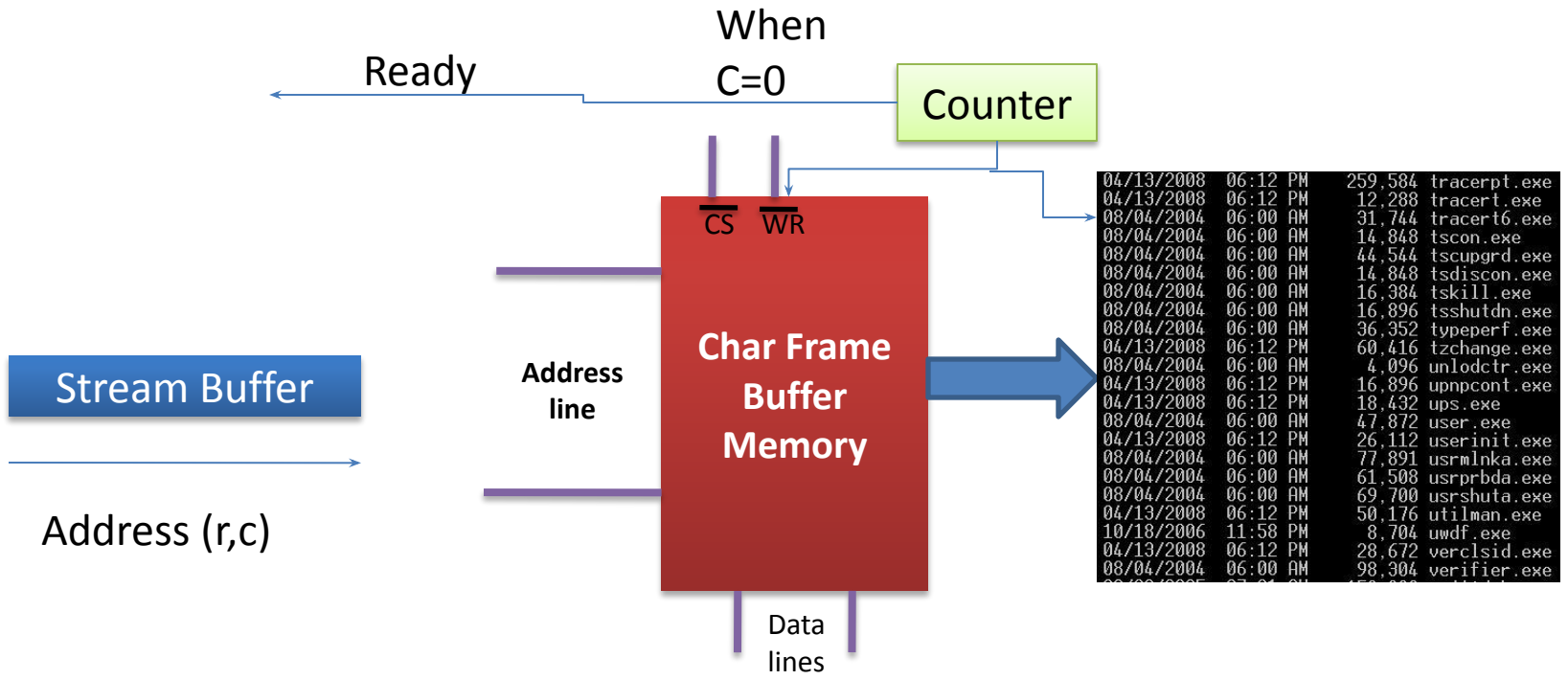
- Interface program to Display content of B,C,D and E after 1 Sec Delay

```
DIS: MVI     A,B
     OUT     FCH
     MVI     A,C
     OUTFDH
     MVI A,D
     OUTFEH
     MVI A,E
     OUTFFH
     CALL DELAY          ;1sec delay
     JMP DIS;
```

Multiplexed 25x80 Char Display



Generic Model of Char Monitor



- Delay of Monitor is 1/50 Sec, After Every 50 Second it makes ready
- From stream buffer it writes to Frame buffer after getting command. (Flush stream command)

Speed of Display

- LED is very high speed
  - You can write to LEDs at very high speed
  - Display meant for to see some thing (Is it good?)
- 30 Frames/Sec is more then enough for human eye (>30 blink make human eye Fixed)
- No of blink > 30Hz
  - Human can not differentiate ON/OFF state, it will be seen AS ON state
- Video display make default 30-60 Frame/Sec
- Monitor run at speed 30-60 Frame/Sec

Speed of Monitor and Disk

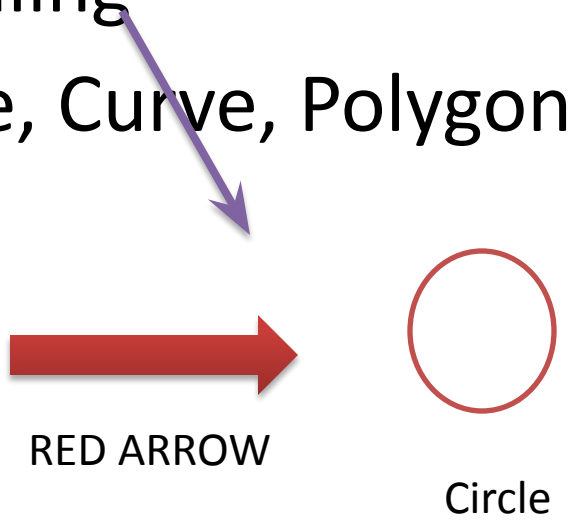
- Speed is fixed (60Frame/Sec)

```
for(i=0;i<10000;i++){
   printf("HelloWorld");
}
```

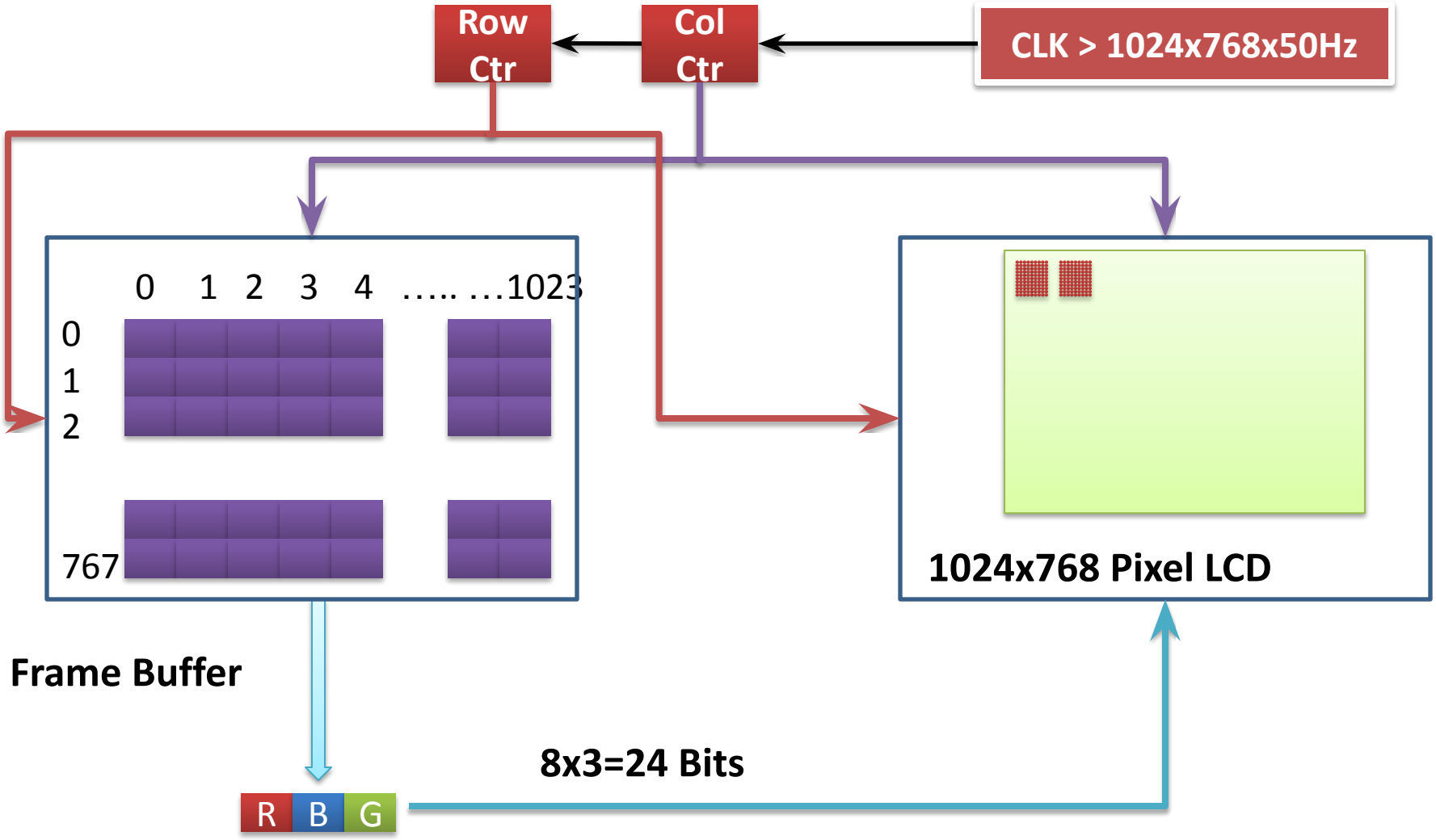
- $ a.out
- $ a.out > outputfile
- $ a.out > /dev/null

Migration from Char to Graphics/Video

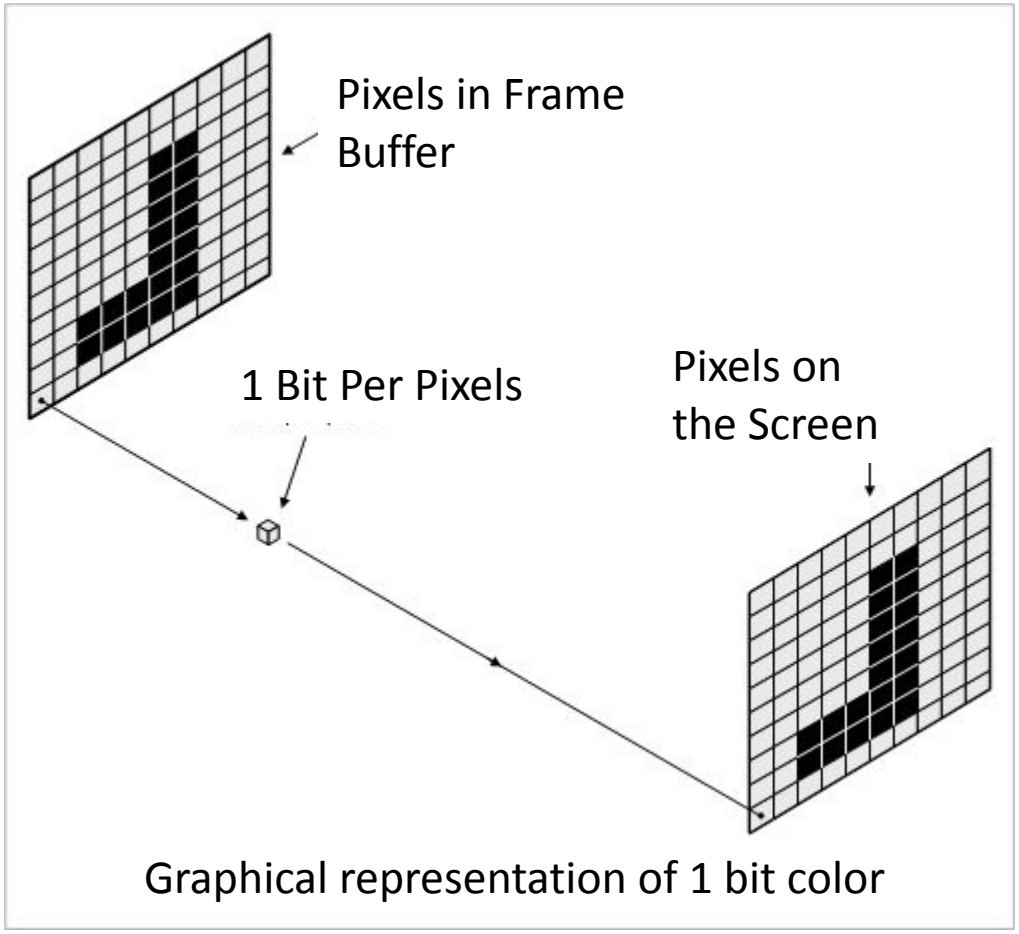
- Char display (80x25 char, 5x7pixel=400x175)
- CRT Monitor (400x600, 640x480,600x800)
- LCD Monitor (1024x768,1280x1024,…)
- Graphics visually more appealing
- Display Line, Circle, Rectangle, Curve, Polygon
  - Character using this primitives
  - True type font



Multiplexed 1024x768 pixel display

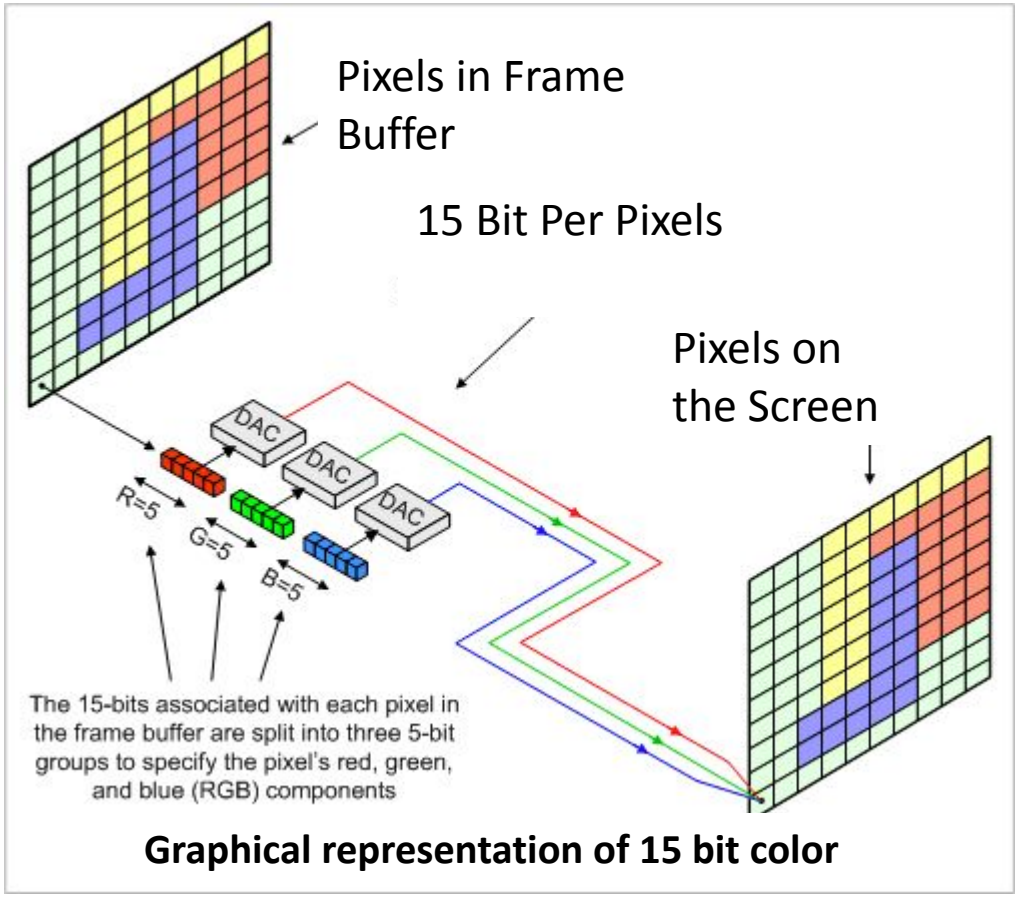


Frame Buffer (1 Bit Pixel): Grey



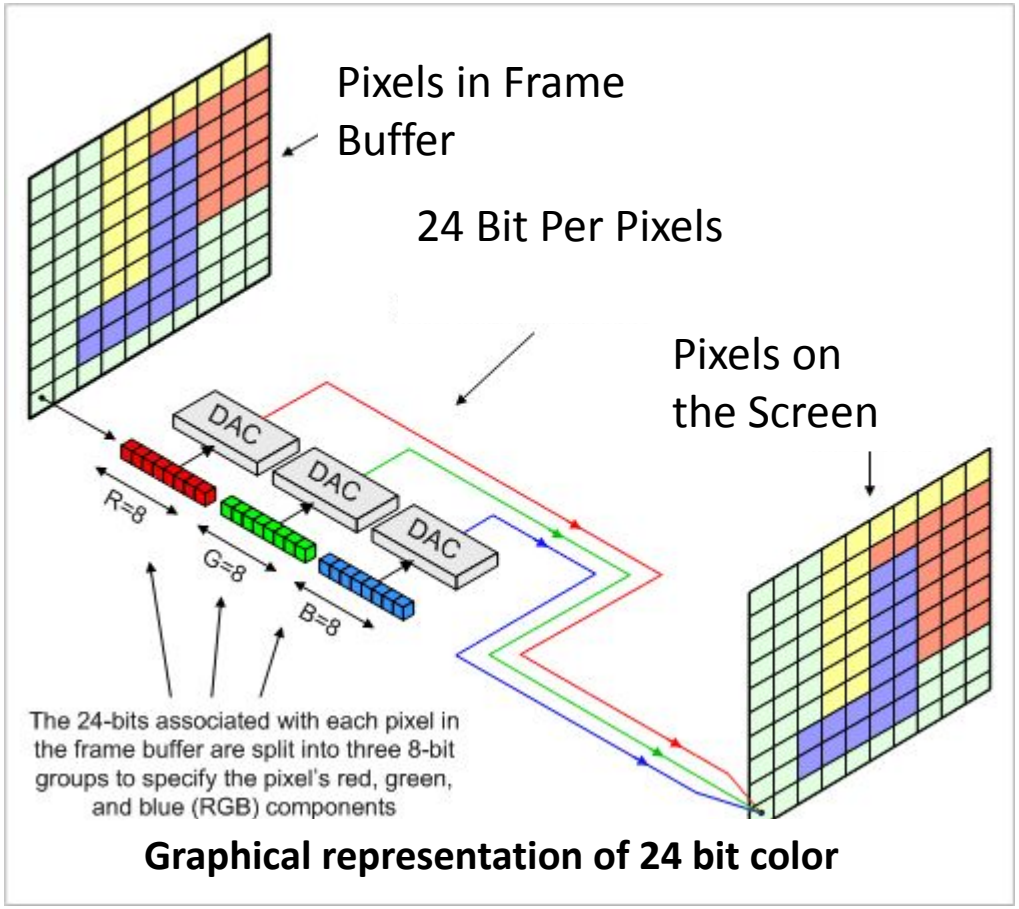
Graphical representation of 1 bit color

Frame Buffer (15 Bit Pixel)



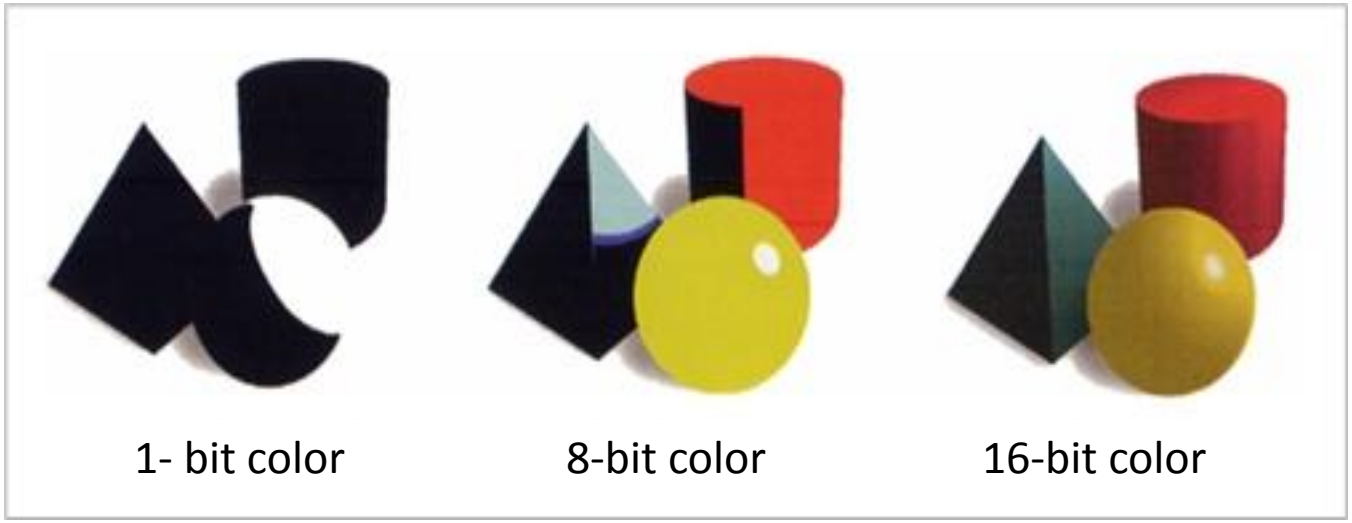
Graphical representation of 15 bit color

Frame Buffer (24 Bit Pixel)



Graphical representation of 24 bit color

1bit, 8 bit & 16 bit color



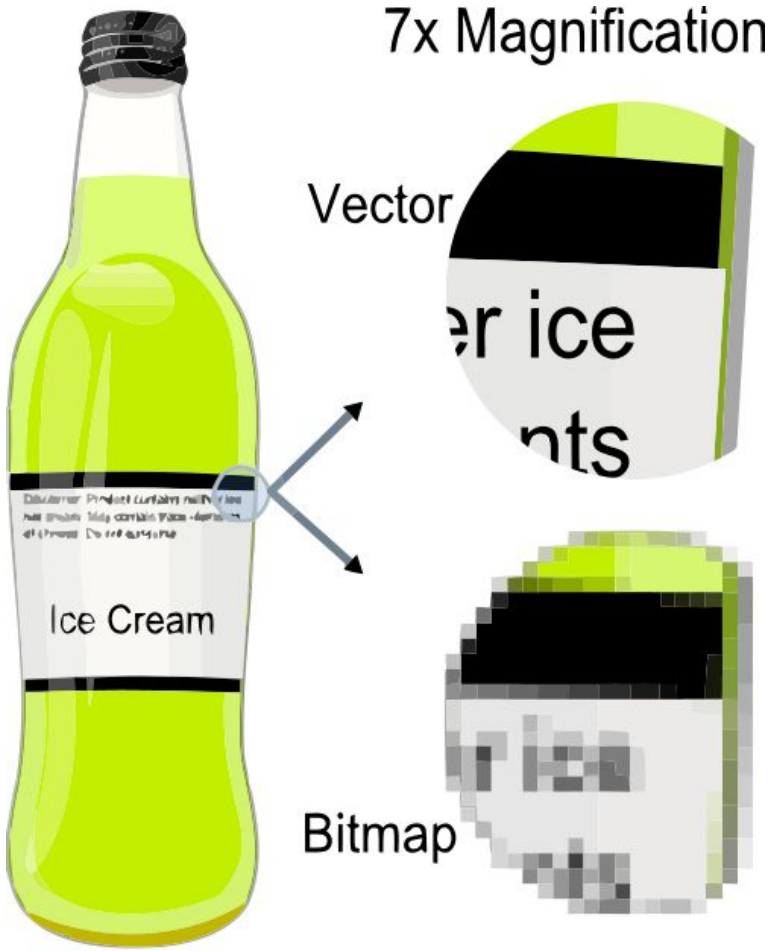
1- bit color

8-bit color

16-bit color

Graphics

- **Vector graphics:**
  - Use geometrical primitives based on mathematical equations, to represent images in computer graphics
  - Points, Lines, Curve, shapes or Polygons
- **Raster Graphics**: Complementary to Vector Graphics
  - Representation of images as an array of pixels
  - photographic images

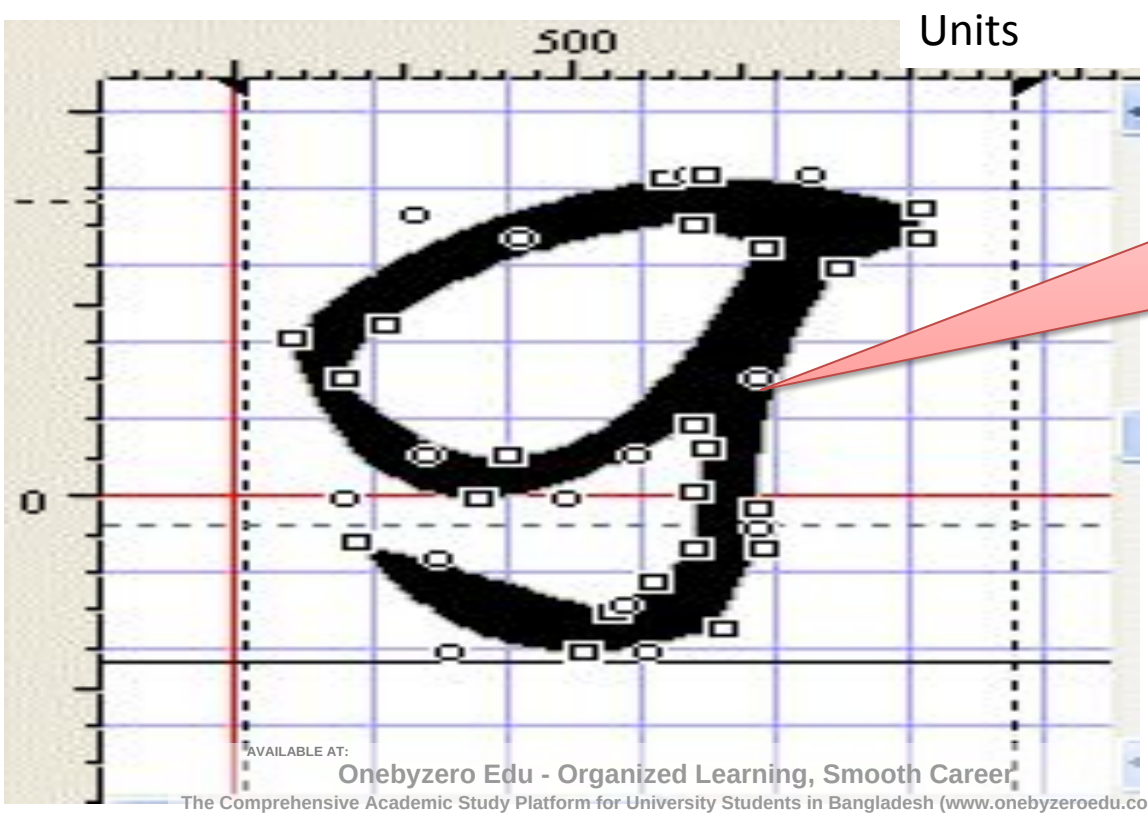


Vector graphics

- Store the primitives in the FILE
  - Word, Photoshop, Xfig, GNUPlot, PS, HTML Tag
- Raster: Store the Pixel values in the FILE
  - BMP, PNG, JPG
- At runtime, process the primitive and generate Pixel to raster the screen (Display)
- Who do this?
  - Software
  - GPU (hardware accelerated routine)

Character Vs Font

- Computer font formats: TrueType Font
  - Where each letter is created from Bézier curves
- Many varieties of font for a character

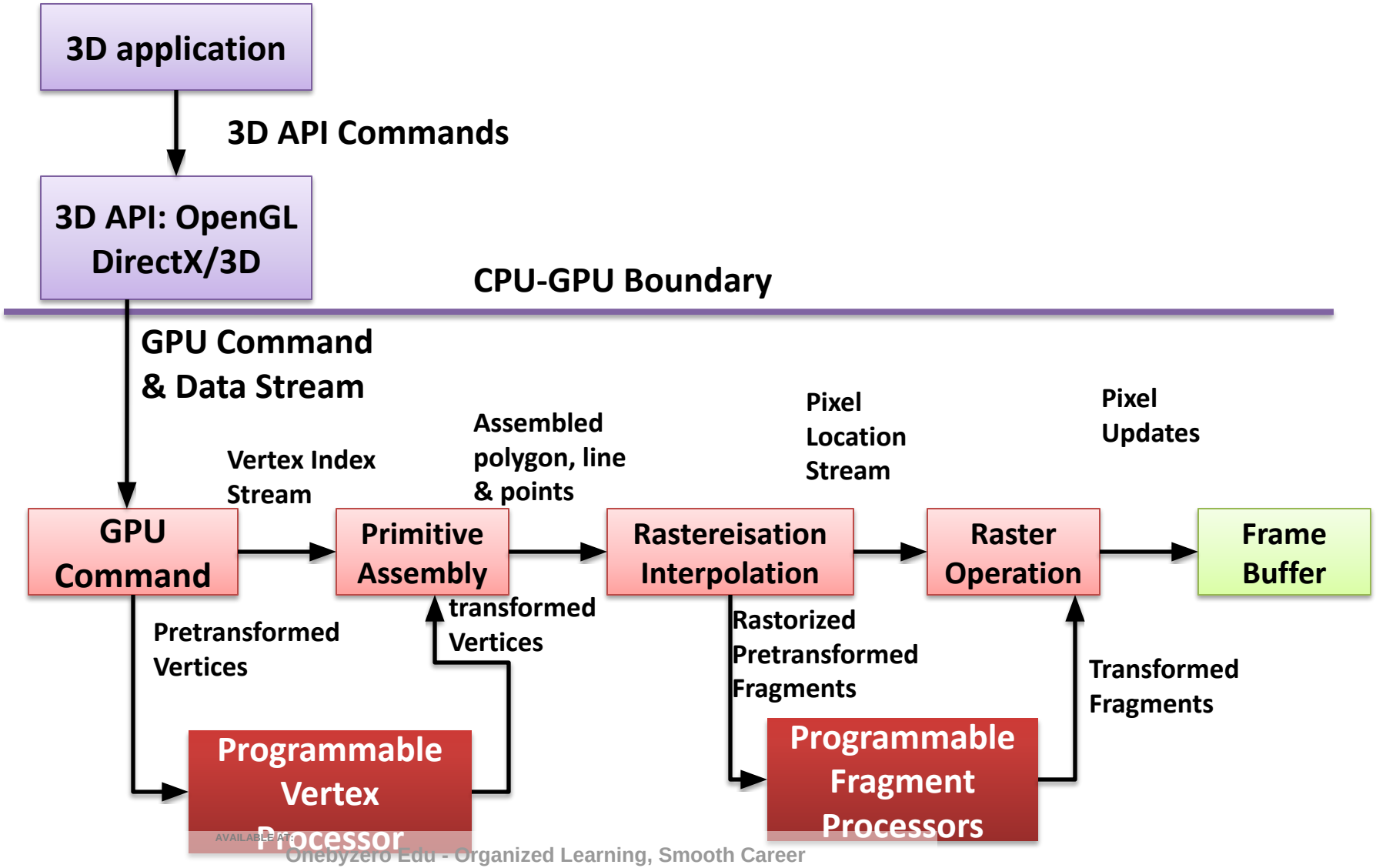


Points with unit and curve properties are stored

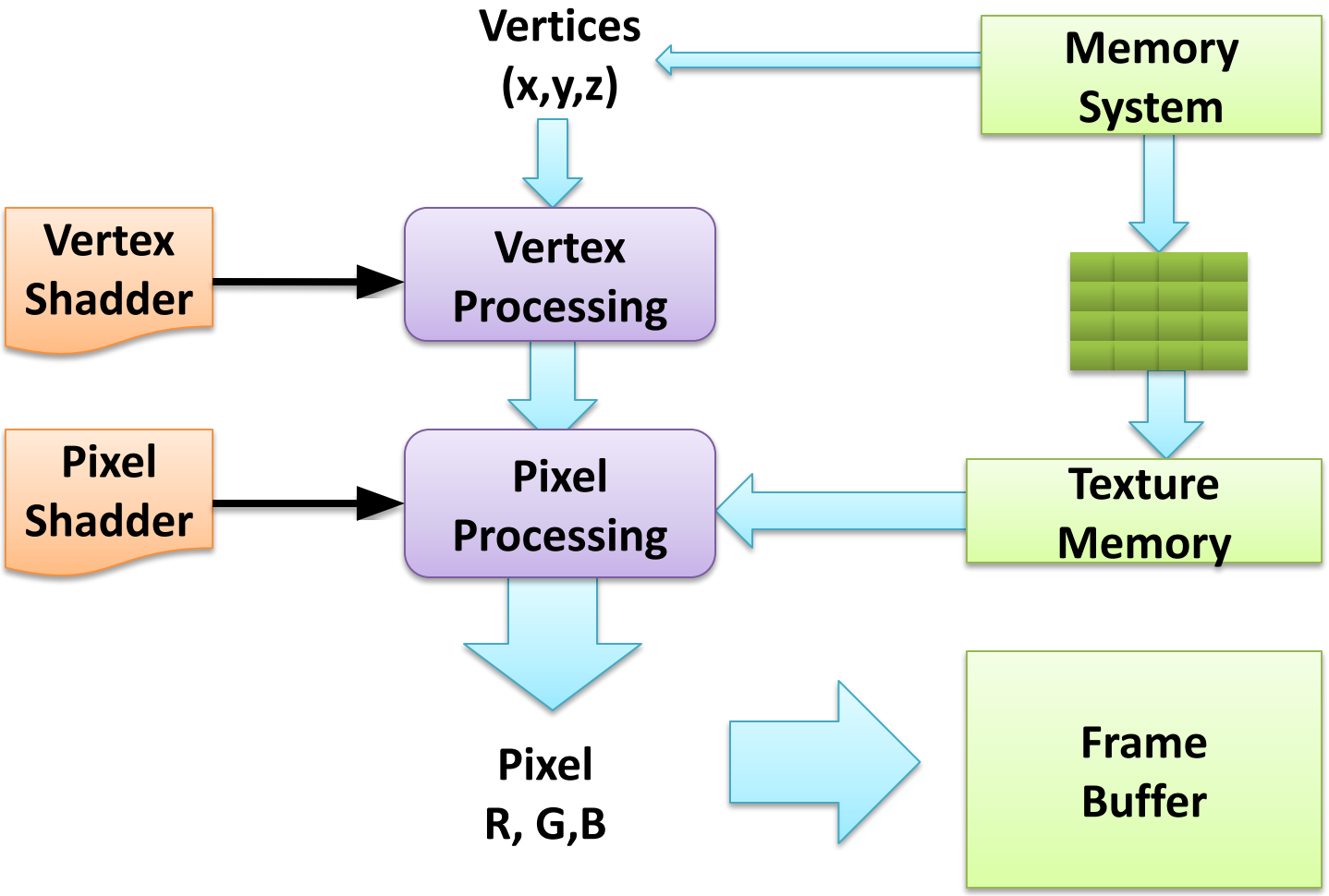
Graphics Cards

- GPU : specialized processor that accelerates 3D or 2D graphics primitives operations
- Lots of Floating point operations
- Accelerates Primitives
  - Line, circle, polygon, mesh, projection, sphere,

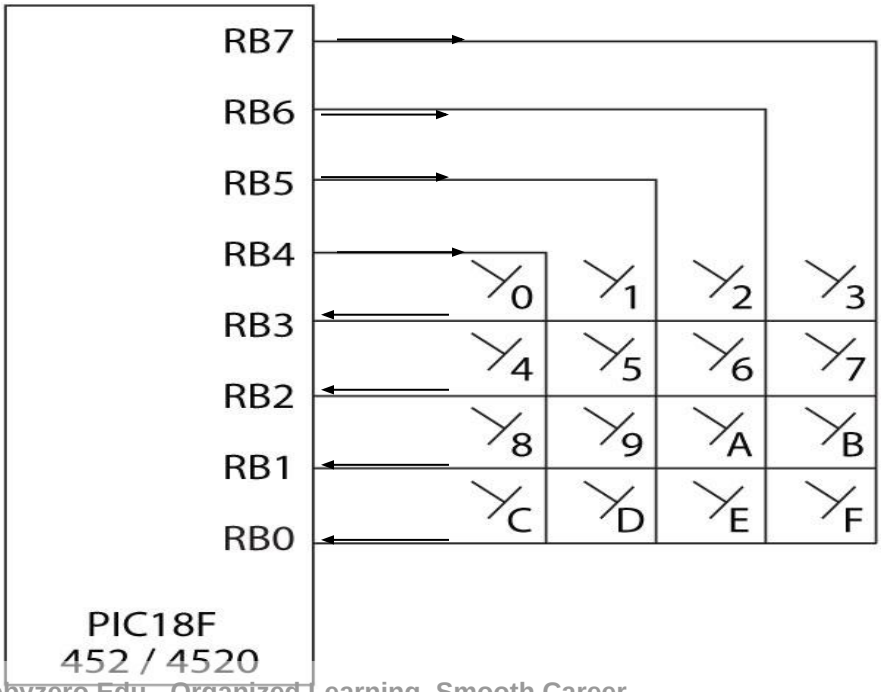
Graphics System



Graphics System



Keyboard



Reference

- R S Gaonkar, “Microprocessor Architecture”, Unit II preface, Chapter 14 and 17

Thanks