Computer Graphics Framebuffers

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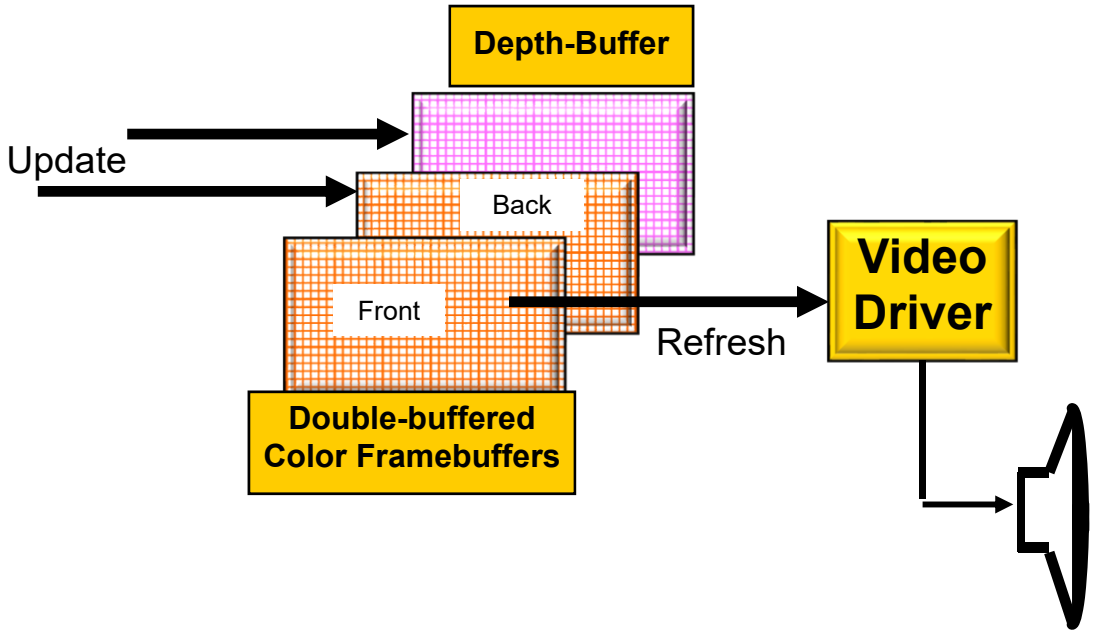
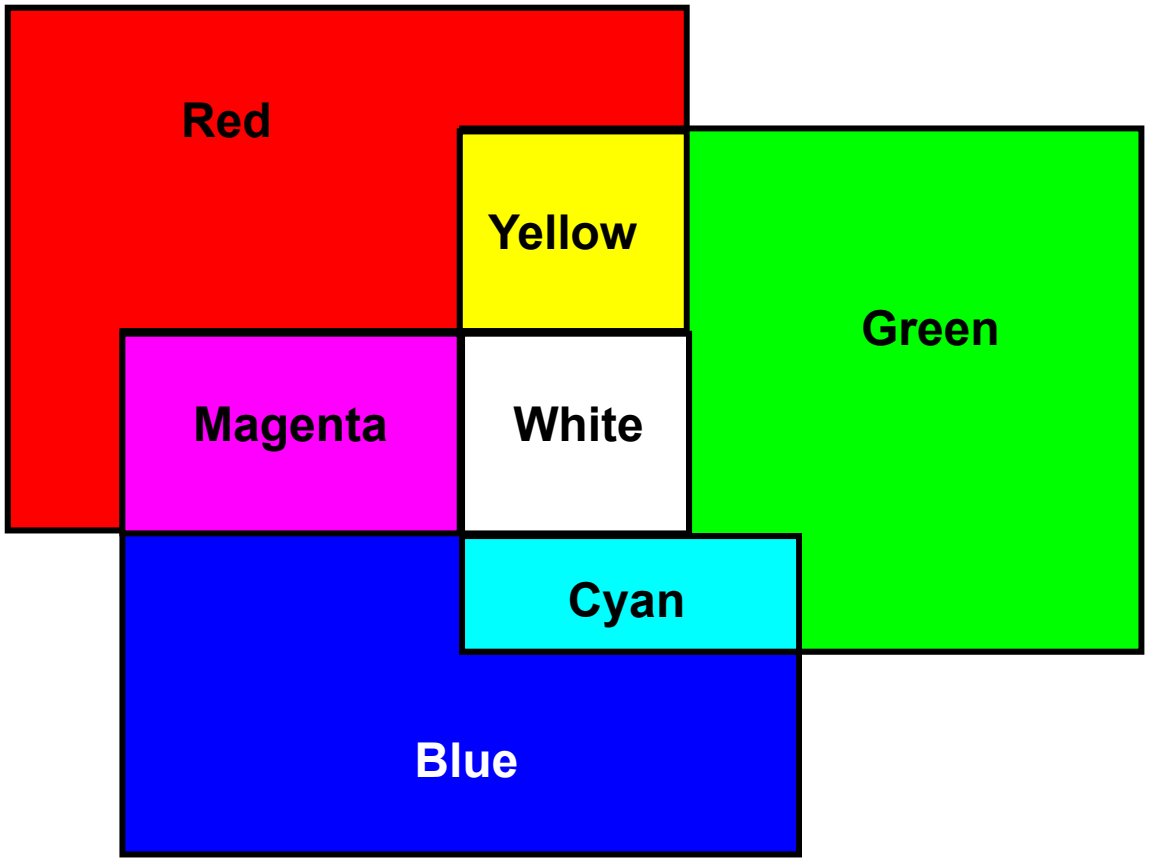
Computer Graphics

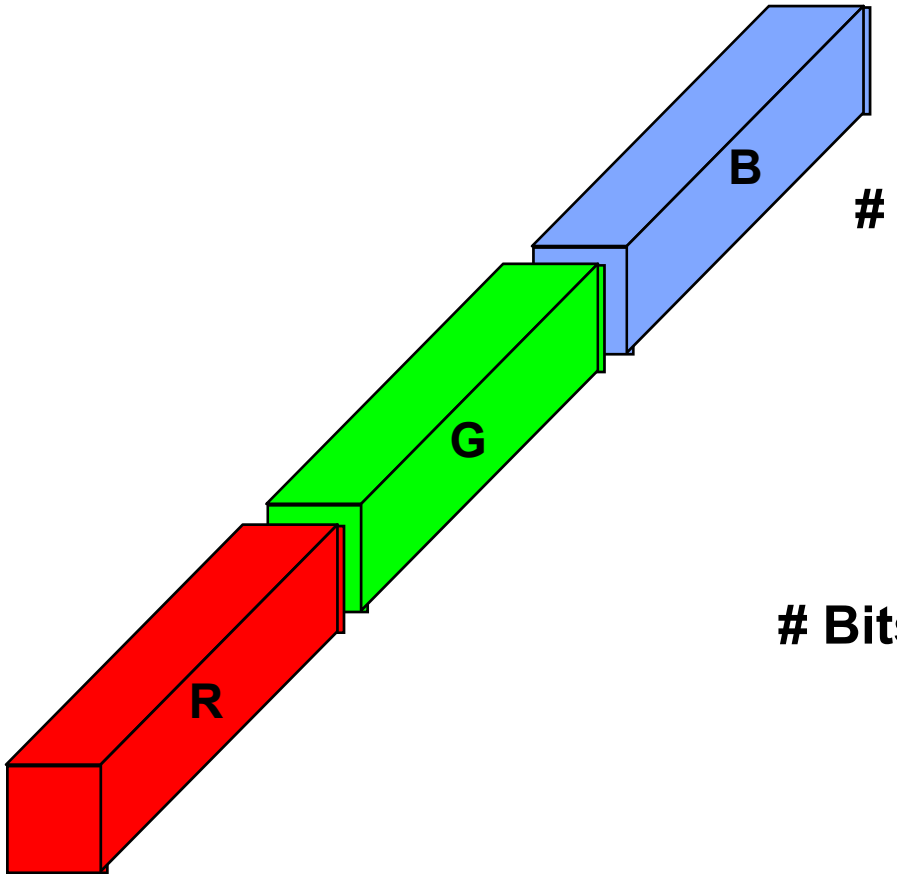
The Framebuffers



The Framebuffer Uses RGB Colors



The Framebuffer: Integer Color Storage

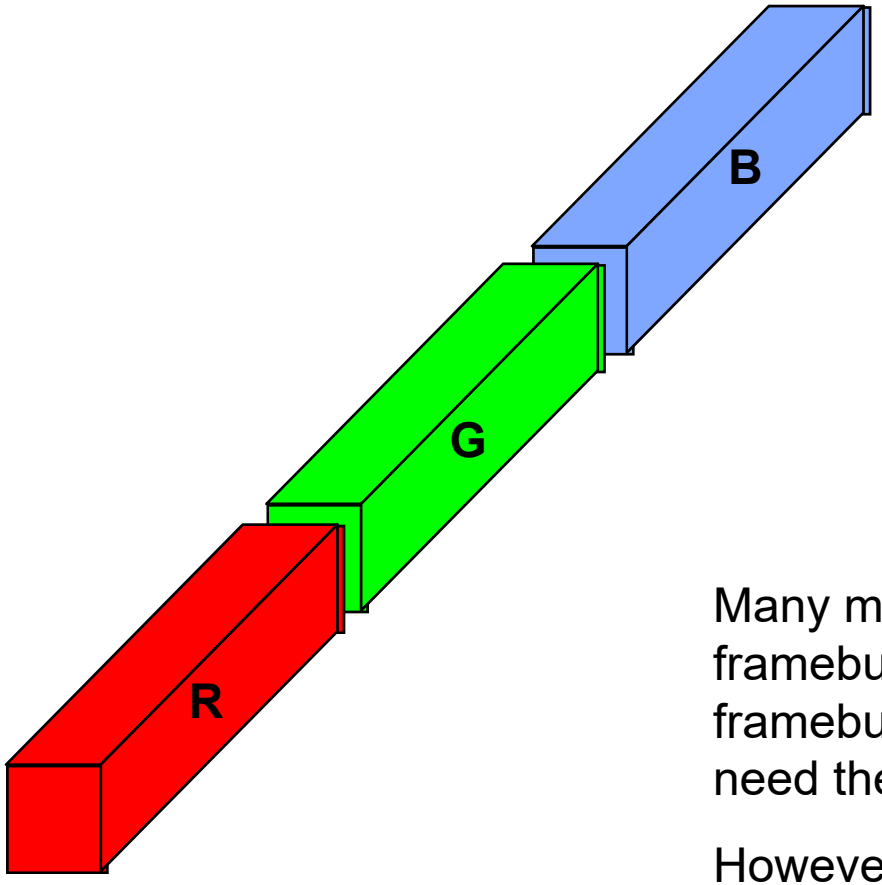


# Bits/color	# Intensities per color
8	$2^8 = 256$
10	$2^{10} = 1024$
12	$2^{12} = 4096$

# Bits/pixel	Total colors:
24	$2^{24} = 16.7$ M
30	$2^{30} = 1$ B
36	$2^{36} = 69$ B

The Framebuffer: Floating Point Color Storage

- **16- or 32-bit floating point for each color component**



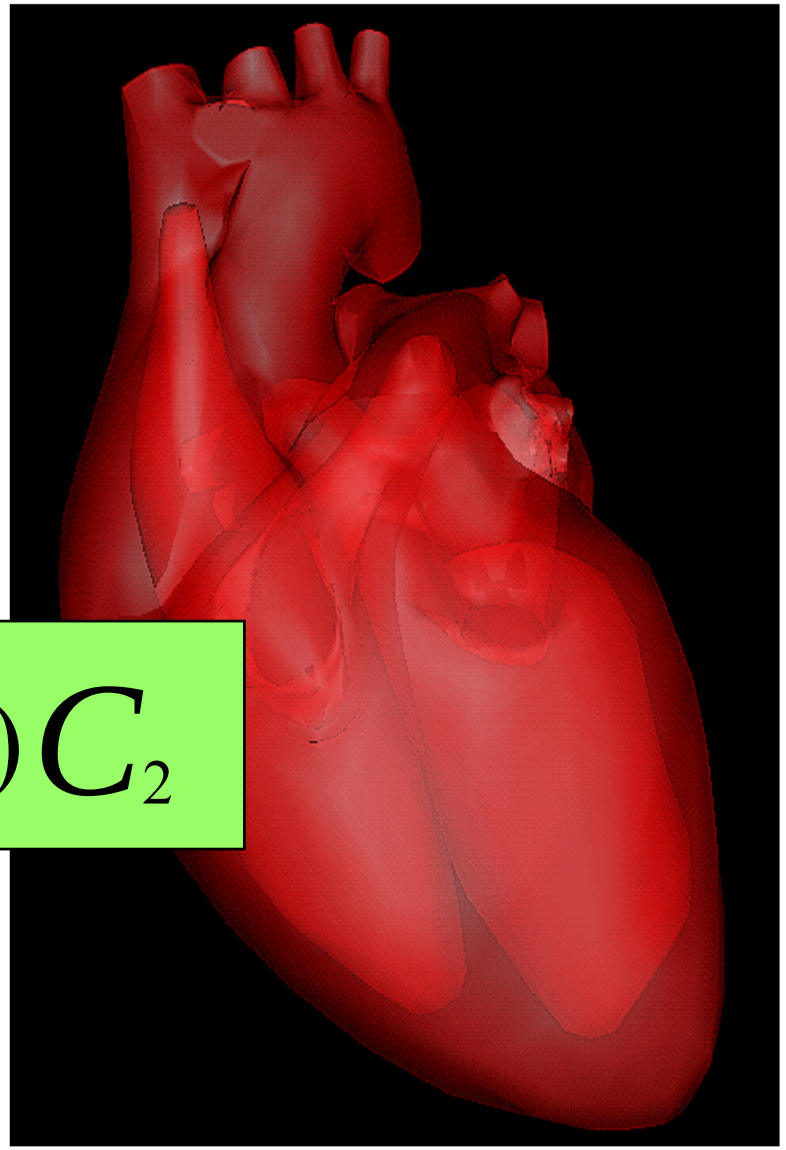
Why so many bits?

Many modern algorithms do arithmetic on the framebuffer color components, or treat the framebuffer color components as data. They need the extra precision during the arithmetic.

However, the display system cannot display all of those possible colors.

The Framebuffer

- ***Alpha*** values
  - Transparency per pixel
    $\alpha = 0.$ is invisible
    $\alpha = 1.$ is opaque
  - Represented in 8-32 bits (integer or floating point)
  - Alpha blending equation:



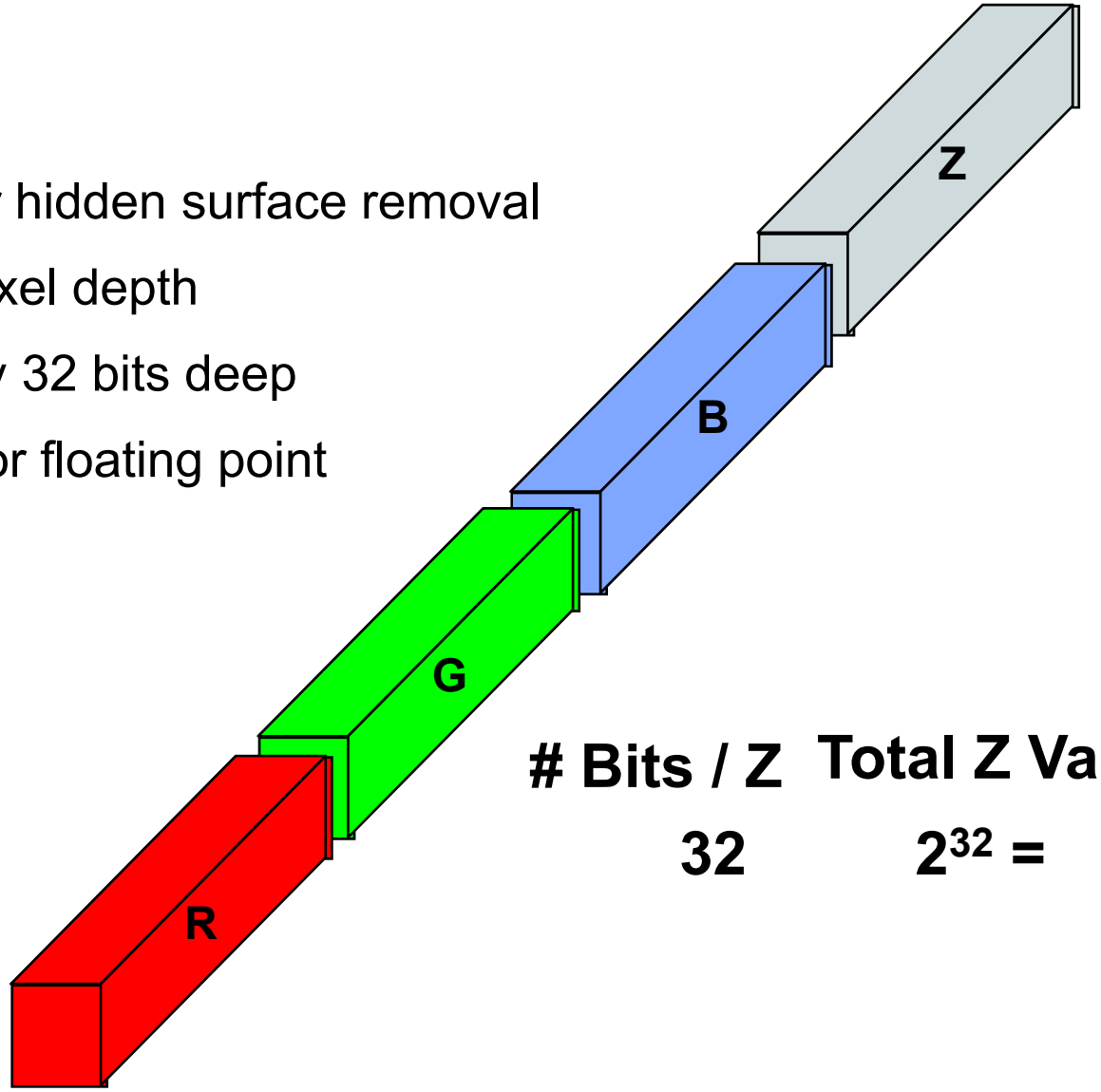
$$Color = \alpha C_1 + (1 - \alpha) C_2$$

$$\mathbf{0.0} \leq \alpha \leq \mathbf{1.0}$$

Note: this is really ***blending***, not transparency!

The Framebuffer

- ***Z-buffer***
  - Used for hidden surface removal
  - Holds pixel depth
  - Typically 32 bits deep
  - Integer or floating point



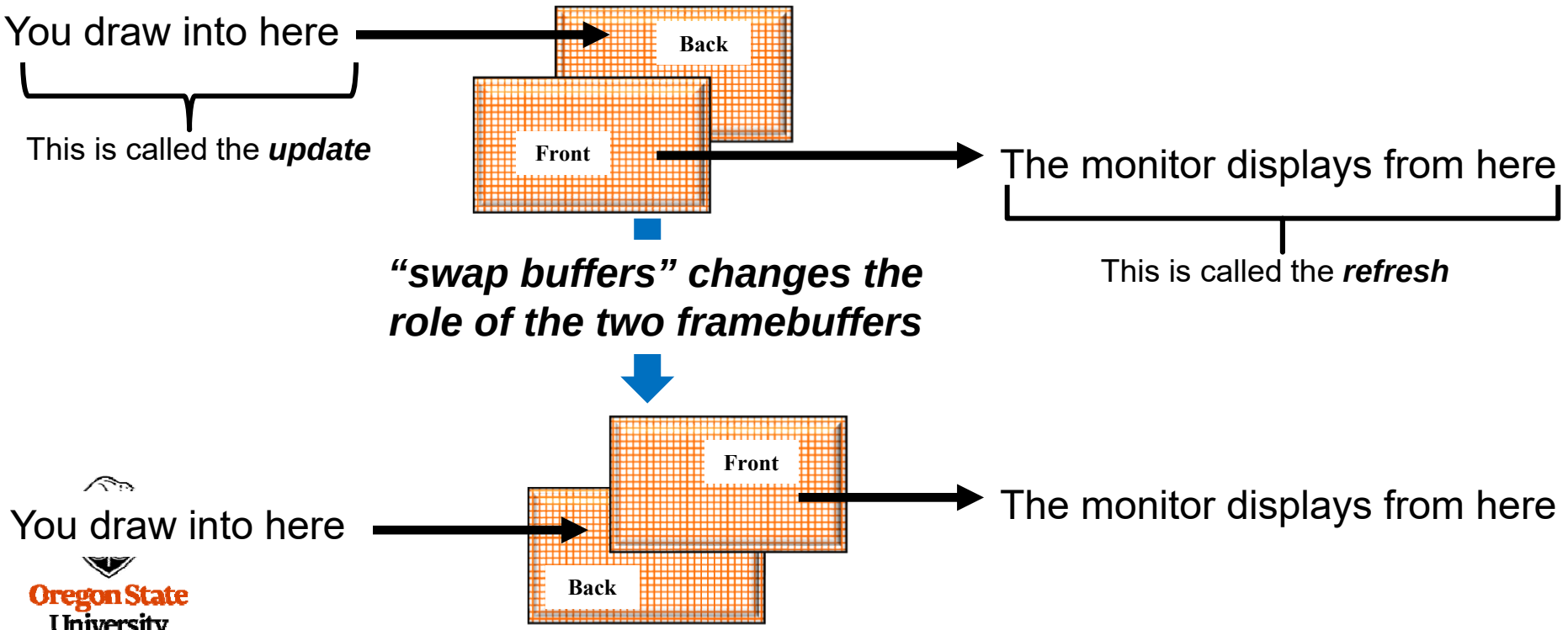
# Bits / Z	Total Z Values:
32	2^{32} = 4 B

glutSwapBuffers( )

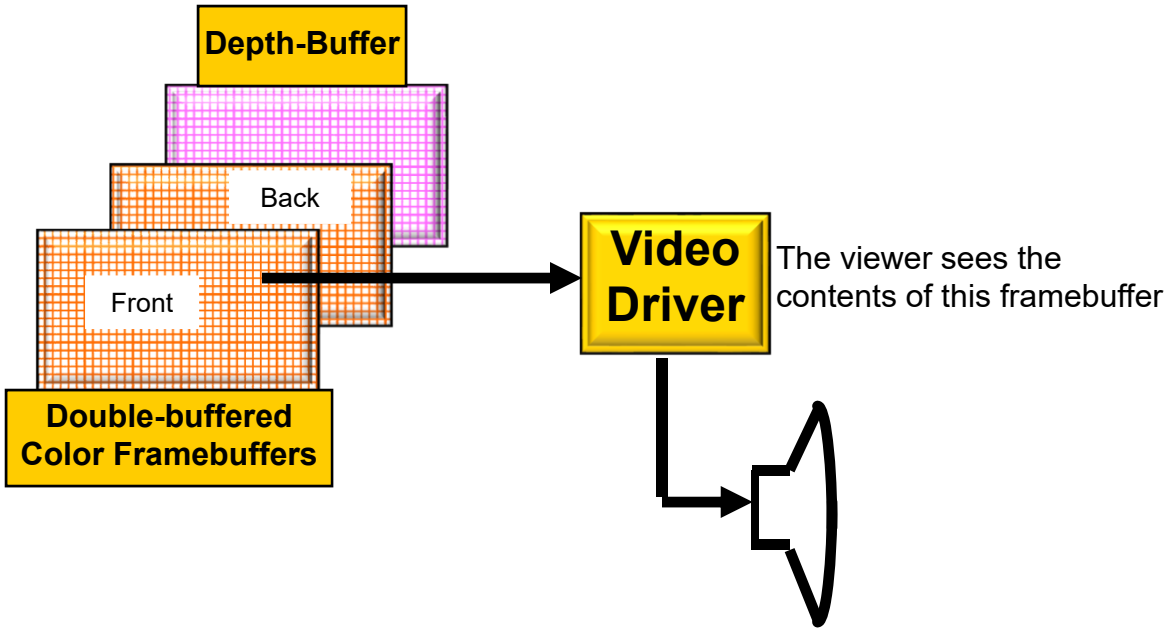
```
// swap the double-buffered framebuffers:

glutSwapBuffers( );
```

```
glutInitDisplayMode( GLUT_RGBA | GLUT_DOUBLE | GLUT_DEPTH );
```

```
glDrawBuffer( GL_BACK );
```



The Video Driver



The Video Driver

- N ***refreshes*/second** (N is between 50 and 100)
- The framebuffer contains the R,G,B that define the color at each pixel
- Because of the double-buffering, **Refresh** is asynchronous from **Update,** that is, the monitor gets refreshed at N (60) frames per second, no matter how fast or slowly you update the back buffer.