

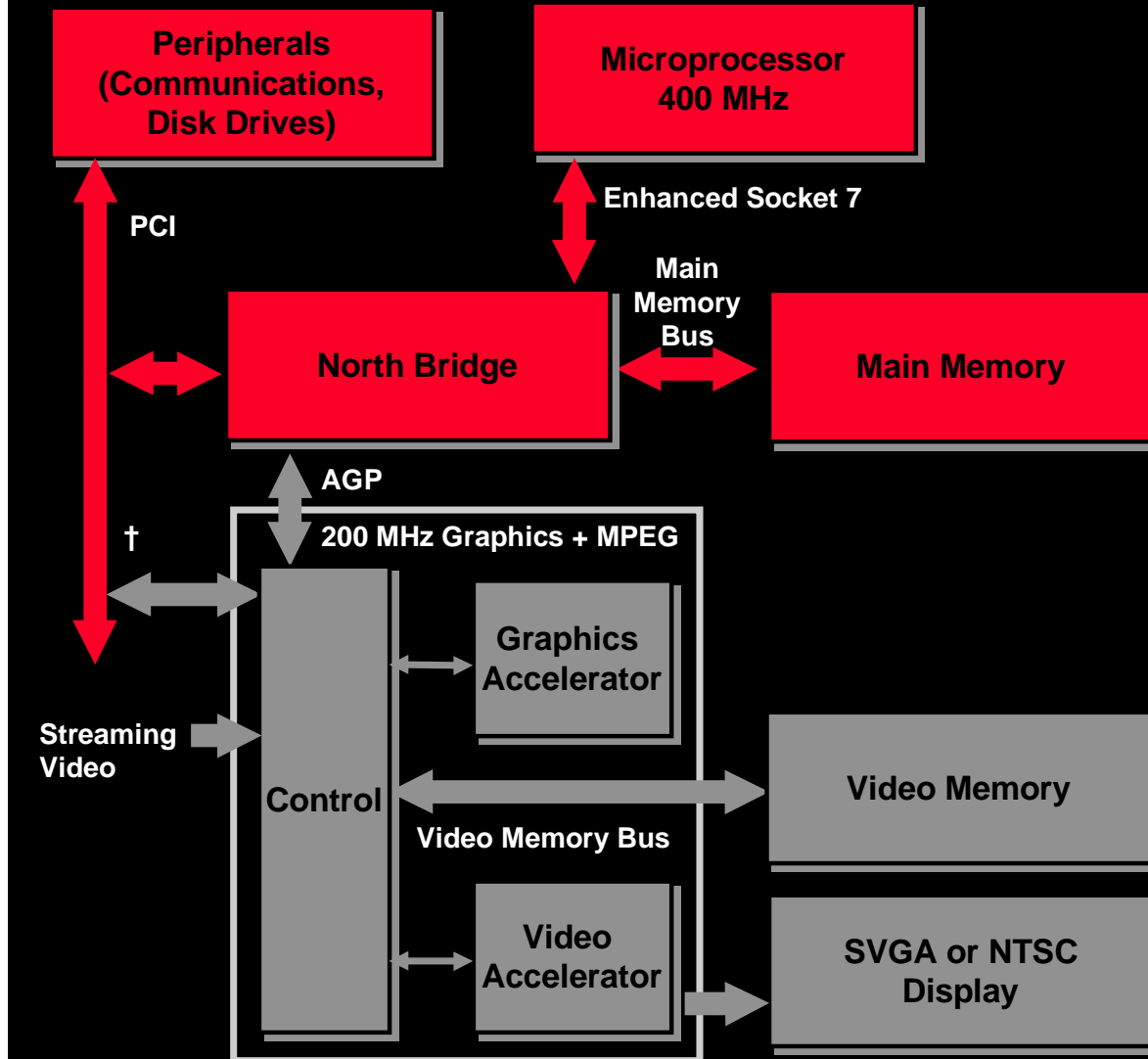
The 3D Graphics Pipeline

3D Graphics Pipeline Stages

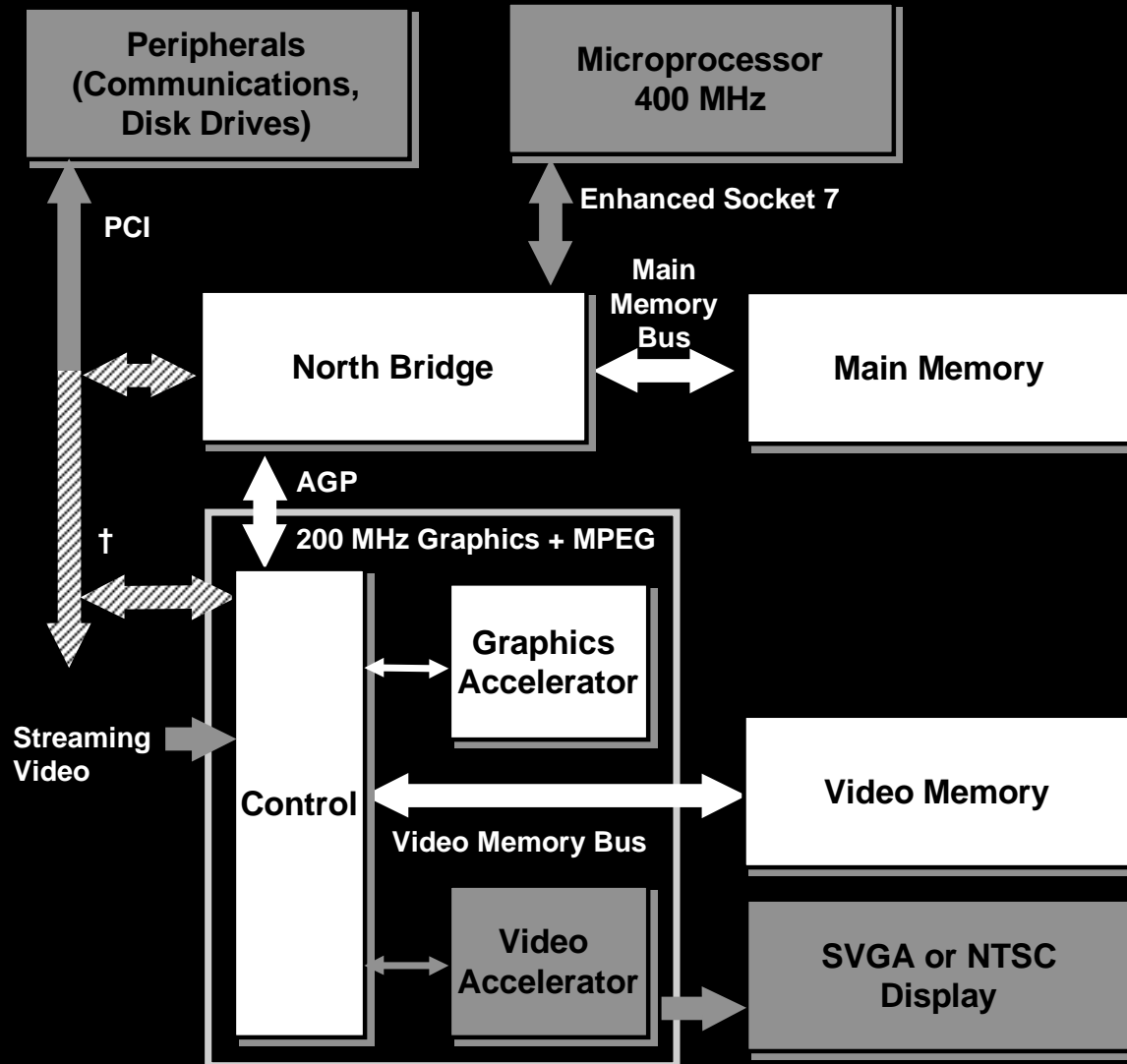
Stage One — Geometry

- Build 3D Scenes and Prepare to Map to Display Frames
 - Object Definition
 - Modeling and Positioning
 - World-space Definition
 - lighting
 - surface attributes
 - Eye-space Translation
 - perspective
 - clip to eye-space
 - back-face culling
- Setup Display Lists for Rendering Stage
- Define Position of Multiple Windows, Cursors, and Sprites

† In non-AGP systems the display adapter is connected via the PCI Bus, reducing the PCI bandwidth available to geometry stage processes. In AGP systems the display adapter is not connected to the PCI Bus.



3D Graphics Pipeline Stages

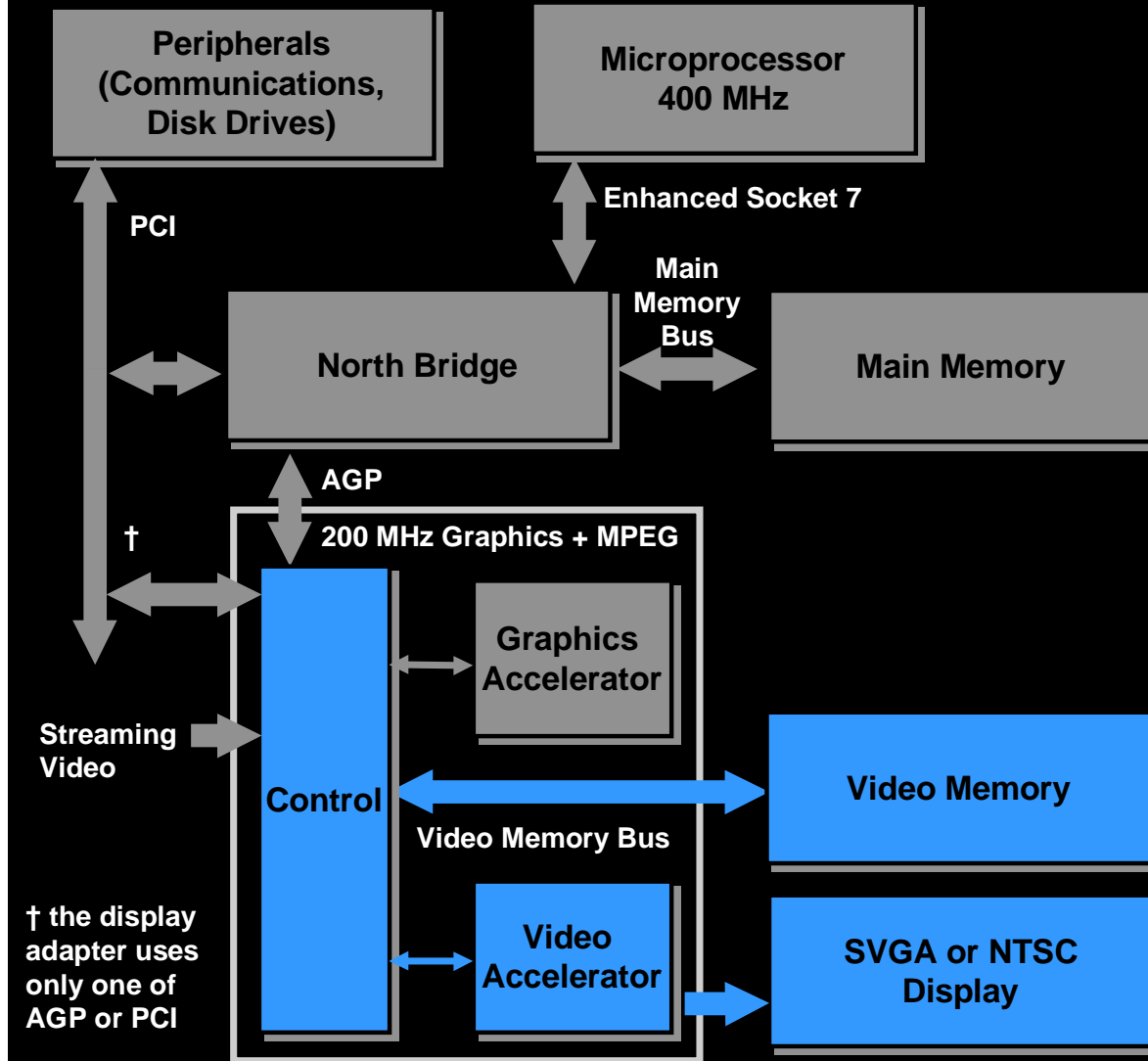


Stage Two — Rendering

- Build Bit-Maps in Frame Buffers
- Execute Display Lists Setup in Geometry Stage
 - Draw Circles, Triangles, Lines, and Points
 - Clip to Screen Space
 - Remove Hidden Surfaces, Depth Cueing
 - Coloring, Shading, and Texture
 - Move Texture Maps from Main Memory to Video Memory as Required

† In non-AGP systems the display adapter is connected via the PCI Bus, with diminished bandwidth available for rendering stage processes. In AGP systems the display adapter is not connected to the PCI Bus.

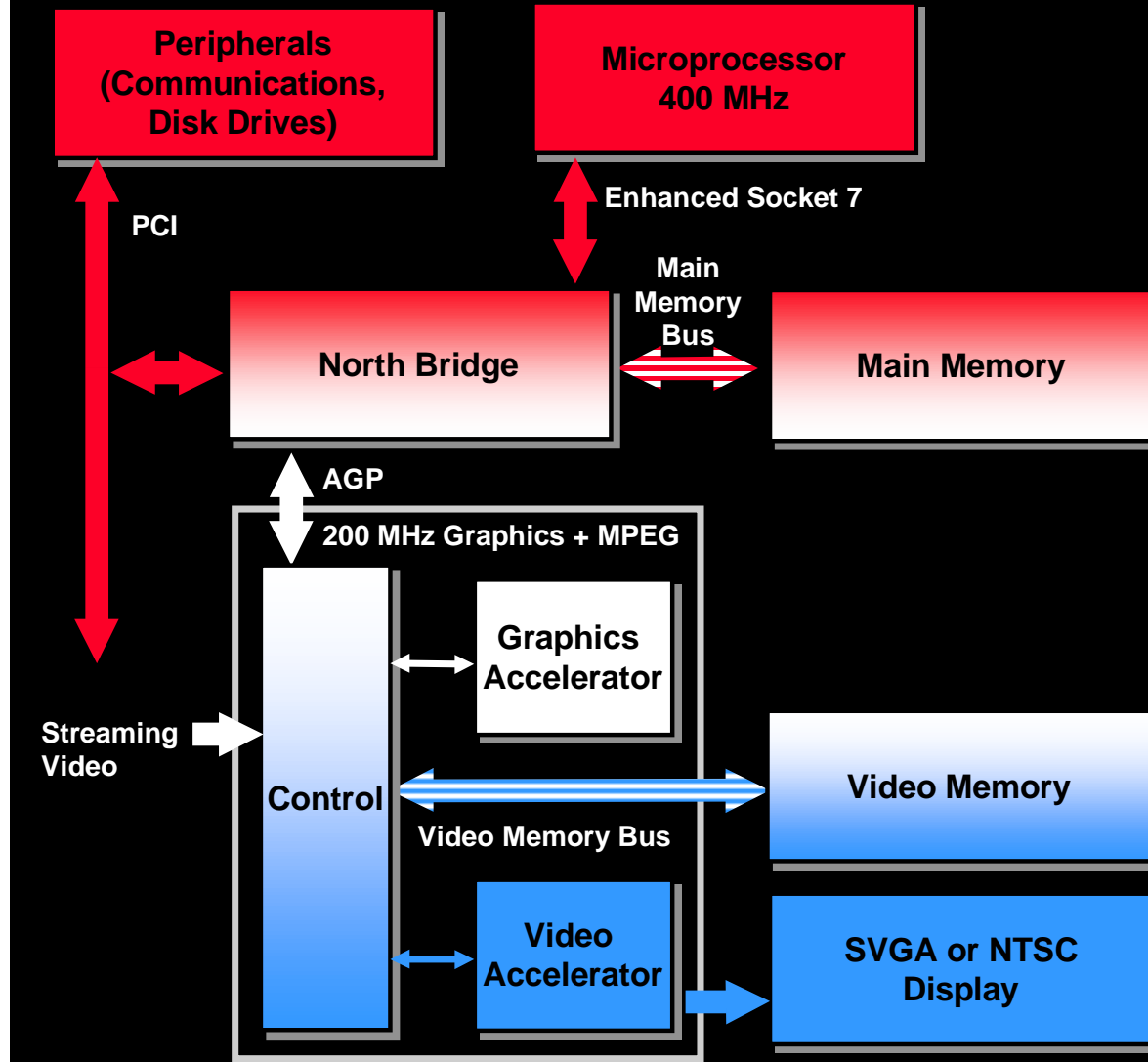
3D Graphics Pipeline Stages



Stage Three — Display

- Frame Buffer Fetch
- Pixel, Scanline, Frame Timing
- Color Look Up
- Hardware Scaling
- Display multiple windows
- Insert moving cursors, sprites, and video
- Format YUV 4:2:2 video for RGB
 - interpolation (decompression)
 - color space conversion
 - frame rate conversion
- Convert Digital Pixel Data to Analog Signals

3D Graphics Pipeline Stage Overlap

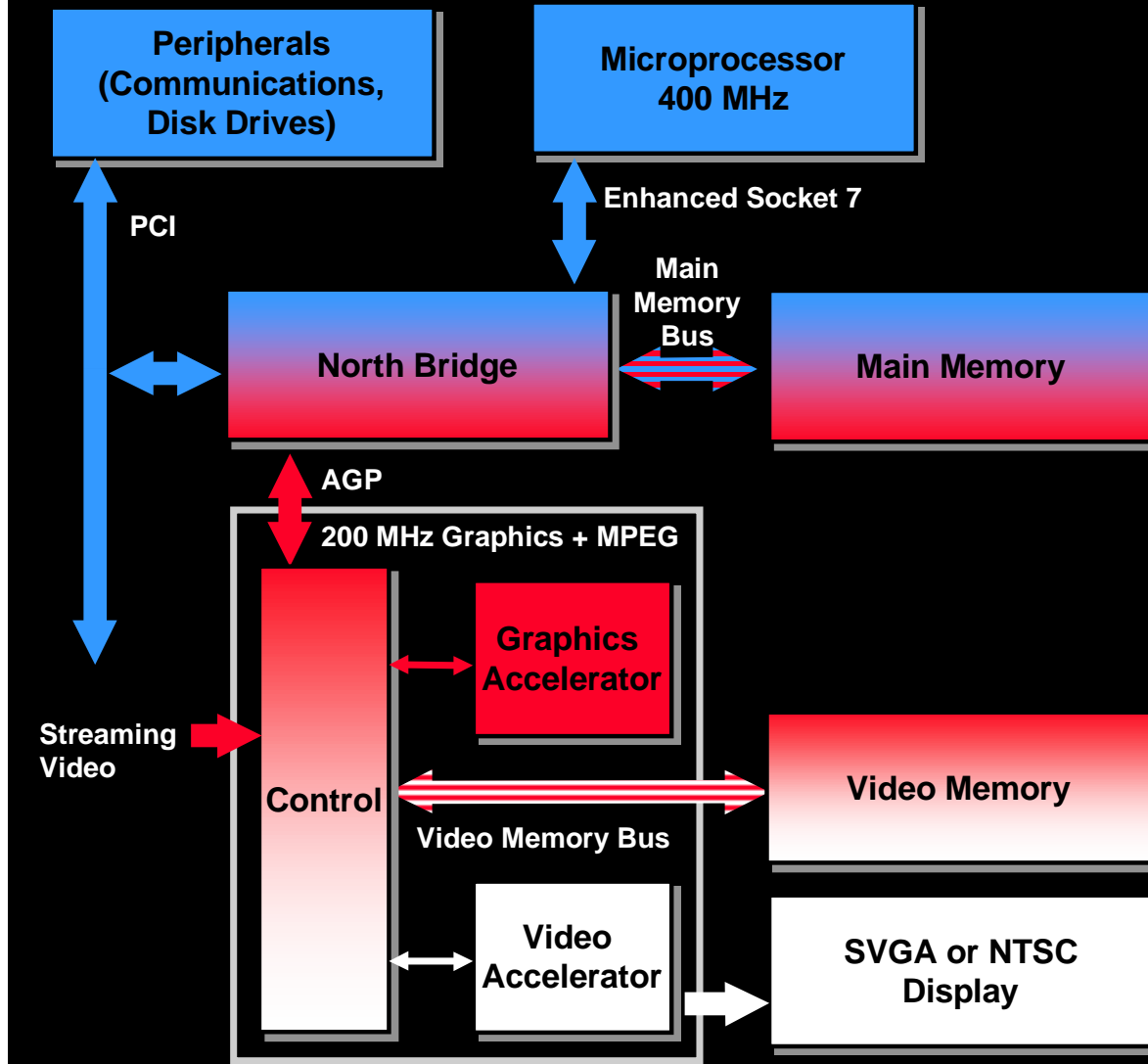


Frame 3 is being composed in the Geometry Phase, while

Frame 2 is being drawn in the Rendering Phase, while

Frame 1 is being painted to the screen in the Display Phase

3D Graphics Pipeline Stage Overlap

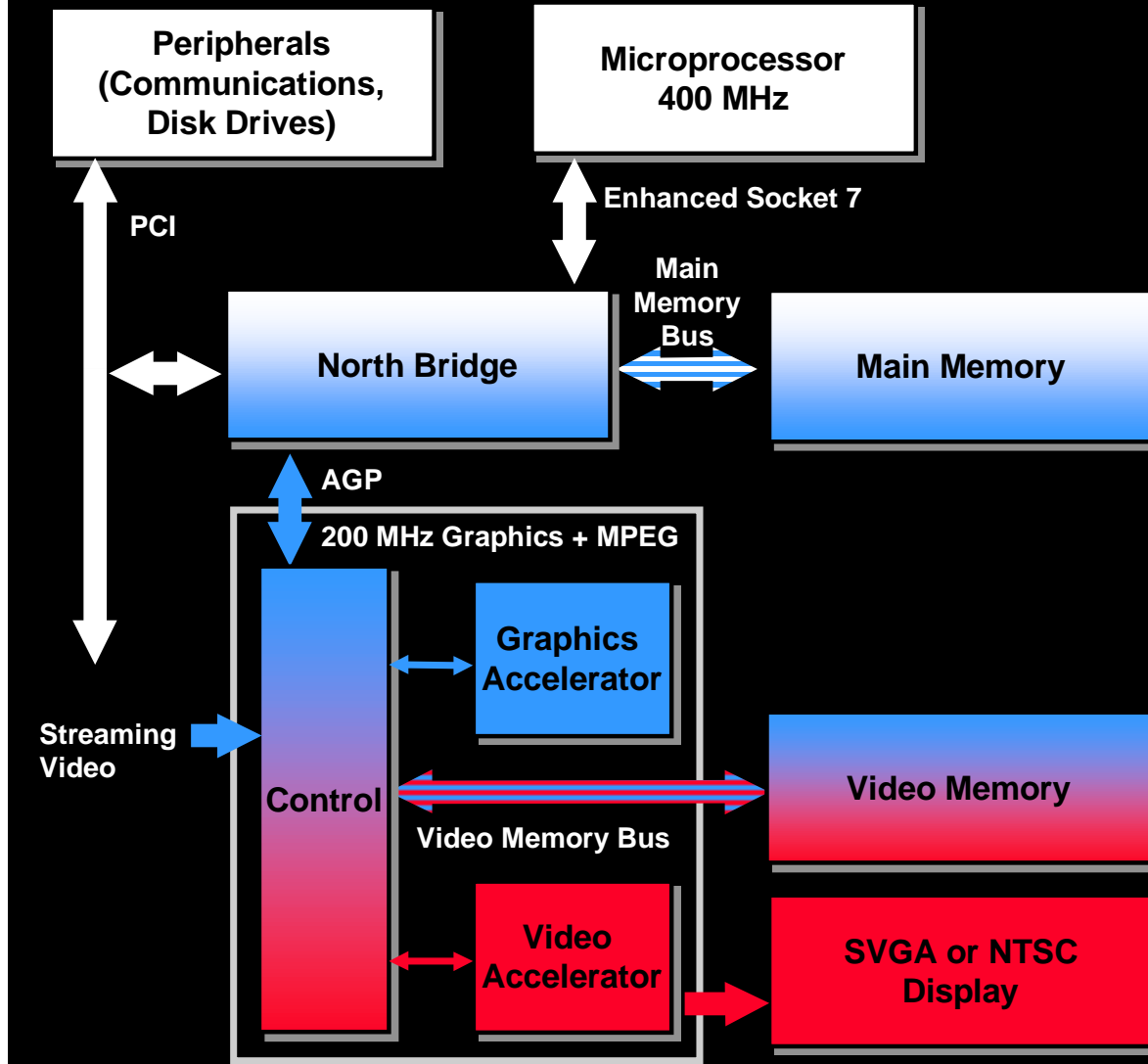


Frame 4 is being composed in the Geometry Phase, while

Frame 3 is being drawn in the Rendering Phase, while

Frame 2 is being painted to the screen in the Display Phase

3D Graphics Pipeline Stage Overlap



Frame 5 is being composed in the Geometry Phase, while

Frame 4 is being drawn in the Rendering Phase, while

Frame 3 is being painted to the screen in the Display Phase