Overlay Plane and Video Windows Support in Summit Series

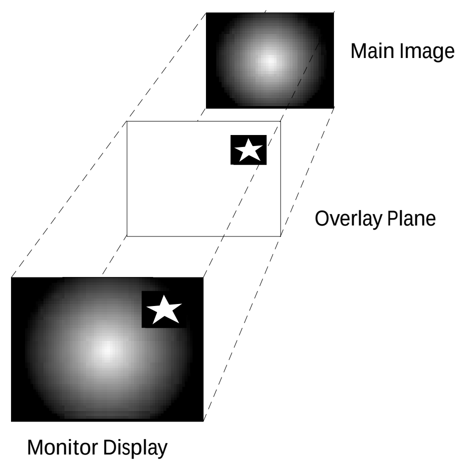
Introduction

This document describes two of the advanced features in Accelerated-X Summit Series products - Overlay Plane support and support for Video Windows - that support special hardware on some graphics cards. The XFree86 graphics support software that is provided free by the Linux distributions either does not support these features at all or does not support them correctly.

Overlay Plane Support

Some graphics chipsets/cards provide hardware support for an "Overlay Plane" that can be used to display (usually) temporary windows on top of (usually) 24-bit (24 bpp) rendered images without destroying the portion of the 24-bit image under the temporary window. The overlay image is often 8 bpp (eight bits of color depth) and is used as a popdown menu or template. By using an overlay plane, the time expense of having to re-render the occluded portion of the 24-bit image when the overlay image is moved or closed is eliminated. In complex images, this savings can be significant.

The comceptual effect of the use of the Overlay Plane is shown at the right. The Overlay Plane is transparent everywhere except for the small window with the star. By replacing the 8-bit values where the star image is with the transparent value, then the entire Overlay Plane is transparent allowing the main image to be displayed.



While the feature can be implemented in various ways, for simplicity we will use an example that uses 8 bits of color per pixel for the overlay image and 24 bits of color for the main image. The display device will display 1024x768 pixels.

The Overlay feature requires a section of memory in the Output Buffer for the overlay image that holds a byte of memory for each pixel in the monitor display. The eight bits can define 256 values which are used as an index into a Color Look Up Table, CLUT, where each entry is a 24 bit color. One of the 256 index values is used to define a “transparent color.” When this value is stored in a byte that represents one of the overlay pixels, that overlay pixel is “transparent,” and the pixel color for the main image is to be obtained and output.

The main image memory will require three bytes (minimum for 24-bit color) for each pixel to hold the color value for that pixel. The "output mechanism" of the graphics card, which includes the digital-to-analog converter (assuming an analog monitor) and CRT Controller, scans the contents of the Output Buffer and sends pixel color data to the monitor on a pixel-by-pixel, line-by-line basis, synchornized to the monitor. If the overlay pixel is not transparent, then the eight bits in the overlay memory are used as the entry into the CLUT to obtain the 24 bit overlay pixel color value which is sent to the monitor. If the overlay pixel is transparent, then the 24 bit color of the main image is sent.

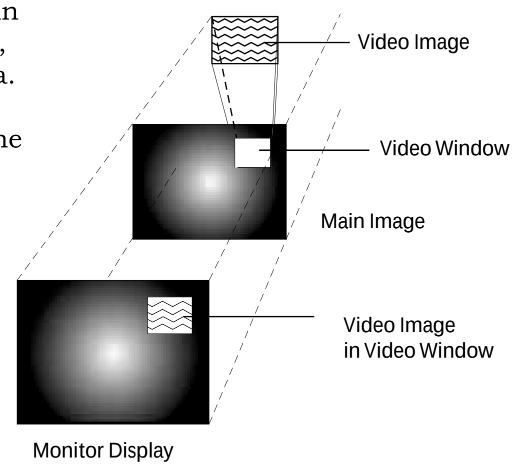
Use of the overlay plane will reduce the speed of graphics performance somewhat. Accelerated-X enables overlays by default. XFree86, of course, does not. In benchmarking the two systems, a fair comparison requires that overlays be disabled in Accelerated-X when running speed tests against XFree86.

It is interesting to note that even though Matrox provides to XFree86 (in binary form) the OpenGL driver for the G450, which has overlay capability, the feature is not implemented for the XFree86 X server. Apparently the XFree86 X server design is makes the use of overlays impractical.

Video Window Support

The Video Window, sometimes called a "Video Overlay" is handled in a somewhat similar fashion as the Overlay Plane. In this case, however, the video information is actually behind, or "underneath" the main image plane, conceptually speaking.

Incoming video information is first captured and stored in a separate block of memory on the card in a YUV format, instead of the RGB format used for rasterized image data. To be able to view the video image in a window on the monitor, all of the main image pixels inside the area of the video window are "made transparent," allowing the video pixels to be seen instead. As in the previous overlay example, this is accomplished by assigning one color value to represent transparency.



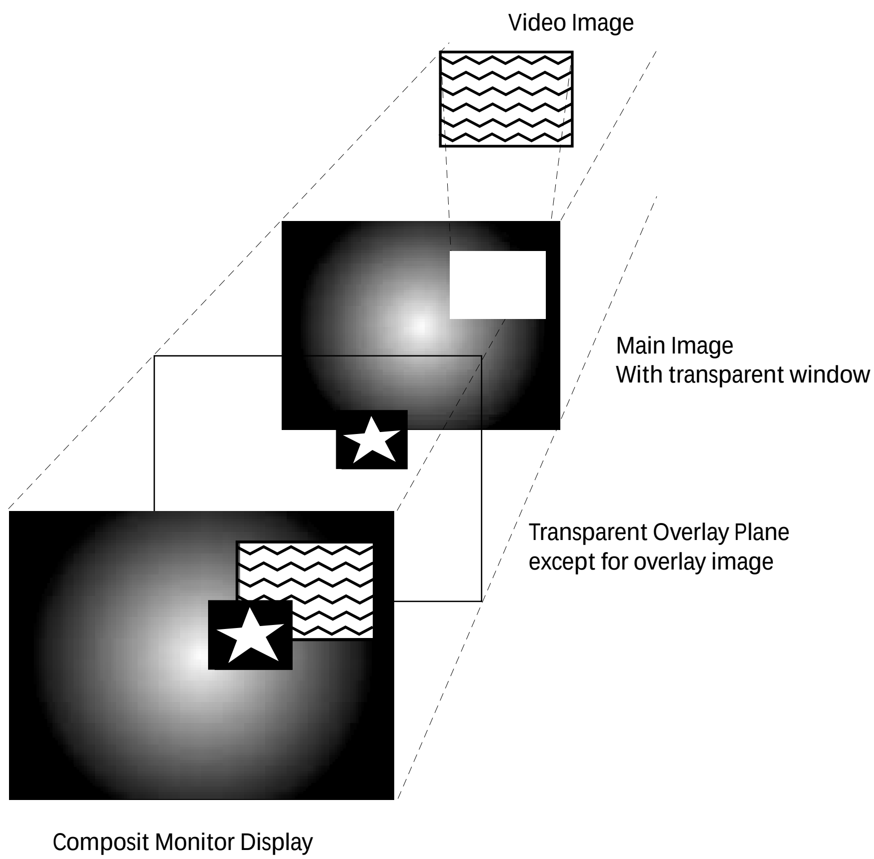
When the display output mechanism on the card encounters that value in the 24-bit portion of the Output Buffer, it treats this value as the transparent value and accesses the corresponding pixel data in the video data memory. The video data, which are stored in a YUV format, are converted "on the fly" by the output mechanism to RGB format and scaled up or down to fit the video window. Some cards can upscale the video frame, say from 320x240 pixels to fit a 800x600 pixel window, but cannot downscale. In this case, if the video frame is larger than the video window in pixels, the video image is clipped (on the right and bottom) to fit the window.

Since the main image data in the video window area are destroyed, moving or closing the video window requires a re-rendering of that portion of the main image. Depending upon the size and complexity of the portion to be rendered, the delay in filling the exposed area may be noticable.

Now With Both Video Window AND Overlay Plane

Should one wish to have both of these features active at the same time, it is nice to know that it is possible, and that the two work will together without difficulty. Of course, the graphics card must support overlay planes and must have the video capture hardware and memory, and the on-board hardware to support both features. This will narrow the field of eligible cards.

If an overlay and a Video Window are superimposed, what is the effect? Well, since the video "plane" is behind the main image, and the overlay "plane" is in front of the main image, the overlay will prevail and overlay the Video Window area that is common to both the overlay image and the video data image.



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