# US-4967378-A Method and system for displaying a monochrome bitmap on a color display

(1) TECHNICAL FIELD  
(2) This invention relates generally to a computer system for displaying information on a color display, and more specifically a method and apparatus for updating the bitmap memory of a graphics adapter.  
(3) BACKGROUND ART  
(4) The output devices of a personal computer often include a graphics adapter and a monochrome display. The graphics adapter (GA) contains a bitmap memory that is accessible by the computer's central processing unit (CPU) and the GA's CPU. Each bit in the bitmap memory corresponds to one pixel on the display screen. To display data, the GA CPU reads the bitmap memory. If a bit is 1 then the GA turns the corresponding pixel on. If a bit is 0 then the GA turns the corresponding pixel off. By changing the contents of the bitmap memory, a computer program can effect a change on the display screen.  
(5) To accommodate color displays the GA needs to be more sophisticated. A single bit in bitmap memory per screen pixel is not sufficient to represent more than two colors. If four colors are to be displayed, then two bits per pixel are needed; if eight colors are to be displayed, then three bits per pixel are needed; if sixteen colors are to be displayed, then four bits per pixel are needed; and so on. Each bit per pixel is conceptually considered to be in a separate plane, with a one bit per pixel bitmap maintained for each plane. FIG. 1 illustrates a bitmap with four planes. The GA CPU will read the 4 bits for each pixel from each of the four planes and turn the appropriate color on for that pixel on the screen.  
(6) The GA bitmap memory is typically an 8-bit byte (a byte is a sequence of adjacent binary digits operated upon as a unit in a computer) that is, eight bits can be written to the bitmap memory at a time. To fill an entire bitmap memory in a conventional computer system, the computer CPU would generally for each plane write each byte. Thus, the total number of byte output to the GA is the number of planes times the number of bytes per scan line times the number of scan line.  
(7) DISCLOSURE OF THE INVENTION  
(8) It is an object of the present invention to provide a method and system for efficiently displaying a monochrome bitmap on a color display.  
(9) It is another object of the present invention to provide such a method and system that will minimize the number of CPU to GA write operations required to write a monochrome bitmap to a color bitmap memory.  
(10) It is another object of the present invention to provide such a method and system that can efficiently display a monochrome bitmap to portions of a color bitmap memory that are not byte aligned with the monochrome bitmap.  
(11) These and other objects, which will become apparent as the invention is more fully described below, are obtained by an improved method and system for updating a multiplane bitmap memory. In preferred embodiments, logical operations are used to generate the color bitmap memory enabling a monochrome bitmap to be written efficiently to a color bitmap memory. The invention updates the bitmap memory with a number of writes that is independent of the number of planes in the bitmap memory. The number of writes is on the order of the number of bytes per scan line times the number of scan lines per plane.  
(12) In preferred embodiments, the registers and logical units of the GA are initialized to permit efficient updating of the bitmap memory. First, the multibit representations for the two preselected display colors are compared to identify bitmap planes having common bit values for each color. The input for logic units for the identified planes are then forced to 0. The latch registers for each plane of the bitmap memory are then set to the bit value for the first preselected color in that plane. The input values from the monochrome bitmap, as altered by the force-to-0 operation for common planes, are logically exclusively ORed with the latch register values to produce the bitmap memory values for displays.  
(13) One preferred embodiment includes an alternate method of update of the bitmap memory to allow efficient updating of edge portions of a display for which the single plane monochrome bitmap and multiplane color display are not byte aligned.