

# Wall Display Systems

using  
**Linux or Solaris**  
and the

**X Window System**

## **Xi Graphics Has The Graphics System Software**

With the recent addition of the new WallDisplay (HX) Series to the Summit Series of X servers and graphics driver products, Xi Graphics has greatly expanded the Wall Display capabilities of its "X graphics" software product line. The HX Series complements the Multi-head (MX) Series introduced with the Summit Series in 2001. Together, the MX and HX Series offer a wide range of capabilities for wall or console mounted monitors. Some features are common to both Series, while other features are offered in only one or the other.

Probably the most important feature common to both Series is that they are based on Xi Graphics' **Accelerated-X** implementation of the industry-standard X Window System ("X") for UNIX. Summit Series code is high-quality, commercial software, developed by Xi Graphics for users who need stable, high performance graphics, backed by rapid, competent customer support. **Accelerated-X** is architected and implemented "from scratch" by Xi Graphics for use with open source Linux and other UNIX kernels.

### **HX Series Key Features**

- Ô Single Logical Screen (across multiple chips)
- Ô Multiple Xscreens per Chip Allowed
- Ô Mixed SLS and Multi-screen Allowed (some limitations)
- Ô All Xscreens & Monitor Outputs Hardware Accelerated
- Ô Powerful, Simple Graphical Configurator
- Ô "Hidden Pixel" Capability
- Ô Pixel "Voids" Capability
- Ô Mixed Monitor Resolutions (some limitations)
- Ô Rotate (any, all monitors) Option (some limitations)
- Ô "T" & "L" Monitor Configurations Allowed
- Ô Cursor Wrap, non-Wrap Controls
- Ô PCIe & 64-bit Platform Capability
- Ô Image Overlay Support
- Ô XVideo Input Support

### **MX Series Key Features**

- Ô Multiple Cards/Chips
- Ô Multiple Xscreens per Chip Allowed
- Ô SLS per Chip Allowed
- Ô Mixed SLS and Multi-screen Allowed (some limitations)
- Ô All Xscreens & Monitor Outputs Hardware Accelerated
- Ô OpenGL SLS Capability (some limitations)
- Ô Powerful, Simple Graphical Configurator
- Ô Rotate (any, all monitors) Option (some limitations)
- Ô Mixed Monitor Resolutions Allowed (some limitations)
- Ô Cursor Wrap, non-Wrap Controls
- Ô PCIe & 64-bit Platform Capability
- Ô Image Overlay Support
- Ô XVideo Input Support

## Accelerated-X Means Quality

Software intelligently designed, skillfully implemented, thoroughly tested, and supported by the group that did it. Xi Graphics has developed and licensed **Accelerated-X** graphics software - X servers and graphics drivers for over ten years to industry and individuals for use on hundreds of different models of graphics cards/chips running on various operating systems - including open source Linux kernels - and computer platforms when fast, stable, and

## Move From Windows to "X"

Microsoft Windows and the X Window System are very different animals, graphically speaking. The six-monitor display depicted below is displaying a single image that is "stretched" across all six monitors - standard with MS Windows. With X, the standard basically assumes that each monitor (head) will have its own xscreen. To provide X with the capability to stretch a single xscreen across multiple graphics cards/chips while employing hardware-acceleration on all monitors for fast performance, requires

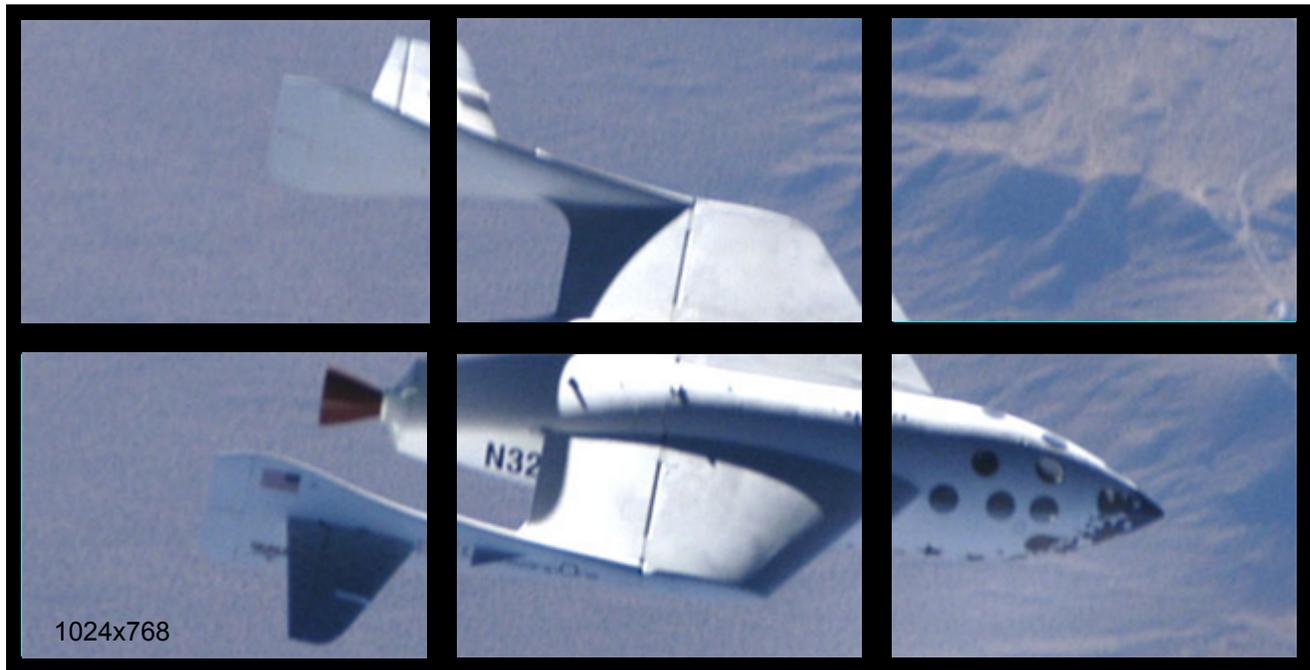


Figure 1. Single Logical Screen (w/o "hidden pixels")

trouble-free performance is required. The **Accelerated-X** Summit Series software is used in countless applications, including mission critical ones such as Air Traffic Control and Medical systems.

## Quality Software, Quality Service

The X Window System software is a very large body of very sophisticated software that operates between an OS kernel and applications software ("clients") to control ("drive") the graphics hardware in a computer system. Whereas X servers and graphics drivers provided to the Linux distributions by the "freeware community" have been generated by many "contributors" of varying levels of expertise and are often lacking in performance stability and follow-on service, the Summit Series software is supported by the organization that originally developed it. And that support is free, which means the original work has to be of high quality, or the support load would break

that the graphics sub-system (the X server, graphics driver(s) and kernel interface driver) all be specifically designed and implemented to accomplish this. It is not there "by default." And it is a major piece of engineering effort to do it (SingleLogicalScreen) right.

## Accelerated-X Does it Right

One of the ways to observe the difference between X.org X servers and high-quality, high-performance commercial X servers (such as Summit WallDisplay HX Series) is by comparing a Wall Display with several - 6, 8, or even 16 displays - operating with a single xscreen. Summit HX Series will be fast, stable, easy to install/configure, feature rich, whether on Linux, Solaris, x86 or SPARC platforms, and will be supported by the same group that developed it. Support is seldom required. It too is commercial quality, and, as we have said elsewhere, it is free.

## "Hidden Pixels" Feature

The large graphic on the first page illustrates the idea of hidden pixels in a multi-monitor display. Notice how the text in the banner seems to be on the "other side" of the panel frames. There are image pixels behind the framework, but they are "blocked" by the framing, giving the impression of looking through a multi-pane picture window. The more typical configuration is to have all image pixels displayed, offset at the boundaries of the monitors, as shown in Figure 1. Both configurations are available in Summit HX Series.

## Large Pix Maps Can Ruin Your Day

One of the severe limitations in X.org/XFree86 X servers is the poor handling of pix maps, esp. large ones. Application and GUI developers often are unaware of the processing load caused by liberal use of pix maps. With multi-card/chip systems, this can result in very poor system performance with

## Mixing Monitor Resolutions

An example of a multi-monitor configuration with mixed resolutions that has one xscreen stretched over three monitors and a second xscreen servicing a fourth monitor is shown in Figure 2. In this case, the top monitor of the "inverted T" configuration has a different resolution than the other three. The cursor can travel over all four monitors, with or without wraparound. Support for such configurations is available in the HX Series, and, with some limitations, also in the MX Series.

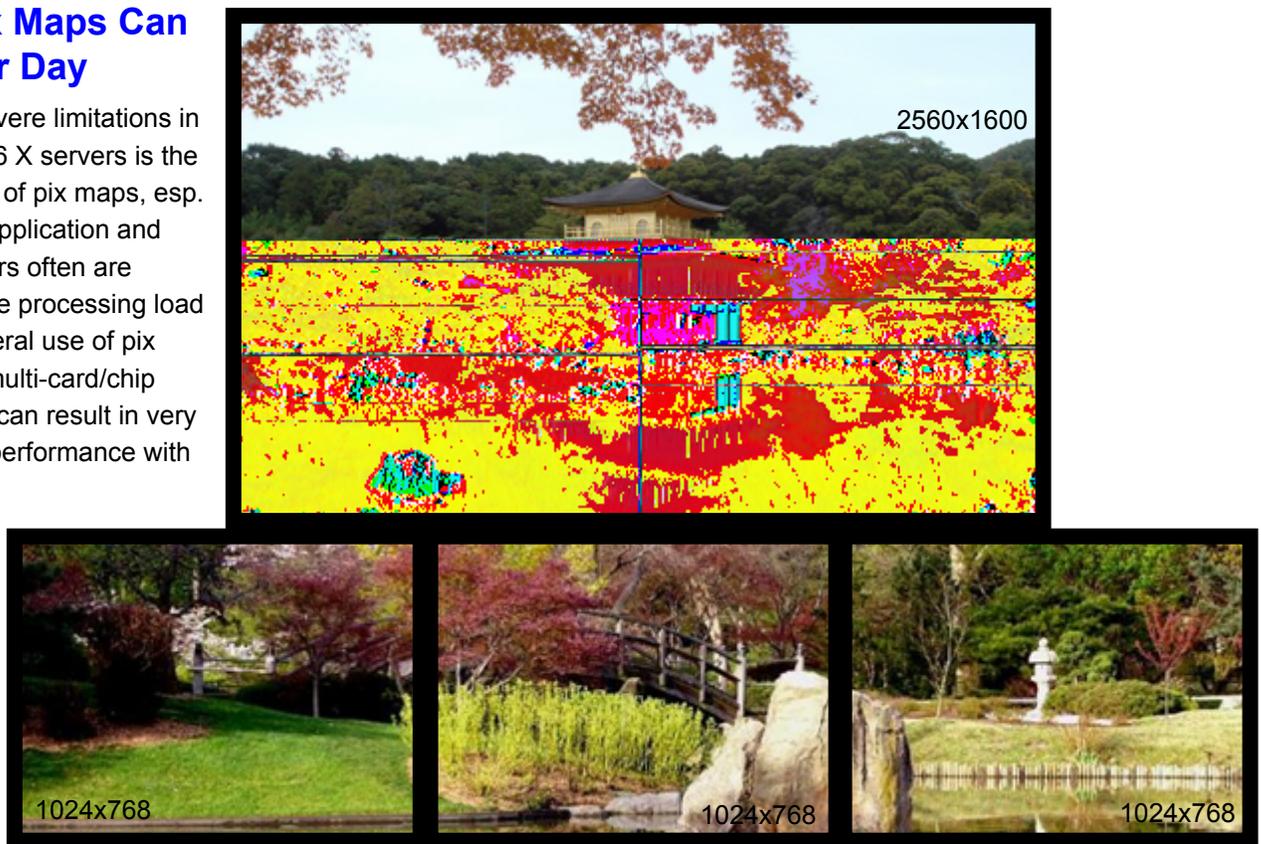


Figure 2. "Inverted T" Configuration w/Res Mix

the open source freeware X servers. The design of the Summit WallDisplay HX Series included special attention to this problem, and sophisticated methods to maintain high performance while using pix maps were developed. This high performance design is now used in Summit Custom (CX) products for Air Traffic Control applications that may also require real-time recording of the graphics sub-system activities for later replay. Because of the larger (and growing) size of the display real estate being deployed in new ATC systems, this was no small feat, and one that no other Linux/UNIX

## All Displays Hardware Accelerated

A complaint often heard when X.org/XFree86 X servers are used in multi-card/chip Wall Display systems is the inability to get full hardware acceleration on all monitor displays. This complaint is never lodged against **Accelerated-X**, since all monitor displays are hardware accelerated. Yes, even if there are 16 or more (the standard HX product supports up to sixteen monitors - the "Level 3" case - but support for up to 32 monitors is available as an option).

## Rotation - Low cost Portrait Mode

Software image rotation in X can save big bucks by avoiding the cost of monitors designed for portrait mode operation. With X.org/XFree86-based graphics systems, however, the performance hit when using image rotation, is quite large, especially with large and/or multiple monitors, sometimes large enough to make the feature unusable. This is the result of a poorly designed X server base to begin with, and when the additional graphics processing load required by rotation is added, the system just cannot cope.

Xi Graphics' HX Series does not suffer from the deficiencies of the open source X servers/drivers, since none of code is used in **Accelerated-X**. Instead, Xi Graphics' X graphics sub-system code is all commercial code, designed by a highly skilled group of developers working at one location for one company. And the results are quite impressive. The added load of performing the rotation is handled with ease, causing only a slight reduction in performance, even with large graphics real estate, such as that shown at the right - two 30" Apple Cinemas running on a Matrox RG200 remote graphics box. with dual Dual Link capability.

## 32- and 64-bit Platforms Supported

And not just the x86 architecture. Xi Graphics products are also running on SPARC, PPC, and PA RISC platforms. If an Accelerated-X code base runs on one platform, porting to another is mostly routine. And because the code is clean, commercial code, even the inevitable bugs are routine fixes. While most Wall Display systems are run on x86 (using MS Windows), systems using X are on x86, SPARC, and some PA RISC platforms.

## Linux is Popular, Solaris is Solid

Again, these are two very different animals. Linux is a kernel from the Linux group. Other (loosely associated) groups put out the X.org/XFree86 open source X servers/drivers that are used with the (many) Linux kernels. The X server/driver code one gets with a Solaris kernel is generally Sun Microsystems code, which is coherent, well designed and tested by Sun. Solaris has a reputation as code done by "grownups,"



probably because Solaris is apparently developed first for use with Sun's SPARC product line - a product line targeted mostly at the large commercial accounts. Since Sun's Solaris software is developed primarily for the purpose of selling large amounts of Sun's premium SPARC hardware, shoddy Solaris OS software would be a big problem.

On the other hand, Linux kernel software is not designed to sell anything from the Linux group. Maybe this accounts for what appears to be a noticeable lack of discipline in the design and distribution of the code? In fact, maybe the code distributed by the the open source X.org/XFree86 crowd is so poor because they too are not designing code for the purpose of selling anything (except, maybe, consulting time)? Maybe, though, it is because there are just too many "cooks in the broth." 4

## Unusual Configuration A

To illustrate some of the features available in the HX Series, a few unusual and/or overly complicated examples are presented. This first one is simple. It is a horizontal string of monitors side-by-side configured with a single xscreen. The number of monitors in the string shown below is only seven, but could be any number up to the HX Series horizontal pixel limit of 32,768, or 20 monitors if each monitor had a resolution of 1600x1200. There is only one xscreen in use, so the entire display is a SingleLogicalScreen in this case, displaying a single image across all seven monitors. The display on all monitors is hardware accelerated.



## Unusual Configuration B

This example is of a wall display of twelve monitors (could be many more) configured with four xscreens, two of which stretch across multiple monitors. One SLS ("stretched desktop") xscreen has a (synchronous) video window that is scaled up and is crossing monitor boundaries. An XVideo window assigned to an xscreen cannot be moved (dragged) to another xscreen, but can be moved about within its own xscreen. There can be multiple video windows assigned to an xscreen. HX Series (Silver Edition) supports up to six video windows per display (X server) if the underlying hardware is capable. Two of the xscreens are using overlays image overlays. This configuration is an example of the power and flexibility of the HX Series.



## Unusual Configuration C

Making use of the Rotate feature, this configuration has two big Apple Cinemas and a couple of 1600x1200 monitors in showing a single xscreen. All monitors are hardware accelerated. Rotate is also full hardware accelerated. While a photo used in this figure, the actual display would be a computer generated image, and could also have overlays and multiple video windows. If the application required, Record and Playback could be used (it is an optional feature in the HX Silver Edition) with very small loss of performance because of the method of recording used. Instead of trying to record the images, Accelerated-X recording method takes periodic snapshots and captures the incoming commands and data to the X server between snapshots mixed with timing markers. The commands and data are provided to the recording application in either compressed or uncompressed format. On playback, the X server just recreates the image(s) that were created by the original incoming commands and data.



Note that there is a rectangular section of the SingleLogicalScreen display that is not shown. It is configured as a "black hole." Applications could render to such a hole, but the result would not be displayed. Similarly, if the cursor space is not properly configured, the cursor could be moved into the hole and "lost." Configuring the territory for the cursor is easy, however, and black holes can be off limits to the cursor.



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## About Xi Graphics

Since its founding in 1994, Xi Graphics only business has been the development and licensing of X Window System graphics sub-systems software (X servers, graphics drivers, kernel modules, and OpenGL rendering pipelines) for use with various UNIX® operating systems, including the Linux kernel(s). Graphics support for nearly a thousand graphics cards/chips models have been developed since that time, using confidential documentation provided by the graphics card/chip manufacturers themselves under Non-Disclosure Agreements.

Xi Graphics software has earned a reputation for high performance in terms of speed, features, and stability. Customer support is provided free, usually by the developers themselves. This management technique has the effect of insuring that the high quality standards of the Company are met before the software is released, not many months or even years later.

Software is normally licensed in binary form only, and normally on a per computer basis. For highly specialized or unusual situations, other arrangements may be available.

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