

# Silicon Motion's New Video Wall Solution

offers superior picture quality, scalability and flexibility

## Introduction

The market for video walls is growing rapidly, thanks to the emergence of demand in various new market sectors. Video walls have long been used in niche applications, such as control centers for road traffic, air traffic, rail transportation or industrial processes, and in large entertainment and exhibition venues.

Now, however, consumer-oriented operations such as shops and shopping malls, bars, restaurants and mass transit stations are discovering the power of video walls to engage viewers' attention for entertainment, information or advertising content.

This presents a new opportunity to manufacturers of video wall display equipment to satisfy the particular requirements of this emerging customer type, as well as of existing users.

These new retail sector users will be attracted by video wall equipment which has a combination of attributes:

- **Ease of installation**
- **Ease of use**
- **Scalability and flexibility to enable users to add display screens or modify their layout after the initial installation**
- **High picture quality, compatible with 4K Ultra High Definition (UHD) content, and even higher resolutions**

To offer this improved value, manufacturers of video wall equipment will need to look beyond legacy technology for image processing, such as HDMI splitters. As this paper shows, a new architecture for video wall content processing and management pioneered by Silicon Motion provides an attractive combination of high performance, flexibility and simple user control, while minimizing the required investment in hardware infrastructure.

## The twin drawbacks of today's most widely used option for content processing

Today, the most common method for displaying a single video stream across multiple display panels is an HDMI splitter. The input is typically an HDMI or DisplayPort bitstream. A splitter produces a fixed number of HDMI outputs supporting a fixed configuration of display panels. To implement a new video wall, the user connects the content source to the splitter's input via a single HDMI cable, and the multiple display panels to the HDMI splitter's output via multiple HDMI cables.

This approach, however, has two serious drawbacks. The first can be seen immediately on installation. The second might only come to light after the initial installation has been completed.

The first, obvious, drawback is picture quality. The splitter only has access to data in HDMI or DisplayPort format, which has already been processed for rendering on a single display. In the HDMI splitter,

this bitstream is crudely re-sized and scaled for display over multiple panels, a process which degrades picture quality. This means that, for instance, content which can be rendered in 4K UHD resolution on a single display panel will typically appear in worse than High-Definition (HD) resolution when rendered on a typical 2x2 or 3x3 array by an HDMI splitter.

The second drawback, which often only becomes apparent after installation, is the splitter's fixed configuration. The user purchases an HDMI splitter for a fixed configuration of, for example, 2x2 display panels.

But the user's requirement might change after installation. The user might want to use the four panels in a 4x1 configuration rather than the original 2x2 configuration. Or perhaps the size of the video wall needs to be increased, calling for a 2x4 array to replace the original 2x2 array.

The first HDMI splitter is now useless, because HDMI splitters can only support a single configuration. To supply content for the new 4x1 or 2x4 array of panels, the user will have to discard the first HDMI splitter and replace it with a completely new splitter – and do so every time they wish to change or expand their video wall array.

This means that an investment in an HDMI splitter is neither scalable nor flexible.

### **CAT: a proven algorithm for video image processing**

Many video wall operators have continued to use HDMI splitters despite their lack of flexibility and the poor picture quality they provide. In many cases, this is because of their ease of use.

This means that there is a market opportunity for a new type of video wall equipment that can match the HDMI splitter for simplicity while offering the additional benefits of high picture quality and the freedom to change display configurations and extend video wall installations easily and at no or low cost.

As described above, this is impossible to achieve when image scaling is performed on an HDMI or DisplayPort bitstream.

In a new solution for video wall equipment developed by Silicon Motion, therefore, image processing and scaling operations are applied to the uncompressed video source, using Silicon Motion's Content Adaptive Technology (CAT) software. The CAT software for image processing and data compression is already proven in use in USB hubs and PC docking stations, enabling users to display any content on any monitor via limited-bandwidth USB connections.

### **This same software underpins the outstanding performance of a new Silicon Motion video wall solution.**

The CAT software, which is compatible with any laptop, PC or server based on the Windows® 10 operating system, performs image processing on the original video content. The software can split the content across any configuration of display panels. It then compresses the re-scaled content for transmission over a single USB channel to a video wall box, a Single In Multiple Out unit which routes the video content to multiple display panels.

The prime advantages of this CAT software-based solution are:

**High picture quality** – the CAT software is able to scale the image to maintain the original content's resolution across multiple panels. The CAT software is capable of processing up to 16K content for rendering on a video wall. While today, most content to be displayed on video walls is of 4K or HD resolution, the CAT-based technology offers a future-proof solution that is already compatible with the next two generations of video camera technology.

**High compression** – the CAT software can compress a 4K UHD bitstream at a data rate of 1GB/s to an output of just 50MB/s with no loss of picture quality. This means that, in the Silicon Motion video wall solution, all video data between the content server

and the video wall box can be carried over a standard USB 3.0 cable.

### Advanced content management –

operators can take advantage of multiple video configuration options, such as artistic or mosaic display layouts (see Figure 1), and advanced features such as bezel reduction and the addition of advertising content and watermarks.

**Low latency** – the duration of CAT software processing operations is less than that of a standard broadcast video frame. Negligible latency means that content is displayed on the video wall with no time lag – an important feature for safety- or time-critical users such as air traffic control centers.



Fig.1: the CAT software enables rotation of displays to any angle

### New from Silicon Motion: complete hardware / software solution for video walls

Silicon Motion has now combined its CAT software with a dedicated graphics processor system-on-chip (SoC) for video wall applications, the SM769, as part of a complete solution for video wall installations.

The SM769 decompresses the video bitstream supplied by the CAT host computer. It then converts the video signal to an HDMI, LVDS or analog signal and supplies the output to one or two displays.

The complete solution for video walls combines all the SM769 hardware with all the required software. It consists of:

- **The SM769 graphics processor SoC**
- **Video wall graphics driver and manager, based on CAT technology**
- **User control software**
- **Hardware reference designs for video wall boxes in various output port configurations**

The controller software, operating in a familiar Windows 10 environment, is simple for end users to learn, and enables operators to quickly and easily configure the equipment's outputs for any array of display panels (see Figure 2). The software supports very large arrays of up to 64 panels.

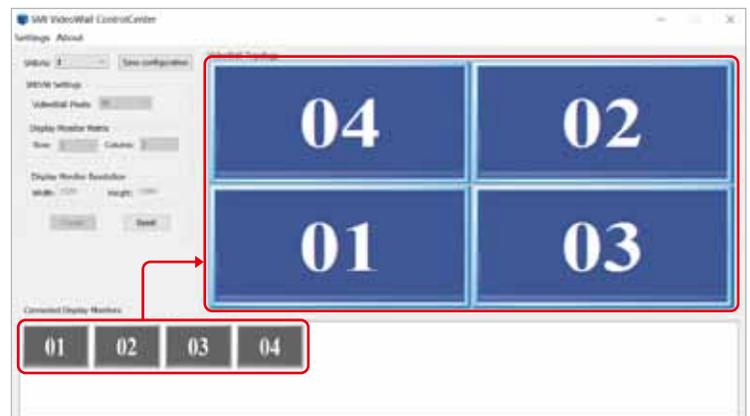


Fig.2: the Silicon Motion user software for configuring a video wall

The reference designs accelerate the product development process for manufacturers of video wall equipment. Figure 3 shows a reference design board for a video wall box supporting up to eight HDMI display panels via four SM769 SoCs.

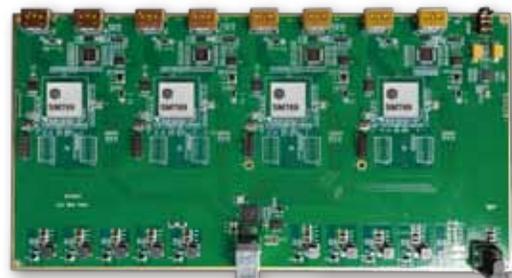


Fig.3: a reference design developed by Silicon Motion for an eight-display video wall box

## A flexible and scalable architecture

The Silicon Motion video wall solution, then, benefits from superior software and hardware technologies: the CAT software, the SM769 SoC and the user-friendly control panel software.

The operation of this solution offers complete flexibility and scalability to the video wall operator. A typical user's architecture is shown in Figure 4. This demonstrates that the Silicon Motion video wall solution can handle any input, including content on a Windows 10 desktop, and provide for easy user control on a standard laptop PC or tablet.

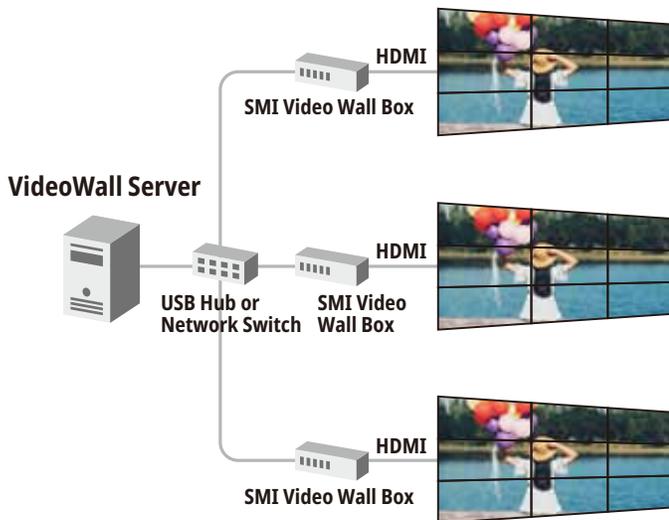


Fig.4: architecture of video wall installation using SM769-based video wall boxes

This solution offers **flexibility** because the display panel configuration is made in the user control software as shown in Figure 2. A user might, for instance, initially install a 3x3 panel array, driven by a 10-port video wall box. After installation, the user can change the configuration as shown in Figure 5 without any change to the video wall box: all the configuration changes are made in the user's control panel.

## 9 Display Configuration Examples

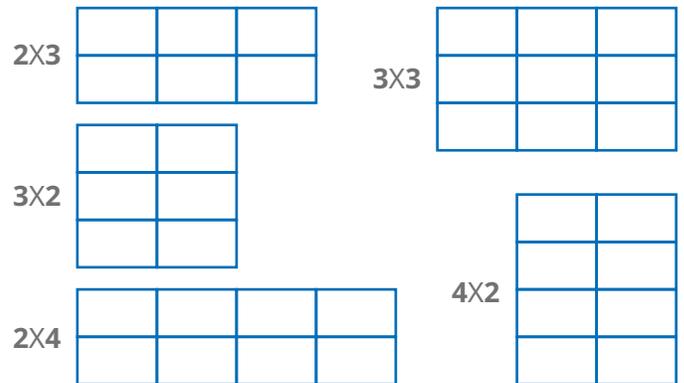


Fig.5: one 10-port video wall box can support any configuration of up to 10 display panels. This diagram shows just some of the configuration options.

It is also **scalable**: if the operator of the 3x3 array wishes after initial installation to expand the video wall to a 4x4 array, this simply requires the addition of a new six-port video wall box to the first 10-port box.

This is in contrast to the cost of use of an HDMI splitter: the original 3x3 splitter would need to be discarded, and replaced by a new, more expensive 4x4 HDMI splitter.

## High performance, low system cost

Other attributes of the Silicon Motion video wall solution help box manufacturers to bring additional value to the end user.

**High picture quality** is clear to any viewer of an SM769-based video wall, which can display HD and 4K UHD content in its native resolution today, and already supports the future 8K and 16K standards. For instance, a 4x4 array of HD (1080p) display panels can today display 8K content in 8K resolution when rendered via the Silicon Motion graphics software and two 8-port video wall boxes, each containing four SM769 SoCs.

The Silicon Motion solution is also notable for its **low system cost**. The Silicon Motion software runs on any standard PC or server. The connection from the content server to the video wall box is via a standard, low-cost USB 3.0 cable. And if an installed array needs to be expanded, an extra box may be added while retaining the existing box.

### Expert support for video wall equipment manufacturers

Silicon Motion has designed its video wall solution to be easy for equipment manufacturers to implement, while offering substantial extra value to users compared to conventional HDMI splitters.

Silicon Motion offers its technology as a complete hardware/software solution, including user control panel software in three variants to meet the needs of different users. The features of the user software are shown in Figure 6.

The Silicon Motion video wall box reference designs are available free of charge and are backed by full documentation including design files and schematics. Silicon Motion’s engineering teams are ready to advise customers on the electrical, thermal and mechanical implications when modifying a reference design.

### New opportunity in the video wall market

By adopting the Silicon Motion video wall solution, manufacturers have the opportunity to transform a market dominated today by low-performance HDMI splitters, replacing this inferior technology with a new product category, the video wall box, which offers users massively improved picture quality, simple installation using standard computer and connector technologies, and the freedom to quickly re-configure and extend video wall installations with little or no extra investment in video wall equipment.

Essential Version	
<ul style="list-style-type: none"> <li>• Video Wall Setup</li> <li>• Any Layout Configuration (2x2, 3x3, 1x4 and etc in Landscape orientation)</li> </ul>	
Matrix Wall	Artistic Wall
<ul style="list-style-type: none"> <li>• Clone All/Partial Displays</li> <li>• Bezel Reduction</li> <li>• Projectors edge blending</li> <li>• Panel Color Calibration</li> <li>• Four Degree Rotation (Portrait/Landscape)</li> </ul>	<ul style="list-style-type: none"> <li>• Clone All/Partial Displays</li> <li>• Bezel Resolution</li> <li>• Projectors edge blending</li> <li>• Any Degree Resolution</li> <li>• Any Shape/Resolution Display</li> </ul>
CMS (Content Management System)	
<ul style="list-style-type: none"> <li>• Multi Zone &amp; Window Management</li> <li>• Window-less Video Player</li> <li>• Multi Image Player</li> <li>• Running Ad Banner Insertion</li> <li>• Logo/Brand Watermark</li> <li>• Content Scheduling</li> </ul>	

Fig. 6: the video wall control panel is offered to end users in three versions

For more information about SM769, please go to [www.siliconmotion.com](http://www.siliconmotion.com)