



# Video Wall Planning in Cisco Vision Dynamic Signage Director

This module describes information about how to plan deployment of video content in Cisco Vision Dynamic Signage Director. It includes the following topics:

- [Video Walls, page 35](#)
- [Dual Video, page 35](#)
- [Video Synchronization, page 36](#)
- [Macroblocking, page 36](#)
- [Multicast Video Scaling, page 37](#)
- [Supported Video and Audio Formats, page 37](#)
- [Static Graphic Formats, page 40](#)
- [Event States and Event Scripts, page 41](#)
- [Guidelines for Event States and Event Scripts, page 41](#)
- [Guidelines for Video, page 42](#)
- [Best Practices for Video Walls, page 42](#)
- [Video Wall Requirements, page 45](#)
- [Prerequisites for Video Walls, page 45](#)
- [Restrictions for Video Walls, page 47](#)
- [Video Wall Design Examples, page 47](#)

## Video Walls

A *video wall* is a group of displays that show synchronized content and convey a single, much larger screen. Cisco Vision Director supports different video wall design methods depending on the type of media player controlling the video wall. A common use for video walls is to vary the video wall layout and content over the course of an event.

## Dual Video

Dual video regions allow you to overlay two video regions—a secondary local or multicast video region and a primary video region. The dual video template provides the following capabilities:

- Shows two video feeds at the same time

## Video Synchronization

- Places video-based advertisements
- Promotes a moment of exclusivity during an event
- Applies luminance (luma) keying to the secondary video region

## Video Synchronization

For display of synchronized local content (video or images) in your video wall, daisy-chain the DMPs. To support different types of content on each display in the video wall, such as four different TV channels, use a direct connection per TV display.

In this cabling method for local video synchronization, a single media player is connected to each TV display in the video wall using the HDMI Out and RS-232 connections, see [Figure 1 on page 36](#). It can be used for video walls playing local video that do not rely on the tile matrix capabilities of the TV.

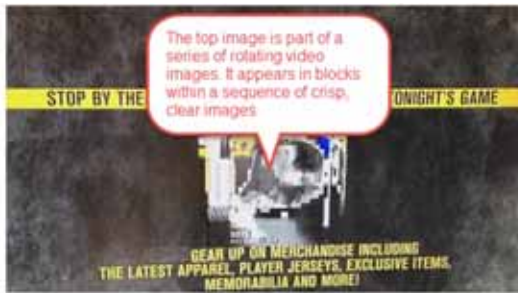
**Figure 1** Cabling Video Wall with One DMP Per TV Display



With this architecture, you can develop content at 3840 x 2160 resolution. Then, divide your video into four 1920 x 1080 pieces for synchronized playback. This method will use the maximum resolution for each display giving you the highest possible quality for your presentation.

## Macroblocking

Macroblocking is a video artifact where areas of a video image appear as small blocks or squares. Video content that contains large IFrames can cause macroblocking during playback on DMPs, as shown in [Figure 2 on page 37](#).

**Figure 2 Macroblocking Video Content Example**

Using constant bit rate (CBR) video is a requirement, adhere closely to the content guidelines to reduce the issue. If you are using the Adobe Creative Cloud video encoding tool, you might have to use the special settings to work around a problem with non-standard H.264 support. The rendition settings include using VBR as detailed below.

**Note:** Please pay special attention to the Key Frame Distance setting below.

#### Render Settings

- VBR, 1 pass
- Target: 10 Mbps
- Max: 12 Mbps
- Key Frame Distance: 9

For more information, see the [Release Notes for 6.4 Cisco Vision Dynamic Signage Director](#).

## Multicast Video Scaling

Multicast video scaling means many video monitors can display formatted (scaled) content simultaneously. It is intended for use with video walls and allows scaling of a multicast video region across a video wall display for both portrait and landscape orientation.

**Note:** Content scaling works on multicast video and local video, as well as external URLs and HTML.

## Supported Video and Audio Formats

The tables below define the supported video and audio formats for full-screen video stored locally on the media players and played through a video playlist.

**Note:** For best performance, we recommend constant bit rate (CBR) for local video playback on the media players. Variable bit rate (VBR) will also work but synchronized video playback could be compromised.

**Note:** Cisco Vision Dynamic Signage Director supports UHD/HD video content with UHD resolution (local and streaming video) on the DMPs. Graphics with UHD resolution are not supported. DMP-2K media players only support HD/SD content.

**Note:** We do not recommend using UHD video within an HTML Frame. Doing so could cause undesired performance implications.

**Table 1 Supported Video/Audio Formats for Localized Files for the SV-4K (UHD), CV-UHD, and CV-UHD2 DMPs**

Format	SV-4K, CV-UHD, and CV-UHD2 DMPs
Models	<p>HD/SD is supported. Video content with UHD resolution is supported only on the SV-4K, CV-UHD and CV-UHD2 players. Refer to for UHD video content specifications.</p> <p>MPEG-2 TS (transport stream) required for seamless looping of video files MPEG-4 Cisco Vision Dynamic Signage Director supports:            .mpg, .mpeg, .mp4, .m2t, .m2ts, and .ts file types.            .mp4 is recommended to reduce black frames.</p> <p>H.264 Specifications: Support for Main or High Profiles up to Level 4.2, AAC audio, CBR audio (VBR is not supported).</p> <p>H.265 for CV-UHD2 and CV-UHD2.</p>
HDR/HDR10 and Dolby Vision	Only the CV-UHD2 DMPs.
Video Resolution	Max supported resolution: 3840x2160X60p
Aspect Ratio	Widescreen 16:9 (1.0 square pixels)
Field Order	Progressive
UDP Multicast and File-Based Video	<p>Codec: H.264</p> <p>Encapsulation: MPEG2-TS or MPEG-4</p>
Video Bit Rate Encoding	Recommend 30-40 Mbps constant bit rate. Note that a second video recorder can simultaneously support a second 1080p video at up to 40 Mbps.
Max Bit Rate	<p>AC3: 640 kbps</p> <p>MP2 audio: 384 kbps</p>
Audio Streaming	Cisco Vision Dynamic Signage Director does not support streaming audio, for example audio-only tracks.
Local Audio Sample Rates	48kHz

**Table 2 Supported UHD Resolution Video Formats for the SV-4K, CV-UHD, CV-UHD2**

Format	SV-4K, CV-UHD, and CV-UHD2
Models	Only video content with UHD resolution is supported. Graphics with UHD resolution are not. MPEG-4 highly recommended. Other formats have not been tested.
Video Resolution	3840x2160x60p
Color Depth	UHD video can be encoded at 4:2:0 subsampling with 8 bits (Main Profile) or 10 bits (Main 10 Profile) of depth.
Main Profile	If your display components support HDMI 2.0, you can display a UHD video at 60p; encode the file using the Main 10 profile (10 bits of color depth with 4:2:0 chroma sampling) at level 5.1. If your display components do not support HDMI 2.0, you can display a UHD video at a max of 30p (with 8 bits color depth). Use a Main profile at level 5.0
HDR/HDR10 and Dolby Vision	Only the CV-UHD2 DMPs.
Video Encoding	H.265 High Efficiency Video Coding (HEVC). H.265 version 1 profiles only—Main and Main 10.
Video Encode Bit Rate	2000 to 25000 Kbps
Bitrate	CBR between 30 and 40 Mbps. Note that the second video decoder can simultaneously support a 1080p video at up to 40 Mbps.
Max Streaming Bit Rate (with HDMI-In Encoding)	We recommend two times the video encode bit rate. DMP encoding can be up 60 fps at 720p, or up to 30 fps at 1080p.

**Table 3 Supported Color Depths for UHD Video**

Resolution	8bit	10bit	12bit
4Kp24 4Kp25 4Kp30	4:4:4 (RGB)	4:4:4 (RGB)	4:4:4 (RGB)
4Kp50 4Kp60	4:4:4 (RGB) 4:2:0	4:2:0	4:2:2 4:2:0

**Table 4 Supported Video/Audio Formats for Localized Files for DMP-2K, CV-HD, and CV-HD2 DMPs**

Models	DMP-2K, CV-HD, and CV-HD2 DMPs
Format	HD/SD is supported. MPEG-2 TS (transport stream) MPEG-4 Cisco Vision Dynamic Signage Director supports: .mpg, .mpeg, .mp4, .m2t, .m2ts, and .ts file types. mp4 is recommended to reduce black frames. H.264 Specifications: Support for Main or High Profiles up to level 4.2, AAC audio, CBR audio (VBR is not supported).
UHD (SDR) Video	CV-HD2 only
Video Resolution	1920x1080
Aspect Ratio	Widescreen 16:9 (1.0 square pixels)
Field Order	Progressive

**Table 4 Supported Video/Audio Formats for Localized Files for DMP-2K, CV-HD, and CV-HD2 DMPs**

Models	DMP-2K, CV-HD, and CV-HD2 DMPs
UDP Multicast and File-Based Video	Codec: H.264 Encapsulation: MPEG2-TS or MPEG-4
Video Bit Rate	Recommend 30-40 Mbps constant bit rate. Note that a second video recorder can simultaneously support a second 1080p video at up to 40 Mbps.
Audio Streaming	Cisco Vision Dynamic Signage Director does not support streaming audio, for example audio-only tracks.
Local Audio Sample Rates	48 kHz

**Note:** Test the devices that you plan to connect to the HDMI-In port to stream content for support of HDCP. Most Mac OS and Windows laptops should work for HDMI-In video encoding for non-copy-protected content. It is up to the device manufacturer and OS whether or not HDCP pass-through is supported.

## Static Graphic Formats

Static graphics are used for advertisements or informational messages that do not require motion. This could include Welcome messages for luxury suites or directional information after an event. Static graphics are stored locally on the media players. [Table 5 on page 40](#) lists the allowable formats for static graphics.

**Note:** Content scaling is supported for .png files, widgets, external URL content, and external URL channels. Content is scaled down so it will not bleed over the region sides. Aspect ratio is maintained for .png files and widgets. External URL (content and channel) will fill the region.

**Table 5 Static Graphic Formats**

Graphic Format	DMP-2K, SV-4K, CV-HD, CV-UHD, CV-HD2, and CV-UHD2
JPEG, non-progressive, 8-bit RGB CMYK, and grayscale.	Yes
JPEG duotone	Not supported
JPEG, progressive	Yes
PNG	Yes 8, 16, 24, and 32-bit (24-bit with 8-bit transparency) recommended
Image Resolution	Max supported resolution: 2048x1280x32bpp (for 4K/UHD players). For non-4K/UHD players, use images that are no more than 1920x1080.

## Guidelines For Static Graphics

- Best practice: upload files in batches of 100 files or fewer. The total file size must be less than 100 MB.
- For vertical content in Release 5.0 and earlier, graphics and video are not auto-rotated by the DMPs. Create them in a vertical format and then rotate them 90 degrees for a vertical screen. From Release 6.0 and later, vertical content can be rotated at the DMP.
- DMPs can be configured (using the **dmp.portrait** parameter in **Display Specifications**) to automatically rotate content for proper orientation on vertically-positioned displays. See [Content Orientation, page 67](#).
- Content file names can have "-" and "\_", but not space(s) and other special characters.

- Content scaling is supported for static graphics, widgets, local and multicast video, external URLs, and channels (multicast video and external URLs).

## Event States and Event Scripts

Event states and event scripts control when and what content displays over the course of an event. For example, a Welcome message for Pre-game, a food promotion at halftime and an Exit message at the end of the game. An event state is a period of time in which the group of screens will exhibit the same behavior (e.g., the same screen template, playlists and channel). Event states can change over the course of time (Pre-Game, In-Game, Post-game, etc.).

## Guidelines for Event States and Event Scripts

Consider the following guidelines when creating event states and event scripts:

- Cisco Vision Dynamic Signage Director displays the default video channel / non-event state on the media players when an event script is not running on it.
- When you use Proof of Play (PoP) content in your playlist, and especially when your PoP content is included near or up to the end of the playlist, define a final script state (without any PoP content) that runs for at least 60 seconds so that all PoP data has time to be captured by Cisco Vision Dynamic Signage Director. This last event state is commonly set up to turn off the displays in the venue.
- When you configure a script action for a zone, by default, all groups within that zone inherit the defined action. You can override this inheritance by configuring a script action for a particular group within that zone.
- When a zone contains multiple groups, and if you configure script actions for a particular group, those actions will apply only to that group.
- Cisco Vision Dynamic Signage Director supports only one RS-232 command per event state.

[Table 6 on page 42](#) describes some guidelines for general script support in Cisco Vision Dynamic Signage Director.

**Note:** While these limits have been tested with basic Cisco Vision Dynamic Signage Director operation, the combination of maximum values and complexity of your system and content can potentially impact the actual limit. Test your script content for expected behavior before using in production.

**Table 6 Script Guidelines and Limitations**

Script Guideline	Mini/Small	Standard	Large
Max number of simultaneous scripts (when per-script multicast is in use)	50	200	500
Max number of event states per script	12	25	25
Max number of items per event script	300	1200	1200
Max number of scripts	50	200	500
Max number of simultaneously running scripts	5	100	250
Maximum number of templates in different groups/zones for a script state	12	50	50

## Guidelines for Video

Consider the following guidelines for deployment of video content in Cisco Vision Dynamic Signage Director:

- Video files can range in size. Release 5.0 and later releases support a maximum 4 GB file size.
- Be sure that your video content meets the requirements described in [Supported Video and Audio Formats, page 37](#).
- Test the devices that you plan to connect to the SV-4K, CV-UHD, or CV-UHD2 HDMI-In port to stream content for support of HDCP. Most Mac OS and Windows laptops should work for HDMI-In video encoding for non-copy-protected content. The device manufacturer and OS determine whether or not this is supported.
- Generally speaking, stretching a piece of content across multiple screens is not supported. However, scaling of multicast video is supported. See [Automated Content Import to Library Inbox, page 69](#).
- For dual video playback on the CV-UHD2 DMP, the secondary video should not contain audio.
- The audio track for any local video content should be sampled at 48 kHz.
- All local video content must include an audio PID (even if silent, without an audio source present).
- Use progressive video modes instead of interlaced to achieve optimal video display.
- For frameless external HTML browser content, the videos will likely render at the lowest layer. We do not recommend rendering video content on the external HTML.

**Note:** Content scaling while keeping the same aspect ratio is supported for static graphics, widgets, local and multicast video, external URLs, and channels (multicast video and external URLs).

## Best Practices for Video Walls

When implementing video walls, consider the following best practices:

- Use the same media player model (all CV-UHDs, or all CV-UHD2s, and so on) throughout the video wall.
- Use the same TV model throughout the video wall with a uniform bezel size (ultra narrow bezel strongly recommended).

**Note:** TV screens with an ultra narrow bezel help ensure the best viewing experience without important text or data being cut in half.



## Best Practices for Video Walls

- While using multicast videos for both video regions is supported, we recommended using a combination of multicast and locally-stored videos for the video regions (or local video for both video regions).
- Create video to be the same size as the video region where it will be rendered. This avoids any unnecessary video scaling.
- Use consistent video aspect ratio.
- Design video regions so that they are consistent with the aspect ratio of video content.
- For best performance of local video playback on the media players, use Constant Bit Rate (CBR). Variable Bit Rate (VBR) will also work but synchronized video playback could be compromised.
- Whenever possible, a PTP TTL of 1 provides better sync for file-based video content.

## Video Offset Control for Video Walls

To generate your best looking video wall displays, it's important to set the offset control value. These improvements compensate for the TV painting/scanning process and may be especially useful for fast-moving video.

**To set the video offset control value:**

1. Go to **Configuration > Groups & Zones**.
2. Click **Group <->Zone**.
3. Click **+ Add** or **Edit**. The dialog box appears (Figure 3 on page 43).

**Figure 3** New Group or Edit Group Dialog Boxes



4. Calculate the **Video Offset** value.

The general formula is:

$$(\text{row} - 1) \times (1/\text{fps}) \times 1000 = n \text{ milliseconds}$$

## 2X2 Video Wall

- Total wall resolution: 3840 X 2160
- Each TV videomode: 1920 X 1080 X 60p
- Row 1: delay 0 ms
- Row 2: delay = 17 ms

Two display parameters also enhance your video wall outcomes: **dmp.vsynchDomain** and **dmp.pcr.mode**. Setting **dmp.pcr.mode=1** turns the functionality on. When coupled with enhanced sync, it will use the PCR to control vsync for streaming video walls. Setting **dmp.pcr.mode=0** will use PTP to control vsync for file-based video walls.

## Best Practices for Video Walls

- The PCR mode setting is received from the Display Specification information (i.e., from deviceMibs.json). When no PCR mode property is in the json file, it is assumed to be disabled.
- When enhanced PCR handling is enabled, both primary and secondary regions that use video stream as source will enable the new PCR handling behavior. The PCR attributes will only be applied to streaming video, if the video source is over UDP, RTP, or RTSP (only if currently supported by the runtime).
- File-based content will not have the PCR attributes in the video HTML element.

**Note:** These Display Parameters only work with DMP firmware version 8.2 or higher.

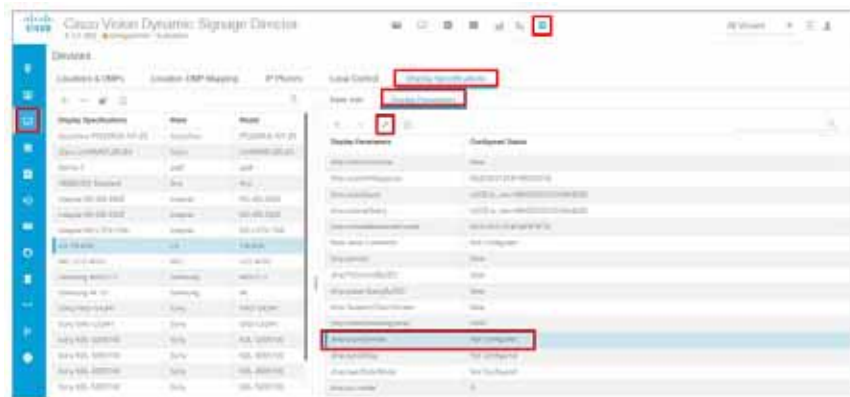
## Setting dmp.vsyncDomain Key

Set the key **dmp.vsyncDomain** for all the DMPs in the video wall with the same value (Figure 4 on page 44).

### To set the values for the DMPs:

1. Click **Configuration > Devices > Display Specifications > Display Parameters**.
2. Select the device from the left panel and scroll to **dmp.vsyncDomain**. Select it.
3. Click **Edit** and the Edit Configuration Setting dialog box appears. Type in the value.
4. Click **Save**. Repeat for every device in the video wall using the exact same value.

**Figure 4** Set Value for dmp.vsyncDomain Key for DMPs in Video Wall



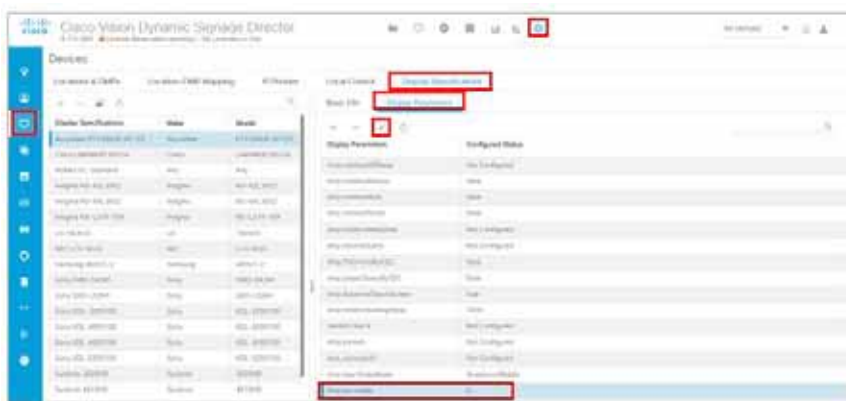
## Setting dmp.pcr.mode Key

Set the key **dmp.pcr.mode** for all the DMPs in the video wall with the same value (Figure 5 on page 45).

### To set the values for the DMPs:

1. Click **Configuration > Devices > Display Specifications > Display Parameters**.
2. Select the device from the left panel and scroll to **dmp.pcr.mode**. Select it.
3. Click **Edit** and the Edit Configuration Setting dialog box appears. Change the value to 1.
4. Click **Save**. Repeat for every device in the video wall.

**Figure 5 Set Value for dmp.pcr.mode Key for DMPs in the Video Wall**



## Video Wall Requirements

- DMPs in a video wall must be on the same VLAN and connected to the same access switch. PTP is also required.
- To achieve best synchronization with multicast video, the streamed video must conform to ISO-3818-1, using the current state of the DMP firmware, any 2 DMPs can be +/- 1 frame off.

## Prerequisites for Video Walls

Before you deploy video walls and create the content for them, meet the following conditions:

### To play local video or image content in a video wall:

1. Create the overall format of the video wall.
2. Edit the content into separate 1920x1080 files that contain the segment of content to be shown on each display.

For example, in a 2x2 video wall (4 screens), the original content should be in 3840x2160 format (that is, 2 times 1920x1080).

3. Break the content into (in this example, four) individual files of 1920x1080 format to show the appropriate portion of the content for the 4-screen display.

## Prerequisites for Video Walls

**For DMP content synchronization:**

- Each media player must be in its own group.
- For each region, the playlists must have the same number of items, type of item, and duration of each item, or have no playlist at all in the region (empty).

Table 7 on page 46 shows an example of playlist content for a 2x2 video wall with a mix of local video and image content. Notice that all first items in each of the four playlists are of the same type (PNGs), with the same duration, but the content itself is not the same. Likewise, the second item in each playlist is video content with the same duration, but different files.

**Table 7 2x2 Video Wall Playlist Example for the CV-UHD2, CV-UHD, or SV-4K**

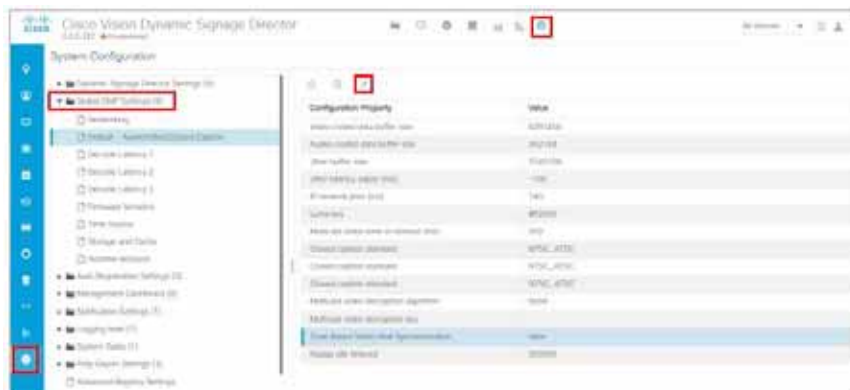
Content Item	Playlist 1	Playlist 2	Playlist 3	Playlist 4
1	30s: PNG 1-1	30s: PNG 1-2	30s: PNG 1-3	30s: PNG 1-4
2	34s: MP4 2-1	34s: MP4 2-2	34s: MP4 2-3	34s: MP4 2-4
3	21s: MP4 3-1	21s: MP4 3-2	21s: MP4 3-3	21s: MP4 3-4

- Trim local video item duration to boundaries in seconds and not fractions of seconds.

**Note:** If your imported video content duration is in fractions of seconds, then the content screen shows the actual item duration for the video. However, the system actually rounds that content duration for the playlist to even time boundaries (in seconds). Also, if you manually change the item duration within the Cisco Vision Dynamic Signage Director UI, the content playback will be truncated.

**For zone-based video wall synchronization:**

- Put each media player in its own group.
- Collectively, place the groups that are part of the video wall in a zone.
- Select the “Use as Video Wall” checkbox when you create the zone for the DMP groups.
- Click **Configuration > System Configuration > Global DMP Settings > Default Audio/Video/Closed Caption**.
- Set the **Value** of **Zone Based Video Wall Synchronization** to “**true**”. If necessary, click the **Edit** icon. The Edit Configuration Setting dialog box appears.

**Figure 6 Zone-Based Video Wall Synchronization**

## Restrictions for Video Walls

Before you create video walls, consider the following restrictions:

- All screens in the video wall should use 1920 x 1080 format.
- Widgets, external URLs, and multicast video tuning synchronization are supported by the DMP-to-DMP content synchronization feature.
- When using zone-based content synchronization for video walls, one device controls synchronization. If that device stops showing video, then all displays in the video wall stop showing content.

**Note:** Due to limitations in display technologies (where lines are scanned/displayed from left-to-right, top-to-bottom), a 2x2 video wall with fast motion may show out of sync, regardless of video source (multicast or file-based). The visual out-of-sync becomes more evident as the number of rows in the wall increase. A 1xn video wall, where objects move across the screens, is less susceptible to the TV display's scan behavior.

## Video Wall Design Examples

This section provides examples of some of the more common and currently deployed video wall designs in Cisco Vision Director venues.

**TIP:** Be sure to consult with the video wall experts from the Cisco Creative Services team for any of your video wall ideas, including non-standard configurations. This team can help you with ideas, best practices, and wiring diagrams to ensure a successful deployment.

### TV-Based Tile Matrix Video Wall Example

Figure 7 on page 48 shows a video wall commonly used in a concourse area, with a larger game feed for groups of patrons to watch, along with rotating sponsor content displayed beside the game. This wall is actually a 2X2 and a 1X1.

**Figure 7 2x3 Video Wall Content Example**

A 2x3 video wall is the most common video wall that Cisco recommends because in the left 2x2 group of displays, the game feed maintains the proper 16:9 aspect ratio of the HD game feed.

The right 2x1 group of displays can work independently from the game feed and show sponsor, social, or other content throughout the game. The user also can change the type of content that plays during the game. For example, during half-time or period break, when there is no game feed, the user can switch the 2x2 to play full screen sponsor content, while changing the 2x1 to show upcoming events or team branded content so that there are not any sponsor conflicts.

[Figure 8 on page 48](#) shows the cabling for the video wall example, where two Cisco DMPs are used to break the wall into different display areas.

The first DMP provides the 2x2 game feed and the second DMP provides the 2x1 sponsor ads.

**Figure 8 Video Wall Cabling Example Using TV Tile Matrix Functionality**

These dedicated DMPs provide the video signal for the group of TVs that the DMP is connected to through the daisy-chain. Depending on the screen manufacturer, the RS-232 connections can also be daisy-chained if this feature is available.

When operating in tile matrix mode, the TVs are fed the same video signal. Based on the TV's tile matrix configuration, the TV knows to first scale input video to the size of the configured x,y dimensions, and then to display its "piece" of the overall display based on its configured position within the matrix.

**Note:** If you want to show multiple types of content, such as four different channels on each of the screens, connect a Cisco DMP behind each TV.

## Other Video Wall Configurations

While the 2x3 video wall is the most commonly used video wall configuration, using the information and concepts for the video wall examples, you can create any number of different video wall configurations.

Video Wall Design Examples

Figure 9 4x4 Video Wall Example



Figure 10 3x5 Video Wall Example



Figure 11 2x7 Video Wall Example



## Video Wall Design Examples