S4671 - SEE THE BIG PICTURE: SCALABLE VISUALIZATION SOLUTIONS FOR HIGH RESOLUTION DISPLAYS

Doug Traill - Senior Solutions Architect
LARGE FLAT WALL DISPLAYS

MOSAIC

Creating a single unified Desktop
Up to 16 Displays
Supported on Quadro + NVS
Linux, Windows 7 + Windows 8

Image courtesy of Vislogix 6x6 interactive display wall built using MOSAIC
IMMERSIVE DISPLAYS

Quadro Sync
Sync's up to 4 GPUs in workstation
MOSAIC with Sync
Supported on Quadro K5000 + K6000
Linux, Windows 7 + Windows 8

Image courtesy of Visbox
Immersive Room - driven by 1 workstation with 4 Quadro K5000s + Quadro Sync
ULTRA HIGH RESOLUTION DISPLAYS USING CLUSTERS

Quadro Sync
Up to 50 Quadro Sync cards in a cluster
Control via NVAPI
Control + Monitor using NVWMI

Image Courtesy of BARCO/Elbit Systems - 4k cluster
NOT EVERY SURFACE IS FLAT

Warp + Intensity Adjustment API

Projection Correction

Curved Surfaces

Projection Mapping

Image courtesy of Christie Digital - Projection mapping on to a one fifth scale physical car

S4622 - Virtual Automotive: Projection Mapped Graphics for Automotive Design
- Tuesday 3.00pm  Room 210G
# Quadro Features for High Resolution Display Walls

<table>
<thead>
<tr>
<th>Custom Resolutions</th>
<th>MOSAIC</th>
<th>Tiled Displays</th>
<th>10/12 bit Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>GTF, DMT, CVT, CVT-RB, Manual timing</td>
<td>Seamless Desktop across multiple GPUs</td>
<td>Automatic MOSAIC setup on tile displays using Display ID</td>
<td>Support High Dynamic Range Displays</td>
</tr>
<tr>
<td>EDID Management</td>
<td>MOSAIC + Sync</td>
<td>Ultra high resolution Desktop</td>
<td>3D Stereo</td>
</tr>
<tr>
<td>Capture and Read EDID from file</td>
<td>Framelock, Overlap support, 3D stereo</td>
<td>Up to 16k by 16k</td>
<td>OpenGL/DirectX, active, passive, pixel packed</td>
</tr>
<tr>
<td>4K resolution</td>
<td>GPU Direct 4 Video</td>
<td>External or Internal Sync</td>
<td>Display Port MST</td>
</tr>
<tr>
<td>DP1.2 per connector or HDMI1.4b</td>
<td>Picture-in-Picture support</td>
<td>Genlock/TTL Sync, Internal Sync</td>
<td>Support multi-streaming devices</td>
</tr>
<tr>
<td>Warp + Intensity API</td>
<td>NVAPI/NVWMI</td>
<td>Display Clone Modes</td>
<td>GPU Affinity</td>
</tr>
<tr>
<td>Edge-blending, projection mapping, Windows + Linux</td>
<td>Programmatically control driver</td>
<td>Display Port Clone, Pan &amp; Scan clone, 4K cloning</td>
<td>Multi-GPU support and Swap Groups</td>
</tr>
</tbody>
</table>
MOSAIC - WHY IS IT NEEDED?
- WINDOWS ON ITS OWN - INDEPENDENT DESKTOPS
WINDOWS ON ITS OWN
- INDEPENDENT DESKTOPS
WITH MOSAIC
- ONE LARGE DESKTOP
MOSAIC - SUPPORTED ON NVS + QUADRO

- Unified Desktop up to 16 Displays*
  - i.e. for Digital Signage - 4 NVS510 cards for 16 displays
  - For interactive content - 4 K5000s

- All cards in the system must be identical
- All displays must support common display timing
- Support Bezel Correction
- Windows 7, 8 + Linux support.

*All displays need to have identical timing.
*16 display support for Kepler GPUs
# MOSAIC WITH SYNC FEATURES

<table>
<thead>
<tr>
<th>GPU Options</th>
<th>Number of Synchronized displays/projectors from a single system with MOSAIC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Up to 2</td>
</tr>
<tr>
<td>K6000</td>
<td>1 GPU</td>
</tr>
<tr>
<td>K5000</td>
<td>1 GPU</td>
</tr>
<tr>
<td>Q5000</td>
<td>1 GPU</td>
</tr>
<tr>
<td>Q6000</td>
<td>1 GPU</td>
</tr>
<tr>
<td>Quadro Plex 7000</td>
<td>1 System</td>
</tr>
</tbody>
</table>

- Seamless, Tear-Free Displays
- Projector Overlap
- API for Warp & Intensity Adjustment
- Active and Passive 3D Stereo support
- Windows 7 & Linux
- XP support limited to 2 displays per GPU

*SLI support - must be certified platform -  http://www.nvidia.com/object/quadro_sli_compatible_systems.html
*XP - R319 is last released driver branch
## SIDE NOTE - ON MOSAIC NAMING

<table>
<thead>
<tr>
<th>Display Card</th>
<th>Windows</th>
<th>Linux</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 NVS510</td>
<td>MOSAIC</td>
<td>metatmodes</td>
<td>Bezel correction - no overlap</td>
</tr>
<tr>
<td>Multiple NVS510</td>
<td>MOSAIC</td>
<td>Option “BaseMOSAIC”</td>
<td>Bezel correction - no overlap</td>
</tr>
<tr>
<td>Single K4000</td>
<td>MOSAIC</td>
<td>metatmodes</td>
<td>Bezel correction - no overlap</td>
</tr>
<tr>
<td>Multiple K4000s</td>
<td>MOSAIC</td>
<td>Option “BaseMOSAIC”</td>
<td>Bezel correction - no overlap</td>
</tr>
<tr>
<td>1 K5000</td>
<td>Premium MOSAIC MOSAIC with Sync</td>
<td>Metamodes</td>
<td>Overlap supported</td>
</tr>
<tr>
<td>Two K5000s (no SLI or Sync)</td>
<td>MOSAIC</td>
<td>Option “BaseMOSAIC”</td>
<td>Bezel correction - no overlap</td>
</tr>
<tr>
<td>Two K5000s with SLI or Quadro Sync</td>
<td>Premium MOSAIC MOSAIC with Sync</td>
<td>Option “SLI” “MOSAIC”</td>
<td>Overlap support. Even using Quadro Sync its called “SLI” “MOSIAIC”</td>
</tr>
</tbody>
</table>
Synchronization

Focus on the image and not the artifacts
WHY IS SYNC IS IMPORTANT?

Bezel’s hide sync issues !!!

Image from gizmodo.com
MULTI-GPU SYNC

- Framelock
- Stereo lock
- Swap lock
Vertical Sync is the pulse that indicates the start of the display refresh.

To avoid tearing on a single screen, the application swap buffers are synced to vertical sync.

Although all three displays may have the same refresh rate, vertical sync start may be different.

This can result in tearing between displays.
**FRAMELOCK/GENLOCK**

- **Framelock/Genlock** provides a common sync signal between graphics cards to insure the vertical sync pulse starts at a common start.
- This is commonly referred to as **Frame Synchronization**
- **Framelock** - Synchronization is generated from a master node. All other nodes would be sync to this.
- **Genlock** - synchronization is from an external sync generator (house sync). Each node attached to the genlock signal is synced from that signal.
- **Framelock & Genlock** can be mixed in the cluster. With the master node being synchronized from the genlock pulse.
No information that tells a display or stereo glasses which eye is left or right
STEREO LOCK

No stereo lock

This will result in eyes being swapped between displays
STEREO LOCK

Stereo sync is in phase between GPUs.
SWAPBUFFERS

<table>
<thead>
<tr>
<th>GPU</th>
<th>Display</th>
<th>Time (0-80)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front</td>
<td>Scan</td>
<td>0-16</td>
</tr>
<tr>
<td>Back</td>
<td>Scan</td>
<td>16-32</td>
</tr>
<tr>
<td>Front</td>
<td>Scan</td>
<td>32-48</td>
</tr>
<tr>
<td>Back</td>
<td>Scan</td>
<td>48-64</td>
</tr>
<tr>
<td>Front</td>
<td>Scan</td>
<td>64-80</td>
</tr>
</tbody>
</table>

- Draw (1) - Front
- Draw (2) - Back
- Draw (3) - Front
- Draw (4) - Back

- Scan (1) - Front
- Scan (2) - Back
- Scan (3) - Front
- Scan (4) - Back
SWAPBUFFERS IN A CLUSTER

Each node is now rendering a scene with different complexity i.e from least to highest we get:
1. node 3  ~ 16ms = 60fps
2. node 4  ~ 36ms = 30fps
3. node 2  ~ 53ms = 15fps
4. node 1  ~ 99ms = 10fps

• With each node running at a different rate the user would perceive tearing on the screen.
• We need a mechanism to ensure that each node will *swap* at the same time.
SWAP GROUP AND SWAP BARRIER

- NVIDIA Extensions to OpenGL /DirectX (via NVAPI)
  - Swap Group - provides synchronization of multiple GPUs in a single host
  - Swap Barrier - provides synchronization of GPUs across multiple nodes.
  - Use RJ45 (framelock) connection on Quadro Sync - so faster than sync over a network

With Swap Barrier each node will wait until all nodes have completed their render
1. node 3 ~ 16ms = 10fps
2. node 4 ~ 36ms = 10fps
3. node 2 ~ 53ms = 10fps
4. node 1 ~ 99ms = 10fps
LET THE OS MANAGE MULTIPLE DISPLAYS

All rendering occurs on one GPU 0

Pixels are copied across PCIe bus
Application needs to be multi-threaded (4 Draw threads)

Needs be programmed using GPU Affinity (nvidia extensions) for Max performance

Application should use NV swap groups to sync swap buffer between GPUs

Quadro Sync needed for framelock
MOSAIC HIDES THE COMPLEXITY

Logical GPU

App
WHAT DOES SYNC DO

Synchronize Multiple Displays

• Align the scan out of multiple displays, GPU’s, and systems

• Maintain Stereo alignment between multiple systems

• Synchronize to an internal or external timing source

Co-ordinate Buffer Swaps

• HW based swap synchronization within a node or between clusters

• Prevent tearing and image mis-alignment
G-SYNC GAMING MONITORS

- Approaches the problem differently
  - GSYNC is a module put into the display
  - Currently vsync tells GPU when to update
  - Gsync tells the display when to update

- Currently only works for single displays attached

- Future version may support multiple displays.
MOSAIC
Setup and configuration
SETTING UP MOSAIC

**Control Panel**

**ConfigureMosaic**
- Large display walls

**Driver Install**

**Download from NVIDIA driver section**

**NVWMI**
- Setup from a remote machine
  - Powershell scripts
  - Program directly

**NVAPI**
- Incorporate MOSAIC setup into your own application
- Registered Developer for NDA access NVAPI
MOSAIC GRIDS

Rows x columns <= 16
Max Horizontal or vertical Pixels <= 16384

Enumeration of the Grid always starts top left and goes left to right
**Bezel correction will increase overall pixel size**

i.e. each display is 1920x1080

Bezel per column is 100

Total horizontal width = 1920*4 + 100*3 = 7980

**Overlap correction will decrease overall pixel size**

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**UNDERSTANDING TOPOLOGIES**

Column overlap or bezel correction

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<tbody>
<tr>
<td>5</td>
<td>6</td>
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<td>13</td>
<td>14</td>
<td>15</td>
<td>16</td>
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BEZEL AND OVERLAP CORRECTION

• Bezel Correction
  - Will make the image look continuous as we render under the bezel

• Overlap Correction
  - For projectors it maintain the Aspect Ratio of the display.
ANATOMY OF A SYSTEM

- CPU0 PCIe 1
- CPU0 PCIe 2
- CPU1 PCIe 1
- CPU1 PCIe 2
- GPU-0
- GPU-1
- GPU-2
- GPU-3
- Quadro Sync card
- stereo sync bracket
- con0
- con1
- con2
- con3
REAR PANEL - BOXX 8950 - 4 K6000S

VESA Stereo Bracket

GPU 0

GPU 1

GPU 3

GPU 2

Quadro Sync

Slot 2

K6000 - Master GPU will have a green LED after POST

Slot 4

Slot 6

Slot 8

VESA stereo - only one per system required
 Doesn’t require PCIe slot - just a blank

Connect to all 4 GPUs.
 At boot-up LEDs will be amber showing GPU connected
PORT NUMBERING

Ports auto enumerate depending what is attached –

i.e. A + D are attached
A = 0,0
D = 0,1

A + B + D are attached
A = 1,0
B = 1,1
D = 1,2

A + B + C + D are attached
A = 2,0
B = 2,1
C = 2,2
D = 2,3
RELATING PORTS TO GRID

configureMosaic.exe set rows=3 cols=3
configureMosaic.exe set rows=3 cols=3 out=0,0 out=0,1 out=0,2 out=1,0 out=1,1 out=1,2 out=2,0 out=2,1 out=2,2
MANAGE EDID
BENEFITS OF MANAGING EDID

- EDIDs can be lost due to switches/extenders
- If a cable is unplugged it doesn’t cause a hot plug event
- Can help with staging a system
- Can fake a display if it is not present.

Limitations

- Not supported on DP1.2 displays.
PORTRAIT MODE

- Some operations are best done by Command line
  - i.e. Portrait mode requires that GUI starts in Landscape mode - it’s a feature ;-)
QUADRO DISPLAY OUTPUTS

- **4 Display Connectors → 4 Displays**
  - 2 DVI-DL, 2 DP 1.2
    - Only one VGA output on DVI
  - DP 1.2 support High Bit Rate 2 (HBR2) and Multi-Stream
    - Total of 4 independent heads
    - High Bit Rate 2
      - K5000 - 3840x2160 30bit @ 60Hz on a single connector
      - K6000 - 4096x2160 30bit @ 60Hz on a single connector
  - Stereo through an optional Stereo Bracket - same as Quadro 4000
K5000/K6000 - SUPPORTED OUTPUTS

- Up to 4 Single link or Dual Link* DVI
  - DP to DVI dongle
  - DP to DVI dongle
  - Native DVI
  - Native DVI

- 4 HDMI
  - DVI to HDMI adaptor

- 2 Display Port displays or 4 Display Ports using MST**
  - DP to HDMI dongle
  - DVI to HDMI
  - DVI to HDMI

- 3 VGA ports
  - DP to VGA dongle
  - DP to VGA dongle
  - DVI-I

- Dual link requires active dongle for DP connectors
- **MST allows for DP to be daisy-chained. Support 4 displays per card
MOSAIC ACROSS MULTIPLE GPUS + 1
MOSAIC ACROSS MULTIPLE GPUS + 1
NEW FEATURES IN R334 DRIVER

Premium MOSAIC = MOSAIC with Sync

Sync Capability Information
Indicates whether or not card or system can be sync’d.

R331 driver
- GPU and port number OSD
MOSAIC TIPS

MOSAIC does not work with ECC on
- Make sure it is off
MOSAIC TIPS

Make sure there is no Mirror Driver installed

Mirror Driver is installed by remote admin software. It will sit between the OS and graphics driver.

Will often break
- 3D stereo
- accelerated video playback
- MOSAIC + Sync
4K DISPLAYS + MOSAIC

Prosumer

4K 84” TV
(Single HDMI input)

Professional

ASUS/Dell/Sharp 32” monitor
(Single DP1.2 input)

4K 84” panel
(four HDMI input)

4K Stereo Projector
(Up to 8 inputs)
WHAT IS 4K?

4K Video Bandwidth ~567MHz @ 60Hz

Ultra High Def (UHD) Video Bandwidth ~533MHz @ 60Hz

Single Video Connection Bandwidth
- SL-DVI = 165MHz
- DL-DVI = 330MHz
- DP1.1 ~330MHz
- HDMI* ~340 MHz
- DP1.2** K5000 ~540MHz
- DP1.2** K6000 ~592 MHz

- HDMI 1.4 supports 4k/UHDTV at 24 & 30 Hz for single cable
- HDMI 2.0 will support 4K @60Hz at 4:2:0 color
- ** DP1.2 can drive 4K but implementation will vary per Graphics card.
Display Port can support higher color depth desktop

**DRIVING 4K - MULTIPLE CONNECTIONS**

- **Quadrants**
  - 4 DVI or HDMI/DP
  - Each input is
  - 4K – 2048 x 1080@60Hz
  - UHD – 1920x1080@60Hz

- **Stripes**
  - 4 DVI or HDMI/DP
  - Each input is
  - 4k – 1024x2160@60Hz
  - UHD – 960x2160@60Hz

- **Side by side**
  - 2 DL-DVI/DP
  - Each input is
  - 4k – 2048x2160@60Hz
  - UHD – 1920x2160@60Hz
DP1.2 AND VESA DISPLAY IDS

- Display Port 1.2 input
  - Panel acts a Multi-streaming hub
  - So two 1920x2160 channels over single cable

- Vesa Display ids
  - New extension to VESA EDID standard
  - EDID identifies its preferred display resolution.
  - New extension identifies position in tiled display
  - NVIDIA driver (R331) will automatically enable MOSAIC when it detects these displays to give single Desktop.
MOSAIC USING SCRIPTS

- **Configure MOSAIC**
  - NVIDIA developed tool
  - Can be used in batch file
  - Useful for complex installs
    - i.e. multi-GRIDs

- **NVWMI**
  - Powershell, WMIC, C# etc
  - Example script in backup.
  - Can be used remotely
MOSAIC GRIDS

- 12 Projectors, driven by 3 K5000s
- Floor and Front wall - 4 projectors
- Side walls are 2 projectors
- 4th GPU used a console output
- After configuring MOSAIC set Sync.
- Dual boot - works with Linux.

configureMosaic.exe set rows=1 cols=1 out=0,0
nextgrid rows=2 cols=2 overlap=384,240 out=1,0 out=1,1 out=1,2 out=1,3
nextgrid rows=2 cols=2 overlap=0,240 out=3,0 out=3,1 out=3,3 out=3,2
nextgrid rows=2 cols=2 overlap=384,480 out=2,0 out=2,1 out=2,2 out=2,3
MOSAIC VERSUS EQUALIZER

MOSAIC with Clip
- Improves fill performance

Flat Wall
- 4 1920x1200 monitors
- 2x2 MOSAIC layout

Equalizer
- Open source
- API intercept to convert applications to run on multi-GPUS

Quadro K6000s - driving 3840x2400 display
ADVANTAGES OF MOSAIC

- Advantages
  - Performance
  - Reduce model load time
  - Reduce System complexity

- Disadvantages
  - Performance gain will be app specific
  - Increased memory usage on the card
    - May limit memory size.

- MOSAIC with clipping enabled with command line tool - configure_mosaic_clip_to_subdev
- Full screen apps only (if you drag windows over GPU boundary you will see tearing).
- Supports DirectX and OpenGL
- Contact QuadroSVS@nvidia.com if you want a copy of the utility
VIDEO DISPLAY CONTROLLERS

• Features
  ▪ Dual link DVI or DP input
  ▪ 2 or more DVI outputs

• Examples
  • CYVIZ XPO.3
  • DataPath X4
  • Pixell VP-4xx
  • Planar Quad Controller
  • Black Diamond Video - DVI splitter
  • Matrox Triple head to Go
  • Etc

330 MHz video bandwidth

Each output up to 165 MHz

1:1 pixel mapping of input to output
VIDEO CONTROLLER VERSUS DP MULTI-STREAM HUB

- **Video Controller**
  - Splits a high resolution video signal across multiple displays
  - Single K5000 could have 4 controllers each splitting 4 ways to give a total of 16 displays

- **Display Port Multi-Stream hub**
  - Video signal for 4 monitors is carried by one Display Port cable
  - Multi-Stream hub routes signal to 4 separate displays
  - Max displays from a single K5000/K6000 using MST is 4!!
36 DISPLAYS DRIVEN BY 9 OUTPUTS

- Planar Quad Controller
- 3840x2160@30z
  - Split to 4 1920x1080 panels

- MOSAIC makes it easy for multi-touch

Image courtesy of Vislogix
NVS 510 DISPLAYPORT 1.2 STREAM CLONING

- Allows 4 Display Heads to drive 16 Displays
  - 4x4 cloned images.

- Primarily used in digital signage markets such as airports, restaurants, and hospitality.
Building a cluster
QUADRO SYNC - HARDWARE + SOFTWARE

- **Hardware**
  - RJ45 - Framelock for synchronization of multiple displays to a common internal sync
  - BNC/Genlock - Framelock for synchronization of multiple displays to a common external house sync

- **Software**
  - Requires application to be written with extensions
  - Swap Group and Swap Barrier are OpenGL & DirectX Extensions that provide enhanced synchronization of the graphics swap buffer.
QUADRO SYNC FEATURES

- Increased Swap Barrier Support
  - Up to 25 Quadro Sync cards in single chain.
  - 50 Quadro Sync cards in a cluster
  - 4 GPUs per Quadro Sync - 200 GPUs with Swap Barrier Support

- Sync Delay and Skew settings
  - Ability to adjust sync delay per Quadro card.

- Control via NVAPI
  - public developer version
  - Example code on how to control Quadro Sync (works with GSyncII)

- Control via NVWMI
  - Allows remote access control across a cluster
When the board boots after shutdown ALL the Sync and Stereo lights turn **Solid Amber**, like at the left

- A reboot will not change the LEDs from the previous state, only a power cycle does
- The LEDs change to the correct status after the driver loads

If there are no LEDs illuminated on system boot, check the power cable
WIRING A CLUSTER

- Connect the nodes with quality CAT 5 cables, no longer than they need to be

- Put the timing server in the middle
  - This system should have the stereo connector for active stereo if needed
EXTERNAL SYNC

- **3 Formats of Sync Sources**
  - TTL: 3.3V, 50% duty cycle, high impedance
  - Bi-Level Composite (NTSC/PAL): 75Ω, ±300mV
  - Tri-Level Composite (HDTV): 75Ω, ±300mV

Grass Valley ADVC G4 (bi/tri level) <= 60Hz

Agilent 3350B (TTL, bi/tri level) variable
CHECKING SYNC STATUS

LEDs on the board
- Frame Lock Sync & Stereo Phase per GPU (not display)
- House/External Sync
  - Solid Green - Present
- Frame Lock connectors
  - Amber Output
  - Green Input

Control Panel
- System Topology Viewer provides per display sync information
SYNC + POWERSHELL

query_sync.ps1

```
=query_sync [-auth] node1 node 2 node 3 ...
```

- `auth` - prompt for username/password

node1.. is the list of machines to query.

Contact us at QuadroSVS@nvidia.com if you want a copy of the script
SYNC + POWERSHELL + NVWMI

- Query Sync
- Set Sync on remote machines
- Monitor Sync events
  - Report to log if framelock status changes.
PARTNER/CUSTOMER PRESENTATIONS

**Tue**
- 3.00pm, Roy Anthony, Kevin Moule - Christie Digital - RM 210G - Virtual Automotive: Projection Mapped Graphics for Automotive Design
- 5.00pm, Tim Woodward, Diamond Visionics - RM 210C - GPU-based Visualization for Flight Simulation.

**Wed**
- 2.00pm Room 2101 - Erik Beaumont, Ventuz - Beyond 4k: Video Walls and Interactive Displays at High Resolutions using multi-machine Clusters

**Thurs**
- 2.00pm Room 211A - Julian Berta, MechDyne - Stereo3d Video Streaming for Remote Collaboration
- 2.30pm Room 211A - Raj Surati, Scalable Display Technologies - Mid-tier VR: Cost Reducing the Cave by Embracing the GPU
EXHIBITORS

- Workstation OEMS
  - HP
  - Dell
  - Lenovo
  - Boxx Technologies
  - Exxact Corp
  - GraphStream

- Display/Software
  - IGI (#932)
  - Scalable Display Technologies
  - VizRT
  - RTT
SUMMARY/QUESTIONS

- Quadro SVS
  - Reduces complexity.
  - Contact us at QuadroSVS@nvidia.com
$namespace = "root\CIMV2\NV" # Namespace of NVIDIA WMI provider
$class    = "DisplayManager" # class to be queried
$computer = "localhost"       # substitute this values with remote machine names or IP of the
$executionTime = 3            # Allow a delay of 3 seconds for execution of the method
$displayManagerInstance = Get-WmiObject -class $class -computername $computer -namespace $namespace

# Validate the Grids first
$method    = "validateDisplayGrids"
$grids     = @()
$grids    += "rows=1;cols=2;stereo=0;layout=0.0 0.1;mode=1600 1200 32 60" #add grid 1 parameters
$grids    += "rows=1;cols=2;layout=1.0 1.1;mode=1280 1024 32 60"           #add grid 2 parameters
$params   = $displayManagerInstance.GetMethodParameters($method)
$params.grids = $grids

#Validate the Grids
Start-Sleep $executionTime
"Calling $classname.$method()"
$result= $displayManagerInstance.InvokeMethod($method,$params,$null)
$result

if($result.ReturnValue)
{
    #Validation passed now create the DisplayGrids
    $method="createDisplayGrids"
    Start-Sleep $executionTime
    "Calling $classname.$method()"
    $result= $displayManagerInstance.InvokeMethod($method,$params,$null)
    $result
}