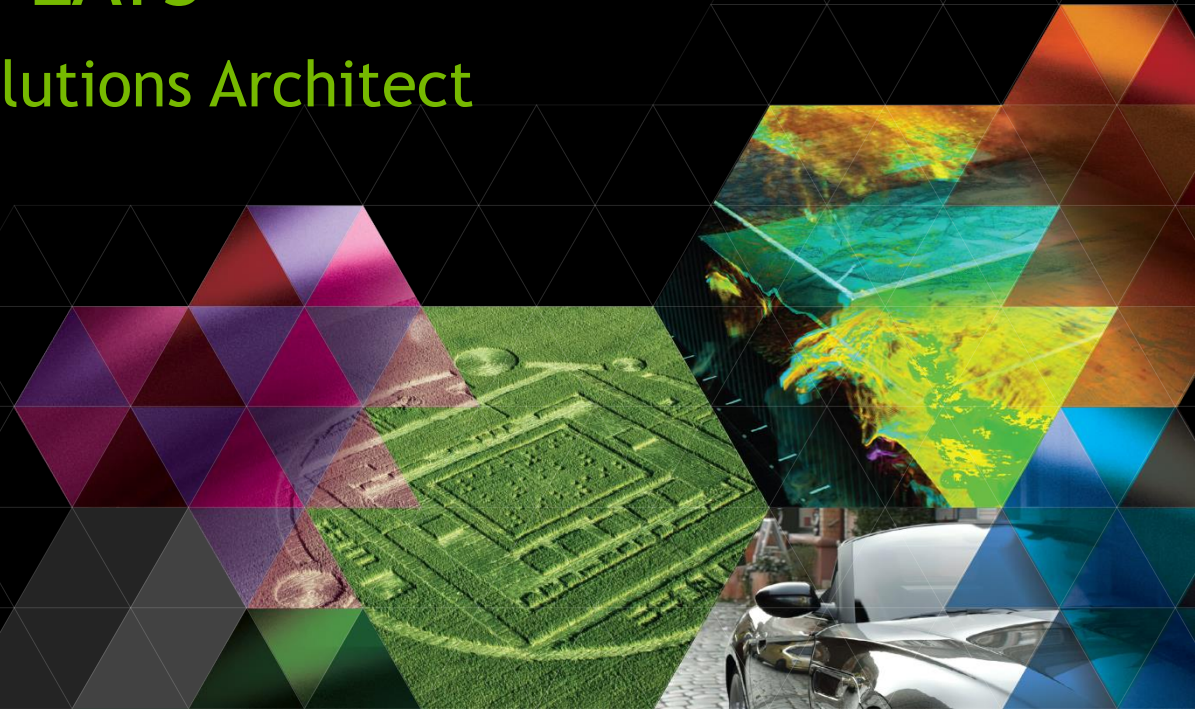


# S4671 - SEE THE BIG PICTURE: SCALABLE VISUALIZATION SOLUTIONS FOR HIGH RESOLUTION DISPLAYS

Doug Traill - Senior Solutions Architect



# LARGE FLAT WALL DISPLAYS



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

## MOSAIC

Creating a single unified Desktop

Up to 16 Displays

Supported on Quadro + NVS

Linux, Windows 7 + Windows 8

# 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



Image Courtesy of BARCO/Elbit Systems - 4k cluster

## Quadro Sync

Up to 50 Quadro Sync cards in a cluster

Control via NVAPI

Control + Monitor using NVWMI



# 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

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

# MOSAIC - WHY IS IT NEEDED?

- WINDOWS ON ITS OWN - INDEPENDENT DESKTOPS



# WINDOWS ON ITS OWN

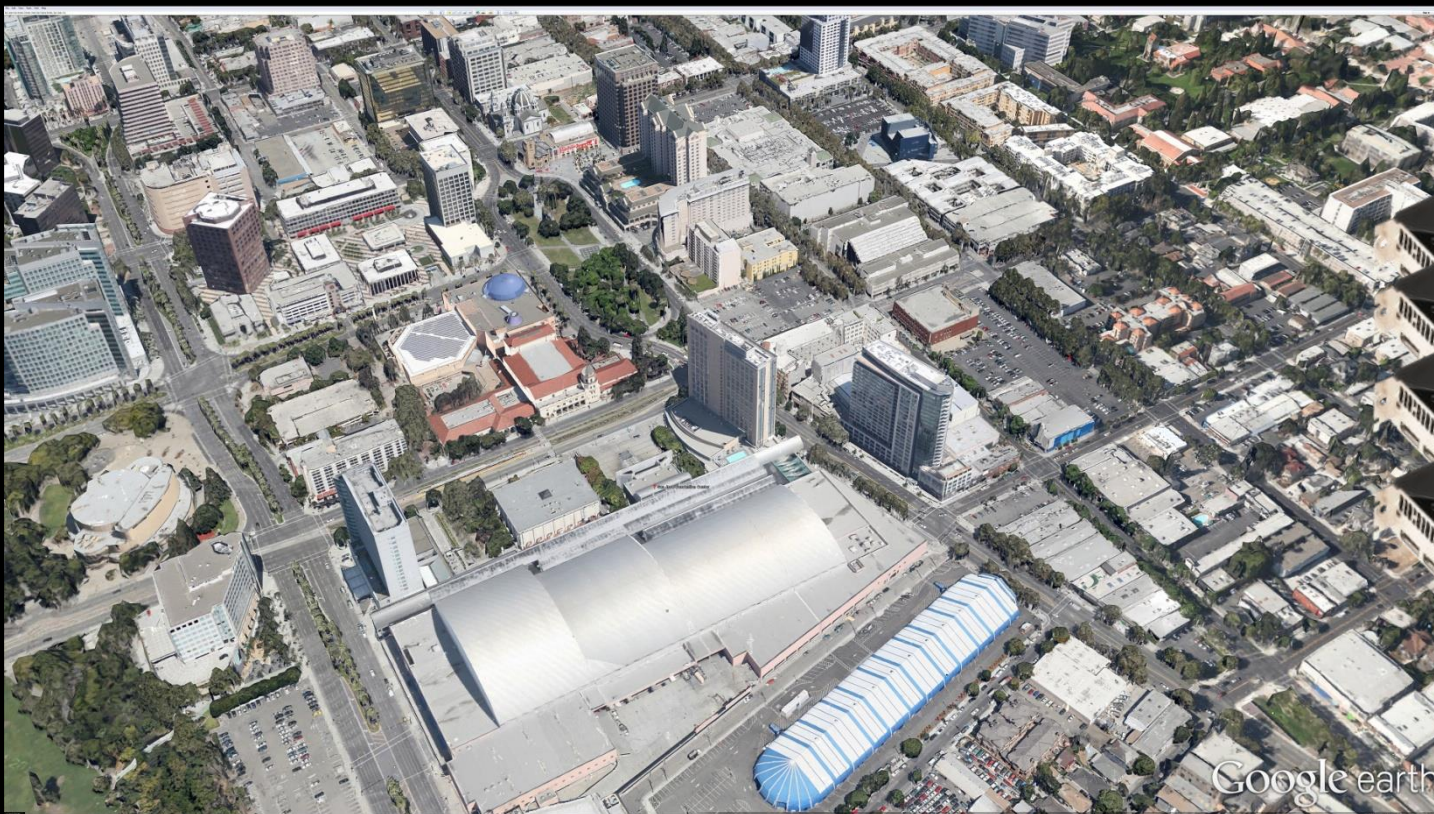
- INDEPENDENT DESKTOPS





# 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

	Number of Synchronized displays/projectors from a single system with MOSAIC				
GPU Options	Up to 2	Up to 4	Up to 8	Up to 12	Up to 16
K6000	1 GPU	1 GPU	SLI (2GPUs) or 2GPUs + Quadro Sync	3GPUs + Quadro Sync	4GPUs + Quadro Sync
K5000	1 GPU	1 GPU	SLI (2GPUs) or 2GPUs + Quadro Sync	3GPUs + Quadro Sync	4GPUs + Quadro Sync
Q5000	1 GPU	SLI (2GPUs)			
Q6000	1 GPU	SLI (2GPUs)			
Quadro Plex 7000	1 System	1 System	2 Systems + DHIC		

- 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](http://www.nvidia.com/object/quadro_sli_compatible_systems.html)

\*XP - R319 is last released driver branch

# SIDE NOTE - ON MOSAIC NAMING

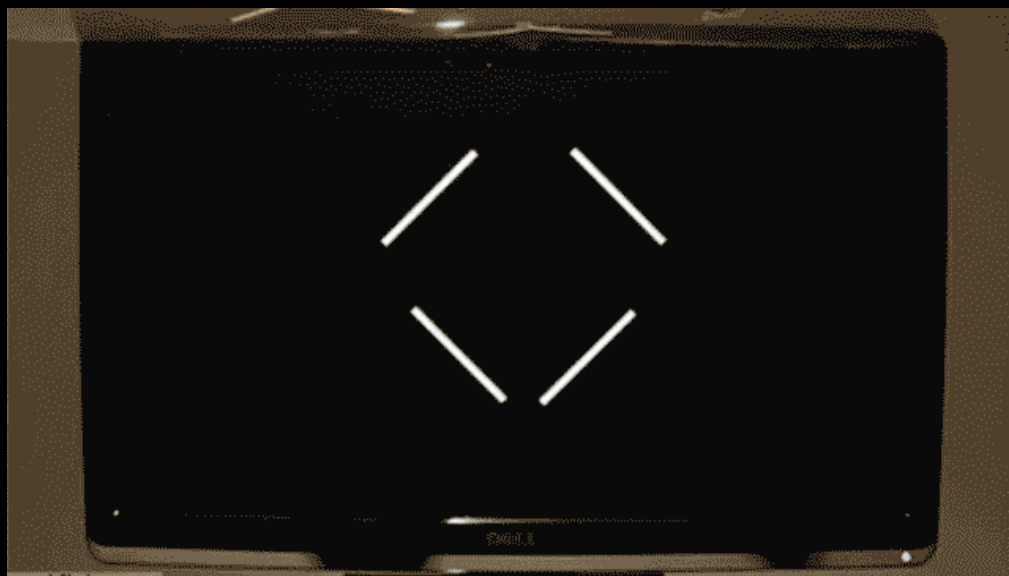
Display Card	Windows	Linux	Notes
1 NVS510	MOSAIC	metatmodes	Bezel correction - no overlap
Multiple NVS510	MOSAIC	Option "BaseMOSAIC"	Bezel correction - no overlap
Single K4000	MOSAIC	metatmodes	Bezel correction - no overlap
Multiple K4000s	MOSAIC	Option "BaseMOSAIC"	Bezel correction - no overlap
1 K5000	Premium MOSAIC MOSAIC with Sync	Metamodes	Over lap supported
Two K5000s (no SLI or Sync)	MOSAIC	Option "BaseMOSAIC"	Bezel correction - no overlap
Two K5000s with SLI or Quadro Sync	Premium MOSAIC MOSAIC with Sync	Option "SLI" "MOSAIC"	Overlap support. Even using Quadro Sync its called "SLI" "MOSIAC"



# Synchronization

Focus on the image and not the artifacts

# WHY IS SYNC IS IMPORTANT?



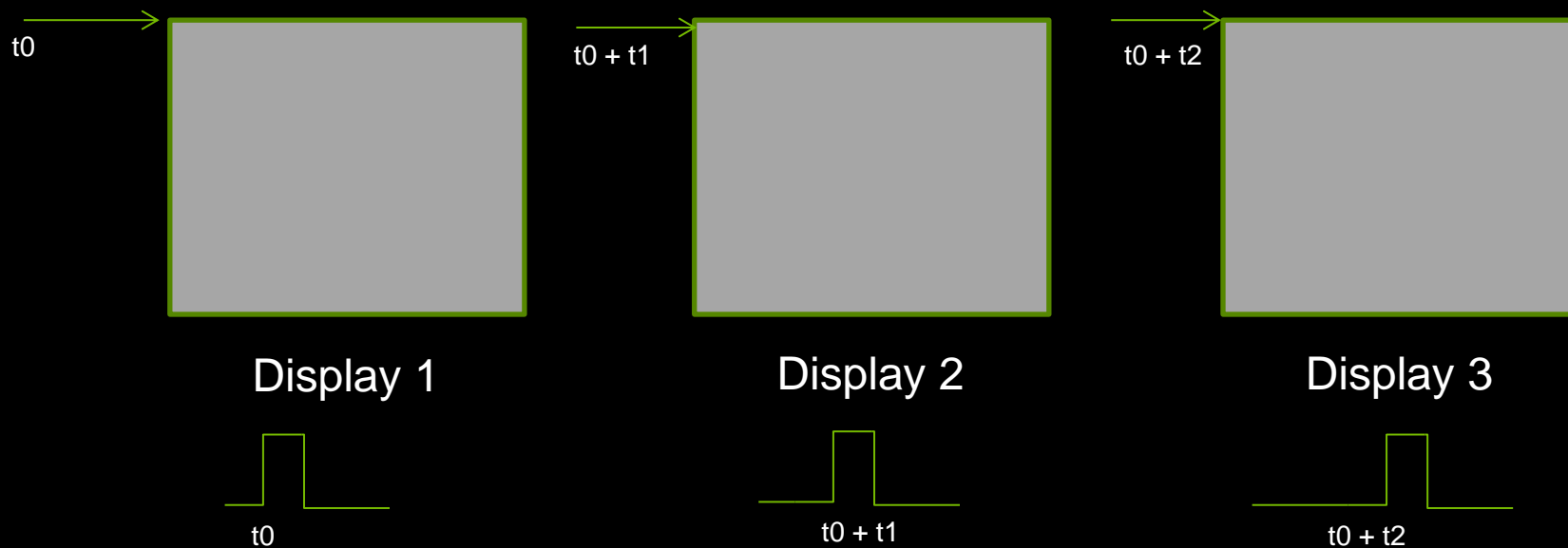
Bezel's hide sync issues !!!

Image from [gizmodo.com](http://gizmodo.com)

# MULTI-GPU SYNC

- Framelock
- Stereo lock
- Swap lock

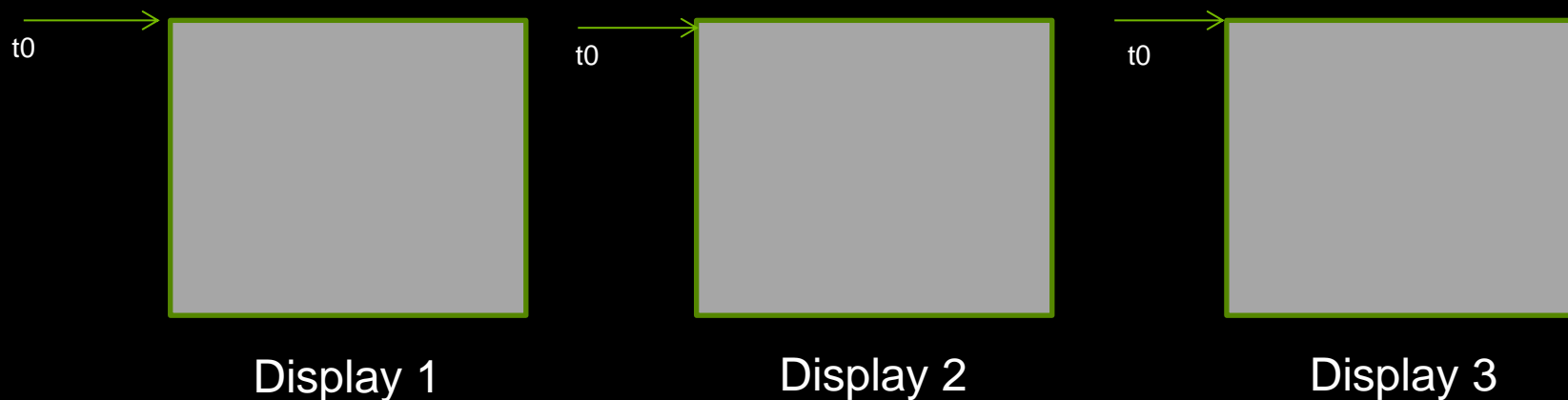
# VERTICAL SYNC



- *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.

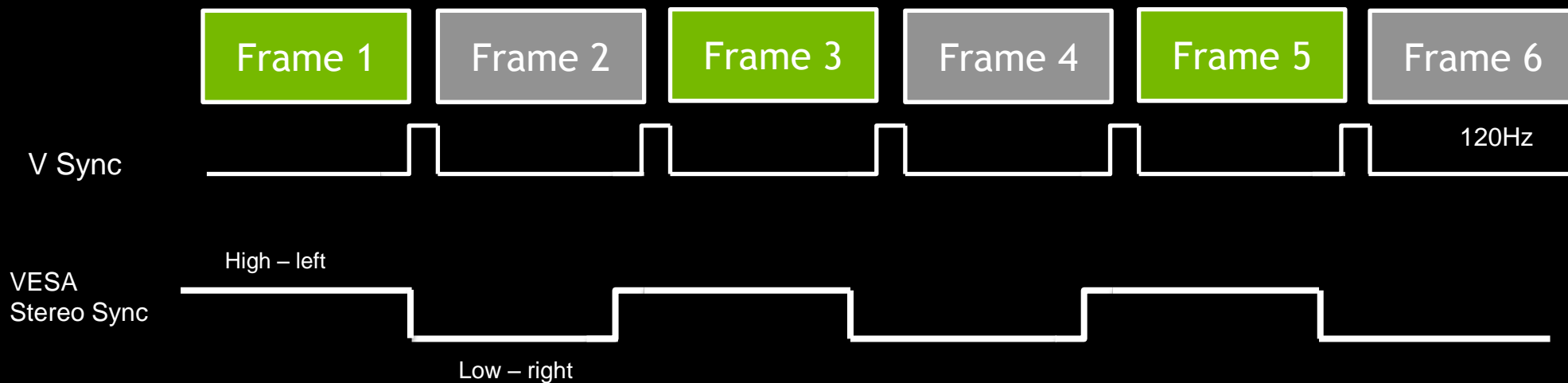


# FRAMELOCK/GENLOCK



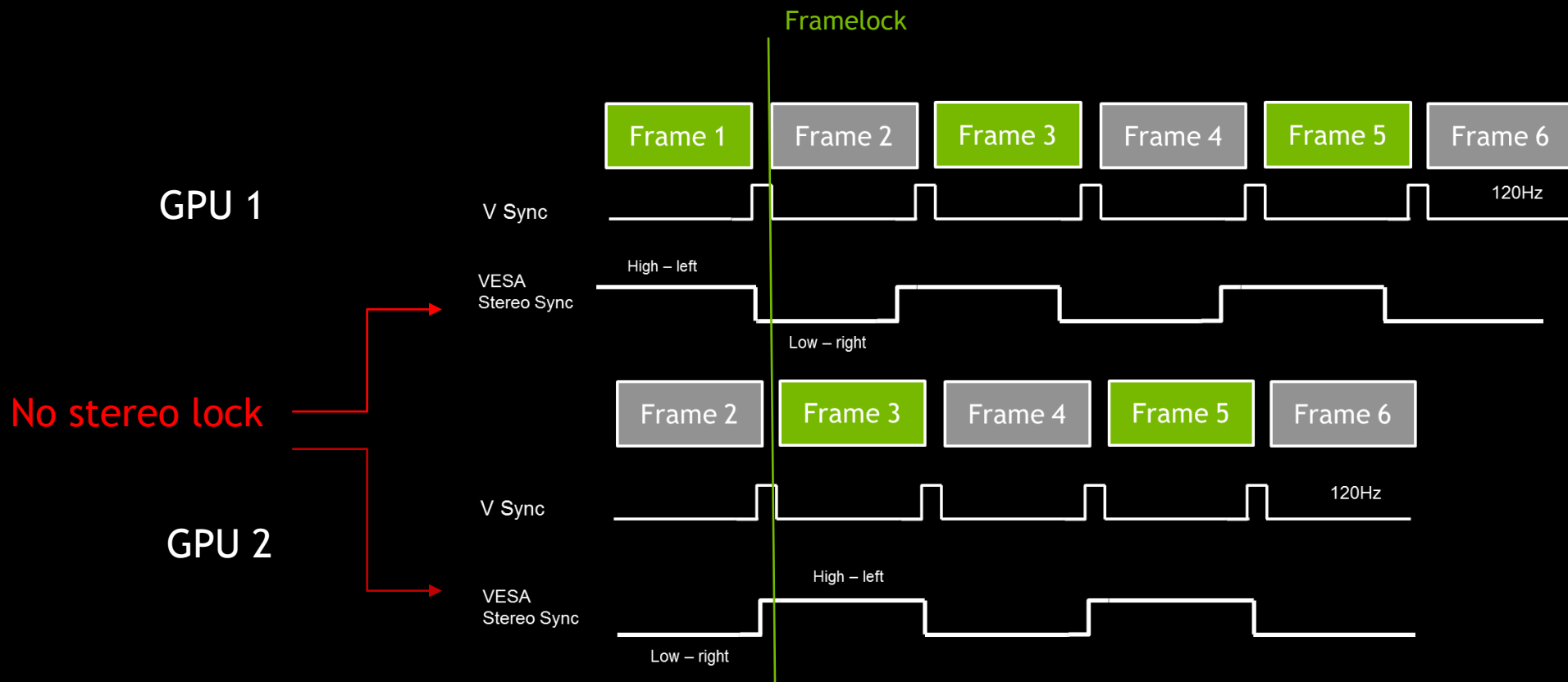
- *Frame Lock/Gen Lock* provides a common sync signal between graphics cards to insure the vertical sync pulse starts at a common start.
- This is commonly referred to as *Frame Synchronization*
- *Frame Lock* - Synchronization is generated from a master node. All other nodes would be sync to this.
- *Genlock* - synchronization is from an external sync generator (house sync). Each node attached to the genlock signal is synced from that signal.
- *Frame Lock & Genlock* can be mixed in the cluster. With the master node being synchronized from the genlock pulse

# STEREO LOCK



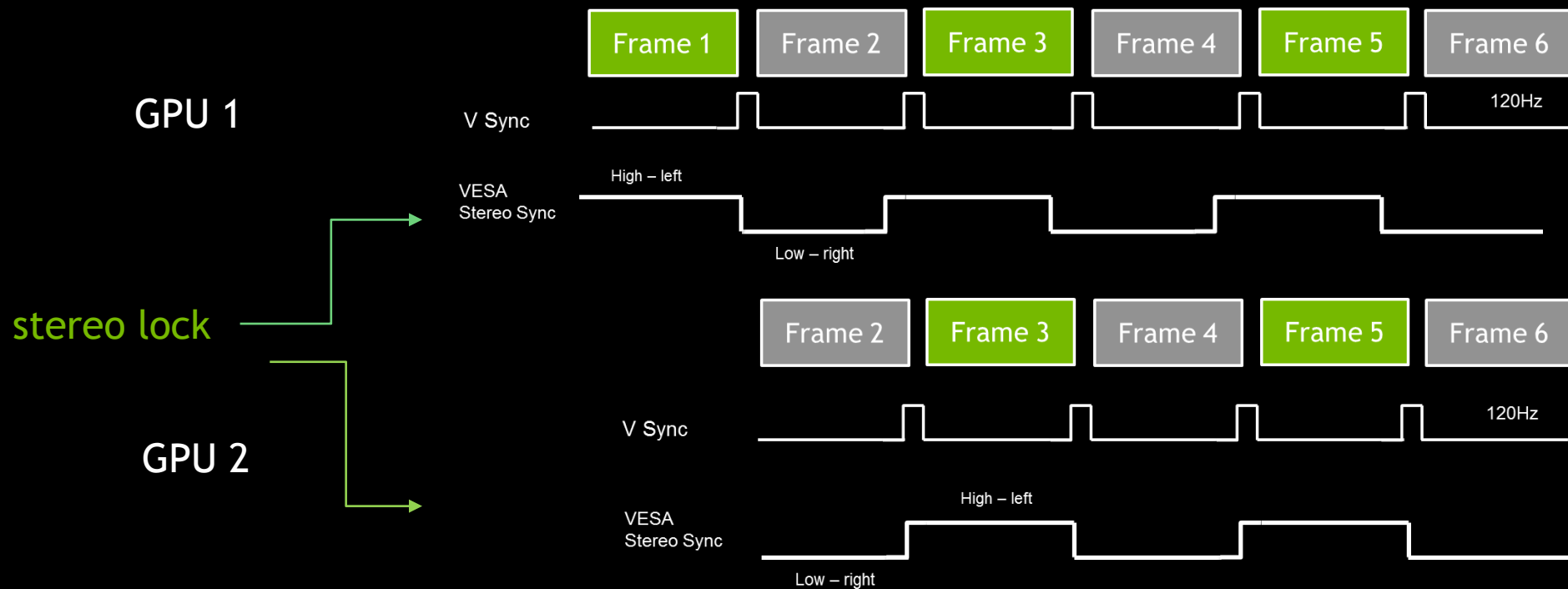
No information that tells a display or stereo glasses which eye is left or right

# STEREO LOCK



This will result in eyes being swapped between displays

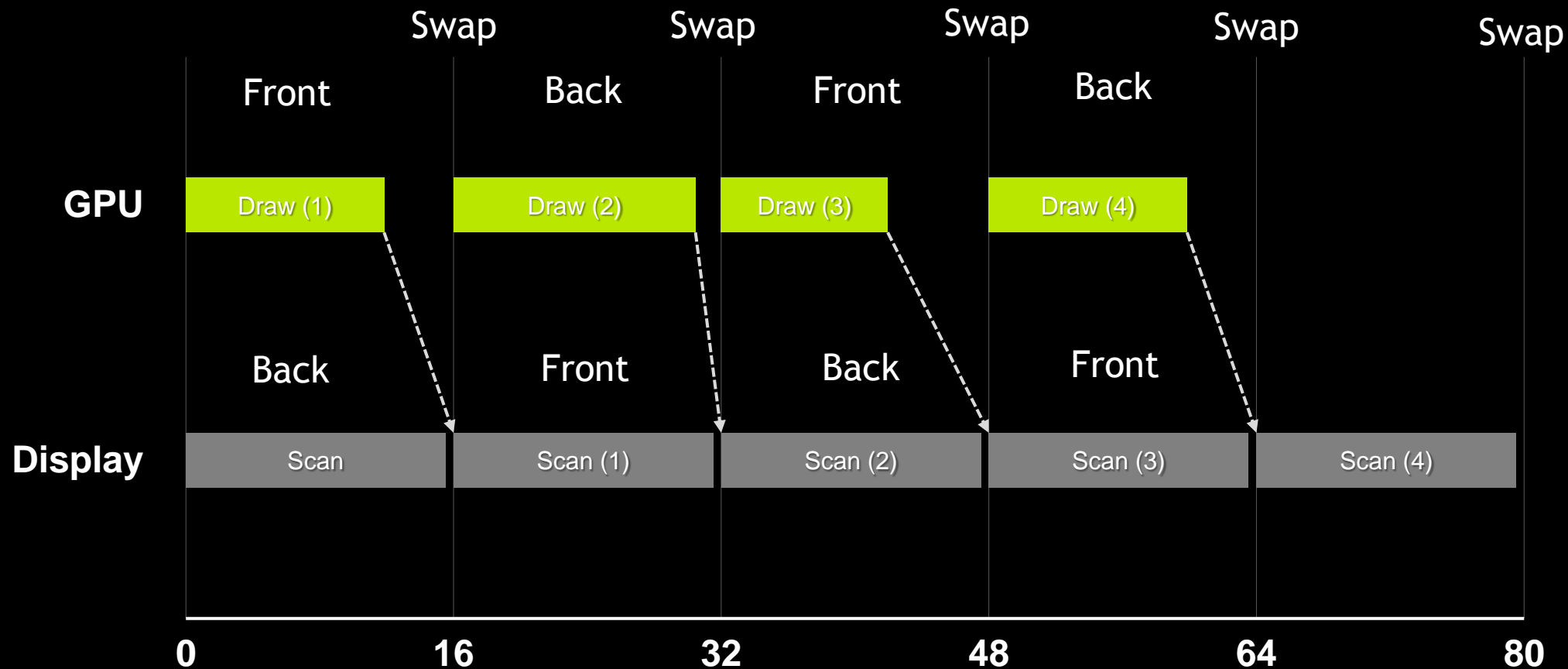
# STEREO LOCK



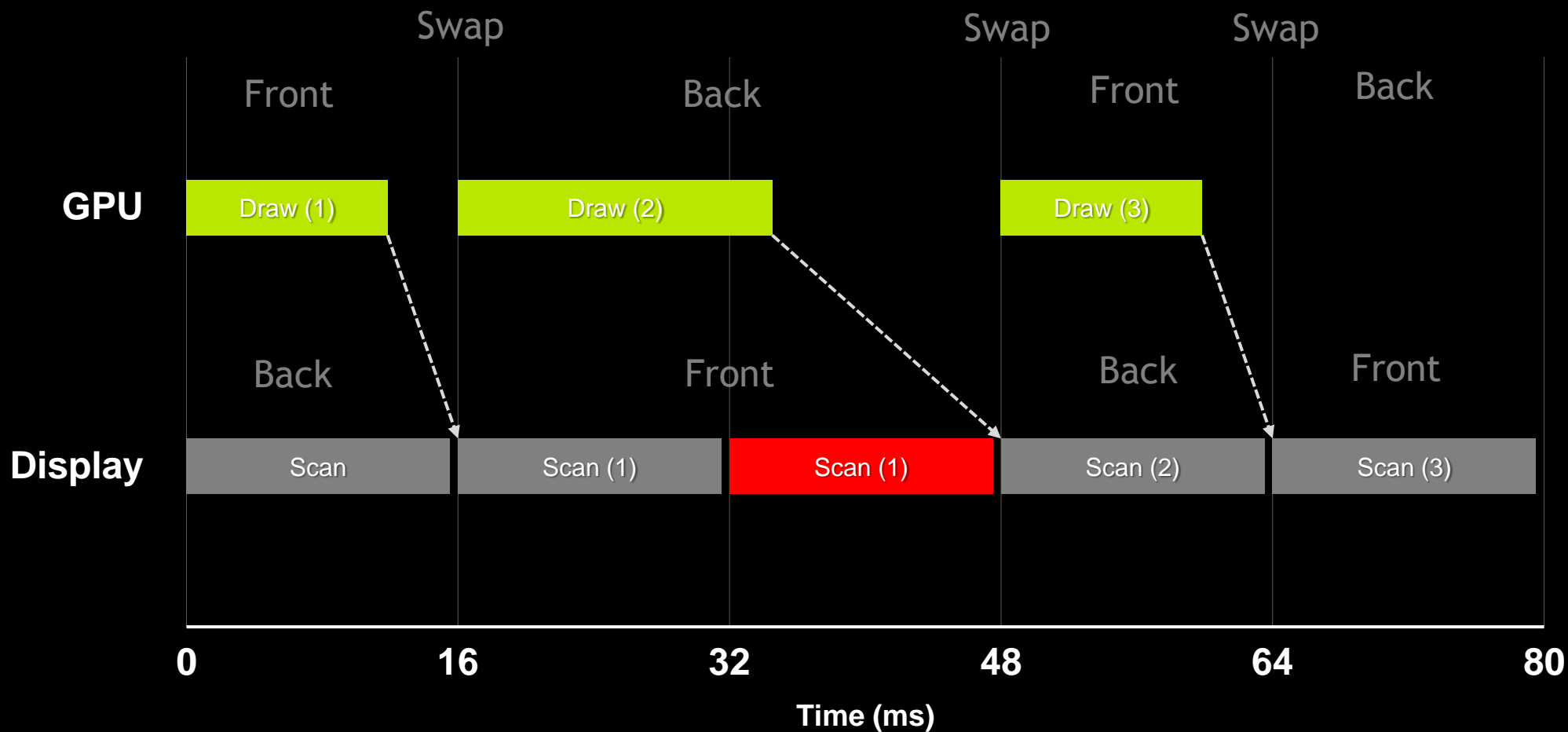
Stereo sync is in phase between GPUs



# SWAPBUFFERS



# SWAPBUFFERS



# SWAPBUFFERS IN A CLUSTER



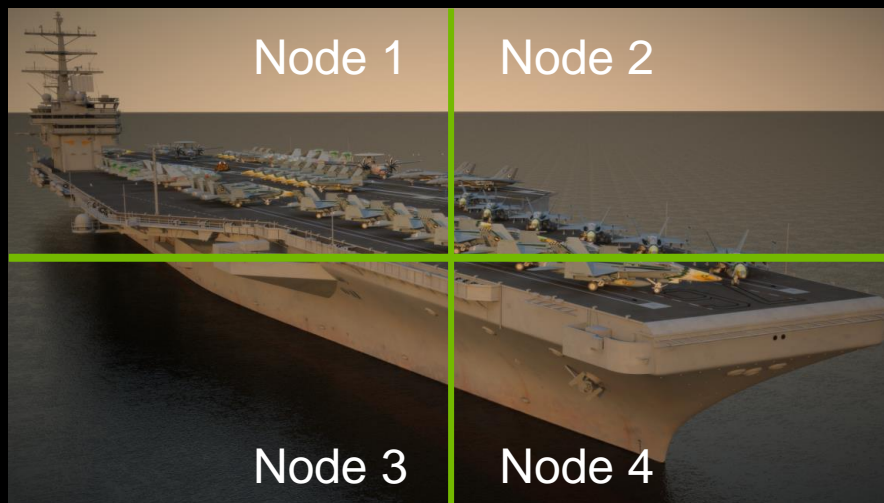
Each node is now rendering a scene with different complexity i.e from least to highest we get:

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 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

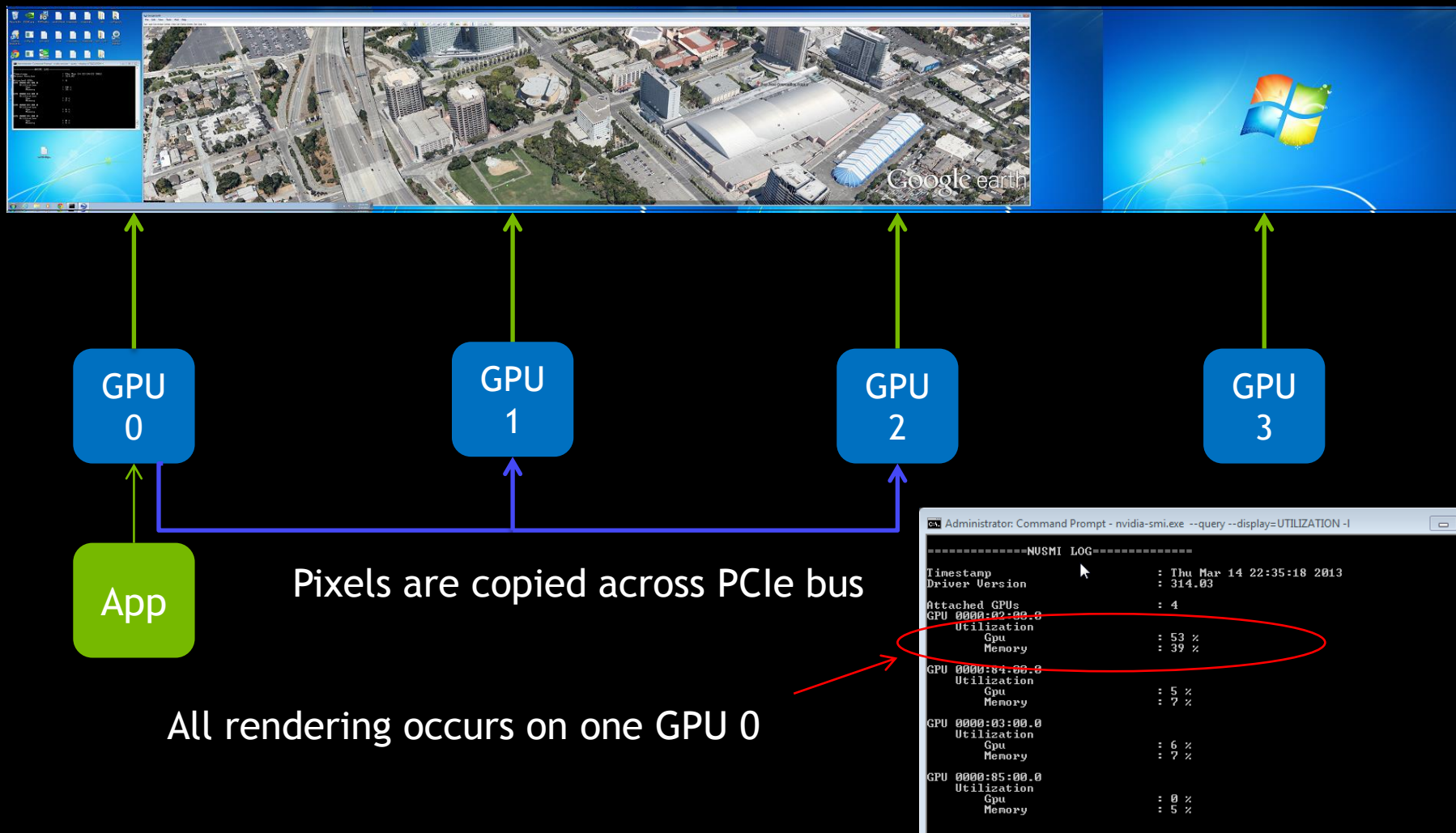


With *Swap Barrier* each node will wait until all nodes have completed their render

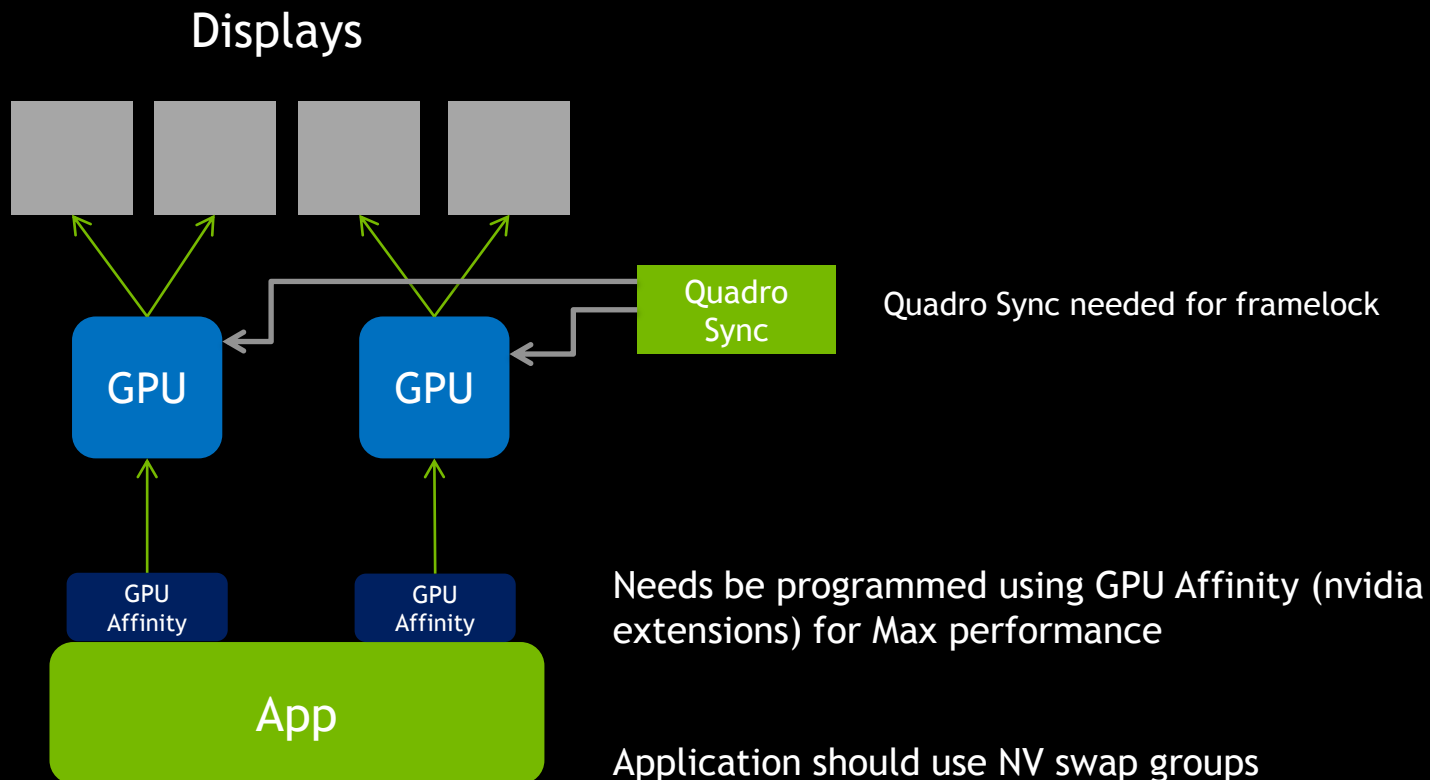
1. node 3 ~ 16ms = 10fps
2. node 4 ~ 36ms = 10fps
3. node 2 ~ 53ms = 10fps
4. node 1 ~ 99ms = 10fps



# LET THE OS MANAGE MULTIPLE DISPLAYS

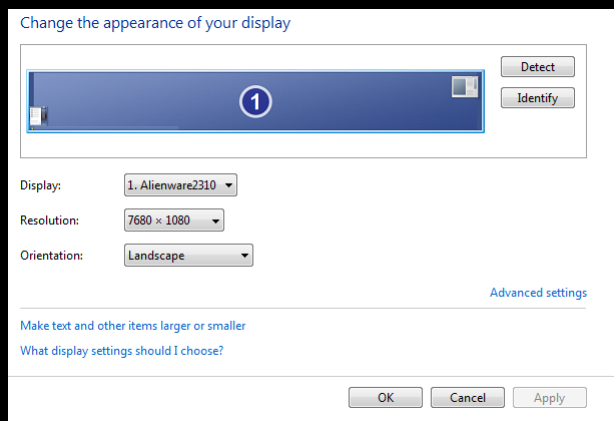
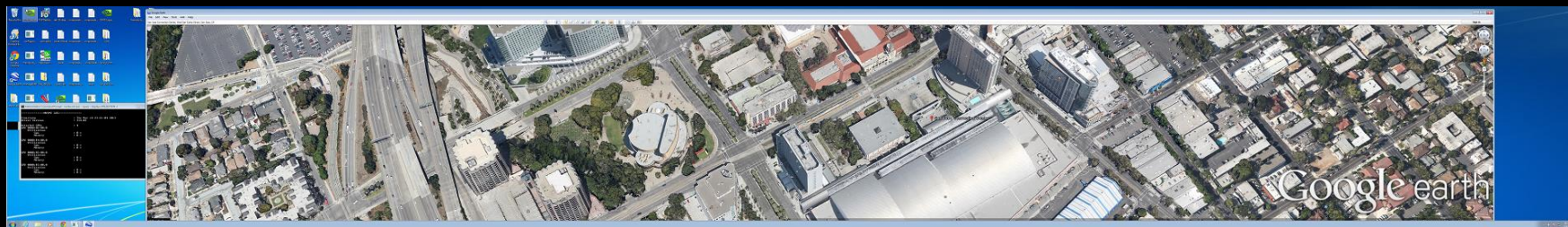


# APPLICATION WITH GPU AFFINITY



Application needs to be multi-threaded  
(4 Draw threads)

# MOSAIC HIDES THE COMPLEXITY



Logical GPU

App

```
Administrator: Command Prompt - nvidia-smi.exe --query --display=UTILIZATION -I
=====NUSMI LOG=====
Timestamp                               : Thu Mar 14 23:22:54 2013
Driver Version                           : 314.03
Attached GPUs                             : 4
GPU 0000:02:00.0
  Utilization                             :
    Gpu                                   : 10 %
    Memory                                : 7 %
GPU 0000:84:00.0
  Utilization                             :
    Gpu                                   : 10 %
    Memory                                : 7 %
GPU 0000:03:00.0
  Utilization                             :
    Gpu                                   : 10 %
    Memory                                : 7 %
GPU 0000:85:00.0
  Utilization                             :
    Gpu                                   : 10 %
    Memory                                : 7 %
```

# 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

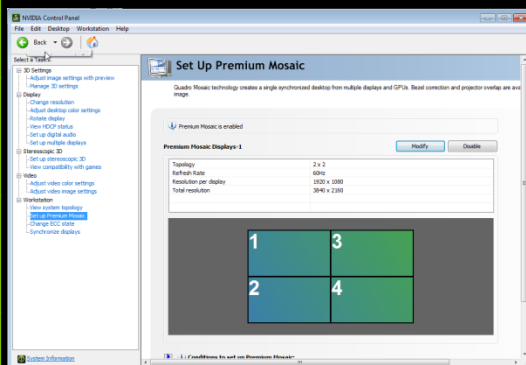
- Approaches the problem differently
  - GSYNC is a module put into the display
  - Currently vsync tells GPU when to update
  - Gsync tells the display when to update
- Currently only works for single displays attached
- Future version may support multiple displays.



# MOSAIC

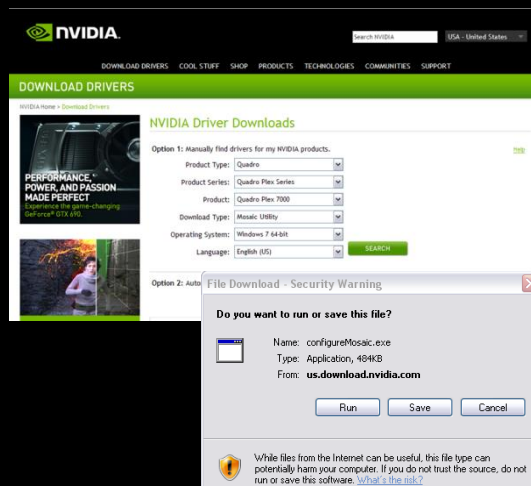
Setup and configuration

# SETTING UP MOSAIC



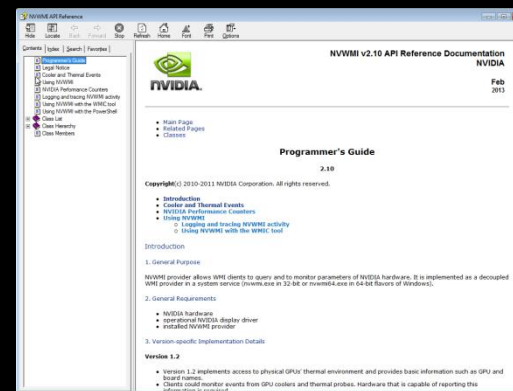
Control Panel

Driver Install

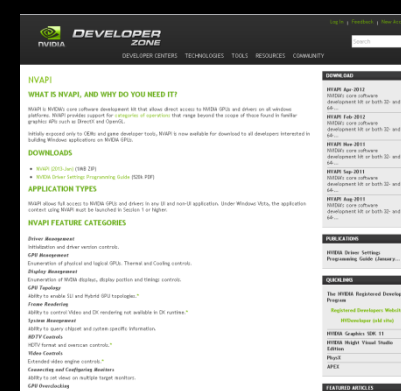


Configuremosaic

Large display walls

Download from  
NVIDIA driver  
section

NVWMI

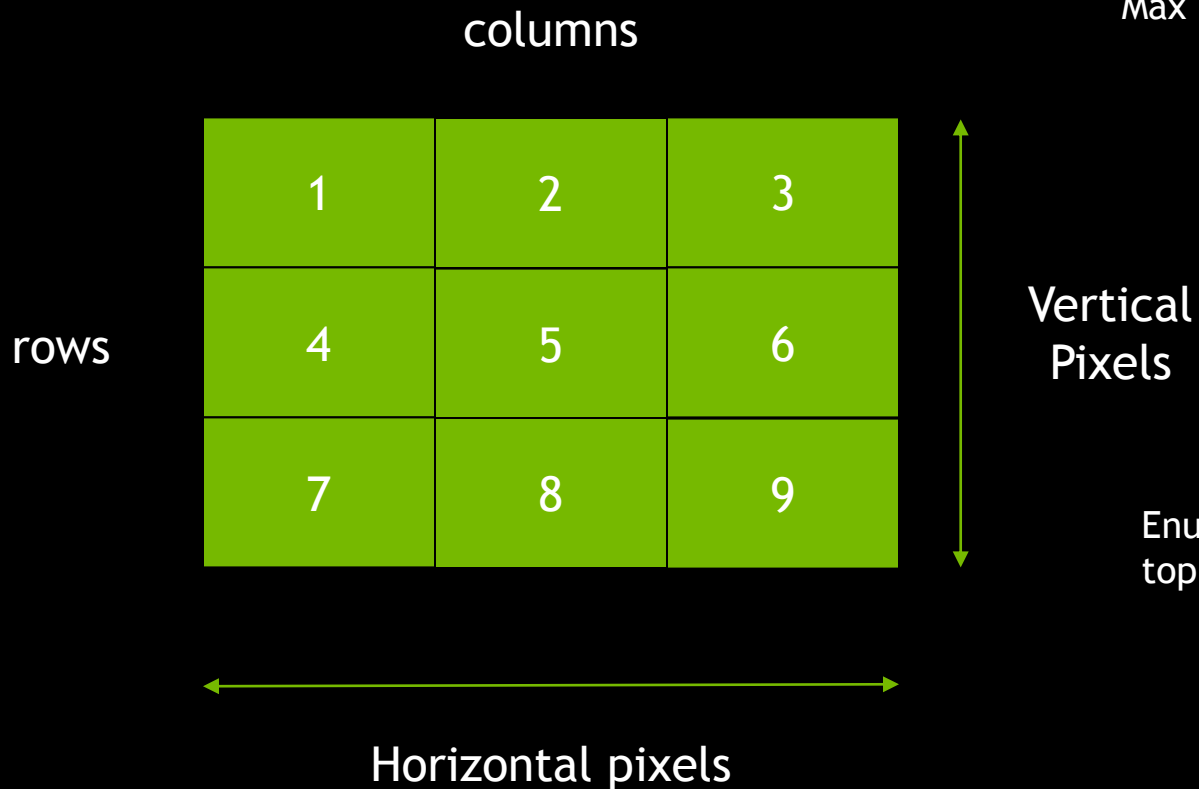
Setup from a remote machine  
Powershell scripts  
Program directlyInstall with Driver -  
under advanced  
options

NVAPI

Incorporate MOSAIC  
setup into your own  
applicationRegistered  
Developer for NDA  
access NVAPI



# MOSAIC GRIDS



Rows x columns  $\leq 16$   
Max Horizontal or vertical Pixels  $\leq 16384$

Enumeration of the Grid always starts  
top left and goes left to right

# UNDERSTANDING TOPOLOGIES

Column overlap or bezel correction

Row  
Overlap or  
Bezel correction

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

Bezel correction will  
increase overall pixel size

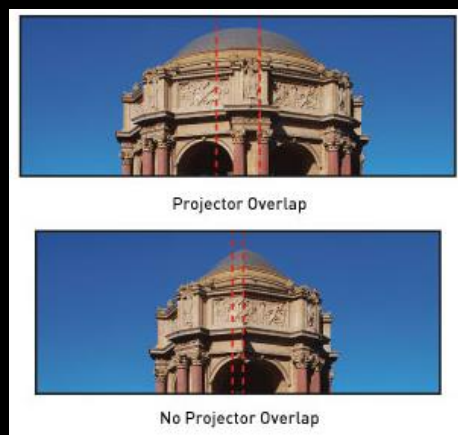
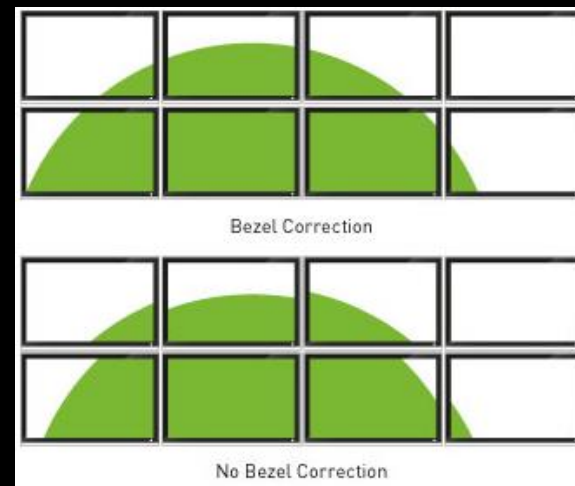
i.e each display is 1920x1080  
Bezel per column is 100

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

Overlap correction will  
decrease overall pixel size

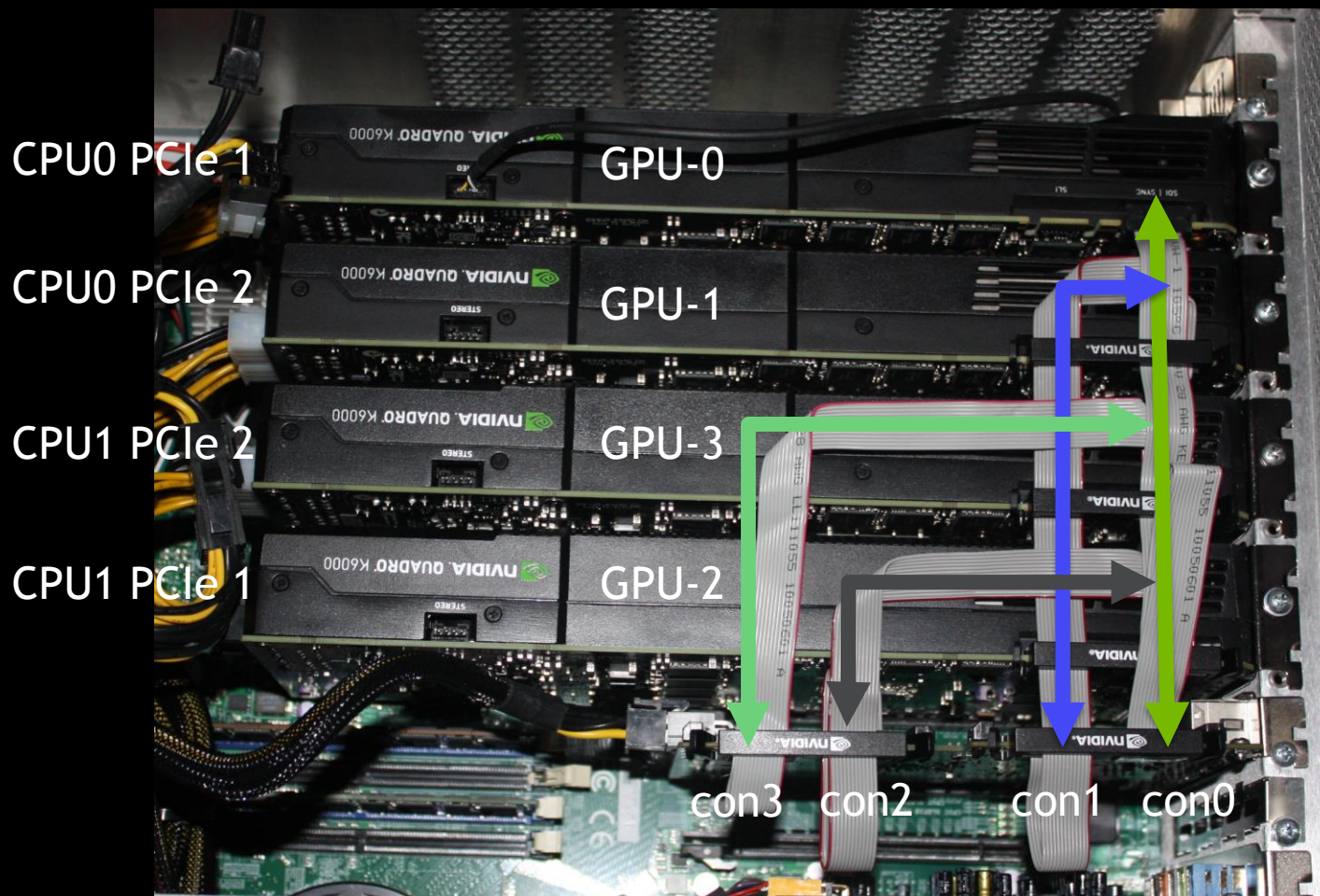
# BEZEL AND OVERLAP CORRECTION

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



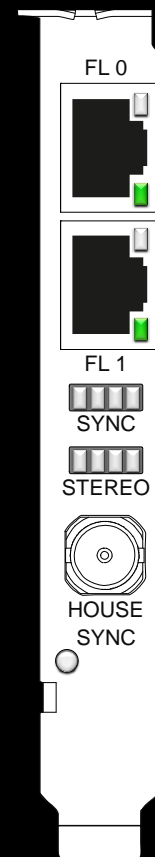
- Overlap Correction
  - For projectors it maintain the Aspect Ratio of the display.

# ANATOMY OF A SYSTEM



stereo sync bracket

Quadro Sync card



# REAR PANEL - BOXX 8950 - 4 K6000S

VESA Stereo Bracket

GPU 0

GPU 1

GPU 3

GPU 2

Quadro Sync



Slot 2

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

K6000 - Master GPU will have a green LED  
after POST

Slot 4

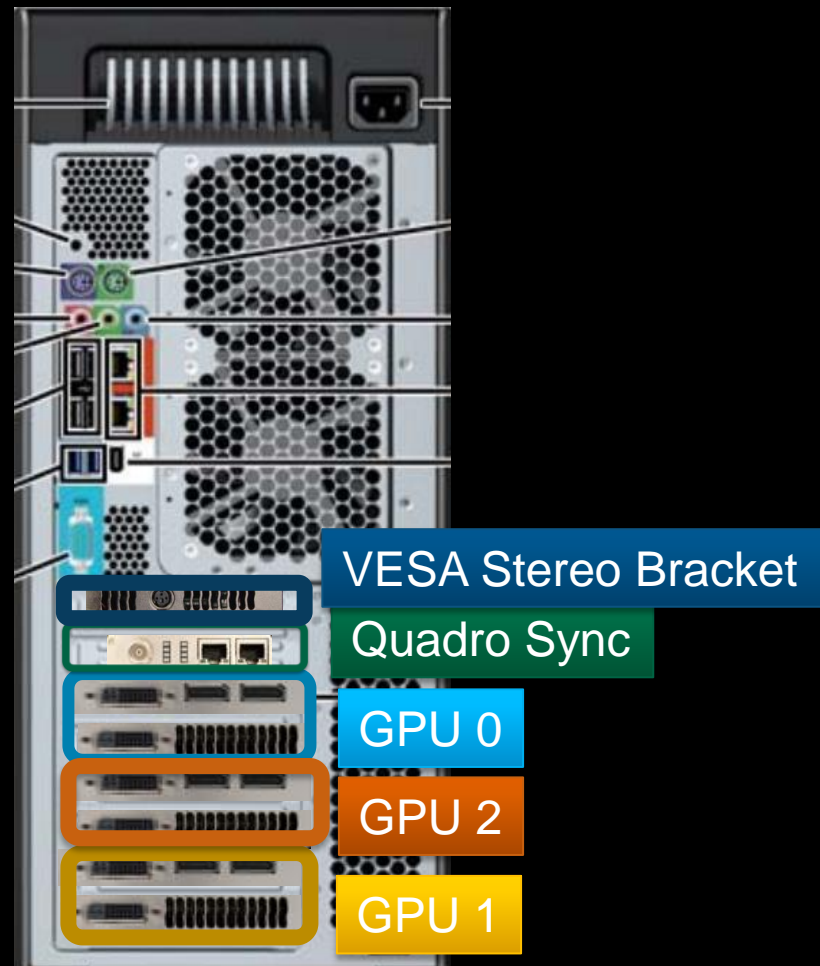
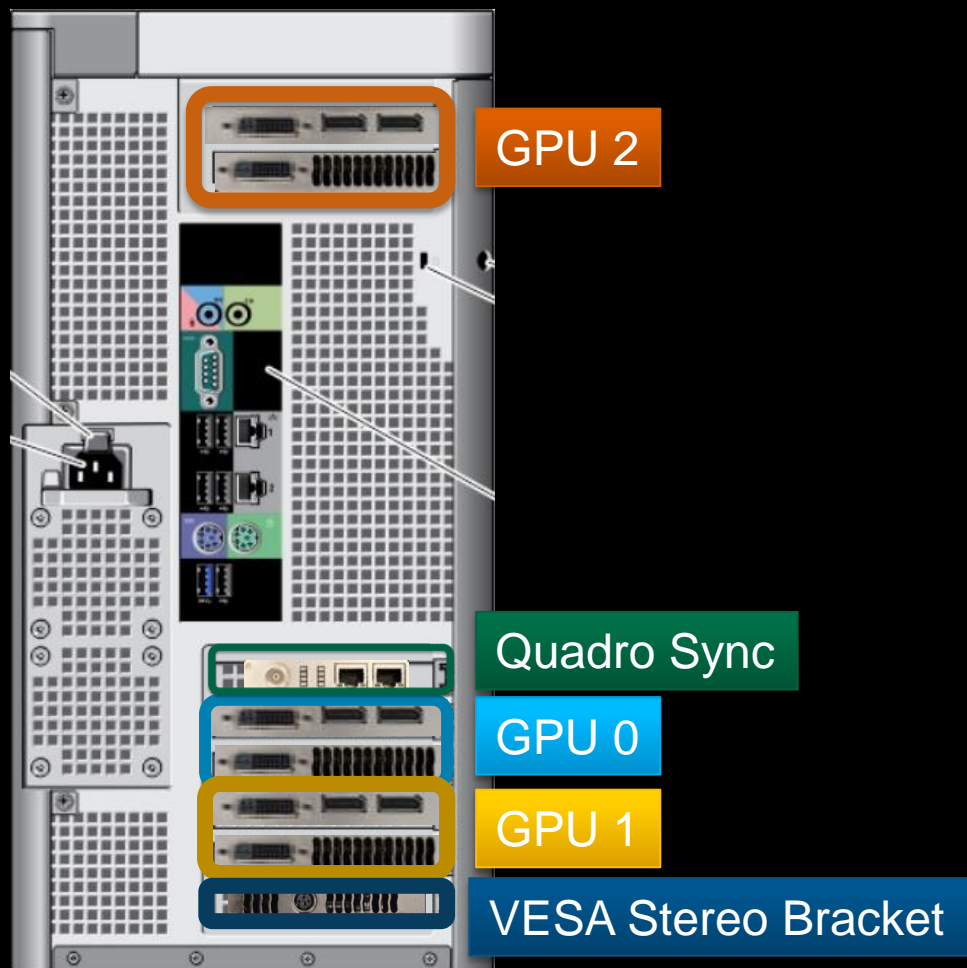
Slot 6

Slot 8

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

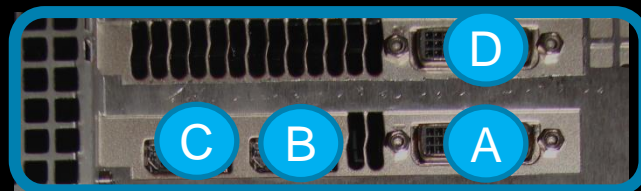


# DELL T7600 + HP Z820

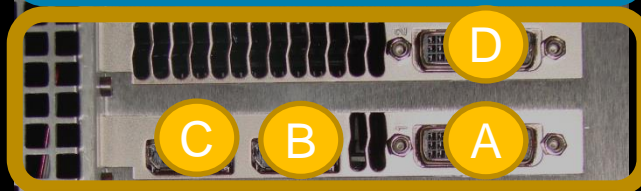


# PORT NUMBERING

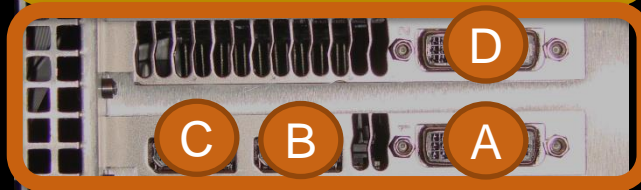
GPU 0



GPU 1



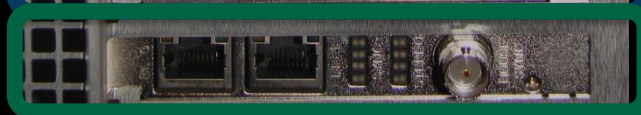
GPU 2



VESA Stereo Bracket



Quadro Sync



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

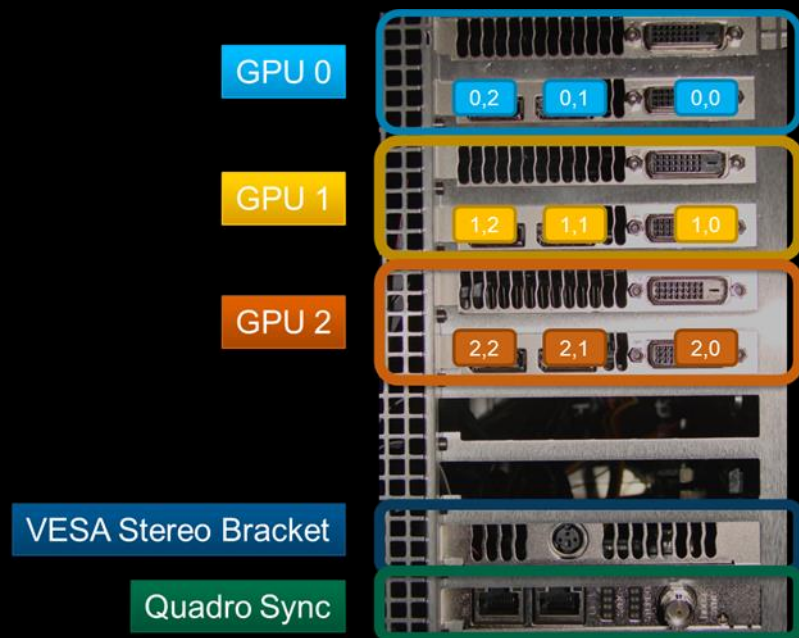
B = 2,1

C = 2,2

D = 2,3



# RELATING PORTS TO GRID

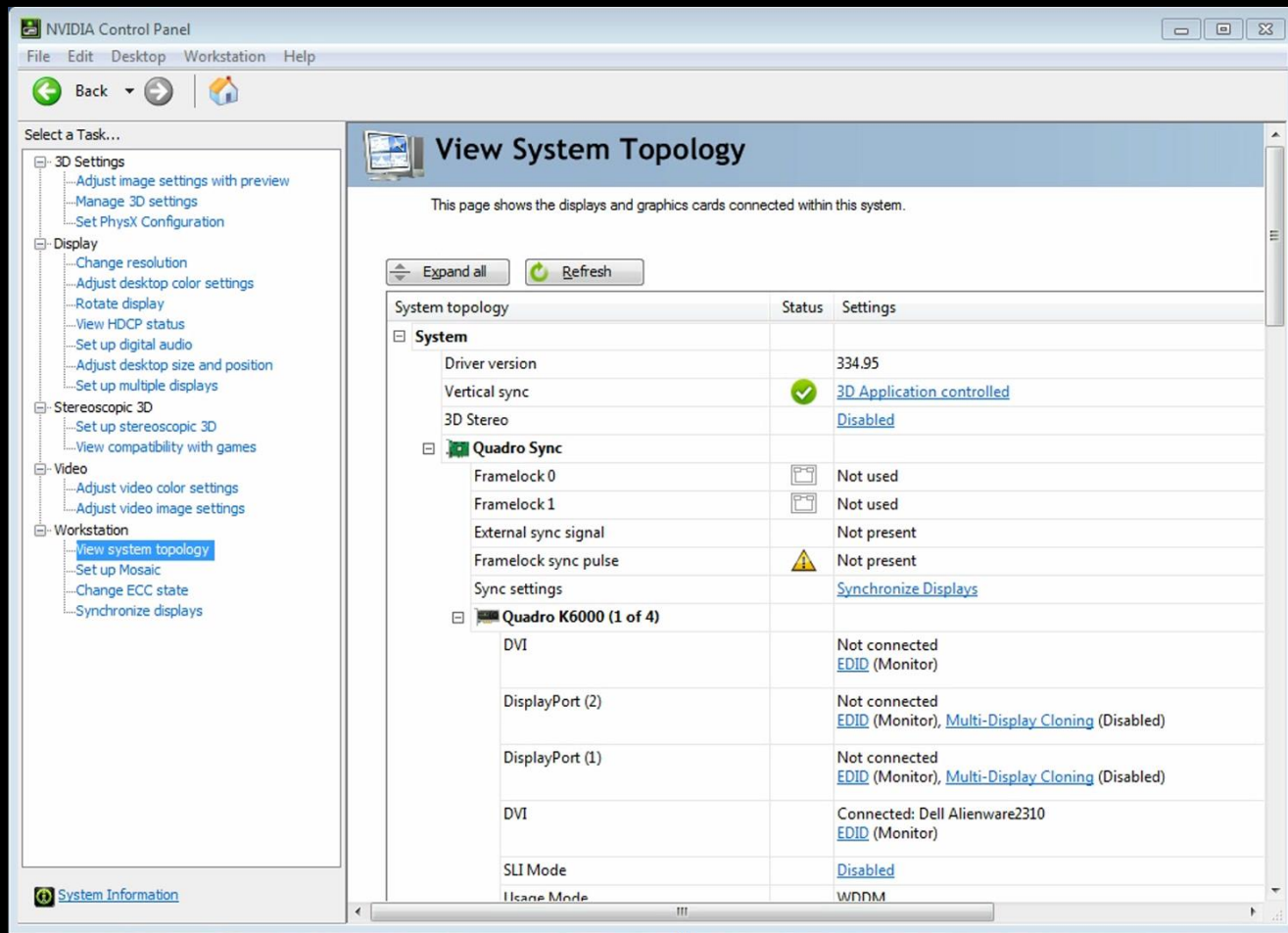


`configureMosaic.exe set rows=3 cols=3`

`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`

1 2 3 4 5 6 7 8 9

# MANAGE EDID



**NVIDIA Control Panel**

File Edit Desktop Workstation Help

Back

Select a Task...

- 3D Settings
  - Adjust image settings with preview
  - Manage 3D settings
  - Set PhysX Configuration
- Display
  - Change resolution
  - Adjust desktop color settings
  - Rotate display
  - View HDCP status
  - Set up digital audio
  - Adjust desktop size and position
  - Set up multiple displays
- Stereoscopic 3D
  - Set up stereoscopic 3D
  - View compatibility with games
- Video
  - Adjust video color settings
  - Adjust video image settings
- Workstation
  - View system topology**
  - Set up Mosaic
  - Change ECC state
  - Synchronize displays

**View System Topology**

This page shows the displays and graphics cards connected within this system.

Expand all Refresh

System topology	Status	Settings
<b>System</b>		
Driver version		334.95
Vertical sync	✓	<a href="#">3D Application controlled</a>
3D Stereo		<a href="#">Disabled</a>
<b>Quadro Sync</b>		
Framelock 0	📁	Not used
Framelock 1	📁	Not used
External sync signal		Not present
Framelock sync pulse	⚠	Not present
Sync settings		<a href="#">Synchronize Displays</a>
<b>Quadro K6000 (1 of 4)</b>		
DVI		Not connected <a href="#">EDID</a> (Monitor)
DisplayPort (2)		Not connected <a href="#">EDID</a> (Monitor), <a href="#">Multi-Display Cloning</a> (Disabled)
DisplayPort (1)		Not connected <a href="#">EDID</a> (Monitor), <a href="#">Multi-Display Cloning</a> (Disabled)
DVI		Connected: Dell Alienware2310 <a href="#">EDID</a> (Monitor)
SLI Mode		<a href="#">Disabled</a>
Hydra Mode		WDDM

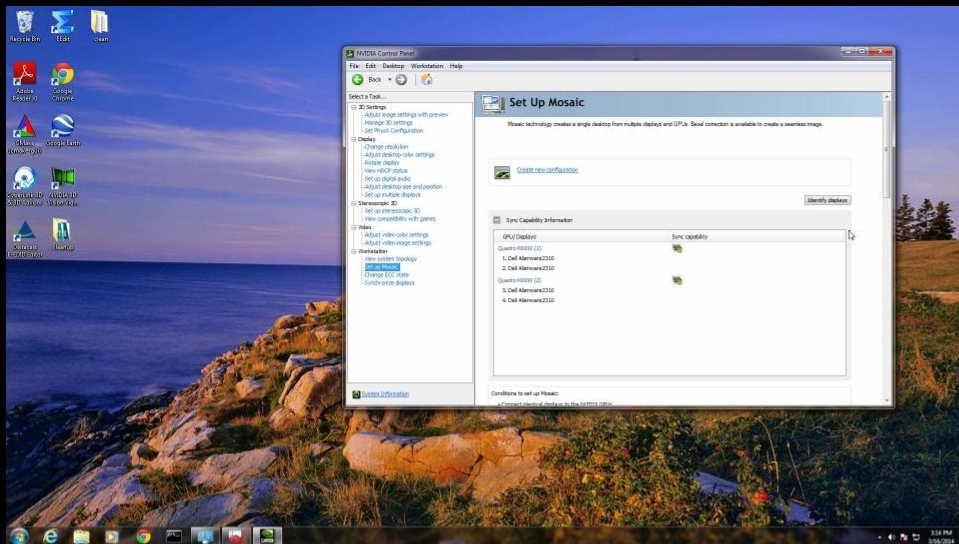
**System Information**

## 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.

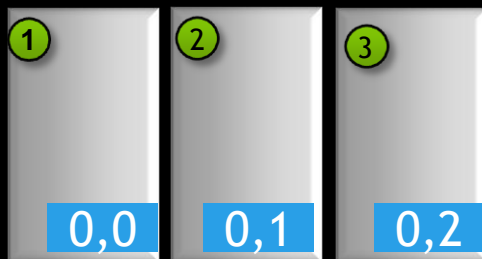


# GPU TECHNOLOGY CONFERENCE



# 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 ;-)



Rotate values

90  
180  
270

`configureMosaic set rows=1 cols=3 rotate=90`

# QUADRO DISPLAY OUTPUTS



K5000



K6000

- 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



- DP to DVI dongle
- DP to DVI dongle
- Native DVI
- Native DVI

Up to 4 Single link or Dual Link\* DVI



- DP to HDMI dongle
- DP to HDMI dongle
- DVI to HDMI
- DVI to HDMI

4 HDMI



DVI to HDMI adaptor



DP to HDMI adaptor



- DP
- DP

2 Display Port displays or  
4 Display Ports using MST\*\*.

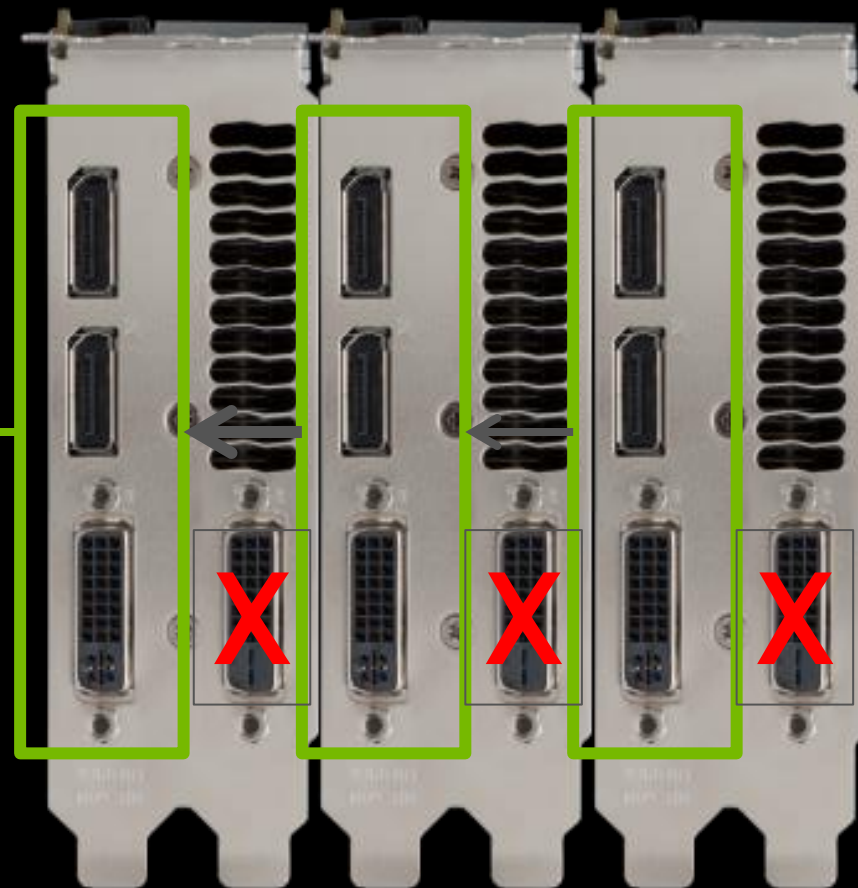


- DP to VGA dongle
- DP to VGA dongle
- DVI-I

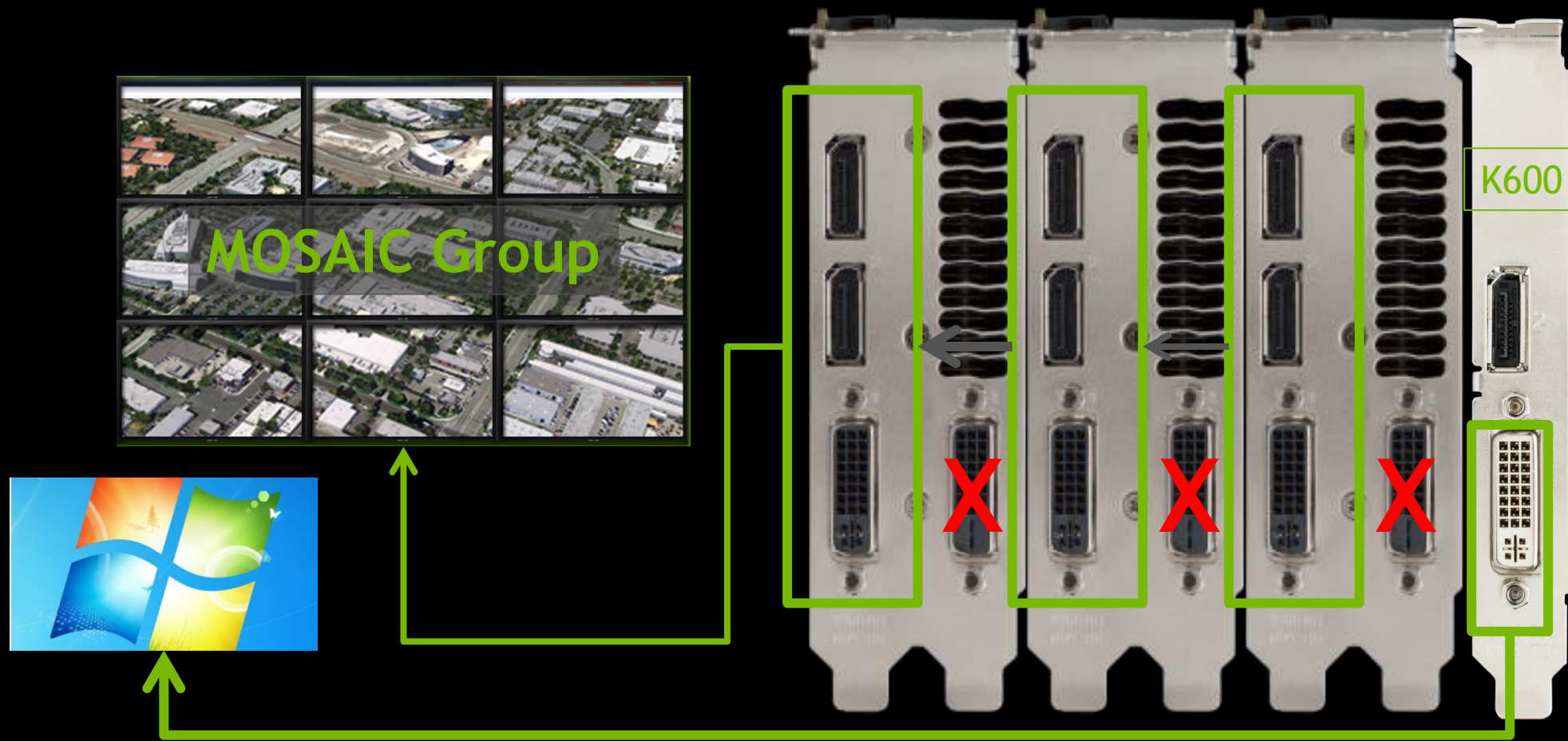
3 VGA ports

- 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

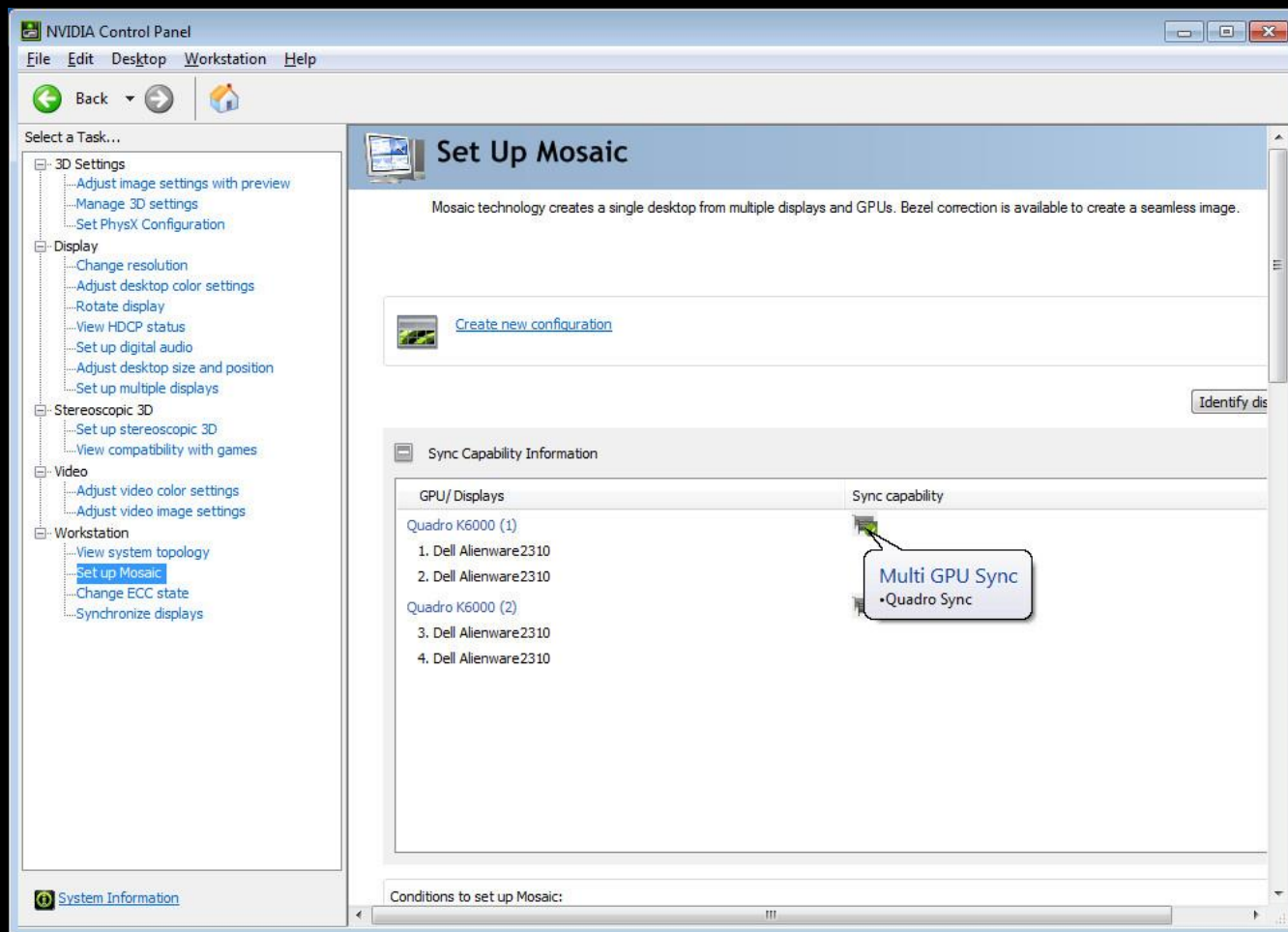
Premium MOSAIC= MOSAIC with Sync

Sync Capability Information

Indicates whether or not card or system can be sync'd.

R331 driver

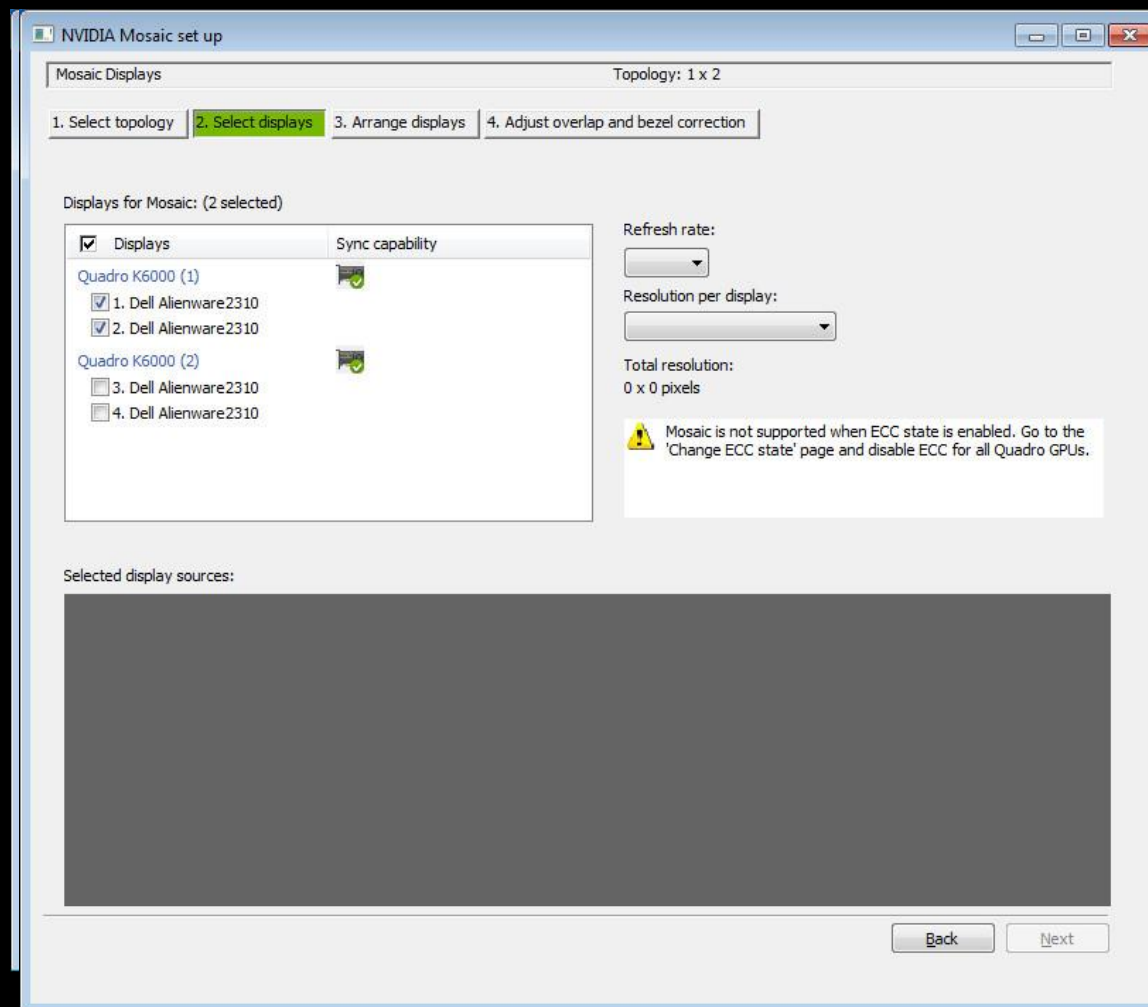
- GPU and port number OSD



# MOSAIC TIPS

MOSAIC does not work with ECC on

- Make sure it is off



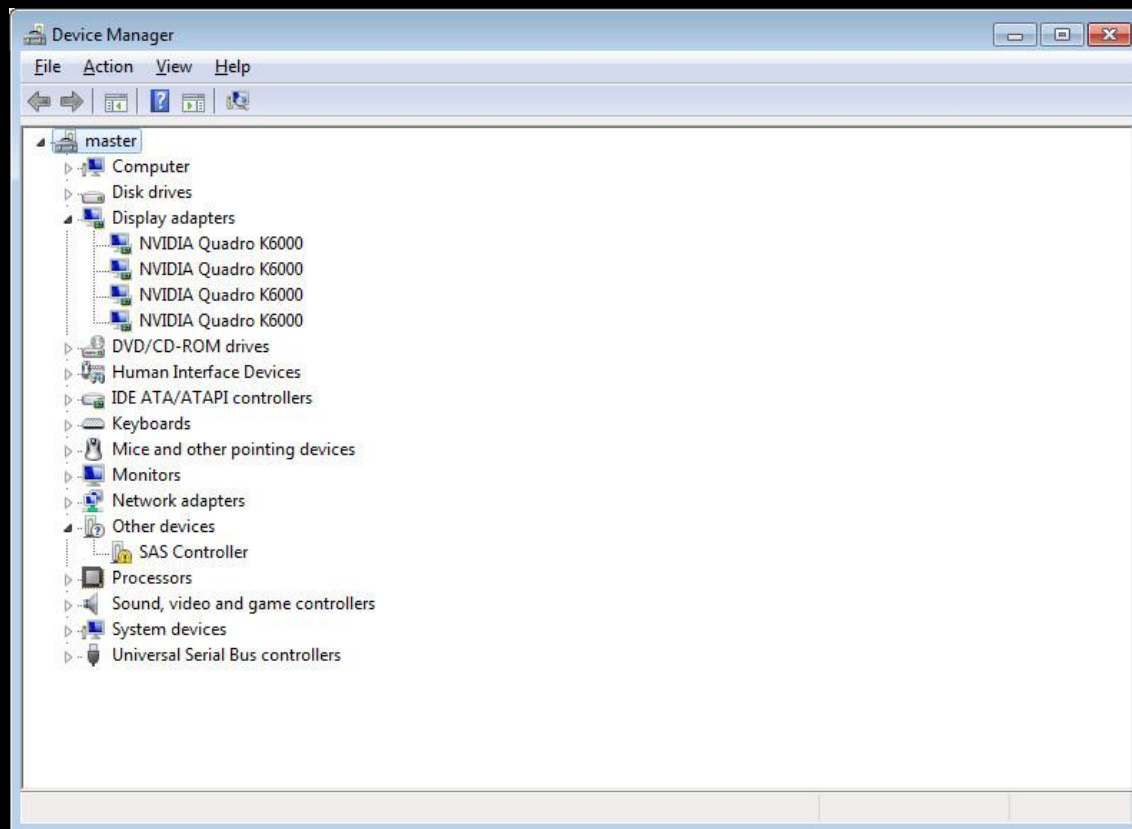
# MOSAIC TIPS

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)

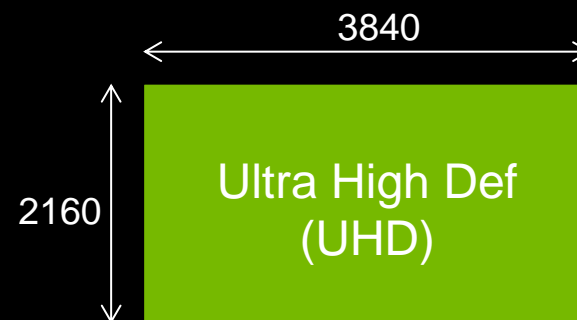


4K Stereo Projector  
(Up to 8 inputs)

# WHAT IS 4K ?



Video Bandwidth  
~567MHz @ 60Hz



Video Bandwidth  
~533MHz @ 60Hz

## Single Video Connection Bandwidth

SL-DVI = 165MHz

DL-DVI = 330MHz

DP1.1 ~330MHz

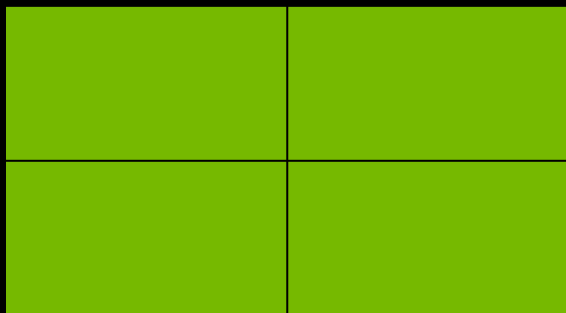
HDMI\* ~340 MHz

DP1.2\*\* K5000 ~540MHz

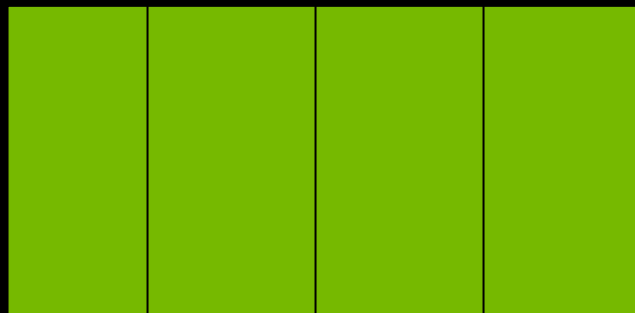
DP1.2\*\* K6000 ~592 MHz

- 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.

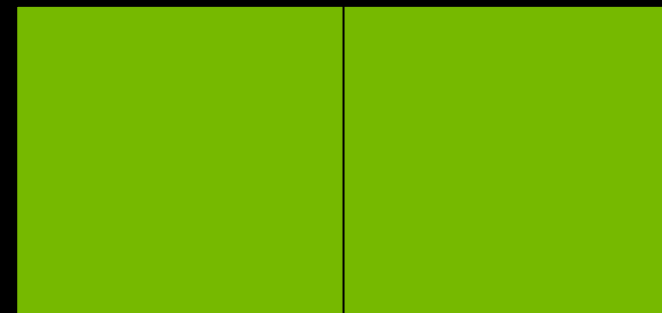
# DRIVING 4K - MULTIPLE CONNECTIONS



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

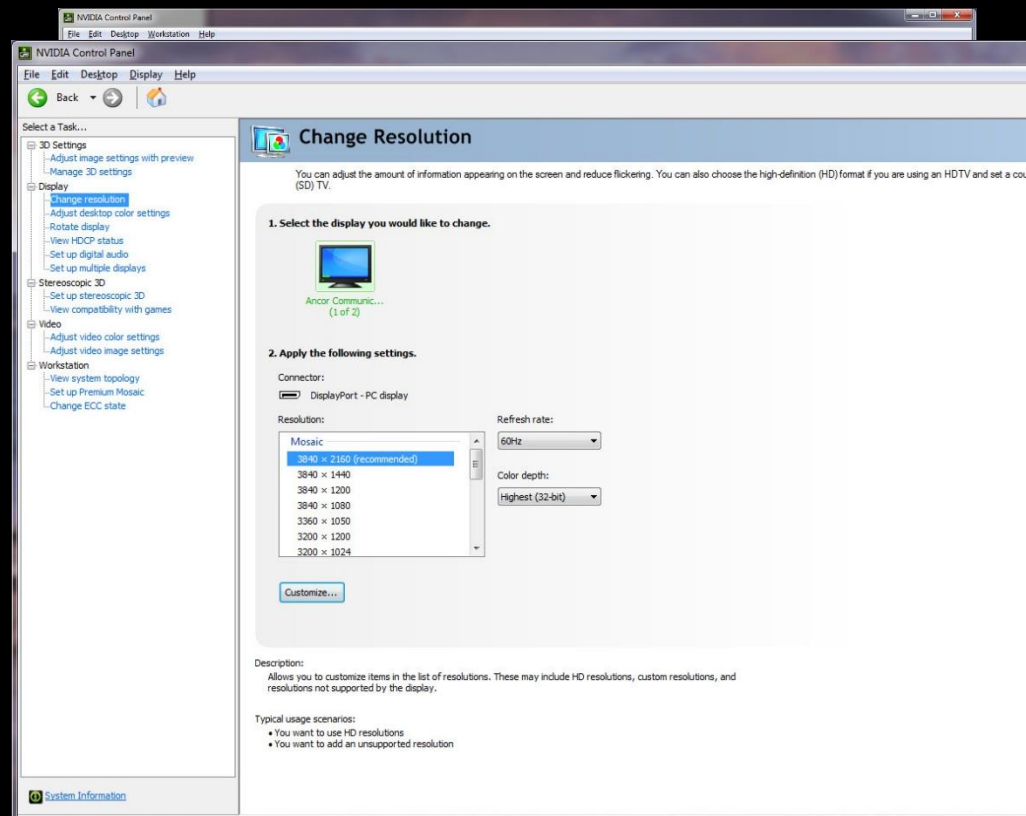


Side by side  
2 DL-DVI/DP  
Each input is  
4k – 2048x2160@60Hz  
UHD -1920x2160@60Hz

Display Port can support higher color depth desktop

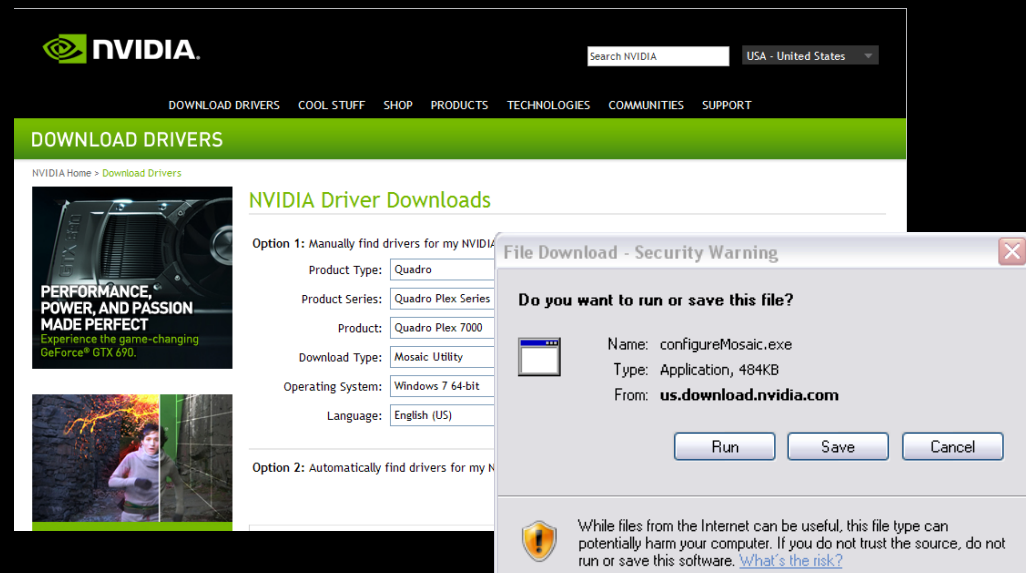
# DP1.2 AND VESA DISPLAY IDS

- 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. mutli-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
- 4<sup>th</sup> GPU used a console output
- After configuring MOSAIC set Sync.
- Dual boot - works with Linux.

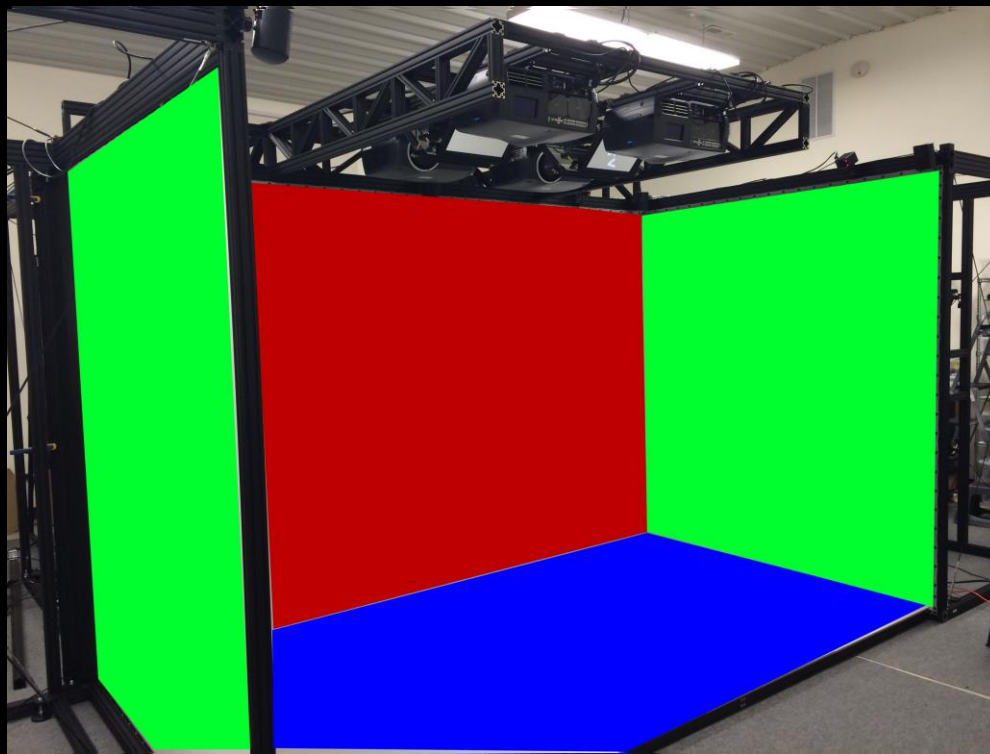


Image courtesy of VisBox

```
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

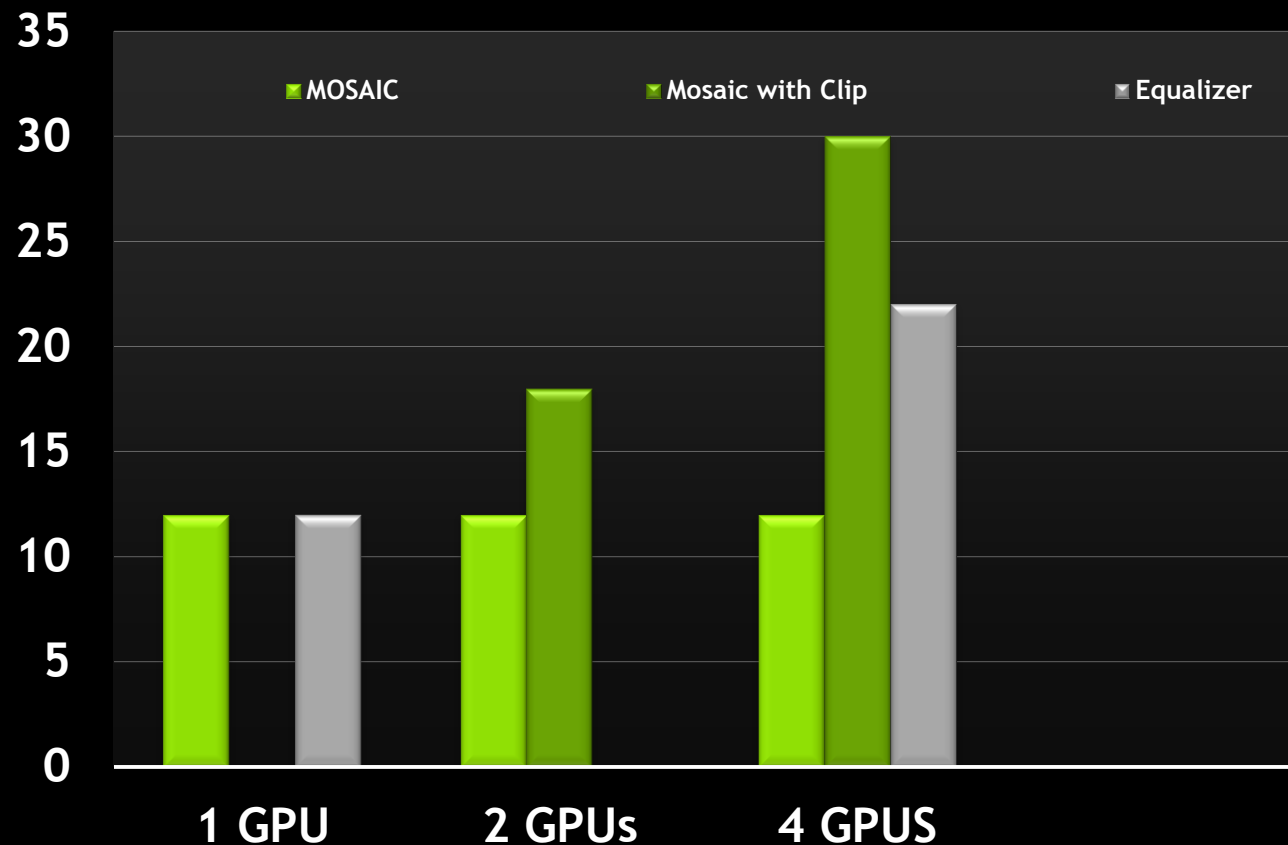
- Improves fill performance

## 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

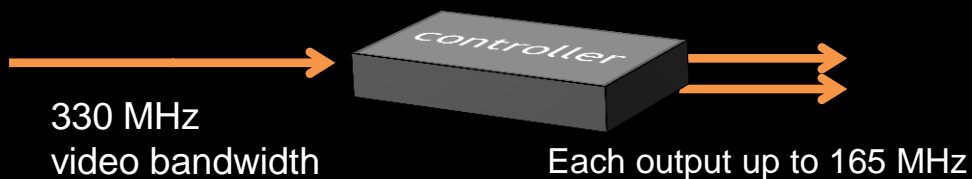
- Performance gain will be app specific
- Increased memory usage on the card
  - May limit memory size.

- 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](mailto: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

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

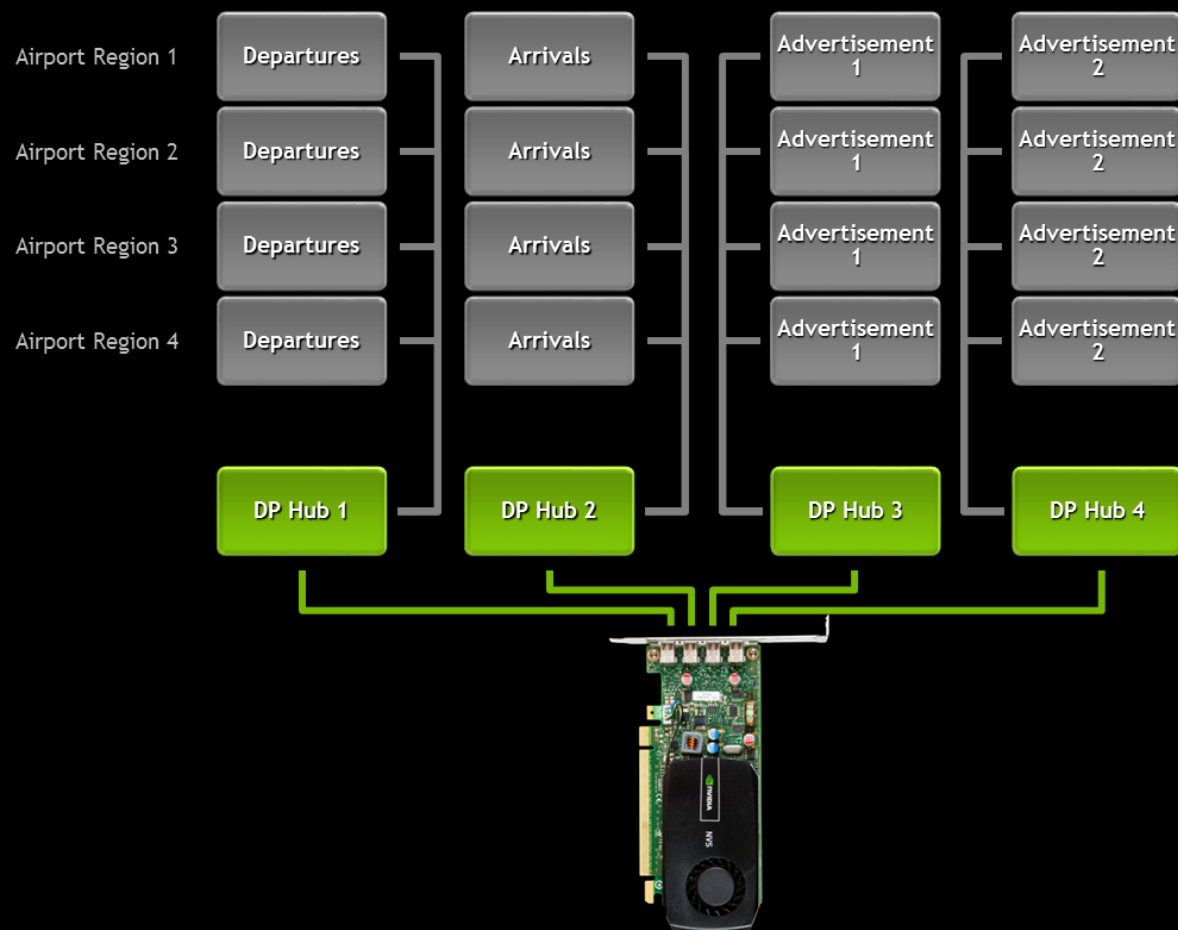
- Planar Quad Controller
- 3840x2160@30z
  - Split to 4 1920x1080 panels
- MOSAIC makes it easy for multi-touch



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

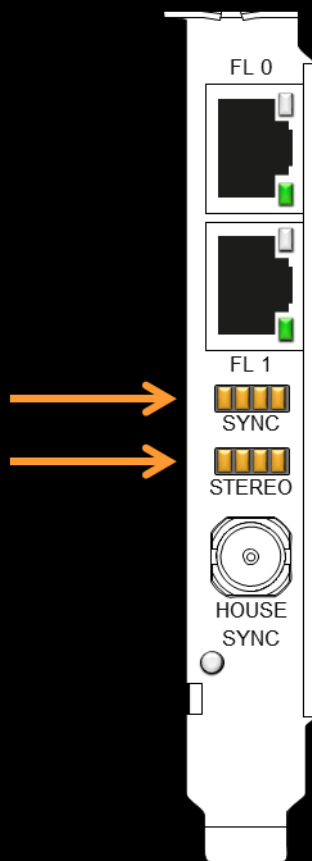
- *Requires application to be written with extensions*
- Swap Group and Swap Barrier are OpenGL & DirectX Extensions that provide enhanced synchronization of the graphics swap buffer.



# QUADRO SYNC FEATURES

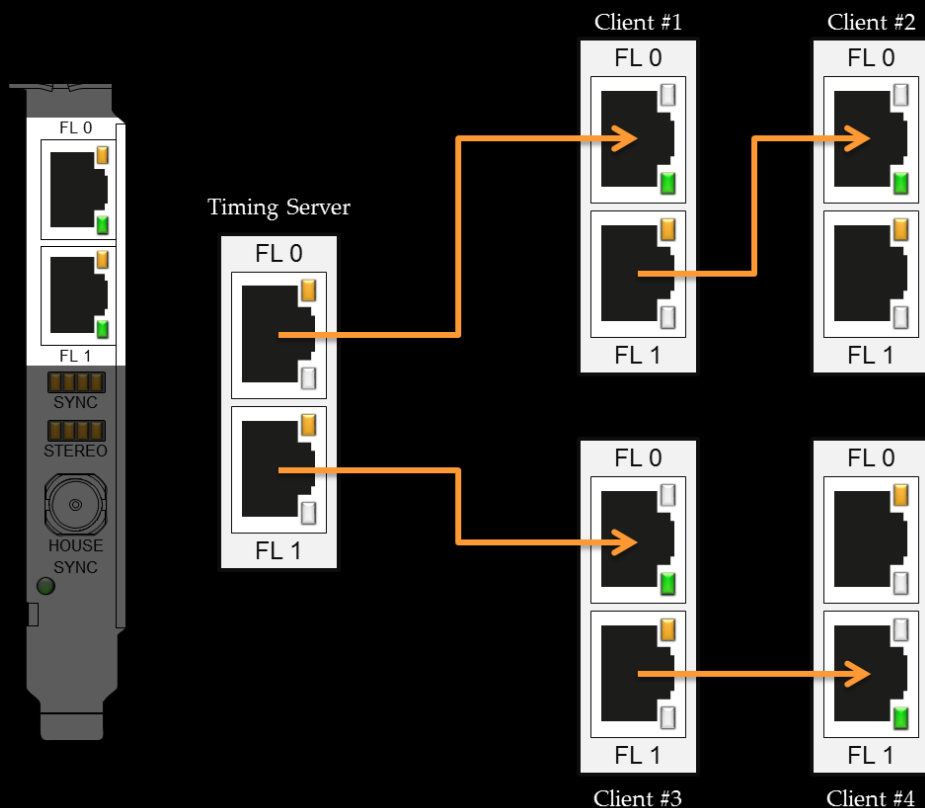
- Increased Swap Barrier Support
  - Up to 25 Quadro Sync cards in single chain.
  - 50 Quadro Sync cards in a cluster
  - 4 GPUs per Quadro Sync - 200 GPUs with Swap Barrier Support
- Sync Delay and Skew settings
  - Ability to adjust sync delay per Quadro card.
- Control via NVAPI
  - public developer version
  - Example code on how to control Quadro Sync (works with GSyncII)
- Control via NVWMI
  - Allows remote access control across a cluster

# BOOTING



- 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

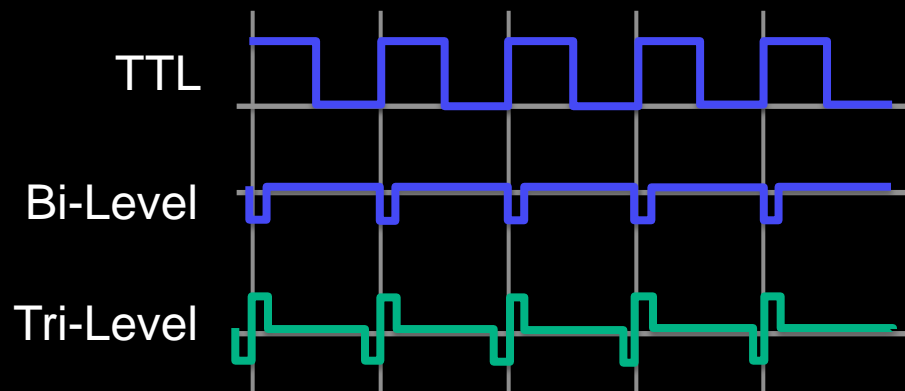
# WIRING A CLUSTER



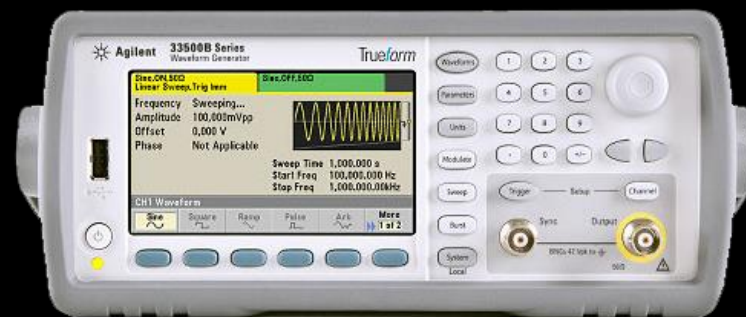
- Connect the nodes with quality CAT 5 cables, no longer than they need to be
- Put the timing server in the middle
  - This system should have the stereo connector for active stereo if needed

# EXTERNAL SYNC

- 3 Formats of Sync Sources
  - TTL: 3.3V, 50% duty cycle, high impedance
  - Bi-Level Composite (NTSC/PAL): 75Ω,  $\pm 300\text{mV}$
  - Tri-Level Composite (HDTV): 75Ω,  $\pm 300\text{mV}$



Grass Valley ADVC G4 (bi/tri level)  $\leq 60\text{Hz}$

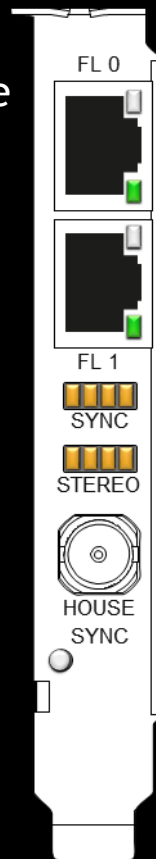


Agilent 3350B (TTL, bi/tri level) variable

# 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

automated computer con... (1 of 2)		
Display state	Server	
Resolution, refresh rate	<a href="#">1920 x 2160 pixels, 49.996 Hz</a>	
	Horizontal (2200)	Vertical (2300)
Active	1920	2160
Border	0	0
Front porch	13	8
Sync width	140	10
Back porch	127	122
Polarity	Negative (-)	Negative (-)
Timing	The display is locked to an internal timing signal	
EDID source	<a href="#">Monitor...</a>	
OS Screen Identifier	1	



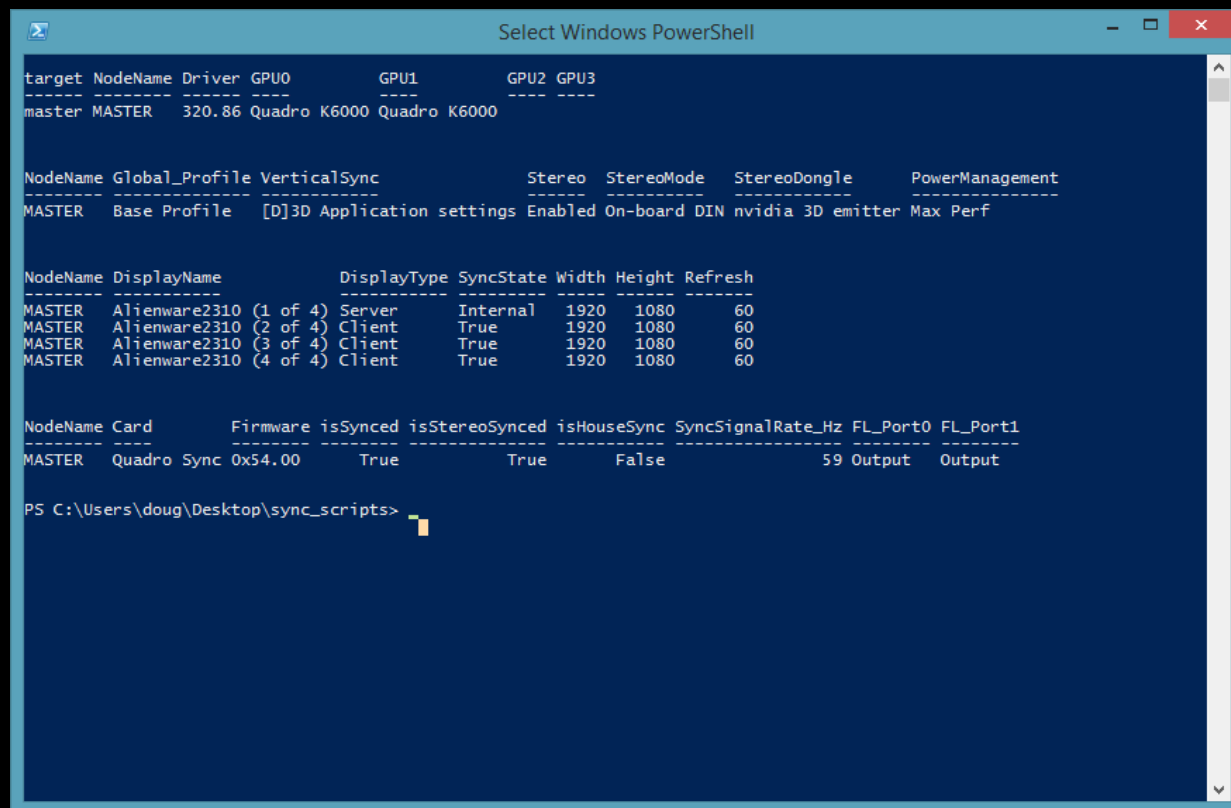
# SYNC + POWERSHELL

query\_sync.ps1

.\query\_sync [-auth] node1 node  
2 node 3 ....

-auth - prompt for  
username/password

node1.. is the list of machines to  
query.



```

target  nodeName  Driver  GPU0      GPU1      GPU2  GPU3
-----  -
master  MASTER    320.86  Quadro K6000  Quadro K6000

nodeName  Global_Profile  VerticalSync  Stereo  StereoMode  StereoDongle  PowerManagement
-----  -
MASTER    Base Profile    [0]3D Application settings  Enabled  On-board DIN  nvidia 3D emitter  Max Perf

nodeName  DisplayName  DisplayType  SyncState  Width  Height  Refresh
-----  -
MASTER    Alienware2310  (1 of 4)  Server  Internal  1920  1080  60
MASTER    Alienware2310  (2 of 4)  Client  True  1920  1080  60
MASTER    Alienware2310  (3 of 4)  Client  True  1920  1080  60
MASTER    Alienware2310  (4 of 4)  Client  True  1920  1080  60

nodeName  Card  Firmware  isSynced  isStereoSynced  isHouseSync  SyncSignalRate_Hz  FL_Port0  FL_Port1
-----  -
MASTER    Quadro Sync 0x54.00  True  True  False  59 Output  Output

PS C:\Users\doug\Desktop\sync_scripts>
  
```

Contact us at [QuadroSVS@nvidia.com](mailto: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.

```
Windows PowerShell

target  nodeName  driver  GPU0      GPU1 GPU2 GPU3
-----
sync1   SYNC1      320.78  Quadro K5000
sync2   SYNC2      320.78  Quadro K5000
sync3   SYNC3      320.78  Quadro K5000

nodeName  Global_Profile  VerticalSync      Stereo      StereoMode      StereoDongle  PowerManagement
-----
SYNC1     Base Profile    [D]3D Application settings [D]Disabled [D]On-board DIN [D] NVIDIA DRIVER Contro...
SYNC2     Base Profile    [D]3D Application settings [D]Disabled [D]On-board DIN [D] NVIDIA DRIVER Contro...
SYNC3     Base Profile    [D]3D Application settings [D]Disabled [D]On-board DIN [D] NVIDIA DRIVER Contro...

nodeName  DisplayName      DisplayType  SyncState  Width  Height  Refresh
-----
SYNC1     DELL 2408WFP      Internal     1280     720     60
SYNC2     DELL 2408WFP (1 of 2) Internal     1280     768     60
SYNC2     DELL 2408WFP (2 of 2) Internal     1280     720     60

nodeName  Card      Firmware  isSynced  isStereoSynced  isHouseSync  SyncSignalRate_Hz  FL_Port0  FL_Port1
-----
SYNC1     Quadro Sync 0x52.00  False     False           False         60 Input  Output
SYNC2     Quadro Sync 0x54.00  False     False           False         60 Input  Output
SYNC3     Quadro Sync 0x54.00  False     False           False         60 Input  Output

PS C:\Users\doug\Desktop>
```

# 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
- 2.30pm Room 210H - William Paone, Boeing - NVIDIA Driven Image Generation in Immersive Fast-Jet Simulators.

## ▪ 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](mailto:QuadroSVS@nvidia.com)

# WMI EXAMPLE - POWERSHELL SCRIPT

```
$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
}
```