Scalable Display Manager ™ - Automatic camera-based projector alignment software

- **One-touch recalibration**
- **Fast, efficient & cost-effective**
- **Perspective calibration**
- **Supports multiple & dynamic eyepoint**

Scalable Display Manager (SDM) is a software application that automatically calculates warps and blends for multiple projector arrays for cylindrical, dome, and any shape or size of screen. SDM is directly integrated with many leading image generators, warping boxes and media playback devices. Powered by patented camera-feedback technology, SDM calculates pixel perfect warps and stores the results as a Scalable Mesh File (SMF). The automatic recalibration guarantees your display is ready with a touch of a button eliminating costly downtime and reducing maintenance.

Benefits of Scalable Display Manager:

- Scales across multiple PCs, warping boxes or other integrated solutions
- Intuitive user interface
- One-touch recalibration
- Fast multi-projector alignment and blending
- Precise pixel alignment for mesh uniformity
- Reduced maintenance costs and time

Features:

- Custom system configurations
- Multiple screen geometries supported - flat, cylinder, domes and custom .OBJ
- Support for diskless IGs
- Distributed rendering applications
- Field of view automatically calculated for immersive environments
- Lightweight display client
- Software or dongle licenses available
- Orthographic and perspective mesh options
- Supports multiple and dynamic eyepoint
- Supports day/night switching for mechanical baffles
- Scheduled calibrations run daily/weekly without user intervention

Target Markets:

- Military simulation
- Virtual & augmented reality
- Visualization environments
- Command & control rooms
- Business collaboration and conferences rooms
- Interactive and touch displays

At a glance:

- Military Simulation applications
- Perspective Mesh (3D)
- Distributed rendered applications
- Military accuracy

- Unlimited projectors
- Unlimited resolution
- Unlimited cameras
- Multiple Scalable Mesh Files delivery mechanisms

SPA - Scalable Panel Assembly - Display calibration software

Multi-panel alignment.
Warp & blend unlimited panels.
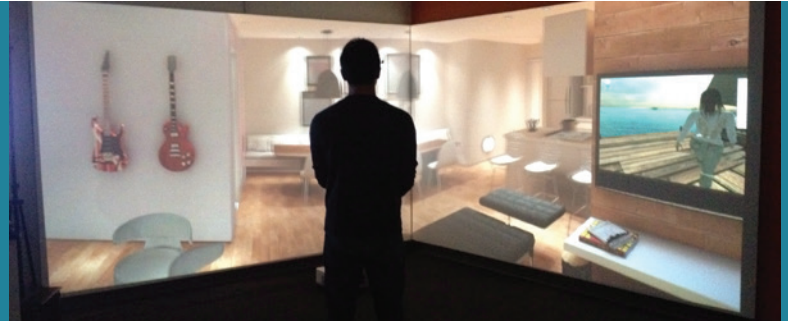
Scalable Panel Assembly (SPA) is Scalable's software application specifically designed for panel-based displays such as articulated screens, faceted screens, and CAVE™ environments.

SPA uses camera(s), mouse input or a combination of the two when creating the Scalable Mesh File (SMF). SPA builds upon most of the features and interoperability of Scalable Display Manager and adds the flexibility to easily mix edge-butted and edge-blended displays into a single display. Once the Scalable Mesh File (SMF) has been generated, it can be ported to a wide range of locations including: warping boxes, projectors and GPU or SDK enabled applications.

Benefits of Scalable Panel Assembly

• Flexibility to mix edge-butted and edge-blended projectors
• Supports any polygonal screen
• Supports single-projector and multi-projector facets
• Fast multi-projector alignment and blending
• Reduced maintenance costs and time
• Precise pixel alignment for mesh uniformity

Target Markets:

• Virtual & augmented reality
• Visualization environments
• Command & control rooms
• Interactive and touch displays
• Museum displays
• Advanced video playback and digital signage

Features:

• Easy maintenance of CAVE™ systems
• Unlimited panels
• Increased pixel efficiency, no lost pixels in blend zones
• Fewer camera constraints

Basic Requirements:

• Scalable Host OS: Windows® Scalable Display Client OS: Windows or Linux
• Logitech C920 Webcam, Canon Rebel Series or Gigabit Ethernet camera*
• At least 4GB of RAM, 3GB of hard disk space and 100Mbit network card

Visit www.scalabledisplay.com for specific model recommendations

Scalable Software Development Kit

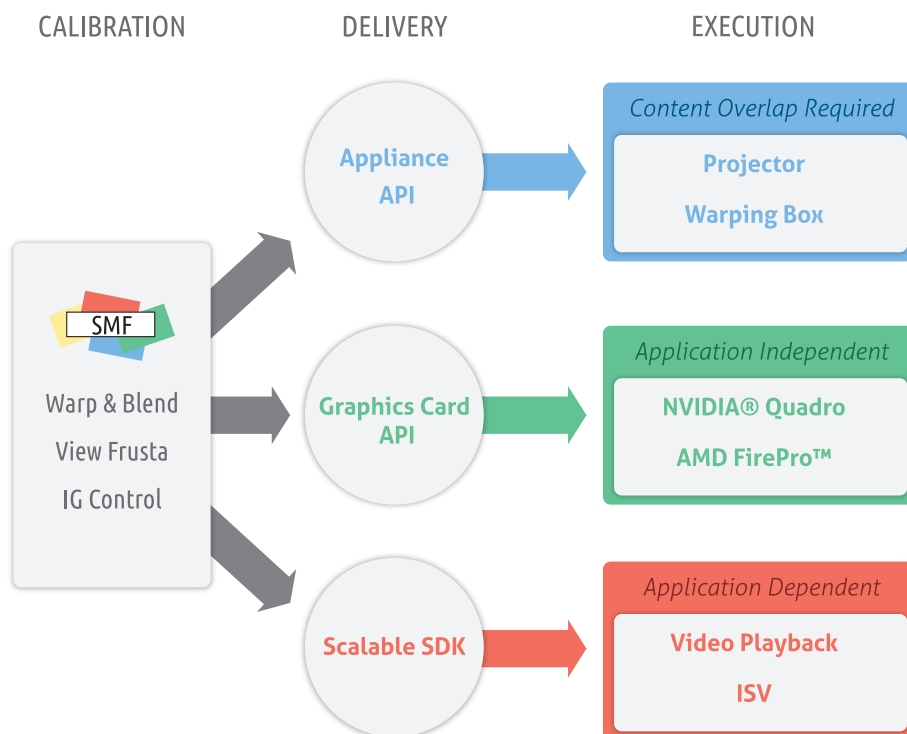**Integrate Scalable auto-calibration into your own OpenGL or DirectX image generation packages.**
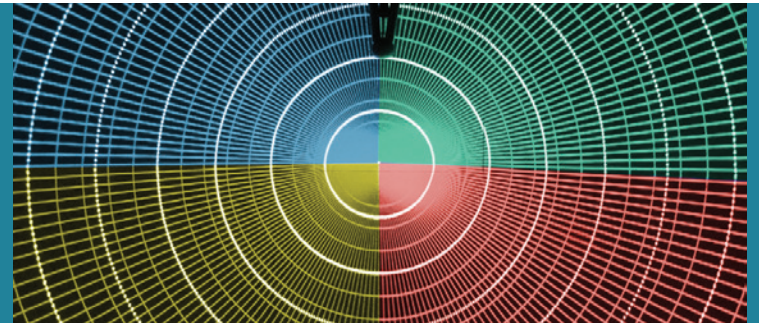
Scalable SDK (Software Development Kit) includes a few lines of code that an Independent Software Vendor (ISV) can add to their own application to create an interface between **Scalable Display Manager** (SDM) and their own software solution. SDM is an automatic camera-based geometric distortion correction and color matching solution used to seamlessly align images from multiple projectors. SDM automatically calculates *Scalable Mesh Files* (SMF) that contain instructions to be applied by the ISV application.

Scalable Display Manager uses a patented camera-generated feedback system. This purely digital approach enables display systems which cannot be engineered by conventional means, either mechanically or optically.

Three key elements in the Scalable Mesh File instructions:

• Warp & blend instructions.
• View frusta instructions: provide each instance of the ISV software with an OpenGL view to render based on its associated projectors footprint on the screen.
• Remote API: allows the auto-calibration process to be started and stopped at the IG's behest.

Functional diagram of SDK insertion points:

CALIBRATION   DELIVERY   EXECUTION

SMF

Warp & Blend
View Frusta
IG Control

Appliance API → *Content Overlap Required* **Projector Warping Box**

Graphics Card API → *Application Independent* **NVIDIA® Quadro AMD FirePro™**

Scalable SDK → *Application Dependent* **Video Playback ISV**

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ScalableDesktop™- Automatic camera-based warp & blend software

- Single PC applications
- Scales Windows® desktop
- One-click recalibration
- Industry leading speed & accuracy

ScalableDesktop is a software application that warps and blends multiple projectors that are driven from a single PC. **Scalable**Desktop is compatible with NVIDIA® Quadro® professional graphics cards.

Benefits of Scalable Desktop**:**

- Scales across multiple graphics cards - Scale to 16 X HD and beyond from a single PC.
- Application independence - All Windows applications, including the Windows® desktop, are seamlessly blended without compatibility concerns.
- Aspect ratio control - The GPU accounts for projector overlaps resulting in square pixels and fewer aliasing artifacts.
- Software only - Warps and blends without the need for dedicated hardware.

Features:

- Automatic edge-blending - Camera-based calibrations for pixel perfect blends.
- One-touch re-calibration - Enhanced automation built-in for users to update a calibration with one touch or with automatic scheduled calibrations.
- Projector agnostic - Compatible with all makes and models of projectors.
- Camera options - Supports Logitech C-920, Canon Rebel series and Gigabit Ethernet cameras. Multiple camera body and lens combinations supported.
- Screen geometries - Support for flat and curved screen geometries.

Target Markets:

- Data analytics
- After-action review
- Deployable & portable display systems
- Architectural Visualization
- Ultra High-Resolution Desktop Workstation

At a glance:

- Single Computer
- Orthographic Mesh (3D)
- Scales Windows® through graphics driver
- Up to 16 x HD

The Scalable Mesh File (SMF)

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The SMF is an instruction set that contains all necessary warp & blend information

		Graphics Card			Appliance	
		Quadro Driver NVAPI	**FirePro Driver** DOPP	**Any GPU** SDK	**Box**	**Projector**
SMF delivery	Warp	GPU driver	GPU driver	Auto import to IG via SDK	Appliance API	
	Blend	GPU driver *** Spatial Dithering	GPU driver *** Spatial AND Temporal Dithering	Auto import to IG via SDK	Appliance API *** Bitmap (Better) or Parameter (Good)	
	Frusta *Always auto calculated*	Manual import to IG (or Auto via partial SDK)	Manual import to IG (or Auto via partial SDK)	Auto import to IG via SDK	Manual import to IG (or Auto via partial SDK)	
	Dynamic Frusta	N/A	Optional	N/A	N/A	
	Software Color	Optional	Future	N/A	Future	
	Projector Color	N/A	N/A	N/A	N/A	Auto

SMF Graphics Cards Integration

Scalable worked with AMD® and NVIDIA® to develop a GPU driver level integration of our SMF. The benefit is reliable latency-free warp and blend that gets applied to any application. This eliminates the need for an SDK integration for warp and blend. We recommend a partial SDK integration for automatic importation of view frusta data.

SMF via Scalable SDK

The Scalable SDK (Software Development Kit) adds auto-calibration functionality to IG applications by automatically delivering warping and blending information via the SMF.
• Supports Windows®-based OPenGL and DirectX IG applications
• Integrates easily via single dynamic link library (DLL)
• Supports dynamic eyepoint for head-tracked applications
• Over 40 IG integrations completed

SMF via Appliance API

Scalable has worked with a range of vendors that have implemented warp & blend functionality on stand-alone appliances such as warping boxes or projectors.
These partners implement the warp and blend in several ways:
  • Application Specific Integrated Circuits (ASICs)
  • Field Programmable Gate Array (FPGA)

Image Generator Partners

METAVR — VRSG	Bohemia Interactive — VBS-IG	Quantum3D — Mantis	TRANSAS — Navi-Trainer Pro	
DIAMOND VISIONICS — GenesisRTX	antycip SIMULATION — MyIG	agi — STK	CSC — V-Ship	Realtime technologies, inc
AECHELON TECHNOLOGY — PC-Nova	PRESAGIS — VegaPrime5	KONGSBERG — Polaris	LOCKHEED MARTIN — SAGE	

System Integration Partners

applied minds

CUBIC

Electric picture DISPLAY SYSTEMS

LASER SHOT

IMMERSIVE DISPLAY SOLUTIONS

J.F. Taylor, Inc.

Esterline

PSI

L3 communications

Q4

RSi

NORTHROP GRUMMAN

VDCDS

URS

TJ INC.

LOCKHEED MARTIN

GENERAL DYNAMICS

FIDELITY TECHNOLOGIES CORPORATION

SAIC

NOVA TECHNOLOGIES
An Employee-Owned Engineering Company

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Scalable Projects

A summary of some of the installations with ScalableDesktop or Scalable Display Manager.

Simulation - Military

JTAC Trainers
Air National Guard - AAJTs
Marines - MSAT
Marines - SAVT
US Army - Joint Fires Dome

Task Trainers
Marines - LSOT
Marines - MCAT-P, MCAT-P2
US Coast Guard - CG-AWT

Flight Simulators
AFRL - OBVA program
FADEA
US Air Force - F-16
US Marines - EA-6B

Bridge Simulators
US Navy - Littoral Combat Ship

Command & Control
AEGIS

Simulation - Civilian

Bridge Simulators
Memorial University - Newfoundland
STAR Center - FL

Driving Simulators
Ferrari
Nissan
Stanford University
Williams F1

Flight Simulators
Agusta Westland
Bell Helicopter
Eurocopter
Northrop Grumman
Rockwell Collins
Virgin Galactic

Commercial Equipment Simulators
Coal Mining
Concrete Pump
Dock Side Crane

Museums
Museum of Modern Math
Perot Museum

Planetariums
Applied Minds
California Museum of Science
Fitchburg State
Petroleum Development Oman (PDO)

Visualization Walls
Chevron
Disney
Jaguar Land Rover
MIT Lincoln Labs
Target
Walmart

Collaboration Rooms
Adobe
Baker Hughes
Hewlett Packard
Northeastern University
P&G
US Navy - AEGIS Program

Lobby Displays
Amore Pacific
AOL
Gensler

Universities
Brown University - CAVE
MIT - Lobby Display
National Chengchi University
North Carolina State - Research Center
Northeastern University - Visitor Center
Osaka University
Ritsumei University
University of North Carolina
University of Phoenix

Other
Federal Aviation Administration
Google
Grand Hyatt - DFW
HKS Architect
Microsoft
Schindler
Sony
Sports Club LA