NVSG – NVIDIA Scene Graph

Leveraging the World's Fastest Scene Graph

NVIDIA.

Agenda

- Overview NVSG
- Shader integration
- Interactive ray tracing
- Multi-GPU support

NVIDIA Scene Graph (NVSG)

The first cross-platform scene graph with full hardware shading support through latest visual computing technology to achieve a new level of realism.

Why use NVSG?

Performance

Reduces amount of data

Structures data to allow culling and sorting

Support from NVIDIA

The global leader in computer graphics

Productivity

Manages graphics hardware, reducing requirement for OpenGL coding

No-cost tool

License free of charge

Scalability

Works seamlessly with complex hardware configurations

NVIDIA SLI ready

Shading

Takes full advantage of Cg/CgFX/MetaSL

Abstracts low-level shader work

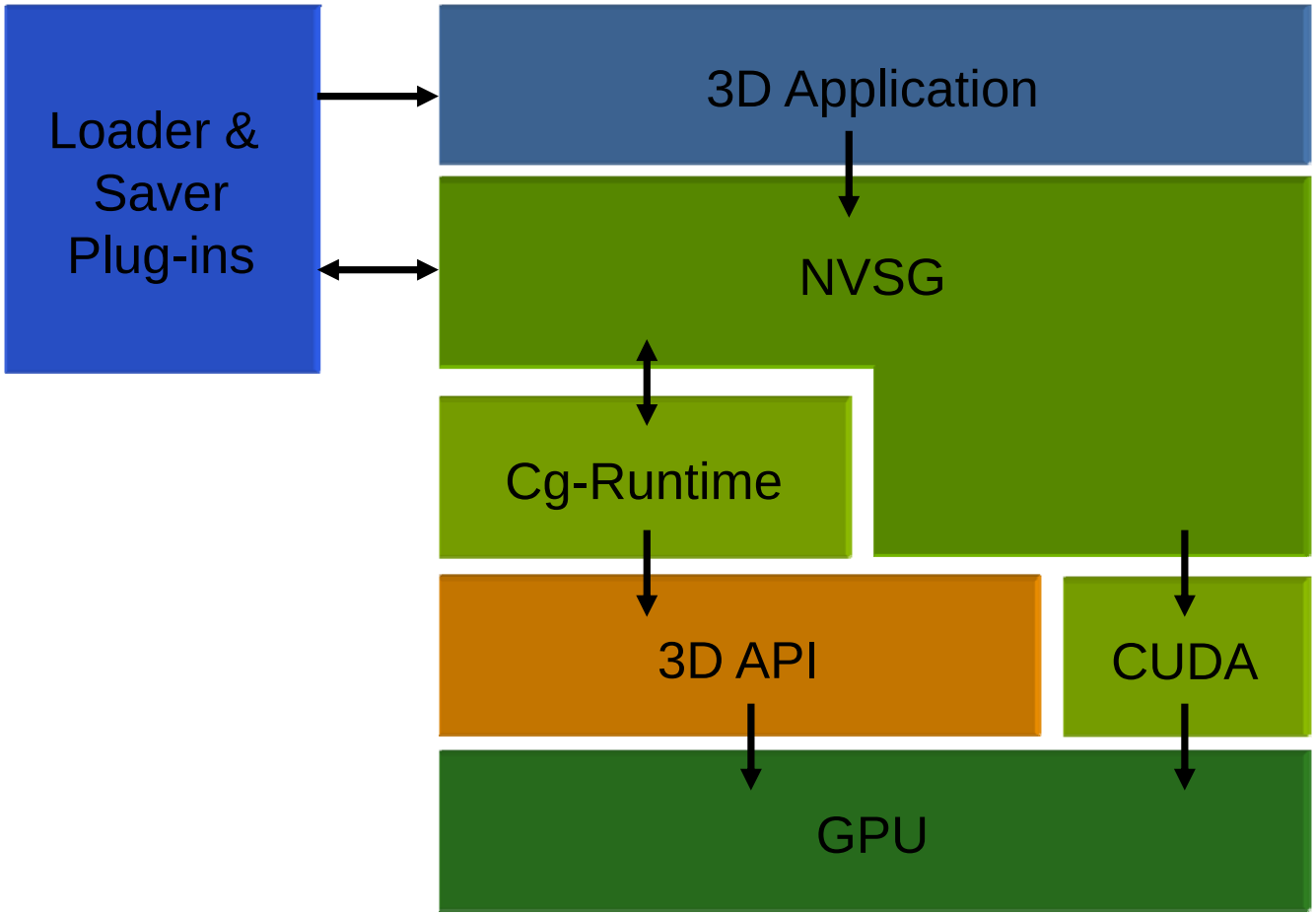
Markets

- Automotive
- Training & Visualization
- Vis-Sim
- Virtual Reality
- Broadcasting
- Digital Studio
- Gaming
- Oil&Gas
- Misc…

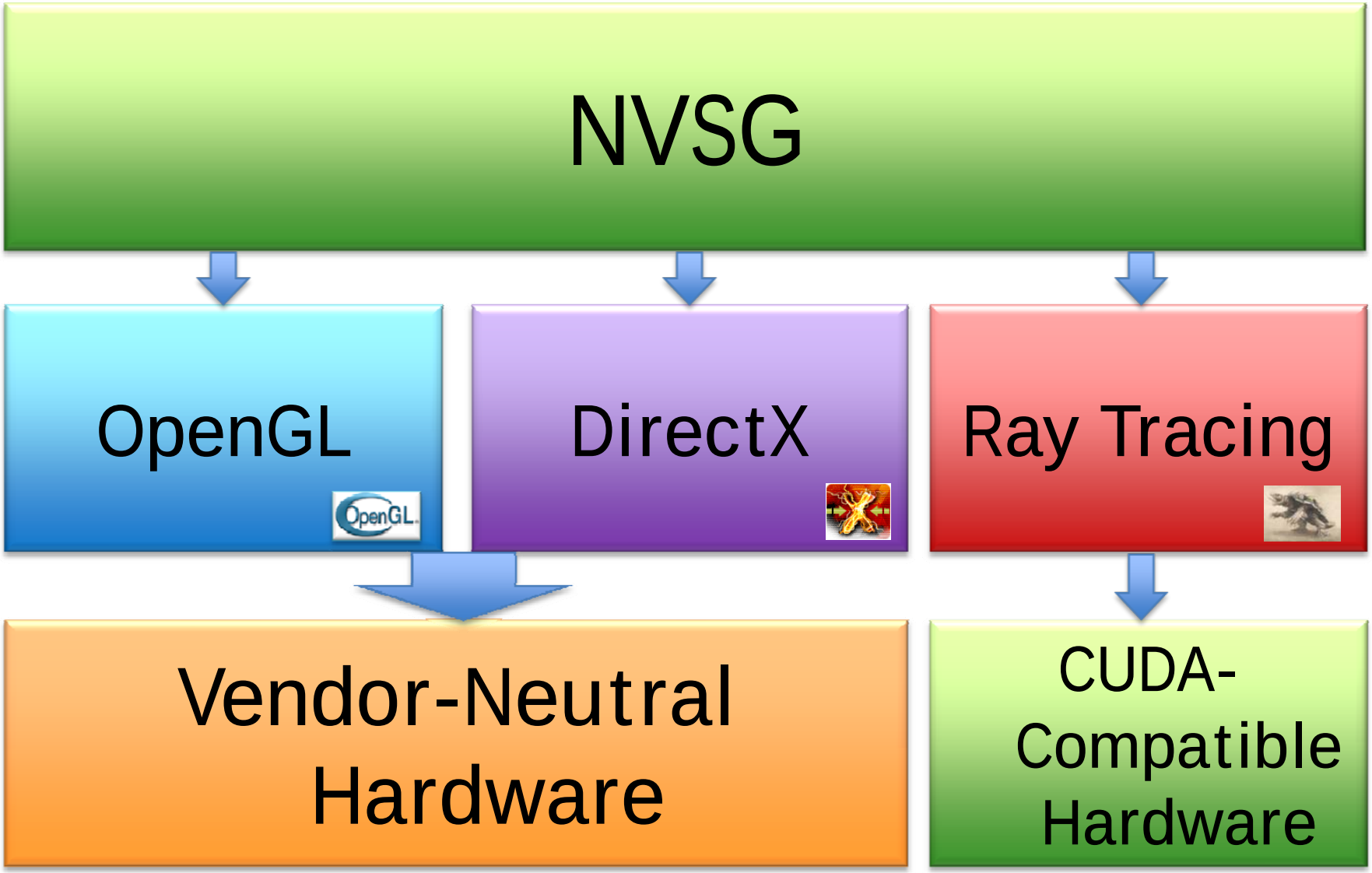
NVSG - „NVIDIA Scene Graph”

- C++ scene-graph API
- OS Independent
- Multi-thread safe
- Fast
- Shader support
- Cluster aware
- Latest GPU support
- Easy to use
- Easy to extend
- Future proof
- Free to NVIDIA developers

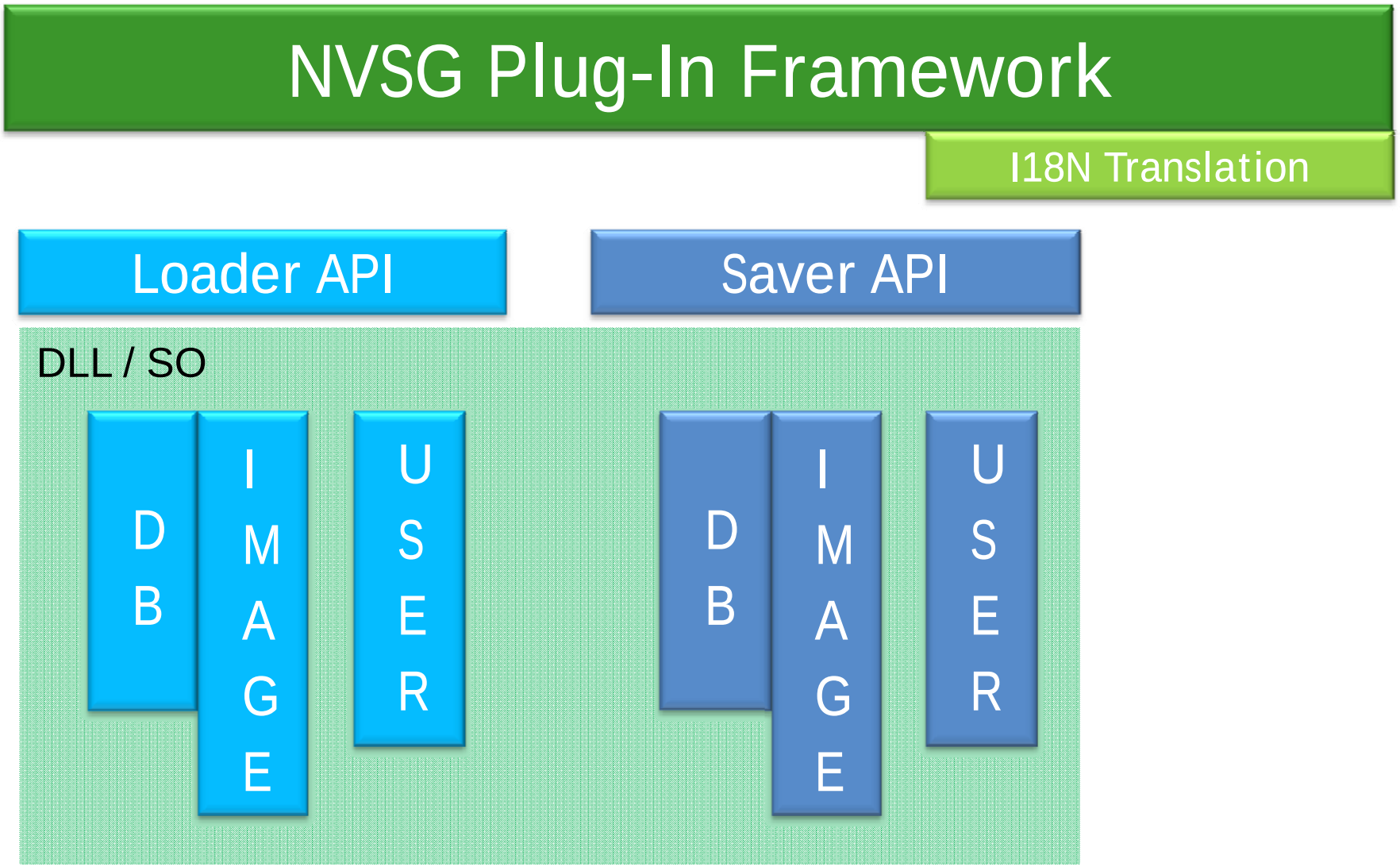
NVSG Software Stack



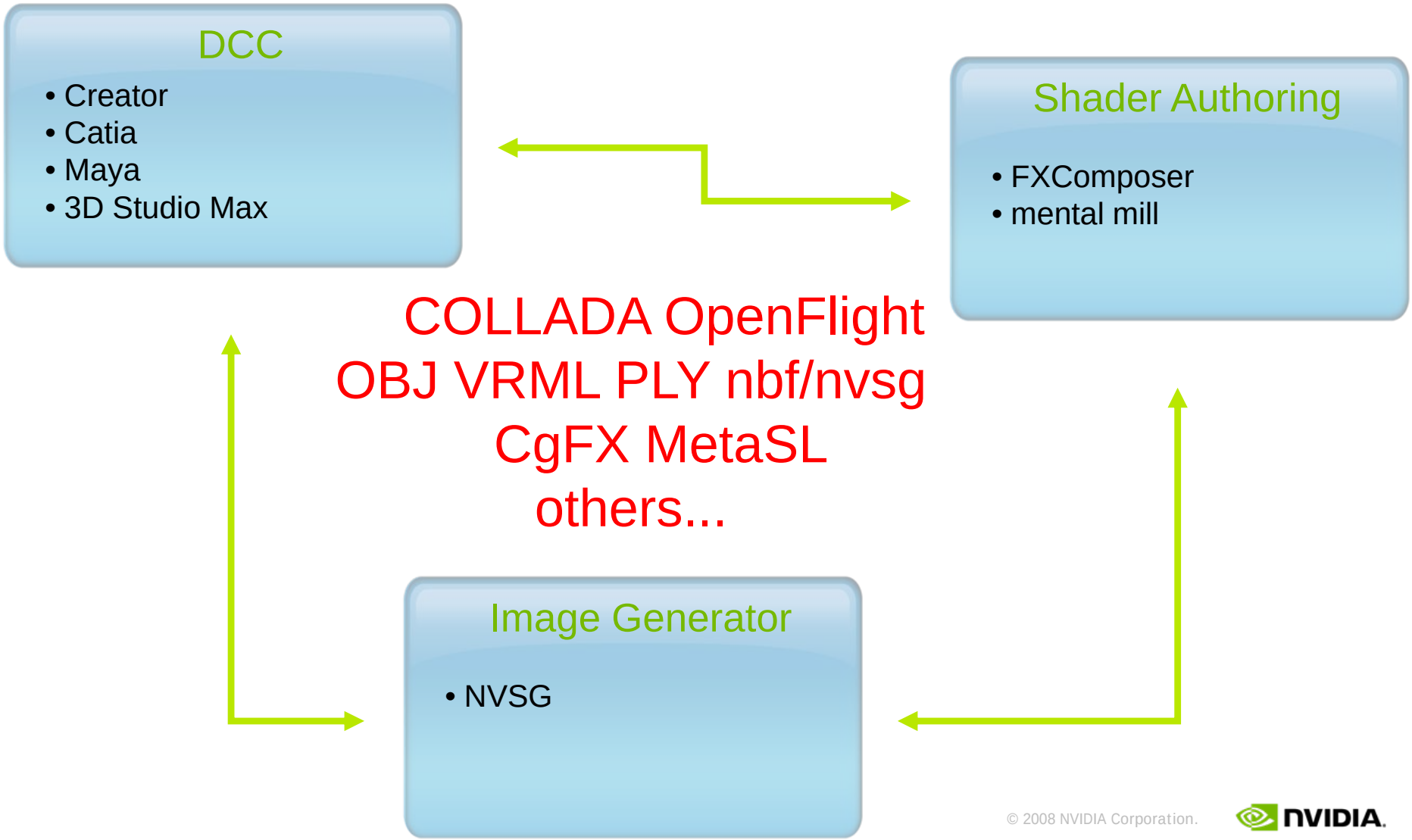
Device-Independent Rendering



Plug-in Architecture



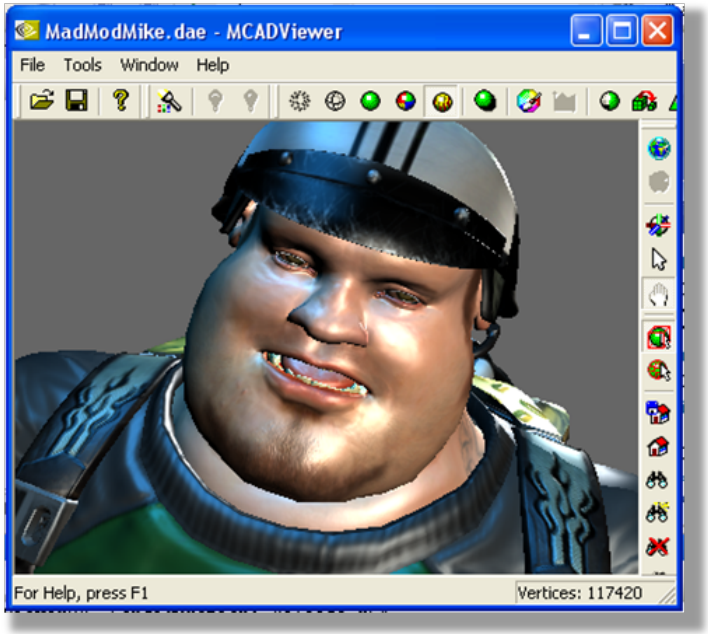
Interchange Formats

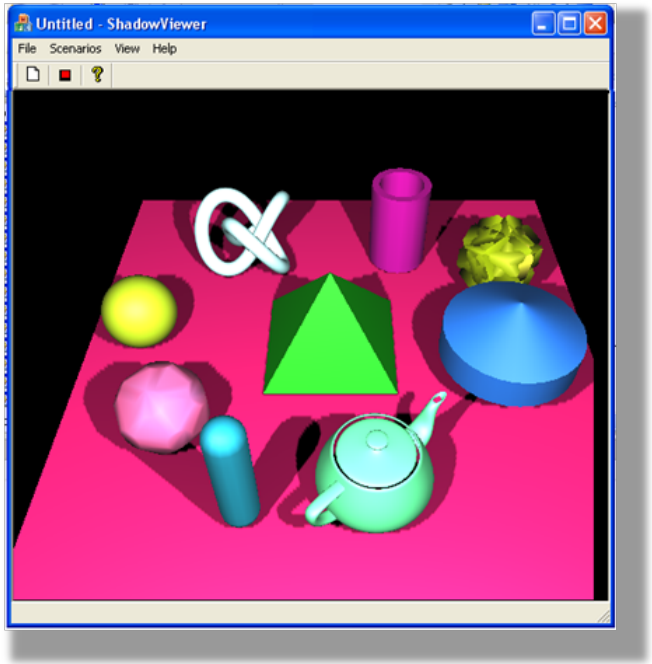


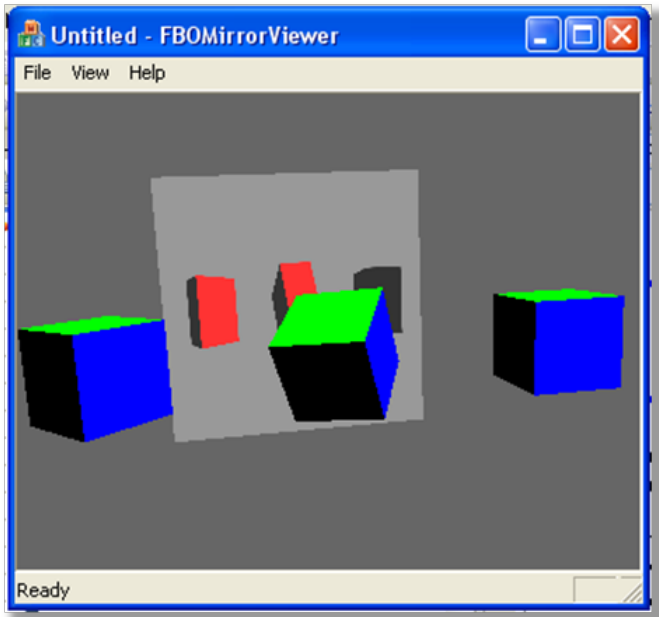
Differing Render Targets

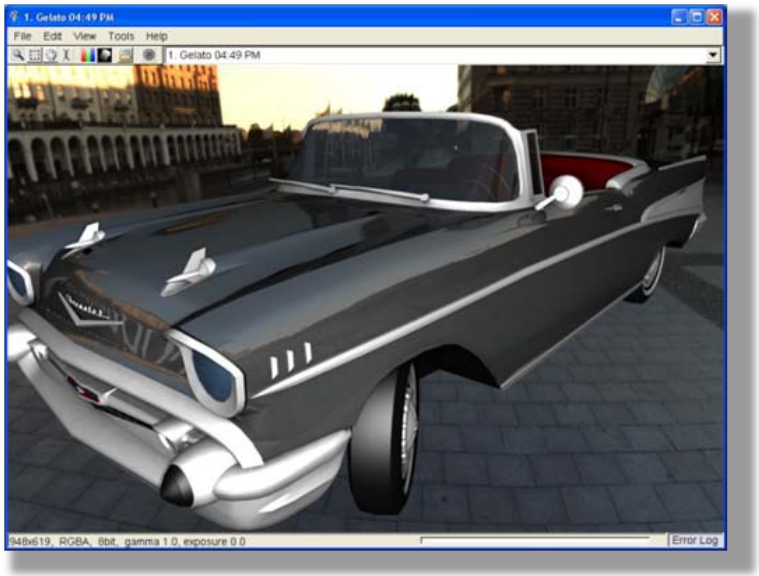
- Framebuffer
- FBO
- 2D Overlay
- Ray Tracing
- Broadcast Graphics Hardware
- Transform Feedback
- Gelato

Shadows, Effects, Skinning





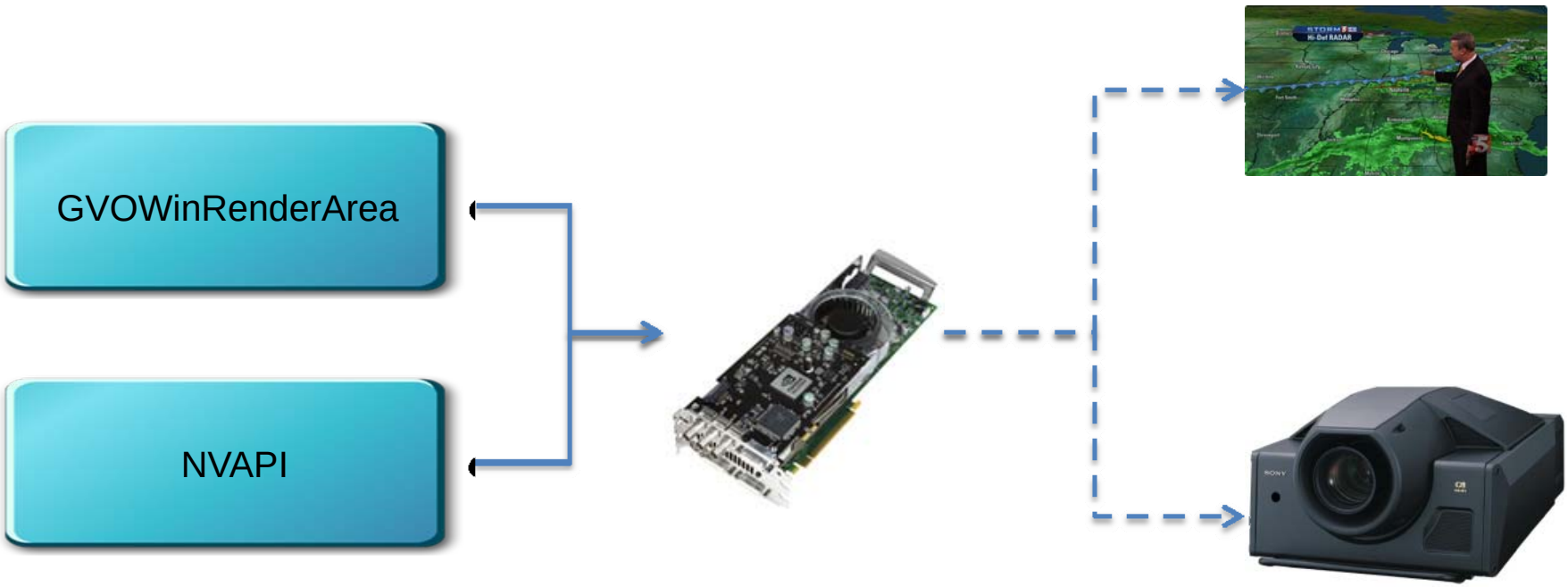




GUI, Menus, overlays,…

GVO / SDI Broadcast Graphics

- Uncompressed 8-, 10-, or 12-bit SDI formats
- Enabling a direct connection to broadcast monitors, switchers, tape decks, or SDI projectors.
- Source code example

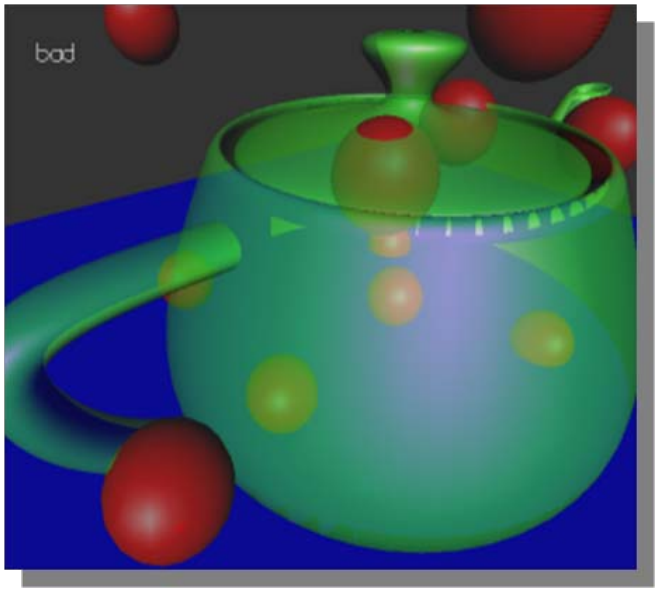


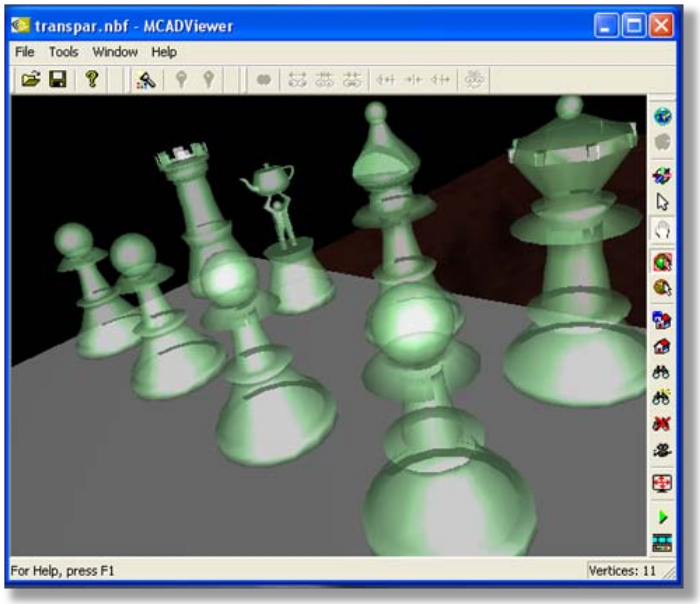
Multipass Rendering

- Depth of Field
- Order Independent Transparency
- FSAA
- Stereo (implementation dependent)

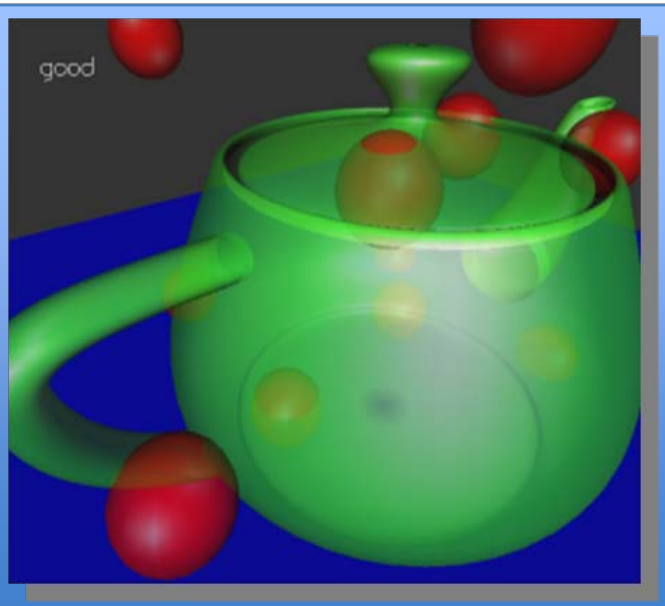
Order Independent Transparency

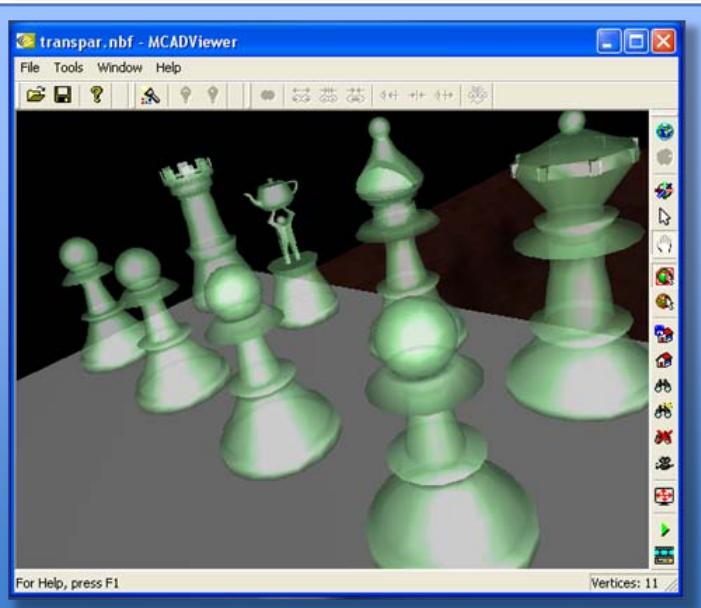
Without OIT



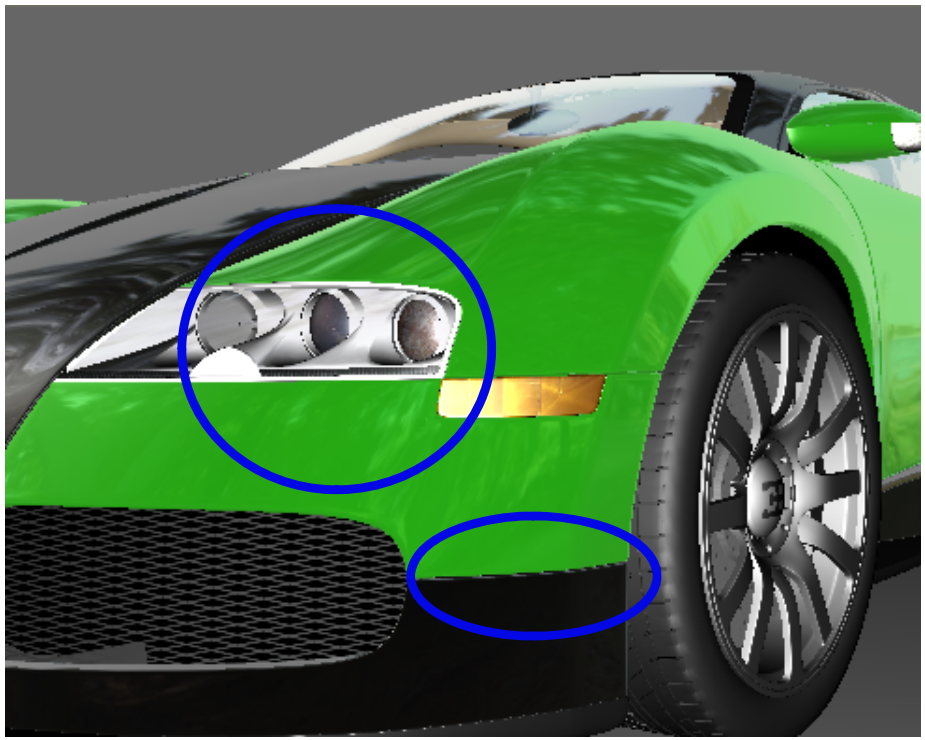


With OIT

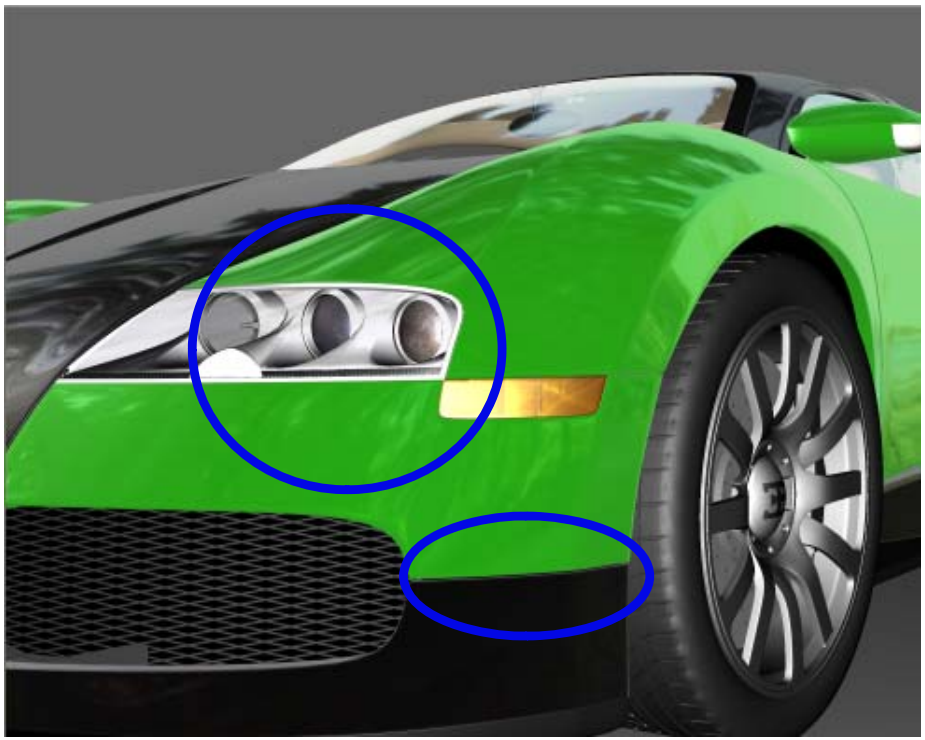




Improved FSAA Quality



No FSAA



16x MPAA

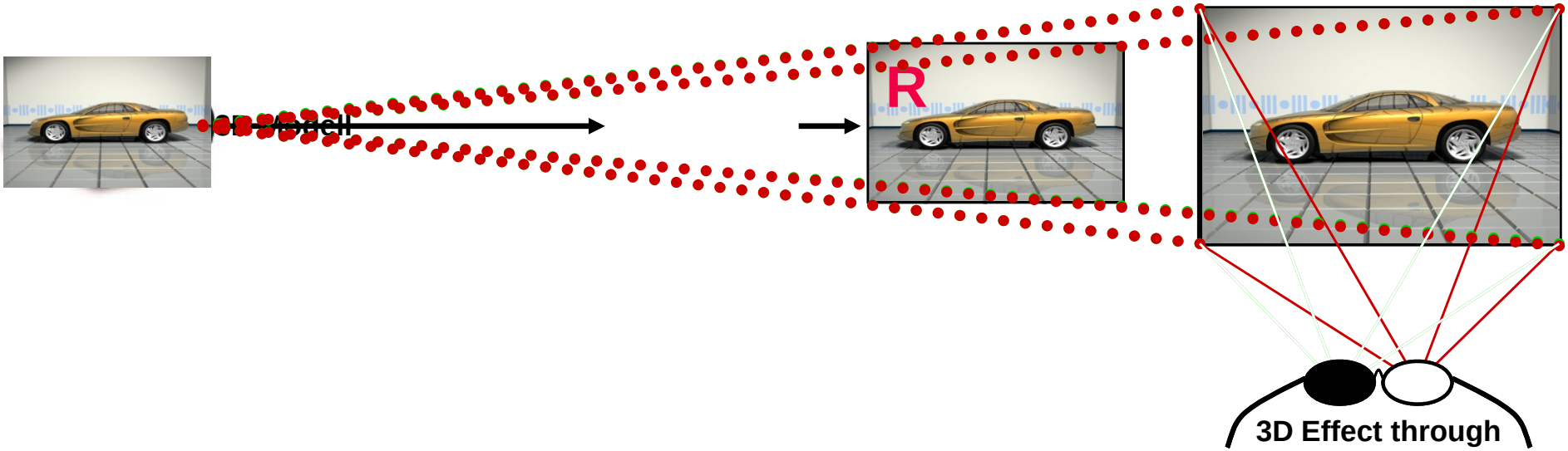
MPAA: Combine HW FSAA with Software controlled FSAA to get benefits from both worlds:
maintain speed and quality

Stereo

- Quadbuffered Stereo
- Passive stereo with independent outputs

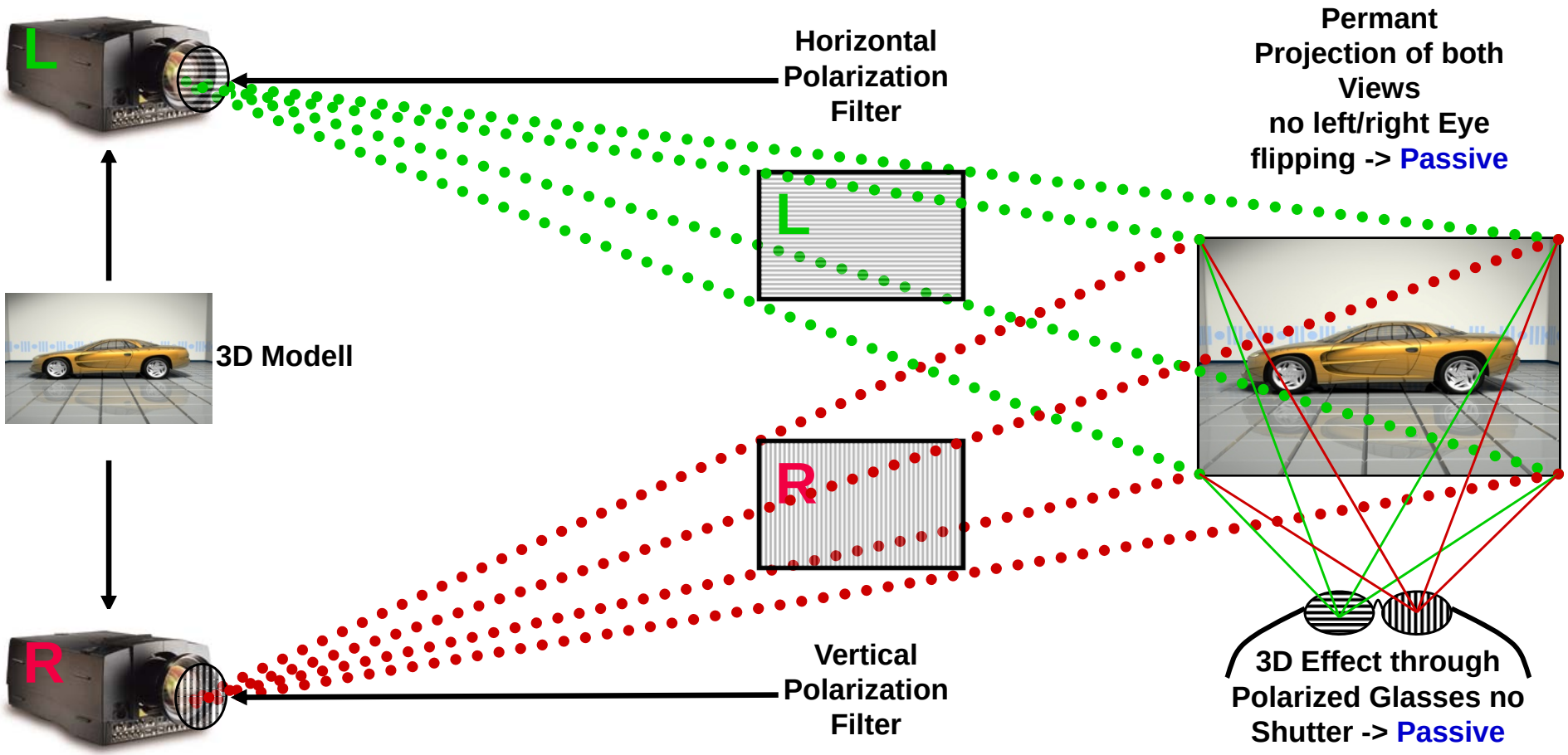
Active Stereo

Sequential Projection of both Views left/right Eye flipping -> Active



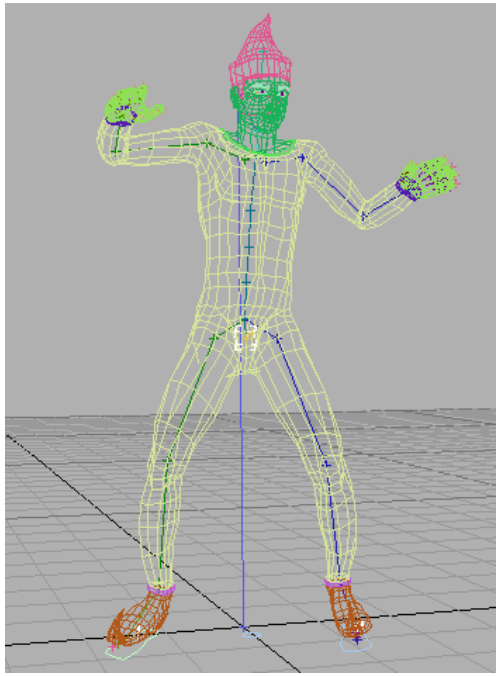
3D Effect through Shutter Glasses -> Active

Passive Stereo



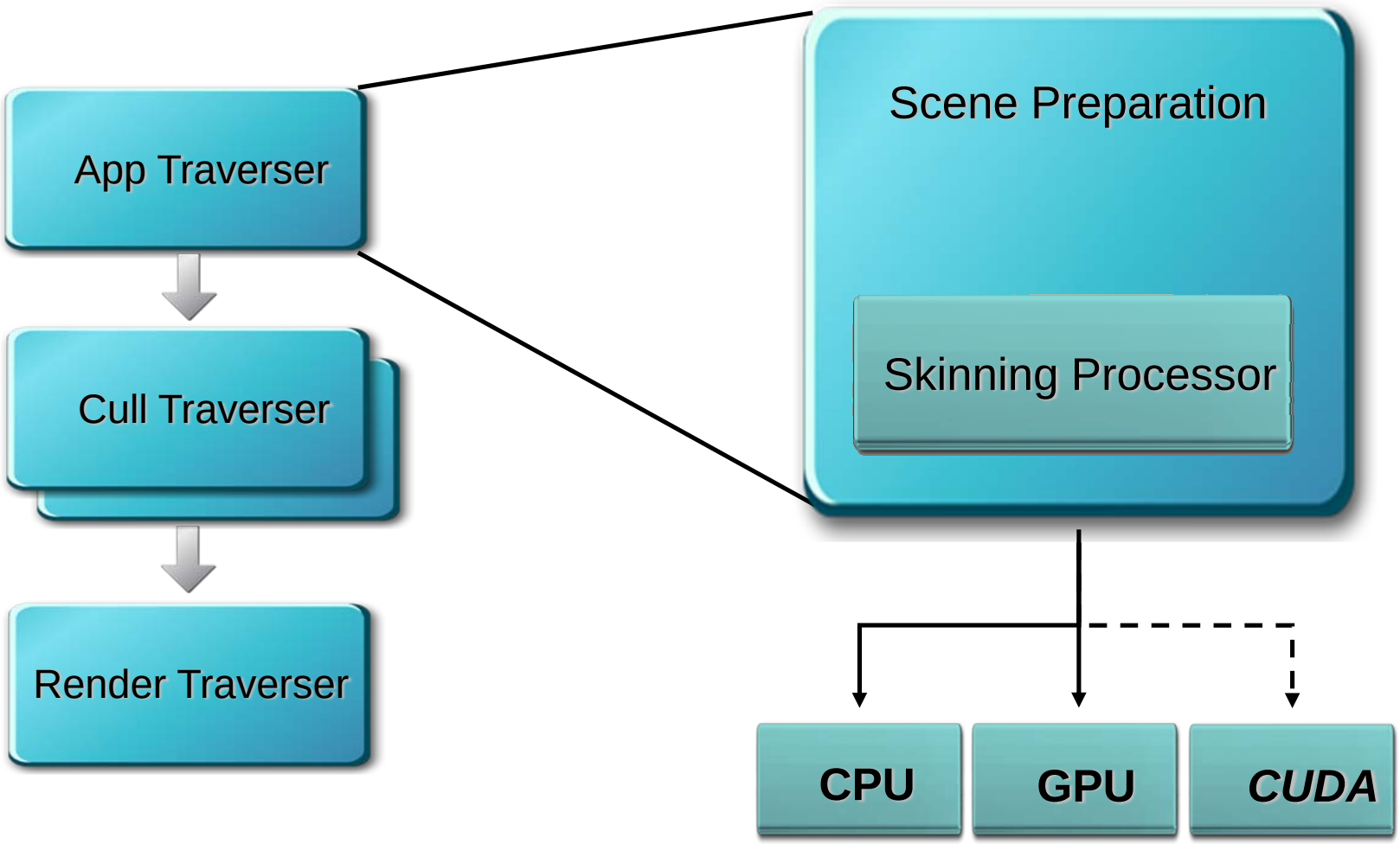
Improved Skinning

- Usage of skinning processors
  - CPU skinning processor
  - GPU skinning
    - minimal requirement: Shader Model 4
  - Future: CUDA skinning

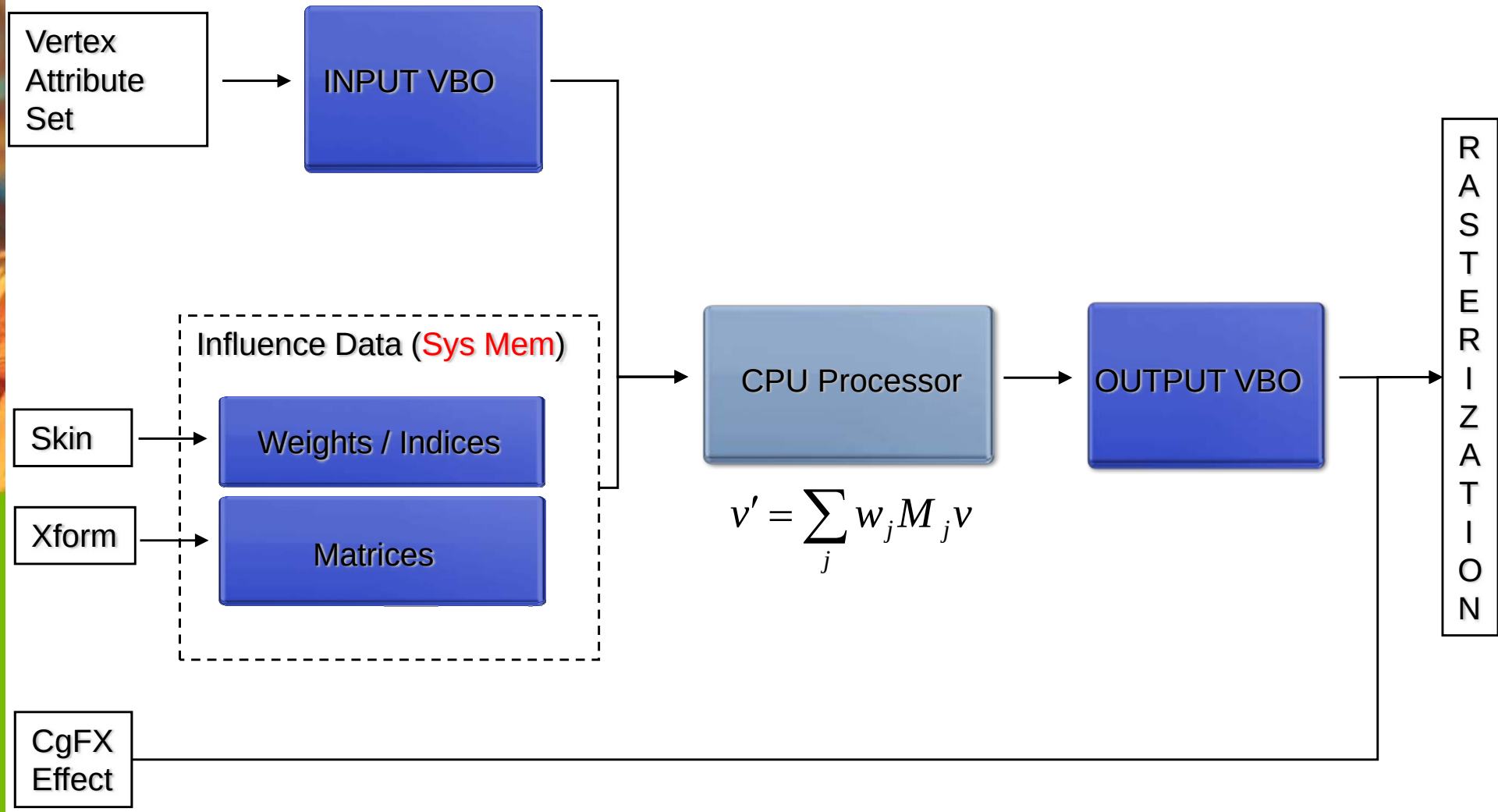


Scene	Old Skinning	CPU Skinning	GPU Skinning
Chameleon.nbf	12	66	975
Hatealien.nbf	12	61	760
Seymour.dae	na	66	850

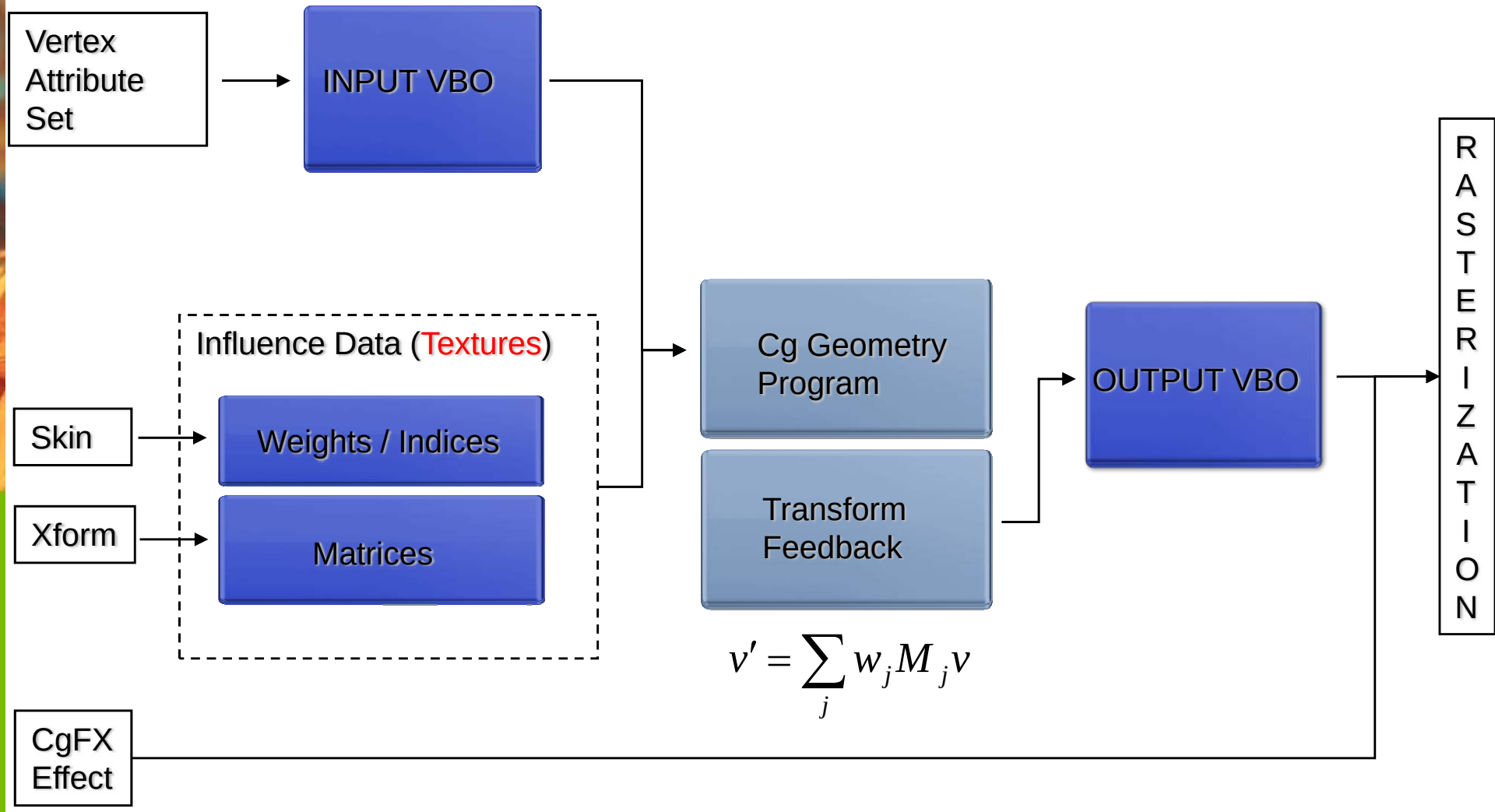
Skinning Implementation



Skinning Processors - CPU



Skinning Processors - GPU

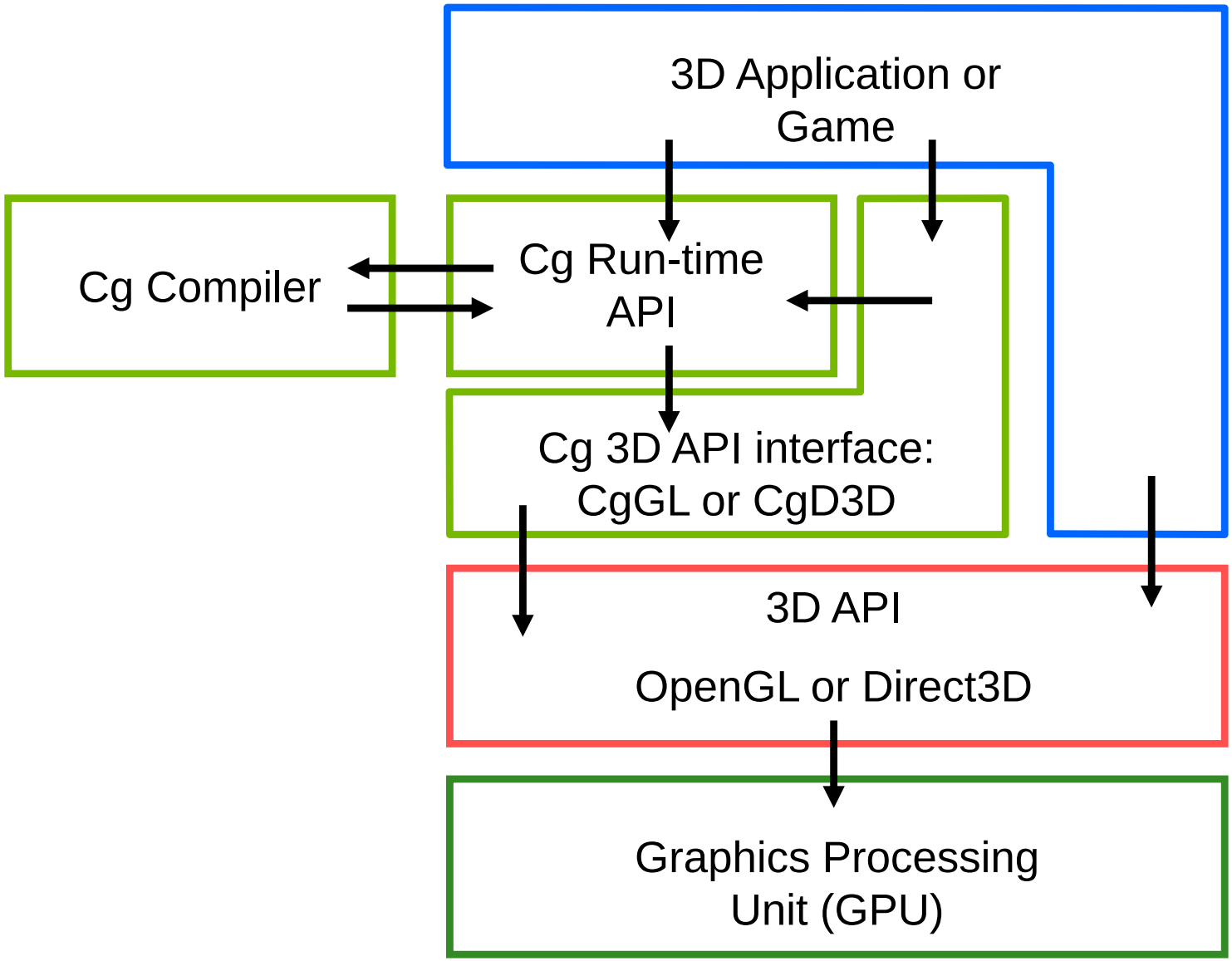


Shaders - Cg

- GPU Shading language inspired by C
- API-independent
  - OpenGL or Direct3D
- Platform-independent
  - NVIDIA, AMD/ATI, PS3
  - Windows, Linux, MacOS X, Solaris
- Hardware and API variation managed with “profiles”
  - Profile = execution environment + compiled program format
  - Profiles can determine
    - How types are represented
    - Available standard library routines
    - Semantics of execution
- Part of 3D content creation tool chains

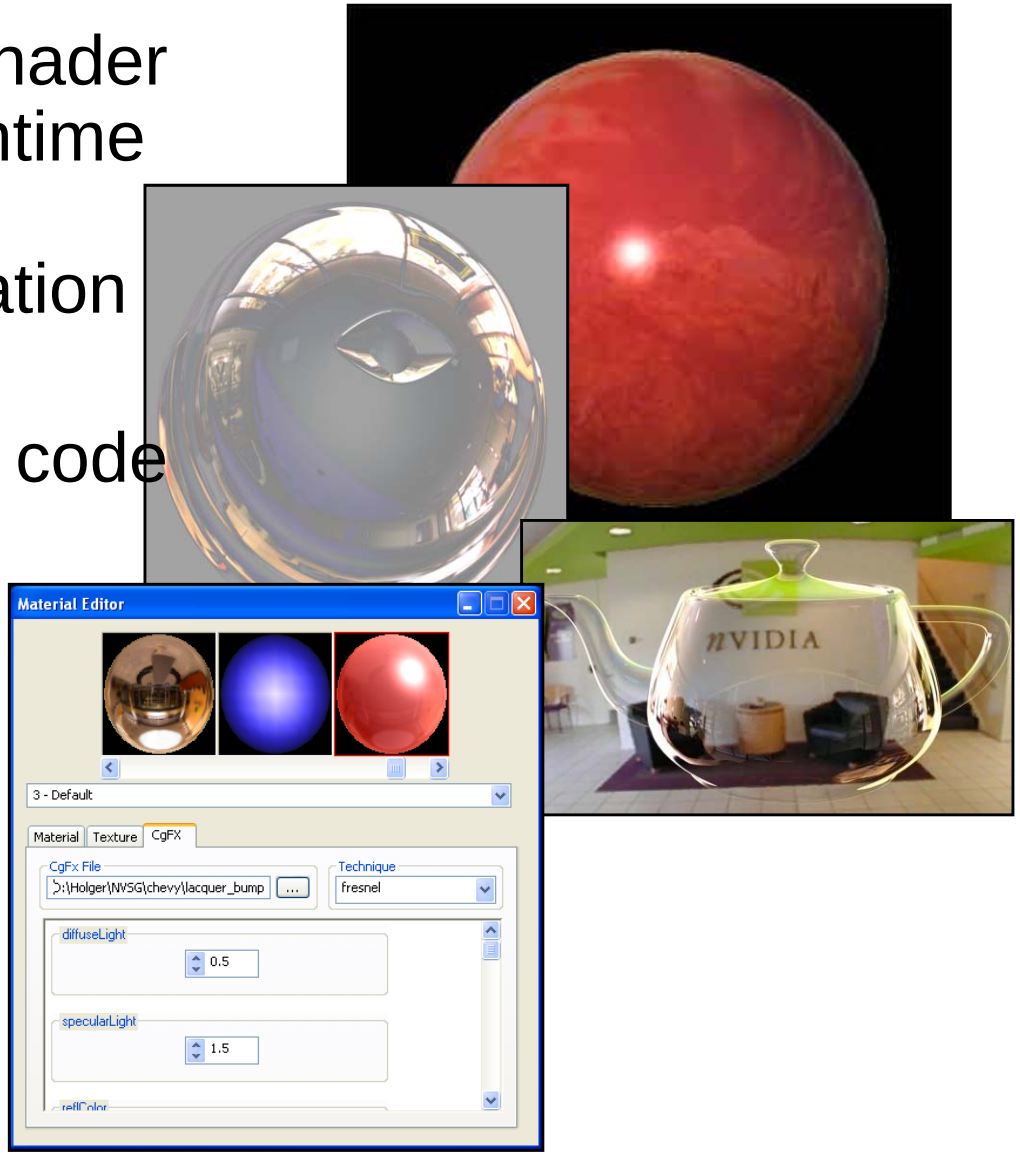
Write your shaders in Cg; deploy them to any API or platform

Cg software stack



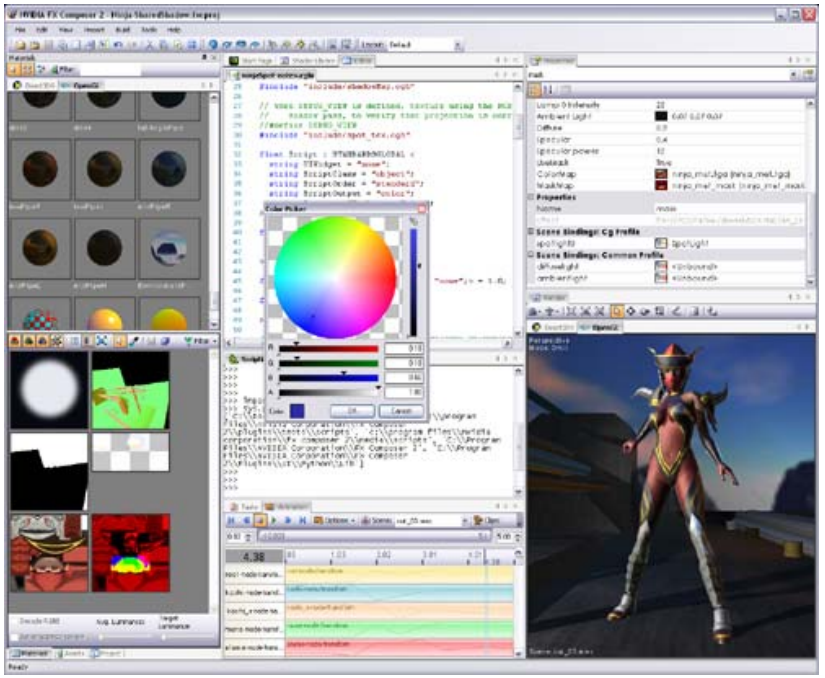
CgFX support

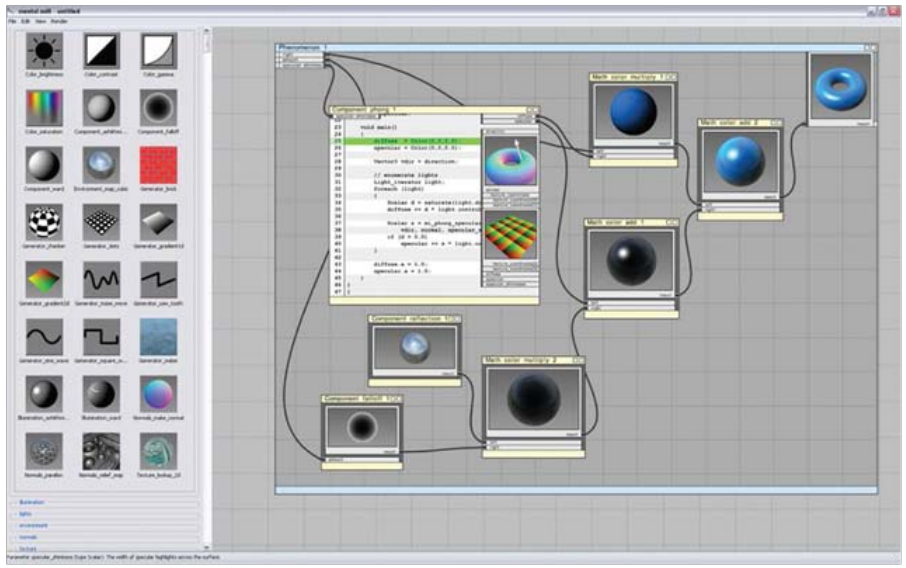
- Metafile format used for shader description. The CgFX runtime takes care where to put textures and other information for the shader
- No shader specific C/C++ code needed!



Shader Authoring Tool Integration

- Shader authoring tools
  - FXComposer
  - mental mill



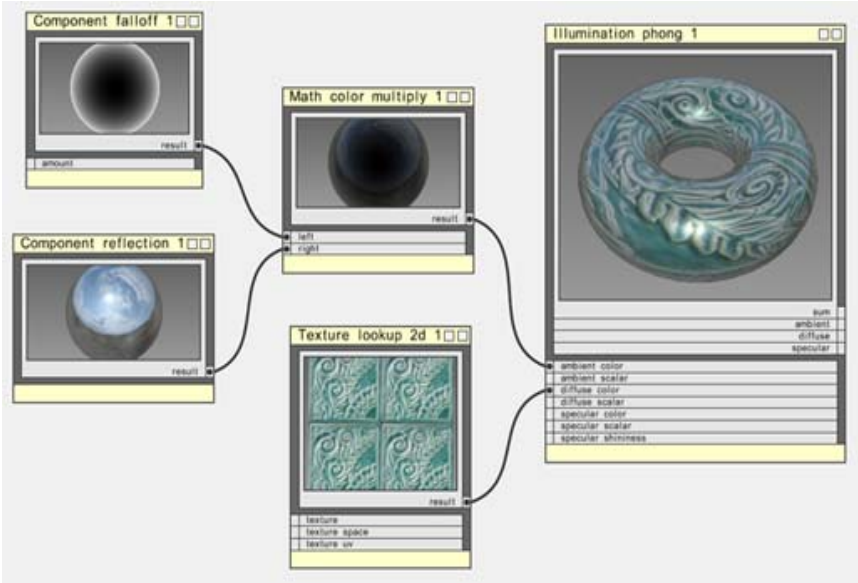


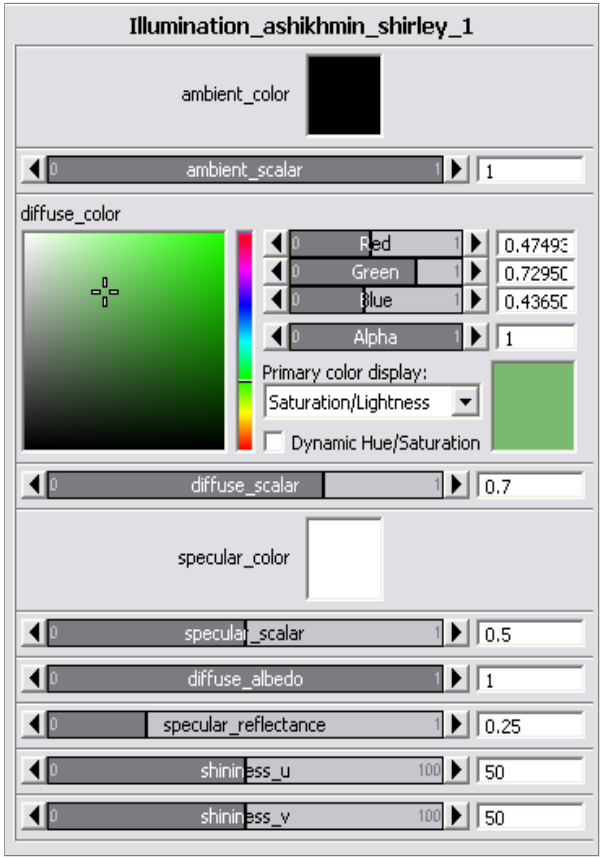
- Visual programming
- Drag & Drop
- Debugging

mental mill®

Shader creation for all levels of technical expertise

- Shader creation without programming for non-technical users and Artists
- Familiar graph editing paradigm
- Simple parameter editing

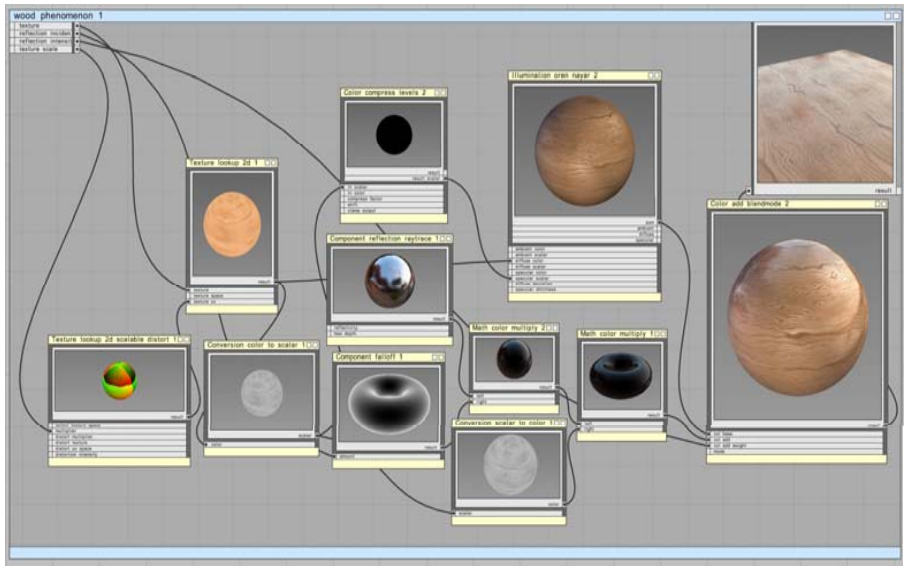




MetaSL™

Easy to use meta language for shader writers

- Shaders can be exported for use in:



Autodesk Maya

mental ray®

FX Composer 2.5

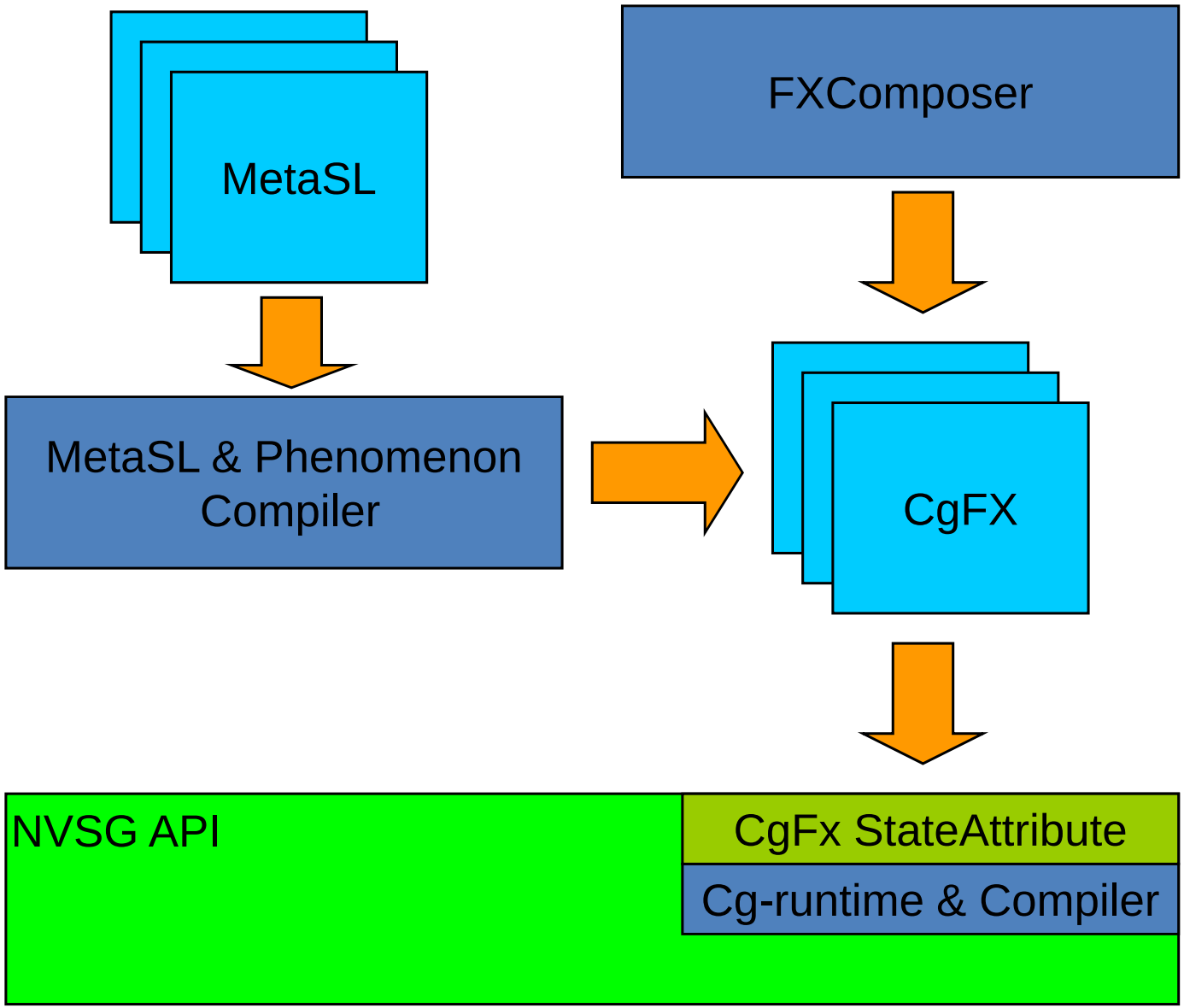
NVSG

SOFTIMAGE|XSI

CATIA

SolidWorks

Workflow – Shader Integration



Interactive Ray Tracing

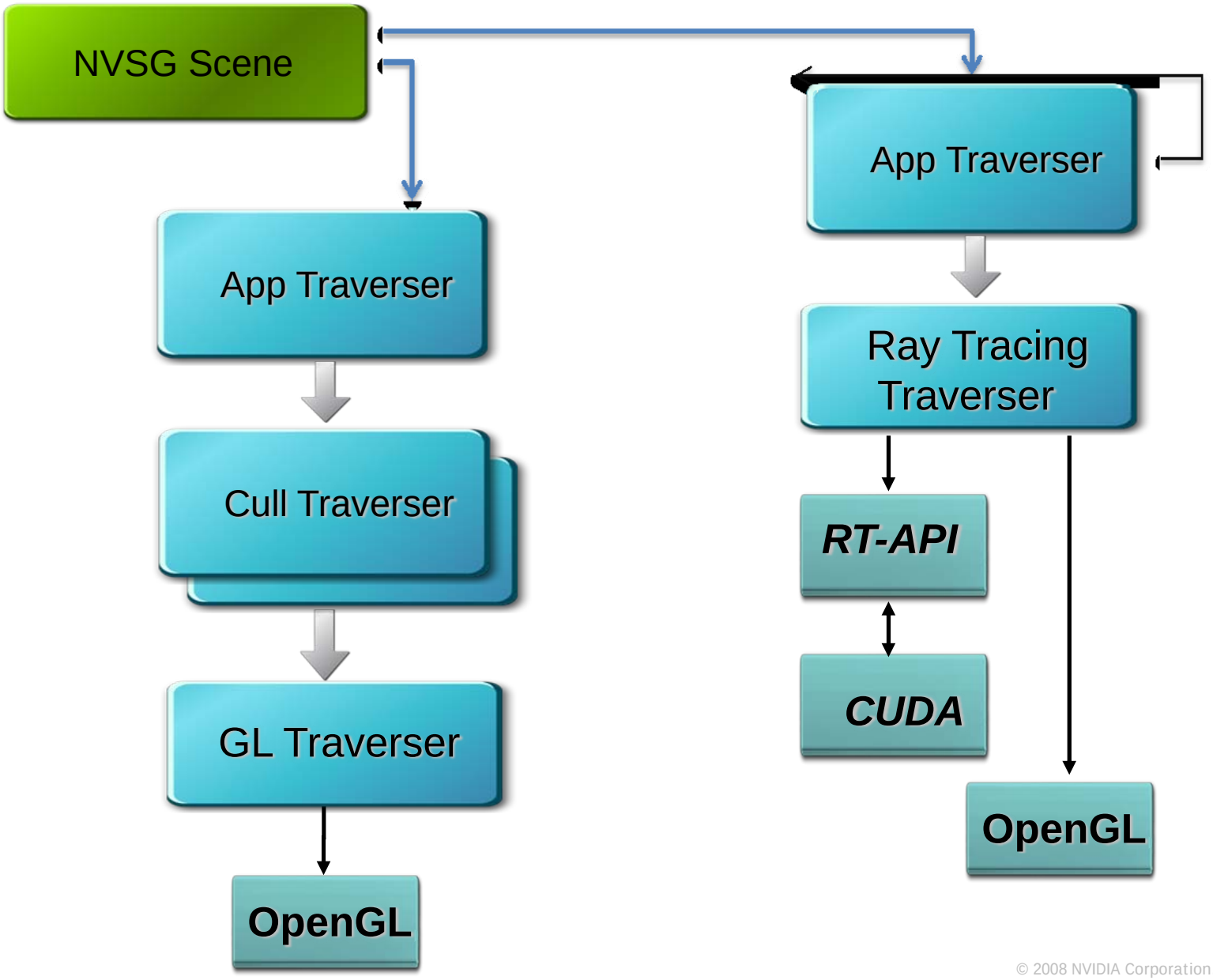
- CUDA Everywhere

- Low Level: SDK
- High Level: NVSG Integration

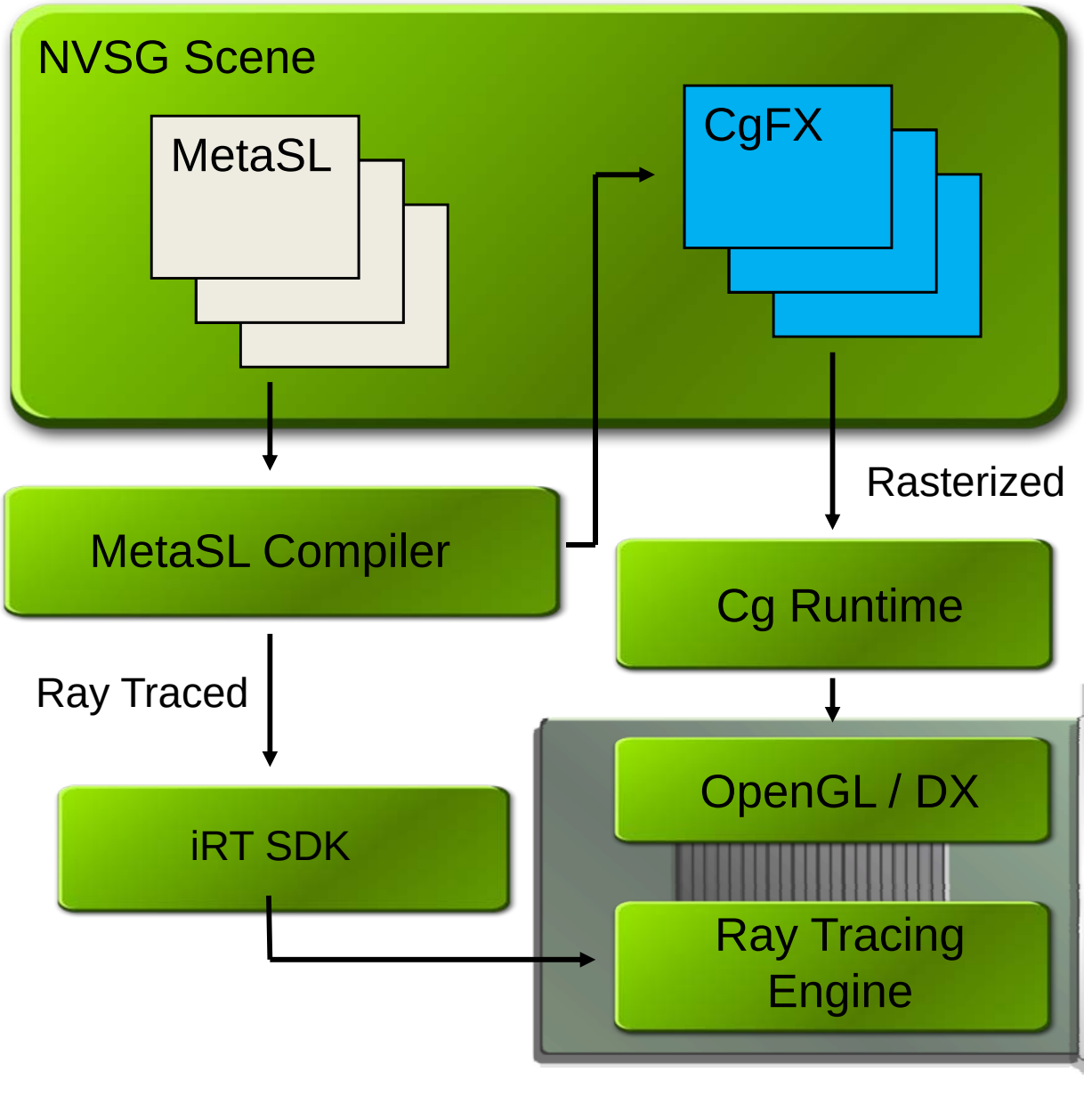
Ray Tracing SDK

- C++ SDK
- Shader-based (CUDA*)
- Dynamic Scenes
- Hybrid rasterization/ray tracing
  - Use the right tools to get maximum performance and quality

RT Scene Traversal in NVSG

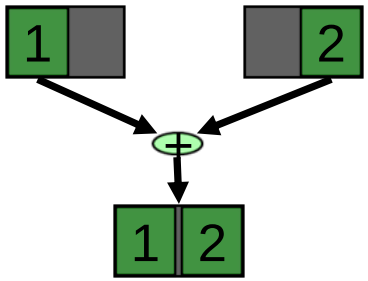


Ray Tracing Shaders in NVSG

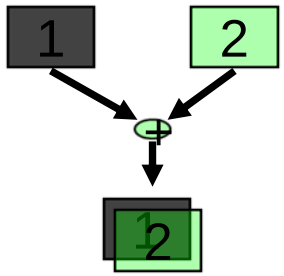


MGPU SDK - NVScale

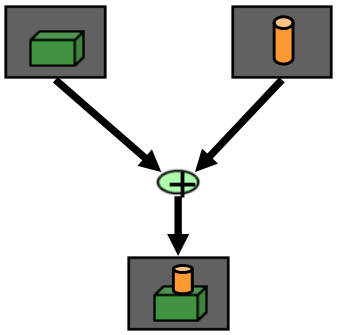
- Image compositor for sort first and sort last based applications
  - Screen tiling, alpha and depth based compositing
  - Platforms: win32/64, linux 64
  - Compositor implementation based on latest technologies, no migration effort for applications (next gen hardware will provide faster transport)
  - Configurable: 1-1, n-1, hierarchical



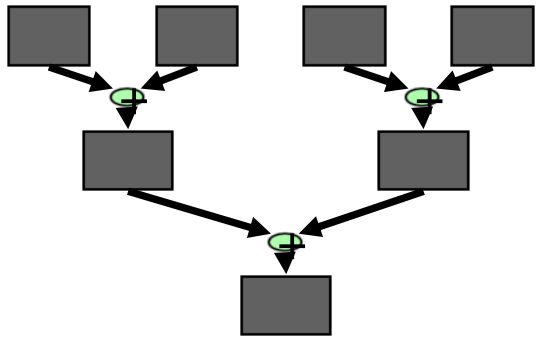
Screen Tiling



Alpha compositing



Depth compositing

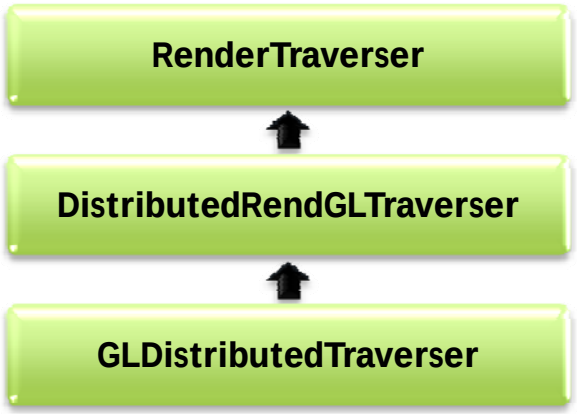


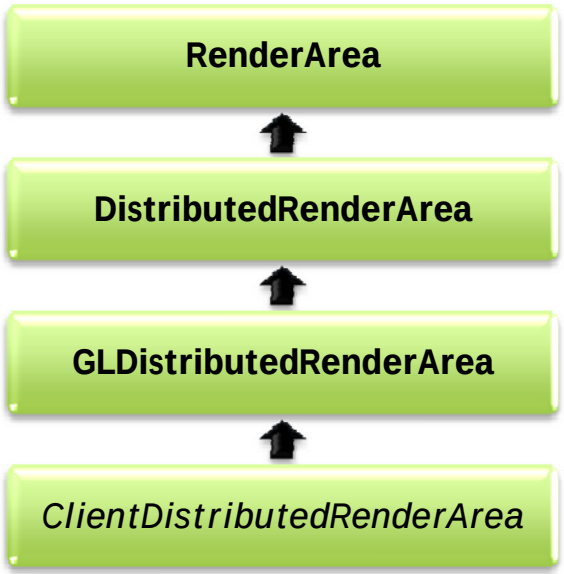
Hierarchical compositing

Distributed rendering with NVSG

GLDistributedRenderArea

- Clients must derive from this and integrate with windowing system
- Optionally select GPUs to be used
- Uses MGPUSDK for image composition





DistributionTraverser

- Assigns GPUs to handle scene graph objects based on distribution scheme
- Distribution scheme assigns objects to optimally balance load on GPUs

GLDistributedTraverser

- Multiple instances (one per GPU)
- Instances run in parallel
- Each instance only renders objects assigned to its GPU
- Triggers image composition when ready

Dinosaurs in the Museum

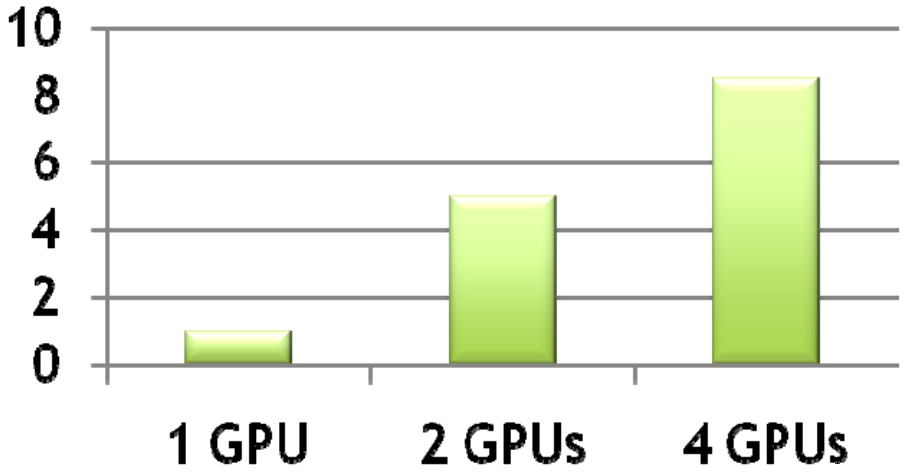
Model characteristics:

- Model designed in Maya, AutoDesk
- 217 Million Triangles

Rendering Hardware:

- HP xw8600 with 32 GB System Memory
- 2xD2's with 16GB total video memory

Rendering Performance:



Total max. triangle throughput = 1.3 GTri/s

Thank You!

Feedback & Questions: nvsghelp@nvidia.com