

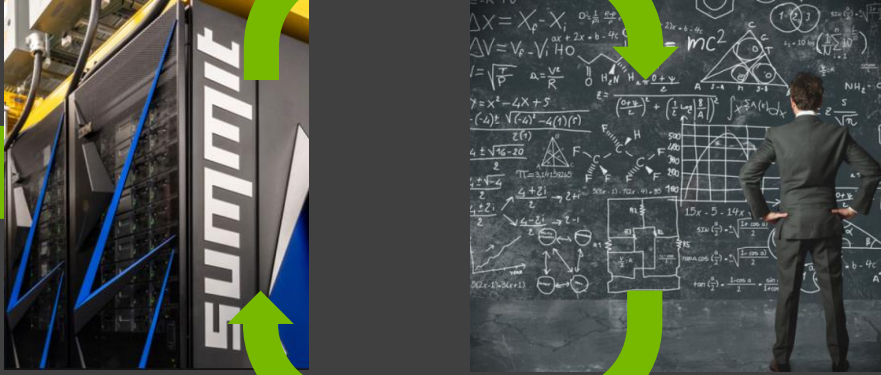


LEVERAGING NVIDIA OMNIVERSE FOR IN SITU VISUALIZATION

Mathias Hummel and Kees van Kooten, 06/20/2019

SCIENTIFIC VIS VS. EDUTAINMENT

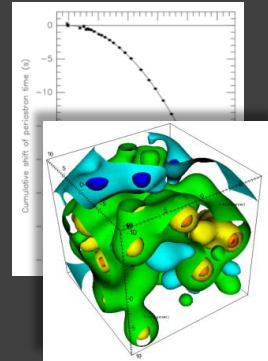
Science



Extract information, gain insight
Visual cues, interactivity enhance focus

Helps to understand data

ParaView/Catalyst, VisIt/libSim, Matlab, Python,...



Edutainment



Tell a story
Support story with visual FX

Catch viewer's attention

Houdini, Blender, Maya, ..

VISUALIZATION TASKS

Iso-surfaces,
Iso-volumes

Field Operators
(Gradient, Curl,..)

Streamlines

Coordinate
transformations

Feature
extraction

Clip, Slice

Compositing

Surface
Rendering

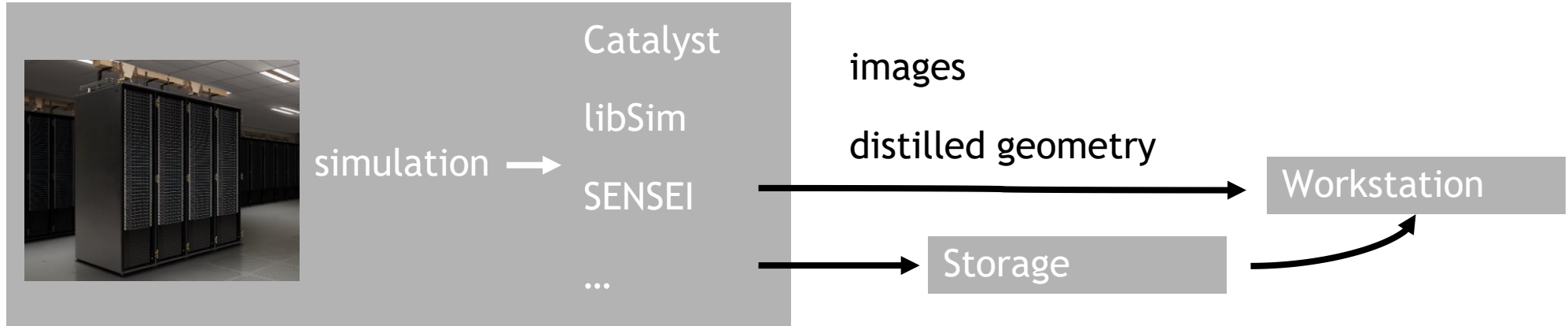
Thresholding

Binning,
Resample

Line
Rendering

Volume
Rendering

IN SITU FRAMEWORKS



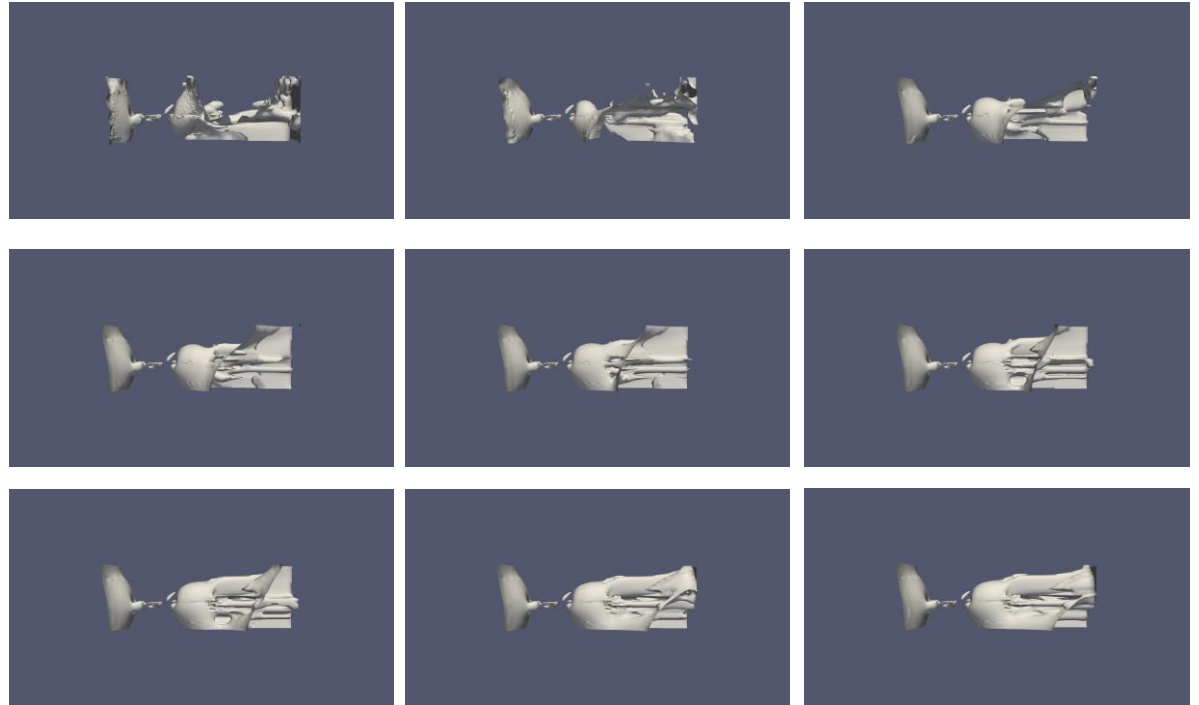
IN SITU RENDERING

Post / coprocessing: define

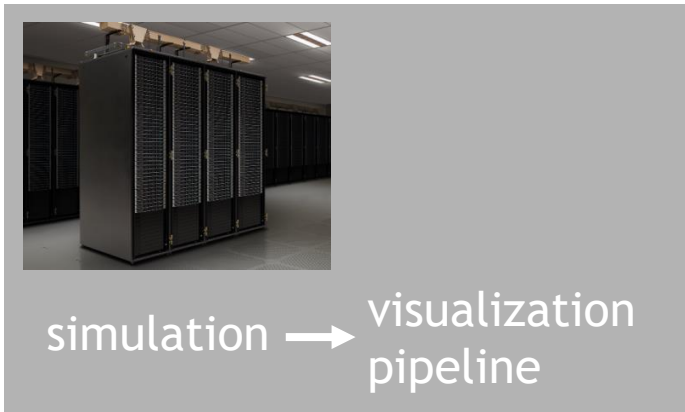
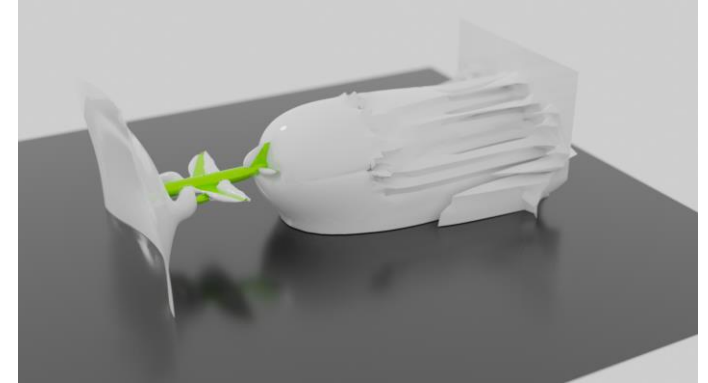
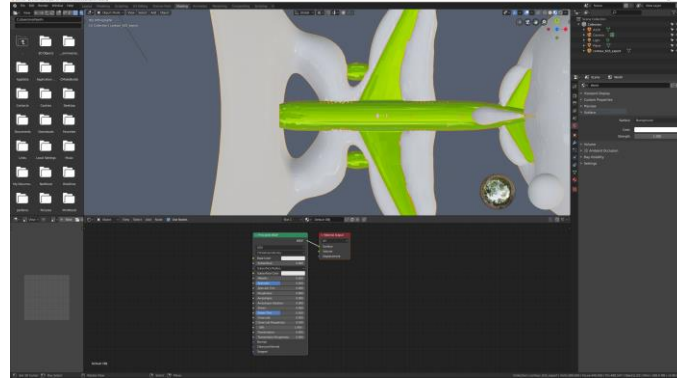
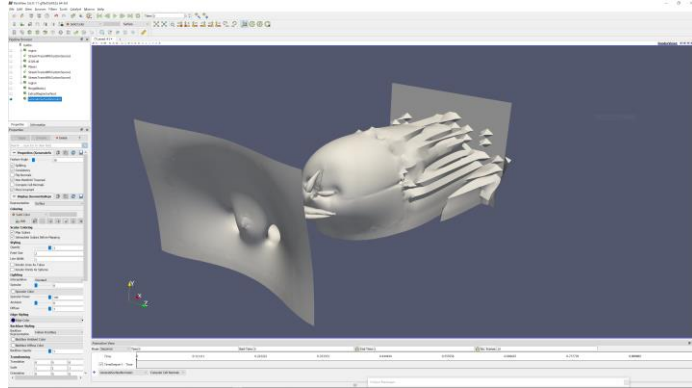
- time sampling
- visualization pipeline

Rendering: also define

- color maps
- view parameters / camera path



OUTREACH AND PRESENTATION



3D authoring
tools

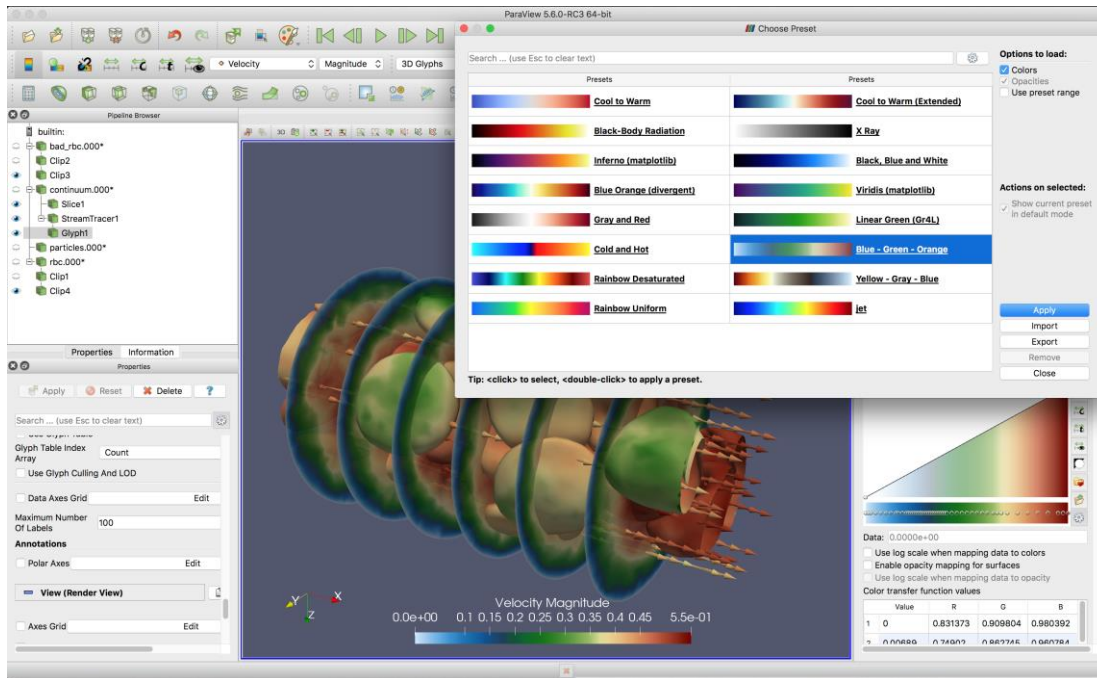
rendering
software

The background is a dark blue field with a network of thin, light green lines connecting various points. Some points are small, bright green dots, while others are larger, glowing blue spheres. The lines and points create a sense of depth and connectivity, resembling a complex network or a stylized molecular structure.

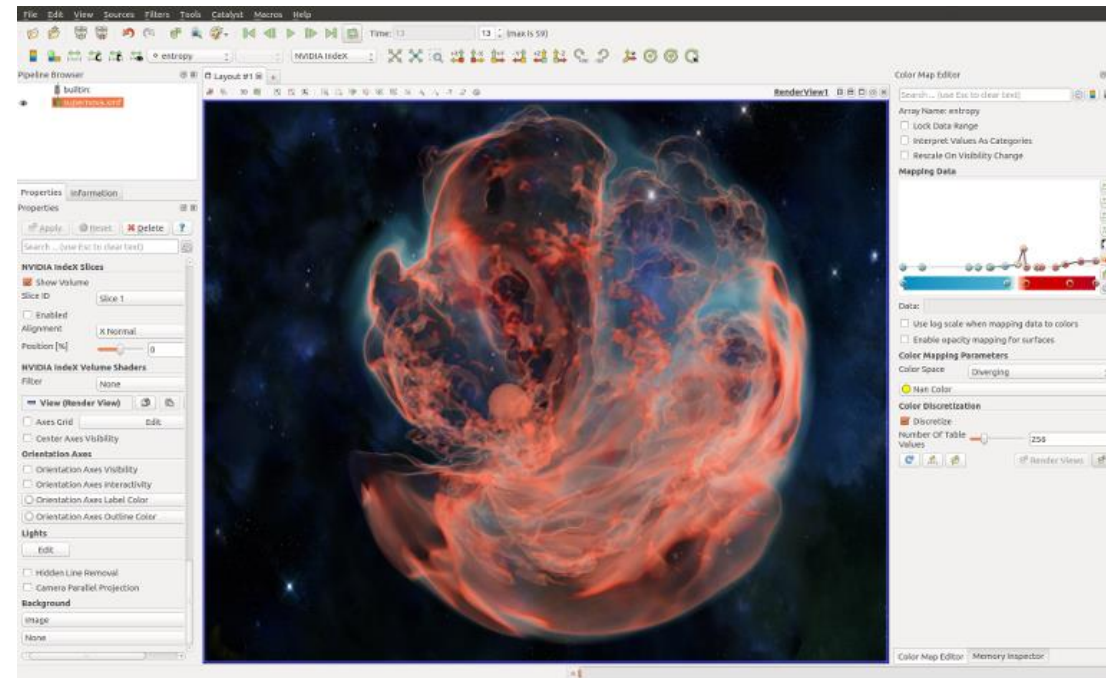
PREVIOUS WORK AT NVIDIA

KITWARE PARAVIEW

Open-Source (Distributed) Visualization Package



OpenGL



NVIDIA IndeX Plugin



VISRTX

Visualization Framework Powered by NVIDIA RTX Technology

Progressive forward pathtracer with NEE/MIS

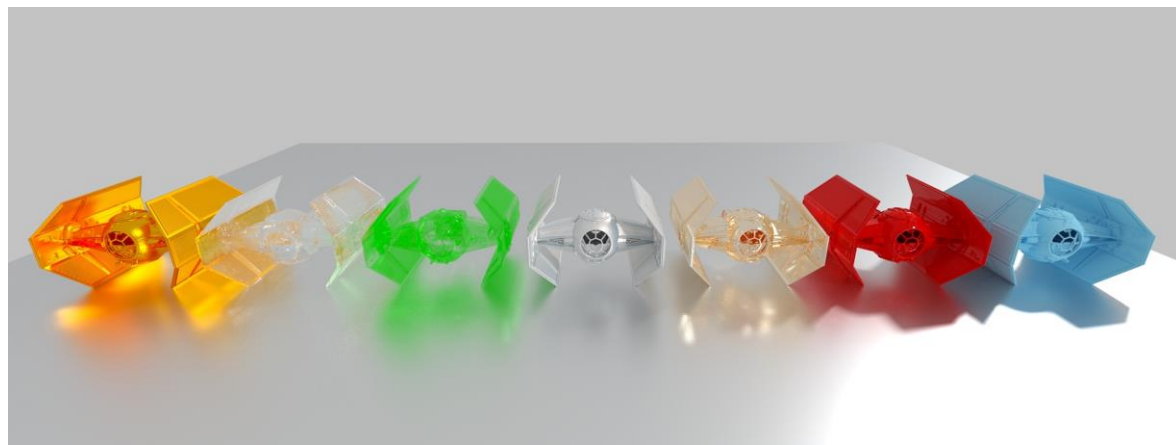
Hardware-acceleration through OptiX

MDL for physically-based materials

AI denoiser

Area lights, Depth of Field, Tone mapping,
etc.

Open-source C++ library

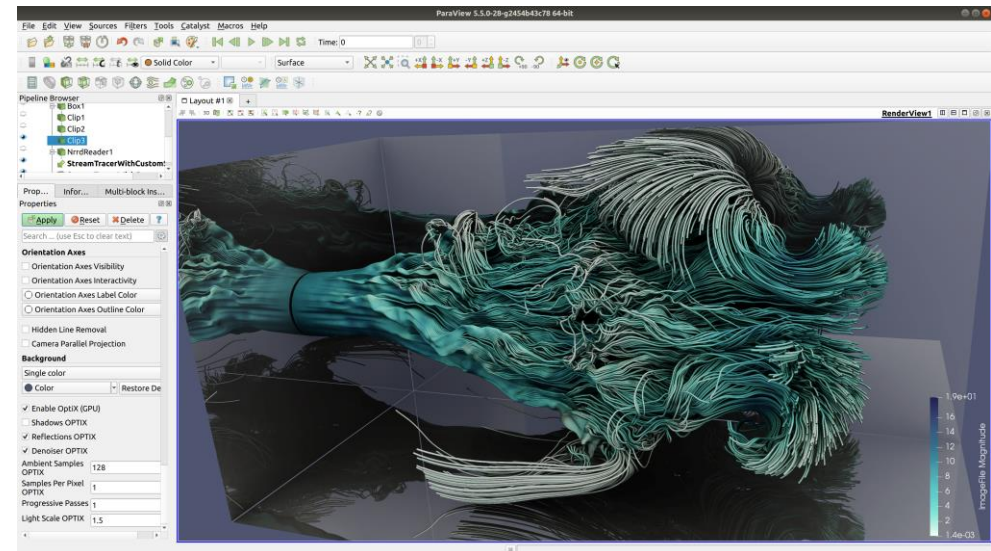
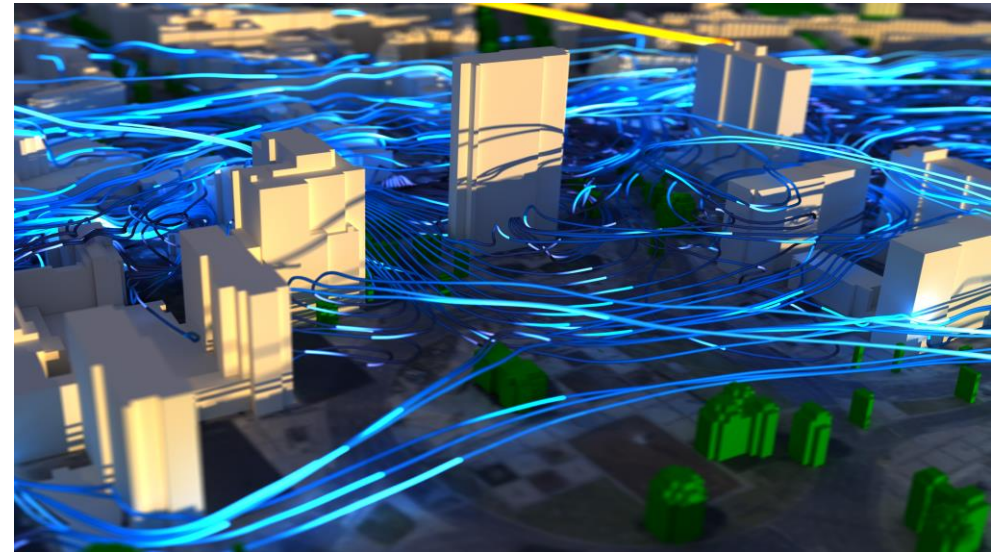


<http://github.com/NVIDIA/VisRTX>

VISRTX + PARAVIEW

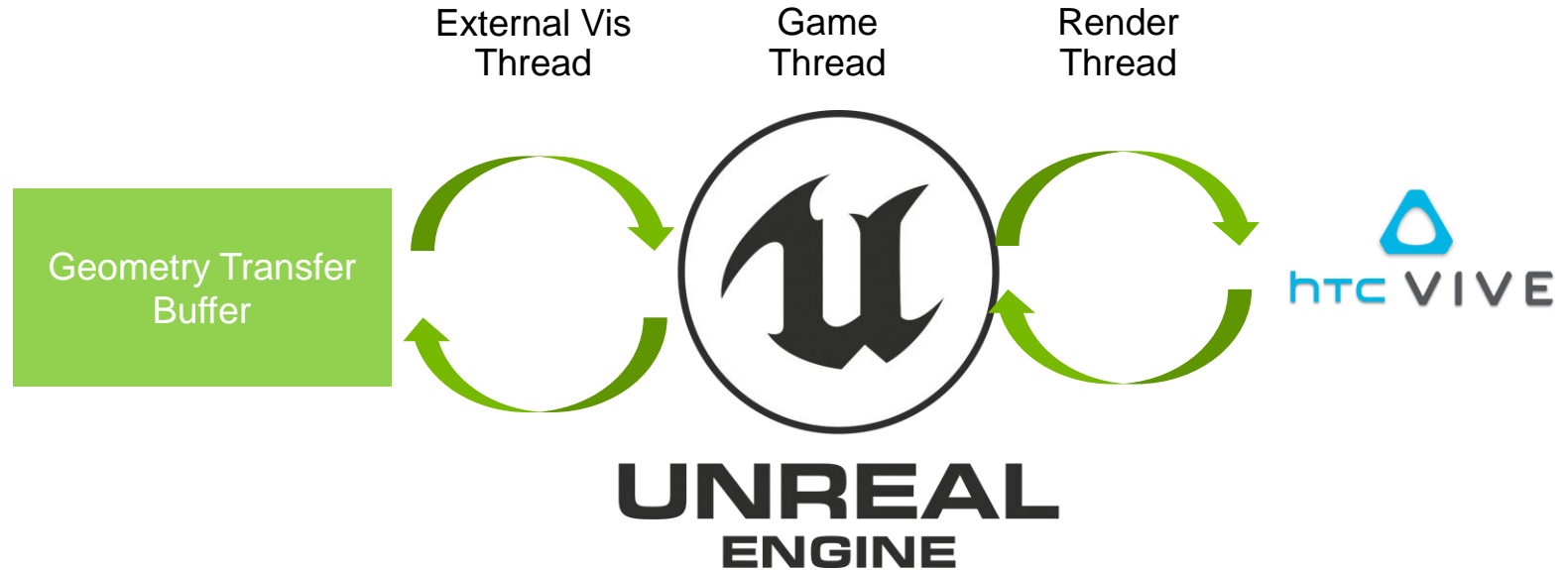
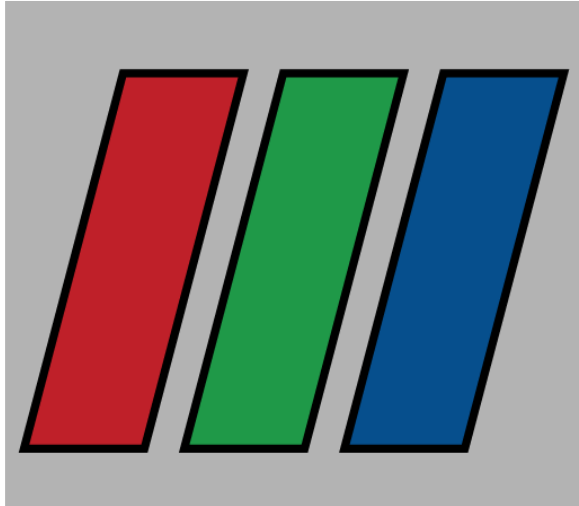
VisRTX open-source on GitHub

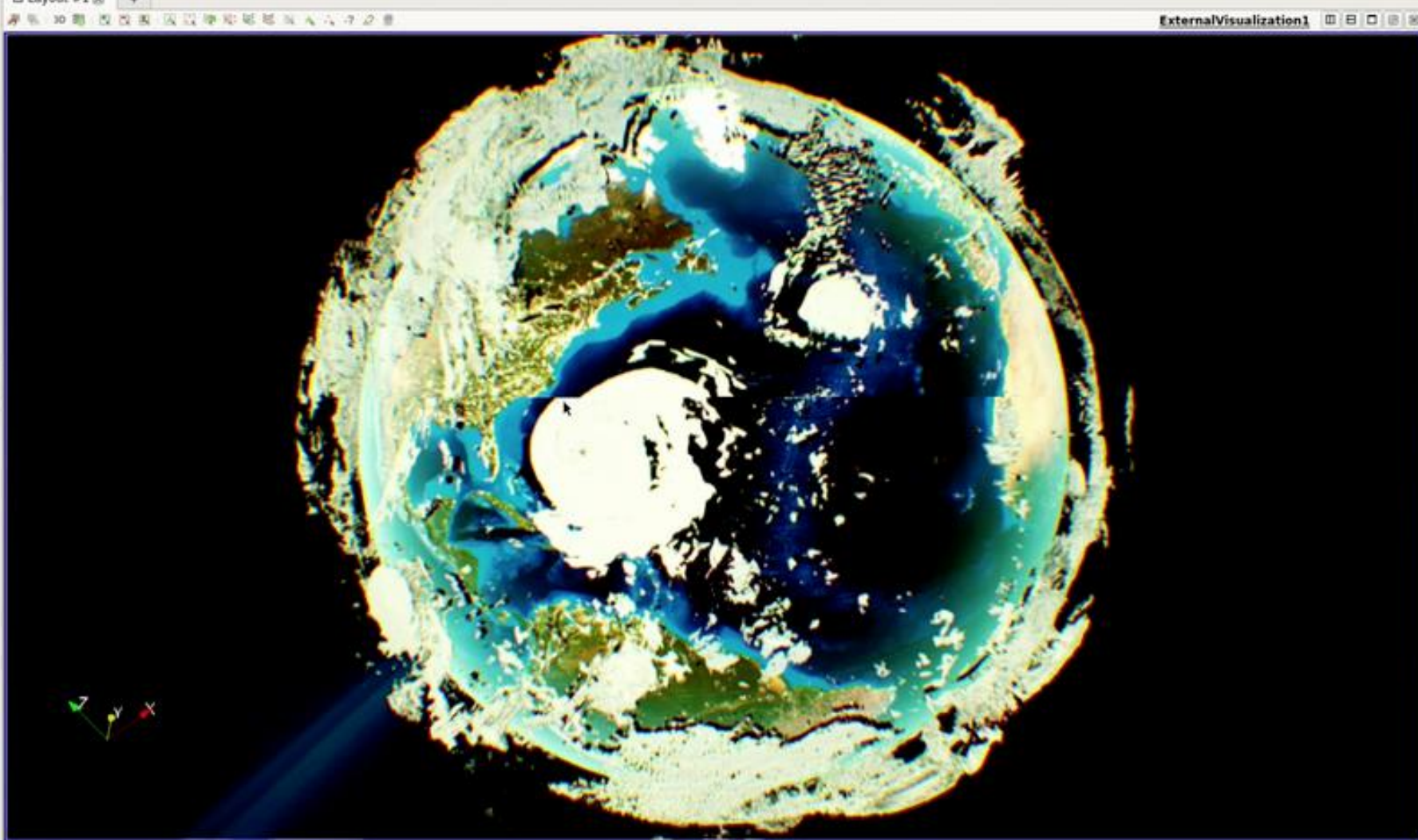
Shipped with upcoming ParaView 5.7



ParaView - Unreal Bridge (Holodeck)

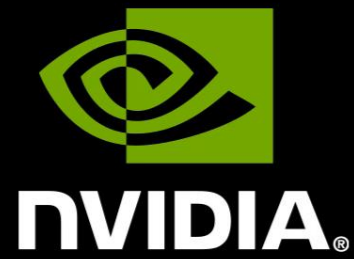
Leveraging Tools Developed for Entertainment







NVIDIA OMNIVERSE

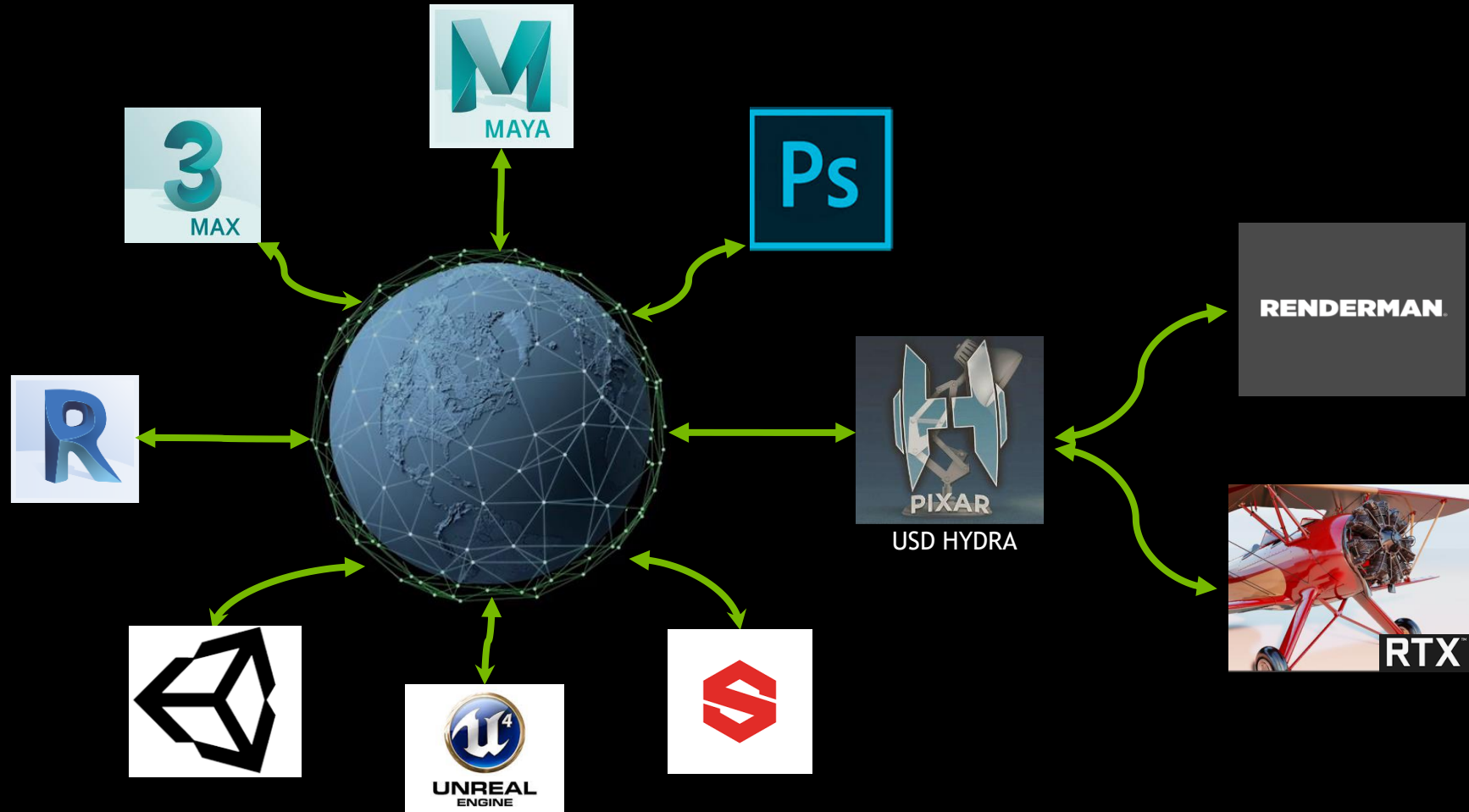


NVIDIA Omniverse



OMNIVERSE AT GTC 2019

CONNECTING ALL TOOLS



OPEN PLATFORM

Omniverse

Open Platform for USD Collaboration and Realtime Rendering

Client SDK

(USD + MDL + Omniverse Connection)

Collaboration Server

(Local or Hosted)

Pipeline Tools Framework

(USD Viewer, Editor, Microservices, Pipeline)

Hydra Realtime Raytracer

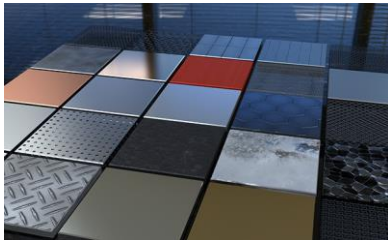
(physically accurate)

Omniverse Kit



UNIVERSAL SCENE DESCRIPTION (USD)

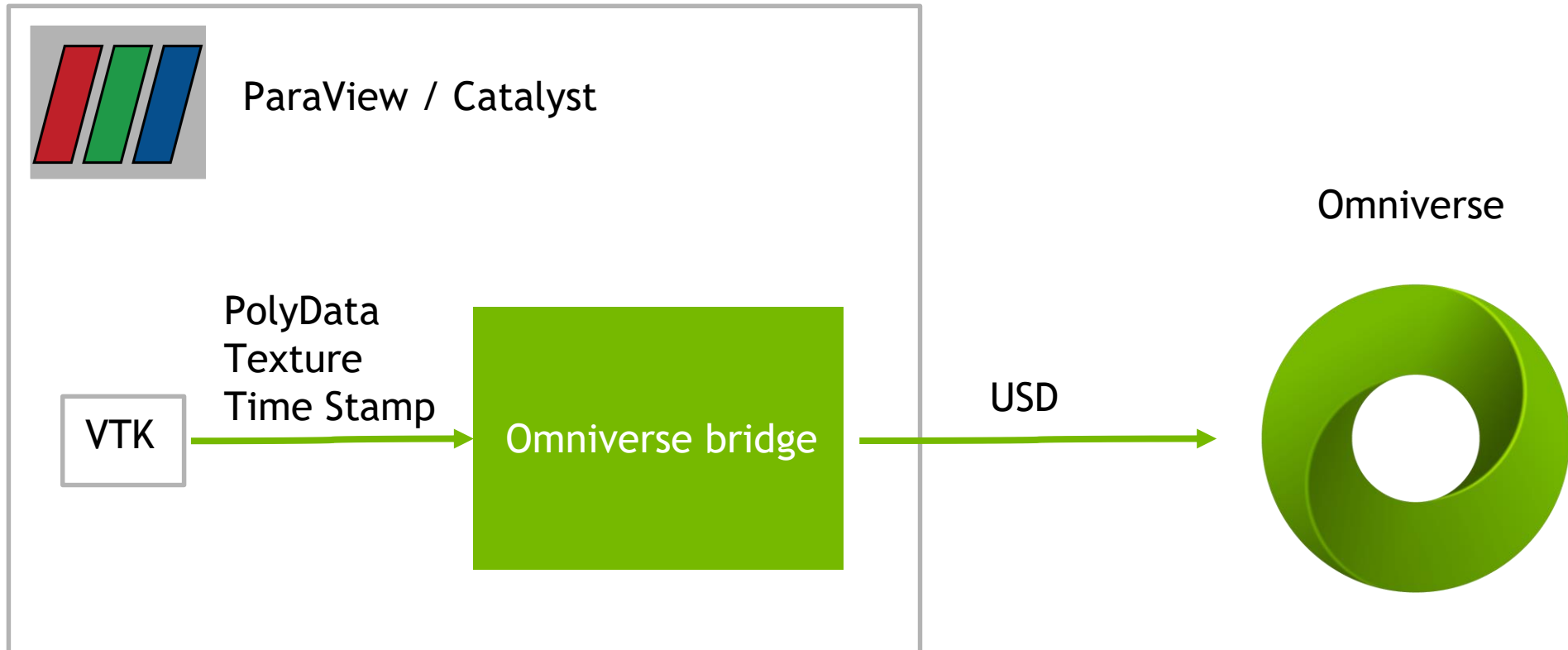
- Represent, assemble 3D assets
- Scenegraph representation
- Override properties through layers
- Extended with support for Material Description Language (MDL)



```
#usda 1.0
(
    upAxis = "Y"
    defaultPrim = "mesh"
)

def Mesh "mesh"
{
    uniform bool doubleSided = 1
    int[] faceVertexCounts = [3, 3, 3, 3, 3, 3,
    int[] faceVertexIndices = [351, 352, 353, 35
    normal3f[] normals = [(0.57735026, 0.5773502
    point3f[] points = [(0.5, 0.5, 0.5), (-0.5,
```

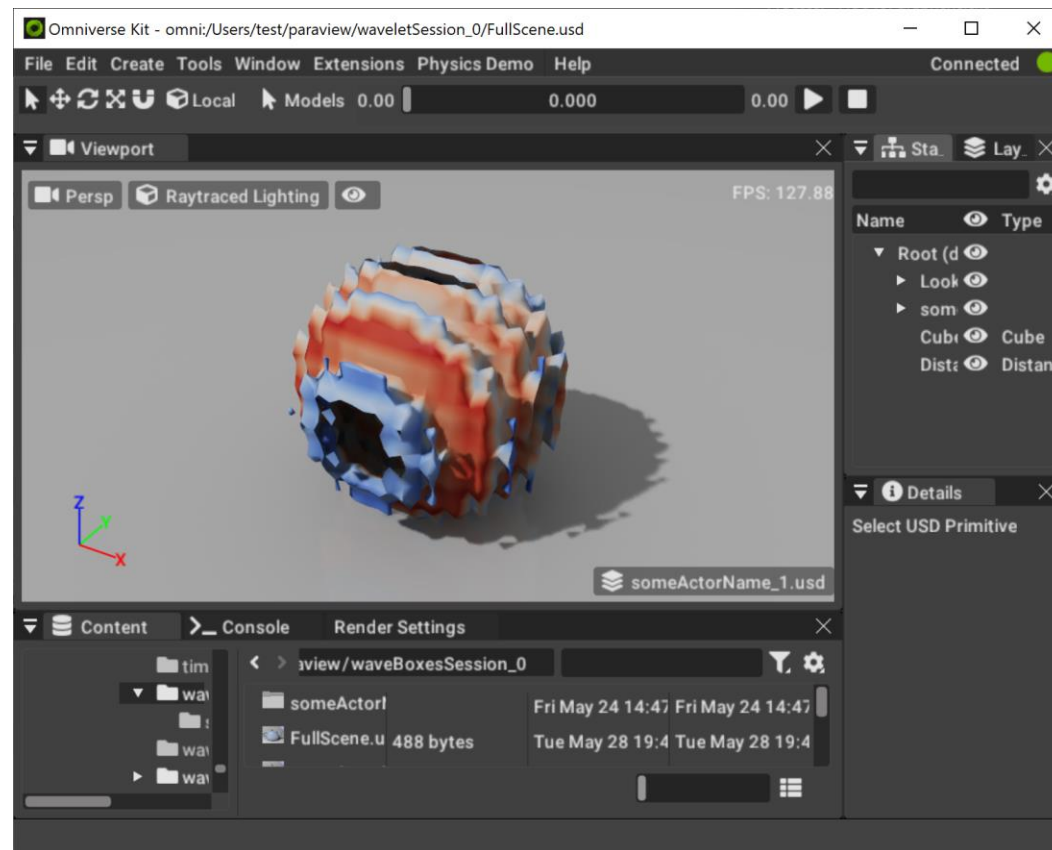
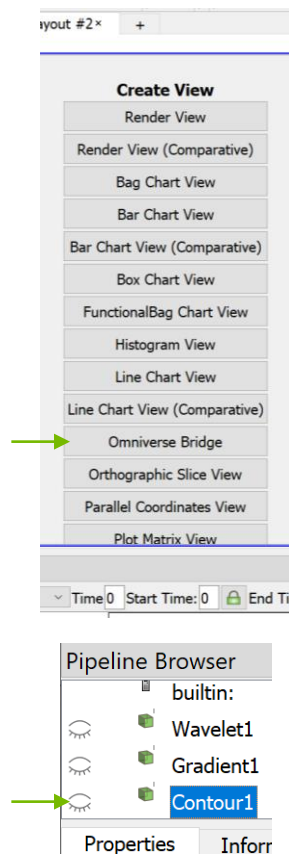
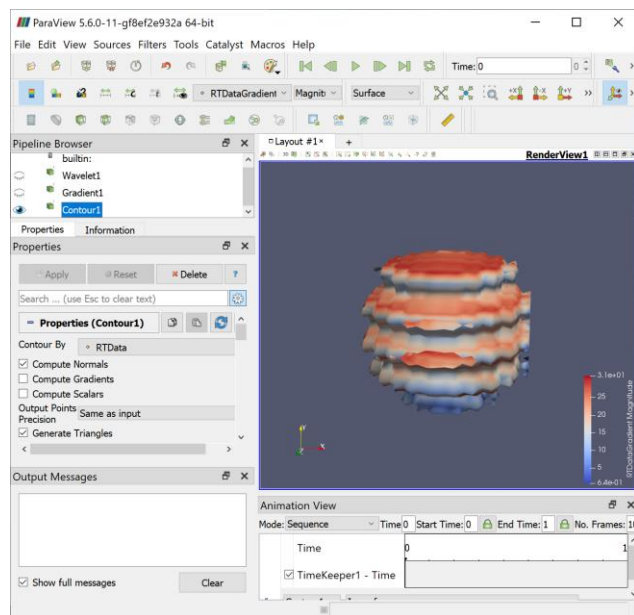
INTEGRATING PARAVIEW WITH OMNIVERSE



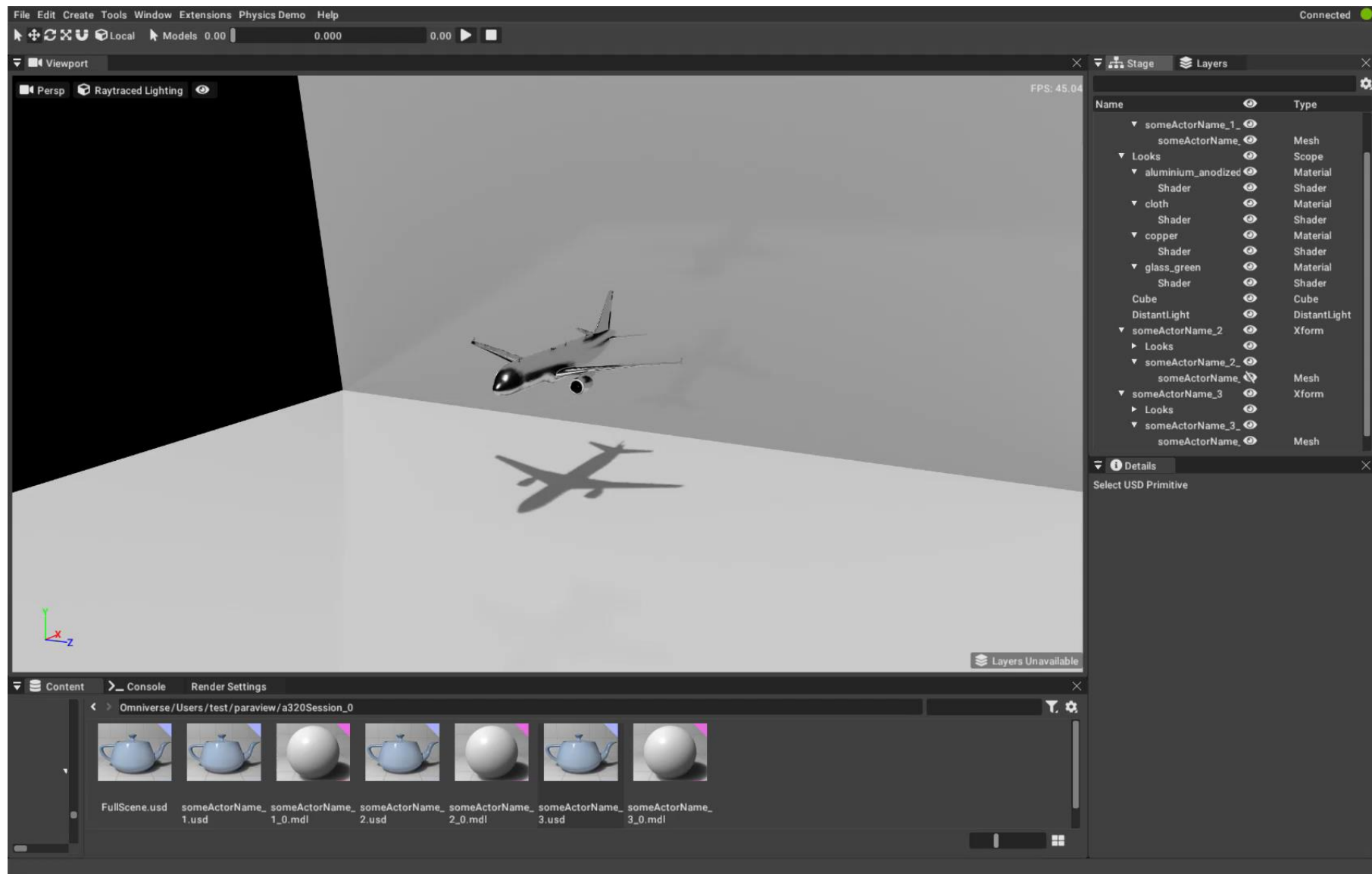


EXAMPLES

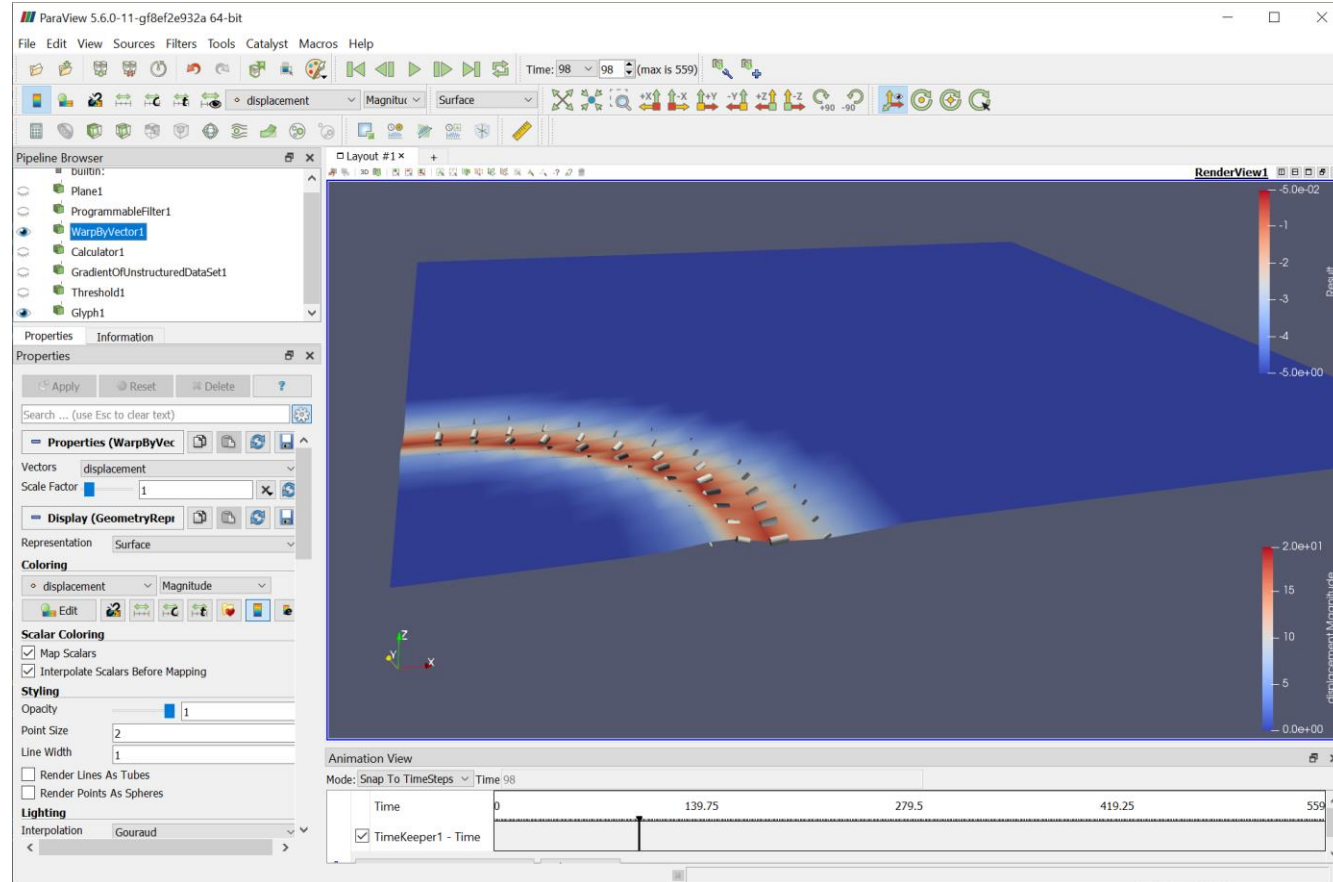
TRIVIAL EXAMPLE: WAVELET

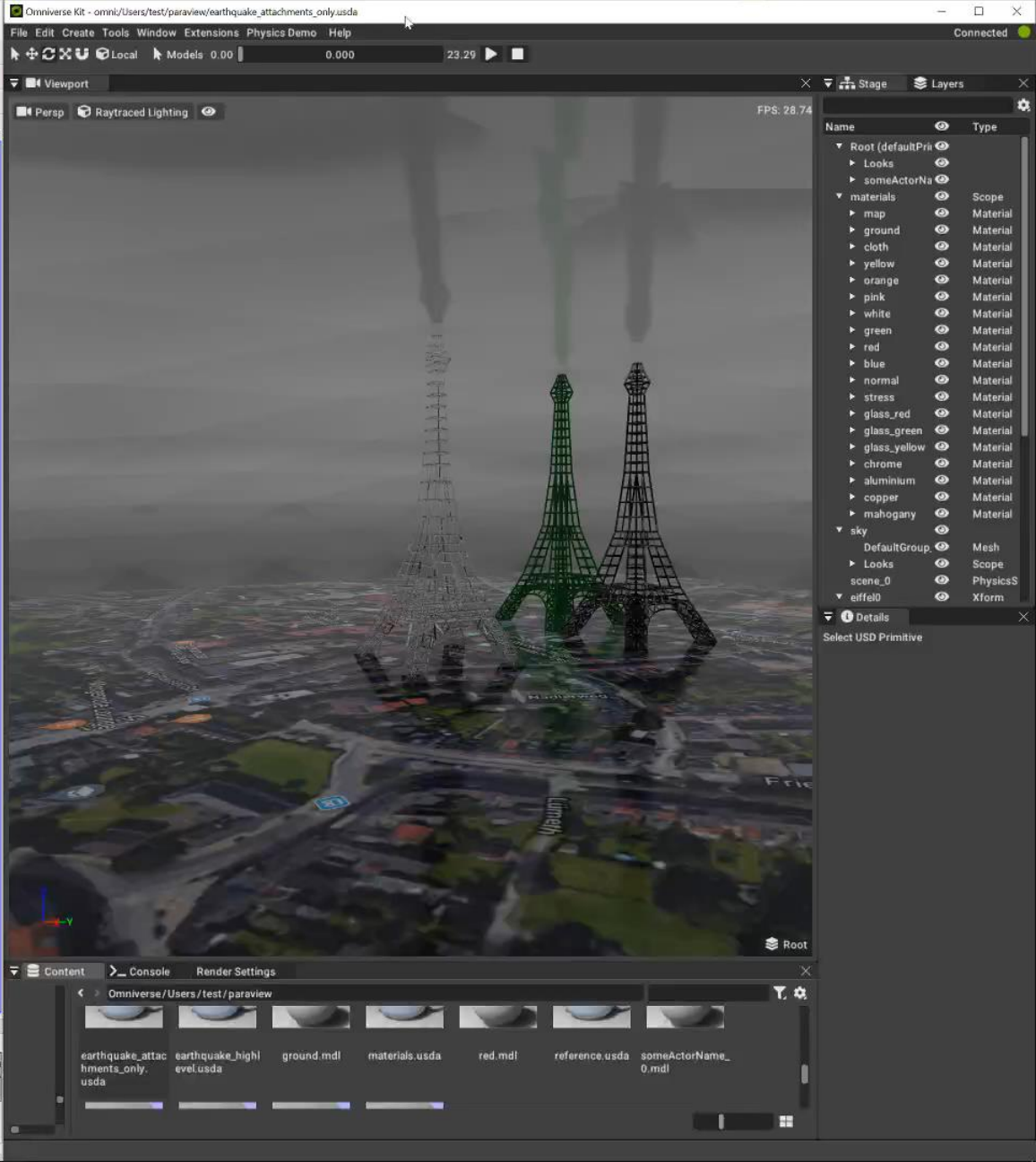
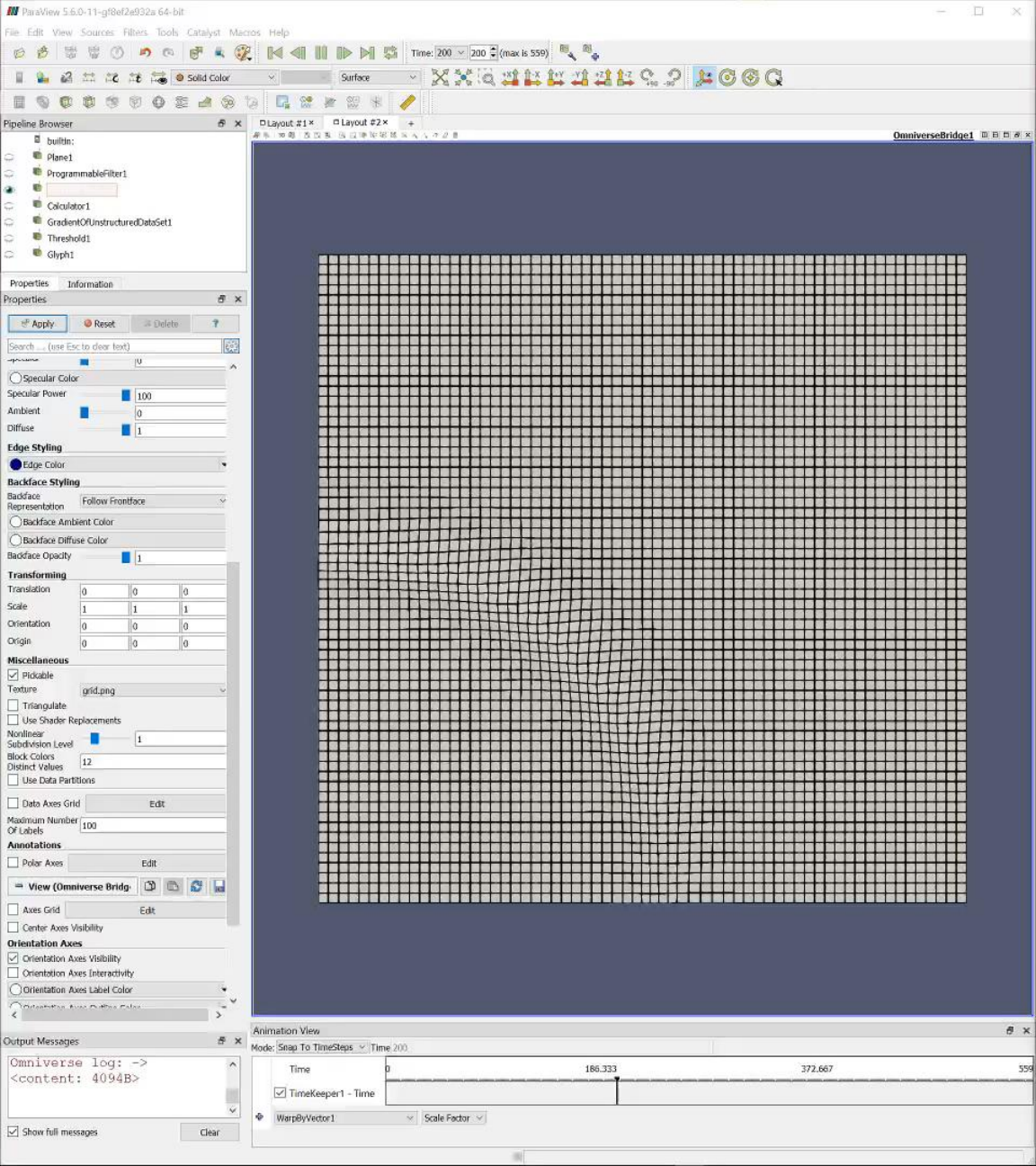


EXAMPLE: “AIRLINER”



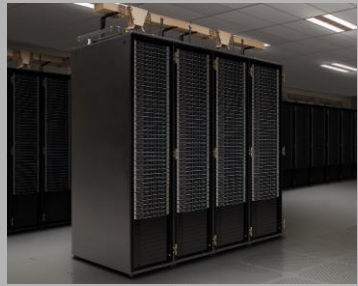
EXAMPLE: “EARTHQUAKE”





WORKFLOW

 Omniverse Kit



simulation → ParaView/
Catalyst

Omniverse
bridge

USD



3D authoring tools

Image manipulation tools

...

```
omniverseBridge1 = CreateView('OmniBridgeRenderView')
```

```
#with catalyst:  
coprocessor.RegisterView(omniverseBridge1)
```

CONCLUSION

Proof of concept:

- ParaView integration with NVIDIA Omniverse
- Utilize Omniverse as a 'Rosetta Stone' for distilled visualization geometry
- Avoid copy-and-convert hell, get collaboration for free
- Use established tools to compose scenes, produce animations, render high-quality images
- Leverage advanced game-engine features with minimal effort

TALK TO US!

- What do your visualization geometries look like?
- How would like to see volume data represented?
- Where could game physics enter your picture? Fluids? Rigid bodies?

Contact us: mathiash@nvidia.com, kvankooten@nvidia.com

More about Omniverse: <https://developer.nvidia.com/nvidia-omniverse>

