



# AS501544 | The Omniverse of Collaboration

Visualization Using USD

Eric Craft

XR and Visualization Program Manager

Mead & Hunt



# Eric Craft

- XR/Visualization Professional
  - Passionate about creating visualization and immersive realities that enhance the understanding of projects
- Technical Problem Solver
  - Dedication to user experience, customer success, research and bug resolution
- Over 20 years experience
  - Using creative background, professional experience, and business education to deliver the needs of the client and the business





# Existing Visualization Workflows



## Aviation

- Civil3D
- AutoCAD
  - Export to **Infraworks** to **FBX** for **Lumion/Twinmotion** workflow



## Architecture & Building Engineering

- Rhino3D
- Sketchup
- Revit
  - Enscape3d
  - Lumion (**LINK/DAE/FBX**)
  - Twinmotion (**LINK/UDATASMITH/FBX**)
  - 3ds max (**FBX**)
- Infraworks
- FormIt
  - Lumion (**FBX/DAE**)
  - Twinmotion (**FBX**)



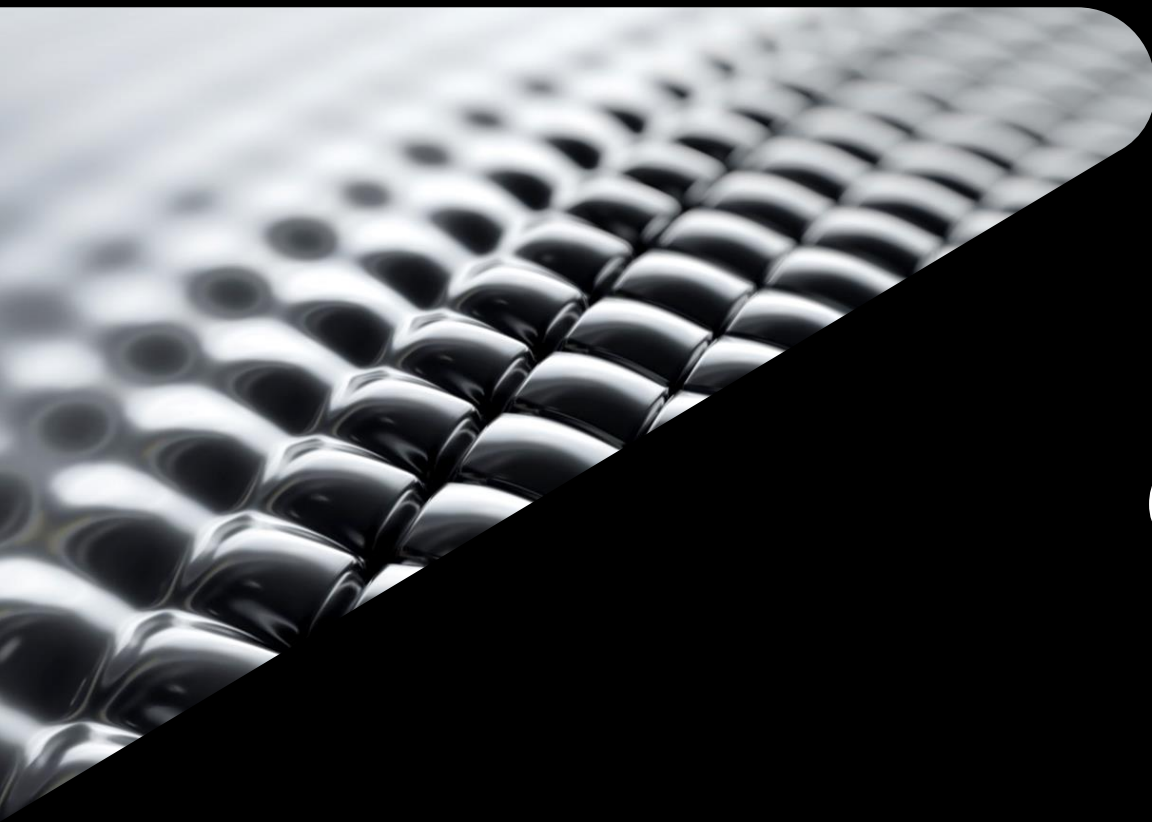
## Transportation

- Bentley Products
- iTwin
- OpenRoads
- OpenBridge
- MicroStation
  - LumenRT

# Agenda

- Learn how to setup and configure Nvidia Omniverse Workstation
- Learn about selecting the right Omniverse App for the job
- Learn about USD and collaborative workflows
- Learn about the power of extensions and extendibility





# Setup and Configuration

Omniverse Workstation and You

## INDIVIDUAL

Best for Creators and Developers

[Download](#)

## ENTERPRISE

Best for Teams

[TRY IT FREE](#)

### FEATURES

Connects to industry-leading 3D design tools



Unlimited multi-app collaboration



Multi-user collaboration for **up to 2** users



Multi-user collaboration for **more than 2** users



Scalable, real-time RTX rendering



Physically-accurate simulation with PhysX 5.0, Blast, Flow



Inspect, modify, or use 300+ pre-built extensions to develop and build enhanced solutions



Tested & optimized for NVIDIA-Certified Systems™



Scale Nucleus collaboration to the data center or private cloud



Enterprise Security Management (SSO, SSL)



Enterprise deployment tools

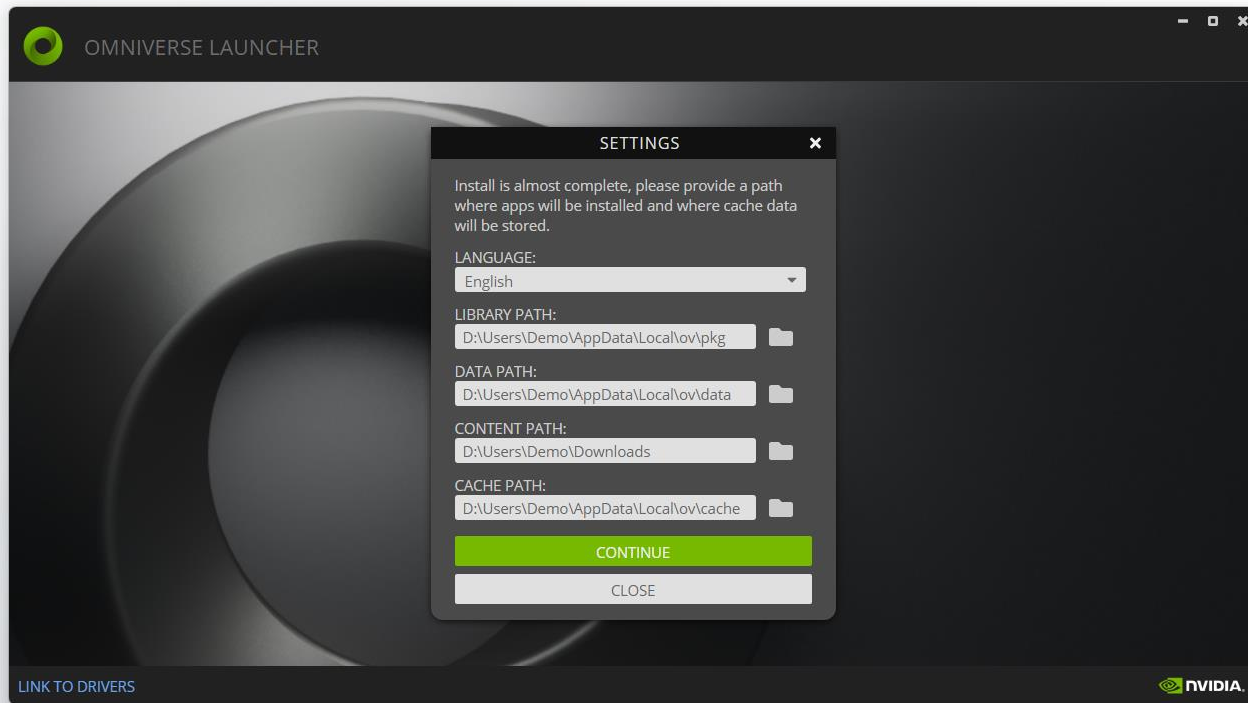


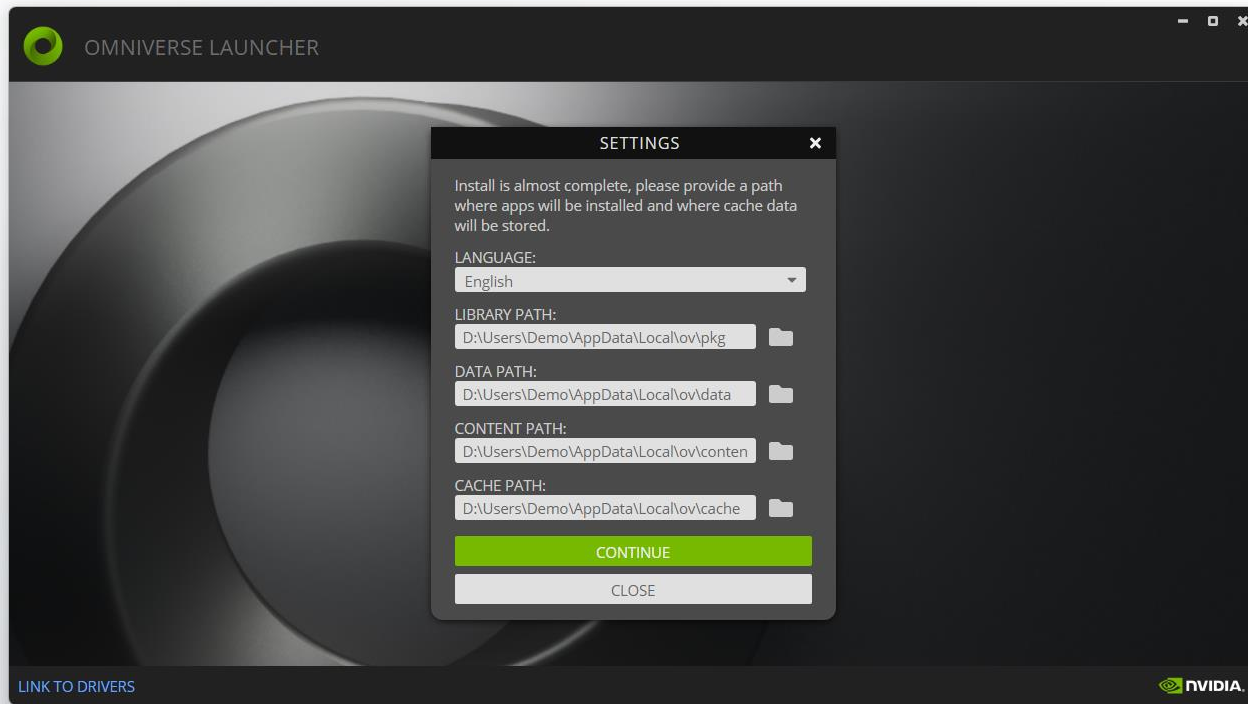
NVIDIA Enterprise Support

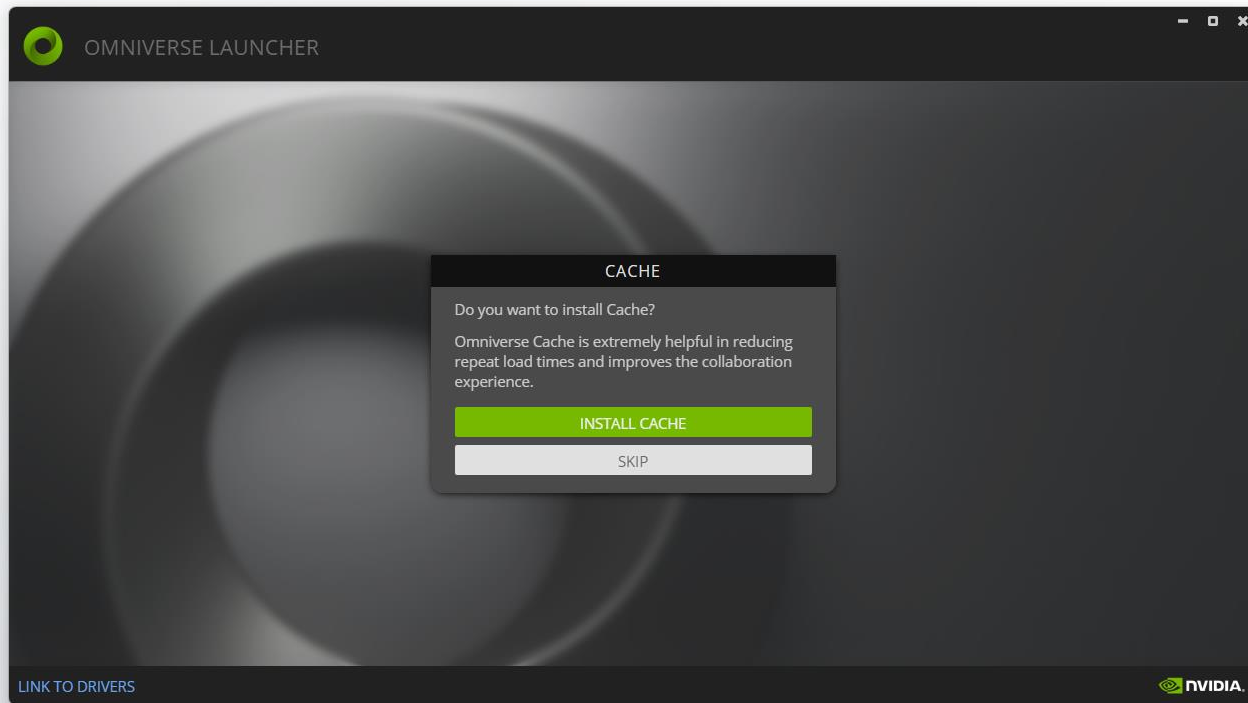


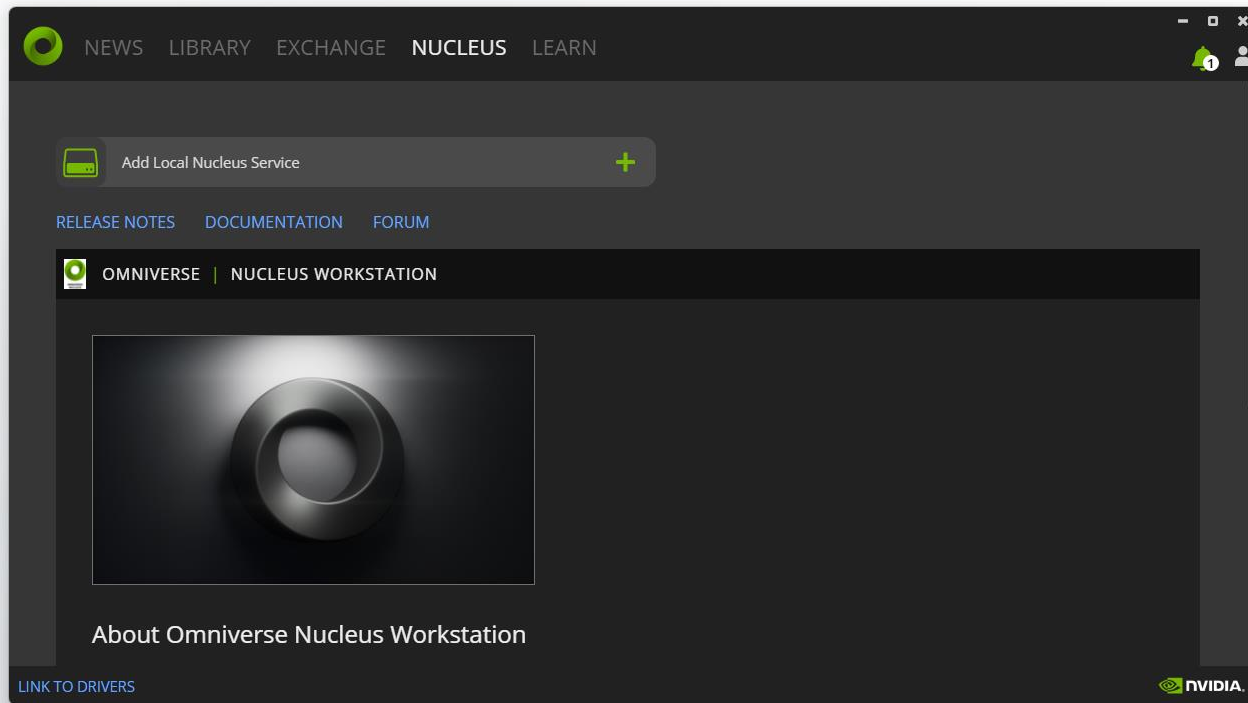
FREE


[SEE PRICING >](#)











NEWS LIBRARY EXCHANGE **NUCLEUS** LEARN

1

CREATE ADMINISTRATOR ACCOUNT ✕

You are about to install a Nucleus Collaboration Server. Please create the Admin User Account. This account will have full administration capabilities on the installed server.

Note: This account is not related to your NVIDIA Developer or any other NVIDIA Accounts.

administrator

\*\*\*\*\*

\*\*\*\*\*

First Name


Last Name




Email

COMPLETE SETUP

BACK

CANCEL

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[COMPLETE SETUP](#)

[BACK](#) [CANCEL](#)


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[COMPLETE SETUP](#)

[BACK](#) [CANCEL](#)


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[localhost](#) / [NVIDIA](#)


omniverse



|           | File      | Date modified          | Type   | Created by | Modified by |
|-----------|-----------|------------------------|--------|------------|-------------|
| localhost |           |                        |        |            |             |
| NVIDIA    |           |                        |        |            |             |
| Assets    | Assets    | 12/31/1969, 6:00:00 PM | Folder | omniverse  | omniverse   |
| Demos     | Demos     | 12/31/1969, 6:00:00 PM | Folder | omniverse  | omniverse   |
| Materials | Materials | 12/31/1969, 6:00:00 PM | Folder | omniverse  | omniverse   |
| Samples   | Samples   | 12/31/1969, 6:00:00 PM | Folder | omniverse  | omniverse   |
| Library   |           |                        |        |            |             |
| Projects  |           |                        |        |            |             |
| Users     |           |                        |        |            |             |




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localhost / NVIDIA

omniverse

|           | User               | First Name | Last Name | Email | Account Type | Administrator                       | Read Only                |
|-----------|--------------------|------------|-----------|-------|--------------|-------------------------------------|--------------------------|
| localhost |                    |            |           |       |              |                                     |                          |
| NVIDIA    | admin              |            |           |       | System       | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Assets    | administrator      |            |           |       | Internal     | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Demos     | deeptag_service    |            |           |       | System       | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Materials | omniverse          |            |           |       | System       | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Samples   | search_service     |            |           |       | System       | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Library   | snapshot_service   |            |           |       | System       | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Projects  | tags_service       |            |           |       | System       | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Users     | thumbnails_service |            |           |       | System       | <input checked="" type="checkbox"/> | <input type="checkbox"/> |


USER MANAGEMENT

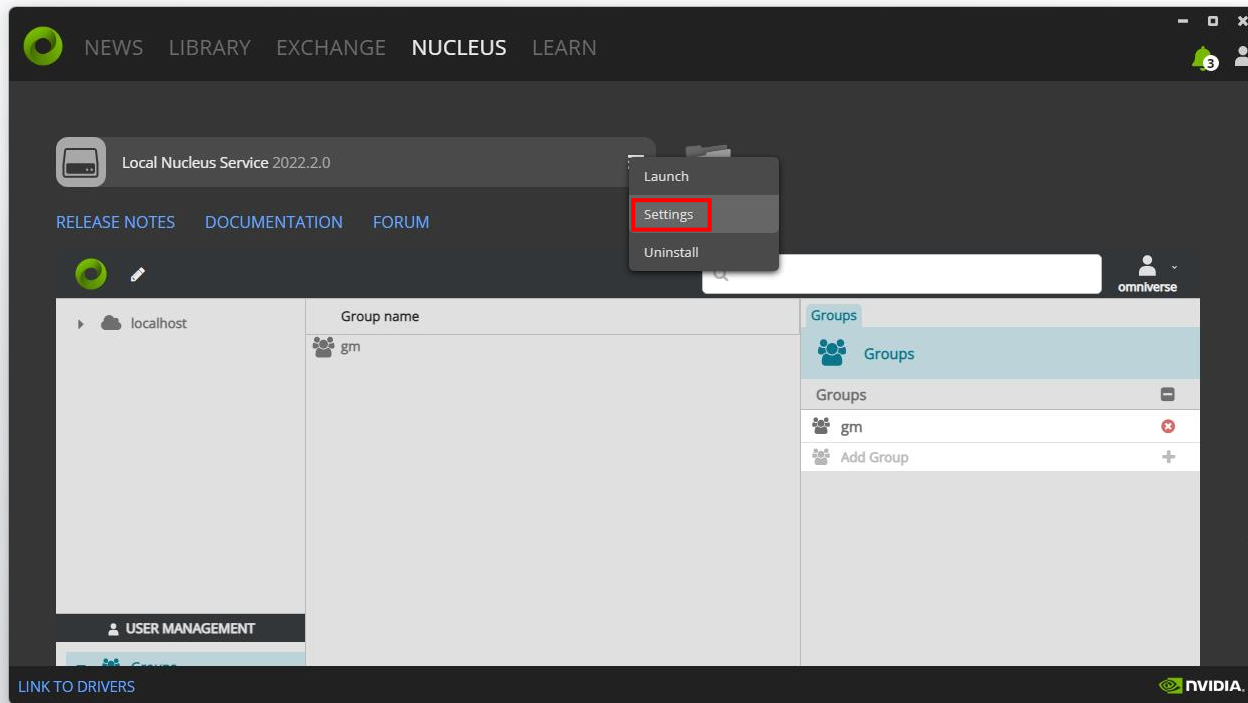
Groups

gm

Users

LINK TO DRIVERS





# Applications

[Enable sharing](#)[Configure ports](#)

SERVICE

[Restart all](#)

STATUS

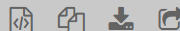
LOG

**Auth** v.1.4.4-877

D:\Users\Demo\AppData\Local\ov\pkg\nucleus-workstation-2022.2.0\Auth

Launch on System Monitor startup: ☒[Stop](#)

✓ RUNNING

**Cache** v.2.7.12-1454

D:\Users\Demo\AppData\Local\ov\pkg\cache-2022.2.0\Cache

Launch on System Monitor startup: ☒[Stop](#)

✓ RUN

**Discovery Service** v.1.4.5-630

D:\Users\Demo\AppData\Local\ov\pkg\nucleus-workstation-2022.2.0\Discovery Service

Launch on System Monitor startup: ☒[Stop](#)

✓ RUN

**Nucleus** v.113.27

D:\Users\Demo\AppData\Local\ov\pkg\nucleus-workstation-2022.2.0\Nucleus

Launch on System Monitor startup: ☒[Stop](#)

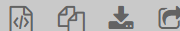
✓ RUN

**Search Service** v.3.2.1-462

D:\Users\Demo\AppData\Local\ov\pkg\nucleus-workstation-2022.2.0\Search Service

Launch on System Monitor startup: ☒[Stop](#)

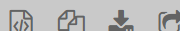
✓ RUNNING

**Tagging Service** v.3.1.2-1042

D:\Users\Demo\AppData\Local\ov\pkg\nucleus-workstation-2022.2.0\Tagging Service

Launch on System Monitor startup: ☒[Stop](#)

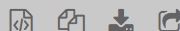
✓ RUNNING

**Thumbnail** v.1.5.0-1126

D:\Users\Demo\AppData\Local\ov\pkg\nucleus-workstation-2022.2.0\Thumbnail

Launch on System Monitor startup: ☒[Stop](#)

✓ RUNNING



## Enable sharing

You're going to share your Nucleus services on a public network which makes them accessible by other people.

New users can be invited to your server by the user management panel available for system administrators in Navigator; or other users can register their own accounts, if you enable the option below.

Allow other users to register new accounts: ☐

[Share](#)[Cancel](#)

Search



ALL

COLLECTIONS

APPS

CONNECTORS

CONTENT

EXTENSIONS



CODE



CREATE



VIEW

APP (20)



OMNIVERSE AUDIO2FACE



BLENDER 3.2 ALPHA USD  
BRANCH



OMNIVERSE CACHE



OMNIVERSE CODE



OMNIVERSE CREATE



OMNIVERSE DRIVE



OMNIVERSE FARM AGENT



OMNIVERSE FARM QUEUE



ISAAC SIM



OMNIVERSE KAOLIN



OMNIVERSE KIT



OMNIVERSE MACHINIMA  
BETA



OMNIVERSE MARBLES RTX



OMNIVERSE MINeways



OMNIVERSE NUCLEUS  
NAVIGATOR



OMNIVERSE SHOWROOM



OMNIVERSE STREAMING  
CLIENT



USD USDVIEW



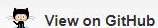
OMNIVERSE VIEW



OMNIVERSE XR BETA

# Path Copy Copy

Copy file paths from Windows explorer's contextual menu



Donate

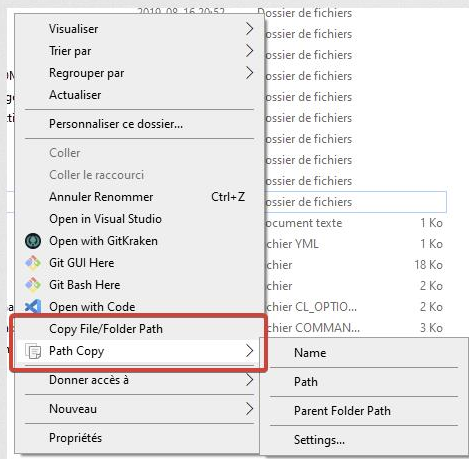


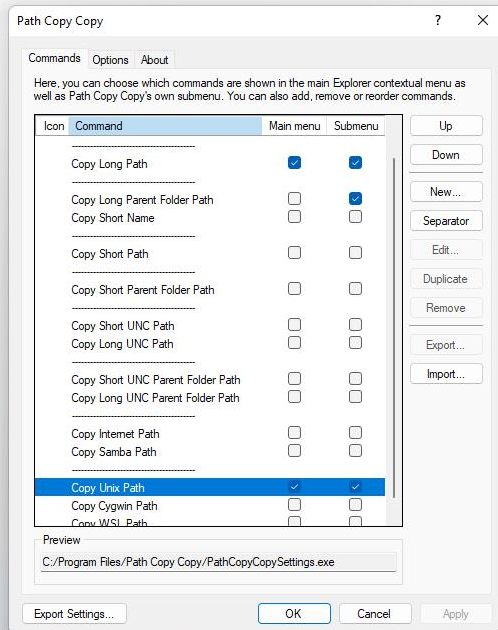
Path Copy Copy is an add-on for Windows Explorer that adds contextual menu items on all files and folders allowing the user to copy the path(s) in various formats. Idea copied from "Path Copy".

Path Copy Copy works on Windows 7 SP1 or later. Grab the [latest release here!](#)

For help and information, please refer to the [wiki](#).

Path Copy Copy is [free software](#). See the [project on GitHub](#) for more information, to file issues, etc. Also, if you use and like Path Copy, please consider [donating](#) to fund future development and customer support.








# **Setup and Managing Apps and Connectors**

Omniverse Launcher to the Rescue





ALL

COLLECTIONS

APPS

CONNECTORS

CONTENT

EXTENSIONS

▶ FEATURED (3)

▼ APP (20)



OMNIVERSE AUDIO2FACE



BLENDER 3.2 ALPHA USD  
BRANCH



OMNIVERSE CACHE



OMNIVERSE CODE



OMNIVERSE CREATE



OMNIVERSE DRIVE



OMNIVERSE FARM AGENT



OMNIVERSE FARM QUEUE



ISAAC SIM



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OMNIVERSE MARBLES RTX



OMNIVERSE MINEWAYS



OMNIVERSE NUCLEUS  
NAVIGATOR



OMNIVERSE SHOWROOM



OMNIVERSE STREAMING  
CLIENT



USD USDVIEW



OMNIVERSE VIEW




OMNIVERSE XR BETA


▶ CONNECTOR (34)


▶ CONTENT-PACK (8)


▶ EXTENSION (1)


APPS ▾

 Code


 Create


 Machinima Beta


 USDView

 View


FILE MANAGEMENT ▾

 Cache

 Drive


 Nucleus Navigator

CONNECTORS ▾

 Connectors

LAUNCH   
2022.1.3

[RELEASE NOTES](#) [DOCUMENTATION](#) [TUTORIALS](#) [FORUMS](#)

 OMNIVERSE  
CODE



## About Omniverse Code

Omniverse Code is a developer focused Omniverse App.

Tags

MEDIA & ENTERTAINMENT

MANUFACTURING

PRODUCT DESIGN

SCENE COMPOSITION

VISUALIZATION

RENDERING

BETA

Publisher

NVIDIA

Developer

NVIDIA

Date published

8/5/2022, 12:00:00 AM

Date installed

8/22/2022, 11:22:31 PM

Version

2022.1.3

A close-up, black and white photograph of a woven mesh or fabric texture, showing a grid of small, rounded, interlocking shapes. The texture is diagonal, running from the bottom left towards the top right. The lighting creates highlights and shadows on the mesh, giving it a three-dimensional appearance.

# The Right Omniverse App

Selecting the Best App for the Job

Search



ALL

COLLECTIONS

APPS

CONNECTORS

CONTENT

EXTENSIONS

FEATURED (3)

APP (20)



OMNIVERSE AUDIO2FACE



BLENDER 3.2 ALPHA USD  
BRANCH



OMNIVERSE CACHE



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OMNIVERSE CREATE



OMNIVERSE DRIVE



OMNIVERSE FARM AGENT



OMNIVERSE FARM QUEUE



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BETA



OMNIVERSE MARBLES RTX



OMNIVERSE MINEWAYS



OMNIVERSE NUCLEUS  
NAVIGATOR



OMNIVERSE SHOWROOM



OMNIVERSE STREAMING  
CLIENT



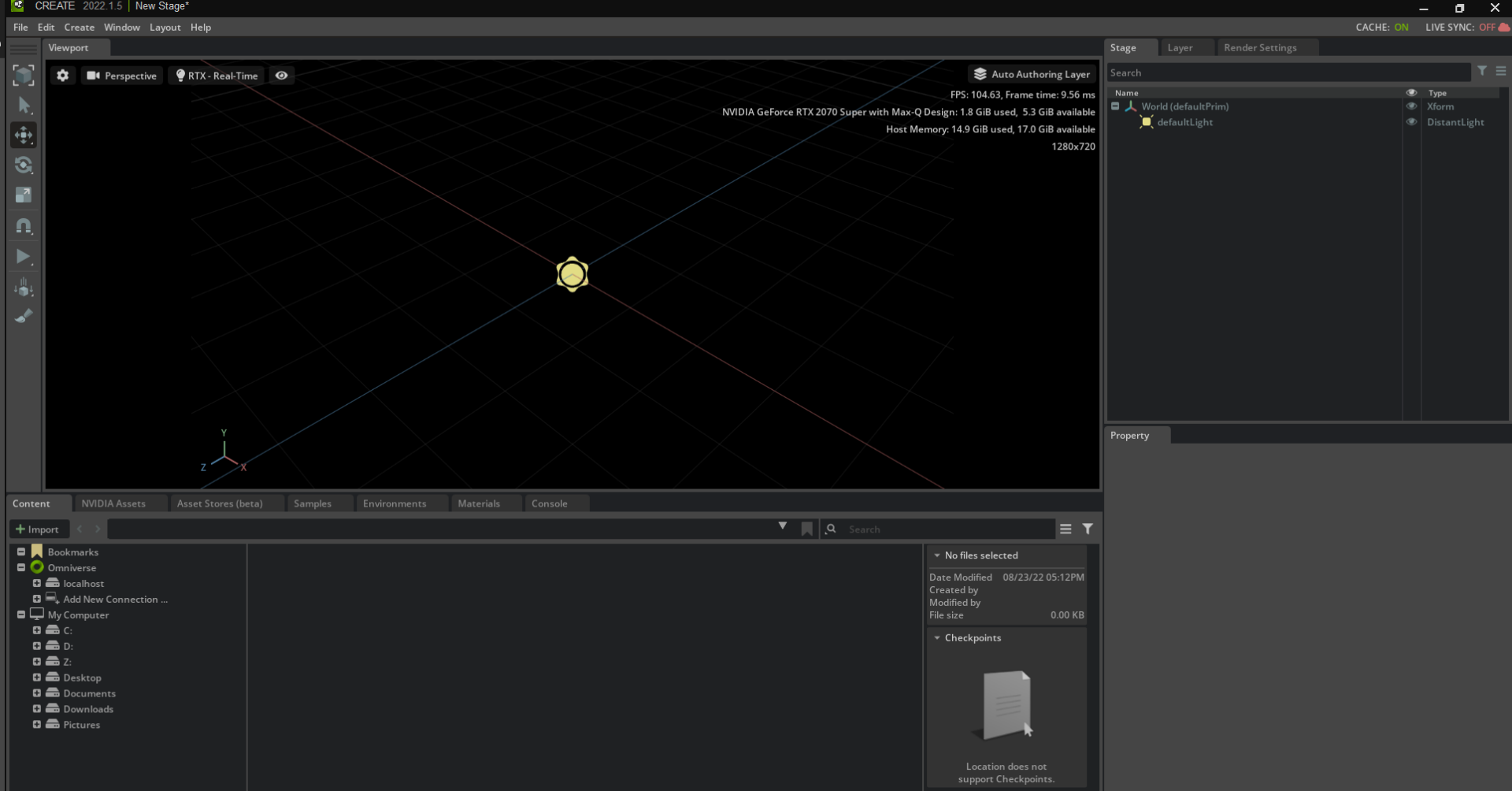
USD USDVIEW

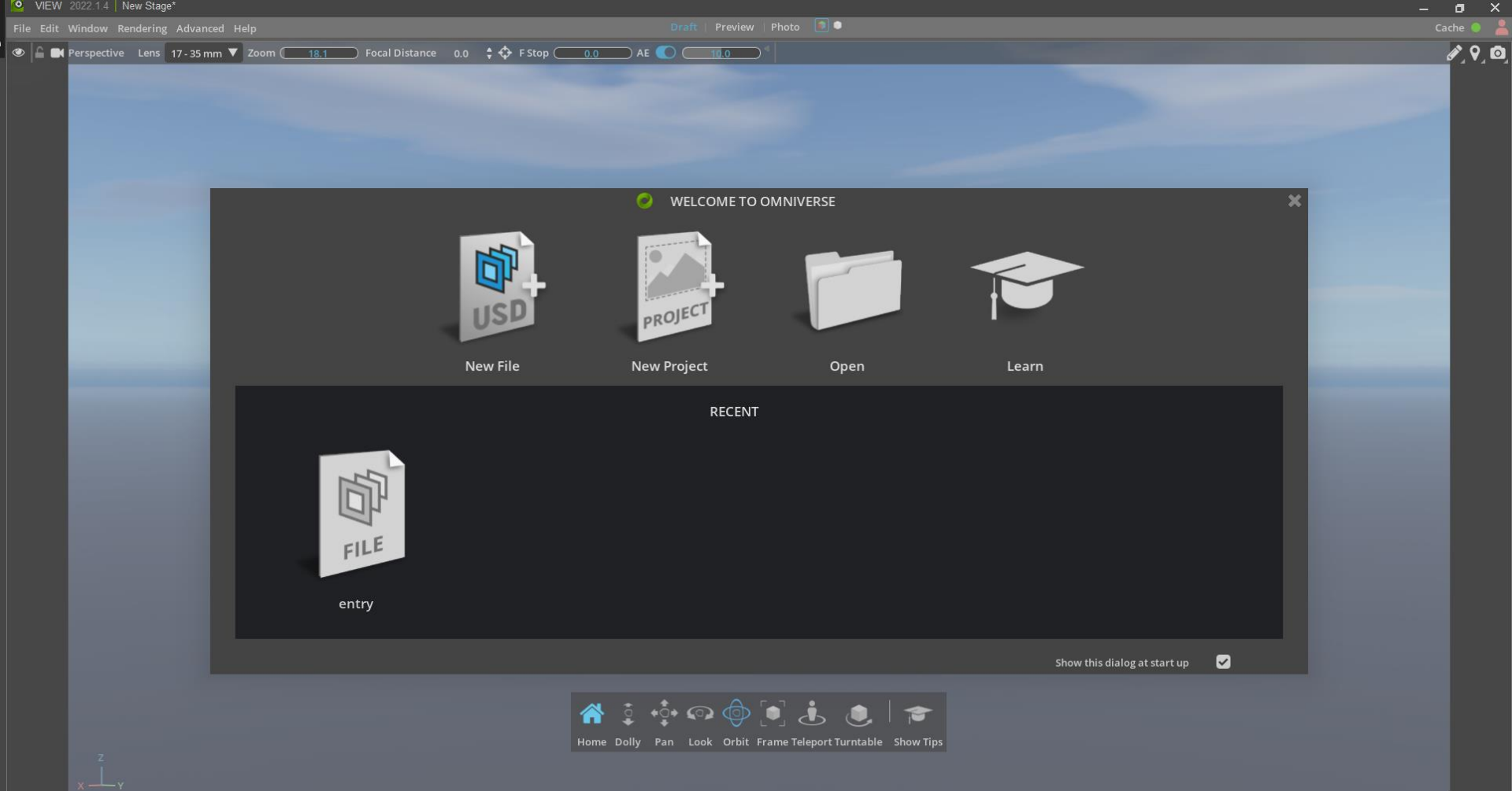


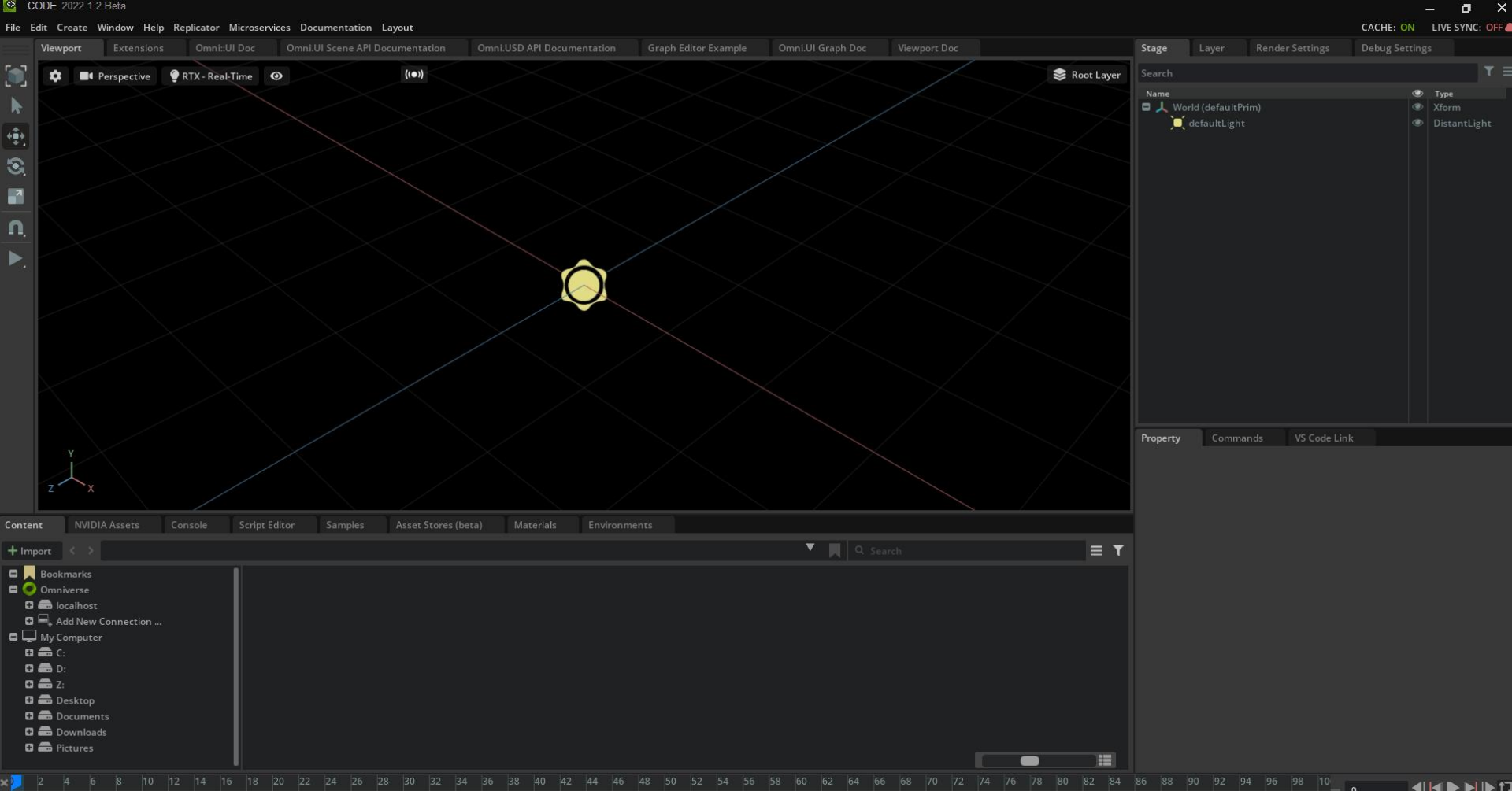
OMNIVERSE VIEW

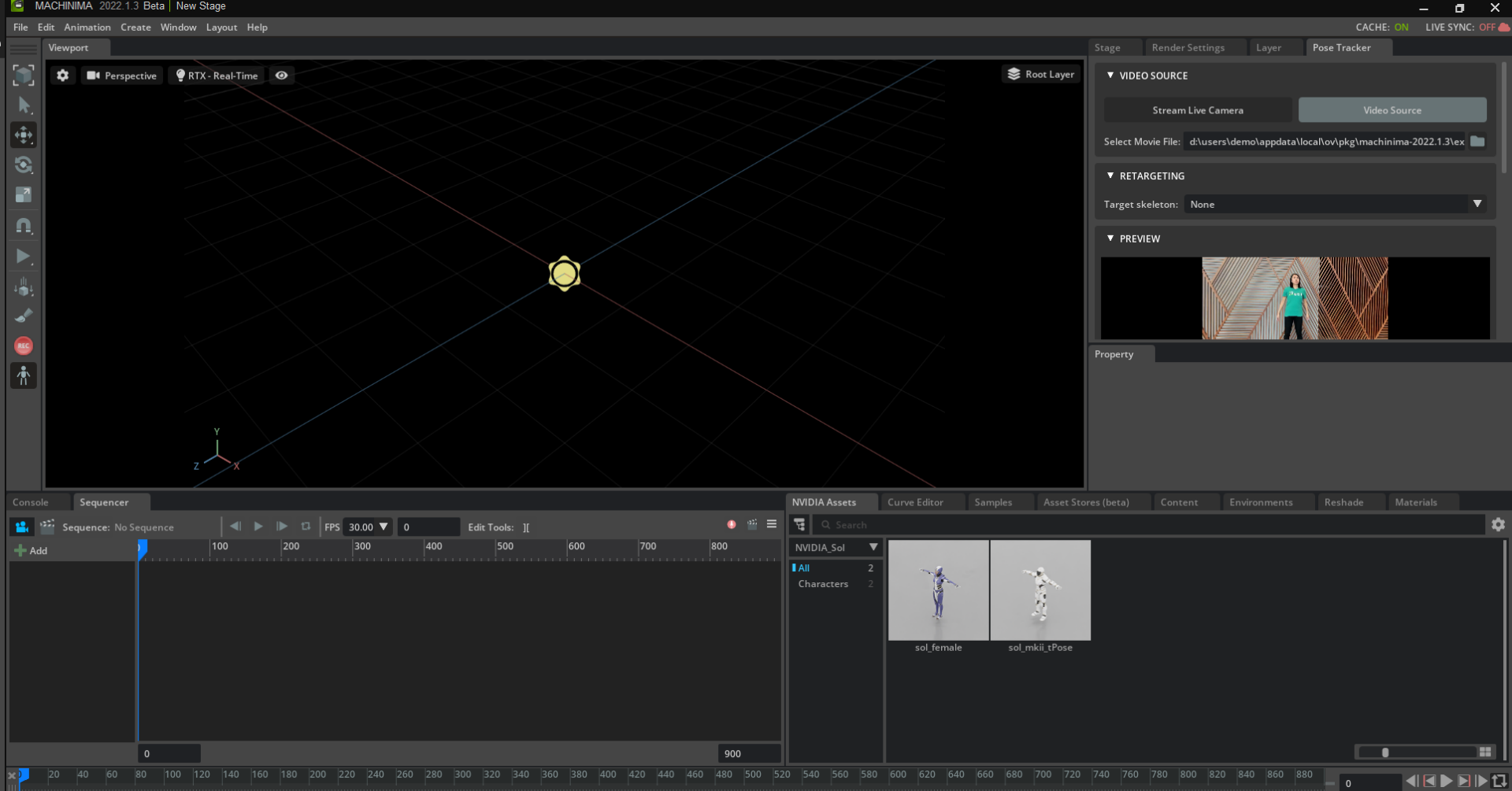


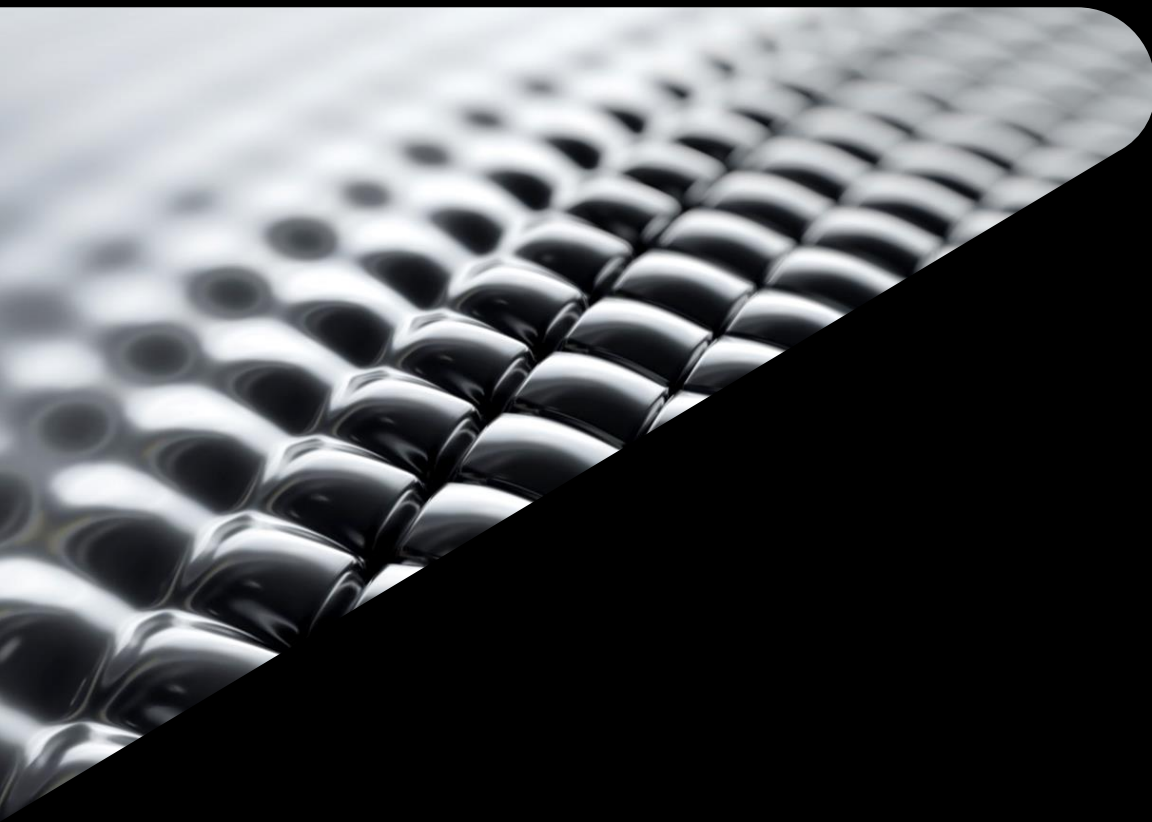
OMNIVERSE XR BETA











# USD and Omniverse

Welcome to the Omniverse

## Introduction to USD

- [What is USD?](#)
- [Why use USD?](#)
- [What can USD do?](#)
  - USD can represent:
  - USD can compose and override:
  - USD/Hydra can image:
  - USD can be extended/customized:
- [What can't USD do?](#)
  - No GUIDS
  - Not an execution or rigging system
- [Heritage of USD at Pixar](#)

### What is USD?

Pipelines capable of producing computer graphics films and games typically generate, store, and transmit large quantities of 3D data, which we call "scene description". Each of many cooperating applications in the pipeline (modeling, shading, animation, lighting, fx, rendering) typically has its own special form of scene description tailored to the specific needs and workflows of the application, which is neither readable nor editable by any other application. **Universal Scene Description (USD)** is the first publicly available software that addresses the need to robustly and scalably interchange and augment arbitrary 3D scenes that may be *composed* from many elemental assets.

USD provides for interchange of elemental assets (e.g. models) or animations. But unlike other interchange packages, USD also enables assembly and organization of any number of assets into virtual sets, scenes, shots, and worlds, transmitting them from application to application, and non-destructively editing them (as *overrides*), with a single, consistent API, in a single scenegraph. USD provides a [rich toolset](#) for reading, writing, editing, and rapidly previewing 3D geometry, shading, lighting, physics, and a growing number of other graphics-related domains. In addition, because USD's core scenegraph and [composition engine](#) are agnostic of any particular domain, USD can be extended in a maintainable way to encode and compose data in other domains.

Concretely, USD is an [open source project](#) released under a [modified Apache license](#).

### Why use USD?

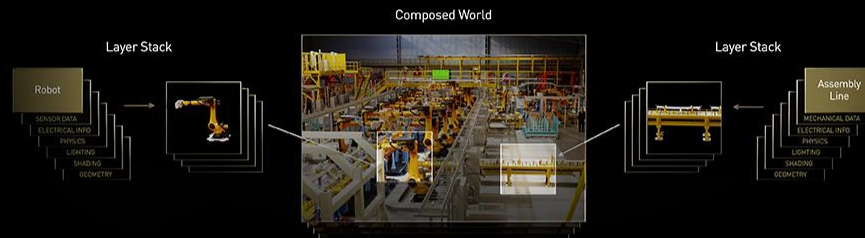
USD is the core of Pixar's 3D graphics pipeline, used in every 3D authoring and rendering application, including Pixar's proprietary *Presto* animation system. Pixar is deeply committed to evolving and improving USD to address the following ongoing production concerns:

- Provide a rich, common language for defining, packaging, assembling, and editing 3D data, facilitating the use of multiple digital content creation applications.

Like many other interchange packages, USD provides a low-level data model that stipulates, at a "file format level", how data is encoded and organized, plus a (extensible) set of high-level schemas that provide

# Universal Scene Description (USD)

Open, Extensible Ecosystem for 3D Worlds



## Building the Open Metaverse with Universal Scene Description

Universal Scene Description (USD) is an open and extensible ecosystem for describing, composing, simulating, and collaborating within 3D worlds, originally invented by Pixar Animation Studios.

Thanks to its design and features, USD is poised to be the open standard that enables the 3D evolution of the internet - the metaverse.

USD encompasses a collection of fundamental tools and capabilities accelerating workflows, teams, and projects, whether you are creating assets and environments for large-scale, connected virtual worlds or building the tools that will make these worlds possible.

/root/alab\_set01/lab\_workbench01\_0001/workbench01/bencht0p02/decor\_foam\_hand01\_0001

Navigation Show

| Prim Name          | Type             | Vis |
|--------------------|------------------|-----|
| root               | Scope            | V   |
| root               | ALEditFrameRange |     |
| framerange         | ALAudio          |     |
| music              | ALAudio          |     |
| effects            | ALAudio          |     |
| dialogue           | ALAudio          |     |
| mixdown            | ALAudio          |     |
| audio              | ALAudio          |     |
| alab_set01         | Xform            | V   |
| camera01           | Xform            | V   |
| dmp_skydome_alab01 | Xform            | V   |
| remi               | Xform            | V   |
| stoat              | Xform            | V   |
| lighttrig01        | Xform            | V   |
| blob_layout_shot   | Xform            | V   |

? Search for prim by name

Find Prim

| Type | Property Name               | Value   |
|------|-----------------------------|---|
| Ⓢ    | World Bounding Box          | [(39.51311106309473, 99.45346598481133, 6.034329280423174)...(50.12682768216611, 146.6922369465728, 15.856204136151597)]                              |
| Ⓢ    | Local to World Xform        | ((0.015077314684392329, 0, -0.999886330830614, 0), (0, 1, 0, 0), (0.99988...92329, 0), (44.74486428614314, 104.3996344075103, 10.262913240449528, 1)) |
| Ⓢ    | Resolved Preview Material   | <unbound>   |
| Ⓢ    | Resolved Full Material      | <unbound>   |
| Ⓐ    | model:applyDrawMode         | False   |
| Ⓐ    | model:cardGeometry          | cross   |
| Ⓐ    | model:cardTextureXNeg       |   |
| Ⓐ    | model:cardTextureXPos       |   |
| Ⓐ    | model:cardTextureYNeg       |   |
| Ⓐ    | model:cardTextureYPos       |   |
| Ⓐ    | model:cardTextureZNeg       |   |
| Ⓐ    | model:cardTextureZPos       |   |
| Ⓐ    | model:drawMode              | inherited   |
| Ⓐ    | model:drawModeColor         | (0.18, 0.18, 0.18)  |
| Ⓐ    | primvars:glimpse:lightGroup | screens   |
| Ⓐ    | proxyPrim                   |   |

? Search for property by name

Find Prop

Render: 256.89 ms (0.89 FPS)  
Playback: n/aCamera: renderCam  
Complexity: Low

Value Meta Data Layer Stack Composition

| Layer   | Arc Type | Arc Path                     | Has Spec |
|---|----------|------------------------------|----------|
| entry.usda                                      | root     | /root/alab_set01/lab_work... |          |
| main.usda                                       | sublayer | /root/alab_set01/lab_work... | no       |
| mk020_0281.usda                                 | sublayer | /root/alab_set01/lab_work... | no       |
| mk020_0281_lighting.usda                        | sublayer | /root/alab_set01/lab_work... | no       |
| mk020_0281_lightingrenderovers.usda             | sublayer | /root/alab_set01/lab_work... | no       |
| mk020_0281_fx.usda                              | sublayer | /root/alab_set01/lab_work... | no       |
| mk020_0281_crowd.usda                           | sublayer | /root/alab_set01/lab_work... | no       |
| mk020_0281_charfxcache.usda                     | sublayer | /root/alab_set01/lab_work... | no       |
| mk020_0281_fxcache_charfxcache_stoat_geo.usda   | sublayer | /root/alab_set01/lab_work... | no       |
| cache.usda                                      | sublayer | /root/alab_set01/lab_work... | no       |
| mk020_0281_fxcache_charfxcache_stoat_alfro.usda | sublayer | /root/alab_set01/lab_work... | no       |
| cache.usda                                      | sublayer | /root/alab_set01/lab_work... | no       |
| mk020_0281_fxcache_charfxcache_remi_geo.usda    | sublayer | /root/alab_set01/lab_work... | no       |
| cache.usda                                      | sublayer | /root/alab_set01/lab_work... | no       |
| mk020_0281_animation.usda                       | sublayer | /root/alab_set01/lab_work... | no       |
| mk020_0281_animfxcache.usda                     | sublayer | /root/alab_set01/lab_work... | no       |
| mk020_0281_fxcache_animfxcache_stoat_geo.usda   | sublayer | /root/alab_set01/lab_work... | no       |
| cache.usda                                      | sublayer | /root/alab_set01/lab_work... | no       |
| mk020_0281_fxcache_animfxcache_stoat_alfro.usda | sublayer | /root/alab_set01/lab_work... | no       |
| cache.usda                                      | sublayer | /root/alab_set01/lab_work... | no       |

1004.0 1004.0

1057.0 1057.0

Play

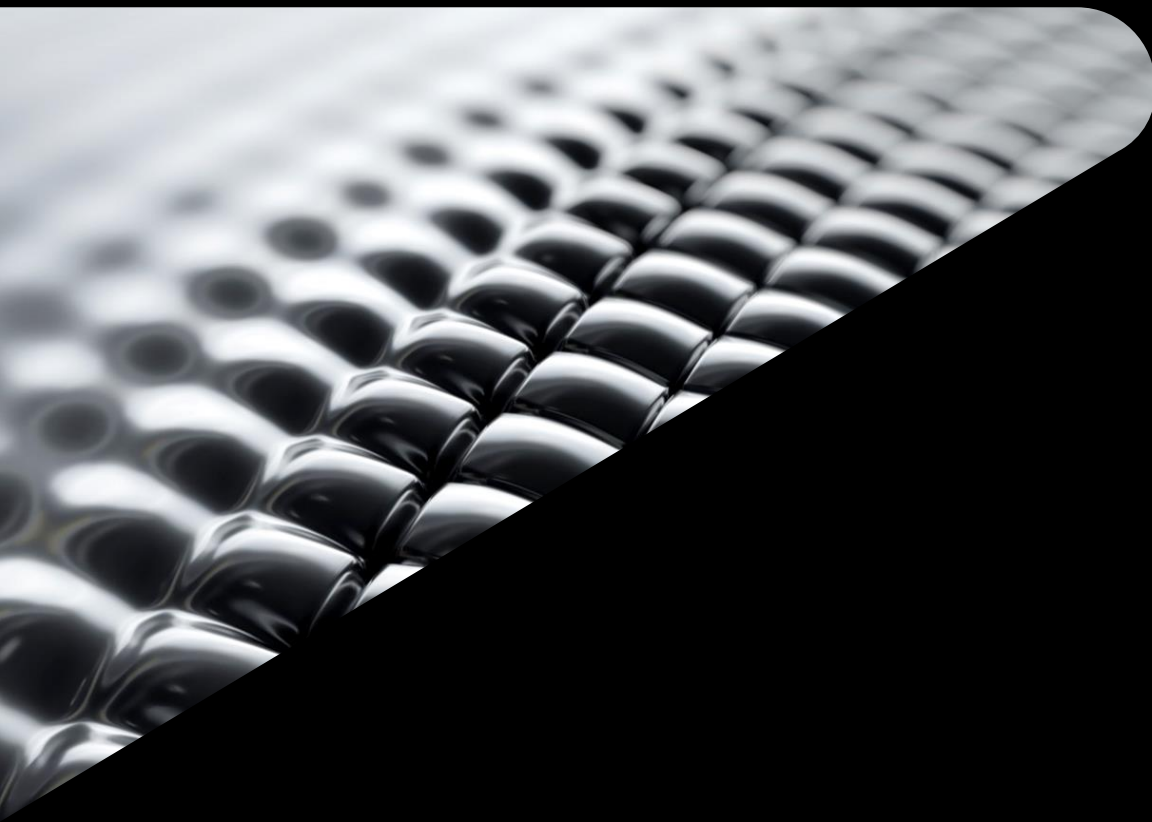
# NVIDIA Omniverse

Connect and Create Virtual Worlds

Get Started

## A New Era of 3D Design Collaboration and World Simulation

NVIDIA Omniverse™ is an easily extensible platform for 3D design collaboration and scalable multi-GPU, real-time, true-to-reality simulation. Omniverse revolutionizes the way we create and develop as individuals and work together as teams, bringing more creative possibilities and efficiency to 3D creators, developers and enterprises.

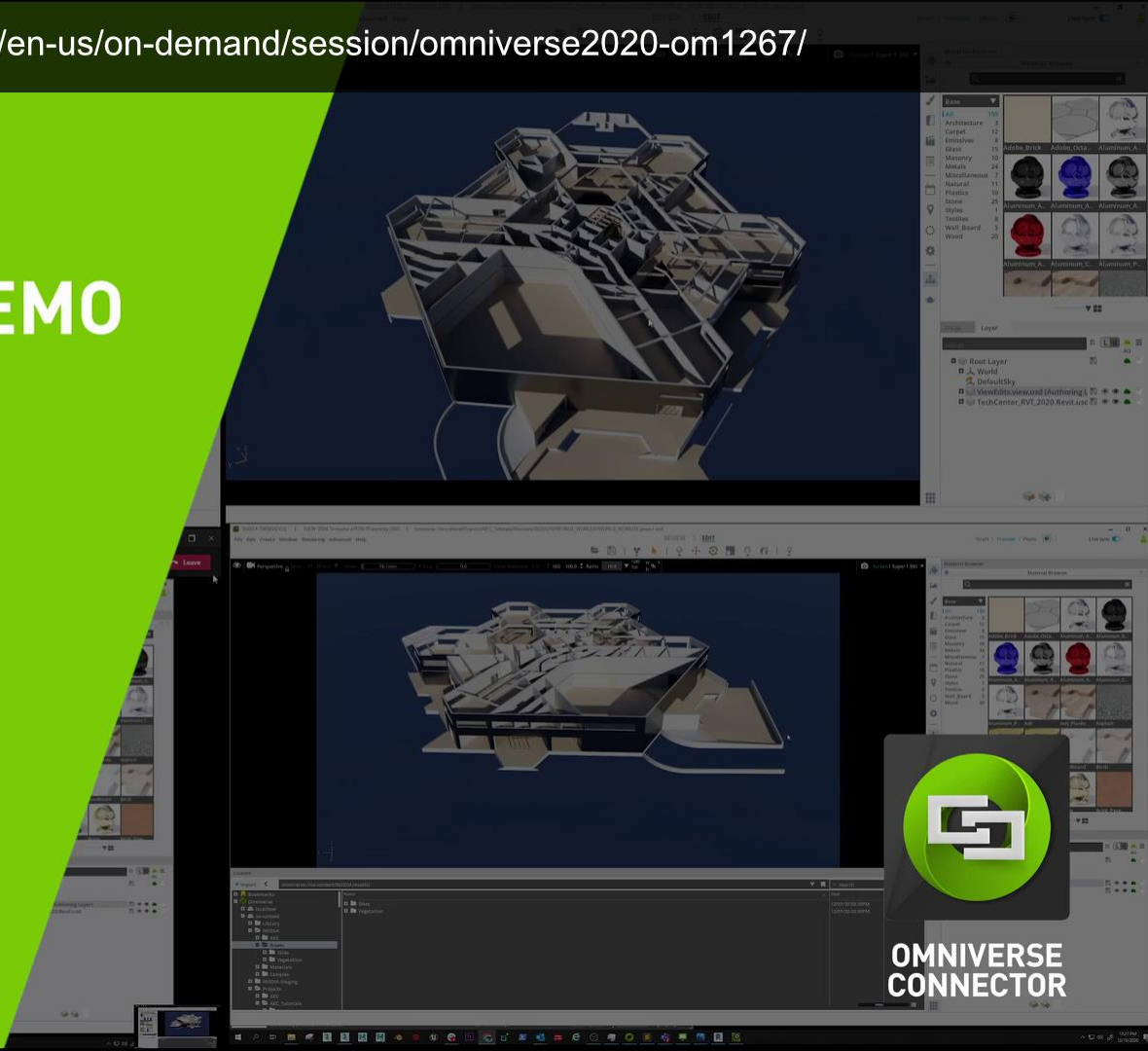


# Connector Workflows

The Omniverse of Collaboration

# OMNIVERSE WORKFLOW LIVE-SYNC ARCHITECTURE DEMO

Dave Tyner



OMNIVERSE  
CONNECTOR

Properties

3D View

3D View: From Parkir ▾ Edit Type

Graphics

Detail Level: **Fine**

Parts Visibility: Show Original

Visibility/Grp...: Edit...

Graphic Displ...: Edit...

Discipline: Architectural

Default Analy...: None

Show Grids: Edit...

Sun Path: ☐

Extents

Crop View: ☒

Crop Region ...: ☒

Far Clip Active: ☒

Far Clip Offset: 130468.1

Scope Box: None

Section Box: ☐

Project Browser - rac\_advanced\_sa...

Views (all)

Floor Plans

01 - Entry Level

01 - Entry Level - Furn

02 - Floor

03 - Floor

Roof

Site

Ceiling Plans

01 - Entry Level

02 - Floor

03 - Floor

Roof

3D Views

03 - Floor Public - Day

03 - Floor Public - Nig

Balcony View

Building Courtyard

**From Parking Area**

(3D)

Elevations (Building Elevation)



Environments Materials Console

Environment Options

Ground ☐ Off ☐ On ☐ Shadows Only ☒

Ground Size: 5000 cm

Time of Day

11:59 AM May 11, 2022

6:00 AM 6:00 PM

1x

Location

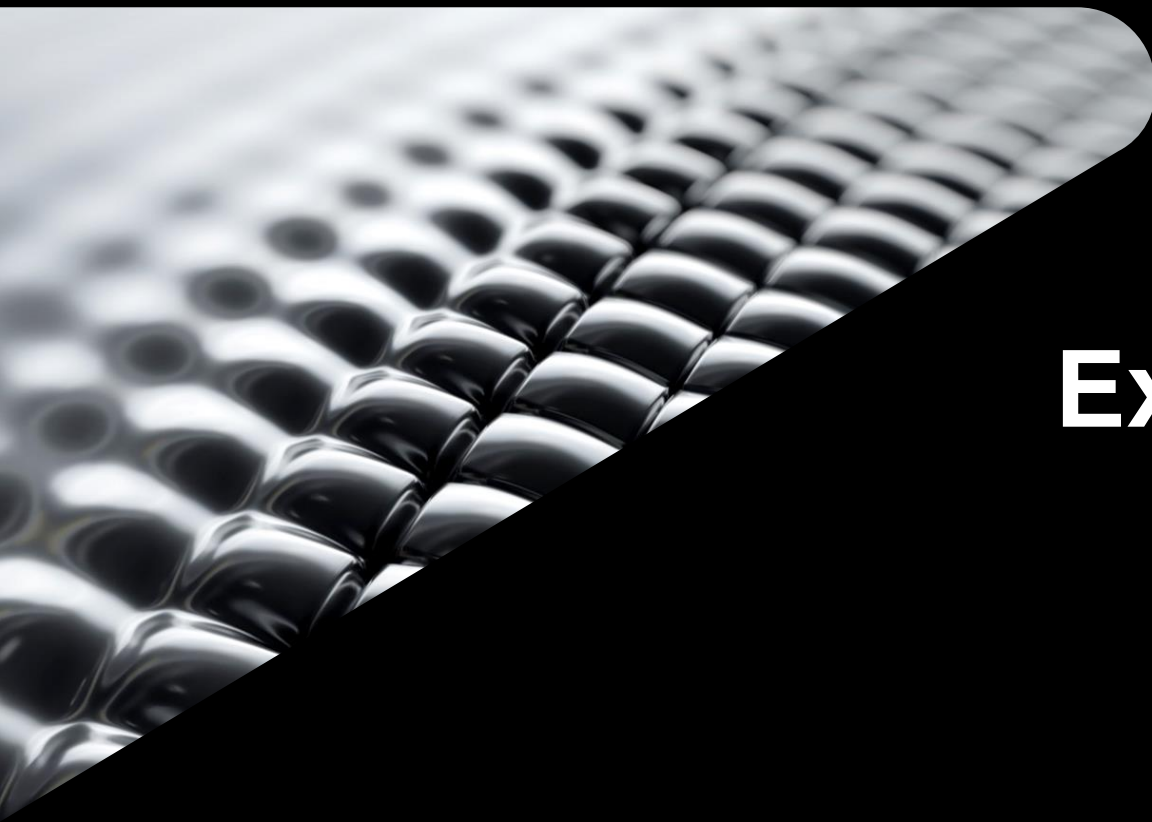
Preset: Custom

Latitude: 42.991

Longitude: -71.461

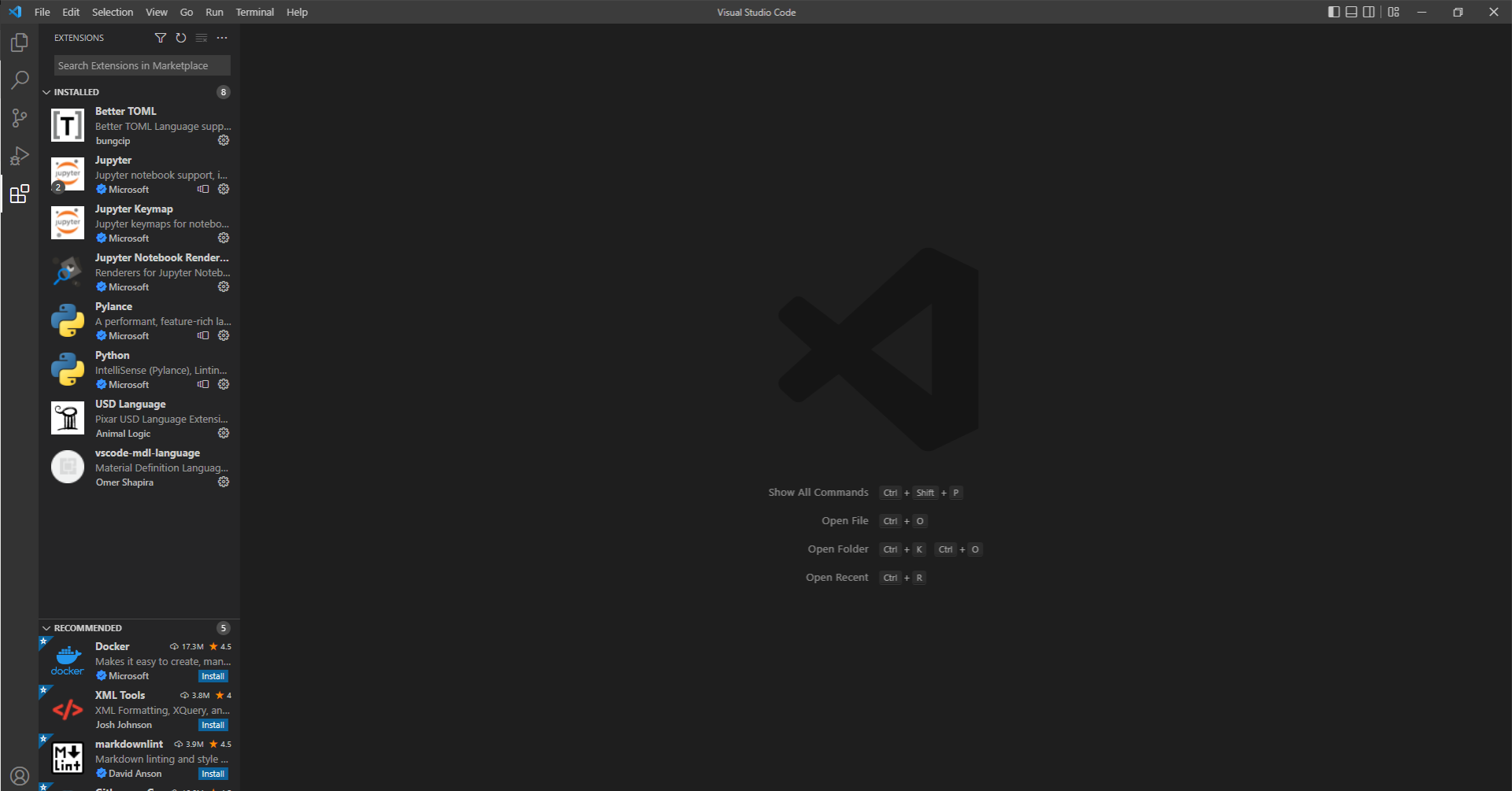
Clouds: CumulusHeavy CumulusLight NightSky

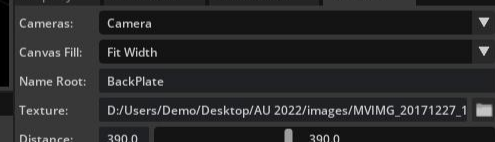
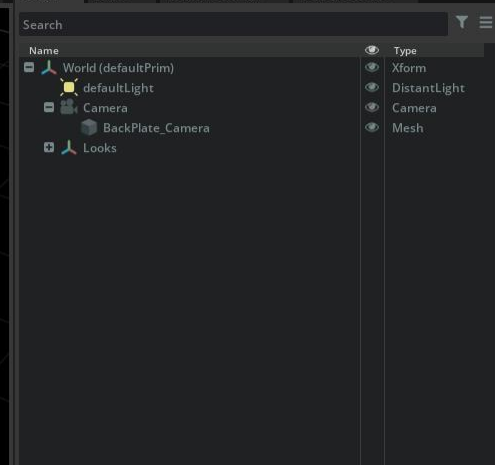
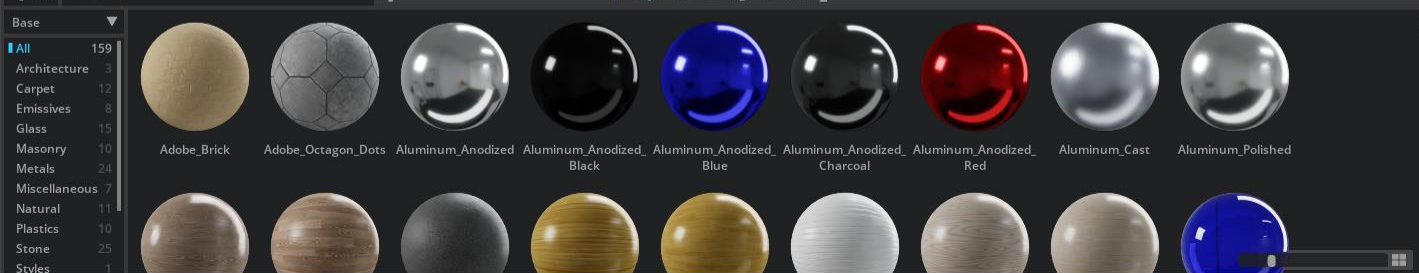
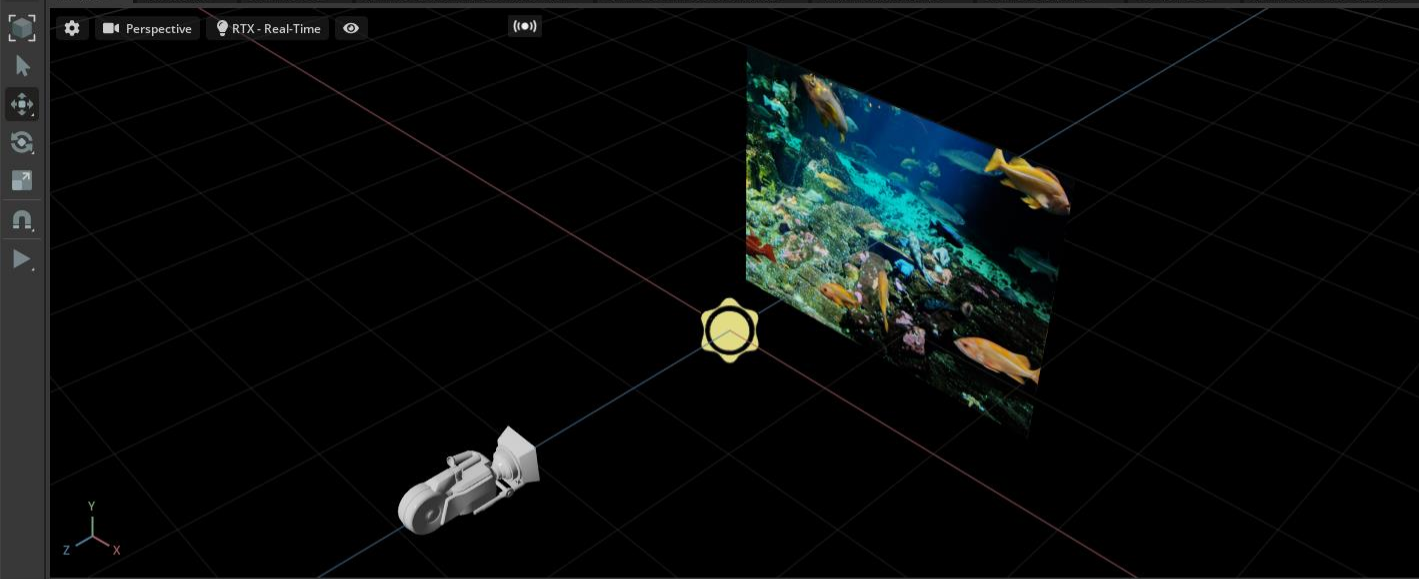
Reflections: com\_Exhibitio adams\_place\_bridge approaching\_storm autoshop\_01

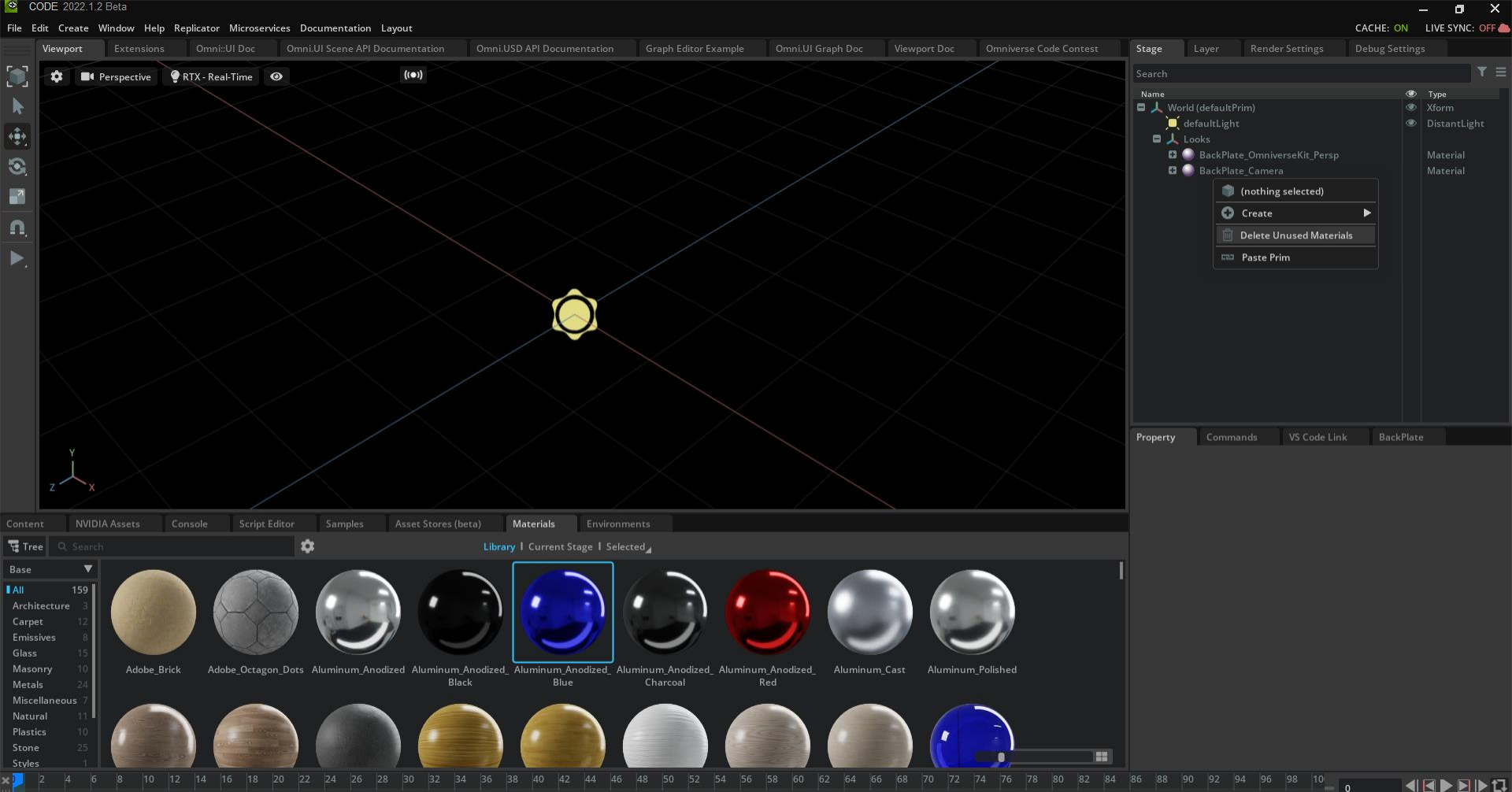


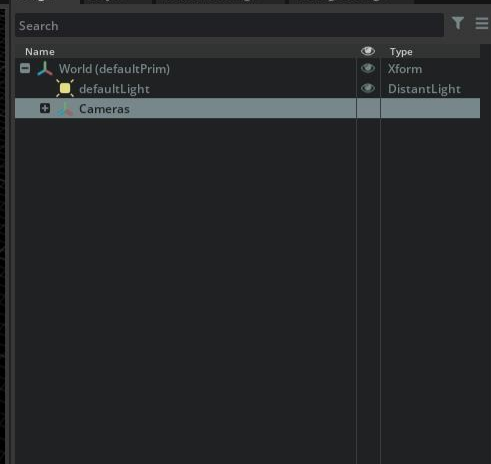
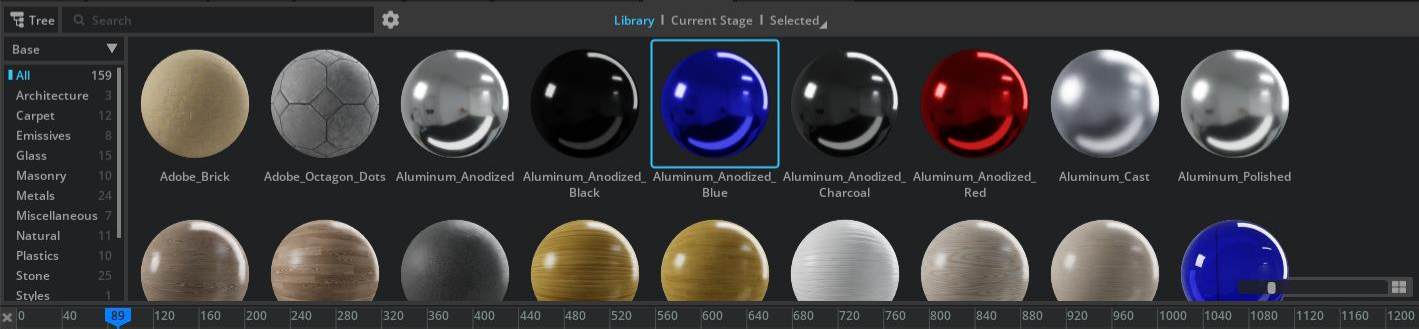
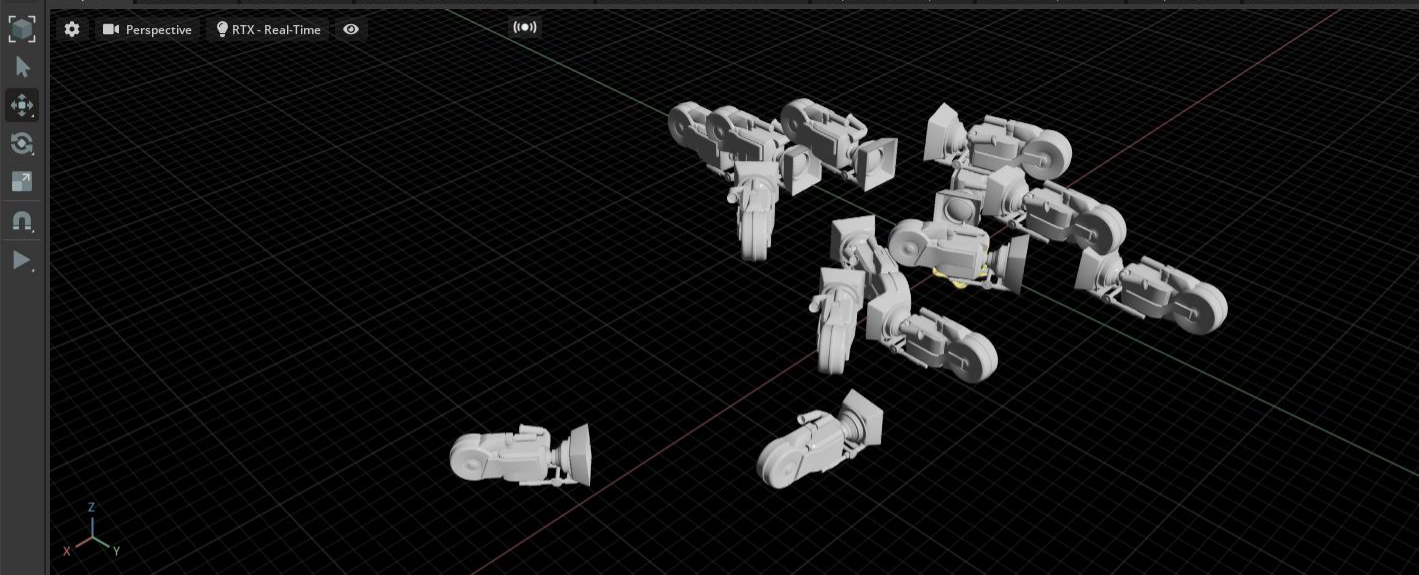
# **Extensions and Extendibility**

Powering Up Omniverse









CREATE 2022.1.5 | New Stage\*

File Edit Create Window Layout Help

Viewport

Perspective

RTX - Real-Time

Auto Authoring Layer

FPS: 63.99, Frame time: 15.63 ms

NVIDIA GeForce RTX 2070 Super with Max-Q Design: 2.5 GiB used, 4.6 GiB available

Host Memory: 4.7 GiB used, 17.2 GiB available

1280x720

World (defaultPrim)

defaultLight

Cube

Looks

Water\_Pool\_Clear\_Blue

Shader

ActionGraph

computeGraphSettings

ShaderWriteAttrib

on\_tick

to\_float

multiply

constant\_double

Environment

Type

Xform

DistantLight

Mesh

Material

Shader

ComputeGraph

ComputeGraph!

ComputeNode

ComputeNode

ComputeNode

ComputeNode

ComputeNode

ComputeNode

Payload

Property

Content

NVIDIA Assets

Asset Stores (beta)

Samples

Environments

Materials

Console

Action Graph

Nodes

Variables

doub

Constants

4

Constant Double

omni.graph.nodes.ConstantDou

Constant Double4

omni.graph.nodes.ConstantDou

Constant Double3

omni.graph.nodes.ConstantDou

Constant Point3d

omni.graph.nodes.ConstantPoin

ActionGraph

On Tick

Update Period (Ticks)

Only Simulate On Play

Absolute Simulation Time (Seconds)

Delta (Seconds)

Animation Time (Frames)

Is Playing

Animation Time (Seconds)

Time Since Start (Seconds)

Constant Double

Value

Multiply

A

B

Product

To Float

value

Float

Write Prim Attribute

Exec In

Exec Out

Name

Prim Path

Use Path

Prim

Value

A close-up, black and white photograph of a highly textured, woven mesh material. The mesh consists of many small, rounded, interconnected loops, creating a complex, three-dimensional pattern. The lighting highlights the glossy surface of the material, with bright reflections and deep shadows that emphasize its texture. The image is partially obscured by a diagonal black bar that runs from the bottom left towards the center, separating the texture from the text area.

# **Resources and Q&A**

## USD Resources

Pixar

USD

Universal Scene Description (USD) API

NVIDIA Developer

USD

Working with USD Python Libraries

USD Python API Notes

## Omniverse Resources

NVIDIA

Omniverse Documentation Site

Omniverse Utilities Helpful utilities in the Omniverse.

Omniverse Workflows Objective based tutorials using Omniverse.

Omniverse Kit API

Frequently Used Python Snippets

NVIDIA On-Demand: Omniverse Video Lists <sup>[1]</sup>

Omniverse Forums

Third Party

Official Omniverse Channel (Discord)

omniverse-kit-extension (GitHub)

**PHYSICALLYBASED** A database of physically based values for CG artists <sup>[2]</sup>

NVIDIA Omniverse Channel (YouTube)

NVIDIA Studio: Omniverse Search (YouTube)

NVIDIA: Omniverse Search (YouTube)

PathCopyCopy <sup>[3]</sup>

## Visual Studio Code

Visual Studio Code

Visual Studio Code Extensions

### Releases

No releases published

[Create a new release](#)

### Packages

No packages published

[Publish your first package](#)

# How to contact me



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