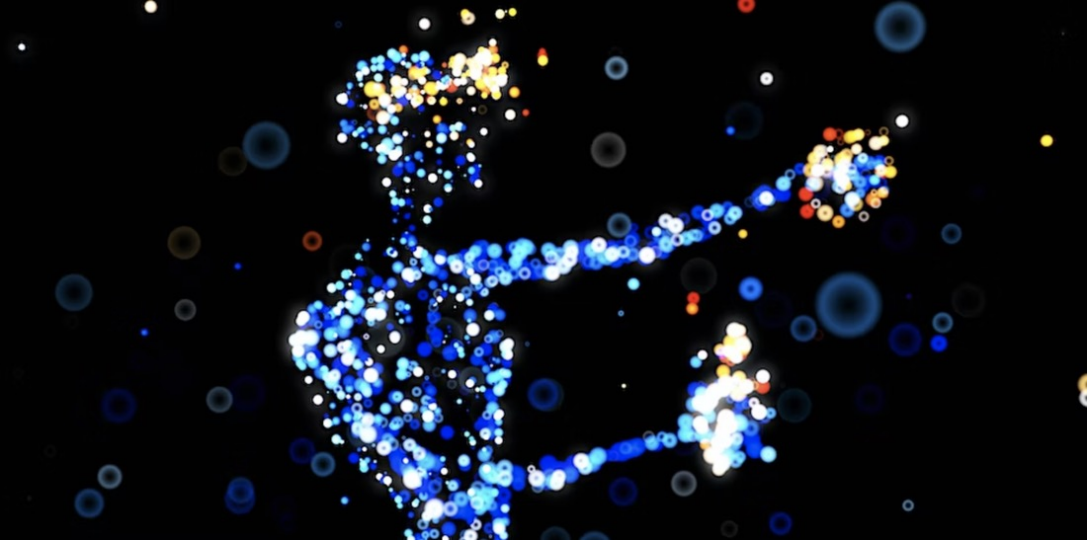
AUSTIN FORUM

ON TECHNOLOGY & SOCIETY

Connect. Collaborate. Contribute.™



Simulation, Visualization, Digital Twins, and the (Useful) Metaverse

February 7, 2023

Marc Hamilton
VP of Solutions Architecture and Engineering
NVIDIA

Welcome to the

Austin Forum on Technology & Society!

We bring leaders, thinkers, builders, creators, and learners together to ***connect, collaborate, and contribute!***

Thank you for joining our community online or in-person!

Before we get started, join our slack

Why join the Austin Forum Slack workspace?

- Continue and deepen the conversation after Austin Forum events
- Find new opportunities for collaboration, mentoring, working, and more
- Promote local events and relevant Tech & Society opportunities
- Because this gives *everyone* in our community—online and in-person—the *same* way to ask questions!
- ***We are going to clean up up channels and simplify the space before the next event***

How?

1. Open a web browser
2. Go to: www.austinforum.org/slack
3. Click "Join the Austin Forum Slack Workspace"
4. Enter your email address
5. Check your email to confirm Slack invitation
6. Enter your name and click "Create Account"
7. You're in! You can use the Slack mobile app now, too.
8. To submit questions during the event, in the channel **#event-questions** (add to your view using **+ Add channels**)

Austin Forum Team!

Jay Boisseau
Executive Director

Allison Warner
Logistics

John Lockman
Tech Director

Delanie Majors
Communications Coordinator

Mary Garza
Web/UX Designer

Thank you for sponsoring tonight, Abilitie!

https://invitedmba.com

invitedmba
by abilitie

The Mini-MBA For Aspiring Leaders

- Ivy-League Faculty
- Virtual Global Cohorts in the Metaverse
- Hands-on Business Competitions

12 Weeks
March 11-May 20th
Wednesday & Saturday meetings
$1,850

Apply by February 10 with "AustinForum" for $200 credit

Welcome KUNGFU.AI as an annual partner!

KUNGFU.AI

Dr. Steve Kramer
Chief Scientist

Stephen Straus
Co-founder and
Managing Director

Our Annual Partners Make This Possible!

Please contact us if you want to become an annual partner!

We have **4** kinds of programming!

Live onthly events	Online weekly content
Presentation + Networking events • Expert presenter-focused • In-person and online—hybrid • Recording and slides posted online	**Podcasts – Austin Forum Upload** ***(new episodes!)*** • Audio only • Conversation formats • Hosted in major podcast stores, AF website
Discussion events • Participatory for everyone • In-person ***or*** online • Never recorded—speak freely!	**Blog – Austin Forum Update** ***(just rebooted)*** • Web-based (on Medium) • Weekly(ish) articles • Multiple formats: "Techsplanations," interviews, analyses/positions, and series

Austin Forum Upload: New episodes out now!

GET IT ON Google Play | Listen on Apple Podcasts | Listen On Spotify

- Four new episodes in 2023:
  - **ChatGPT**
  - **The Economy & Tech Sector**
  - **SXSW 2023 Preview**
  - **Mis-/Dis-/Malinformation**
- Next two episodes will be:
  - LastPass, Passwords, Pitfalls & Recommendations
  - Generative AI and Art

Austin Forum Presentation + Networking Events: Experts Share, Inform & Inspire

5:15	Cash bar opens, and free snacks. Mingle in-person w/speakers & attendees, or chat w/online attendees
6:15-7:25	**Main event & presentation** ***Ask questions in AF Slack #event-questions channel, Tweet with #realityAF @AustinForum***
7:25-7:40	**Q&A with presenters**
7:40-7:45	**Final comments/slides**
8:00	Post-event networking w/speakers, attendees, and free drinks & eats

Q: What Technologies Make Digital Seem "Real" to You?

(30 seconds)

1 2 3 4 5 6 7 8 9 10

11 12 13 14 15 16 17 18 19 20

21 22 23 24 25 26 27 28 29

Questions for speakers?

Submit questions in the AF Slack channel #event-questions for a chance to *win a SXSW 2023 badge!*

Must be in-person and present at ~7:45PM to win!

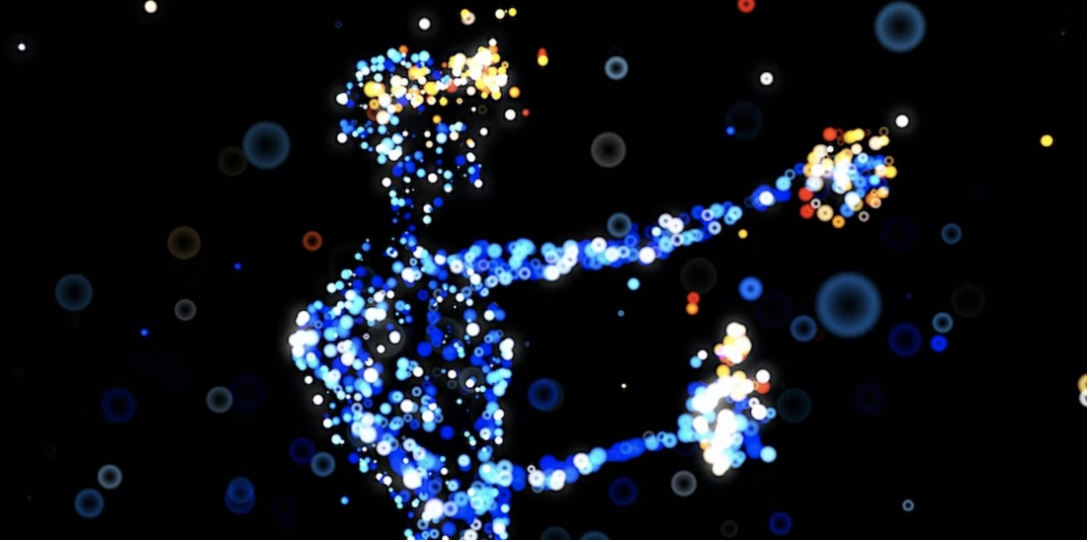
Must use your name (first and last) on questions!

SXSW

And now, our featured presentation…

Please:

- ✓ ***Respect our speakers & audience*** by not talking during their presentation, and in your comments & questions
- ✓ ***Ask questions*** in the AF Slack in the #event-questions channel
- ✓ ***Share key points*** via Twitter w/hashtag #realityAF and tag @AustinForum
- ✓ ***Learn, think, and enjoy!***



Simulation, Visualization, Digital Twins, and the (Useful) Metaverse

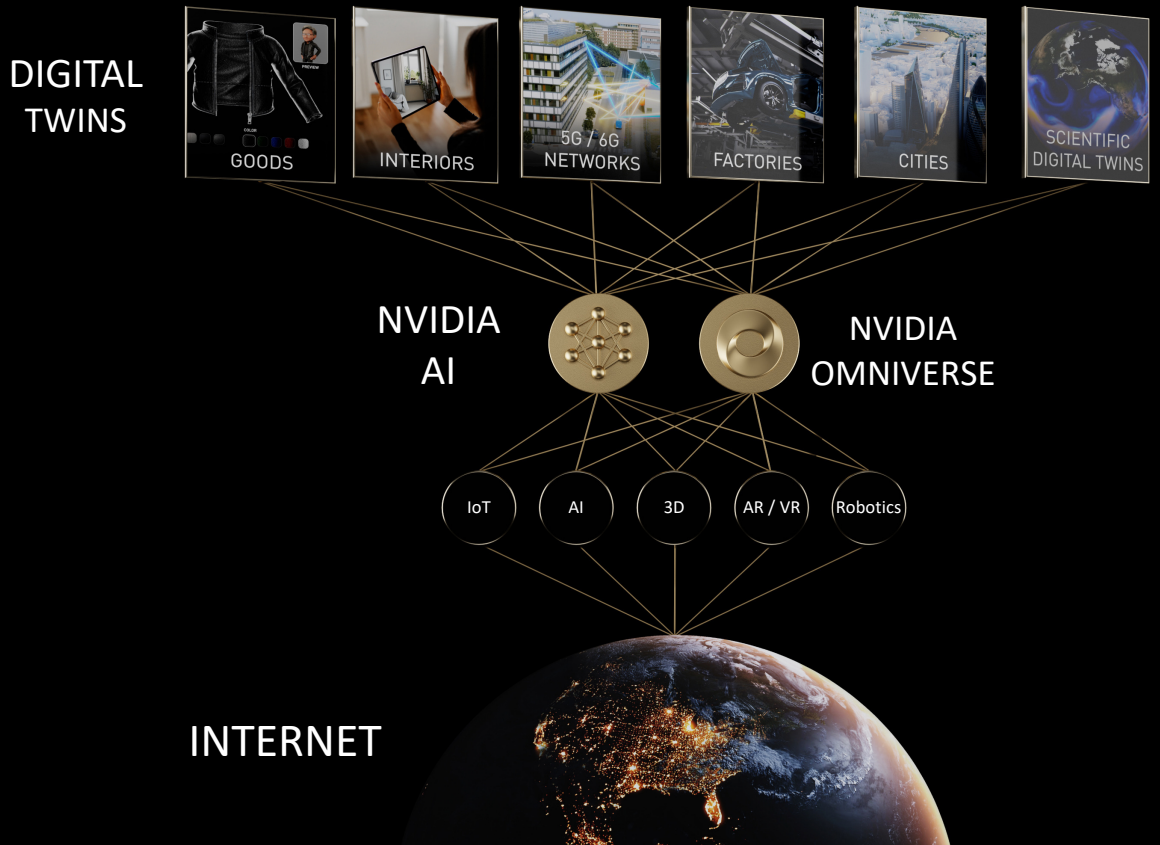
February 7, 2023

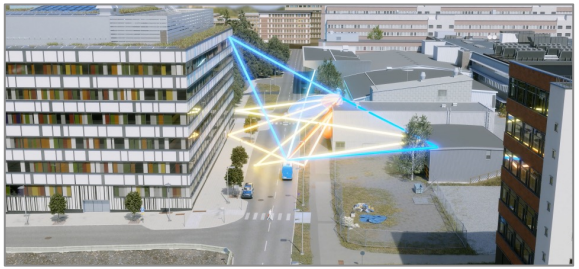
Marc Hamilton
VP of Solutions Architecture and Engineering
NVIDIA

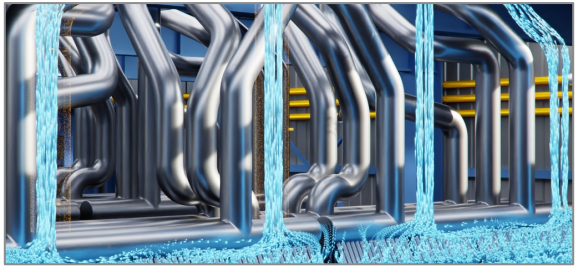
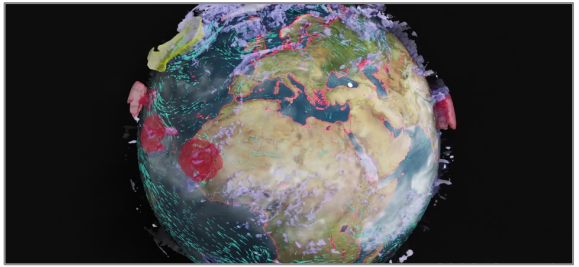
Simulation, Visualization, Digital Twins, and the (Useful) Metaverse

Marc Hamilton | Austin Forum/February 7, 2023

The Metaverse is the 3D Evolution of the Internet

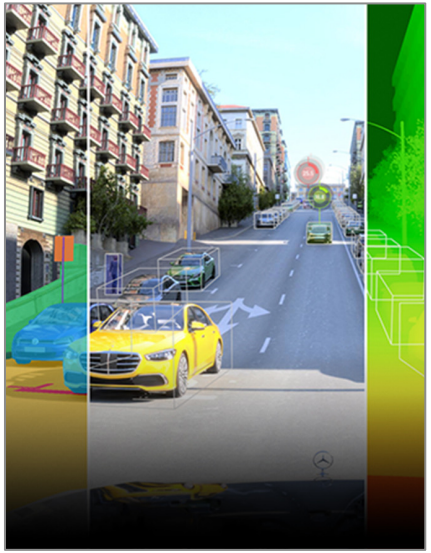




Metaverse Applications are Here Today

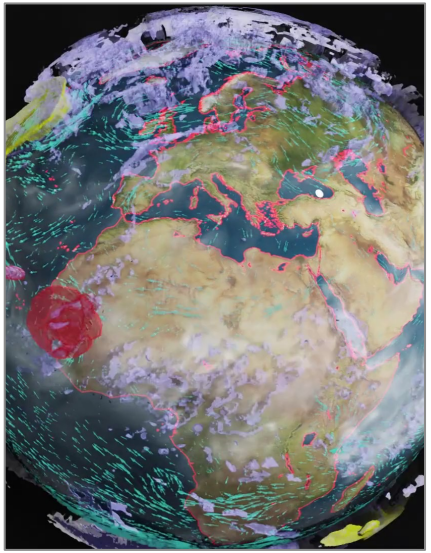
DRIVE Sim



Isaac Sim

Omniverse ACE

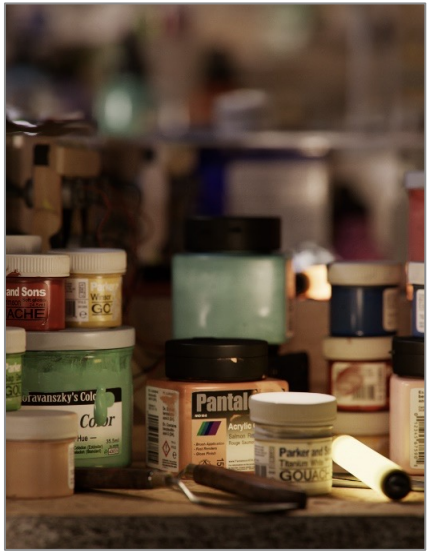
Earth-2



NVIDIA Built Omniverse To Enable Virtual Worlds

RTX Technology

Demand For Simulation

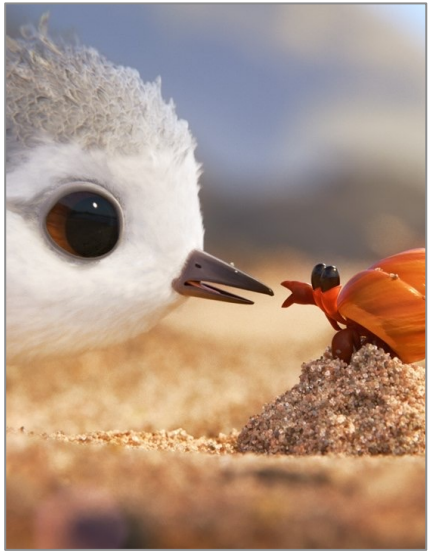


Data Center GPU Compute

Physically Accurate Simulation

USD

Scalable Simulation



AI Revolution

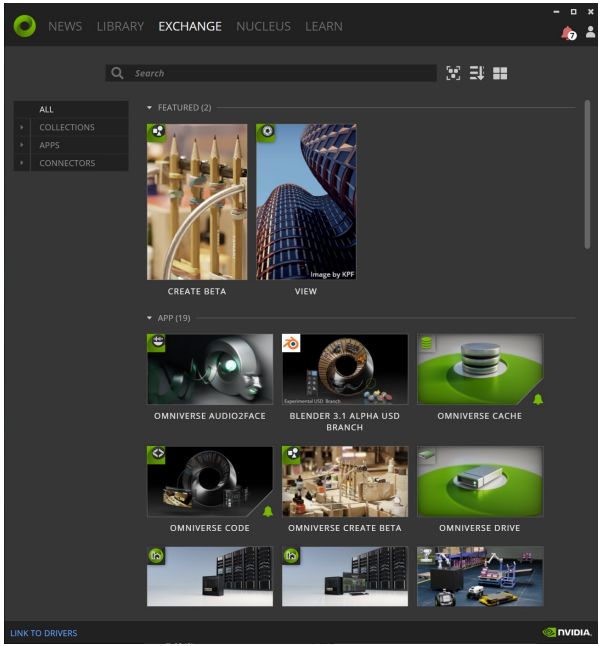
Powerful Asset Interchange

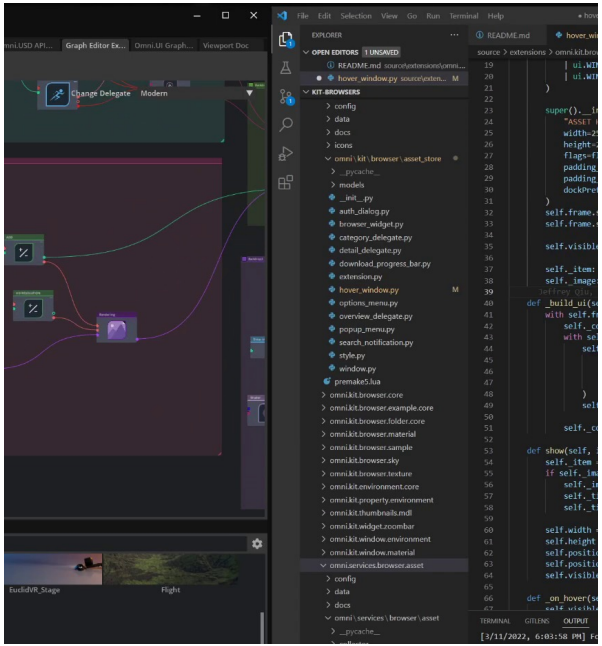
The Big Bang of Omniverse

Confluence of Enabling Technologies

WELCOME TO OMNIVERSE

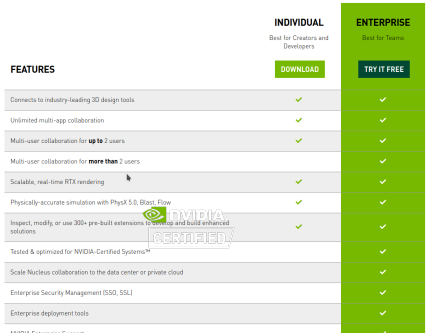
Platform and building blocks for Digital Twins



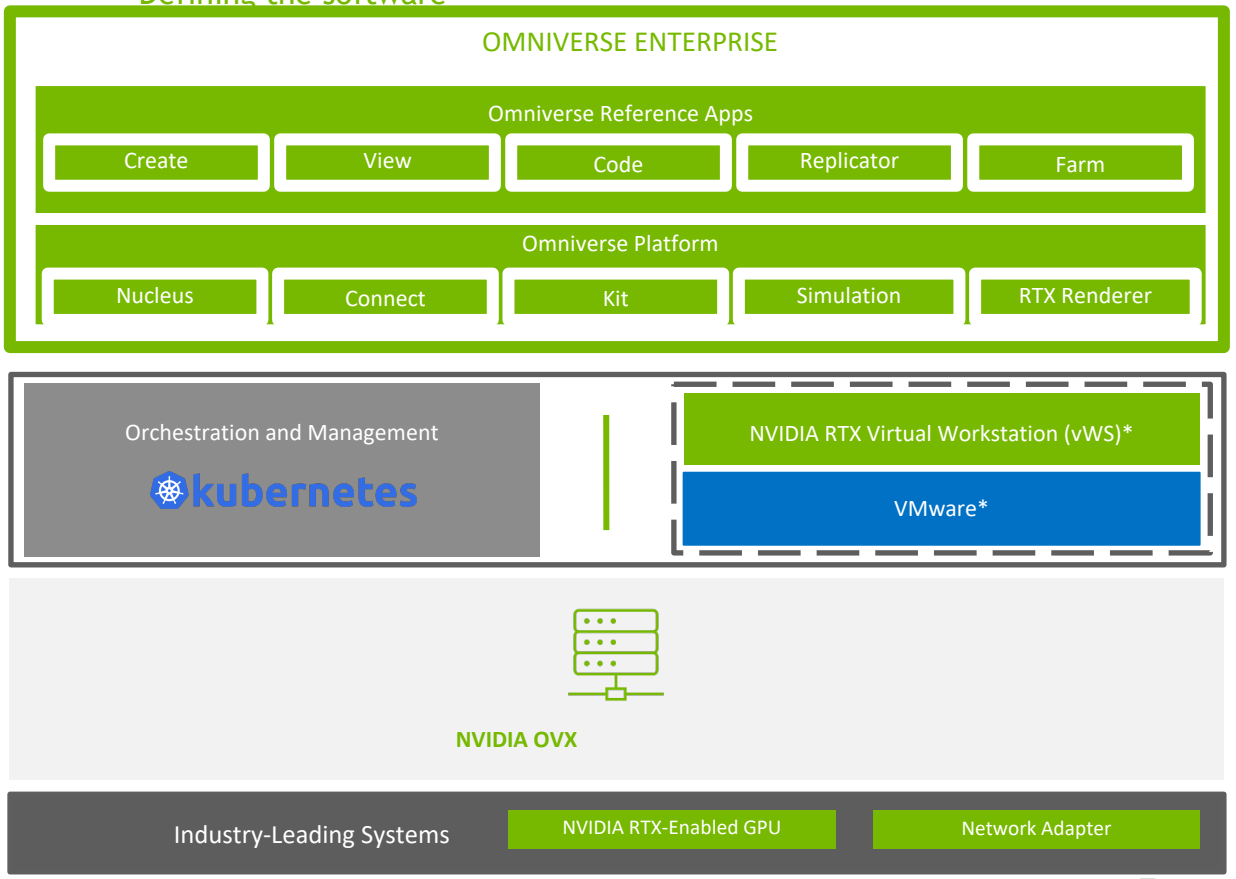


What is Omniverse?

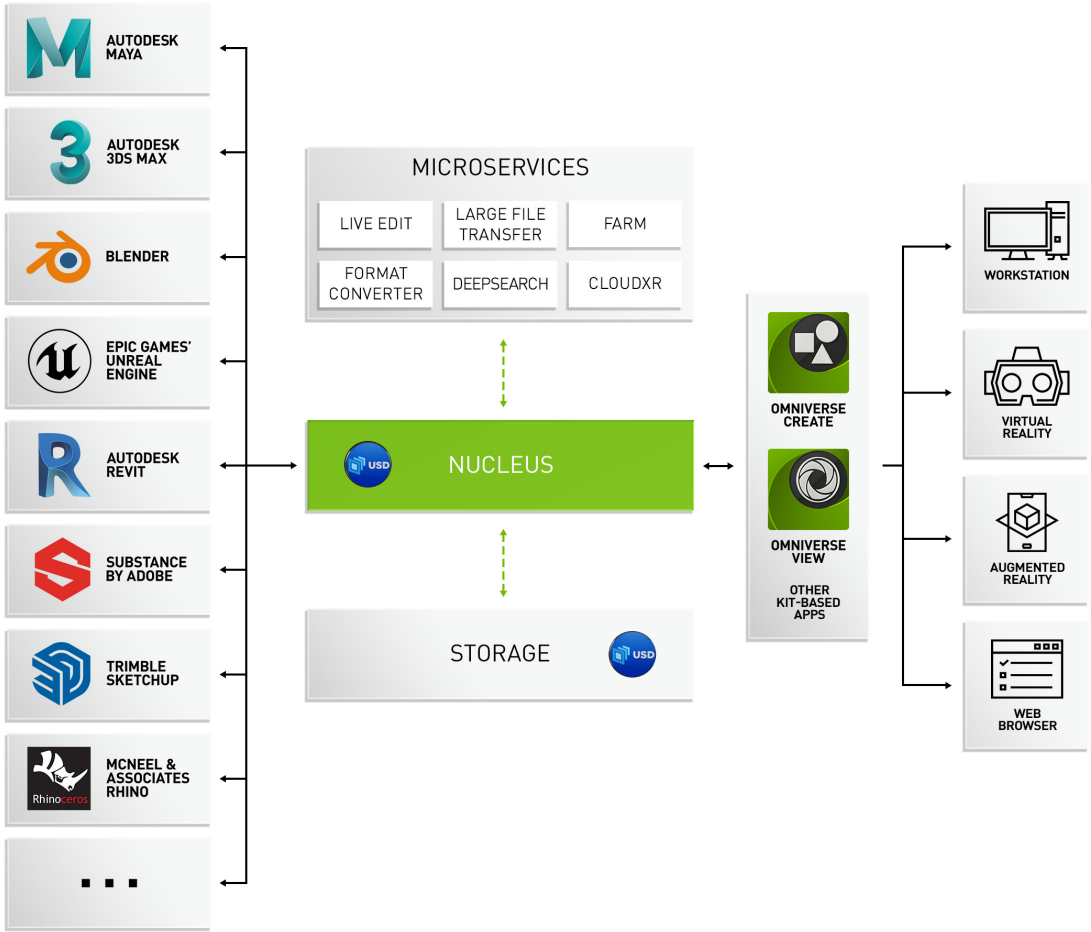
- Omniverse is a software suite designed for:
  - 3D rendering
  - 3D collaboration
  - Synthetic data generation
  - 3D world generation
  - Real time 3D interactivity
- Omniverse is a collection:
  - Applications
  - Platforms
- Omniverse comes in two
- forms:



Defining the software



NVIDIA OMNIVERSE



CONNECTING TO OMNIVERSE

Multiple Ways to Interact – Many in Real-Time, with Automated

BI-DIRECTIONAL CONNECTOR	Real-time updates shared between apps after a single export/import. Material conversion supported.	**GENERALLY AVAILABLE**	AUTODESK 3DS MAX, AUTODESK MAYA, UNREAL ENGINE
		BETA	ipolog
UNI-DIRECTIONAL CONNECTOR	Real-time updates from apps are reflected in Omniverse but aren't shared back. Material conversion supported.	**GENERALLY AVAILABLE**	GRAPHISOFT Archicad, AUTODESK REVIT, Rhinoceros, SketchUp
		BETA	CHARACTER CREATOR, CityEngine, iClone, creo, onshape, ParaView
USD EXCHANGE VIA OMNIVERSE DRIVE	Similar to uni-directional but no Connector. Allows for USD or texture export.	**BETA**	blender, CINEMA 4D by MAXON, Houdini, ZBrush, Ps, Ds, Pt
KIT EXTENSIONS	Kit Extensions developed by partners that 'connect' their apps or tools to the platform.	**BETA**	LIGHTMAP, RADiCAL, REPLICA
EXPORT / IMPORT	Conversion to USD via direct import or third-party app. Materials often converted manually.	**EXPORT AND IMPORT**	FBX, GLB, glTF, OBJ, OpenVDB, USDZ, USD
		IMPORT	3D PDF, 3DS, 3DXML, 3MF, ACIS, Alembic, CATIA V4, CATIA V5, Collada, DWF, DWG, E57, IFC, IGES, Inventor, JT, LXO, MD5, NX, Parasolid, PRC, PRO/E, ShapeNet, Solid Edge, SOLIDWORKS, STL, STP, U3D, URDF, VDA-FS, VRML, X3D

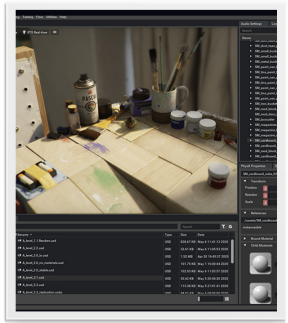
Advanced Tools and Technologies

Foundational Platform Components

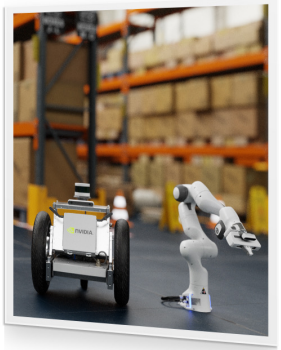
NUCLEUS

CONNECT

KIT



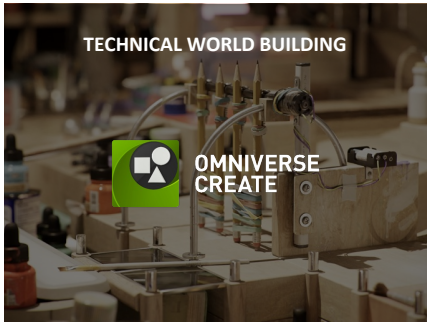
SIMULATION

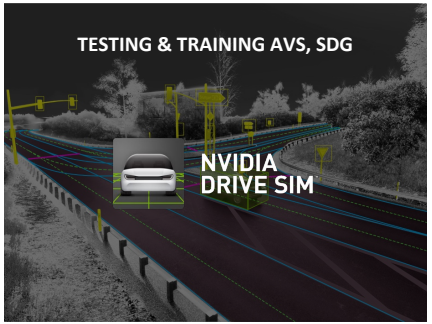


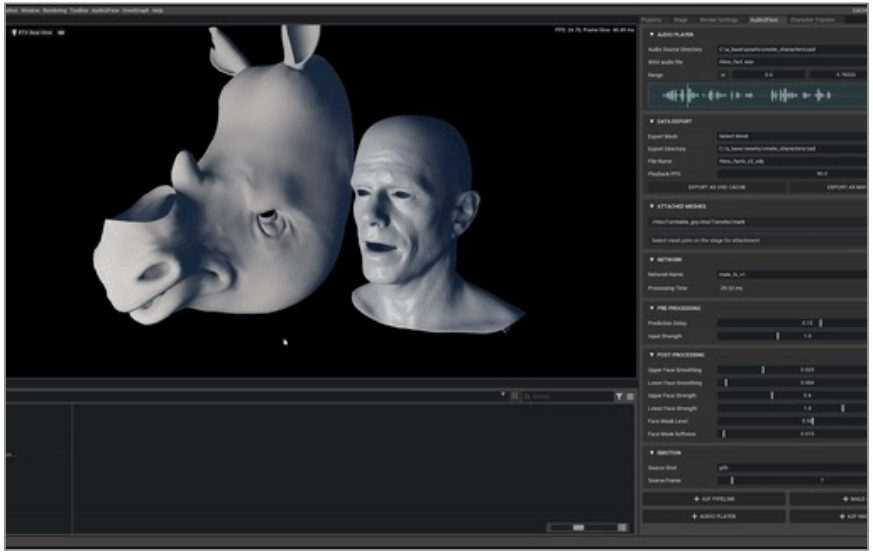
RTX RENDERER

Reference Applications Built On Omniverse

Sample Applications to Inspect, Extend, Copy, Emulate







OMNIVERSE
AUDIO2FACE

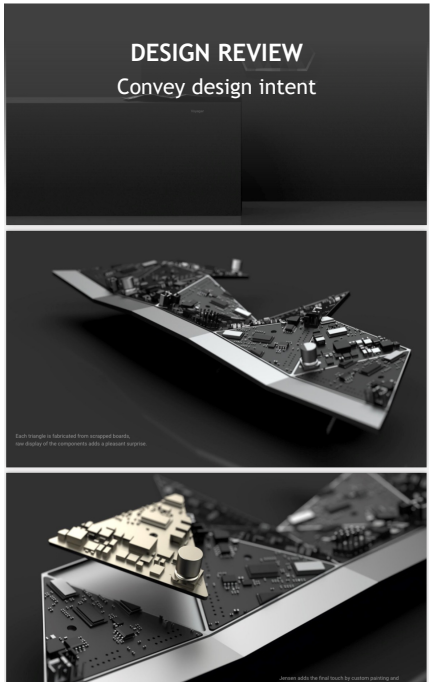
Omniverse Audio2Face

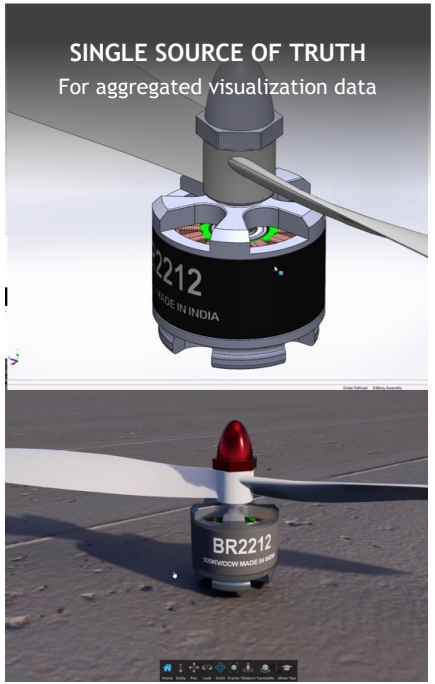
AI-Powered Facial Animation from an Audio Track

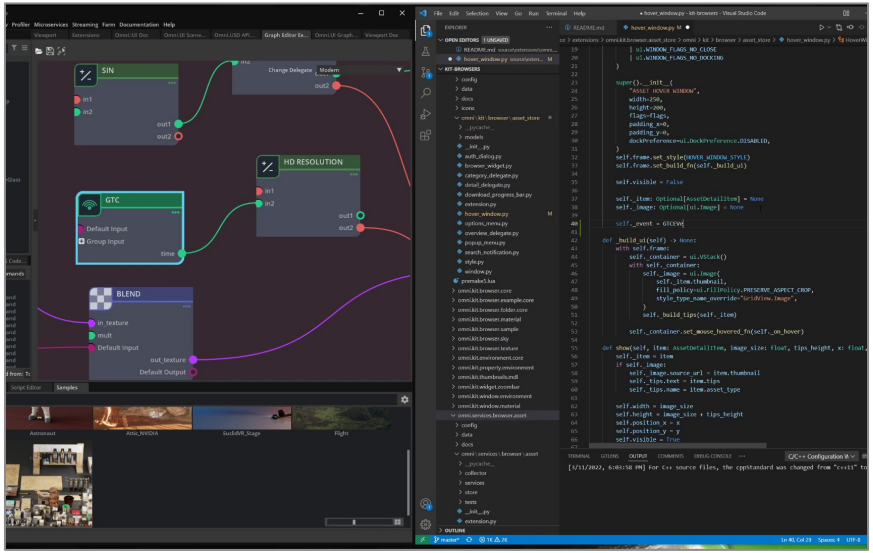
- Powered by NVIDIA AI
- Instant automatic facial animation with realistic, believable motion
- Switch between voices, genders, and languages
- Use dialogue track, or singing
- Recommended GeForce RTX 3070, NVIDIA RTX A4000 or higher

omniverse can enhance the design process

Connecting 3D Workflows, Simulating Physically Accurate, Full Fidelity Models





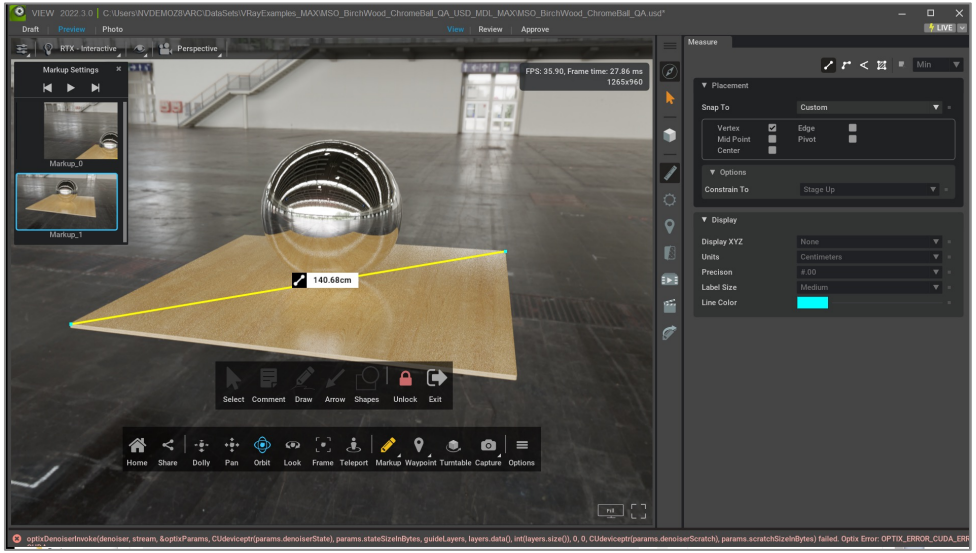


OMNIVERSE CODE

Omniverse Code

- Simple to learn and use – easy user interface, interactive documentation, sample templates, and ‘Hello World’ exercises
- Helps developers and power users achieve maximum output with minimal code – free to use any of the 300+ NVIDIA-built Omniverse Extensions in their projects, so no need to start from scratch
- Easily package and publish to a private or public registry
- Includes Omniverse Kit runtime

Integrated Development Environment (IDE) to build Omniverse extensions, apps, microservices



OMNIVERSE VIEW

Omniverse View

- Simple to use tools for project reviews including camera waypoints, annotations, measure, and markup
- Ability to make minor environment or material iterations and edits to present multiple options
- Quick toggling between real-time ray traced and ultra-high-fidelity path-traced mode allows teams to visualize interactively

Immersive, true-to-reality visualization for reviews & approvals

OMNIVERSE CREATE

- Simplify world building with intuitive layout tools and physics
- Breathtaking photorealism with physically-accurate materials, and real time ray and path traced rendering
- Advanced simulation capabilities with NVIDIA PhysX 5, Flow, and Blast integration

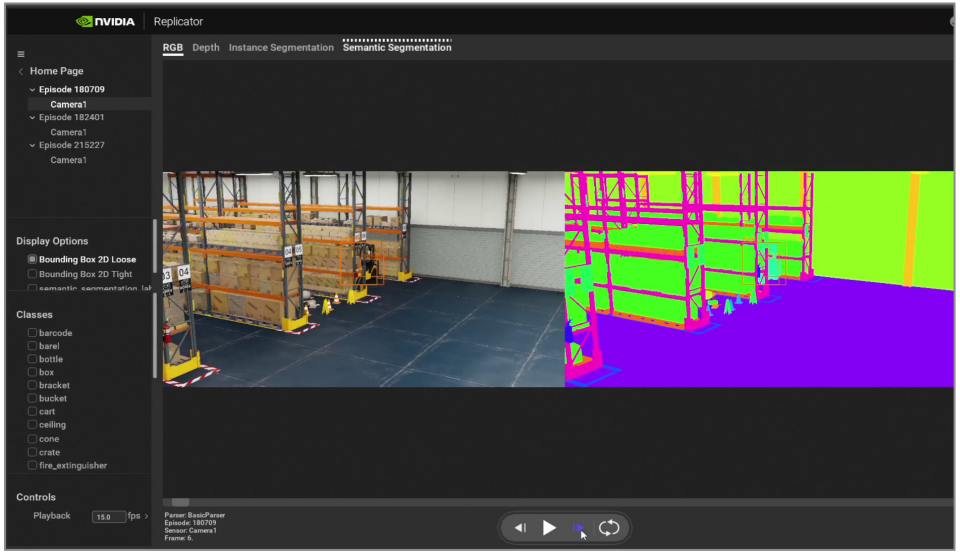
Omniverse Create

Advanced USD Scene Composition, Lighting, Rendering

- Omniverse XR App allows you to bring your 3D work into human scale and place them in photorealistic scenes.
- View, review and annotate Omniverse scenes in VR
- Control the lighting of the scene from within VR.
- Navigate through world-scale models with ease.
- Manipulate 3D objects in VR

Omniverse Create XR BETA

VR Optimized Reference Application



- SDK to build custom synthetic data generation pipelines
- Bootstrap AI model training
- Generate quality data faster than ever
- Integrates seamlessly with existing SDG tools

Omniverse Replicator

Build Custom Synthetic Data Generation Pipelines

NVIDIA PhysX

Rigid & Soft Body Dynamics, Destruction, Fluid & Fire

Import Physics Instance

Offline from External 3rd Party Application

NVIDIA Modulus

Accelerated with Physics-ML Platform

Physics Simulation in Omniverse

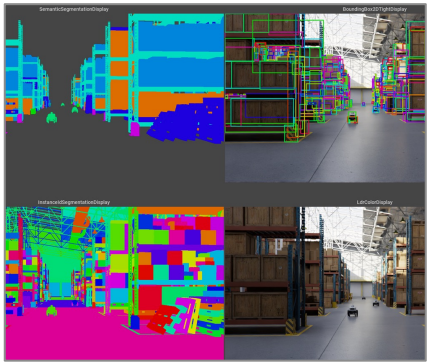
Multiple Ways to Ingest and Simulate Physics in Omniverse

NVIDIA Omniverse Cloud

Connecting Apps Running in Cloud, On-Prem, or Edge Devices

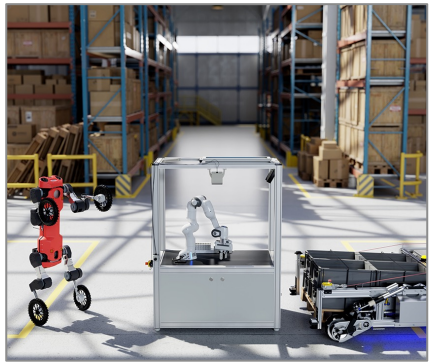
Omniverse Farm

Scaling Engine for 3D Workloads



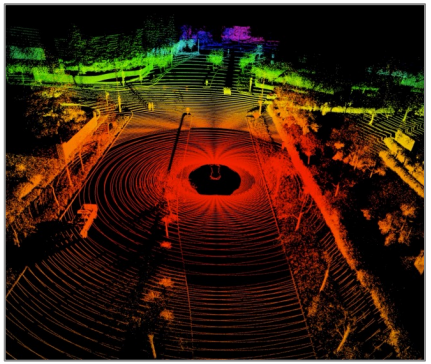
Omniverse Replicator

Synthetic 3D Data Generation



Isaac Sim

Training & Simulating Robots



DRIVE Sim

Training & Validating Autonomous Vehicles

Omniverse Nucleus

Collaboration & Database Engine

AVAILABLE TODAY

Self-Service Cloud Container Deployment
Bring-Your-Own-License
Enterprise Supported

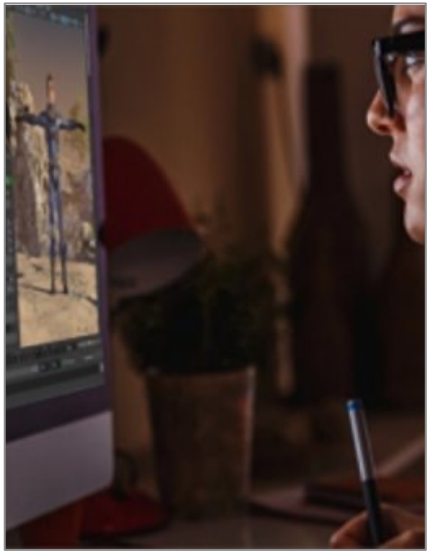
IN DEVELOPMENT

Managed Services/SaaS
Pay-per-consumption
Will be Available from CSPs

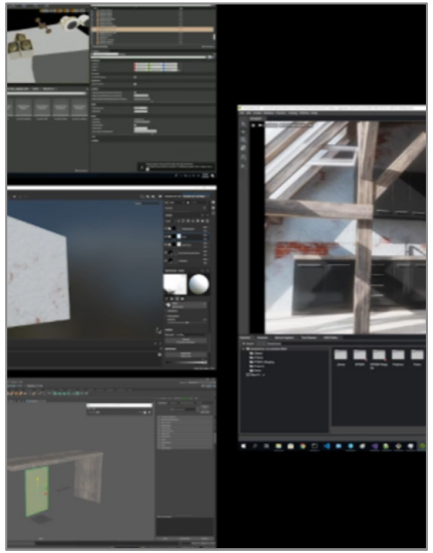
NVIDIA

Concept Art & Design

Previsualization



Real-Time Dailies



Content Collaboration

Media & Entertainment

Example Use Cases

DNEG

CHALLENGES

- ✕ Making creative decisions with limited visual information, such as reduced scene information including no lighting or fur
- ✕ No context of character interactions with self and environment
- ✕ Notes on renders take a long time to turnaround and implement any changes requested

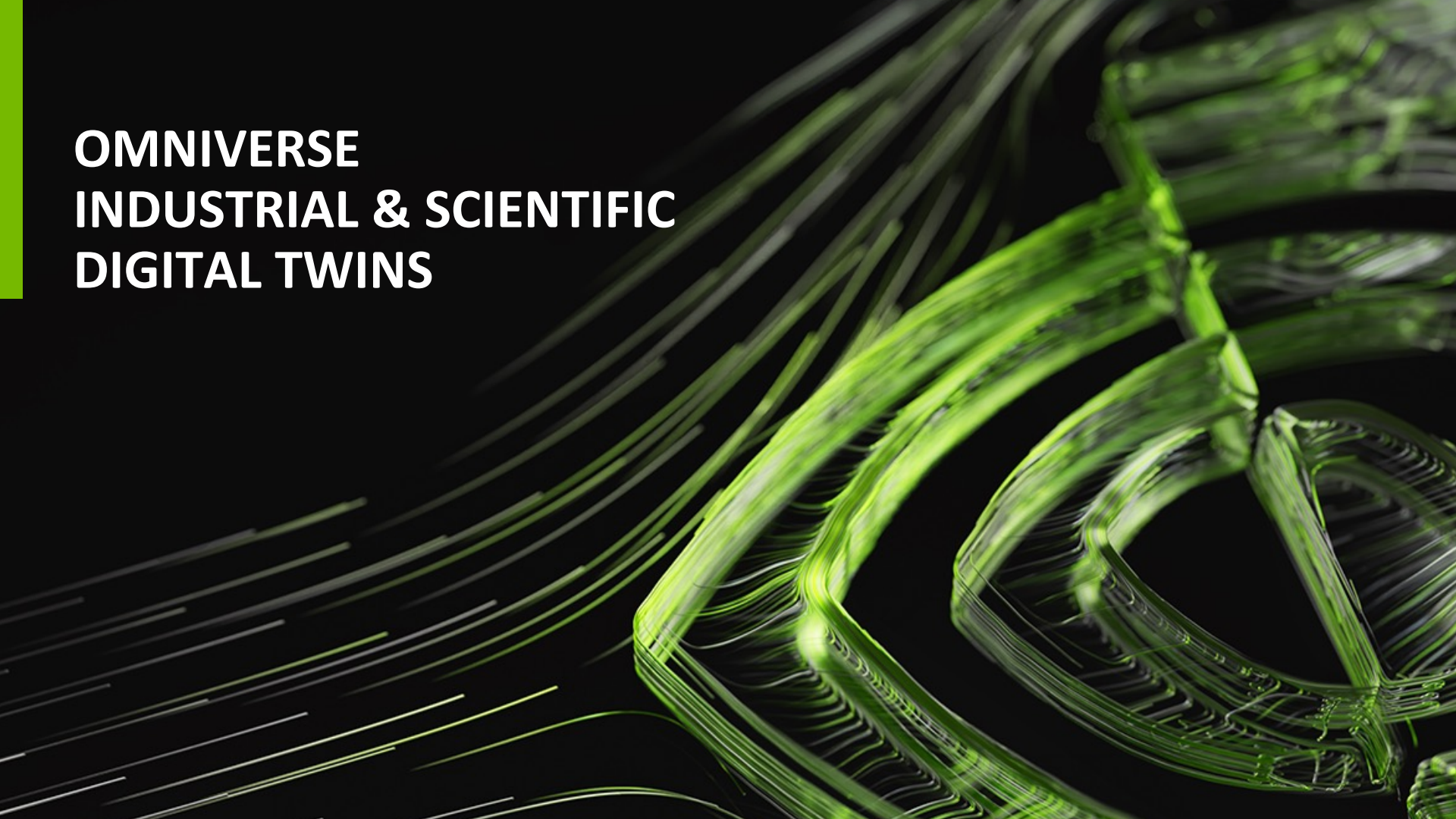
OMNIVERSE VALUE

- ☑ Artists can see their work in context at full fidelity before they deliver and get closer to final frames faster
- ☑ No long wait times for renders, accelerating review cycles from days to hours
- ☑ A flexible non-linear workflow means departments can contribute at the same time. Reviews are interactive and iterations can be made on the fly

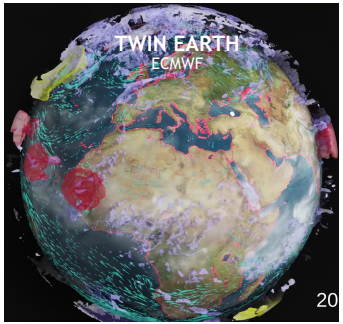
Transforming Global Film Production Workflows

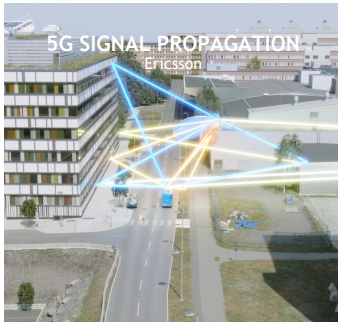
DNEG – Leading Visual Effects and Animation Studio

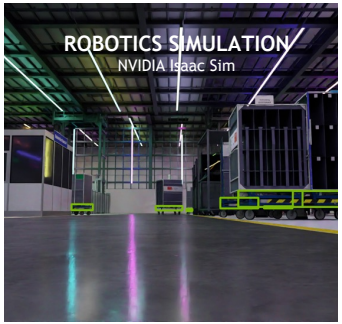
OMNIVERSE INDUSTRIAL & SCIENTIFIC DIGITAL TWINS

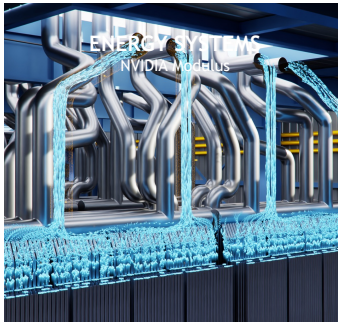


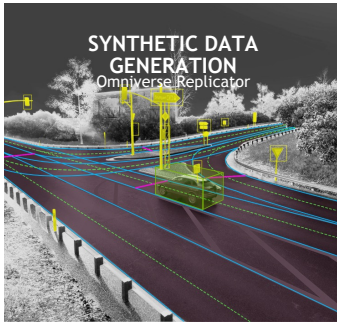
OMNIVERSE DIGITAL TWINS ARE SOLVING OUR GREATEST CHALLENGES





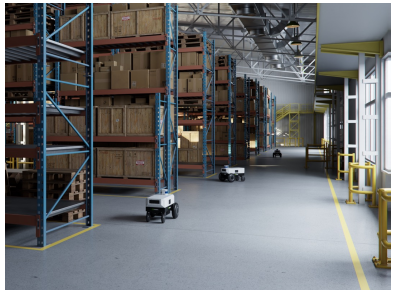




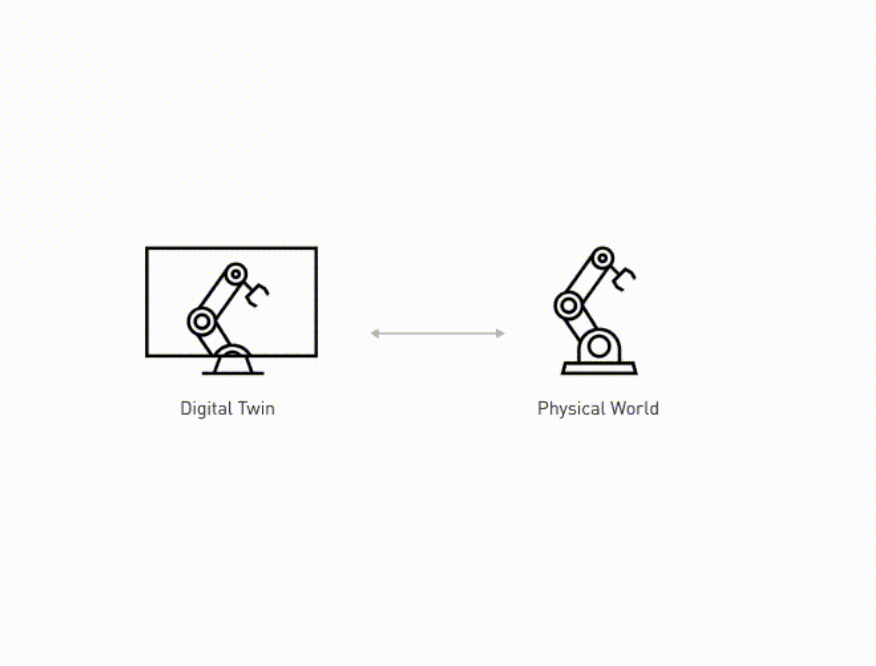


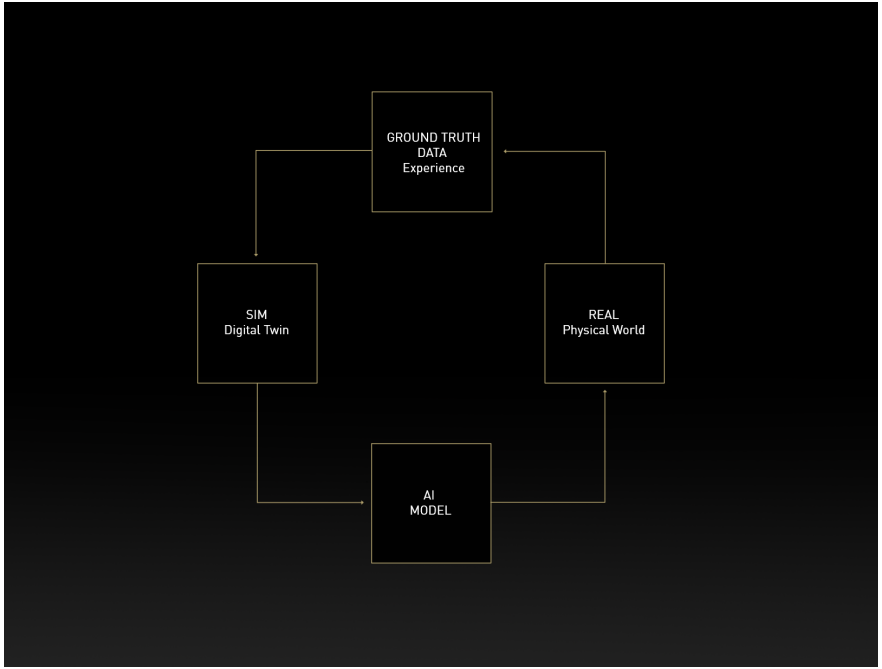
WHAT IS AN OMNIVERSE DIGITAL TWIN?

PHYSICALLY ACCURATE REPLICA	PERFECTLY SYNCHRONIZED	AI-ENABLING, AI-ENABLED	INTEROPERABLE AND EXTENSIBLE SINGLE SOURCE OF TRUTH



What is a Full Fidelity, Live Digital Twin?





A digital twin is a large-scale, physically accurate simulation of an asset, process, or environment with multiple autonomous systems perfectly synchronized with real-world data streams.

Building a Digital Twin

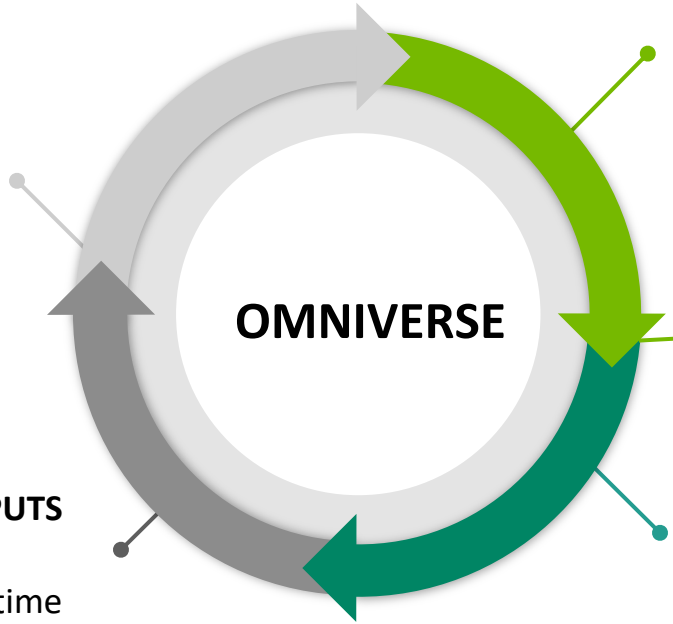
Multiple Steps, Different Entry Points

AUTONOMOUS SYSTEMS

Connection and operation of multiple autonomous, robotic systems for optimization, management, and oversight

SENSOR MODEL INPUTS

Connection and real time streaming of data inputs from physical twin



FULL FIDELITY VISUALIZATION

Aggregation of 3D datasets, materials, lighting, visualizing in real time

CUSTOM 3D TOOLS

Workflow dependent, building own custom tools to connect, enhance, or expand workflows.

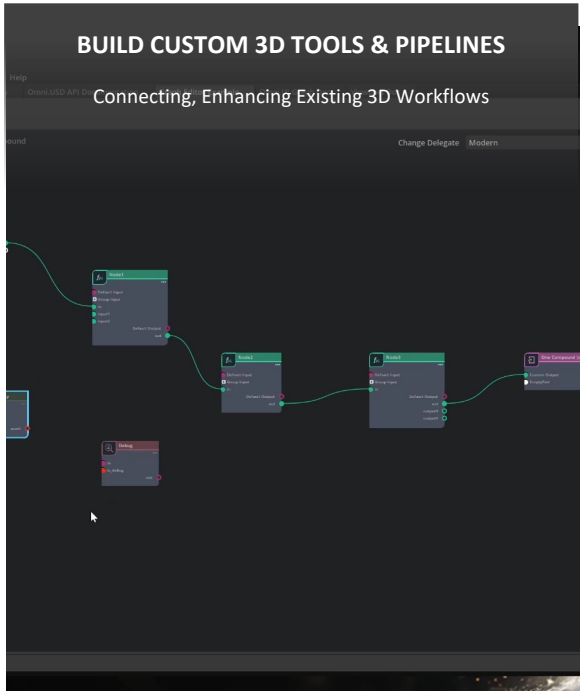
PHYSICS SIMULATION

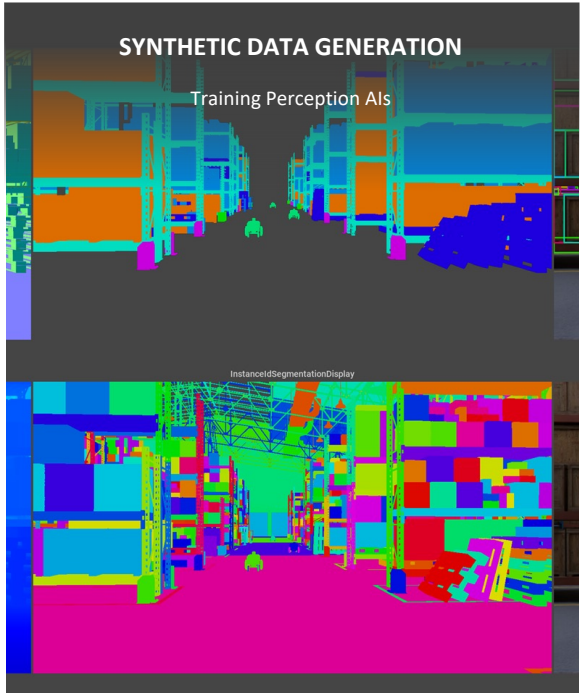
Addition of physics simulation through microservices

NVIDIA.

Starting Blocks to a Digital Twin

Getting Started on the Digital Twin Journey with Omniverse Enterprise





Even Digital Twins Start with Full Fidelity Visualization

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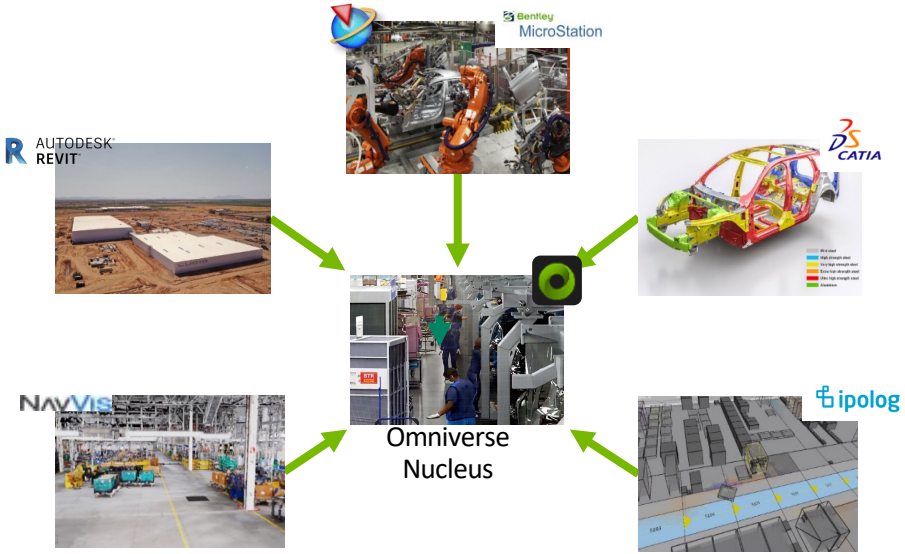
Connect and Visualize Full Fidelity 3D Datasets from Disparate Apps



- ☑ Has 3D datasets from multiple 3D tools
- ☑ Needs to do 3D rendering
- ☑ Wants to see 3D data all in one place, in real time
- Have had experience with data loss or model decimation from game engines

External Agency Designs Architecture Data in Revit → MicroStation Layout Data is Live Linked to Omniverse → Omniverse Data is Referenced for Production Planning → Process Simulate and Designer are Live Linked to Central Omniverse Model → Omniverse Stages Become Central Layout for Digital Factory

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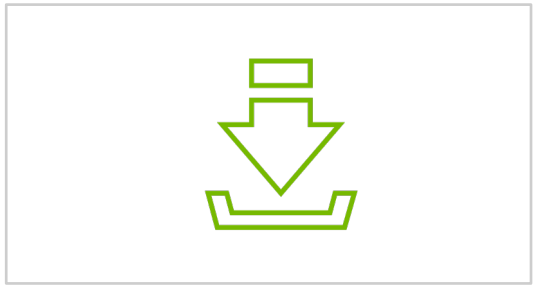
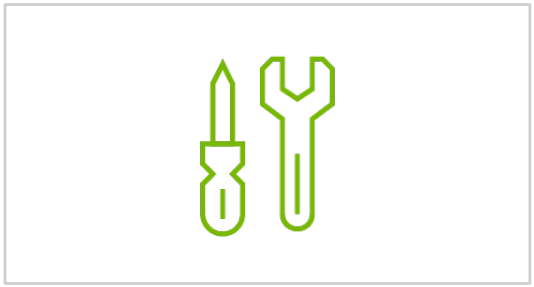
SEE YOU IN OMNIVERSE

EXPLORE OMNIVERSE ENTERPRISE



DOWNLOAD OMNIVERSE
nvidia.com/omniverse



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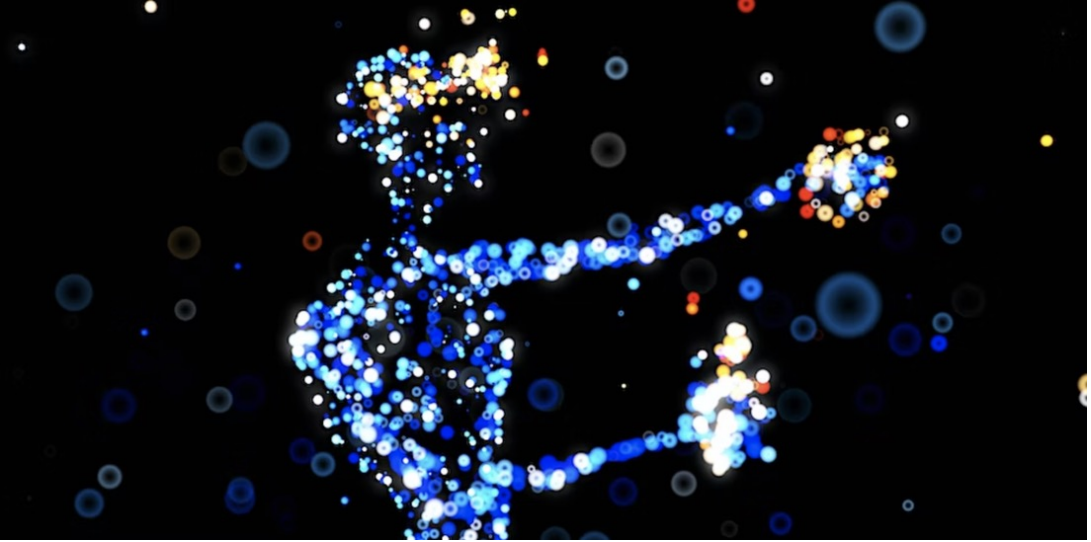

Q&A for

Simulation, Visualization, Digital Twins, and the (Useful) Metaverse

Marc Hamilton
VP of Solutions Architecture and Engineering
NVIDIA

Q: What is the best thing you learned tonight?

(30 seconds)

1 2 3 4 5 6 7 8 9 10

11 12 13 14 15 16 17 18 19 20

21 22 23 24 25 26 27 28 29

Join Us for More Great Content in 2023

- **Schedule will be posted at www.austinforum.org**
- Presentation and discussion topics for 2023 will include
  - Digital Twins and Multiverses
  - Tech & money, markets, finance
  - AI and data science
  - Robotics, autonomous vehicles/drones,
  - Manufacturing tech
  - Personal digital health & wellness tech
  - and more!

Plus:

- New podcast episodes **now**
- Rebooted blog Feb 1
- and stay tuned for hands-on labs and tutorials!

Thank you again for tonight, Abilitie!

https://invitedmba.com

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