

Real-Time Visualization and the Epic MegaGrant Program

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PDF for Web



Agenda

- My background
- “Game Engines” – untapped potential
- Trends and opportunities
- Epic Games and their Unreal Engine
- MegaGrant program



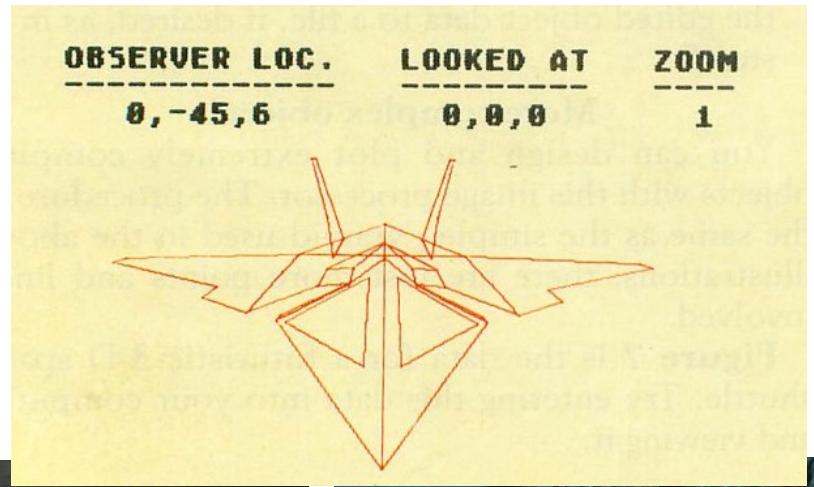
Only the tip of the iceberg
Not a formal academic presentation

Background

- Instructor, PhD student, Industrial and Systems Engineering at Auburn
 - Mod / Sim / Vis, Data Science & Machine Learning
 - Product Development and Innovation Curriculum Development
- Life-long fascination with modeling and simulation of all types
- Co-Founded n-Space in 1994 with funding from Sony
- 23 years, 45 games – Call of Duty, Toy Story, Star Wars, etc.
 - Console, Win / Mac, handhelds, mobile / tablet
 - Most publishers, genres, demographics
 - Concept to completion
 - Primarily internal tech (“n-Gin”) for ≈18 years



“GRAPHICS,” 1974 - 2016



“Game Engines”

For this Talk...

- Graphics is not the thing. It's the thing that gets us to the thing.
- Real-time visualization is emerging as a vital tool in industry and research
- “Game Engine” = versatile, robust, extensible development platform
- Integrates very wide variety of:
 - Assets
 - Inputs
 - Modeling / analysis / simulation methods
- Creates a range of real-time outputs:
 - Media ranging from static print to fully interactive mixed reality
 - Data streams for real-time control of devices or further analysis
- Not just a post-process image generator!

Game engine = development platform

"A game engine is **a software-development environment** designed for people to build video games. The core functionality typically provided by a game engine includes **a rendering engine** ("renderer") for 2D or 3D graphics, a **physics engine** or collision detection (and collision response), **sound**, **scripting**, **animation**, **artificial intelligence**, **networking**, **streaming**, **memory management**, **threading**, **localization support**, **scene graph**, and may include **video support for cinematics**.

Implementers often **economize** on the process of game development by reusing/adapting, in large part, the same game engine to produce different games or to aid in porting games to multiple platforms."

Wikipedia



Click to Watch Video (Vimeo Link)



Transforming Real-Estate Visualization with an XR-Based Digital Twin of Tampa - Unreal Engine.

<https://www.unrealengine.com/en-US/spotlights/transforming-real-estate-visualization-with-an-xr-based-digital-twin-of-tampa>



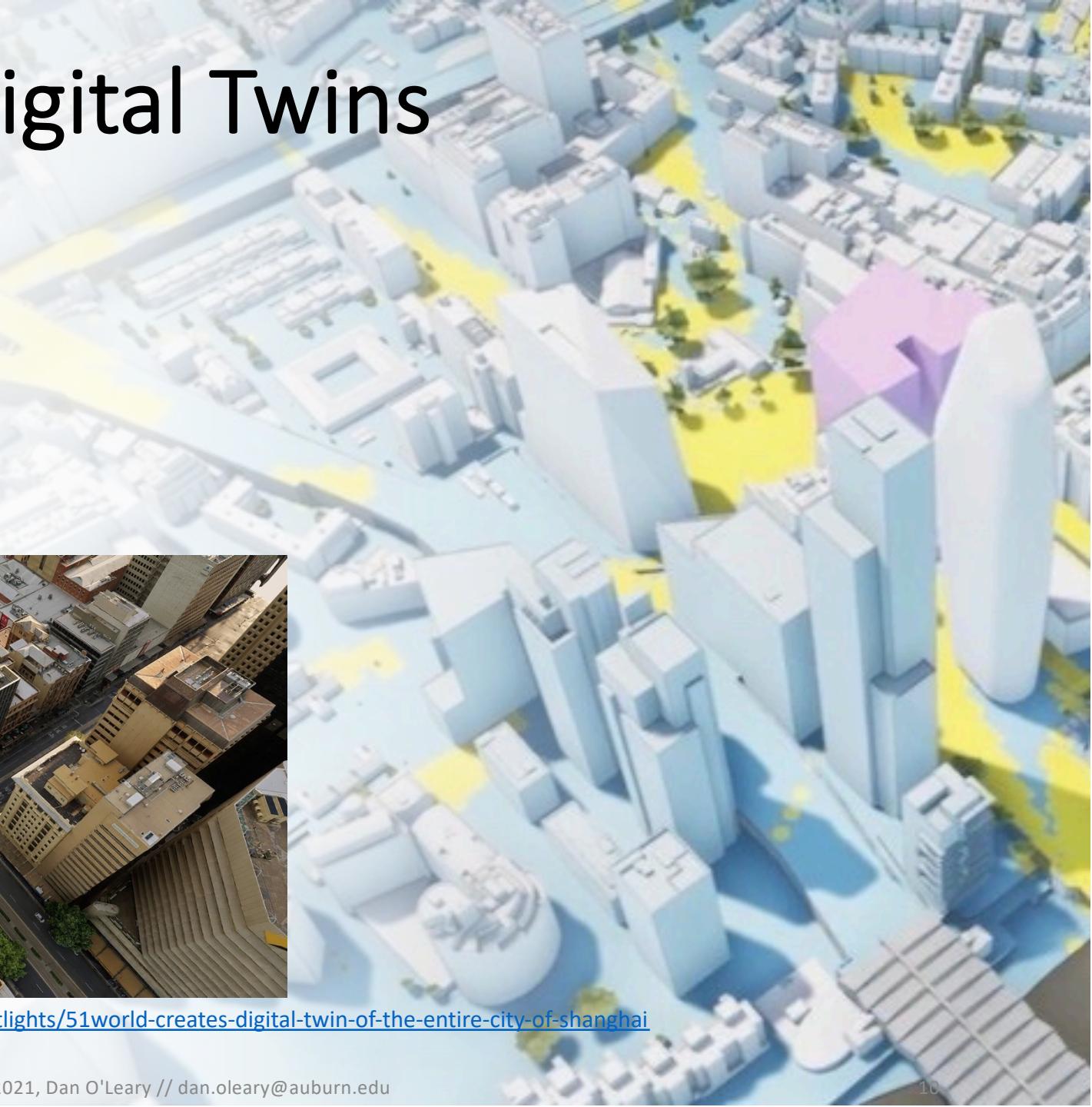
Water Street Tampa

Illustrates Potential 56 acre, \$3B real estate development project

Transforming Real-Estate Visualization with an XR-Based Digital Twin of Tampa - Unreal Engine.

<https://www.unrealengine.com/en-US/spotlights/transforming-real-estate-visualization-with-an-xr-based-digital-twin-of-tampa>

Smart Cities / Digital Twins



<https://www.unrealengine.com/en-US/spotlights/51world-creates-digital-twin-of-the-entire-city-of-shanghai>

REAL-TIME!

~~Game Engine~~



WMG
THE UNIVERSITY OF WARWICK

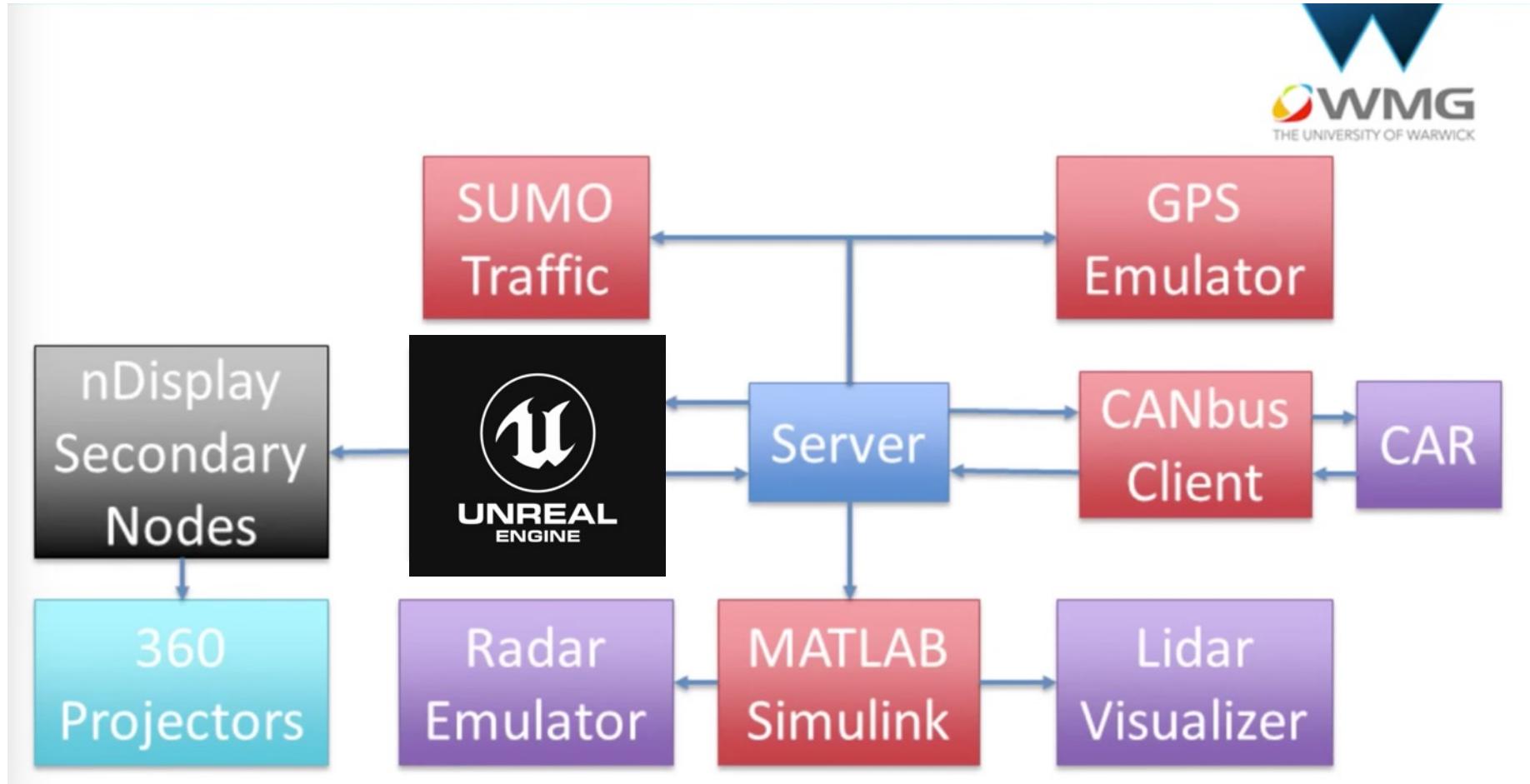
A Fully Immersive Driving Simulator for Autonomous Vehicles, July 2020. <https://youtu.be/T2M8u-8tBlc>
<https://www.unrealengine.com/en-US/spotlights/meet-the-hybrid-real-time-simulator-for-testing-autonomous-vehicles>

3xD Simulator for Intelligent Vehicles

- WMG at University of Warwick
- Drive-In, Driver-in-the-Loop installation
 - Connect any real vehicle via CAN bus (bi-directional)
 - 360° visuals via 8 projectors
 - LiDAR, Radar, and camera models
 - Simulate traffic, weather, vehicle dynamics
 - Re-Built using the Unreal Engine – flexibility, fidelity, extensibility
- Multi-purpose: autonomous vehicle and human factors research and development, promotion

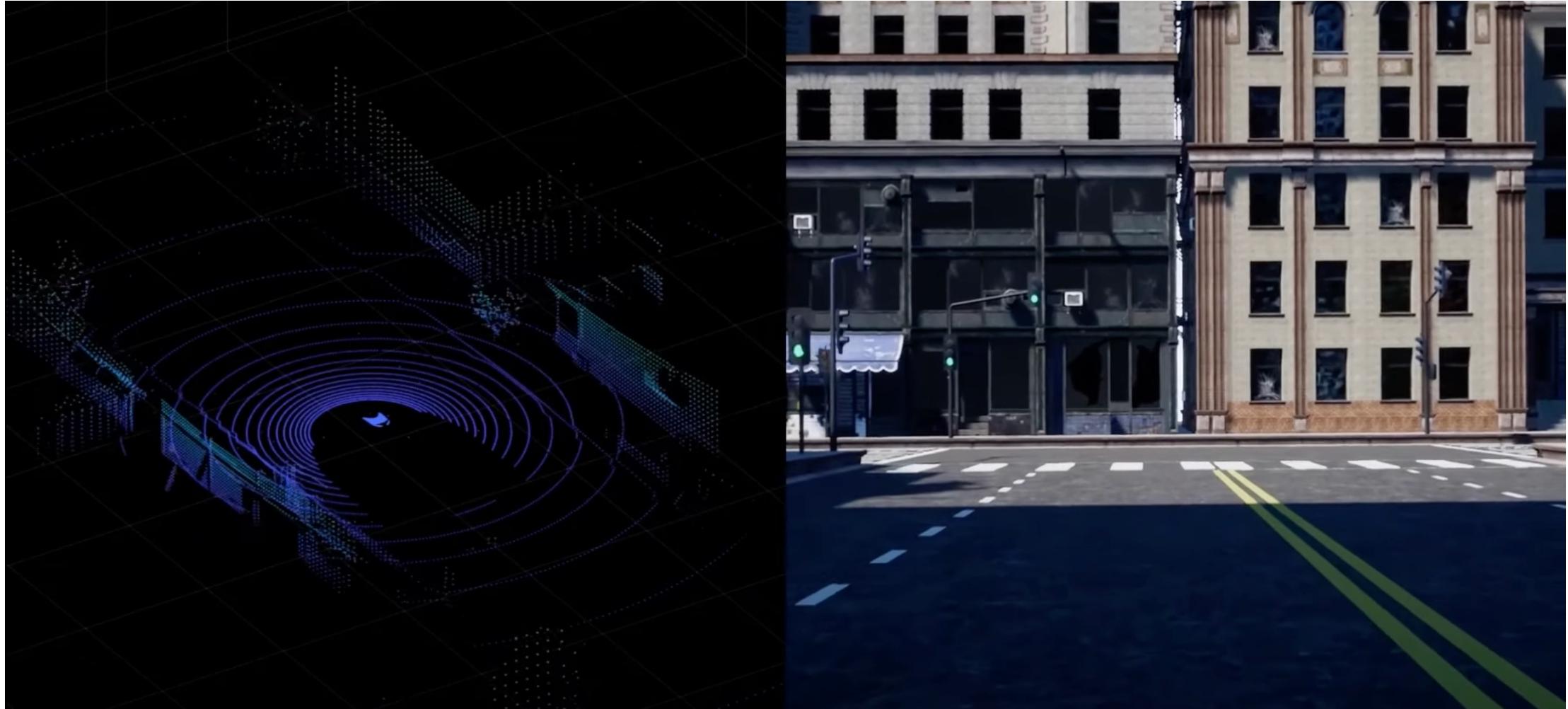
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System Block Diagram



A Fully Immersive Driving Simulator for Autonomous Vehicles, July 2020. <https://youtu.be/T2M8u-8tBIC>

Click to Watch Video (YouTube Link)



A Fully Immersive Driving Simulator for Autonomous Vehicles, July 2020. <https://youtu.be/T2M8u-8tBlc>

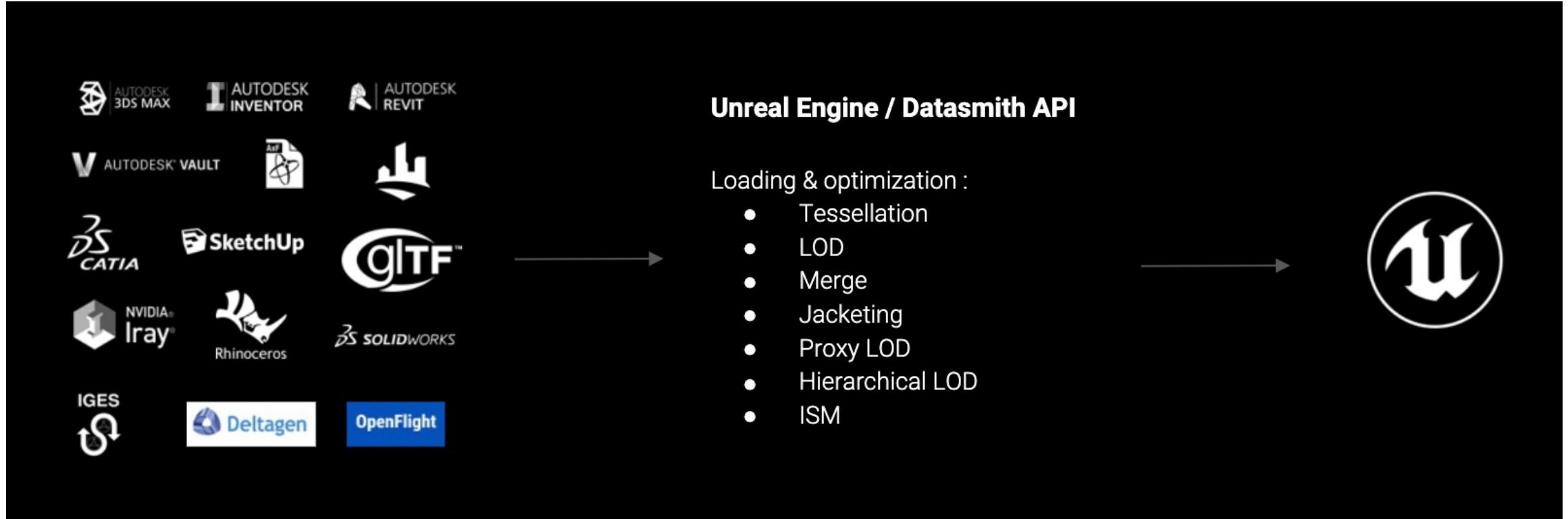
Real-Time Integration, Processing, Output...

- Leverage original assets for multiple purposes
Design, engineering, marketing, prototyping, simulation
- Support various user input
Keyboard, mouse, game controller, touch, motion, midi
- Reference multiple data sources
Sensors, internet, databases, external processes
- Analyze data and model processes
Simulation, machine learning
- Output to multiple media formats
Print, web, audio, video, AR/VR, data
- Drive physical outputs
Cameras, motion controllers, midi devices



e.g. Simulation

Use the files you like...



Using Unreal Engine in Simulation Applications, Unreal Fest Online, July 2020. <https://youtu.be/nEvM8WijoXw>

The pipeline you like...

Adapting to traditional simulation content creation pipelines

TrianGraphics
Trian3DBuilder

ESRI
CityEngine

VectorZero
RoadRunner

Presagis O2U

LiDAR Point Cloud
(UE 4.24 free plugin)

OpenStreetMap
(free plugin)

ASCEND - ARL

Presagis Terra Vista
(UE4 output compiler WIP)

UNREAL FEST ONLINE

Using Unreal Engine in Simulation Applications, Unreal Fest Online, July 2020. <https://youtu.be/nEvM8WjioXw>

The models you like...

The collage displays six different simulation applications:

- MathWorks - Simulink**: A screenshot of the Simulink interface showing a block diagram for a "Passenger Vehicle" system, including a "Lane Change Reference Generator" and "Controller" blocks.
- Mechanical Simulation - CarSim**: A screenshot of the CarSim software showing a blue sports car on a track, with multiple sub-windows displaying graphs of vehicle performance metrics like speed and torque.
- Offworld - Tracked Vehicles**: An image of a tracked vehicle, specifically a tank, with the text "Enhanced Vehicle Plugin" overlaid.
- CM Labs - Vortex**: A screenshot of the Vortex software interface, showing a truck in a construction-like environment with various simulation controls and data overlays.
- NVIDIA - AGX**: A screenshot of the AGX software interface, showing a dark-colored car with a transparent body, possibly for visual effects or collision detection analysis.
- Ballistic model**: A screenshot of a ballistic simulation interface featuring a large bullet trajectory visualization and a list of features:
 - EXTERNAL BALLISTICS - SIMULATING, GRAVITY, DRAG, WIND
 - PHYSICAL MATERIAL DEPENDENT PENETRATION SYSTEM
 - RICOCHETS
 - MULTIPLE SUBMUNITIONS PER SHOT
 - EASY SETUP AND USE

UNREAL FEST ONLINE

Using Unreal Engine in Simulation Applications, Unreal Fest Online, July 2020. <https://youtu.be/nEvM8WijoXw>

Deploying to the platforms you like...

Supports all major platforms including



UNREAL FEST ONLINE

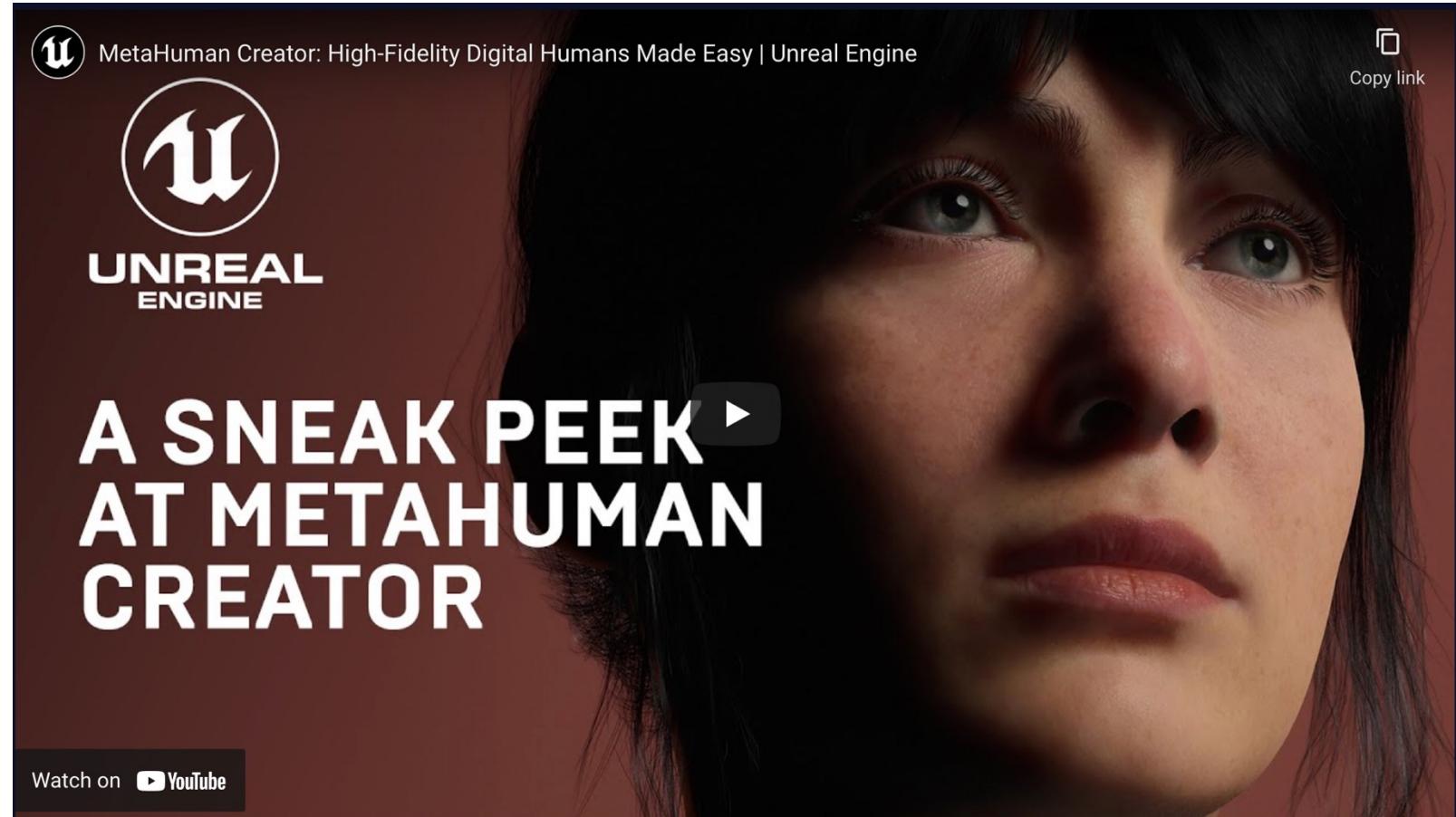


Using Unreal Engine in Simulation Applications, Unreal Fest Online, July 2020. <https://youtu.be/nEvM8WijoXw>

Trends and Opportunities

Unstoppable Technology

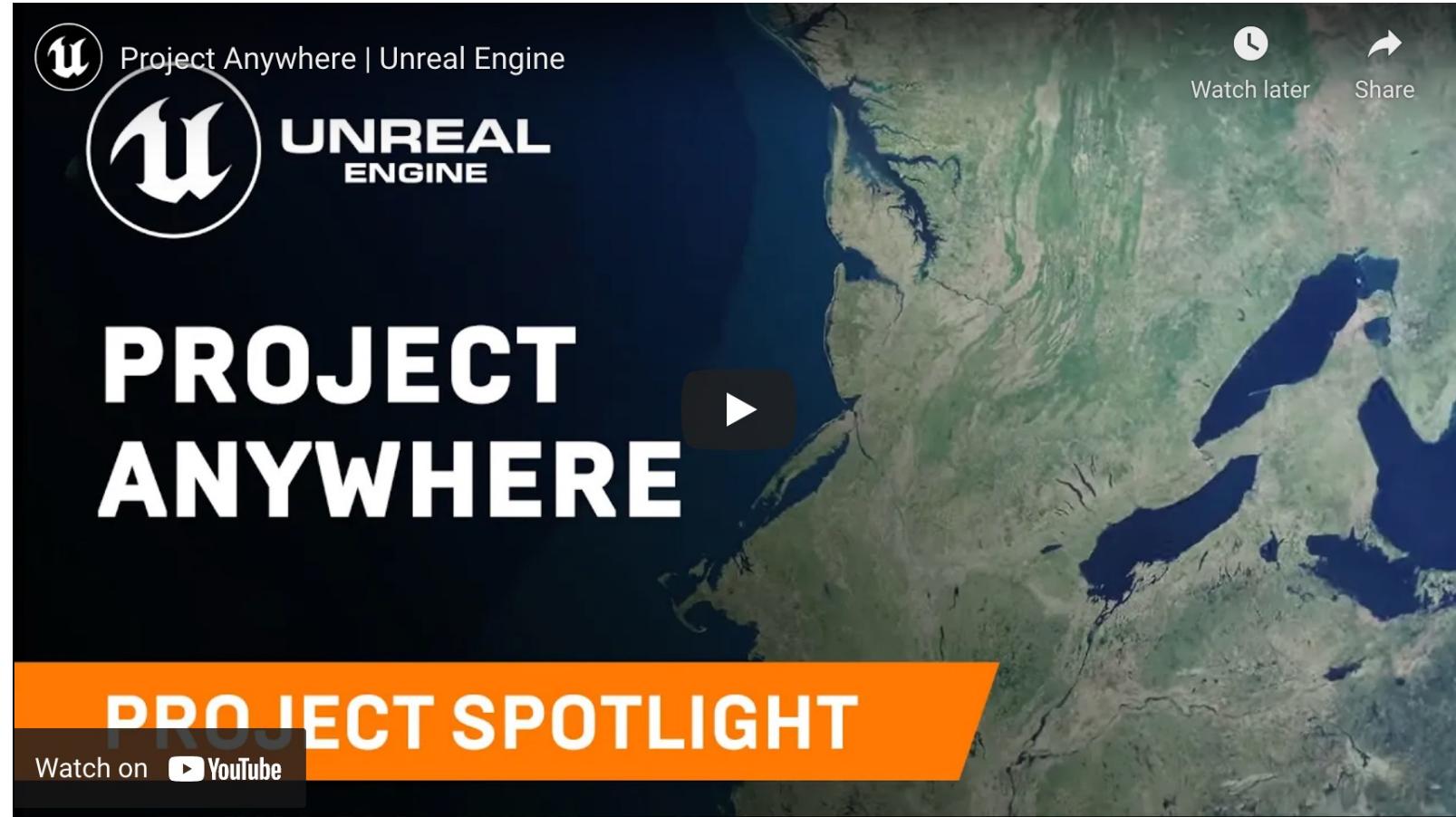
Accelerating
Democratizing



[Click to Watch Video \(YouTube Link\)](#)

Ambitious Scale

Problems
Solutions



[Click to Watch Video \(YouTube Link\)](#)

Broad Adoption

Enterprise Education

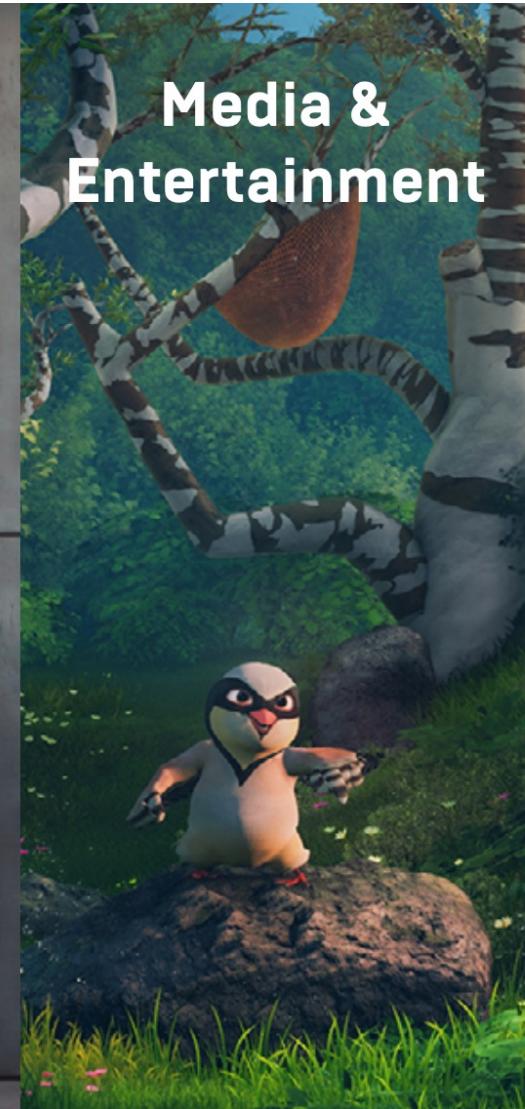
Media Defense



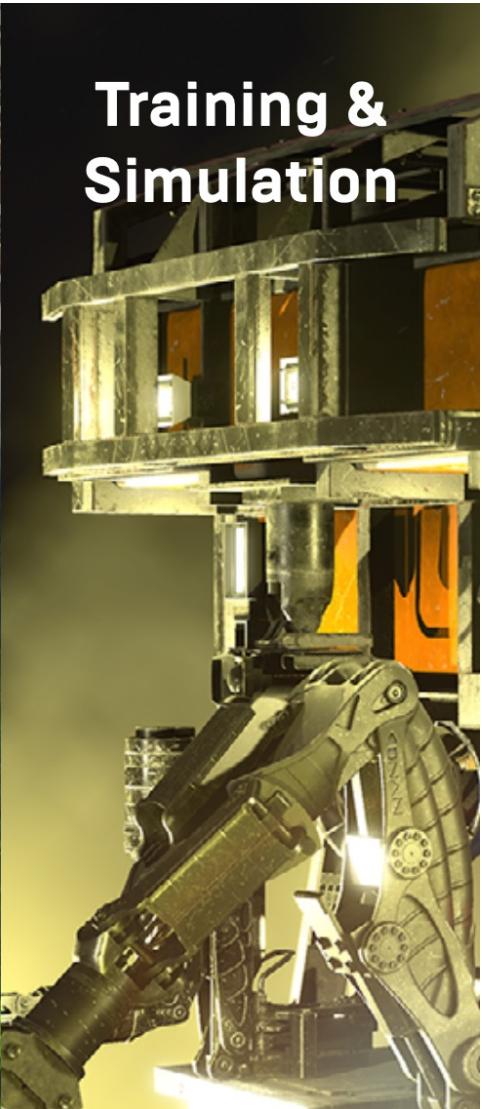
Automotive



Architecture



Media & Entertainment



Training & Simulation

Growth Market

Jobs & Consolidation

DEMAND FOR **REAL-TIME 3D SKILLS**, WHICH ARE AT THE TECHNOLOGICAL FRONTIER OF 3D GRAPHICS, HAS GROWN

601%

FASTER THAN
THE **MARKET**
OVERALL



IT NOW ACCOUNTS FOR

10%

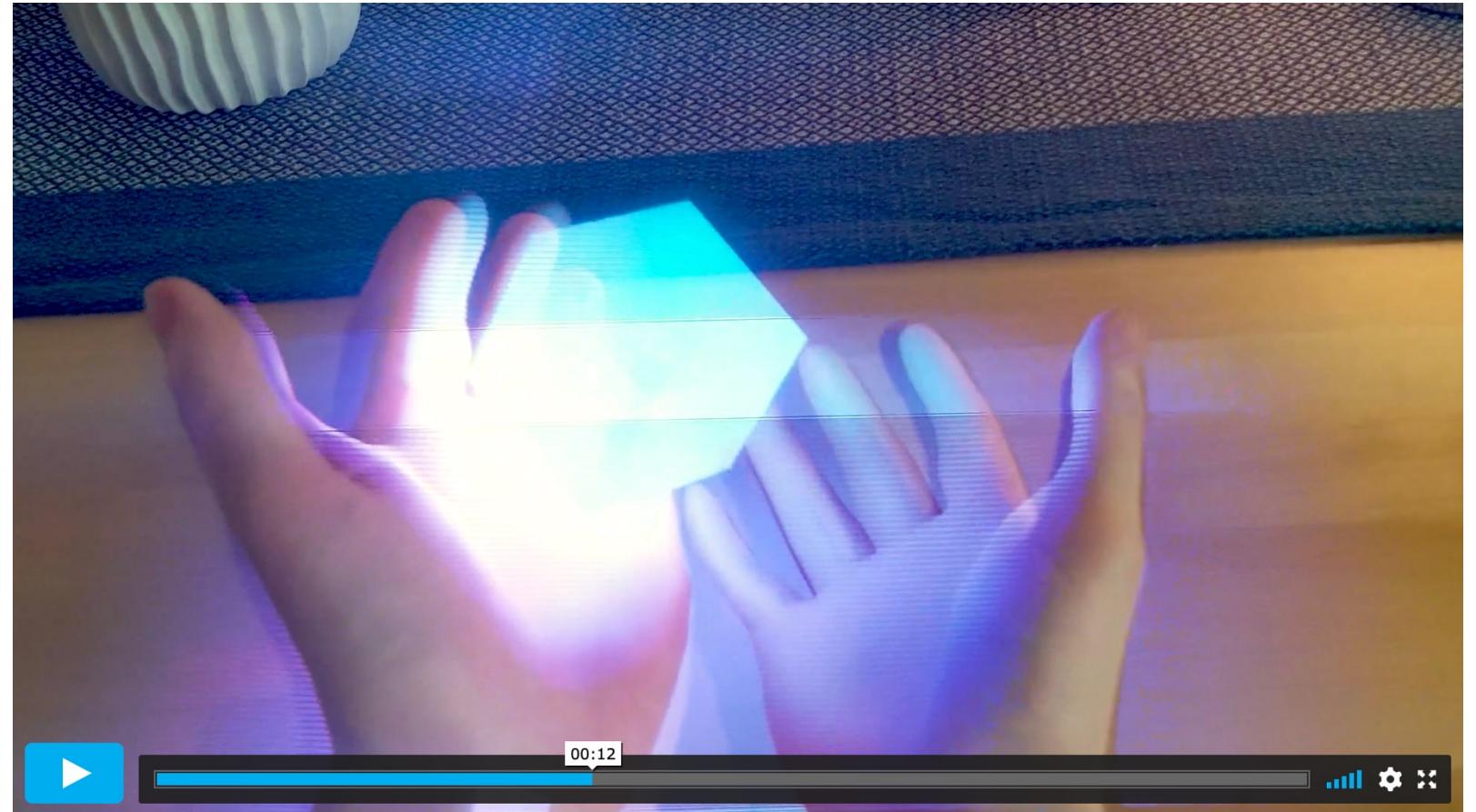
UP FROM **4%** IN 2013 IN TOTAL THERE WERE

31,339

OPENINGS CALLING FOR
REAL-TIME 3D SKILLS
BETWEEN OCTOBER 2017
AND OCTOBER 2018

Spatial Computing

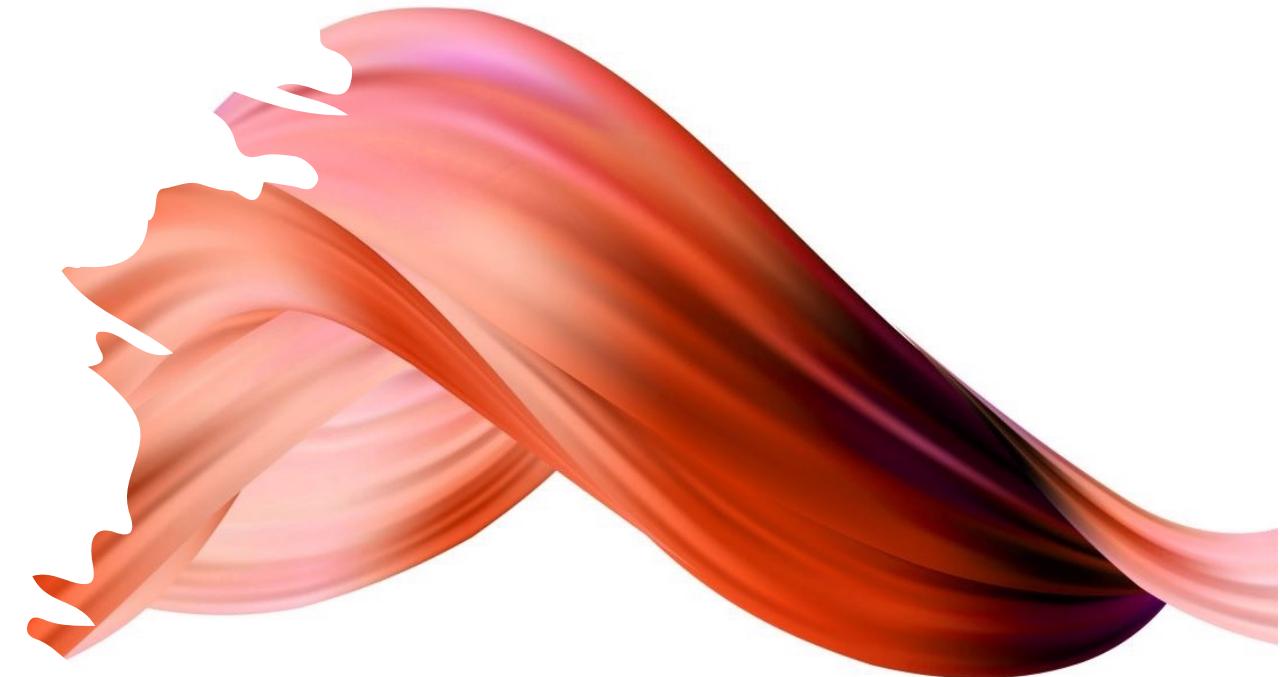
AR / VR Mixed Reality



[Click to Watch Video \(Vimeo Link\)](#)

Touching Holograms. <https://medium.com/microsoft-design/blank-story-e286ac1fb11a>

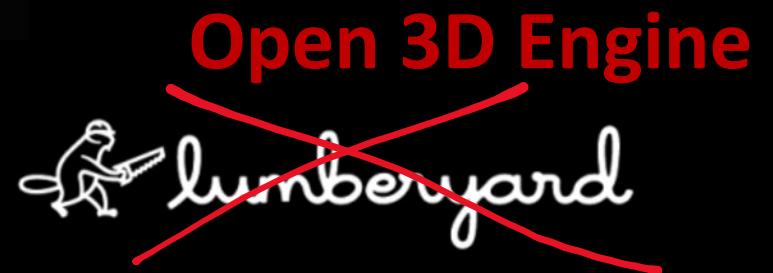
The future of XR isn't an evolution of the graphics pipeline, it's the revolution of personalized computing.



Dave Weinstein, Director of XR at NVIDIA

AI Integration will be Fundamental for the Future of XR. <https://skarredghost.com/2021/06/22/nvidia-xr-ai-weinstein/>

Epic, Unreal, and MegaGrants



Epic Games

- Privately owned company with HQ in Cary, North Carolina
- Co-Founded 1991 by Tim Sweeney (CEO & maj. shareholder)
- Offices world-wide, 5000+ employees
- Investors include TenCent, Disney, and Sony
- Completed \$1B raise in April '21, total in four rounds \$4B since '18
- \$28.7B valuation – 35x increase in < 9 years
- One of the most influential “dark horse” tech companies in the world
- 2020 was forecast to be \$5 billion with EBITDA of \$1 billion

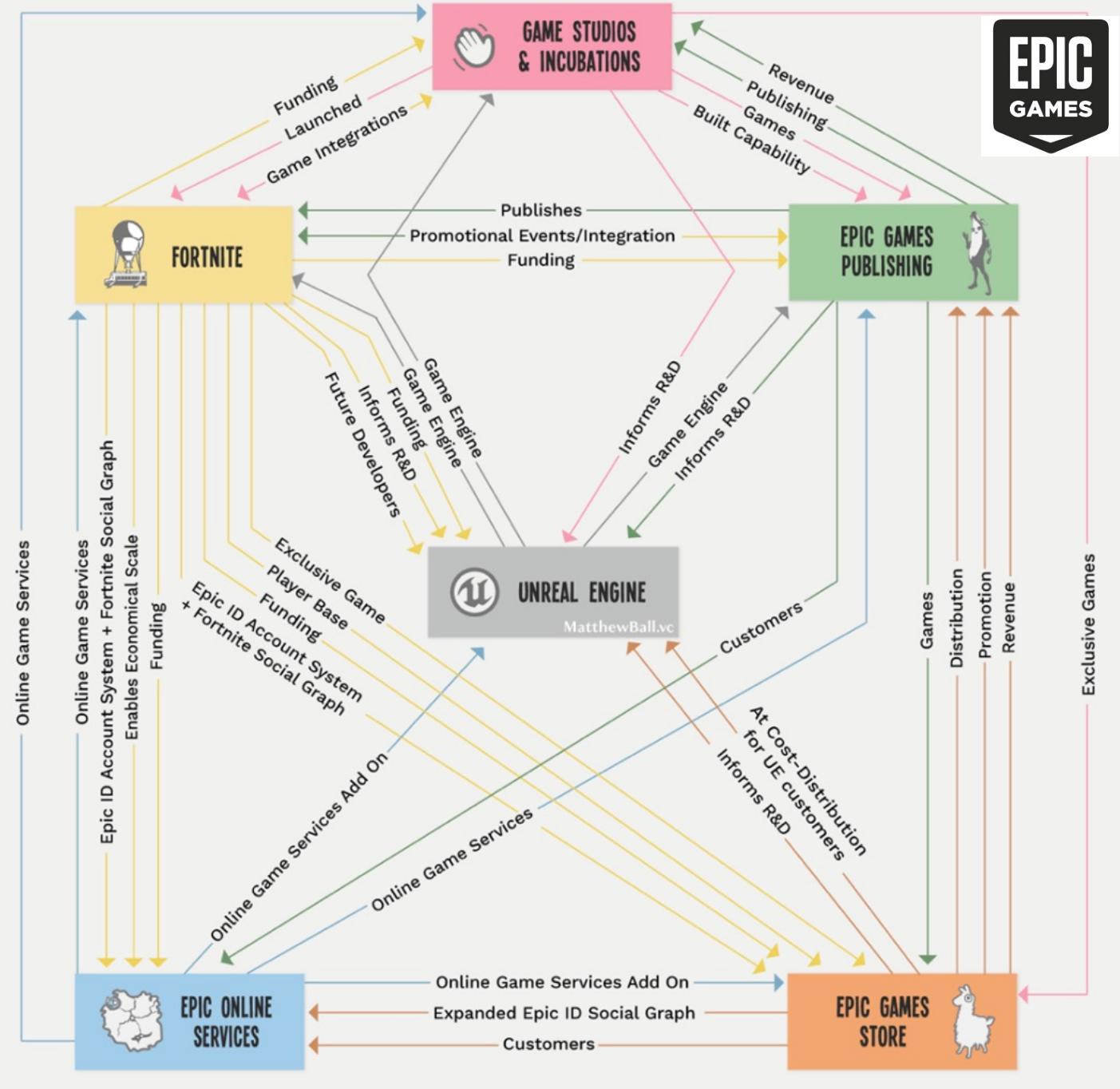


<https://www.epicgames.com/site/en-US/news/announcing-a-1-billion-funding-round-to-support-epics-long-term-vision-for-the-metaverse>

<https://venturebeat.com/2020/06/15/epic-games-shareholders-seeking-to-sell-stake-for-750-million-at-17-billion-valuation/>



60-80M monthly active users
> 12M concurrent players
\$1B profit / yr since 2017 (April 2020)



“Flywheel” of self-reinforcing loops

Many zero-revenue / very low margin
With huge indirect financial benefits

At the center of it all... Unreal Engine

Bike_Demo

File Edit Asset Window Help

Save Browse Import Execute Commit

Perspective Lit Show Rendering

Search... Content Demo Front_plastic_x_-light Front_geometries Front_plastic_x_-light Geometries Materials Master M_DatasmithCAD color_6179c9ff color_d6d6ebff Gas_tank_-lightning_c Geometries Gas_tank_-lightning Geometries Materials Master M_DatasmithCAD color_6179c9ff color_d6d6ebff Unreal_Sportbike_SLD A Geometries 4000_ATNO_PART1

Current Screen Size: 1.670149
#Static Meshes: 601
#Meshes drawn: 2,015
#Triangles To Draw: 4,771,419
#Vertices Used: 4,012,289
Approx Size: 82x214x122

Search... Label Type Preview World Front_plastic_x_-Data Front_plastic_x_-Actor Front_plastic_StaticMesh Gas_tank_-lightnData Gas_tank_-_ligh Actor Gas_tank_-_liStaticMesh Unreal_Sportbike Data Unreal_SportbikActor Cable_1 Actor Clutch_cabla Actor Clutch_c:StaticMesh Clutch_c:StaticMesh Cooler_injeActor Cooler_injeStaticMesh Cooler_injeActor Cooler_injeStaticMesh

Inp Filen Out Fold Sub-Level Bike

Search Details Transform Location 0.0 0.0 0.0 Rotation -0.00 0.000 -0.00 Scale 1.0 1.0 1.0 Mobility Static Static Move

Search Select By Condition Is Class Of Actor Label Bounding Volu Float Bounding Volum String Actor Tag Metadata Value Object Name Operations On Actor Compact Scene 7/23/21

Tessellation Datasmith Tessellation Set Mobility Set Simple Collision

Assign Materials Substitute Material By Table BikeMaterialSubstitution

Cleanup

Dataprep Graph Zoom -3

Intercooler_body_B0

color_333333ff

Element 0 Textures

Physics

UNREAL ENGINE

DATAPREP

Presentation © 2021, Dan O'Leary // dan.oleary@auburn.edu

FREE and OPEN, few strings attached



**UNREAL
ENGINE**

- Free to use
 - All engine features and full suite of integrated tools
 - C++ source code for the entire engine (GitHub) under license
 - Extensive documentation, tutorials, support resources
- 100% royalty-free, except games / interactive products
 - Games 5% royalties after the first \$1M gross revenue
 - Explicitly exempt: in-house commercial applications, location-based entertainment, animated films, consulting work, development fees
- FAQ / EULA: <https://www.unrealengine.com/en-US/faq>

DATABASE COMMUNICATOR



Blueprint SQL/ORACLE/MySQL ...

John Poole

★★★★★ v 7

\$29.99



Enhanced Vehicle Plugin

Offworld Defence Simulations

★★★★★ v 19

Free



VehicleSim Dynamics

Mechanical Simulation

★★★★★ v 88

Vehicle AI Plugin

313 Studios

★★★★★ v 6

Free



LAV IFV INFANTRY FIGHTING VEHICLE

Offworld Defence Simulations

★★★★★ v 2

\$129.99



AI Behavior Toolkit

Drix Studios

★★★★★ v 164

\$89.99



TCP/IP
UDP
Shared Memory
File

ObjectDeliverer

ObjectDeliverer

ayumax

★★★★★ v 33

Free

UE Marketplace Official and Community

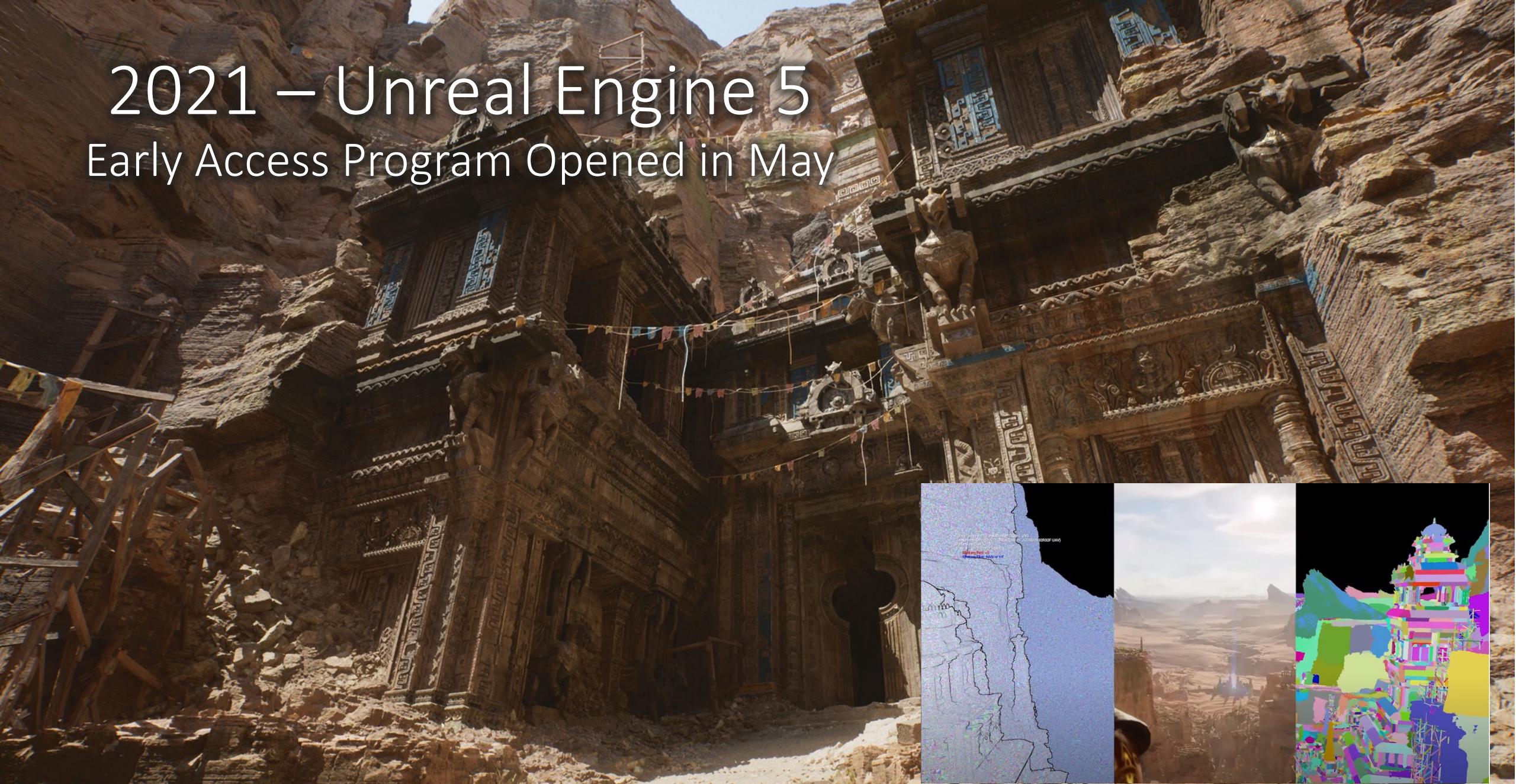
Environments, Characters,
Animations, Plugins,
Blueprints, etc.

Low cost / Free

[https://www.unrealengine.com/
marketplace/en-US/store](https://www.unrealengine.com/marketplace/en-US/store)

2021 – Unreal Engine 5

Early Access Program Opened in May



A First Look at Unreal Engine 5 - Unreal Engine. <https://www.unrealengine.com/en-US/blog/a-first-look-at-unreal-engine-5>

Future Promise

- Graphics is not always the thing.
 - It's often the thing that SELLS the thing (consumers, execs)
 - Sims / Training – fidelity & accuracy → presence → learning outcomes
- Physically based rendering + “Limitless Geometry”
- Intuitive lighting and modeling – no tricks / hacks required
- Leverage original geometry from film, CAD, photogrammetry, etc.
- “Final pixel quality” in a single real-time pass
- Reduces friction, sparking adoption by much broader user base
- Diminishing returns on ultimate visual quality – engine developers shifting focus to ease of use, accessibility, other differentiators and markets

Resources / Support

- Industry-specific support pages for focus areas
 - Automotive, training & simulation, architecture, etc.
- Online Learning Portal – video-based courses
- Extensive Documentation
- Webinars
- Community support – AnswerHub, wiki, forum
- YouTube channel
- Whitepapers
- Conference presence including GDC and SIGGRAPH
- Paid support available including support engineers, classroom training





EVENT

Build: London '19 for Architecture:



EVENT

Unreal Academy London 2019



EVENT

Unreal Dev Days 2019

Epic MegaGrants

Make Amazing Things

Epic Games has committed \$100 million to support game developers, enterprise professionals, media and entertainment creators, students, educators, and tool developers doing amazing things with Unreal Engine or enhancing open-source capabilities for the 3D graphics community. Show us your projects and you could earn a financial grant to help fuel your success!

<https://www.unrealengine.com/en-US/megagrants>

Epic MegaGrants

- \$100M in “no strings attached” grant funds
- No repayment, no royalties, no IP claims, etc.
- No formal reporting required
- Available to groups, individuals, companies, institutions, etc.
- Awards typically \$5,000 – \$500,000, varies by sector
- 1-page web application, 3-6 month decision timeline (90 day goal)
- Use funds to do “whatever will make your project successful”
 - Innovative projects in / around Unreal
 - Or enhance open-source 3D graphics ecosystem
 - Games, enterprise applications, research, or education



Applying for an Epic MegaGrant: Make Your Submission Stand Out, July 2020. <https://www.unrealengine.com/en-US/events/unreal-fest-online-2020>

Epic MegaGrants

- 5-year plan started in 2019
- Goal: 1000 awards totaling \$20M each year
- \$13M awarded first year in 200 grants
- As of November: total of \$60M awarded to over 1,000 recipients
- As of last summer: 9,000 applications, over 100 countries
- All human selection process – no bot filtering



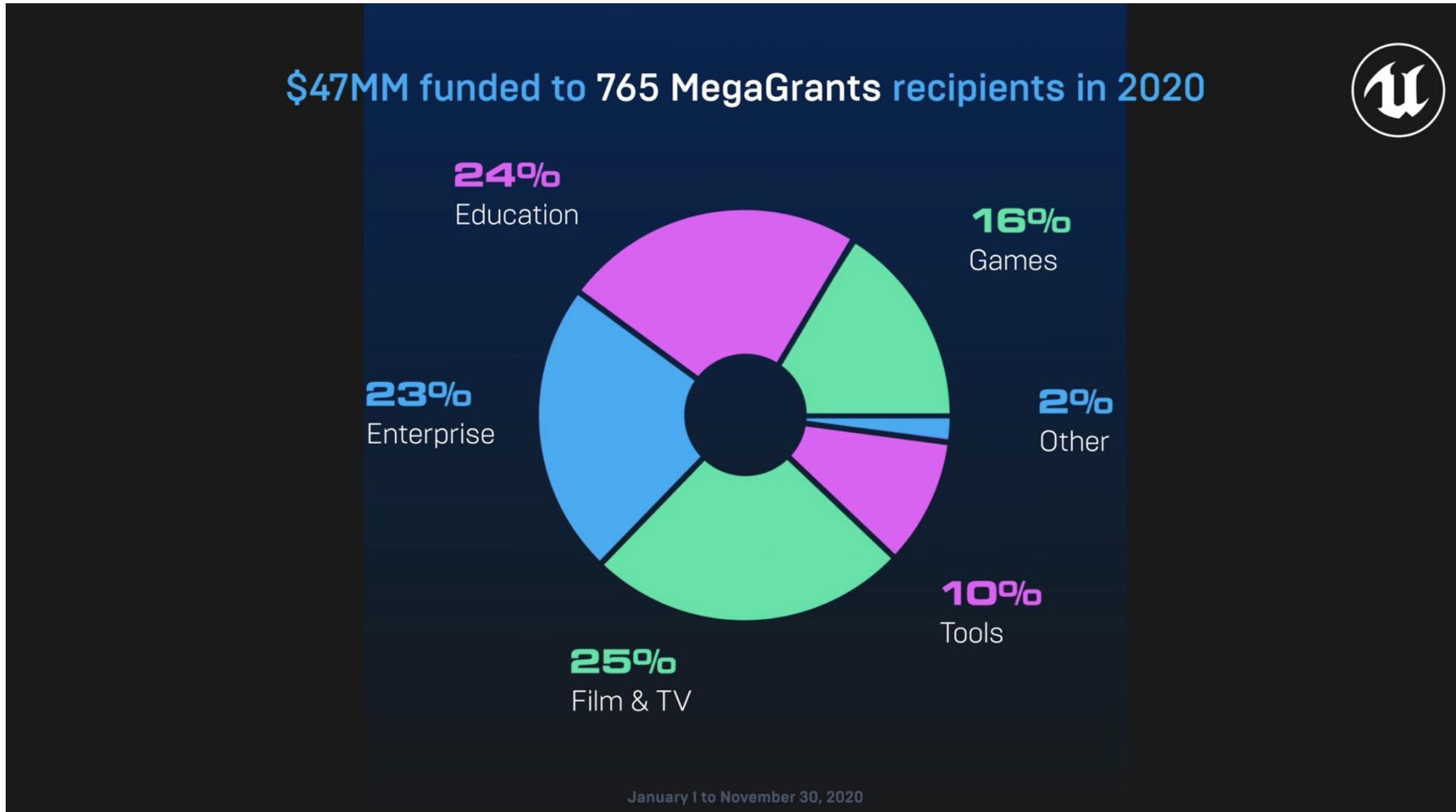
Epic MegaGrants Fall 2020 Update. <https://www.unrealengine.com/en-US/blog/epic-megagrants-fall-2020-update>

Applying for an Epic MegaGrant: Make Your Submission Stand Out, July 2020. <https://youtu.be/JxI7Ui34Y4>

Epic MegaGrants Reaches \$13 Million Milestone in 2019 - Unreal Engine. <https://www.unrealengine.com/en-US/blog/epic-megagrants-reaches-13-million-milestone-in-2019>

Epic Games Provides over \$42 Million in Epic MegaGrants. <https://www.unrealengine.com/en-US/blog/epic-games-provides-over-42-million-in-epic-megagrants>

Ahead of Schedule...



Real-time Roundup: The Growth of Interactive 3D and Emerging 2021 Trends
<https://www.unrealengine.com/en-US/blog/real-time-roundup-the-growth-of-interactive-3d-and-emerging-2021-trends?sessionInvalidate=true&lang=en-US>

Project

Project Name *

Website

Project Video

Link to project build

Most important for games

Project Type *

Describe your project *

5,000 Character Maximum

Describe your next steps and plan to develop your project *

5,000 Character Maximum

Target platforms for your project *

Personal

First Name *

Last Name *

Email *

Country / Region *

Company / Institution

I am applying for my company / team (I am not an individual)

Funding

I am requesting a particular amount of funding

Hardware Request

I am requesting Magic Leap One hardware

My project is at or beyond the prototype phase

I'd like to receive news, surveys, and special offers from Unreal Engine and Epic Games.

SUBMIT

RESET

MegaGrants at Auburn ISE

- Two awards in Industrial and Systems Engineering
- 100% Award rate!
- Dr. Konstantinos Mykoniatis
 - AR/VR-Based Training in Lean Manufacturing
 - Initial results favorable
 - Follow-up grant application processing
- Dr. Richard Seseck
 - Backster 2.0: Next Generation Visual Tool for Ergonomic Assessment



Tips for Submission

Applications should Demonstrate:

- Your project is a good use of Unreal Engine, synergy
- Your project supports the community, has broad benefits
- The grant helps your project grow, amplifies your efforts
- Passion and excitement for the project proposal, vision
- Concrete understanding of the plan / budget (high level, subject to change)

Epic Prefers:

- Not to fund hardware or other fixed assets
- Not to be the only source of funding



Conclusion

- 3D visualization is ideally suited for communicating complex ideas and solving complex problems
- Techniques perfected in the games industry allow us to do that most effectively – high fidelity, interactive, real-time, collaborative
- The pace of improvement shows no signs of slowing
- Mixed reality / spatial computing, procedural content generation, and digital twins will be just a few of the many vibrant topics moving forward

Conclusion

- Challenges of COVID have demonstrated an even greater need for new ways to connect and collaborate at a distance.



This Editorial Team Ditches Zoom And Instead Starts Using Red Dead Redemption For Meetings, Here's How It Goes For Them

Like Bored Panda on FB:  Like 15M

 **Giedrė Vaičiuolaitė**
BoredPanda staff

This Editorial Team Ditches Zoom And Instead Starts Using Red Dead Redemption For Meetings, Here's How It Goes For Them | Bored Panda.

<https://www.boredpanda.com/red-dead-redemption-work-team-meeting>

Conclusion

- The Means, Motive, Opportunity exist to make an impact
 - Epic Unreal and MegaGrant
 - Students, research, and the call to innovate
 - Real-Time Visualization
- Go make something Epic!



Thank You!



Contact: dan.oleary@auburn.edu