Real-Time Visualization and the Epic MegaGrant Program

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7/24/2021

PDF for Web

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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

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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

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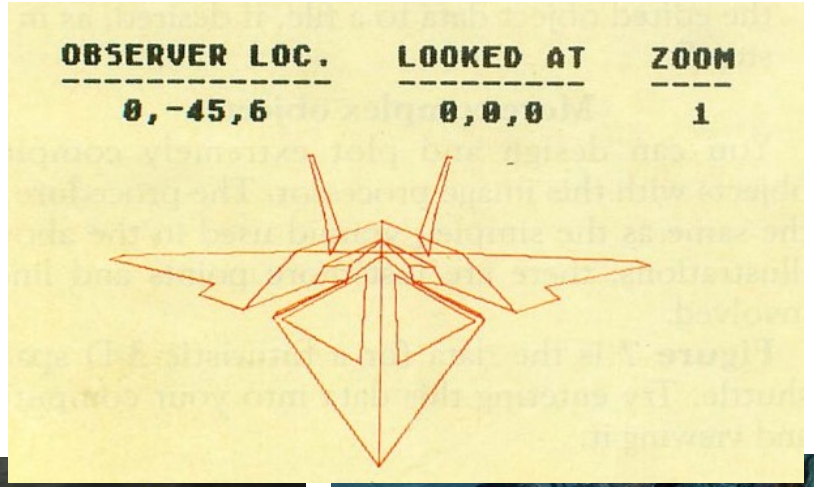
“GRAPHICS,” 1974 - 2016



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“Game Engines”

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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!

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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

UNREAL FEST ONLINE

Slide: Using Unreal Engine in Simulation Applications, Unreal Fest Online, July 2020
https://youtu.be/nEvM8WjjoXw. Definition from Wikipedia.

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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

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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

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Smart Cities / Digital Twins

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

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~~Game~~ Engine

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3xD Simulator for Intelligent Vehicles

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

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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

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

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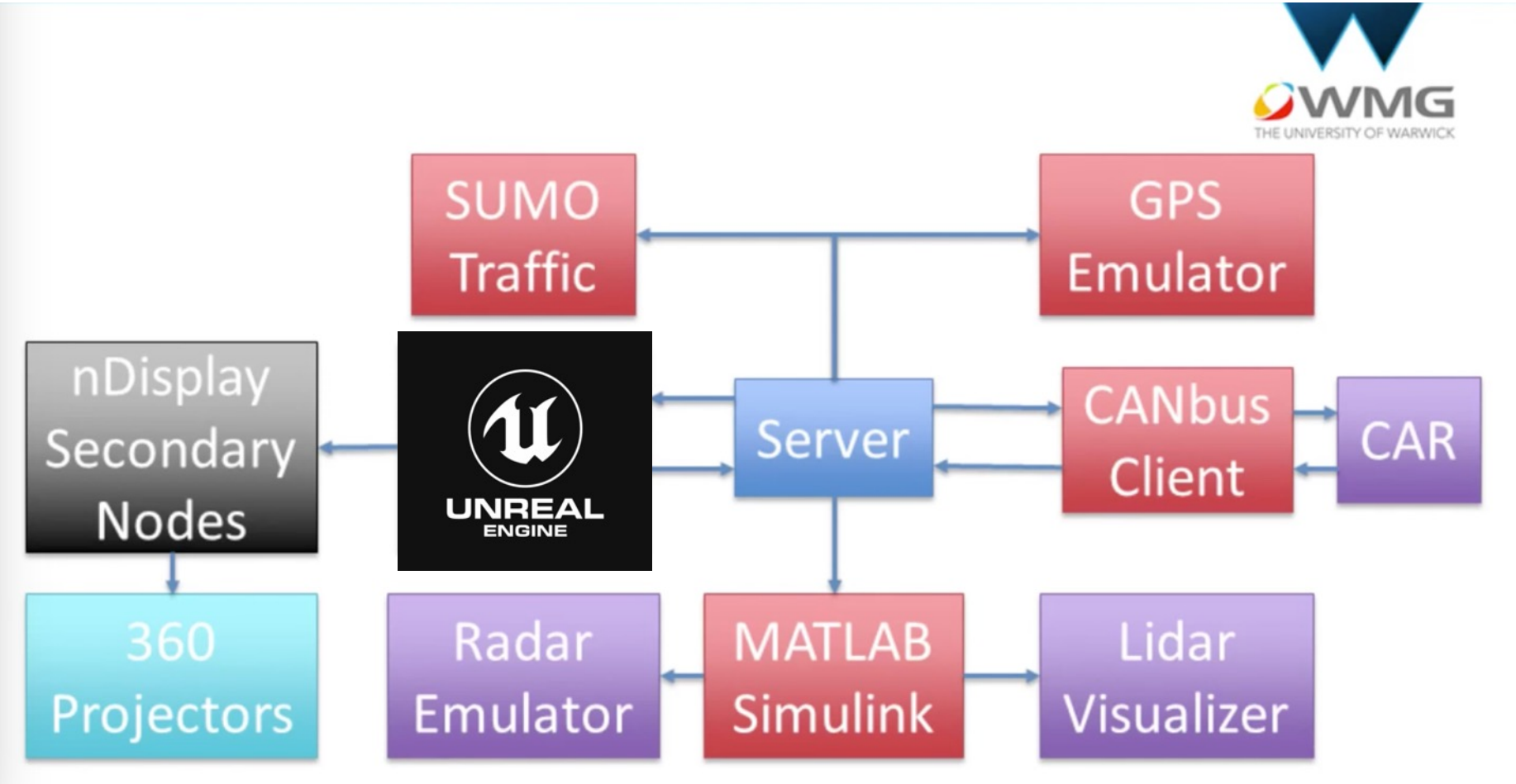
System Block Diagram



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

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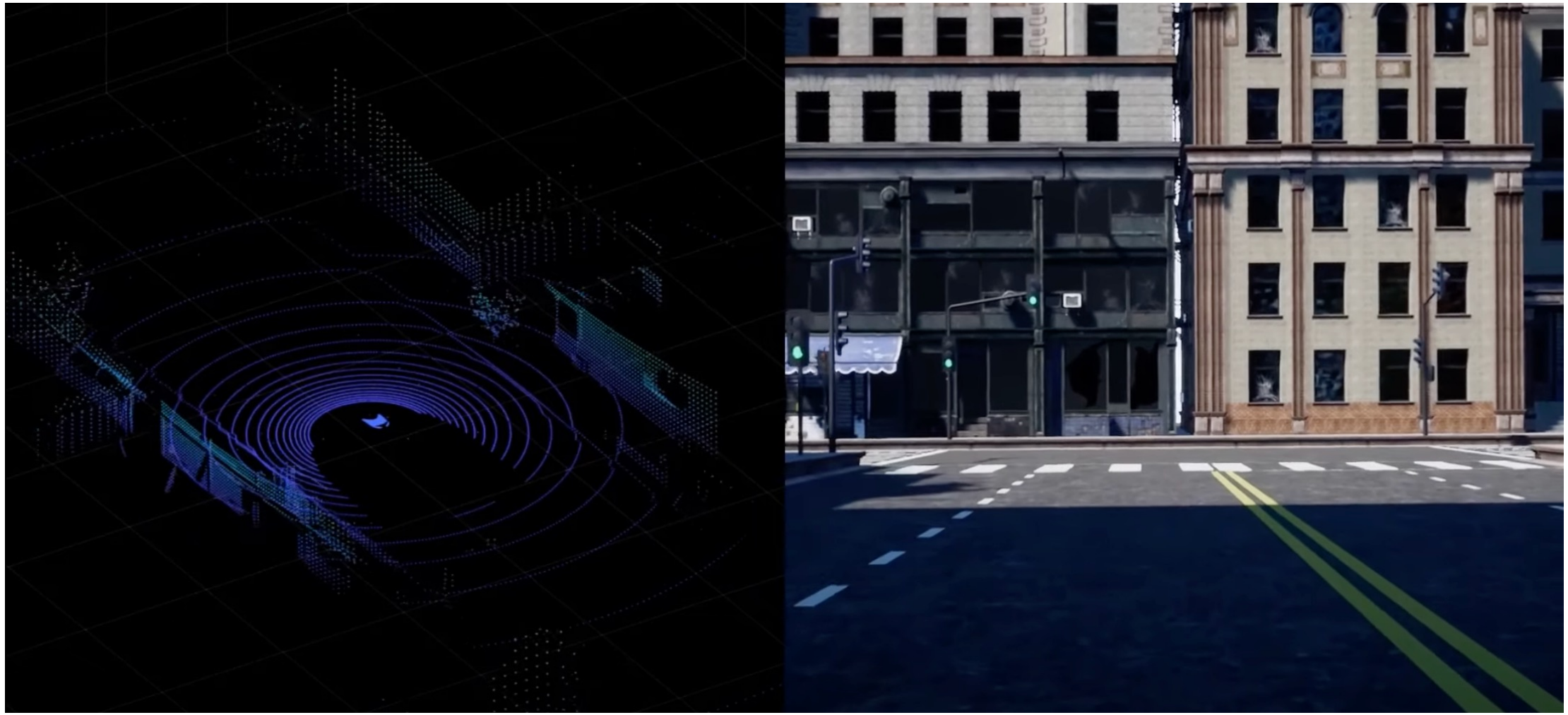

A Fully Immersive Driving Simulator for Autonomous Vehicles, July 2020. https://youtu.be/T2M8u-8tBIc

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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

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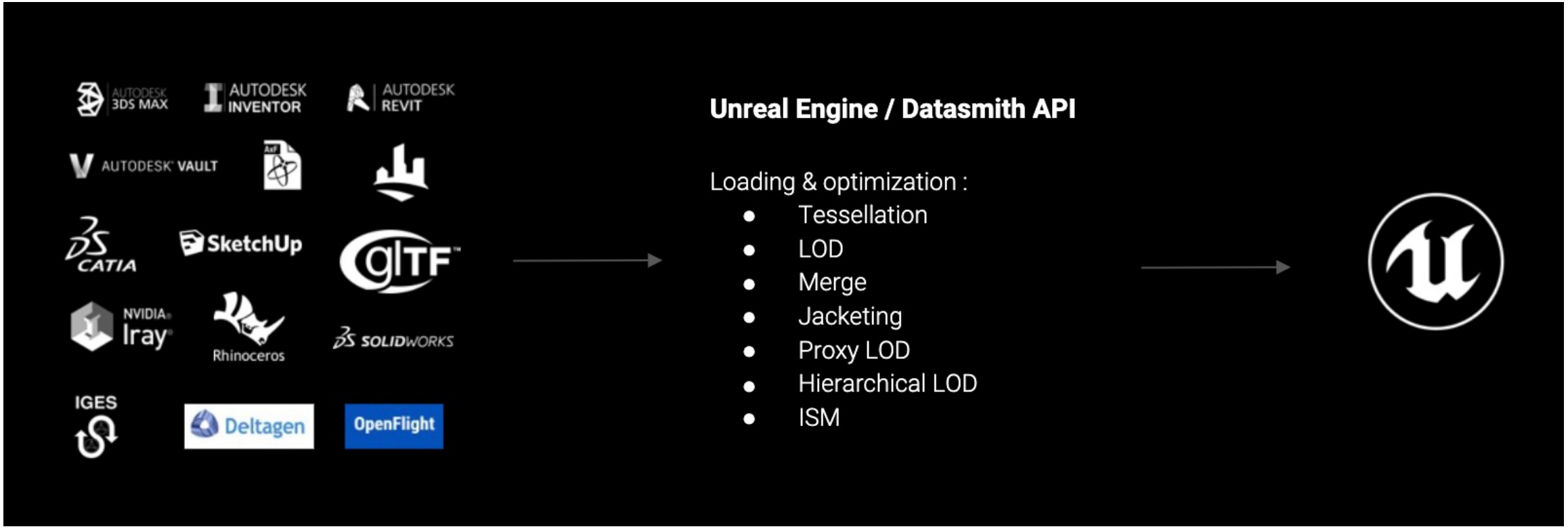
e.g. Simulation
Use the files you like…



Using Unreal Engine in Simulation Applications, Unreal Fest Online, July 2020. https://youtu.be/nEvM8WjjoXw

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The pipeline you like…

Using Unreal Engine in Simulation Applications, Unreal Fest Online, July 2020. https://youtu.be/nEvM8WjjoXw

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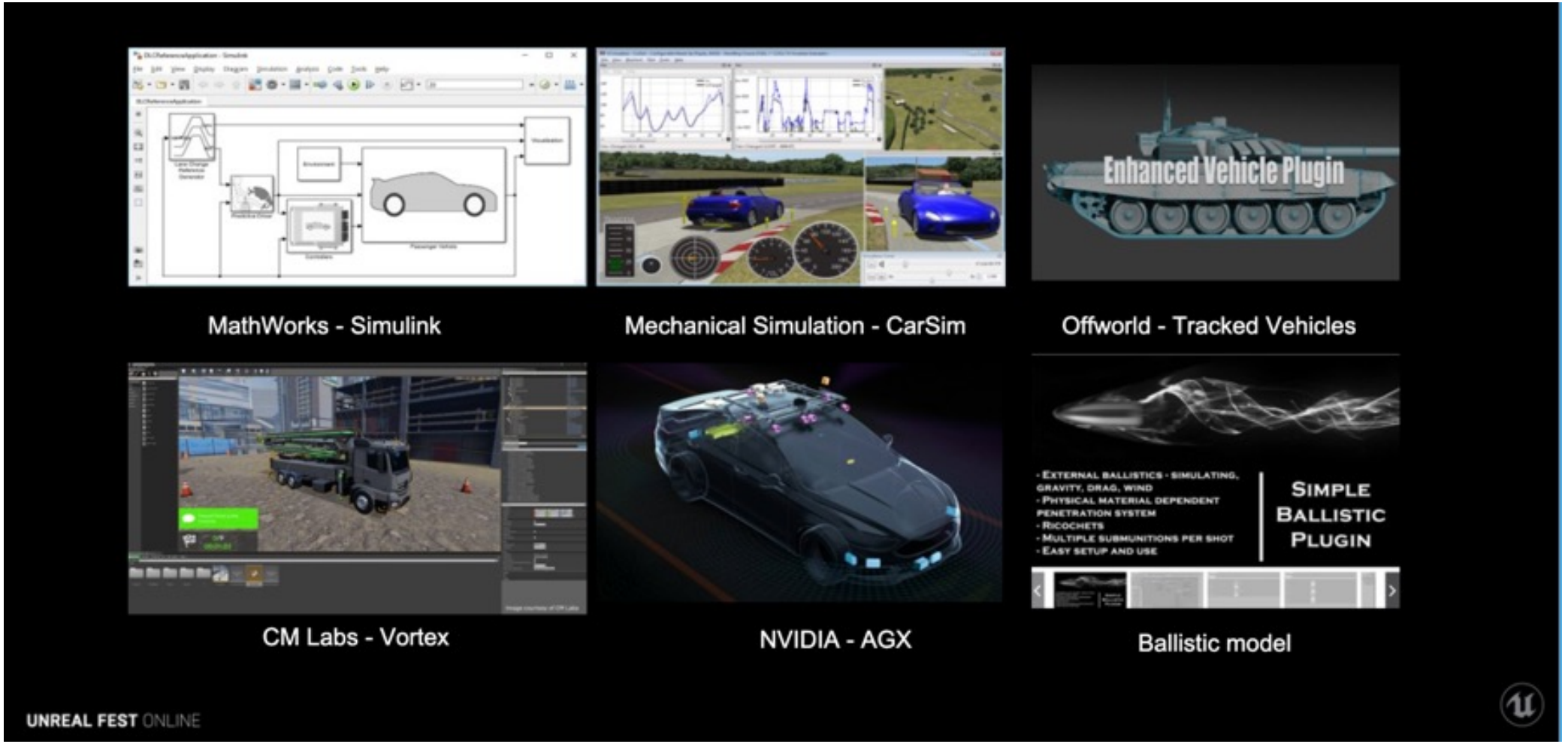
The models you like…



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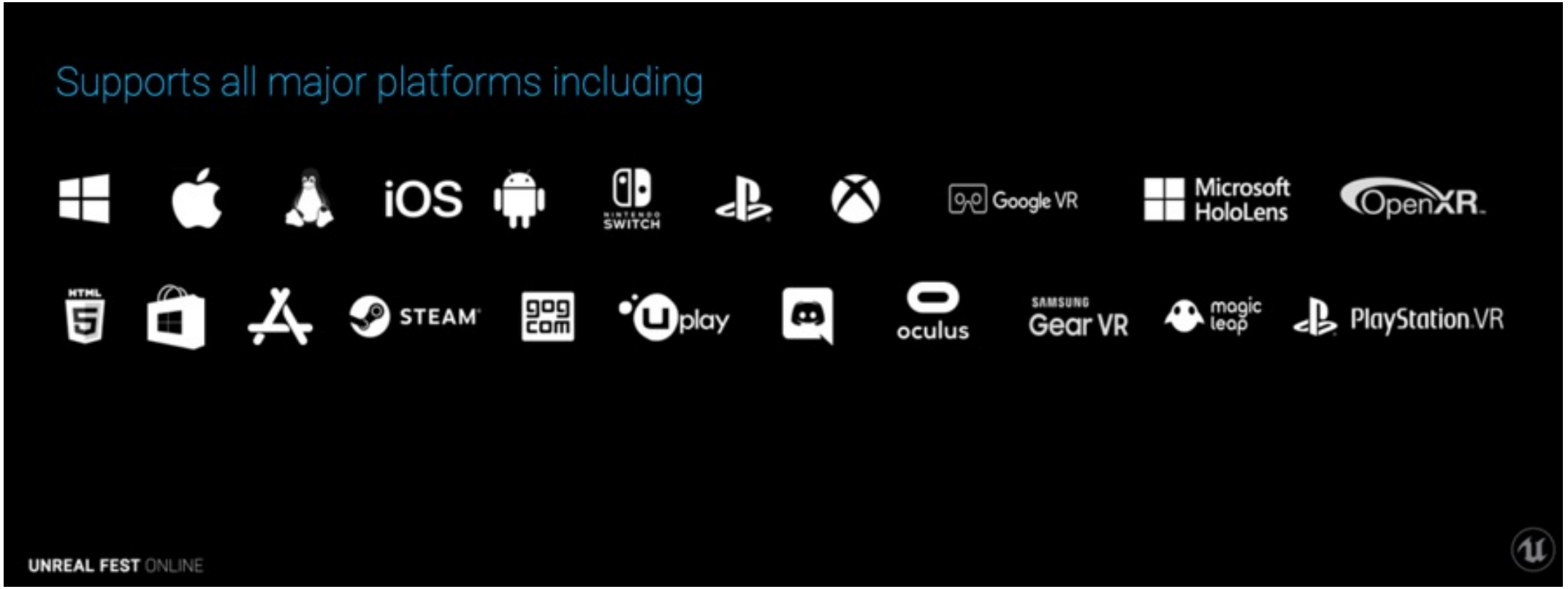
Deploying to the platforms you like…



Using Unreal Engine in Simulation Applications, Unreal Fest Online, July 2020. https://youtu.be/nEvM8WjjoXw

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Trends and Opportunities

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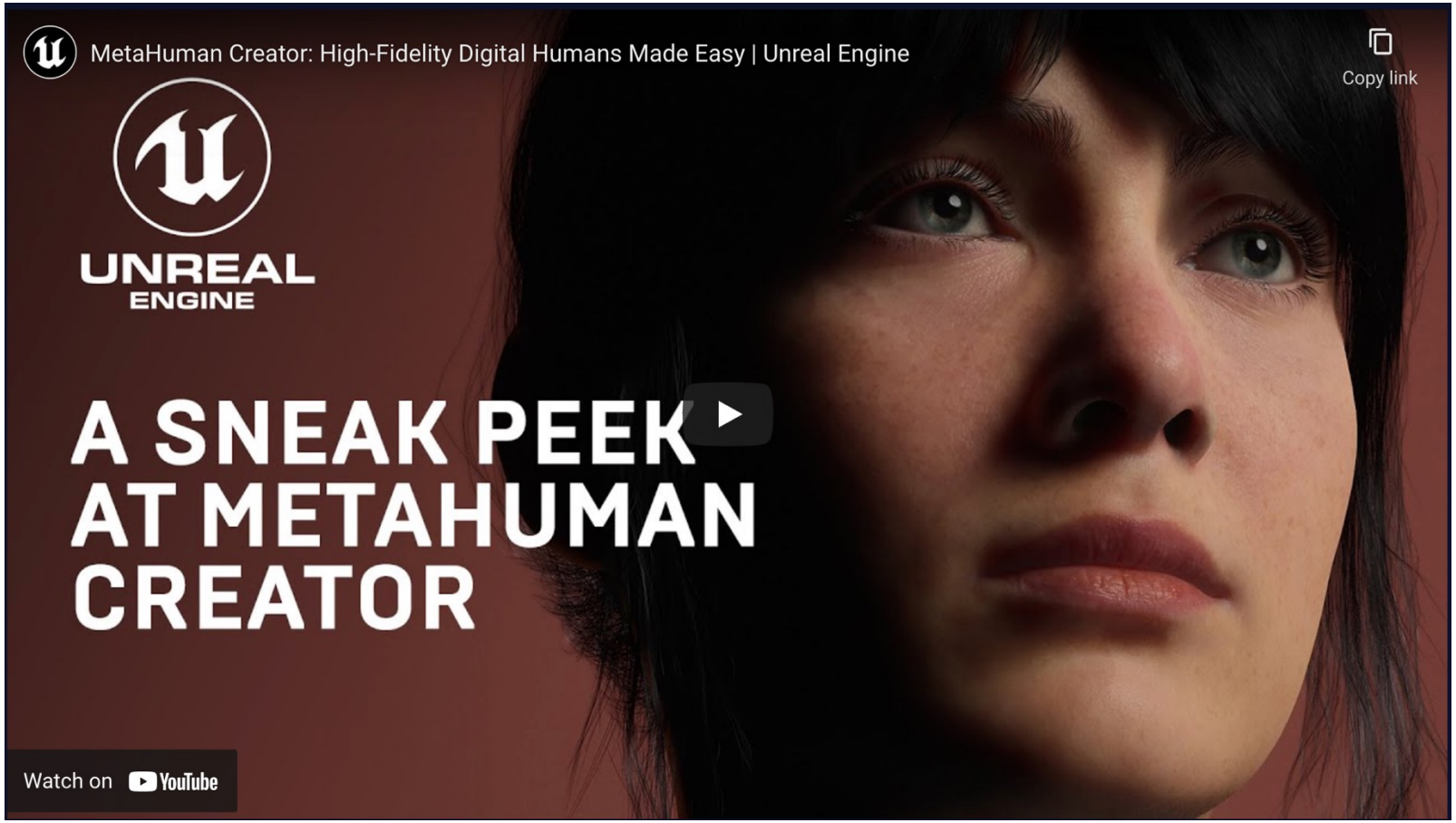
Unstoppable Technology

Accelerating
Democratizing



Click to Watch Video (YouTube Link)

For more information on MetatHuman Creator, see my article: Digital Twins of Another Kind

Digital Humans | MetaHuman Creator. https://www.unrealengine.com/en-US/digital-humans

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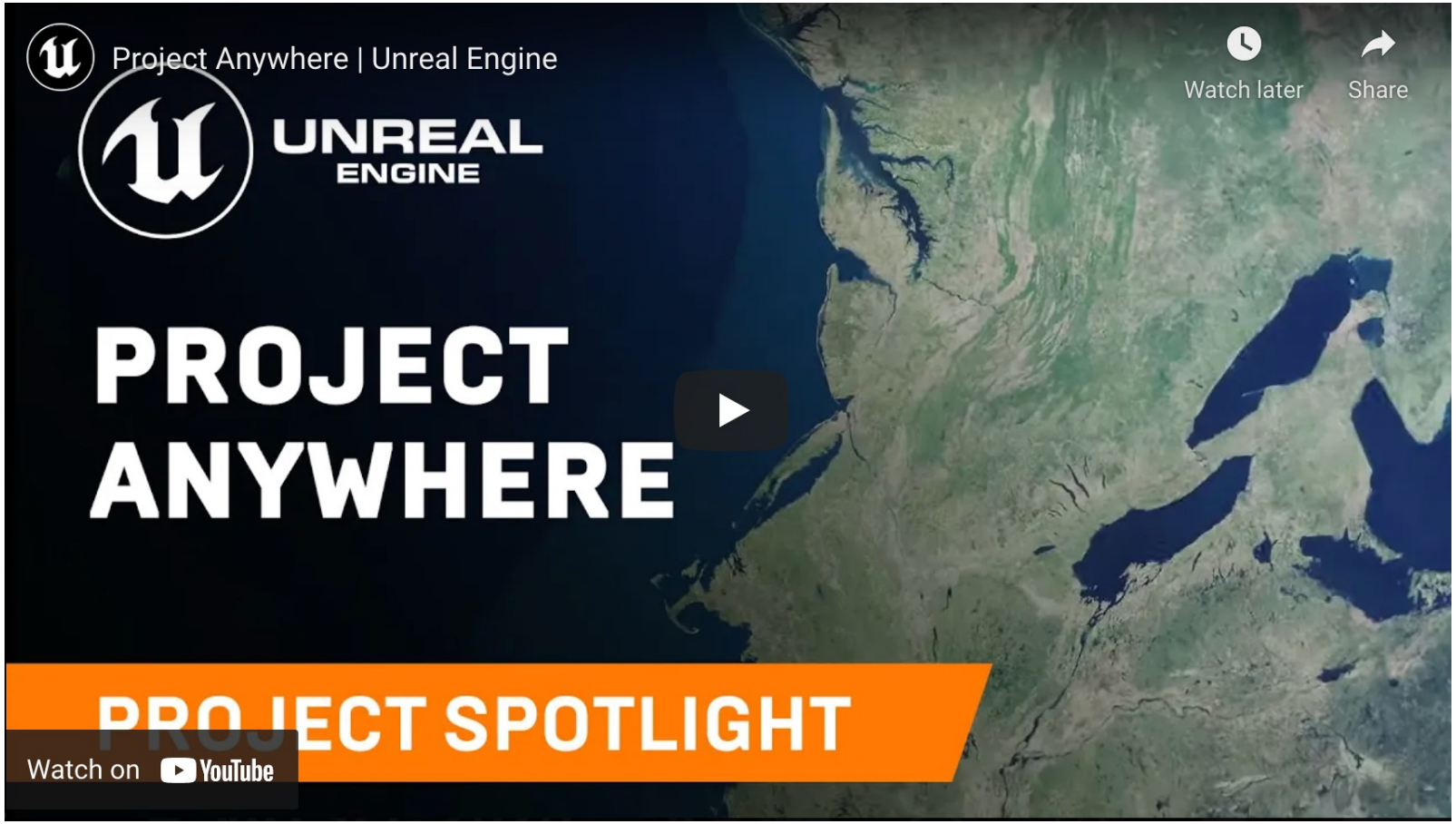
Ambitious Scale

Problems
Solutions



Click to Watch Video (YouTube Link)

Project Anywhere. https://www.youtube.com/watch?feature=youtu.be&v=lZXTZphgyps

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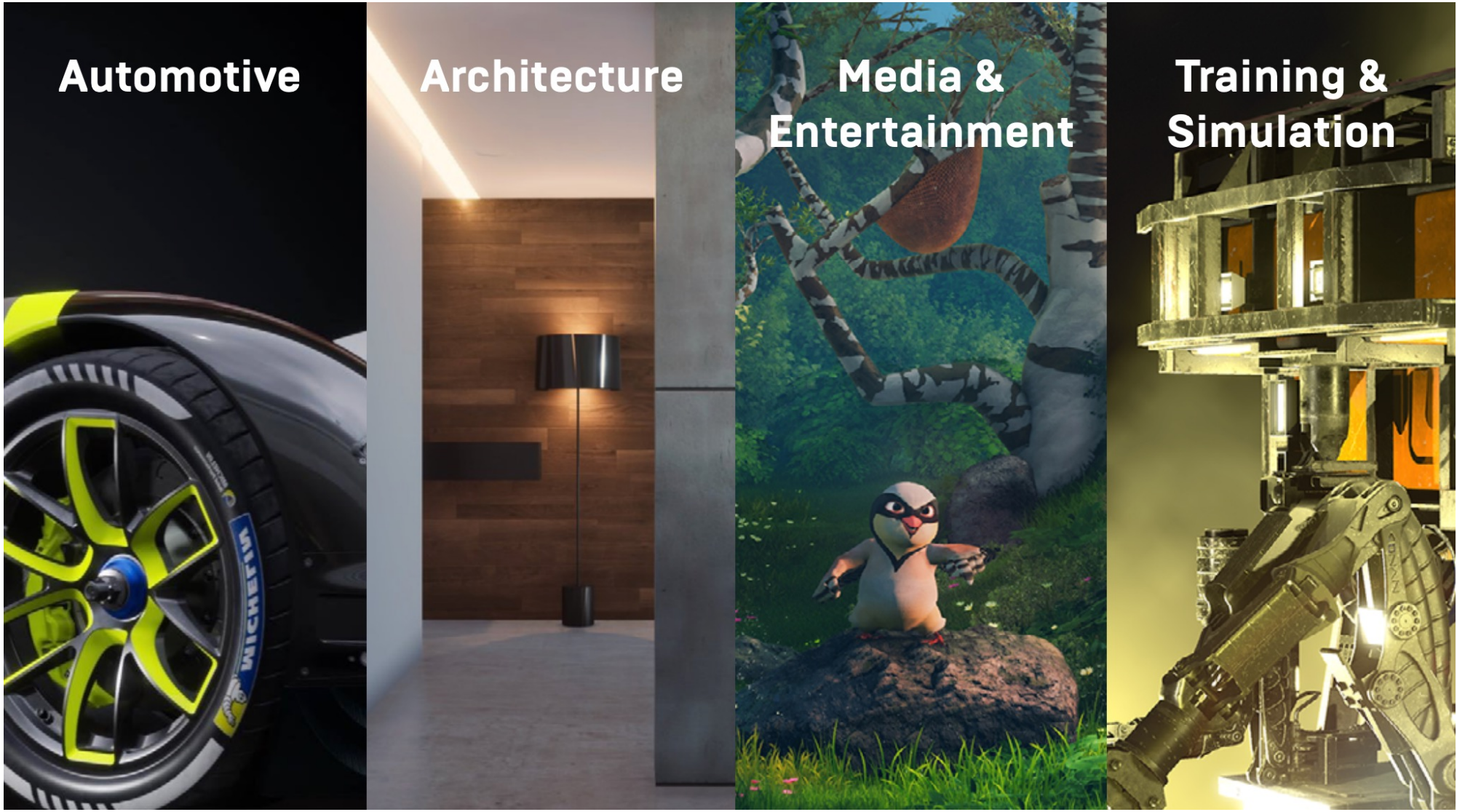
Broad Adoption

Enterprise
Education
Media
Defense



Creator's Field Guide to Emerging Careers in Interactive 3D. https://www.unrealengine.com/en-US/blog/prepare-for-the-jobs-of-tomorrow-with-a-new-field-guide-for-creators

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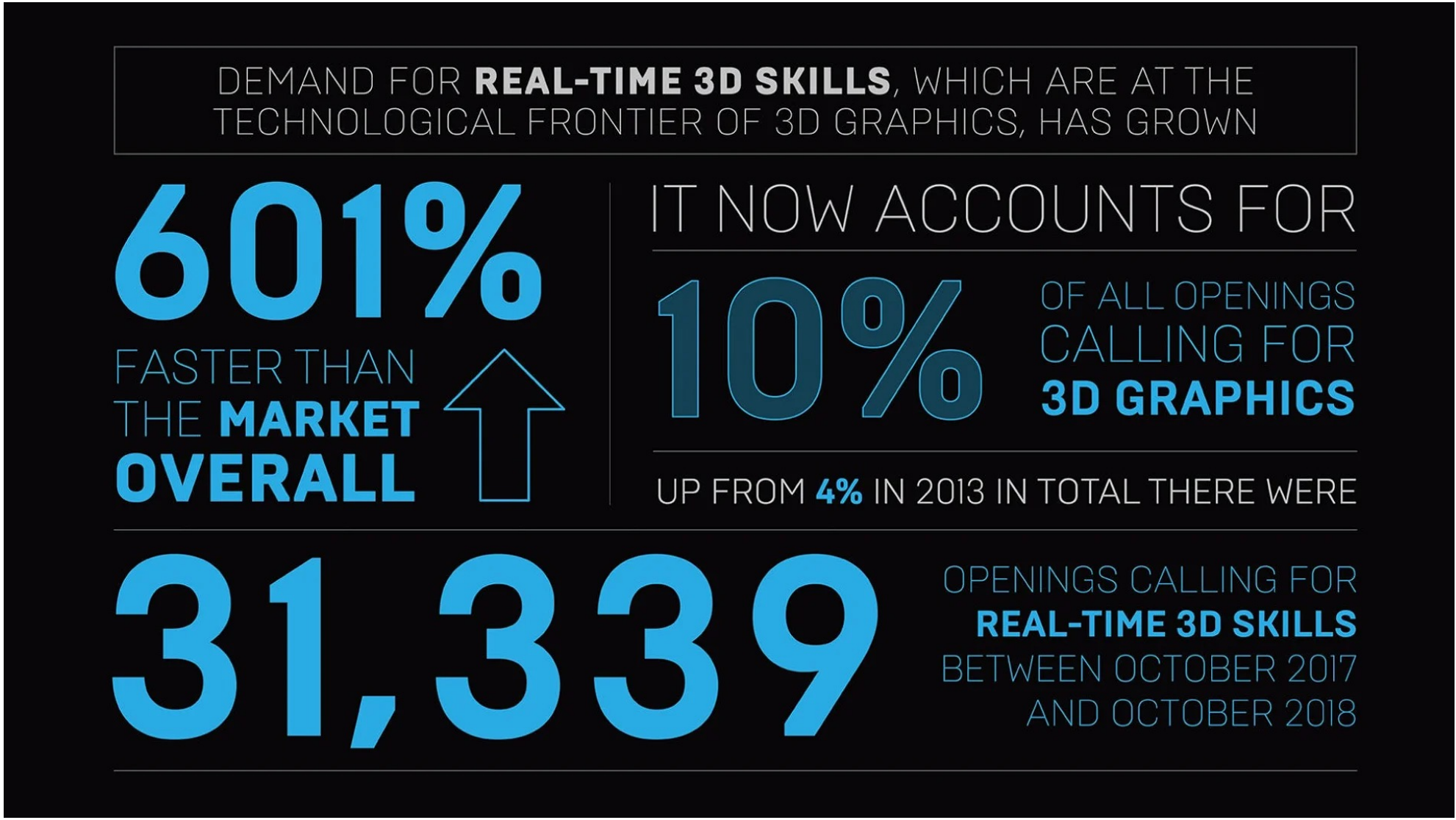
Growth Market

Jobs & Consolidation



Creator's Field Guide to Emerging Careers in Interactive 3D. https://www.unrealengine.com/en-US/blog/prepare-for-the-jobs-of-tomorrow-with-a-new-field-guide-for-creators

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Spatial Computing

AR / VR
Mixed Reality

Click to Watch Video (Vimeo Link)

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

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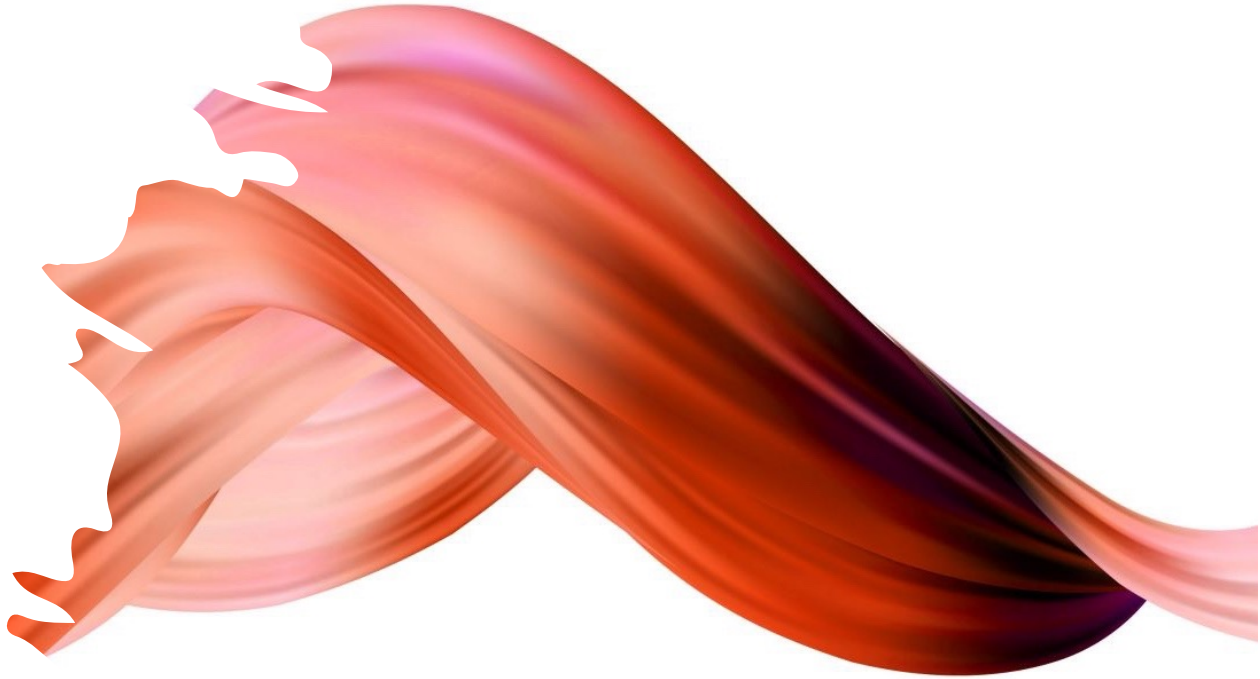
The future of XR isn't an evolution of the graphics pipeline, it's the revolution of personalized computing.



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/

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Epic, Unreal, and MegaGrants

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UNREAL
ENGINE

unity

CRYENGINE®

source™

Open 3D Engine

~~lumberyard~~

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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/

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

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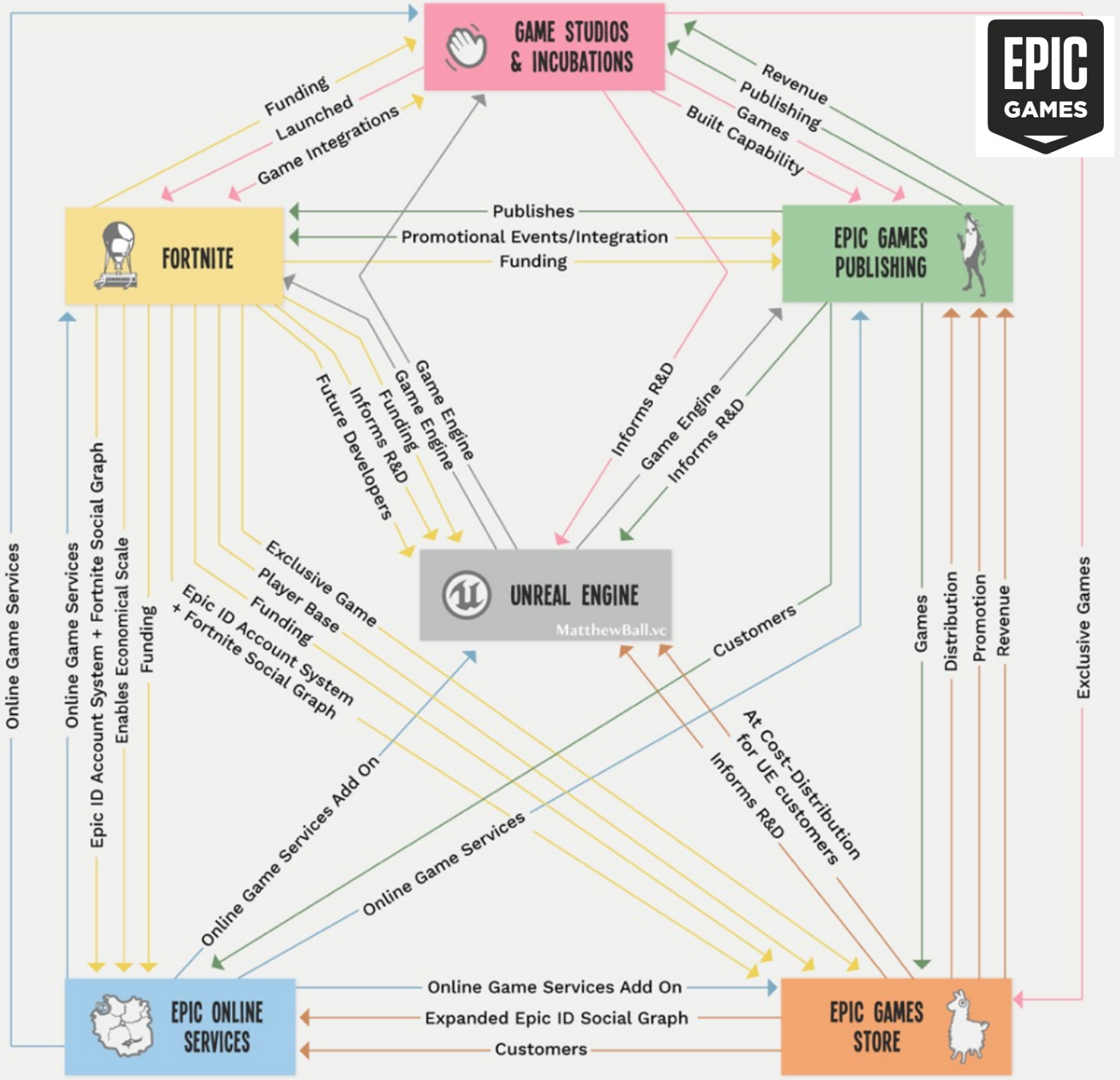

"Flywheel"

of self-reinforcing loops

Services, Technologies, Experiences, Acquisitions, Funding

Many zero-revenue / very low margin

With huge indirect financial benefits

At the center of it all…

Unreal Engine

The Epic Games Primer: Parts I-VI Directory — MatthewBall.Vc
https://www.matthewball.vc/all/epicgamesprimermaster

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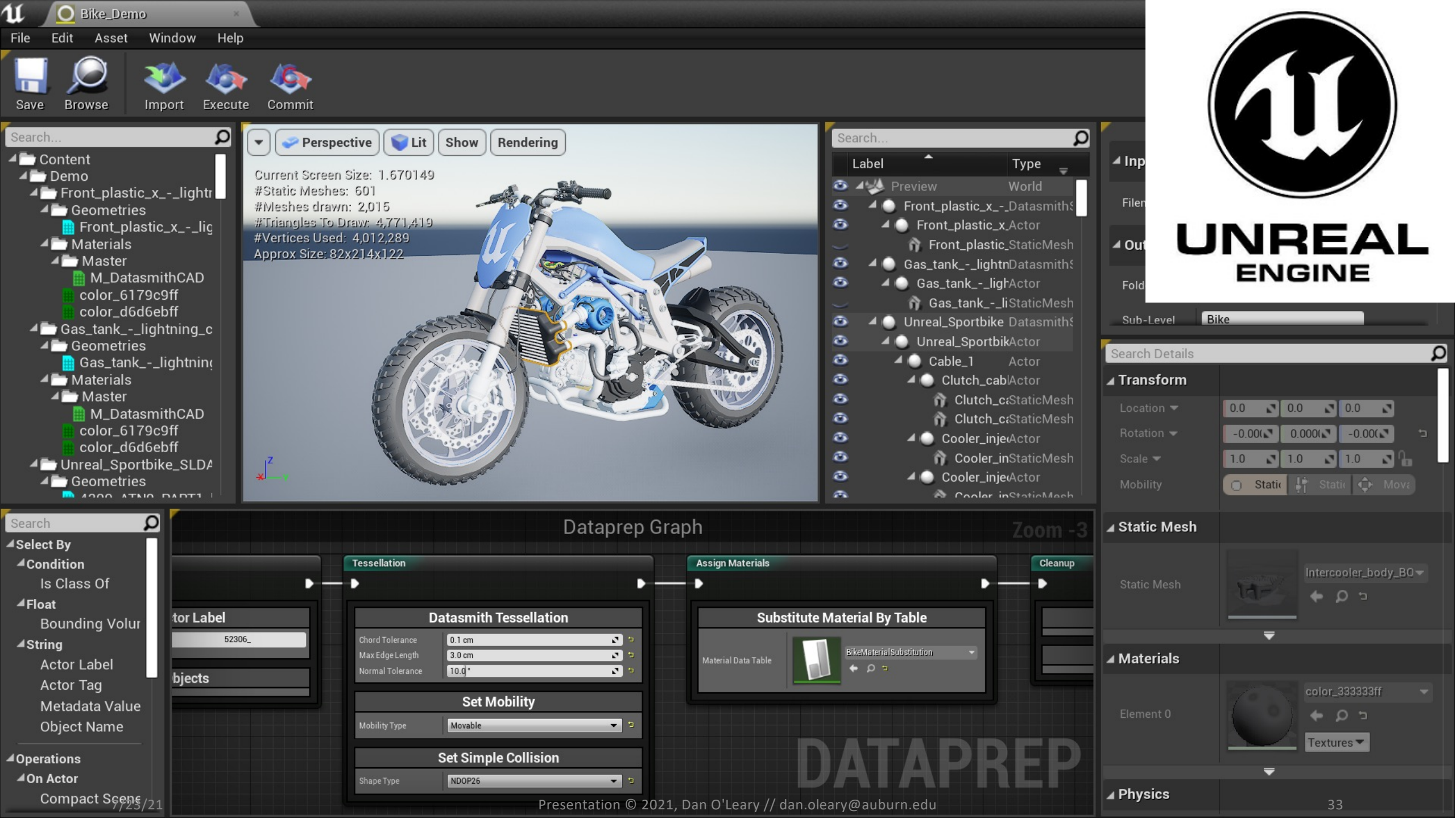

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FREE and OPEN, few strings attached

- 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

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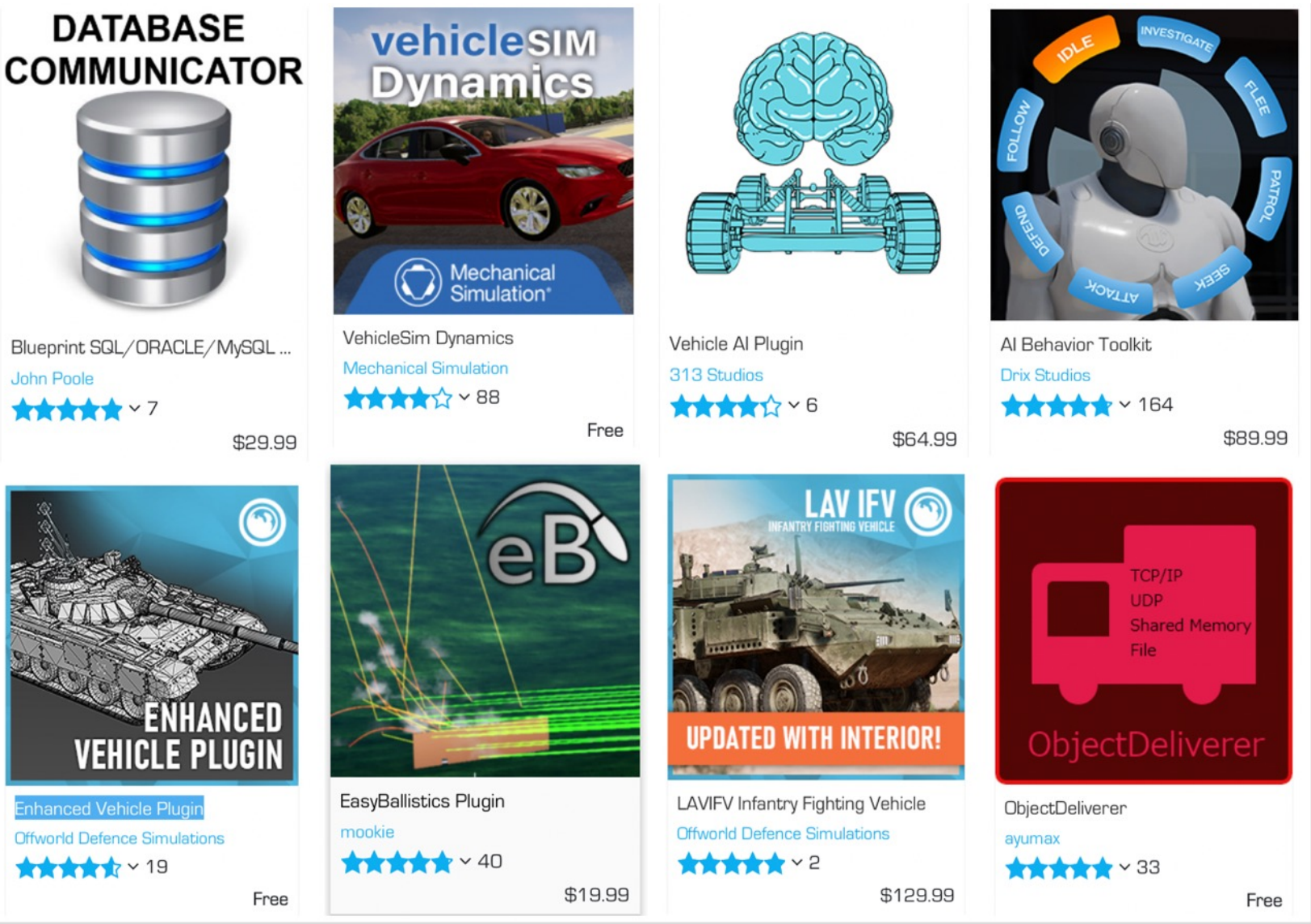

UE Marketplace

Official and Community

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

Low cost / Free

https://www.unrealengine.com/marketplace/en-US/store

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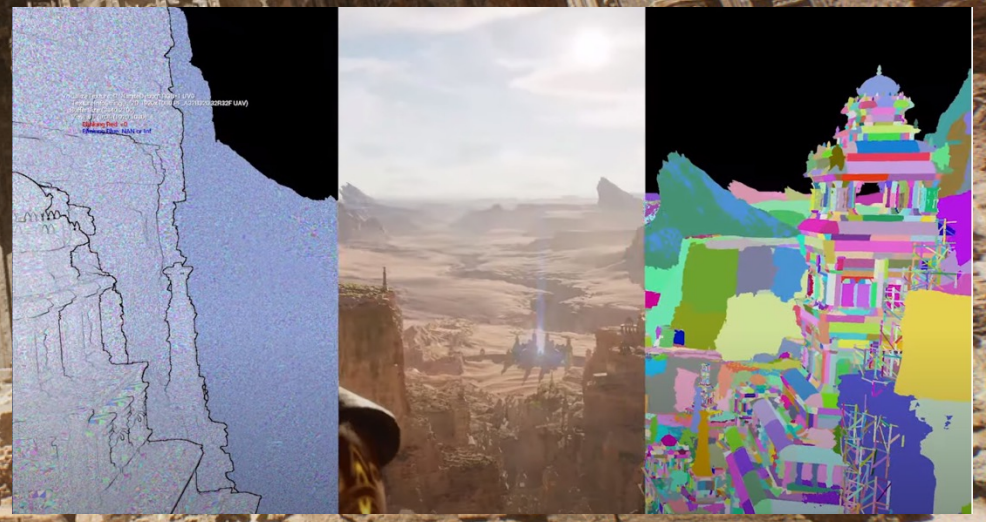
2021 – Unreal Engine 5

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

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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

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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

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EVENT

Build: London '19 for Architecture:

EVENT

Unreal Academy London 2019

EVENT

Unreal Dev Days 2019

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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

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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

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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

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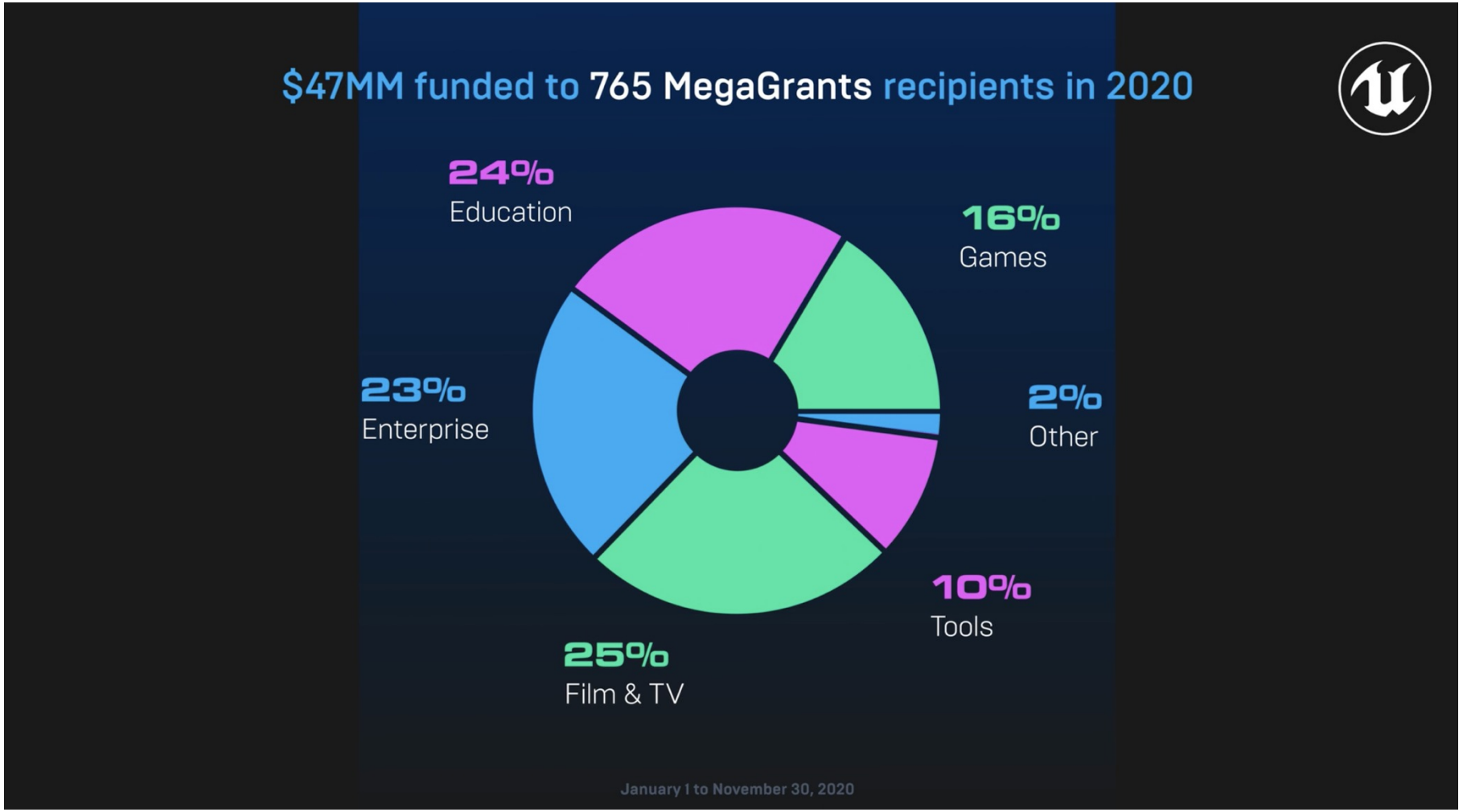
Ahead of Schedule…



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?sessionInvalidated=true&lang=en-US

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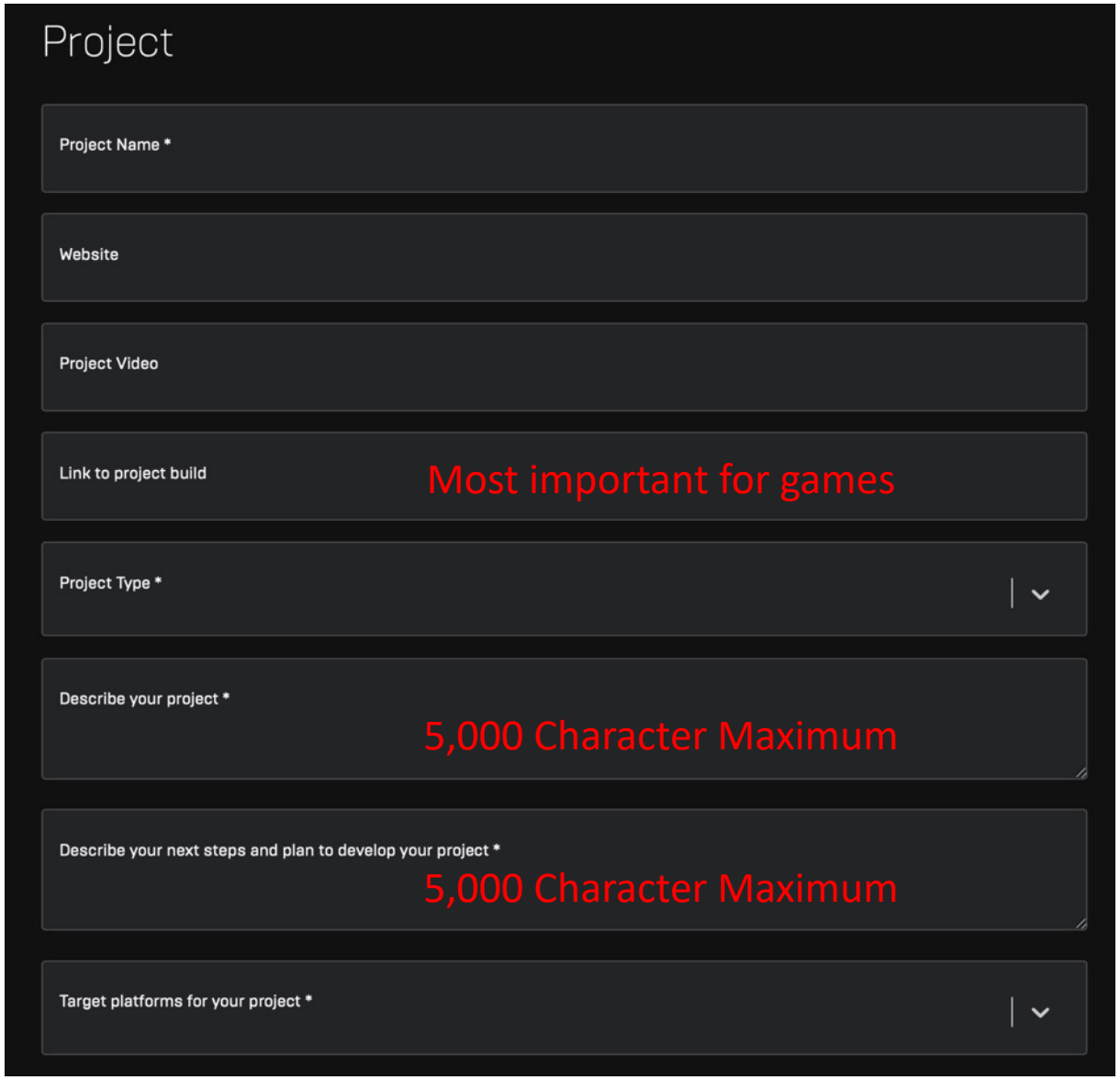

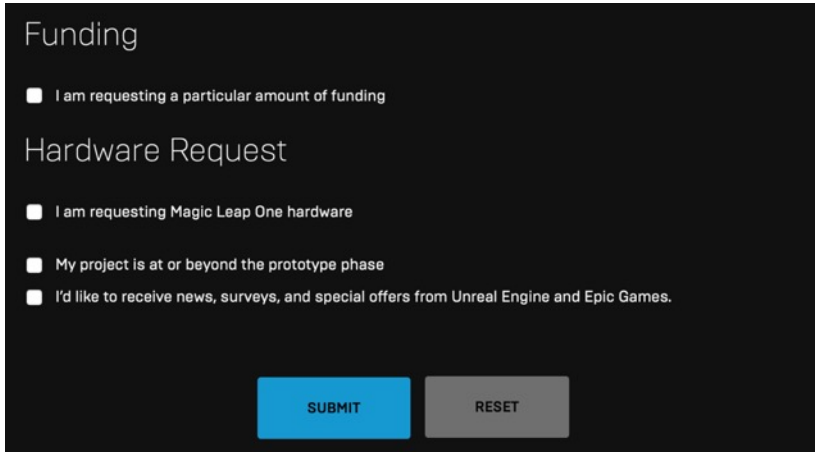

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MegaGrants at Auburn ISE

- 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 Sesek

  Backster 2.0: Next Generation Visual Tool for Ergonomic Assessment

AUBURN UNIVERSITY

INDUSTRIAL & SYSTEMS ENGINEERING

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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

Applying for an Epic MegaGrant: Make Your Submission Stand Out, July 2020. https://youtu.be/_Jxl7Ui34Y4

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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

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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

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Giedrė Vaičiulaitytė
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

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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

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