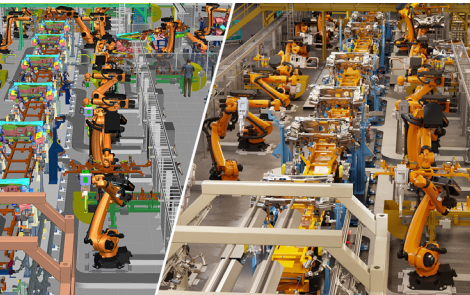


SPECIAL DIGITAL  
ISSUE

# ENGINEERING INNOVATION WITH DIGITAL TWINS



Advanced  
**PRODUCT DEVELOPMENT**  
Resource Center



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# Welcome Virtual Engineering Innovations

**T**he Advanced Product Development Resource Center (APDRC) is an ever-growing repository of information to help design engineering teams take advantage of new and innovative technologies that help them create better designs faster.



Increasingly, virtual experiences play a role in design, simulation, testing, product management, and collaboration. NVIDIA Omniverse has emerged as an important platform to help far-flung stakeholders collaborate on new designs, and simulate performance in a virtual environment, regardless of what software tools they are using.

In this Special Digital Issue from APDRC, we take a look at how manufacturers and engineering software vendors are leveraging Omniverse as well as digital twin technology in general to optimize their product design and simulation activities.

You can learn more by visiting the resource center at [APDRC.com](https://www.apdrc.com) for the latest developments on technological advances, videos, white papers and more from *Digital Engineering*, Dell and NVIDIA. We hope you enjoy the digital issue.

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Engineering and Manufacturing Workflow Guide >



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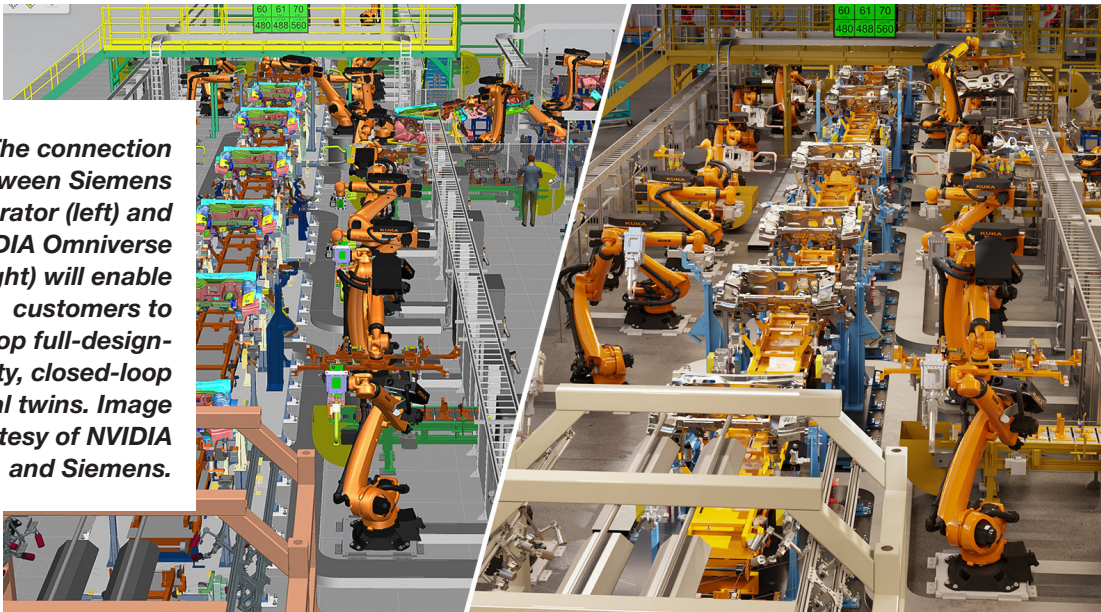


<sup>1</sup>Based on IDC Quarterly Workstation Tracker, CY2023Q1 (units)

# Product Development in NVIDIA Omniverse™

NVIDIA Omniverse has expanded its capabilities for helping manufacturers collaborate and improve product development processes.

*The connection between Siemens Xcelerator (left) and NVIDIA Omniverse (right) will enable customers to develop full-design-fidelity, closed-loop digital twins. Image courtesy of NVIDIA and Siemens.*



**D**uring the NVIDIA GTC 2021 Conference, NVIDIA officially rolled out [NVIDIA Omniverse Enterprise](#), a scalable, end-to-end platform enabling enterprises to develop custom 3D pipelines and simulate large-scale, physically accurate virtual worlds.

Omniverse Enterprise is based on Universal Scene Description (USD), the Open-Source 3D scene description language developed by Pixar. At GTC, NVIDIA also announced a number of Omniverse Connectors for a growing list of popular design, visualization, and other software tools, as well as the [Omniverse Connect](#) family of extensions and application plug-ins that allow

users to connect their existing applications to Omniverse.

For companies in the manufacturing sector that may not be fully familiar with how Omniverse can be leveraged for product development and design, we spoke to Mike Geyer, Omniverse Product Manager at NVIDIA, about how these capabilities are evolving.

**For manufacturers, what types of workflows can NVIDIA Omniverse potentially enable when it comes to product development processes?**

**Mike Geyer:** To take a step back, Omniverse has been in development for several years, and it grew out of tools that NVIDIA had initially built for our own use. We realized we did not have a good way to connect many of these foundational capabilities, but if we did it would be very valuable for our customers. Since the launch, our customers have been experimenting with a number of product development applications.

From an NVIDIA perspective, we see three functional areas when it comes to use cases in manufacturing. They are full-fidelity visualization, custom application development, and synthetic data generation. By combining these functional areas in different configurations, manufacturers are able to go beyond just visualization, and actually add physics simulation and develop full-scale digital twins of their products and environments. That is how we are thinking about Omniverse and how to address the needs of our customers, and that framework is also informing our roadmap for the next evolution of the platform. All of these are applied in the service of building Digital Twins to model and simulate large, complex systems.

**What is full-fidelity visualization?**

**Mike Geyer:** To unpack full-fidelity visualization, what we see is the need to visualize a full spectrum of products in 3D, from discrete products such as electronics, to entire factories. Full-fidelity visualization of products would include rendering and other advanced tools, but this aids collaboration for design reviews. Omniverse delivers the ability to connect existing tools and enable multiple users in different locations to work together in different tools at the same time.

To make this level of visualization possible, we are connecting and extending existing tools with something we call ‘Connectors’. The goal isn’t to reinvent software already on the market, it’s to seamlessly connect and extend those capabilities. For example, we are continuing to develop

connectors that can provide a live sync capability to existing software tools like PTC Creo and McNeel Rhino. We have also made a software tool kit and source code and documentation available to partners and customers so they can develop their own connectors. We are continuing to build those based on what our customers need.

We also have a tool in Omniverse Launcher called Connect Sample, which provides sample code for writing your own connectors. We have partners who have written these Connectors themselves in just a few days.

This ecosystem approach connects and extends existing tools, and this is the on ramp for full-fidelity visualization where companies can start to do that. We can bring those different things together to facilitate a more rich design review process. On the factory scale, this is really about aggregating massive data sets to conduct a factory fly through. You can do a quick evaluation of space planning, material flow, etc. There are some really interesting Connectors now. We have a [Visual Components](#) connector to create factory-level simulation studies, and [ipolog](#) has done interesting stuff around logistics and material flow optimization.

**You also mentioned application development – how are customers leveraging those capabilities?**

**Mike Geyer:** Manufacturers have traditionally been forced to use software the way that vendor designed it. With Omniverse, every company has foundational tools to build their own applications. A lot of our larger customers are already approaching Omniverse from that perspective.

One customer has a very specific conceptual design review process, which is how they review new product variants and product concepts with leadership. They have built a simplified interface so that leadership can drive the design changes. They can interact with 3D models, change colors and materials, and look at what-if scenarios. It is entirely custom to them, and it

looks like an internally developed tool.

On the factory side, one customer has developed their own user interface for collision detection and analysis. Other customers have built custom user interfaces. For app development, we offer [Omniverse Kit](#) (which is Python) and [Omniverse Connect](#) (C++).

**We have written in the past about the use of [Omniverse and digital twins](#). How does synthetic data dovetail into this?**

**Mike Geyer:** I would preface this by looking at what is going on with artificial intelligence (AI). In the manufacturing space, AI is more commonplace. Companies are using AI tools for generating creative concept art, for example, and in applications like generative design.

NVIDIA first introduced the idea of [synthetic data generation around self-driving cars](#). To get certified, these vehicles have to drive billions of miles, which is not practical. So you have to create these virtual environments that use synthetic data for that AI training. I would say that anywhere customers can imagine AI being applied is a place that synthetic data can be leveraged.

This is where Omniverse has a really compelling story, because you are not just visualizing things, but you can [develop virtual worlds](#) and [digital twins](#) that can be used to train an AI to help make decisions for itself, or to help augment human decision making. Where we are seeing that initially is in a lot of factory and warehouse applications, where you have vision-guided systems. You can use synthetic data to retrain vision guidance systems for robots when

there are physical changes to the environment, for example. Rather than taking months to do this, you can retrain the AI that guides those systems synthetically in a few days.

**Finally, for manufacturers who are just starting to investigate Omniverse, what sort of hardware requirements do you recommend?**

**Mike Geyer:** Well, on the GPU side we generally recommend at least an [NVIDIA RTX™ A5500](#) or [NVIDIA RTX™ A6000](#) in your workstation. For users who want to test out Omniverse and RTX, we offer a cloud-based trial version through [NVIDIA LaunchPad](#), which allows them to explore the ways in which they can leverage Omniverse without needing an RTX GPU. However, to get the full benefit of Omniverse Enterprise for product design, a professional workstation with an advanced NVIDIA GPU is the best option.

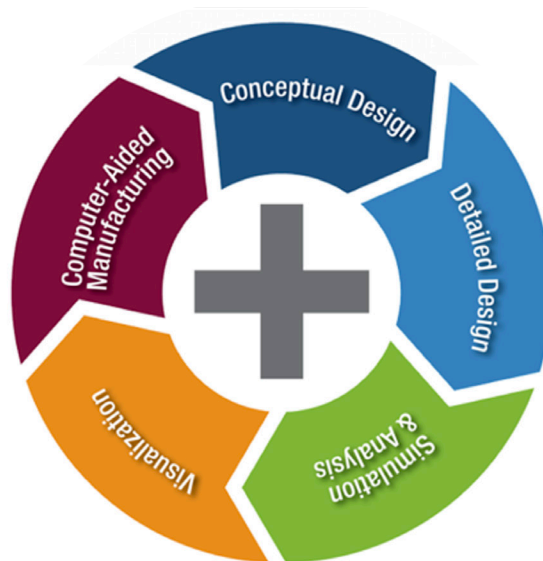
You can learn more about Omniverse and product development at the NVIDIA GTC Conference this week. This recent [blog post](#) outlines the Omniverse-related content at the conference.

In addition, Dell Technologies previously published a [blog](#) outlining how Omniverse Enterprise could be used in conjunction with its own Dell Precision workstations, Dell EMC VxRail or Dell EMC PowerEdge servers for 3D design and production. According to author John Kelly, Omniverse Enterprise can enable conceptual design reviews across locations; AI training and simulation for production robotics; supplier location; and creating massive, interactive factory layout datasets.

Dell also published a related [white paper](#) on leveraging the power of Omniverse on Dell Precision workstations. **DE**



# The Advanced Product Development Resource Center



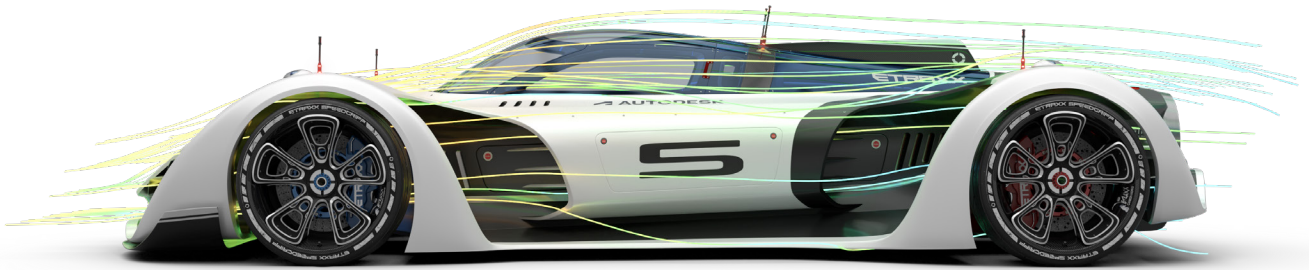
Produced in partnership with Dell and NVIDIA, the Advanced Product Development Resource Center is an ever-growing repository of information to help design engineering teams capitalize on digital distribution through the use of today's most advanced computing, design, simulation and visualization technologies.

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*The evolving engineering workflows demand new technologies and new approaches, per Dell and NVIDIA's presentation at AU 2022. Image courtesy of Florian Coenen.*

# Real-Time Rendering, AR, VR, Simulation and **Digital Twins Increase Computing Demands**

Dell and NVIDIA explain the evolving engineering workflows

**T**he shift from physical testing to software-based simulation has created a need for more powerful workstations, robust enough to load large mesh models and run complex multiphysics solvers. Furthermore, topology optimization or generative design tools integrated in CAD packages and multi user collaboration by remote workers also demand more

compute power, making older-generation workstations underequipped.

At Autodesk University 2022, Scott Hamilton, Dell's Industry Strategist; and Himanshu Iyer, NVIDIA's Manufacturing Industry Manager, tackled the topic in a talk titled "Next Generation Technologies Making New Workflow Paradigms Possible" (AU Industry Talk, [CP502941](#), available on demand).

"The way we design has completely

changed. You're not just looking at the mechanical parts, electrical components, and software, but you're looking at them altogether. So being able to do that in an integrated fashion is important," noted Hamilton.

Autodesk Fusion 360 exemplifies this workflow. On day two of the conference, Jeff Kinder, Executive VP of Product Development and Manufacturing Solutions, Autodesk, announced, "Industry-leading Ansys

simulation technology is being integrated into Fusion 360 to power a new extension that will quickly provide useful insights about printed circuit board (PCB) signal quality as a part of the board design process.” This, he added, signifies an expansion of Autodesk’s partnership with Ansys. SOLIDWORKS, part of Dassault Systèmes, also offers integrated PCB design tools.

## Automotive, AR, & VR

The rise of digital twins, and the use of Augmented Reality (AR) and Virtual Reality (VR) devices to interact with them, also demands more compute capacity and a larger memory footprint. The workflow is typical in automotive, where car makers use GPU-accelerated visualization packages such as Autodesk VRED to scrutinize the digital prototypes’ surfaces and crevices for aesthetics. The French transportation firm Alstom uses VRED with NVIDIA GPUs to visualize its locomotive designs.

“With NVIDIA RTX™ and VRED GPU raytracing, we are able to [achieve a significant performance](#) increase over CPU ray tracing, accelerating our renderings from minutes to milliseconds,” said Fabien Normand, Alstom’s VR specialist. “With RTX scalability and Autodesk VRED, we can now spend less time optimizing our models for raytracing performance and more time designing. The results look amazing on our 32-million-pixel stereoscopic power wall.”

In Dell’s desktop, mobile, and data center products, NVIDIA RTX GPUs provide the necessary graphics power for raytraced visuals with real-time response. It provides graphics memory up to 48GB for those working with large assembly models.

“Immersive rendering and visualization workflows are driven by the GPU memory available,” said Iyer. “When rendering these large data sets, NVIDIA GPU based technologies like AI-driven denoising accelerate the process and DLSS (Deep Learning Super-sampling) upscales the resolution of images ... Several simulation applications from Ansys, Altair, Siemens and [Dassault Systèmes] SIMULIA also benefit from discrete GPUs and run natively on GPUs much faster than CPUs.”

A recent eBook from Jon Peddie Research on GPU-acceleration in CAE features the performance benefits of running simulations on GPUs.

## Diving into Omniverse

NVIDIA Omniverse™ Enterprise is a scalable, end-to-end platform enabling enterprises to develop custom 3D pipelines and simulate large-scale, physically accurate virtual worlds.

The primary means of interacting with Omniverse is through ‘connectors’, Iyer explained. “Connectors are bi-directional, meaning the data can go to Omniverse and back. This is happening in real time,” he said. “If you make a change in Autodesk Revit, the Omniverse user gets a notification alerting him or her that things have changed. Changes in Omniverse are automatically communicated to the Revit user as well.”

The growing list of Omniverse connectors include Autodesk 3ds Max, Autodesk Maya, Autodesk Revit, Trimble SketchUp, McNeel Rhino, and Epic Games (Unreal Engine), among others.

For real-time interactive workflows, the workstation’s CPU core count and GPU memory are critical, Hamilton explained. “Maximizing CPU clock speed (GHz) provides the best experience during the manipulative portion of the creative process [3D modeling tasks in CAD, for example],” he said. For visualization, analysis, and rendering, the GPU offers a significant performance boost, he added.

“When you’re spinning around the model, looking at it from different angles, or walking through a virtual building—that’s when you’re putting a lot of computing workload. This is where the GPU’s memory speed and sequential storage performance are important,” said Hamilton. “For multi-threaded computational work, like rendering and simulation, you use as many cores as possible, both CPU or GPU cores, because these workloads are ideal for parallelization.”

Real-time response is important to creative workflows as “your productivity starts dipping with anything taking more than half a second,” said Hamilton, citing “[The Economics of Rapid Response Time](#),” an IBM paper by Walter J. Doherty and Ahrvind J. Thadani.

According to the paper, “Rapid system response time, ultimately reaching sub-second values and implemented with adequate system support, offers the promise of substantial improvements in user productivity. IBM and others have verified this and demonstrated that lower unit job costs can result.” **DE**



# Deutsche Bahn on Track with Country-Scale Digital Twin

Using NVIDIA Omniverse™, the rail operator is undertaking an unprecedented AI-fueled optimization project.

**T**he digital twin, created with [NVIDIA Omniverse Enterprise](#), will leverage artificial intelligence (AI) to help Digitale Schiene Deutschland (DSD, part of Deutsche Bahn) create a perception and incident prevention and management system that will detect and react to irregularities during rail operation, and optimize response and rescheduling operations.

The company presented a demonstration of the technology at the recent [NVIDIA GTC conference](#).

“With NVIDIA technologies, we’re able to begin realizing the vision of a fully automated train network,” said Ruben Schilling, who leads the perception group at DB Netz, part of Deutsche Bahn. According to Schilling, the future railway system will improve the capacity, quality and efficiency of the network.

Deutsche Bahn will use Omniverse to create a photorealistic and physically accurate emulation of the entire rail system, including tracks running through cities and countrysides, and details from sources such as station platform measurements and vehicle sensors.

According to Mike Geyer, Omniverse Product Manager at NVIDIA, Deutsche Bahn will use geospatial tiling to build out the landscape in this massive digital twin. “They will use 5G wireless communication, a sensor network and edge devices, so they can identify anomalies over time and help better coordinate rail operations. Omniverse combines and aggregates all of the data they are collecting, and the resultant digital twin will be used to train their AI network.”

### **A Comprehensive Digital Twin Project**

Deutsche Bahn first began publicly discussing its plans for digital twin technology in 2020. In 2021, the company announced it was working with train manufacturer [Stadler](#) to develop a virtual image of a complete train. The company also invested 15 million euros in a smart sensor technology project, called

[Sensors4Rail](#), to help monitor and optimize its operations, as well as leveraging HD mapping technology from HERE Technologies and LiDAR-base data to map objects along its routes. The company is also working with [AP Sensing](#) to gather live data along its tracks.

You can read more about the Deutsche Bahn vision for digital twins [here](#).

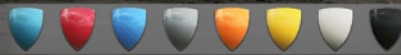
The company will use Omniverse to connect computer-aided design datasets that have been built within the [Siemens JT](#) ecosystem with its HD 3D maps and simulation solutions. All of these data sources can be combined into a single virtual model in Omniverse.

Once the full-scale digital twin of the network is built, Deutsche Bahn will be able to run optimization tests, validate network changes, run simulations, and train the AI system that will help automate responses and rescheduling.

“If there is an obstacle on the track, rather than making a phone call to someone who will have to then re-route multiple trains, the technology on the trains will see that obstacle and then alert other trains that they need to alter their routes,” Geyer says. “That is the level of automation they are aiming to ultimately achieve.”

You can learn more about the project in this [NVIDIA blog](#).

Looking to get started with digital twins? [See a simple five-step roadmap](#) to set yourself and your organization up for success. **DE**



WHEELS INTERIOR PAINT BACKDROP OPTIONS

*Image courtesy of RIMAC and NVIDIA.*

# Reinventing 3D Configurators

Electric vehicle company RIMAC leverages NVIDIA Omniverse™ technology to create a highly realistic vehicle configurator.

**A**t the recent NVIDIA GTC conference, electric vehicle innovator RIMAC showed off a new 3D configurator for the company's Nevera Hypercar. The solution, powered by NVIDIA Omniverse, provides realistic renderings of the vehicle in a variety of configurations – all made possible by the simulation capabilities of the NVIDIA platform and technology. By using the Omniverse Cloud offering, customers can access the solution from any device. (You can access the configurator [here](#).) RIMAC also plans to leverage Omniverse

for design and marketing activities.

The new 3D configurator allows RIMAC to preview the vehicle for customers without having to pre-render each feature or layer, which will save time and money. NVIDIA Omniverse can work with full design fidelity CAD and 3D datasets from a variety of software sources, and designers are able to work on NVIDIA-powered RTX workstations or access the platform via the cloud.

We spoke to Andrew Morris, product manager for Omniverse Manufacturing at NVIDIA, about the project.

#### **Can you explain how the configurator project came together and how RIMAC leveraged the capabilities of Omniverse?**

The core part of all of this is that we have Universal Scene Description (USD) as a single source of truth. That is what cuts across all of this. With RIMAC, we had a [showreel](#), the vehicle was doing donuts, we had some beauty shots, some really cinematic scenes, and the same USD file was used for all those things. By getting the team to rally around Omniverse and the USD framework, you can distribute that to multiple teams and collaborate on that content without worrying about the format.

It was pretty slick. We just had a few weeks before our developer conference NVIDIA GTC to pull that together, which demonstrates how easy it is to get teams to ingest, simulate, and collaborate on their existing data. The other thing we wanted to highlight with RIMAC was the powerful nature of the visualization tools. Variants are a core part of a configurator experience – you want to change the paint color, the trim, or maybe swap out the wheels. The configurator brings that together to showcase the RIMAC vehicle.

There is also the benefit of being able to create your own lightweight user interface and viewing application based on the Omniverse platform's development SDK called Omniverse Kit, and thanks to the extensible nature of the Omniverse platform to be able to view and

create on the platform, and then build custom applications.

With a configurator, the end user is sitting at home using the most convenient device they have on hand. We used our [NVIDIA Graphics Delivery Network \(GDN\)](#), which was announced at GTC, to host and distribute high performance, low-latency, high fidelity advanced 3D experiences to people around the world on every device..

#### **What can other manufacturers learn from this project, in terms of what Omniverse can bring to their applications?**

That Universal Scene Description (USD) is a powerful key to unlocking today's cumbersome manufacturing workflows. You can leverage USD to seamlessly bring core engineering data from design and engineering, to manufacturing, through to marketing. This is unheard of today. With today's configurators, you create 2D images of different views and options and then composite those together to create the various permutations that people may select. So you are limited in the number of permutations you can select - and you're not able to see it fully real time ray traced, so it doesn't look realistic, like it would when you see the product in the real world. The RIMAC configurator built in Omniverse exposes the full 3D engineering model, and you can change the materials and assets directly on that model, and then view it from any angle. If you want to introduce new options, you don't have to create all new logic.

That creates huge efficiencies, because creating those 2D layers can be time consuming and error prone. The other key piece is being able to take advantage of Omniverse RTX enabled graphics and physics, and having that streamed to you as well for a fully interactive, intuitive, and realistic experience. We built a complete stack for that end-to-end solution.

This is not just for automotive. You can use this for any product where you want to provide a more immersive experience on a phone or tablet, or via an extended reality (XR) experience.

You can learn more about the project in [this video](#). **DE**



Image courtesy of NVIDIA and Mercedes-Benz.

# Mercedes-Benz Takes Factory Planning Into the Omniverse

Automaker is building a full-scale digital twin of its factories for new electric vehicle platforms with NVIDIA Omniverse™.

**R**etooling a production plant for a new vehicle is a resource-intensive and often disruptive undertaking for auto manufacturers. Vehicle production involves the coordination of thousands of parts and workers, along with robotic assembly systems and a complex logistics infrastructure.

To prepare for the launch of its new electric vehicle platform, which will be manufactured in 2024 at its site in Rastatt, Germany, Mercedes-Benz is building a digital twin of the factory using the [NVIDIA Omniverse platform](#). By designing and planning manufacturing facilities in Omniverse, the automaker will be able to rapidly simulate new facility configurations virtually and, in the process, reduce waste and continuously enhance operational quality.

Mercedes-Benz and NVIDIA announced the project at CES 2023.

According to an [NVIDIA blog](#), Mercedes-Benz is establishing a digital-first planning process that will enable them to design and to test the complete production lines without disrupting ongoing production at the current site. They will then roll out the process to other parts of the production network to create a more agile manufacturing ecosystem.

According to the blog:

“With Omniverse, Mercedes-Benz planners can access the digital twin of the factory, reviewing and optimizing the plant as needed. Every change can be quickly evaluated and validated in the virtual world, then implemented in the real world to ensure maximum efficiency and ergonomics for factory workers.”

Omniverse is a scalable, end-to-end platform enabling enterprises to build and operate metaverse applications.. Omniverse allows users to create custom 3D pipelines and simulate large-scale virtual environments quickly and collaborate with team members at any location, regardless of what design and simulation software they use locally.

In addition to Mercedes-Benz, a number of major end users across industries are leveraging Omniverse for large and complex design and simulation projects. [Deutsche Bahn](#), for example, is using Omniverse Enterprise to build a country-scale digital twin of its rail network. [Siemens Energy](#) is using Omniverse to predict corrosion progression in power plants, while the [UK Atomic Energy Authority](#) has tapped Omniverse to help design and develop a fusion reactor power plant.

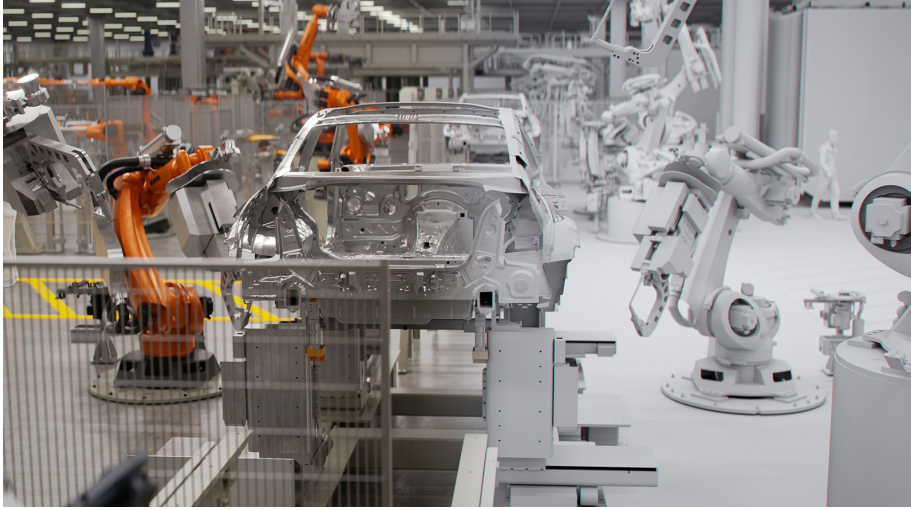
## Update to Omniverse Enterprise

At CES, NVIDIA also rolled out the latest update of Omniverse Enterprise, which includes improvements in real-time NVIDIA RTX™ ray and path tracing, new deployment options, and new Omniverse Connectors, plugins to popular 3D tools, to enterprise customers.

The release includes support for the new [NVIDIA Ada Lovelace architecture](#), which can deliver up to a 3X improvement in performance when coupled with the [NVIDIA RTX™ 6000 Ada Generation GPUs](#).

New Omniverse Connectors (which enable seamless workflows with third-party software platforms) include Adobe Substance 3D Painter, Autodesk Alias, PTC Creo and Kitware Paraview. There have also been improvements to the core Omniverse platform components, new cloud containers, and other new features.

You can read more about the Omniverse Enterprise updates [here](#). **DE**



*Carmaker BMW began production virtually in Omniverse.  
Image courtesy of NVIDIA & BMW.*

# NVIDIA GTC 2023: GPUs Enable New Advanced Workflows

AI workloads set to become part of design and simulation.

**T**he importance of GPU acceleration and compute power was on display at the recent [NVIDIA GTC 2023](#) conference in March 2023. At the annual event, the company announced new capabilities and use cases for its Omniverse platform, showcased its new family of GPUs, and how its technologies will enable advanced artificial intelligence (AI) workflows.

NVIDIA GTC 2023, a virtual event exploring advancements in AI, accelerated computing, and industrial digitalization, drew an estimated 250,000 participants - a new attendance record, said NVIDIA CEO Jensen Huang.

GPU acceleration has gone mainstream, spreading from Excel and CFD to genomic sequencing. “Ansys, Siemens, Cadence, and other leading CFD solvers are now GPU accelerated,” said Huang in his virtual GTC keynote on March 21st.

Cadence Design Systems, highlighted in Huang’s keynote, is already a household name in electronics design and multiphysics simulation software.

“With Cadence’s CharLES CFD solver, accelerated by NVIDIA® CUDA®, at equivalent system cost, NVIDIA A100 Tensor Core GPU is nine times the throughput of CPU servers, or at equivalent simulation throughput, NVIDIA is nine times lower cost, or 17 times less energy consumed,” Huang pointed out.

Beyond product-level simulation, NVIDIA is also serving the market for system-level simulation with digital twins. To enable such applications, the company is bolstering its NVIDIA Omniverse platform.

“Omniverse is a platform for industrial digitalization that bridges digital and physical. It lets industries design, build, operate, and optimize physical products and factories digitally, before making a physical replica,” said Huang. Omniverse has been downloaded about 300,000 times, he reported.

## **BMW Virtual Production Underway**

The costlier the physical prototype, the greater the digital twin’s appeal. For running what-if scenarios and simulating failure modes, doing it in pixels is less expensive than conducting destructive physical tests. That may explain why automakers have embraced [NVIDIA’s Omniverse](#) as a place for their digital twins.

“For next generation Mercedes Benz and Jaguar Land Rover vehicles, engineers use NVIDIA DRIVE Sim™ in Omniverse, to generate synthetic data to train AI models, validate the active safety system against the virtual driving test, and simulate real driving scenarios ... Working with [logistic and transport software maker] Idealworks, BMW uses NVIDIA Isaac Sim and Omniverse to generate synthetic data and scenarios to

train factory robots,” Huang pointed out.

BMW has already begun a global rollout of Omniverse-hosted virtual factories. In conjunction with GTC, [the carmaker announced](#), “More than two years before the official launch of series production, vehicle manufacturing is already underway in the future plant Debrecen—virtually, at least, as Debrecen is the BMW Group’s first facility to be planned and validated completely virtually.” (You can see a demo [here](#).)

This could set precedence for other carmakers and manufacturers, to plan and test out production activities in digital replicas before the metal cutting begins. BMW said it is “taking a digital-first approach to validate and optimize complex manufacturing systems across its production network using NVIDIA Omniverse Enterprise.”

## Cloud Partners for Omniverse

To support an expanding set of industrial use cases and workflows, NVIDIA is offering NVIDIA Omniverse Cloud, built on Microsoft Azure. Think of it as a development platform enabling enterprises and developers to unlock industrial digitalization, offered via a PaaS model.

“Microsoft Azure will host two new cloud offerings from NVIDIA: [NVIDIA Omniverse Cloud](#), a platform-as-a-service giving instant access to a [full-stack environment](#) to design, develop, deploy, and manage industrial metaverse applications; and [NVIDIA DGX™ Cloud](#), an AI supercomputing service that gives enterprises immediate access to the infrastructure and software needed to train advanced models for generative AI and other groundbreaking applications,” [announced NVIDIA](#).

CAD and simulation software users can work with Omniverse via connectors, developed by NVIDIA and its partners. The latest additions to the [growing list of connectors](#) come from, among others, Siemens, Rockwell Automation, and Unity.

## New GPUs Accelerate Design, Visualization Performance

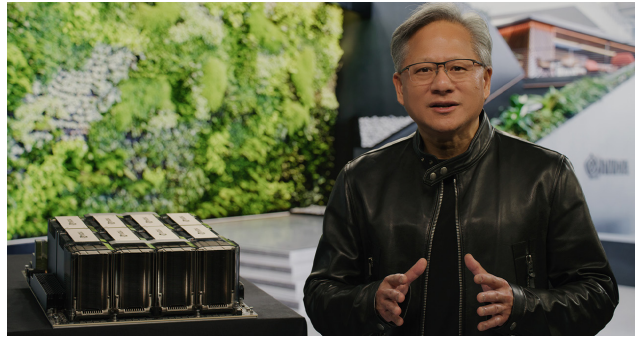
At the conference [NVIDIA announced](#) six new NVIDIA RTX™ GPUs for laptops and desktops based on Ada Lovelace architecture that the company says can enhance the performance of workstations for AI, design, simulation, and metaverse applications.

The NVIDIA RTX™ 5000, NVIDIA RTX™ 4000, NVIDIA RTX™ 3500, NVIDIA RTX™ 3000, and NVIDIA RTX™ 2000 Ada Generation [laptop GPUs](#) deliver improved performance and up to 2x the efficiency of the previous generation. For the desktop, the [NVIDIA RTX™ 4000 SFF \(small form factor\) Ada Generation GPU](#) features new RT Cores, Tensor Cores and CUDA cores with 20GB of graphics memory to deliver incredible performance in a compact card.

NVIDIA’s new laptop GPUs deliver up to double the performance and power efficiency over the previous generation for mobile workstations, the company says. Next-generation workstations featuring the new NVIDIA RTX GPUs will be available from partners like Dell Technologies later this year.

## Hardware to Boost Natural Language

Lately, the AI-driven chatbot ChatGPT, developed by OpenAI, has ignited new enthusiasm for AI-powered apps that can simplify complex tasks, from research to programming. Huang, a long-time AI advocate, called ChatGPT “the AI heard around the world.” In his keynote, he said, “A new computing platform has been invented. The iPhone moment of AI has started. Accelerated computing and AI have arrived.” This is good news for NVIDIA as the company’s offerings include the NVIDIA DGX H100, a GPU-accelerated system for processing AI workloads, available from hardware partners such as Dell.



*NVIDIA CEO Jensen Huang anticipates AI workloads to become part of the future. Image courtesy of NVIDIA.*

“Half of the Fortune 100 companies have installed DGX AI supercomputers. DGX has become the essential instrument of AI. The GPU of DGX is eight H100 modules,” said Huang. The NVIDIA® H100 Tensor Core GPUs are recommended for machine learning and training applications, such as natural language processing. They come with NVIDIA® NVLink™, allowing users to connect up to 256 H100 GPUs to tackle Exascale workloads.

## Foundations for The New Era

NVIDIA announced the launch of NVIDIA AI Foundations Cloud Services, to “enable businesses to build, refine, and operate custom large language models and generative AI models that are trained with their own proprietary data and created for their unique domain-specific tasks,” according to the announcement.

“Enterprises can use the NVIDIA NeMo language service and the NVIDIA Picasso image, video and 3D service to build proprietary, domain-specific, generative AI applications for intelligent chat and customer support, professional content creation, digital simulation and more,” said the announcement.

Ansys, a leading simulation software maker, believes AI-driven chatbots could dramatically lower the learning curve for complex FEA and CFD programs. At the recent [OzenCon](#), hosted by Ansys reseller Ozen Engineering, Ansys CTO Dr. Prith Banerjee said, “Today, when you use a simulation tool such as Ansys HFSS for electromagnetic simulation or Ansys Fluent for fluid simulation, you must set up a hundred different parameters. You have to almost have a Ph.D. in aerospace engineering to know which parameters to set. In the future, with technology like ChatGPT, you can say, ‘Run an external aerodynamic simulation over a Boeing 747 plane,’ and it will figure out for that particular case, what are the fluid settings to use.” **DE**



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# Siemens Envisions AI-Powered Digital Twins as Part of Industry Transformation

CEO Tony Hemmelgarn outlines visions and roadmaps at Siemens Realize LIVE 2023

In his keynote at Siemens Realize LIVE in Las Vegas, Tony Hemmelgarn, President and CEO of Siemens Digital Industries, laid out the fabric of living, breathing digital twins—the digital thread.

“What we mean by a digital thread is currently connected data, the information flow,” he said. “[You get] the biggest payback if you do the full digital thread. But many times, our customers start with just one or more components.”

This year, there’s a new thread to add to the digital twins discussion: how to weave AI (artificial intelligence) into its predictions and operations.

## AI in Teamcenter

[Siemens recently struck up a partnership with Microsoft](#) to bring AI-powered collaborative apps that accept incident reports in natural speech. “Studies suggest over 70% of quality issues go unreported. The reason is, there’s no access to the tools. It’s hard to use paper-based tools,” said Hemmelgarn.

Justin DiNunzio, Marketing Manager, Siemens Digital Industries Software, clarified, “The natural language processing occurs in the Teamcenter app for Microsoft Teams, which leverages Azure OpenAI Services to translate and prepopulate the problem report.”

The partnership is also expected to bring more AI-powered functions to equipment diagnostics, and asset and process management. “Siemens and Microsoft are also collaborating to help software developers and automation engineers accelerate the code generation for Programmable Logic Controllers (PLC), the industrial computers that control most machines across the world’s factories,” according to the announcement of the partnership.

Hemmelgarn said, “[The generative AI] is automatically writing the PLC (Programmable Logic Controller) code that has to be adjusted ... So the AI is writing the code to make the change. The manufacturing engineers not only receive a notification on what’s going on, but he gets direct access to the updated code. He can use it on the robot, bring it right to the edge device and upload it.”

Himanshu Iyer, Senior Industry Manager, Manufacturing/Product Development, at NVIDIA said, “Many of the processes associated with building a digital twin are graphics and compute intense. NVIDIA GPUs and platforms like Omniverse enable teams to connect 3D design and simulation applications for collaborative design workflows and allow users to build physically accurate virtual worlds for training, testing and operating AI agents such as robots and autonomous machines.”

### AI in NX

AI will also become part of NX, changing how you might learn and use the software. The key is to let the AI do the heavy lifting, so you won't have to remember every menu bar and command. “We have the machine learning capability, or the technology that predicts commands based on usage patterns. This allows the designers to become really proficient [in NX] without years of practice,” revealed Hemmelgarn during his keynote.

S. Ravi Shankar, Siemens' Director of Solutions & Technical Marketing, provided details about a preview technology, not yet ready for public distribution. “You can interact with NX through a ChatGPT-like interface to ask the program to build you a simulation model for a certain purpose. In the background, AI works with Simcenter tools to build a model. Then you can say, ‘Run these types of scenarios.’ So you're interacting with the software like an assistant. Your job becomes much more about interpreting the simulation results and making some changes and tweaks. This can speed up the process of performing simulation,” he explained.

### AI on the Shop Floor

One area AI has proven to be quite powerful is in image processing. Siemens appears to be exploring ways to leverage this for search and retrieval operations. Hemmelgarn said, “We see examples of frontline workers going out to

an assembly to perform some kind of service operation on a component but are unable to find the part number.” One solution, he speculated, would be AI-aided image-based identification. “All these images can come together and, from those, we can automatically determine what that part is back in the database,” he explained.

Siemens and NVIDIA are collaborating to bring together Siemens Xcelerator's vast industrial ecosystem and NVIDIA Omniverse's AI-enabled, physically accurate, real time virtual world engine. This enables full-design-fidelity, live digital twins that connect software-defined AI systems from edge to cloud. The concept was demonstrated at the Hannover Messe trade show in April 2023.

At the event, Siemens unveiled a digital model of new FREYR Battery factories created using Omniverse. Leveraging an integration between Siemens Xcelerator and NVIDIA Omniverse, the [demonstration](#) included 3D representations of the entire factory. Such a model can be used for production planning, virtual client meetings, and simulating potential changes in a facility.

“Highlighting the integration between Siemens Xcelerator and NVIDIA Omniverse, the demo features 3D representations of the infrastructure, plant, machinery, equipment, human ergonomics, safety information, robots, automated guided vehicles, and detailed product and production simulations,” [NVIDIA wrote in a blog post](#).

“You know, if you look at almost every engineering project today of any significant complexity, we simulate the product before we go to production,” said NVIDIA CEO Jensen Huang in a recent [blog](#) posting. “And yet, for most plants and most factories, it's nearly impossible to do that today ... and so we needed to create a very large-scale simulation platform: Omniverse.”

For more on [Siemens Realize LIVE](#), read [DE 24/7's report here](#). [DE](#)

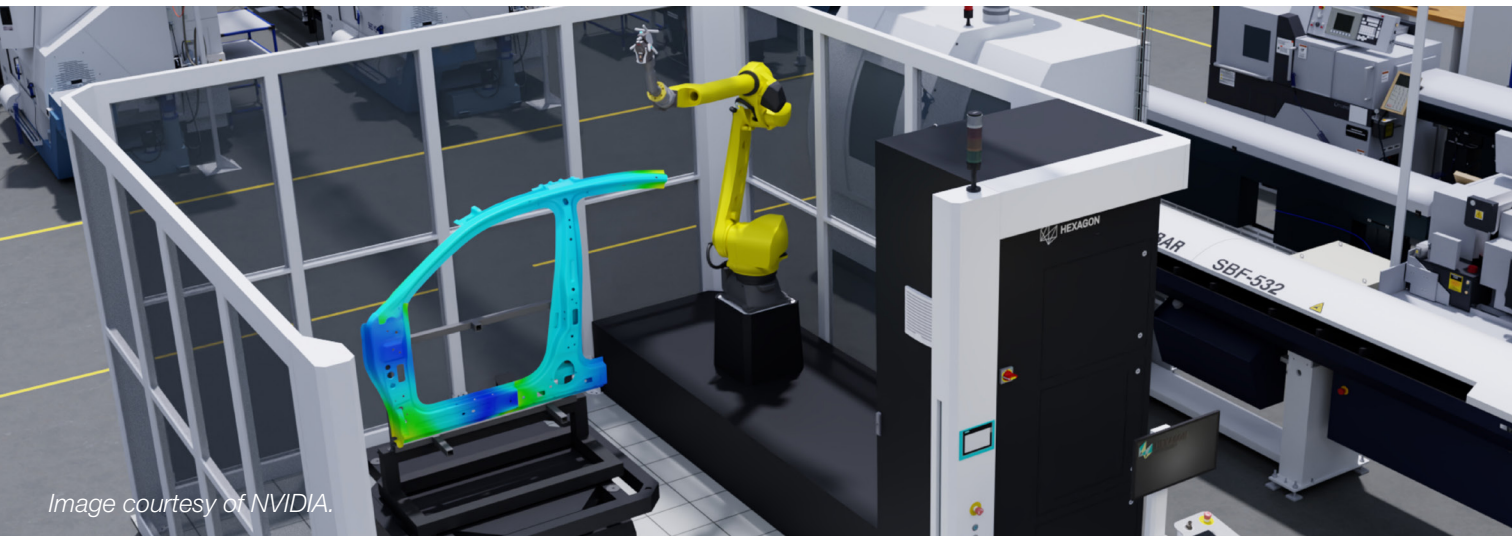


Image courtesy of NVIDIA.

# The Next Evolution of **Digital Product Development**

Hexagon and NVIDIA team to enable next-stage digital twin development.

**D**igital twin technology creates a virtual model of real-world objects and systems, but they can also serve as the foundation for increasing quality and productivity by allowing companies to simulate, train, and test new products and systems on a collaborative virtual platform.

At the [HxGN LIVE Global](#) event in Las Vegas in June, Hexagon AB and NVIDIA [announced](#) that they were collaborating on a solution to enable industrial digital twins that encompass reality capture, manufacturing twins, artificial intelligence, visualization, and simulation.

According to Hexagon CEO Paolo Guglielmini, the company wants to allow its customers to build digital twins

of everything from small components to complex assemblies and even entire factories or cities. The NVIDIA collaboration will advance these goals by combining NVIDIA technology with Hexagon's manufacturing and reality capture expertise.

Hexagon's HxDR reality capture platform and Nexus digital reality platform for manufacturing will connect with the NVIDIA Omniverse™

platform. Users can leverage the connected solutions to aggregate and simulate complex data for virtual factory planning and design, operational planning, and process quality optimization. [The Hexagon Smart Digital Realities™](#) approach will allow users to build physically accurate, synchronized and AI-enable digital twins.

“Omniverse is a virtual world simulator for AI-enabled industrial applications that enables you to aggregate and simulate ultra complex data from specialized tools such as HxDR, and Nexus,” said NVIDIA CEO Jensen Huang, speaking the HxGN LIVE keynote. “Industries are racing to digitize their physical processes. The opportunity is immense ... digitalization will enable these industrial businesses to become software defined to achieve the next level of automation.”

You can learn more in this [demo](#).

“Our Hexagon innovation team has been working with NVIDIA to develop opportunities that unite reality capture, AI, simulation, data analysis and visualization with seamless collaborative planning platforms,” said Paolo Guglielmini, President and CEO, Hexagon, in a press release. “With NVIDIA technologies and Hexagon’s Smart Digital Realities, our solutions will deliver real-time comparisons of real- and virtual-world models.”

You can read more about the partnership in this recent NVIDIA [blog](#).

Manufacturers can leverage the integration solution for virtual, collaborative planning with a unified interface, optimizing workflows.

At the conference, Hexagon CTO [Burkhard Boeckem](#) explained that these technologies can help companies aggregate data from multiple sources to create seamless virtual worlds, and then apply AI and simulation to

those environments to predict performance and improve optimization. The spatial computing technology that Hexagon brings to the equation can accelerate industrial metaverse adoption.

“The fantastic has become the realistic,” Boeckem said. “The industrial metaverse is unifying multiple technologies – spatial computing, visualization, AI and digital reality technologies – that converge to form a truly immersive experience.”

Hexagon is also developing an AI-enabled web application using the [NVIDIA Omniverse](#) platform that will let teams perform real-time comparisons of digital twins and their physical counterparts to further improve planning and operations.

At the conference, Hexagon also announced its [Reality Cloud Studio](#) (powered by HxDR), an SaaS application for easy to use reality capture. Data can be uploaded directly from compatible sensors in the field to create meshed digital twins for use on-site via any device. The company also released [Nexus for Developers](#), a development environment that allows users to build native SaaS applications for engineering and manufacturing that leverage the Nexus digital reality platform.

Engineers that want to leverage the Omniverse-based solutions such as the one created by the Hexagon-NVIDIA partnership will need the right workstation hardware to fully take advantage of the capabilities of the platform. Dell Technologies and NVIDIA have published a brochure explaining how Dell Precision workstations have been optimized to run NVIDIA Omniverse applications. You can download it [here](#). **DE**