INTELLIGENCE UPDATE

Nvidia's vision: digital twins and automated facilities

Dr. Rand Talib 2 Jan 2026

A wide range of software tools is used to design, build and operate data centers, but these systems typically function in isolation. Engineering models, architectural tools, construction workflows and operator platforms such as data center infrastructure management (DCIM) rarely share a unified data structure or simulation environment, which leaves gaps between design intent and operational reality. As AI facilities grow toward capacities of hundreds of megawatts or more, these disconnects become harder to manage.

Against this backdrop, Nvidia has introduced the Omniverse Data Center Solution eXtension (DSX) Blueprint, a software framework that aims to link digital twins, modular construction workflows and AI-driven operational optimization into a single life cycle model. Rather than proposing a new design methodology, DSX is Nvidia's attempt to unify disparate software environments and create a continuous digital representation of an AI facility from planning through to operations. Its practical relevance will depend on how widely these tools are adopted and how well they perform under real-world constraints.

Digital twins across full facility life cycle

Nvidia intends DSX to reposition digital twins from static design files into software environments that engineers and operators actively use during live operations. If organizations adopt this approach, teams could maintain a continuously updated model of the facility, test configuration changes before implementation, and rehearse failure or recovery scenarios without impacting the production environment.

This model relies on two components, OpenUSD and SimReady asset models. OpenUSD, originally developed by Pixar Animation Studios, provides a shared 3D scene format that allows architects, engineers and operators to work from the same underlying model. SimReady assets are high-fidelity equipment models supplied by vendors that behave correctly in simulation, giving all teams a consistent mechanical, electrical and thermal representation.

By combining these elements, Nvidia aims to create a persistent digital model that aligns more closely with real-world facility behavior than traditional engineering or DCIM systems. Whether operators adopt and maintain these digital twins in practice remains uncertain, but the approach addresses longstanding gaps in how data centers integrate design and operations software.

AI agents embedded into power and cooling controls

Nvidia also proposes that AI agents become part of future operational workflows. Most operators today do not use digital twins or autonomous control systems, so the integration of AI agents represents a significant shift from current industry practice. In the DSX framework, Nvidia partners such as Phaidra and Emerald AI that specialize in AI tools for data center operations, develop agents that are trained and tested within the digital twin environment before any real-world use.

Nvidia highlights early demonstrations of this approach conducted at Digital Realty's research center in Virginia (US) and in conceptual deployments for large sites such as the Stargate complex in Texas (US). These are pilot or validation environments rather than fully autonomous production deployments. In theory, and once fully proven, engineers could use these agents to recommend or eventually adjust cooling set points, workload placement and power allocation at scale. Any ability to influence demand in response to grid conditions would require substantial testing, clear safeguards and operator oversight. In practice, such actions might involve shifting workloads or modifying temperature set points, but these remain experimental.

Nvidia's DSX Boost and DSX Flex illustrate the direction they aim to move toward. DSX Boost focuses on performance per watt optimization and DSX Flex explores potential coordination with grid conditions to dynamically balance energy supply and demand. These capabilities remain part of a software blueprint rather than established operational practice, and adoption will depend on issues such as model accuracy, override authority, data quality and the stability of autonomous control loops.

Standardized and modular deployment

By using the DSX software tools, design engineers may be able to create repeatable modular construction strategies that rely on prefabricated power and cooling blocks, which are validated in the digital twin before they are built and shipped. This approach is intended to reduce engineering variance between deployments and shorten commissioning timelines.

Modular construction itself is not new, but DSX places it inside a unified simulation and data environment so that different engineering and construction teams can work from the same model. This could improve design consistency across multiple sites. However, external constraints such as grid interconnection queues, permitting requirements, land availability and cooling resources will continue to limit how quickly large AI facilities can be deployed.

Operational and industry implications

Using a unified blueprint and a persistent digital twin throughout the facility lifecycle could shift operator responsibilities toward maintaining model accuracy, supervising AI-driven recommendations and validating automated decisions. A continuously updated model may help close design-to-operations gaps and support more rigorous scenario testing, although it also introduces risks related to incorrect assumptions, model drift and incomplete telemetry.

Nvidia applies this approach within its DSX framework, but the broader concepts extend beyond any single vendor. Shared formats such as OpenUSD may improve integration across tools, although meaningful standardization will require wider industry participation.

> ## The Uptime Intelligence View
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> DSX provides a useful indicator of where AI-facility design and operations may be heading, but it remains an early-stage architectural concept rather than an immediately deployable model. The integration of continuous digital twins, autonomous control agents and modular infrastructure reflects real industry pressures, particularly energy constraints, staffing challenges and the need for repeatable build processes. However, operators should expect uneven adoption and considerable validation before these methods become mainstream. In the near term, DSX is most significant as a signal of increasing convergence between simulation, automation and operations rather than a prescriptive blueprint for today's data centers.

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