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Real-time Manufacturing Operations With AI-optimized Intelligent Edge Solutions From Google, Powered by Intel

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Abstract: Seeking competitive advantages, manufacturing organizations are increasingly embracing digital initiatives such as AI to modernize operations, improve efficiency, and minimize business risk. As digital needs increase, traditional edge infrastructure deployments can often prove inadequate. Google Distributed Cloud (GDC), powered by Intel, can address several fundamental challenges facing modern manufacturers. It is an AI-optimized intelligent edge platform that can deliver cloud-native capabilities directly to factory floors and other edge locations, eliminating the latency constraints that can otherwise limit AI deployments in manufacturing environments.

Empowering Manufacturing Organizations With AI

Digital initiatives continue to transform manufacturing operations, enhancing workplace efficiency, security, and safety. The need to stay competitive fuels a demand for continuous innovation, including integrating AI. For modern manufacturing organizations, key digital business priorities requiring IT and infrastructure modernization include:[1]

- **Factory and process optimization** to boost efficiency and optimize operations to yield higher quality with greater throughput.
- **Improving quality and inspection efficacy** by leveraging AI-based visual inspections to analyze high-resolution images and video feeds in real time and detect defects with superior speed and accuracy.
- **Enhancing security and asset protection** via AI-based image inspection and recognition to improve physical security as well as material and inventory control systems.
- **Workplace safety** by leveraging cameras and wearables that enable real-time alerts or automated corrective measures to protect workers.
- **Reducing scrap and waste** by using AI to enhance quality control to reduce defects and wasted raw materials.

To achieve business priorities such as these, manufacturing organizations need superior technical capabilities and infrastructure on premises and at the edge. Traditional IT infrastructure options can provide do-it-yourself optimization. However, they add unnecessary complexity, especially when the

[1] Visit https://www.youtube.com/watch?v=zcLl37rMZuA to see how Google Distributed Cloud is addressing some of the biggest challenges in the manufacturing industry.

organization is trying to leverage rapidly evolving technologies such as AI, increasing the burden on onsite personnel and slowing down the initiatives. While turnkey solutions can simplify deployments, the rigid nature of those architectures can limit flexibility to support future innovation, increasing the risk of having to rip and replace the solution when needs change. Modern manufacturing operations require infrastructure that provides the flexibility to integrate future digital initiatives, such as AI, while also simplifying the environment.

Infrastructure Priorities of Modern Digital Manufacturers

Minimizing risk to operations and the overall business remains paramount, but finding ways to reduce the complexity burden on internal personnel and control costs is essential to ensuring profitability.

For modern manufacturers, addressing the top three challenges while providing flexibility to adapt to future needs, such as integrating AI, is often unrealistic with traditional infrastructure deployments. The architectural complexity along with the rigors of ongoing maintenance places too great a burden on personnel. Ideally, manufacturing organizations need an architecture that will provide a consistent, resilient, low-latency application experience for current demands, while providing a path to integrate new innovations.

Benefits of AI-optimized Intelligent Edge Infrastructure

AI-optimized intelligent edge infrastructure leverages public cloud architectures to deliver an extended cloud experience to onsite locations. These solutions differ from standard turnkey options by offering a platform designed for extensibility and flexibility, rather than one tuned to support just a few applications.

Unlike traditional IT deployments, this infrastructure is fully consumable as a service. This eliminates much of the upfront architectural effort, as the organization only pays for what the application environment uses. For modern manufacturers, this approach provides the following advantages:

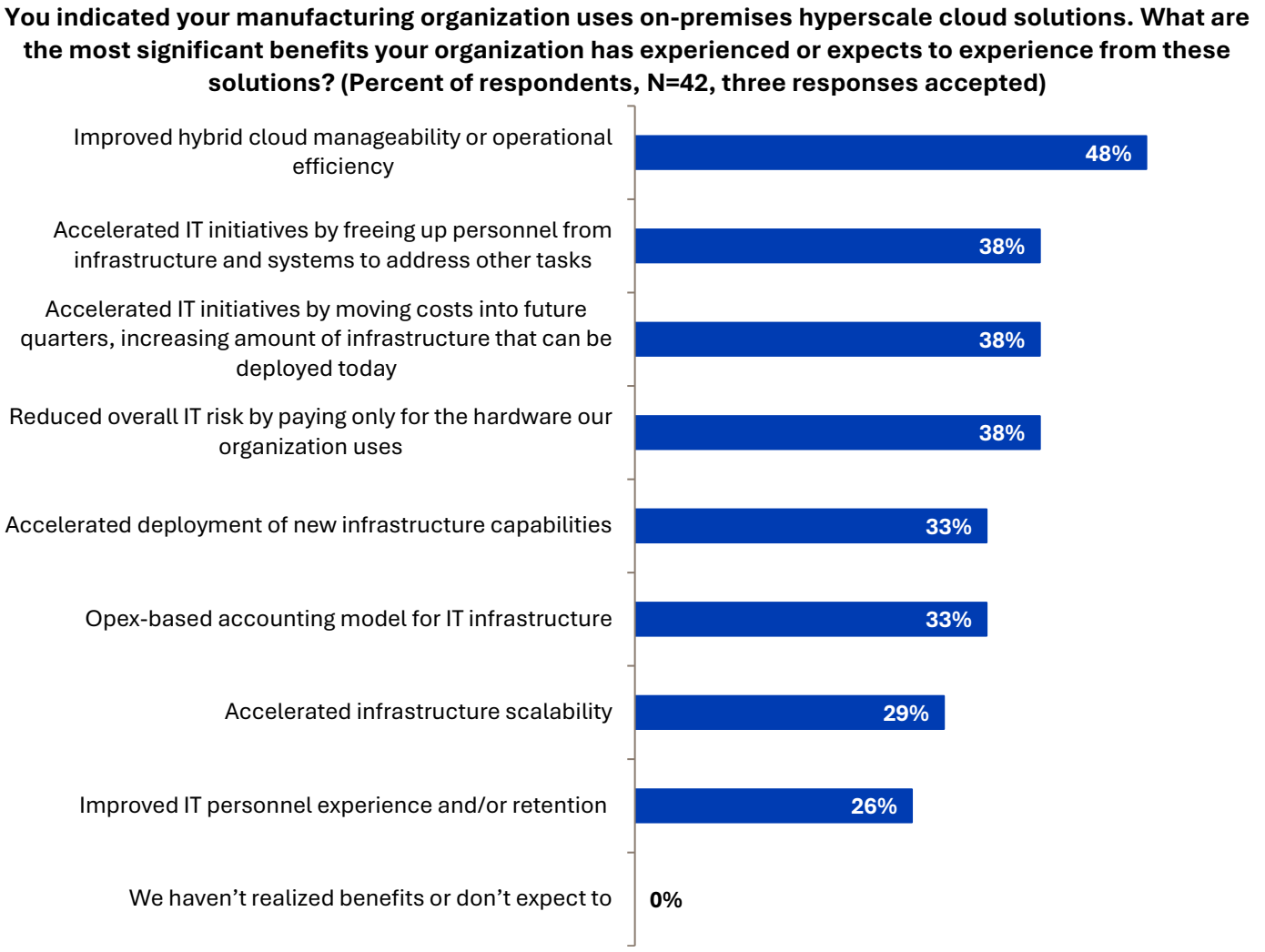
- **Reduced technology decisions.** These systems provide the same advantages as turnkey solutions in that they come with a predetermined, pre-validated, and pre-integrated set of edge infrastructure hardware and software technologies. That advantage greatly reduces the effort required for design, selection, validation, integration, and sourcing.
- **Integrated deployment and monitoring services.** Intelligent edge solutions will typically include a full lifecycle-as-a-service approach, covering design, testing, staging, deployment, and production monitoring, all included in the core licensing structure. It might also include software and hardware maintenance, further simplifying total cost of ownership and operations.
- **Full flexibility.** Although they are pre-validated and deployed in a similar fashion to turnkey solutions, these platforms offer adaptable compute architectures in the public cloud to support flexible application options (including internally developed applications, open source apps, or options licensed from independent software vendors).
- **AI-readiness.** These solutions are specifically meant to support AI technologies, including access to the latest AI and generative AI models.

Google Distributed Cloud, Powered by Intel, for Intelligent Manufacturing at the Edge

Google Distributed Cloud, powered by Intel, is composed of compute, storage, and networking hardware that is pre-built and pre-validated. It includes, by default, Google Kubernetes Engine, an open source platform that automates management, deployment, and scaling of containerized applications and services while supporting legacy VM requirements.

Figure 1 highlights the benefits manufacturing organizations get by leveraging intelligent edge solutions such as GDC. For manufacturing organizations, solutions such as GDC deliver benefits tied to simplification as well as accelerating operations and deployments while improving the personnel experience. In addition, these solutions reduce risk while accelerating access to new capabilities.[2]

Figure 1. Benefits to Manufacturing Organizations



Source: Omdia

[2] Source: Enterprise Strategy Group (now Omdia) Research Report, *Private AI, Virtualization, and Cloud: Transforming the Future of Infrastructure Modernization*, July 2025.

Google Distributed Cloud, powered by Intel, offers multiple benefits for manufacturers, including:

- **Intel Advanced Matrix Extensions.** Intel Advanced Matrix Extensions (AMX) is a dedicated, built-in accelerator designed to optimize deep learning training and inference. Working within the latest 4th and 5th generation Intel Xeon Scalable processors, Intel AMX and its deep learning training and inference performance improvements make it ideal for workloads such as natural language processing, recommendation systems, and image recognition.

  By leveraging Intel AMX, manufacturers can reduce TCO by eliminating the cost and complexity of specialized discrete accelerators for many AI workloads. They'll also boost performance by achieving up to 14x better training and inference performance compared with previous generations, and they'll optimize for the edge by running complex BF16 and INT8 matrix operations directly on the CPU (making it ideal for space-constrained factory floors). For example, a manufacturing organization seeking to improve and automate product-defect detection would save time and costs thanks to accelerated analysis of video from computer-vision cameras mounted on robotic arms.

  GDC leverages Intel processors to deliver multi-application support designed for AI. It supports both VMs and containers with optional GPU, enabling consolidation of existing and new AI-based applications on a single platform. The optional GPU support runs those visual inspection AI models directly on the factory floor, catching defects in real time. That capability eliminates the need to stream high-resolution video feeds to the cloud, solving the latency and connectivity problem.
- **A highly available and scalable infrastructure designed for edge deployments.** Google Distributed Cloud Edge offers fully managed, highly available Google Kubernetes Engine clusters and is designed for high availability in environments with limited or intermittent internet access.
- **An optimized footprint for onsite edge facilities.** Three small-form-factor servers directly connect to a location's network equipment.
- **Multi-edge location manageability.** Google Distributed Cloud Edge provides the ability to centrally manage deployments across tens of thousands of locations. Organizations centralize applications in the cloud while enjoying the latency and connectivity advantages of running applications locally.
- **Integrated automation.** Google's automation and site reliability engineering practices control operational costs while helping to ensure uptime.
- **A platform-based architecture for hybrid cloud operations.** Google's platform technology offers consistency with its public cloud services, simplifying the ability to build applications in the cloud and deploy them to hundreds or even thousands of sites in a consistent, seamless manner. This is an important benefit, as 77% of manufacturing organizations agreed that consistency of experience across data center and cloud environments delivers significant operational benefits.[3]
- **Integrated services for the infrastructure lifecycle.** Inclusive professional services accelerate deployment onsite, reducing demands on internal personnel. GDC also includes 24/7 operational monitoring and maintenance services.
- **Optimized operational costs.** Google offers the ability to reduce IT costs and resource spending with its fully managed hardware and software, eliminating the need for upfront architectural sizing

[3] Ibid.

and reducing the burden on internal personnel. Cost is based on usage to reduce the risk of overprovisioning infrastructure relative to business demand.

Conclusion

The manufacturing sector stands at a critical inflection point. AI-driven transformation is no longer optional; it is now almost essential for competitive survival. With 81% of manufacturing IT leaders reporting increased infrastructure complexity and 86% taking on additional responsibilities to support digital transformation,[4] traditional approaches to edge infrastructure are beginning to prove inadequate to meet the demands of intelligent manufacturing.

Google Distributed Cloud, powered by Intel, can deliver cloud-native capabilities directly to factory floors and other edge locations. It eliminates the latency and connectivity constraints that can otherwise limit AI deployments in manufacturing environments. The platform's ability to run visual inspection models locally, manage thousands of edge locations centrally, and provide seamless hybrid cloud operations positions manufacturers to capitalize on AI's transformative potential while maintaining operational control. In addition, GDC's pre-validated architecture, integrated lifecycle services, and usage-based pricing model remove traditional barriers to edge deployments, enabling manufacturing industry IT teams to focus on innovation rather than infrastructure management.

To thrive in the next decade, manufacturers will likely require successful AI deployment at scale across their operations. GDC provides the foundation to make that vision a reality, delivering the performance, reliability, and operational simplicity required to transform manufacturing operations for the AI era.

[4] Source: Enterprise Strategy Group (now Omdia) Research Report, *IT Transformed: Inside the Convergence of Hybrid Cloud and AI*, July 2025.

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