Technical Reseach Study

PROWESS

The Power of the Cloud at the Factory Edge

Prowess Consulting finds that Microsoft® Azure® Stack HCI can uniquely benefit manufacturers by extending hybrid and multicloud capabilities to the edge.

Forces Driving Transformation in Manufacturing

Manufacturing is the bedrock of the global economy. But manufacturers must digitally transform to stay competitive. Maintaining their competitive edge is no longer a matter of simply having better product offerings. Now, maintaining competitive advantage for manufacturers increasingly relies on applying modern technologies like advanced analytics, artificial intelligence (AI) and machine learning (ML), edge computing, and industrial IoT (IIoT). For example, a McKinsey & Company study showed that a majority of manufacturing opportunity for improvement is based on optimizing operations through transformative edge technologies such as the Internet of Things (IoT), which could represent USD 0.5–1.3 trillion in economic value created by the manufacturing industry by 2030.[1]

Edge computing is required to drive the applications and use cases that power the Fourth Industrial Revolution (Industry 4.0):

- By 2023, 30 percent of Forbes Global 2000 companies will enhance their plant-floor efficiency with digital twins incorporating real-time sensor data; this will lead to an 80 percent reduction in production bottlenecks in shop floor and warehouse spaces.[2]
- By 2024, 70 percent of Forbes Global 2000 companies will embed quality management across the value chain, including edge locations such as the supply chain and field service, reducing overall cost of quality (COQ) by 25 percent.[2]
- By 2024, 70 percent of Forbes Global 2000 companies will develop industry ecosystem digital operation centers to monitor capacity, expertise, market, and environmental conditions, which are expected to yield 50 percent faster time to market.[2]
- By 2026, 70 percent of Forbes Global 2000 companies will use AI to develop guidance and insights for risk-based operational decision making, which will need to be deployed at the edge.[2]

In light of the transformations sweeping manufacturing—and being driven by manufacturers—Prowess Consulting investigated the role of hybrid and multicloud solutions in the industry. For this study, we focused on Dell Technologies™ solutions and their enablement of Microsoft® Azure® Stack HCI in edge deployments in manufacturing. We examined Azure Stack HCI for its role in bringing hybrid and multicloud capabilities to edge deployments, such as those in manufacturing, because 78 percent of Fortune 500 companies use Microsoft hybrid cloud offerings.[3]

Hybrid and Multicloud Are Game Changers for Transformation

Remaining competitive in manufacturing requires centralized visibility and management across edge sites including factory sites, warehouses, and suppliers. Factory IT solutions must be flexible enough to handle unreliable connectivity at the edge while providing security capabilities that grow to meet both existing and emerging threats. At the same time, manufacturers must be able to unify disparate data sources to provide business insights while maintaining 24/7 factory-line uptime and the vast IIoT deployments necessary to support factory and warehousing requirements.

Increasing the capabilities of edge deployments is critical for manufacturers and their suppliers. For example, 69 percent of manufacturing infrastructure will be deployed at the edge by the end of 2023.[4] Infusing these deployments with transformative capabilities from the cloud will only grow more essential. Already, 60 percent of manufacturers perform AI/ML training at the edge, and 57 percent of them perform AI/ML inferencing at the edge.[4]

Edge computing provides enhanced scalability, repeatability, manageability, and security for critical manufacturing workloads—if manufacturers can have hybrid-cloud capabilities that can extend all the way to their edge deployments.

Azure Arc and Azure Stack HCI

Microsoft Azure is the largest manufacturing cloud service provider (CSP) by market share, making it a natural provider of hybrid cloud services for many manufacturers.[5] It provides resilient, scalable application and data services for legacy applications and software developers, in addition to robust management and governance services for IT operations. But innovation should not be restricted to the public cloud. It should be able to permeate every part of organizations' infrastructure out to the edge.

Azure Arc

Azure Arc provides a model for development, operations, and security for both new and existing applications that is consistent with the Azure cloud model. This consistency enables administrators in manufacturing organizations to use the same tools and the same security and governance technologies to create and manage application resources. Manufacturers can also continue to use existing tools to manage existing apps migrated to virtual machines (VMs) while also bringing cloud-native apps into Azure Stack HCI for performance or data-sovereignty reasons. Azure Arc provides a subset of Azure services for applications, data, and ML to use on both new and existing hardware, virtualized environments, and Kubernetes® platforms.

Azure Stack HCI

Azure Arc extends the Azure control plane to Azure Stack HCI on premises. Azure Stack HCI running on premises and at the edge is delivered as an Azure service that always remains up to date. After Azure Stack HCI is deployed, it becomes a unique and manageable resource in Azure. Administrators can use their existing skills in operationalizing this software-defined infrastructure based on Microsoft Hyper-V®, Microsoft Storage Spaces Direct, and Hyper-V virtual networking. They can also use familiar tooling like Windows® Admin Center, Microsoft® System Center, and Microsoft PowerShell® for day-to-day management. Dell Solutions offers an integrated system for Microsoft Azure Stack HCI that's designed to help streamline a multi-cloud ecosystem based on Azure.

Azure Stack HCI at the Edge: Manufacturing

Azure Stack HCI enables manufacturers to bring cloud intelligence, operations, and Azure services to the edge, close to where data is created and consumed. Utilizing cloud services at the edge through Azure Stack HCI has a number of benefits for manufacturing.

Management and Governance

The central visibility and automation provided by Azure Stack HCI enables flexibility and repeatability of manufacturing use cases across global sites to drive smart outcomes. It enables manufacturers to accelerate and manage legacy manufacturing applications with flexible re-hosting capabilities.

The flexibility provided by Azure Stack HCI also extends to manageability and provisioning. Azure Arc enables fast deployment and automation at scale of Azure Arc–enabled manufacturing application VMs. This allows VM provisioning from the Azure portal or programmatically. And thanks to Azure Kubernetes Service on Azure Stack HCI, you can deploy more modern factory applications and databases on premises from Azure Resource Manager in seconds using the Azure portal or Azure command-line interface (CLI). Administrators can also manage Azure Kubernetes Service on Azure Stack HCI using native Kubernetes tools or other third-party solutions.

Azure Stack HCI also integrates with Azure management and governance services such as Azure Monitor and Azure Policy. This integration can enable manufacturers to manage their fleets at scale using the Azure portal and Azure Resource Manager APIs from anywhere in the world.

Cloud Services

Azure Arc allows organizations to run Azure services on Azure Stack HCI, which helps with data sovereignty and regulatory compliance requirements. This connectivity can enable developers to build and test in Azure but deploy on premises without modifying any code.

Moreover, Azure Stack HCI brings intelligence to applications running on the edge. Manufacturers can build and train models on premises by using Azure Machine Learning, or they can infuse applications running on the edge with intelligence by using Azure Cognitive Services.

Manufacturers can also scale out database instances anywhere—including at the edge—using Azure Arc–enabled SQL Managed Instance and Azure Database for PostgreSQL server, which helps protect valuable data. In addition, manufacturers can run Azure App Service, Azure Functions, and Azure Logic Apps on Azure Stack HCI to deploy and manage cloud-native apps at the edge.

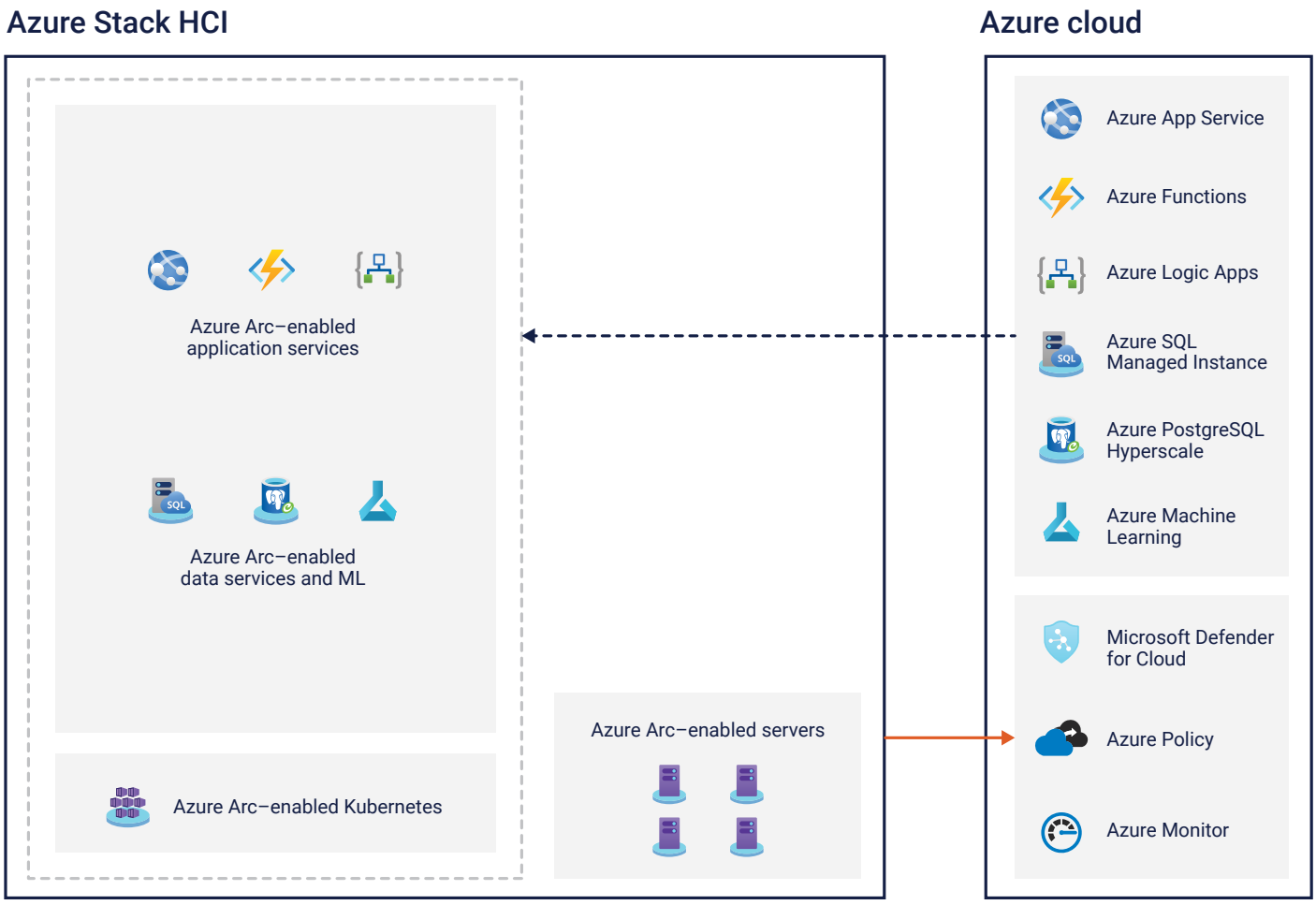

Figure 1 | Relationship between Microsoft® Azure® Stack HCI and Azure cloud services

Security

As applications become more secure, attackers increasingly target other layers of the infrastructure. One part of this widening attack surface is the edge. Azure Arc on Azure Stack HCI enables manufacturers to harden their security posture and detect threats faster, even at the edge. With it, manufacturers can monitor their infrastructure and applications from end to end in order to proactively detect, diagnose, and resolve issues. And Azure Arc also helps manufacturers conform to compliance standards and enforce organizational policies.

Connectivity

Azure Stack HCI simplifies edge computing infrastructure for low-latency applications by placing it where it is needed most—directly at the edge. While many Azure Arc–enabled infrastructure services on Azure Stack HCI ideally should stay connected to Azure, Azure Arc HCI offers an indirect connected mode for intermittent connectivity. In this indirect connected mode, Azure Arc on Azure Stack HCI can operate either fully or intermittently connected to the internet, even for extended periods of time (although it cannot exceed 30 days).

Hardware

Azure Stack HCI also supports a number of hardware features that can speed compute-intensive workloads, reduce networking complexity, and control costs.

GPUs

Azure Stack HCI supports a number of NVIDIA® GPUs, including the NVIDIA A2 and NVIDIA A30 Tensor Core GPUs. GPU support for compute-intensive AI-model training and inferencing can speed up both processes and improve AI performance.

Switchless networking

In order to reduce complexity, Azure Stack HCI supports switchless east-west traffic within clusters of up to four nodes in which each node is connected to every other node. Switchless networking within the cluster limits the need for a switch to traffic moving in and out of the cluster, which can reduce complexity and length of configuration and also lower CapEx costs.

Single-node cost advantage

Not all workloads need the redundancy enabled by clustering Azure Stack HCI servers. Azure Stack HCI can be deployed in a single-node configuration. For example, a manufacturer might save on costs by deploying single-node Azure Stack HCI to factories but be able to deploy Azure Stack HCI to more locations as a result.

Example: Azure Stack HCI in Manufacturing

For sharper insight on how manufacturers can use Azure Stack HCI, consider the example use case of a manufacturing company using Azure capabilities at its network edge. The company uses Azure Stack HCI to help replace aging PC-based applications with the cloud-ready capabilities of compute and storage in order to modernize its operations, while rehosting legacy plant applications on a more secure, scalable platform. Azure Stack HCI contains local compute and storage resources that provide AI and ML to the IIoT and other devices that need real-time performance that the latency inherent in the cloud cannot support.

IoT devices

The company uses Azure IoT Hub to enhance communication between IoT devices and applications. The company uses Azure IoT Edge to bring cloud intelligence to the IoT devices that it uses to monitor its production lines through Azure Arc. Administrators at the company manage data pipelines coming from IoT devices for processing with Azure Data Factory.

Edge processing

The company runs Azure SQL Managed Instance on Azure Stack HCI. It does so in order to take advantage of its on-site scalability and intelligence for localized insights with minimal latency.

Training

Azure Stack HCI also enables the company to train and tune computer-vision models at the edge. The company uses Azure Machine Learning to do so.

Inferencing

Azure Machine Learning running on Azure Stack HCI runs AI models in production on IoT data. It looks for patterns indicative of assembly-line machines that need maintenance before they break down.

DevOps

Azure IoT Edge running on Azure Stack HCI helps modernize the company's environment to support the continuous integration/continuous delivery (CI/CD) pipeline application deployment framework. The company's DevOps personnel can deploy and iterate containerized applications that IT builds and supports via traditional VM management processes and tools.

Azure Stack HCI Integrated Systems

Azure Stack HCI provides flexible deployment options, among them Integrated Systems from Dell Technologies. Prowess found that Integrated Systems provide a fast path forward and rapid time-to-value with Azure Stack HCI. Integrated Systems come from leading hardware vendors with services and software already installed and configured. In Integrated Systems, all components are selected and running with BIOS, firmware, and drivers validated by vendors to optimize the Azure Stack HCI experience.

Azure Stack HCI Integrated Systems also benefit from proprietary software and integrations from vendors. For example, Dell™ OpenManage™ Integration with Microsoft Windows Admin Center provides features that simplify operations for IT administrators, such as for cluster creation, hardware monitoring and inventory, and lifecycle management. Software like this in Dell Integrated System for Azure Stack HCI can increase operational efficiency for manufacturers and lighten the administrative burden.

Conclusion

Manufacturing is transforming. But success in any transformed industry hinges on bringing advanced capabilities to the edge in a scalable and repeatable way. Azure Stack HCI is a single infrastructure and management tool for a wide array of use cases in manufacturing and beyond. Prowess Consulting found that Azure Stack HCI enables manufacturers to deploy, manage, and govern applications, data, and assets at the edge where they are generated and needed, such as on factory floors and in warehouses. By bringing intelligent capabilities and consistent IT management to the edge, with solutions like those from Dell Technologies, Azure Stack HCI reduces risks and operational costs and opens new opportunities. Moreover, Azure Stack HCI can help manufacturers with other aspects of their digital transformation, such as by helping them handle legacy apps while also bringing new, cloud-native apps closer to the actual work at the edge. Proprietary software provided in Dell Integrated System for Azure Stack HCI can help improve manufacturers' operation efficiency further.

[1] McKinsey and Company. "The Internet of Things: Catching up to an accelerating opportunity." November 2021. www.mckinsey.com/~/media/mckinsey/business%20functions/mckinsey%20digital/our%20insights/iot%20value%20set%20to%20accelerate%20through%202030%20where%20and%20how%20to%20capture%20it/the-internet-of-things-catching-up-to-an-accelerating-opportunity-final.pdf.

[2] Microsoft data provided to Prowess Consulting, August 2022.

[3] Microsoft. "Cloud trends show customers increasing investments in hybrid and multicloud." January 2022. https://blogs.microsoft.com/blog/2022/01/27/cloud-trends-show-customers-increasing-investments-in-hybrid-and-multicloud/.

[4] Dell Technologies. "Enabling the Edge Use Cases for Smart Manufacturing." 2021. Data provided by 451 Research and sponsored by Dell Technologies. www.delltechnologies.com/asset/en-us/solutions/business-solutions/industry-market/enabling-manufacturing-edge-use-cases-with-dell-technical-review.pdf.

[5] Capacity Media. "Google Cloud growing 45% a year, with Azure at 40%, says Canalys." August 2022. www.capacitymedia.com/article/2afswwuvis94wy12r320w/news/google-cloud-growing-45-a-year-with-azure-at-40-says-canalys.