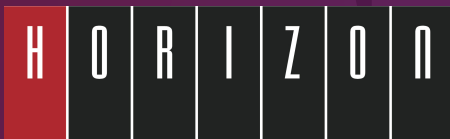


Lenovo

NVIDIA

How edge and AI solutions are transforming the ways retailers and restaurants do business

SOLUTION BRIEF



Providing customers with a seamless, efficient experience is only the first step in achieving customer satisfaction and empowerment

The situation

Competition is driving physical retailers to the edge

Since the pandemic, retailers have been ambushed from every angle. E-commerce is seizing market share, customer behaviors are evolving, and costs are soaring. These market trends enable e-commerce to harness data in ways physical store retailers cannot. Customer profiling, behavior analysis, and real-time data insights have supported better marketing, communication personalization, and service optimization.

The challenging environment has pushed many retailers to the edge, where they have found the technology to strike back — edge computing and AI.

While restaurants and quick-service restaurants (QSRs) face different market forces, increasing numbers are accelerating their adoption of edge computing and AI to streamline processes, cut costs, and gain valuable insights into their customers and operations.

Classic data center architecture is being replaced by data-centric environments, bringing the computing to the data rather than the data to the computing.



The Challenge for retailers and restaurants

A recent GlobalData study into edge computing in the retail and restaurant industries revealed, in the next 24 months:

79% of retailers and restaurants are looking to expand their omnichannel strategy.

51% of retailers and restaurants are focusing on reducing operating costs.

47% of retailers and restaurants are optimizing inventory and product choices.

39% of retailers and restaurants are seeking efficiencies through automating tasks.¹

There is also a growing requirement for retailers and restaurants to invest in technology to improve customer experience.

90% of consumers will pay more for a better customer experience (Forrester).²

74% of drivers will travel up to five minutes further to reach their preferred gas station/food retail location (NACS).³

Customer satisfaction levels trail customer expectations by 21% in retail and 12% in the restaurant industry (PWC).⁴

¹ GlobalData, 2021, Retail in 2021 and beyond: Trends and solutions with edge computing
² Forrester, 2022, How Customer Experience Drives Business Growth

³ NACS, 2022, Convenience Retailers and Consumers Agree: A Good Experience Tops Price
⁴ PwC, 2018, Experience is everything: Here's how to get it right

Lenovo + NVIDIA solutions enable faster insights and smarter decisions

In partnership with NVIDIA, Lenovo edge AI solutions empower data-centric retailers and restaurants, enhancing customer experience and optimizing internal operations. With computing power at the edge, AI can run locally, automating and improving processes while benefiting from low latency and central control through connections to cloud-based nodes. It's powerful computing when and where it is needed.

Lenovo's AI-ready ThinkEdge portfolio comprises purpose-built devices designed to be deployed on-premises. The NVIDIA AI Enterprise suite runs on Lenovo's infrastructure, accelerating the speed at which developers can build and deploy AI applications. The fully integrated AI solution delivers best-in-class availability, security, and scalability with enterprise-level manageability and high-performance data analytics. These innovative solutions help retailers and restaurants deliver business value with the agility to respond rapidly to changing market dynamics while providing an exceptional customer experience.

Most analysts predict edge computing to be the fastest-growing technology segment in the retail and restaurant industries. IDC forecasts 50% of new enterprise IT infrastructure will be at the edge by 2023 and a compound annual growth rate of 15% between 2023 and 2025.⁵ With distributed technology, free from the shackles of standalone data centers, Lenovo edge AI solutions provide the complete platform to help start or accelerate an edge AI journey.

An industry-leading edge AI infrastructure for retail

Optimized performance at the edge: Personalized end-to-end GPU-accelerated solutions from Lenovo and NVIDIA offer fast insights to drive customer experience, productivity, and performance improvements.

A trusted partnership: Lenovo and NVIDIA combine core competencies to power the AI journey for world-leading enterprise organizations. Through a strategic partnership, Lenovo and NVIDIA collaborate on R&D initiatives, AI labs, and AI centers of excellence, helping customers at every stage of their technology adoption process.

Easy and secure edge deployment: Lenovo and NVIDIA provide complete, pre-validated, edge-optimized infrastructure with record-setting performance and low total cost of ownership (TCO). The integrated solution enables the user-friendly and secure operation of AI applications with existing infrastructure management frameworks and facilitates faster AI deployment and time to value.

Management and implementation: Lenovo Local Cloud Automation (LOC-A) offers faster ROI and insights, saving time and money — and reducing carbon footprints — by automating all the manual tasks required to get an entire edge infrastructure network up and running. LOC-A allows it to happen at any scale in hours, not days or weeks as would have been required previously. The provisioning process is simplified by using a zero-touch secure utility running on a smartphone or laptop, which configures, validates, and then onboards the entire spectrum of Lenovo ThinkEdge clients and servers, with limited skillsets required and minimal travel needed.

And with XClarity edge device management tools, edge customers get an easy, one-stop management platform across the entirety of Lenovo edge devices. They no longer have to work in separate applications and screens to ensure their edge servers are online, up to date, operating at maximum efficiency, and delivering the data needed to make important, fast business decisions.

Whether on-premises or in-cloud, customers get device management capabilities with minimal footprint but with a scalable architecture.

Drive customer experience

Smart kiosks and conversational AI:

Use smart devices, touchless kiosks, automated voice order taking, and avatar-based assistant technology to process customer orders efficiently, using machine learning to analyze buying patterns, recognize repeat customers, and make personalized upsell suggestions.

Queue and wait-time management:

Utilize intelligent video analytics and pre-installed security cameras to determine queue length and wait times, identify bottlenecks, and alert store management to resolve issues before customers become frustrated or abandon their purchase.

Omnichannel experiences: Use AI and analytics to provide customers with a unified shopping experience. Share in-store promotions, stock levels, and customer reviews. Offer customers the option of ordering on mobile apps and online for collection in-store.

Curated customer experiences:

Drive perceived tangible value across a buyer's entire lifecycle by combining customer data with AI-driven analytics. Develop an understanding of tastes and preferences for ultra-personalized product recommendations, discounts, and experiences.

Demographic analysis: Gather and analyze anonymous demographic data. Learn about customers with privacy preserved. Continuously optimize messaging and advertising with amplified personalization.

Interactive signage: Transform in-store experiences with personalized signage and deliver customized offers to known customer preferences in a live context.

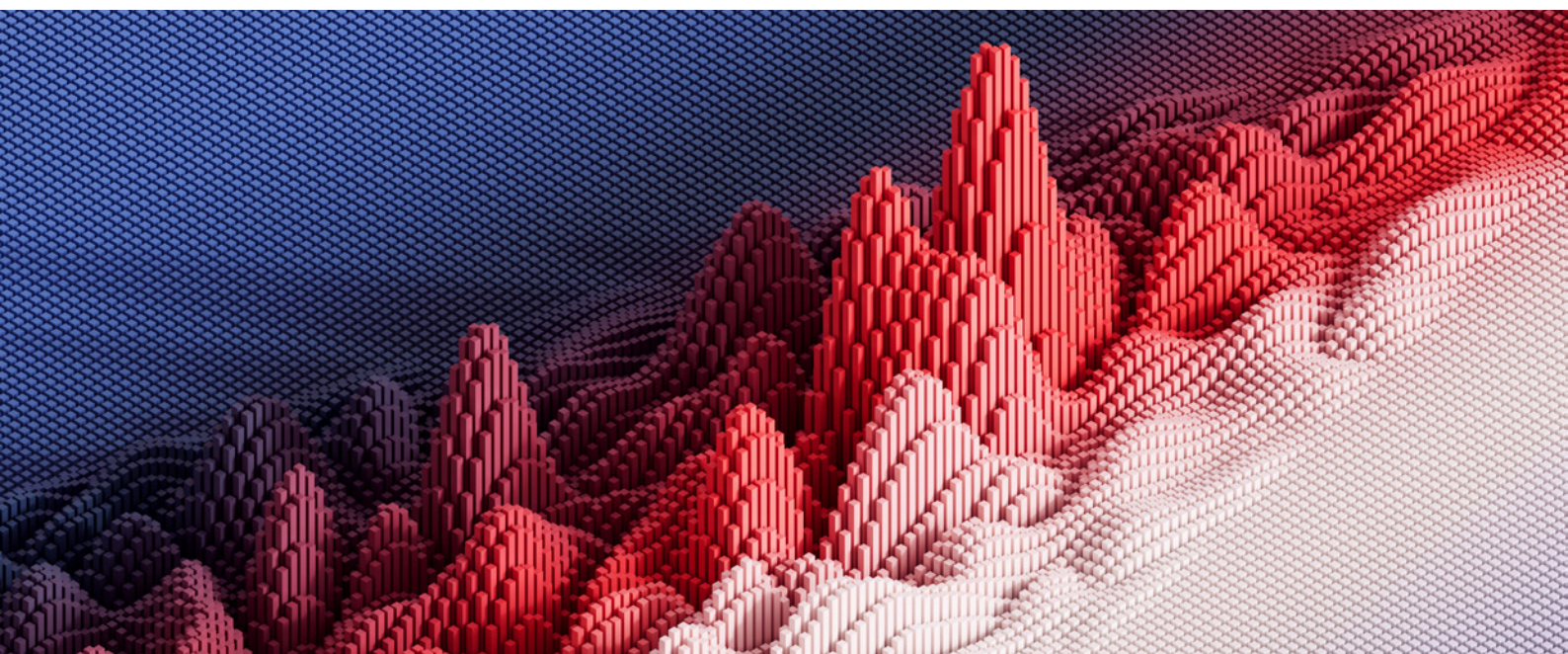
Virtual mirrors: Offer customers the opportunity to visualize apparel without the need to try the clothing on through augmented and virtual reality.

Sanitation management and alerts:

Monitor cleaning and garbage removal. Alert staff when action is needed and empower AI to suggest more efficient cleaning rotations.

Interior/exterior security and safety:

With video and audio processing, analyze events and identify suspicious or unsafe behavior in real time, perform automated safety actions using machine learning algorithms, or alert security to protect customers, employees, and the business.



Achieve operational efficiencies

Inventory inspection: Leverage computer vision to inspect and monitor inventory and gain a real-time understanding of stock/food levels and status.

- In retail and QSRs, gather insights for loss prevention and accidents, shrink, and inventory waste reduction.
- In restaurants, use machine learning to warn or alert staff when food is approaching or beyond acceptable quality thresholds.

Asset protection: Protect retail assets with machine learning to detect anomalous behavior and potential threats at the point of sale; for example, mis-scans, ticket switching, unauthorized discounts, and self-service theft.

Centralized management: Efficiently manage dynamic menus, advertising promotions, and infrastructure through a centralized hub and spoke system deployed through edge technology.

Forecasting: Use machine learning to predict footfall, product sales, and required inventory per store based on customer segments, day of the year, historical data, upcoming events, weather conditions, and promotions.

Staffing forecasting: Track workload and expected customer traffic and forecast future staffing requirements. Use machine learning to generate staff schedules based on employee preferences.

Maintenance and management: Detect equipment malfunctions before they occur and perform proactive maintenance to prevent costly disruptions of air conditioning units, refrigeration systems, lighting solutions, and more.

Energy management and ESG: Leverage edge technology to sense motion, occupancy, and weather conditions for efficient energy management, reducing operating costs and benefiting the environment. Edge computing eliminates the need to send data to a data center, reducing cloud traffic and energy consumption. At scale, this dramatically reduces energy consumption and carbon emissions, making edge computing a highly sustainable solution.



Lenovo and NVIDIA edge AI key technologies for retail and restaurants

Computing and storage: The Lenovo edge ecosystem provides a full range of industry-leading, flexible solutions. Lenovo AI-Ready Systems deliver performance, security, and scalability backed by enterprise-grade support. Lenovo's easy-to-manage storage offers compact, rugged manageability explicitly designed for edge environments.

GPU and Multi-Instance GPU: Multi-Instance GPU (MIG), available on select models, enables single GPU partitioning to run multiple simultaneous GPU instances to optimize the use of resources.

Kubernetes: Lenovo and NVIDIA offer a leading purpose-built solution for deploying, managing, and monitoring applications at the edge. The NVIDIA GPU Operator and NVIDIA Network Operator standardize and automate the deployment of all components for provisioning Kubernetes clusters.

NGC software catalog: The NVIDIA NGC software catalog is the hub for performance-optimized deep learning and machine learning applications. NGC simplifies building, sharing, and deploying software, allowing retailers and restaurants to gather insights faster and deliver value sooner.

NVIDIA AI Enterprise: NVIDIA AI Enterprise is an end-to-end, cloud-native suite of AI and data analytics software, optimized for every organization to excel at AI, certified to deploy on Lenovo NVIDIA-Certified Systems, and includes global enterprise support so AI projects stay on track, allowing organizations to focus on harnessing the business value of AI.

Edge AI Solutions for retailers, restaurants, and QSRs

AI Solutions from ISVs and Technology Partners

Customer Experience Examples

Autonomous Shopping

Adaptive Advertising

Queue Management

Last-Mile Delivery

Retail Operations Examples

Loss Prevention

Store Analytics

Stock-Out Alerts

Safety and Security

AI Libraries, Toolkits, and Containers

NVIDIA Software Catalog (NGC)

Edge AI-ready Technology and Infrastructure

Virtualization Technology and Management

Hypervisors
e.g. VMware ESXI

Storage
e.g. VMware, vSAN

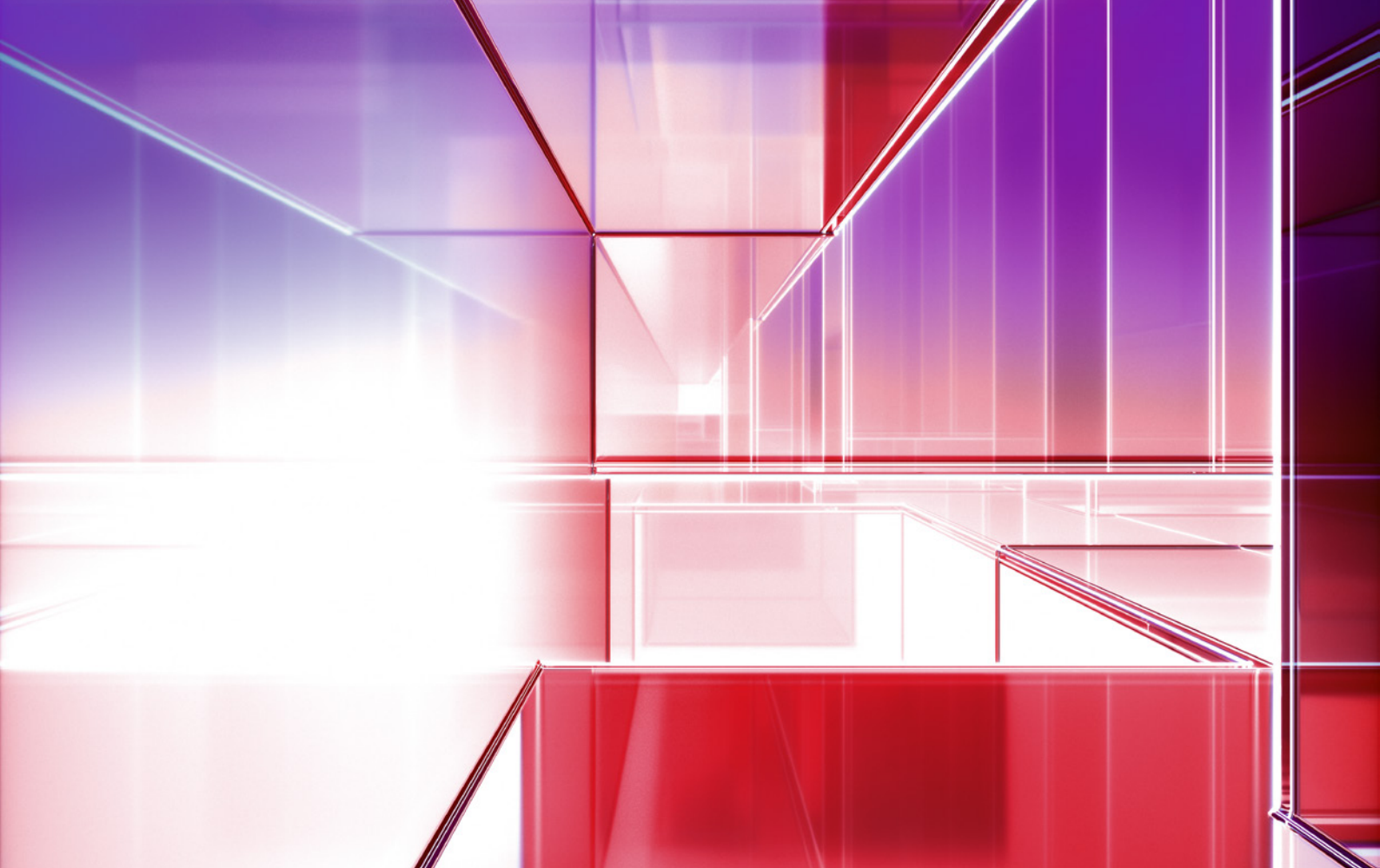
Management
e.g. Lenovo XClarity, VMware vSphere

Lenovo Server and Edge Technology

ThinkEdge Clients and
ThinkStation Workstations
e.g. SE70, P3

ThinkEdge Servers
e.g. SE360 V2, SE450

ThinkSystem Servers
e.g. SR630 V3, SR645 V3



Why Lenovo and NVIDIA?

Together, Lenovo and NVIDIA are developing world-changing technologies to create a more efficient, connected, and digital society. By designing, engineering, and building the world's most complete portfolio of innovative, AI-ready devices and infrastructure, Lenovo and NVIDIA are leading an Intelligent Transformation — to create better experiences and opportunities for millions of customers worldwide.

To find out more, visit <http://www.lenovo.com/nvidia-infrastructure>.

