

White Paper

Future of Loss Prevention: Advancing Fraud Detection Capabilities at Self-Checkout and Throughout the Retail Store

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IDC OPINION

Making a retail purchase without the assistance of smartphones and ecommerce is a faint memory for most consumers. Today, most shoppers start their research online or on their phones; however, 89% still complete their purchases at a brick-and-mortar location. Regardless of where the purchase starts, retailers are undergoing a massive transformation to meet current consumer demands and provide an in-store experience that is relevant. Retailers are digitally enabling their stores (and supply chains) to make their operations omni-channel, connected, engaging, and secure.

The intelligent digital store better serves the customer and, at the same time, better protects retail assets. With a foundation of modern, flexible, and secure edge and cloud technology, the retail store becomes more intelligent and responsive as well as more able to add value to customers and the organization. The ability to analyze and reap insights from customers enables continual refinement and improvement and ultimately higher profitability, a well-supported workforce, and happier customers. Think smart shelves that alert retail associates to restock shelves, smart dressing rooms that track product comings and goings, and computer vision that analyzes product and people movement – with the power of artificial intelligence (AI) and analytics overlaying it all, allowing retailers to dig into data and understand behaviors, preferences, and trends that they never previously had insight into.

If the store is to remain the hub of omni-channel retail, then the store needs to be digitized and integrated into omni-channel capabilities, driving organizations to reach new heights in automation, productivity, and customer satisfaction. For example, retailers are finding more ways to automate checkout with a variety of self-serve and self-checkout capabilities that optimize floor space and labor, speed checkout, and provide choice. With new innovation, however, potential new areas of fraud arise. Shoplifters, thieves, and theft rings start to discover new ways to cheat retailers, leading to increased shrinkage and reduced profitability.

AI and computer vision are technologies that retailers should be assessing to stay ahead of the fraudsters. Technology is a key soldier in the fight against fraud, but operationalizing the front of store to be efficient and effective requires the right combination of devices, data, and analytics integrated into and running on the edge, usually physically in the store itself, to set retailers on a path toward becoming a true digital, data-driven organization. This White Paper offers guidance and solutions for retailers to help prevent avoidable shrinkage at self-checkout. Advanced fraud detection capabilities at

self-checkout improve loss prevention in the short term and establish a foundation that can scale and expand to improve profitability in many other ways.

IN THIS WHITE PAPER

This White Paper outlines how retailers are incorporating computer vision and AI fraud prevention platforms into the vision for the digital store. Today, there is urgency to automate more, provide more contactless self-services, and provide safe, secure, and reliable omni-channel commerce and fulfillment. Providing a variety of self-serve and self-checkout options in-store improves the ease, convenience, and speed with which consumers can complete a transaction in a physical store, which is exactly what consumers want most of the time. Utilizing AI and computer vision helps the retailer improve self-checkout by making it smarter, reducing alerts and associate interactions, and creating a more frictionless and seamless customer experience (CX).

SITUATION OVERVIEW

Retailers will be doubling down on digitizing the store and supply chain operations. What started as a vision for transformation has accelerated into a necessity that will require reprioritizing investments. IDC expects that the automation of many facets of customer engagement and workforce empowerment will rise to the top of these priorities. The store will move in the direction of more customer self-service and higher-level employee engagement (i.e., fewer associates at the checkout counter and more on the store floor assisting customers). Utilizing AI and computer vision helps the retailer improve self-checkout by making it smart enough to reduce fraud while managing a low level of alerts and associate interactions.

Many of the technologies that make up an intelligent omni-channel store, such as AI and computer vision platforms, deliver cascading benefits. The key to success is getting a foundation in place that acts essentially as a hub to continue to solve operational issues one at a time. The digital store built on a strong foundation provides visibility to retailers and interactive, channel-agnostic, and personalized experiences to both consumers and sales associates alike.

Digitally Transforming the Store for the Omni-Channel Customer

What is an intelligent store? To answer this question, it might first be best to mention the key feature of an "unintelligent" store, which is that it is essentially a black box (i.e., what happens in the store stays in the store, and only the mannequins and M&M candies know).

In transforming stores to meet the changing expectations of the consumer, retailers wanted to provide better and more personalized experiences to their consumers and improve their own abilities to understand and meet the needs and preferences of consumers while protecting their own assets and minimizing waste and loss.

As retailers began to bring digital to brick and mortar, they did so with the ecommerce experience in mind, working out new ways to engage their customers in stores and to capture engagement analytics in the process. Several compelling advancements include:

- Wi-Fi for guest access and mobile applications that connect digital and physical experiences, giving the consumer more reasons to shop the stores' extended inventory online instead of going somewhere else to shop

- Information accessible through kiosks, digital signs, and well-equipped store associates, armed with mobile devices
- The growth of self-checkout, providing the ability to pay quickly and without any human interaction – benefits that online shoppers have grown accustomed to
- Near-real-time knowledge of product and people movement made available through various technologies including RFID, computer vision, GPS, beacons, and traffic counters, which informs better assortments, demand management, and customer engagement
- Omni-channel fulfillment options that make it easier for the consumer to choose the preferred experience from an array of offerings including buy online, pick up in store (BOPIS); fulfill from store; buy in-store and ship to home; buy in-store or online and ship elsewhere; and buy online and curbside pickup

Gathering Intelligence at the Edge

There is not one single technology a retailer can "turn on" in the store to become intelligent. An organization must start by becoming a truly digital organization – building a modern, flexible, scalable platform on which it can layer endless use cases. Building an intelligent store comes from a variety of physical technologies, including smart devices such as mobile readers, sensors, cameras, kiosks, and shelves, and a software-defined environment for collecting that data and making use of it.

This requires a big evolution and new thinking. For years, the only data coming in and out of a store typically was collected from order management and POS systems, tracking inventory and purchased items. That data was typically stored on servers on premises and sent to a centralized headquarters location at intervals. Reporting was not available in real time. Over time, those processes have improved. As retailers moving toward digital transformation (DX) have integrated their various software systems, as technology processing speeds have improved and, especially, as data has moved into the cloud, headquarters has been gaining better real-time visibility into that inventory data coming from stores.

But now, in a very short space of time, smart objects, deployed at the "edge" of enterprises (including retail stores, factories, warehouses, vehicles, and laboratories), are making it possible to gather gobs of data from just about anywhere and anything. Near-real-time insights can and should come from the edge to monitor, manage, and orchestrate intelligent processes and actions. Sensors installed in trucks can monitor the health of a truck and predict when it needs maintenance, preventing breakdowns, or can monitor driver performance. Sensors on equipment in factories can do the same. Temperatures in trucks and stores can be consistently monitored. Computer vision can provide a steady stream of data about movement of people and goods.

Today's technological advances in embedded hardware, software, and solution design provide edge systems with artificial intelligence, computer vision, real-time analytics, and resources for other high-performance workloads, which can be performed at the store level. A variety of technology providers now enable functionality and service at the edge that were not previously available. IDC's definition of edge is as follows: edge is an intermediate location between the "core" (cloud and/or traditional datacenters) and connected edge devices (i.e., IoT sensors). Common characteristics of these edge platforms include:

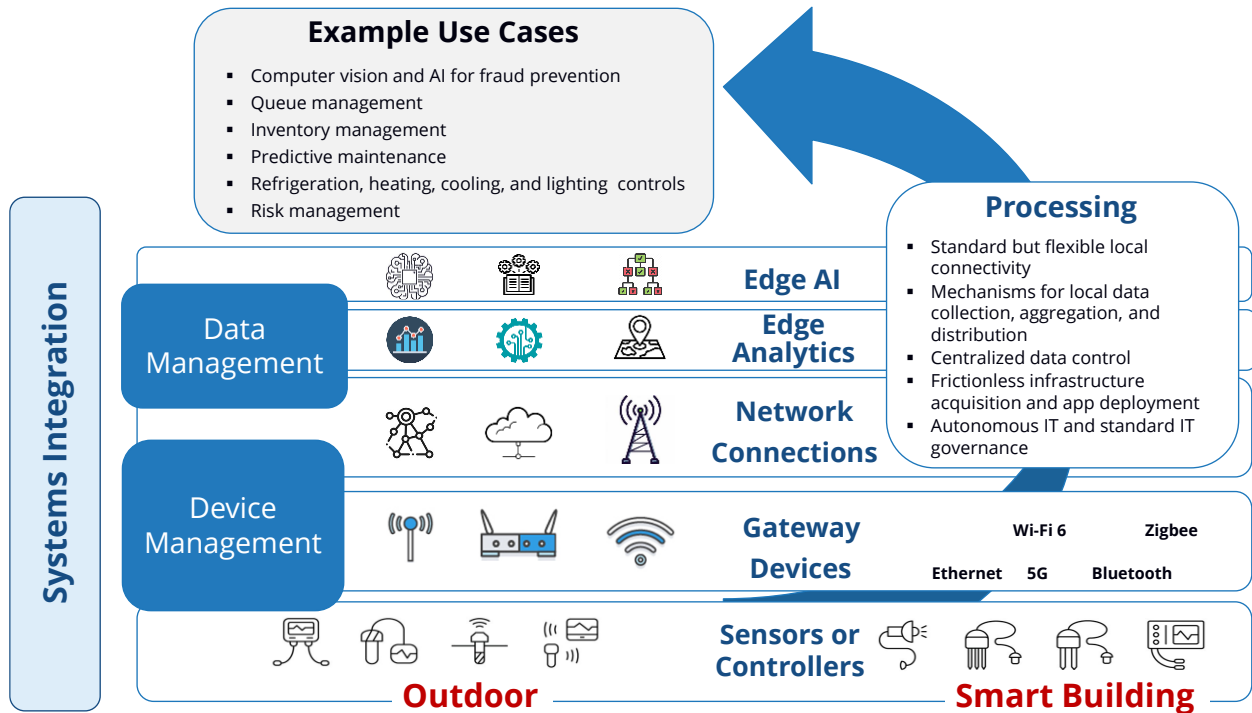
- Standard but flexible local connectivity
- Mechanisms for local data collection, aggregation, and distribution
- Centralized data control

- Frictionless infrastructure acquisition and app deployment
- Autonomous information technology (IT) and standard IT governance

There are numerous opportunities to capitalize on edge platforms in retail connected store applications, but this White Paper focuses on computer vision and AI fraud prevention capabilities (see Figure 1).

FIGURE 1

The Edge Platform for Connected Store Applications



Source: IDC, 2020

So why is tackling the loss prevention problem at self-checkout such a great place to initiate AI and computer vision-enabled platforms? Let's look at the alternatives and the value in prioritizing this initiative.

Global Theft at Retail

Before discussing how retailers thwart theft, let's look at the problem. Theft is not a new problem for retailers; they have been combatting both employee and customer theft for as long as there have been stores, working to come up with solutions to prevent both. Yet shoplifters say they are caught, on average, just once in every 49 times they steal, and chronic offenders say they are arrested once in every 100 times they steal. In total, shoplifting results in nearly \$50 billion in retail crime annually in the United States alone, according to the National Association for Shoplifting Prevention, and almost \$100 billion globally. And while retail theft and fraud have been trending down over the past couple of decades, due to the implementation of technologies such as anti-theft EAS tags and security cameras,

trends such as self-checkout stations and leaner labor forces have created new challenges, and organized retail crime (ORC) is on the rise. Another statistic on the rise is employee theft, which accounts for more than half of the estimated external theft/shoplifting total for many retailers.

Theft problems at front of store are not new. For years, shoplifters have walked out the door with merchandise they have stolen and stuffed into bags or into their clothes; for years, employees have been "sweethearting" product to friends and family by simply not ringing it up or by ringing up items that are cheaper than the items being purchased.

Anti-theft tags that set off alarms don't always work as deterrents, either. Because tags sometimes set off alarms even when deactivated, sales associates often wave the customers on, assuming a glitch and not an actual theft. Retailers typically do not pursue shoplifters outside of a store and rarely prosecute when they are caught.

The opportunities to steal are increased with self-checkout, where customers can more easily and less flagrantly take merchandise in the normal course of their checkout process. An item doesn't have to be secretly shoved into a bag somewhere deep in a store aisle while looking over a shoulder. It can be openly placed in a bag as customers move items across the scanner, purposely avoiding some – likely the more expensive items – as they go.

Alternatively, in what is dubbed "ticket switching," a customer may scan a far less expensive item in place of a big-ticket item, placing both in the bag casually as if nothing out of the ordinary is happening. And, unfortunately, it is not all that out of the ordinary. As mentioned previously, the installation of self-checkout stations can initially be a shock for retailers when they see the associated shrink.

Typical shrink at retail, 1.8% on average but ranging from 1.5% to 2.5% of annual revenue depending on the retail segment, can spike when self-checkout is implemented. Self-checkout necessitates better loss prevention methods at the front of store. Technology can help. Today, 26.4% of retailers say they are currently deploying a loss prevention solution and 25.2% are piloting a solution or working through a proof of concept.

Keeping an Eye on Product and People

Today, many retailers deploy cameras and EAS solutions and some utilize RFID-enabled systems to thwart theft in the store and at the door. Some of the different ways retail currently utilizes technology to perform loss prevention are as follows:

- **EAS.** The sound of the EAS alarm sounding at exit is familiar to most people because EAS devices are only as effective as store associates make them. Leave a tag on a product or forget to deactivate it at checkout, and the alarm sounds, creating an embarrassing situation for a good customer. An unfortunate consequence of unwarranted alarms is that store employees sometimes ignore them unless the retailer has dedicated loss prevention or security staff tasked with the responsibility of taking action. Criminals have also found ways to shield the tag so that they can leave the store with undetected booty hidden somewhere on their person or in a bag. Recent innovations leveraging real-time monitoring and analytics have improved the performance and reliability of these systems, with improved uptime and fewer nuisance alarms.
- **Cameras.** Retailers leverage camera data in a variety of ways. Most of the big-box operators have loss prevention or security staff that actively monitor the store for theft and other risky

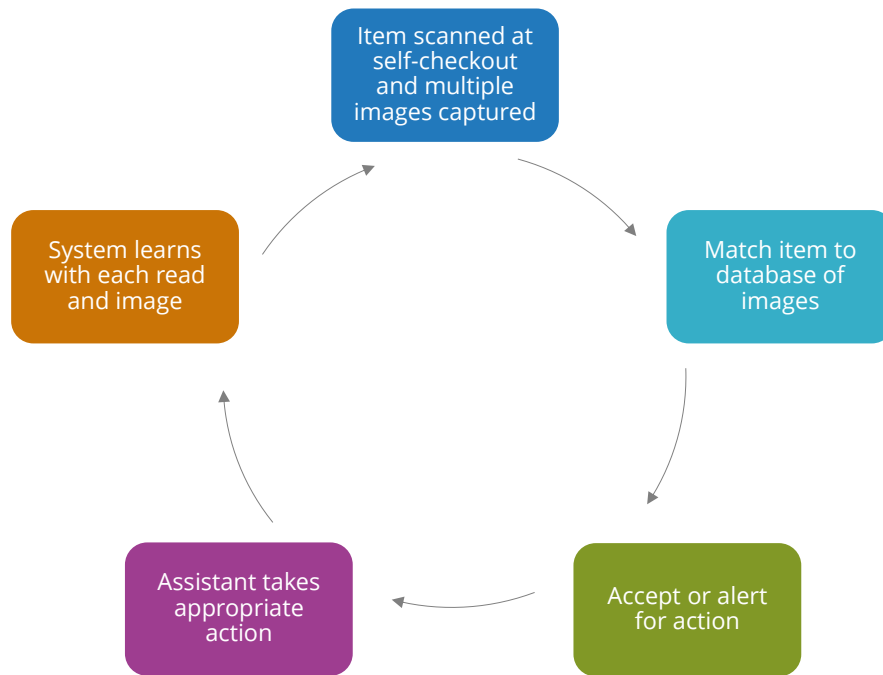
behaviors. Other retailers collect and store a week's worth of video, or more, in case they need to do discovery or get proof of a crime.

- **RFID-enabled loss prevention (often coupled with inventory management).** Apparel, sporting goods, and jewelry retailers are the most frequent users of RFID-enabled loss prevention solutions. Most items are tagged with RFID labels or hard tags, such as EAS, which makes this effective, but most retailers still haven't justified RFID tagging many of their products.
- **Organized retail crime prevention networks.** Retailers often work with loss prevention networks to get ahead of ORC. They report crimes to the network and receive alerts in return so that they can warn security in neighboring stores.
- **Self-checkout fraud prevention.** Classic self-checkout systems detect variances to expected weight and alert a self-checkout shopper assistant to validate that the item has been scanned correctly. In the past, frequent alarms impeded the speed of self-checkout, but retailers have generally improved the accuracy of the data and/or changed the weight tolerance on each scan so that the transaction is not disrupted as often.

While each of the previously described capabilities plays a valuable role in thwarting theft in retail, imagine the improvement in performance possible with an AI- and computer vision-enabled platform that "learns" – that continually improves on its ability to identify and validate items accurately – so that nuisance alerts don't happen as often. Video and AI combine to be powerful catalysts to reduce theft at self-checkout (see Figure 2). Today, a cohort of devices, aided by software and AI, can be brought together to "see" products as consumers bring them through checkout to identify, in real time, if the UPC barcode they are scanning matches the product that they are taking and to alert an associate immediately.

FIGURE 2

Self-Checkout Fraud Prevention with Computer Vision and AI



Source: IDC, 2020

Here's how computer vision and AI fraud prevention work.

As a customer scans an item at the POS self-checkout, an overhead camera sees the item being scanned, and it matches that image with the item that has been scanned at POS to see if the item is one and the same. The cameras are tied to the POS system so that there is a time stamp linking video to purchase transaction.

If the two do not match, the system can be set up to generate a dashboard or mobile alert to a store supervisor or staff as soon as the transaction is complete and to freeze interactions before they are processed, allowing the retailer to review the video immediately to see the ticket switching and take immediate action, whatever that may be. In fact, with a system that works in real time, a retailer is provided with a way to remediate the situation without ever having to confront a customer with an accusation of shoplifting (i.e., the retailer can simply advise the customer of a discrepancy in the system and give the customer the opportunity right then and there to pay for the items that weren't rung up or to leave without them). Retailers may also choose to do nothing at all, but with the analytics gathered from the video, they learn lessons that can be applied to how merchandise is tagged or where it is placed in the store that can help mitigate loss further.

With Artificial Intelligence, the System Learns by Itself

Items, of course, are scanned at different angles, held by different sides, and moved across the scanner with different flourishes and speeds – and many products look alike. So how does the system know it has made a match? This is where AI comes in. As items are scanned, the self-learning system

collects the video images and ties them to their identifying UPC barcodes. Over time, as that item is scanned repeatedly, the computer builds up knowledge of the many faces of the product, getting better and better over time at recognizing and identifying the item with computer vision, with increasing ability to match the item record to the POS database with extremely high accuracy and to manage that for high numbers of products, in the 100,000 SKU range. When the computer sees something not already in the database, it adds it. Just 5-10 scans of an item are typically required with some systems to achieve repeatable accuracy nearly all the time. The camera can also be trained in advance to recognize images of items fed in different positions; even without a dedicated effort to complete such an exercise, the computer vision tied to video analytics will quickly learn to recognize products and match them to POS.

Not all vendors operate within the same context, and product category and store format will be the biggest contributing factors to how retailers prioritize computer vision and AI fraud prevention measures. Retailers of CPG products, grocers, general merchants, and convenience, home and garden, specialty, and drug stores have the greatest install base of self-checkout solutions to date and are the biggest beneficiaries. But apparel and softlines retailers – primarily department stores, fashion, and general merchants – will find the greatest fraud prevention benefits in other areas of the operation. For example, mall-based operators have the highest rate of employee theft (about 60%), and therefore, computer vision at checkout can stop sweethearting. When extended to other areas including lockers, receiving, and stock rooms, employee theft can be detected with greater reliability. That said, all retailers benefit from monitoring additional areas. Table 1 highlights a list of the most likely areas of focus by retail segments.

TABLE 1

Computer Vision and AI Fraud Prevention Priorities and Sequencing

	Apparel and Softlines Retailers: Primarily Department Stores, Fashion, and General Merchants	Retailers of CPG Products, Grocers, General Merchants, Convenience, Home and Garden, and Specialty and Drug Stores
Self-checkout scan validation	X	X
Checkout area (self and staffed)		X
Bottom of basket at checkout		X
Sweethearting	X	X
Receiving	X	X
Employee lockers	X	X
Trash and recycling	X	X
Entry and exit doors	Mall operator	X
Parking lot security	Mall operator	X
Whole store	Whole mall	X

Source: IDC, 2020

Loss Prevention: A Good Place to Begin

As retailers work toward digital transformation, the possibilities unfold. No matter the size of an organization, however, resources are always limited, and it's impossible to tackle all challenges and

opportunities simultaneously. Customer experience is an attractive opportunity to pursue, but it can be difficult to quantify results. On the other hand, loss prevention is a standout when it comes to its quantifiable nature and ability to turn a quick return on investment (ROI). Retailers that have implemented the types of systems at self-checkout described in this White Paper have seen as much as a 40% reduction in shrink in as little as six months.

Start small, with a pilot project and a single checkout lane, so that you can test as you go, learn lessons, and ensure that you can keep your business running without skipping a beat.

When you have implemented successfully at one self-checkout lane, you can scale by expanding your visibility with more cameras and to more lanes. From there, you can leverage your system by integrating to other cameras within and outside of the store and into other loss prevention capabilities well beyond the self-checkout area.

Once the AI and computer vision platform is in place, many additional use cases can be implemented including customer engagement analytics, curbside pickup (license plate identification), parking lot security, in-store security, in-store inventory management, risk avoidance, and tie-ins to customer engagement via digital signs, POS, kiosks, smart shelves, and augmented reality.

FUTURE OUTLOOK

The Intelligent Digital Store

Moving into the future requires a digitally transformed organization residing on a strong, modern infrastructure that combines a core foundation, cloud, and edge technology, both operational (OT) and informational. The intelligent store is agile, able to quickly adapt to new shifts in consumer behavior and trends and changes in product portfolio, store operations, and processes. With a strong foundation that enables agility, an organization can move quickly to build and scale technology to solve real challenges that return and add money to the top and bottom lines.

With a portfolio of core, cloud, and edge systems and technologies working together, the store becomes a complex organism, an ecosystem, that begins to provide understanding around customer demographics, customer actions and engagements, inventory analytics, store systems, and facilities analytics.

Recommended Best Practices

- Start small in one store with a few self-checkout or kiosk devices.
- Focus on the process:
 - Is the system reducing false positives? (More false positives create disruptions and lead to less trust.)
 - Decide how to engage if a situation arises. What is the most optimal experience?
- Establish a plan for program extension. Decide when more lanes or stations will be monitored or when to implement additional processes (bottom of the basket detection, items scanned with a handheld scanner, and additional product categories including apparel).
- Decide on the metrics of success that warrant enterprise rollout.
- Establish a plan for cost-effective solution rollout.

Considerations for the Future

IDC expects that retailers will accelerate investment in capabilities to reduce the friction in commerce, store-level inventory management, delivery, pickup, and so forth in the next 12-18 months. Longer term (i.e., the next two to three years), investment in digital transformation will move the industry closer to the vision of the future store, with more automation to drive efficiencies and value from store footprints.

Computer vision and AI will enable a long list of use cases in retail, and initiating an effort to reduce fraud at checkout is practically a no-brainer. Start conservatively and dream big. Ultimately, camera data will improve physical security, loss prevention, merchandising compliance, inventory management, and a number of other use cases in stores. The edge platform enables much more: it provides the foundation for the connected store.

CHALLENGES/OPPORTUNITIES

Orchestrating a scalable end-to-end edge solution is a complex endeavor and requires open and intelligent edge platforms that can support the integration of a wide variety of third-party solutions. With an increased number of workloads being run at the edge, a retailer needs software-defined functionality as well as flexible software and hardware architecture that enables greater scalability.

Identifying the right self-checkout system for your business is a complex task. It requires an integrated solution that includes a strong core foundation, cloud, and edge technologies that can interface with each other. Data is generated from cameras, sensors, and other devices, and servers store, process, and analyze that data on location. Staying ahead of the fraudsters requires:

- Cameras
- AI and analytics
- API-enabled integrations
- Mobile device alerting
- Facial recognition
- Ruggedized field-grade servers/systems
- On-premises microdatacenters

You will also need:

- A business and IT team that understands the challenges of selecting, implementing, and making a front-of-store loss prevention system successful
- A labor force trained to understand how to react to and manage shoplifting when it is identified

CONCLUSION

Necessity is the mother of invention/innovation, and retailers now understand that they need to accelerate technology investments in the store to enable omni-channel commerce and fulfillment. Customer-centric and pragmatic retailers will make the investments that will drive improvements in productivity and profitability. Computer vision and AI at the edge enable more frictionless and contactless commerce. The future connected store will operate at a faster pace, process transactions

more accurately, and require less employee interaction, adding up to greater growth and profitability opportunities.

It's already possible now to start creating the connected store of the future; and many retailers are well on their way to seamless and frictionless retail. But companies need to start with use cases that provide fast return on investment that enable them to start building a core foundation based on cloud and edge technology and infrastructure. Leveraging customer self-serve and self-checkout improves employee productivity and customer satisfaction, and computer vision and AI reduce fraudulent customer behavior, further improving profitability. With quick ROI and self-learning capabilities under their belts, retailers will be emboldened to expand and dig deeper into the capabilities of these integrated technologies storewide.

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