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HARD DATA, SMART DECISIONS

Retail On The Edge

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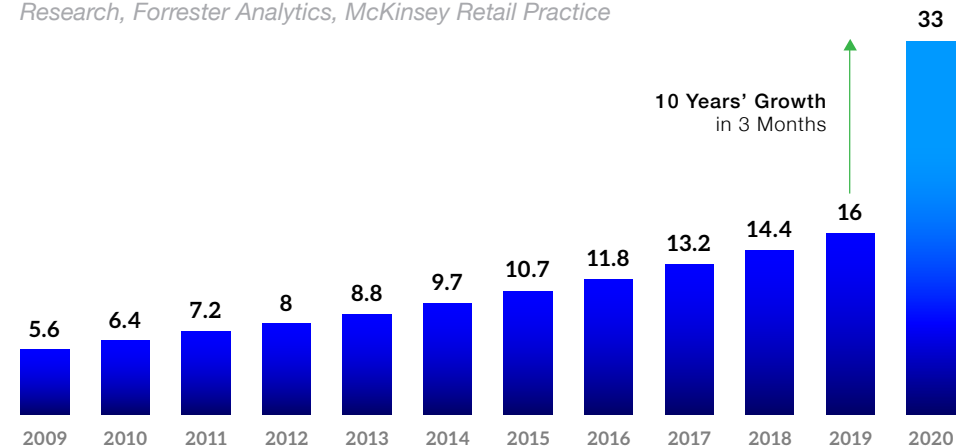
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# Retailing Today

With a title like **Retail on the Edge** it is easy to deduce that we are talking about the challenges of retail based on the COVID-19 pandemic. We have seen massive changes around the world since the year started. And like many retail trends that were growing already, the pandemic pushed ecommerce in all its facets into hyperdrive. US Department of Commerce data shows that due to the surge in late March and April, online shopping saw the equivalent of 10 years or organic growth in the first 4 months of 2020. However, this is only a portion of the reason for Retail on the Edge.

While pure-play ecommerce growth alone would challenge many retailers, it is the explosion of new customer journeys such as Click and Collect, Buy Online Pickup in Store, Local Delivery from Store and Ship from Store that have added a great deal of complexity to the retail operations. Retailers have also seen a proliferation of IoT devices ranging from mobile devices, CCTV, self-service systems, RFID, Computervision, kiosks, digital signs, electronic shelf labels and others that are generating massive amounts of data at the store level. Software systems including shelf planning compliance, video analytics, and new mobile applications are all involved and the data generated simply can overwhelm LAN and WAN networks. Finally, there is the unique challenge of management that can come with all of these devices, leading to the needs for virtualization to simply manage and maintain security and operations in the systems.
So when we talk about Retail on the Edge, yes it involves the rapid change of retail, but our focus is on where the processing of all these data inputs reside.

## U.S. E-COMMERCE PENETRATION, %
*Source: Bank of America, U.S. Department of Commerce, ShawSpring Research, Forrester Analytics, McKinsey Retail Practice*

**10 Years' Growth** in 3 Months

| 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|------|------|------|------|------|------|------|------|------|------|------|------|
| 5.6 | 6.4 | 7.2 | 8 | 8.8 | 9.7 | 10.7 | 11.8 | 13.2 | 14.4 | 16 | 33 |

## GROCERY CLICK & COLLECT AND LOCAL DELIVERY SURGES
*Source: Company Reports*

# 350-400%
GROWTH DURING PANDEMIC

# Drivers to Edge Computing

WHAT IS THE EDGE?

Like many terms that emerge in retail, you will get many different definitions for edge computing is. For a single definition we use the following: ***the edge is a new architecture that includes the optimal place of processing of data which is outside of the data center and does not rely exclusively on cloud computing, but relies on virtualization and system consolidation to balance management, cost and store experience. It includes processing optimization, network optimization, security optimization, and operations optimization.***

When we talk of edge computing it is easy to think only about data created in the store and accessed at home office, creating streams of data out of the store. But equally important is managing the data streams and analytics that come back into the store in real time. So when we talk about edge computing, it is about the processing on one side as well as the insight and access from fast and relevant data coming back.

Within that edge computing definition there are several subcomponents that are specific to where the processing is best optimized.

## MICROSERVICES ARCHITECTURE

## +750%

## EDGE COMPUTING

## +460%

**DEVICE LEVEL EDGE** This is the edge where the processing is best completed in the IoT device itself. This is necessary because the amount of data generated (most often from imaging) would overwhelm the WiFi networks. Examples here include robots checking inventory, CCTV cameras checking shelf-compliance or frictionless retail operation that check consumer baskets.

**SHELF LEVEL EDGE/ACCESS POINT EDGE** This is edge computing where tools related to shelf inventory with weighted shelves, perpetual RFID monitoring, price management for ESLs or other digital signs that are interacting with consumers in real-time might be used. The processing needs are heavy enough on an individual basis because of the times per second things are monitored, so the processing at the edge simply sorts through what has changed since the last read and passes along the network only what has changed each period.

**BACK OF STORE EDGE** This level of edge computing is where we to see the power of server consolidation, virtualization and containerization come into play. Put simply, rather than a

server spinning up a complete copy of the operating system for each application, containerization allows for the sharing of core operating system functions across applications allowing for many servers to be consolidated into a single box. This level of edge computing is specifically around processing the data before it is passed up the WAN connection and for internal interoperation of apps within the store.

**UPSTREAM EDGE** While we would generally refer to cloud computing as centralized computing outside of the physical location, the emergence of 5g has opened the opportunity to greatly speed the processing and servicing of applications that would previously be centrally hosted or back of the store hosted, but can now include neighborhood/city/regional processing edge that perform similarly to if the application was hosted inside the back of the store. 5g not only provides for increased speed, but the drop in latency from 50ms to less than 7ms provided by the integration of 5g and edge computing makes the difference almost imperceptible for browser-based applications. So, for a company with a number of stores in a city, this allows for mission critical applications to be housed closer to the stores but with consolidated management and reduced processing where the software solutions also are optimized as if in the store location.

## EDGE SYSTEM ARCHITECTURE A KEY TO OPTIMIZING NEW CUSTOMER JOURNEYS

When edge computing used, how much more likely are retailers to have optimized each customer journey prior to COVID surge/impact?

**82%** SHIP FROM STORE

**127%** BUY ONLINE, RETURN IN STORE

**128%** BUY FOR PICKUP IN ANOTHER STORE

**134%** LOCAL DELIVERY

**139%** CLICK & COLLECT

**168%** BUY IN STORE, SHIP FROM WAREHOUSE

*Source: IHL Group - Rise of the Digital Store*

# 7 Decisions to Make When Deploying Edge Computing

When retailers move to edge computing there are specific decisions that must be made along the way. The steps are the following:

**WHERE IS THE DATA BEST PROCESSED?** As we discussed earlier, at the core of edge computing is the optimal location of processing for each IoT input that includes consideration for the mission critical nature of the data, the type of data, and how much data is being generated. Most often it is the LAN and particularly WiFi that can get quickly overwhelmed if this decision is wrong.

**WHAT DATA TO KEEP, WHAT TO DISCARD?** The very nature of IoT devices includes the opportunity to continually monitor the things they measure. But a great way of reducing the network and data challenge from the devices is that after the baseline data set, the only data that needs to be passed along to the end storage system is that which has changed since the last measuring period. So for instance, a perpetual RFID system can generate a read every second or less. If there are 20,000 items with tags in a store, after the initial complete update, the updates every second can be only the 100 items that might have moved in the last second. So the sensors read all 20,000 items, but if 19,900 have not moved, the only data pushed up the network are those 100 that changed.



**WHERE IS DATA BEST STORED?** In most cases, this is a decision that is at the back of the store edge, upstream edge or in the cloud. But some IoT solutions create unique storage challenges. Using the RFID example again, the technology allows for each item to have a unique identifier to that device. What this means is that instead of having a UPC or a SKU that is a parent with so many items (let's say 50 items per store and 500 stores), now each item is it's own specific record and 25,000 times more data if you track at that level. There are clear benefits for ship from store, click and collect, reduced return fraud for RFID, but retailers must determine which data they can reasonably measure and manage.

**HOW TO BEST MANAGE THE SYSTEMS AND DATA?** Retailers need to realistically decide what data is actionable and what data do they have the resources and desire to use. Even before IoT, retailers have been data rich, knowledge poor. The data must be clean, actionable, and be used by their staff to be beneficial. You need to manage the data and manage the systems themselves. Thankfully, edge computing provides tools for virtualization and management to help simplify management to make life easier for retailers.

**WHAT DATA NEEDS TO BE STREAMED OR BATCHED?** IOT and edge computing shift the store to being both a data destination as well as a data source. What was primarily a discussion on limits of data downloaded to the store is now about data uploaded. However, not all data needs to be streamed in real time. For instance, inventory change, orders, POS, labor stats and many IoT sensors monitoring energy usage or video must be monitored in real time and requires streams of data. Others, such as daily reports, CRM and loyalty data needs only be reported in batch during off-peak times. A computer vision application monitoring self-checkout services can generate orders of magnitude more data streamed from the store than in the past thus impacting the network store connectivity models.

**WHAT DATA IS NEEDED BACK IN REAL-TIME?** When it comes to operational snapshots, solutions upstream in the cloud are able to consolidate the data from the store in real-time and provide a dashboard of comparison of other stores in the region. This allows for immediate adjustments in pricing, promotions and other operational tweaks. Here, the key thing is the insight from is a continuous streaming handshake between the stores and the enterprise so that the information can be timely and actionable. Retailers must decide if the interaction of systems is best handled within the store or upstream. A real-life example could be a deli order. A barcode is printed when you order that 1lb of turkey. That information needs to be entered into the PLU database. If the only checkout option is at the store level, this data does not need to be uploaded to a central database before deploying to the PLU lookup for the POS systems. However, if you are allowing frictionless checkout via a consumer's device and app, you do need to have that data uploaded as soon as it is created so that when the consumer scans the item, it shows up appropriately on their app. This both ensures better security and enhances the customer experience.

**HOW WILL YOU STAGE, DEPLOY, INSTALL AND MAINTAIN YOUR EDGE?** While on the one hand edge computing allows for the consolidation of servers and devices, edge computing is primarily adopted because of the proliferation of devices and inputs in the store. Asset management, virtualization, maintenance, and procurement are critical components. As you deploy, choosing the right service partner that can limit the number of calls and optimize the cost considerations becomes a key part of the edge computing decision process. Having too many hands in the maintenance process opens security holes and increases cost.

## EDGE COMPUTING SUPPORTS HIGHER INVESTMENTS IN TRADITIONAL TECH

How much more likely current users of edge computing are to invest in these systems this year.

*Source: IHL Group - Rise of the Digital Store*

| | |
|---|---|
| POS | 56% |
| Self-Checkout | 194% |
| Consumer Mobile Checkout | 90% |

0    100%    200%

# Common Catalysts for Edge Computing Architecture Decision

When considering edge computing, the options can be overwhelming if you decide to jump right. There is usually some sort of catalyst need that helps drive the move to edge and it is usually some large need to upgrade that broadens into a bigger review. Coming into 2020, some of the key drivers that made retailers consider a move to the edge architecture were related to updated checkout technologies or to support for all of the new digital journeys that have an online purchase but a store level fulfillment component. The reasons can vary dramatically by retailer and segment. A need to refresh how POS is done at the store is usually a key driver. In our recent study, retailers who were prioritizing either a POS Infrastructure Upgrade or POS Concept Evolution (single app across devices) were 52 and 39 percent more likely to be deploying edge computing architecture. Retailers supporting new customer journeys like click and collect, local delivery, and checkout via an app on the consumer's device are also 45% more likely to deploy edge computing.
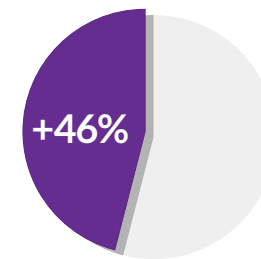
## PRIORITIES THAT CORRELATE TO EDGE COMPUTING

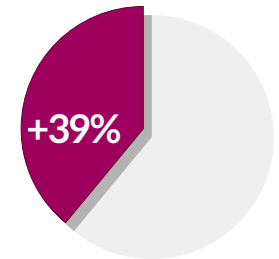Retailers prioritizing these items are far more likely to deploy edge computing architecture compared to others.

*Source: IHL Group - Rise of the Digital Store*
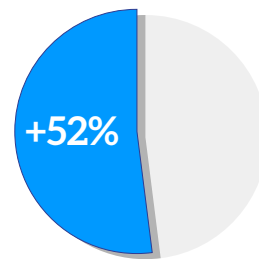


**+52%**
POS Infrastructure Update

**+46%**
Customer Journey Design & Support

**+39%**
POS Concept Evolution (mobile/consumer checkout)

Since these are often the catalysts, the primary initial edge solution surrounds the back of the store. Here we are looking at solutions that provide for improved usability, common applications across devices, server consolidation due to optimized resources, virtualization, and management.

The next option is usually around optimizing the network for all the different IoT devices providing data input at the store level that require constant monitoring or image/video content. These solutions work in conjunction with the back office or upstream options, however, the data generated is so massive

that the actual processing must occur at the device level first or it will overwhelm networks. Examples of this are computer vision for inventory control, space planning compliance, CCTV solutions for loss prevention and/or operations, heat mapping, and shopper tracking solutions. These devices then must be secured and remotely managed on a schedule, but they are often processing independently and consistently.

These first two components are primarily around processing inputs within the store, but retailers of today must also both share upstream and download data in real time. It is about having fast data, removing latency, and supporting real time operations while enjoying the benefits and analytics that can be done through computing outside of the facility but in near proximity. These are solutions that are focused on the impacts that require streaming data and analytics. Think dashboards, digital orders, and actional analytics. Solutions here are leveraging regional data centers or emerging technologies like 5g with its improvements of speed and lower latency to move some processing outside of the store without sacrificing performance.

Finally, 5g is opening the door to even further customer service options at the store level that many retailers wouldn't deploy today. Due to network limitations and security concerns, many retailers would greatly limit product brands from deploying their own devices for customer service at the store level. However, 5g opens the opportunity for a brand to have their own self-service kiosk and expert be available at the point of decision in stores that would support video communication. And it can

do so without having to touch the retailer's network. Imagine always being able to speak to an expert for that home improvement project while in store who can guide you to exactly what to purchase for your situation, eliminating the 3-trip to the store project. Edge computing, as individually deployed by retailers, will include of these types together as we move forward. What is best will be determined by the type of retailer and their specific needs.

# Why the Future is Edge Computing

At IHL we firmly believe that edge computing is critical to retail's future success in this decade. For the past 7-8 years the retailers that have succeeded were early to embrace ecommerce and the need for a single version of the truth on their data regarding inventory (across the chain) and customers (regardless of channel shopped). This then moved to providing associates better tools for saving the sale or inventory visibility through mobile or POS access across the change. The leading retailers such as Walmart, Target, Kroger, Macy's, Levi's, Lululemon, Tesco, Adidas, Marks & Spencer and others are now leading the charge in using computer vision and RFID technologies to get to accurate inventory counts in real-time at the store level to support all of the new customer journeys. Most retailers are off 15-25% on their inventory counts and spending significant amount of money on extra inventory or simply losing sales. As well, retailers are losing 3-8 margin points vs walk in customers on these journeys if those systems and processes are not opt-in. Having accurate inventory counts to support Click and Collect, Local Delivery, BOPIS and traditional walk-in customers is crucial. But this is just one area where IoT and edge computing can add value.

The bottom line is that the retailers that not only survive and thrive in the next decade will be those that are able to apply Artificial and Machine Learning to operational data at the store level. Yes, ecommerce is key part of retail's growth, but the key advantage that retailers have over pure-play ecommerce competitors is the stores and proximity to the customer. Optimal inventory, optimal processes and optimal delivery are key to this success and all will require edge computing to be successful. This requires the processing of massive amounts of data that can only be done by computing on the edge. So retail is not only on the edge, but it's future is on the edge. Those companies that recognize and leverage this first will win the decade. First one to clean data to apply.

## HIGHER % OF DIGITAL REVENUES WHEN USING EDGE COMPUTING

*Source: IHL Group - Rise of the Digital Store*

**5%** SHIP FROM WAREHOUSE

**34%** LOCAL DELIVERY & OTHER METHODS

**46%** SHIP FROM STORE

**150%** CLICK & COLLECT

▶ Age of Systems Integration for Unified Commerce

▶ Better Tools for Associates

## THE NEXT BATTLEGROUND IN RETAIL *Source: IHL Group*

▶ Fixing Inventory Issues

▶ AI/ML on Store Operational Issues

2015          2020          2025