A Microservices Approach to Improving Inventory Availability and Order Optimization

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Retail IT professionals are under tremendous pressure. On one hand, competition from Amazon and evolving consumer behaviors are requiring the rapid delivery of complex, convergent, and immersive online and in-store shopping features.

On the other hand, rising order volumes and the volatility of peak season make it difficult for IT organizations to plan for and scale to forecasted and unexpected spikes. This is the reality every retailer faces in today's modern commerce landscape.

This modern commerce reality is forcing IT organizations to rethink their present commerce strategies, technologies, and architectures. Based on our research, and engagement with many of the top retailers in the world, inventory availability and order optimization sit at the very center of these transformation efforts. Why? Because the features required to unlock the convergent experiences business leaders and consumers alike want, current order management systems (OMS) fail to optimize inventory and orders with the scale, modern architectures, and intelligence required.

In this white paper, we've summarized the approach that top retailers and IT leaders in the industry, many of whom are Blue Yonder customers, are taking to address modernizing inventory availability and order optimization. We also discuss their approach and best practices, which, we believe, companies should consider when trying to improve the performance of their commerce businesses (both technology architecture and sales).

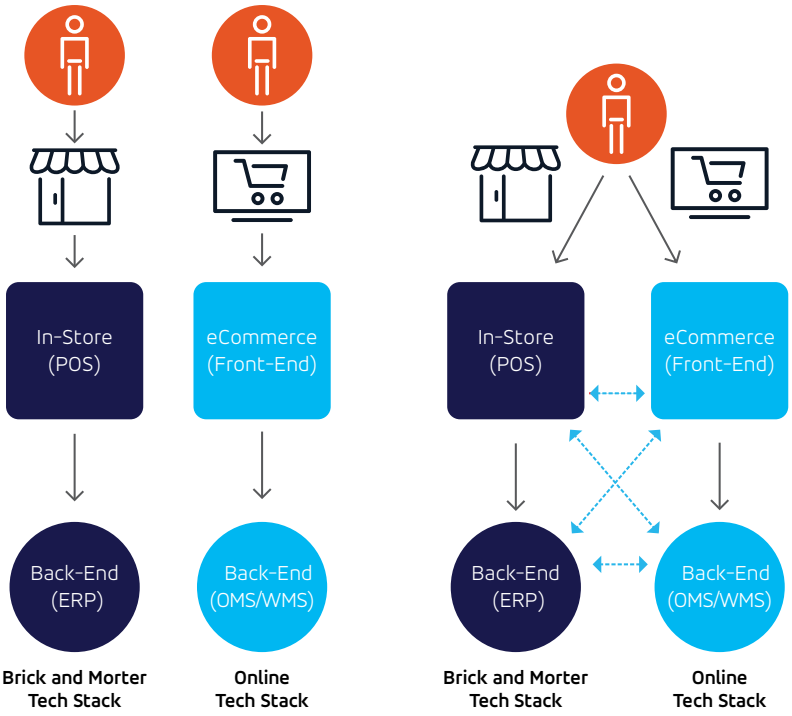
The Current Commerce Technology Landscape

As introduced above, the current retailer landscape is one where the business strategy and needs of the consumer have outpaced the technology capabilities of their present technology and software approaches, whether homegrown or through previously installed packaged software solutions. Traditional technology stacks struggle to effectively support the demands of the modern consumer – and that of "New Retail" – which include the following:

- A unified, integrated experience across channels (i.e., omnichannel)
- Customer-centric speed and convenience delivery offerings, such as
  - **Immediacy** (e.g., same-day delivery)
  - **Fast & Free** (e.g., free 2-day, next-day delivery)
  - **Convenience** (e.g., curbside pick-up, timeslot delivery/pickup, calendar delivery)
- Intelligent systems capable of understanding and recommending the optimal fulfillment path in alignment with company strategies
- Highly robust and performant systems to address millions of transactions across mobile, desktop, in-store, partners, marketplaces, etc.

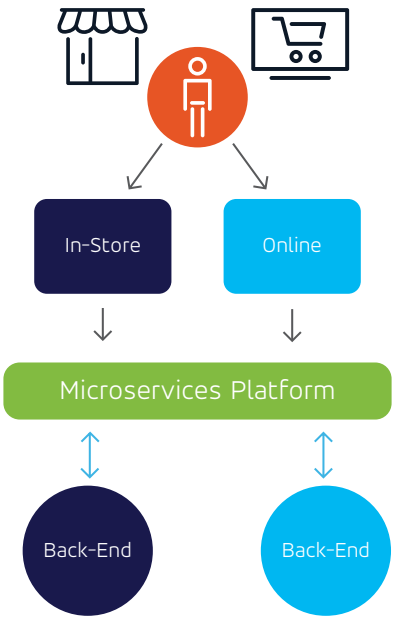
This new reality, where customer-centric choice and flexibility are at the heart of the experience, presents the need to rethink previously installed IT architectures and models **(see Figure 1)**. It's time for a sea change that turns the architecture 90 degrees to a more integrated, horizontal approach vs. a vertically-stacked approach. Retailers are in the midst of making sizeable investments in the re-architecture of existing models to support convergent and immersive customer experiences. Monolithic and channel-centric e-commerce product platforms are being replaced by horizontal, microservices, open-source, cloud, continuous development, and DevOps framework approaches **(see Figure 2)**.

Figure 1: Traditional Models



Traditional retail and e-commerce technology stacks began as separate vertical stacks (i.e., channel-centric), then multiple connections were added to support a minimal convergent experience.

Figure 2: New Retail Approach



A horizontal, highly integrated, microservices-based approach that meets the technical requirements of the new retail experience.

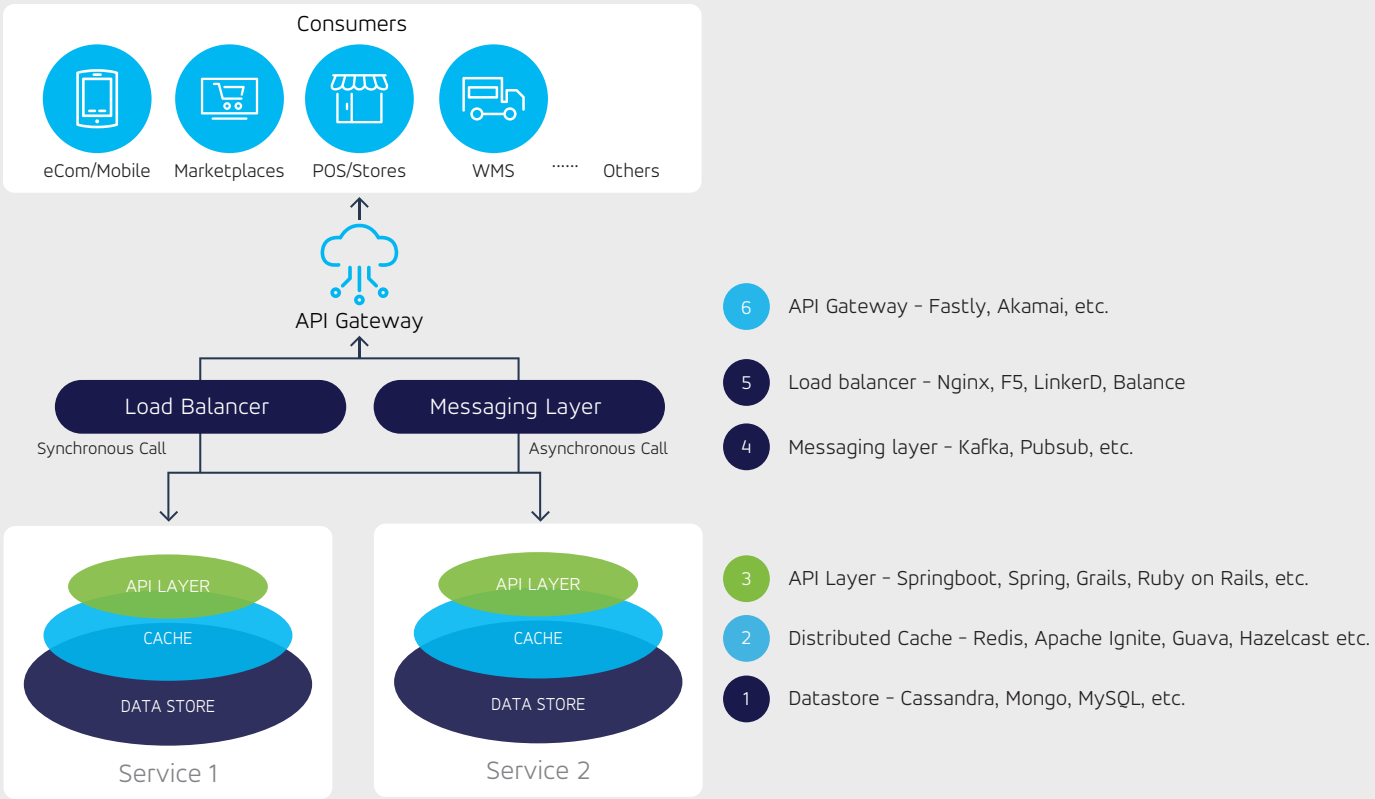
A New Approach: Headless Commerce

The migration from a dedicated, full-stack commerce architecture to a microservices-based architecture is a growing trend amongst retailers. Microservices are highly scalable, individual business logic and technology stacks (e.g., availability, pricing & promotions, catalog, etc.) that are independently developed, deployed and managed by a vertical team across the organization (e.g., Product, Engineering, UX, etc.). The team builds and exposes functional microservices through a call and response structure (APIs) to consumer applications requiring the service. From an industry perspective, one of many terms gaining traction to explain this approach is **headless commerce**. Headless refers to anonymizing the front-end and focusing on horizontal microservices capable of serving any consumer system (front- or back-end).

The majority of top retailers we interviewed are either in the middle of a full-scale re-architecture of their monolithic systems to microservices, or at a minimum, reviewing areas of their technology stack hindering the realization of corporate business strategies, primarily focused around inventory and order optimization features (e.g., buy online, pick-up in store, 2-day/1- day ship, ship from store, etc.). These efforts are emerging as the highest priorities within retailer business and IT organizations. Some of the key benefits propelling retailers to microservices are: Continuous integration & deployments allowing for faster time to market of capabilities and features Tighter integration of business and technology teams (product models & DevOps)

- More immersive user experiences through deep contextual interactions exposed through APIs
- Scale and performance flexibility, and the ability to identify and remove bottlenecks in individual bloated stacks
- Lower cost to maintain through modern open-source technologies
- More modern architecture approach attracting talent with modern skillsets

Figure 3: Typical Microservices Components



The Technical Approach to a Microservices Framework

The typical infrastructural components to support a microservices framework include **(see Figure 3)**:

1. Datastore: scalable persistence layer (database) for reads & writes

2. Caching layer: caching for faster reads, and potential writes (through write-through cache). This layer is where majority of reads will occur for systems requiring high volume/low response times

3. APIs & endpoints: the messages to be exchanged as part of each microservice

4. Messaging layer: messaging and interface where events and topics are published

5. Load balancer: balancer across all of the requests into the services

6. API gateway and/or queue manager: interaction layer with consumers

Modernizing Inventory Availability and Order Optimization

Traditionally, retailers maintained inventory availability either through custom legacy solutions, or packaged solutions such as IBM Sterling Order Management™. As online and store experiences converged, inventory availability, at the location level, became the key to enabling omnichannel features such as view in-store, BOPUS, etc. To enable these consumer shopping features, some retailers attempted to expose availability directly to the front-end via callable services. However, this approach faced scale, performance, and resiliency issues.

To address this issue, multiple copies of availability are exchanged between the OMS and digital platforms. This interaction results in inconsistencies, delays, and multiple points of failure, especially at the time of peak where items and volumes become abnormally high. As a result, nearly every large retailer is either in the process of extracting inventory from OMS into standalone Inventory Availability Microservice or upgrading their Order Management packages to separate Inventory into a separate service. Many of the retailers we interviewed are approaching inventory as two separate entities & paths:

Perpetual Systems (Inventory Accounting)

Typically sourced through systems such as WMS or Store Inventory systems. These are the system of record for the physical, on-order, and in-transit inventory, primarily used for Inventory visibility accounting. They are typically not designed to be front-facing.

Inventory Availability Microservice

A separate "system of truth" for inventory availability that either receives supply feeds from perpetual systems or directly from the source systems (WMS, POS, etc.). This allows for the distillation of on-hand inventory into discrete availability pictures based on interactions (selling channels, type of demand, etc.). They can also record demand from various consumers through feeds and reservations. These systems typically become the single source of truth for a product's and location's availability picture and serve all consumers with the real-time availability picture.

Using the strategy above, many of the retailers we interviewed have also created a Delivery Commitment Microservice that leverages the intelligence of the Inventory Availability Microservice and combines it with the location data of the consumer to determine optimal scenarios for delivery, balancing cost, speed, and consumer convenience. This microservice then is able to generate the optimal delivery options and commitments to be displayed to the consumer.

One important benefit of the Delivery Commitment Microservice is that it also enables order optimization to be removed from the OMS, further simplifying the OMS footprint. By doing so, retailers can leverage this Delivery Commitment Microservice for both pre-order and post-order optimization and commitments.

Performance and scale are key benefits to a microservices architecture. Our recommendation, as well as that from the majority of retailers, is to pursue extremely aggressive response times to support front-end calls from webpages -- such as the search and product detail pages -- which will create heavy traffic for the microservices. Typical guidelines implemented by key retailers are single to double-digit millisecond response times for the Inventory Availability Microservice and doubledigit response times for Delivery Commitment Microservice. Both services should be able to scale to handle greater than tens of thousands of transactions per second. This ensures scalability for both normal and peak volumes.

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1+1=3: Combining Microservices to Create a Fulfillment Component

By loosely coupling both Inventory Availability and Delivery Commitment Microservices, retailers are creating a Fulfillment Component. This business and technical capability highlights several of the key benefits of a microservices platform: speed to market and agility. Each microservice can very quickly be leveraged by others to create more complex, useful, and intelligent components. In this case, the Fulfillment component provides selling channels -- such as the front-end, POS, and mobile -- the ability to obtain availability, services, and delivery commitment (i.e., exact delivery date) information. When fully utilized, this component combines customer and location data to provide market-based last-mile options **(see Figure 4)**, and surface offerings like free next-day and same-day delivery to qualifying markets. While some retailers are looking to expose this information as early the website's search page to provide fulfillment clarity and urgency to buy messaging (e.g., through near you, order by get by, limited quantity, delivers on dates, etc.) as a sales generation approach, others expose in a minimalistic approach with detail shown as late as order summary page. Regardless of retailer strategies in this area, all retailers are moving towards capabilities to expose more meaningful fulfillment information during a consumer's journey. Most retailers think the earlier in the consumer's journey the better, as some estimates show that doing so can increase conversion rates by 10-30%.

Inventory Microservice
\+ Delivery Microservice
= **NEW Fulfillment Component**

Figure 4

Combining Inventory Availability and Delivery Commitment Microservices creates a Fulfillment Component, which, if leveraged early in the customer journey can positively impact conversion rates.

Conclusion

Consumer needs are evolving more rapidly than anyone could have predicted. However, yesterday's vertically-oriented technical architectures have not kept pace and are preventing retailers from creating an integrated and seamless shopping experience that the modern consumer demands. As a result, top retailers have begun evolving their technical architectures to be horizontal and microservices-based, providing data and intelligence to any consumer, at any time, front-end or back-end.

Top retailers have realized that separating inventory availability from traditional front-end and back-end technology stacks unlock the ability to deliver robust features, provides greater technical flexibility within the overall architecture, while solving the scale, performance, and synchronization issues faced today. Further, doing the same with order optimization allows the delivery of customer-centric fulfillment features business leaders require while ensuring the promising and execution of those features meet customer expectations within the company's overall fulfillment strategy (for example, offering a cost-effective free 2-day shipping offering). By starting with inventory and fulfillment optimization, two functions where current OMS solutions struggle, these retailers see immediate technical benefits and also a positive impact on sales.

This newly architected capability can then serve as a platform to provide future benefits with additional microservices for fulfillment as well as pricing and promotion, for example. The net result is the ability to rapidly provide today's customercentric shopping features that business leaders are requesting and position IT well to provide solutions that support the future commerce strategy.

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Luminate Commerce

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About Blue Yonder

At Blue Yonder, we're fearless leaders. We're the leading provider of end-to-end, integrated retail and supply chain planning and execution solutions for more than 3,000 customers worldwide. Our unique solutions empower our clients to achieve more by optimizing costs, increasing revenue and reducing time to value so they can always deliver on their customer promises.

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