Digitizing the $35-trillion supply chain with the Internet of Things (IoT)

arm

Intelligent IoT devices are enabling unprecedented supply chain visibility and innovation. Businesses can monitor a product's location and physical condition from the factory floor to the front door. But to succeed in today's hyper-accelerated, omnichannel world, businesses must digitize their supply chains with the right IoT strategy.

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White Paper

The new supply chain: digitized, consumer-driven, regulation-ready

72%

of businesses say improving the customer experience is their top priority.

Today's consumers demand fast and easy access to products and services. Smartphones, mobile commerce, and an on-demand economy are creating a consumer's market fueled by instant gratification and real-time communication.

Leading companies are stepping up, providing consumers a range of benefits, from same-hour delivery service to real-time visibility into order fulfillment. But while these offerings enhance the customer experience, they also put new pressures on an organization's supply chain. Forget about four-week delivery windows and basic barcode readings. Today's consumers want to know how many items are in stock, the materials used in products and where they're sourced, how their order will be fulfilled, and what time to expect it on their doorstep. No wonder 72 percent of businesses say improving the customer experience is their top priority.[1]

The consumer-driven supply chain

To understand the modern consumer, consider Kourtney, a mother of three who's juggling a busy work schedule while planning her daughter Mia's birthday party. Kourtney purchased an acoustic guitar for Mia from a popular online retailer. Because of her hectic schedule, Kourtney needs the guitar to arrive at her office between 4pm and 6pm on a Friday—the day before Mia's birthday party.

Forget about four-week delivery windows. Consumers expect to know what time a product will land on their doorstep.

In the past, identifying and tracking Kourtney's purchase would have required manually scanning and interpreting a barcode—a time-consuming and labor-intensive process. At best, Kourtney might have known what day the package would arrive. Fortunately, the e-retailer where Kourtney purchased Mia's guitar relies on embedded sensors to manage its delivery network.

These sensors enable IoT-supported parcels to actively communicate with their immediate environment, alerting Kourtney when her package passes a pre-set location, such as a state border, and telling her precisely when it will reach the front desk at her office. That's because unlike barcodes with their limited identification and coarse location capabilities, IoT sensors can track everything from identification and continuous location, to a product's physical condition. This helps improve supply chain visibility and last-mile fulfillment.

A more dynamic supply chain, explosive e-commerce

To create these data-driven customer experiences, organizations require real-time and unfettered supply chain visibility. This can be a challenge in today's increasingly omnichannel universe where brands engage consumers across multiple channels with a variety of products, prices, and services. Traditional supply chains are often split into physical and digital channels, which prevents disparate teams and consumers from sharing a unified view of a product's availability and location. This often leads to inconsistent customer experiences and prolonged last-mile fulfillment.

Another challenge for supply chain managers is the meteoric rise of e-commerce. Total e-commerce sales for 2017 reached $453.5 billion, an increase of 16 percent from 2016.[2] New warehouses are being built at a record pace to accommodate this explosive growth. And traditional retailers are investing in omnichannel initiatives, which allow consumers to buy products online and pick them up in physical stores—or have them delivered.

$453.5 billion

Total e-commerce sales in 2017[2]

Safer, fresher food through better supply chain visibility

This imperative for supply chain reinvention extends beyond customer satisfaction. For example, to reduce shrink and spoilage, some of the country's biggest grocery store chains are demanding that their suppliers deliver on-time, in full (OTIF) or face stiff fines for late warehouse deliveries.

Additionally, new regulations require companies to provide better supply chain visibility. The Food Safety Modernization Act (FSMA) is fundamentally changing the way food is sourced, prepared, delivered, and consumed in the U.S. by establishing strict food safety and hygiene standards in the supply chain. And then there's the Drug Quality and Security Act (DQSA), which requires organizations to increase supply chain visibility to easily identify and trace prescription drugs throughout their distribution.

The Internet of Things (IoT) effect

The logistics industry was one of the first to adopt IoT technology. In the 1980s, many logistics companies deployed telematics technology to improve the tracking and monitoring of their vehicles and containers. Fast forward to today and some of the same companies are using IoT technology to further improve supply chain visibility, omnichannel and last-mile fulfillment.

"The supply chain has to change in order for companies to compete. It's a radical change requiring major investments. But it's an issue of survival."

Thomas Kurian, Head of Marketing, Transportation and Logistics, Arm.

To engage today's more demanding consumers and capitalize on a booming e-commerce market, companies need exceptional supply chain capabilities. "The supply chain has to change in order for companies to compete," says Thomas Kurian, Head of Marketing, Transportation and Logistics, Arm. "It's a radical change requiring major investments. But it's an issue of survival."

Approximately 85 percent of global companies agree that IoT will be used to gain better visibility into the identification, location, and condition of products, assets, transactions, or people, according to analyst firm Forrester.[3] And the IoT market will grow from more than 32 billion semiconductor devices shipped in 2016 to 74.1 billion in 2025, according to analysis by IHS Markit.[4]

The shift from pallets to packages

The need for a digital supply chain is growing. For decades, shipping companies and manufacturers transported products in containers or pallets straight to a retailer's distribution center. But that practice is changing as companies deliver packages and items directly to the consumer.

"In the e-commerce world, I'm not buying a pallet, I'm buying a package or an item."

Thomas Kurian, Arm.

"In the e-commerce world, I'm not buying a pallet I'm buying a package or an item," says Kurian. "So the pick-pack-ship process in the supply chain is completely changing."

As a result, keeping tabs on individual items and providing customers real-time visibility into the supply chain requires instrumentation and visibility at the item and package level. This is a capability that only IoT technology can provide.

380million

Bluetooth Low Energy (BLE) beacons will be used for supply chain asset visibility by 2021.

Bluetooth Low Energy (BLE) beacons are the most cost-effective technology for achieving real-time visibility into supply chain assets and inventory. Acting as digital barcodes, but without requiring manual scanning, BLE beacons provide continuous information on the identity, location, and environmental condition of supply chain assets, including temperature, shock, and humidity. By 2021 it's estimated that 380 million BLE beacons will be used for asset visibility solutions in the supply chain.[5]

A cold case for sensors

There is a wide range of applications for BLE sensors. For example, cold chain logistics involves managing the flow of products from origin to destination in a temperature-controlled supply chain. Cold chain logistics includes an uninterrupted series of refrigerated production, distribution, and storage activities.

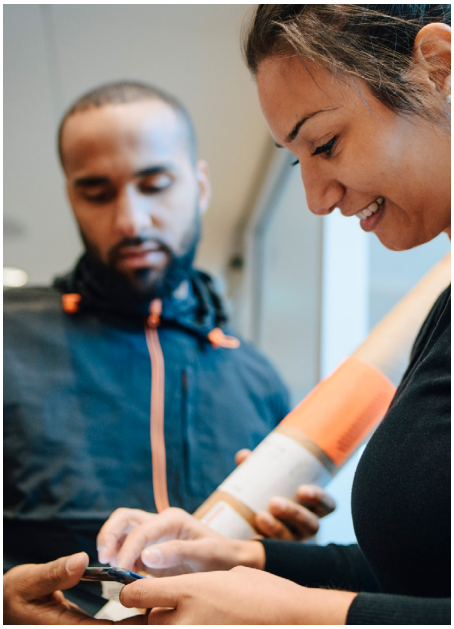
For pharmaceutical companies a security breach represents one of the most expensive operating costs in its cold chain. Although security breaches are rare, a pharmaceutical company must destroy its entire shipment when they happen. However, using BLE sensors, pharmaceutical companies can continuously monitor the shipping conditions of items during transit and take any necessary actions proactively. This data can then be downloaded over a BLE link for analysis to ensure compliance with industry regulations.

On the road to reduced waste, enhanced safety

Another application for BLE sensors is transportation. IoT-enabled trucks and shipping containers provide real-time insights into the location and condition of products throughout the supply chain. For example, Walmart recently launched Eden, an intelligent food system designed to ensure fresh produce throughout the company's thousands of retail stores.

Walmart hopes to eliminate $2 billion in food waste with an IoT-enabled food distribution system.

Deployed in 43 distribution centers, Eden uses sophisticated machine learning (ML) technologies throughout the supply chain. These ML technologies are combined with an algorithm that crunches USDA food product specifications, Walmart's own strict product standards, and more than a million photos to prioritize the flow of perishable goods worldwide.[6] The system is helping Walmart optimize the delivery of one of its best-selling grocery items, the banana. With Eden, Walmart can monitor the temperature of shipping containers and the ripeness of bananas they're carrying. If necessary, Eden can reroute the containers to a closer store so the bananas don't arrive too ripe. Using Eden, an IoT-enabled food distribution system, Walmart hopes to eliminate $2 billion in food waste over the next five years.[6]



Saving lives with sensor technology

BLE sensors and IoT-powered asset tracking can not only reduce food waste and damage, but can also prevent major catastrophes. The Centers for Disease Control and Prevention estimate that one in six Americans gets sick from contaminated foods or beverages, leading to 3,000 deaths each year.[7] And the U.S. Department of Agriculture estimates that foodborne illnesses cost $15.5 billion each year.[8]

Smart devices for asset tracking allow companies across the retail, agriculture, and manufacturing industries to:

- Minimize product loss
- Glean accurate analytics on how products are selling
- Determine real-time geographic location of products
- Receive data on a package's condition, such as whether it's been opened
- Measure the capacity of each load to determine a vehicle's spare capacity
- Optimize travel routes for better fleet efficiency and reduced fuel consumption
- Re-route shipments for on-time delivery
- Know precisely when a product arrives at a loading dock or port

Visibility into freight shipment improves inventory management

IoT technologies help organizations more accurately manage their inventory by augmenting established technologies, such as barcodes. However, IoT technologies allow organizations to track inbound and outbound inventory at a more granular level by providing real-time visibility into when inventory will arrive, or experience delays. This information allows organizations to better predict future inventory requirements, react quickly to real-time customer demands, eliminate surplus inventory, and increase the efficiency of employees.

Key considerations for digital supply chain success

Although IoT technologies provide many asset tracking and inventory management benefits, digitizing the supply chain also introduces new challenges. For example, consider the General Data Protection Regulation, a European Union (EU) privacy law designed to protect EU citizens' personal data in transactions throughout EU member states. The law requires companies that use data-transmitting sensors for asset tracking and inventory management to adopt more secure device provisioning and data governance practices. One way to address this challenge is by enforcing role-based access to supply chain data, which gives different stakeholders different levels of access to item information.

Another key consideration when deploying IoT in the supply chain is workload. The collection of IoT information should be autonomous. Some systems may collect data purely for asset tracking analytics, while others may use data to take automated actions, such as altering the temperature of a shipping container. In either case, an IoT-supported supply chain should require minimal human intervention.

A checklist for digitizing your supply chain

Migrating from legacy systems to sophisticated sensors takes the right combination of solutions and stakeholders.

Trusted partner

Purchase technology solutions from a trusted global technology partner with IoT experience and a track record of working with supply chain leaders.

Platform flexibility

Select a robust IoT platform with the flexibility for either an on-premises or cloud-based deployment.

Cloud services

Choose a cloud-agnostic platform that fits your cloud infrastructure to ensure security and control of sensitive data. A cloud platform should be scalable and easy to manage.

IoT devices

Select device management technology with the scale and simplicity to securely manage millions of devices.

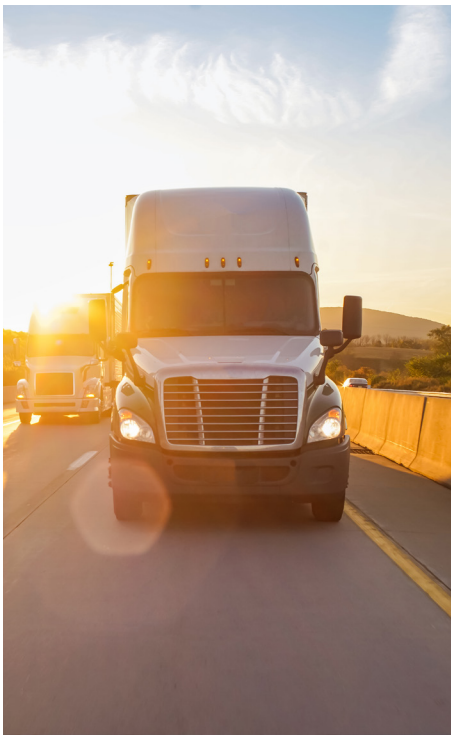
IoT security

Ensure chip-to-cloud security for trust-based access to data from devices and applications.

Systems integration

Enable secure device provisioning and perform consistent firmware updates across supply chain systems.

To select a deployment approach, organizations must carefully assess their supply chain performance and security needs. For example, a large global brand is more likely to want as much control over its data as possible. In this case, an on-premises solution would be the best choice. Start-ups, on the other hand, may want to take advantage of the cost savings and flexibility of a cloud deployment.

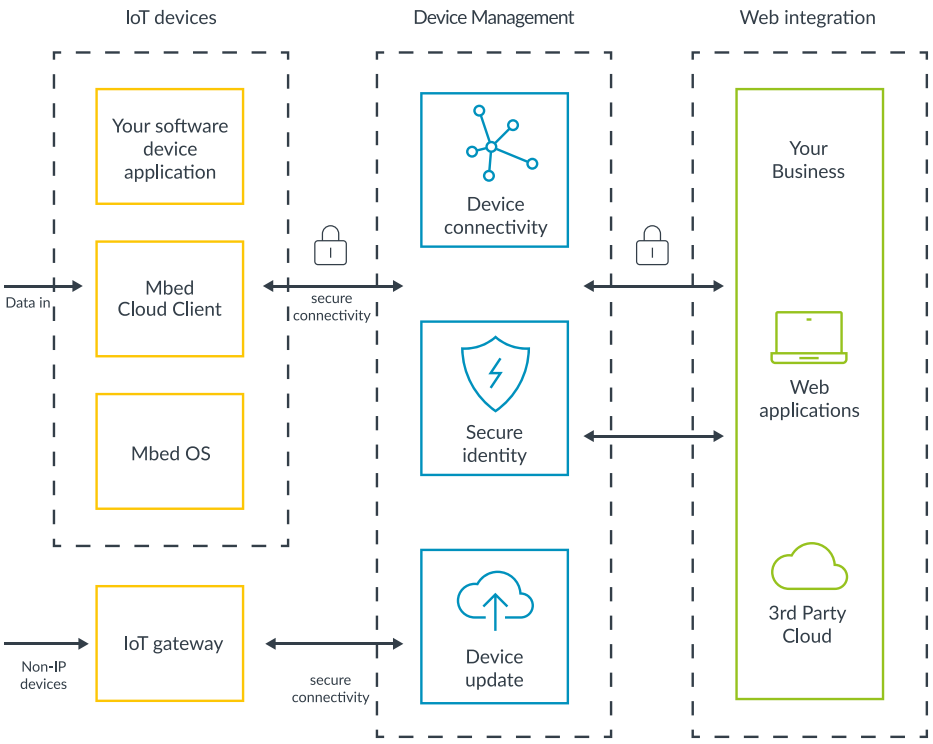


An essential IoT supply chain toolkit

Migrating from a legacy to a digital supply chain system is a challenging task. The following Arm solutions can help simplify the process and enable a secure digital supply chain.

Mbed IoT Platform

Mbed IoT Platform comprises device software and cloud-based device-management services to provide a powerful, integrated approach to connected devices. The Mbed IoT Platform secures the device, communications between the device and cloud, and provides device-management services to ease deployment and lifecycle management.



Mbed IoT Platform simplifies IoT device development, provides end-to-end security, and delivers services to manage and update devices throughout their lifecycle.

Mbed OS

With connectivity support available for WiFi, BLE, NB-IoT, and more, Mbed OS brings together all the components required for developing connected, intelligent devices, including security, connectivity, and drivers for sensors and I/O devices.

Mbed Device Management

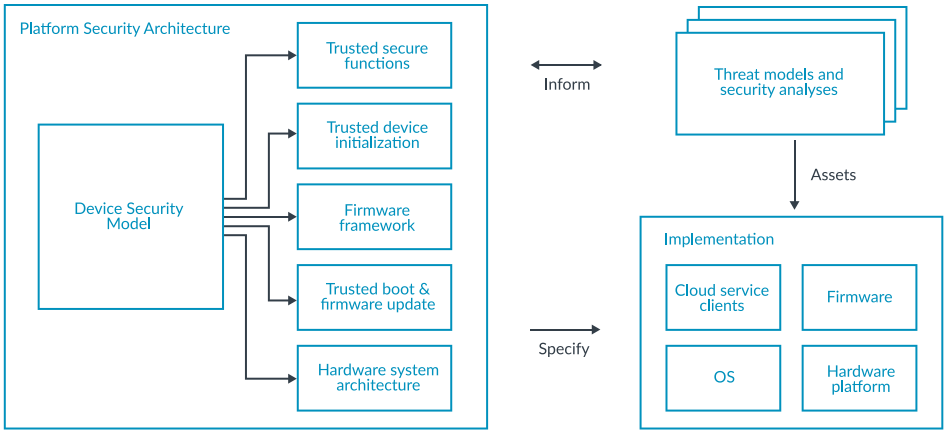
Mbed Device Management provides secure and scalable IoT device management for any device, network, or cloud. It allows users to provision and connect a wide variety of IoT end nodes and achieve reliable and cost-effective software updates that help extend product lifetimes. Mbed Device Management can be deployed as a cloud solution, on-premises, or hybrid-cloud solution.

TrustZone

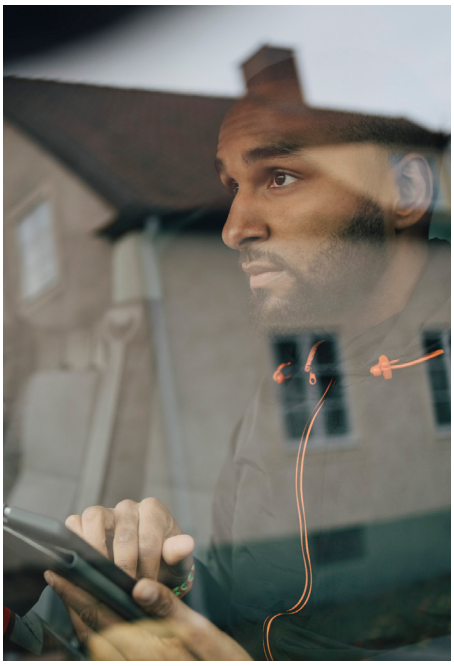
Arm TrustZone technology protects assets by providing a foundation for system-wide security on a trusted platform. TrustZone's hardware-based security technology can be built into SoCs by semiconductor chip designers for secure end points and a device root of trust.

Platform Security Architecture (PSA)

Arm's Platform Security Architecture (PSA) provides a comprehensive set of threat models, security analyses, hardware and firmware architecture specifications, and an open source firmware reference implementation. The result is better security for all connected devices throughout a supply chain.



Conclusion



Today's e-commerce explosion and evolving consumer demands are accelerating the adoption of IoT technologies in the supply chain. Organizations need to deliver the right quantity of product, at the right time, in the right condition, to the right location.

It's a big challenge, but one that a digitized supply chain can solve by:

- Increasing supply chain visibility
- Providing omnichannel support
- Improving last-mile fulfillment
- Enhancing regulatory compliance
- Supporting individualized delivery

With worldwide spending on the IoT predicted to reach $1.4 trillion in 2021,[9] the universe of intelligent devices and rate of data connectivity is only accelerating. Solving today's supply chain challenges may be the best way to prepare for that future.

Learn how early adopters of IoT technology are digitizing their supply chains.

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