



FEATURE

Creating IoT ecosystems in transportation

Logistics companies are looking to connect IoT technologies to traditional systems

Alan Taliaferro, Ryan Ernst, Usman Ahmed, Anupama Harolikar, and Shiladitya Ray

Transportation providers' customers want more speed, visibility, and customization. Outfitting trucks with IoT sensors was the first step. Next: Companies are moving to create connected ecosystems.

Introduction

Many companies across industries are feeling the pressure of rising customer expectations for speed, customization, and more¹—and looking to their supply chains to meet the new demand. The problem: Most leaders know far less about what's going on than they would like. Deloitte's *Global chief procurement officer study 2018* found that only 6 percent of organizations have full visibility into their supply chain, and 65 percent of organizations have poor or no visibility beyond their tier-1 suppliers.²

To shed some light on supply chains, transportation providers seem to be embracing Internet of Things (IoT) technologies. The goal is visibility as well as agility—the ability to quickly respond to demand—while ensuring regulatory compliance.

Of course, it's not as simple as installing a few sensors. Logistics companies are looking to create holistic ecosystems in which the physical and digital worlds are not only constantly exchanging information, but also drive meaningful action. Such a transformation requires moving from a traditional siloed approach to implementing IoT technologies and then to a more holistic, integrated one that aims to manage execution by connecting IoT technologies to traditional systems and other application technologies.³

This article will focus on these IoT-connected ecosystems within transportation and discuss some key strategic considerations for transportation organizations as they strive to successfully design, implement, and operate them in their organizations.

IoT in transportation today

IoT-enabled processes are increasingly common across a range of industries, spurred by the growing availability of cloud storage and faster, more ubiquitous connectivity.⁴ The global IoT market is forecast to surpass the US\$1 trillion mark in 2022,⁵ and a recent survey suggests that 80 percent of companies expect to adopt IoT technologies over the next five years.⁶

The transportation industry, for its part, has been moving to incorporate IoT technologies such as telematics hardware and software in trucks, with an estimated spend of US\$71 billion in 2019,⁷ although progress has been uneven. North America has been leading the adoption, with 42 percent of all owned commercial vehicles forecast to have

More and more, the increased visibility and lower latency provided by IoT systems are becoming table stakes for carriers and others in the logistics space.

DEFINING AN IOT ECOSYSTEM

An IoT *solution* consists of sensor networks that generate various types of data that a company can analyze to create insights for making business decisions. An IoT *ecosystem* links those solutions with other digital tools and technologies to create even greater value for the company and its customers.

Today in logistics and distribution, the most relevant technologies for an IoT ecosystem tend to be artificial intelligence (AI), predictive analytics, blockchain, and cloud computing. But the concept of an IoT ecosystem is technology-agnostic: In the future and in other industries, compelling value could be created by integrating edge and quantum computing, augmented reality, and other technologies. Regardless of the specific technologies involved, all elements of the ecosystem work together to ensure the seamless flow of information to action.

telematics by 2021,⁸ driven in part by compliance requirements necessitating the use of digital logs equipped with position tracking. Other key markets are quickly catching up, with the penetration for telematics hardware and software forecasted to top 95 percent for all new trucks sold by 2026 in North America, Western Europe, and developed Asia.⁹ As barriers to implementation fall and deployment proliferates across distinct use cases, the days when IoT-enabled operations offered a competitive advantage in transportation are likely coming to an end.¹⁰

Organizations are rapidly adopting digital technologies beyond the IoT, of course. Over the next five years, the adoption rate for robotics and automation could reach 70 percent, with nearly two-thirds of companies deploying predictive analytics and artificial intelligence.¹¹ The growing use of these additional technologies within transportation and logistics creates an opportunity to integrate disparate systems and move to a more advanced stage of digital capability. To truly differentiate and drive value creation for themselves and their customers, transportation providers should embrace the next generation of sensor-based systems: true IoT ecosystems.

IoT ecosystems in transportation

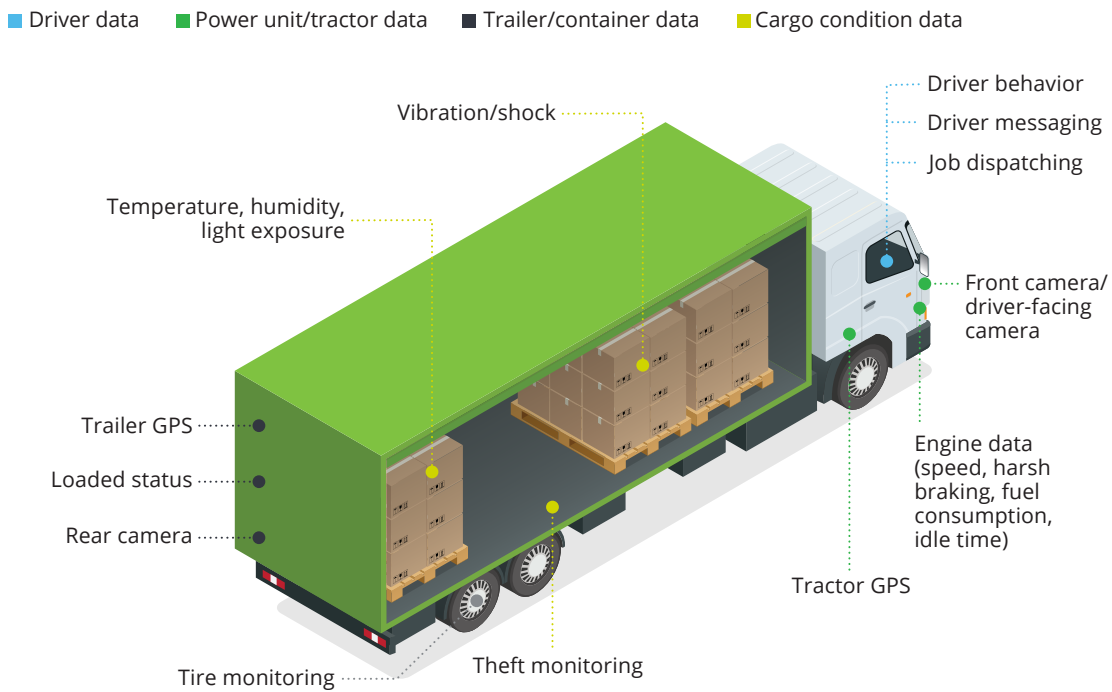
WHAT DOES A CONNECTED TRANSPORTATION ECOSYSTEM LOOK LIKE?

To see the power of a truly connected IoT ecosystem, consider the example of connected vehicles. As figure 1 illustrates, today's connected trucks not only move freight but typically generate vast amounts of data, such as location, engine status (speed, idle time, fuel levels), environmental conditions (temperature, moisture, light exposure), vehicle data (shocks, movement), driver behavior (tiredness, erratic driving patterns), and security (theft, tampering, alarm activations).

Uploading this data from a smart fleet to a cloud-based data system and feeding it into other technologies and transportation processes can support routing, shipment tracking, quality compliance, fleet management, driver performance management, and safety. In an end-to-end IoT-enabled transportation ecosystem, information would flow seamlessly throughout the network creating an information value loop (see figure 2).¹²

FIGURE 1

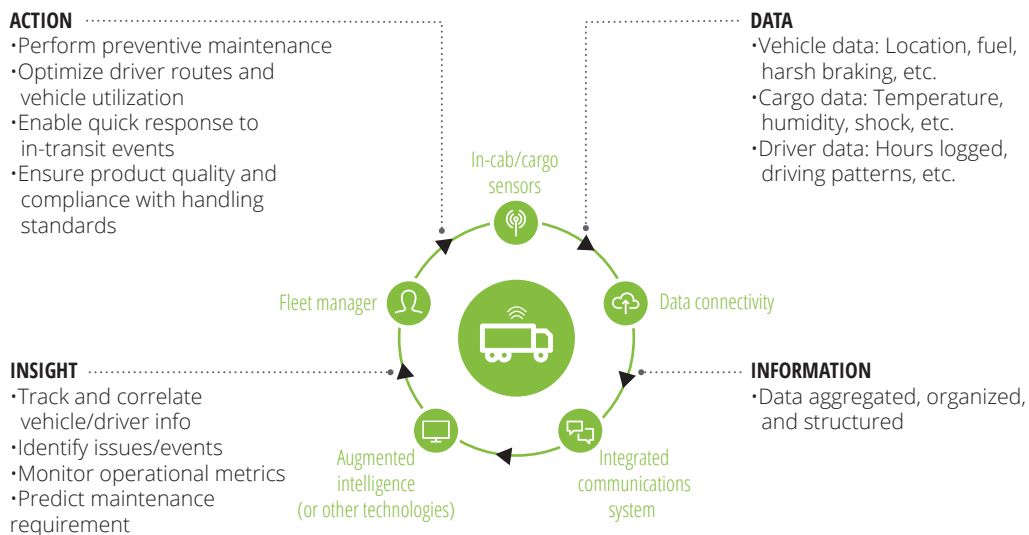
An IoT-enabled fleet vehicle¹³



Source: Deloitte analysis.

FIGURE 2

Information flow in the transportation ecosystem¹⁴



Source: Deloitte analysis.

Here, different vehicles' in-fleet sensors can automatically upload telematics data such as fuel consumption, location, and cargo temperature into connected cloud architectures, which can aggregate the information into structured data sets and feed it into predictive analytics algorithms that leverage AI. The resulting insights on vehicle condition, driver performance, cargo quality, and more, can enable the enterprise's control center to monitor fleet performance and safety metrics and predict maintenance issues, downtime, cargo problems, and even road accidents. Transportation businesses can utilize these real-time insights to take appropriate action, including route optimization, dynamic scheduling, preventive maintenance, and rapid response in the event of a breakdown or crash.

The potential applications extend beyond the connected vehicle:

Terminal operations. With the help of IoT and location tracking technologies such as GPS, terminals (or trucking stations) can get updated information on inbound shipments, such as expected time of docking, shipment quantity, and

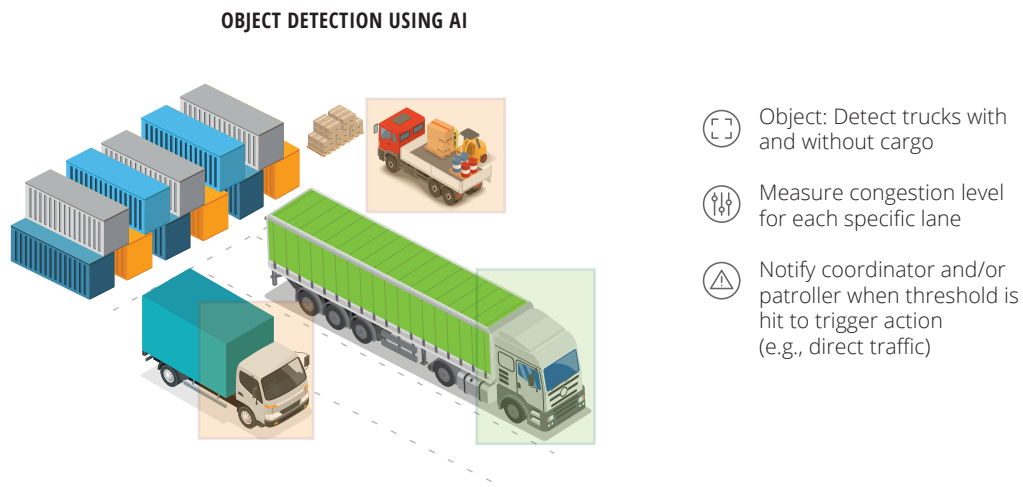
storage requirements. Combining IoT with AI and predictive analytics enables terminals to use this data intelligently to better plan outbound shipments and manage capacity. Using IoT-enabled dashboards, the terminal can maintain updated metrics on capacity utilization and shipment timing.

Recently, a leading port began testing the use of object detection sensors in order to track cargo-filled trucks lining up at each lane at ports with multilane terminals,¹⁵ enabling automated monitoring of congestion at the lane level (see figure 3). This data is uploaded to a cloud-based system. When the congestion threshold—determined using predictive analytics—is breached, a trigger is sent to the controller to redirect and streamline traffic. With the help of an IoT-enabled ecosystem leveraging AI, the port authorities are able to increase lane efficiency, reduce truck turnaround time, and improve operations planning at the terminal.

Transportation safety. Accidents, injuries, ineffective drivers, road safety—and the resulting losses—are some of transportation companies'

FIGURE 3

Multilane traffic monitoring using an AI-enabled IoT ecosystem



Source: Deloitte analysis.

most visible and high-risk issues. Relevant technologies in the market focus on improving transportation safety: In-vehicle telematics solutions use accelerometers, trackers, and engine monitors to gather location, fuel consumption, speed, and braking data.¹⁶ Aggregated data points are fed to safe-driving analytics applications to monitor digitally calculated safety limits. Connected physical devices (such as mobile phones) provide feedback to drivers and others via alerts when safety thresholds are breached, completing the physical-to-digital-to-physical loop of a complete ecosystem. Analysts expect IoT telematics solutions to reduce both fuel consumption and the cost of incidents and insurance.¹⁷

Predictive maintenance. Smart technologies—marrying IoT to safety and maintenance plans within asset management systems—can enable transportation providers to manage asset maintenance holistically.¹⁸ Trenitalia has implemented an IoT-enabled solution that uses data-gathering sensors capturing weather conditions and equipment stress in its trains to feed a remote diagnostics platform in real time. Combined with AI and predictive analytics, this can enhance predictive maintenance capabilities to predict impending failures.¹⁹ This allows for fixes to be enabled when the asset is being utilized—improving productivity, efficiency, and asset longevity—and is expected to reduce fleet maintenance costs by up to 8 percent.²⁰

Fleet monitoring and routing. The IoT ecosystem enables all points in the network to communicate with each other in real time with integrated communications systems technology. Leveraging low-latency information, a transportation provider can establish a dynamic network that accounts for demand and fleet availability and make real-time decisions regarding fleet routing and management.

For example, for a transporter, an IoT ecosystem consists of connected devices on the on-road fleet, collecting route information and sending constant updates to the cloud. With the effective use of analytics, business owners can take dynamic routing decisions and communicate with the network in real time using integrated communications systems technology.²¹ In addition to advanced safety and better predictive maintenance, transporters can make use of driver assist technologies to determine conditions suitable for fleet platooning in order to reduce draft and increase fuel efficiency.

DHL's fleet management solution, SmarTrucking,²² uses sensor-enabled trucks to gather fleet data (location, weather, traffic, and shipment information) and telematics to transmit this data to a centralized control tower. Using predictive analytics, intelligent data science, and onboard diagnostics, the control tower makes real-time decisions on dynamic routing and fleet allocation, resulting in route optimization and efficient fleet scheduling and improved shipment visibility. SmarTrucking is expected to reduce transit times by up to 50 percent and increase real-time tracking reliability to over 95 percent across road networks in India.²³

Product life management (cold chain).

Traditionally, moving sensitive products through the supply chain (for example, pharmaceuticals or temperature-sensitive food products) has carried a high risk of losses, further magnified by the challenge of measuring these losses during transportation while ensuring compliance with stringent food safety requirements. IoT ecosystems can help improve cold chain transportation efficiency while ensuring product safety and quality—and can pinpoint issues causing product value loss by using analytics on sensor data.²⁴

A leading industry retailer has been testing the use of IoT ecosystems for its cold chain management, with sensors enabling real-time temperature and

humidity monitoring during product movement. This enables the company to monitor and distribute products more safely and efficiently and improve delivery quality while lowering loss-based costs and gaining visibility into the cold chain transportation process, with projected annual savings of US\$1.3 million in cold chain compliance and asset efficiency.²⁵

Building a transportation IoT ecosystem

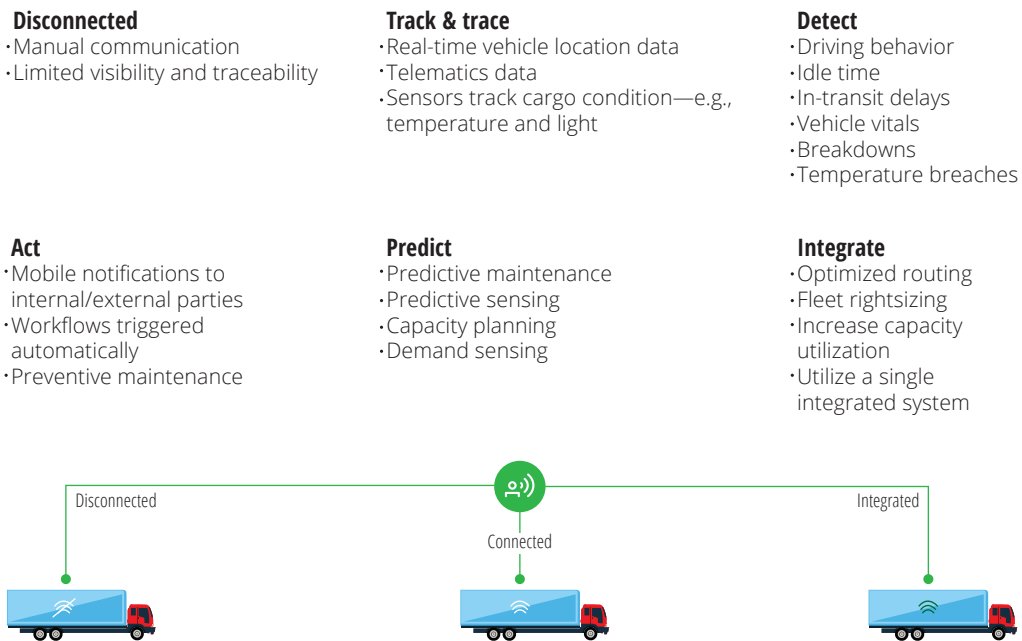
IoT ecosystems that stitch together sensor-based data with legacy systems (such as transportation and warehouse management systems) and newer technologies (such as cloud-based storage, AI, and predictive analytics) hold tremendous promise for those engaged in moving goods. And while dreaming big is important, it is just as crucial to

understand that mastery takes time. Moving an organization from a world of manual, often paper-based systems to a digitally enabled and fully integrated enterprise happens in steps (see figure 4). In the **disconnected state**, communication between nodes is manual, with no real-time visibility or traceability. With the addition of *tracking and tracing* capabilities, the organization is able to quickly *detect* variations such as delays, breakdowns, and noncompliance. This **connected state** enables businesses to *act* on the system's real-time data. In the **integrated state**, IoT solutions are used in conjunction with other technologies to *predict* events and enable real-time dynamic decision-making.

To move up the maturity curve, as with any successful digital transformation, it can be helpful to look at each of three strategic levers: *process*, *people*, and *technology*.

FIGURE 4

The IoT maturity model for transportation²⁶



Source: Deloitte analysis.

PROCESS: IDENTIFY YOUR GOALS

Begin by focusing on your end goals, asking:

What are your business needs? Assess your current state of operations and identify the gaps between your organization and consumer/industry expectations, by looking at customer metrics and competitors' technology adoption rates. After aligning on pain points and what you are trying to solve for, identify high-value, target-rich data that is easy to access, available in near-real time, has a large footprint (affecting major parts of the organization or its customer base), and can effect meaningful change in prioritized areas.

What adoption strategy is best suited for your business? Once you have scoped out your needs and goals, chalk out your road map for this journey. Since IoT-driven implementations can be data-heavy, invest your time in understanding the data being collected through IoT technologies and how it can be leveraged by other technologies and processes to create a rich and impactful ecosystem. Use the mantra "Think big, start small, scale fast" to assess your risks and returns while having your goals in mind.

PEOPLE: PREPARE THE ORGANIZATION

It's no secret that preparing your talent is a key factor in any successful technological evolution. In a recent Deloitte survey, around 63 percent of the respondents identified hiring and retaining the ideal skilled workforce as the biggest barrier in their respective organization's transformation.²⁷ Once you have identified the technological requirements (*what*) for your organization:

Identify your organizational and talent needs (*who*). Do you need technical resources to support the business? Will you require full-time employees or contractors/partners? Do you need personnel with nontransportation skill sets (analytical, health and safety, etc.)? Think creatively and holistically about what work will need to be done, where, and by whom in the future.

Explore strategies to recruit, retain, manage, and develop those people (*how*). Recruit the right talent. Invest in the importance of career experience. Create compensation and rewards that are not only competitive among your peers but also among the broader set of employers you may be vying with for talent—including tech companies.²⁸

TECHNOLOGY: IMPLEMENT THE SYSTEM

Most commonly, organizations can run into interoperability problems when overarching, cross-platform, and cross-domain applications are to be built. Given the large number of stakeholders involved, which can include platform and software providers, sensor vendors, developers, and users—not to mention multiple parts of your own organization—setting up an IoT ecosystem requires deep collaboration across the technology stack. Failure can mean lost business opportunities and stifled innovation.²⁹

One effective way for organizations to build their IoT ecosystems is to look for solutions that are specific to your industry and are already rooted in your issues. Solutions that come tailored to industries and sectors are typically able to generate results more quickly than those that have to be reworked to fit your environment.³⁰ For example, transportation companies can look into evolving their current telematics solutions into IoT-enabled ecosystems that can be connected to asset management solutions, resulting in increased asset turns and improved asset safety and security. At the same time, companies should be creative and look into applicable use cases from other industries.

As you approach the implementation, consider the following high-level road map:

Update the current framework

- Identify enhancements required to modernize platforms and create an ever-evolving

ecosystem in order to harness the power of data to drive smarter, faster decisions.

- Look out for potential roadblocks when setting up the information flow (for example, connectivity issues in the communication layer, data volume, and the frequency being transmitted across interfaces).

Embrace strategic technologies and partnerships

- Leverage scalable solutions through accelerators and aggregators, which can result in eliminating a majority of the development work, hastening ROI, and increasing profitability.
- Team with compatible partners to achieve greater speed, scalability, and depth of expertise.³¹

Implement IoT-based ecosystems

- Integrate current frameworks and partner

The process might seem daunting, but you don't have to do it alone. Look for best practices and third-party solutions that you can easily leverage and scale within your organization. Think big, start small, scale fast.

solutions, with data seamlessly flowing through cloud-based solutions.

- Build visibility tools for the organization and customers on top of the ecosystem to drive value.

Final thoughts

Technology adoption is an evolutionary process. As logistics and distribution organizations embark on the journey of digital adoption, they should keep in mind these overarching principles:

- Focus on the business of IoT, using the technology to create real business value, not just connecting stuff for the sake of connecting stuff. Start with the end in mind.
- Logistics and distribution organizations should not stop at embracing digital connectivity. To unlock the full competitive advantage and drive down their operational costs, organizations should think about integrating IoT technologies with automation and analytical capabilities. The advantage to IoT is visibility; the advantages to a connected IoT system are more educated and efficient supply chain decisions that can drive value to the business.
- Transportation organizations are expected to need to develop alliances and partnerships to be leaders in the years ahead. This will likely require data sharing and a willingness to collaborate to gain higher performance and improved customer service. Companies should choose their partners wisely and leverage their IoT ecosystems to enhance the strength of their networks.
- People are critical to your success. Invest in elevating your talent to effectively manage new technologies and processes.

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