What you need to know about IoT

The right information can change the world

50 billion

"things" connected to the Internet by 2020.

Contents

The right information can change the world.

The Internet of Things is how it happens.

At AT&T, we help companies of every size develop IoT solutions to lower costs, gain efficiencies, and improve competitive advantage. We know the IoT decisions you make today impact your business tomorrow.

Inside these pages, you will learn about the latest IoT trends across a variety of industries, experience how IoT solutions are impacting business today, and gain insight into how to build global IoT applications – quickly, affordably and securely.
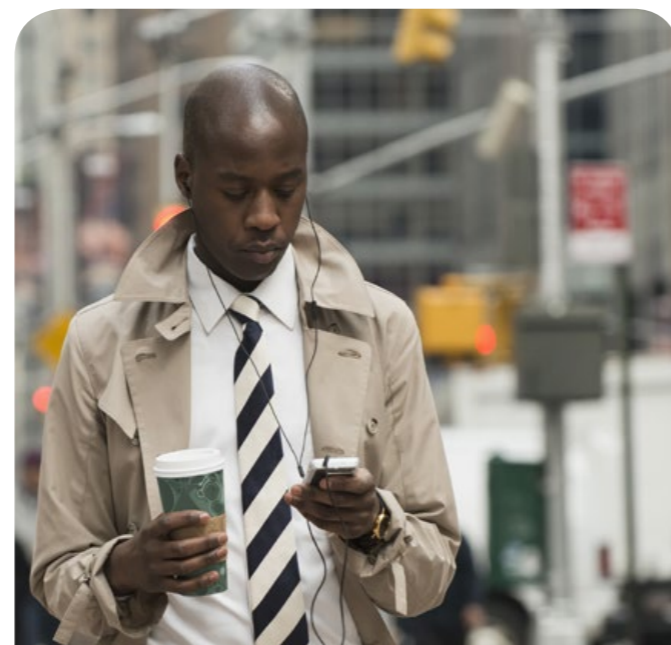
Business leader,

We're operating in a time when virtually anything can be connected to the Internet. Entirely new experiences, revenues, profitability, customer relationships, business insights, and processes never thought possible are now achievable using the Internet of Things (IoT).

Harnessing data to predict, learn, and make real-time decisions can create a distinct competitive advantage for your business. Knowing the value of the data is the first step to driving positive change using the IoT. With that, you can better execute a winning strategy across many departments in your organization.

From marketing teams and new product development to operations and IT, unlocking the value of IoT solutions in your business may not be as simple as connecting devices to the Internet, but it can be easier than you think.

This AT&T report on the Internet of Things and how 'the right information can change the world' is intended to share insights that can help you turn the Internet of Things into a strategic advantage. It includes topics that can help drive your organization to success, including:

- Accelerate innovation

- Better understand the challenges your IT organization may face

- Learn about IoT in use today from industries like automotive, transportation, and municipal infrastructure

We are excited about the Internet of Things. Thank you for the opportunity to share our leadership, knowledge, and experience in IoT with you. Please reach out and visit us soon at att.com/iot.

Chris Penrose
Senior Vice President
AT&T Internet of Things

What you need to know about the Internet of Things

Greater efficiency, new revenue, lower operating costs, and increased customer satisfaction all contribute to the reasons the Internet of Things is high on the list of many business leaders.

We know businesses are serious about the Internet of Things:

- IDC predicts the global market for the Internet of Things will nearly triple, reaching $1.7 trillion by 2020.[3]

- An estimated 50 billion "things", ranging from sensors in cars and traffic lights to utility meters and household appliances will be sharing data over the Internet by 2020.[4]

- As the leader in North America for the Internet of Things, we have connected more than 25 million devices to our network and continue to grow.

- In Q3 of 2015, we added a record 1.6 million connected devices in a single business quarter.

- And in just the last 24 months, AT&T has experienced a 250% increase in data usage from our IoT customers.

85% of global organizations are considering or exploring an IoT strategy
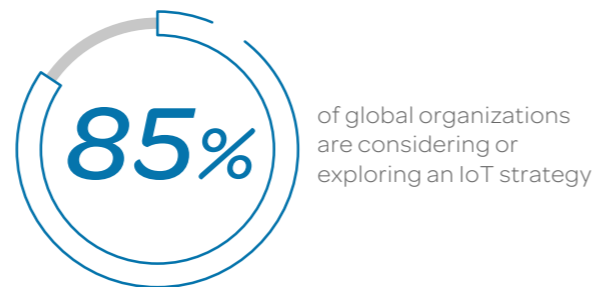
The Internet of Things is moving from concept to reality fast. Business leaders are creating momentum in many industries, including:

- In automotive, Machina Research estimates the number of IoT connections to grow from 125 million in 2014 to approximately 1.2 billion in 2024, representing a CAGR of 23%.[5]

- In transportation, Berg Insight forecasts 15.5% compounded growth of active fleet management systems through 2019.[6]

- In Smart Cities, Frost & Sullivan research shows that between 2011 and 2014, approximately 37 million smart meters were shipped in the United States and approximately 5 million in Canada.[7]

You want the bottom-line results, profitability, and cost reductions that IoT can produce. You know your industry, business, and customers, and which connections can drive maximum value. But how do you turn your visions of a connected future into a reality?

The best way to help our customers transform their businesses with IoT is to provide the services and platforms that cover the entire technology value chain, from devices and connectivity to platforms and applications. This way, your organization has the tools and resources to focus attention on innovation, rather than face many of the challenges that can arise from building IoT solutions for the first time.

More than 50% of developers actively working on IoT solutions are thinking globally.
Source: IDC [2]

**5 Questions every business should ask before it builds its first IoT solution:**

1. What does IoT mean for my business?

2. What is the return on investment and how do we see our company changing in the next 2 to 5 years?

3. How quickly can we test theories while minimizing costs?

4. Does our CIO have the right mix of developer talent to design and build a new solution?

5. Are our plans global?

Evaluating ROI

The Internet of Things is growing steadily alongside the already well-established smartphone, tablet, PC, and consumer electronic markets. According to IDC, a global provider of marketing intelligence, IoT is expected to grow at a compound annual growth rate (CAGR) of 19.2% through the forecast period (2014–2020), whereas all the "other" connected devices will grow at a CAGR of 9.5%.[8]
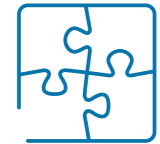
## IoT Versus Other Connected Devices
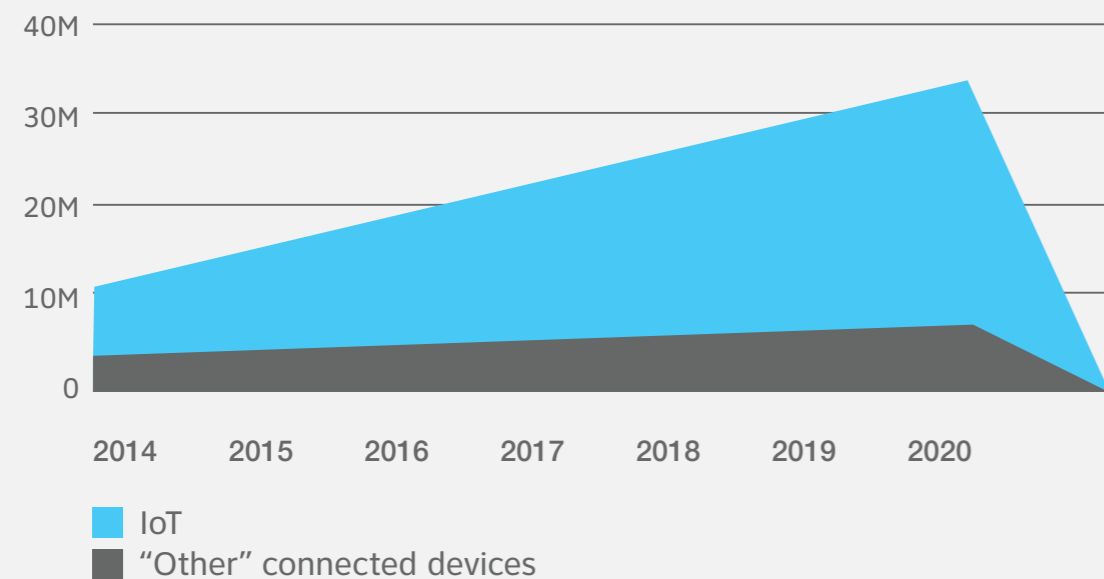
Source: IDC 2015

In this report, we define the Internet of Things (IoT) as the digitization of elements of the physical world, in which products and other "things" are outfitted with intelligent sensors and tags that let them communicate across the Internet without human intervention. This definition excludes smartphones and tablets.

The Internet of Things can be defined as the connection of everyday objects and machines so that they work seamlessly together across modern networks. The data collected must be aggregated, often disbursed amongst legacy backend systems, as well as stored and analyzed. With this, the data can be transformed into meaningful information in order to create new service opportunities and optimize business processes.

Companies often deploy IoT solutions for one of two reasons – efficiency gains or cost savings. With more innovation, companies are looking at IoT services to enable new business models, or create new revenue streams. Whether your interests are motivated by cost savings or improved revenue, the IoT is uniquely positioned to help with both.

The Internet of Things: The connection of everyday objects and machines so that they work seamlessly together across modern networks.
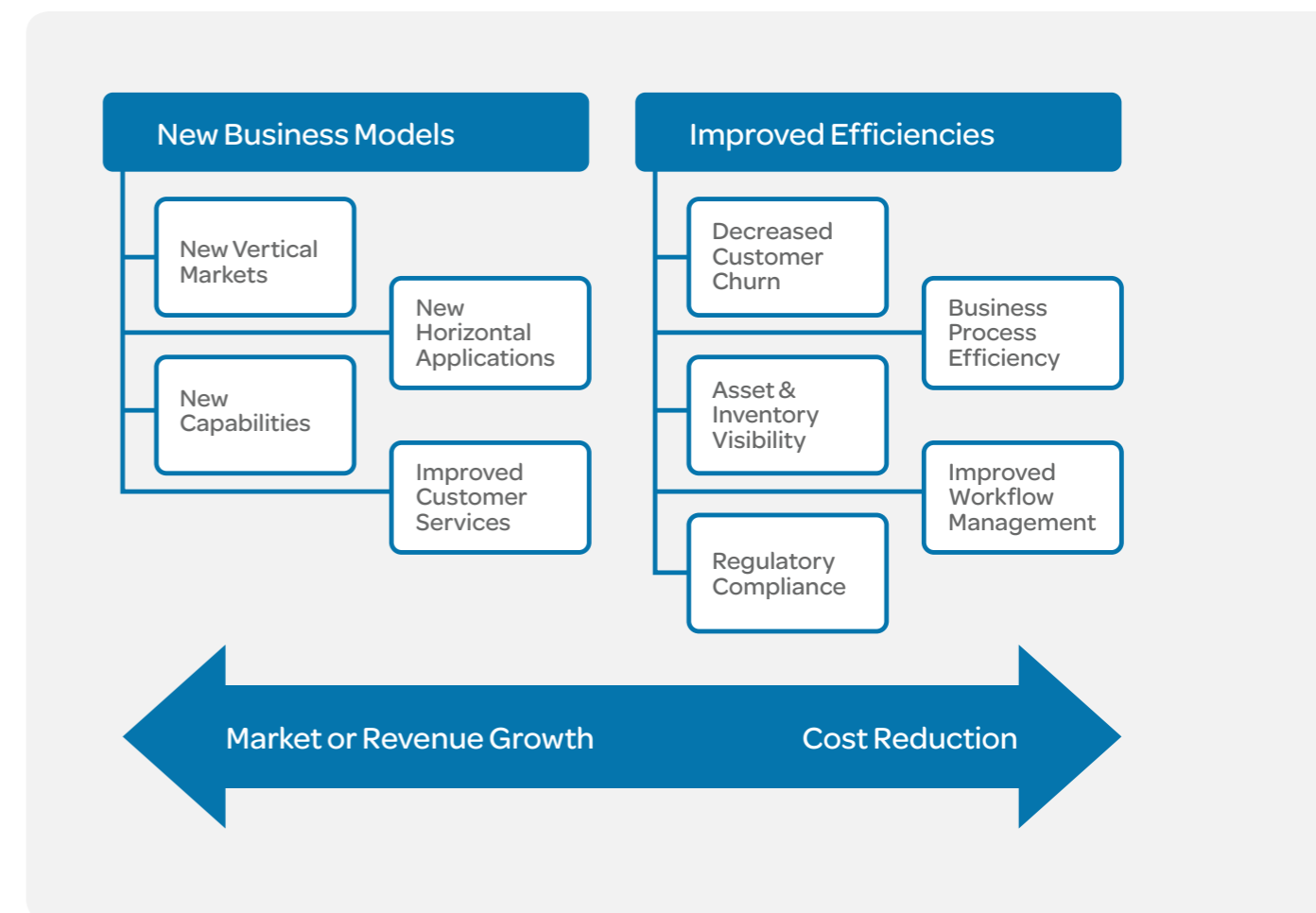
The developer's conundrum

In June 2015, AT&T and IDC fielded and completed a survey looking to gain a deeper understanding of developers and developer communities that are targeting IoT solutions, markets, and endpoints.

During the study, two primary obstacles were uncovered. First, developers are challenged to cut through all the noise about the endless potential of IoT and find the right focus. The second challenge is finding the right partner to work with to bring to market an application or solution that is effective, or where applicable, revenue generating.

+ Developing IoT applications is challenging

The majority of our developer audience (53.7%) found the process of developing IoT applications somewhat challenging, while another 9% expressed that it has been a very challenging process.

Q. Please choose the response that best describes your experience developing IoT applications.

Organized process
37.3%

Very challenging process
9.0%

Somewhat challenging process
53.7%
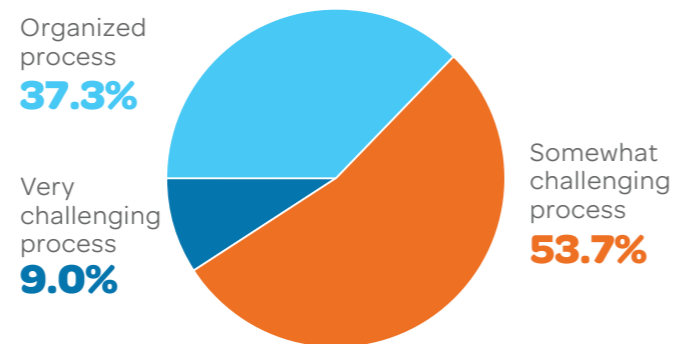
Source: IDC
The Developer's IoT Playbook: What to Expect and Where to Turn to Fast-Track Your IoT Initiatives

+ A shortage of skilled IoT developers is a primary obstacle

The shortage of skilled mobile developers is the primary barrier to efficient release cycles ahead of a number of well-known technical challenges.
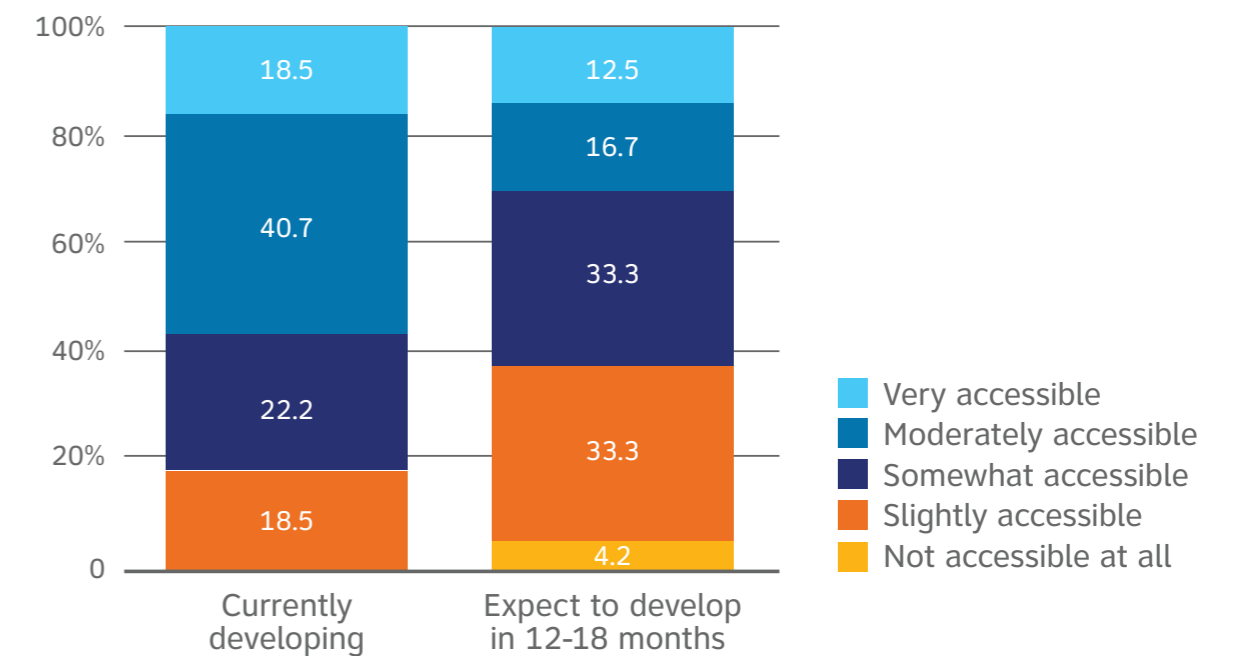
A lack of available talent has impeded the pace of enterprise mobilization.

In Appcelerator and IDC's 3Q14 Mobile Trends Report, both developers *(41.3%)* and IT decision makers *(33.5%)* cited "finding skilled resources" as the number one obstacle to timely app releases.

+ Training for IoT development is limited

82% of active and 87% of aspiring IoT developers indicated that technical information is less than readily accessible. This strongly suggests that developers are looking to vendors and service providers for better and more comprehensive toolsets and developer support resources, and that where such resources exist, IoT development is poised to accelerate.

Q. Please choose the response that best describes your experience developing IoT applications.

	Currently developing	Expect to develop in 12-18 months
Very accessible	18.5	12.5
Moderately accessible	40.7	16.7
Somewhat accessible	22.2	33.3
Slightly accessible	18.5	33.3
Not accessible at all		4.2

Source: IDC
The Developer's IoT Playbook: What to Expect and Where to Turn to Fast-Track Your IoT Initiatives

+ The Case for a Comprehensive, Platform-Centric Resource

The active IoT developers surveyed tell us they are using a broad variety of tools and resources to support their work. Aspiring developers' expectations about resource requirements lag behind what active developers tell us they are using in practice. This delta highlights how easy it is to under appreciate the need for resources in a new development domain like the IoT before projects are actively engaged.
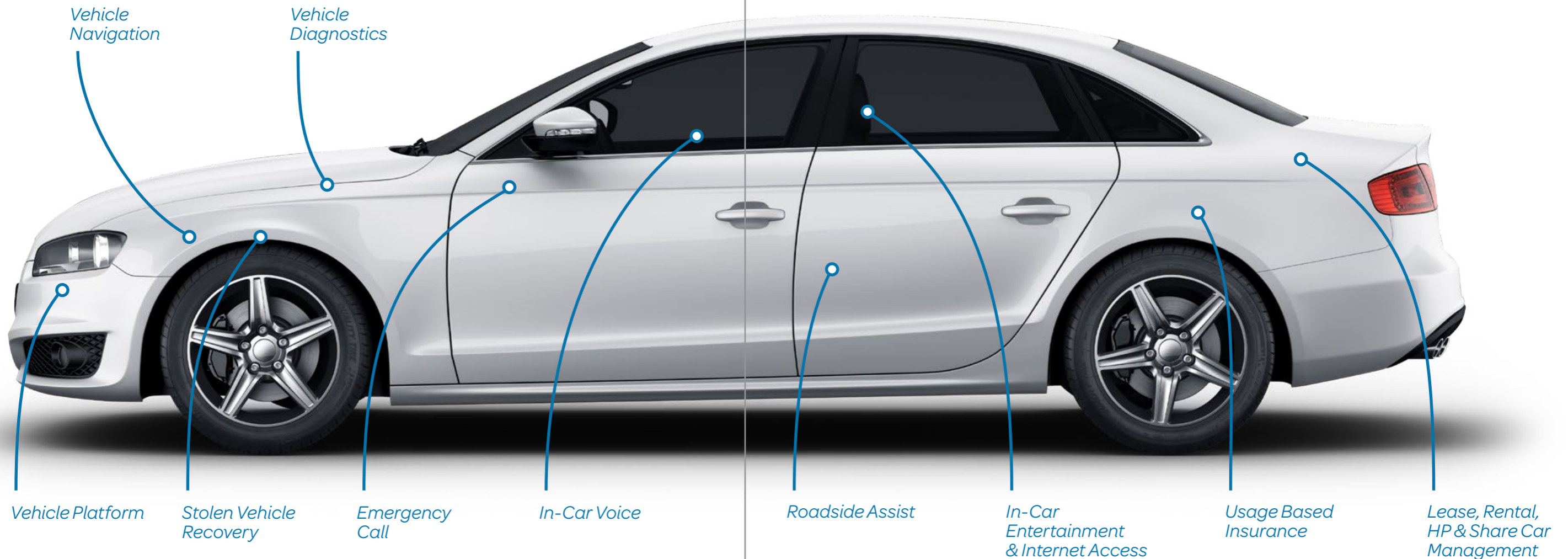
> > Get the Full Report

Driving the connected car revolution

9 Relationships with the top automakers in the world

10M+ Connected cars expected on the AT&T Network by the end of 2017

AT&T Drives IoT Innovation

Our goal with AT&T Drive is to bring together the top players in the industry to collaborate and accelerate innovation for end users. We want to give connected car drivers access to IoT applications that provide enhanced in-car experiences while continuing to focus on driver safety. It's hard to overstate the importance of the safety features. They include vehicle-to-vehicle communication and vehicle-to-infrastructure services. This combination creates an awareness zone around the driver's car that helps drivers anticipate and respond more rapidly, and appropriately, to potentially dangerous situations.

Vehicle Navigation

Vehicle Diagnostics

Vehicle Platform

Stolen Vehicle Recovery

Emergency Call

In-Car Voice

Roadside Assist

In-Car Entertainment & Internet Access

Usage Based Insurance

Lease, Rental, HP & Share Car Management

The connected car opportunity

1.2 billion

total M2M connections in the automotive sector globally by 2024

1 Machina Research estimates that at the end of 2014 there were approximately 125 million M2M connections in the automotive sector globally. By 2024, this will have grown to 1.2 billion, representing a CAGR of 23%.[9]

2 The ability to add connected services gives the automotive OEMs hope that they can create innovative, driver-oriented services that will bring in new revenue streams, reach out directly to the end customer so as to deepen the relationship, win valuable after-sales service business, and differentiate their cars from those of their competitors.
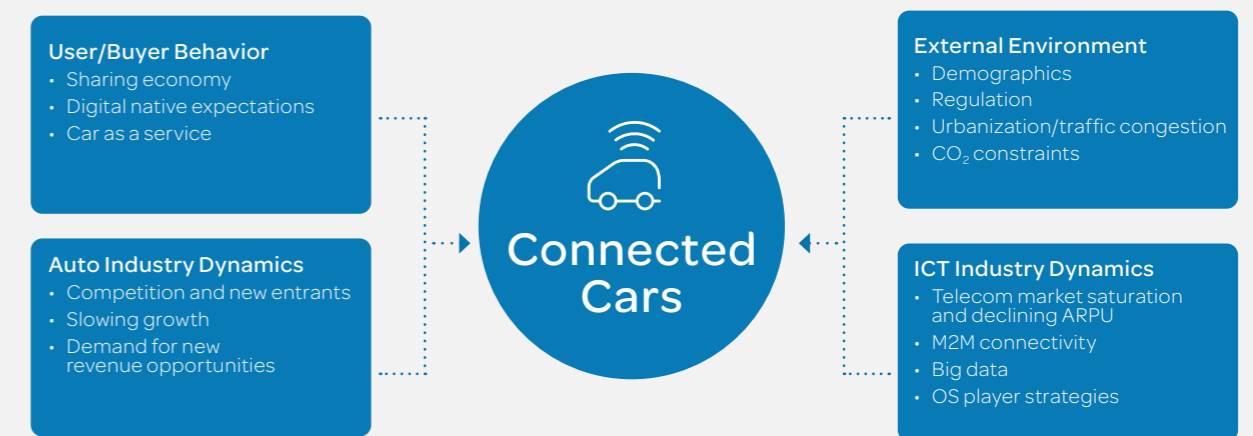
3 The arrival of Big Data, the Cloud, 4G and dedicated machine-centric provisioning platforms means that the telecom industry has some new tools to offer the automotive sector. The last few years have marked a sea-change due to one key factor: the advent of increasingly ubiquitous access to broadband networks. This allows the intelligence to reside on the network rather than on the device itself. The next five years may herald the shift from offline to online intelligence.

4 The next generation of car purchasers simply won't accept un-connected cars. It will seem natural to be able to access web applications and content from the driver's seat, albeit in ways that are appropriate to an in-car context.

5 In the near future, the idea that in-car users should only have access to media content that they physically brought with them into the vehicle, or broadcast media not targeted to their specific preferences, will seem quaint.

Increasingly, drivers will simply expect cars – like most other things that they own or use – to be connected to the Internet.

Factors driving the advent of the connected car

User/Buyer Behavior
- Sharing economy
- Digital native expectations
- Car as a service

Auto Industry Dynamics
- Competition and new entrants
- Slowing growth
- Demand for new revenue opportunities

Connected Cars

External Environment
- Demographics
- Regulation
- Urbanization/traffic congestion
- CO_2 constraints

ICT Industry Dynamics
- Telecom market saturation and declining ARPU
- M2M connectivity
- Big data
- OS player strategies

Source: Machina Research, 2015
Factors driving the advent of the connected car
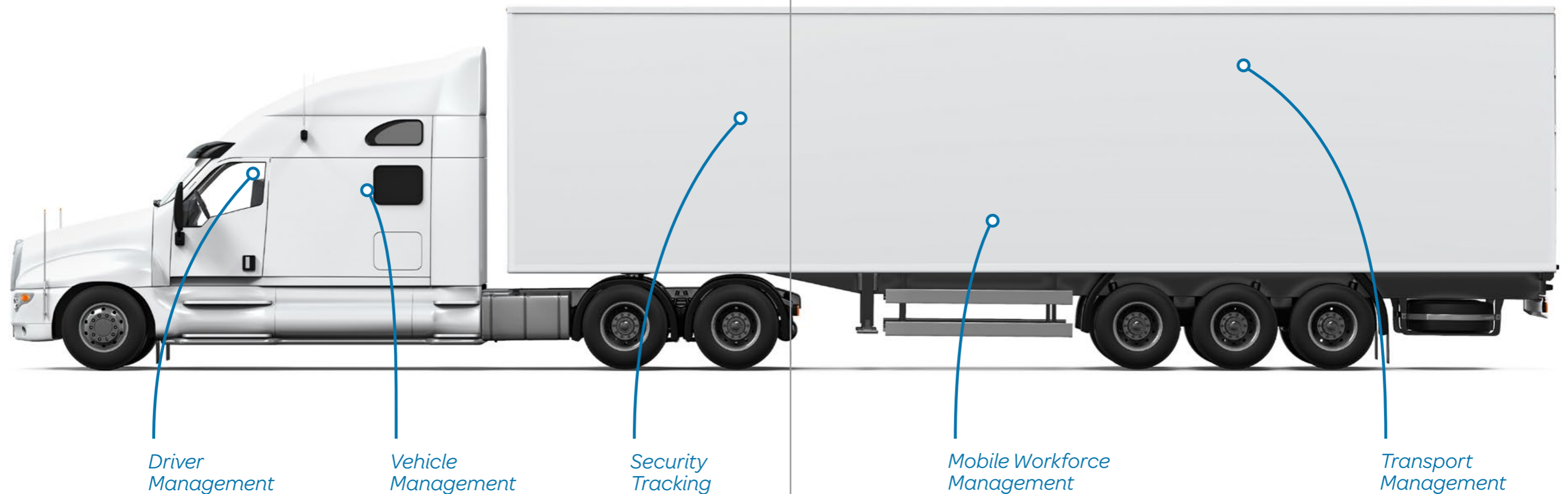
Fleet Management: End-to-End

1.9M Fleet vehicles on the AT&T network (as of Q2 2015)

74K Vehicles makes AT&T's own service fleet one of the largest commercial fleets in the US

The Internet of Things gives fleet managers the ability to monitor exactly where every asset is, 24 hours a day, 365 days a year. Even more important, businesses can use IoT applications to measure how their vehicles are being used. These solutions combine real-time global asset tracking with a wide variety of innovative, value-add services to save thousands, even millions, of dollars in unnecessary maintenance, DOT fines, and insurance expenses.

Driver Management

Vehicle Management

Security Tracking

Mobile Workforce Management

Transport Management

AT&T in the transport and telematics markets

9 of the top 10

Fleet management solution providers in the US market use connectivity services from AT&T

9.7M

Predicted number of active fleet management systems in use in North America by 2019

Source: Berg Insight, 2015[11]

1 In the future, fleets are expected to use vehicle data in a more analytical fashion. They will integrate new data sources to realize efficiencies, including the use of predictive capabilities for maintenance and operations.

2 Berg Insight anticipates a future scenario in which the global fleet management market is dominated by a handful of providers with installed bases measured in the millions.[10]

3 The Internet of Things - together with Big Data - is expected to create a marketplace for data analytics that will feed into decision support for fleet management and other solutions.

4 AT&T has extensive experience in serving the US transportation market. Out of AT&T's close to 25 million connected devices, in service, transportation-related IoT applications account for around 2 million units in North America.

5 AT&T's full portfolio supports basic fleet tracking needs, as well as the consultative selection of more advanced solutions. Fleets commonly adopt telematics systems from AT&T to improve management efficiency, proof of delivery, and driver productivity by using applications that streamline dispatching, routing, tracking, and reporting.

6 AT&T sets itself apart from the competition by working with a strong ecosystem of partners, offering a range of solutions designed to appeal to the needs of all segments in the transport sector. Both AT&T's history of success in the transportation market and its robust network of global SIM capabilities are industry differentiators.

The North American fleet management market is expected to experience strong growth in the upcoming years

The North American Fleet Management Market

Active FM units (millions)

Year	
2014	4.4
2015	5.2
2016	6.0
2017	6.4
2018	7.0
2019	9.4
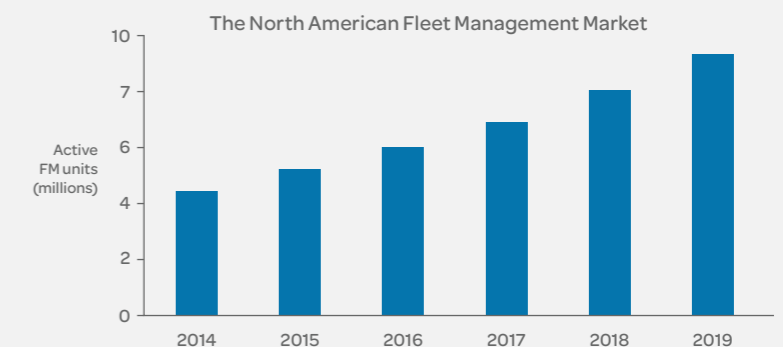
Source: Berg Insight, 2015[12]

Fleet case study:
B&P Enterprises

See the whole story

B&P Enterprises is an emergency response specialist operating 200 vehicles and over 400 other pieces of construction and marine equipment across the US. One of the company's major challenges was managing their rapid growth, including accurate tracking for all of their fleet resources.

B&P turned to AT&T and its innovative fleet solutions to develop a comprehensive, simple-to-implement program that would create immediate cost savings.

B&P's Bottom Line Results

80%
Fleet solution provided 80% decrease in DOT violations

86K
Fleet solutions saved $86,000 annually on insurance

"It's a huge benefit. The solution was cost effective, and we saw a return on investment immediately. AT&T also helped us setup and implement the new technology."

James Hinton, Environmental Health & Safety Director/DoT Manager, B&P Enterprises

AT&T
Smart Cities

66%
of the world's population will live in cities by 2050

60-80%
of global greenhouse gas emissions will be generated by cities

Source: United Nations, World Urbanization Prospects, 2014[13]

The Internet of Things gives cities powerful new tools for saving money and operating more efficiently. These innovative, intelligent solutions build more livable cities today, as well as a powerful bridge to the future.

*Smart
Security*

*Smart
Buildings*

*Smart
Healthcare*

*Smart
Energy*

*Smart
Transportation*

*Smart
Governance*

*Smart
Homes*

*Smart
Infrastructure*

Smart city case study:
Mueller Water Products

Working together with IBM and Mueller Water Products, AT&T is developing a solution that makes it possible to detect leaks in water mains. The three companies came together after the federal government issued an invitation for companies to showcase their smart city solutions.

This proof of concept is now a commercialized smart water solution for large companies, municipalities, or even water parks – leveraging acoustic technology provided by Mueller Water Products.

Acoustic sensors placed along the pipes trigger alarms when they sense sound changes that may indicate leaks. AT&T's LTE network carries the sensor information to computing resources running a water management application from IBM.

Mueller Water's Bottom Line

30%
of the pipes serving populations of +100,000 are 40 to 80 years old

Source: U.S. Environmental Protection Agency[14]

6 billion
gallons of water lost per day in the US

Source: American Society of Civil Engineers[15]

"Although the range of our IoT solutions continues to expand and evolve, the purpose for creating them remains the same: to help businesses streamline processes, reduce costs, be more productive, and create new products and lines of business."

Mobeen Khan
AT&T, AVP IoT Strategy and Product Management

AT&T and the Smart Grid - an insight into best practice enablers in the U.S. utility sector
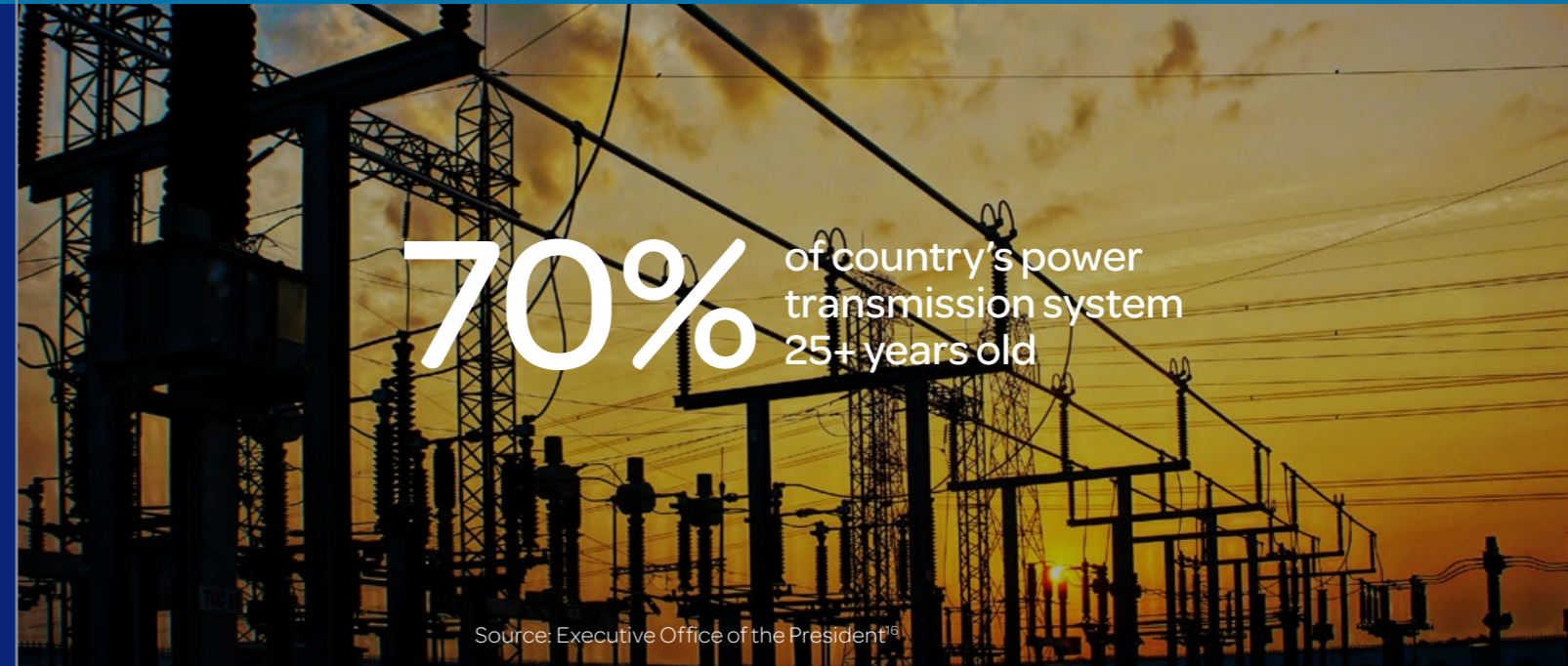
70%
of country's power transmission system 25+ years old

1 Combined utilities in the US generate approximately $370 billion in annual sales, making it one of the most important and visible verticals in the IoT. Bringing the industry into the 21st century is essential, with AT&T being an important enabler.[17]

2 However, utilities lose between one half and 1% of revenue to unpaid bills that are typically written off. This translates to $1 billion.[18]

3 AT&T has also been a pioneer in developing cellular reference designs for smart grid devices. In 2013, AT&T formed a global partnership with GE that led to the development of smart grid devices for smart meters and IoT devices for smart city applications.

4 To make it easy to support prepaid energy, AT&T's Cellular Reference Design for GE residential electric meters means that they are already prepay-enabled

5 One of the more successful approaches to date has been to implement power curtailment measures by modernizing the existing metering infrastructure. Investment in smart meters has produced a growing market for promoting sustainability initiatives in which companies such as AT&T are playing an important role as an enabler through its wireless offerings.

6 The AT&T M2X Data Service is another example of enabling of future technologies consisting of a managed service for developers aimed at advancing IoT applications. This cloud-based data store lets enterprises collect, analyze, and share data that can be tracked over a period of time from connected devices. For the utilities vertical, this is an important tool for enhancing edge computing to the grid, allowing for the decentralized rectification of issues around outage management.

AT&T's utility strategy targets four specific areas:

Rationalizing a Data Plan for Smart Grid Meters	**Reducing Complexity to Implement Smart Grid**
Capitalizing on Changes to the Existing Meter Infrastructure	**Developing Cellular Reference Design for Internet of Things**

Your supply chain under your command

AT&T Cargo View with FlightSafe®

Access global supply chain awareness and stay in control.

AT&T Cargo View with FlightSafe® puts you in control and helps you stay on top of your shipments from end to end. FlightSafe® devices with sensors travel with your cargo and stream information directly to you, so you maximize valuable tracking data and close monitoring gaps. Whether your cargo is on the ground or in the air, there is no detail too small when it comes to your business.

GPS | Temperature Sensor | Pressure Sensor | Light Sensor | Shock Sensor | Motion Sensor
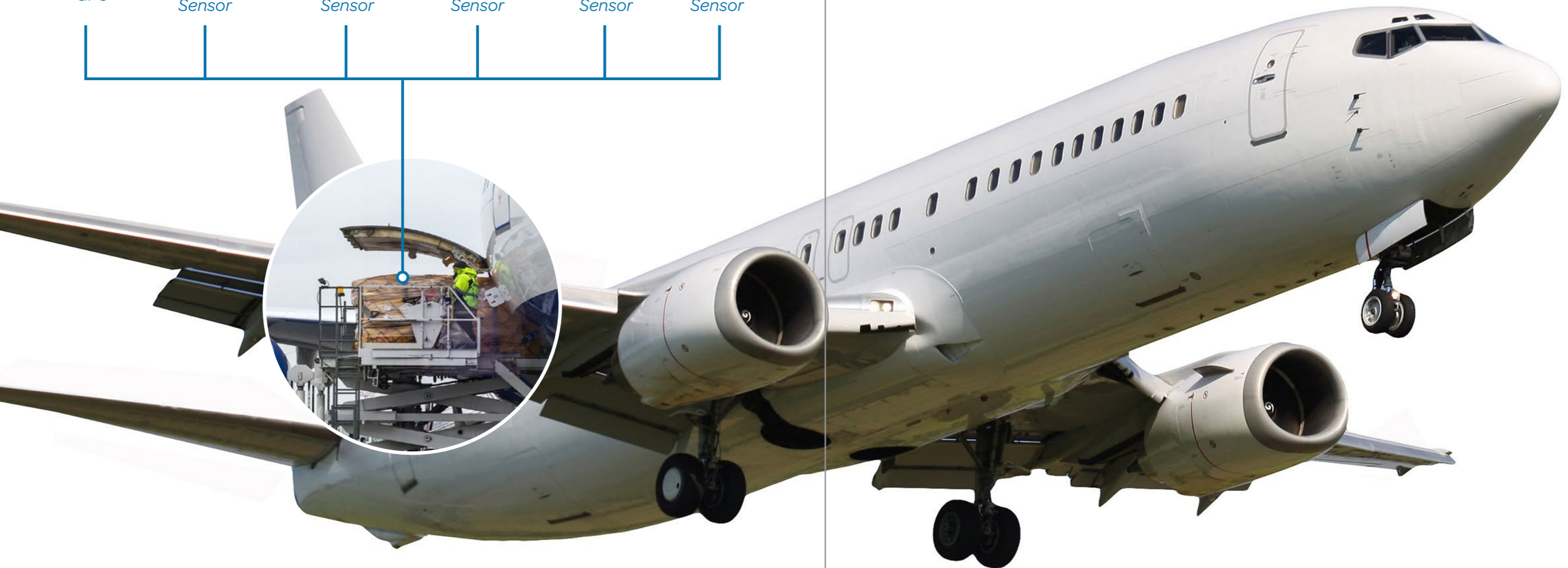
The need for proactive response

Supply chains have become larger and more interconnected. The globalization of the economy has created new challenges for transportation and logistics providers, including:

- *Higher operating costs and commodity prices*
- *A new, more complicated regulatory environment*
- *The need to transform crew productivity and operations*
- *Fleet management optimization and on-demand asset availability*
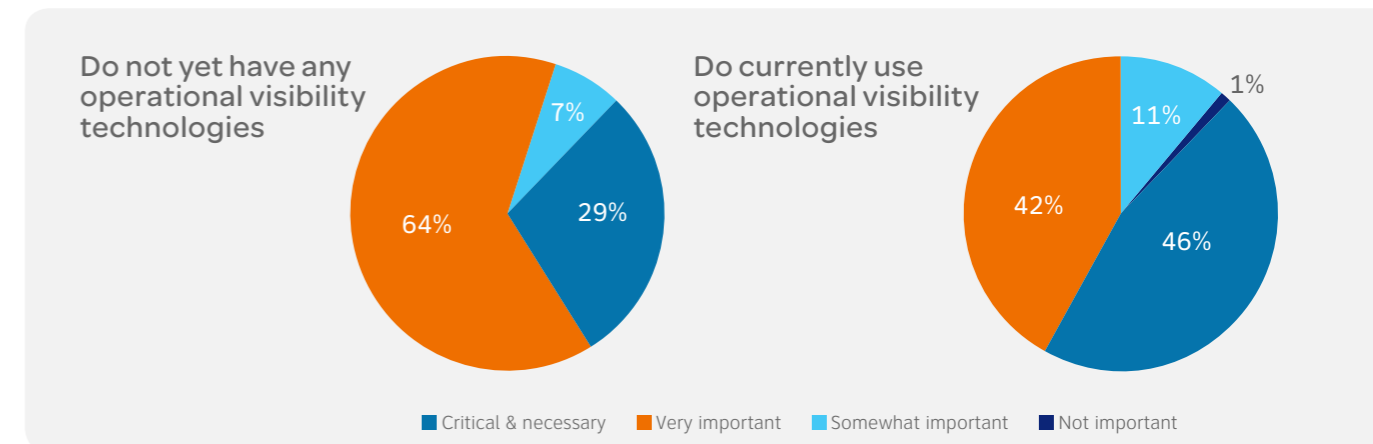- *Demand for customer service improvements*

In 2014, EyeForTransport Reports, in conjunction with AT&T, conducted a global survey of shippers and logistics providers to find out how the supply chain views the importance of operational visibility and monitoring technologies now and in the future. Key findings include:

1 Timeliness of information is the #1 challenge in the supply chain today

When asked about the number one problem in the supply chain today, 65% of respondents who have not deployed visibility solutions say 'timeliness of information is a 'big challenge'. This compares to 46% saying the same for those who have deployed solutions. This data illustrates that operational visibility solutions are dramatically reducing the problem of timely information and can be interpreted as a primary solution when problems do exist.

2 Increasing visibility is a top priority for those responsible for the movement of goods

When asked how important operation visibility technologies are to their businesses, around 90% of respondents reported that improving operational visibility and real time information is either 'critical and necessary' or 'very important.' Stated another way, less than 1% of all respondents said improving operational visibility was 'not important.'

Do not yet have any operational visibility technologies

64% · 29% · 7%

Do currently use operational visibility technologies

42% · 46% · 11% · 1%

■ Critical & necessary ■ Very important ■ Somewhat important ■ Not important

3 Companies that use monitoring technologies are moving beyond location data

Location information is very prevalent today with over 80% of businesses using it within the supply chain. However, the industry is moving beyond reporting just location, with over 40% of respondents reporting temperature data and over 40% using visibility data for security reasons to combat theft. Other operation visibility information in use includes engine telemetry, tilt sensors, tire pressures, driver performance, and proof of delivery.

4 Companies expect to see ROI within 2 years.

The returns will also come faster than you may think. 80% of companies who have already deployed some solutions and are looking to expand their use, believe that they will get a return within 2 years on their new deployments.

Between 2-3 years: 11% · More than 3 years: 9% · Within 2 year: 80%
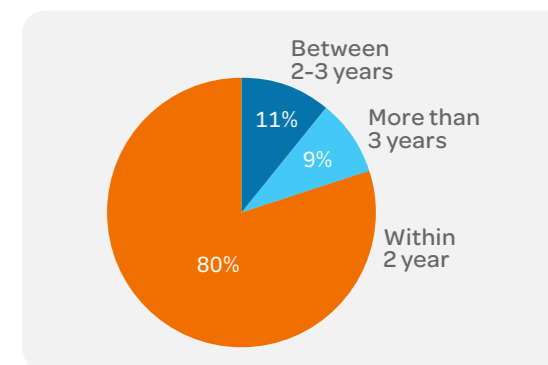
5 The technology outlook for IoT solutions in use by the transportation and logistics industry is strong.

The technology trend for operational visibility in transportation and logistics has now reached a point where deploying a compelling, automated solution to monitor goods in transit is commonplace. The new emphasis regarding receipt of timely information is in a number of areas; not just location, but humidity, temperature, and security can also be solved with the adoption of a fully automated IoT solution.

> > Get the Full Report

Asset management case study:
Maersk Line

In one of the largest agreements of its kind, Maersk is working with AT&T to track and monitor the condition of refrigerated containers with perishable goods. Before AT&T's solution, onsite supply chain managers were forced to check the condition of each container manually. Maersk now has near real time visibility into the conditions of each refrigerated container at almost any part of its journey along the supply chain. Shipping supervisors can monitor mechanical performance to help ensure the equipment is in proper working condition.

Maersk's Bottom Line Results

619 Container Vessels
Maersk Line is the world's largest container shipping company

+280,000
Refrigerated containers monitored via wireless

"AT&T's technology helps ensure container conditions are optimized and their contents arrive in proper condition – no matter the length of the journey."

Amdi Krogh, Maersk Line's Vice President and Head of Assets & Deployments

Taking the Next Step

While the Internet of Things may sometimes seems like a new buzzword or technology fad, it is hardly new at all. The move towards adding sensing, diagnostic, and communications capabilities to the "things" that are important to a business has been slowly moving forward for at least the last two decades.

What is new, however, is the rapid pace of innovation around it, and the expectations of what it means to business. Just as the Internet progressed quickly from an unknown technology to the dominant vehicle for global information exchange, and the Smartphone has gone from luxury device to a ubiquitous one in nearly every corner of the globe, IoT will look radically different in just a few years time.

Price decreases in sensors, chips, and broadband access, coupled with our improving ability to store and use data in the Cloud, is driving the current stage of fast IoT growth. However this rapid innovation will only be useful to companies who can master the business logic needed to make it serve their purposes.

This report has detailed many of the challenges and opportunities that business leaders and their teams will face as they move forward with plans that will incorporate the IoT into their businesses.

For most businesses the key question is not whether to adopt IoT solutions, but how to best use them.

Ultimately, a company's ability to realize the true potential of the Internet of Things is driven by its skill in utilizing the connectivity and information that comes from it. AT&T has helped companies big and small connect more than 25 million IoT devices to our network and the number is growing every day. Is your business ready to take advantage of the new potential the Internet of Things delivers?

Start a conversation with us today by visiting www.att.com/iot.

Sources

1. Internet of Things in Logistics, DHL Trend Research | Cisco Consulting Services, 2015
   http://www.dhl.com/content/dam/Local_Images/g0/New_aboutus/innovation/DHLTrendReport_Internet_of_things.pdf

2. The Developer's IoT Playbook: What to Expect and Where to Turn to Fast-Track Your IoT Initiatives, IDC, 2015

3. Worldwide Internet of Things Forecast 2015-2020, IDC, 2015
   http://www.idc.com/getdoc.jsp?containerId=prUS25658015

4. Internet of Things in Logistics, DHL Trend Research | Cisco Consulting Services, 2015
   http://www.dhl.com/content/dam/Local_Images/g0/New_aboutus/innovation/DHLTrendReport_Internet_of_things.pdf

5. The Connected Car, Fleet Management, and Telematics, M2M Now Magazine, April-May 2015
   http://www.m2mnow.biz/2015/04/27/32498-m2m-now-magazine-april-may-2015/

6. AT&T in the Transport and Telematics Space, M2M Now Magazine, April-May 2015
   http://www.m2mnow.biz/2015/04/27/32498-m2m-now-magazine-april-may-2015/

7. AT&T and the Utilities - An insight into best practice enablers in the U.S. utility sector, M2M Now Magazine, July-August 2015
   http://www.m2mnow.biz/2015/07/08/34626-m2m-now-magazine-july-august-2015-edition/

8. The Developer's IoT Playbook: What to Expect and Where to Turn to Fast-Track Your IoT Initiatives, IDC, 2015

9. The Connected Car, Fleet Management, and Telematics, M2M Now Magazine, April-May 2015
   http://www.m2mnow.biz/2015/04/27/32498-m2m-now-magazine-april-may-2015/

10. AT&T in the Transport and Telematics Space, M2M Now Magazine, April-May 2015
    http://www.m2mnow.biz/2015/04/27/32498-m2m-now-magazine-april-may-2015/

11. ibid

12. Berg Insight, Fleet Management in the Americas, November, 2015
    http://www.berginsight.com/ReportPDF/Summary/bi-fmam5-sum.pdf

13. World Urbanization Prospects, United Nations, 2014
    http://esa.un.org/unpd/wup/highlights/wup2014-highlights.pdf

14. The Clean Water and Drinking Water Infrastructure Gap Analysis, U.S. Environmental Protection Agency, 2002
    http://www.m2mnow.biz/2015/07/08/34626-m2m-now-magazine-july-august-2015-edition/

15. Infrastructure Report Card, American Society of Civil Engineers, 2009
    http://yosemite.epa.gov/water/owrccatalog.nsf/7322259e90d060c885256f0a0055db68/7a8df50b74d1585585256c44005dba46!opendocument

16. Economic Benefits of Increasing Electric Grid Resilience, Executive Office of the President, August 2013
    http://energy.gov/sites/prod/files/2013/08/f2/Grid%20Resiliency%20Report_FINAL.pdf

17. AT&T and the Utilities - An insight into best practice enablers in the U.S. utility sector, M2M Now Magazine, July-August 2015
    http://www.m2mnow.biz/2015/07/08/34626-m2m-now-magazine-july-august-2015-edition/

18. ibid

MOBILIZING
YOUR
WORLD[SM]

att.com/IoT