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Smart Cities Are Built On The Internet Of Things

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Smarter Cities Are Built On The Internet of Things

By all accounts, the Internet of Things (IoT) represents a huge opportunity for cost savings and new revenue generation across a broad range of industries. Lopez Research provided a primer on IoT and described how IoT impacts the manufacturing industry in the first two briefs in the IoT series. This brief will highlight several examples of how IoT is being used to create smarter cites.

In its most basic definition, the Internet of Things describes a system where items in the physical world, and sensors within or attached to these items, are connected to the Internet via wireless and wired network connections. The Internet of Things will connect inanimate objects as well as living things. IoT will connect everything from industrial equipment to everyday objects that range from medical devices to automobiles to utility meters.

Cisco offers a slightly broader definition that it calls the "Internet of Everything" (IoE), which brings together people, process, data, and things to make networked connections more relevant and valuable than ever before by turning information into action. Cities globally have the potential to claim $1.9 Trillion in value from IoE over the next decade, according to Cisco's study.[i]

General Electric defines a subset of this as the "Industrial Internet", which focuses on combining industrial equipment with intelligent decisioning systems. GE and the World Bank predict that roughly 46 percent of the global economy or $32.3 trillion in global output can benefit from the Industrial Internet. Meanwhile, IBM has defined sensor-enable devices and their associated systems as "Smarter Planet". Regardless of what we call it, it's clear that these new connected devices will provide new data sources, new challenges in collecting and analyzing this data and new opportunities to improve products and services.

Smarter cities are based on smarter infrastructure. There are many ways that IoT can help governments build smarter cities. One method is through optimizing services related to transportation, such as traffic management, parking, and transit systems. Let's look at three examples of how this is happening today.

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Minimizing Congestion With IoT

Traffic management is a problem that most cities and municipalities face today. With over half of the world's population living in cities in 2012, investing in smart traffic management solutions makes sense. Many cities are looking at ways to improve public transportation and provide better services within the city such as smart traffic signals. Highway administrators are also looking for new ways to manage long-distance passenger and goods traffic more efficiently.

Intelligent IoT–enabled transportation systems improve capacity, enhance travel experiences and make moving anything safer, more efficient and more secure. The local police, emergency services and other government services can use these sensor networks with smart traffic management to gain citywide visibility to help alleviate congestion and rapidly respond to incidents. For example, The Toronto Intelligent Transportation Systems Centre and Testbed, developed a system known as MARLIN-ATSC (Multi-agent Reinforcement Learning for Integrated Network of Adaptive Traffic Signal Controllers) to improve traffic flow with smart signals that process traffic information locally. Tests of the system on 60 downtown Toronto intersections at rush hour showed a reduction in delays of up to 40 percent. The test also showed it cut travel times by as much as 26 percent.

Singapore has adopted an Intelligent Transport strategy and set of systems. It has one of the least congested major cities, with an average car speed on main roads of 27 km/hr., compared to an average speed of 16 km/hr. in London and 11 km/hr. in Tokyo. The city uses an Electronic Road Pricing system where the tolls vary according to traffic flows. It has an Expressway Monitoring and Advisory System that alert motorists to traffic accidents on major roads. It also has a GPS system installed on the city taxis, which monitors and reports on traffic conditions around the city. Information from all of these systems is feed into the Intelligent Transport System's Operations Control Centre, which consolidates the data and provides real-time traffic information to the public.[ii]

Cities and municipalities are also collaborating to build interconnected intelligent traffic management systems that optimize the overall road capacity within a region and between regions. For example, the city of Amsterdam now uses TrafficLink's SCM system

that is connected to the traffic system of the national government. Both centers can view and automatically manage traffic within the region. The city plans to expand the service to in-car and navigation equipment to further reduce congestion. [iii]

Improving Parking With IoT

The Internet of Things can also make life easier for citizens and visitors through smart parking. Streetline, a smart parking company, estimates that 30 percent of urban traffic is caused by motorists looking for parking. In a study that measured traffic in one Los Angeles 15-block area for a year, researchers found that drivers drove more than 950,000 miles, produced 730 tons of carbon dioxide and used 47,000 gallons of gas searching for parking.[iv]

Smart wireless sensors embedded in parking spots can gather the real-time status of municipal and garage metered parking spots. The sensors can track if a spot is occupied, empty, or expired. It sends this information to a data management system, which links to a mobile application for drivers. Once a person can use an application to find an available parking spot, the city can fundamentally change traffic patterns and consumer behavior. Smarter parking could minimize traffic congestion, reduce carbon emissions and eliminate labor inefficiencies associated with parking enforcement.

IoT Helps Keep The Trains On Time.

Yarra Trams, operator of Melbourne, Australia's 100-year-old tram network, is using Internet of Thing technology to improve day-to-day tram operations and passenger experience. It's the largest operating tram network in the world with more than 250 kilometers of double tracks. It manages more than 91,000 pieces of equipment and 487 trams traveling on 29 different routes. Neil Roberts, director, ICT, for Yarra, says, "We are committed to delivering a world class service to all our passengers, but keeping our trams running is no simple task. Our greatest asset in tackling this challenge is data and smarter infrastructure software. In late 2013, we began operating the first of fifty new E-Class trams. They joined a fleet of eight different classes of trams of varying ages dating back to 1939."

One challenge obviously is that older trams have very different maintenance needs than new. In addition to managing repairs across new and aging infrastructure, Yarra's operations center and maintenance teams are charged with keeping trams running and re-routing passengers even when streets are flooded. When major events like the Australian Open are held in Melbourne, Yarra increases tram service in specific areas to accommodate heavy passenger traffic.

To ensure trams are available when and where passengers need them, says Roberts, "we have turned 91,000 pieces of tram equipment into 91,000 data points. Sensors and reports from our employees and passengers provide information in real-time about tram equipment, services and maintenance issues. For example, an automated wheel-measuring machine housed at a tram depot detects the condition of a tram's wheel. The data allows Yarra to alert maintenance teams to potential issues and ensure necessary repairs are made before service is disrupted.

"With this kind of data, as well as mobile technology," says Roberts, "we can prevent service disruptions, schedule predictive maintenance, quickly re-route trams and better communicate information about tram services to passengers."[v]

These are just three examples of how IoT is changing transportation within cities. In future briefs we'll provide examples of how IoT is being used to save energy, improve water and waste management and

Three Steps To Improve Transportation With IoT

IoT requires a company to modify its network-connectivity models and prepare for a massive increase in real-time information. CXOs must redesign processes with multiple interaction models in mind, including machine to machine (M2M) and people to machine communications. Obviously smarter traffic systems are one area that municipalities and transportation entities should be evaluating. However, there are several basic areas that operations and IT should be evaluating to support these efforts, which include:

- **Defining which processes benefit from IoT.** A successful strategy will define what new data could be available from sensor-enabled equipment. It will then map

this data against existing processes and look for ways that IoT data can optimize operations and assets while improving service and safety. Work flows and apps that benefit from location and environmental data, such as asset tracking and equipment health, are a logical starting point.

- **Building an open IP infrastructure for IoT.** Many industrial systems have traditionally used proprietary networks for communications. As transportation companies look to build IoT networks they should look for solutions that leverage IP. For example, the city of Barcelona is using a Cisco WiFi Mesh network in the Born District to provide connectivity and infrastructure-based management services different metropolitan devices, such as sensors, cameras and actuators. It connects environmental smart sensors report in real-time on temperature, noise, humidity, gas and dust-particle concentration and more.
- **Defining a strategy for big data processing and analytics.** Governments need to cost effectively store and analyze large volumes of disparate data from IoT and other sources. One place to start is evaluating the various NoSQL databases that have recently come to market. Governments also need an API strategy that will allow third parties to access part of this data for the public good. For example, Amsterdam's department for Infrastructure, Traffic and Transportation made all of its data available to developers who are using it to create apps that improve the flow of people throughout the city.

Summary

In this new world, IT and operations management can be the lead architects of business transformation. Transportation companies will use IoT to save energy, improve transportation and improve public safety. To be successful, governments must build the right network infrastructure, imbed context from IoT into business workflows and design a foundation for gathering and understanding sensor data.

About Lopez Research

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Lopez Research, founded in 2008, is a market research and strategy consulting firm that specializes in how mobile technologies, big data and cloud computing will create contextual "Right Time Experiences". The company's mission is to understand the evolution of these trends, provide thought leadership, and assist both enterprise and technology vendor clients in building winning market strategies.

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[i] http://newsroom.cisco.com/release/1308288

[ii] http://cityclimateleadershipawards.com/singapore-intelligent-transport-system/

[iii] http://cityclimateleadershipawards.com/projects/detail/id/58/slug/smart-traffic-management

[iii] http://amsterdamsmartcity.com/projects/detail/id/58/slug/smart-traffic-management

[iv] "Becoming a Smarter City," p.4, http://www.streetline.com/smart-cities/smart-city-whitepaper/

[v] Neil Roberts. "How Big Data Keeps Yarra Trams Running on Time, Rain or Shine," (September 16, 2013), http://asmarterplanet.com/blog/2013/09/yarra.html