The Internet of Things: The Analytic Possibilities are Endless

The buzz around the term "Internet of Things" (IoT) amplifies with each passing day. It's taking some time, however, for everyone to fully comprehend just how valuable this phenomenon has become for our world and our economy. Part of this has to do with the learning curve in understanding the sophisticated technologies and analytics involved. But part of it is the sheer, staggering scope of value that's possible worldwide. A **comprehensive study** in June 2015 by the McKinsey Global Institute, in fact, concluded that IoT is one of those rare technology trends where the "hype may actually understate the full potential."

The Internet of Things is our constantly growing universe of sensors and devices that create a flood of granular data about our world. The "things" include everything from environmental sensors monitoring weather, traffic or energy usage; to "smart" household appliances and telemetry from production-line machines and car engines. These sensors are constantly getting smarter, cheaper and smaller (many sensors today are smaller than a dime, and we'll eventually see smart dust: thousands of small processors that look like dust and are sprinkled on surfaces, swallowed or poured.)

As the volume and variety of sensors and other telemetry sources grows, the connections between them and the analytic needs also grow to create an IoT value curve that's rising exponentially as time goes on. **IDC predicts** the installed base of IoT connected things will reach more than 29.5 billion in 2020, with economic value-add across sectors by then topping $1.7 trillion. Indeed, Gartner and others have anointed the IoT as a **top strategic trend** in technology, and few industries will remain untouched by the tremendous possibilities and value the IoT is creating.

A World of Possibilities

We are increasingly seeing examples of IoT play out in everyday life. Consider how it's now possible to monitor cargo, not just tracking a package from origin to destination, but also its transportation conditions throughout the journey. Light sensors can be placed within a container to determine when it has been opened. Additional sensors can monitor humidity and temperature for sensitive-items like food, pharmaceuticals, chemicals, flowers, or artwork.

At grocery stores, sensors can now track which aisles you visited, where you spent the most time within those aisles and even what type of items you lifted and browsed. Sensors on board most new cars, meanwhile, can track things like speed, braking, engine conditions and other factors; this provides new clarity for insurance companies looking to assess driving habits or auto manufacturers hoping to understand an engine breakdown or part failure.

Believe it or not, these are some of the more modest examples of what the Internet of Things is making possible. As device and analytic capabilities become more robust, we are seeing more and more complex systems. Today's Ford Fusion, for example, has upwards of 70 sensors and 145 actuators generating more than 4,700 signals and 25 gigabytes of data hourly.

These growing capabilities allow for more advanced "point solutions" to address specific consumer or businesses needs. Already on the market, for instance, are smart braking systems in automobiles that combine laser sensors with braking and engine actuators to detect an imminent collision and automatically stop the car if the driver doesn't take evasive action.

With More Connections Comes More Capabilities

This upward trend in IoT value will continue exponentially as capacity and performance of sensors and embedded computers grow in accordance with Moore's law and economics. Today's sensor that detects the refrigerator door opening will evolve soon enough into the micro computer keeping track of the entire inventory inside the refrigerator.

What's more, the level of connectedness between IoT devices is constantly improving, and this connectedness is a key driver of IoT's growth. The McKinsey report, in fact, found that advances in connectivity and interoperability between IoT systems is critically important to capturing maximum value; anywhere from 40-60 percent increases in value can be obtained this way, depending on the business setting.

Let's illustrate this concept of connectivity by literally connecting our refrigerator anecdote with the grocery analogy we mentioned earlier. We're nearing the point where we'll be able to use sensors in refrigerators to gauge when we are running low on certain food items and automatically reorder through our local grocer or online retailer of choice.

We can also expect to see increasingly sophisticated screens in stores, along with mobile interfaces for portability of the retail experience from store to online through smartphones and tablets. Imagine shoppers walking through a grocery store in a connected world. A monitor in the fresh tomatoes and celery aisle will recommend purchases based on prior buying habits, flag out of stock items at home and suggest useful recipes based on what's in the basket so far.

The Future Rests on a Foundation of Smart Analytics

You can see how the Internet of Things is growing through this exciting interplay between devices and connectivity, enabling more and more complex systems and capabilities. The key driver of value, however, depends on the analytics we can apply on machine data to reap insights and competitive advantage.

As we build better algorithms for the burgeoning IoT digital infrastructure, we are learning to use connection-based "smart analytics" to get very proactive in predicting future performance and conditions and even prescribing future actions. We spoke before about sensors that can diagnose what may have gone wrong when an engine or a part failed. What if we could predict such a failure before it ever happens? With advanced smart analytics today, we can. It's called predictive maintenance and it utilizes a probability-based "Weibull distribution" and other advanced processes to gauge "time to failure" rates so we can predict a machine or device breakdown before it happens.

One major provider of medical diagnostic and treatment machines has leveraged predictive maintenance to create "wear-out models" for component parts in its products. This enabled early detection and identification of problems, as well as proactive root cause analysis to prevent down time and unplanned outages. The result is increased up-time of machines, extended maintenance windows and longer lifetimes for costly components.

A large European train manufacturer, meanwhile, is leveraging similar techniques to prevent train engine failure. It's a key capability that has enabled the firm to expand into the leasing market; the company increasingly doesn't sell trains, but rather leases them to the operators. It's a profitable line of business, but only if the trains remain operational: If a train is out of service, the company doesn't get paid.

Analytics and "Systems of Systems"

There is really no limit to how far we can take this alchemy of sensors, connections and algorithms to create more and more complex systems and solutions to the problems facing businesses—even society at large. As a recent Harvard Business Review article on technology and competition pointed out, a dynamic "system of systems" approach can lead to tremendous industry-changing, and even world-changing, innovations. The article cites global agriculture—feeding the world's people—as an IoT success story. Heavy machinery, irrigation systems, soil and nutrient sensors, financial information and weather data are all connected and analyzed in ways that supercharge farm yields and efficiencies.

Google's self-driving car, meanwhile, is another revolutionary system of systems innovation built from many smaller point solutions. We already mentioned automatic braking; together with other systems covering everything from acceleration and engine performance to navigation and steering, you get a world changing innovation that is more than the sum of all the smart systems that went into it. Once we have our self-driving car, however, we'll eventually graduate to an even larger system of systems environment of many such cars coordinating with each other—and with centralized networks governing traffic and roads—for efficient and driverless transport on a massive scale.

Zoom out even further and we're getting into "smart city" territory, where all sorts of civic infrastructure and functions are coordinated and optimized by IoT-driven analytics. IDC, in fact, has identified federal, state and local government clients as leading IoT buyers, with an estimated market size of $265 billion in 2014 and compound annual growth rates of more than 10 percent through 2017.

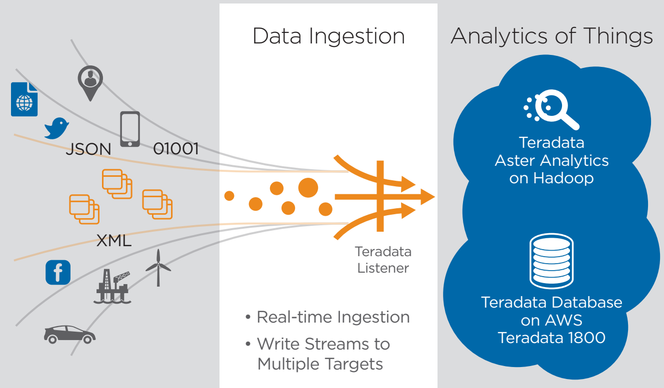
Building Architectures for Future-Proof IoT Analytics

Devices of all types are coming online and connected in networks at break-neck speed today, but for all the promise and potential success is impossible without the right analytics architectures in place. Investing in the right platforms for analyzing IoT data will separate the market leaders from the also-rans. Most companies today still struggle to capitalize and make use of all this IoT data. Indeed, McKinsey's June 2015 IoT report found that less than one percent of IoT data is currently used; and those uses tend to be straightforward things like alarm activation or real-time controls rather than advanced analytics that can help optimize business processes or make predictions.

Even the most tech-savvy businesses are now realizing that extracting value from the data is a difficult and skills-intensive process. The hardest thing for any manufacturer to do is to analyze the entire process from supplier goods testing, through design, to manufacturing to delivery and use. This means all the data needs to be analyzed as a whole to see correlations that cause quality problems.

Better analytics allow for an ever-widening dashboard of operations and paths to value. Key priorities include intelligent "listening" to massive streams of IoT data to uncover distinctive patterns that may be signposts to valuable insights. We must ingest and propagate that data in an analytical ecosystem with advanced machine learning algorithms, operating at scale to reap sophisticated, actionable insights.

Teradata IoT Capabilities



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Agility is key: Architectures need to follow multiple streams of sensor and IoT data in real-time and deploy an agile central ingestion platform to economically and reliably listen to all relevant data. Architectures should also be configured to deploy advanced analytics—including machine learning, path, pattern, time series, statistics, graph, and text analytics. The entire environment should be thoroughly self-service to enable rapid innovation of any new data set and avoid bogging down IT personnel with costly, requirements-driven custom projects.

These are the kind of capabilities companies must pursue to economically spot and act upon new business opportunities made possible by the Internet of Things. It takes a good deal of investment and strategic planning, but the payoff in terms of analytic insights and competitive advantage is well worth it. But, time, as it tends to do, moves ahead at constant velocity and the inflow of data multiplies each moment. Every business must think today about how to more effectively collect, organize and analyze the growing wave of IoT data, and start working on a new way forward.

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