Capitalizing on the Business Value of the Internet of Things: The Time to Act Is Now

While the full impact of the Internet of Things (IoT) may seem like a far-off future event, that future is happening right now. This massive network of physical objects with IP addresses or other radio signals that communicate with each other over the Internet is rapidly increasing, and the pace is accelerating. Companies in every industry and sector are seizing the opportunities IoT offers. If your firm does not enter the ring soon, your competitors will certainly leverage IoT to improve efficiencies and reduce costs—thus increasing the pressure on your organization.

Studies indicate approximately 12 billion devices currently connect to the Internet worldwide—this includes basic computing devices such as servers, desktops, laptops, smartphones and tablets.[1] As IoT utilizes embedded technology to extend connectivity beyond these traditional devices to a diverse range of everyday things—such as thermostats, vehicles, appliances, wearables, electronic devices and vending machines—the IoT footprint will expand tremendously.

[1] *ABI Research estimates that by 2020, the number of IoT devices will swell to as many as 40.9 billion.*

The Internet of Things remains as one of the top emerging technologies in the 2016 Gartner Hype Cycle Report. There is increased acceleration in the IoT space in both the public and private sectors. What was once further out now seems to be accelerating towards us—fueled by many technological advances, cost optimizations, business use cases and innovations in different verticals that can be cross-leveraged.

Despite the IoT tsunami, many firms find themselves unable to capture its potential. The technologies required to seize upon the IoT opportunity seem too complex to grasp and deploy successfully, and the benefits too vague.

At first glance, this certainly appears to be an acceptable reaction. Exactly how does a company go about embedding technology into all of its devices to generate meaningful and actionable data that can improve efficiency, increase revenue or enhance customer intimacy? How can all of these devices connect to the Internet to transmit and receive information? And if successful in connecting all these devices, how can a company then link IoT systems to core applications by adding an additional dimension to your data to reduce mean time to repair or make emergency medical procedures more effective?

Although answering these challenges by building a technology system to seize the IoT opportunity is complex, many companies are already getting it done. Even better, IoT has matured enough that technology providers have developed best practices and know the pitfalls to avoid. By working with the right partner, your company can soon find itself leveraging the IoT to provide value, gain more customers and increase market share in the digital economy.

The Endless Possibilities of the Internet of Things

A number of use cases are already fueling the implementation of the Internet of Things to improve quality of life, create operational efficiencies and generate contextual awareness. Some use cases have grown at an unprecedented pace due to the consumerization of some of these "Things," while others have risen from industrial control systems.

At CES 2017, the Internet of Things technologies were clearly the dominant theme, and the uses of IoT have spread across the spheres of healthcare, the environment, city management, retail operations, supply chains, banking and a host of others. Here are just a few examples of the uses of these "Things" in our lives:

Personal Devices: Bluetooth-enabled pedometers can now talk to smartphones to transfer data that can be analyzed in many ways. The groundswell in the consumerization of the pedometer has led to many start-ups and manufacturers building innovative solutions, and of course the apps to go with them. Starting from a simple display that showed the number of steps taken, and expanding capabilities to sense if it was a regular walk or an intensive run, pedometers started to peak the interest of consumers. Advancements in technology enabled additional sensors to be added to the pedometer, particularly in the area of Micro Electro Mechanical Systems (MEMS). Today, most wearables have multicore processors, 512MB of memory, 3-axis accelerometers, a magnetometer, a gyroscope, barometer, Bluetooth, and a high quality display running on a light OS, all in a smaller package. The consumerization of wearables is an important turning point for the success of IoT.

Healthcare Sensing: Healthcare sensors and underlying technologies have gone through a major evolution. As wellness awareness in consumers increases and the cost of the sensor-laden wearables decreases, the quality of sensing will also significantly improve. The healthcare IoT is context-aware to enable the gathering of information that is relevant about patients, the environment, patient activity and other factors that help healthcare professionals respond in a manner that saves lives. Composite sensor arrays can help by creating an enhanced experience—leveraging and combining ECG, blood oximeters and heart pulse monitors.

Healthcare insurers want to provide personal-device sensors for their insured clients. Some employers are encouraging employees to stay fit and granting them devices such as the Fitbit® as part of their corporate wellness program. The ultimate vision is that data and other medical facts about consumers can be integrated into electronic medical records. This will create a place where authorized doctors, healthcare providers and insurers/healthcare exchanges can use the data to improve the quality of healthcare.

Home Sensing: The cost of these sensors is also reaching a point where they are now affordable and simple to install and configure. Within minutes of set-up, homeowners can monitor their entire home. Solutions also enable the control of appliances in the home, as well as views of the data that can be generated from wherever homeowners can operate smart devices. The 'smart' nature of these sensors is the ability to sense that no one is at home, so the HVAC can automatically switch to a power save mode.

It can also tune into energy alerts and help conserve energy. Companies such as Insteon and Google, with its Nest acquisition, have opened up the space even wider with multiple products.

Retail Sensing: Retail has a number of use cases where IoT is being deployed in a manner that generates efficiencies in operations; enhances supply chain functions; creates improvements to stores, warehouses and depot operations; and provides higher-quality service to customers. For example, store sensors can help identify customers as they walk into a store. This is helpful for managers and associates to know if a high-value customer walks in based on historical purchase data. This can help in improving customer touch points: customers could be identified via an RFID embedded into their store card, and the sensor can then pick up the aisles the customer frequents, which gives the store the ability to target customers with promotions while they are navigating the aisles. This information is important to store planners for understanding flow patterns and helping place products in aisles. The IoT also offers a host of other possibilities for the retail sector including the ability to monitor food temperature in refrigeration cases for spoilage and carbon footprints of a store or a group of stores in a region.

Industrial Control: A number of industrial control systems also leverage the IoT through communication protocols that are widely used for industrial automation such as RS-232, RS-485, CAN Bus and ModBus. Multiple strategies are being used to read data from sensor meshes within the control systems and provide data back to industrial controllers. Almost all sensors in industrial control are closed loop systems, but recent changes in IoT have opened up the data they produce so that other systems can consume it. Many industrial sensors have ruggedized construction and the capability to sense carbon monoxide, temperature, humidity, pressure, acceleration, orientation, pH, luminosity, vibration and exerted force to name a few. The methods to connect these sensors are already located on many existing industrial buses. For example, a Programmable Logic Controller (PLC) may utilize a ModBus. If that is the case, the sensors can be developed to talk on that industrial bus. There are also a number of wired and wireless options available that connect from one base station to another via WiFi, GPRS, ZigBee, Bluetooth/BLE, 6LoWPAN, RF-868/900 MHz and other fast developing ones such as Thread.

IoT Deployment Challenges

While the promises of the IoT are great, development work must proceed deliberately and address a number of challenges inherent in IoT technology. Technology providers have already developed solutions for some of these challenges while others are yet to be encountered in the real world. Theoretical analysis on how to manage these solutions exists, but there are limitations to the infrastructure as it stands today.

The data generated by the IoT presents a couple of challenges due to the fact that companies are dealing with unprecedented levels of volume, velocity, variability, veracity and variety. These are attributes of Big Data. Companies are tracking data from a variety of sensors against a time which adds another dimension to transactional systems. The reliability is increasing, but the focus must be on deploying multiple, low-cost sensors that require low power and low maintenance.

Here is a quick rundown of the major challenges companies face when trying to leverage the IoT:

Managing Big Data Output: The IoT can produce a magnitude of data that few companies are prepared to support. Companies need to access the data right away because there is a short time window of value. This drives the need to collect, extract and consolidate the data quickly to generate actionable insights. But the pay-off is huge—distilling the data down quickly improves customer interactions, employee productivity and business-process efficiencies, such as preventative maintenance.

Connecting IoT to the Core Business: With the higher volume and greater velocity of data that IoT generates, the IoT platform itself must be a single-purpose platform in order to be efficient. But as the analysis determines certain conditions, the platform must also invoke workflows and other processes for which there are existing and established systems. For example, airplane sensors detecting maintenance requirements will need to trigger workflows that exist in another 'open' complementing system when the plane pulls into the gate. Given the number of sensors and special-purpose implementations, IoT systems will thus need platforms that communicate with other platforms in an API-like manner.

User Experience and Interface: The user displays of the data are critical. Sensors will capture a lot of the raw data, and some device-processing will occur. This means the sensors will sense changes and use an ADC to convert it to readable data, but it will have to convert the reading to the right metric unit. The data will then be sent via the propagator to the integrator, and the integrator then needs to visualize the data along with the transactional data. This is where dimensional data modeling and visualizing the data becomes important.

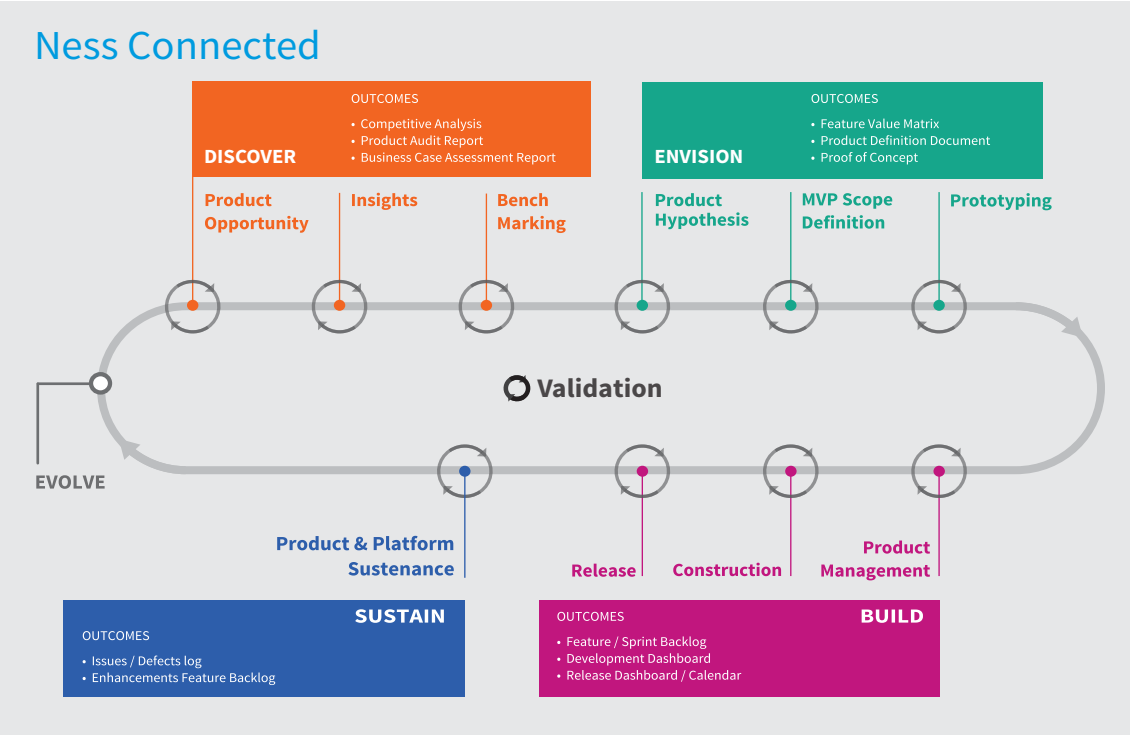
Technology Skills: This includes innovative thinking to apply IoT technology to achieve business initiatives and to solve business problems.

Companies also require development skills for their IoT platform—the ability to write the code to make the IoT happen and to make sense of all the data that the IoT generates. Companies also need technology skills to address the rapid nature of change: once data generation begins, the lifespan of each app is incredibly short before another idea is required.

Mobility: As mobility plays an increasing role in the way businesses run their operations and communicate with customers, embedded things in devices will need to cross the air gap between remote systems and their parent network as their connection into the IoT.

Overcoming the Challenges in Pursuit of Efficiency

Designing and deploying a simple process to deal with the various types of IoT complexities is critical. As the challenges above illustrate, there are many intricacies, new paradigms, shifts in thinking and technologies to cope with. The process illustrated below highlights the stages of the journey to build and sustain an IoT-based product—either by itself or by integrating it into the business. We see that building solutions that uses the IoT expands into newer business models. A traditional software or product development lifecycle (SDLC/PDLC) will not be sufficient to get the alignment needed across the business. Using a fully integrated process will ensure all stages are covered. In either case, the process has checkpoints to ensure the vision is achieved:



The above process takes the organization through the various stages of thinking and implementing an IoT-based solution:

The **Discover Stage** helps the organization understand the needs of the business and the opportunities for how the business can leverage the IoT. And most of all, management can discover the potential that the IoT presents for the future of the organization.

The **Envision Stage** involves transforming and fine-tuning the opportunities into goals as well as determining the value and establishing the minimal viable product parameters. Later, we describe the breakdown of steps while creating this MVP—an

important step in developing something viable that uses the IoT directly within the business. It is prudent that organizations objectively look at the potential, the opportunities and the edge that one might create with IoT.

The **Build Stage** is set in motion once the MVP is built out and evaluated as viable for the business. Depending on the extent of the functionality that needs to be built out, an organization must follow a path that will provide a product that is close to the vision. To create an organization to do this, it is important to align with a partner that has deep product engineering and development capabilities. Ensuring engineering effectiveness by way of using Agile methods in model-driven architectures, performing test-driven development and applying the discipline of continuous integration minimizes deviations. Such an approach also establishes corrective measures to ensure that the product is built properly. This is key because implementing IoT requires alignment with the business, hardware vendors, software vendors, integrators, users and consumers along with a whole new way of building solutions that cross multiple channels and form factors.

The **Sustain Stage** is where the IoT is supported, managed and extended throughout the organization's ecosystem. Once the initial product release is completed, expectations will run high. Hence it is important to consider the feature release in a manner that provides increasing value and relevance to all concerned parties, i.e. does the organization see value through the IoT for its business? Does the IoT improve and make the business more profitable? From the perspective of customers, is value derived through the IoT improving their quality of life? Does the IoT simplify their life?

The **Evolve Stage** is especially important for the IoT. Due to early inclusion, many organizations are attempting to see where the IoT fits their business or the data that it generates. As much as the IoT will evolve the business of the organization, businesses and customers will also help IoT evolve to become more mature. The Evolve Stage thus helps discover new opportunities or even open newer business models that are relevant in today's digital economy.

What Is Needed to Make IoT Work

To make the Internet of Things work properly, it helps to break it down into some basic core requirements:

Understanding What the IoT Ecosystem Will Achieve: IoT provides solutions to solve very specific and well-defined problems, and the sheer number of moving pieces is so large that a clear end-state vision must be in place; for example, the faster turnaround times of planes and less gate time, quicker responses to medical emergencies, or faster responses to weather-related issues.

Data and Analytics: This core requirement includes the sources of data (the single version of the truth or even federated) and the precise answer and insight that data intends to yield. This insight will trigger very specific workflows, which are critical because false positives will be more expensive than the costs the company is seeking to save.

Sensor Development: This involves identifying the necessary characteristics to make the system work. What are the sensors measuring? What is the frequency of transmission? How do you troubleshoot sensors if they are not producing the proper data?

Platform Integration and Interfacing: This determines all the links that must be established to gain that desired precious efficiency. Once you determine the answers, what remedies must result from that insight? Many organizations have complex workflows and processes that must incorporate IoT insights in order to achieve the desired result.

Start Your Journey Now — Before Competitors Gain the Edge

The Internet of Things will truly change the quality of life. It has already touched us in many ways in our day-to-day lives, and there are a number of sensors around us that we do not notice but currently help us in making better decisions.

As with most new technologies, IoT must have a defined purpose. Start with a definition of the problem you are seeking to overcome—the number of variables is too great to dabble. Then seek a service provider that can provide the following services:

- A structured approach that goes beyond traditional SDLC/PDLC
- Big Data, platform integration and interface-design expertise
- Innovative thinking
- A partnership with a shared-risk relationship
- Agile methods

Organizations must not wait as they embark on the IoT journey—moving slowly enables competitors to gain the edge, and there is a first-mover advantage as smart-connected products are fast-changing the nature of traditional business models. In the end, this journey is about the Internet of Everything—not just the technology that builds the Internet of Things, but also the process and people who make it possible.

It is critical to engage with an organization that is aligned with product development and has engineering expertise in its blood. While many organizations talk about Agile development and that they feature an end-to-end process, as you explore deeper, you often find they do not have the required engineering rigor. Partnerships with software and hardware integrators/solution providers are key, but to fully realize the benefit of the IoT, it is important to partner with an organization that can deliver (in an integrated manner) the maturity of user experience engineering combined with product/platform engineering and data engineering.

The technology may seem very overwhelming, and with other technology issues such as ERP, supply chains, BYOD and payroll, you may feel as though you do not have time to consider the IoT. But the future of IoT is truly here and now. There is no time to wait because competitive pressure is growing more extreme.

About Ness Digital Engineering

Ness Digital Engineering designs, builds, and integrates digital platforms and enterprise software that help organizations engage customers, differentiate their brands, and drive profitable growth. Our customer experience designers, software engineers, data experts, and business consultants partner with clients to develop roadmaps that identify ongoing opportunities to increase the value of their digital solutions and enterprise systems. Through agile development of minimum viable products (MVPs), our clients can test new ideas in the market and continually adapt to changing business conditions—giving our clients the leverage to lead market disruption in their industries and compete more effectively to grow their business.