FOUR KEY STRATEGIES TO KICKSTART YOUR IoT REVOLUTION

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Executive Summary

With the Internet of Things (IoT), businesses are evolving into nimble organizations by integrating operational technology (OT) with information technology (IT) to create new, more efficient and more effective business processes.

All IoT transformations need to start with the same question: “What are we solving for?” In most cases, IoT initiatives start with a failure point, broken process, or lack of actionable insight to guide key business decisions or enable better customer satisfaction.

This white paper outlines four key areas for organizations to consider when starting their IoT transformation: understanding what IoT is and what it means to you; ideation and creating business use cases; infrastructure impacts; and tiered deployment models.

This white paper is intended for CIOs, CEOs, or IT directors in charge of IoT transformations.

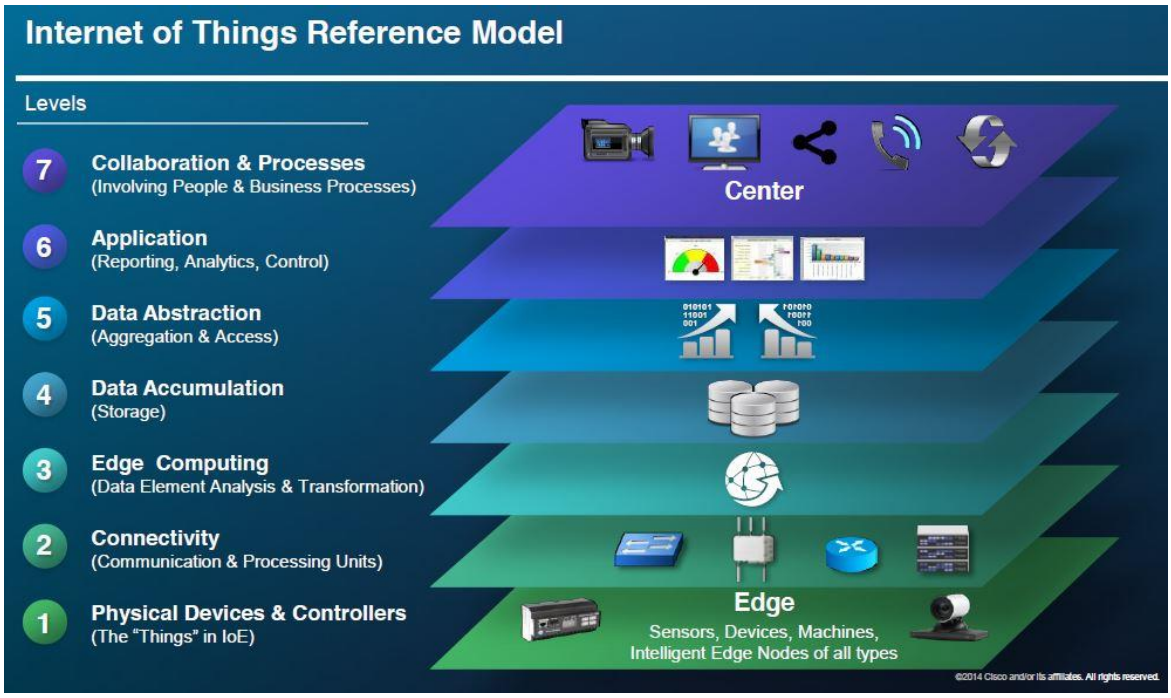
Key Step #1: Understanding What IoT Is, and What It Means to You

According to Gartner, IoT is the network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or the external environment.

In addition, the Industrial Internet Consortium (IIC) has defined a reference model that includes requirements for open interoperability standards, as well as common architectures to connect smart devices, machines, people, processes and data in order to speed up the adoption process.

The reference model has seven layers, starting with the physical devices and controllers (sensors are included in this layer), connectivity, edge computing, data accumulation, data abstraction, application, and finally collaboration and processes.

Table 1 – The IIC's Internet of Things Reference Model (graphic courtesy Cisco)



How soon will organizations be using IoT? In 1990, about three million people were using the Internet. Less than 30 years later, more than three *billion* people use it regularly, and it's difficult to imagine even functioning without this vital part of our lives. IoT promises to produce the same kind of dependency and impact on our daily lives and businesses.

What business segments benefit from IoT? Manufacturing, healthcare and retail have already been reaping the benefits of IoT by using sensors to obtain data that enables them to manage their business and provide better, more efficient service to their customers. Asset-intensive companies—such as energy, manufacturing, oil and gas, utilities, healthcare, mining and transportation—are turning their unconnected 'dumb' assets into smart, data-producing assets. This information is enabling companies to make better decisions than ever before.

What is slowing down the adoption process? Some of the items slowing down progress have included lack of standards and reference architectures for businesses to utilize when deploying and designing solutions. Another common threat is security risks brought on by new, untested technology. Collectively, the adoption of IoT technologies is being impacted by security concerns, lack of all-encompassing data policies—from sensors to new customer data, technology complexity, lack of subject matter experts and business readiness.

Key Step #2: Ideation and Creating Business Use Cases

The use cases for IoT are vast and beyond imaginable at this stage in the maturity cycle. Phrases often grumbled by organizations trying to reinvent themselves and stay ahead of their competition are, "Our organization needs better insight. If we could sense failure points sooner, we could provide better service to our customers." Organizations in this situation can use process evaluation tactics such as Lean Value Stream Mapping to determine failure points and IoT improvement opportunities. Some examples of a failure point may include:

- **Inability to track or monitor product supply chain,** resulting in product delays, poor customer satisfaction or inventory issues.
- **Inability to locate critical assets,** resulting in lost revenue, inefficient process, and wasted time and resource salary.
- **Unplanned machine maintenance issues,** resulting in multimillion-dollar project delays, contractor scheduling issues, and poor customer satisfaction.
- **Poor customer satisfaction** due to lack of communication of service status, resulting in lost revenue and customers.
- **Lack of actionable insight** that would help to make better business decisions or (among many other things) time-sensitive health management decisions possible.

This list is extensive, and evolving with hundreds of new ideas every day.

Spend "a day in the life": If you are struggling with the ideation step for IoT, a common approach is to facilitate "day in the life" exercises with the key subject matter experts. Document the work stream and associated failure points. When are your customers waiting on your services? How can you improve your customers' interaction with your business? What process could you fix if you could sense the failure earlier? The value of IoT is recognized once we create the linkage between business process, existing architectures, and IoT technologies that enable new and improved business processes.

Create use case and high-level technology requirements: To determine feasibility of your IoT idea it's necessary to create a use case and complete a high-level technical requirements document. A custom IoT use case framework should be adopted by your organization to facilitate and manage IoT ideas. A key item to include in this framework is the derived insight response time based on each use case. The derived insight response time will help determine how close to the ground or sensor the computation and analytics need to occur. If the answer is milliseconds, a fog computing component will need to be included in technical requirements. If instant computation and analytics is not required, the computation can occur further up in the architecture stack, or a cloud solution may even be leveraged. This response time affects all layers of the IoT reference architecture in which data is in motion—sensor, network, fog computing, storage, abstraction and analytics, and compute.

Aligning and prioritizing: After you have determined the opportunity, the next step is to understand which use case to implement first. Assuming annual business goals are defined for your organization, stack rank the enterprise business goals based on impact to the business area implementing the IoT solution (e.g. production or supply chain). The second step is to group IoT ideas under the business goal that most relates to the benefit derived from your IoT idea. The third step is to build a matrix that includes all of the ideas, and cross-reference these ideas with existing enterprise (CRM, HRMS, etc.) systems. This alignment process will provide you a prioritized IoT roadmap based on enterprise goals and department impact, and organized by existing enterprise technology.

Key Step #3: Infrastructure Impacts and Design Considerations

Sensor: The type of sensor and communication (derived insight response time) requirements go hand-in-hand with the network design. When deciding which sensor is best, you will need to consider the required sensor range based on the footprint of the project, power consumption, and bandwidth/data rate requirements of the sensors being used in this solution. The goal is to implement a sensor that meets your needs but requires the least amount of power in order to maximize the lifespan of the sensor battery.

Network: The second tier of the IoT reference architecture is the network layer. Your network needs the ability to support robust security policies so you can ensure that your data is protected from the edge all the way to the data center.

IoT can run on multiple types of wired or wireless networks. Within wireless there are several types including but not limited to wireless personal area networks (WPANs), wireless metro area networks (also called mesh networks), Wi-Fi, Low Energy Bluetooth, Bluetooth, and other legacy types. The key point is to find the right network type that meets your desired network design need.

When determining your network architecture, your network design needs to incorporate latency, throughput, fault resiliency, scalability, hops, and range in association with the derived insight response time. The end-to-end network requirements will need to be included in the cost model and overarching solution design model. This end-to-end network requirement contains everything from the sensor to the network through the analytics—which may occur at the network level if basic analytics are required. In some cases this may also include a network path to the cloud, potentially a cellular network and maybe even a Bluetooth network to an earpiece. All of the connections need to be tested and measured to ensure that your derived insight response time goal is achieved.

Storage and compute: One of the issues with IoT is the explosive growth of data that is generated by chirping sensors. One industry analyst reported that 96 percent of the data received from sensors is just raw data, rather than the kind of actionable insight that businesses need to make decisions faster.

The varieties and amount of data are causing IT leaders to rethink their storage strategy. IT leaders need to verify that their storage system has the capacity to digest complex data as efficiently as required by your IoT use case. One of the potential solutions is object storage, which is designed for large amounts of data in distributed environments. In some scenarios, large files such as video, photos and audio may need nearby ingestion points to support the derived insight response time and IoT use case. Please note that this new dispersed data model goes against the current trend to centralize your storage environments in order to achieve various cost-saving measures.

Data protection is also a critical factor to consider when designing your storage strategy. Most of the data being sent from sensors represents a point in time and cannot be recreated. Key factors to consider when choosing your data storage are scalability, accessibility, speed and price.

When a threshold or alert level needs to be computed and processed immediately, fog computing can manage the transaction at the edge instead of sending the data all the way through the IoT stack. This computing layer can also be used to evaluate or format the data in order to achieve faster processing at the higher layers of the IoT reference architecture.

Data abstraction/aggregation: The rivers of digital information flowing into your IoT use case need to be harmonized and made available for other systems to access. This data abstraction and aggregation layer consolidates sensor generated with data (often Operational Technology or OT) from traditional enterprise (Information Technology or IT) systems such as CRM, HRMS, ERP or others. This layer facilitates the hand-off between data and systems that inspire actions or responses to occur. The key design considerations here are how many data sources do you need to incorporate into your solution, and which data sources may impact your derived insight response time. These systems may need hardware or software improvements if legacy or inadequate hardware is currently being used. For example, an insurance company wants to enhance the value they deliver to their customers by providing proactive alerts. As part of the design, they integrate sensor data with their current policy management systems. The policy management system was developed in 1976 and continues to be maintained on the same unsupported legacy hardware. In order to provide the necessary value to their customers they would need to research systemic upgrades to achieve the derived insight response time that their IoT use case requires.

Application: Analytics are used to enable a human- or system-generated decision based on monitoring asset data by sensing temperature, motion or sound, to name a few. In some cases an action or control will be triggered based on data elements derived from a company's ERP system. In other cases a decision could be made based on data from multiple sources, including even external Web services such as Accuweather.com or Google maps. Actionable insight may be derived from a sensor that sends data to a business intelligence system, which then produces a report for an end-user.

The majority of the actions at the application layer are derived from data at rest. If a real-time actionable insight is required, it is typically programmed to occur in the fog computing layer.

A key item to plan for in this level of your design is how adaptive your application layer is to newly developed technology advances or changes. IoT sensors, systems and integration points are being invented at a rapid pace. Ensuring that your application platform can integrate with new technologies is essential.

Collaboration and processes: The actionable insight is presented to the user in the top layer of the IoT reference architecture. These are often control systems, business intelligence and analytic tools, or business applications. In some cases a notification is sent, or the actionable insight is programmed to automatically trigger an action in another connected system. This layer needs to be adequately tested to ensure that the actionable insight is delivered per the design, and that no outside interference or delays are present with current technology. For example, a mission-critical notification is sent to a mobile device that may have limited or poor service when not connected to the corporate network. This may not be the best delivery method for a mission-critical system notification.

Key Step #4: Deployment Stages

The purpose of this section is to outline the journey of how most organizations adopt IoT, and how your business can benefit from each of these stages in the process.

Stage 1: Optimize through integration

This tier represents the foundation for all IoT implementations.

Enterprise systems: To start your IoT adoption, focus on existing business systems and processes within Sales, Marketing and/or Supply Chain for your deployment use cases. What "actionable insight" does each of these teams need in order to get ahead of your company's competitors? What processes need to be improved, or what costs need to be reduced? Incorporate your new data into existing enterprise tool sets like data warehouse, enterprise applications, etc.

Sensors: Begin your business optimization project by adding sensors to existing assets after determining what insight needs to be derived, and how a sensor can be used to surface the data. This first step will represent your use case.

Network: After completing your use case and documenting your necessary derived insight response time, you will need to assess your network to ensure that appropriate latency, throughput, fault resiliency, and scalability are sufficient from beginning to end of your use case.

Stage 2: Transform your value proposition

Now that you have implemented the first phase of your IoT project and have begun collecting data, it's time to transform the value you provide to your customers. The two key items needed are big data and analytics.

Big data: The first item needed to transform your value proposition is new or previously unused data. The "muscle" behind IoT solutions is the tools that you deploy to manage your data. These tools need to be able to compile massive amounts of data, aggregate it with data from multiple sources, and parse it out in digestible chunks. In addition, these tools will need to be able to address the data wherever it resides, whether in the data center or at the edge nearest to the sensors.

Analytics: We can now monetize the data by combining the streams of sensor data with current enterprise systems, facilitate the analysis, and finally produce real-time decisions. Predictive analytics is the "brain" that produces the actionable insight that organizations are capturing with IoT solutions. Analytics is helping companies predict failure in their process before it ever occurs.

New value propositions: In the past, your sales cycle was complete when the product arrived in your customers' hands. With the integration of sensors you may now be able to provide additional services by sharing the value of this newly derived data. This could include anything from product tracking to monitoring services, dynamic pricing models based on demand, proactive maintenance, and so on.

Stage 3: Optimizing the solution

IoT product innovations will continue to be introduced to the market at lightning speed. The ability to constantly improve your deployment should be accounted for in your planning. The two best areas to gain efficiencies in your IoT deployment are edge/fog computing and cloud solutions.

Edge/fog computing: Edge computing adds efficiencies to the technology stack by computing, sorting and optimizing data at the edge, as close to the sensor as possible. In some cases you can increase your derived insight response time by splitting the workload between the fog computing layer and the additional layers at the upper levels of the technology framework.

Cloud: Efficiently storing and processing the massive streams of data also have an impact on the financial success of your project. Legal state requirements for data storage need to be reviewed if an off-premise solution is chosen.

Conclusion

The rapid growth of IoT sensors and solutions is driving higher expectations of IT and supporting systems, including networking, storage, analytics, sensors, application and compute. We are standing at the forefront of the merger between Operational Technology and Information Technology. The Internet of Things is transforming (and in most cases improving) how we live, work, play, and stay safe and healthy—as well as how companies, cities and countries operate more efficiently. This technology will improve our ability to sense failure points sooner, improve business operations, and utilize the information we have to make actionable insight a part of our daily lives. This is a new, groundbreaking era for technology; hopefully this paper will prepare you for the future of the Internet of Things.

If you are interested in solutions and consulting that can help you implement a successful IoT strategy, speak to your Sirius representative or contact Jill Klein at jill.klein@siriuscom.com.

About the Author

Jill Klein is an IT consultant at Sirius Computer Solutions. In her more than 20 years in the IT industry, she has held positions ranging from engineer to director of strategic initiatives at several FORTUNE 500 companies including Gateway and ConAgra Foods. She is actively involved in her community, and frequently speaks at local universities including the University of Nebraska Omaha and Bellevue University. She has published several white papers and articles that have appeared in InfoWorld magazine. She developed the IoT planning strategy called *derived insight response time* (DIRT). Her current focus is developing and delivering solutions for the Internet of Things and mobility, and IT process reengineering focusing on ITIL and Lean manufacturing best practices.