From concept to reality: Tackling the inherent complexity of IoT projects

WHITE PAPER

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Abstract

We live in an age where virtually every imaginable object – from industrial equipment to smart city infrastructure, autonomous vehicles, and more can be connected to the Internet. Internet of Things (IoT) projects typically involve a large number of devices, a proliferation of application programming interfaces(APIs), and humongous amounts of data. All of these factors can tax the traditional strategies, skills and technologies used by integration professionals.

According to forecasts by IHS, the installed base of IoT devices will go up from 15.4 billion devices in 2015 to 30.7 billion in 2020 and 75.4 billion in 2025.[1] Add to this, the explosion of Big Data and the convergence of social, mobile, analytics, and cloud (SMAC) technologies, and you have an IoT ecosystem brimming with complexities - for organizations as well as individuals.

This whitepaper explores IoT integration challenges, details the best practices to overcome them, and highlights the key factors organizations must consider while evaluating IoT service providers.

[1]Forbes, Roundup of IoT Forecasts and Market Estimates, 2016, https://www.forbes.com/sites/louiscolumbus/2016/11/27/roundup-of-internet-of-things-forecasts-and-market-estimates-2016/#6c075ebb292d

New risks presented by IoT projects

As IoT technologies become mainstream, unknown risks are emerging, primarily due to the entry of new parties who could be potentially liable in a loss scenario. For instance, take the case of a smart factory with IoT-enabled manufacturing equipment that suffers an electrical fire from a malfunctioning piece of equipment. Now, assume that the fire investigators rate the most probable cause as the IoT enablement of the equipment, citing evidence that someone had hacked into the sensors and operational controls in the equipment that measured heat. This resulted in erroneous information being sent via the internet, which led to the override of critical safety controls of the machinery, causing the electrical fire.

Assuming the manufacturer's property insurance policy will pick up the cost of the loss, the question then becomes whether the insurance company will collect money from potentially responsible third parties? These third parties can include the equipment maker, component suppliers, the sensor manufacturer and installer, and even the sensor software developers. It's likely that the parties may lack adequate cyber insurance to address the potential liability. What this really means is adoption of IoT technologies calls for a whole new way of thinking about the products and services your business provides. This represents a huge opportunity for device manufacturers, service providers, and other businesses that can forecast risks and efficiently manage the wave of high-velocity data to drive business value for their customers and markets.

Assembling IoT components onto the right foundation - at the right time and in the right format

Regardless of the role an organization plays within the IoT value chain— be it a device manufacturer, system integrator, cloud or service provider - it's important to understand how to maximize the benefits of the technology. This is critical to capitalize on its highly diverse and rapidly changing opportunities. However, constantly changing customer demands and exploding number of IoT use cases further complicate the daunting task of handling humongous quantities of existing and projected data, and deriving valuable insights from IoT technologies. Even though hardware and connectivity capabilities are rapidly evolving, continuous changes to the embedded software that provides IoT value, can put vendors of partial solutions in the unenviable position of constantly having to reintegrate, retest, and recertify the individual components. For starters, here are three key integration complexities to address:

- **Differences between fieldbus protocols and IT protocols:** Fieldbus protocols and the machinery that run on them have completely different purposes and requirements. For a database engineer accustomed to data produced by typical computer applications, it requires a great deal of effort and study to bring data from Modbus, EtherNet/IP and Profinet devices into a common database.

- **Differences between programming languages:** The most common programming languages for computer platforms are C/C++, Python, Java, .Net, etc., all of which offer a rich set of tools, software, and application programming interfaces to support various database applications and platforms. These programming languages, however, do not have any tools or support for industrial protocols. For the industrial space, IEC 61131-3 is the most common programming language that offers deep integration with industrial protocols. However, IEC 61131-3 is not designed to integrate with the database platforms used by IT networks and systems.

- **Lack of familiarity with networking technologies used in IoT and its application in Industrial IoT (IIoT):** Most engineers and users are fairly familiar with the networking technologies leveraged in commercial IoT applications, especially wireless. However, the adoption of networking and wireless technologies has been limited in the industrial world, partly due to the common perception that wireless networks are inherently unstable.

Managing complexities with the right platform

At a time when flexibility and speed to market can spell the difference between failure and success of IoT projects, selecting the right platform can be critical to managing IoT's inherent complexities. Developing solutions for IoT requires unprecedented collaboration, coordination, and connectivity for each piece within the system, as well as across the system. To achieve this, organizations need a platform that can:

- Acquire and manage data to create a standards-based, scalable, and secure platform
- Integrate and secure data to reduce cost and complexity while protecting the investment
- Analyze data to extract business value from it by way of actionable insights

Edge computing is one of the solutions many businesses have begun exploring to tackle the integration challenges of IoT devices. The concept involves placing computers at the edge of networks, closer to the machinery and equipment being monitored and managed. The idea is that additional computing and data processing at the edge will simplify the integration of industrial equipment data into an IoT database. This approach offers many benefits for the majority of industrial users who are not in a position to replace existing equipment.

Two key developments have made edge computing a highly attractive and compelling option for businesses today:

- **Development of most industrial fieldbus protocols into standard Ethernet-based protocols:** A decade ago, it was a given that equipment communication would be conducted over proprietary, closed fieldbus protocols that required specialized hardware. Industrial Ethernet has completely changed the landscape, and almost all the modern popular fieldbus protocols are now standard Ethernet-based. That means a computer platform can easily use its Ethernet interface to communicate with most of today's industrial equipment.
- **Boom of communication equipment providers catering to the industrial user for communication over different types of media:** Edge computing can be used to restructure and store the raw device data into a database-friendly format, and the other pieces of equipment can be used to collect and/or transmit the data as needed.

There is going to be a growing demand for flexible and easy-to-use solutions that are tailor-made for industrial users, , rather than commercial products bolted onto industrial equipment. This is one reason why leading IT infrastructure providers have started combining multiple device functions, including 4G LTE connectivity and industrial protocol support, into their edge computing products. This makes it possible for software engineers to access industrial data while working with the IT programming language and databases that they are most comfortable with, instead of having to work with multiple devices and develop their own protocol conversion algorithm. It also reduces the overhead for system integrators and users that are trying to read the industrial protocol data and place it onto a computer database.

Overcoming IoT integration challenges: Five steps[2]

1. Adopt an API-First Approach

An API-first strategy is particularly relevant to IoT projects because they rely heavily on mobile and cloud computing, technologies which already use an API-centric approach. This should not, however, be misinterpreted as an API-only approach. APIs alone do not sufficiently address all the capabilities needed to securely and reliably scale up integration in large distributed systems."Determine the integration requirements for a specific IoT solution that can't be handled via APIs, and then assess whether the built-in integration capabilities of your IoT platform will suffice," said Mr. Lheureux.

2. Identify Communication Requirements for IoT Devices

First, identify how 'things' in your project will communicate, and select the best technology accordingly, ranging from cellular networks to short range wireless such as Bluetooth or ZigBee. It's also important to consider factors such as the number, and type, of things and how different technologies will handle these variables. Then look for the network topology — considering the potential role for edge computing or gateways — that best suits the specific requirements for device autonomy, localized computing, device aggregation and so on. Once these areas have been qualified, it's possible to assess whether a bundled IoT platform meets requirements for the project, or whether extra solutions will be needed to build a network for things.

3. Leverage Cloud for Data and Process Integrations

This step focuses on integrating IoT platforms with core business processes. Most Gartner clients report that the built-in integration capabilities of their IoT platform are good enough for initial deployments, such as an exploratory Mode 2 project." Consider using your IoT platform for the initial implementation and then use a commercial integration solution, like an iPaaS platform, to scale up the project or support more complex integration, to implement workflow, or multiple IoT projects, or to access advanced integration features such as high-performance, general-purpose translation," Mr. Lheureux said.

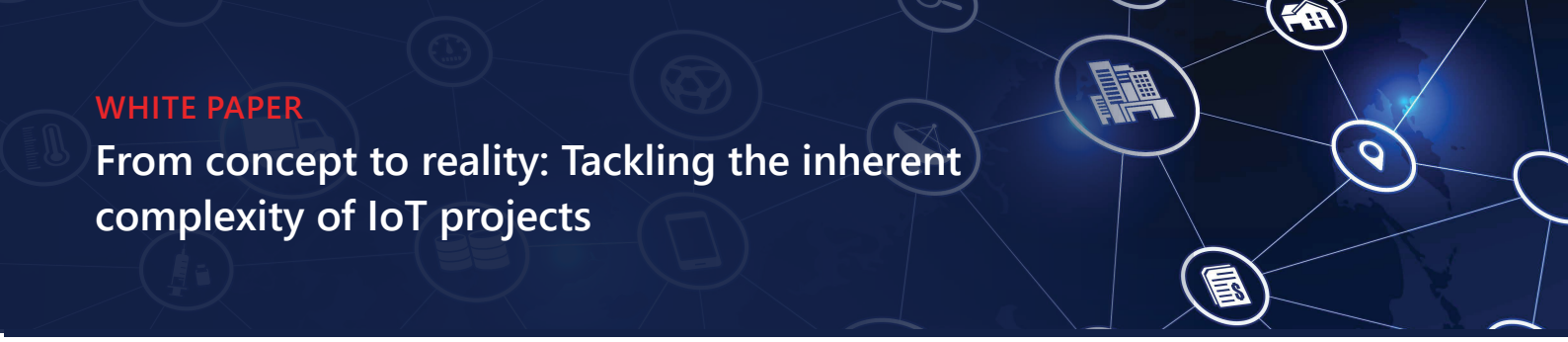
4. Selectively Use Traditional Software

Most mid-to-large-sized organizations have substantial investments in traditional on-premises integration middleware. While these tools are generally not optimized for IoT device connectivity or cloud services integration, they can likely help if your project is on-premises, or if your IoT platform must integrate with data and applications that are mostly on-premises.

5. Use API Management Tools

API management capabilities vary widely in different IoT platforms or other types of middleware. At minimum, you should plan for the possibility of adding a third-party API management solution to your IoT project, to ensure secure and reliable scaling as APIs proliferate. This is especially true if your project involves many APIs, or has APIs that connect with many consumers, are exposed on public networks, or return sensitive or restricted data." IoT projects are often associated with disruptive business models and in the excitement, an appreciation of the potential complexity can be lost," said Mr. Lheureux. "To avoid disappointment, integration leaders must address the diverse integration requirements for IoT projects."

[2]Gartner, Smarter With Gartner, "5 Steps to Address IoT Integration Challenges" Rob van der Meulen, May 4, 2017



What to look for when selecting an IoT provider: Three key considerations

Selecting an IoT service provider is a critical step for organizations as the right partner can spell the difference between success and failure of their IoT initiatives. Specifically, organizations should be mindful of the following three considerations before taking the plunge:

1. Deep understanding of IoT complexities and industry expertise:

A good IoT provider must have a sound understanding of the complexities and life-cycle of enterprise solutions. Experience in managing large-scale projects by applying systems engineering and agile practices, and the ability to adopt an iterative MVP strategy, is also critical. A partner who is well equipped to provide comprehensive technology services spanning design, planning, build, deployment, management, and decommissioning of services is uniquely positioned to seamlessly take your IoT initiatives from concept to reality.

2. Outcome based partnership:

Businesses should clearly define desired metrics from IoT projects and engage only with IoT providers that mutually agree to those goals, and commit to delivering valuable outcomes within specified SLAs. An experienced team that understands the go-to market urgency and can effectively execute holistic, robust, and tailored solutions can ensure your organization's successful adoption of IoT solution(s). The result: superior outcomes such as reduced TCO, greater IT-business alignment, and unprecedented operational efficiencies.

3. Culture of continuous improvement:

Innovation is at the core of IoT success. IoT providers that strive for continuous improvement in every aspect of their business by embracing new technologies and leveraging analytics and intelligent automation, are able to deliver superior outcomes, helping their clients gain a competitive edge.

Connecting the dots to realize value from IoT projects

Smart factories, consumer electronics, automobiles, homes, and even smart cities currently exist. Using sensors to monitor equipment health, temperature, and other variables is also not new. IoT's real promise lies in connecting those sensors to derive data-driven insights that can turn ideas into actions not just for one business, but several other directly and indirectly connected businesses as well. However, IoT is not a plug-and-play solution – deriving real value from it requires expertise, due diligence, and an integrated, scalable, yet simplified infrastructure. Whn implemented correctly, it presents limitless possibilities for businesses and consumers alike. According to a McKinsey report, linking the physical and virtual worlds through IoT could generate over USD 11 trillion in annual value by 2025. Is your organization poised to leverage IoT's full potential?

About the author

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Manyphay Viengkham has over 17 years of Energy Industry experience designing, building, deploying industrial software. She holds Bachelor Degrees in Computer Science and Biochemistry and Masters in Business Administration. As the Senior Director of Microland's Industrial IoT business, she is responsible for leading the organization's IoT strategy and team in delivering Professional IoT Services.

Before joining Microland, she held various software development and leadership roles within the utility industry (Electric Generation, Electric T&D, Water Filtration, Wastewater Collection & Treatment, Broadband Services) which extended over 9 years. In the following 7 years, she joined General Electric as the Senior Systems Engineer in the GE Smart Grid Solutions team leading system solution architecture, development, and deployment of projects and new product initiatives. In her last role with GE, she served as the Senior Program Manager, leading multiple Predix based solution deployments and worked across the development team delivering asset optimization and efficiency solutions.

Manyphay has also been actively involved with the IEC as the USNC representative to the IEC Strategic Group 3 – Smart Grid and IEC SEG1 – Smart Cities. Currently she leads as the Convenor/Chair of the IEC Systems Resource Group. She's also served on the International Council of Systems Engineers (INCOSE) board for several years. More details about her professional experience on LinkedIn (www.LinkedIn.com/in/Manyphay)

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About Microland

Microland accelerates the digital transformation journey for global enterprises enabling them to deliver high-value business outcomes and superior customer experience. Headquartered in Bangalore, India, Microland has more than 3,800 professionals across its offices in Australia, Europe, India, Middle East and North America. Microland partners with global enterprises to help them become more agile and innovative by integrating emerging technologies and applying automation, analytics and predictive intelligence to business processes.

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