HOTIFY

Virtualization for Digital Transformation

Overview

There are more connected devices on this planet today than the total human population of the world. Researchers estimate that by the year 2020, there will be an averagen of seven connected devices for each human being. Most of these devices will not need any human interaction to operate. They will gather data, communicate with each other and send their measurement to the cloud to be further processed. The insights generated from this massive amount of data will create trillion dollar opportunities for businesses and unlock new revenue streams by understanding consumer behavior, and optimizing industry's methods & processes.

This whitepaper provides a brief outline of the effect of the massive IoT transformation upon the manufacturing industry, that will lead into the next phase of evolution, also known as Industrial IoT or Industry 4.0. Furthermore, it will describe the challenges faced while applying Industry 4.0 principals into practice, and how IoTIFY's last mile virtualization solution can help achieve that with greater pace, flexibility and ease.

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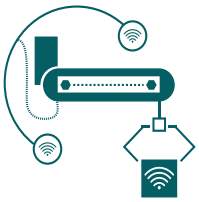
What is Industry 4.0?



Industry 4.0, which is also known as Industrial Internet can be defined as the next phase in the digitization of the manufacturing sector marked by evolution of cyber physical systems.

A brief timeline for previous generation of Industries:-

1784

Industry 1.0

Introduction of mechanical production facilities mainly powered by water, steam and coal.

1870

Industry 2.0

Introduction of mass production factories, powered by electricity. The concept of Assembly lines was born.

1970

Industry 3.0

Introduction of industrial automation through application of IT, software and robotics. Integration of software with systems.

What are the key enablers for Industry 4.0?

The rise of Cloud

The evolution of cloud computing has fundamentally redefined the way processing, storage, and networking are approached by the industry. The astonishing rise in data volumes, cheaper computational power, improved and low-cost digital connectivity such as new low-power wide-area networks have enabled manufacturers to collect and sift through massive volumes of data, filtering out critical insights needed to drive the next phase of growth.

Analytics and BI

With the emergence of analytics and advanced business intelligence capabilities, the industries could now connect the dots between assembly lines of isolated production facilities with online sales channels and consumer behavior analytics. Automakers are now analyzing data from recent online orders to understand better the needs of car buyers. By analyzing this data, they can reduce custom configuration choices to focus only on high-margin options.

Human Machine Interactions

Handheld computing devices, touchscreen terminals embedded inside machines, wearables and intelligent sensors make it possible for factory workers see data in real time and work more efficiently by having a real-time awareness of the entire manufacturing plant. For example, wearable glasses and headset give precise information about the content in a box by automatically scanning labels.

Cyber Physical Systems

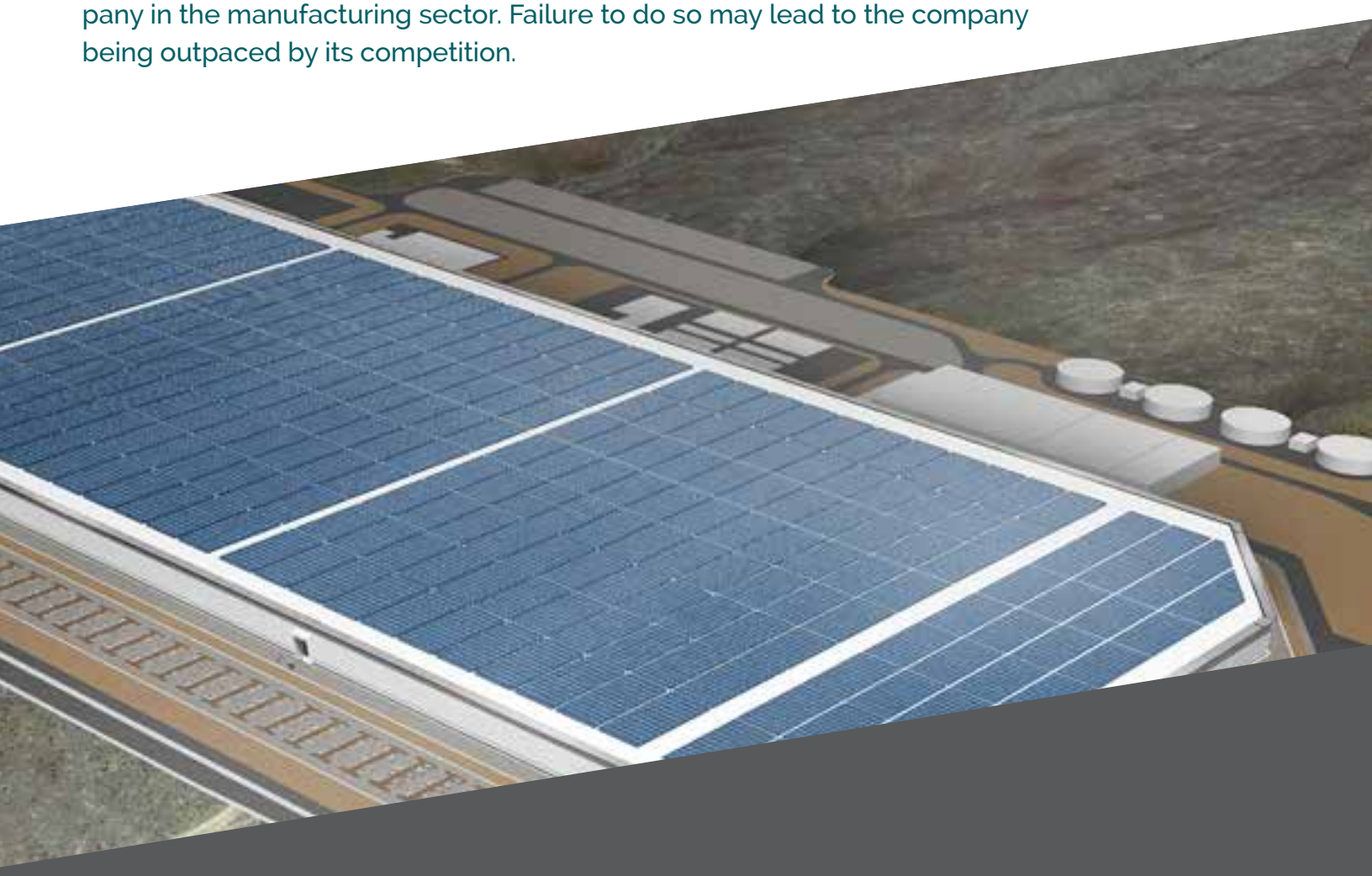
The merging of advanced software and hardware systems has enabled cyber-physical systems that are radically transforming manufacturing and industry. The industrialization of 3D printing drastically reduces the time it takes for an idea to go from design to production. The improvement in this technology now allows automakers like Local Motors to 3D print almost all the parts of a concept car.


The Journey to
Industry 4.0

Overview

Industry 4.0 changes the very nature of industrial manufacturing, allowing factories to respond to daily sales and consumption forecasts. These changes will affect every corner of the factory and the supply chain, as an entire factory will be able to be modeled as an evolving and adapting system. Just in time and Just in sequence are essentially iterated one step further.

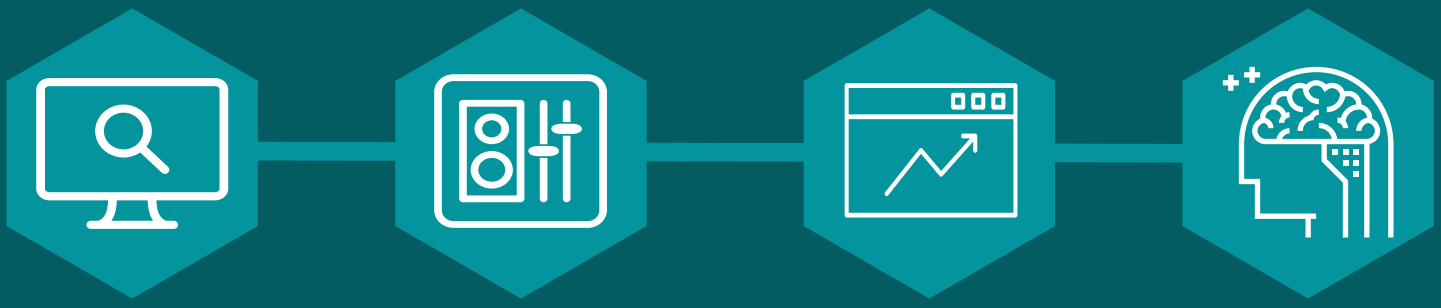
Understanding how to quickly and effective transition to Industry 4.0 is crucial for every company in the manufacturing sector. Failure to do so may lead to the company being outpaced by its competition.



To quickly understand how an Industry 4.0 factory will operate consider the giant gigafactory being built by Tesla in the deserts of Nevada serves as a classic example of how future factories are going to look like with advancement of the IIoT. The entire factory has been designed to be a tightly integrated assembly and work like a giant machine. Once completed, this will be the largest human made building on earth producing more lithium ion batteries annually than were produced worldwide in 2013.

Phases of Transformation

Understanding the need to move to Industry 4.0 is easy. Knowing how to get there isn't so obvious. Like in any transformation, a clear focus should be maintained and a well-crafted path set forward. We believe such path will have four distinct milestones, with business collateral improvements associated to each step. One should not give a company's manufacturing foundations for granted, regardless of the ever evolving landscape. °



1 Monitoring

2 Controlling

3 Optimizing

4 Autonomous

1. Monitoring

During the first step of transformation, industries develop an awareness of all the data generated and flowing into their systems.

This stage enables companies to measure what is happening in their systems, filter noise, and understand the important data points. From a technology perspective, this step requires digitization of manual processes, putting sensors and connectivity into the products and plants, and merging data from disparate sources into a common storage for further processing.

Many companies would argue they already have ERP systems and similar tools in place to measure critical operations, business information and parameters. However there is a fundamental difference here: The majority of data generated by existing ERP tools human-driven. In contrast, the data generated by Industry 4.0 companies will be completely automated in nature--generated and captured through sensors via automated methods.

How this looks:

An iron ductile manufacturing plant places small, low-power sensors on a crane to moves the molten iron through the factory. By monitoring the vibration, the manufacturer can know if the crane's engine is beginning to fail--weeks before the engine failure occurs.

2. Controlling

The second stage of IIoT transformation is reached when an organization develops the capability to start controlling products, processes and assembly lines via remote methods.

Most of the control logic in factories still resides on premises, in form of buttons, knobs, switches and other human-machine interfaces. All these control logics will eventually merge into a common command and control center. Many of the existing installations of power plants, large factories already have such control centers in place today. However, with IIoT, these control center will essentially become a digital hub which gather and analyze all incoming information from plant and sensors, while exerting even more degree of control over every aspect of manufacturing.

How this looks:

The same iron ductile manufacture sets up their system so that when the sensor detects a potential engine failure, a work order is automatically created for a repair technician to be sent to do preventative maintenance. This simple step avoids thousands to hundreds of thousands of dollars in lost revenue from a line shutdown caused by the engine failure.

3. Optimizing

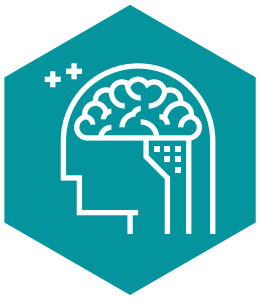
The next step in Industrial transformation is to allow process and workflow optimization by analyzing incoming data and acting upon it

At this stage, the industry is able to analyze the data and make optimization decision to improve the workflow. To begin with, these actions would still be operator assisted and would require human intervention to apply. This is the phase where a significant value gets unlocked by putting IIoT systems in place.

How this looks:

A food processing plant performs camera based analysis for quality of food grain and automatically notifies the supplier for inconsistency in the grain size. It measures the moisture level produced in milling operation and adjust the humidity and temperature levels on grain storage facilities to balance to the op-

4. Autonomous



At this stage, companies develop a semi-autonomous or fully autonomous capability to drive and optimize production without requiring any significant human intervention.

This stage is reached when a factory works like a giant machine itself. It will be able to connect to raw materials, suppliers, and order supplies in advance. It will be able to order replacements or schedule a service for the broken part itself. It will be analyzing the demand from current market and will automatically optimize production of one product vs. another based on predictive analytics.

Such digitalized manufacturing will result in a wide range of changes to manufacturing processes, outcomes, and business models. Traditionally, most companies think of physical flows of material components through the supply chain as separate from information flows and then consider how and where to coordinate and synchronize them. With the IIoT, there will no longer be a difference between information and materials, because products will be inextricably linked to "their" information.

How this looks:

An iron ductile manufacturing plant places small, low-power sensors on a crane to moves the molten iron through the factory. By monitoring the vibration, the manufacturer can know if the crane's engine is beginning to fail--weeks before the engine failure occurs.


The Challenges
For Industry 4.0

The top 5 challenges for Industry 4.0

Manufacturing engineers and integrators have been well aware of challenges and opportunities associated with Industry 4.0 due to immense marketing buzz and hype generated by media.

However, implementing those radical concepts is a huge transformation process, involving not only technology and products, but also the change of mindsets. A study of existing industrial products and processes shows data capture mechanisms are already in place. However, they are not fully exposed to the cloud and lives in its silo. Most of this data remains within equipment and is used only when the equipment undergoes servicing by a field engineer.

With a careful analysis of several surveys and case studies, we have identified 5 major challenges faced by companies wanting to adopt Industry 4.0.

1

Large Investment needs

Huge investment needs could be daunting for SMEs fearing the transition to 4.0 due to the unpredictability of the future value chain.

2

Lack of Skills and Experience

The current IT staff is often insufficient to deal with the vast amount of technology solutions required for Industry 4.0.

3

Lack of Interoperability & Standards

The current IoT ecosystem suffers from the fragmentation of conventional solutions and implementation standard for IoT.

4

Data Security

The vast amount of data generated by a wide variety of sources causes a big concern about the data's ownership and secure access.

5

Legacy Equipments

Industrial IoT needs to take into account the existing and previous generation products which are already in the field.

Benefits of Virtualization

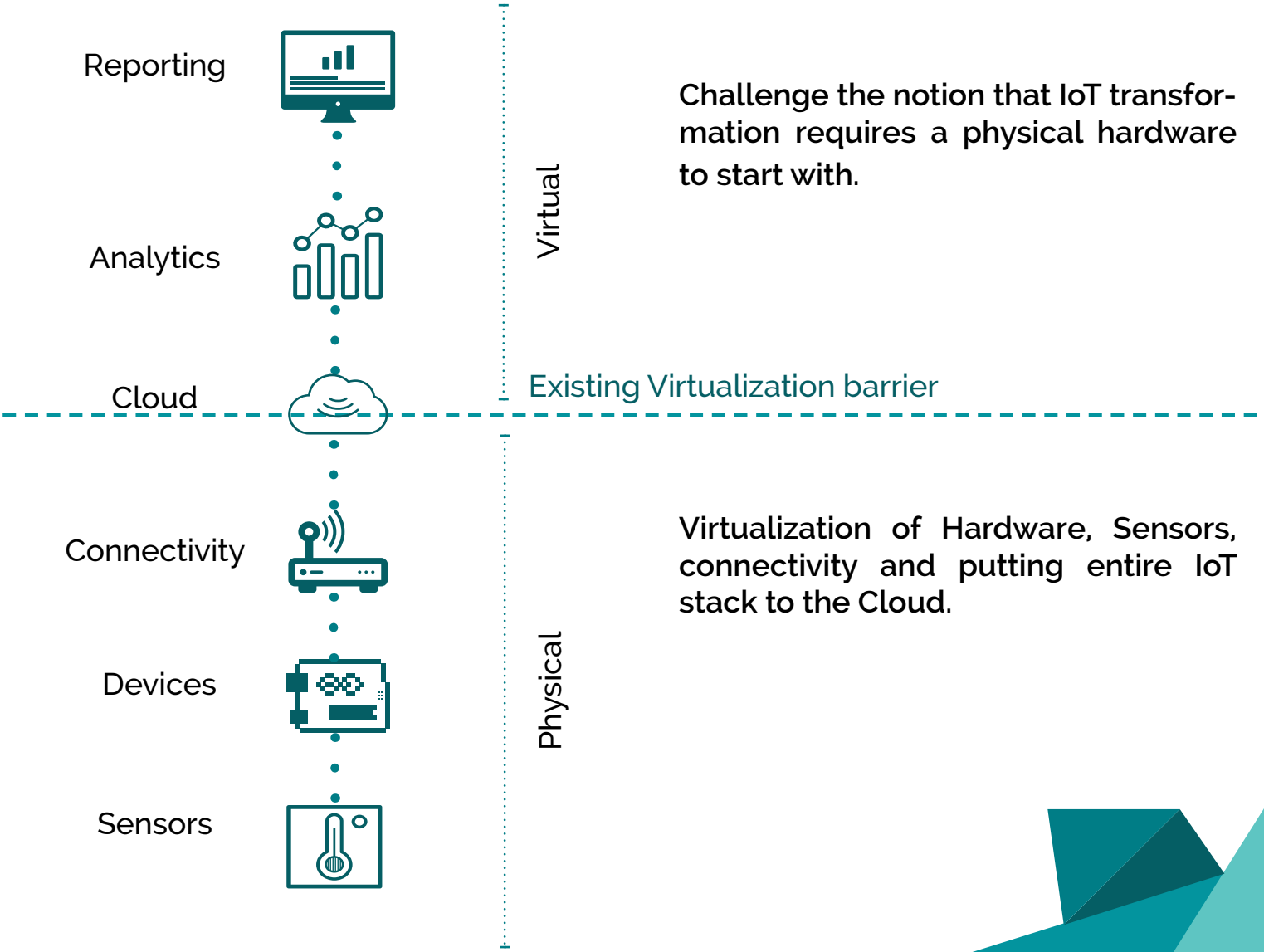
Virtualization as technology already revolutionized the digital infrastructure and created an entirely new segment of cloud computing. The new business models of pay-per-use for computing and storage have disrupted established market players in Server Hardware, Data Storage, Networking, and Computing. With such a tectonic shift, many companies came out of almost nowhere and caught incumbent tech giants off guard. One of the most common examples is online retailer Amazon, which built an entirely new business unit, Amazon Web Services, now earning billions of dollars in revenue along with their traditional retail business.

The effect of virtualization has so far been limited in the IoT industry, being used only to replace traditional server-side infrastructure. With hybrid cloud solutions, industries have begun adopting a cloud infrastructure for their compute and storage needs, while retaining on-site solutions. Unfortunately, the majority of devices, sensors and connectivity have not been affected with the growth of virtualization and are still expected to run on physical hardware.

Technical Overview

Breaking down the Virtualization Barrier

With the power of last mile virtualization, IoTIFY removes the hardware dependency and makes it extremely easy to create virtual prototypes of the new products. With IoTIFY, adding a new sensor to the virtual machine prototype just takes a few clicks.



Challenge the notion that IoT transformation requires a physical hardware to start with.

Virtualization of Hardware, Sensors, connectivity and putting entire IoT stack to the Cloud.

Our Solution Offering

IoTIFY provides industry's first virtualized Industry 4.0 transformation solution: allowing customers build a complete end-to-end solution using virtual models. Using virtual hardware and sensors which behave exactly like their physical counterpart enable our customers to see a live system in operation while visualizing the key metrics they need to operate and generate the greatest ROI.

Using virtual models dramatically decrease the time required to iterate through different potential solution reducing the cost, time, and complexity of prototyping.

Once the solution is fine-tuned and ROI is demonstrated, IoTIFY helps transform the virtual solution to the physical implementation. Once the physical system is fully functional, it could be seamlessly deployed and connected to an already running cloud solution.

Faster

Reduction in time taken to iterate over hardware prototypes, thanks to virtual prototypes.

Cheaper

Savings in reducing cost of hardware prototyping and software development time.

Easier

Reducing complexities in hardware and software development through reuse and leveraging expertise.

Better

Increased quality of output software and hardware due to rigorous emulation and better testability of solutions.

By reducing effort, time and complexity to build a complete IoT value chain in the cloud, IoTIFY helps an organization reduce the risk of failures while providing immense flexibility to build the right system for their needs.

Our Product Portfolio

Our virtualization portfolio consists of three major offerings:

Virtualized Datasets

Virtualized Networks

Virtualized Hardware & Sensors

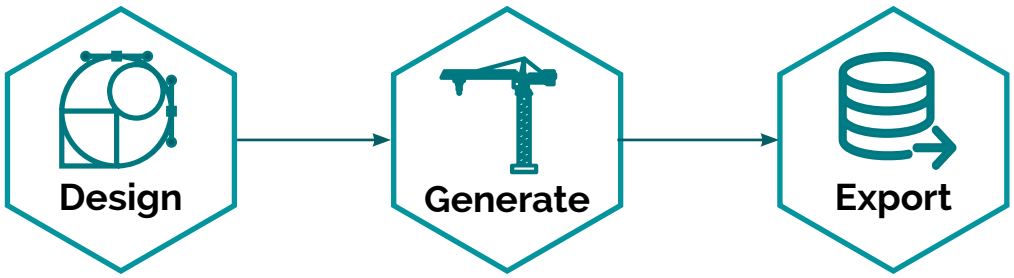
Virtualized Datasets

Having the right kind of data and deciphering its key insights is theprimary objective for predictive analytics. However, getting the right data is a major challenge in itself.

Using our virtualized data sets generation tool, a massive amount of data could be generated to simulate connections from real-world sensors. These data sets could then be imported into a data analytics platform such as AWS or Microsoft Azure to start the first iterations of business analysis.

We help our customer focus on the right kind of data by working backward from the business model, by analyzing the data being currently captured but not yet centrally collected.

We bridge the information gaps while filtering data noise and taking bandwidth and latency into consideration. The data generated through our tools could be completely customized from scratch or generated based upon replication of actual data captured through devices.



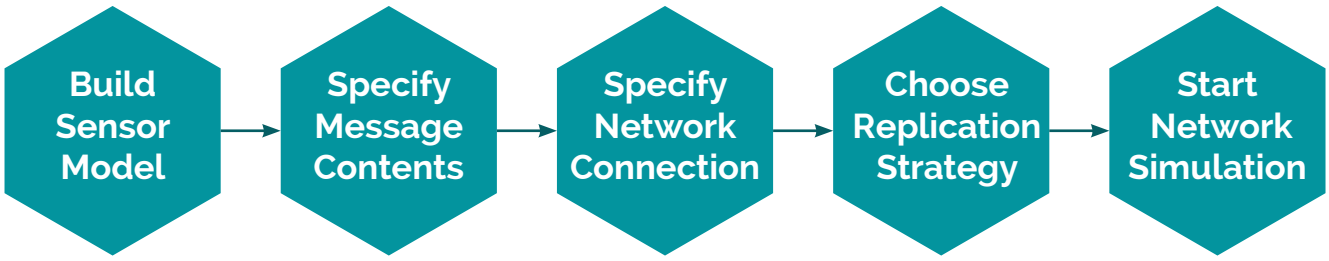
Our Virtualized Dataset is the fastest solution to start measuring with IIoT analytics. It allows you to abstract the entire IIoT implementation based on the data models for your business use cases and then allows you to quickly iterate among the business use cases to focus on the most promising ROI-generating opportunities.

Virtualized Network

Our second offering takes the virtualized data model into account and then takes the solution further by allowing live streaming of this data.

Using our web-based virtualization tools, you can simulate devices in the field and connect them to a central cloud and communicate exactly like real devices. This approach enables easy testing of your real-time analytics engine, as well as estimate the connectivity needs, server side

IIoT devices (the end-point in the IoT ecosystem) are abstracted as a pure network function. In simple terms, each IIoT device could be envisaged as a Network endpoint (A combination of public IP address and source port) which emits predefined data at regular interval to the designated cloud backend. The content of the message, the underlying network protocol to be used, the destination address and many such other parameters can be fully configured, along with frequency and number of such end points. The following diagram illustrates the 5 step process used to build Network Simulation features within IoTIFY



Using virtual endpoint emulation, a real-time analytics solution could be prototyped; allowing customers see important metrics in real time and act upon them. This allows fast and cost-effective business model validation before the actual prototyping phase starts by simulating faults, delays, and real-time communication needs.

Virtual Hardware and Sensors

Virtual Network endpoints takes the IoT solution to a mature stage, where much of the integration with 3rd party ecosystems or ERP solutions begin.

However, there are a few pieces missing for it to be an end-to-end virtualized solution, such as device provisioning, cost of connectivity, firmware and interfacing. With virtual Hardware and Sensors, IoTIFY takes the solution to an operational reality by providing the final steps in the IoT value chain, i.e. a fully functional embedded system emulator. Our virtualization not only emulates the industrial controller but also the most commonly used peripherals in IoT such as GPIO, I2C, LEDs, SPI, USB, Ethernet etc and buses.

By providing a comprehensive virtual environment for hardware emulation, we allow rapid prototyping of IoT applications at a fraction of the current time and cost. The application developed on virtual hardware could be transferred and run on physical hardware, matching the physical world with the virtual development. Essentially, with hardware simulation, IoTIFY allows you to:

- Choose a suitable Industrial platform for target applications.
- Choose the appropriate sensors, actuators and gateways for the application.
- Boot desired operating system with web based IDE.
- Interact with virtual hardware environment via UI and command line.
- Validate the control action of IoT value chain by seeing the actual behavior

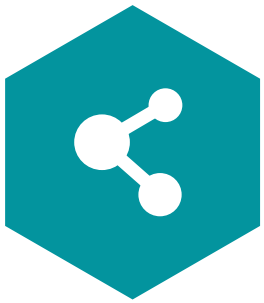
Hardware emulation is extremely useful when trying out custom sensors and developing firmware for IoT application. With hardware emulation, the time needed to build a full scale prototype is drastically reduced from months to days. It also acts as a final stage of system validation before making physical prototypes.


Our Methodology for
Industry 4.0

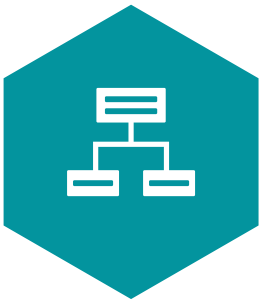
The Approach

The traditional approach to applying IoT technology is to start thinking from sensor data, and then to work backward to business applications. Our belief is that the businesses should focus on the exact opposite , i.e. find the real business needs to solve and then work backward to find the right data, connectivity, sensors and hardware to solve the problem.

At IoTIFY we help our clients navigate through these challenges by empowering them with Last Mile Virtualization. With our unique proposition to virtualize the complete end-to-end product lifecycle management, we help our client achieve the following:



Effective Data Monetization



Faster and Cheaper Experiment cycle

Faster IIoT Transformation

Bridging skill set experience gap

Effective Data Monetization

Most of the M2M data points captured from equipment are currently unused and serve no business or operational purpose. For example, only 1 percent of the 30,000 sensors in an oil rig are actually examined [Link]. M2M should transition to IIoT.

Finding the right amount of data among the collections is a huge challenge. Anomaly detection and control drives most data collection today, but a focus on collecting data for optimization and predication is what can drive the greatest value for manufacturers of the future. A great deal of additional value remains to be captured by deploying more sophisticated IoT applications.

With IoTIFY virtual datasets tailored to industry specific needs, organizations can quickly identify data that matters most for their application. With the ability to swiftly experiment among different data sources, both quantitatively and qualitatively, system designers can quickly come up with the right kind of data models needed to monetize data more effectively . This data set could then be easily derived from existing data generated by the system or could be generated via virtual sensor APIs.

Faster and Cheaper Experiment cycle

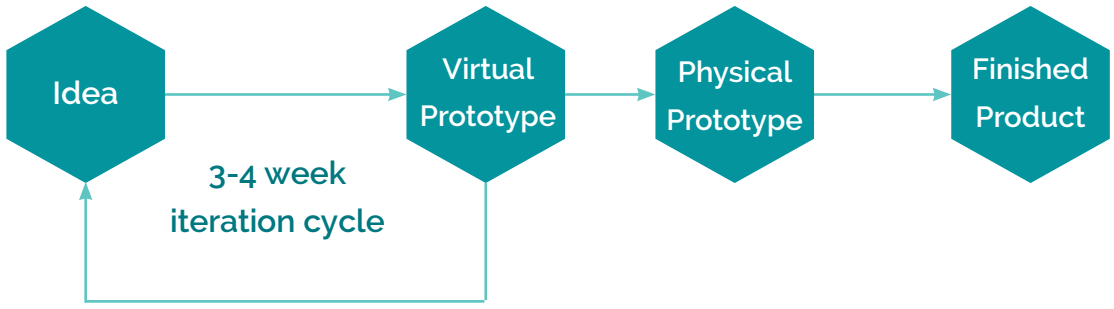
The time to turn a business idea into working prototype could span into months, and product maturity could take years to realize.

Though there are many off-the-shelf solutions available in the market such as Intel Galileo Board, Raspberry Pi and Samsung Artik, integrating the right kind of sensors and actuators while balancing power requirements and bandwidth needs

Every custom-made prototype needs to go through cycles of EMC, vibration, and humidity testing, while time must also be spent creating a rugged casing for the sensor or actuator.. This makes the cost of prototype manufacturing prohibitively expensive for the development of only a few components.

In addition to the prototyping and testing, the complexity of IoT ecosystems requires interoperability with several protocols and interfaces, which are often difficult to

Virtualized Development Model



IoTIFY's innovative virtual hardware prototyping platform drastically reduces the iteration cycle duration. With the simulation of embedded hardware and sensors, each prototype can be swiftly developed, tested and scaled in a virtual environment in order to , cut down the prototype iteration cycle by as much as 75%.

Bridging Skill & Experience Gap

Many industrial manufacturing companies lack the skillsets required to prototype and develop IoT solutions within their own staff.

Acquiring the talent to develop IoT strategy and capabilities is often slow and inefficient, as the number of talented workers are being quickly outpaced by the demand of companies needed IoT solutions. This is why many companies will need to partner with right consultancies and engineering firms to develop and execute their IoT strategy; this is where the experience of IoTIFY and its partners comes into the picture.

Our industry-wide cross-domain expertise helps our customers build proven solutions that exceeds current standards while preparing for future technological evolutions.

Faster IIoT Transformation

IoT transformation has begun and companies that haven't started with their transformation plans risk falling behind their competition.

Bringing IIoT product innovation into a company as early as possible is no longer a luxury, it is a necessity for industrial players who wish to survive the future.

IoTIFY's approach to transformation using virtualization is the shortest way to achieve a realistic IIoT capability in the shortest amount of time, lowest cost, risk and uncertainty. Using virtualization, the dependency upon the linear development stages IoT transformation could be eliminated and replaced with parallel development. This means that the system architectects could work with their data models while cloud platform providers could integrate their solution to customer's other IT infrastructure while development of

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We are here to Help!

Get in touch with us for a free consultantion to understand how your organization could leverage power of Virtual IoT to accelerate Industrial transformation.

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