

# THE ULTIMATE GUIDE TO MACHINE DATA

AND HOW IOT PLATFORMS HELP YOU  
MAKE THE MOST OF IT

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## THE BENEFITS OF MACHINE DATA

**“***Data is the most underutilized asset of any organization.* **”**

When leveraged to the fullest, data can unlock tremendous potential. IoT & AI can help you utilize these underutilized assets.

*Machine data is one of the most underutilized assets of any company. Yet some of the most valuable insights to be gleaned within an organization are hidden in machine data.*

Today, machine data comes in an overwhelming array of formats and is characterized by high variety, velocity, volume, and heterogeneity. Industrial equipment, sensors, and other devices utilized in industrial settings usually have embedded processors and networking capabilities that allow them to store and transmit data. This data provides insight into business-critical information such as performance parameters and anomalies.



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Leveraging the potential of the Internet of Things to access this data has become established practice in predictive maintenance, asset lifecycle management, performance management, monitoring, and diagnostics. Sensor data, for instance, provides information about asset deployment, resource utilization, and resource consumption.

*When used to the fullest, machine data gives you insight into just about any area of your smart manufacturing landscape:*

*when to change  
business models*

*optimize  
customer  
experience*

*learn from  
errors*

*where to  
save time*

*improve  
security*

*how to  
streamline  
processes*

## 05

The data coming from sensors also delivers insights that help identify outliers, or understand the cause of failure. This is why connecting machines to the Internet of Things has become synonymous with decreased downtime, improved productivity, and more customer-centric service.

To make the most out of existing infrastructures, organizations should start utilizing their underutilized assets. This way, the combined powers of IoT and artificial intelligence (AI) untap the tremendous potential hidden in the data coming from legacy systems and machines.

## MANUFACTURERS MAKING FULL USE OF THEIR MACHINE DATA:

**20-50%**

reduction in maintenance planning time

**5-10%**

maintenance cost reduction

**10-20%**

increase in equipment availability and uptime

SOURCE: MCKINSEY MANUFACTURING ANALYTICS STUDY 2020



## 06

INDUSTRIAL COMPANIES THAT  
CONSISTENTLY MAKE USE OF IIOT  
INITIATIVES COUPLED WITH AI:

up to 50%

reduction in product  
development cost

+ 1/3

increase in gross  
marginsup to 25% reduction in operating  
costs

Industrial IoT (IIoT), artificial intelligence (AI), and machine learning (ML) techniques make a powerful trio that changes the story told by data in areas as varied as industrial manufacturing, logistics, or agriculture, as well as asset monitoring and control across industries.

SOURCE: MCKINSEY MANUFACTURING ANALYTICS STUDY 2020

## IOT AND AI FOR MORE DATA-DRIVEN INSIGHT

### Why does IoT data matter?

*IoT data is highly heterogeneous, highly unstructured, and expands exponentially. Once this data is combined with other data and made meaningful, it gains tremendous value in creating the basis for forward-thinking decision-making.*

*Connecting the data from industrial assets with other data sources and partaking in practices of data sharing across the organization are the two factors that make all the difference when it comes to organizational change.*

Today's wide availability and variety of sensors and data processing options expand the possibilities for monitoring, analysis, and control of industrial assets across sites, with or without human intervention. The benefits are immediate as you achieve greater process efficiency and increase the speed of innovation.



### Process efficiency from the ground up

Combining IoT and AI is a powerful cost-saving engine. In extracting data from your heterogeneous assets and putting it in one place, you set the ground for company-wide monitoring, control, and optimization of existing processes. But a closer look into the story told by machine data is not a standalone effort.

**“** *Instead of keeping that data siloed within departments, you make it highly available.* **”**

When analyzed together with other enterprise data, third-party data or public data, you get the full picture of where to streamline, which processes need more attention, and where to direct your innovation efforts.

### Fast product innovation cycles

Once you integrate the insights gleaned from IoT data into your business systems, you begin to use your IoT landscape as a springboard to produce and develop newer products and services that unlock new revenue streams, improve customer loyalty, and pave the way to greater customer-centricity. Within this process, sensor data and machine data are the first and most valuable assets to secure, making sure that your digital transformation efforts are extending all the way from the edge to the cloud.

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### True organizational change

In developing a unique expertise in extracting, transforming, and analyzing large amounts of underutilized machine data, you become capable of high-precision insight to drive organizational change faster.

Utilizing underrepresented IoT data for analytics and AI means not only combining different technologies, but also bringing together experts and processes. This is how you truly consolidate the know-how within your organization.

And this is how you remain on top of competitors who only focus on IoT initiatives or isolated AI solutions.

In cultivating a mindset that prioritizes data as your most valuable asset, using IoT and AI as the unique confluence of technologies to help the data do its work, you achieve genuine, forward-looking transformation.

### Application areas



energy  
consumption  
management



new business  
models



predictive  
maintenance



asset  
performance  
management



product  
development



supply chain  
management



condition  
monitoring

## THE CHALLENGES OF BROWNFIELD ENVIRONMENTS

Machine data is not easy to come by. Smart factory initiatives are notoriously challenging to realize. And one of the first obstacles is right where IoT starts—at the level of gathering IoT edge data and moving that data up the value chain. The majority of industrial machines, legacy devices, and equipment have not been designed with an eye towards IoT connectivity.

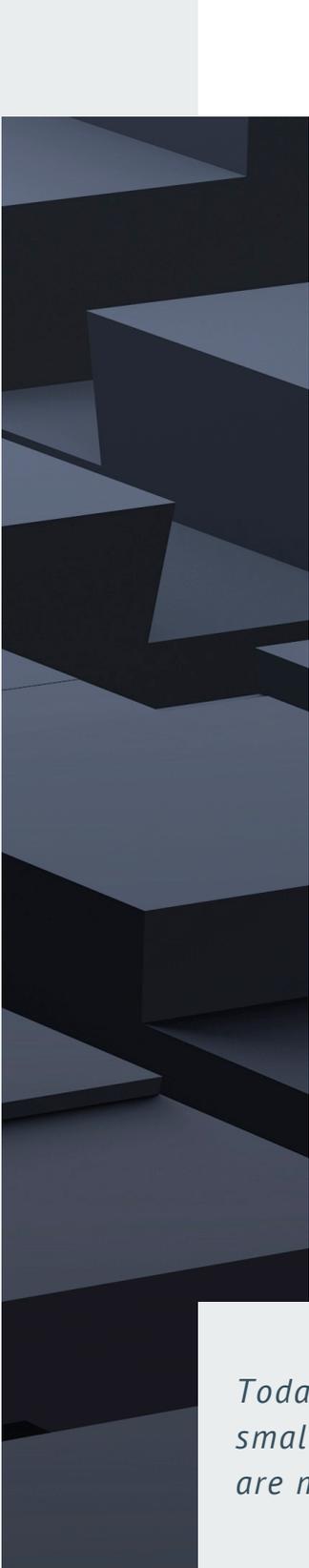
Today, this creates data silos at different operational levels and at various degrees of complexity. To remedy this, one possibility is to discard all existing equipment and start from scratch with a greenfield plant.

Given the costs (and the environmental burden) involved in replacing everything with contemporary IoT technologies, the better option is to work within the **brownfield**, that is, to make use of your existing infrastructure and machines. Today, it is not only possible but also easy to bring your legacy assets online and make them ready for the Internet of Things.

Gathering data from legacy systems and industrial sensors demands retrofitting. This is the first step towards creating a robust and scalable brownfield IoT infrastructure.



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Retrofitting does not have to be expensive, however. Thanks to container technologies and cost-effective scenarios for enhancing the sensing capabilities of legacy devices, IoT platforms make it possible to connect to just about any machine and read out data. This includes both legacy assets from different generations and devices that would habitually tie you to specific vendors.

**Retrofit assets with IoT sensors**

Given the recent slump in sensor prices, a preferred option is to outfit your existing equipment with IoT sensors. This way, even equipment with no prior communicating capability becomes IoT-capable and you can sustainably read out the data coming from your industrial machinery.

A single sensing device can be capable of measuring multiple parameters such as temperature, velocity, flow, humidity, and pressure, to name a few. In attaching sensors and a small industrial-grade computer to collect and aggregate the data, you are ready for the next step—bringing your assets online and collecting the data from within a (cloud) IoT platform using any standard protocol.

*Today's sensors require a minimum of hardware. They are smaller, mostly run on batteries, consume less power, and are more accurate than their predecessors.*

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**Bring IoT connectivity to existing PLCs**

Brownfield PLCs, or legacy variants of the so-called programmable logic controllers, manage legacy automation systems that generate tremendous amounts of production data.

*“But the data remains siloed in local, closed-off environments that make it unavailable for larger-scale insight generation.”*

Bringing legacy PLCs online can unleash the potential hidden within your legacy assets, let you combine the PLC data with data from other sources, and set the foundation for a fully sustainable industrial IoT infrastructure.

Any changes made to operational PLCs to integrate IoT connectivity are extremely costly as they involve prolonged production downtime and levels of complexity that are difficult to scope up from the outset.

Typically, in such cases it is recommended to use a converter that communicates with the PLC and extracts the sensor data to pass it on along the value chain.

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## **Substitute remote I/O units with IoT-capable devices**

Another way to make legacy systems ready for IoT is to replace I/O modules with IoT-capable ones. There are varied possibilities to retrofit remote wireless I/O units in decentral IoT systems to overcome the brownfield hurdle.

Today's I/O devices have built-in cloud connectivity and at the same time can use the existing physical connectivity to communicate with legacy PLCs and sensors. This way, they can extract the relevant data and transfer it directly to the IoT platform.

As the market for wireless I/O devices is continually growing and evolving, replacing I/O modules only while keeping current with new developments proves to be a cost-effective, simple, and flexible retrofit solution.

## **SO WHAT HAPPENS NEXT?**

“Once you have equipped your legacy machines with the necessary retrofit solution, you are ready to extract and analyze the data.”

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## CONNECT TO ANY ASSET: RETROFITTING WITH AN IOT PLATFORM

To utilize the combined powers of IoT & AI, you connect your diverse legacy assets to a single platform to read out IoT data. To do that, you need an IoT platform that is open, hardware-independent, highly flexible, and scalable to serve as the single source of truth for your disparate teams and assets.

Thanks to container technology and a custom flashing application, the [Record Evolution platform](#) makes it possible to turn any machine and piece of legacy equipment into an IoT device. You securely monitor & control these IoT devices from anywhere.

Once your machines and legacy equipment are connected, you are ready to extract and load data to the platform for further analysis. Right on the platform, you can also combine data coming from multiple disparate data sources and consolidate it for insight generation. Taking it from there, the collected and cleansed IoT data becomes part of the larger IoT lifecycle and can create the foundation for many use cases.



## WHAT HAPPENS POST-RETROFITTING

1. **Cleanse and transform** the data coming from legacy devices and machines in real-time or near real-time.
2. **Build machine learning algorithms.** Once the data is transformed into high-quality data that can form long-term data histories, you can start building your machine learning models using that data.
3. **Get ready for insight generation.** Or get started with data mining for greater insight and visualize the insights or ML model performance in customizable dashboards. This is how you get a view of the bigger picture.
4. **Deploy.** Using the insights generated on the basis of the data and the ML algorithms, you build IoT apps to deploy to production. From within the platform, ideally, these can be distributed across various company sites across the globe at the click of a button.
5. **Monitor & update.** The IoT & AI platform allows you to establish iterative processes that involve the continuous monitoring of assets and performance parameters. This allows you to adjust to changing conditions and roll out app updates instantly.

## USE CASE

# COLLECTING IOT DATA FROM TEST VEHICLES TO IMPROVE SQUEAL DETECTION

## Identifying brake squeal noises with Continental AG

*Together with the HBS R&D division at Continental, Record Evolution has developed a pilot for identifying brake squeal noises using Big Data and AI approaches on IoT data collected from test vehicles.*

Using the [Record Evolution platform](#) for end-to-end IoT development, Continental AG was able to implement IoT data collection strategies, Big Data analytics & AI solutions in mobile IoT scenarios. The goal was to improve Noise, Vibration and Harshness (NVH) measurements to better evaluate the circumstances under which brake squeal noise occurs.

The employed end-to-end process starts with data collection from test vehicles, transferring the data to an on-premises cloud environment, data processing in the cloud, and the creation of a database of structured and harmonized high-quality data.



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The next steps are collaboration on the creation of diverse analytical insights into the data and the creation of a custom AI algorithm for edge devices to classify NVH events with high accuracy in near real-time.

To collect raw IoT data, we developed a measurement device based on Raspberry Pi and enhanced it with professional measuring electronics. Devices were installed in multiple test vehicles and were connected to the platform. With the help of the [Record Evolution Reflasher](#), platform users can now easily add new vehicles to their test fleet with just a few clicks and so enrich the existing data pool.

Using the Record Evolution platform for IoT and AI, Continental AG has built a comprehensive system for IoT data collection and analysis. This system can serve as a foundation for the development of multiple use cases, such as apps for NVH detection and real-time NVH prediction based on the identification of patterns that arise prior to an NVH event.

## KEY TAKEAWAYS

“Using a single IoT & AI platform, you consolidate the IoT assets and know-how within your organization. Now you are ready to build your use cases and develop your own products.”

# ABOUT RECORD EVOLUTION

## IOT & AI PLATFORM

Record Evolution is the collaborative end-to-end IoT & AI platform that enables companies of all sizes to develop their own IoT products.

Built to facilitate the development and wide availability of artificial intelligence (AI) in an IoT context, the simple-to-use platform serves as an organization-wide decentral hub for organizing teams and conducting IoT projects, effectively providing broad AI enablement within any organization.

[www.record-evolution.de](http://www.record-evolution.de)



