



BOSCH
Invented for life



5 steps to successful IoT solutions

How you can add value at every level of IoT maturity

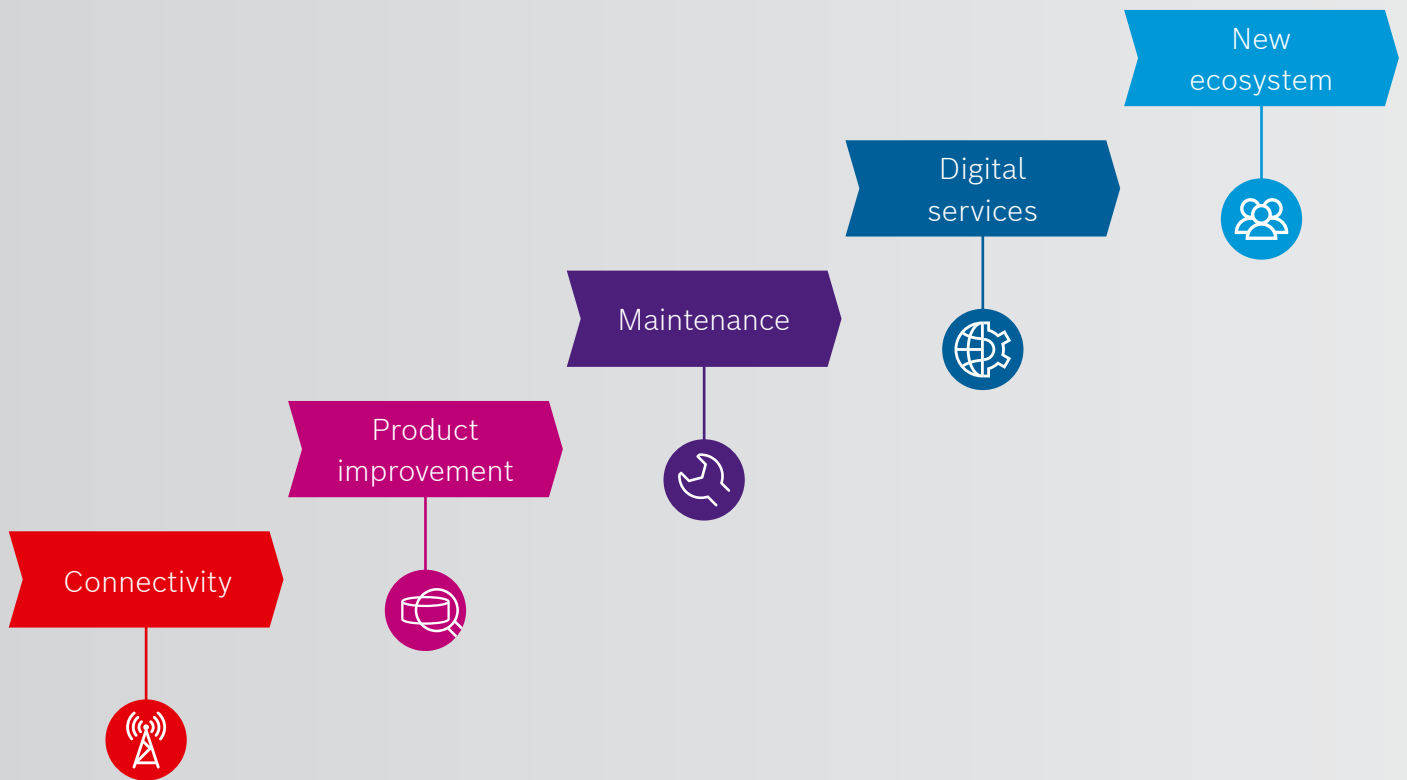
White paper | revised edition May 2020



Editorial

Introduction	4
Maturity level 1 Why connecting devices creates additional features for your customer	5
Maturity level 2 How to leverage field data from connected devices	7
Maturity level 3 Maintenance as a digital service	9
Maturity level 4 Why providing digital services for all your stakeholders is important	12
Maturity level 5 Why you should take an open-platform approach	14
Summary and stumbling blocks	18

The 5 maturity levels of an IoT solution



The various levels of IoT maturity indicate how IoT projects can add value to products.

Introduction

Companies can use the Internet of Things (IoT) to connect products and devices, which allows them to tap new areas of business and to offer their customers entirely new services. In addition, direct lines of communication with customers provide realistic insights into how they use connected products.

Companies will enjoy a clear competitive advantage if they realize it is imperative to connect their products and devices. But those that focus only on the technological aspects of a project have already lost the race. When it comes to the IoT, companies that devote their full attention to customer benefits are the most likely to enjoy long-term success.

It is therefore essential to identify a promising business model before kicking off an IoT project – a model that facilitates lasting relationships with customers and offers them new digital experiences.

But how? You need to identify the key factors of your IoT project that can add value. Examples include new or improved services, higher efficiency, or better quality.



"We have carried out a great many IoT projects with our customers, which has allowed us to pinpoint recurring patterns of added value. In turn, we have used these patterns to create a model of five maturity levels. By examining customer projects and customer solutions, this model illustrates how you can add value at each level."

Thomas Alber
Director of Engineering Software

Maturity level 1

Why connecting devices creates additional features for your customer

Indego Connect is a robotic lawnmower made by Bosch Power Tools. With its embedded SIM card (eSIM), it transfers data via the GSM mobile communications standard to the Bosch IoT Cloud. Owners can use a smartphone app to control this robotic lawnmower and a calendar to program it – from anywhere in the world. Once wires have been installed to mark the edges of the lawn, Indego Connect, can mow without any need for manual intervention. Bosch Power Tools offers a digital service – cloud and app connectivity – as part of the product.

As soon as the customer registers using the app and switches on Indego Connect, this robotic lawnmower becomes a connected product. It is at this point that a digital twin is created: a virtual representation in the cloud of a physical product. A digital twin in the cloud provides information on its twin's operational status; it also enables analyses and assessments based on predefined KPIs.

Digital twins: allow for realistic simulations. Companies rely on digital twins to better understand how their products work as well as how they are set up and used in practice.

Connected products create more points of contact with customers

Once it has the connectivity necessary for an IoT solution, a product has reached the first level of maturity. Connectivity, to be clear, is not merely an interface. Instead, it is a comprehensively managed cloud service.

When it comes to generating value in the IoT – be it customer benefits or an increase in a company's own value – it is essential to be clear about the how. Has a product merely been equipped with a connectivity interface? Or is the product completely connected in the cloud – putting its manufacturer in control? In contrast to a product that is not connected, manufacturers benefit in many ways from connected products.

Advantages include real-time information on product use, such as time frames and frequency, as well as the status and operation of products.

No matter which sales channels manufacturers use, connectivity creates new opportunities for interaction and new points of contact with customers. Manufacturers can also prevent competitors from positioning themselves at the customer interface.

Connected products are likewise tremendously appealing to end customers, as they can access information about the condition of their product at any time. Support technicians can remotely service the product as well.

Manufacturers can leverage these new opportunities to boost sales revenue, which correlates directly to units sold at maturity level one. Connecting a product paves a path to higher levels in the maturity model. If you want to drive your business model forward and tap new streams of revenue, it is vital to push past this initial level.



Maturity level 2

How to leverage field data from connected devices

The second level of maturity is all about being able to utilize the IoT to offer better products and services. Let us look at two examples.

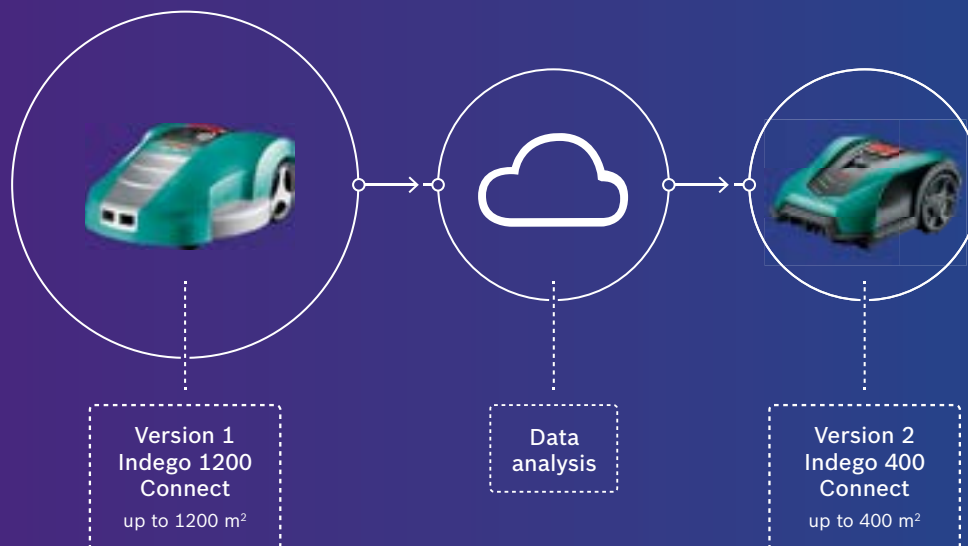
The first generation of Indego Connect was a fairly simple lawnmower; it was not a smart device. But a software update equipped it with an intelligent mowing function. Nobody needed to modify the physical product itself. Indego Connect's intelligence unit runs exclusively in the Bosch IoT Cloud, where it analyzes weather data and forecasts for the product's location to determine ideal opportunities to mow the lawn. This means that the customer enjoys an additional benefit of their otherwise unaltered product, which is now a smart device.

But what about future product developments and enhancements? Here too, information generated in connected environments can add value. Our second example is Indego Connect's map feature, which automatically generates a map of the lawn while mowing and transfers the map to the cloud. This data can be used to calculate the sizes of Indego Connect lawns and in turn, draw accurate conclusions about where customers use their mowers. When specialists design a product such as Indego Connect, they must make certain decisions. How can they, for instance, ideally tailor the size of the mower, rechargeable battery, and the blades to the size of the yards that will be mowed? Although market surveys and market analyses yield some information prior to production this is always very vague compared to the real-world data supplied by digital twins.

Real-world data on how products are used in the field helps companies to examine and improve existing specifications. In this way, they can tweak their products to precisely satisfy market demand before production even begins. Case in point: Bosch Power Tools launched the Indego Connect 400, a smaller version of its robotic mower, for people with modest-sized lawns. It did so thanks to its analysis of usage data generated by the Indego Connect 1200, designed for lawns as large as 1,200 square meters and the only model available prior to launch of the IC 400. The IC 1200 data had indicated that some 75 percent of customers' lawns cover only 400 square meters – or less.

The second level of IoT maturity concerns the manufacture of products modified to meet the actual requirements of real customers. Nowadays, over-the-air software updates make improving products child's play. Most customers are thrilled about not having to buy new products every couple years. Manufacturers benefit too, for they can design the next generation of products to satisfy the needs of markets and customers. Moreover, insights derived from data on product use can help companies identify problems early on. This means that a manufacturer can respond quickly, and even limit potential damage to its reputation by recalling the products.

Figure:
Product use yields insights that
can be incorporated into the
development of new or
improved services and devices.



"The challenge does not lie in equipping a product with a certain technology, but in developing precisely those products that customers really need. In this regard, connectivity grants us a decisive edge in knowledge."

Andrew France

Project Manager – Connectivity, Bosch Power Tools GmbH



Picture: Bosch Thermotechnik GmbH

Maturity level 3

Maintenance as a digital service

Bosch Thermotechnology offers heating and cooling solutions for residential and commercial customers. This manufacturer of heating systems, which markets the Buderus and Junkers product lines, is an excellent example of the third level of IoT maturity: maintenance. For several years now, Bosch Thermotechnology devices have been connected by a cloud solution. As with the robotic lawnmower, connectivity creates a digital twin of each connected device. This digital twin always knows the status of its physical sibling and can collect data on energy consumption, temperatures, malfunctions, and more.

In winter, a failure in a home heating system can make life very unpleasant for the residents. Conventional maintenance companies often must make two on-site service calls: one to pinpoint the cause of the failure and a second to remedy the problem. But making a heating system connected will significantly streamline servicing.

From maintenance to optimization of servicing

At maturity level three, optimizing the servicing process ought to reduce costs and boost customer satisfaction. Once a product has been connected with the cloud, its status can be monitored from anywhere. As for maintenance, there are three distinct categories.

- 1. Corrective maintenance:** Technicians can respond immediately to a failure thanks to basic monitoring of a device's status. Companies usually know what the causes and solutions are.
- 2. Preventive maintenance:** Most failures can be avoided because actual device use – instead of statistics – is utilized to calculate ideal maintenance windows. Companies already know everything they need to know for preventive maintenance.
- 3. Predictive maintenance:** This approach predicts errors that are likely to occur. Data patterns and device use provide a basis for calculating an ideal maintenance window. Compared to preventive maintenance, predictive maintenance is substantially more effective because it also considers any anomalous behavior of devices. If a company is going to upgrade to preventive maintenance, it typically must first acquire new skill sets such as data science, data analytics, big data, machine learning, and deep learning.

In short, corrective and preventive maintenance can reduce costs while boosting customer satisfaction. Instituting predictive maintenance requires more ambition, time, and expertise. Just having a connected device is not enough. Companies also have to collect and analyze data over a longer period to ensure that they can learn from this data and be in a position to make the best possible forecasts.

As the maintenance business constitutes a service, it is clearly important to share insights into maintenance optimization with the companies that handle installation and maintenance for customers.

To this end, Bosch Thermotechnology provides a portal solution for these companies. This portal allows them to connect to their customers' heating systems, permitting access to the equipment's state of health and maintenance history.

If a system malfunctions, the maintenance company is notified. The portal provides technicians with information such as the error code, the cause, necessary measures (including an estimate of time), and a list of required replacement parts.

Armed with all this data, the technician can contact the equipment owner and schedule a repair appointment. The information collected also makes it possible to estimate costs. Ideally, customers will receive a notification before they otherwise learn of the malfunction.

Maintenance companies benefit from this solution in the form of a competitive edge and enhanced customer satisfaction.

Let us review the advantages. Installation and maintenance companies can offer better services, respond quickly to malfunctions or failures, and ideally solve the problem during a single on-site service call. End customers benefit from lower costs thanks to fewer on-site service calls as well as a longer service life for their heating systems.

This type of digital service creates an entirely new type of value and makes it possible to clearly derive a business model that matches the fourth level of the IoT maturity model: the portal solution can be provided to maintenance companies as a commercial, digital service on a subscription basis. This solution can be invoiced per heating system or by the month.

Maturity level 4

Why providing digital services for all your stakeholders is important

Digital services characterize the model's fourth maturity level, which holds even more potential for adding value. It offers an excellent opportunity to target those groups who do not yet own a product; after all, a company can sell a physical product only one time – but its associated digital service multiple times. Although the product remains the same, every new service represents a new potential revenue stream. Once there is a digital twin in the cloud, it is easier for businesses to deploy new services and business models that are likely to succeed, as the initial investment has already been made by this point. However, this approach is not without its challenges, one of which concerns the interdependencies in the value chain.

Let us return to the example of the Bosch Thermotechnology heating system. The system owner must request that their system be connected. Only then can the heating technician access the system and the owner benefit from service.

But if a customer chooses not to take advantage of this service, the business model will not succeed. Bosch Thermotechnology therefore relies on additional incentives for system owners; for instance, a second portal allows them to check and control their heating systems from anywhere in the world. Owners also benefit from helpful hints on how

to conserve energy. Bosch Thermotechnology grants system owners free portal access, which makes the services especially appealing to heating technicians. After all, the portal solution is useful only if heating systems are connected.

If a business model is to succeed, then a digital service must appeal to all parties in a value chain.

Bosch Thermotechnology offers the owners of heating systems genuine added value in the form of free services. In return, owners supply their data, which companies can then leverage for commercial services.

"We support technicians in their day-to-day work throughout the customer journey, including with digital services such as remote diagnostics or remote control, and tools for commissioning systems. These services help boost efficiency in maintaining, repairing, or replacing devices. Today's end customers also expect their new heating system to come with an app that not only lets them operate the system, but also offers additional information, such as energy consumption statistics."

Thomas Matthis
Director Connected Product Solutions, Grow GmbH



Maturity level 5

Why you should take an open-platform approach

We now come to the fifth and most promising level of maturity in IoT projects. An example here is the Connected Building Services by Bosch.IO. These services not only interconnect sensors, equipment, and devices in a building, but also connect all of them to the cloud. The data gathered makes it possible to remotely assess the condition of every piece of connected technology from anywhere. A dashboard provides an overview of the data, including:

- Energy consumption and energy savings for each piece of equipment, each floor, and the entire building
- Visualization of presence data on the use of rooms; also as heat maps for optimizing building efficiency
- Information on a piece of equipment's operating times and usage history for improving maintenance processes

Data on building use can be leveraged to create new digital services that are useful inside and outside the building thanks to cloud connectivity.

This maturity level initially seems similar to the fourth level: insights into use, optimization of maintenance, provision of new services, and so on. Yet a closer look at the example of a connected building reveals that the fifth maturity level is indeed different. Just one company alone cannot connect every type of device, sensor, and equipment in a building and then implement digital services on that basis. There are simply too many technologies at play. As a result, this type of IoT solution must be designed as an open platform so that third-party providers can supply their solutions to add even more value.

The examples we gave for the first four levels of maturity do not allow for third parties to expand existing services or provide an all-in-one solution of their own. That is where the Connected Building Services are different: it was conceived to be an open platform that appeals to third-party providers.

Open platform = open and integrated

But what exactly is an open platform? For starters, it means providing open access to application programming interfaces (APIs). An open platform also makes it possible to integrate a third-party provider's hardware and digital services.

In contrast to maturity levels one through four, ecosystem participants do not themselves need to implement all services. By using a platform such as an open API, a platform provider can simplify service or solution integration for developers from third-party providers. A company can monetize an API by relying on a pay-per-use model to grant access.

The IoT ecosystem in the real world

Let us consider the Connected Building Services once more. Connecting the presence detectors in every room of a building allows us to determine how frequently a room is used – information which is valuable for a range of use cases. However, implementing presence detectors gradually would entail high costs, various risks, and slow time to market. For these reasons, an API is used to make data available to third-party providers; they can, in turn, offer new services based on the room use data.

This data can be used for:

- Creation of an optimized cleaning schedule, updated daily
- Real-time reservations through a connection to a room reservation system
- Determination of realistic demand for rooms based on actual use statistics
- Information on unusual activity detected in the building – at night or on the weekend, for instance – for the company handling building security

A single API and a single set of data can thus be used to meet remarkably different requirements. In contrast to the previous examples of added value, third-party providers within an open ecosystem are positioned as influencers in the value chain.

A building in Austria embodies this ecosystem approach: cameras manufactured by Modcam AB, a Swedish company, are integrated into the Connected Building Services. The images generated by these cameras are processed on site.

Only the resulting metadata – not genuine image data – is transferred to the Bosch IoT Cloud. Heat maps integrated into the building solution's dashboard visualize room use. The open platform made it easy to integrate Modcam's cloud service, which adds even more value for building operators and renters.

"Because of the IoT, innovative business models of the future will be primarily data-driven and integrated. In other words, we will leave behind the concept of 1:1 relationships – the traditional value chain – and shift to multidimensional relationships. We will instead refer to a ‘value network,’ which optimizes the benefits for all players in this ecosystem."

Gabriel Wetzel
Vice President



Summary and stumbling blocks

Our maturity-level model examines in which ways and to what extent an IoT project can add value at the five levels of maturity. With its creation of a digital twin, the first maturity level provides the foundation necessary for maturity levels two through five. The manufacturer should retain control over the digital twin in order to fully tap its potential.

Companies can easily attain maturity levels two and three, as they already possess the requisite expertise. Once products have been connected to the cloud, companies can reduce costs, optimize products, and develop services that appeal to their customers. Companies also benefit from direct contact with customers throughout a product's life cycle.

At maturity levels four and five, companies can tap even more sources of revenue, although at level four, revenue depends on the number of products sold. But at maturity level five, an open platform and open provision of an API to third-party providers lead to good opportunities for increasing profit from every additional product or device you sell.

Five stumbling blocks to avoid during your IoT project

- 1. Initial investment:** Considered from an investment perspective, the first step is the biggest: hardware and connectivity cost large sums of money.
- 2. Life-cycle costs:** Don't forget to consider the operating costs of each product or device that is connected to the cloud for their entire service life.
- 3. Weak business model:** It can be easy to optimize maintenance and improve products, but calculating ROI is more challenging. The added value might not cover the costs of setting up connectivity. It is difficult to find a robust business model at maturity level three.
- 4. A company in transition:** If a manufacturer is to thrive at maturity level four, the entire company must undergo a digital transformation and everybody must embrace a new mindset. This includes new capabilities and skill sets, and an open marketing approach with the corresponding expertise. The company will then be able to work new channels, position its products and services, and grow communities. From an organizational standpoint, it is necessary to reconsider processes before implementing and firmly establishing them.
- 5. Poor ecosystem management:** At maturity level five, companies ought to handle ecosystems and platforms in a way that ensures they are and remain appealing to partners and third-party providers. Companies should also intentionally relinquish a certain degree of control. This is essential if an ecosystem is to blossom and address demand more precisely; less overt control is the goal here. In addition, a balanced API usage model can ensure that a company participates in a growing ecosystem.

Learn more

We will gladly show you the way to the Internet of Things with our IoT Starter Package.

Contact our IoT experts for further information and vital tips.

Free Plans:

Test Bosch IoT Suite for free

Contact our experts

Bosch Global Software Technologies GmbH
Löwentorstr. 72-76
70376 Stuttgart
Germany