IoT – Company Approach to IoT Modeling and Applications

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Critical Review

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Abstract: Using the available literature, this paper attempts to present the company 's approach to IoT modeling and the incorporation of IoT technologies into business processes. Furthermore, a comprehensive overview of IoT technologies and systems of large corporations (Yokogawa, Intel) and commercial access to IoT technologies is provided. In conclusion, based on previous knowledge and scientifically based arguments, the advantages and disadvantages of IoT technologies are presented.

Keywords: IoT, IioT, Digital Intelligence, Total Cost of Ownership, Operations Excellence, Cloud, CloudIoT.

Introduction

Internet of things (or Internet of Intelligent Devices) is a term that today refers to billions of physical devices around the world equipped with sensors and software, which are connected to the Internet in order to collect and share data and information obtained. In this way, the devices enable the so-called "digital intelligence", i.e. devices are given the opportunity to use data at appropriate times without human participation, but also with the help of these data, these devices can independently regulate their work. In short, IoT is a global network that connects smart things. All IoT devices, which are interconnected, participate in communication. Most definitions of IoT technology refer to the combination of everyday things that a person uses on the Internet for the purpose of measuring, collecting, storing and exchanging data with other things and people, that is, the activity of IoT devices is based on collected data.

Distribution Of IoT Technologies

IoT technologies represent a kind of turning point in the future of computer technologies and communications, and the development of these technologies depends on technical innovations in many important areas, from wireless to nano technology. IoT devices are becoming more and more prevalent, so today we have more IoT devices than the number of people in the world. Analyst company Statista announced that by 2025, the number of IoT devices will be around 38.6 billion. According to a report by analytics firm Gartner, more than half of IoT devices are consumer products (smart TVs, smart speakers and other home devices, and the best-selling are smart electric meters and commercial security cameras).

The extent to which IoT technology is widespread and implemented in everyday activities, and the importance of IoT technology for business, is shown by the fact that since 2011 IoT week has been held on a global level. The first conference was held in Barcelona in 2011. IoT makes our homes, offices and our vehicles smarter, more measurable and easier to use. Autonomous vehicles and smart cities, which could be created thanks to IoT technology, could change the way we build or manage public space in the future. On the other hand, what is considered a shortcoming of this system is the fact that many of these innovations intrude too much on our privacy and can have too much of an impact on our private lives. The Internet of Things system consists of smart devices that the user manages through an application through the Internet. The user does not

have to communicate directly with things, but with a service that stores and processes data obtained from smart devices and manages the obtained data. IoT consists of any device that is connected to the Internet. IoT enters all spheres of our lives, and gives us the opportunity to improve the quality of life, products and services, but also reduces maintenance costs, increases the efficiency of business processes, creates new types of jobs, while, on the other hand, there is the possibility of losing jobs, as there is not a man, but a machine at the heart of IoT technology. Also, one of the disadvantages of the IoT is the loss of control over a large amount of data and information, and the misuse of a large amount of private data can occur. Despite these shortcomings, IoT technology is of great interest to creators and users, but also to companies that, with a combination of cameras, sensors and connected devices, receive information about our habits, movements, emotions, regardless of whether we want it or not.

For each of us, who has a smartphone that has GPS, the location of the device is known at all times, as well as its user. Due to all the above, the question arises of monitoring and controlling all this information that the IoT sends about us. It is assumed that it will not be possible to control all the collection of information, so IoT legislation is also required.

Yokogawa Approach

Major vendors of automated equipment, such as Yokogawa, are mostly focused on the potential benefits of the product. Such benefits are offered to their customers, in a wide range of industries, thanks to the integration of IIoT technologies into the business. Although a large number of technologies necessary for adequate and flawless functioning as well as for IIoT support are already available, the necessary infrastructure is still not fully implemented in industrial facilities. To reduce the company's costs for engineers and designers, as well as the cost of their travel, and to compensate for lost time, Yokogawa is developing effective and secure methods to realize remote collaborations between engineers and designers via the Internet. Such ability to communicate and exchange data and ideas would allow engineers to work in teams, through web applications, in real time, on projects regardless of their current location.

Thus, for example, DSC (distributed control system) engineers located in the Yokogawa Industrial Automation (IA) center in Tokyo were able to effectively cooperate with EPC (Engineering, Procurement and Construction) engineers from the USA, engineers of suppliers of packaged and finished goods in Europe, as well as with engineers and end users from a Middle East ownership company. By accurately analyzing the data obtained, Yokogawa identified the great advantages of this type of distance cooperation:

- Not every product needs to be physically delivered
- In the future, there is the possibility of conducting testing on multiple components via the Internet
- Save time and costs for engineers and companies
- The re-testing process has been accelerated, as well as the process of final checking the functionality of equipment and software, and assuring them of their complete correctness before delivery.
- By analyzing the obtained data and storing them, information is available to end users 24 hours a week in order to resolve daily and extraordinary business operations
- Also, large amounts of data are generated from connected devices that serve as a form of database that will make it easier for each user to work as follows:
  - Over time, the amount of data obtained will grow
  - New challenges will be created in operational technologies (OT) and information technologies (IT).

Yokogawa believes that analyzing OT data generated through IoT device tracking, in terms of the most sought-after troubleshooting tools, can help its end users find an easy, simple and fast way to solve their problem. Thanks to the nature of IoT devices, the ease of availability of the required data, and the connection of IoT devices to company assets, leading people can easily access business statistics and thus industrial organizations can improve their business at any stage of business and thus improve TCO (Total Cost). of Ownership) and achieve operational excellence (OpX - Operations Excellence). Yokogawa

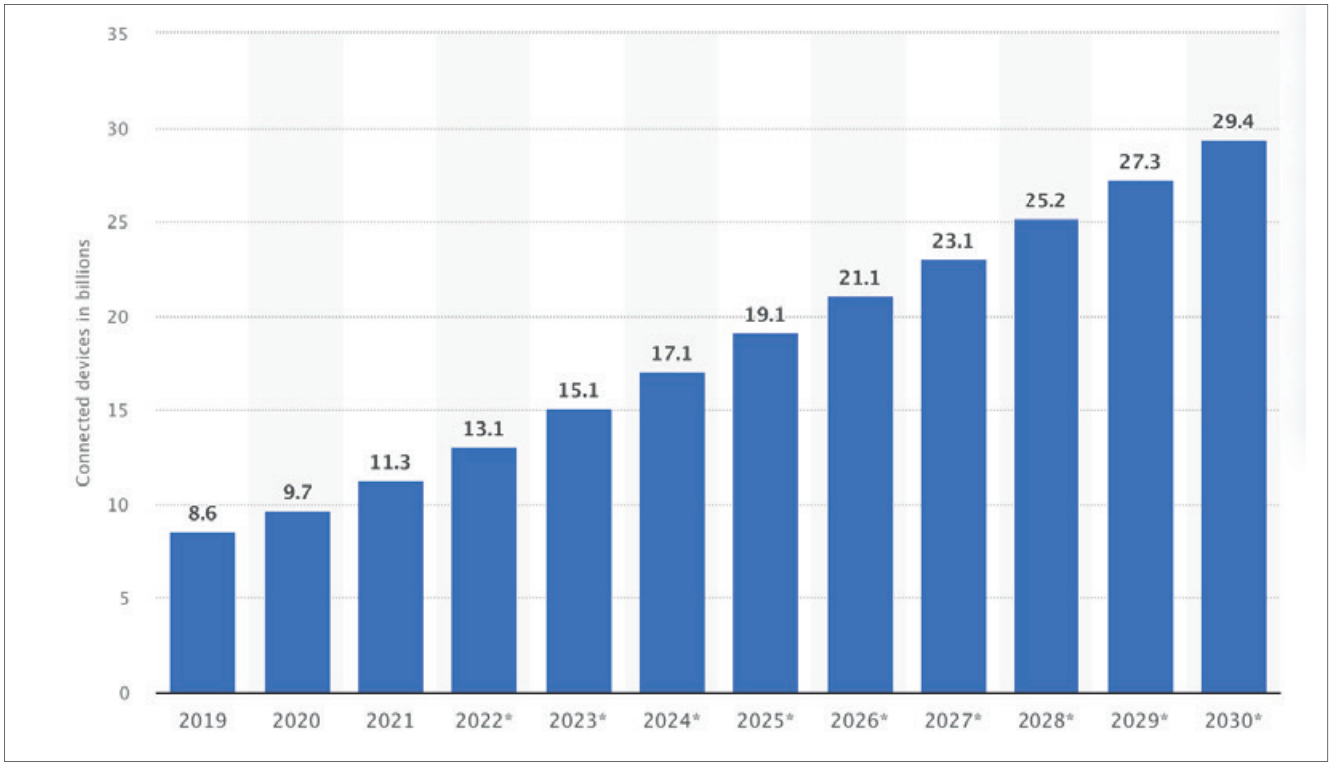

Figure 1: *Number of Internet of Things (IoT) connected devices worldwide from 2019 to 2030 (in billions)/https://www.statista.com/statistics/1183457/iot-connected-devices-worldwide/ 4.4.2022.*

focuses its IoT business on two areas:

- Providing feedback to company professionals to interpret and act in extraordinary OT work processes
- Development of real-time logical and intelligent applications to trigger appropriate automated responses in structural process systems

The key success factors of IoT are:

- Appropriate knowledge in the field of OT and IT
- Clear understanding of operational requirements, which include the need for flexibility and extensibility to address
- Close integration of OT and IT
- Close cooperation between OT and IT suppliers, suppliers and end users, plant engineers as well as process engineers and data collection and processing experts all in order to facilitate and speed up the work process
- Carefully consider how the solution will be maintained and supplemented over time
- Ability to adapt to new business methods
- Impenetrable virtual security
- Secure and durable networks (wired and wireless).

INTEL APPROACH

On the other hand, Intel believes that the opportunities that IoT creates also face great challenges, both for user IoT and for industrial IoT, whose operation and use are much more complex. The challenges that users face when integrating IoT technologies into their business are price, security, organizational alignments and changes in business processes.

Intel's IoT standards help integrate the core platform with the following benefits:

1. Integration from end to end, i.e. the existence of only one IoT network in which all IoT devices of one company are harmoniously integrated. The advantage of such a network system is the reduction of costs and business complexity.

2. Multiple solutions for one problem or user task, i.e. the same interest groups have the opportunity to place products on the market faster.

3. Improved security of end users and their data.

4. Better product quality as well as open standards expand the range of possible solutions from which the user chooses the best for their business.

5. Reducing financial costs and increasing the efficiency of the company.

The three key problems of integrating IoT tech-

nologies into business are:

1. Initial financial costs are difficult to justify investments (large initial investment, long process of return on invested finances and time)

2. IoT changes already existing business processes (it is necessary to educate a large number of employees, change the structures and devices necessary to maintain the work process, ie a long and financially demanding transition process)

3. IoT requires uniformity and harmonization of the way of working work of all companies that use IoT technologies.

Tasks and obligations of the company's IT sector in the integration of IoT technologies into business include:

- Business security and the establishment and maintenance of networks used by IoT devices for their work process
- Use of existing infrastructure
- Limited Internet access, which means targeted access, i.e. the worker can use only the tools necessary for the operation of IoT technologies while other tools are not available to the user
- Control of output data, i.e. what is available to the end user
- Care and maintenance of security and protection systems in order to maintain the confidentiality of company and user data
- Processes for suppliers:
  - Compactness of sensors as well as universality of devices and technologies, i.e. that IoT technologies can be used on all smart devices regardless of the year of production
  - Open standards (software that easily shares data with applications and thus allows the user quick and easy access to the problem and solution in a few clicks)
  - Adaptability to user needs as well as easy technology management
  - Security requirements in the form of obtaining a confirmation of receipt of the order as well as who is responsible for receiving the order or service.

After years of setting up individual IoT solutions and overcoming many obstacles and challenges that arose in meeting new workflows and tasks, and careful analytical work in many key segments, Intel has developed several standard processes for implementing IoT in its business:

- Defined IoT system based on user needs and processes to be monitored
- Classification of data obtained from smart device sensors, ie creating a secure infrastructure that will enable proper management, analysis, protection and storage of data necessary to solve given problems
- Designing a secure and accurate network infrastructure
- Compliance with the rules on corporate data management, ie care for the confidentiality of company data
- Integration and management of IoT devices
- Designing IoT systems so that the work process runs smoothly and easily, which is actually the goal of introducing IoT
- Establishing an end-user support model to quickly diagnose and resolve issues.

Company Approach

The company approach to IoT technologies and their implementation in business processes includes several interrelated processes:

- Development of company-specific IoT, i.e. for the needs of the company's work process in order to accelerate the solution of possible problems
- IoT protection plan and thus confidential data necessary for operation
- IoT device and end user communication plan
- Value-added analytics and the creation of useful algorithms that would speed up the work process and easily overcome possible problems in the work process itself, but there is a chance of too much intrusion into the company's private data
- The diversity of IoT applications and their enormous demand for simplicity represent ideal business and financial opportunities and challenges for IT companies and professionals
- The economic potential or financial savings of the company from the IoT are estimated at 11.1 billion dollars per year until 2025.
- The diversity of applications and devices poses a challenge to the IT world (how to imple-

ment IoT technologies in the business environments of most if not all companies).

Through the implementation of IoT technologies in work processes, large global companies have discovered a number of benefits, the most significant of which are:

- Identifying the needs of companies based on the use of standardized algorithms and accurate imitation of the workflow on the IoT device
- Detailed development of a database of possible problems and the simplest solutions to these problems and tasks for the same stakeholders
- Mapping or merging the most important processes into a functional component that can be presented to basic microservices and IoT resources and thus provide a link to OT
- Organizing and executing harmonized business processes taking into account the flow of large amounts of data as well as the processes of IoT devices themselves that are independent of users, and which are necessary for the precise functioning of the system.

Currently, there is no fully developed IoT system with all the components, but there are a number of bases for such a system (which can be used to obtain a system that is at the same time easy to use, fast, reliable and secure). Work should be done to reduce the gap between the company's perspectives and IoT-focused processes and thus enable applications to be more accessible and uniform for companies and end users in order to realize the full potential of IoT technologies and improve the quality of workflow with financial savings.

Planning and development of business processes involves identifying and defining patterns of business processes within the company or in parts of the company, which can be modernized, and these business patterns include different sources of data and tools for doing business processes. The focus is on processes involving physical means and machines and the ways in which they are related to IoT technologies. In this way, it is possible to analyze and optimize business and introduce fully automated business processes in the work of the company. The highest intensity in automation will be held by the following: production, smart buildings, utility parts of the company, agricultural activities and process industry.

Business Process Model and Notation (BPMN) is a specific standard developed to improve and facilitate business processes. Thus, formal specific processes can be produced that can be executed and then mapped to microservices and IoT resources. BPMN provides companies with the ability to understand and communicate internal business processes in graphic markup based on XML (Extensible Markup Language). Furthermore, in this way, organizations are enabled to quickly adapt to new internal and B2B (Business to business) business needs and circumstances.

IoT operational models are equipped with a basic platform to enable adequate operation of applications and their tools. To date, these platforms have mainly focused on infrastructure services: connectivity, protocol customization, device management, and secure device shutdown. Aspects of the platform are still largely focused on data, i.e. their collection and storage, while the use of this data in the business process is still in its infancy and the full potential of IoT technologies, as originally conceived, has not yet been realized. IoT applications can be enriched and expanded with significant capabilities, as well as effectively integrated into the company's complex business processes. Integration of IoT applications in business processes takes place in several significant phases that require knowledge, time and finances. The basic things to keep in mind are as follows:

- IoT applications should not be viewed in isolation or as an isolated solution to specific and limited problems, but as a set of useful data and procedures that will lead us to the desired goal in the easiest way
- IoT devices should be viewed as parts of the company and it is necessary to integrate the obtained data into the overall processes of the company
- The approach to business process modeling should ensure that the implementation of IoT technologies is efficient and to enable full automation of the company.

In addition to the above company approaches of Yokogawa and Intel, Cloud is also very important for the progress of IoT. Considering the strength of the connection between these two technologies, the concept of CloudIoT was created, which represents

the integration of Cloud and IoT. With Cloud computing, resources, applications, and information shared over the Cloud are also available to other computers and smart devices connected to the Internet. Also, the term Big Data is very interesting, referring to technology that collects and analyzes large amounts of data in real time, but they have a big disadvantage that they collect different data, different accuracy, from both reliable and unreliable sources. Big Data and IoT are closely connected, because with the help of devices and sensors, they collect extremely large amounts of data that are very useful, easily accessible to everyone and have some significance for the organization.

Today we have quite a few things that represent some kind of IoT technology. The Tesla car is at the forefront of this. Namely, this is an electric car that is completely connected to the Internet, collects, analyzes and transmits data in real time, just as the IoT device should work. Also, e-health, which is slowly being introduced in every health system, is a good example of the application of IoT technologies, because health workers have real-time access to a large amount of data that allows easier, faster and more efficient business process of a healthcare institution.

In addition to the company's approach to IoT, it is important to mention the commercial approach to IoT technologies. The goal is to create a smart home that, with the help of smart devices connected to the Internet, makes a home tailored to the owner, ie according to all his life habits. In a smart home, the light is turned on via an application through which the quality of lighting, colors as well as the moment when the light is turned on and off can be controlled. In addition to light bulbs, smart security camera systems, sockets, switches, cooling/heating bodies, etc. are in use today, which are connected via a large number of sensors to an application through which their operation can be controlled.

Unlike corporate IoT, commercial IoT is much simpler, devices are cheaper and more affordable, and easily replace existing devices. One of the most common commercial IoT devices is SMART TV, which is connected to the Internet and is a kind of IoT device. In order for it to become an IoT device in a narrower sense, thanks to technological advances, it is now possible to give commands to the TV by voice, and the latest way of management is that the TV recognizes user gestures and therefore takes certain action. When it comes to controls, the TV monitors and records TV content that the user likes to watch and suggests similar content. All this data is collected, processed and a database of users is created, and this data is further sent to TV manufacturers as well as to companies that offer TV content broadcasting.

In 2021, the first smart bus station was set up in Banja Luka, which also represents the commercial use of IoT technologies. The advantage of such a station is the availability of the current timetable (this has not been the case so far), it provides insight into the map of bus stops as well as data on the current location of the desired bus. The smart station offers the possibility of connecting to the Internet, and thus performs data collection, storage and analysis of data.

Conclusion

Taking into account all the data known so far, the use of IoT technologies to improve the work process has many advantages, but also disadvantages, which are probably crucial why IoT technologies have not yet been implemented in business. Out of the many advantages, first of all, the most significant is the acceleration of the work process through automation with minimal error in business. IoT allows us to solve many requests very accurately and efficiently in a short time. Furthermore, since smart devices replace the human workforce, it is possible to perform the work process continuously, 365 days a year. Another in a series of advantages is that IoT, in fact, represents a kind of base of potential solutions to any problem that may be encountered in business. The solutions are classified by categories, are universal, and according to IoT principles are available to their users 24 hours a day. The last, but not less important advantage, is the ability to analyze the work process at any time, identify potential errors and eliminate them in the shortest possible time, all in order to improve business.

The disadvantages of IoT technologies and their implementation in business processes are, primarily, that there is a gradual reduction in labor demand (because at the heart of technology is a smart machine that analyzes and sends the necessary data).

Also, a lot of confidential information about the company's business, private data about workers, machines and production processes becomes available to other users of IoT technologies and as such can be used illegally. The personal stamp of the company, which is reflected in the specifics of the company's work process, is eliminated, because most of the work within IoT technologies is carried out according to given algorithms and there is no room for creativity and creating some new solutions. In theory, the IoT is expected to operate the device flawlessly for 365 days, 24 hours a day, without user correction or service intervention. However, imperfections in the design, testing, and all other features involved most often lead to several failures during the operation of the IoT device.

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List of abbreviations and acronyms

BPMN – Busniess Process Model and Notation
B2B – Business to Business
CloudIoT – Integration of Cloud and IoT
DSC – Distributed Control System
EPC – Engineering, Procurement and Construction
IA – Industrial Automation
IIoT – Industial Intertnet of Things
IoT – Intertnet of Things
IT – Information Technologies
OpX – Operations Excellence
OT – Operating Technologies
TCO – Total Cost of Ownership
XML – Extensible Markup Language

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Dražen Marinković was born on 1978 in Banjaluka. He finished elementary school and high school in electrical engineering. The Faculty of Business Informatics at the Pan-European University APEIRON Banjaluka enrolled in the academic year 2009/2010. years and graduated with an average grade of 9.81, defending a master's thesis entitled: "NoSQL databases in theory and practice" with a grade of 10. Academic 2015/2016 enrolls in doctoral academic studies of the third cycle at the Pan-European University APEIRON in Banjaluka, at the Faculty of Information Technology, and in the doctoral program "Information Systems in Communications and Logistics" where he passed all exams with excellent grades - excellent, 10. During his doctoral academic studies, as an author and co-author, he published 15 scientific and professional papers, two of which were published in international peer-reviewed journals.

Zoran Avramović was elected a full member of the Russian Academy of Transport (RAT, St. Petersburg, Russia, since 1995), the Russian Academy of Natural Sciences (RAEN, Moscow, Russia, since 2001), the Serbian Academy of Engineering (IAS, Belgrade, since 2004). (formerly: Yugoslav Academy of Engineering - JINA) and the Academy of Electrical Engineering of the Russian Federation (RAEN, Moscow, Russia, since 2007). He is the scientific secretary of the Electrical Engineering Department of the Engineering Academy of Serbia. So far Avramović has published: 371 scientific and professional papers.

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