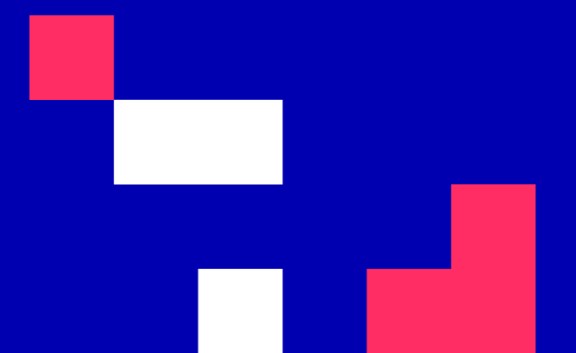University of Cyprus

MAI650 Internet of Things

Vasos Vassiliou

September - December 2023

CS6xx Internet of Things (8 ECTS)

Course purpose and objectives: The purpose of the course is to provide an overview on IoT tools and applications and to introduce to students hands-on IoT communication concepts through lab exercises.

Learning outcomes: Upon completion of this course, students will be able to explain the definition and usage of the term "Internet of Things" in different contexts. More specifically, the students will know how to apply the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming and data analysis

Teaching methodology: interactive face-to-face lectures, group activities and discussions, in class/lab activities, student presentations and guest lectures or significant recorded public lectures

Assessment: Final exam (50%), midterm exam (20%) and assignments/project (30%).

Main text:

Rajkumar Buyya, Amir Vahid Dastjerdi, Internet of Things Principles and Paradigms, Morgan Kaufmann; 1st edition, 2016

J. Biron and J. Follett, "Foundational Elements of an IoT Solution", O'Reilly Media, 2016.

Other reading:

Jamil Y. Khan and Mehmet R. Yuce, Internet of Things (IoT) Systems and Applications, 2019, ISBN 9789814800297

David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, and Jerome Henry, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, 2016, Cisco Press.

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INTRODUCTION

IoT Business Value - Introduction

CONTENTS

1. Business IoT

2. Business Value

3. From traditional business to IoT business

4. Business risks in adopting IoT

5. Example of industries using IoT

INTENDED LEARNING OUTCOMES

Upon completion of this introductory unit, students will be :

1. familiar wit the term of IoT Business Value

2. familiar with the basic term of business value

3. familiar with the main ways of adopting Business IoT

4. familiar with the basic risks that come with the adoption of Business IoT

5. able to present examples of companies using IoT.

Business IoT

Business IoT

IoT technology has made the concept of smart homes possible, and now the time for smart workplaces has arrived.

IoT Attacks

- Business is introduced in the Internet of Things.

- IoT stands for "**common items connected to the internet**",
  - IoT Business will be companies that connect to the internet.

- Business can adopt the idea of IoT in two different ways:
  1. Inside: the employees and the building.
  2. Outside: the products/services.

Business Value

"the core principles or standards that guides the way of the business"

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Business value

- **"What does the business stand for?"**
  - An informal term that includes all forms of value that determine the health and well-being of the business.

- **While business plans and strategies change, the core value of the business remains the same.**

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Examples of Business Value

- Business value are the benefits that a firm generates for its stakeholders and includes a company's long term ability to create revenue, products, services, employment, quality of life and investment returns.

- Examples:
  - Assets
  - Talent
  - Know-how
  - Brand value
  - Products and Services

Is IoT what business need?
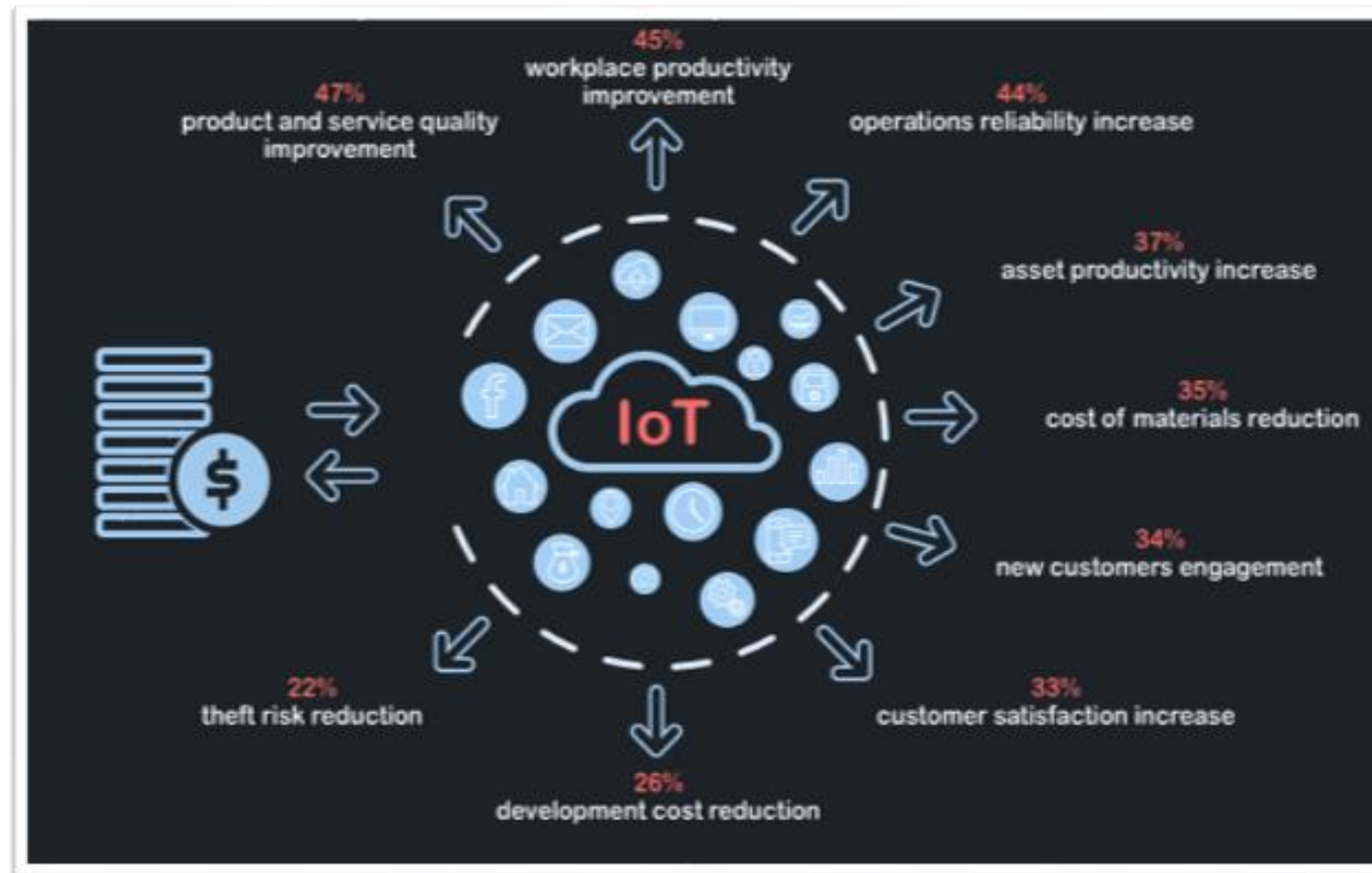
From Traditional Business to IoT Business

From traditional Business to IoT Business

- The business world changes with the introduction of IoT, in the following ways:
    1. Inventory Tracking and Management
    2. Data sharing and Perception
    3. Productivity and Efficiency
    4. Remote Work
    5. Skilled Workers
    6. Create new Consumer demands
    7. Improved Customer Engagement
    8. Shorter Buying Cycles

From traditional Business to IoT Business

1. Inventory Tracking and Management

- When a business relies on storage and warehousing, there is always a need for people in tracking and management it.

- IoT inventions can help the business with the tracking and managing inventory by giving automatically-controlled options.
  - In storage units and warehouses, IoT devices and software, can be installed to help manage inventory changes, while the personnel of the business can invest their time in other tasks.
  - A business can easily track the inventory of items, from the manufacturing facility to its warehouse to deliveries, with the help of IoT-enabled remote scanners.

From traditional Business to IoT Business

2. Data sharing and Perception

- All business function and grow with the help of data collection and exchange:
  - The data is used to study buyer cycle, consumer requirements, the scope for improvements and innovative inventions and methods for advertising and marketing.

- IoT technology offers:
  - Greater access to consumer data.
  - Their devices, will track and record patterns, in which the consumer interacts with the devices.
  - This will allow the smart devices to offer better experience.
  - The data will be collected, shared and interpreted effectively.

3. Productivity and Efficiency

- Businesses, apart from the executions with a super speed, they also need high level of productivity and efficiency to complete their operations.

- IoT software and appliances allow workers to accomplish large-scale tasks in a faster and error-free way.

- IoT devices are connected to each other and can be controlled to improve efficiency, which directly will affect the productivity of the business.

- In general, the profits of the business will increase significantly with the increasement of the productivity and the efficiency.

4. Remote Work

- If the business does not require physical present, due to physical inventory, then employees can handle work remotely.

- IoT technology can allow employees to connect and work remotely.
  - Remote workers are often more efficient and more productive.

- By combining, IoT technology and wireless technology, employees can work from a remote location by tapping into their devices from an office or the factory floor.

From traditional Business to IoT Business

5. New Staffing Members Required

- Businesses will have to recruit new staff members or train the existing ones to make them adapt to new technologies.

- The business will focus on recruiting skilled workers that can handle IoT technologies efficiently.

- The need of more knowledge, will incline more people towards modern technology, which will enhance their value for the future.

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From traditional Business to IoT Business

6. Create new Consumer Demands

- New needs will arise, due to the usage of IoT devices from consumers.

- As they become more familiar with IoT technology, they will begin to demand more things.
  - Things they have never asked before.

- The expectation will rise, for getting more out of every new purchase made and every new order placed.

From traditional Business to IoT Business

7. Improved Costumer Engagement

- The smartness of the devices, will allow the business to use it for monitoring the products and providing proactive support.

- Better customer services will be enabled, with the use of customer services systems that notify the need of repairing or replacing.

- New marketing opportunities will also arise.

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From traditional Business to IoT Business

8. Shorter Buying Cycles

- The buying cycle will become shorter.

- IoT will speed up the buying decision making process as well as orders will be processed faster.

- From verbal placing orders through smart devices, to receiving the products the same day.

Business risks in adopting IoT

Business Risks in adopting IoT

- Is it safe for the business to fully adopt the IoT?

- The risks to the business and infrastructure when adopting IoT are:
    1. Modular architecture of hardware and software
    2. DDoS attack
    3. Complexity of Vulnerabilities
    4. Scalability of infrastructure

Business Risks in adopting IoT

Modular architecture of hardware and software

- Any IoT device has always as its major concern, security.

- The use of web-enabled devices need to give priority to better control with customer interactions.

- The structure of the devices and control parts in modules, gives the ease to hackers to attack or exploit its configuration. In worst case scenario, to destroy its operations at different levels.

Business Risks in adopting IoT

DDoS Attack

- DDoS : Distributed Denial of service
  - A distributed denial-of-service attack is a malicious attempt to disrupt normal traffic of a targeted server, service or network by overwhelming the target or its surrounding infrastructure with a flood of Internet traffic.

- From a high level, a DDoS attack is like a traffic jam clogging up with highway, preventing regular traffic from arriving at its desired destination.

- This attack has two types:
  - Traffic Attack: a huge volume of spam data packets are flooded towards the target, which results in loss of the real requests.
    - These attacks are usually operated with the injection of:
      - Trojans: any malicious computer program which misleads users of its true intent
      - Malware: any software intentionally designed to cause damage.
  - Bandwidth Attack: the target is overloaded with Terabytes or even Petabytes of garbage data, which results in lost system data transmission, server crash or even a complete shutdown.

Business Risks in adopting IoT

Complexity of Vulnerabilities

- Various IoT devices from their design lack advanced security, which makes them vulnerable to attackers.

- To prevent this and get rid of all the vulnerabilities, it is important to implement best practices for testing IoT devices.

Business Risks in adopting IoT

Scalability of infrastructure

- In IoT the IT infrastructure plays a crucial role.

- A scalable IoT infrastructure can handle the take-up of all the devices, applications, traffic and usage data.

- To reduce the cost and improvise the delivery performance, cloud storage and virtualization can be used.

- A cloud platform allows devices to connect securely to cloud applications and store their data over cloud data warehouses.

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Examples of industries using IoT to great benefit

- Healthcare IoT

- Manufacturing and Industrial IoT

- Marketing IoT

Examples of industries using IoT to great benefit

Healthcare IoT

- Healthcare IoT provides:
  - better patient experiences through connected healthcare data systems
  - better management of administered medicine through IoT monitoring solutions.

- Significant development include:
  - Enhanced Drug Management
  - Remote Health and Monitoring
  - Tracking Staff, Patients and Inventory

Manufacturing and Industrial IoT

- The second biggest industry embraced by IoT and digital transformation.

- Also known as IIoT (Industrial Internet of things)or Smart manufacturing or Industry 4.0.

- Manufacturing IoT is deployed through connected sensors and predictive maintenance systems, leading to decreased downtime and higher product quality and output.

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Examples of industries using IoT to great benefit

Marketing IoT

- Marketing IoT delivers real-time behavioral marketing and predictive social media analytics.

- Marketing is very data-driven nowadays, so the IoT data are very attractive to marketers.

- Marketing IoT can be used by the marketers as follows:
  - analyzing customer buying habit across the platforms customers use.
  - more and previously unobtainable data regarding the ways consumers interact with devices and products.
  - getting a better insight into the buying journey and in which stage of it the customer is.
  - real-time interactions, POS notifications and of course targeted and even fully contextual ads.
  - the customer service field whereby issues can be quickly resolved.

Summary

- ❑ **Business IoT**
- ❑ **Business Value**
- ❑ **From traditional business to IoT business**
- ❑ **Business risks in adopting IoT**
- ❑ **Example of industries using IoT**