Industry 4.0 and IT systems

You book a table at a restaurant on your phone. The waiter's tablet already shows your name when you arrive, the kitchen sees the order the moment it is taken, and at the end of the month the accountant does not type a single ticket. One piece of data, typed once, travels through the whole company. How did companies get here, and which programs make it possible?

This lesson answers both questions. First, where the idea comes from: a story of four industrial revolutions that ends in a word you will read everywhere, **Industry 4.0**. Then, who uses IT inside a company, and with which systems. Those systems are exactly the programs a DAM technician builds, integrates and maintains.

What you will learn

- Place **Industry 4.0** at the end of the four industrial revolutions and say what makes it different
- Explain what a **cyber-physical system** is with an everyday example
- Name the typical **departments** of a company and the IT system each one uses
- Say what an **ERP**, a **CRM** and a **PMS** do, and why typing a piece of data only once matters
- Give **differences and similarities** between IT and OT, and avoid the trap of listing only differences

Four industrial revolutions

Revolution	When	What made it possible	What changed
1st	Late 18th century	Steam engine, mechanisation	From handwork to the factory
2nd	Late 19th – early 20th century	Electricity, the assembly line	Mass production
3rd	Second half of the 20th century	Electronics, computers, PLCs and robots	Automated production
4th	Today	Cyber-physical systems, the internet of things, cloud, data and AI	Machines, systems and people **connected**; decisions based on data

The sequence to remember is **steam → electricity → automation → connection and data**. You do not need the exact dates of the first three.

> **Industry 4.0** is the fourth industrial revolution: machines, products and systems connected to each other, generating data that the company uses to decide and to act.

The term was born in Germany. *Industrie 4.0* was presented in public at the **Hannover trade fair in 2011**, as a project of the German government's high-tech strategy, by **Henning Kagermann**, **Wolfgang Wahlster** and **Wolf-Dieter Lukas**.

The difference with the third revolution is not that there are computers. The third revolution already had them. The difference is that now **everything is connected and produces data** that someone uses.

> A **cyber-physical system** is a physical thing (a machine, a building, a vehicle) with sensors, software and a network connection, so that it can be monitored and controlled digitally.

In the city-builder game, the third revolution is a city where the traffic lights change on a timer. The fourth is a city where every traffic light reports the traffic it sees, and you watch and adjust them all from one screen.

> **Not only factories**
> The word says *industry*, but the idea applies everywhere: a hotel whose rooms report their temperature, a port whose cranes report their position, a water network whose pipes report their pressure. A hotel with magnetic keys and bookings in a spreadsheet lives in the third revolution. A hotel that opens the door with your phone and changes prices with demand lives in the fourth.

Who uses IT inside a company

Every company, from a hotel to a software start-up, is organised in **departments**. Each one has its job and its systems.

Department	What it does	Typical IT systems
Management	Strategy and decisions	Dashboards, business intelligence (BI)
Administration and finance	Accounting, invoices, taxes	ERP (finance module), electronic invoicing
Human resources	Contracts, payroll, shifts	Payroll and HR software, time tracking
Sales and marketing	Sales, campaigns, customers	CRM, website, online shop
Purchasing and logistics	Suppliers, stock, shipping	ERP (purchasing and warehouse), warehouse management system
Customer service	Questions, incidents, after-sales	CRM, ticketing system
IT (systems)	Network, servers, security, support	User management, backups, monitoring

Three families of systems you must be able to name:

> An **ERP** (*Enterprise Resource Planning*) brings the company's processes (finance, purchasing, stock, sales, HR) together in **one single database**. Examples: SAP, Microsoft Dynamics 365, Odoo.
>
> A **CRM** (*Customer Relationship Management*) manages the whole relationship with customers: contacts, sales opportunities, incidents, campaigns. Examples: Salesforce, HubSpot.
>
> A **PMS** (*Property Management System*) is the management system of a hotel: bookings, rooms, check-in and billing. Every sector has its own; a shop or a bar has its point-of-sale (POS) system.

Before the ERP, each department had its own program and its own spreadsheet, and the same customer was typed three times: by sales, by the warehouse and by accounting. Three copies means three chances to get it wrong. The point of an ERP is that a piece of data is **entered**

once and everybody sees the same one. In the city, it is one register at the city hall instead of a different notebook in every office.

> **This is DAM work**
> Odoo has an open-source edition (Community), and its server is written mostly in Python, with a web interface in JavaScript. Customising an ERP, connecting it to an online shop or writing a report for it is everyday work for a DAM technician.

IT and OT in depth

In the first lesson you compared what IT and OT manage, where they live, their priority and their lifespan. Here are more differences:

	IT	OT
Response time	Waiting a few seconds is usually acceptable	Real time: the machine cannot wait
Updates	Frequent patches, regular restarts	Very few; production must be stopped and the update planned
Networks and protocols	Internet standards: TCP/IP, HTTP, email	Industrial buses and protocols, some proprietary: Modbus, Profinet, OPC UA
If it fails	Data, time or money are lost	Production stops; there may be physical damage or danger to people
Who runs it	The IT department	Maintenance and plant engineering

And now the part most people forget. The programme asks for differences **and similarities**:

- Both are **hardware + software + networks**, and both must be programmed and maintained.
- Both **produce and consume data** that the company needs.
- Both need **cybersecurity**, backups and access control.
- More and more, they share the same technology: Ethernet, TCP/IP, standard operating systems, virtualisation.

> **IT/OT convergence** is the trend of IT and OT using more and more of the same technology and being connected to each other.

> **Careful: “IT and OT have nothing in common”**
> It is the most common mistake. They have different **priorities** (data versus people and availability) but they are built from the same materials and face the same attackers. In the city, the city hall and the water plant are different buildings, but both have doors, keys and staff who can be tricked.

In class: the systems map

In pairs, each pair took one case:

- **Case A**: the hotel in Calvià, 150 rooms, a restaurant, open from March to November.
- **Case B**: a software company with 25 employees at ParcBit, making custom applications for other companies.

Step	Do this	You should see
1	Make a table with **five departments**, and for each one **one IT system** and **the data** it manages	A table like the one on this page, adapted to your case
2	Find **one piece of data that two departments need at the same time** (for example, a booking: reception and accounting)	The reason an ERP exists: if each department has its own copy, they disagree
3	As a developer: which **integration** between two systems would you program first, and why?	One sentence connecting two systems

Then, individually, the whole class played **IT, OT or both?** with sentences such as "if it stops for ten minutes we lose a whole batch" (OT), "we install the security updates every month" (IT) or "it sends data over an Ethernet network" (both), and each student wrote **two differences and two similarities** between IT and OT on Classroom.

For your project

For Deliverable 1:

- **Section A** lists the departments of *your* company and the real IT systems it uses. Find them and cite them: the company website, its annual report, the press, or its job offers (a job offer asking for "experience with SAP" is a source).
- The **group comparison** of IT and OT must include similarities, not only differences, with examples from your company.

Key takeaways

- Four revolutions: **steam → electricity → automation → connection and data**. **Industry 4.0** was presented in Hannover in 2011.
- A **cyber-physical system** is a physical thing with sensors, software and a connection.
- Each **department** uses its own IT systems; the **ERP** puts them in one database, the **CRM** manages customers, the **PMS** runs a hotel.
- Enter each piece of data **once**: that is the reason integrated systems exist.
- IT and OT differ in **priorities**, response time, updates and protocols, but share hardware, software, networks, data and risks: **IT/OT convergence**.

Quick check

1 What makes the fourth industrial revolution different from the third?

A Computers appear for the first time
B Electricity reaches the factories
C Machines, systems and people are connected and generate data that are used to decide
D Production moves from the workshop to the factory

2 Where and when was the term "Industrie 4.0" presented in public?

A In Silicon Valley, in 1995
B At the Hannover trade fair, in Germany, in 2011
C In Barcelona, at the Mobile World Congress of 2016
D In Japan, in 1980

3 Which system puts finance, purchasing, stock and invoicing in one single database?

- **A** CRM
- **B** ERP
- **C** PMS
- **D** SCADA

4 Which department uses a CRM the most?

- **A** Human resources
- **B** Accounting
- **C** Sales and customer service
- **D** Plant maintenance

5 Reception and accounting each keep their own list of bookings in different programs. What is the most likely problem?

- **A** None: two copies are safer than one
- **B** The two lists end up being different, and someone has to type the same data twice
- **C** The hotel needs more OT
- **D** The bookings cannot be paid by card

6 Which TWO of these are similarities between IT and OT?

- **A** Both need cybersecurity, backups and access control
- **B** Both can be stopped and restarted at any time to install updates
- **C** Both are made of hardware, software and networks
- **D** Both put the confidentiality of data first

7 A city's traffic lights now report the traffic they see and can be adjusted from a control room. Which concept is this?

- **A** Digitisation
- **B** An ERP
- **C** A cyber-physical system, typical of Industry 4.0
- **D** A CRM

You now know the offices of the city. Next, you go down to the plant, where the machines are, and see what happens when both halves are connected: Plant, business and IT–OT.

Solutions

1. C · Computers and PLCs already existed in the **third** revolution. **Industry 4.0** is about **connection and data**.

2. B · It was presented at the **Hannover** fair in **2011** as part of the German government's high-tech strategy.

3. B · The **ERP** integrates the company's processes in one database. The CRM is about customers, the PMS is a hotel's management system, and SCADA belongs to the plant (OT).

4. C · A **CRM** manages the relationship with **customers**: contacts, sales opportunities and incidents. That is the daily work of sales and customer service.

5. B · Two copies of the same data drift apart and double the typing. Entering each piece of data **once** in a shared system, such as an **ERP**, is the fix.

6. A, C · IT and OT share materials and risks: hardware, software, networks and the need for **cybersecurity**. They differ in priorities: OT cannot be stopped easily and puts **people and availability** first.

7. C · A physical thing (the traffic light) with sensors, software and a connection, monitored and controlled digitally, is a **cyber-physical system**: the core idea of **Industry 4.0**.