



Supply Chain Management

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Information Systems in SCM

Information System

Information system (IS)

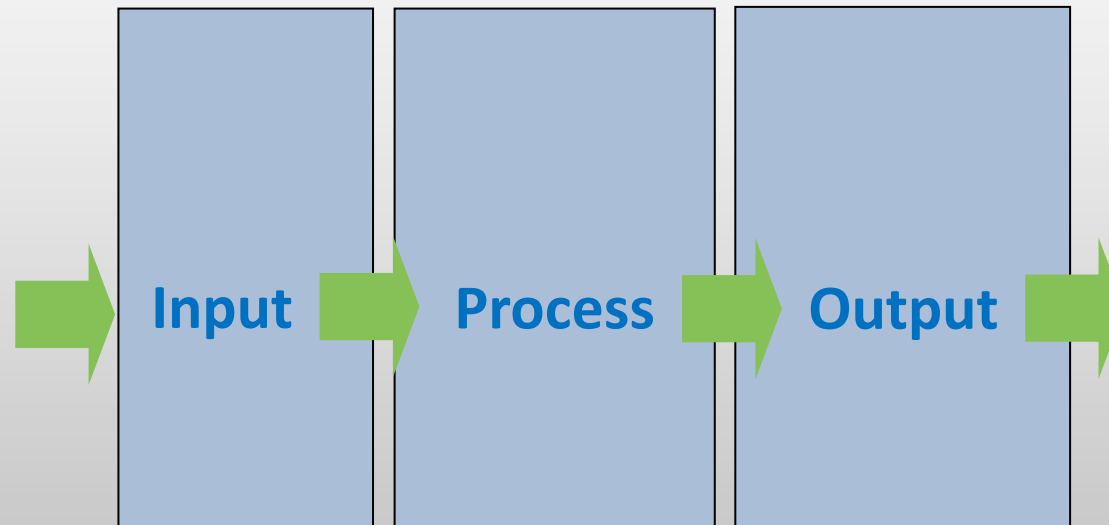
A set of interrelated components that collect (or retrieve), process and store data for providing information, knowledge and digital products to the users.

Businesses utilize IS to manage their supply chain/ operations, interact with their customers, collaborate with their suppliers and, ultimately, execute their competitive strategy.

ISystems Main Components

- Hardware
- Software
- Telecommunications
- Data
- People
- Procedures/ Processes

What ISystems Do



What ISystems Do in a Supply Chain

Employee data

Supplier data

Sales data

Product data

.....

Social Networks data

Sensors data

Material data

Competitors data

Market Segments
data

Regulation data



Input



Process



Output



Employee payments

Supplier Contracts

Production Plan

Replenishment quantities

Picking quantities

Demand/ Sales Forecasting

.....

Inventory Strategy

Promotion campaigns

Customer loyalty programs

Outsourcing strategy

Management reports

Customer profiles

ERP

- Enterprise resource planning (ERP) is an IS that allows companies to (1) **automate and integrate many of their business processes**, (2) share a common, enterprise-wide database and business practices throughout the enterprise, and (3) produce information in real time.
- **Broad scale, modular IS** that integrates a firm's business processes and functions into a single IS that integrates the corresponding data and serves the requirements of the firms processes and functions.
- **IS for identifying and planning the enterprise-wide resources** needed to take, make, ship, and account for customer orders.

ERP ...

- Collects, processes, and provides information about a company's entire enterprise.
- Serves as an **organization's backbone** by integrating and optimizing all the various business processes across the entire firm.
- **Links all of the firm's areas of activity** into a network.
- **Replicates organizational processes in software**, guides employees through the processes step by step, and automates as many of them as possible.

Source: R. Daft, 2010. Organization theory and design. Cengage learning EMEA, ISBN-13: 978-0-324-59889-6, Chapter 8.

ERP ...

- packaged software
- Serves as **transactional processing system**, as well as **management information system (MIS)**, **decision support system (DSS)**, or **executive information system (EIS)**.
- In brief, ERP systems implement functions of all these systems -> They provide to the users (personnel & managers) the big picture quickly and **support quick, effective decisions and actions**.
- Adopts and implements **best practices** in a firm's business processes.
- Facilitates the coordination, collaboration and exchange of information between the various departments of a firm.

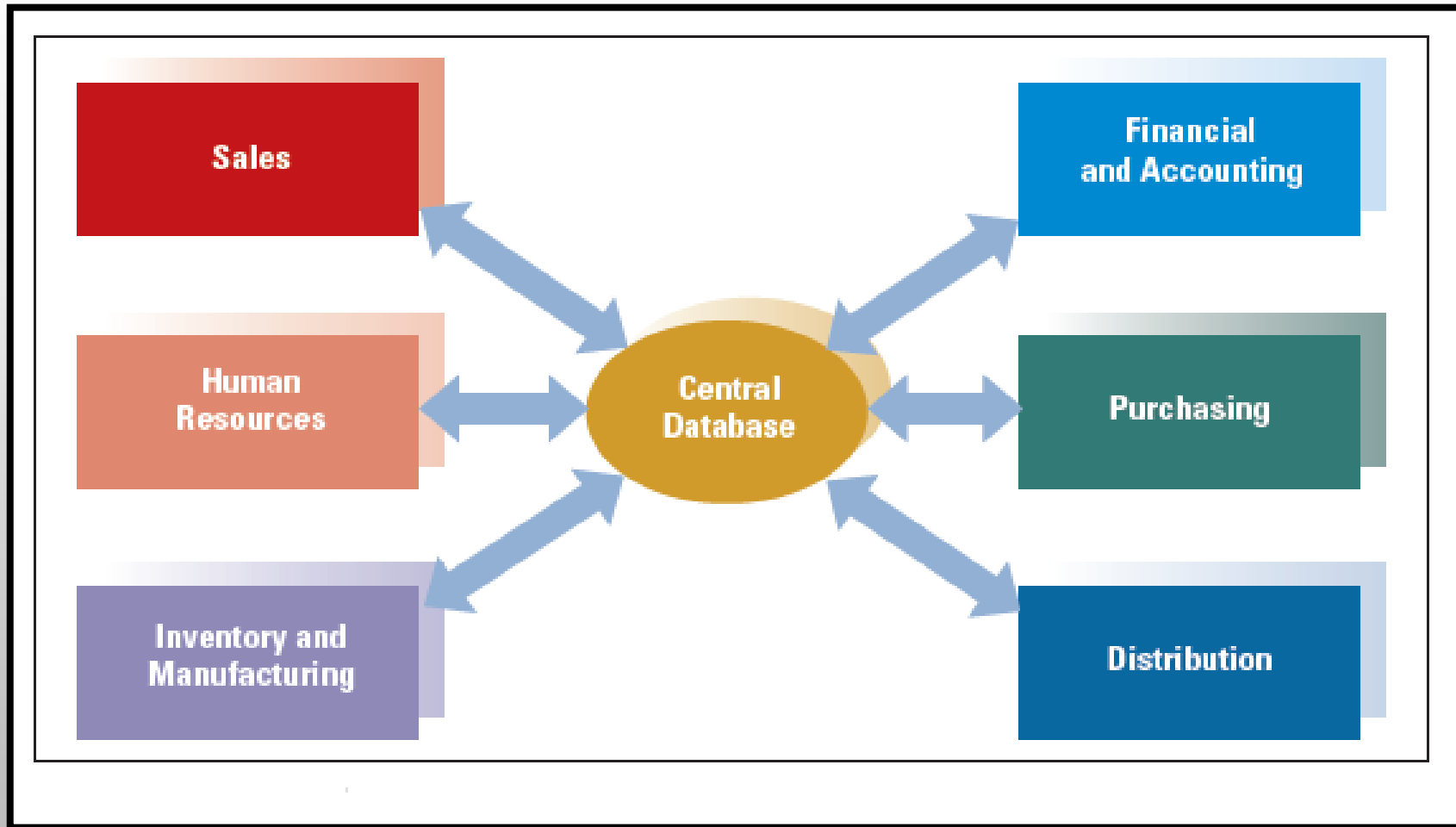
ERP Main Objective

Objective of ERP systems

Coordination of a firm's entire business, from supplier evaluation to customer invoicing.

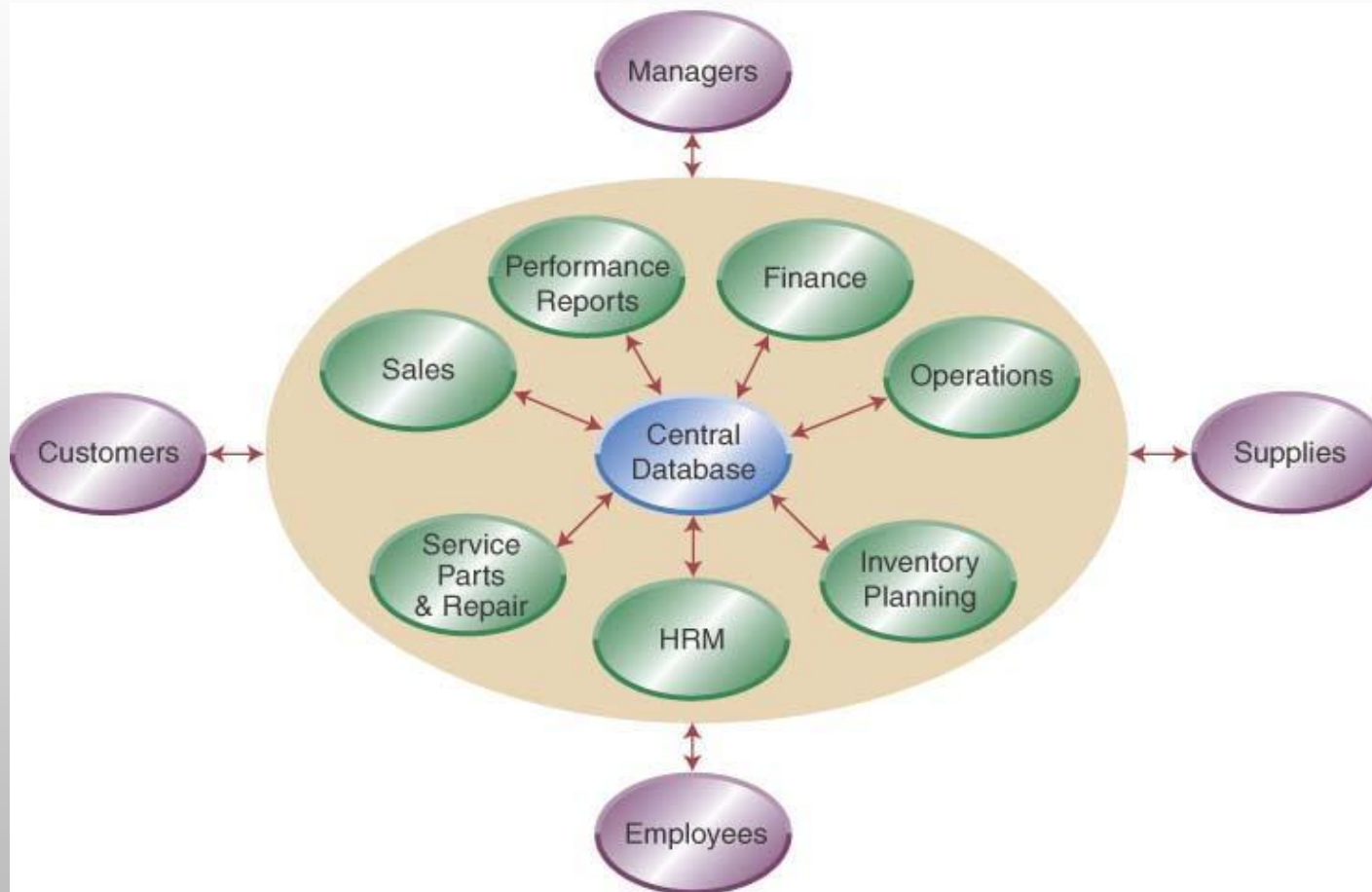
This objective is seldom achieved, but ERP systems are umbrella systems that tie together a variety of specialized systems.

ERP Integrates



Source: R. Daft, 2010. Organization theory and design. Cengage learning EMEA, ISBN-13: 978-0-324-59889-6, Chapter 8.

ERP Integrates



ERP Benefits

- Supply chain information visibility
- Improved data quality and security
- Improved visibility across all business operations (holistic view of a business)
- Improved reporting and planning -> improved decision making
- Improved alignment of competitive strategy and SC strategies
- Increased flexibility
- Sustained involvement of top management

ERP Benefits

- Enhanced/ new business processes (best practices implementation, standardization)
- Business processes automation -> reduced operating costs (e.g. labour costs), reduced errors
- Increased integration, communication and collaboration between business units
- Reduced Costs and stock
- Improved customer service
- Efficient coordination of demand, supply and production

ERP Disadvantages/ Risks

- Expensive
- Complex
- May require major business process reengineering
- Very time-consuming
 - ✓ adoption/ implementation process
 - ✓ adjustment of business
- Risk for a business
- Acceptance risk by the employees/ users (Resistance to change)
- Transition cost (e.g. training cost)

ERP Modules

- Material Requirements Planning (MRP)
- Finance and Accounting (capital, investments, performance reports etc.)
- Human Resources Management (workforce planning, payroll & benefits etc.)
- **Supply-chain management (SCM) software** for sophisticated vendor communication, e-commerce, and the activities necessary for efficient warehousing and logistics.
- **Customer relationship management (CRM) software** for analysis of sales, targeting the most profitable customers, and managing the sales force.
- **Sustainability software** for sustainable workforce issues, transparency for supply-chain sustainability issues, as well as monitoring health and safety activities, energy use and efficiency and environmental compliance.

ERP Implementation Case

Cadbury, a British multinational 123 year-old confectionery company owned by Mondelez Int.

- 2nd largest confectionery brand in the world after Wrigley's.
- Cadbury is headquartered in Uxbridge, London, and operates in >50 countries worldwide.
- Why ERP
 - ✓ Problems concerning production and distribution.
 - ✓ Firm was on a fast paced growth, but its systems could not serve its needs.
- Solution: SAP-based ERP adoption
 - ✓ 5-year IT transformation project, called "Probe"
 - ✓ Aim: integration of Cadbury' supply chain, purchasing, manufacturing, distribution, sales and marketing systems in a global ERP platform.



Source: Chitrangada Roy, 2014. Case study on ERP success(cadbury) and failure(hershey's)

<https://www.slideshare.net/ChitrangadaRoy1/case-study-on-erp-successcadbury-and-failurehersheys>

ERP Implementation Case

- Far from smooth transition to the new ERP
- Challenging implementation and very time-consuming
- Overall, the ERP implementation resulted in significant operating cost savings and increase in efficiency.
 - multi-node resources-management extended throughout its supply-chain
 - significantly better production efficiencies throughout the manufacturing chain
 - complete reengineering of existing warehouse and warehouse management system, and distribution processes.
- The system is also deployed to Cadbury's vendors. A portal called "vendor connect" enables the users to monitor the inventory movement and plan accordingly.



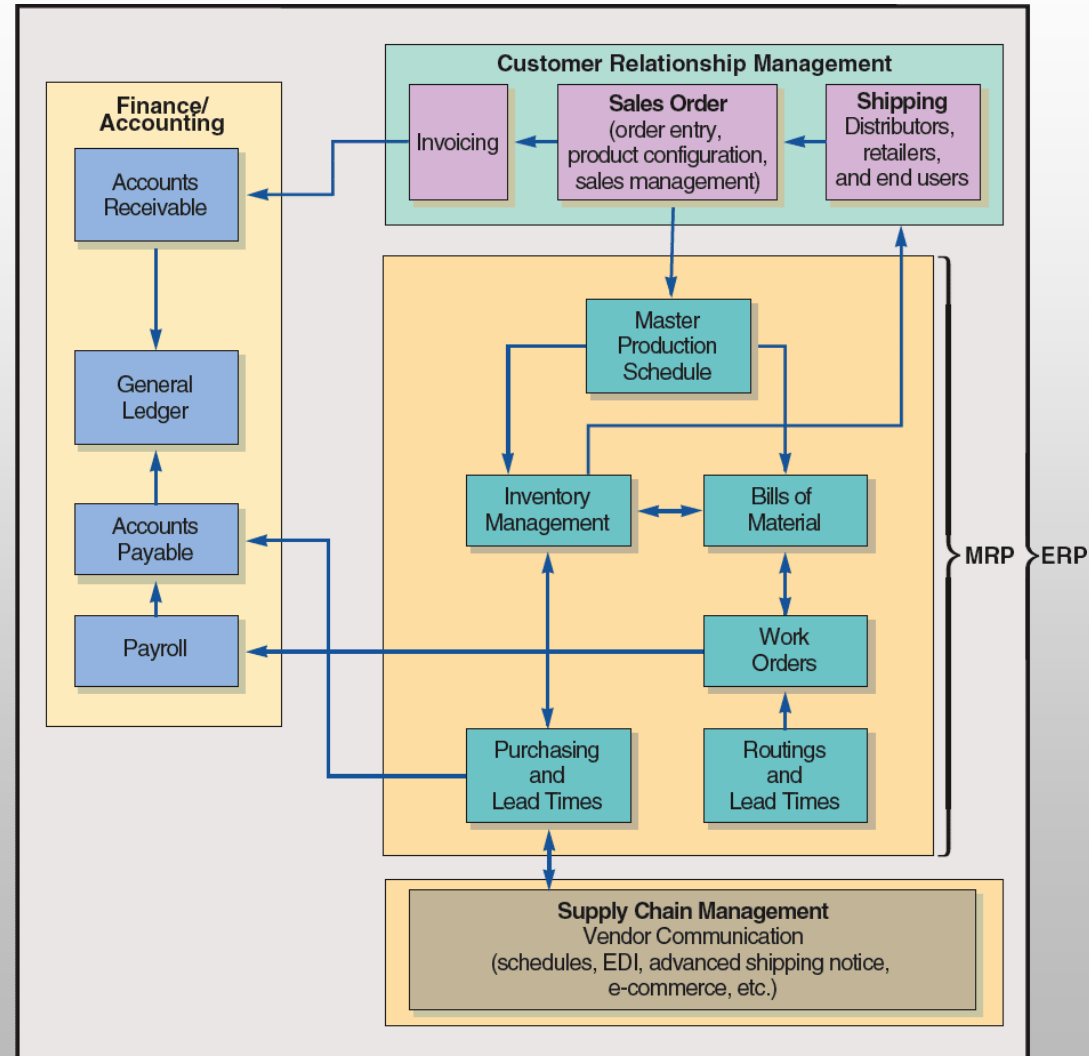
Top ERP Vendors

- | | | | |
|---|-----------|----|-----------------------|
| 1 | Oracle | 2 | SAP |
| 3 | Microsoft | 4 | Infor |
| 5 | Sage | 6 | Epicor |
| 7 | IFS | 8 | QAD/Plex/Deltek/Unit4 |
| 9 | Acumatica | 10 | Odoo |

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ERP and MRP



ERP and MRP



Unique features

Bills of material
Order management
Quoting

Shared features

Manufacturing planning
Inventory management
Reporting/analytics
Warehouse management
Supply chain management

Unique features

Financial management
Integrated business operations
HR management
Customer relationship management
Project management

ERP and MRP

MRP vs. ERP: Major Differences

MRP

- ✓ Works as a standalone system
- ✓ Typically less expensive
- ✓ Has limited users

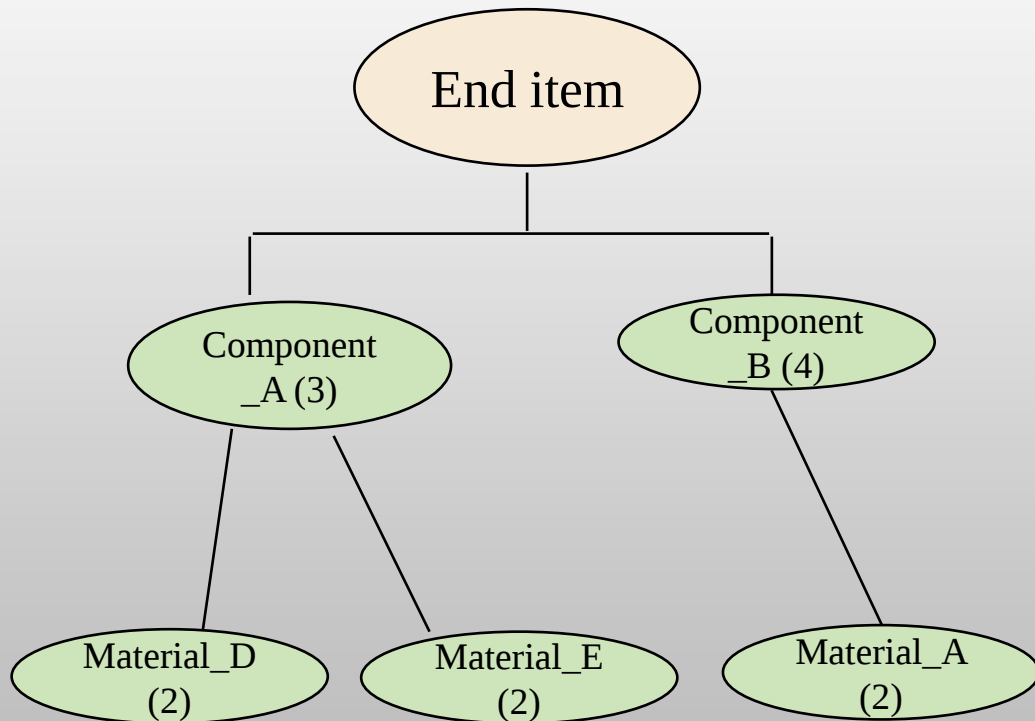
ERP

- ✓ Works as an integrated system
- ✓ Typically more expensive
- ✓ Can have many users

Material Requirements Planning (MRP)

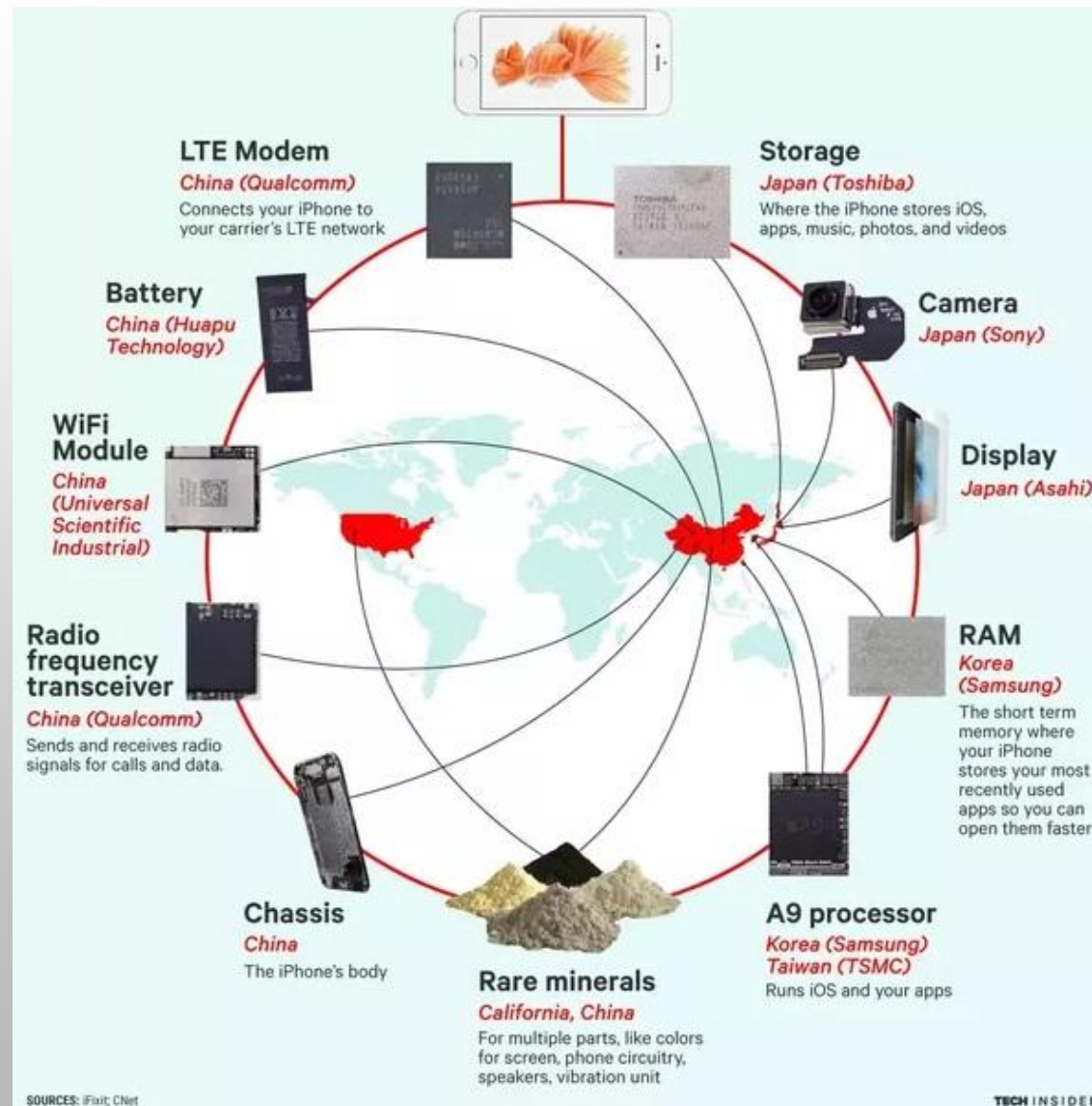
- MRP: A **dependent demand technique** that uses a bill-of-material, inventory, expected receipts, and a master production schedule to determine material requirements of end items.
- MRP system: An IS that translates master schedule requirements for end items into time-phased requirements for subassemblies, components, and raw materials.
- MRP systems support production managers in scheduling and placing orders for items of dependent demand in order to produce the end items.

Dependent Demand



- Dependent demand means that **demand for one item is related to the demand for another item.**
- A firm receives an order for final products -> the components, materials are dependent demand items.
- If we have an order quantity for the end item, the dependent demand for all parts and components can be calculated (**MRP is used**).

Dependent Demand of iPhone 6s



The parts (dependent demand) of the final product come from 4 countries -> very important to schedule the orders of the parts and consider the lead times -> MRP is necessary.

Source:
<http://www.businessinsider.com/where-iphone-parts-come-from-2016-4>

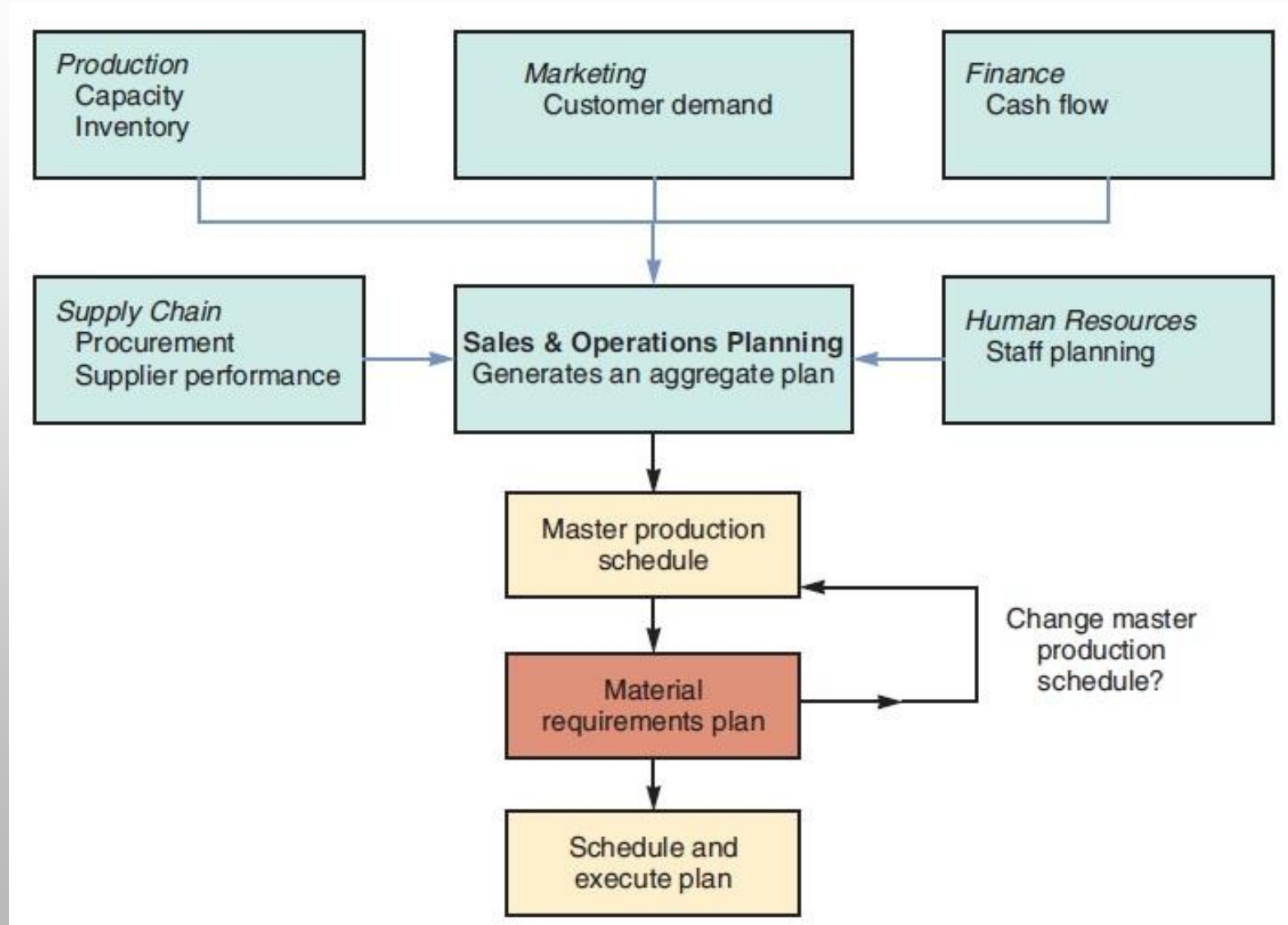
MRP Requires

- Master production schedule (what is to be made and when)
- Product specifications (i.e. Bill of Materials = materials and parts of the product)
- Inventory availability (what is already in stock)
- Purchase orders outstanding (what is on order, also called expected receipts)
- Lead times (how long it takes to get various components)

Master Production Schedule (MPS)

- A timetable that specifies what is to be made (usually finished goods) and when. It specifies how many end items will be produced within specified periods of time.
 - ✓ What to produce
 - ✓ How many
 - ✓ When
- It determines precisely the feasibility of a schedule within aggregate capacity constraints.
- *MPS disaggregates the aggregate plan. The aggregate production plan refers to families of products while MPS refers to specific products.*
- The aggregate production plan sets the upper and lower bounds of the MPS.

Production Planning



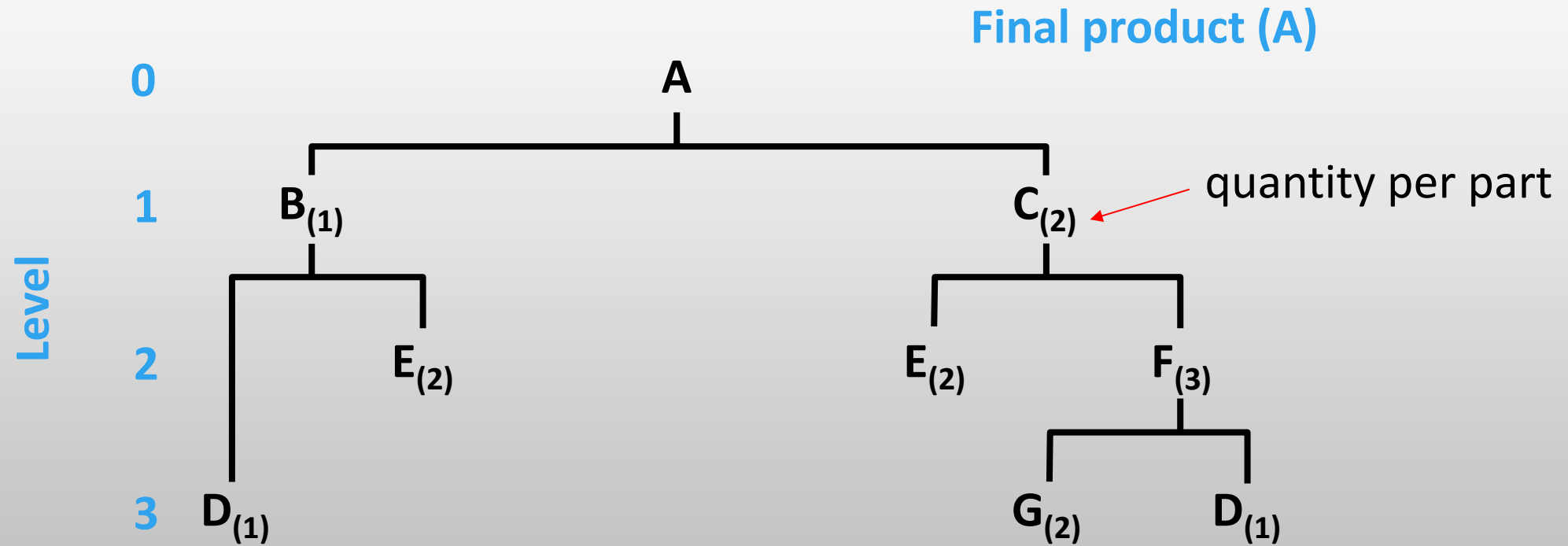
MPS Example

Products	Dec 2017				Jan 2018			
Week	1	2	3	4	1	2	3	4
Master Production Plan								
Dark chocolate Easter eggs			150	100		100		200
White chocolate Easter eggs			100	100	50	50	100	150
Milk Chocolate Easter eggs	300	250		250	350	250	450	400
Aggregate production plan of Easter eggs	1250				2100			

Bill Of Materials (BOM)

- List of components, ingredients, and materials, their description and the quantities needed to produce a final product item.
- **A food recipe is also a BOM.**
- BOM = Product tree structure + quantities per component
 - Product tree Level 0 refers to the final product.
 - Items above any level are called parents
 - Items below any level are called children or components.

BOM – Product Tree Example (1)



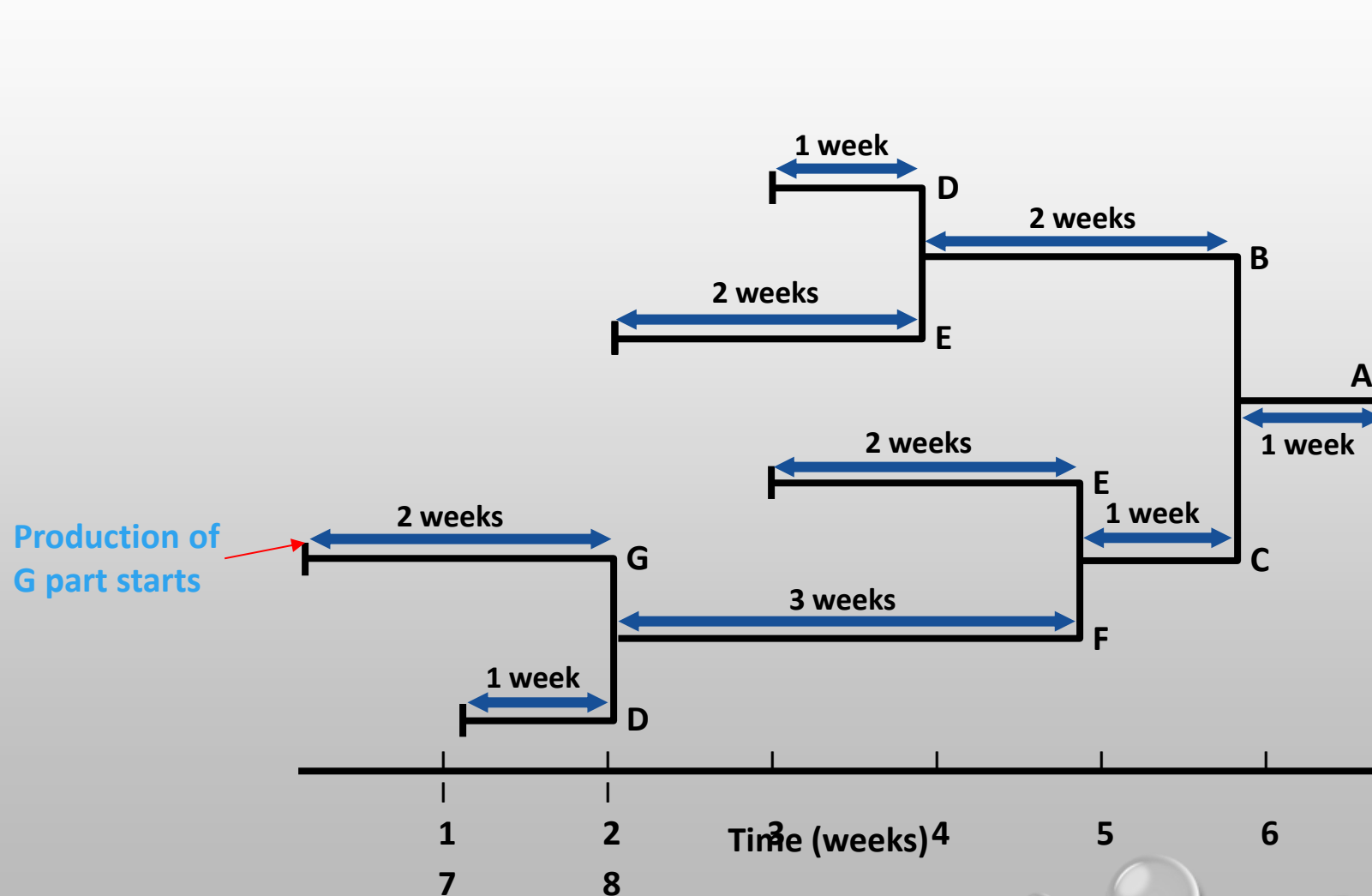
BOM – Product Tree Example (2)

Order of Final Product A	30 items
We need	
Part B	$1 \times \#A = 1 \times 30 = 30$
Part C	$2 \times \#A = 2 \times 30 = 60$
Part D	$1 \times \#B + 1 \times \#F = 1 \times 30 + 1 \times 180 = 210$
Part E	$2 \times \#B + 2 \times \#C = 2 \times 30 + 2 \times 60 = 180$
Part F	$3 \times \#C = 3 \times 60 = 180$
Part G	$2 \times \#F = 2 \times 180 = 360$

Lead Times for Dependent Demand

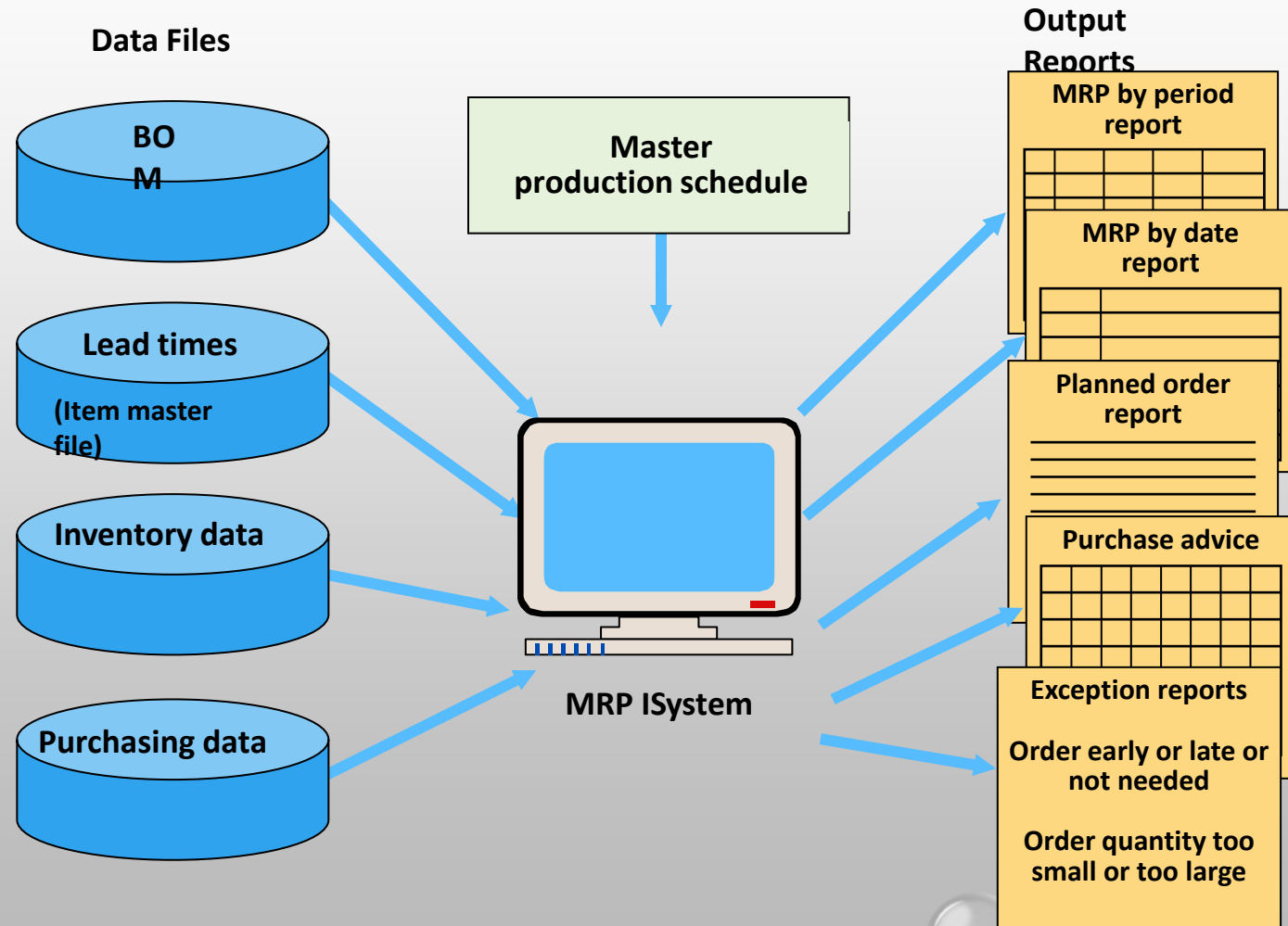
- The time required to purchase, produce, or assemble an item.
 - ✓ Manufactured item: sum of order, wait, move, queue, setup and run times for each component.
 - ✓ Purchased item: the time between recognition of need for an order and when it is available for production.
 - ✓ Lead times -> *Time-phased production* of final product

Time-Phased Production of Product A



Lead time (in weeks)	
Part B	2
Part C	1
Part D	1
Part E	2
Part F	3
Part G	2
A	1

MRP System



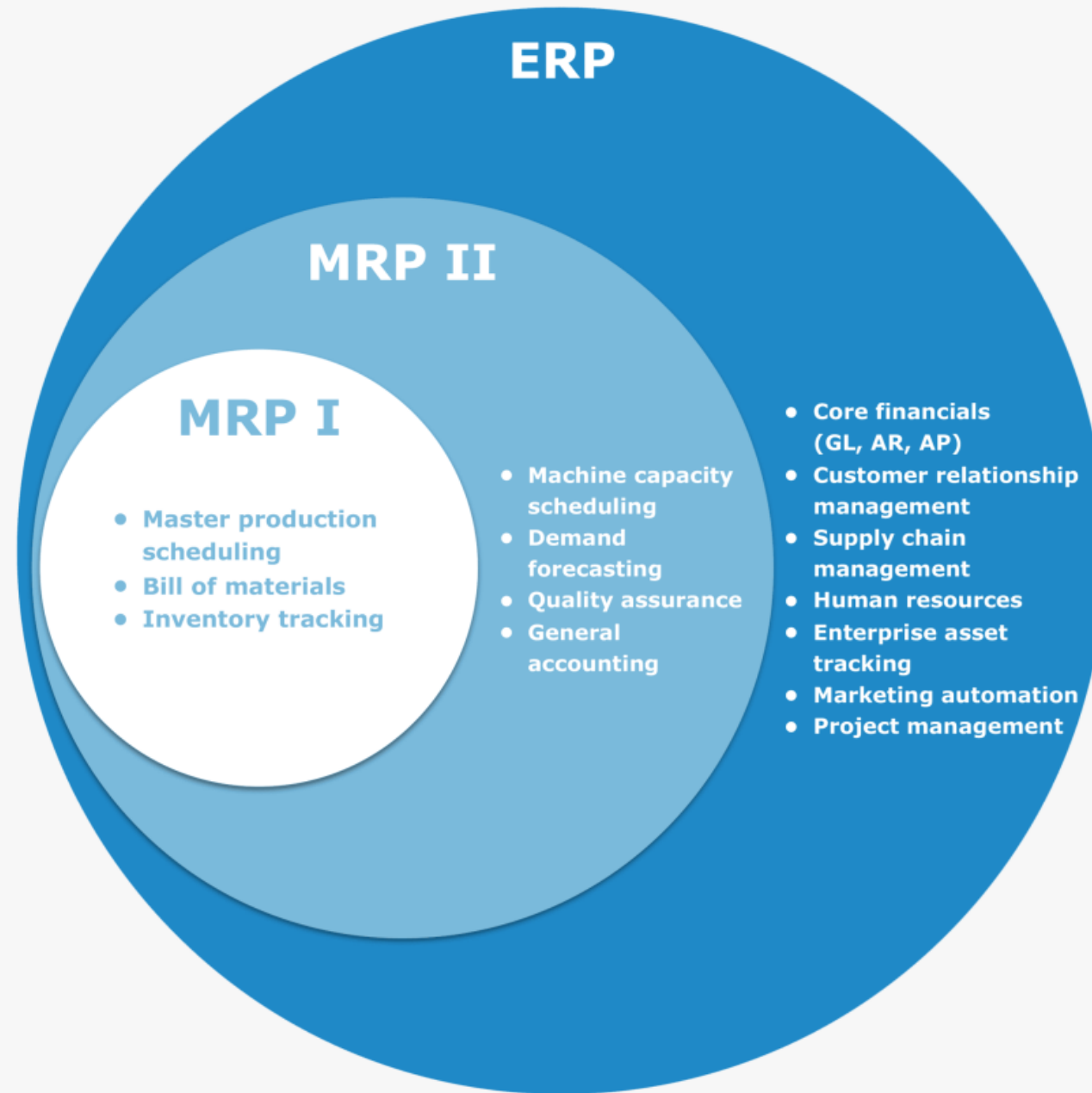
MRP Benefits

- Timely and accurate re-planning
- Low levels of in-process inventories
- Tracking material requirements
- Automatic allocation of production time
- Automatic determination of inventory usage
- Improved inventory planning and scheduling
- **Faster response to market changes and shifts**

MRP II

- MRP II : Manufacturing Resources Planning
- MRP is expanded.
- MRP II concerns not only the planning of materials but the planning and scheduling of all the resources involved in production e.g. costs, labor-hours, machine-hours, capacities etc.

MRP II





IoT-enabled SCM

Ορισμός

Το **Διαδίκτυο των πραγμάτων (IoT)** αποτελεί το δίκτυο επικοινωνίας πληθώρας **συσκευών**, οικιακών συσκευών, αυτοκινήτων καθώς και κάθε **αντικειμένου** που ενσωματώνει **ηλεκτρονικά μέσα**, λογισμικό, αισθητήρες και συνδεσιμότητα σε δίκτυο ώστε να επιτρέπεται η **σύνδεση και η ανταλλαγή δεδομένων**.

Απλούστερα, η φιλοσοφία του IoT είναι η σύνδεση όλων των ηλεκτρονικών συσκευών μεταξύ τους ([τοπικό δίκτυο](#)) ή με δυνατότητα σύνδεσης στο διαδίκτυο ([παγκόσμιο ιστό](#)).

(Wikipedia)

Ορισμός

Το IoT φέρνει/ πραγματοποιεί:

- Συνδεσιμότητα (**connectivity**) μεταξύ 'things' σε κάθε χώρο και κάθε στιγμή,
- Αυτόνομη και Ασφαλής **ανταλλαγή δεδομένων** μεταξύ συσκευών και εφαρμογών/ συστημάτων,
- Διασυνδεδεμένη οικονομική και κοινωνική ζωή,
- Φυσικές δραστηριότητες στον **ιδεατό χώρο** (virtual space)
- Απεριόριστες εφαρμογές για **«έξυπνη» ζωή και «έξυπνες» επιχειρήσεις.**

Ουσιαστικά, το IoT παρέχει για τα αντικείμενα

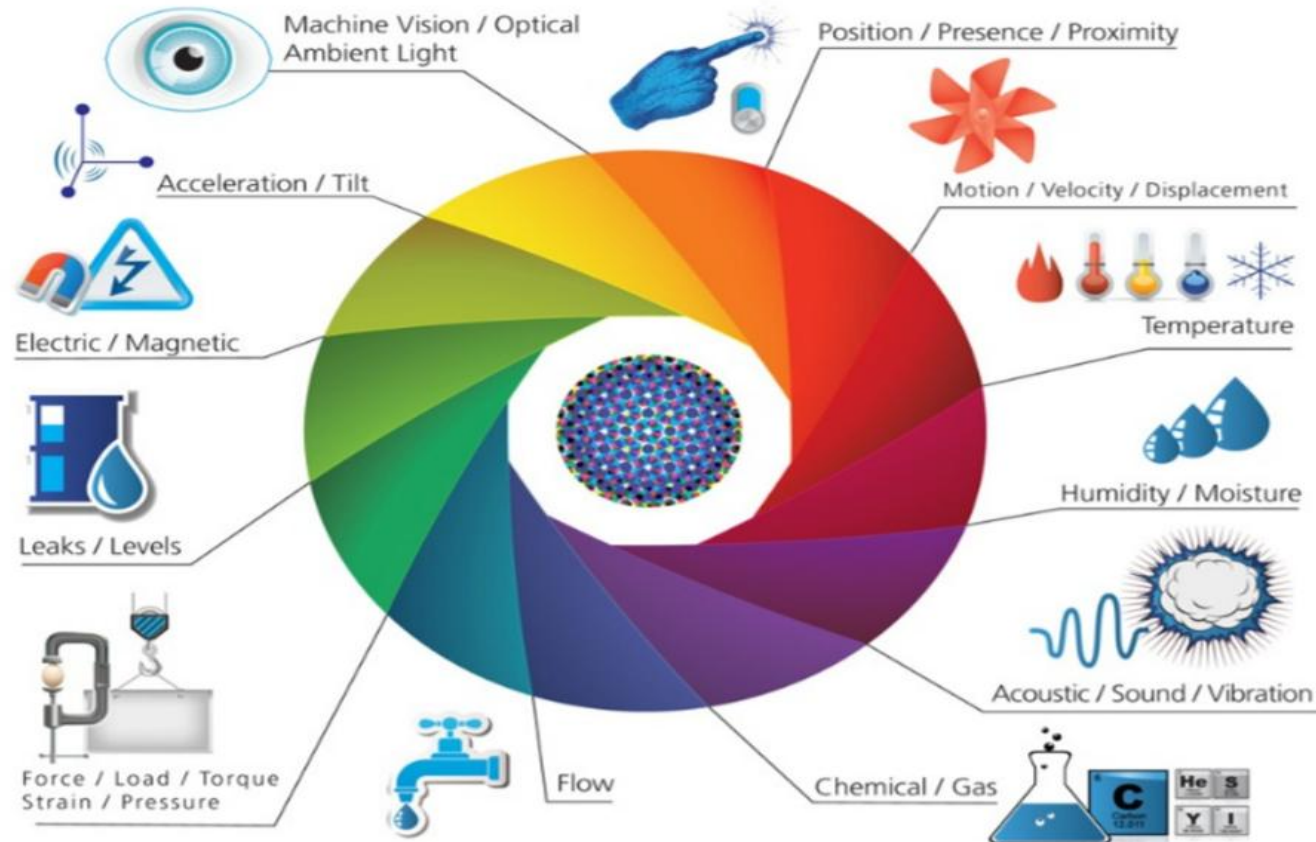
- Μοναδική αναγνώριση
- Πληροφορία σε πραγματικό χρόνο (real time) για
 - Θέση
 - Κατάσταση
 - Περιεχόμενο
- Ιδεατό/ ψηφιακό αποτύπωμα (**digital footprint**)
- Συνδεσιμότητα στο Διαδίκτυο
- Δυνατότητα ανταλλαγής δεδομένων



IoT is driven by:

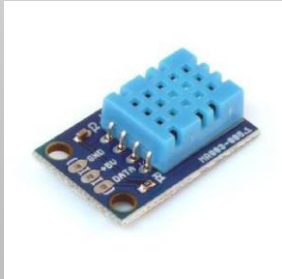
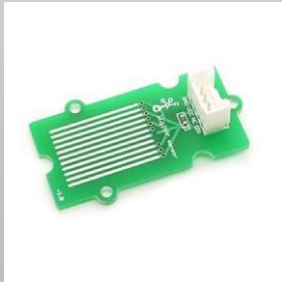
1 SENSORS & ACTUATORS

We are giving our world a digital nervous system. Location data using GPS sensors. Eyes and ears using cameras and microphones, along with sensory organs that can measure everything from temperature to pressure changes.



Source:
<https://www.postscapes.com/what-exactly-is-the-internet-of-things-infographic/>

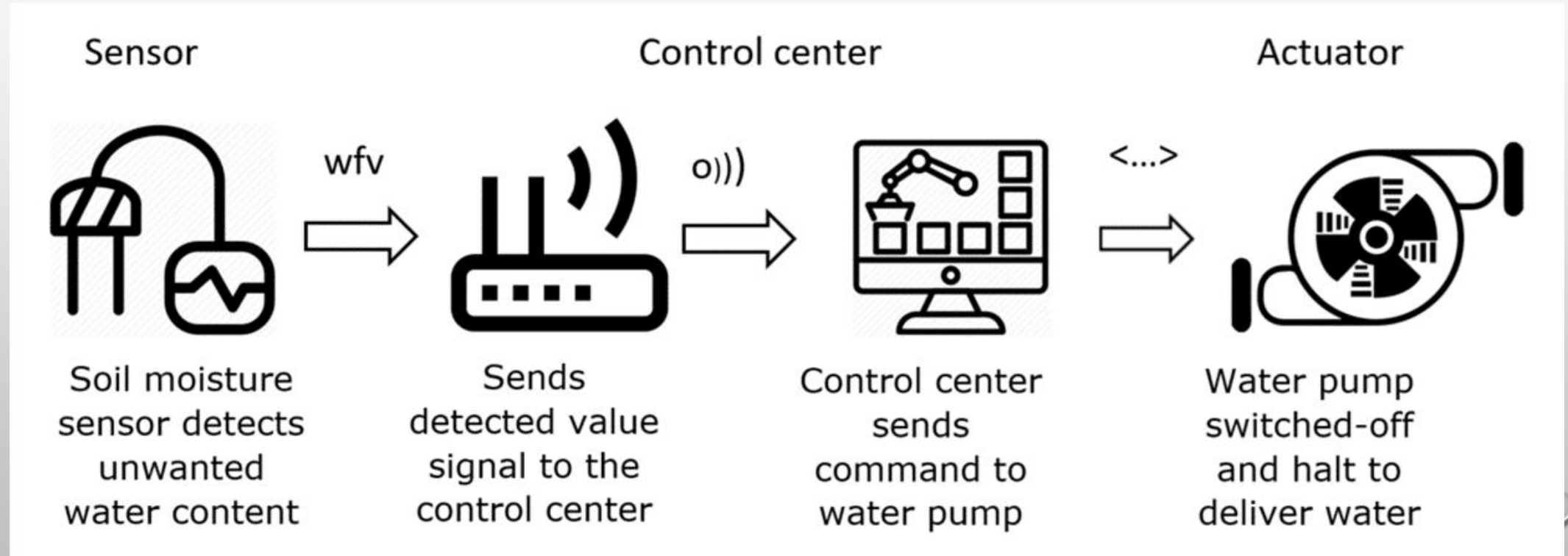
Sensors

Light sensor	Motion sensor	Sound sensor
		
Temperature humidity sensor	Weight sensor	Water sensor
		

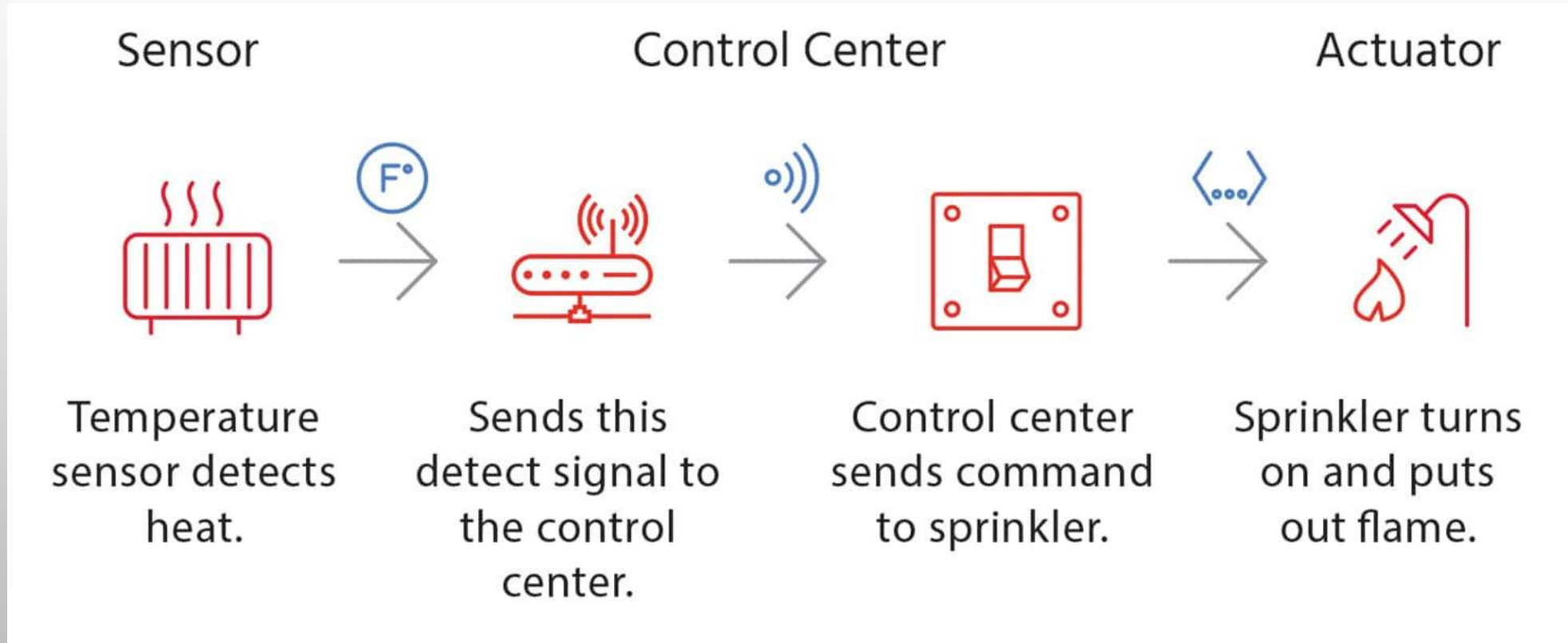
Sensors vs Actuators

SENSOR	ACTUATOR
A device that detects events or changes in the environment and sends that information to other electronic devices	A component of a machine that is responsible for moving and controlling mechanism
Connected to the input ports of the system	Connected to the output ports of the system
Help to monitor the changes in the environment	Helps to control the environment or physical changes
Output is an electrical signal	Output is a movement
Ex: biosensors, image sensors, motion sensors, chemical sensors	Ex: electric motors, stepper motors, comb drives, and hydraulic cylinders
	Visit www.PEDIAA.com

Sensor to Actuator flow

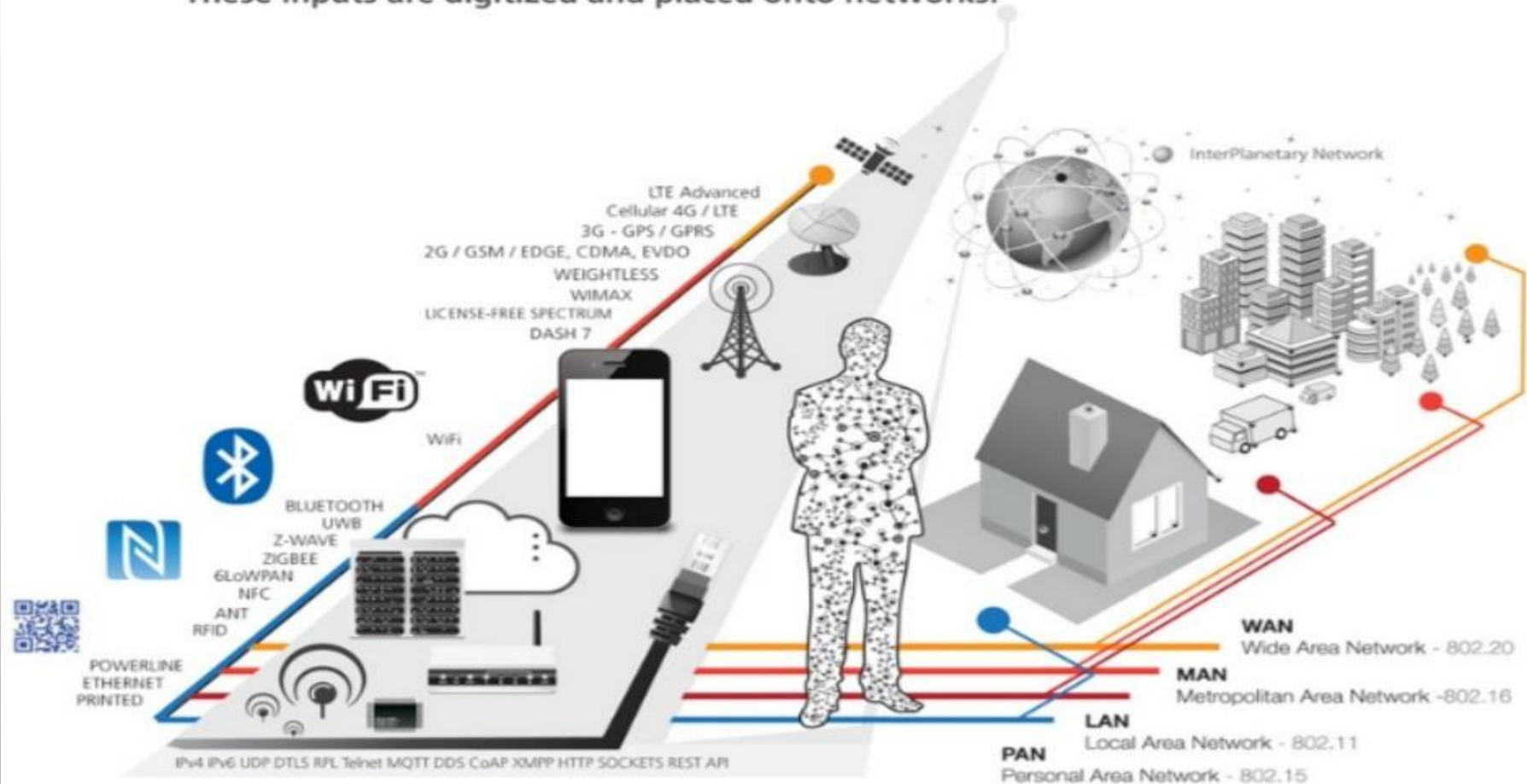


Sensor to Actuator flow



2 CONNECTIVITY

These inputs are digitized and placed onto networks.



Source:
<https://www.postscapes.com/what-exactly-is-the-internet-of-things-infographic/>

RFID (Radio Frequency Identification)

- **Automatic Scanning** – requires no line of sight.
- **Unique object Identification** (e.g. pallet, case, product item)
- **Components**

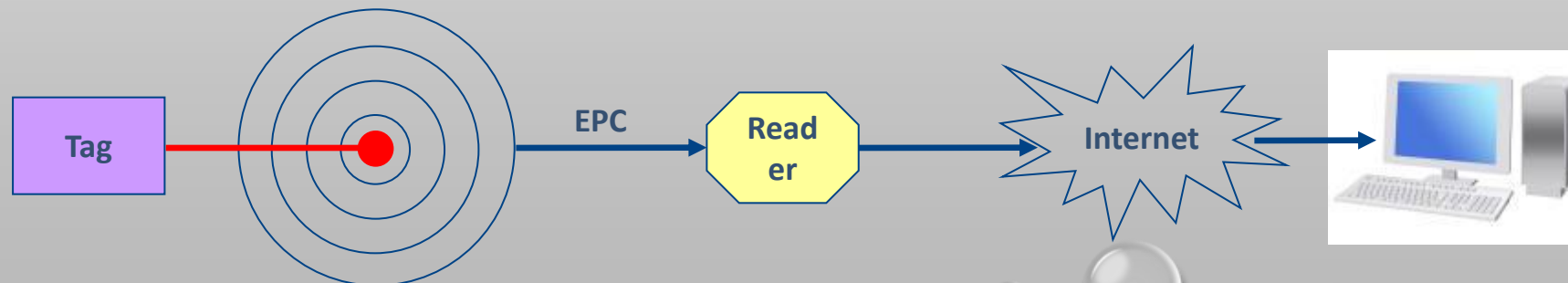
✓ RFID Tag: Chip + Antenna

✓ Reader



chip

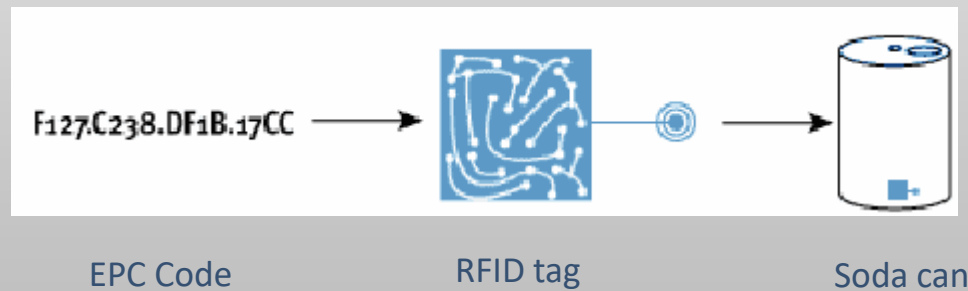
Antenna



RFID data

Tracks of objects' movements

EPC (Electronic Product Code)	Timestamp	RFID reader ID
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Καλή συνέχεια!

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