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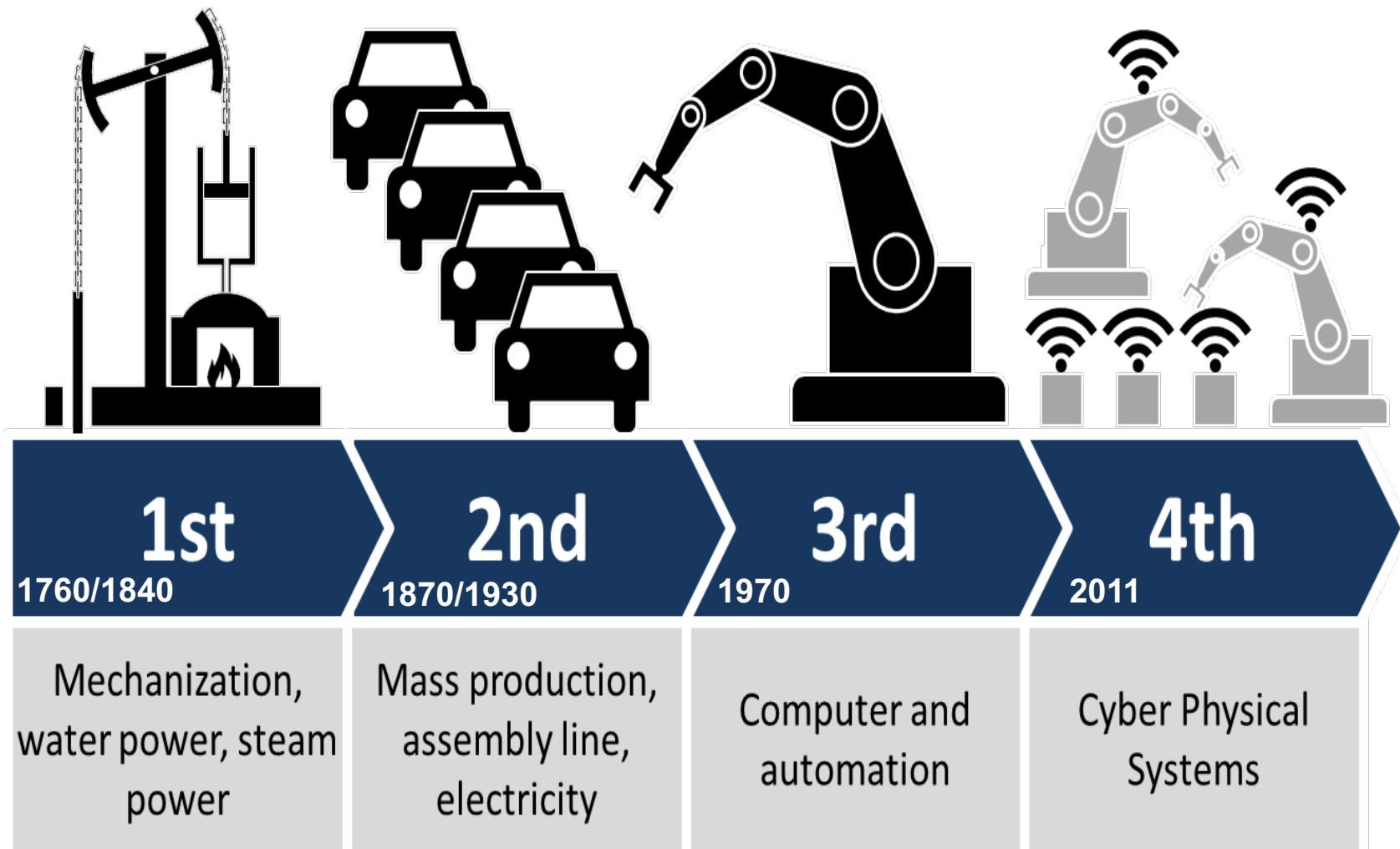
# OPEX & INDUSTRY 4.0

## Part 1

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# Fourth Industrial Revolutions



# Industry 4.0 ?

A series of thin, vertical white lines of varying heights, creating a barcode-like or comb-like decorative element.

What does it mean?

What is it about?

## The 9 technological drivers of Industry 4.0



Industry 4.0 consists in the industrial application of **9 main technological drivers**.

**None** of the 9 drivers is new for manufacturing world.

**Each** of these drivers carry significant benefits both in terms of productivity and of profitability.

**Greater benefits** can be achieved using them in an integrated way.



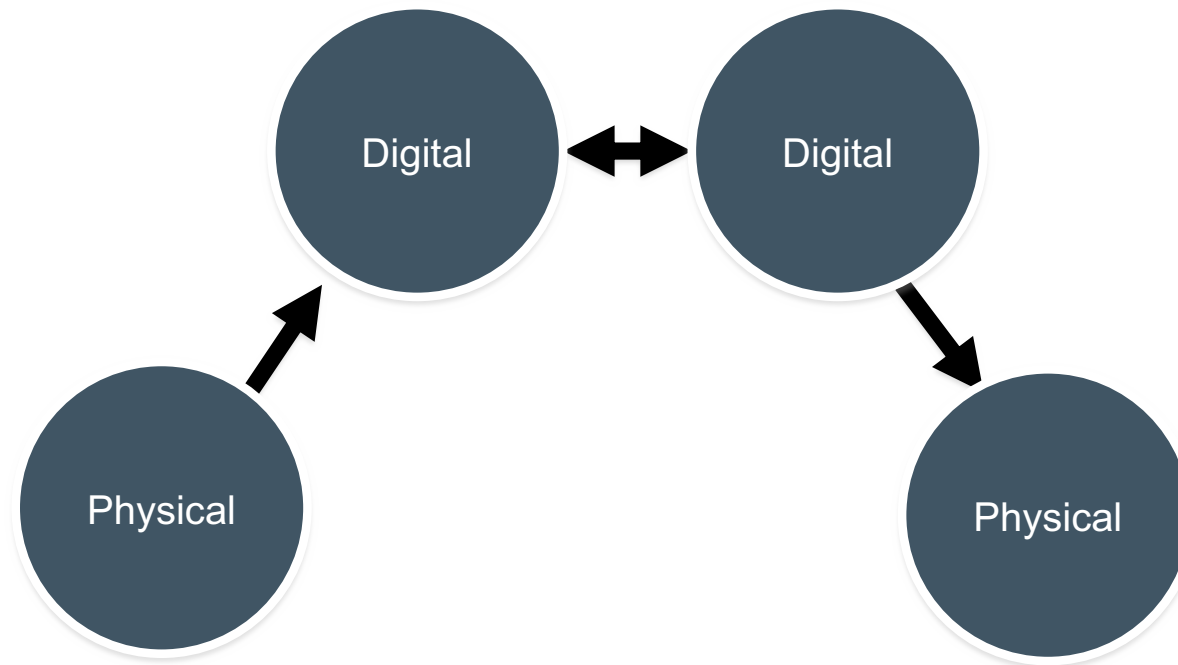
# Example of a possible use

Technology Drivers/Value Chain	Engineering	Purchasing		Logistics			Operations			
	Engineering	Supplier mgmt	Procurement	Inbound	Plant	Outbound	Planning	Production	Maintenance	Quality Control
Advanced Robotics										
Additive Manufacturing										
Augmented reality										
Simulation										
Vertical/Horizontal Integration										
Industrial IoT										
Cloud & cyber security										
Bid data and analytics										

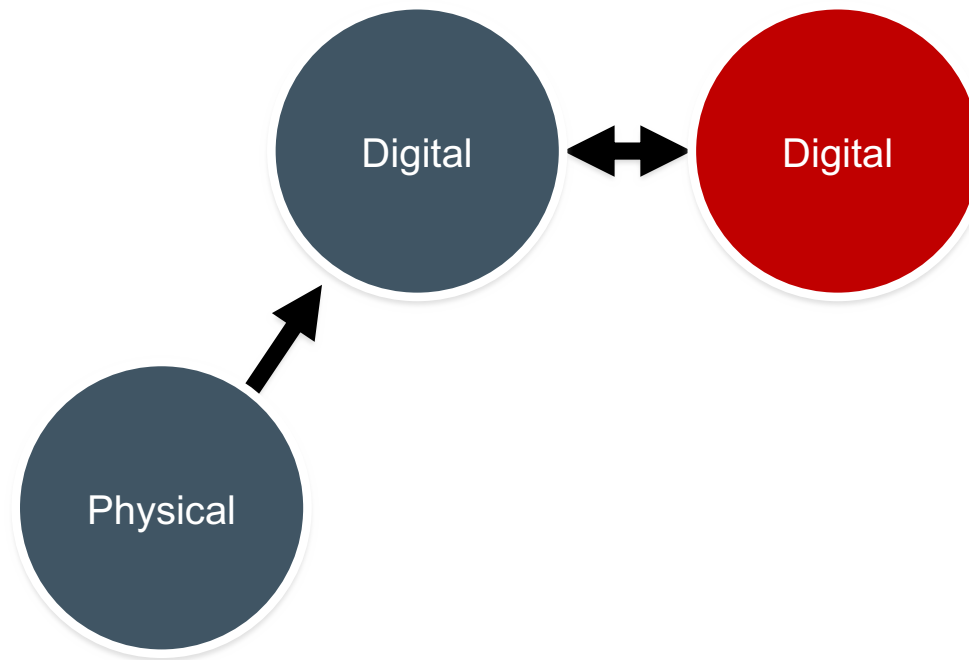
# Data flow: analogical



# New Data flow

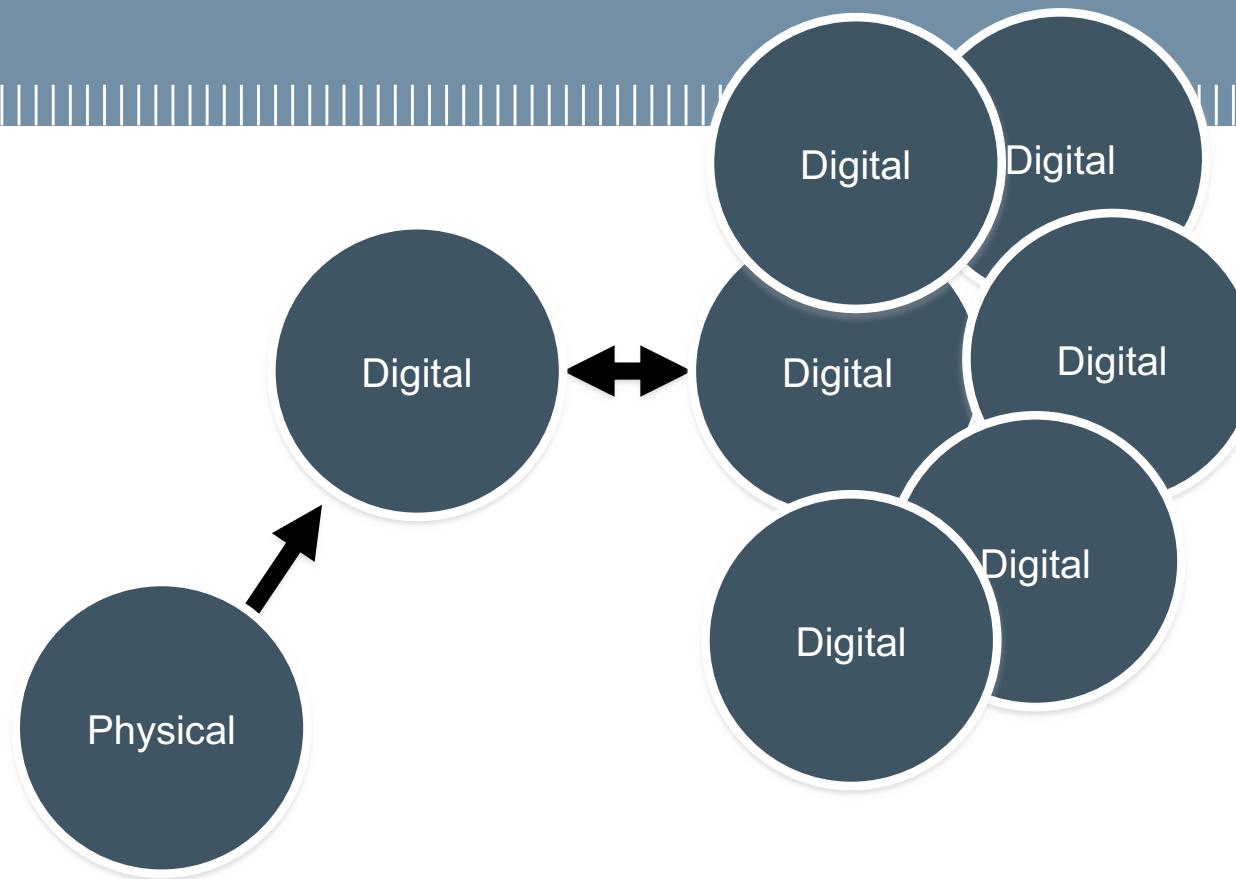


# Rule changing: easier to modify

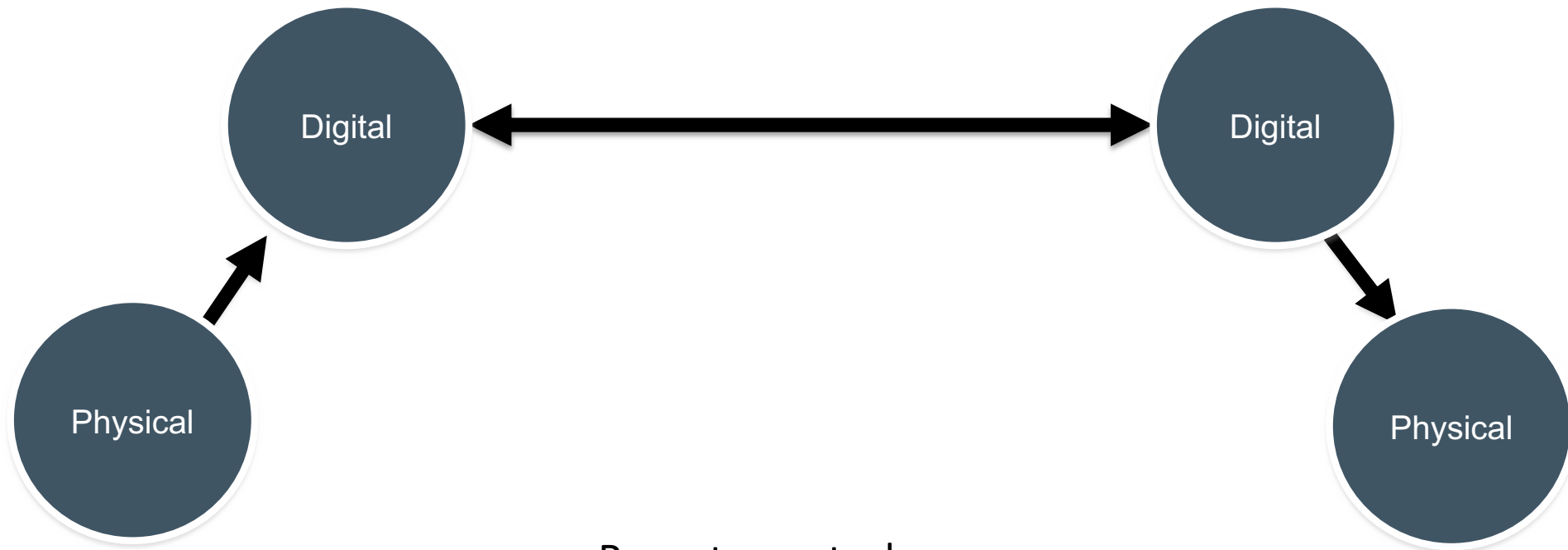




# Rule changing: inexpensive to duplicate



## Rule changing: inexpensive to move



Remote control  
Remote diagnosis  
Distance is no longer an issue

## A number of disruptive technologies will enable digitization of the manufacturing sector

### Digitization of the manufacturing sector – Industry 4.0



Data, computational power, and connectivity

#### Big data/open data

Significantly reduced costs of computation, storage, and sensors

#### Internet of Things/M2M

Reduced cost of small-scale hardware and connectivity (e.g., through LPWA networks)

#### Cloud technology

Centralization of data and virtualization of storage



Analytics and intelligence

#### Digitization and automation of knowledge work

Breakthrough advances in artificial intelligence and machine learning

#### Advanced analytics

Improved algorithms and largely improved availability of data



Human-machine interaction

#### Touch interfaces and next-level GUIs

Quick proliferation via consumer devices

#### Virtual and augmented reality

Breakthrough of optical head-mounted displays (e.g., Google Glass)



Digital-to-physical conversion

#### Additive manufacturing (i.e., 3D printing)

Expanding range of materials, rapidly declining prices for printers, increased precision/quality

#### Advanced robotics (e.g., human-robot collaboration)

Advances in artificial intelligence, machine vision, M2M communication, and cheaper actuators

#### Energy storage and harvesting

Increasingly cost-effective options for storing energy and innovative ways of harvesting energy

SOURCE: McKinsey

*Fil rouge* of Industry 4.0 is represented by **digital availability of information**, as the main and fundamental enabling factor of the fourth industrial revolution.

The four clusters can be seen as main **directions** that development should follow

# Understanding Industry 4.0: Moore's Law

Complexity for minimum component cost [computational power of printed circuits per dollar cost] has increased at a rate of roughly a factor of two per year..... There is no reason to believe it will not remain constant for at least 10 years

(Gordon Moore, 1965)

Today it is common to take 18 months as doubling period for general computing power

# Our mind faces difficulties with non-linear relations

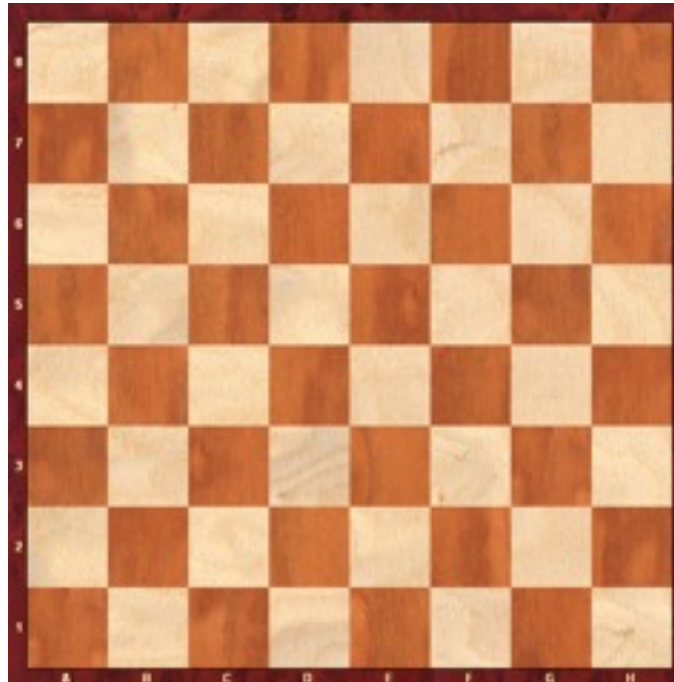
## Viral videos

If everyone sends a message to 10 friends, always different...  
How many steps are required to reach the whole world population?

What if you send it to 100 friends?

# Our mind faces difficulties with non-linear relations

## The game of Chess and the Emperor





## **1996**

Accelerated Strategic Computing Initiative (ASCI) Red

First computer to exceed 1 teraflops

\$55 million to be developed

Big as a tennis court

800 Kw

## **2005**

Cost of a 1 teraflop computer

Dimension

Energy consumption





**2005**

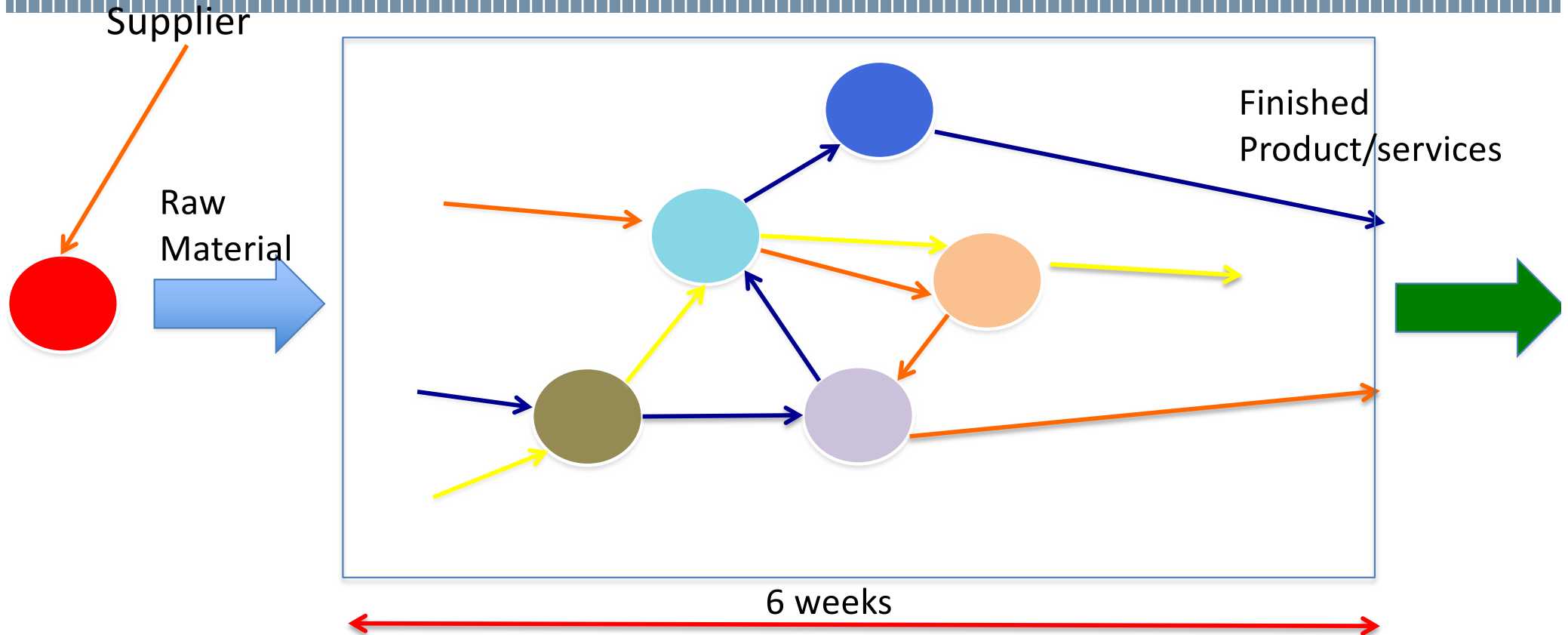
1 teraflops

0,1 mq

140 w

**PLAYSTATION**

# Case study: AdEC advanced electronics company



Competence centers are identified by different colors

Long response time; unreliable due dates; no idea of the advancement status of customer orders

Frequent delay in suppliers delivery of purchase orders

# Assignment

Which investment in INDUSTRY 4.0 technologies would you do to improve AdEC performances. With particular focus on:

- Delivery speed
- Delivery reliability
- Supply Chain efficiency (coordination with the supplier)

Why?



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