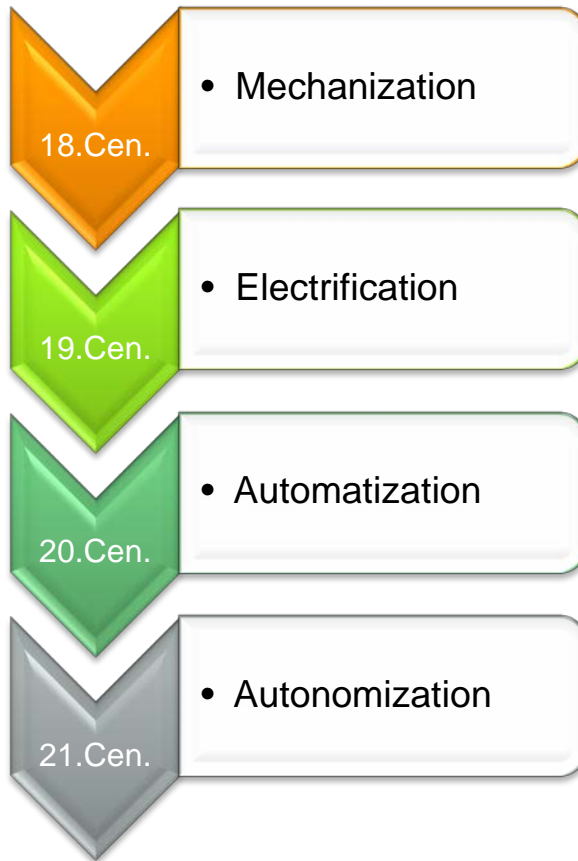

THE INTERNET OF THINGS AND THE 4TH INDUSTRIAL REVOLUTION

How we change our world with modern information technologies
ECITL · Fraunhofer IML · Dortmund 2014 · Prof. Dr. Michael ten Hompel



The 4th «Industrial Revolution»



- The 4th Industrial Revolution is associated with the implementation of CYBER-PHYSICAL SYSTEMS.
- A typical cyber-physical system is:²
 - Linked with the internet («cyber»).
 - Controls itself via software agents.
 - Communicates with other CPS and avatars.
 - Communicates with clouds.
 - Has sensors and actuators («physical»).
 - Perceives and interacts with its environment.

BIN becomes «intelligent» inBin – patented intelligent bin

Self supporter

400Lux of an energy-saving
Candle is enough to supply

The inBin thinks

32 Bit μ Processor
up 512K RAM

Energy storage

Each μ W is saved. Self-discharge < 2% p.a.
7,000 telegrams without recharging

Graphic display

High-resolution communication
2D barcodes, text, graphics

The inBin is communicative

433 MHz, 868 MHz, 2,4 GHz
spontaneous networking IPv6, 6LoWPAN

Safe as a bank

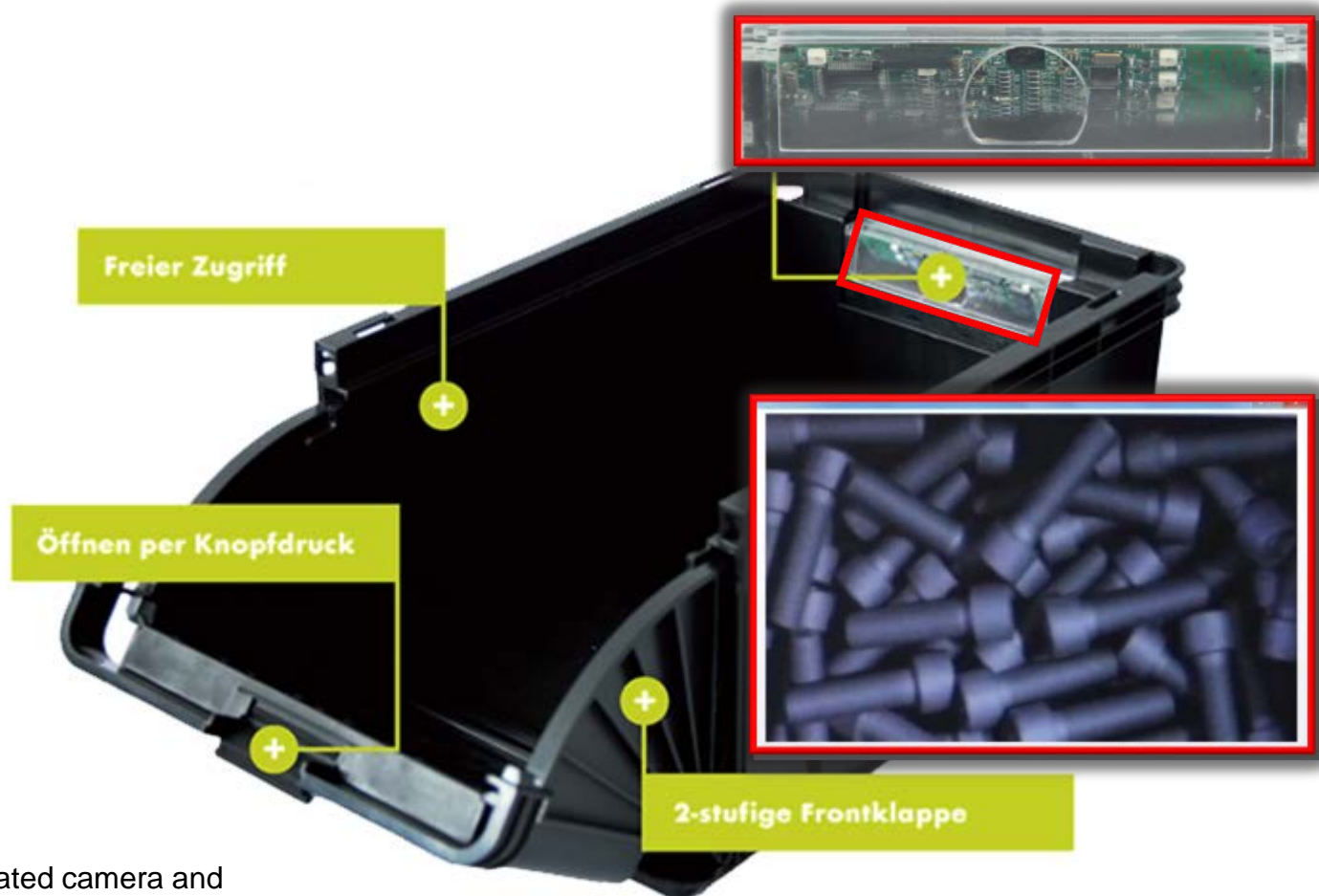
separated 256 Bit crypto core
asymmetric encryption



Associated product of:



BIN becomes «intelligent» «iBin» and the Würth Enterprise Lab



With an integrated camera and cooperating with its cloud the iBin counts the parts which it contains.

RACK becomes «intelligent»

Debrunner Acifer Smart Shelf Display



- Smart shelf display
- Communication 868 MHz
- ePaper display
- Display and update of master data
- Energy Harvesting via solar cell
- Order placing per key press
 - Haptic and optical feedback
 - Status display
 - Order placing in ERP system
 - Delivery receipt (Debrunner article)
 - Order placing corresponds to one article added to the shopping basket

Eine Entwicklung für:



Debrunner Acifer

CONTAINER becomes «intelligent»

DyCoNet · smartULD

- Integration in existing airport IT systems
- Recognizes flight mode
- Multi agent system for the global autonomous network control, use of Ad-hoc networks for container-to-container-communication
- Energy self-sufficient function by energy harvesting
- Environment data will be gathered by sensors, alarms will be set off and transferred to the control panel (Telematics)

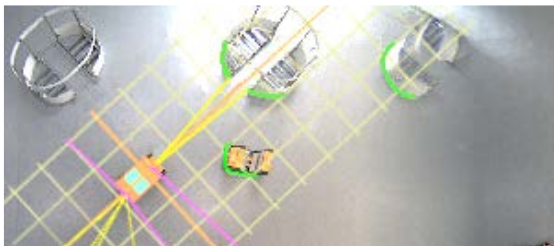


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Bundesministerium
für Bildung
und Forschung

Cellular Transport Systems · CTS · Autonomous moving CTS swarm for Industry 4.0



- Small autonomous transport units (shuttles) replace inflexible conveyor technology.
- CTS follows the self-control principle according to the Internet of Things.
- CTS uses swarm intelligence for handling complex transport tasks.
- Autonomous transport management
- Increase of:
 - Changeability
 - Scalability and Flexibility
- Transport performance where it is required!

Gefördert durch:

Ministerium für Innovation,
Wissenschaft und Forschung
des Landes Nordrhein-Westfalen



RackRacer · Bionic design · 3D Printing

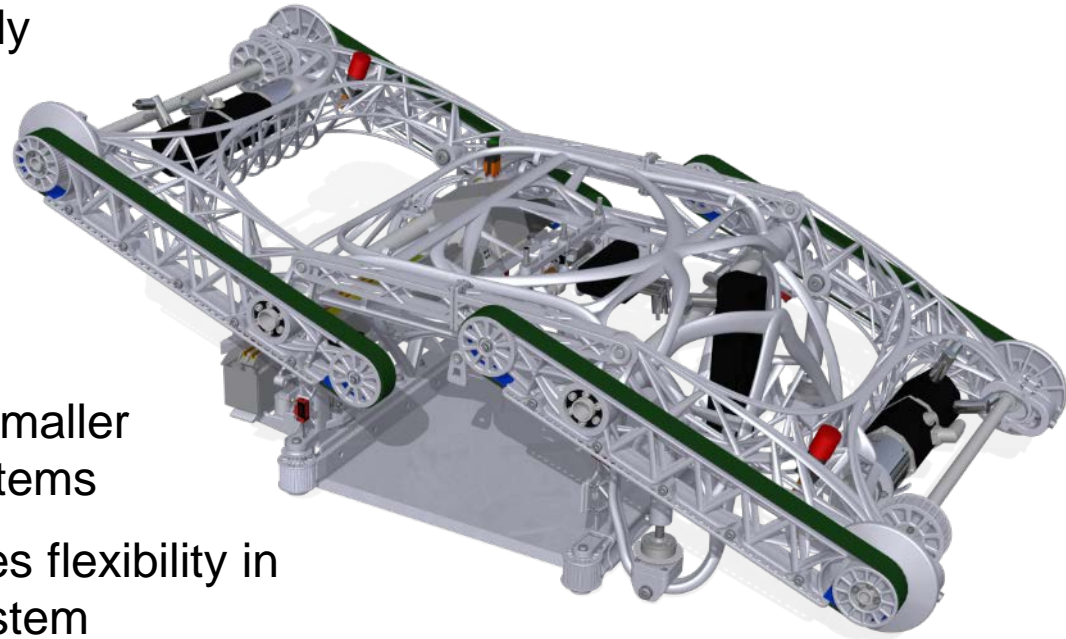
The Dutch royal couple visiting the RackRacer



RackRacer · Bionic design · 3D Printing

Completely new crawler vehicles for miniload systems

- RackRacer move independently on horizontal and diagonal path in the rack
- Functional and cost-related advantages compared to marketable systems
- RackRacer offer potential for smaller and more flexible miniload systems
- Elimination of the lift guarantees flexibility in adapting and scaling of the system
 - Adapting rack capacity
 - Performance scales proportionally to the number of deployed RackRacer



serva transport systems · Automated parking system Prototype development with Fraunhofer IML

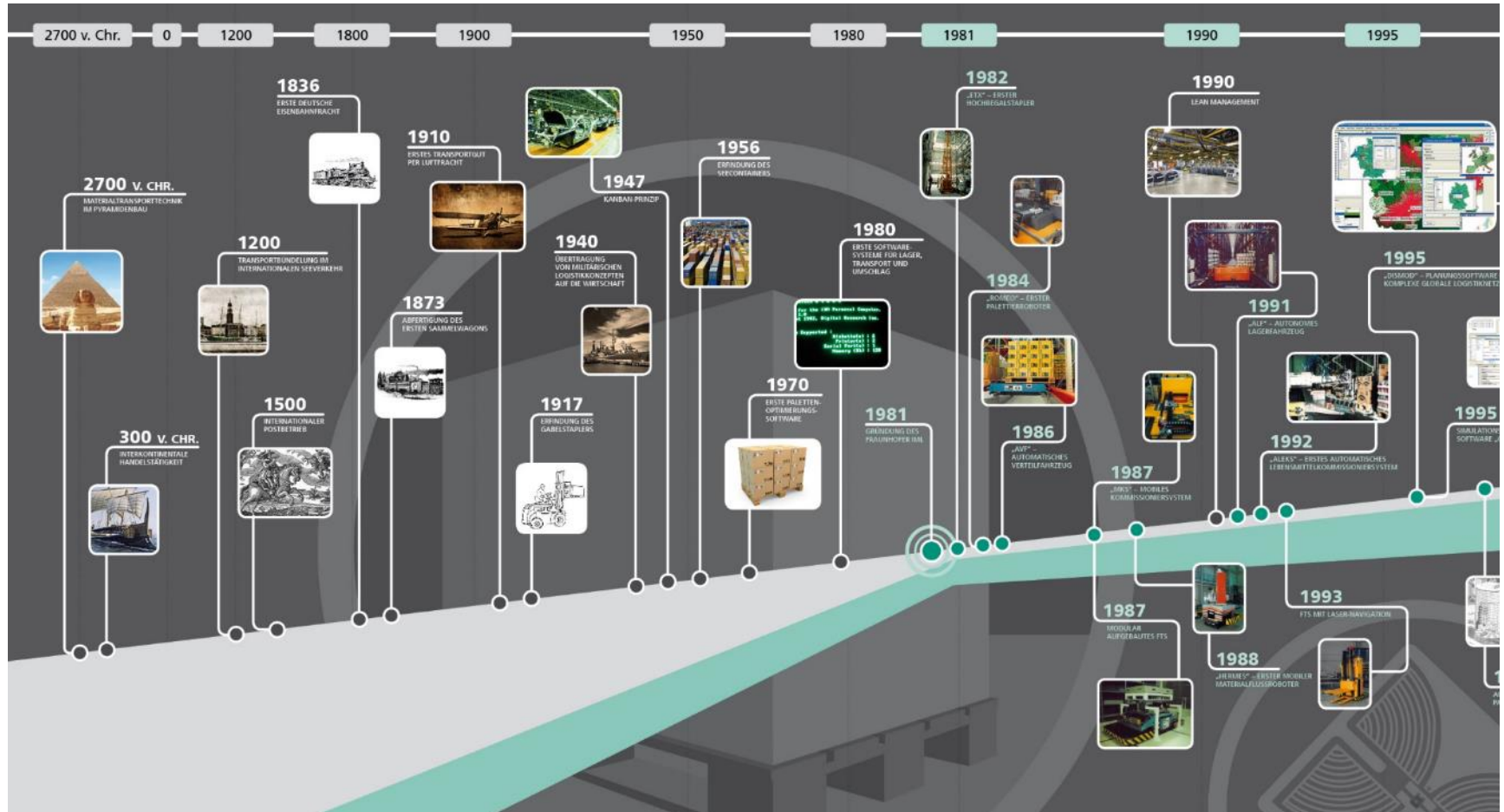


Ray at Düsseldorf Airport

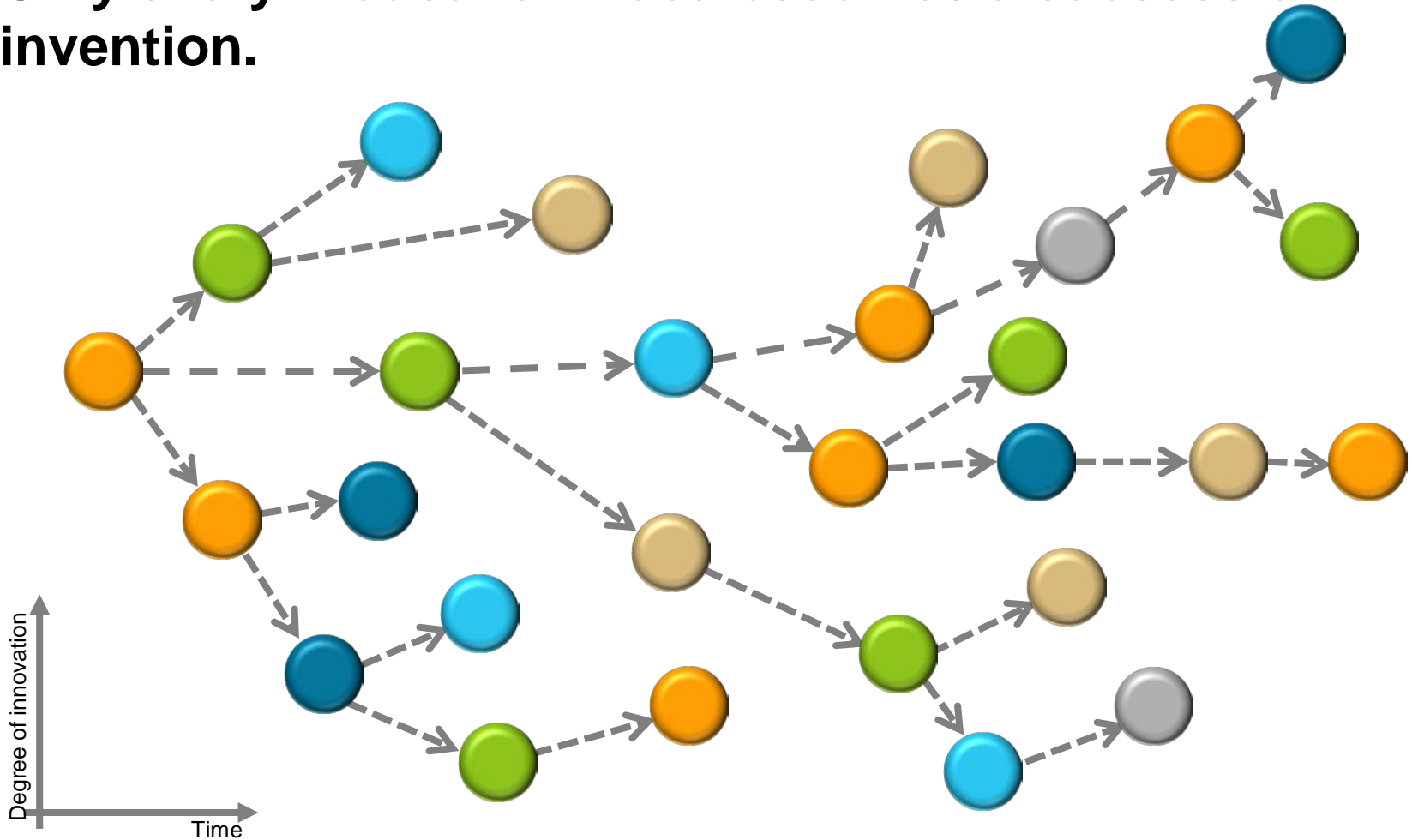


Eine Entwicklung für:

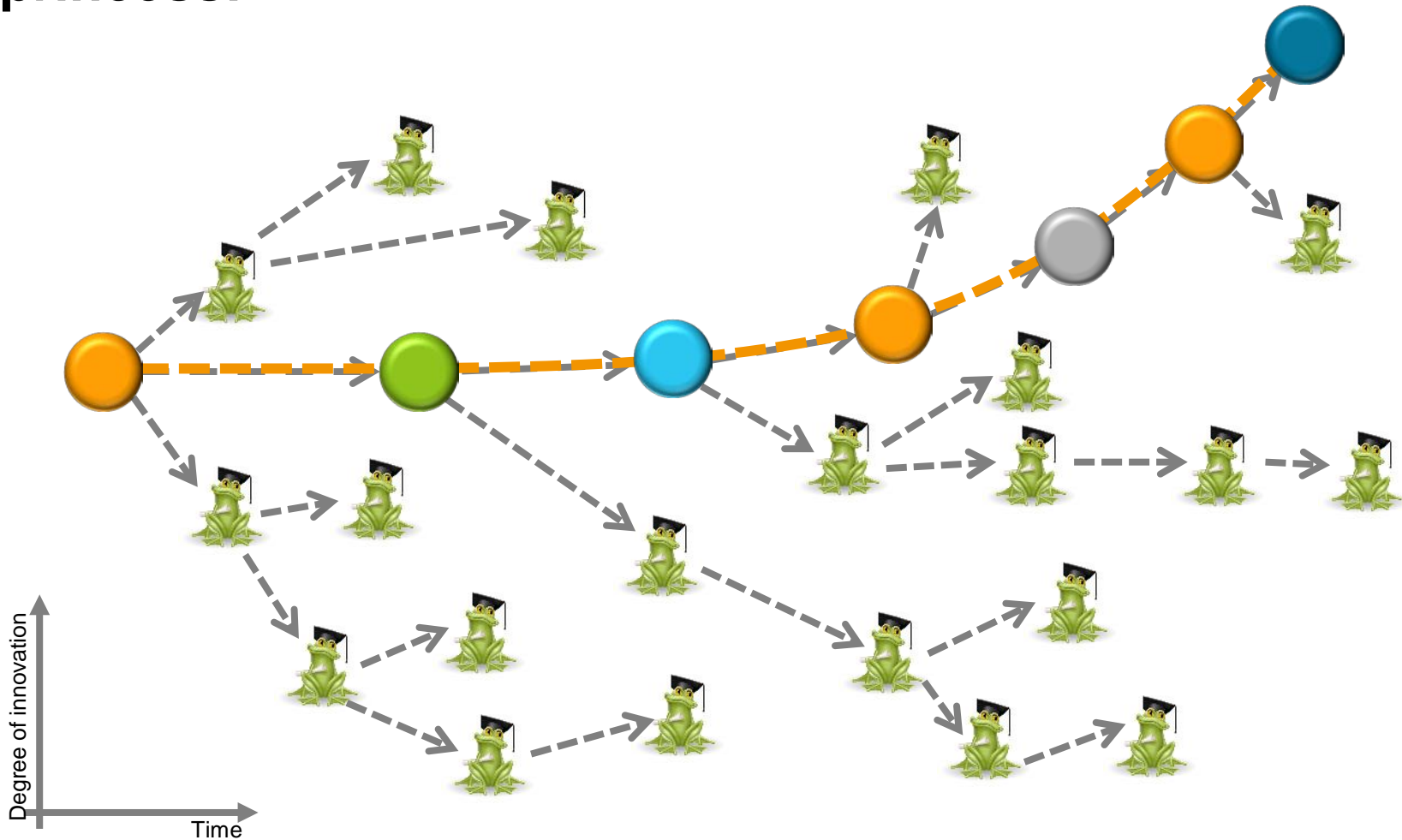
Panta rhei – You cannot step twice into the same stream



**Every innovation is an origin for numerous new possibilities.
Only every thousandth idea becomes a successful invention.**



**Every innovation develops many new possibilities.
We have to kiss a lot of frogs to find a handsome princess!**



We have to kiss a lot of frogs to find a handsome princess!

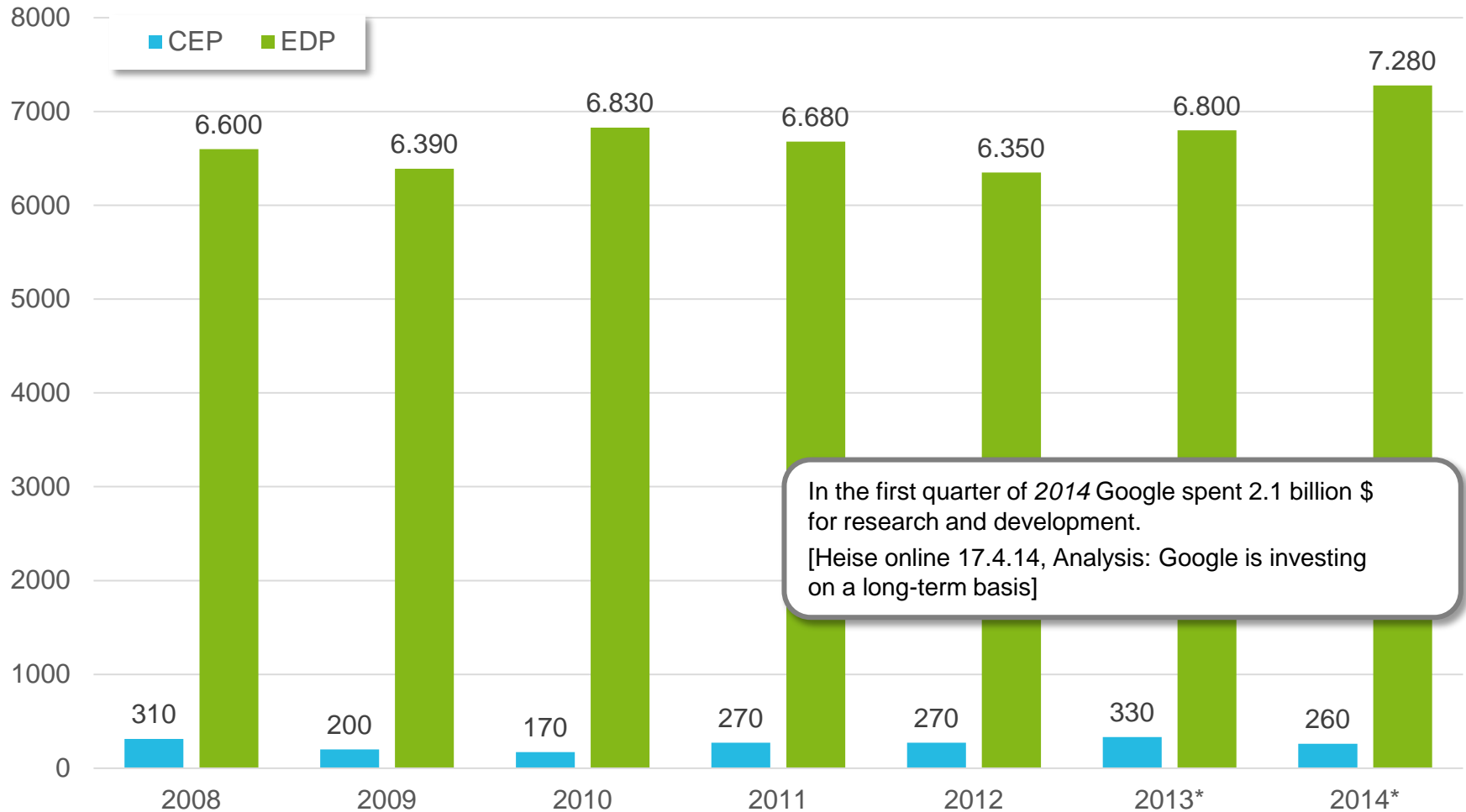


- «The worldwide demand for vehicles will not exceed a million – if only because of a lack of chauffeurs.»
[Gottlieb Daimler, 1901]
- «I think there is a world market for maybe five computers.»
[Thomas Watson, CEO IBM, 1943]
- «There is no reason anyone would want a computer in their home..»
[Ken Olson, President of DEC, 1977]
- «People will never do without the experience to browse through a catalogue.»
[Mail order company to the chances of E-Commerce, 2000]

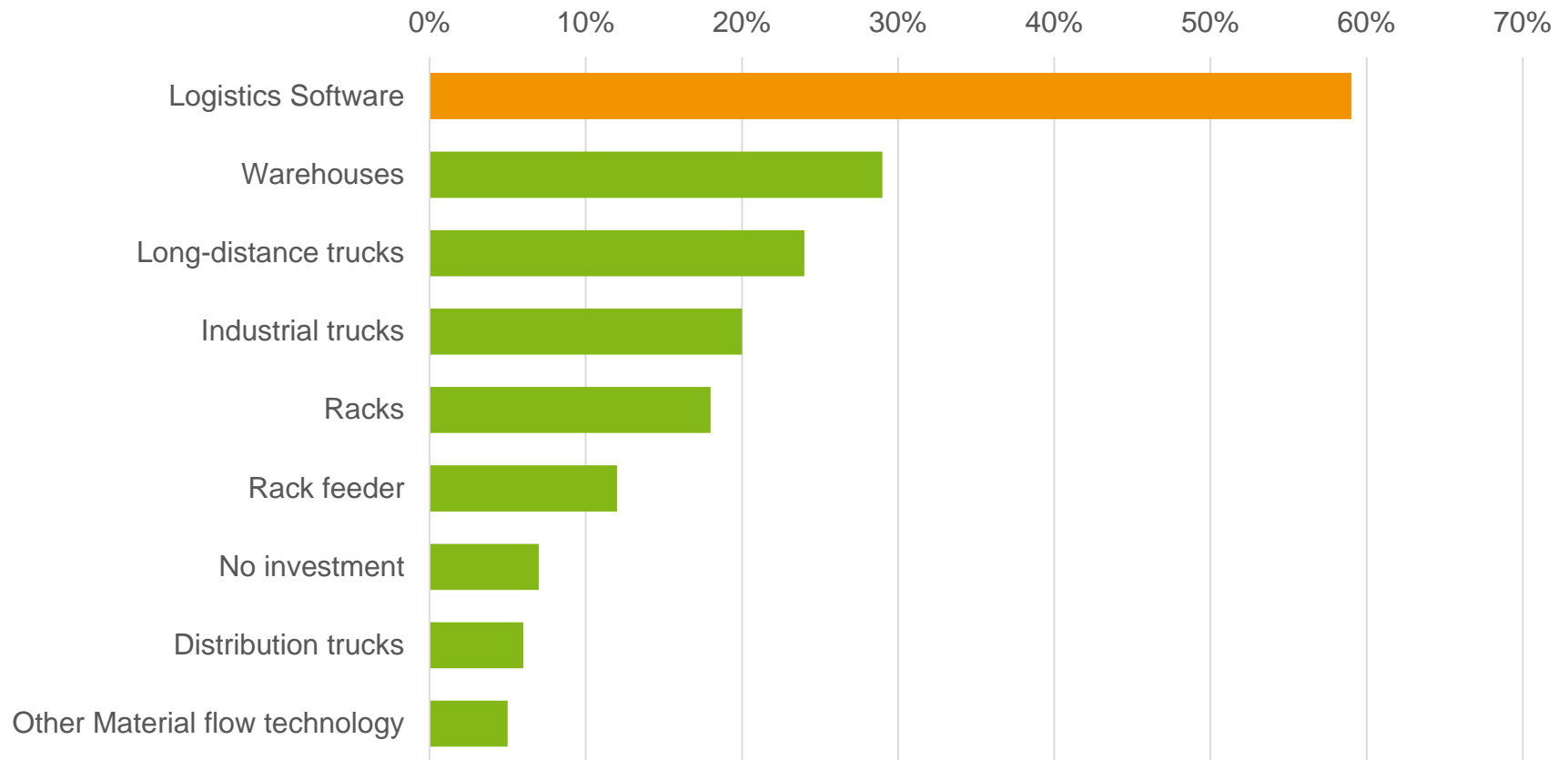
Innovation expenditure

CEP and software, EDP and information services

[D in million €]



Planned investments in the logistics industry in 2014



BRING TOGETHER LOGISTICS AND IT!

The connection between information technology (IT) and logistics holds the potential of the future sustainability of the business and logistics location Europe.

It is therefore the central strategic requirement of logistics to take on a stimulating and leading role in computer sciences and in the development of information technologies.



Capgemini/MIT: How digital leaders outperform their peers in every industry



Information logistics as independent discipline

- Politics and business are required to create framework conditions and to take measures that help to support software technological innovation.
- The information logistics has to be understood as independent environment for research, development and innovation with the objective to PRODUCE SOFTWARE LIKE CARS.



Mega-trends and innovation drivers

- The biggest strategic chance is to push forward the vertical integration of logistics and IT in connection with the European advantages in logistics and production.
- INFORMATION LOGISTICS as connecting link between IT and production plays a key role in both, management and design of the systems.



E-Commerce and M-Commerce

- Successful delivery systems in E-Commerce and M-Commerce base on a comprehensive competence in logistics and IT.
- Companies with no focus on linking IT and business will drop out of the competition in the medium term.

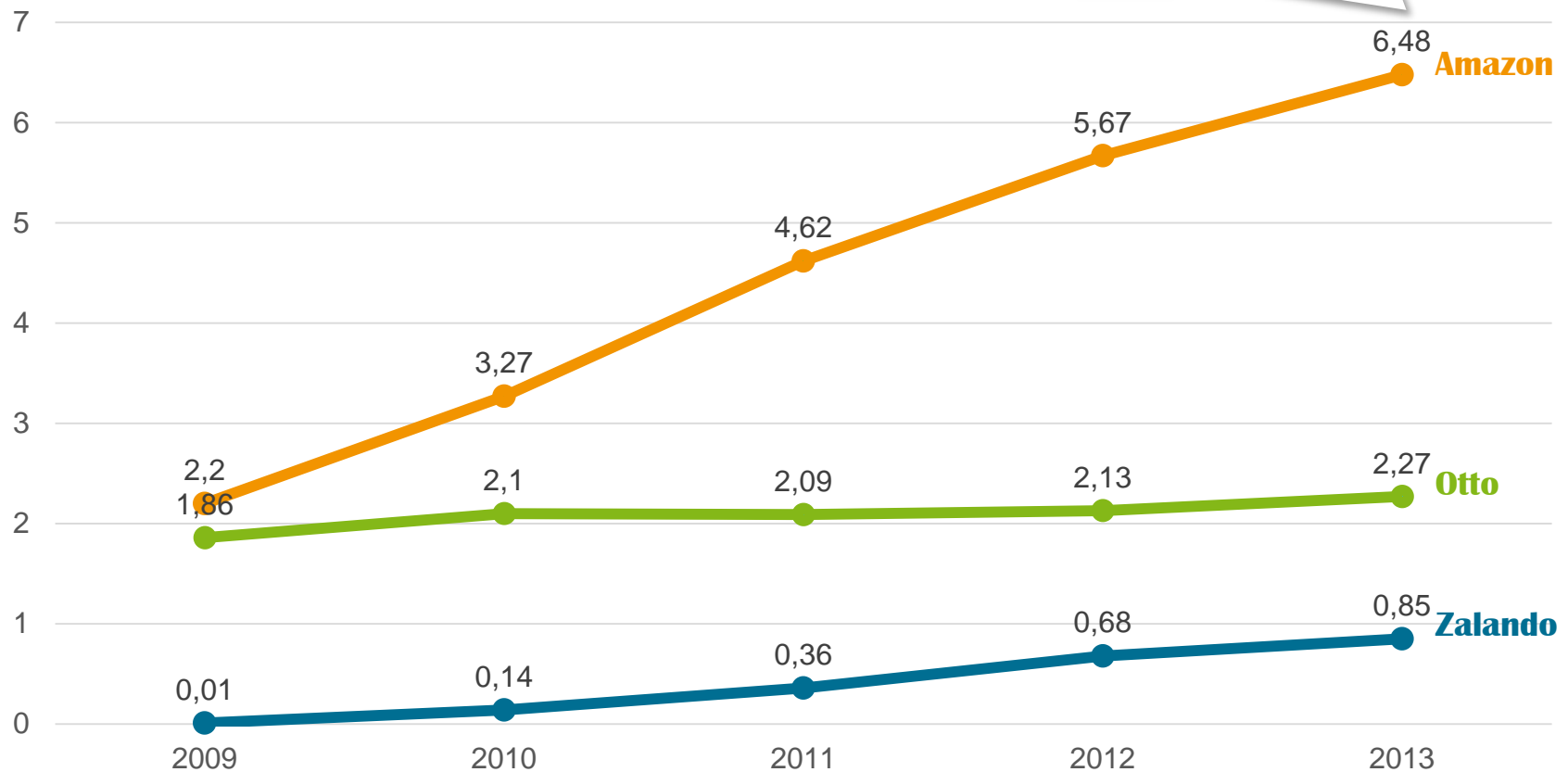
Task of future information logistics are:
Pay, „Online Ad Auctions“, „Real Time Bidding“
and Producing (3D Printing)!



Online turnover of leading trading companies in Germany [2009 until 2013 in billion €]

Amazon counts among the Top Ten of the most innovative companies in the world.

[BCG 2013]



Complexity

- Complexity and dynamics are growing above average in logistics.
- From a European point of view the biggest strategic chance (for new business models) is a quick innovative development of industry-specific IT tools in logistics.
- This has to happen now as the market will be filled within a few years.



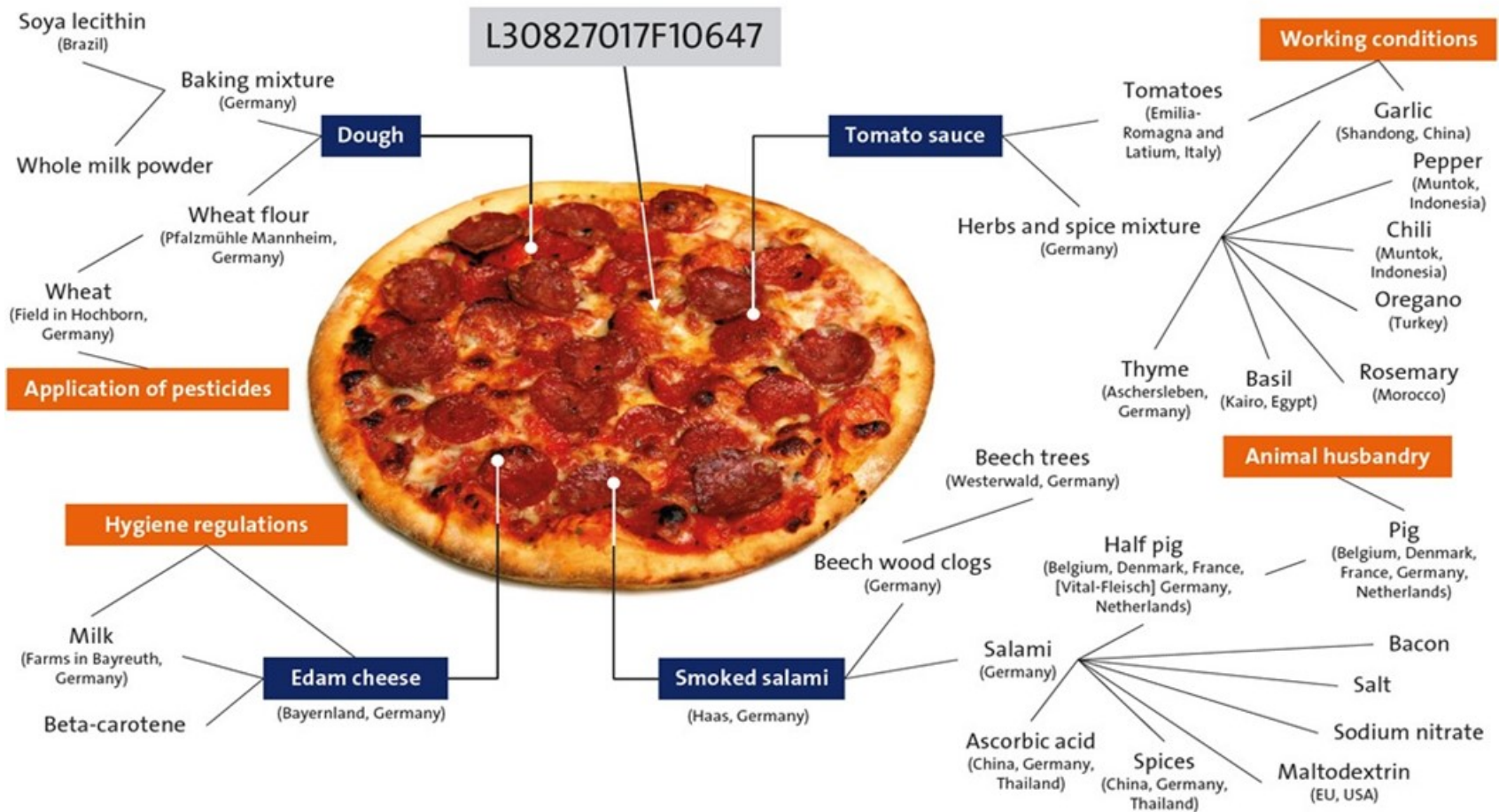
Transparency · (Re)gain control over data!

- Transparency and traceability are the basic principles of logistic management and guarantors for the security and reliability of the supply chain.
- Development and consequent implementation of new information technologies are required to guarantee that.



Transparency

Big Data arrived long ago in information logistics!



Pic.: Otto, Boris; basing on:

*Der Pizza-Code. In: Zeit Online Wirtschaft; zeit.de/2013/31/(July 25th, 2013),

Photo: Joe Gough – Fotolia.com

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The quintessence is...

«Transparency and traceability are possible thanks to modern information technology in every nook and cranny of the globe. Who says there is something he/she doesn't know, lies, is badly organized or is criminal.» [Die Zeit*]

Digital infrastructure - Beyond road and rail

- The amount of logistic data grows by a factor of 1.000 per decade.
- Investments in broadband and mobile data networks need to be increased to ensure Europe's competitiveness and a prompt and secure data exchange.
- The challenge is: NO APP NO BUSINESS!



Security

- Legal certainty on the basis of clear and transparent rules and transnational solutions and agreements are of vital significance for logistics.
- To establish a safe «European Cloud» seems to be as necessary as promising.



4th Industrial Revolution

- The 4th Industrial Revolution and especially the software and hardware developments and the corresponding algorithms and their application in logistics need to be accelerated.



The kids of the 4th Industrial Revolution



Source: UserExperiencesWorks 2012
www.youtube.com/watch?v=aXV-yaFmQNk#t=26
A newspaper is an iPad that does not work.mp4 auf Youtube.de
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People and IT in times of 4th Industrial Revolution

- Logistics in Europe employs approx. 10 million people. Even in times of a 4th Industrial Revolution logistics depends on human flexibility, creativity and inventiveness.
- The control and management of future logistics and production obviously evolves in the direction of a «Social Network» of men and machines.



LET'S PRODUCE SOFTWARE LIKE CARS!

The logistics and the software institutes of the Fraunhofer Society established the new «Fraunhofer Innovation Centre Logistics + IT – FILIT» together.



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