

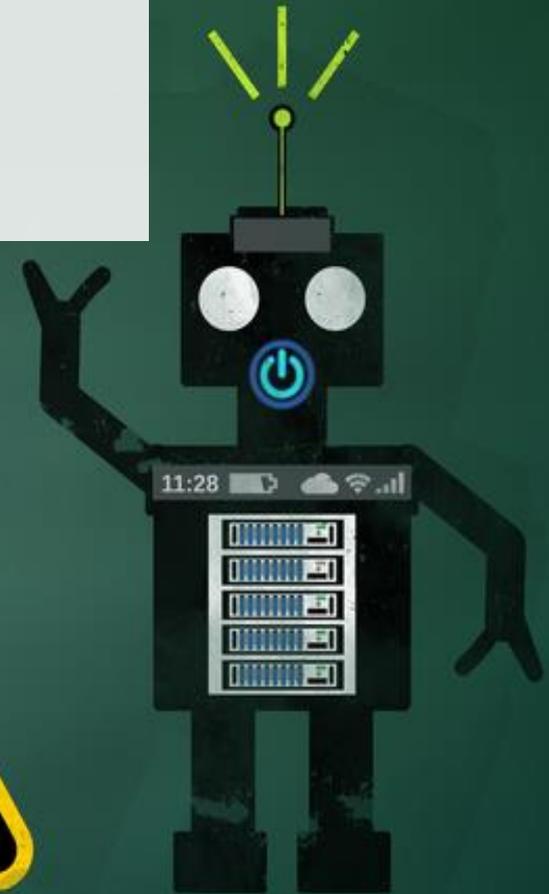
»Quo Vadis Logistik 4.0«

A Short Sketch of Changes and Future Trends in Transportation and Logistics

CPS.HUB NRW - Podiumsveranstaltung
Logistik 4.0 April 27th, 2016

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Transporeon GmbH



I. Introduction – What is Transport-Logistics 4.0?

- 4.0 – a revolution of artificial intelligence
- About 4.0 breakthroughs and emerging mega trends
- From Industry 4.0 to Logistics 4.0

II. The main competences of Logistics 4.0

- Digitalization
- Network collaboration
- Service-level extension

III. Future Perspectives & Summary

- Robotization
- Urbanization
- 3D fabrication
- The End!!

... leading to the 4th industrial (r)evolution...

Breakthroughs - A new era of artificial intelligence

Communication technology

bandwidth and computational power

Embedded systems

miniaturization

Watson
2011

Semantic technologies

information integration

Google Car
2012



→ Systems of “human-like” complexity

... leading to the 4th industrial (r)evolution...

Breakthroughs - Everybody and everything is networked

Communication technology

bandwidth and computational power

Embedded systems

miniaturization

Semantic technologies

information integration

Car2Infra-
structure



Smart
Grid



Team
Robotics

Swarm
Robotics



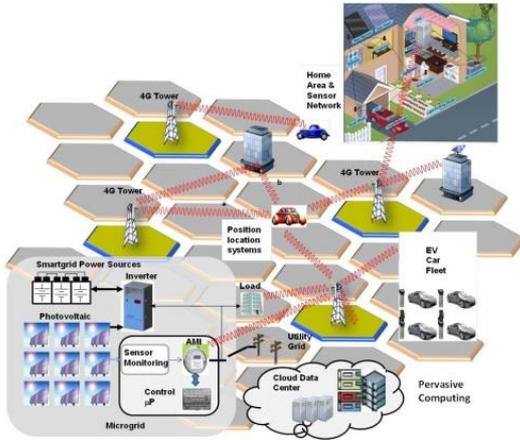
Smart
Factory



Everybody and everything is networked. - Big Data & Cyber-Physical Systems

"Internet of Things & Services, M2M or Cyber Physical Systems are much more than just buzzwords for the outlook of connecting 50 billions devices by 2015."

Dr. Stefan Ferber, Bosch (2011)



Vision of Wireless Next Generation System (WiNGS) Lab at the University of Texas at San Antonio, Dr. Kelley



Weidmüller, Vission 2020 - Industrial Revolution 4.0
Intelligently networked, self-controlling manufacturing systems)

„local“
to „global“

„local“
to „global“

around 1750

around 1900

around 1970

today

1st industrial revolution

Mechanical production systematically using the power of water and steam

Power revolution

Centralized electric power infrastructure; mass production by division of labor

Digital revolution

Digital computing and communication technology, enhancing systems' intelligence

Information revolution

Everybody and everything is networked – networked information as a "huge brain"

And how do these systems work?

Communication technology

bandwidth and computational power

Embedded systems

miniaturization

Semantic technologies

information integration



Towards intelligent and (partly-) autonomous systems AND systems of systems

around 1750

1st industrial revolution

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Digital computing and communication technology, enhancing systems' intelligence

today

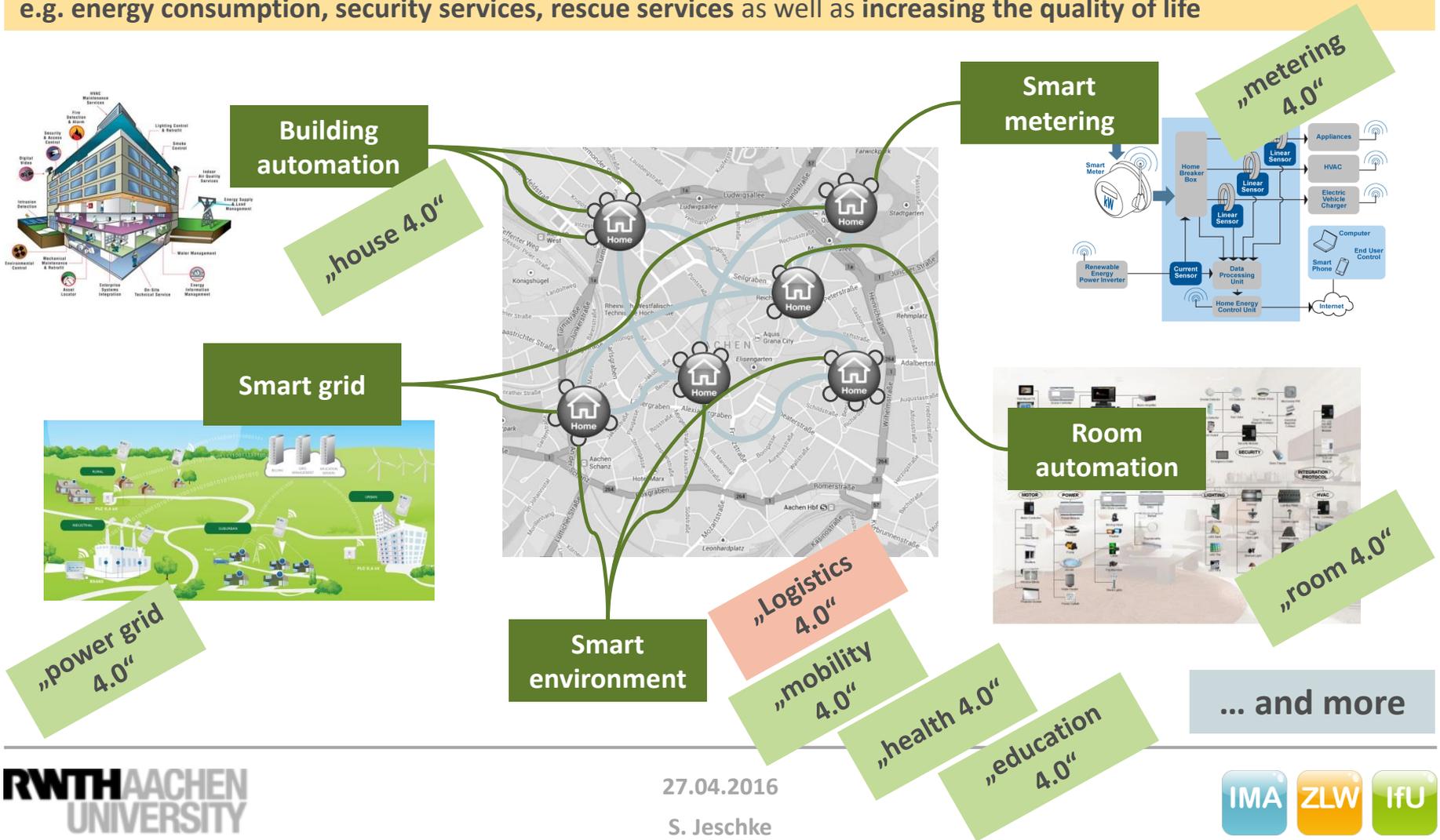
Information revolution

Everybody and everything is networked – networked information as a “huge brain”

Not restricted to industry: cyber physical systems in all areas

Back to: "The earth converted into a huge 'brain' " ... (Tesla 1926)

Integrating complex information from multiple heterogeneous sources opens multiple possibilities of optimization: e.g. energy consumption, security services, rescue services as well as increasing the quality of life





What is Logistics 4.0?

How will be the future of logistics or Logistics 4.0?



→ Definition along two different time scales:

1. short-term:

data-driven, highly networked processes between heterogeneous players (optimization, efficiency, transparency of processes, ...)

2. medium-term:

autonomous systems and self-organization of systems of systems

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Big Data Processing through Intelligent Cloud Solutions

Here, the term “cloud” is used in a maximum liberal style, namely as a solution for data storage and analysis somewhere outside of the place where the data are originally generated.

Cloud Functionalities



Information integration

Complex data integrated and processed by platform services

Cooperation

Information exchange between cloud and teams

Granularity

Access to single data and aggregated information



User Interaction

Availability of information

Information available through powerful web services

Client Access

Access to information from anywhere and at any time

Omnichannel Management

Data access through various ways for heterogenous systems



The future of information access is **service-oriented** and **omnipresent**.

“No access” is neither an option nor is it an allowed excuse...

→ Who the heck needs BIG data? - Let's make sense out of them...

→ The Big Data analysis pipeline...

! ... transfers big data (many...) into smart data (meaningful data)

! ... accumulates intelligence from information fragments

! ... is a pipeline of aggregating (artificial) intelligence.





Traditional logistics companies

Who is in the center of this development? Who is hosting the data?

?

What is the role of traditional logistics companies, and how / to which degree do IT- and cloud providers enter the scene?

Microsoft
Cloud Platform

Respond more quickly to changing business needs with a flexible, hybrid cloud platform



(New)
Cloud and IT
companies

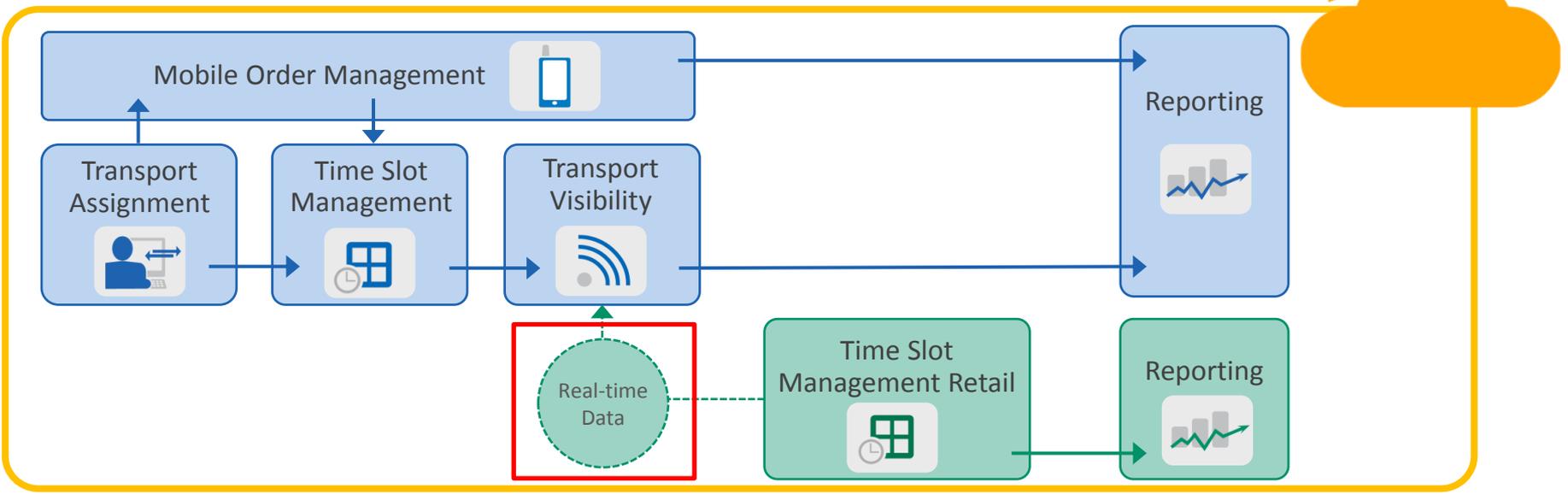


New transportation management companies

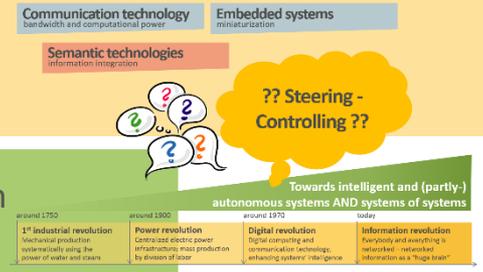
➔ Developing IT logistics solutions using transport data for flexible logistics and intelligent decisions



! For example in transport execution and delivery



→ Decentralized systems are usually modelled by concepts all close to “Multi Agent Systems”



Usually computerized, but can be extended to biological entities...

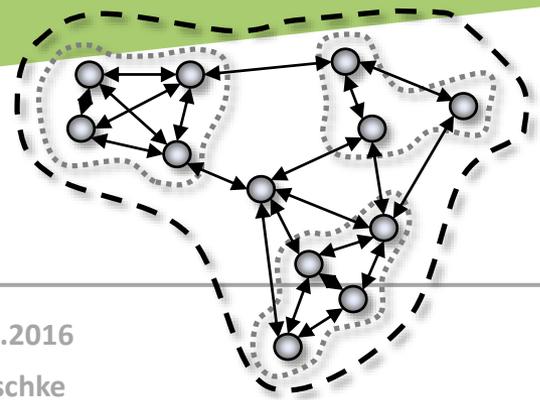
WIKIPEDIA
The Free Encyclopedia

“A **multi-agent system (MAS)** is a (usually) computerized system composed of **multiple interacting intelligent (and potentially heterogeneous) agents within an environment.**”

... 3 important characteristics:

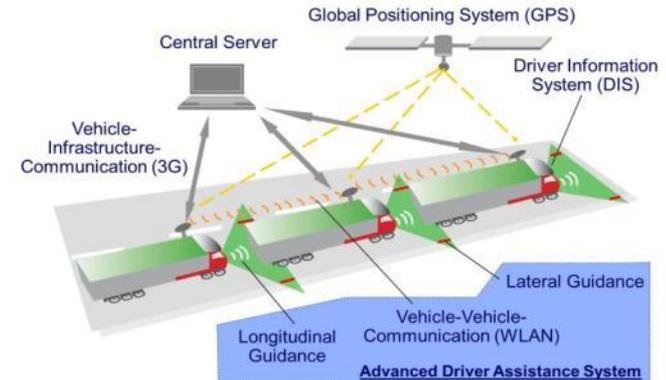
- **Autonomy:** the agents are at least partially independent, self-aware, autonomous
- **Local views:** no agent has a full global view of the system, or the system is too complex for an agent to make practical use of such knowledge
- **Decentralization:** there is no designated controlling agent (or the system is effectively reduced to a monolithic system)”

[Wooldridge 2002]



→ The KONVOI project (several institutes from RWTH & industry partners)

- 2005-2009
- automated / partly autonomous transportation, e.g. by electronically coupling trucks to convoys
-
- several successful tests with trucks: Chauffeur, KONVOI, SARTRE (EU), Energy-ITS (Japan), ...



- Adv. driver assistance system for trucks
- short distances between vehicles of approx. 10m at a velocity of 80 km/h
- Energy-ITS: 4m ! (2013)
- KONVOI:
 - Car2infrastructure components!
 - **Model of multi agent systems**

-
- expected improvements: beyond safety, reduction of fuel consumption and gained road space

macroscopic society design

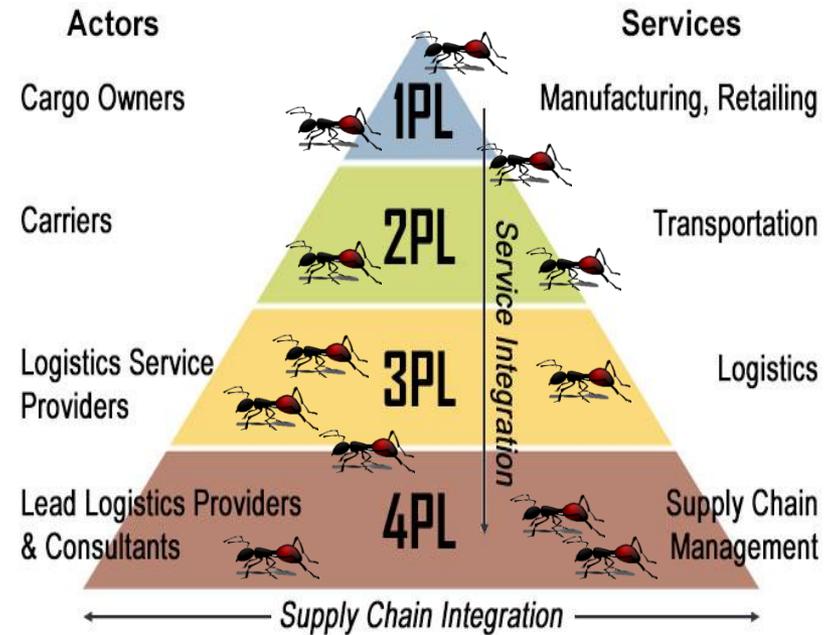
Matching of local optimization goals of agent and global optimization goals. Altruistic vs. egoistic behavior.



→ Managed as a global network;
Community rules:
global optimization

microscopic agent and service design

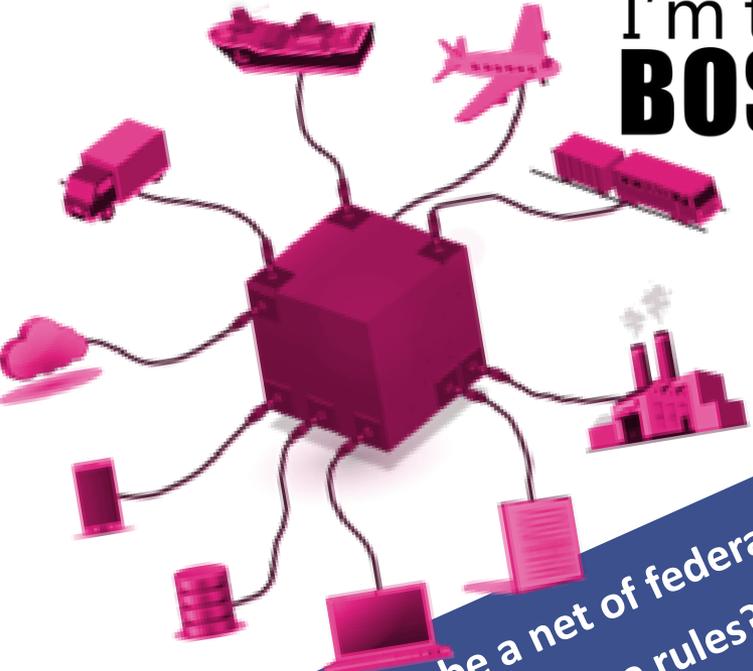
How to build agents that are capable of autonomous action in order to successfully carry out the tasks that we delegate to them?



→ Synchronize all supply chain actors and their different single services:
local optimization



I'm the BOSS

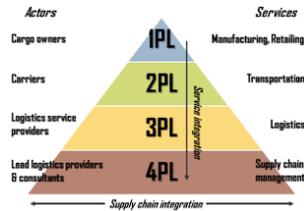
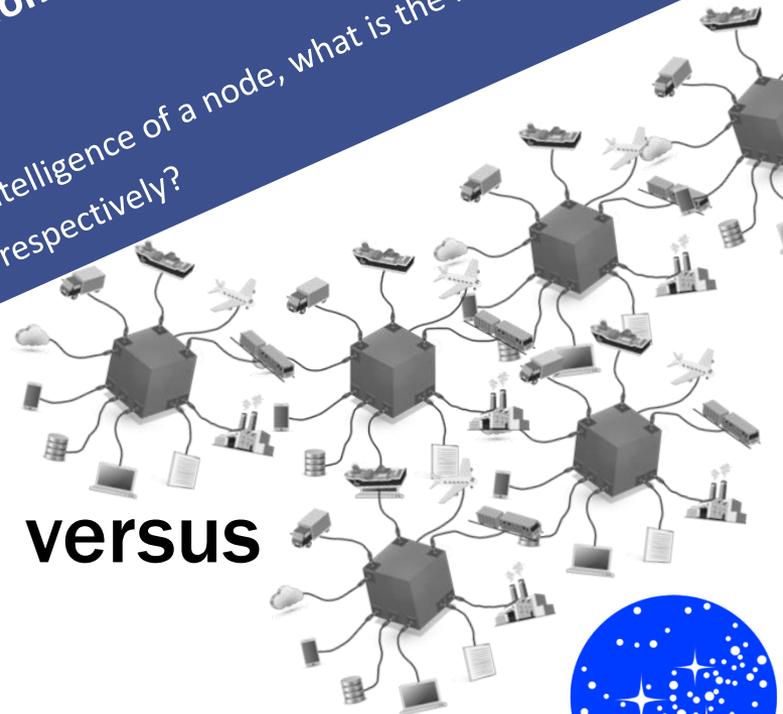


Will there be a net of federal networks or one dominant „octopus“?
And who makes the rules?

What is the intelligence of the single entity, what is the intelligence of a node, what is the intelligence of the whole system? – Thus, what are the different roles, respectively?

?

versus

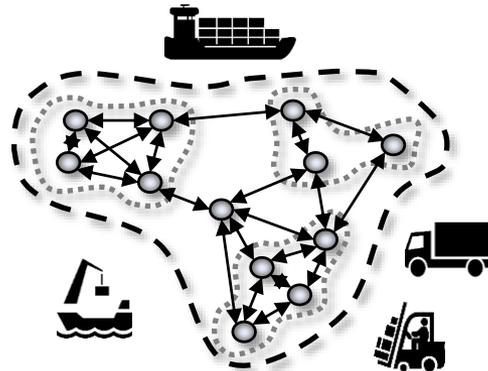


→ Linking industrial and retail enterprises with their logistics service providers

Enabling **all the sequences of operations** involved in transport logistics to be performed online in a way that is both **cost effective** and **transparent**.

→ For Shippers

- Digital Supply Chain
- Agile and informed supply network (extensive information availability)
- Vertical and horizontal connection of the supply chain enabling deeper intelligence for all participants

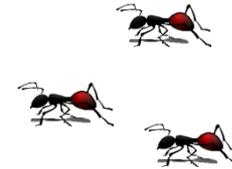


→ For Carriers

- From network collaboration to network integration
- Efficient use of transport resources
- Most efficient and flexible connections between all different existing transport networks (different modes and different providers)

→ Linking industrial and retail enterprises with their logistics service providers

Enabling **all the sequences of operations** involved in transport logistics to be performed online in a way that is both **cost effective** and **transparent**.

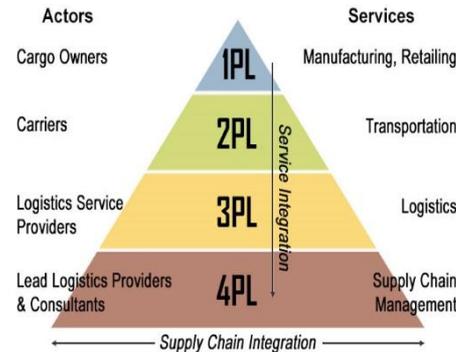


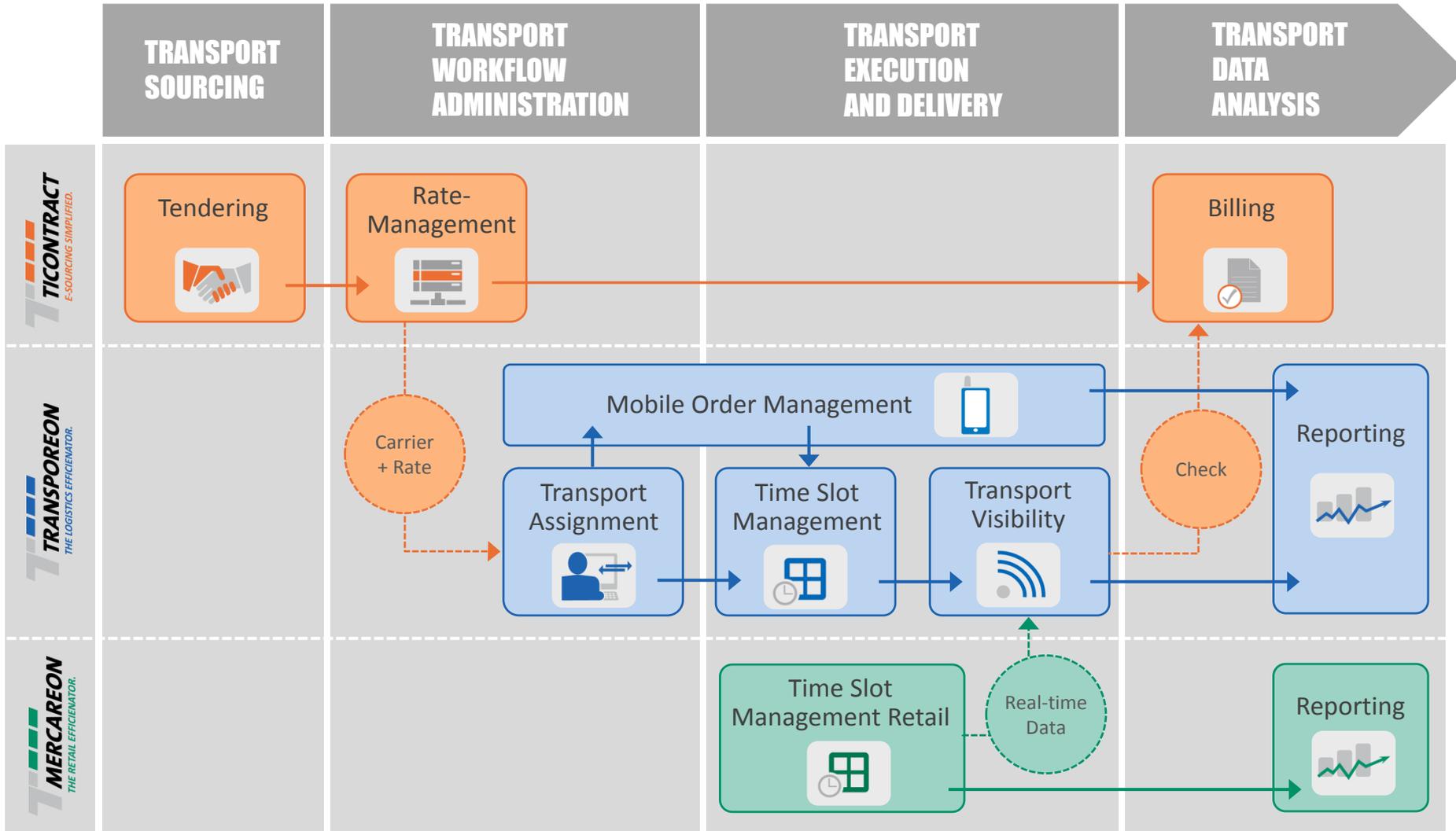
→ For Shippers

- ! Time Slot Management
- ! Transport Assignment
- ! Transport Visibility
- ! Product overview
- ! Mobile Order Management

→ For Carriers

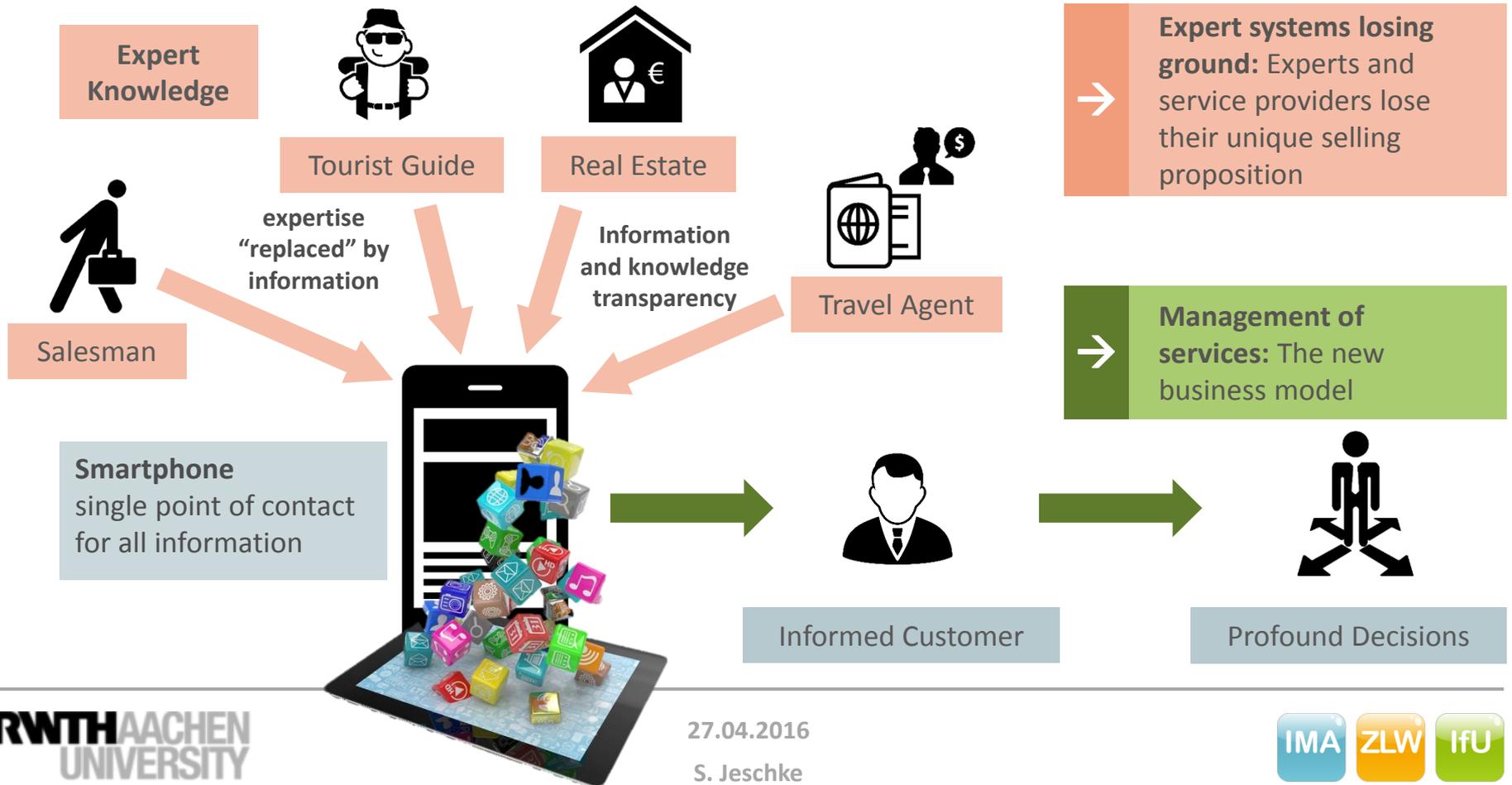
- ! APP for Drivers
- ! Telematics
- ! Carrier interfaces
- ! Freeway
- ! Carrier reporting





Services become available and experts become obsolete!

As information becomes more and accessible, experts lose information power. This observation is inline with all earlier changes along the information chain, starting with the book printing ...

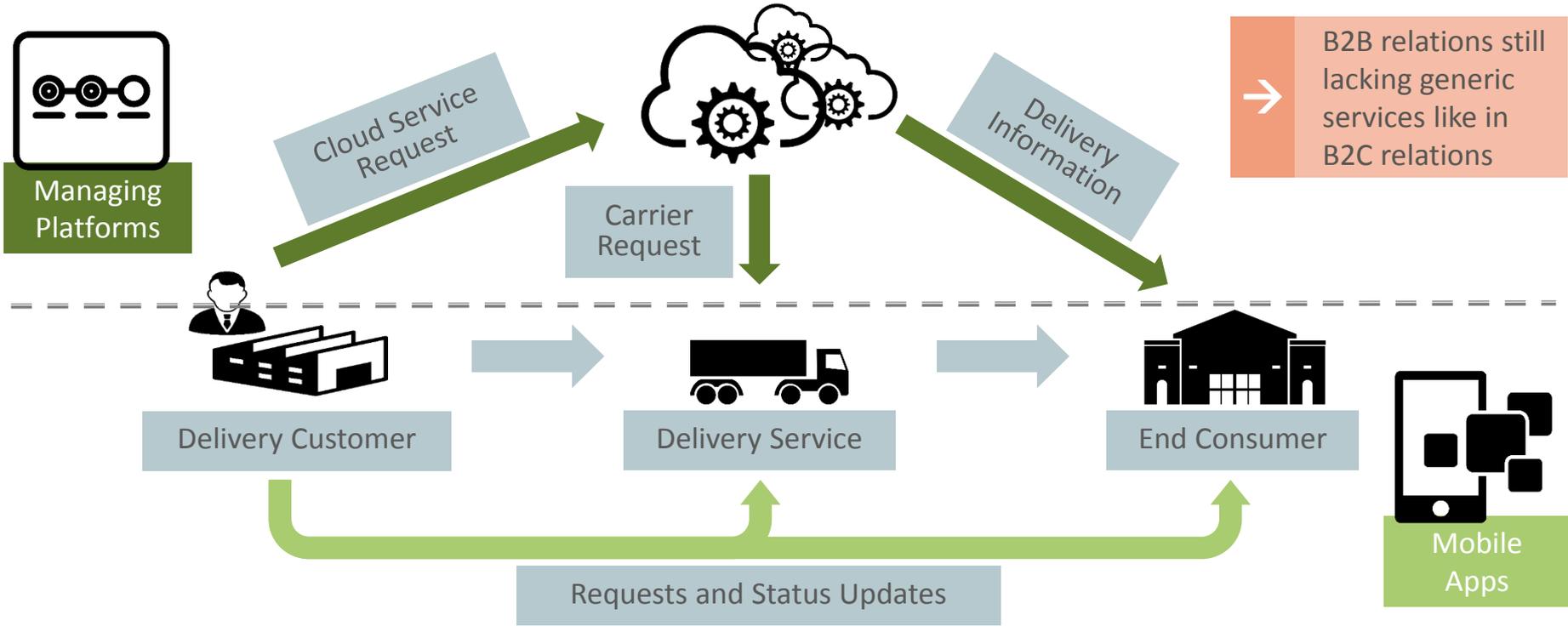


... dealing to „Logistics as a Service“ (LaaSS)

Logistics 4.0 or „Logistics as a Service“ (LaaS)

The terminology is based on concepts as Software-as-a-Service (SaaS), Platform-as-a-Service (PaaS) up to Anything-as-a-Service (XaaS). It is sometimes referred to as "on-demand XY", without hosting or owning the necessary infrastructures and tools.

The philosophy behind it is: "Just do it – I don't care how!"



Service Innovations

Lateral thinking - what's next?



SAS: all types of reliability analysis, e.g. payment moral etc.

Which new business models are about to break through?

- Will the product be delivered to customer before it has been ordered, „Anticipatory Shipping“?
- Send medicine before a disease spreads...
- Who is ordering?
- Which kind of foresight do Big Data Technology will come up with in the future?

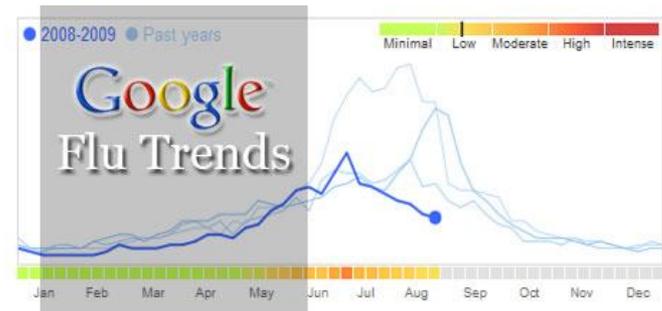


?



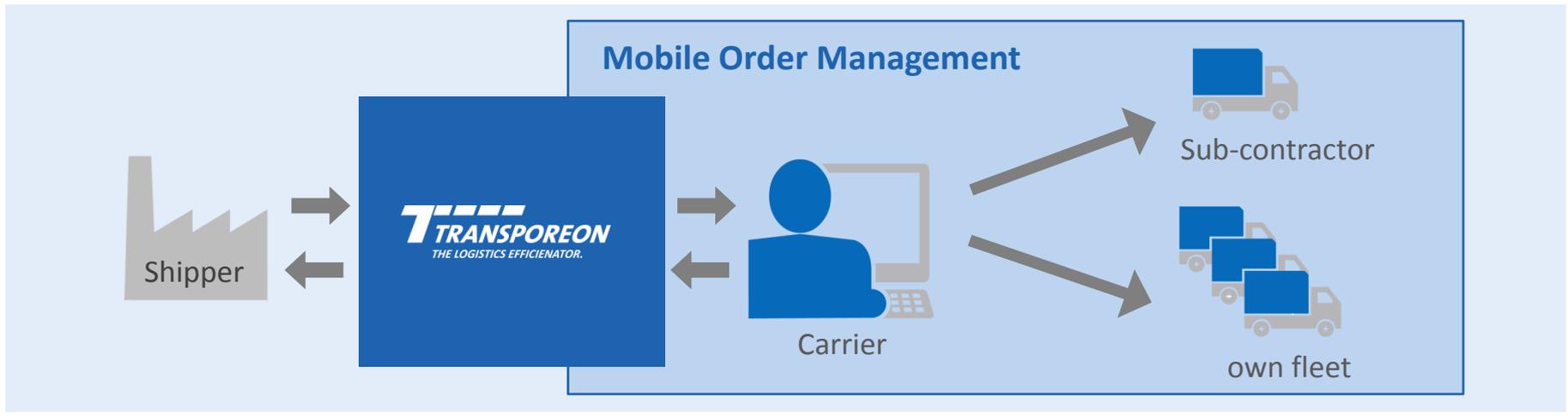
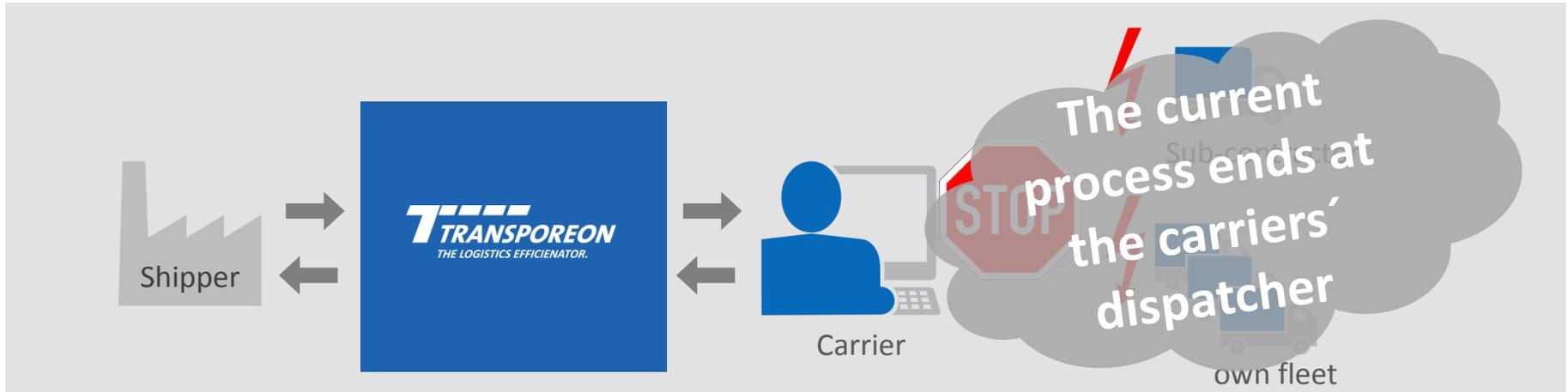
gild

GILD: “Roboter Recruiting”; selecting employees on a purely algorithmic basis





Integration of all service providers and their vehicles for full transparency of the "last mile" – the "MOBLE ORDER MANAGEMENT" approach



Big Data

Artificial Intelligence

Full digitalization

Autonomous driving

Network collaboration

Automation of supply chain

Service innovations

Synchro-modal transport

Sustainable transport

Green Logistics

COST SAVINGS

PROVEN ROI

REAL TIME VISIBILITY

REDUCE IDLE TIME

EFFICIENCY GAINS

COMMUNICATE MORE EFFECTIVELY

Google Deepmind

ICH FAHRE 100% ELEKTROSAUBER UND LEISE DURCH MICH

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„My colleague the robot...“



Again more: In a few years, automated driving might outcompete human drivers. Security issues, the demographic change, and the decreasing attractiveness of the job may add to a fast change.

www.cargocap.de



Google



Daimler



DHL



Rolls Royce



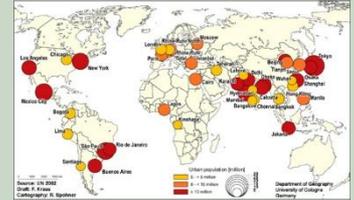
rail-bound caps

Some even more “out of space” concepts

The third dimension



! “In 2030, 70% of all humans will live in cities. Already then, about 10% will live in megacities (i.e., more than 10 Mio people). Escalating...”



[freestyle translation, source pwc studies]

The megacities of the future



At a certain point, due to purely mathematical reasons, extended 3-dimensional building structures can not longer be served by purely 2-dimensional (street) networks.



Third dimension



Above ground



Below ground



The new construction

„Digital warehouses are replacing physical spare parts storages“

[freestyle translation, source Logistik magazine]



!

„3D printing is on its way to leave the somewhat ‘restricted’ areas of spare part business, tool making etc. and is about to become a serious challenger for all traditional manufacturing models“.

[source Prof. Erman Tekkaya, TU Dortmund]



Harbor Rotterdam – 3D printer farm for metal printing (after piloting, now roll-out in 2016)



Water carbonators reaching high sales figures



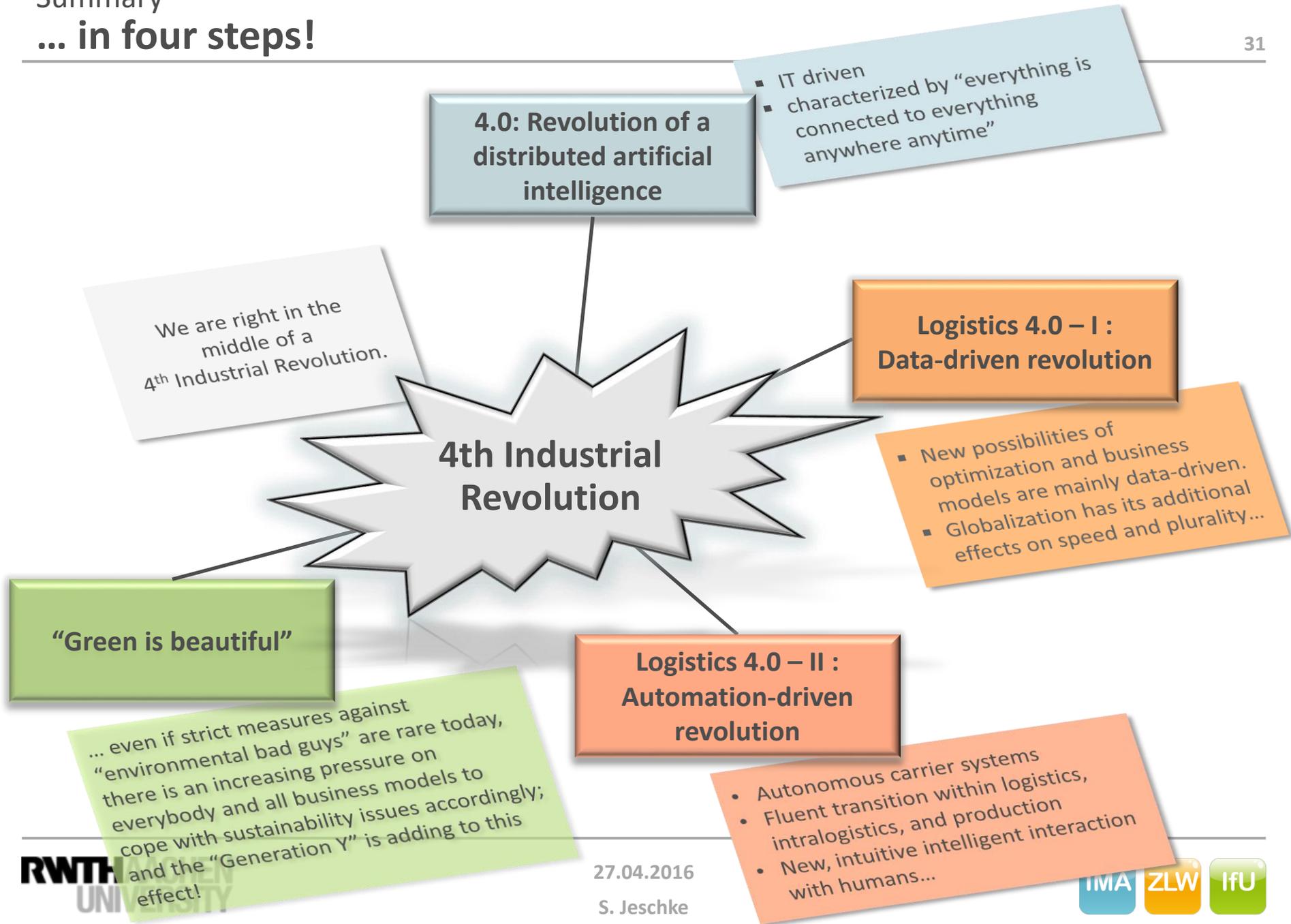
3D printing of house (source Univ. of Southern California 2013)



3D print of pasta – Barilla (tests since 2015)



“plastics instead of parcels?” - UPS moving from logistics to 3D printing (tests since 2013)



Thank you!

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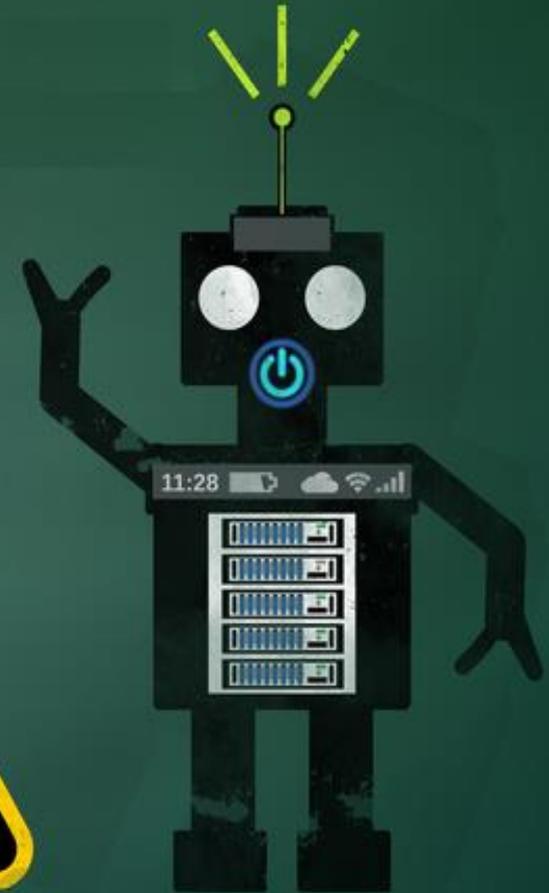
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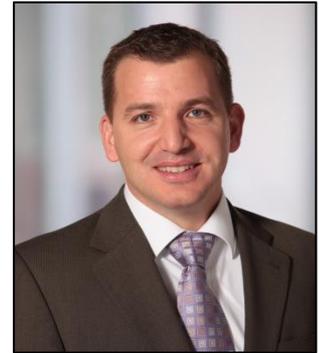
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- 1991 – 1997 Studies of **Physics, Mathematics, Computer Sciences**, TU **Berlin**
- 1994 **NASA** Ames Research Center, Moffett Field, **CA/USA**
- 10/1994 Fellowship „Studienstiftung des Deutschen Volkes“
- 1997 Diploma Physics
- 1997 – 2000 **Research Fellow** , TU Berlin, Institute for **Mathematics**
- 2000 – 2001 **Lecturer**, Georgia Institute of Technology, **GA/USA**
- 2001 – 2004 **Project leadership**, TU Berlin, Institute for Mathematics
- 04/2004 **Ph.D.** (Dr. rer. nat.), TU Berlin, in the field of **Computer Sciences**
- 2004 Set-up and leadership of the Multimedia-Center at the TU Berlin
- 2005 – 2007 **Juniorprofessor** „New Media in Mathematics & Sciences“ & Director of the **Multimedia**-center MuLF, TU Berlin
- 2007 – 2009 **Univ.-Professor**, Institute for IT Service Technologies (IITS) & Director of the Computer Center (RUS), Department of **Electrical Engineering**, University of **Stuttgart**
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- since 10/2011 **Vice Dean** of the Department of **Mechanical Engineering**, RWTH **Aachen** University
- since 03/2012 **Chairwoman VDI Aachen**
- since 05/2015 **Supervisory Board of Körber AG**, Hamburg



1975 Born in **Bad Windsheim/Germany**
1995 – 2000 Studies of **Industrial Engineering** in Kempten, Neu-Ulm and Ulm
2000 Foundation of **TRANSPOREON** in Ulm; now **Managing Director**



Peter Förster studied Industrial Engineering in Kempten/Neu-Ulm and Ulm with strong focus on Marketing. Following graduation he joined Siemens ICN Information and Communications Networks as Junior Marketing Consultant, simultaneously establishing the TRANSPOREON GmbH with his university friends. The company was founded in the year 2000. As Managing Director, Mr. Förster focuses primarily on product and innovation management.

TRANSPOREON Group's transportation platform allows manufacturers, retailers and carriers to fully digitize their transportation logistics processes. Today, the TRANSPOREON Group is the European market leader, linking over 1,000 shippers, 55,000 carriers and 100,000 users in over 100 countries.