FRIEDRICH-ALEXANDER
UNIVERSITÄT
ERLANGEN-NÜRNBERG

SCHOOL OF BUSINESS
AND ECONOMICS

Smart Service

Transformation through Digital Services

Dear members of the ISLA,

Thank you for inviting me to the Service Logistics Innovation Focus Day in Erlangen and for your interest in *Smart Services*. Because I arrived shortly before my talk and had to leave soon after, there was only little room for discussions.

Therefore, please do not hesitate to contact me, if

- you'd like to discuss issues related to the phenomenon of *smart services*,
- set-up applied research or consulting projects related to *smart services* or business process analytics (process mining, process monitoring).

All our online offerings are under construction but work:

www.is.rw.fau.de ● martin.matzner@fau.de ● @ismama

649.20 bn €

498.80 bn €

Forbes – World's most valuable brands 2017:
https://www.forbes.com/powerful-brands/list/#tab:rank

Agenda

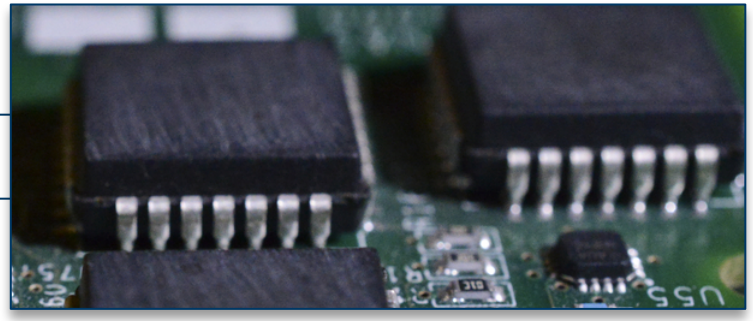
1 The First and the Second Machine Age

2 Smart Products

3 Smart Data

4 Smart Service

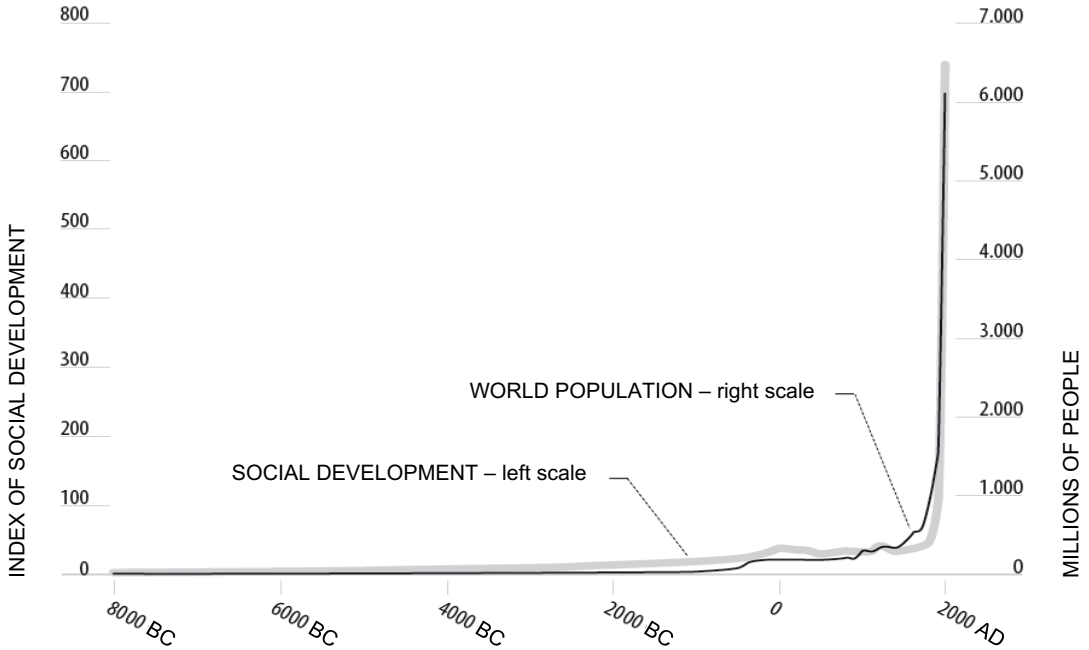
Agenda



How information technology transforms our world

Development of the world

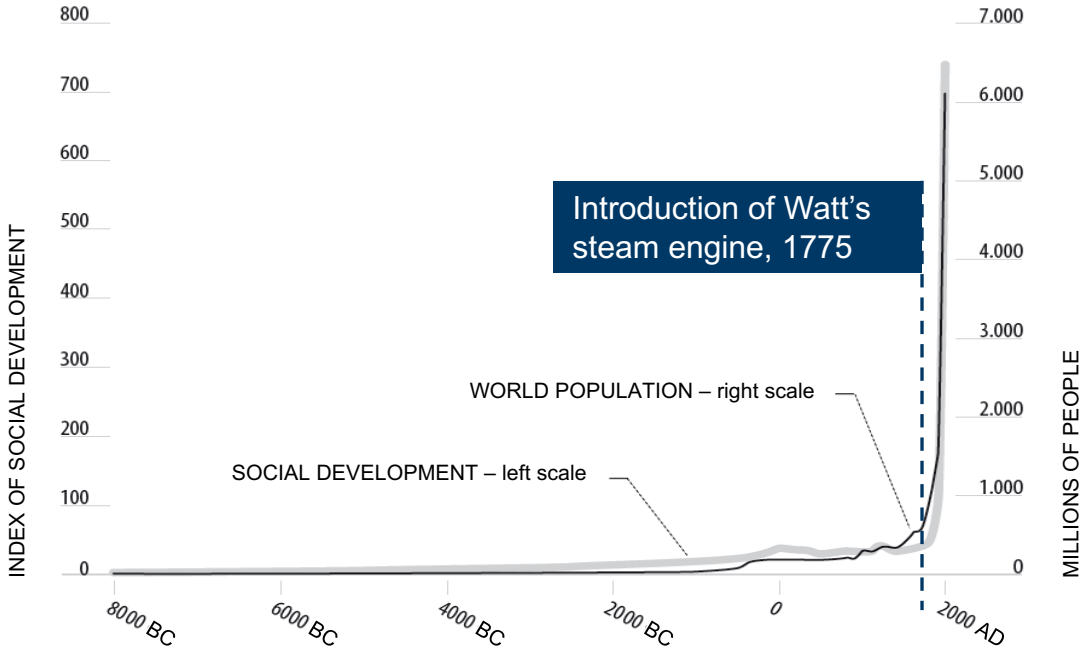
What were the most influential achievements of mankind?



Brynjolfsson & McAfee (2014)

The First Machine Age

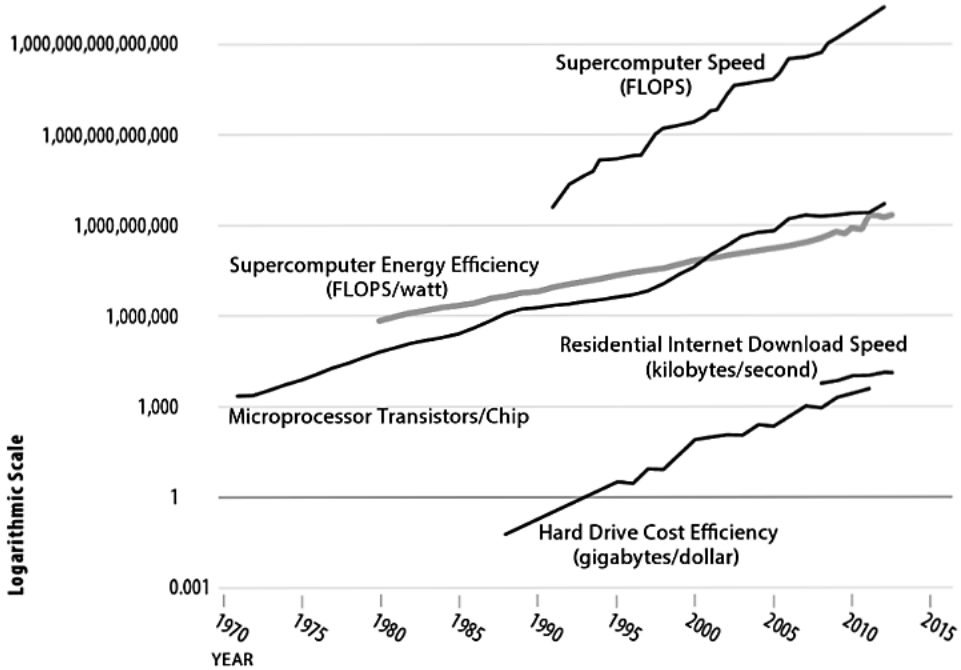
The steam engine was the pioneer of an unprecedented development



Brynjolfsson & McAfee (2014)

Hardware-development

The processing power increases rapidly in several dimensions



Brynjolfsson & McAfee (2014)

The Second Machine Age

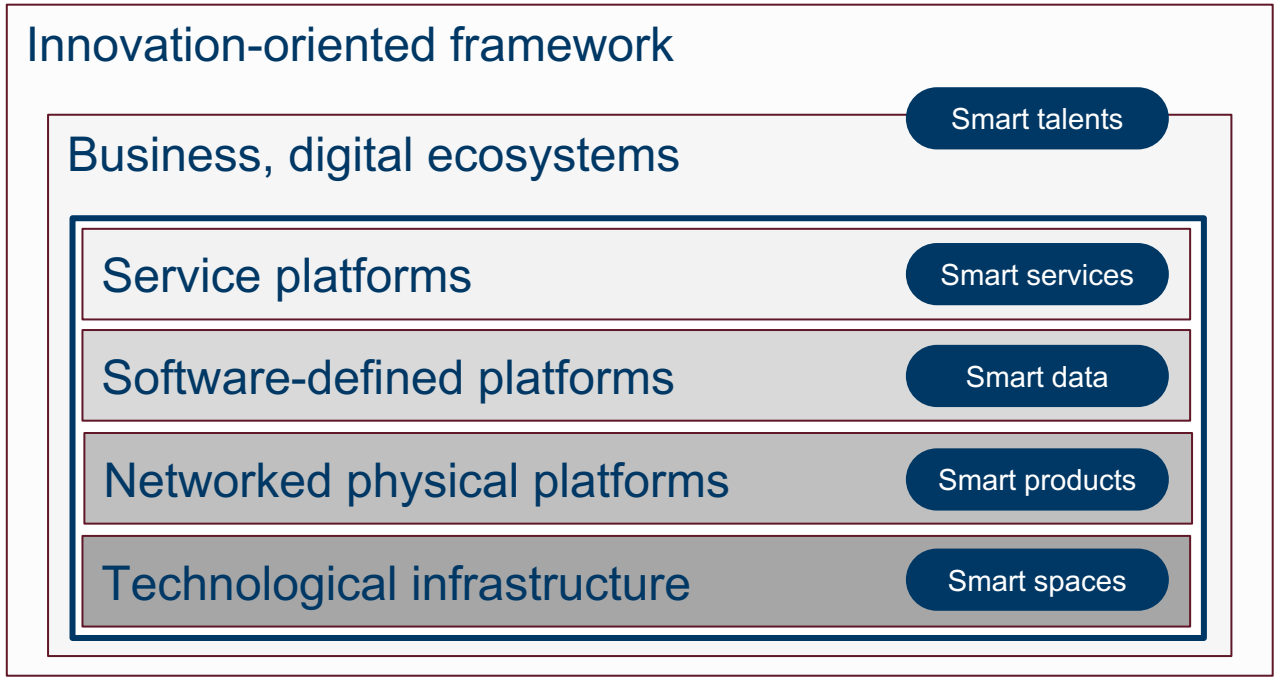
Information technology establishes the Second Machine Age

- Rapid increase in processing power (Moore‘s Law)
- Penetration of the world with smart objects
- Rapid innovation processes by:
  - Discretionary divisibility of information at marginal costs
  - Mobilization of people through the internet, crowdsourcing
  - Machine learning through automatic analysis of large amounts of data
  - Innovation through recombination

Brynjolfsson & McAfee (2014)

Layer Model

From smart infrastructure to digital services



Acatech (2015): Smart Service World: Recommendations for the Strategic Initiative Web-based Services for Businesses (short version)

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Smart Products capture and link contextual data

Smart Products

Pioneer of digital transformation in industry

Smart Products are products with embedded computers that are networked with remote systems

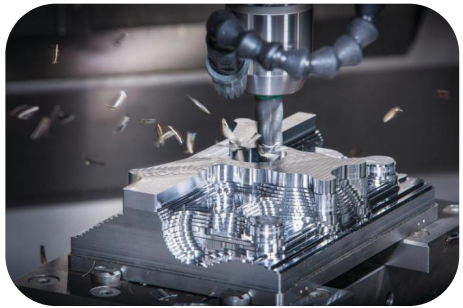
Smart Products pave the way for service business models

- digitally-modified
- innovative digital

Smart Products change “levels of digitization” in processes and decisions

Digitization of the physical world

Use cases in industrial enterprises



What is a Smart Product?

Characteristics

Sensor systems

- Data collection in physical environment

Smart Product

Based on Weiser (1993); Weiser (1991); Satyanarayanan (2001); Acatech (2011); Porter and Heppelmann (2014); Allmendinger and Lombreglia (2005); Atzori, Iera, and Morabito (2010).

What is a Smart Product?

Characteristics

Sensor systems | **Connectivity**

- Standardized communication protocols
- Remote access to data and functions

Smart Product

Based on Weiser (1993); Weiser (1991); Satyanarayanan (2001); Acatech (2011); Porter and Heppelmann (2014); Allmendinger and Lombreglia (2005); Atzori, Iera, and Morabito (2010).

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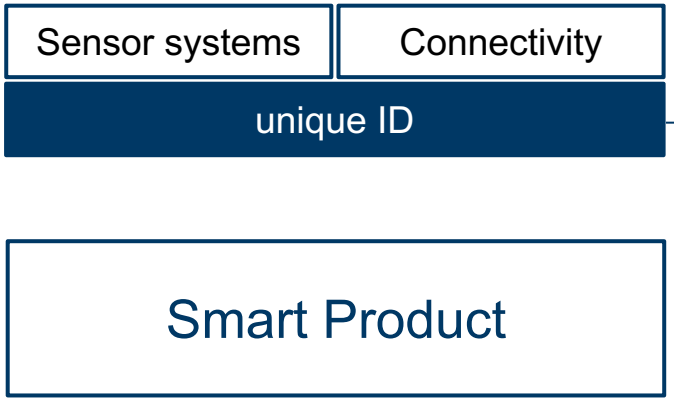

- Addressability by other products and IS
- Identifiability (entity)

Based on Weiser (1993); Weiser (1991); Satyanarayanan (2001); Acatech (2011); Porter and Heppelmann (2014); Allmendinger and Lombreglia (2005); Atzori, Iera, and Morabito (2010).

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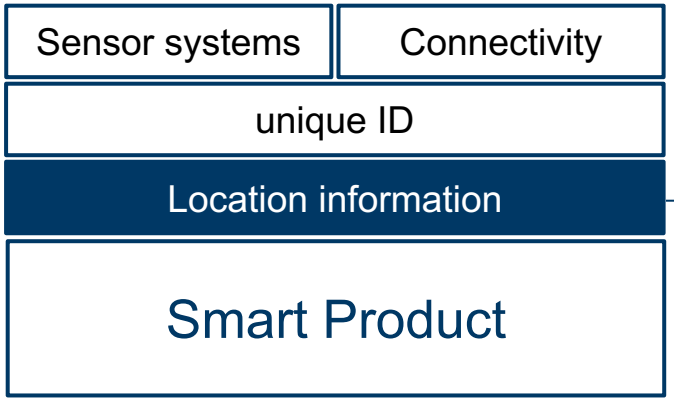

- Location knowledge
- Localizability through other products and IS

Based on Weiser (1993); Weiser (1991); Satyanarayanan (2001); Acatech (2011); Porter and Heppelmann (2014); Allmendinger and Lombreglia (2005); Atzori, Iera, and Morabito (2010).

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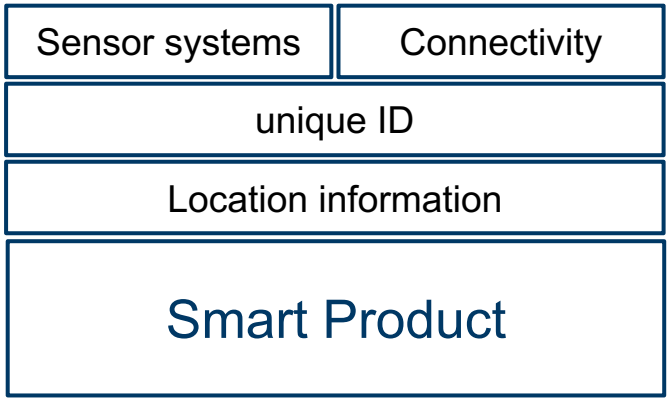

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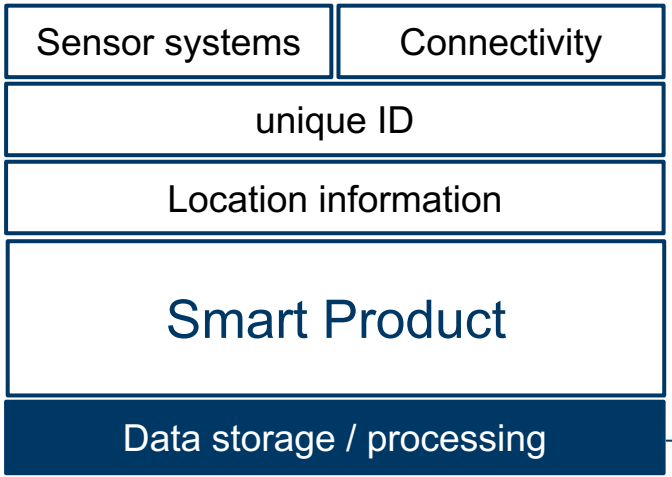

- Condition-, usage-, context data history
- Autonomous behavior through local processing
- Influencing physical and digital spheres

Based on Weiser (1993); Weiser (1991); Satyanarayanan (2001); Acatech (2011); Porter and Heppelmann (2014); Allmendinger and Lombreglia (2005); Atzori, Iera, and Morabito (2010).

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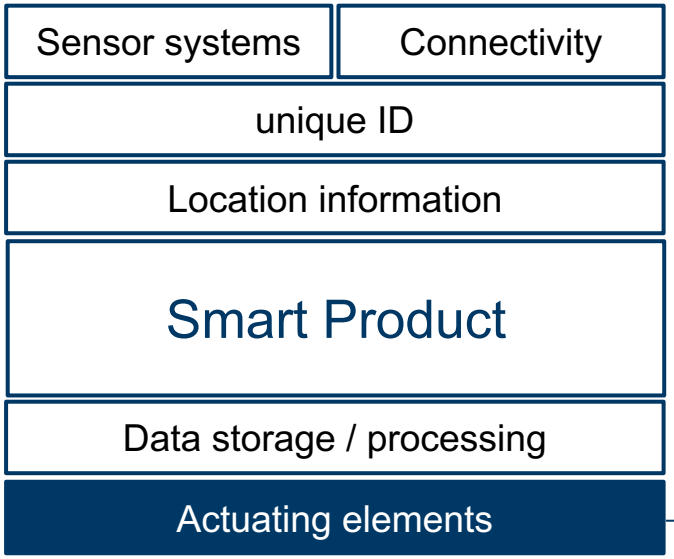

- Manipulation of the physical environment

Based on Weiser (1993); Weiser (1991); Satyanarayanan (2001); Acatech (2011); Porter and Heppelmann (2014); Allmendinger and Lombreglia (2005); Atzori, Iera, and Morabito (2010).

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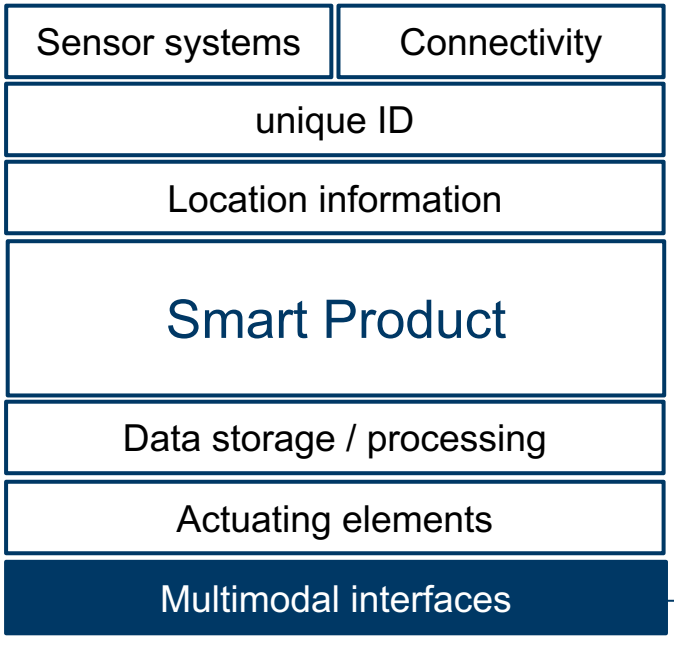

- to human-machine interaction

Based on Weiser (1993); Weiser (1991); Satyanarayanan (2001); Acatech (2011); Porter and Heppelmann (2014); Allmendinger and Lombreglia (2005); Atzori, Iera, and Morabito (2010).

What is a Smart Product?

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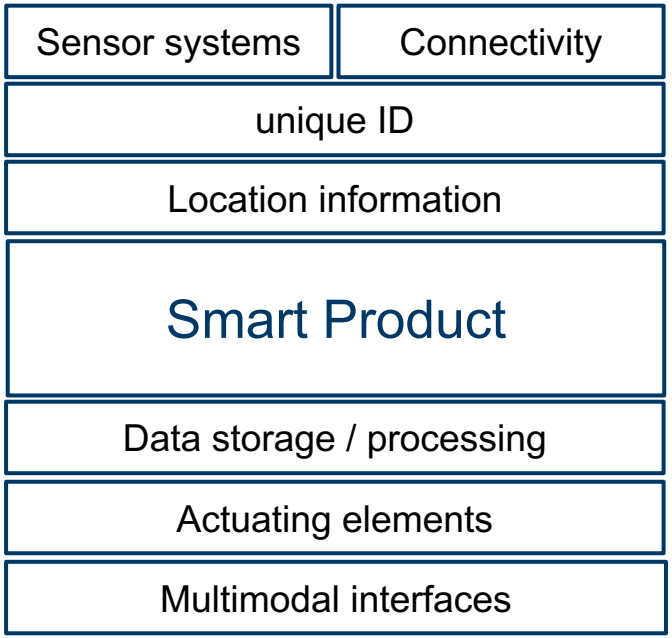

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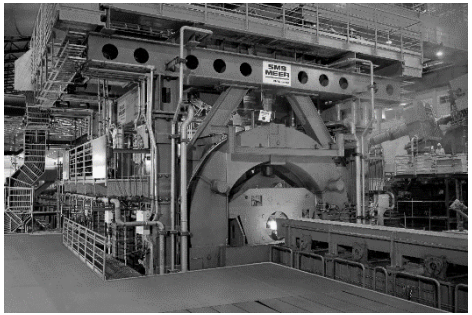
Smart Products

Smart Products can be found in B2B and B2C scenarios



Sensor systems	Connectivity
unique ID	
Location information	
Smart Product	
Data storage / processing	
Actuating elements	
Multimodal interfaces	

Illustration: https://www.fitbit.com

Sensor systems	Connectivity
unique ID	
Location information	
Smart Product	
Data storage / processing	
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Multimodal interfaces	

Beverungen et al. (2017)

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Data of the usage of Smart Products in the filed

Big Data

https://datascience.berkeley.edu/what-is-big-data/

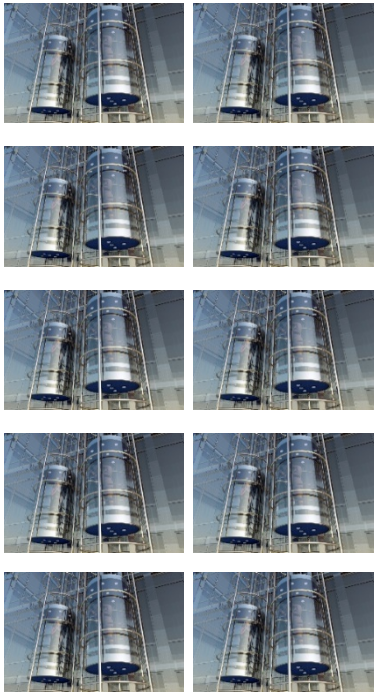
Smart Data

Context-sensitive and aggregated data

- Customer use Smart Products to add individual value
- Smart Products enable customers configuration to their own requirements
- Smart Products can return context-sensitive data “from the field”
- Service providers aggregate data from the *Installed Base* and create new value-added services

Aggregation of contextual data

Use case: networked elevator



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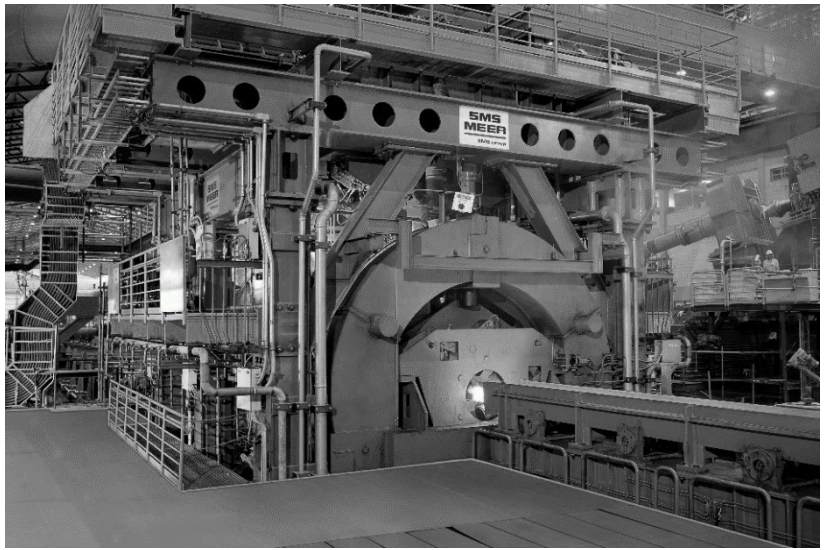
Digital value-added services based on Smart Products and Smart Data

More efficient service processes

Current services are provided more efficient

- Predictive maintenance based on fine-grained data in real-time
- Remote access and remote maintenance of technical installations
- More efficient implementation of maintenance- and corrective maintenance measures (e.g. spare parts logistics)



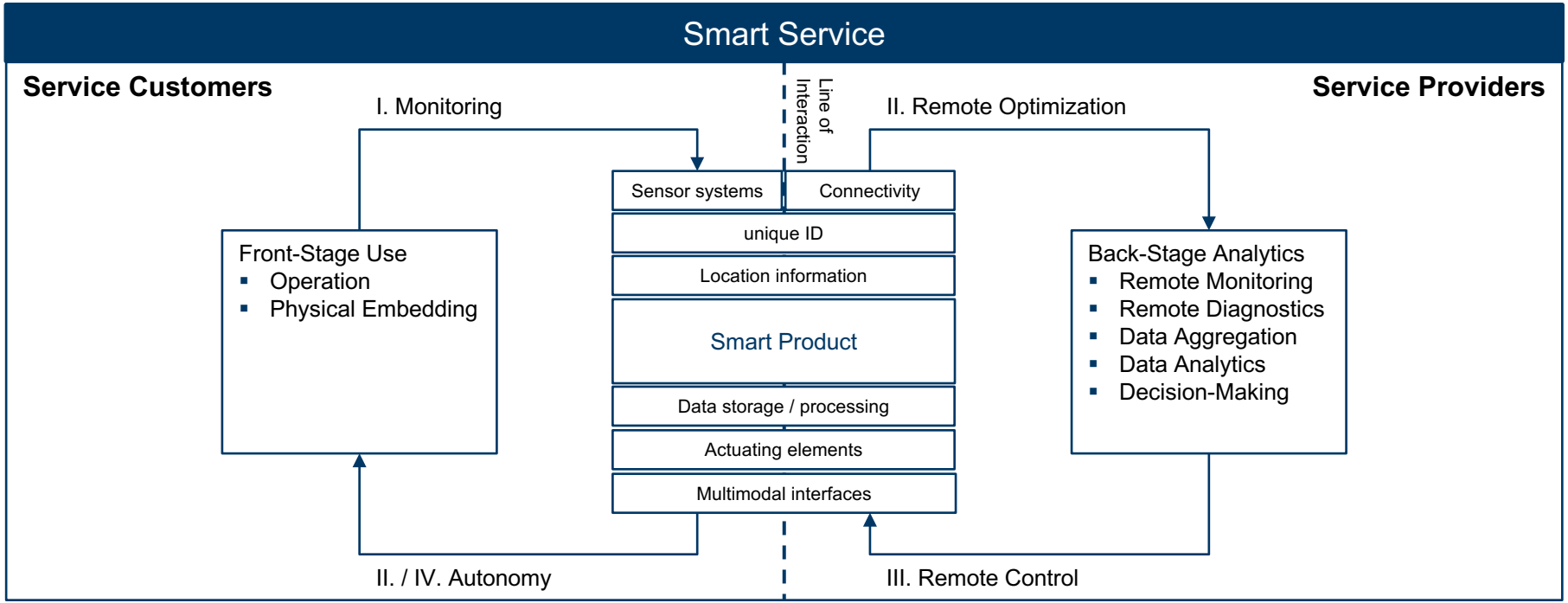
Digital value-added services

New digital business models are enabled

- Billing of services according to the actual utilization of the service by the customer
- Collection of usage data from the customer's service system
- Comparison with the usage of other facilities by analyzing aggregated data

Smart Service

Interactions between service customers and providers



Beverungen et al. (2017)

Interaction with the customer

Digital, continuous, context-sensitive interaction

- **Digital**: Smart products form a communication channel between customer and provider
- **Context-specific**: The service delivery becomes more customer-specific and considers the context of individual customers
- **Aggregated**: Smart Products serve as platform for new services and make platform providers appear
- **Continuous**: The contact with the customer is "online", beyond individual service episodes

References

- Abschlussdokument ‚European Policy Outlook' der Konferenz der deutschen Ratspräsidentschaft 2007 , Towards the Internet of Things', (Federal Ministry of Economics and Technology 2007).
- Atzori, L., Iera, A., & Morabito, G. (2010). The Internet of Things: A survey. Computer Networks, 54(15), 2787–2805. doi:10.1016/j.comnet.2010.05.010.
- Beverungen, D.; Müller, O.; Matzner, M.; Mendling, J.; vom Brocke, J. (2017). Conceptualizing Smart Service Systems. Electronic Markets, forthcoming.
- Brynjolfsson, E., McAfee, A. (2014). The Second Machine Age. W.W. Norton & Company, New York, London. https://tanguduavinash.files.wordpress.com/2014/02/the-second-machine-age-erik-brynjolfsson2.pdf
- EPoSS. 2008. *Internet of Things in 2020: A Roadmap for the Future*. *Rfid Working Group of the European Technology Platform on Smart Systems Integration (Eposs)*. http://www.smart-systems-integration.org/public/documents/publications/Internet-of-Things_in_2020_EC-EPoSS_Workshop_Report_2008_v3.pdf
- Haller, S. (2010), "The Things in the Internet of Things", Paper presented at the Internet of Things Conference, Tokyo, Japan 2010, http://www.iot2010.org/.
- Kagermann, H. (2014). Industrie 4.0 und Smart Services. In W. Brenner & T. Hess (Eds.), Wirtschaftsinformatik in Wissenschaft und Praxis SE - 19 (pp. 243–248). Springer Berlin Heidelberg. doi:10.1007/978-3-642-54411-8_19.
- Kagermann, H., Riemensperger, F., Hoke, D., Ag, S., Helbig, J., Stocksmeier, D., … Bosch Gmbh, R. (2014). Impressum Herausgeber Arbeitskreis Smart Service Welt Englische Übersetzung Layout und Satz Logogestaltung Grafiken. Retrieved from www.acatech.de.
- Kagermann, Henning, Wolfgang Wahlster, and Johannes Helbig. "Umsetzungsempfehlungen für das Zukunftsprojekt Industrie 4.0." Abschlussbericht des Arbeitskreises Industrie 4 (2013).
- Keskin, T.; Kennedy, D., "Strategies in Smart Service Systems Enabled Multi-sided Markets: Business Models for the Internet of Things," System Sciences (HICSS), 2015 48th Hawaii International Conference on , vol., no., pp.1443,1452, 5-8 Jan. 2015.
- Provost, F.; Fawcett, T. (2013): Data Science for Business. What you need to know about data mining and data-analytic thinking. O´Reilly Media, Sebastopol, CA, USA.
- Spohrer, James C.; Demirkan, Haluk, "Introduction to the Smart Service Systems: Analytics, Cognition, and Innovation Minitrack," System Sciences (HICSS), 2015 48th Hawaii International Conference on , vol., no., pp.1442,1442, 5-8 Jan. 2015.

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