Beilen, 30 November 2016

BNG BANK

THE FOURTH INDUSTRIAL REVOLUTION

QUESTIONS CONCERNING INFORMATION, COMPLEXITY AND ETHICS

©PROF. DR. BEN VAN LIER DIRECTOR STRATEGY & INNOVATION

December 1, 2016

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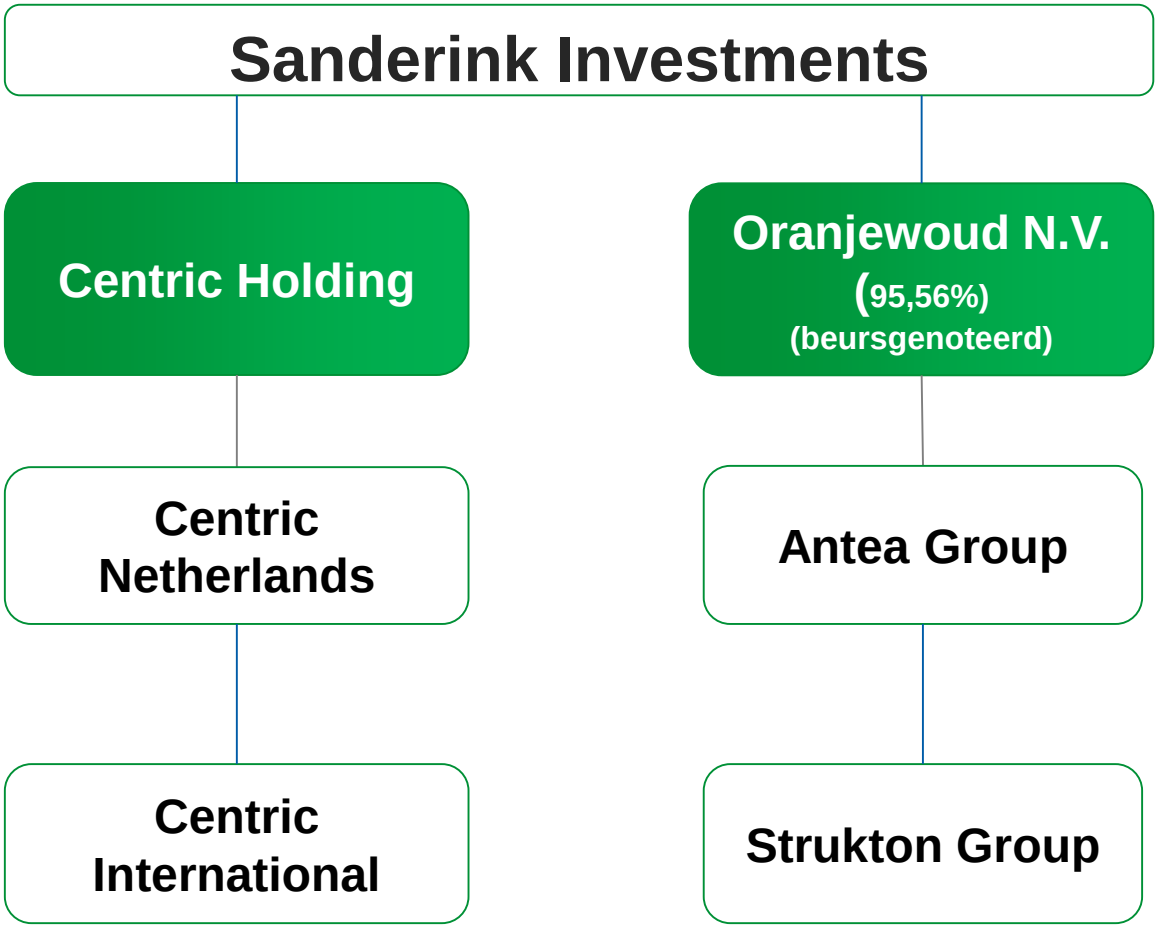

Sanderink Investments
Centric Holding
Oranjewoud N.V.
(95,56%)
(beursgenoteerd)
Centric Netherlands
Antea Group
Centric International
Strukton Group

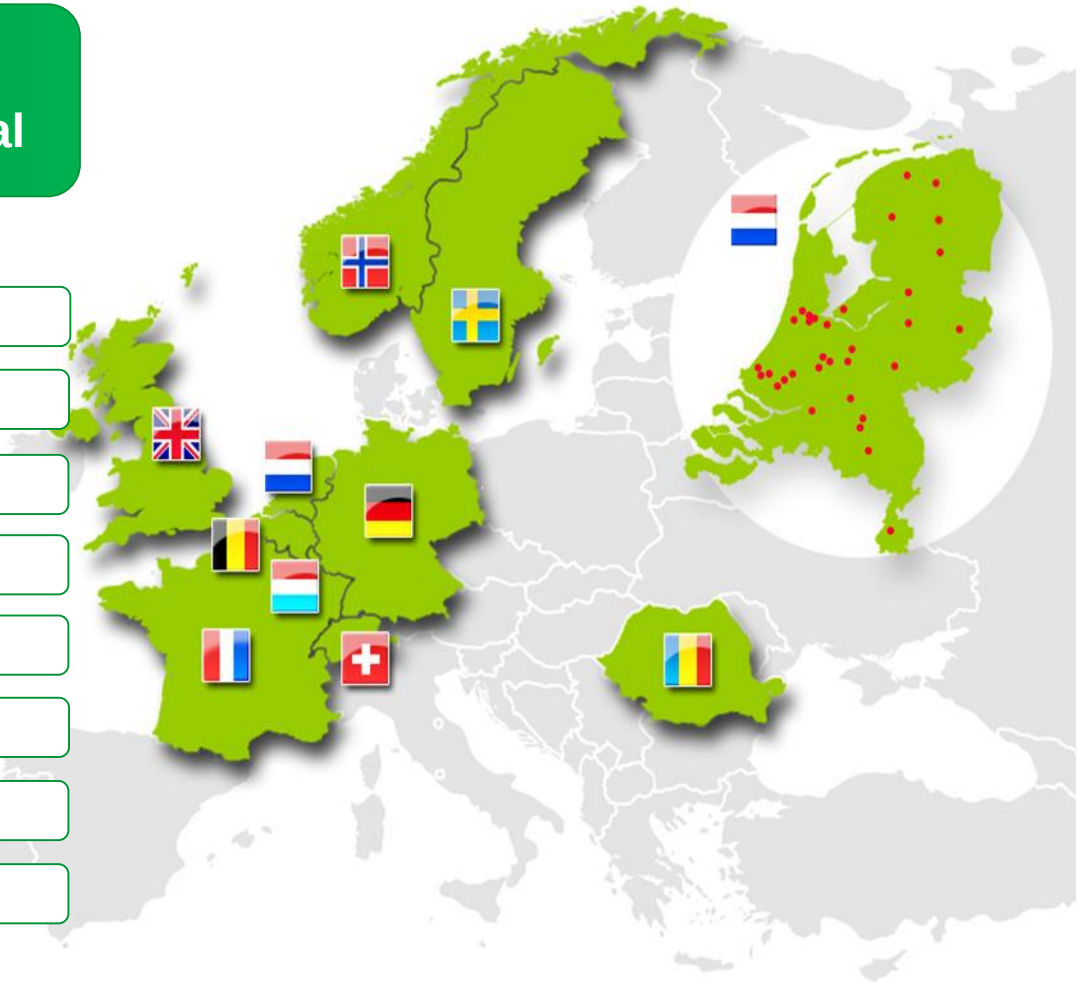
CENTRIC HOLDING

Centric Netherlands

- Software Solutions
- IT Outsourcing
- BPO
- Staffing Services

Centric International

- Belgium
- France
- Germany
- Luxembourg
- Norway
- Romania
- Sweden
- Switzerland



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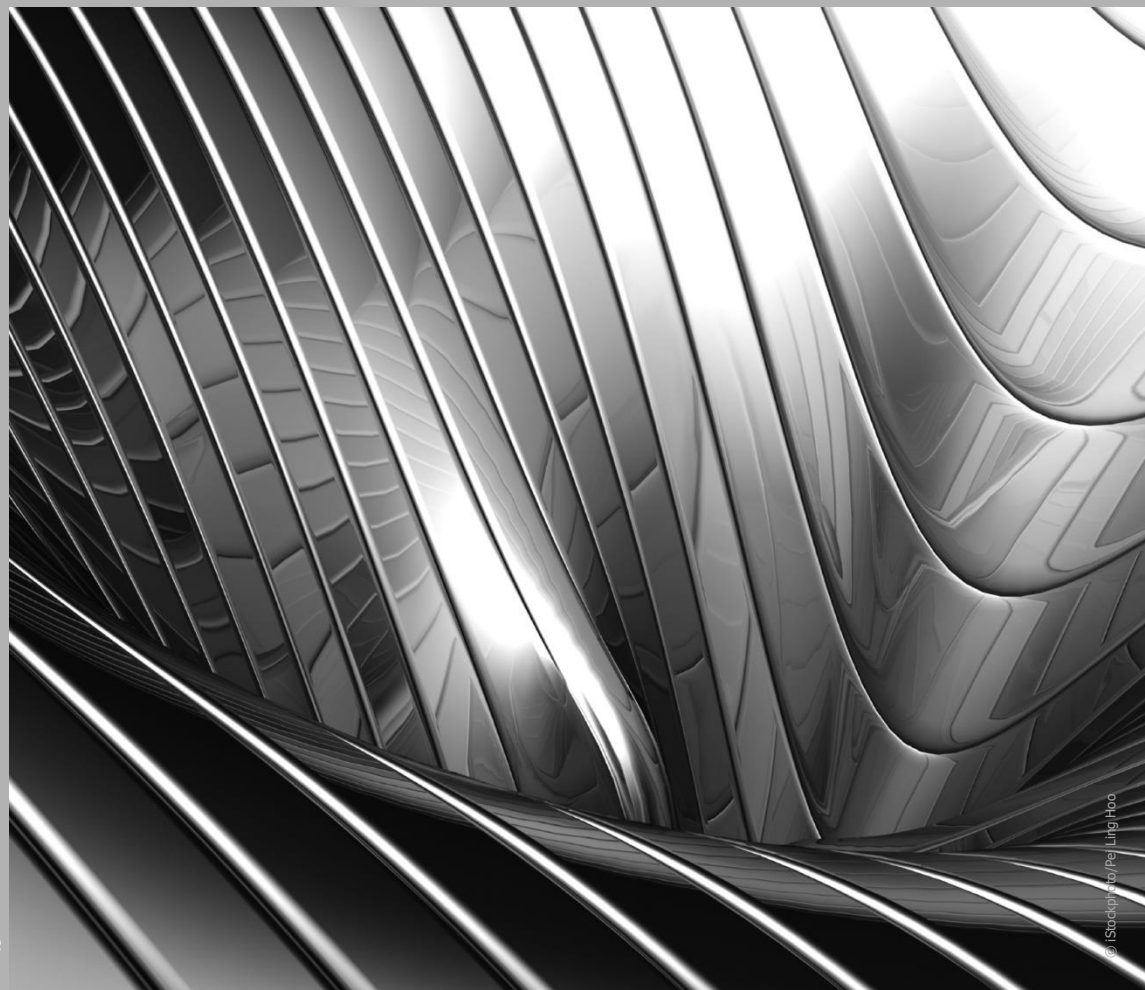
Steinbeis

Technologie.Transfer.Anwendung.

Systems & Complexity Theory Interoperability of Information Network Centric Operations

Prof. dr. Ben van Lier CMC



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UNIVERSITY OF APPLIED SCIENCES

exceed expectations

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Welcome to Rotterdam

Why study in Holland? ›

Ben van Lier
Lector

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REPRESENTATIONS

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INDUSTRIAL TECHNOLOGIES
2016 CREATING A SMART EUROPE

Advisory Board

22 – 24 June 2016 | RAI Amsterdam

Forum Smart Industry
smart industry

dutch digital delta
connect and create

Holland High Tech
Holland

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PHENOMENOLOGY (MODERN ONTHOLOGY)

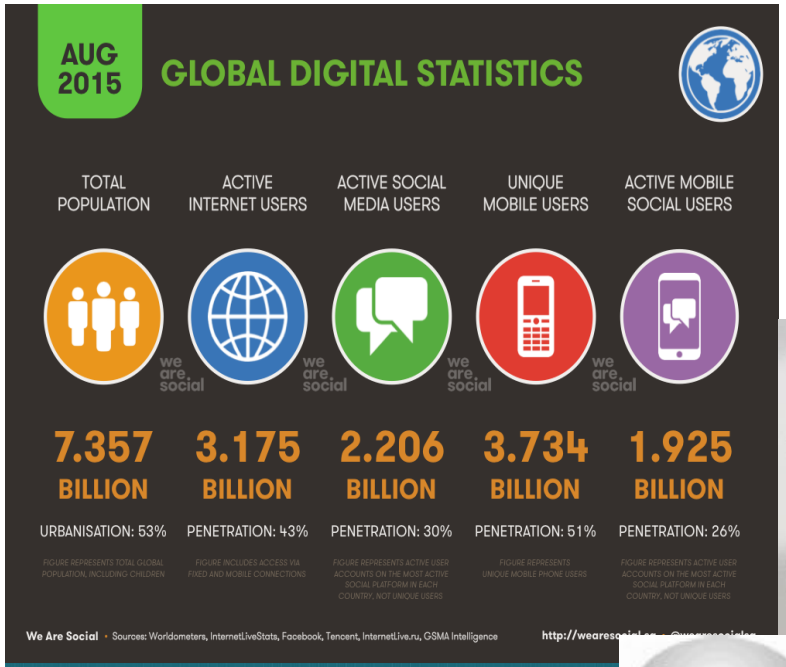
Martin Heidegger The question concerning technology (1954:24)

The essence of modern technology lies in Enframing;
Thus the question as to how we are to arrive at a relationship to the essence of technology, asked in this way, always comes too, late.

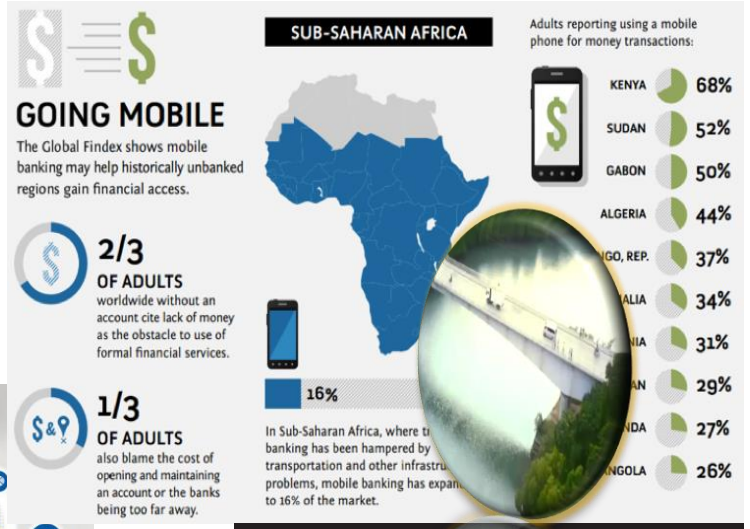
But never too late comes the question as to whether we actually experience ourselves as the ones whose activities everywhere, public and private, are challenged forth by Enframing.

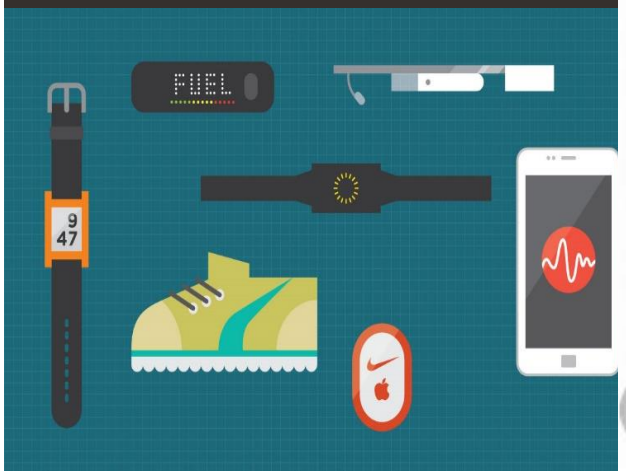
Above all, never too late comes the question as to whether and how we actually admit ourselves into that wherein Enframing itself comes to present.

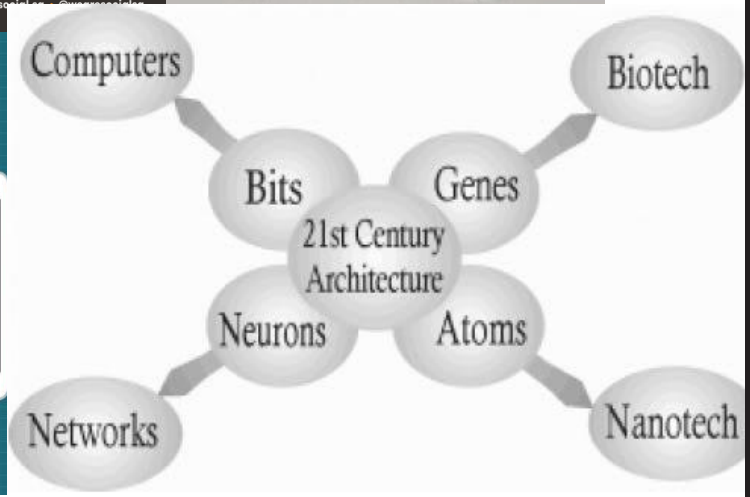
TECHNOLOGY

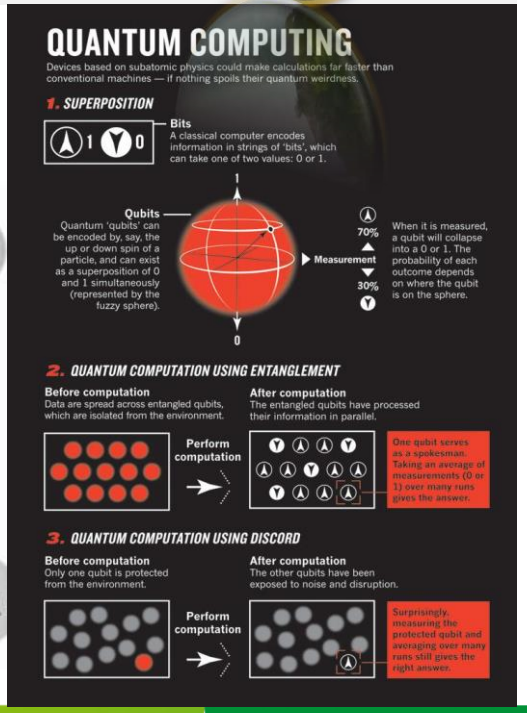


Square
CellTell
Mpesa
Zain Zap









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INTERNET OF THINGS – HISTORY

Mark Weiser Ubiquitous Computing (1991)

The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indisguishable from it.

Kevin Ashton Internet of Things (1999)

A system to describe where the Internet is connected to the physical world via ubiquitous sensors.

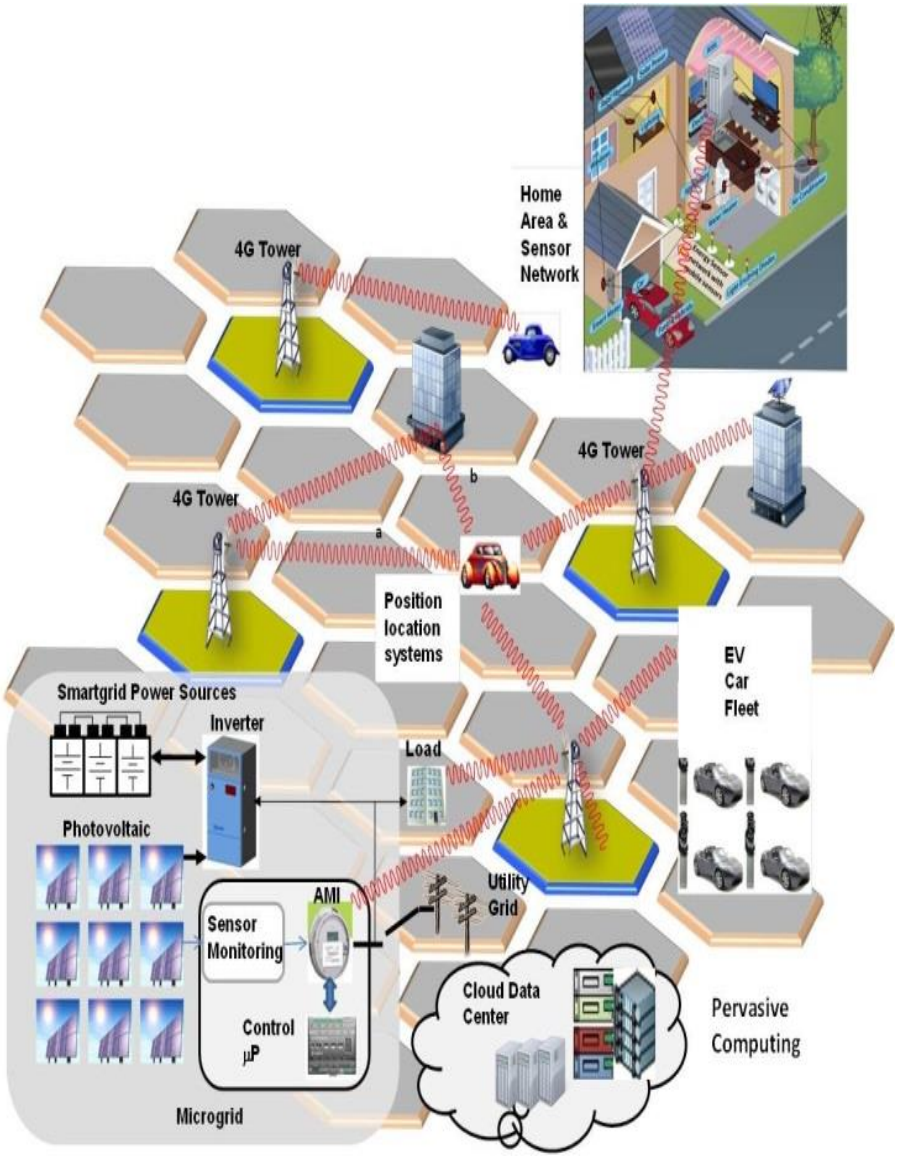
Sundmaeker c.s. Internet of Things (2010)

In the context of Internet of Things a thing could be defined as a real/physical or digital/virtual entity that exists and move in space and time and is capable of being identified either by assigned identification numbers, names and/or location addresses

CYBER PHYSICAL SYSTEMS

Cyber Physical Systems (CPS) are smart systems that include engineered interacting networks of physical and computational elements. These highly interconnected and integrated systems provide new functionalities to improve quality of life and enable technological advances in critical areas such as personalized healthcare, emergency response, traffic flow management, smart manufacturing, defense and homeland security, and energy supply and use.

Framework for Cyber-Physical Sytems Release 1.0, May 2016, CPS Public Working Group, NIST



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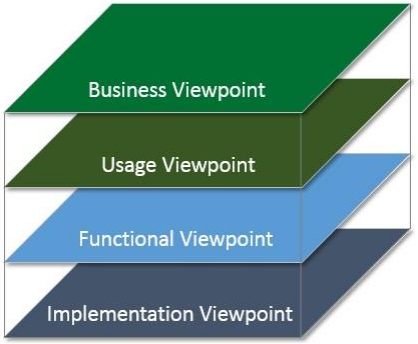
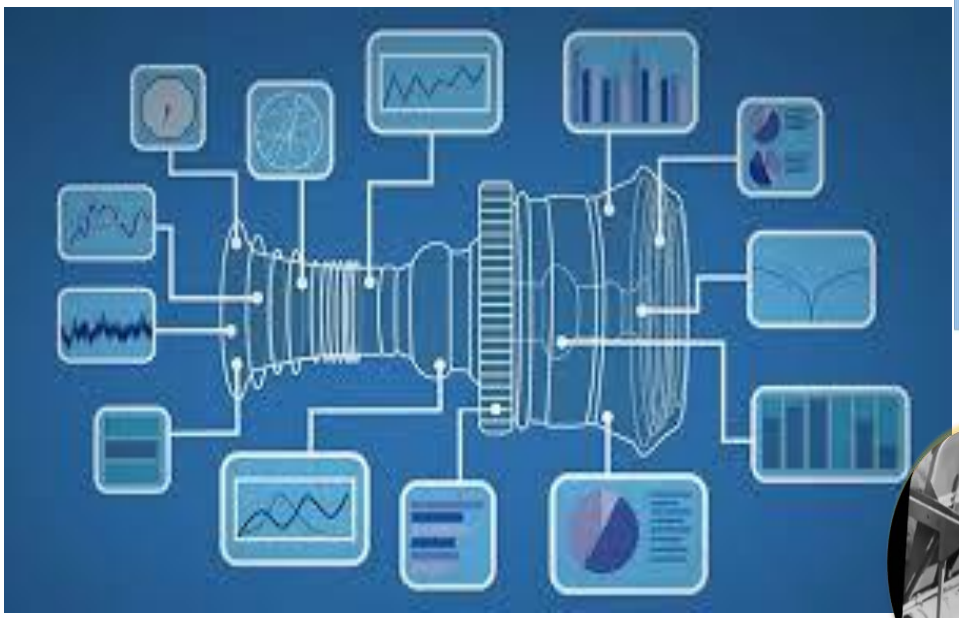
INDUSTRIAL INTERNET (REFERENCE ARCHITECTURE)

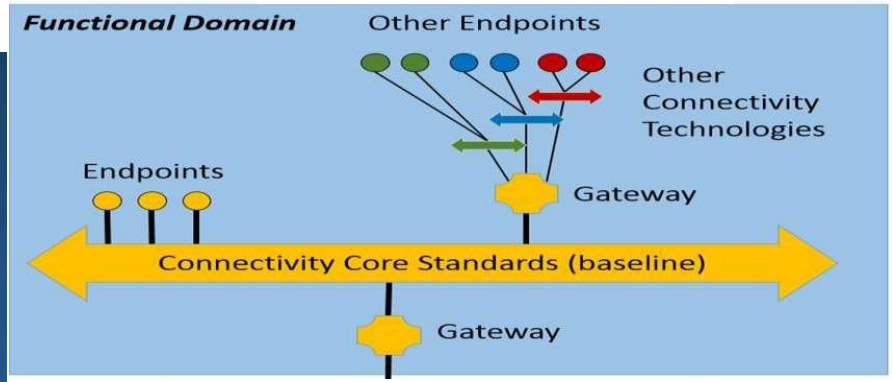
PEOPLE & MACHINE CONNECTED

"The more we can connect, monitor and manage the world's machines, the more insight and visibility we can give our customers to reduce unplanned downtime and increase predictability."

Jeffrey R. Immelt, Chairman and CEO of GE







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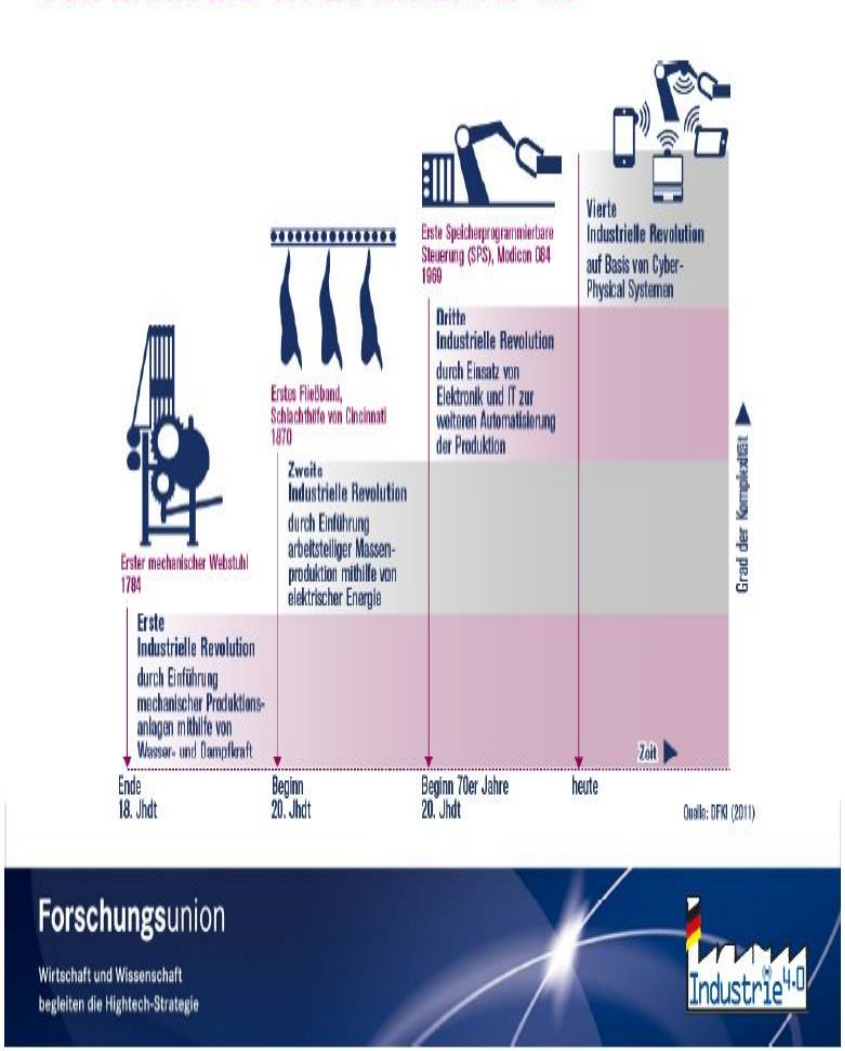
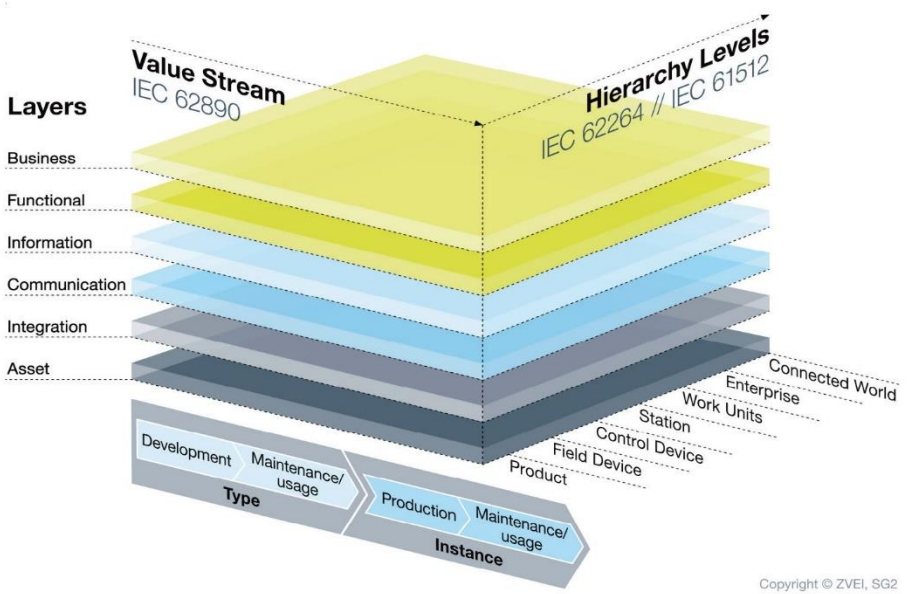
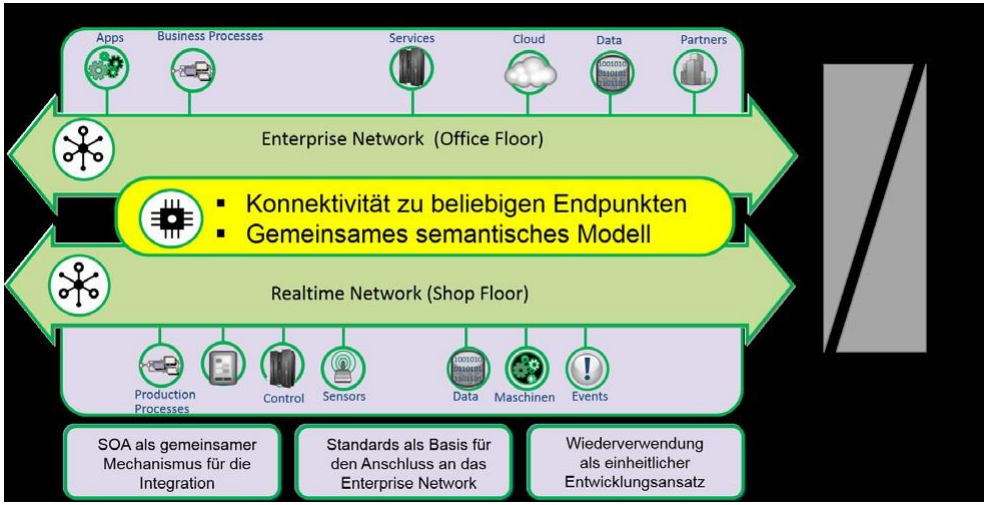
INDUSTRIES 4.0 REFERENCE ARCHITECTURE







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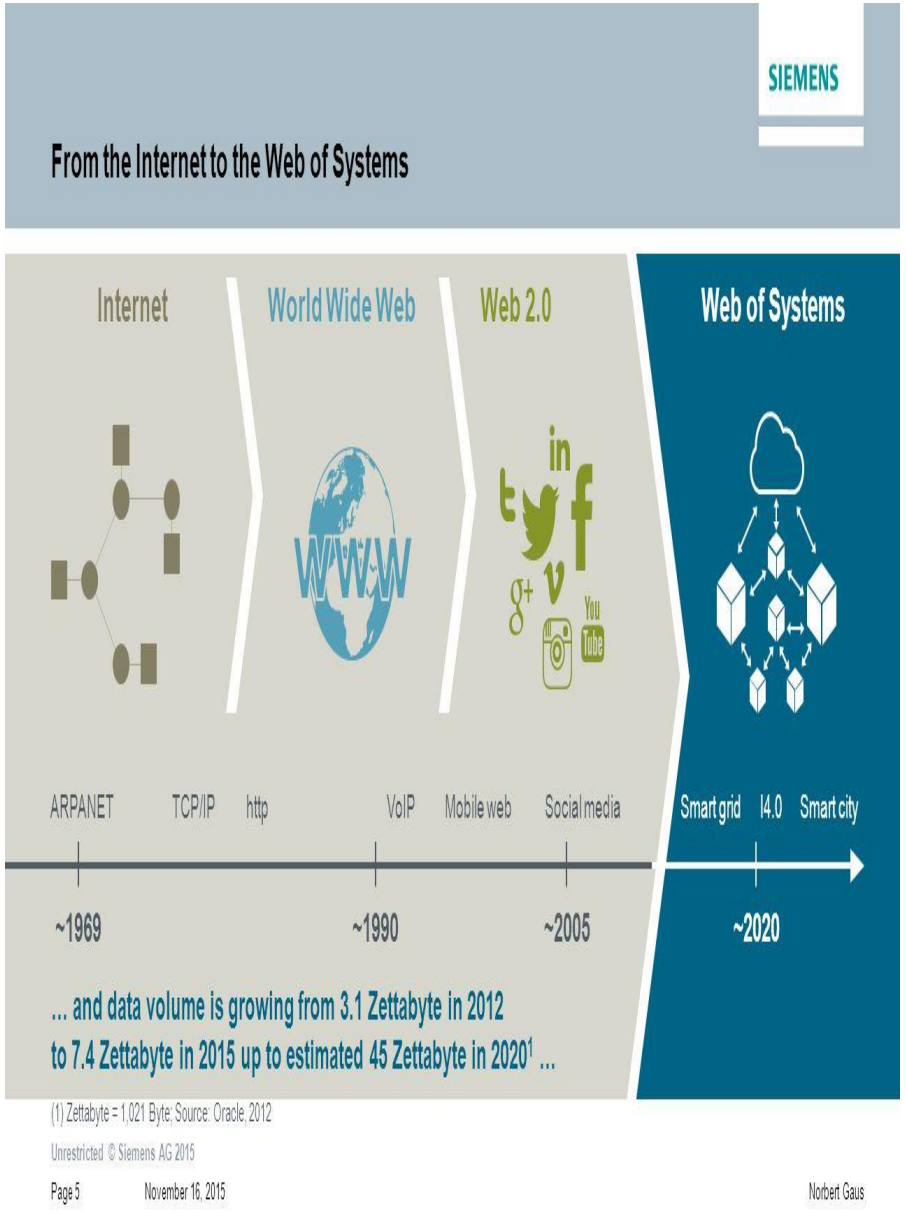
WEB OF SYSTEMS

"That's why Siemens has further detailed and expanded the concept of the Internet of Things for industrial applications. We call this approach the Web of Systems. In a Web of Systems, devices and machines such as those produced by Siemens, as well as their interactions in systems, are the center of a digitally - networked industrial landscape - also reflecting the context of the future Industrie 4.0"



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DUTCH INDUSTRY FIT FOR THE FUTURE

APRIL 2014

In the coming decade, a network-centric approach to production will replace linear production processes

Digitisation is brought to another level within Smart Industry.

The third pillar to Smart industry is about the next generation of manufacturing technologies.

Together with Germany, the Netherlands is keen to take the lead. Here and now.
Dutch Minister Kamp, 14 april 2015, Hannover Messe

ACTIEAGENDA
smart industry
DUTCH INDUSTRY FIT FOR THE FUTURE

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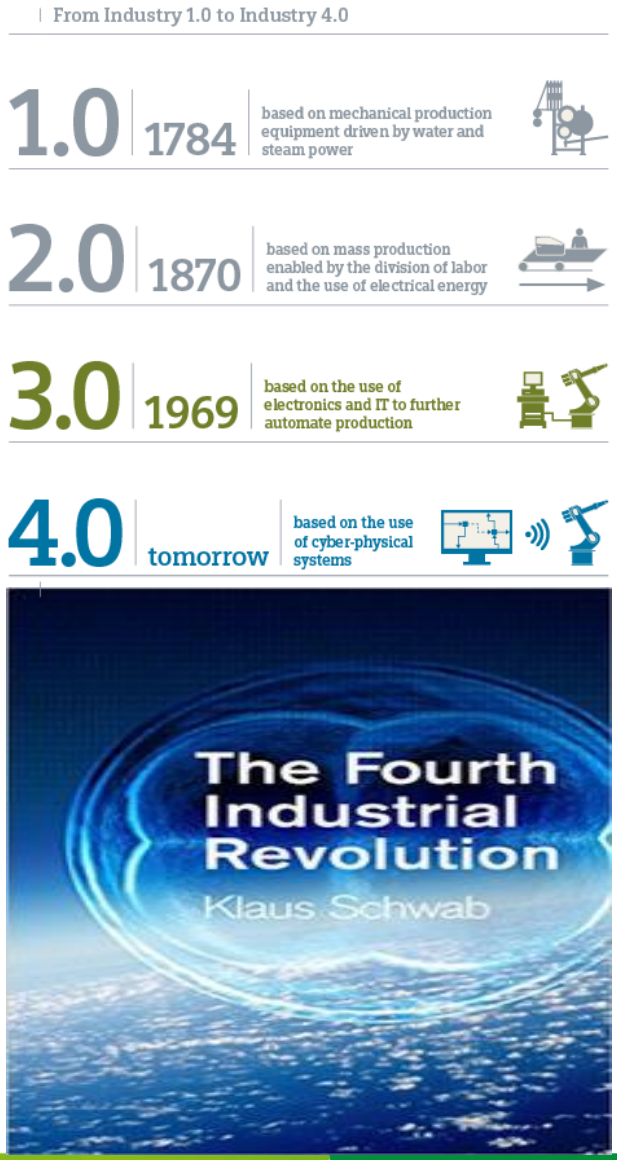
THE 4TH INDUSTRIAL REVOLUTION

“we do not yet know how the transformations driven by this industrial revolution will unfold, their complexity and interconnectedness across sectors imply that all stakeholders of global society – governments, business, academia, and civil society – have a responsibility to work together to better understand the emerging trends”.

Schwab K. 2016 WEF



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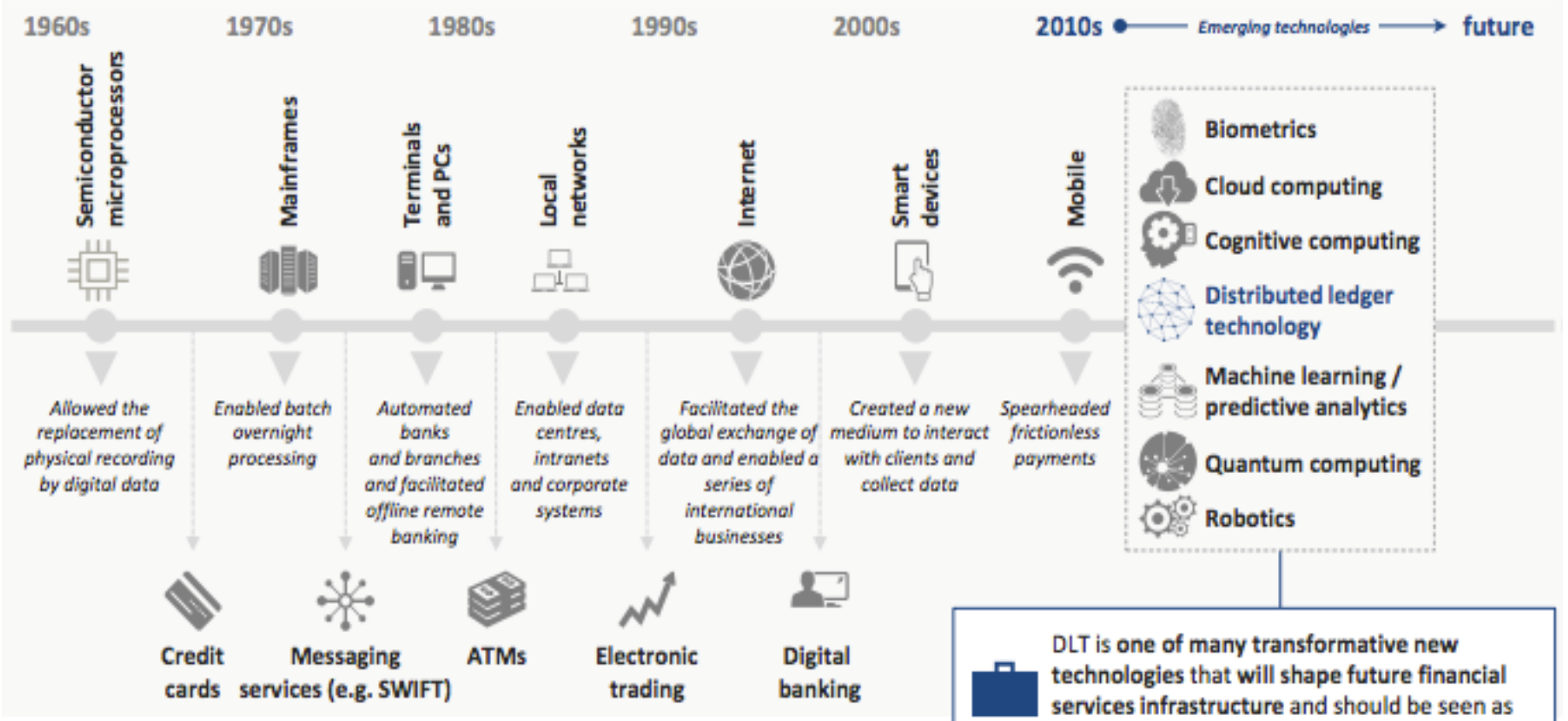
FINANCIAL SECTOR AND BLOCKCHAIN

Over the last 50 years, technology innovation has been fundamental to financial services industry transformation. Today, multiple technologies poised to drive the next wave of financial services innovation are converging in maturity.



DLT is **one of many transformative new technologies** that **will shape future financial services infrastructure** and should be seen as **part of a toolbox**

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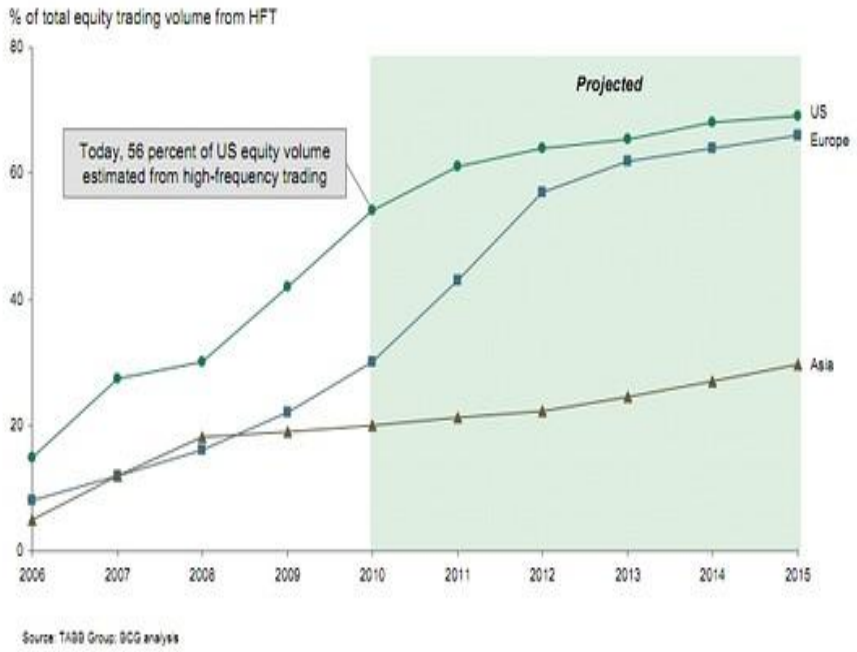
HIGH FREQUENCY TRADING I

The development and the role of machines within financial markets are an inherently dynamic process that can only be properly understood from an ecological and evolutionary perspective (Farmer and Skouras 2010)

Around 73% of the trading volume on U.S. equity market is due to HFT but only 2% of 20.00. firms trade using HFT. (Ahlstedt and Villysson, 2012)

Exhibit 3.3.2-1: Significant growth in high-frequency trading (HFT)



Source: TABB Group; BCG analysis

[redacted]

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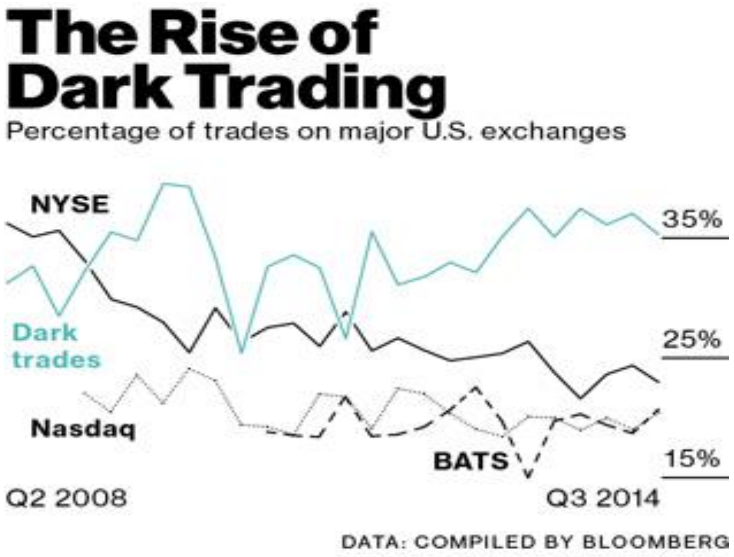
HIGH FREQUENCY TRADING II

The financial sector has developed into a new all-machine phase, characterized by large numbers of sub-second extreme events

Dark Trading: executing orders without providing transparency in advance to the market concerning that specific order

Speed and the quality of access to electronic markets subsequently encourages the further use of algorithms to be able to make automatic decisions quickly

Autonomous Software Agents



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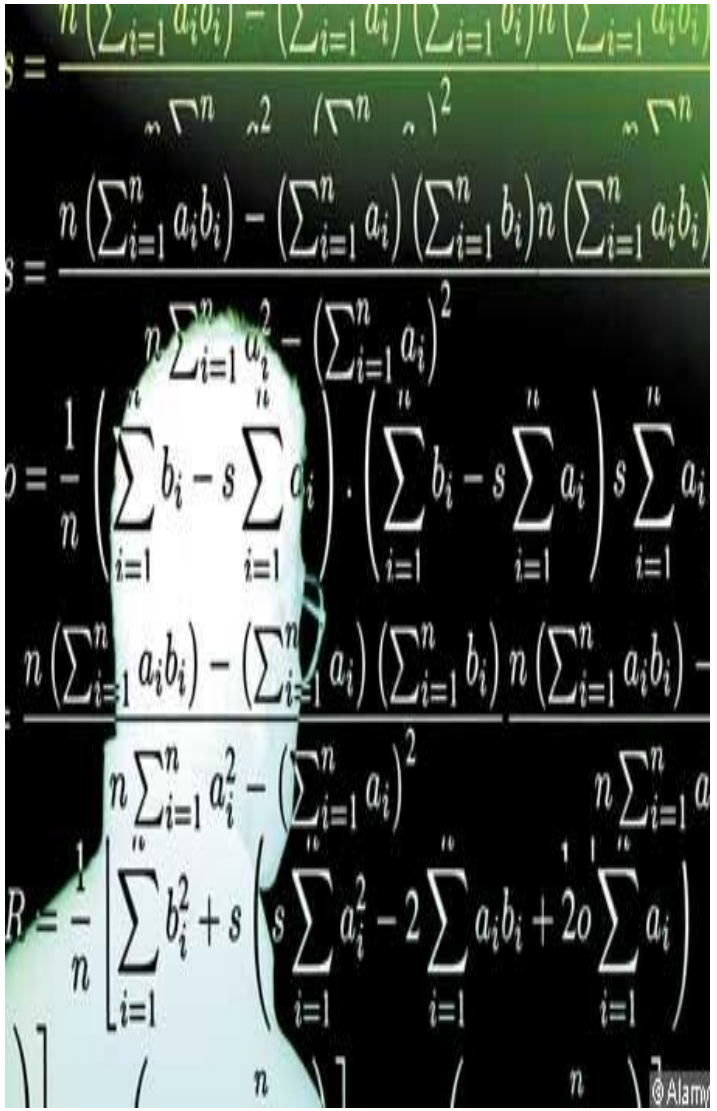
HIGH FREQUENCY TRADING III

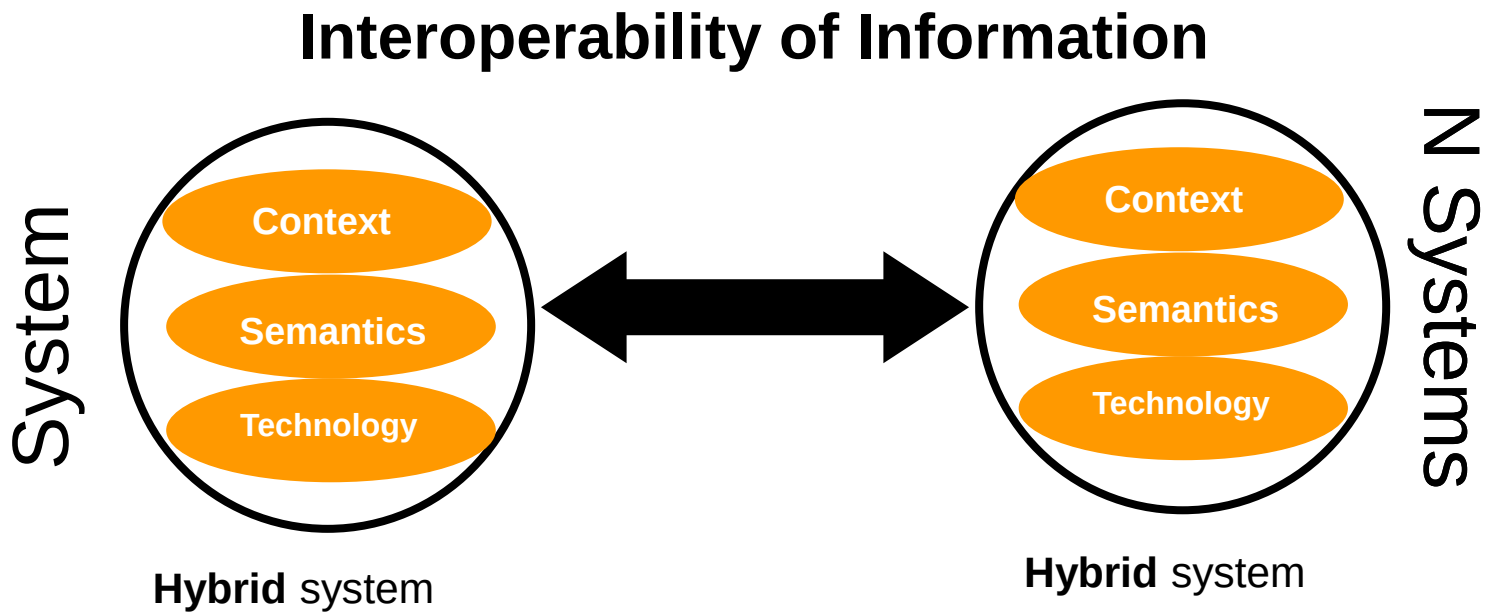
The implications of the coming into being of this global ‘interconnected ultra large scale’ and ‘complex socio-technical’ system such as the financial sector cannot be foreseen at this time, Cliff c.s. (2011-dr-3).

The enormous size and complexity of this socio-technical system-of-systems means that new types of problems or risks can arise at any time and at any place



INTEROPERABILITY OF INFORMATION

SYSTEMS THEORY



"The realisation of mutual relations between two or more systems and entities in order to use these connections to exchange and share information to further develop activities, functionality or production".

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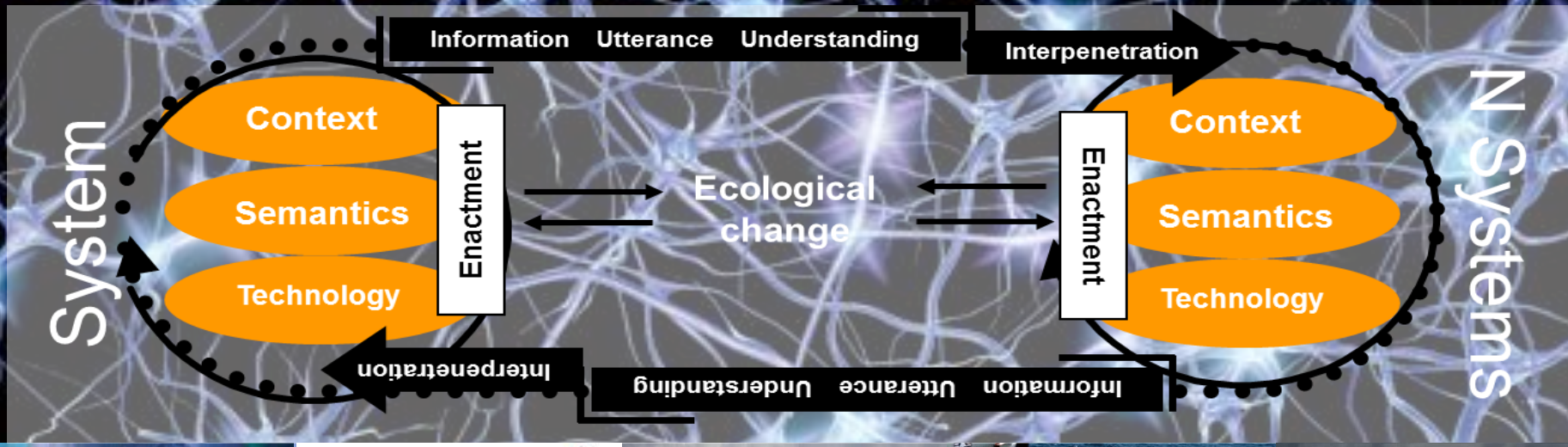
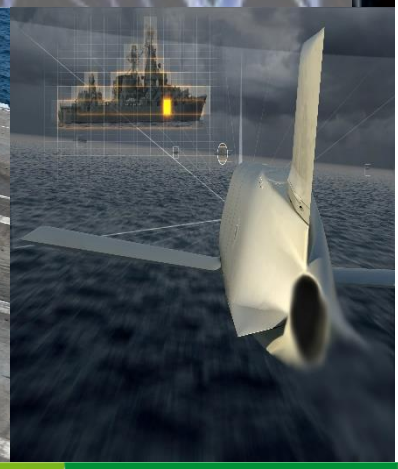
INTEROPERABILITY OF INFORMATION

Enactment i.e. the act of assigning meaning





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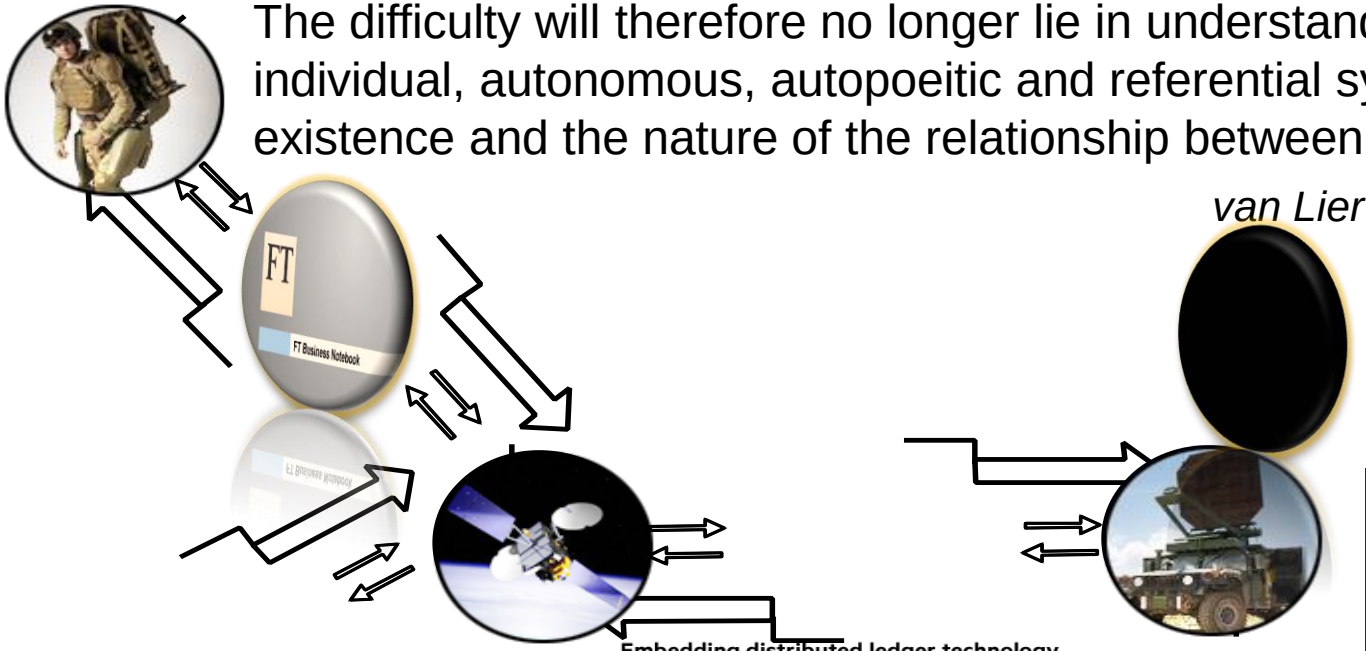
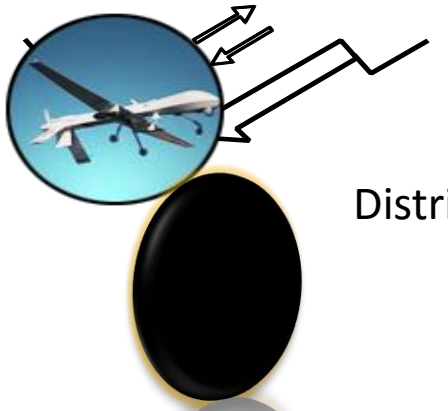
NETWORK-CENTRIC APPROACH

The difficulty will therefore no longer lie in understanding each individual, autonomous, autopoeitic and referential system, but in the existence and the nature of the relationship between these systems

van Lier & Hardjono, 2011

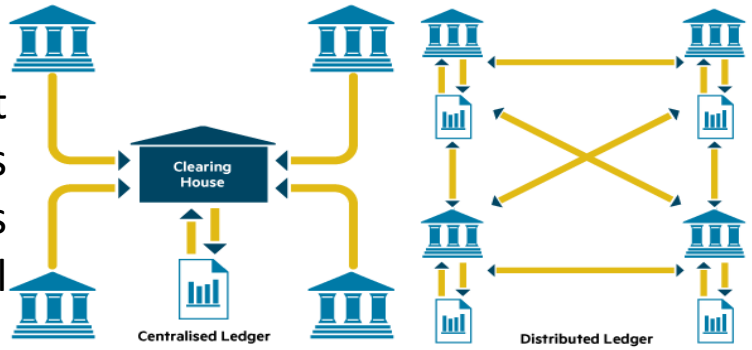




Fault Tolerant
Consensus
Distributed Ledgers
Protocol

Embedding distributed ledger technology

A distributed ledger is a network that records ownership through a shared registry



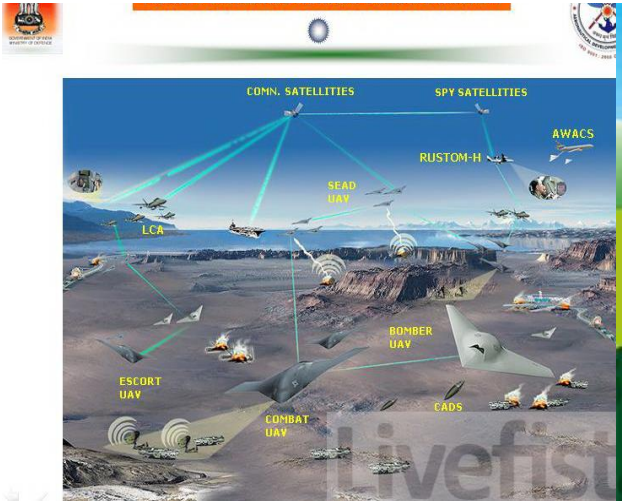
In contrast to today's networks, distributed ledgers eliminate the need for central authorities to certify ownership and clear transactions. They can be open, verifying anonymous actors in the network, or they can be closed and require actors in the network to be already identified. The best known existing use for the distributed ledger is the cryptocurrency Bitcoin

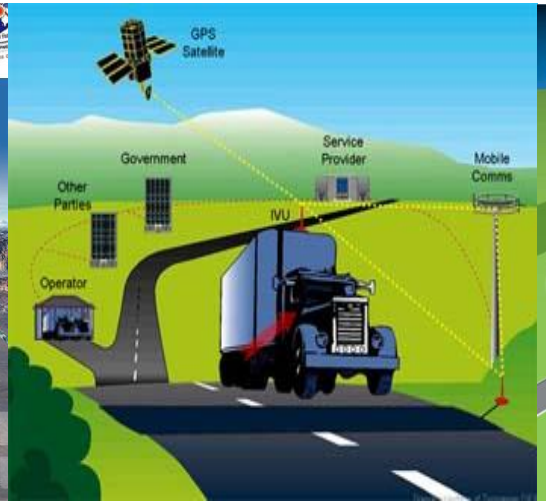
FT graphic. Source: Santander InnoVentures, Oliver Wyman & Anthemis Partners

CYBER PHYSICAL SYSTEMS OF SYSTEMS

The concept of Systems-of-Systems has been developed to characterize large, distributed, systems that consists of interacting and networked, but partially autonomous, elements and can show emergent behaviour.

Trans-Atlantic Research and Education Agenda 2013





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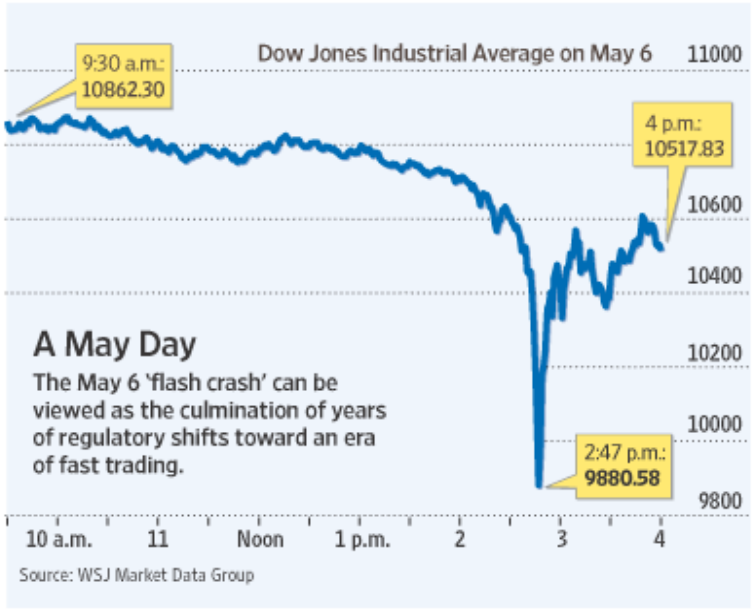
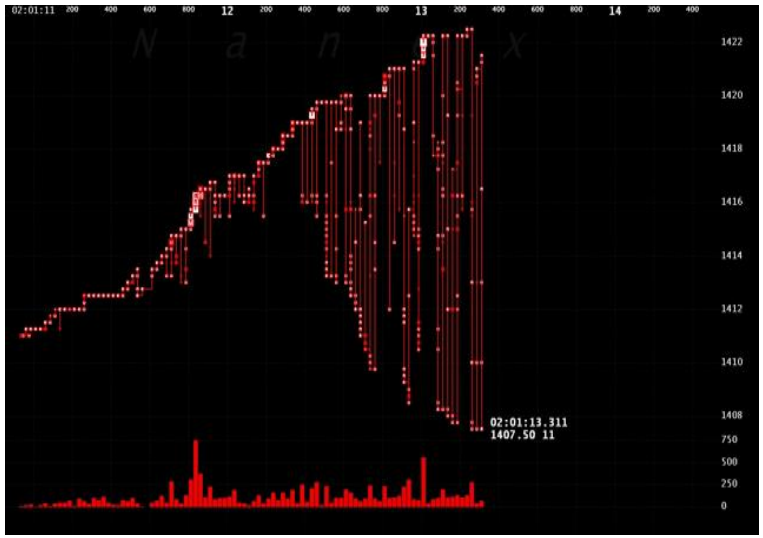
FLASH CRASH I

Performing High Frequency Trading demands the availability of the fastest possible computer systems and connections and these have therefore become essential in the global trade in financial products.



On, may 6, 2010 in the course of about 30 minutes U.S. stock market indices, stock index futures options, and exchange-traded funds experienced a sudden price drop of more than 5 percent, followed by a rapid rebound. (Kirilenko, c.s.,2011)



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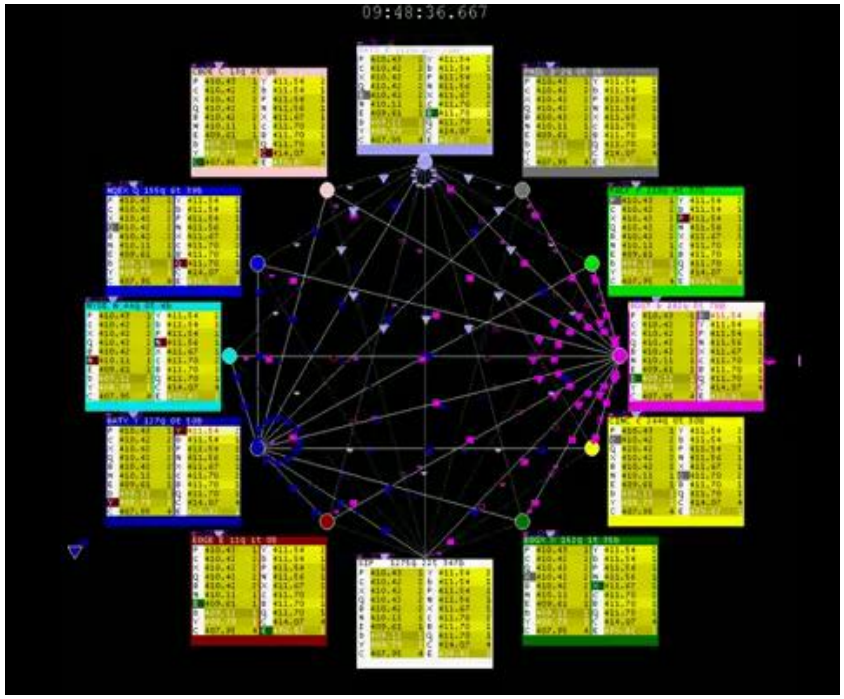
FLASH CRASH II

Complexity is shaped by the ever larger number of places where trade is performed, including in the US at least 13 stock exchanges, at least 40 dark pools and an innumerable number of trade activities performed by internal traders employed at banks and institutional investors.

These 'agents' create an increasing number of mutual transactions and from this ever increasing quantity arise new and as yet unknown characteristics which we have never experienced before



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COMPLEXITY

Roughly, by a complex system I mean one made up of a large number of parts that interact in a nonsimple way. In such systems, the whole is more than the sum of the parts, not in an ultimate, metaphysical sense, but in the importance pragmatic sense that, given the properties of the parts and the laws of their interaction, it is not a trivial matter to infer the properties of the whole

(Simon H. A.,1969)

Because complexity results from the interaction between the components of a system, complexity is manifested at the level of the system itself. There is neither something at al level below (co-source), not at a level above (a meta descritpion) capable of of capturing the essence of complexity. *(Cilliers, 1998)*

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SELF-ORGANIZATION

This refers to the system that starts with its parts separate (so that the behavior of each is independent of the others state) and whose parts then act so that they change towards forming connections of some type

Ashby W.R. 1962 pp. 266

Self-organization may be defined as a spontaneous (i.e. not steered or directed by an external system) process of organization i.e of the development of an organized structure. *Heylighen F. 1989*

We proposed that self-organizing systems, rather than a type of systems, are a perspective for studying, understanding, designing, controlling and building systems.

Gershenson C. and Heylighen F. 2003

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EMERGENT PROPERTIES

You cannot sum up the behavior of the whole from the isolated parts, and you have to take into account the relations between the various subordinate systems which are super-ordinated to them in order to understand the behavior of the parts. B*ertalanffy von L. 1969*

Weak emergence attributes the apparent underivability of emergent phenomena to the complex consequences of myriad non-linear and context dependent micro-level interactions. *Bedau M. 2008*

One of the new characteristics of organised complexity which we still need to learn to understand is the so-called emergent properties arising from this complexity. *Lier van B. 2015*

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QUESTIONS?

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December 1, 2016

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