

# Modelling Sustainable Systems and Semantic Web

## Data and Information

Lecture in the Module 10-202-2309  
for Master Computer Science

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# The Internet as a World of Fictions

## Data and information – a first approximation

Bit streams and **data packets**.

- ▶ There are no bit streams on the "Internet", but rather data packets that are sent and received at the devices. Data packets are generated and transformed back again from bit streams at the 4 lower levels of the OSI stack.
- ▶ Fiction of the universally networked end devices and reality of the net failures.

The mouse phenomenon

- ▶ Tools and their use. The spoon.
- ▶ Fictions in everyday life. Discussion.

# The Internet as a World of Fictions

## The Notion of Fiction

**Fiction** as socially supported, guaranteed and sustained *consensus* on a *shortened way of speaking* about a *social normality*.

- ▶ Fictions are a specific way of dealing with a increasing complexity of the world.
- ▶ Fictions in this sense are not a new phenomenon.
- ▶ Fictions and Myths
  - ▶ A *myth* in its original meaning is a story. The religious myth links human existence with the world of gods or ghosts. Myths demand to be valid for the truth they claim. ... The ensemble of all myths of a nation, a culture, a religion is called *mythology*. (Wikipedia)

# The Internet as a World of Fictions

## Complexity and Clock Frequencies in a Society

- ▶ A clock (or timing) is used to impress a periodicity to a sequence or to synchronise processes. The system clock in a computer determines the working speed of many components. (Wikipedia)
- ▶ Timing is also essential for the coordination and synchronization of social activities.
- ▶ Development of complexity and clock rates of computer chips see <https://arxiv.org/pdf/1803.00254.pdf>
- ▶ Moore's Law (1965) states that complexity of integrated circuits with minimal component costs doubles on a regular basis. Depending on the source, the period is 12 to 24 months.
- ▶ But the „human clock rate“ does not change ...

# The Internet as a World of Fictions

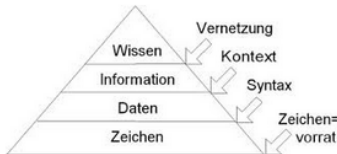
## Fiction of the universal end-to-end connection and its realization as a scale-free network

- ▶  $v(k) = c \cdot k^{-a}$  – proportion of nodes with  $k$  neighbors ( $v$  as valence).
- ▶ Example with  $a = 3$ :  $v(1) = 0.832$ ,  $v(2) = 0.104$ ,  $v(3) = 0.031$ ,  $v(4) = 0.013$ ,  $v(5) = 0.007$ ,  $v(6) = 0.004$ , ...
- ▶ Compared to a random network (another model!) the proportion of nodes with many connections (hubs) decreases slower.
- ▶ How quickly does the graph break down into several subgraphs if nodes are removed?
- ▶ Scale-free networks are robust against the failure of a larger number of randomly selected nodes, but not against failure of a small number of hubs.
- ▶ Robustness: Each node is embedded in a local socio-technical infrastructure, which takes care of its operation, maintains the "social normality" and thus reproduces the "fiction".

# Data and Information



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## Wissenspyramide



## Syntax, Semantics, Pragmatics

### Data and Information. A first definition

*Information = interpreted data*

*Data = formalized information*

Both (formalization and interpretation) are only "valid" in a special natural, technical or social *embedding* – a *context* (or pragmatics) – and thus assume a "working fiction".

Compare this also with the concert example in the first lecture.

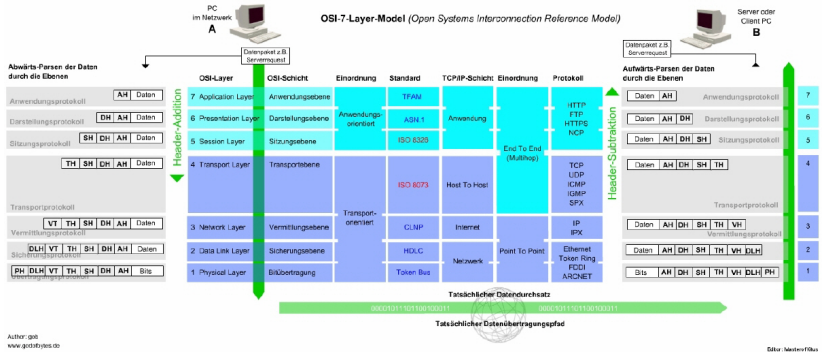
## Syntax, Semantics, Pragmatics in the OSI layer model

We consider such a *pragmatically* contextualized interplay of (formalized) *syntax* and (formalized) *semantics* on different levels at the example of the OSI stack.

- ▶ Each layer is based on a fiction (i.e., social normality) and its language representation given as formalized syntax.
- ▶ This formalized syntax was practically produced on the previous layer.
- ▶ On this basis a further pragmatics is realised through language constructions as special way of speaking (semantics).
- ▶ This special way of speaking in turn is formalized for use on the next layer.



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Source: Wikipedia,  
<http://prima-it.de/images/osi7layermodell.jpg>

# Data and Information

## Syntax, Semantics, Pragmatics in the OSI layer model

*Explanation of this idea:*

Layer 1:

- ▶ Syntax = modulated waves,
- ▶ Semantics = bit sequences (first fiction),
- ▶ Pragmatics = diversity of transmission media

Layer 2:

- ▶ Syntax = bit sequences,
- ▶ Semantics = frames (second fiction),
- ▶ Pragmatics = control of the transmission speed of the bit sequences, addition of checksums for error detection

## Syntax, Semantics, Pragmatics in the OSI layer model

Layer 3:

- ▶ Syntax = frames,
- ▶ Semantics = data packets (third fiction),
- ▶ Pragmatics = routing and organization of forwarding of packets across multiple nodes

Etc.