AV Lecture in Summer Term 2018

Dr.-Ing. Alexander **Willner**

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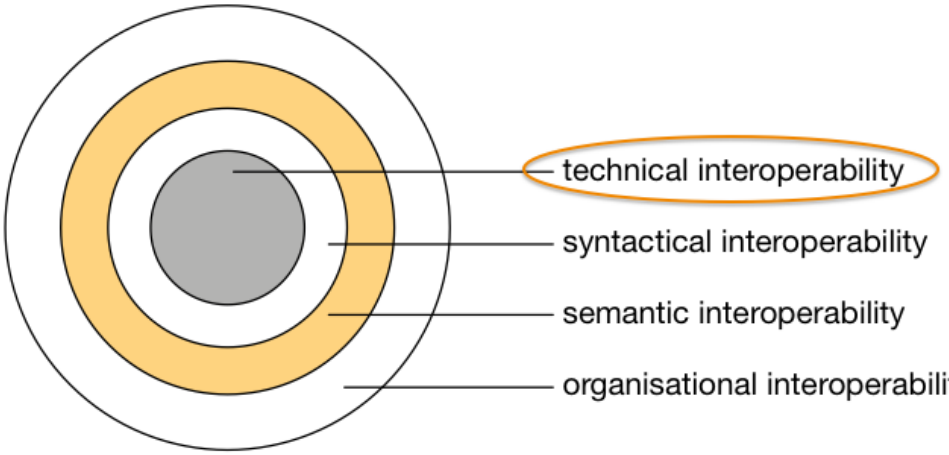
THE LAST LECTURE

5 minutes

- This lecture is divided into 4 different areas
- We talked about the second part

DIFFERENT LEVELS OF INTEROPERABILITY



ETSI White Paper: Achieving technical interop.

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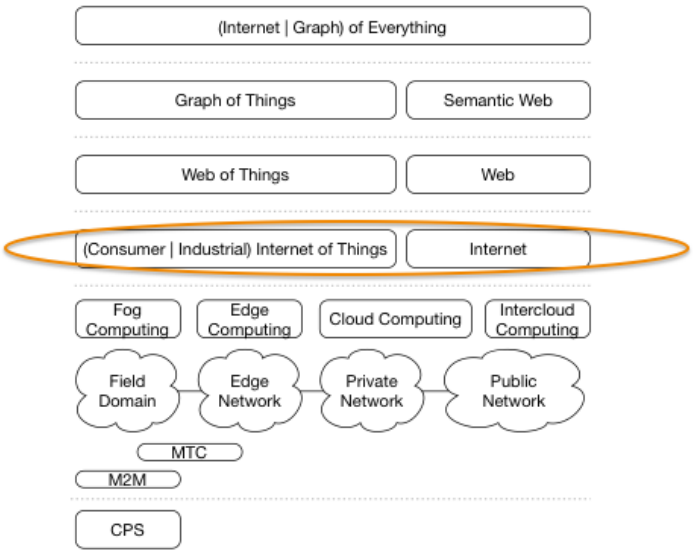
INDUSTRIAL INTERNET OF THINGS



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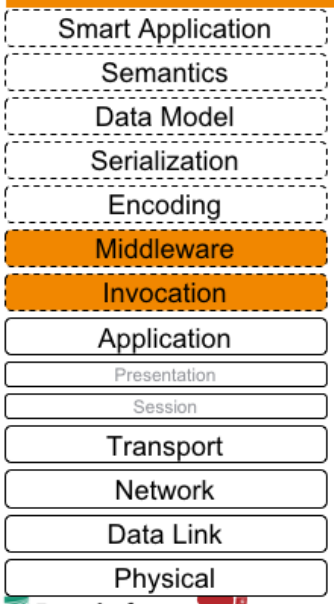
OPEN PLATFORM COMMUNICATIONS UNIFIED ARCHITECTURE



OPC UA API

Binary, XML RPC

HTTP, AMQP, Proprietary

TCP

IP

OPC UA

Background: Automation.
Application: Vertical.

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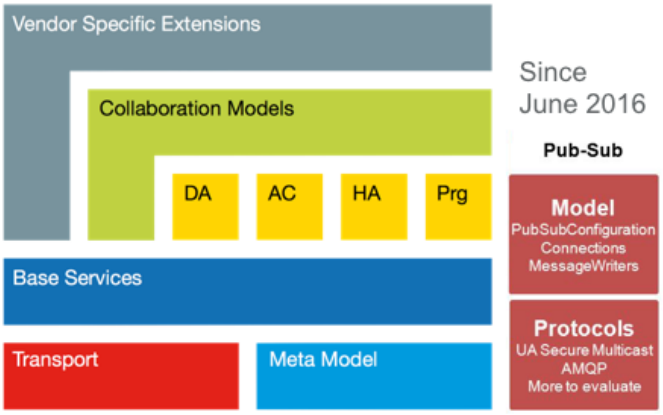
OPC UA LAYER MODEL



Since June 2016

Pub-Sub

Model
PubSubConfiguration
Connections
MessageWriters

Protocols
UA Secure Multicast
AMQP
More to evaluate

Collaboration Models / Companion Models: domain expert models

Meta Model: generic object model

Transport: SOAP or TCP

Base Service: query, subscribe, method invocation, …

DA: Data Access

HA: Historical Access

AC: Alarms and Conditions

Prg: Program

OPC Foundation

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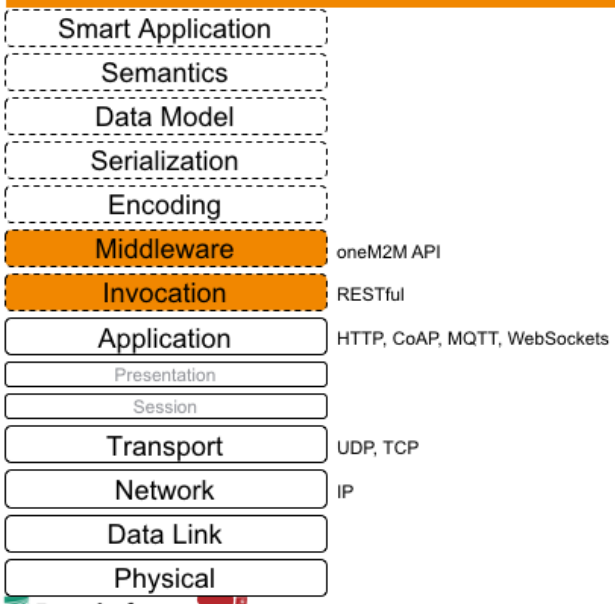
ONEM2M



Background: Telecom.
Application: Horizontal.

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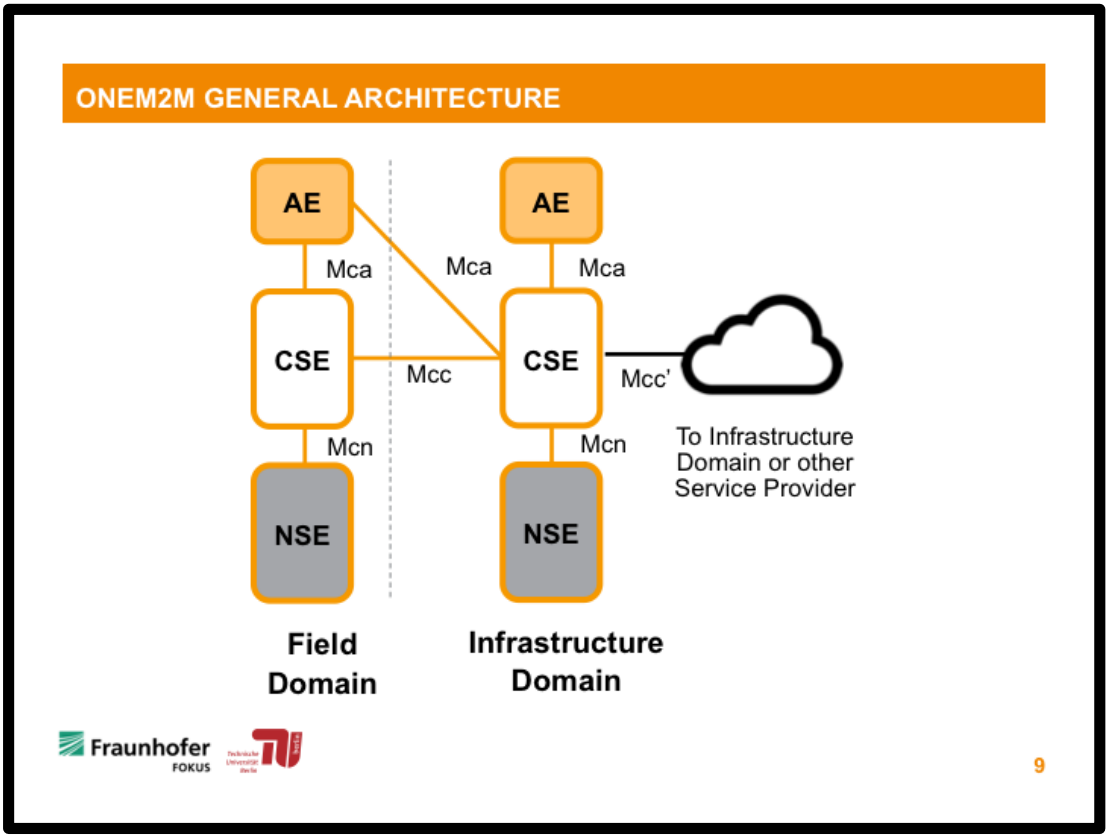
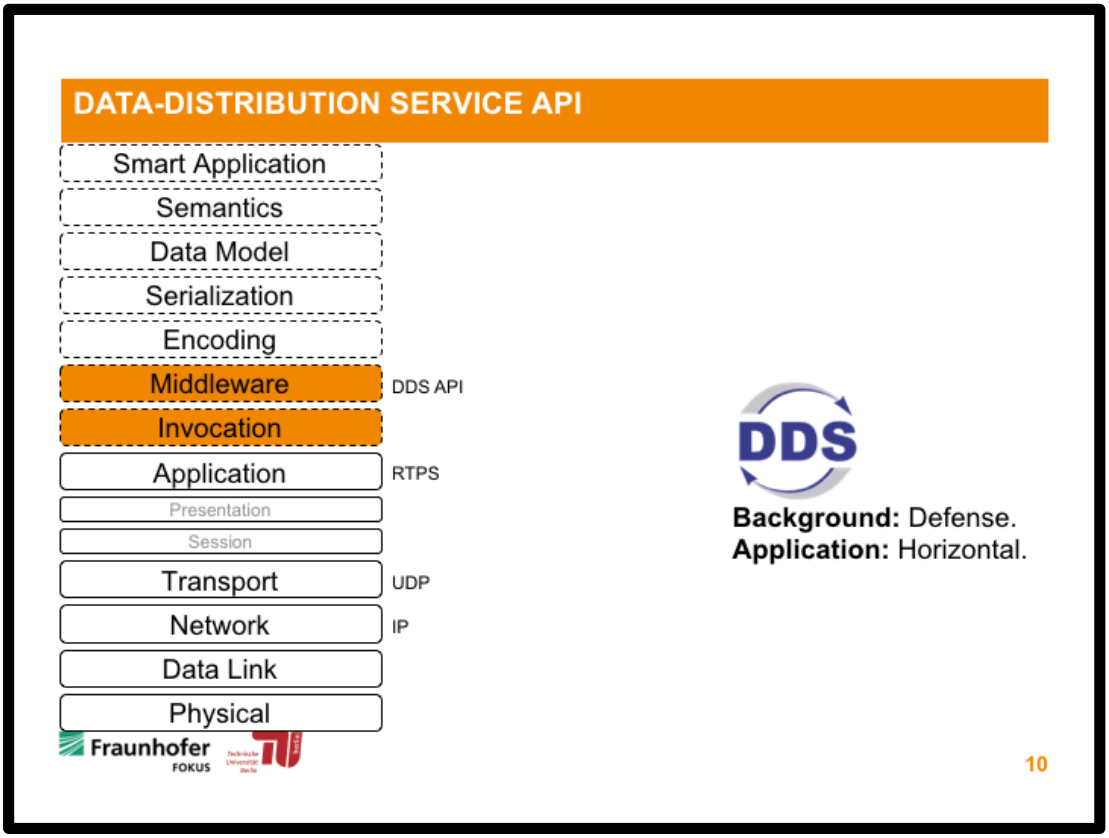
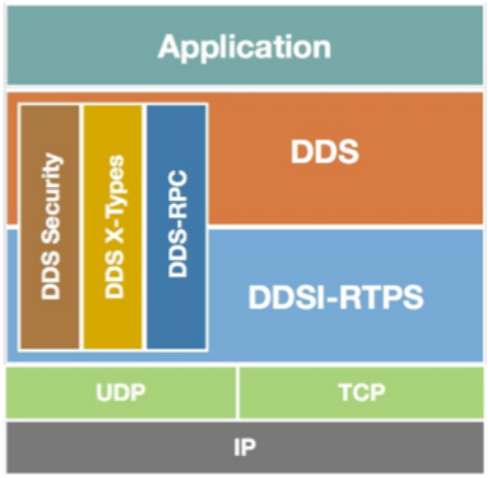


- Three horizontal layers (AE, CSE, NSE)
  - AE -> applications
  - CSE -> middleware
  - NSE -> other service
- Two vertical domains (Field, Infrastructure)
  - Infrastructure -> management
  - Field -> shop floor, devices
- Three different interface (Mca, Mcc, Mcn)
  - Mca -> AE to CSE
  - Mcc -> CSE to CSE
  - Mcn -> CSE to NSE
- One Network per Service Provider



- Real-Time Publish-Subscribe (RTPS) Wire Protocol

DDS STANDARD STRUCTURE



Prism Tech

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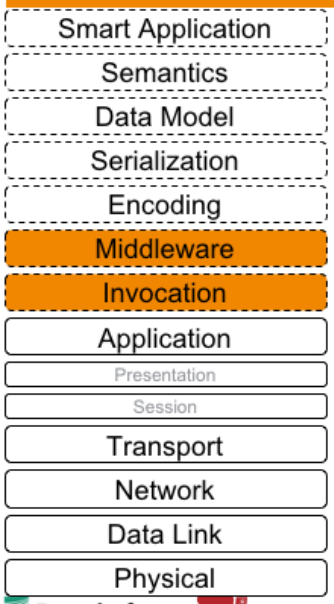
W3C WEB OF THINGS (WOT)



Background: lack of interoperability across platforms

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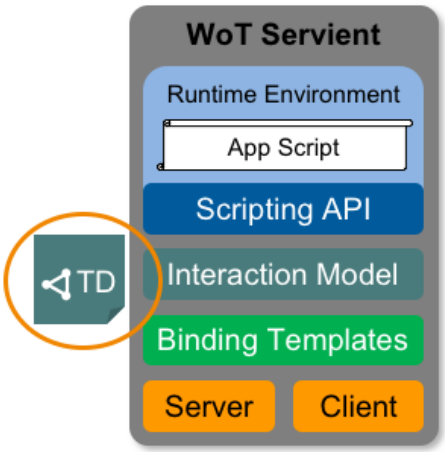
W3C WOT BUILDING BLOCKS



Based on W3C WoT Intro slides

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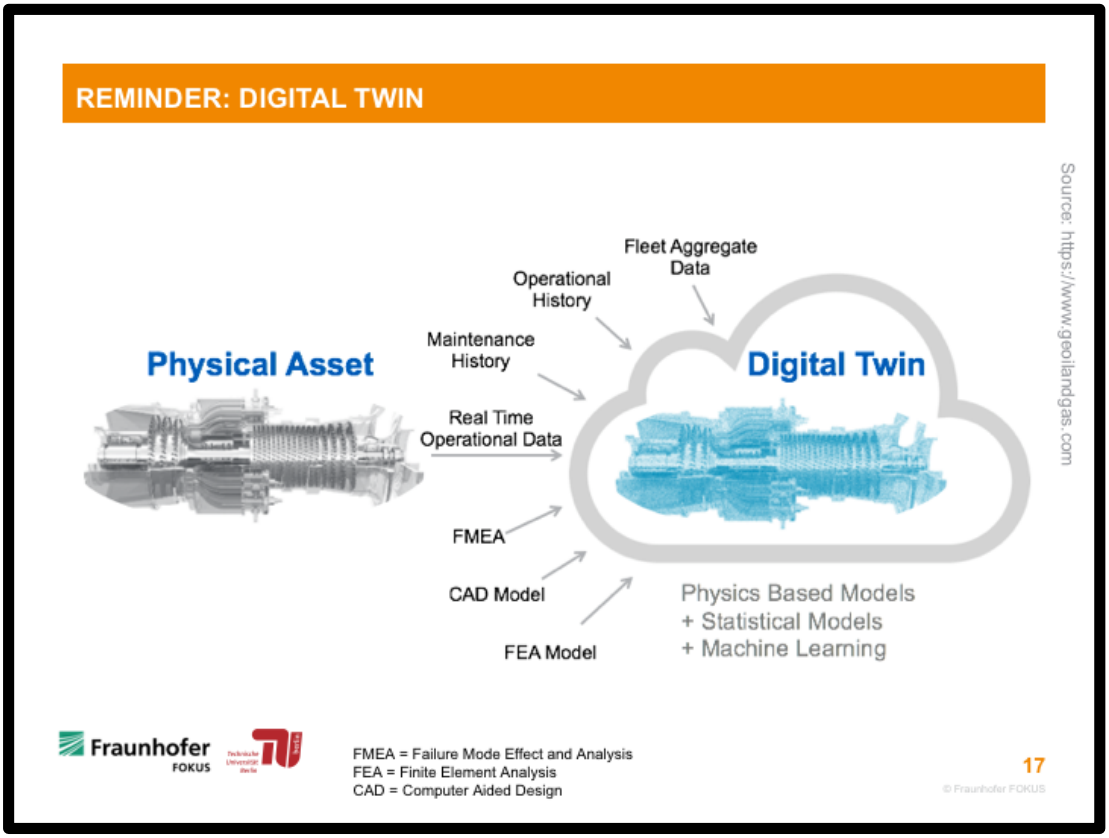
THE LAST LECTURE

Questions?

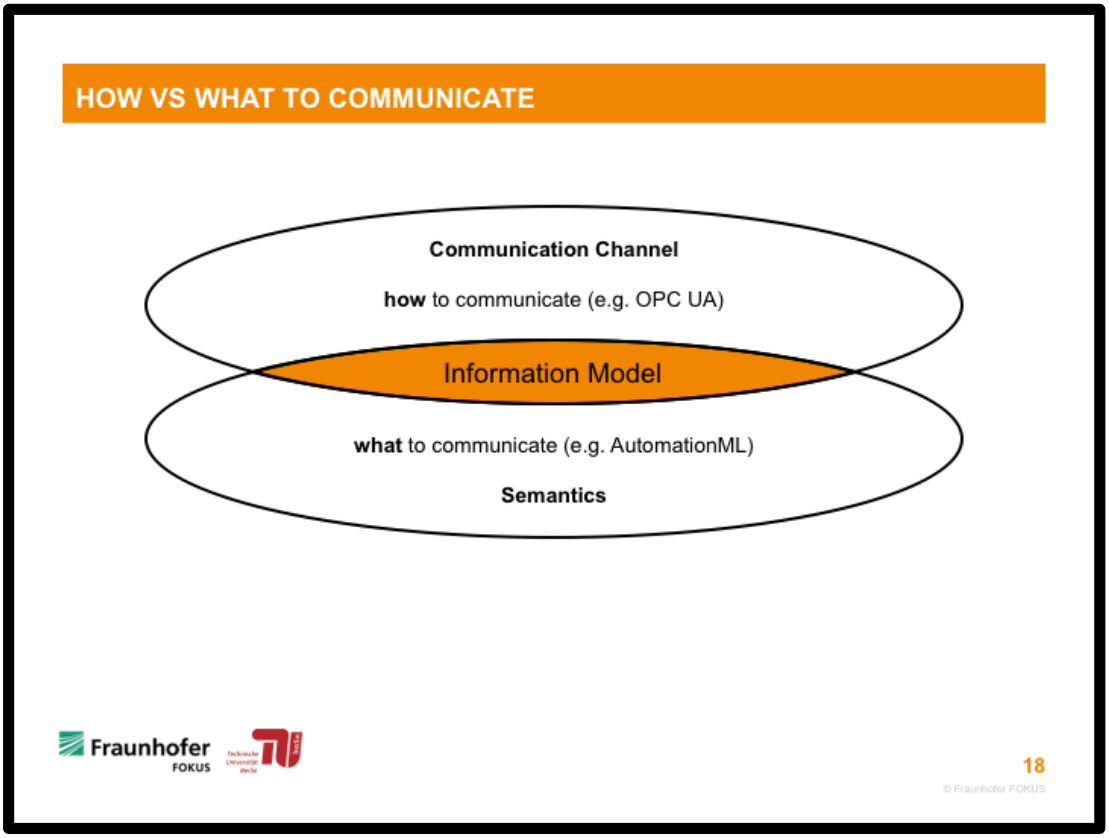
PLAN FOR TODAY

5 minutes

- This lecture is divided into 4 different areas
- We now talk about the third part
- Note that we changed the order

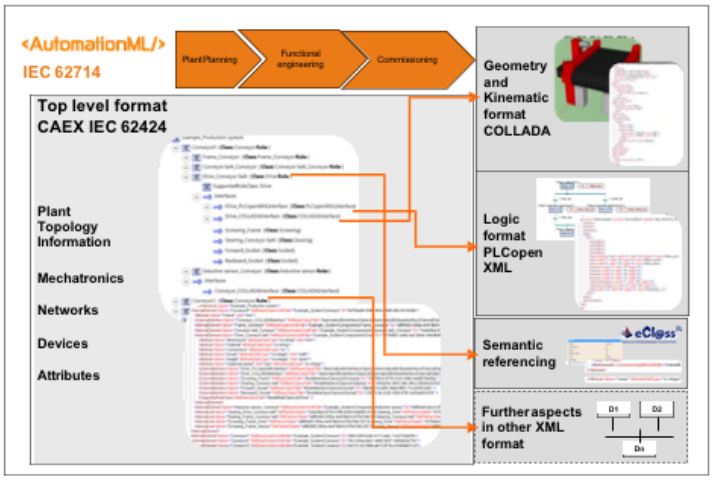


- Concept for initial simulation
- Augmented by further static and dynamic information



- OPC UA specifies HOW to communicate.
- AutomationML specifies WHAT

REMINDER: AUTOMATION ML IN OPC UA AS DIGITAL TWIN?



https://www.automationml.org

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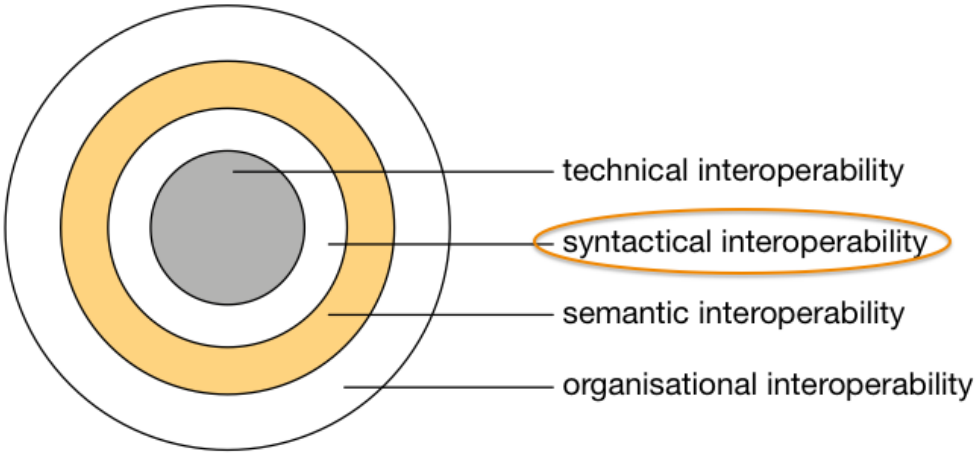
DIFFERENT LEVELS OF INTEROPERABILITY



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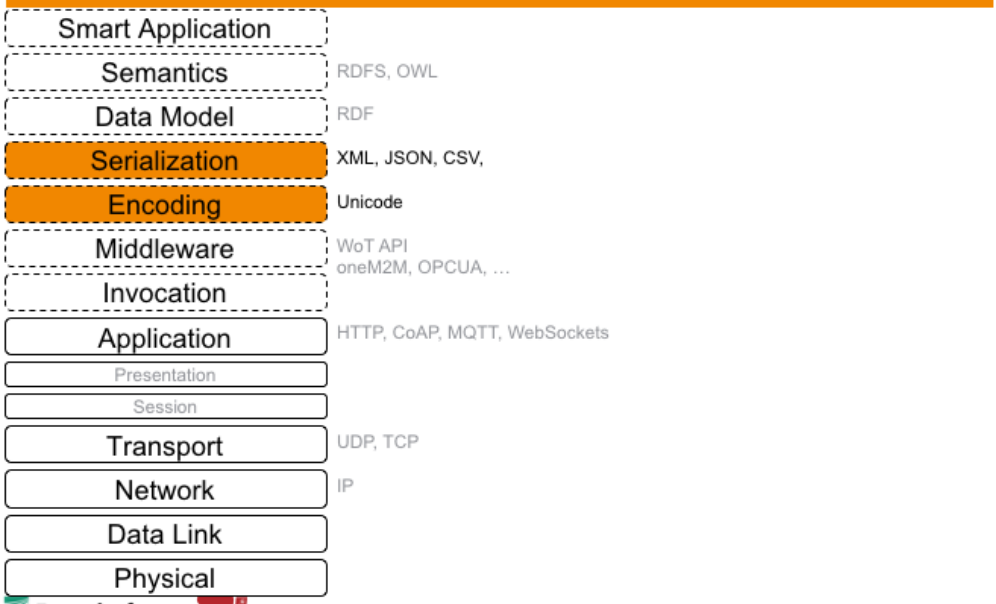
SYNTAX



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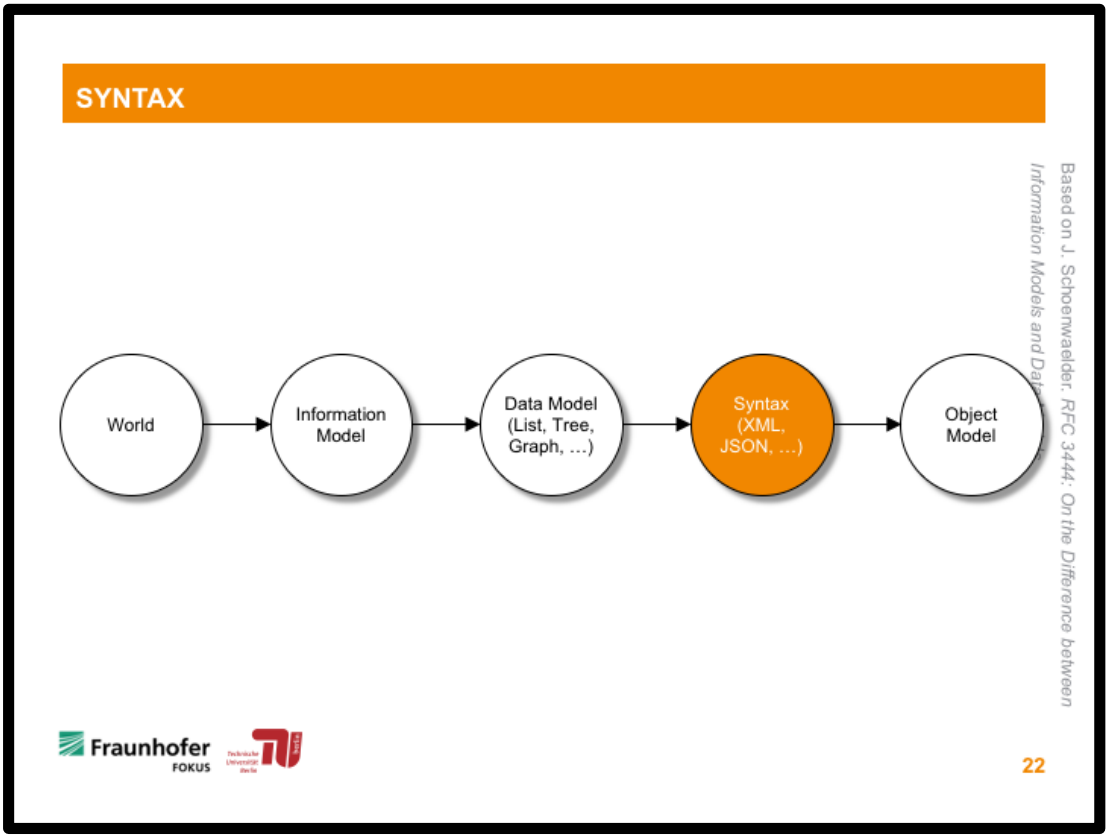
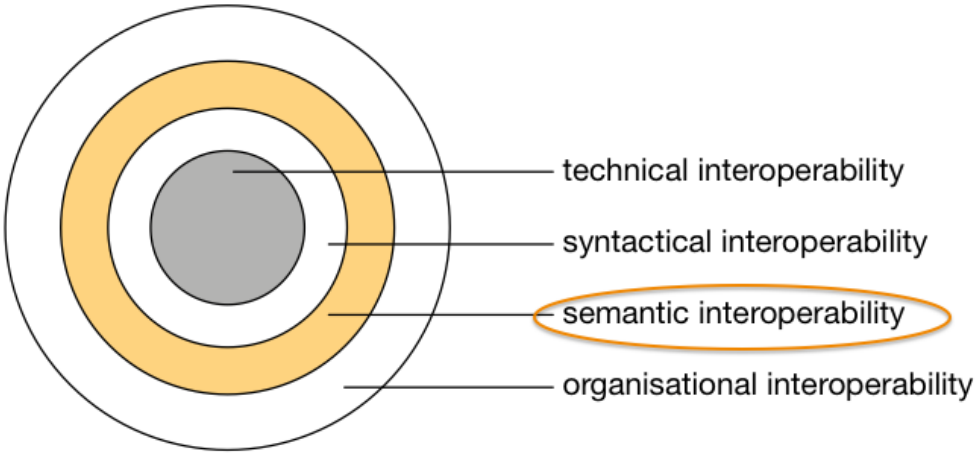


- Data modeling in computer science
  - World: the “thing" in real life
  - IM: abstract description (e.g. a word document)
  - DM: data structure (e.g. a tree following XML Schema)
  - Syntax: serialization (e.g. a XML document)
  - OM: using the data in code (e.g. using JAXB)
- Structure based semantics → meaning of data depending on their position in a model
- XML, JSON, YAML, … all are serializations of a tree
- Example for the serialization of a list? → Comma Separated Values (CSV)

DIFFERENT LEVELS OF INTEROPERABILITY



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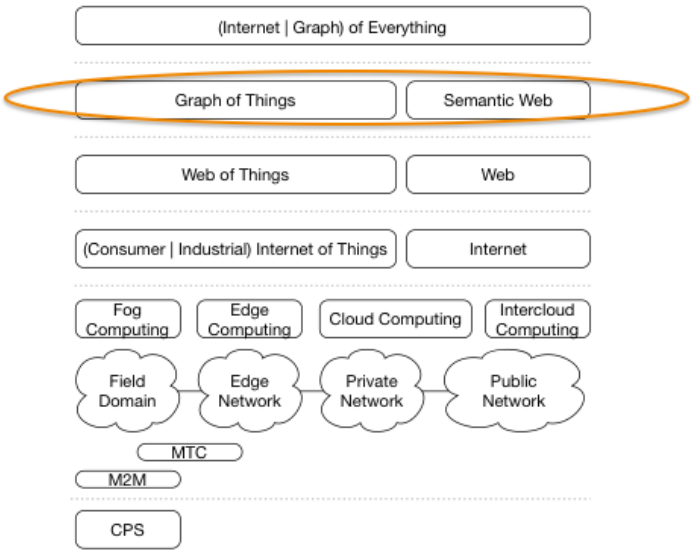
GRAPH OF THINGS



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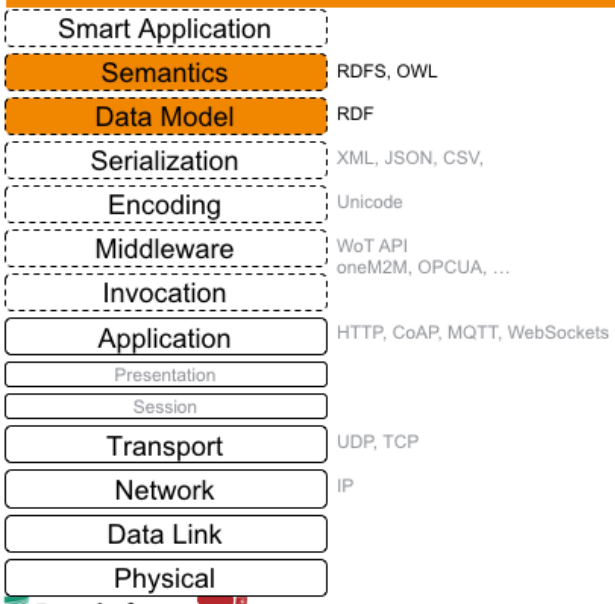
SEMANTICS



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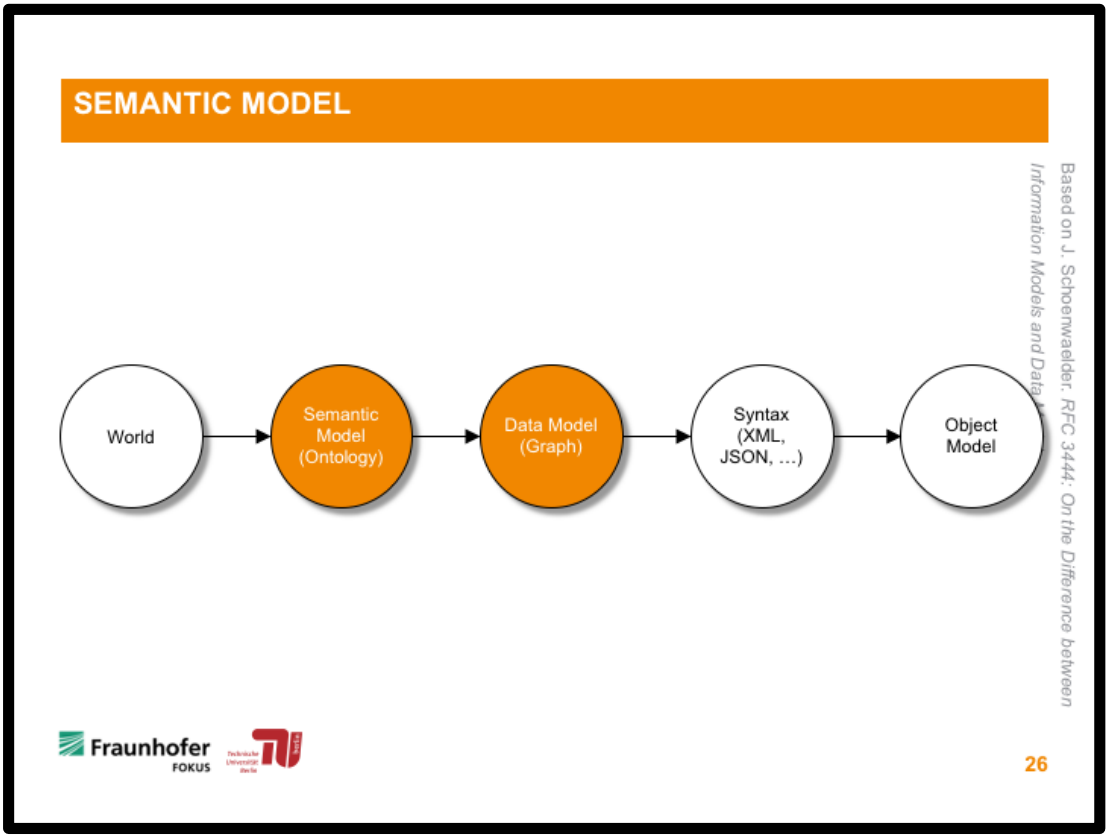
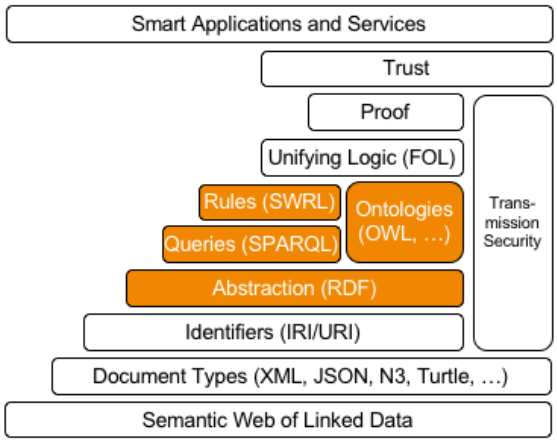


- To formally describe knowledge, we‘ve to focus on higher layers
- Approach: formal description of an information model (aka ontolgy) and using a linked graph data structure to store it

MODIFIED SEMANTIC WEB LAYER CAKE



Based on https://medium.com/openlink-software-blog/6ba5c6ac3fab

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- The exciting technology stack behind it
- Resource Description Framework (RDF) -> graph-based data model (remember: subject-predicate-object)
- Web Ontology Language (OWL) -> formal information model
- Semantic Web Rule Language (SWRL) -> rules to extract implizit knowledge

5 STAR LINKED OPEN DATA

T. Lee, Linked Data

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PLAN FOR THE NEXT STEPS

Questions?

SHORT MOTIVATION

4 minutes

NEW LANGUAGE FOR MACHINES (1 MIN)

https://youtu.be/OvfU1NpCJQQ

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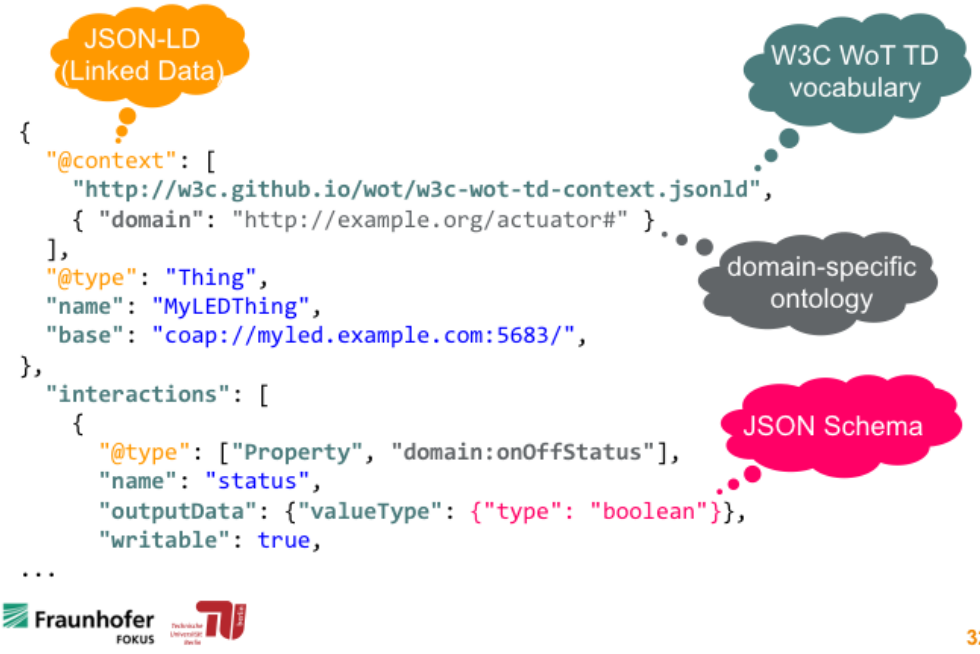
WEB OF THINGS THINGS DESCRIPTION EXAMPLE

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W3C WoT slides

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