



# Web of Things: HTML to Semantics towards Al

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- Context Web of Things Perspective of :
  - Co-editor of the Joint Standard of W3C and OGC, The Semantic Sensor Network
  - Co-chair of Semantic and Linked Data Task Force, W3C Web of Things Interest Group
- Agenda
  - > The Web Programming Paradigm for Things
  - > W3C Thing Description for Bootstrapping Semantics
  - > Towards AI Integration guided by "Anchored Semantics"



Source: https://www.w3.org/TR/wot-architecture/



## The Same Web Programing Paradigm





Source: https://www.w3.org/TR/wot-architecture/

## Thing Description and IoT Schema.org





Source: https://w3c.github.io/wot-thing-description/

Furonean Commission

Canonical URL: http://iotschema.org/Temperature

InteractionPattern > Property > Temperature

Canonical URL: http://iotschema.org/SetTargetTemperature

InteractionPattern > Action > ChangePropertyAction > SetTargetTemperature

Specification of an action acting on some property of type TargetTemperature.

#### Taxonomy of Semantic Concepts







## A Web Mashup of Near-Realtime Web of Things



#### http://graphofthings.org/: integrating >200K live sensor sources as a simple web mashup



Danh L.P. et al. The Graph of Things: A step towards the Live Knowledge Graph of connected things. J. Web Semantics 2016



Source: https://neo4j.com/whitepapers/internet-of-things-graph-databases/



### Towards AI Integration driven by Semantic Graphs





Source: https://www.amazingbyte.com/artificial-intelligence-the-new-future-technology/





- Anchored Semantics for parameterizing AI features
  - > Unified Data model in RDF/JSON-LD for semantic interoperability
  - > Semantic-driven sensor/data fusion via logic and statistical reasoners
  - Interlinking Enterprise Knowledge Graphs to IoT applications
- From Academia to Adoptions and Standardizations
  - > W3C/OGC Semantic Sensor Network, JSON-LD 1.1, etc
  - Industry adoption of Thing Description and W3C Web of Things: Siemens, Intel, Oracle, Fujitsu, etc
  - > More Semantic-driven IoT Standards in W3C, OneM2M and ETSI, etc
- Tool Chains for Integration of Symbolic and Statistic AI
  - Javascript: RDFJS, SPARQL.JS, Graphql JS, TensorFlow.js and DeepLearning4J+GraalVM(Java to JS using Polyglot VM), etc
  - RDF and reasoners, Machine learning for edge devices: TensorFlow Mobile, RDF4LED (30 million RDF triples for Raspberry Zero), etc
  - $\succ$  Conversational AI  $\rightarrow$  Semantic-driven Chatbots





The Third Wave of AI, Source: DARPA, https://youtu.be/-O01G3tSYpU

More Updates at The 8th International Conference on the Internet of Things (IoT 2018), from October 15–18, 2018 in Santa Barbara, California, USA. http://iot-conference.org/iot2018