

Next Steps for the Web of Things, Part 2: Data Standards Development and Consolidation

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Abstract

In part 1 of our presentation we identified some key problem areas and strategic directions for the Web of Things. In part 2 we will discuss technical planning to support those strategic directions. Discovery, data management, and interoperability have been identified as key challenges. Certain infrastructure components have also been identified as candidates for further standardization. We need a comprehensive technical plan to address these challenges in a coordinated and effective way. Data models and data modelling technologies are key. We suggest extending and unifying web service and thing descriptions and emphasizing W3C semantic standards RDF and JSON-LD 1.1 as key foundational technologies upon which an interoperable IoT data management approach and unified schema can be based.

The IoT Standards Landscape and WoT Extension Points

Figure 1 diagrams how WoT fits into the IoT standards landscape. There are numerous standards for structured data payloads (JSON, CBOR, XML, EXI, etc.) and communication protocols (HTTP, CoAP, DDS, MQTT, etc.). WoT Thing Descriptions cover some of these standards but not all. At the semantic level, there is still no common data model technology for IoT services. WoT Thing Descriptions focus on IoT devices and services, but some IoT services, such as edge computing services, overlap with web services, which currently use a different set of standards (OpenAPI, RAML). Several important WoT infrastructure components, such as discovery services, proxies, and authentication mechanisms, have as yet not been standardized. We have identified a set of gaps in the current WoT standard relating to interaction models, security and privacy, networking, structured data and schema interoperability, edge computing and AI, open data portals, and scripting. These are all potential “extension points”.

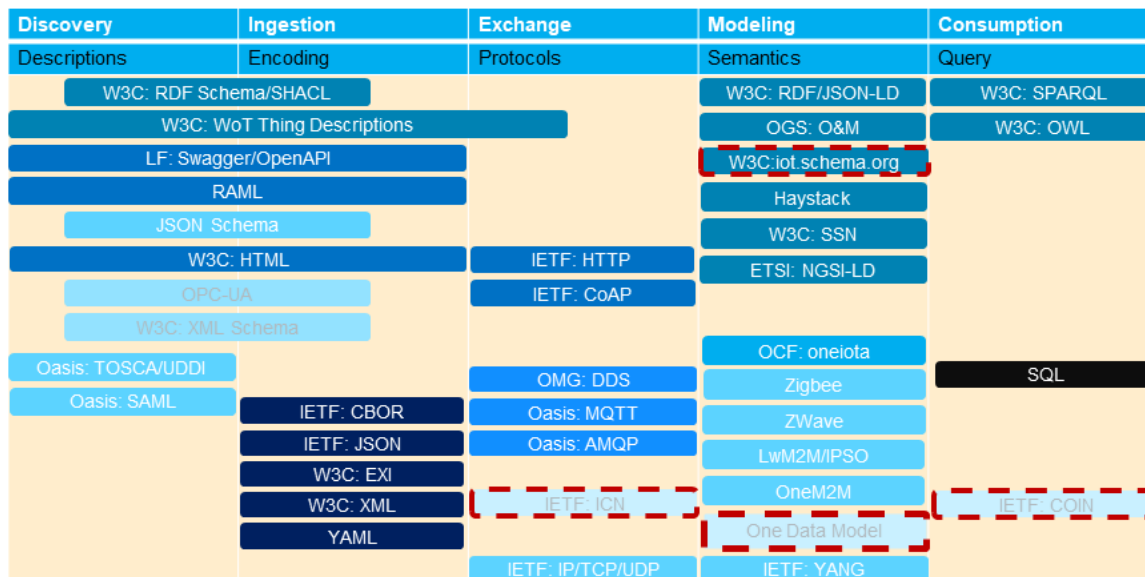


Figure 1 Current IoT standards landscape, with a focus on data and metadata.

Standards Consolidation

Figure 2 outlines one possible future IoT standards consolidation, focusing on the key challenge of data models and semantic interoperability. This standards consolidation scenario would be the end point of a path that uses RDF-based data models as a rallying point. Here we assume that a single IoT data model can be achieved for all structured data formats, that these data formats can be extended to support linked data semantics, and that we can converge on a common set of data models for IoT devices supported by a common IoT schema and set of data modelling technologies. We need to consider the concrete steps that can be taken within W3C specifically to achieve this end state and within other standards organizations.

We have developed and intend to present a detailed plan for how this consolidated end state can be achieved, but it requires coordinated and sustained effort across multiple standards bodies.

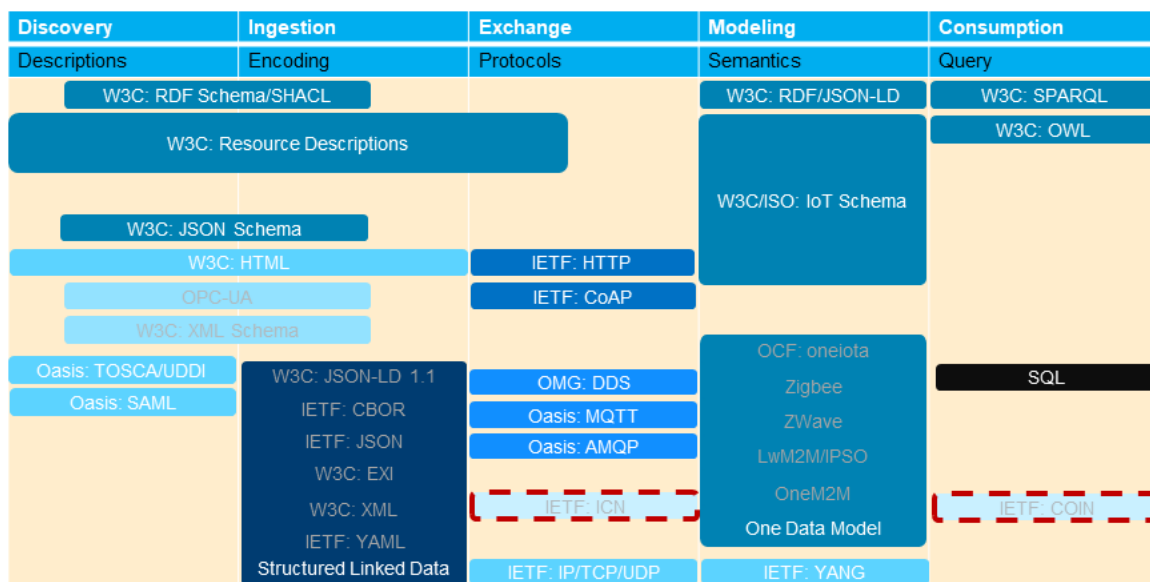


Figure 2 A possible future consolidated standards landscape.

Conclusion

For the WoT to achieve its potential several gaps need to be addressed. Exactly which gaps we prioritize will depend on the target market we decide to address first. However, interoperability is a key problem in nearly every IoT market. Currently there are far too many competing standards, leading to a confusing and inefficient marketplace. Addressing this important problem will require coordinated effort across multiple standards bodies over an extended period. The WoT and other W3C standards, such as RDF and JSON-LD, can play a pivotal role in this consolidation.

During the workshop, we intend to overview the standards landscape with the goal of formulating an action plan to achieve the necessary standards consolidation.