EcoG GmbH
Gänslerweg 24
82041 Furth / Oberhaching

W www.ecog.io
E info@ecog.io

Position paper

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Dr. Johannes Hund, CTO, EcoG GmbH

Disrupting domains since 1989, the Web now hits EV charging

Since starting out as a linked document store for scientific papers, the Web was not only expanding in size, but also the areas in which the web technologies are used were continuously extending, disrupting the space they are applied. Also in IoT domains, web technologies will become a disrupting game changer.

The Web expands and supersedes domain technology

In the IT world, many applications formally using dedicated protocols and clients are now superseded by the Web. For example, NNTP newsgroups were replaced by forums on websites, for file storage, web pages are used instead of Gopher and FTP. This trend keeps on, a third of all email traffic is done by webmail applications, Desktop applications get replaced by web service offerings or Web technology is used outside of the browser (e.g. mobile webviews, PWAs and Elektron). RESTful APIs have replaced SOAP Webservices and other IT integration technologies. A common observation is that, if not bound by other factors, every new IT software project will by default choose a web frontend as user interface and a REST API as B2B interface.

The IIOT is moving towards domain silos

And the outreach of web technologies will go far beyond IT. In the IoT, especially in the various IIoT domains, we experience a consolidation of “legacy” protocols, such as e.g. ModBus towards domain-specific standards such as OPC UA in the manufacturing industry, IEC 61850 in the smart grid and BACnet in building industry. This way, various domains are forming silos that pose a tremendous challenge for cross-domain interoperability.

Web of things positions itself as a bridge layer between these domains, enabling the

inter-domain as well as IT integration based on web technologies and best practices. Standardized WoT technologies of course also promise a shared benefit in terms of documentation of the principle functionality, tooling and libraries as well as interoperability among all implementors.

We believe that WoT will not only have its place between the domains but will also disrupt the domains from within.

Example Case Study: EV charging domain

Taking OCPP in the EV charging domain as an example, we see that these protocols also affect the innovation within the respective domains. Like most of the aforementioned domain protocols, OCPP is designed for remote monitoring and control of a field device (an EV charge station), using a message-driven architecture. Technically OCPP based on SOAP, and in newer versions it's equivalent — JSON, messages over a websocket. The specification defines messages designed for the specific use-case, state information and metadata are implicit. The charging stations connect to a backend provided by the operator, secured by TLS.

We at EcoG are strong supporters of web technologies and specifically the Web of Things standards. It is my belief that the web technologies will supersede OCPP, if not all domain protocols. The reasons for this are manifold, as described in the following paragraphs.

Nearly all IIoT systems are multi-stakeholder systems. There is rarely one singular responsible owner of the complete system, but many different parties involved in the application and interacting with the system. Usually, remote monitoring and control protocols do not reflect this, as security measures are mostly tailored to secure the connection between device and operation backend, but do not include authorization and authentication of individual interactions by different parties.

In our example of the EV charging domain, parties that can interact with the EV charger include:

- the driver of the EV
- the vehicle owner (e.g. rental service, corporate fleet)
- the charge point operator
- the mobility service provider resp. energy supplier
- the owner of the charger site (e.g. a mall, store, or rental, building)
- the grid operator
- the charger manufacturer
- the vehicle manufacturer

Each of these stakeholders has a different intention and therefore different interactions and data points they need to access. OCPP, like most industrial domain protocols, offers solely “all or nothing” access for a single backend (usually the charge point operator). Web-grade security, on the other hand, allows a fine-grained authorization of interactions for individual stakeholders.

Besides the system operation, integration into various IT systems is necessary. This can range from authentication and authorization of charger users using single-sign-on systems (e.g. OIDC or SAML) to accounting, billing and payment or scheduling/data services which require integration to maps or calendars. As mentioned before, REST APIs are the “lingua franca” of IT integration, making integration with Web technologies seamlessly possible, while integration with OCCP is only possible via intermediaries and proprietary protocol translations.

Another important aspect is the in-field integration and interaction of devices, e.g. integration of the charging station with parking sensors, cashier/POS systems, the vehicle’s IVI or the user’s mobile. This kind of local integration is not possible with systems designed only for a single interface to the backend and is a key feature of web-based systems.

Fog-computing (a.k.a. Edge processing) plays an important role in IIoT, especially in field installations with poor or intermittent internet connectivity, as e.g. often found in EV charging. This enables an evolutionary leap just like Client-side javascript brought to web applications. Standardized scripting APIs and sandboxed runtime environments like e.g. web browsers or Web Assembly on IIoT devices unlock the potential of Javascript developers (where Stack overflow studies reveal that 75% of all developers are javascript developers) to rapidly create applications for the devices. This enables addressing the long-tail market, the sum of niches (comparable to the app economy on mobile phones).

WoT will grow from cross-domain boundaries into the domains

As mentioned in the paragraphs before, several aspects within an industrial domain are not addressed by the domain protocol silos but are elegantly solved with web technologies. This situation is amplified even more when the applications require interactions across domains. The seamless adaption of different domain protocols using the web of things can be the tipping stone for the adoption of web technology not only at domain-borders but also inside the bridged domains.

These factors make Web technology in general, and specifically, the Web of Things approach a promising strategic decision across and inside all IoT domains.