STRATEGIES FOR DATA-DRIVEN DIGITAL TRANS-FORMATION IN THE PLANT

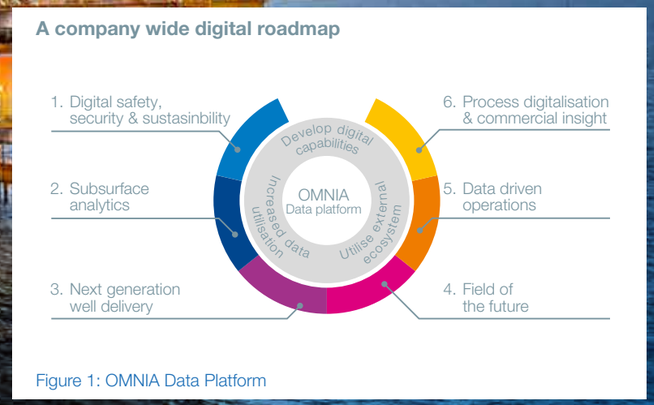

Figure 1: OMNIA Data Platform

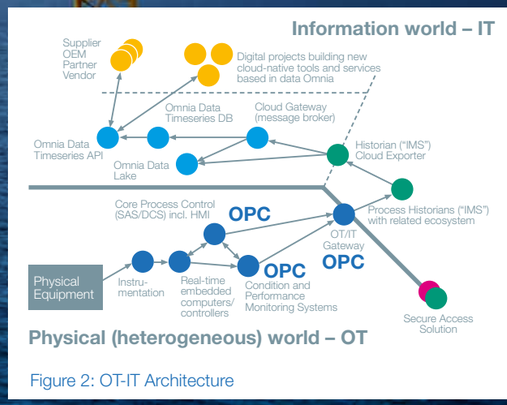

Figure 2: OT-IT Architecture

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Equinor is a broad energy company of 21,000 colleagues committed to turning natural resources into energy in more than 30 countries worldwide. As the largest operator in Norway and international leader in offshore operations and renewable energy, Equinor is shaping the future of energy.

Digitalization is transforming the way Equinor works to support their strategies and goals, which are to use data to improve safety; reduce development and operating costs; increase recovery and discovery; and reduce greenhouse emissions.

EQUINOR'S CLOUD-BASED DATA PLATFORM

Equinor has created OMNIA, a cloud-based data platform on Microsoft Azure to support their digital roadmap. It covers six programs, cutting across three key enablers – developing digital capabilities and leadership; utilizing the external ecosystem; and increasing data utilization (figure 1).

Mr. Pinheiro states, "The idea behind this platform is to move from silos of data and across our value chain to one common platform that orchestrates all our data across the value chain."

»Data without any context is quite useless.«

In the world of data-driven operations, he goes on to say that, "data without any context is quite useless. You need context to ensure that humans and machines understand what the data means in order to be able to use it. So, when you have data in context, you have information, which can be used for analysis and visualization." He goes on to explain how Equinor's business decisions are made faster and better, based on the insights derived from the contextualized and/or analyzed data. All of this forms Equinor's four pillars to achieving Data-driven Operations: 1) Data, 2) Context, 3) Analysis and Visualization, and 4) Business Decisions.

OPC UA is a connectivity framework for industrial automation data – OPC UA systematically supports the contextualization of data available from Equinor's industrial automation and control systems.

EQUINOR'S OT/IT ARCHITECTURE

When viewing the architecture of the heterogeneous, OT world and the connectivity to the information, IT world, the physical equipment is connected to real-time controllers, which sends data to the core process control and HMI system. The data is tunneled through an IACS Data Gateway with Prediktor's MAP Gateway software utilizing OPC UA reverse connectivity towards an IT/OT Gateway, also with Prediktor´s MAP Gateway software, which is then enriched with information models that adds context and sends the data further out to a Process Historians (IMS), which is, in turn, sent to an IMS Historian Cloud Exporter. (figure 2). From the Cloud Exporter, the data goes through a message broker or Cloud Gateway for storage in the OMNIA Data Lake. The data is also made available in the OMNIA Timeseries Database so that if a data-consumer (Supplier, OEM, Vendor, Partner, etc.) requests access to particular data within OMNIA, a ticket is created wherein the OMNIA team prepares a Timeseries API to satisfy the request.

»The most powerful game changer… is OPC UA«

Notwithstanding the connectivity framework that has been built, data without context is nonetheless useless. Sensors can still provide value, quality, and timestamp; but humans and software cannot know if the data is related to a pump, a motor, a valve; or whether the data point is related to hydrocarbons, upstream/inlet, or downstream/outlet areas. To answer these questions, additional context is needed to make the sensor data actionable.

"The most powerful game changer, to obtain context, is OPC UA." said Mr. Pinheiro". It has the ability to turn data into information – data in context – with the OPC UA information modelling framework. Its ability to standardize on information across vendors and products, using OPC UA companion specifications, results in interoperability."

»…two of our four pillars… are already established.«

He continues, "OPC UA, as an open, international, industry-independent, and secure connectivity framework, is supporting Equinor in making real-time, contextualized data (information) available. So, this means that two of our four pillars for becoming data-driven are already established. But to do this at scale and with speed, we need interoperability. So, it is important that we have our vendors implementing OPC UA so we can lift the data from our [field] level into OMNIA in a much easier and faster way."

In facilities which utilize heterogeneous automation and control hardware and software – which describes almost every process or factory scenario – if each vendor is delivering the same type of data in different vendor- and system-specific interfaces, with vendor- and system-specific information models and semantics, then humans have to spend a lot of time interpreting incongruent data by mapping and transforming the data.

INTEROPERABILITY DEFINED

Interoperability means that similar information is organized and defined in a standardized way, regardless of vendor or system – agreeing on common and open formats, information models, and connectivity standards, while having well-defined and understood interfaces. Mr. Pinheiro asserts that, "We, meaning the entire industry, need to agree on standard information models for given domains and assets."

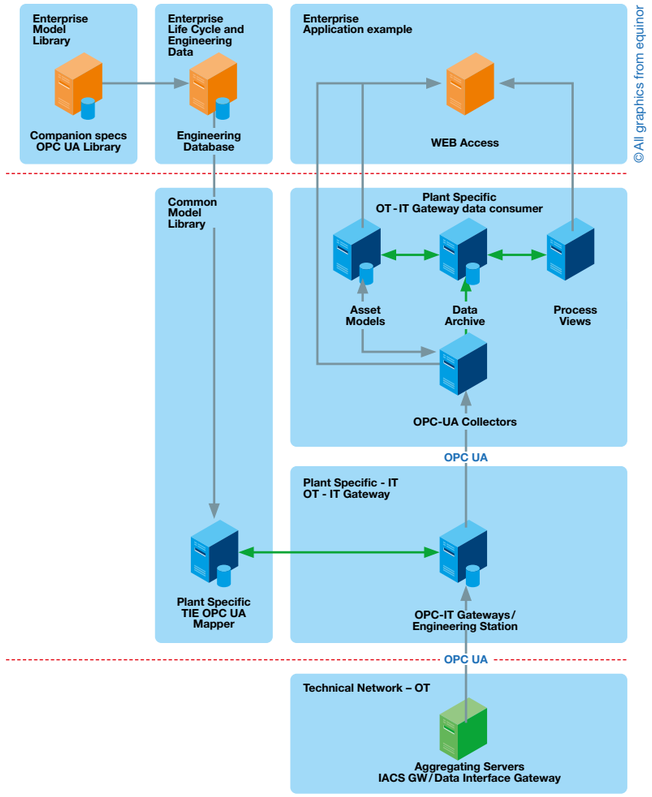

Figure 3: OPC UA Aggregation Architecture

»There is no manual intervention – it's an automatic process.«

OPC UA PROVEN IN USE AT SCALE ABOARD JOHAN SVERDRUP

OPC UA has been implemented and proven in use at scale on Johan Sverdrup. The facility started production in 2019. This field, alone, is massive – it produces 30% of Norway's total production, with OPC UA being a central part of the digitalization strategy since 2015. The facility has 19 OPC UA servers aggregated into a single, central OT/IT Gateway, with Prediktor´s MAP Gateway software, using OPC UA Aggregation Architecture (figure 3).

The Enterprise Model OPC UA Library contains all of the templates of all the objects, types, and classes that are defined in all of the different equipment that Equinor has throughout their operations. The Engineering Database has within it all of the equipment tag names. Therefore, when merging the OPC UA Library – which is a template that can be used with ANY project – with the Engineering Database, the result is a plant-specific OPC UA Mapper; meaning that, on Johan Sverdrup, Equinor and Prediktor have combined all of the types and all of the objects from the library, thus automatically assigning types to all the equipment. There is no manual intervention – it is an automatic process.

All that's left to do is to assign the classes which provides the attributes to be shown on the upper levels of the architecture.

Each of the field sensors are providing OPC UA data and are connected to the Aggregating Servers (e.g., IACS Gateway or DIG Servers) where the data is replicated to the OT/IT Gateway. Once combining the data available from the Aggregating Servers with the plant-specific structure, then the information model becomes fully populated. From there, the information model is sent to OPC UA Data Collectors and Data Archives. Data is made available from the WEB Access Application to anyone with a phone, a tablet, or a computer, via the Digitalization Tool.

SOME METRICS

The Equinor OPC UA Template Library consists of 50 objects, 90+ classes, 920+ attributes, with the same library being used across multiple assets, including renewable energy projects – it's not strictly an oil and gas library.

Equinor's visualization consists of 745+ pictures that are connected to the available data.

The OPC UA Server, containing Prediktor´s MAP Gateway software, started with 190,000+ tags, but since the latest upgrade, now hosts almost one-million tags transferred to the infrastructure present on Microsoft Azure.

The Equinor OPC UA Asset Structure has defined over 31,000 pieces of equipment – these are the equipment to which earlier reference was made when speaking of automatic "Type" assignment. These comprise over one-million "Items" and "References".

EMBRACE OPENNESS AND GIVE BACK TO THE COMMUNITY

Equinor utilizes and benefits from the OPC technology community and, by open-sourcing Equinor's information models, they give back to the community. This link, https://github.com/equinor/opc-ua-information-models, is where the information library is hosted on Github, and it is now also available in the UA Cloud Library of the OPC Foundation https://uacloudlibrary.opcfoundation.org. It is available to the global community for open utilization at no charge. Equinor believes that being open is the key to adoption and that openness is the spirit of OPC UA.

END USER BENEFITS

Notwithstanding a wide array of end user benefits, Equinor highlights several, which are related to a reduction in the total cost of ownership. For example, there are efficiencies gained in the exchange of data, without needing human translation in the middle. There's an increase in the flexibility of the overall architecture with easier replacement of components (plug & produce), since the interfaces and information are the same across vendors. Furthermore, OPC UA is designed for use across industries making it seamless for a supplier to utilize the same interface and the same information model for myriad customers across various industrial sectors.

With respect to innovation, opportunities and in keeping with Equinor's goal to be a data-driven operator, they assert that, by utilizing the intention behind OPC UA, it's easier and cheaper to access higher-quality, contextualized data from plant operations and the industrial automation and control systems. Equinor sees improved access to innovation due to broader communities, ecosystems, and competencies. Additionally, there will be greater competition since owner/operators need to compete on business value and not vendor lock-in.

ONGOING AND FUTURE AREAS OF FOCUS

Equinor is advocating scaling-up broader usage and standardization of OPC UA Information Models. There is huge potential for vendors to expand their offerings of OPC technologies. Additionally, there is a strong thirst for tighter integration between the plant floor and cloud applications/services, making data and its context available from OPC UA servers, exposing all the data to OMNIA. Furthermore, there is a gap that can be closed between engineering and operations by aligning AutomationML and OPC UA.

Equinor envisions benefits through alignment of international initiatives, like NAMUR Open Architecture (NOA), NAMUR Module Type Package (MTP), Open Process Automation (OPA), Plattform Industrie 4.0, especially since each of them point to OPC UA as one of several key building blocks.

Last, but not least, it would be Equinor's wish to have the end user community unified as "one voice" while addressing suppliers with industry requirements pertaining to OPC UA technologies.

João Pinheiro,
Senior Technical Team Lead at Equinor