



OPC UA DEFINED AND HOW IT IMPACTS OIL & GAS

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About This Document

Scope of the Document

This document defines the OPC Unified Architecture (OPC UA) communications technology as it relates to applications within the oil and gas industry. The intended audience includes Plant Managers, Operators, Manufacturing Executives, Process Engineers, IT Professionals, Maintenance Personnel and end users in oil and gas operations.

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Document History

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OPC UA Defined

OPC Unified Architecture is an important building block that enables users to build the next generation of automation software solutions.

OPC UA is the result of a multi-year collaboration of industry leaders that built an open standard for exchanging information in a rich, object-oriented and secure fashion. This standard represents the answer to the fundamental need for mapping and exchanging real-life information in an object-oriented way.

Object-Oriented

The information carried within an object is far richer than the information carried with simple raw data, as many automated applications were designed to process. Rather than analyzing a single, isolated row of data, however, it's far more interesting to analyze the data in terms of its relationship with other data and in terms of the operation that can be performed.

Any real-life object carries a tremendous amount of information within it. For example, when thinking in terms of objects, the information carried by an "oil tank" object is far superior to the simple combination of individual row data for pressure and tank level. A physical oil tank is an object that we can physically interact with by filling or emptying, by changing a reference pressure set point or by analyzing how a change of a parameter affects the others. This information is logically grouped and must be analyzed all together.

In software terms, an object is a collection of properties (pressure, tank level), methods (fill, empty) and events (tank level is too high, pressure is too low). Objects are organized in hierarchies in such a way that an object can contain simpler, smaller objects as properties (the valve of an oil tank can, itself, be an object that exposes properties, methods and events). When thinking in these terms, it's clear how beneficial it would be to map the data of a tank farm into a hierarchy of objects.

The object-oriented nature of OPC UA enables re-usability of assets across on-shore and off-shore operations and provides a common object management method to support complex and flexible data models.

Service-Oriented

OPC UA has a dual nature: it is object-oriented and it is service-oriented. The service-oriented nature of OPC UA allows for broader interoperability with other platforms, as well as for increased visibility and security.

Communication over a network has always been a potential security risk. OPC UA security involves the authentication of clients and servers, the authentication of users, the integrity and confidentiality of their communications, and the verifiability of claims of functionality. The OPC Unified Architecture security model secures communications, while its encryption ensures that data security is held to the highest standards.

Impact on Oil & Gas Industry

Over the past decade, software vendors have used Object-Oriented and Service-Oriented Architectures to design products that are both scalable and reliable. However, these successful architectural models only recently started to be used for the exchange of information in offshore oil and gas production.

More recently, the ability to collect and analyze exponentially growing sets of data is at an unprecedented level, due to the wide adoption of Big Data. At the same time, mobile devices are transforming the way people interact with the environment, connecting to a tremendous amount of information anytime, anywhere.

As the scale of Oil and Gas operations increase, managing and extrapolating meaningful relationships from data will only get more complex. In addition, the need for remote access to data and remote collaboration will increase along with the number of widely dispersed assets and mobile workers.

With mobile solutions now able to connect to OPC UA, BACnet, SNMP, Modbus TCP/IP, Web services and more, there is unlimited potential gain in tapping into the Industrial Internet of Things. With simple connectivity, mobile devices are enabling operators, field service workers, managers, executives and others in the industry to securely visualize oil fields, offshore rigs, pipelines and refineries. Anyone with a mobile device can use best in class apps to remotely monitor assets, instantly access operational key performance indicators and respond to alarms and alerts in real time.

Slowly, but surely, the industry has adopted real-time monitoring and wireless communication systems, experiencing significant gains in efficiency, safety and cost savings. Recent advances in mobile technology spark change in how quickly the industry adopts and leverages products that software vendors now provide.

OPC UA Standard

OPC UA does not replace existing standards such as OPC, but rather complements them by providing a common interoperability layer for exchanging information and orchestrating processes. OPC UA embodies all the functionality of the existing OPC servers and allows for backward compatibility with previous standards.

One of the key problems with standards of this magnitude is that implementing them can be quite challenging. The OPC Foundation has taken many steps to guarantee that the implementation of the standard would be a relatively straightforward and easy process.

To facilitate the adoption of the new standard and to reduce the barrier to entry, the OPC Foundation developed an OPC UA software development kit (SDK). The SDK is the entry point to jump-start your existing applications and make them OPC UA-enabled. The SDK consists of a series of application programming interfaces and sample code implementations. To that end, the UA specification is written to be platform-agnostic and, for that reason, the SDK comes in different flavors to facilitate adoption on different platforms. The .Net, ANSI C and Java sample implementations are provided to OPC Foundation members.

Each "flavor" of the SDK is designed to fit special needs in terms of platforms, memory and processor requirements, but they are all capable of seamless interoperation with each other. The .Net version of the SDK is more suited for rich client/server implementation, while the ANSI C version is more suited for thin implementation for embedded devices, where memory footprint and CPU utilization are more important. The Java implementation is more suited for the Web environment and thin clients, but can also be used in other environments. Each software vendor can pick the implementation that they prefer, depending on the unique requirements for performance, cross-platform capability and Internet-friendliness.

In addition to the SDK, the OPC Foundation has also provided a series of binary adapters. The adapter can be used to grant direct access to all legacy COM-based OPC servers from the OPC UA Client. Simultaneously, the adapter can also be used to grant access to a subset of OPC UA server features from legacy OPC clients.

Compliance Tools

Software programming is not an exact science. Even with the availability of the OPC UA SDK sample code, there is still room for errors such as misinterpretation of the specification or simple coding errors. So how do you reduce the number of errors and guarantee an unambiguous interpretation of the standard? How do you ultimately guarantee interoperability between software produced by different vendors?

To facilitate the successful adoption of OPC UA solutions, the OPC Foundation introduced a series of compliance tools aimed at verifying that a given product is fully compliant with the standard. Software vendors can submit their applications to independent test companies that will certify the compliance with the standard using the compliance tools. Having a certified solution guarantees reliable data exchange between applications from different vendors, and is beneficial for everyone.

The OPC UA SDK enables software vendors to quickly move information horizontally between devices on different industrial networks from different vendors, as well as vertically from the plant through the enterprise of multi-vendor systems – with stops in between.

Several leading suppliers have partnered to provide end-to-end solutions that leverage the OPC Unified Architecture to deliver value to end-user customers. Interest in these technologies continues to increase, ensuring that OPC UA is on the road to success as the leading standard for exchanging information throughout the enterprise for the Oil and Gas industry.



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