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TOP TIPS

WHY OPC UA IS THE IIOT PROTOCOL OF CHOICE

As a communication protocol for industrial automation, the OPC Unified Architecture (OPC UA) has rapidly become the protocol of choice for PLCs and PACs as the number of Industrial Internet of Things (IIoT) deployments continue to multiply. The reasons are crystal clear. The OPC UA provides organizations with a secure, platform-independent, scalable, and object-oriented client-server architecture for representing and communicating information.

1. Security first.

Whenever an organization is collecting, analyzing, storing or moving data, security is an absolute must. As such, security is an integral component of OPC UA technology. OPC UA provides a mechanism to protect the confidentiality and integrity of information and to determine whether applications are trustworthy – a fundamental need of Industry 4.0. Specifically, the OPC UA server provides a set of services dedicated to creating a secure connection. Once created, it applies the security protocol to messages between the client and server to ensure the integrity and confidentiality of messages. UA security consists of authentication and authorization, encryption and data integrity via signatures.

2. Platform independence and scalability.

The inherent platform independence and scalability of OPC UA make it a critical technology for the industrial internet. An intelligent device with an embedded OPC UA server and client can achieve bi-directional communication with other intelligent devices. An aggregation server can concentrate, normalize and enrich information from underlying servers, consequentially making aggregated information available to high-level clients. The aggregation server plays an important role in minimizing the number of connections that resource-limited devices need to manage.

Since today's IIoT includes multiple diverse components (often running on an array of operating systems), OPC UA's platform independence is crucial. For instance, an OPC UA aggregation server might run on Windows whereas an OPC UA embedded server might run on real time operating systems such as VxWorks. OPC UA's ability to provide secure data exchange independent of platform and operating-system is essential to converge disparate systems into one secure system. The resulting chain of systems – from low-level devices to PLC and PAC systems to enterprise applications – ultimately integrates with OPC UA to form a system of systems.

3. Object oriented.

By design, OPC UA servers expose information for clients to find and consume. The collection of information that servers make available to clients is called the AddressSpace, which standardizes object representation. AddressSpace defines objects in terms of variables, methods and their relationships to other objects. Furthermore, OPC UA AddressSpace unifies the three classic data models (Data Access, Alarm and Events as well as Historical Data Access) into one information model – making it easy to connect the dots between data values that are read to events that are raised based on those data values. Being object-oriented means servers can provide type definitions for objects and their components.

Because OPC UA uses object-oriented techniques, it can formulate an information model that serves a specific problem domain. By using ObjectType, VariableType, DataType, and ReferenceType NodeClasses, an information model can be constructed where the type definitions convey meaning and can represent entities found in the problem domain. This allows vendors and standards organizations to create a known object model that client applications and tools can be written against allowing operators from the factory floor using PLC to PAC system to the data scientists using BIG data in cloud platform for fleet level analysis – to find the right information and present that information in the right context, at the right time.

4. High availability.

OPC UA enables servers, clients and networks to be redundant by providing services to achieve redundancy in a standardized manner. OPC UA clients, especially ones that aggregate data from several underlying servers, typically need to be fault tolerant. To meet this requirement OPC UA allows identically configured clients to work as a redundant pair.

OPC UA server redundancy allows clients to have multiple sources to obtain the same information. OPC UA has two modes of server redundancy: transparent and non-transparent. In transparent redundancy, the fail-over from one server to another does not require any actions from the client; actually, the client is unaware that the failure has occurred. In non-transparent redundancy, the failure from one server to another requires the client to take actions to ensure the continuation of information flow between the client and server.

Network redundancy also provides multiple paths for client and servers to communicate thus eliminating a single point of failure.

5. Inner and outer loop control capabilities.

One of the advantages of the outcome optimizing controls (OOC) is a built-in system to support inner and outer loop control strategies. As shown in **Figure A,** an inner loop provides deterministic control and an outer loop provides non-deterministic advice to the inner loop to achieve a goal, such as minimizing a cost function. With OPC UA's inner and Outer Loop control strategy, the inner loop provides deterministic control. The outer loop provides non-deterministic advice to the inner loop in order to achieve a goal such as minimizing a cost function. OPC-UA as a secure, platform independent and objected oriented protocol is the obvious choice for communicating between the inner and outer loop. Coupling the knowledge of OPC UA type definitions with the OPC UA services for discovering information, the outer loop knows what information to seek and has the means to find that information, making it possible to configure and deploy outer loop apps in a semi-automated manner.

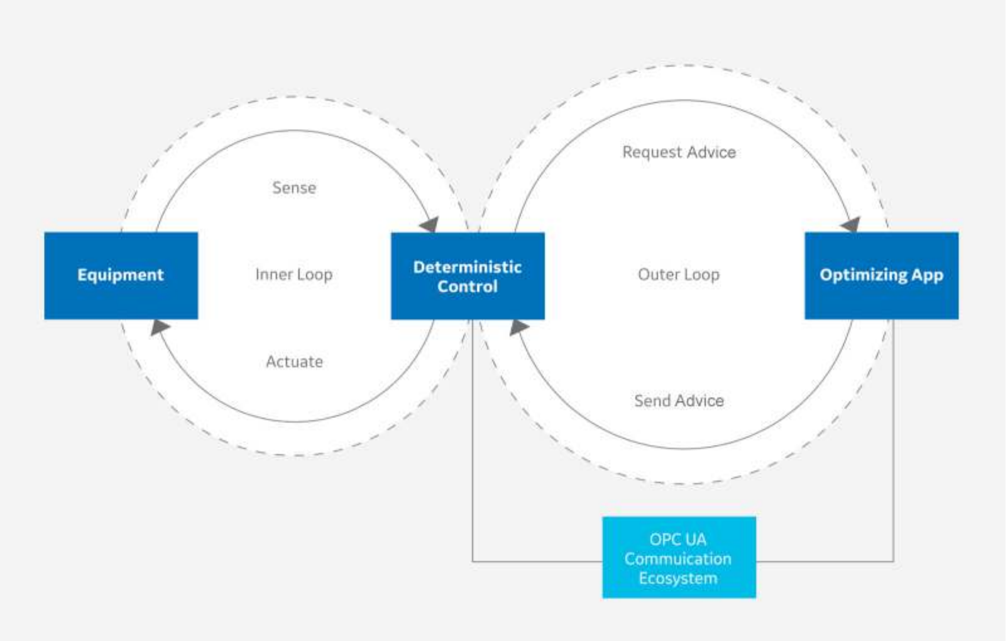

Figure A

Bottom line: The inherent security, platform independence, high availability and scalability combine to position OPC UA as the protocol of choice as today's organizations focus on building out expansive IoT environments.