Introduction to Unified Architecture

The Next Generation of System Interoperability

Thomas J. Burke
OPC Foundation President & Executive Director
OPC Foundation’s New Opportunity

Improve the Existing … and … Find Its Place in …

- **Next Gen Systems**: Enterprise Interoperability
- Many complex information structures
  - Many groups working on semantics: schemas+
- Complex exchanges between platforms
  - Business & Integration processes (scenarios)
  - Consolidation of standards – less overlap
  - Reduce complexity, easier decisions, …
  - Faster progress
- **New architecture with bigger scope**:  
  - Service-based (SOA, SBA, …)
  - Scope includes other platforms:
    - Microsoft, Oracle, SAP, IBM, …
# The Enterprise IOp Challenge …

OPC Foundation Taking on a Larger Role

<table>
<thead>
<tr>
<th>Maturity Level Environment</th>
<th>Interoperability Attributes</th>
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<tbody>
<tr>
<td></td>
<td>People</td>
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<tr>
<td>Dynamic Level (Flexible)</td>
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<td>A</td>
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<tr>
<td>Unified Level (Standardized)</td>
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<tr>
<td>Integrated Level (Selective)</td>
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<td>A</td>
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<td>6</td>
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<tr>
<td>Connected Level (Open)</td>
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<td>C</td>
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<tr>
<td>Isolated Level (Manual)</td>
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</table>
Suppliers Platforms Are Required for Unification
Not Enough Industry Standards – Will Be Evolutionary
OPC Unified Architecture
A Basis for Unifying “Aspects of” Supplier Platforms?
Platform Concepts Defined
OPC UA: Unify Component Frameworks?

Application Configurations

Industry Specific Extensions

Application Products & Suites

Application Component Frameworks

Role-based Portal Environment
Workflow Management
Data Management, ...

Integration Server, Messaging,
Directory Services, ...

Operating System - Networking

Technology Platform

Application Platform

Monitor & Manage

Security

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Enterprise Interoperability Fundamentals

- Existing OPC Interfaces within new capabilities …
- Component-based information modeling
  - Operations Application must have Flexible Asset and Resource Modeling
- Accommodate many semantic standards
  - ISA/B2MML, OAGi, RosettaNet, CIDX, …
- Support standard messaging (above)
- Support reliable enterprise-wide orchestration
  - Within Enterprise and Operations Platform Tools
- Strong security integrated with infrastructure
  - Better management of security information
## Where Does OPC UA Help?
(Definitely a work in progress)

<table>
<thead>
<tr>
<th>E-IOp</th>
<th>OPC UA</th>
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</thead>
<tbody>
<tr>
<td>Support Legacy Systems</td>
<td>Existing OPC I/F’s … Subscription Model</td>
</tr>
<tr>
<td>Unified Data Models</td>
<td>(Does not define data models)</td>
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<tr>
<td></td>
<td>Provides Common Object Management Methods</td>
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<td></td>
<td>Supports more complex and flexible models</td>
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<tr>
<td>Unified Semantics</td>
<td>(Does define semantics or address mapping to Apps)</td>
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<tr>
<td></td>
<td>Complements Industry Standards</td>
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<tr>
<td></td>
<td>Create and Expose Object Structures</td>
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<tr>
<td>Unified Messaging</td>
<td>(Does define or address messaging)</td>
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<tr>
<td></td>
<td>Complements Industry Standards</td>
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<tr>
<td></td>
<td>Create and expose Object Commands (Methods and Programs)</td>
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<tr>
<td>Unified Orchestration</td>
<td>(Does not address orchestration)</td>
</tr>
<tr>
<td></td>
<td>… Exposes common services (for Orchestration)</td>
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<tr>
<td></td>
<td>… Exposes Standardized Programming I/F’s</td>
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<tr>
<td></td>
<td>… Provides common state model for managing services</td>
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<tr>
<td>Security</td>
<td>(Does not specify user data management, …)</td>
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<tr>
<td></td>
<td>Encryption, Digital Signatures, PKI</td>
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<tr>
<td></td>
<td>Web Service Security Standards</td>
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<td></td>
<td>Traceability &amp; Audit Records required</td>
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</table>

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How is OPC UA Going to Work?
Use UA-Based Software Supplier Platforms and Tools

- Use Platform Tools (Portal, UI, ...) to Create Role-Based Common Views by Browsing and Accessing Shared UA Objects and Commands
- Use Platform Tools (BPM, EAI, ...) to Create Processes and Mappings by Browsing and Accessing Shared UA Objects and Commands

“Conform to UA Security Guidelines”

Provide Tools to “Import” Industry Standards into UA and Create Shared UA Objects and Commands

OPC UA Suppliers

- Communications
- Unified Information & Events
- Unified Processes & Workflow
- Context Views & Concepts

OPC UA Client Suppliers

- Provide Tools to Create and Expose Application Object Info and Commands as UA Services and Programming I/Fs

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Questions:
Once we Understand …

Explore the Implementation of UA
- How will Commands get created?
- How will industry standards (semantics, messages, …) be used on OPC UA?
- How do we expect Enterprise Apps to use OPC UA?
- What do we expect suppliers to implement?
- Will OPC Foundation manage any shared code?
- Who is working on UA and what are their deliverables?
  - How can we become more aware of its status and monitor its progress?

(If we run out of important things to talk about)
- OPC UA talks about Objects - How does OPC UA compare to CORBA?
Today’s Integration Challenges

- Numerous incompatible protocols
- Complex configuration and maintenance
- Islands of automation
- Rigid infrastructure
- Vulnerability to system and network failures
- Security or lack there of…
Numerous Incompatible Protocols
The Inter-Enterprise Nightmare

The Problem
- Many different vendors
- Custom made solutions
- Proprietary technologies
- Point-to-point Integration
- Limited “real-time” information
- Maintenance nightmare
- Multiple dependencies

Solution
**OPC Unified Architecture**
Unified Architecture Evolution

- Asset Management
- Production Control
- Inventory Management
- Purchasing

- HMI Visualization
- SCADA

Production Management Systems

The Automation paradigm

The Enterprise paradigm

The Automation paradigm

The Enterprise paradigm
COM Interfaces

- An interface is a collection of methods or related functions and procedures that perform some specific service that the COM object will provide.

- COM does not specify the implementation of interfaces, only their behavior in interacting with clients.

A client accesses a COM object's services through pointers to its interfaces.

Each interface provides one or more functions

- Function1()
- Function2()
- Function3()
OPC Unified Architecture Motivation

DCOM retires

Better Integration (DA, HDA, AE)

OPC-UA

Internet

.NET new Communication architecture

Service Oriented

More Areas of Application (MES, ERP)
OPC-UA (OPC Unified Architecture) extends the highly successful OPC communication protocol, enabling data acquisition and information modeling/communication between the plant floor and the enterprise.
OPC Unified Architecture

- Web Services / XML
- Easy Configuration and Maintenance
- Increased Visibility
- Broader Scope
- Reliability Reliability Reliability
- Security Security Security
- Performance
- Platform Neutrality
- Legacy Products Plug Right In...
OPC Interface Unification

- **SOA** (Service Oriented Architecture)
- **Single set of Services**
  - Query, Read, Write, Subscribe…

The UA Server embodies the functionality of existing OPC Servers using a single set of services.

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Specification Layering

Clients written to just the base can still discover and access all data from the derived layers!
OPC Unified Architecture Base

- **Architecture**
  - Integration of DA, A&E, Commands, Complex Data, and Object Types

- **Designed for Federation**
  - abstract data/ information from the plant floor, through information models, and up to enterprise systems

- **Information Modeling**
  - development and deployment of standard information models to address industry domains specifics

- **Complex Data**
  - OPC Standard & Domain & vendor specific…..
OPC Unified Architecture Base

- **Security**
  - Collaboration, Development & Reference

- **Enterprise Integration**
  - OPC UA standard messaging system

- **Robustness / Reliability Designed & Built in…**
  - NO Failures
  - Sequence numbers, keep-alives, resyncing, and support for redundancy

- **Commands**

- **Companion Standards**
  - industry groups define what OPC Unified Architecture “transports”
Putting it all together

Data Model

Object Model

Type Descriptions

SOA Model

DA, HDA, and A&E

Abstract Services

OPC UA

 Protocol Independent

Plant floor and Internet Access

Comms Model

Platform Independent

Object Model

Abstract Services
OPC Provides Industry-Standard interoperability, Productivity & Collaboration

ERP, SAP ... Corporate Enterprise

OPC Unified Architecture

Manufacturing, Production and Maintenance

OPC Unified Architecture

Adv. Control

HMI

MES

SCADA

Batch

PC-Based Control

PLC

DCS

Industrial Networks

Data Acquisition

??........??
OPC - Going Forward (Technology)

Vision

OPC UA Next

End user feedback

Next theme

Vendor Requests

OPC - Going Forward (Technology)
OPC Roadmap

**OPC (First Generation)**
- Connectivity
- Real-time data, Alarms, Historical Data
- OPC DA
- OPC A&E
- OPC HDA
- OPC XML
- OPC…

**OPC (UA Generation)**
- Robustness & Reliability
- Interoperability
- Connectivity
- Compliance & Certification
- MES & ERP Connectivity
- Profile support
  - OPC UA Core
  - OPC DA
  - OPC UA - A&E
  - OPC UA - HDA

**Next Significant Step**
- Diagnostics
- System Administration
- Configuration Change Notification
- Consistency Check between layers

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Vision

Transition from Device Connectivity to Data connectivity
OPC is Dedicated to Interoperability

- Security
- Reliability
- Interoperability
- Performance
- Adopted Standard
- Open Platform
- Automation to Enterprise Integration
- Openness, Productivity & Collaboration
Questions?

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