Techniques to Improve OPC Connectivity

John Weber, President & Founder
Software Toolbox Inc.

Agenda

• Survey
• OPC DA Review
• OPC HDA Review
• OPC A&E Review
• OPC for Expertune Users
• OPC for TIPs Users
• OPC Tunneling – aka avoid DCOM!
• OPC Data Aggregation
• OPC Use Cases You Might Not Think Of!
• OPC Best Practices
• OPC Unified Architecture (UA)
• Questions & Answers
“And the Survey Says”

- How many of you have a good idea of what OPC Data Access (DA) is?
- How many of you are truly “comfortable” with OPC DA when you use it?
- How many of you know what OPC is?
- How many of you are using OPC technology in your plant or business?
- How many of you feel comfortable with OPC technology?

Data Access Basics

Communications drivers bridge the gap between applications and devices
Communications Drivers

- **Physical Connections**
  - RS-232
  - RS-485
  - RS-422
  - Ethernet

- **Protocols**
  - Modbus RTU
  - Data Highway Plus
  - Profibus
  - Ethernet/IP

Communications drivers know the physical connection and protocol for the device, and are driven by the application that wants the data.

The Driver API Nightmare

Each Vendor has their own driver API (Application Programming Interface)

Customers could not mix or use drivers from multiple vendors, no Interoperability.
The Driver API Dream

Each Vendor now using OPC DA as common interface (Data Access)

Customers can now mix and use drivers from multiple vendors, complete Interoperability

Data Access System Refresher

OPC DA now provides the glue between the applications and the driver, the device connections and protocol remain the same.
OPC DA Under the Covers

- Based on Microsoft’s COM (Component Object Model)
- Client/Server architecture
- COM provides the basic framework
- OPC defined the actual functions of DA (Data Access)
- COM allowed for remote access using DCOM (Distributed COM)

Client/Server and OPC DA

- The Client Consumes data services
- The Server Provides data services
- COM is the Middle Man
- OPC Servers and Clients in most cases are separate programs now
- OPC Servers only act on commands from an OPC Client
Key Features of OPC DA

• Provide browsing for OPC Servers on PCs
• Provide browsing of data tags available in Servers
• Provide data tag group management
• Provide standard Read functions for data tags
• Provide standard Write functions for data tags
• Provide standard method of data conversion and translation of data tags
• Provide robust error handling and reporting on all functions and device status

Browsing for OPC Servers

• Similar to locating PCs on your Network
• Allows OPC servers on both Local and Remote PCs to be located
• Allows the OPC client to locate specific versions of OPC servers
Browsing for OPC Data Tags

- Allows data tags to be located like browsing for files on a hard drive
- OPC Servers can use “Branches” similar to Folders to group similar Data Tags for easier representation to users
- Browse filtering simplifies the task of locating tags in large applications

Communications Driver
OPC Server
HMI
OPC Client

Browse Functions

OPC ServerRoot
+ Machine_Cell1
  + Cycle_Count
  + Cycle_Time
+ Temperatures
  + Zone1.Temp
  + Zone2.Temp

OPC Tag Group Management

- Data Tags can be placed in groups within the OPC server by the OPC client
- Groups can be turned on and off by the OPC client
- The update rate on a group controls how often data is read from the device
OPC Asynchronous Reads

- Asynchronous Reads allow the OPC Client to keep running while the server gathers the data
- The OPC server returns the data via a data callback to the OPC Client

OPC DA Data Write Functions

- Write Data via Synchronous I/O
  - Blocks the OPC Client like Synchronous reads
- Write Data via Asynchronous I/O
  - Like the Asynchronous reads, the write allows the OPC Client to continue to run
  - Both write operations will return error codes to confirm the write operation has succeeded or failed.
OPC DA Data Reliability

- OPC DA servers supply the **Current Value** of a device or process tag
- Status on the **Quality** of the tag
- **Timestamp** of the time the tag was read

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OPC Historical Data Access
OPC to Data Storage Scenarios

- Gathering Data from n OPC Servers from n Devices and logging to remote database(s)
- Logging Data to text or database from 1 OPC Server reading from n Devices

OPC - From Live to Historical

- OPC DA Server gets the live data into the Historian
- The Historian writes the data to the data store
- OPC HDA Server retrieves historical data for display & analysis client application

Definition: OPC HDA = Historical Data Access
OPC Alarm & Events

OPC A&E - Alarms and Events

• Standard interfaces for:
• Create and Manage Alarms and Events
• Allow clients to subscribe to messages it needs via filtering
• Support simple, complex and multi-tier systems
Multiple Levels of Capability

• Alarm and Event Servers
  • Simple Detection and Reporting
  • Sophisticated Collection from Multiple Sources and Reporting to Multiple Clients

• Alarm and Event Clients
  • Operator Stations
  • Event/Alarm Data Logging Components
  • Event/Alarm Management Subsystems

Client / Server Interactions

Operator Station 2
Operator Station 1
Event/Alarm Management Server
Simple Alarm/Event Server
Simple Alarm/Event Server
Device w/ Alarm Info
Event Logger, etc.
SPC Module

A/E Clients
A/E Servers
OPC for TiPS & ExperTune Users

OPC for Expertune Users
Putting it into perspective

- Tuner/Analyzer
  - Subscription/Asynchronous Reads only
  - OPC DA Client
- Plant Triage
  - Subscription/Asynchronous Reads
  - Period Synch Read for Data Integrity
  - OPC DA Client
  - OPC DA Server
  - OPC HDA Client
  - OPC HDA Server
OPC for Expertune Users
Best Practices

- Plant Triage Configurator
  - Sets up DCOM settings
  - Sets up user accounts & passwords
- New Users – Planning to use OPC?
  - Install Expertune “Connectivity Tester” first
  - Great troubleshooting tool
- Use Plant Triage OPC Interfaces to Make Plant Triage “Part of the Entire Solution”

OPC for TiPS Users
LogMate AMS - TRAC
OPC for TiPS Users
LogMate AMS - TRAC

- OPC A&E Client Interface
- Pull Alarm & Event Data from A&E Sources – HMI’s, DCS, etc.

OPC for TiPS Users
LogMate AMS – KPI Setup
OPC for TiPS Users
LogMate AMS – TRAC Setup

Improving Your Results With OPC
OPC Tunneling

- DCOM – what lies behind the challenges
  - Timeout
  - Non-Cancellable synchronous calls
  - Moving target of OS patches
- DCOM tutorials help but don’t remove DCOM
- Matrikon is not the ONLY solution!
- OPC UA might be a solution… but not today
- Problems with “OPC Command” tunneling
- How “Data tunneling” solves these problems
- Example application & tools involved

OPC Tunneling
What is Tunneling?

- Moving OPC Data via simple TCP/IP port connection
- Eliminating DCOM and Expanding Data Transport Choices
**OPC Tunneling**

**Why Tunnel?**

- No DCOM!
- No Remote Procedure Calls (RPC)
- Network Interruptions
- Low-bandwidth networks
- Improve System **Performance & Reliability**
- Reduce Network Traffic
- Remove Firewall Issues
- Connecting to Non-Windows Systems

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**OPC Data Aggregation**

**What Is Aggregation?**

- Bringing together data from multiple sources
- Data sources don't all have to be OPC servers!
OPC Data Aggregation
Why Aggregate?

• Insure common, consistent update rate
• Limit # of OPC connections
• Bring disparate data sources together (OPC, DDE, ODBC)
• Overcome OPC server limitations
• Overcome OPC client limitations
• Reduce network traffic
• Improve system performance
• Save money on OPC client & server licensing with some applications!

OPC DataHub

The Swiss Army Knife of OPC!
The Perfect Tool to Leverage Your OPC Investments
Unique OPC Use Cases

HMI to HMI Scenario

Benefits:
- Feedback
- Feedforward
- Single Operator, Multiple Machines
- Interplant Communications

HMI/SCADA System
Brand X – Plant Standard

HMI/SCADA System
Brand Y on New Machine
Using Web Browser to display data

Using Excel to get data from Plant Triage
OPC Usage Best Practices

- Evaluate & Select OPC Server
- Configure OPC Server
- Test with Test Client
- Validate Values
- Know what you need and how often
- Tags or No Tags in OPC Server?
- If you write your own OPC Clients...avoid synchronous transactions
- Systems are only as good as weakest link

To Tag or Not to Tag?

Tags in the OPC Server when...:

- HMI client expects/wants you to
- Need to Insulate HMI configuration from PLC configuration changes
- OEM desires insulation from PLC model change
- Need Easy changes w/o HMI development license
To Tag or Not to Tag?

No tags in the OPC server when

- Need to avoid multiple databases and..
- HMI system prefers it this way
- Benefits of tagging not important to you
- Retrofitting existing HMI where PLC addresses are in the HMI
- Existing standards

OPC Unified Architecture (UA)

UA Doesn't Replace OPC DA/HDA/A&E
It Complements Them!
OPC Interface Unification

- SOA (Service Oriented Architecture)
- Single set of Services
  - Query, Read, Write, Subscribe…
- Named/Typed relationships between nodes
- Rich data model
- Secure binary transport
- Firewall friendly

The UA Spec embodies the functionality of existing OPC Servers & Clients using a single set of services

Migrating to OPC UA

- Migration can be done in stages
  - OPC Foundation Developed Wrappers
  - Customize Wrappers using UA Reference Designs
  - Full Native UA Implementations
- OPC UA can be layered on top of COM based applications
  - COM OPC Servers and Client can be wrapped and their functions encapsulated using OPC UA functions and transport methods
  - Used separately or together, existing COM based OPC products can be integrated into an OPC UA application or benefit from security and remote connectivity of OPC UA
- The OPC Foundation will provide this technology to OPC members
Scaling the Mountain in Stages

Base Camp (COM Based OPC Products)

Camp 1 (UA Wrappers)

Camp 2 (Customize UA Reference Implementation)

Summit (Native OPC UA Products)

Camp 1 (DA Server Wrapper)

Wrapping a COM Server with OPC UA

- The wrapper is a UA Server with a COM OPC client interface
- The UA Server manages:
  - The Session
  - The Security
  - Transport selection and encoding
- The UA Server maps the address space of the COM based server to a UA view within the UA address space
- COM OPC functions are mapped to their UA equivalents
- Data Change callbacks are mapped to Notification messages sent on periodic publish polls from a UA client that owns the session
Camp 1 (DA Client Proxy)

Wrapping a COM Client with OPC UA

- The client proxy is a normal COM server with a UA Client interface
- The client proxy maps normal OPC calls to UA functions and objects
- The UA client proxy manages:
  - The Session
  - The Security
  - Transport selection and encoding
- The UA proxy maps and converts COM browsing to UA Address Space view access
- Group management is mapped to Node and Monitor Item management
- Item management is mapped to Properties and Subscriptions

Camp 1 (AE & HDA Wrappers & Proxies)

AE and HDA will follow an implementation path similar to the path shown for DA servers

Migration of AE and HDA products can follow the same multistage approach to move to UA
The Summit (Native UA Products)

- Native UA Implementations can benefit from the rich information model of UA
- Native UA applications provide greater security and access control
- Improved feature set through broader functions of UA Specification
  - DA, AE, and HDA
- Native UA implementations will be closer to true platform independence
- Native UA Implementations are the ultimate goal
  - OPC UA development takes time
  - Existing products will need to broaden their support for a rich information model and complex data sets
  - Existing products will benefit by supporting more OPC functionality than just OPC DA, AE, or HDA by themselves

Questions & Resources

- Questions & Discussion…
- Questions After You Leave…
  - Email: jweber@softwaretoolbox.com
  - Phone: 704-849-2773 or 888-665-3678
  - Web: www.softwaretoolbox.com/opc
- Other resources
  - OPC UA Portal – www.softwaretoolbox.com/opcua
  - OPC Products - www.softwaretoolbox.com/opc
  - Software Toolbox Tech Support – support.softwaretoolbox.com
  - OPC Foundation – www.opcfoundation.org