Data Exchange with Databases
Using a Configurable In-Chassis Module

Bob Muniza
Product Sales

Claudia Griesmer
Product Support

June 10-11, 2013
• Online Development Inc
• tManager....dedicated module for enterprise-to-controller data exchange
  – Value for the developer
• Positioning
  – FactoryTalk Historian ME
  – FactoryTalk Transaction Manager
  – Separate computer running OPC
• Applications / Existing Customers
• Case History
• Headquartered in Knoxville, TN USA
  • North American Headquarters with coverage for Europe and Asia
  • Founded in 1989

• Core Competency: Computing and Communications platforms
  – Develop and produce factory automation hardware and software modules for Rockwell Automation and other companies under the OLDI brand
  • Main focus is the design and development of off-the-shelf automation products
tManager Overview

- Configurable, dedicated module used for Data Exchange
  - No PLC code modification
  - Industrialized packaging
- Replaces a software/PC-based solution
  - Data exchange in the control layer
  - No code development or management
    - Data exchange is configured via straightforward mapping with a drag and drop GUI
  - No need to deal with O/S upgrades, patches or viruses

Reduces installation and maintenance costs
Computer Adapters

Database
• Microsoft SQL
• Oracle
• MySQL
• Excel/Access
• IBM DB2
  • AS400
  • System I

Messaging
• Red Hat Jboss JMS
• IBM WAS JMS

Communication
• TCP/UDP
• FTP
• Bi-Directional Email

Controllers

Rockwell Automation

ControlLogix®  CompactLogix  SLC 500

PLC-5®  MicroLogix  FlexLogix

Schneider Quantum  Siemens S7-300 or S7-400

New Installations or Add to Existing Systems

“Configure & Go” Data Transfers
• tManager enumerates controller & database tags/structures
• Easy configuration via graphical user interface
  1. Define path to controller(s)
  2. Define path to database or message queue
  3. Map data sources to data destinations
  4. Setup triggers
  5. Place into run
• Functoids provide tag manipulation without the need to modify PLC code
• Copy/Paste & Search/Replace reduce development time
• SQL code can be shared with IT to aid in start-up troubleshooting
• Entire User-Defined Data Types (UDTs) can be mapped to a database XML column as one item to optimize communication
Configurable Elements

Automatically Found

- Database Tables
- PLC Tags

What You Define/Configure

- Messages
- Maps
- Endpoints
- Triggers
Enumeration of Controller Tags

- 0: 1756-L63/A LOGIX5563 - Logix_SLOT0
- 1: 1756-ENBT/A - Slot.1
- 10.212.212.61: PLC5 CPU - PLC5_1
- 10.212.212.62: SLC500 CPU - SLC500_1
- 10.212.212.64: Micro Logix CPU - MicroLogix_1
- 10.212.212.67: Compact Logix CPU - CompactLogix_1
- 3: 56eATM-tManager
- 5: RAS6-cATM-KPW
- 6: RAS6-cATM-BLY90

- Ethernet Ports
  - Ethernet IP
    - 10.212.212.62: SLC500 CPU - SLC500_2
  - Modbus
  - Siemens S7
    - 10.0.104.15\Rack 0\Slot 2: Siemens S7 - SiemensS7_1

- SLC500_1 Tags
  - B3[2]: INT16
  - C5[2]: COUNTER
  - F8[10]: FLOAT32
    - F8:0
    - F8:1
    - F8:2
    - F8:3
    - F8:4
    - F8:5
    - F8:6
    - F8:7
    - F8:8
    - F8:9
  - F8:9: FLOAT32
  - N7[10]: INT16
  - N10[200]: INT16
  - R6[1]: CONTROL
  - S[83]: INT16
  - T4[2]: TIMER

- CLX_Demo_eATM Tags
  - CAR: CarModel
    - RFID: INT16
    - MODEL1: STRING[83]
    - PAINTTYPE: INT16
    - PAINTLEVEL: INT16
    - OILTYPE: INT16
    - OILVOLUME: FLOAT32
  - count50: INT32
  - count100: INT32
  - count500: INT32
  - count1000: INT16
  - count2000: INT16
  - count5000: INT8
  - CYCLE_TIME: INT16
  - FAIL_COUNT: INT16
  - LINE_NUMBER: INT16
  - Local:1:C: AB:1756_MO
  - Local:1:l: AB:1756_MO
  - Local:1:O: AB:1756_MO
  - Local:3:C: AB:1756_MO
  - Local:3:l: AB:1756_MO
  - Local:3:O: AB:1756_MO
  - Model: STRING[83]
  - Order_Complete: OrderUDT
Enumeration of Database tables
• **Maps:** used to define the specific data that is transferred to or from the controller
  - In addition to controller tags, can add functoids, constants & macros (for example, timestamps) to maps

• **Functoids:** allow you to perform operations on inputs within a MAP before they are written to outputs.
  - Eliminates the need to modify the PLC/PAC or Database code
• **Message Path** – used to link triggers, maps, and endpoints
  – If multiple triggers are used, the map will execute if any 1 of the triggers fires
• The **View SQL** button on the Message Path screen displays the SQL code generated by the tManager
  – Helpful during startups. Can copy the code and send it to IT, so they know how the tManager is communicating with the database
• **All configurations are stored in onboard memory**
  – Configurations can be backed up and restored. Individual components can be imported and exported

• **Search and Replace** allows you to quickly replace items in the tManager Projects based on textual matching for rapid deployment in multiple plants or applications.
  – Tags
  – Database Columns
  – Procedure Parameters
  – Database Tables
  – Procedures/Functions
  – Maps
Mapping UDTs to XML Columns

- Mapping entire User-Defined Data Types (UDTs) to one XML column saves development time
- Optimizes controller and database/JMS communication
Once configured, all data transfers are handled by the module itself.....no other software is required.

Store & Forward (module buffering) and Failover
- Store & Forward: If communication is lost, data can be stored on the tManager.
- Failover: On loss of communication, messages can be transferred to/from an alternate destination.

Logs and Notification
- Diagnostics, status and transaction monitoring via user configurable logging.
- Configurable email alerts for transactions failures, loss of connectivity, server interruptions and other errors.
- Email Notification adapter included with every tManager.

Time-Stamped data
- The time the data is retrieved from the controller can be sent to the database along with the tag data (TIMESTAMP macro).
Data will be written to the tManager’s non-volatile compact flash if communication is interrupted, and written to the original destination once communication is resumed.

Optional email notification
Failover

- Can specify alternate database(s) or messaging endpoint(s) that data is sent to/read from when the original destination/source is not available
- Optional automatic recovery attempt
A Transaction Log keeps a log of transactions that have occurred on a trigger or endpoint

- Can be individually selected and configured for each trigger/endpoint
- Database endpoint logs include the SQL messages sent to the database, data being transferred, and any database error messages
- Trigger logs include the values of the trigger variables, along with the values of the input tags used in the maps the trigger fires

Simplifies Startup and troubleshooting

Historical record for regulatory requirements or ongoing machine analysis

- Configurable FTP or SMTP export
• **Audit log**: contains user changes that have been made

• **System Log**: contains errors and events that have occurred

• **Enable notification**: if enabled, an e-mail/text will be sent when Warning, Error, or Fatal entries are logged

• Log files can be exported when they become full
You can gather information and then use the tManager's **Email Notification Adapter** to place that information into the body of an email. For example, an email can be sent when equipment parameters go out of range, and the email can include the parameter numbers.
• Not a PC so virus resistant
  – No FTP access
  – No telnet access
  – No remote desktop access

• 2 electrically isolated Ethernet ports
  – 1 typically for your control network
  – 1 typically for your business network
  – Module supports persistent routes through gateways; compatible with your network security features

• Access for configuration only though the tManager GUI
  – Granular user privileges

• Audit and Transaction logging
Granular rights, down to the individual Project level, can be defined.
Benefit: Straightforward Maintenance

- Configuration is stored in a single backup file
  - Restore file to spare compact flash or module
- Flexible and easy-to-implement spare part options
- No restrictions on loading GUI software on multiple PCs
- Extensive help
  - Context sensitive online help
  - Knowledgebase (http://kb.oldi.com)
  - Service Requests
  - Live support sessions via WebEx
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>OLDI tManager</th>
<th>Separate Computer with OPC, Custom SW or Packaged SW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Integration</td>
<td>Excellent...ControlLogix Module with full backplane communications</td>
<td>None (external white box or industrial computer)</td>
</tr>
<tr>
<td>Plant Maintainable</td>
<td>Yes</td>
<td>Generally no</td>
</tr>
<tr>
<td>Security</td>
<td>Excellent...access only via GUI; w/ password protection; no remote desktop, FTP or other access means</td>
<td>Poor to Excellent Depends on IT process and discipline</td>
</tr>
<tr>
<td>Software Update Control</td>
<td>Excellent...no forced updates</td>
<td></td>
</tr>
<tr>
<td>Flexibility to configuration change</td>
<td>Easy....change-on-the-fly with GUI</td>
<td>Requires SQL expertise</td>
</tr>
<tr>
<td>Total Cost of Operation</td>
<td>Low....single module (includes configuration software) + person to configure</td>
<td>Medium to High....external computer + operating system + application(s) software + people to program</td>
</tr>
<tr>
<td>Store and Forward</td>
<td>Yes</td>
<td>Not Available with OPC</td>
</tr>
<tr>
<td>Database Failover</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Email Notification of Errors and Warnings</td>
<td>Yes</td>
<td>Could be written with custom software</td>
</tr>
<tr>
<td>Automatic Transaction Logging</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>
Differences between Relational Data & Historians

Transactional (Relational Data) ..transferred by OLDI’s tManager

– Used for storing process and production data as records and relationships
  • Products, recipes, units, machines, orders, order lines, batches, etc.
– Can retrieve complex relationships of data records quickly. However, not optimized to retrieve large amounts of records from the same table

Historian (Time Series Data)…transferred by FactoryTalk Historian ME

– Much data very quickly (in the case of FactoryTalk Historian ME…..as fast as 10ms and 2500 events/sec)
– Use of compression to reduce the amount of memory needed
– Relatively simple data (pressure, temp etc.)

A data historian can’t replace a complete plant database, and a relational database is not a replacement for a good historian.
There is room for both technologies in a good plant data model.
Applications Enabled Include:

- Track and trace…e.g. regulatory
- Recipes and build-to-order requirements
- Equipment configuration
- Measuring and control
- Sensor data reporting
- Feedback for OEE
tManager Industry Segments

- Vehicles & Construction Equipment
- Food & Beverage
- Oil & Gas
- Converting: Fiber & Textiles; Forest Products; Plastics & Rubber; Printing & Publishing
- Material Handling & Packaging
- Metals & Metal Forming
- Life Sciences
- Mining and Aggregates
- Other: Consumer Products; Semiconductor; Mfg NEC; WWW
- Machinery

© 2013 Online Development Inc. All Rights Reserved.
• **Challenge:** Werner Electric, a Rockwell Automation distributor, needed to automate routing of totes through a 24,000 square foot low bay picking area of their main Distribution Center
  – Integrate with business system via MS SQL Server
  – Release empty totes for new orders
  – Route totes through system to shipping
  – Ten picking zones
  – 10,000 Transactions per day
  – Report statistics via email daily
tManager: Automated Warehousing/Tote Routing

Solution:

- VMWare Image
- Windows 2008 R2
- SQL Server 2008 R2
- tManager enables bi-directional data exchange between ControlLogix and the database

Business Network

CLX with tManager

Device Level Ring

PanelView Plus 6 HMI

Cognex DataMan 300 Barcode Reader
Results:

- Increased productivity by over 50%
- Handshaking from tManager module validates transaction complete
- ControlLogix not burdened with message handling
- Routing statistics are emailed to operations daily
- Simplified troubleshooting
- tManager automatically alerts key support personnel upon detection of any errors
- Decreased Downtime
Why Chosen:

- Out of box hardware solution
- Browse all ControlLogix tags
- Enumerate and browse Database Schema
- No additional PAC/PLC code
- Easy to use Visual interface
- Ease of configuration transactions
- Automatic email alerts
- Variety of triggers available
- Logging and Error Reporting Capabilities
Scenario

- **Challenge:** Current process had operators waiting for assays to be input by lab, then had to retrieve them and do calculations manually before entering into HMI. Subject to delay or transcription/calculation errors
- Needed a way for assays to be delivered straight to the PLC promptly and accurately
  - Third party software package used to record laboratory assays for Precious Metals and other elements
  - Some assays used in the PLC logic on the plant floor
  - New expansion to the plant greatly increased the amount of assays needed in PLC logic
• Every 4 minutes, LIMS server sends changes to FTP site visible to Process SQL Server
• SQL database SSIS package scheduled to retrieve all assay changes from FTP site every 4 minutes
• SQL stored procedures created to retrieve exactly the assays needed
• tManager module used to communicate directly to the process network’s SQL server
Results

- Assays delivered to plant floor in minutes of being approved
- Assay results accurate
- Only changes being updated
- PLC detects changes in assays (new results)
- Calculations done automatically for process control
- Assays available to PLC for other calculations
To Learn More... tManager Solutions Website

- Product Presentations
- Customer Case Studies
- Demonstration Videos
- Request:
  - WEBEX session
  - Product Quote
  - Demo Quote