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RTX:LINK – AN EPANET-RTX SOFTWARE TOOL FOR WATER UTILITIES TO IMPLEMENT REAL-TIME ANALYTICS

INTRODUCTION

RTX:LINK is an EPANET-RTX-based software tool developed for drinking water utilities, small and large, to harness supervisory control and data acquisition (SCADA) data and the power of real-time analytics. RTX:LINK provides a web browser view - via smart phone, tablet or computer - of all available utility SCADA data through a cloud analytics service to allow the water utility to remotely access and analyze their SCADA data in real-time. RTX:LINK provides remote access to all available hydraulic and operational data (e.g., tank levels, flows and pressures) and a few water quality metrics (e.g., percent tank turnover per day or per week) to help inform and alert operators, engineers or managers to potential problems. Figure 1 is a schematic of the RTX:LINK software tool.

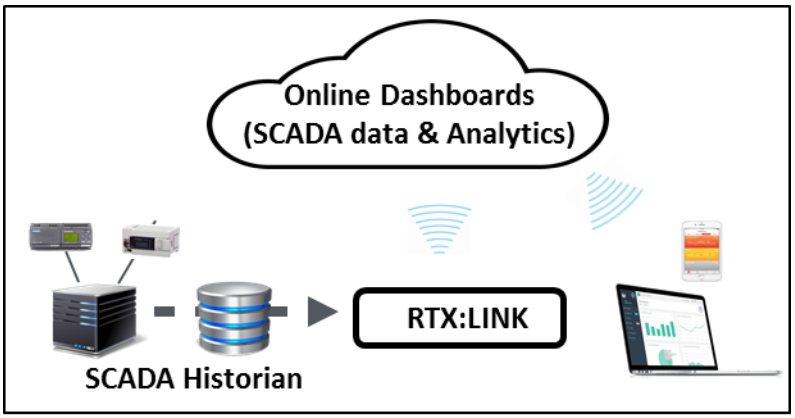

Fig. 1. RTX:LINK is an open source software tool to help water utilities make better use of their SCADA data and implement real-time analytics

The U.S. Environmental Protection Agency (EPA) developed EPANET-RTX as an object-oriented software library comprising the core data access, data transformation and data synthesis (real-time analytics) components of a real-time hydraulic and water quality modeling system. The library was released as an open-source software project on September 24, 2012 to advance real-time modeling capabilities using the hydraulic and water quality solvers of EPANET. EPANET-RTX provides the methods and software tools by which operational data can be connected with a network infrastructure model, and the resulting network simulation model can be calibrated,

verified and continually tested for accuracy using operational SCADA data. Until now water utility engineers have been unable to efficiently test and continuously demonstrate that their water distribution system network model accurately represents system behavior. “Real-time EPANET,” as it is better described, promises to change the way water utilities, commercial vendors, engineers and the drinking water community think about modeling. No longer will water utilities rely on “planning models” for operational analyses, the real-time model will automatically incorporate actual operational decisions over time.

To date, EPANET-RTX technologies have been applied at full-scale in eight medium to large utilities, as well as one small utility. The data requirements of EPANET-RTX for these applications have been modest, consisting of relatively standard remote telemetry information about production flows, tank levels, pump statuses, and valve settings. Currently RTX:LINK is being piloted within the City of Milford, a small drinking water system in southwest Ohio.

DESCRIPTION OF RTX:LINK

RTX:LINK provides a simple, secure, read-only access to key operational data streams (e.g., those stored within a SCADA historian), through web-based dashboards for trending and alerting. RTX:LINK includes a setup wizard to establish database connections and select the data streams to archive. It then provides automatic and continuous transmission of SCADA data streams from the process historian to a modern, high-speed cloud database, and self-configures real-time dashboards for data visualization.

Two applications of the RTX:LINK software tool will be available depending on the level of interest of the water utility to connect their SCADA data to a cloud analytics service for anytime-anywhere access. Here are their specifications:

- Fully functional, cloud-connected version – Time-series SCADA data analytics will be provided for all available SCADA data assets (e.g., flows, pump speeds and statuses, pressures, tank levels, chlorine additions, water quality metrics of interest such as percent daily tank turnover).
- Non-cloud-connected version – Single value-based SCADA data analytics will be available and viewable from a web browser, but only internally from the control room or where SCADA data access is available and permitted.

RTX:LINK is designed to be platform-independent. The RTX:LINK application will be a cross-platform executable, and will be able to be run from anywhere in the water utility that has access to the SCADA historian. Both of these applications will be Microsoft Windows compatible and

downloadable as a ZIP file with associated instructions, including information related to setting up the necessary cloud analytics account (if selected by the utility).

RTX:LINK leverages as much utility data and information as is available for greater and improved decision-making. The piloted version of RTX:LINK within the City of Milford includes a web-based interface (remotely accessed by the water plant supervisor via his smart phone), which provides both raw and processed data streams of hydraulic and operational data (e.g., tank levels, flows, and pressures) and tank water quality metrics (i.e., percent tank turnover per day) to help inform and alert operators, engineers or managers to potential problems. The next phase of RTX:LINK testing will be expanded to additional small drinking water utilities. This next phase of testing will seek to integrate real-time analytics and real-time modeling.

BENEFITS OF RTX:LINK

The benefits of RTX:LINK to the water utility include the following:

- Staff has anywhere and anytime access to SCADA data analytics via a mobile dashboard.
- Provides increased attention to potential operational and emergency problems related to hydraulic metrics, equipment and facility operations. Enables staff to quickly catch a wide range of potential problems observable through SCADA data (e.g., potential problems related to pump operation, flows, pressures, tank operation and disinfectant management).
- Supports improved water quality management. Disinfectant loss and disinfection byproduct formation in the distribution system are a function of residence time, which is affected by day-to-day system operational policies and decisions, particularly those associated with water stored in tanks. By providing real-time, accurate information about operational effects on tank residence time and mixing, real-time analytics can improve awareness of tank water quality, which can lead to operational changes that improve disinfectant management.
- An entry point to advanced model-based predictive real-time analytics using both real-time SCADA data and network infrastructure model to warn of problems.

NEXT STEPS

RTX:LINK is currently being prototyped in the City of Milford, Ohio where it is providing the water department supervisor 24-hour access to tank levels and turn-over metrics, pump statuses, and distribution system flows via his smart phone. Milford's Water Department Supervisor, Matt Newman, states, "Having access to my operational data in real-time keeps me on top of the system performance even when I am not at the plant. This tool helps me manage my staff and resources by providing greater flexibility and real-time information."

The RTX:LINK project team is looking for 4-6 additional, small utility partners to collaborate with EPA and to further evaluate and test RTX:LINK in their systems. The objective of this next phase of testing is to use RTX:LINK to bring cloud-based, real-time data analytics to additional partnering small water utilities to measure key variables related to tank water quality and clearwell disinfection. Through interactive collaboration, facilitated by regular web meetings, surveys and data collected by the utilities for compliance or other purposes, the EPA and utility project team will assess the benefits associated with providing real-time accessible metrics of distribution system water quality. These collaborations and testing platforms will allow EPA to further improve the software for future use by all water utilities.

Ultimately, RTX:LINK is planned for distribution as a free open-source product once the project team has completed its full testing and evaluation at pilot utilities.

EPANET-RTX, including RTX:LINK, development is open to partnerships and collaboration. Both water utilities and the software development community have participated in pilots to demonstrate improvements and identify opportunities for enhancements and research, an approach that EPA values greatly as we strive to develop useful tools to the water industry.

FOR MORE INFORMATION

The intended audience for RTX:LINK are water utilities and their consultants as well as software developers within the drinking water community. RTX:LINK is an open-source software project and, if collaborators are interested, there are various ways to get involved (e.g., connecting to the code repository, looking over coding conventions and using the issues tracker to make a feature request and communicate with the developers). To learn more about RTX:LINK and real-time modeling using EPANET-RTX or ongoing enhancements, visit the repositories of EPANET-RTX and RTX:LINK at https://github.com/OpenWaterAnalytics.

CONTACT INFORMATION

For more information, visit the EPA Web site at https://www.epa.gov/homeland-security-research.

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