System Performance Innovation Fact Sheet

Roadway Weather Information Systems Information Relay

Description of the Challenge or Opportunity

Roadway Weather Information Systems Information Relay

Understanding the motivation.

The RWIS Information Relay is designed to provide the system "middle ware" that allows the capture and export of district Roadside Weather Information System (RWIS) data to the web. It also provides scheduling and formatting of RWIS data to comply with national standards that enables the delivery of reliable Traveler Information. In addition, the relay provides real-time failure data and complete up-time statistics, both site-by-site and system wide. This allows technicians to quickly identify problem sites and allows for performance monitoring based on actual measured data.

The relay is the initiating device that polls environmental and pavement data from remote RWIS field elements on a scheduled basis. The data then undergoes a initial data integrity evaluation for national standards (NTCIP) compliance. Upon passing the check, it is then processed into four standard export formats (XML, JSON, CSV and TXT). These four "data feeds" are then deposited the Caltrans Commercial Wholesale Web Portal and other remote servers for use by internal and external websites. The relay also provides a "technician dashboard" feature that monitors all critical processes and reports statistics in a clean, effective user interface. This enables system performance monitoring and facilitates system and site troubleshooting.

The RWIS Information Relay concept relies on the "atomic" device model of machine-to-machine communications. This processing device resides at each TMC but close to the field on the district's field element network. It is designed to be a processing engine that does a limited number of functions very well. Because it is an atomic device on a network, interaction with field elements and other devices are "forced" to comply with specific information transfer protocols. This improves reliability, data transparency and greatly simplifies trouble isolation.

Steve Hancock, HQ Traffic, has in-depth knowledge about the RWIS Information Relay.

Information Regarding the Innovation

Defining the need.

- How does innovation support the Department's mission, vision, and goals?

- Safety: Integral to exporting RWIS information for winter operations. Remote diagnosis and troubleshooting minimizing on-road exposure of equipment maintenance personnel.
- Stewardship and Efficiency: Ability to measure RWIS system performance, to ensure that the RWIS asset is accurate, reliable, and available.
- System Performance: Better travel decision for vehicle and freight operators.
- Organizational Excellence: Internal innovation to improve the safety of travelers and employees, and efficient management of Caltrans assets.

- How does the innovation improve safety and system performance?
  The RWIS Information Relay improves both safety and system performance by ensuring that RWIS information is readily available to the public on the World Wide Web, and by ensuring that the up-time of the RWIS network in D-2 is maximized. The device provides failure notification and remote troubleshooting, thus minimizing exposure to equipment maintenance personnel.

- Did the innovation have widespread interest in the originating district?
  The RWIS Information Relay has been widely accepted within District 2 as a unique and critically important component of the districts traveler information effort.

  - Was there immediate acceptance of the innovation?
    Yes.

  - To what extent is the innovation being used in the originating district?
    The innovation has been continuously used by District 2 since it its introduction over three years ago.

- Have you been approached by other districts interested in implementing the candidate innovation?
  The RWIS Information Relay has been deployed in District 3 as a proof-of-concept for wider deployment.

  - If the implementation of this innovation been attempted in another district, what was the outcome?

The RWIS Information Relay has been widely accepted in D-3 as a beta version (Michael Mullen D-3 contact).

- How broad is the interest?
  The interest is broad in other districts and other transportation entities such as State DOTS (the RWIS Information Relay has been discussed at various national events including the Western States Forum). Districts with RWIS include D-1, D-2, D-3, D-6, D-8, D-10.

- Is the implementation scalable?
  Yes, the system is fully scalable and was designed with wider scale deployment in mind. That said, the system would require some effort to populate the system with district specific RWIS devices and minor modification (see the section below titled "Estimates the Cost" for more specific information). For this reason, we suggest that a contractor be identified to complete this effort, thus saving precious human district resources for more meaningful work effort.

Estimating the cost.

- Cost to implement the innovation in originating district?
  We plan to use the District 3 deployment as an example. District 3 utilizes 15 RWIS to monitor road weather conditions.

  Deployment of the District 3 RWIS Information Relay cost about 120 hours of staff time. This included setting-up and installing the server, configuring sites, network modifications, RWIS modification, travel, some training, and other incidental work required to turn-up the Information Relay. The material cost for this deployment was approximately $2500 and included a Cisco router and three modems. For districts with a greater number of RWIS not connected to a network, you can expect the material cost to increase approximately $500 per RWIS for a modem. Three of the RWIS in District 3 required a software upgrade to support NTCIP. The software upgrade requires about 5 hours of staff time (not including travel time) to complete and requires a site visit. A district with more non-NTCIP compliant RWIS will cost more in resources. The Information Relay is hosted on a Linux server. Most, if not all TMC's in each district should have a virtual server in which a Linux distribution can be loaded. For those districts without a virtual server, or limited capacity, the Information Relay can be run on a standalone server, slightly increasing cost for the deployment.

- Offsetting factors?
  None.

- Estimated lifecycle/maintenance costs?
  Maintaining the RWIS information relay cost us about 50 hours last year. This includes bug fixes, server maintenance, support for District 3, and configuring new sites.

- Were you able to identified supporting resources?
  No
  - Local partners?
    No
  - Federal funding?
    No

- How long did it take to implement the innovation in your district?
  The District 3 deployment took about 3-4 months. Staff did not work on this deployment exclusively, as we had to integrate the deployment into a demanding workload.

Quantifying the benefits.

- Estimated annualized benefits to the originating district?
  - Polls field element data at regular, configurable intervals
  - Pushes data in 4 common file transfer formats to the Caltrans CWWP2 feed
  - Logs communication diagnostics to aid in network troubleshooting
  - Reports measured network availability

Understanding the risks.

- Barriers to implementation of the innovation?
  None known.

- Risks associated with implementation?
  1.) Network issues vary between districts, integrating this innovation into existing architecture, could be a hurdle. In District 3 we came across three RWIS with no network connection. We had to install a dial-on-demand router to connect to those RWIS 2.) Old RWIS that can't convert to NTCIP.

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What lessons were learned?

- Lesson learned – What would you do differently?

  Nothing
- Do you believe that the innovation is best propagated to other districts by staff or contractor?

  Contractor.

Other considerations.

- Are there any similar processes or products that you considered, but determined to be inappropriate?

  No known equivalent products

- Did the innovation follow a System Engineering process?

  Yes, but not the Federally defined System Engineering process

About the Originating Author/Team

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