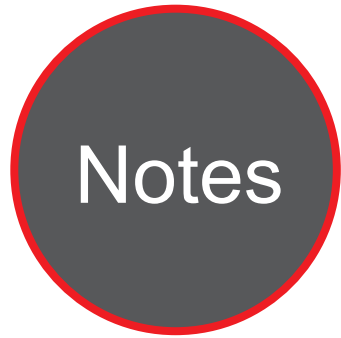




Caltrans Division of Research,
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Research



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Transportation
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Project Title:
Modernization of Center-to-Center
Data Communication Standards

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Task Manager:
Supanpreet Kaur
Transportation Engineer (Electrical)
supanpreet.kaur@dot.ca.gov

Modernization of Center-to-Center (C2C) Data Communication Standards

A research project by UC Berkeley PATH program to review the current Traffic Management Data Dictionary (TMDD) and National Transportation Communications for ITS (Intelligent Transportation Systems) Protocol (NTCIP) standards and recommendations for modernization of these standards.

WHAT IS THE NEED?

Current Center-to-Center (C2C) data communications are based on National Transportation Communications for Intelligent Transportation Systems (ITS) Protocol (NTCIP) (2304 and 2306) and Traffic Management Data Dictionary (TMDD) 3.0x data standards. These standards are based upon Simple Object Access Protocol (SOAP) web services, a method of communication first developed in 1998 and introduced as a World Wide Web Consortium (W3C) specification in 2003. The latest proposed standard for TMDD, version 3.04 continues to use SOAP-based web services as its sole communication mechanism.

Future uses of C2C communications will demand high speed, high volume communication methods. The California Connected Corridors program's need for real-time intersection signal status and detection information over a relatively small regional area (approximately 15 miles by 2 miles) is testing the limits of the SOAP based technology. In addition, as future traffic management center systems need for new sources of data increases, such as the addition of vehicle-to-infrastructure related data, the ability to manage data at higher throughput and speed will become even more critical. The SOAP based web services' high verbosity and need for Extensible Markup Language (XML) parsing limit both its speed and throughput, and adversely impact today's modern traffic management center capabilities.



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WHAT ARE WE DOING?

The objectives of the project will include a review of the current TMDD standard, the current state-of-the-art in software and systems capabilities for high speed and volume communications, and current and future transportation center requirements. With that analysis, a gap analysis will be conducted, and a set of recommended changes to the TMDD specification (and NTCIP specifications, if required) will result. A reference implementation that provides example software using the recommended changes will be provided as well.

WHAT IS OUR GOAL?

The goal of this project is to provide a specification proposal for the modernization of the TMDD and NTCIP specifications, including:

1. Use of more modern data transmission protocols suitable for high speed, high throughput data requirements.
2. Alignment of the specification with up-to-date standards of compatibility with existing software development methods, frameworks, and tools.
3. Selection of transmission methods and protocols suitable to a project needs and budget.
4. Updating to include methods suitable for modern infrastructure environments, include cloud-based and hybrid infrastructures.
5. Inclusion of security standards and protocols specific to the communication methods selected.
6. A reference implementation of the communication standard proposal.

WHAT IS THE BENEFIT?

The outcome from this project will provide public agencies useful information for the assessment of existing TMDD and NTCIP standards and plan for any upgrades needed to these standards for modernization of Center-to-Center Data communication.

WHAT IS THE PROGRESS TO DATE?

Standards Recommendation Reports have been completed. Three standard recommendation reports for Data and System Security, Data transmission and Data structures have been released. A TMDD Modernization Sample Implementation Administration and User Guide was completed. The Kafka services implementation was completed. The implementation utilizes Kafka, including the Kafka broker, Kafka Connect, Confluent Control Center for Kafka, Zookeeper, and the Kafka rest proxy. In addition, two MongoDB database replication clusters (one owner center and one external center) are used. These components were integrated into the same Docker implementation as the SOAP services. This completes the owner center and external center applications. The documentation for the owner center and external center applications were completed, along with the final presentation.

IMAGE

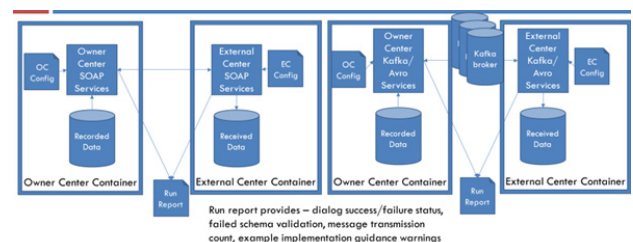


Image 1: Reference Implementation Design