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MONITORING AND ANALYSIS OF THE INTEGRATED NETWORK (MAIN) PHASE II RESEARCH RESULTS

SUMMARY

A new web application tool called the Monitoring and Analysis of the Integrated Network-Core Data Exchange (MAIN-CDX) can support the monitoring and troubleshooting of Interoperable Train Control (ITC)-compliant Positive Train Control (PTC). The tool provides a standard method of requesting ITC-PTC asset data from other railroads, replying to requests received for asset data, and tracking request status through the use of a dashboard. Through the use of the user interface, MAIN-CDX provides railroads the capability to manually create requests for ITC-PTC asset data and manually respond to requests for data received.

Railinc Corp. developed MAIN-CDX under the sponsorship of the Federal Railroad Administration (FRA) and with the guidance of Transportation Technology Center, Inc. (TTCI) and an advisory group (AG) consisting of Class I railroads, shortline railroads, passenger and commuter railroads, and ITC-PTC vendors. TTCI also supported the development, testing, and implementation of the new application.

Through the development of use cases for automating the creation of requests for ITC-PTC asset data from other railroads, and for responding to those requests, TTCI identified the need for four new Interoperable Train Control System Management (ITCSM) messages. The new ITCSM messages were created, tested, and integrated with MAIN-CDX enable the railroad industry to:

- Create requests for data and respond to those requests either manually, through MAIN-CDX, or automatically, using the ITCSM messages.
- Integrate railroads that prefer to use MAIN-CDX (to manually request/respond) with railroads that prefer to use ITCSM messages (to automatically request/respond).

MAIN-CDX has been well-received by the industry and is currently being used by ITC-PTC railroads in both the manual and automated (auto) capacity.

BACKGROUND

When an ITC-PTC issue arises during interoperable operations, data from another railroad's ITC-PTC asset(s) is often required. Prior to MAIN-CDX, such data exchanges were initiated by the host railroad requesting data from the foreign ITC-PTC assets via phone or e-mail. That process resulted in significant delays in receiving the data, and due to the informal nature, the data received in some cases was not what the requesting railroad required, resulting in additional delays.

Interoperable railroads using ITC-PTC agreed that a standard tool was needed to request and transfer ITC-PTC data among one another. The industry requested that the standard tool initially support manual entry for the request and transfer of ITC-PTC data with a method to integrate an automated process for supporting the same capabilities.



Figure 1 shows an overview diagram of MAIN-CDX, with railroads A and B having manual and

auto capabilities and railroad C being a manual railroad user.

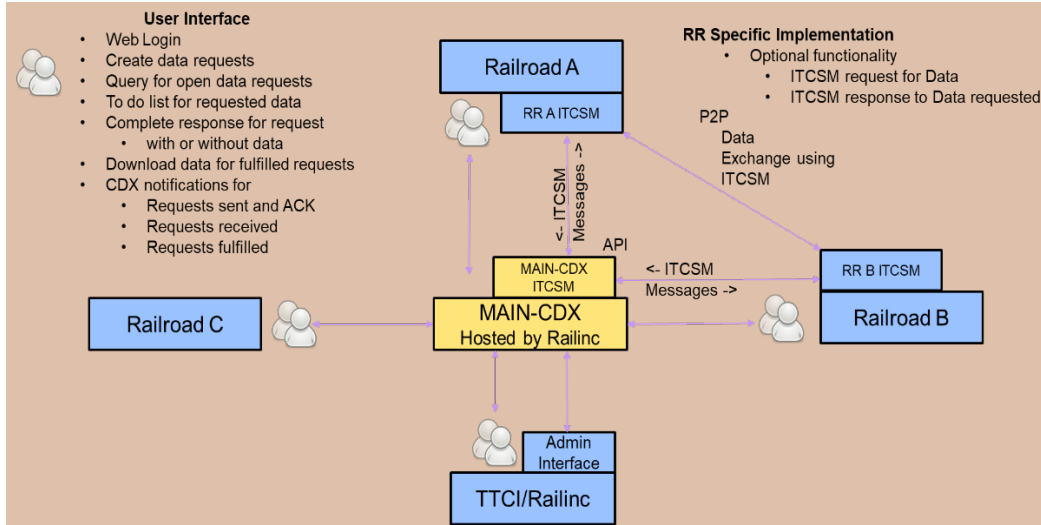


Figure 1. MAIN-CDX – Overview Diagram

OBJECTIVES

The initial objective of the MAIN Phase II project was to support the industry’s immediate need for a standard tool that could manually create requests for ITC-PTC asset data from other railroads, respond to requests for data received, and track request statuses through the use of a dashboard. The MAIN-CDX tool also needed to notify railroads when a request for data was received or when data was provided for a request – as well as periodically notify railroads of open requests.

After MAIN-CDX met the railroads’ needs for manually requesting and transferring data, the next objective was to develop a method to integrate railroad back offices to the application to support the automation of ITC-PTC asset data requests and responses to those requests.

METHODS

TTCI conducted this project with assistance from an industry AG. The overall approach involved working with the AG to identify the requirements needed to efficiently request ITC-PTC asset data from another railroad, reply to requests for data, and track request status. To achieve this, TTCI first identified the input and output data

needed for the MAIN-CDX application and the use cases supported by MAIN-CDX.

TTCI supported Railinc in developing and testing the MAIN-CDX application, which provided a user interface consisting of three main features:

- A dashboard for viewing details of requests created or received by the railroad signed into the application.
- A “Create Request” page for creating a request for ITC-PTC asset data from another railroad.
- A “Response” page for responding to a request received.

TTCI and Railinc collaborated with the AG to determine and develop the capabilities of each of these features within MAIN-CDX. In addition, the group determined the requirements to provide notifications from MAIN-CDX to railroads when a request has been received is either still pending or has been addressed.

User Acceptance Testing (UAT) by participating members of the AG was completed prior to making the MAIN-CDX tool available to the industry. Feedback from the UAT and industry use was reviewed with the AG to determine



additional capability and improvements for future releases.

TTCI developed message requirements for four new ITCSM messages to support the industry's interest in automating requests for ITC-PTC asset data from another railroad and automating the responses to requests. TTCI collaborated with the AG and the ITCSM working group to develop and review the requirements for the ITCSM messages. These requirements have been recommended for inclusion in a future release of the *AAR Manual of Standards and Recommended Practices* (MSRP), Standard S-9460.

The requirements were used to add the ITCSM messages into the Systems Management Gateway software, implement the messages within railroads' back offices, and to implement the messages within the MAIN-CDX application.

Another round of UAT, with participating members of the AG, was completed to test and verify the capabilities of MAIN-CDX using the new ITCSM messages.

RESULTS

The MAIN-CDX application, first released to the industry in December 2018 to support manual data requests and transfers, was well-received. MAIN-CDX application updates for manual data requests and transfers have been tested and released, based on industry feedback.

To support automation of the data requests and transfers, the four new ITCSM data transfer messages created are:

- 10303 Data Transfer Request Message
- 10304 Data Transfer Response Message
- 10305 Notification Message
- 10306 Notification Response Message

The 10303 Data Transfer Request Message and 10304 Data Transfer Response Message can be used by railroads that implement the ITCSM messages to send or receive requests and responses. These messages can be sent either

to MAIN-CDX, if the request is going to a railroad using the MAIN-CDX application, or directly to another railroad that has also implemented the ITCSM messages. The 10305 Notification Message and 10306 Notification Response Message are used to notify MAIN-CDX to support logging and tracking the request status of data requests and responses that occur between two railroads using ITCSM messages.

By integrating the MAIN-CDX application and the new ITCSM messages, four different data transfer paths were created:

- Manual-to-Manual: Initiating requests and sending responses over the MAIN-CDX application.
- Manual-to-Auto: Initiating the request in the MAIN-CDX application, mapping and sending the request to the responding railroad using ITCSM messages, and using ITCSM responses from the responding railroad to update the manual request within MAIN-CDX.
- Auto-to-Manual: Request is received at MAIN-CDX by ITCSM message and the ITCSM request is used to generate a manual request in MAIN-CDX for the responding railroad. The manual railroad responds to the request using the MAIN-CDX application. MAIN-CDX and the requesting railroad use ITCSM messages for updating the response.
- Auto-to-Auto: Requests and responses are sent directly between two railroads using ITCSM messages. ITCSM messages are sent to MAIN-CDX for notification purposes.

The MAIN-CDX application supports the integration of the ITCSM messages and the four different data transfer paths. This release was provided to the industry in December 2020.

As of the date of this Research Results, MAIN-CDX is used by 298 users across 54 different railroads. There have been over 23,400 requests created with an average of about 1,300 requests per month over the 6 months prior to date.



CONCLUSIONS

The MAIN Phase II project successfully provided the industry with a standard tool, MAIN-CDX, to efficiently create requests for ITC-PTC data assets from another railroad, respond to requests for data, and track request status. MAIN-CDX meets the industry needs for creating these data requests both manually, using the user interface of MAIN-CDX, or with increased automation, using the new ITCSM messages developed.

FUTURE ACTION

Continued industry use of the MAIN-CDX application will be supported by Railinc. Railroad feedback on the MAIN-CDX application and the different methods of transferring data will be used for updates to future releases. Railinc will also support the integration of ITCSM message exchanges as railroads implement the new ITCSM messages within their back offices.

Data currently provided in response to requests for ITC-PTC asset data has been sufficient for the industry's troubleshooting and analysis needs, but the industry has expressed interest in future work to further standardize ITC-PTC asset data to improve the troubleshooting and analysis. The need for additional standardization may be clearer as the tool matures, and as railroads continue to use the data provided.

ACKNOWLEDGMENTS

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