Case Study: FHWA HPMS

FHWA HPMS Overview

The Federal Highway Administration's (FHWA's) Highway Performance Monitoring System (HPMS) collects highway information from State DOT's (Department of Transportation) to determine the extent, usage, condition, and performance of the Nation's highways. The information is used for highway needs assessments, transportation performance measures, apportionment of highway funds and numerous research applications. State DOT's report data to the FHWA annually, in two bulk uploads, in a format and collection process explained in the HPMS Field Manual. The data is processed through a validation engine in the HPMS Software. The validation engine checks the data for inconsistencies and reports the findings back to the data providers. Having a robust validation engine can reduce the review time of the data and make it available for production. To future proof the HPMS validation engine, FHWA was looking for a Commercial Off The Shelf (COTS) solution that could provide similar validation capabilities but extend them to include additional types of validations. FHWA chose to contract with 1Spatial Inc. to implement its 1Integrate rules engine to upgrade its system to meet the current requirements.

Challenge

The original HPMS System had adequate custom validation tools for their time, however the system needed an upgrade for numerous reasons. The original validation process involved many custom scripts that required a highly skilled programmer to update the source code as legislation and policies changed yearly. The system was built on Microsoft's Silverlight which was due to reach its end of support in 2021.The process did not scale and could only process one state at a time which resulted in extremely long wait times for State DOT's to receive feedback regarding their submitted data quality. The validation checks were non-spatial, which could lead to duplicate or inaccurate reporting. The validation reports came back as a tabular report that did not integrate easily into each DOT's source system. All these challenges resulted in State DOTs frustration and consternation during HPMS submittal season.

Solution

FHWA contracted with 1Spatial Inc. to provide and implement its 1Integrate rules engine. Doing so allowed FHWA to upgrade its system to overcome the challenges mentioned above. 1Spatial Inc., worked alongside FHWA to assist with authoring the rulesets that matched the required existing validation checks performed by the existing system. Further, 1Spatial Inc. workshopped with FHWA to help identify additional validations, leveraging top-

ological relationships, to increase the performance of the system resulting in much quicker turnaround times for state DOT's. The solution is scalable and will support up to 5 concurrent statewide validation sessions. The 1Integrate implementation currently runs side by side with the former system and will become the core validation engine with the release of HPMS 9.0.

Advantages of the solution:

- COTs product updates with quarterly releases
- Configurable Rules Engine where SME's (not developers) can update rulesets to support changing legislation/policies
- Multiple States can be processed at one time and can scale out to support more if needed (currently up to 5 state submittals processed simultaneously)
- Topological Checks help identify duplicate\missing reporting
- Spatial report datasets easily integratable into core HPMS systems

Benefits

By implementing 1Spatial's 1Integrate product to perform the HPMS validations, FHWA can move away from having to rely on developer resources. They will no longer be dependent on these resources to maintain and update the validation checks every year. Also, by leveraging COTS technology, FHWA will receive updates to keep up with current security patches and underlying software. Now, FHWA can validate multiple states (up to 5) to ensure no states have to wait. The smaller states no longer have to worry about being behind the larger states. By leveraging 1Integrate, FHWA is expanding the rule catalog to include spatial and topological level validation checks. Leveraging 1Integrate to perform spatial and topological validation checks will improve the validation checks performance and will identify and help states correct the topological and geometric issues with their networks. The state suppliers also get the added benefit of the provision of a geospatial report which can be utilized in their geospatial technology to pinpoint the exact location and type of issue(s) identified. This makes fixing the data a much more streamlined process, thereby gaining efficiencies. Fixing the topological and geometric issues will empower FHWA to automate the integratation of data sources into new products like a nationwide routable interstate network.

Future

1Spatial continues to assist FHWA as they move 1Integrate into production and as part of the team to implement the new HPMS 9.0 application, set to be released in 2022. Further, 1Spatial will continue supporting other use cases of the rules engine such as automating the generation of a nationwide routable interstate network and automating the road centerline change detection between federal agency data suppliers into the Federal Lands dataset.