CIRRUS BY PANASONIC V2X

Panasonic

How to Achieve Interoperable Priority and Preemption

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How to Achieve Interoperable Priority and Preemption

There are many different technologies and approaches to delivering priority and preemption for approved service vehicles. Legacy systems operated primarily at the edge with dedicated hardware that served a specific deployment. Advancements in connectivity and data collection/processing have made it possible today to consider priority and preemption systems that not only deliver metrics to monitor and report on system efficacy but also integrate across multiple platforms to reduce dependency on deployment of dedicated hardware by leveraging systems already in vehicle. Panasonic proposes the architecture described in this paper to achieve interoperable priority and preemption for connected fleets

Key Use Cases

Before outlining an architecture for interoperable priority and preemption, first let's examine why such features are desired. There are several key use cases grouped into two categories here.

Preemption for emergency and critical fleet vehicles is a first use case. In general, this service works to change the light green in the direction of travel as soon as possible and hold the light until the vehicle has passed. Exact implementation is dependent on the rules programmed into the specific traffic signal controller, but the overall use case is to give a green light as fast as possible for safe passage of the vehicle. This service is typically reserved for vehicle classes such as ambulance, fire, and snowplow.

The second use case is signal priority, which generally grants quicker and longer greens to the requesting vehicle's direction but may not hold the light for as long or respond as quickly as in a preemption case. This type of service is used by transit and freight vehicles to allow large vehicles faster passage with goals of reducing emissions, braking, and route time variability associated with stopping at lights.

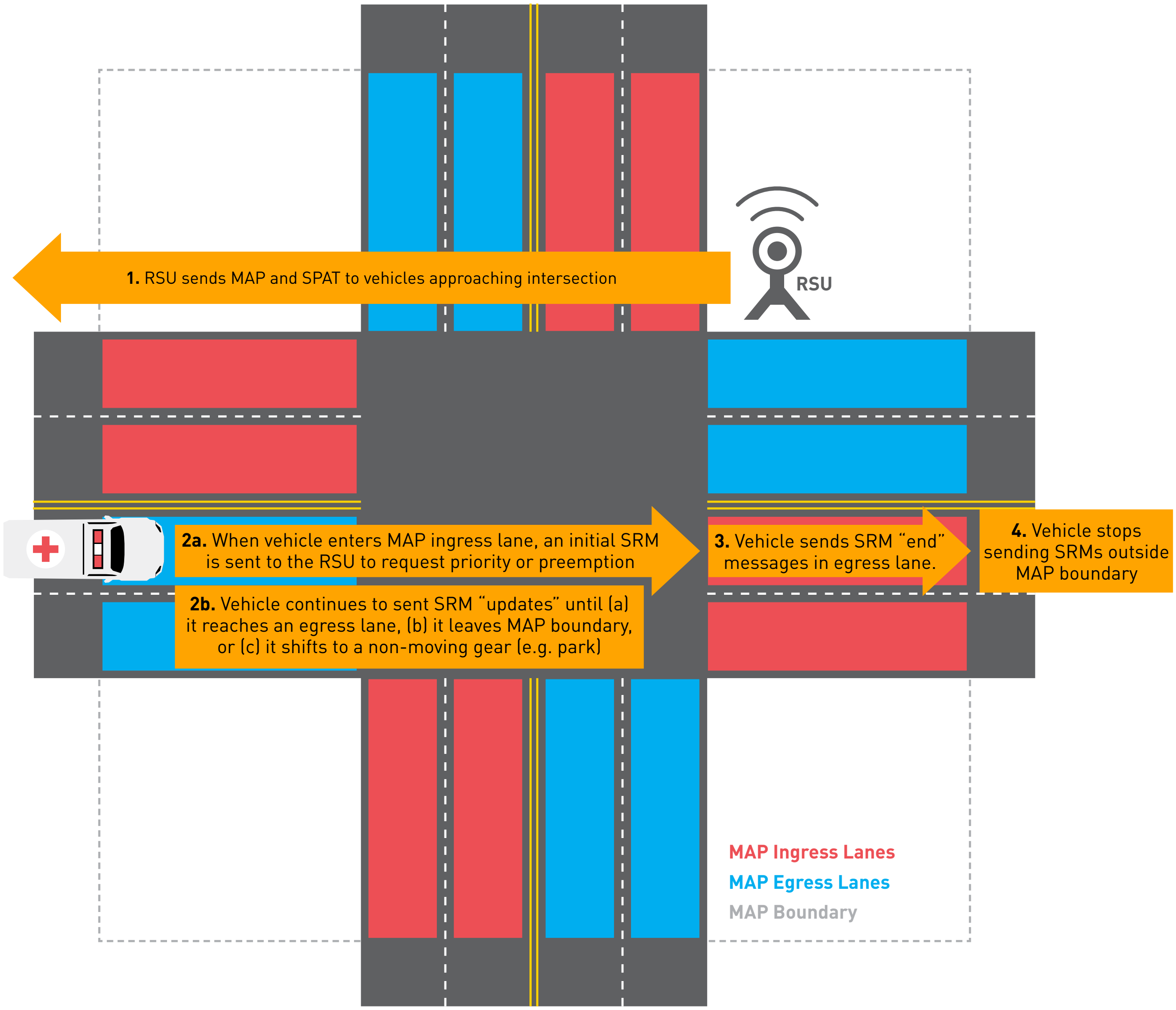

Figure 1. Representation of intersection MAP data that is captured by the CIRRUS platform

Interoperable Design

As a case study on interoperability of this architecture, two specific implementation types are examined. The first is standards-based J2735 V2X priority and preemption via MAP, SPAT, SRM, and SSM messages from OBUs and RSUs. The second is proprietary vehicle telematics data as an input to requests at intersections equipped with cloud-connected traffic signal controllers.

V2X OBUs and RSUs are designed to deliver priority and preemption via 5.9GHz edge applications. These services generate standards-based datasets that can be collected by RSUs configured to forward these messages to a defined endpoint such as the CIRRUS cloud platform. When the data is collected by CIRRUS, algorithms have already been developed to optimize data storage and analytics for use in metric reporting such as number of vehicles requesting and impact on the journey (e.g. idle time, emissions, or traversal time reduction).

Dashboards and aggregated insights are available to any V2X-equipped intersections from day one within CIRRUS, and because V2X deployment can support additional use cases there are other features already developed in CIRRUS such as traffic events and driver warnings generated from V2X datasets as well as the priority and preemption analytics described here.

For fleets that do not have OBUs already deployed in vehicles, or for intersections that do not have RSUs, other options exist to unlock priority and preemption with existing hardware via cloud connectivity. CIRRUS can leverage vehicle telematics from any source to identify and generate a request at a specific location. CIRRUS can also send the request to the intersection via NTCIP or through API connection to the traffic signal controller network. These options enable more locations and more vehicles to participate in services without additional hardware deployment and associated maintenance.

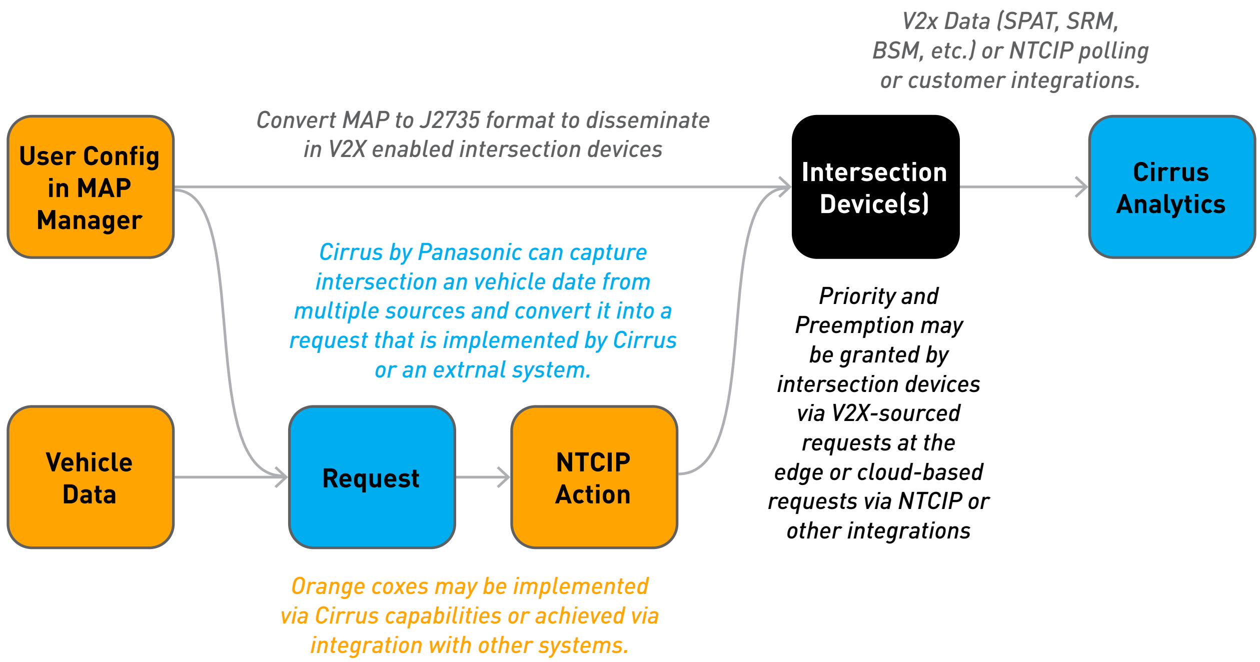

Figure 2: Key components of the CIRRUS by Panasonic platform.

System Architecture

The CIRRUS by Panasonic platform has integration points (in orange) for scaling priority and preemption services through collaboration or partnership with different system operators.

CIRRUS can accept intersection MAP configuration and vehicle telematics data from multiple sources. Users can directly enter the intersection configuration data in CIRRUS's MAP manager feature, compatible with both V2X as well as proprietary or custom deployment types. Similarly, vehicle data can be collected from V2X based systems like OBUs or other sources such as GTFS real time feeds, AVL systems, or other on-board connected hardware like Panasonic TOUGHBOOK. These inputs are processed by CIRRUS's request logic to determine when and where priority and preemption services are needed based on location, user-defined vehicle triggers (e.g. siren/lightbar active, transmission in drive, bus behind schedule, etc.), and intersection configuration (e.g. signal group needed to serve the request based on the lane in which the vehicle is approaching the intersection).

Once the request is created, CIRRUS can send the request to the traffic signal controller via NTCIP, or to another system for implementation such as an IOO's ATMS. In addition to sending the request over NTCIP, CIRRUS can also optionally collect data over NTCIP through regular polling for analysis such as whether the request was granted and how the signal timing might have changed from routine operations as a result

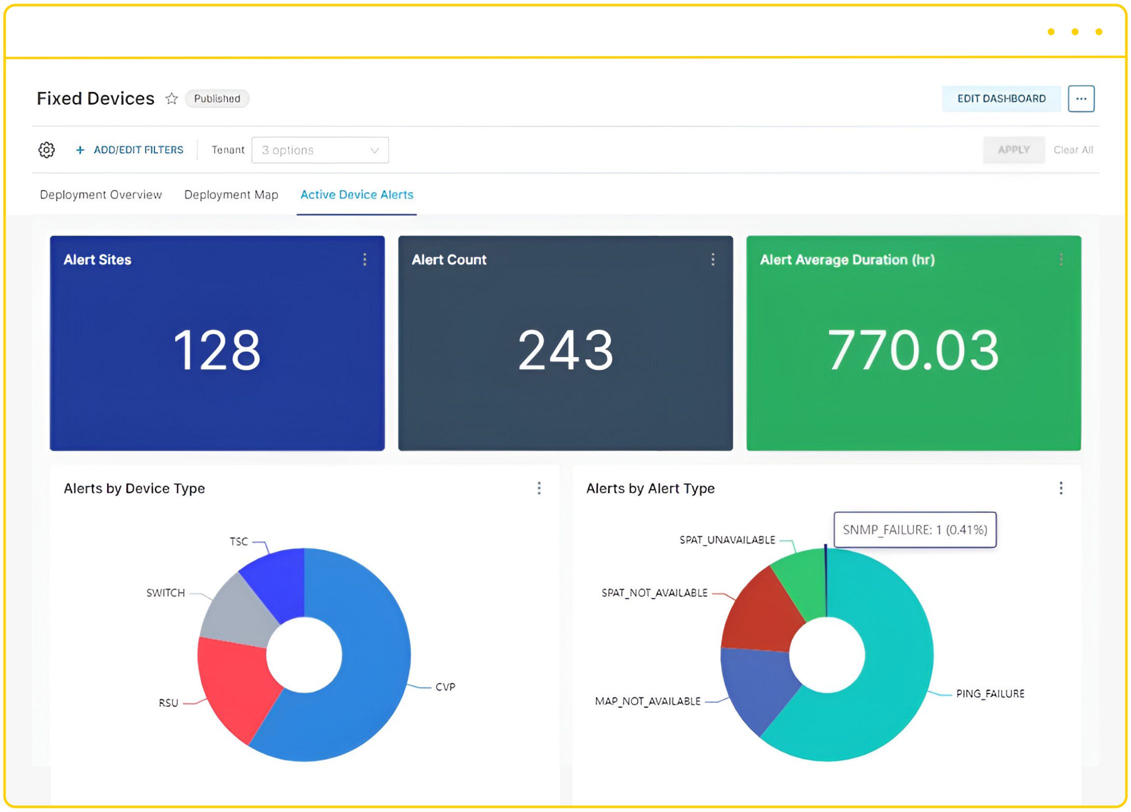

Figure 3: Sample of individual fixed device health alerts as shown on the CIRRUS dashboard.

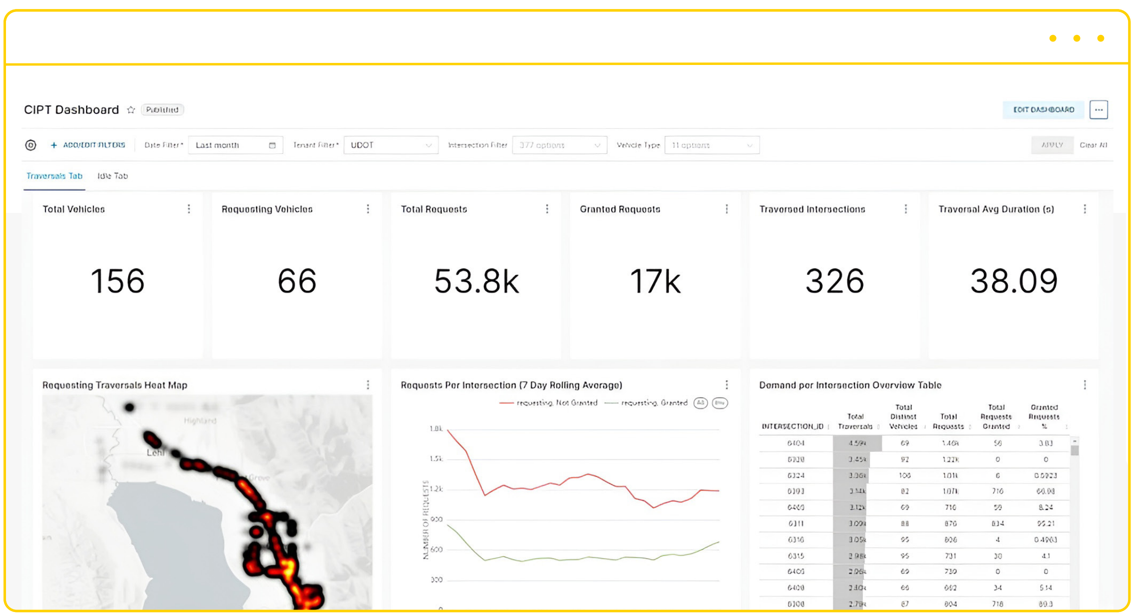

Figure 4: System efficacy metrics as shown on the CIRRUS dashboard.

Impact Reporting

A key value add of CIRRUS's interoperable priority and preemption feature set is data collection and reporting. The CIRRUS team has years of experience deploying, operating, and maintaining priority and preemption solutions and has developed tools to support health monitoring and efficacy analyses. Some examples of data processing enabled by CIRRUS include individual device alerts, intersection site configuration alerts, and system level benefits.

The dashboard above shows a sample of individual fixed device health alerts detected by CIRRUS. The CIRRUS architecture is extensible to report on V2X-based alerts such as SPAT and MAP issues derived from the PFS CIMMS logic as well as other alert types applicable to any permanently network connected device (ICMP/ping) or device compatible with standards such as SNMP and NTCIP.

CIRRUS is also able to detect and report on system level issues and benefits delivered. Some efficacy metrics generated through CIRRUS data collection include analysis of idle events at intersections and the impact on idling when priority and preemption is granted or not granted.

What's Next?

Panasonic is ready to integrate with your deployed systems to enable scalable, cloud-based priority and preemption services for your critical fleets. Let's talk about how Panasonic's Smart Mobility solutions can make your fleet safer and more cost effective.

About CIRRUS by Panasonic

CIRRUS by Panasonic is a division of the Panasonic Corporation of North America's Smart Mobility Office. Formed in 2017, our connected vehicle applications are among the first to shift signal priority applications from legacy hardware units to cloud technology.

The CIRRUS platform enables instant and safe communication between vehicles, infrastructure, intersections, and the operations teams who manage them. Our optimized, patent-pending algorithms incorporate data from edge devices, external systems, and cloud products for a scalable, complete, end-to-end solution.

Learn more at **https://mobility.na.panasonic.com/CIRRUS**

About the Author

As the Head of Technology for CIRRUS by Panasonic, **Lauren Cordova** leads data, analytics, cloud, and edge engineering functions to deliver advanced transportation solutions for government and fleet markets. Lauren's deep expertise in data architecture design has led to several industry-first approaches to managing connected vehicle data at scale, with multiple patents pending. Lauren has 20 years of experience as a mechanical, systems, and data engineer developing technology for NASA, medical, defense, energy, and transportation solutions. She holds a B.S. in Mechanical Engineering from The University of Texas at Austin, and is based in Denver, CO.