iW-RainboW-G26
Telematics Control Unit Open-Source Tree (OSTree)

Robust solution for managing software updates in connected vehicles

Introduction

OSTree, short for "Open-Source Tree," is a versioned file system designed to manage the root file system of a Linux-based operating system. Initially developed for managing the Linux desktop, OSTree has found its way into various telematics solutions, including the Telematics Control Unit (TCU), Telematics Gateway, and Rugged Telematics Device.

Recently, iWave delivered the OSTree framework to a leading automotive customer, enabling seamless and consistent updates across a fleet of TCUs. Facing challenges in managing diverse TCU specifications across their vehicle fleet, our client sought a solution for reliable, secure, and efficient software updates. With an extensive portfolio of diverse vehicle models and the rapid evolution of automotive technology, the company found it challenging to ensure the reliability, efficiency, and security of software updates across its entire fleet of connected vehicles.

Challenges

- Difficulty in managing software updates across a variety of fleet models
- Traditional methods for software updates presented reliability challenges
- Addressing concerns about downtime during software updates
- Ensuring the security and integrity of updated software
- Difficulty in managing limited storage resources on TCUs

Solution Highlights

Recognizing the challenges faced by our client, iWave collaborated closely to implement a robust solution leveraging OSTree technology. As an embedded solutions provider with a focus on automotive applications, iWave brought its expertise to the table, aligning the OSTree framework with the specific needs of the automotive industry. Advantages of incorporating OSTree in TCUs include:

- Implement atomic updates to enhance reliability
- Utilizing rollback capabilities for risk mitigation
- Adoption of a versioned filesystem for systematic management
- Optimizing storage space efficiently
- Facilitating a secure environment for sensitive data operations

OSTree introduces atomic, transactional updates, a game-changer in TCU software management. By employing this approach, updates on the TCU are either fully applied or not applied at all. Thereby minimizing the possibility of incomplete or unsuccessful updates that could jeopardize TCU functionality.

This ensures a consistent and reliable user experience. This rollback functionality enhances TCU reliability, minimizing downtime and providing a safety net against unexpected challenges introduced by updates.

The adoption of a versioned filesystem allows multiple versions of the file system to coexist facilitating seamless switching between different software versions, enabling A/B system updates. The ability to track changes through different snapshots ensures a structured approach to software evolution. OSTree optimizes storage space through hard links and **deduplication techniques**. This is particularly critical in TCUs, where storage resources are often limited. In the security-sensitive environment of TCUs, OSTree maintains the integrity of the software update process. Through cryptographic signatures and checksums, only trusted updates are deployed, reducing the attack surface and ensuring the reliability of the entire system.

Creating and Managing OSTree Repositories

- Setting Up an OSTree Repository
  Leveraging the meta-updater layer in Yocto, the setup and maintenance of OSTree repositories were streamlined. This provided a user-friendly interface for repository management.

- Managing Repository Versions:
  OSTree's versioning system facilitated the creation and storage of different snapshots of the file system tree. This ensured that changes could be tracked, and older, known-good states could be easily restored in case of issues.

- Ensuring Repository Integrity:
  Robust security measures, such as cryptographic signatures and checksums, were implemented to ensure the integrity of OSTree repositories. This protects against tampering and unauthorized updates, guaranteeing the reliability of software updates.

With an OSTree repository populated with versions of the file system tree, the deployment of updates to TCUs became a secure and efficient process. This minimized the risk of conflicts, ensured that devices received the correct updates, and enhanced overall update reliability.

By addressing challenges related to reliability, rollback capabilities, storage optimization, and security, OSTree empowers TCUs to operate efficiently, ensuring the safety, performance, and reliability of connected vehicles. The streamlined repository management and secure deployment processes further contribute to the seamless evolution of in-car software systems.

For more information, please contact mktg@iwavesystems.com.