The Eclipse Foundation brings open source software to the automotive industry

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The auto industry has always adopted a proprietary-first approach to building software, but things may be changing. With most vehicles now running millions of lines of code, many OEMs and tier one suppliers have begun to explore the possibility of leveraging open source software stacks.

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Introduction

While automakers previously sought to differentiate based on features like drivability and trim, increasingly they are turning to software features and driver experience as a way of standing out from the competition. With this newfound emphasis on software, automakers are beginning to leverage the open source software stack as a way to accelerate development and testing. Open source is also useful in that it encourages cross-industry collaboration and standards interoperability. Canada-based nonprofit the Eclipse Foundation is working to drive innovation in this area.

451 TAKE

So far, the Eclipse Foundation has created four working groups directly related to automotive – OpenADx, openMobility, openPASS and openMDM – each of which has several high-profile partnerships with OEMs and tier suppliers. Bosch is partnered with all four. The ultimate metric, however, is not how many partnerships the Eclipse Foundation can accumulate but how frequently its open source technology is deployed in the real world. In this regard, openMobility's Eclipse SUMO project stands out, having been downloaded almost 75,000 times last year. The automotive industry is deeply entrenched and not very susceptible to disruptive approaches like open source, so the Eclipse Foundation must continue to leverage its nearly 20-year history and over 300 members as it looks to increase open source software adoption throughout the industry.

Context

The Eclipse Project – a Java-based open source development platform – was created by IBM in 2001 and was supported by a consortium of software vendors. In 2004, the Eclipse Foundation was created to be a steward of the Eclipse community. Now 16 years old, the organization has more than 300 members and is home to over 375 open source projects across IoT, automotive, systems engineering, and other domains. It is structured as an independent nonprofit corporation and is headquartered in Ottawa. Mike Milinkovich has been executive director of the Eclipse Foundation since its creation in 2004.

In May, the Eclipse Foundation announced plans to expand to Europe. It will base its European operations in and move its legal headquarters to Brussels, a move prompted by recent growth internationally. The foundation noted during our briefing that roughly 70% of its paying members and about 70% of its developers are based in Europe. It has filed with the EU and is awaiting royal decree before opening its office in Brussels.

As noted, the Eclipse Foundation has four working groups related directly to automotive: OpenADx, openMobility, openPASS and openMDM. It also oversees Kuksa, a platform for vehicle-to-cloud connectivity.

OpenADx

The purpose of OpenADx is to accelerate the development of the autonomous driving (AD) toolchain. The AD toolchain encompasses the development, testing and validation of software-based autonomous driving functionality. For instance, how does a car distinguish between a pedestrian and construction cone? How does it detect an impediment in the road and react in time to avoid it? All of these questions require autonomous vehicle applications that must be developed, tested and validated before they are deployed in the real world. The challenge has been that there are hundreds of competing tools across the toolchain, few of which were designed to be compatible with each other.

The OpenADx working group was formed to make the AD toolchain more accessible by enhancing integration capabilities and creating an industry-wide reference architecture. One of OpenADx's initial projects, Cloe, is a closed-loop simulation kit for testing autonomous driving software components. OpenADx is also working on a project called iceoryx, an initiative to address the large (and increasing) data transfer requirements in vehicles.

The working group has several notable members. Along with Bosch and Microsoft, which teamed up to start OpenADx in 2017, there is ADLINK, Continental, DENSO, IBM, Red Hat, Renesas, Samsung, Siemens and ZF.

openMobility

OpenMobility is the working group dedicated to fostering the development of mobility modeling technologies. Some of its common use cases include the simulation of ADAS systems, the prediction/ optimization of traffic flows, and the evaluation of new businesses like mobility as a service.

The working group's primary project is Eclipse SUMO (Simulation of Urban MObility), an open source multi-modal traffic simulation package that was created at the German Aerospace Center in Berlin 20 years ago. The software package allows developers to create a digital twin of a city for the purpose of modeling real-world traffic systems with motorized vehicles, public transportation, pedestrians and cyclists, as well as route finding and emission calculations. The biggest members of openMobility are AVL, Bosch, DLR, Fraunhofer and Vector.

In 2019, SUMO was downloaded 70,000-75,000 times worldwide. The US had the most downloads, followed by China, India and Germany. One interesting real-world use case is occurring at Oak Ridge National Laboratory, where researchers have set up a supercomputer to simulate the entire Dallas/Fort Worth International Airport. The models will help the researchers understand traffic patterns in the vicinity of the airport and be able to recommend improvements.

openPASS

in 2016, openPASS was created in response to the rise of advanced driver-assistance systems (ADAS). The goal was to create a platform capable of doing virtual simulations of ADAS so that it would be possible to assess the safety of these systems and their impact on traffic. The result of the working group is sim@openPASS. The current members of openPASS are BMW, Mercedes-Benz, Bosch, Toyota Europe, TÜV Süd and Volkswagen of America.

openMDM

The openMDM working group develops open source software to help manage the data produced by vehicle development tests – for instance, tests of ADAS, powertrain, crash safety and pedestrian protection systems. Given the quantity and variety of automotive test data, developers at OEMs, tier one suppliers and tool vendors increasingly need measured data management systems. Such systems are key to managing data across dozens of car models and can speed up development cycles and product validation. To address this, openMDM offers a toolkit that allows developers to compose applications for measured data management systems.

Eclipse Kuksa

Kuksa is the Eclipse Foundation's open source development ecosystem for connecting vehicles to the cloud. The ecosystem offers an in-vehicle platform, a cloud back-end platform, and an app development IDE for the development of new functionalities. V2X scenarios, vehicle maintenance, security, and over-the-air updates are all within the scope of Kuksa.

The major companies involved are Bosch, NXP and Ericsson. A few universities are also involved, including Dortmund University of Applied Sciences and Arts, Technical University Eindhoven, Paderborn University and University Oulu.

Competition

The Linux Foundation's Automotive Grade Linux (AGL) project is the Eclipse Foundation's main rival. The AGL is building an open source OS for vehicles to address ADAS, safety, autonomous driving and telematics. It has dozens of high-profile members, including DENSO, Mazda, Panasonic, Renesas, Suzuki, Toyota, Honda, AISIN AW, Amazon Auto, Mercedes-Benz, Ford, NTT Data, Qualcomm, SAIC, Volkswagen, and more. The AGL should not, however, be viewed purely as a competitor of the Eclipse Foundation. They are rivals, to be sure; however, the two foundations also play complementary roles in the automotive open source ecosystem. The AGL is focused primarily on developing an in-vehicle open source OS, while the Eclipse Foundation is building an automotive development ecosystem and toolchain. Additionally, the Eclipse Foundation's Kuksa project has a relationship with the AGL.

Also vying with the Eclipse Foundation is the Autoware Foundation, an open source automotive organization created at Nagoya University in Japan in 2015. Like the AGL, the Autoware Foundation should be viewed as a 'frenemy.' While it definitely competes in certain areas, it also works alongside the Eclipse Foundation as a member of OpenADx and as an associate member of the foundation.

Finally, Baidu Apollo's open source autonomous driving platform is an ascendant challenger and will contend with the Eclipse Foundation if it keeps adding members to its ecosystem. As of September, Baidu Apollo had 200+ members in its ecosystem, including 34 automotive OEMs (Chinese OEMs, plus BMW, Daimler, Ford, PSA, Honda, Hyundai, Toyota, Volkswagen, Volvo, and more), over 50 hardware/software vendors, 20-plus tier ones, and several government and education entities. Baidu has made its Apollo platform open source in a bid to become the Google Android for autonomous vehicles.

SWOT Analysis

STRENGTHS
The Eclipse Foundation's nearly 20-year history, over 300 members, and 375-plus ongoing projects gives it the clout it needs to impact the software direction of the automotive industry.

WEAKNESSES
Open source software may have promise for the automotive industry, but since it goes squarely against historical industry trends, adoption may take a long time.

OPPORTUNITIES
The automotive industry is currently in the midst of a massive paradigm shift. The push for C.A.S.E. – connectivity, autonomous, sharing and electrification – sometimes called the guiding principle of the future of mobility, should allow different business approaches like open source to influence the industry.

THREATS
Proprietary technology should always be viewed as a threat to the Eclipse Foundation's open source goals. This is particularly true for the automotive industry, where the incumbent set of vendors – automotive OEMs and tier suppliers – are deeply entrenched.