FEDERATE

Software-Defined Vehicle Support and Coordination Project

D1.3 Second Project Report M18

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1 Executive Summary

This report summarizes the work of the consortium in the months M13-M18 (covering 01-SEP-2024 to 31-MAR-2025) regarding the project objectives. It summarizes the activities of the five work packages (WP) and provides brief overviews on the results achieved.

All WPs are operating as planned, and partners collaborate in **periodic meetings** (weekly or bi-weekly) as scheduled. A full consortium info meeting is held once a month (every 2nd Tuesday), to spread project-wide info and updates. Weekly core team meetings in between (every Tuesday) are used to manage the project and align activities.

After having achieved all three milestones of Y1, the next two Milestones (MS4 and MS5) were at the end of this reporting period:

#	Title	Partner	Month	Verification
MS4	Feedback on repository I	VIF	18	Received feedback on high-level requirements in repository ≥ 50.
MS5	Members of European SDV ecosystem I	VDIVDE	18	Members (organizations) of European SDV ecosystem ≥ 40.

Major achievements from the period M13-M18 include

- A number of highly visible **presentations and dissemination activities** of FEDERATE and the Software-Defined Vehicle- SDVoF at important events, see WP5 section in this report.

- The **open repository** collecting descriptions of BBs on GitHub (https://github.com/CSA-FEDERATE/Proposed-BuildingBlocks), which was established during Y1, was **substantially improved** and extended now including the planned results of HAL4SDV, SHIFT2SDV, and planned contributions of several companies (OEM's) and tiers.
  Accessibility and usability of the repo were improved. In addition, a function to export information in tabular form (as XLSX file) is now available.

- A **GA Meeting** on 20-NOV-2024 in Graz, Austria. The meeting focused on the progress and strategic direction of the FEDERATE project. Key topics included updates on architecture, strategic recommendations, and the building block inventory.

- **Successful Y1 Review** in Brussels (30-JAN-2025); the resulting "overall assessment" states:
  "The project has fully achieved its objectives and milestones for the period"

- **Two Sherpa Governance Group (SGG) meetings** were held, progressing (amongst other things) the discussion for a sustainable governance of the SDVoF initiative:
  - SDVoF Virtual Sherpa Governance Group Meeting 10-JAN-2025

    - SDV F2F Sherpa Governance Group in Paris on 11-FEB-2025

- To promote FEDERATE's visibility,
    - two Webinars, and
    - two new newsletters, and
    - nine presentations at highly visible conferences and other public events, and
    - weekly LinkedIn posts
      were published (see WP5 section for details)

Within the reporting period M13-M18, only **1 deliverable** was planned to be submitted – which is this document D1.3 (Second Project Report)

2 Introduction

2.1 Introduction - Purpose of this document

This report summarizes the consortium's work during M13-M18 of the project, focusing on the achievement of the project objectives.

2.1.1 Project Objectives (according to section 1.1.2 of the DoA)

The Coordination and Support Action (CSA) FEDERATE aims to support the activities of the EC's ***SDV of the Future*** (SDVoF) initiative, now called Vehicle of the Future.
This includes the support of related ChipsJU, Horizon Europe-Programmes (2Zero and CCAM) and national funded Research, Development and Innovation (RDI) projects, as well as related SDV Initiatives (like Eclipse SDV, COVESA. SOAFEE, and AUTOSAR). The goal is to establish an open-source ecosystem for Software-defined Vehicle (SDV) development.
In detail, the FEDERATE targets to:

Objective 1: Collect and evaluate **future trends** (automated driving, V2X, EdgeAI at the SDV and the connected infrastructure) to predict SDV related ones and derive high-level requirements for stakeholders (industry, government, research and community) and to deduce definitions of common non-differentiating building blocks (software components, containers, SDKs, services, ...) that are reusable and scalable across departments and companies, taking into account already existing high level requirements from the stakeholders and those already worked out in the Sherpa group meetings.

Objective 2: Derive a **common understanding (glossary)** about building blocks in a layered service-oriented architecture with harmonized interfaces and required functionalities and features by organizing workshops with stakeholders and the community, and to strengthen the collaboration.

Objective 3: Prepare and maintain a **roadmap** on how to create the identified non-differentiating building blocks of an open Software-defined vehicle Ecosystem. Identify and advise relevant RDI funding programs for missing building blocks, tools and technology developments.

Objective 4: Help to create a **vibrant SDV community** in Europe and furthermore, monitor the performance of the CSA initiative by measuring the activities as well as the support of the stakeholders and the community during the project lifetime.

Objective 5: Foster a **European initiative**, which continues the work of the CSA (FEDERATE) to orchestrate a strong open European collaborative community in maintaining and developing a European Software-defined vehicle Ecosystem.

The work towards the above-mentioned goals that was carried out in M13-M18 of the project is described in the following chapters.

3 Explanation of the work carried out by the beneficiaries and overview of the progress

3.1 WP1 Project Coordination

The objective of WP1 is to ensure an effective and efficient project flow while adhering to the schedule, budget and overall project objectives.

After having achieved all three milestones of Y1, the next two Milestones (MS4 and MS5) were at the end of this reporting period:

#	Title	Partner	Month	Verification
MS4	Feedback on repository I	VIF	18	Received feedback on high-level requirements in repository ≥ 50.
MS5	Members of European SDV ecosystem I	VDIVDE	18	Members (organizations) of European SDV ecosystem ≥ 40.

MS4: Feedback on repository I

With the first set of **54 collected high level requirements** in the repository (https://github.com/CSA-FEDERATE/Proposed-BuildingBlocks), and the feedback collected, this milestone was met.

To collect feedback, FEDERATE promoted the repository via multiple channels, from LinkedIn to newsletters, but most importantly through several dissemination activities at conferences (e.g., OCX24). Feedback was received through questions and comments on these events, as well as through git issues and pull-requests submitted directly at the GitHub repo. All feedback was discussed in WP3 and led to continuous improvements.

MS5: Members of European SDV ecosystem I

Milestone MS5 defined an ecosystem size of at least 40 members at month 18 as goal. With a total number of 59 members at the end of M18, FEDERATE has successfully reached the targeted milestone. The project has currently 28 core team members and 31 accepted associated members (incl. affiliates). As further applications for associated membership are currently under review, the ecosystem will continue to grow in the next months.

3.1.1 Summary of results achieved during reporting period

The results in this WP can be summarized as follows:

- Project results and costs according to plan
- Milestones have been achieved
- Weekly project monitoring and decision meetings with core team held
- Monthly information meetings with full consortium held
- 3rd GA Meeting on 20-NOV-2024 in Graz, Austria took place
- Successful Y1 Review in Brussels (30-JAN-2025)

- Organization of two Sherpa Governance Group (SGG) meetings
- The consortium finally agreed on a final project consortium agreement on March 22nd, 2025.
- A second grant agreement amendment process was started

The following deliverables have been submitted:

- D1.3 (this document)

Major risks and (if applicable) fallback solutions etc.:

Project risks have been identified and are continuously monitored and updated if required.

Deliverable D1.2: "Quality and Risk Management Plan" describes the risk management procedure put in place by the project- management team.

3.1.2 Key achievements during reporting period on task level

Task 1.1 Project Management (AVL)

3.1.2.1 GA Meeting

The **third GA Meeting took place on 20-NOV-2024 in Graz, Austria**, discussing progress and strategic direction of the FEDERATE project.

Figure 1: FEDERATE GA Meeting at AVL Graz, 20-NOV-2024

Key points included:

- **Strategic Recommendations (WP4):** the strategic roadmap (D4.4) was presented by BMW and CONTI. It outlines objectives such as improving agility in software development, reducing time-to-market, supporting new business models, and fostering open communities for collaborative creation of SDV components.
- **Architecture Updates:** VIF provided an analysis of the high-level architecture published in FEDERATE and SDVoF's vision paper, highlighting different perspectives from various groups including VDA, AUTOSAR, Eclipse, and project development teams.
- **Building Block Inventory:** The current state of the building block inventory was presented and feedback was discussed, focusing on collecting available building blocks, identifying cooperation potential, and enabling governance across initiatives. The inventory includes contributions from projects like HAL4SDV and the upcoming SHIFT2SDV, and other Horizon Europe projects.
- **Collaboration with European Projects:** The meeting reviewed relationships with European partnerships 2ZERO and CCAM, discussing alignment with FEDERATE's vision and potential collaborative actions. Similarly, contributions from initiatives Eclipse SDV and AUTOSAR were analysed.

PCA

After an exceptionally long negotiations phase, the consortium agreed on a final project consortium agreement on March 22nd, 2025.

Amendment Request

A second grant agreement amendment process was started during the reporting period, to take care of some partner updates (shift from Renault to Ampere and change of NXP from consortium member to associated partner).

Y1 Review

A **Successful Y1 Review** took place in Brussels (30-JAN-2025). The resulting "overall assessment" states: "The project has fully achieved its objectives and milestones for the period". The list of recommendations has been received and is currently being implemented.

Sherpa Governance Group (SGG) meetings

- WP1 organized of **two Sherpa Governance Group (SGG) meetings**, progressing (amongst other things) the discussion for a sustainable governance of the SDVoF initiative
- SDVoF Virtual Sherpa Governance Group Meeting 10-JAN-2025
- SDV F2F Sherpa Governance Group in Paris on 11-FEB-2025

Task 1.2. Project Risk Management (VDIVDE)

A project risk management process has been established in the first reporting period. Details of the project risk management process are described in the deliverable "D1.2_Quality_and_Risk_Management_Plan_FEDERATE_v0.1", which has been submitted by the end of M6.

The project risks are monitored in each work package and are regularly discussed with the project Core Team. Risks are assessed based on their likelihood of occurrence and the impact on project scope and constraints. Upfront activities to avoid, transfer or reduce a risk as well as activities that will be engaged when a risk has materialized and cannot be avoided are part of the risk response development. Core Team Meetings are used to revise the status of risks, probabilities and impacts, and related actions, and to identify new risks. Risks will be revised monthly, but also after the occurrence of any significant event.

A list of anticipated risks has been created. It was discussed and updated in the reporting period. The anticipated specific project risks are a *limited adoption and uptake of software Building Blocks from the project, Role inconsistencies within the SDVoF Initiative, a lack of visibility of the CSA, missing stakeholder engagement, lack of acceptance in the automotive industry, limited acceptance in the OSS community, a missing glossary* and *a missing reference architecture*.

Upfront measures to tackle the occurrence of the anticipated risks have been defined and are executed. None

of the anticipated risks have materialized so far. The risk with the highest potential impact during the reporting period was limited stakeholder engagement. Continuous involvement of all stakeholder groups, especially the OEMs, that should take up the results from the projects for future is necessary. Consequently, the consortium is taking care that OEMs and major Tier companies are involved in the activities and main decisions of the project. Furthermore, the project has engaged an ambassador to convince decision makers in the top-level management of OEMs and Tiers to actively contribute to the SDVoF Initiative.

3.1.3 Deviations from plan

No significant deviations were reported.

3.2 WP2 Technology and high-level requirements solicitation

In the second project phase leading up to Month 18, Work Package 2 has continued to play a pivotal role in driving coordination, collaboration, and knowledge consolidation within the FEDERATE project. WP2 focuses on strengthening the scientific and technological backbone of FEDERATEs vision by facilitating structured stakeholder engagement, fostering a harmonized understanding of non-differentiating building blocks, and aligning community activities together with WP4 across multiple ongoing projects.

Bi-weekly coordination meetings have remained a cornerstone of WP2 activities, offering a regular platform for alignment and exchange. These sessions included a series of Scientific Board presentations, which featured insightful contributions on key SDV-relevant domains. These discussions have actively supported Objective 1, helping to monitor future trends and derive shared high-level requirements for reusable and scalable building blocks that address cross-sector needs in industry, research, and public policy.

To further promote architectural harmonization and cross-project dialogue under Objective 2, WP2 has successfully launched an open, project-spanning TechTalk series. These events bring together experts from across the SDV ecosystem to discuss complementary work being carried out in parallel projects, explore synergies, and support convergence around a layered, service-oriented SDV reference architecture.
Building on these collaborative efforts, contributions were made to the FEDERATE GitHub repository, not only by submitting building block proposals but also through active participation in the repository's maintenance and refinement process - supporting Objective 3 in its effort to maintain a shared roadmap and technical foundation. In parallel, the University of Oulu (UOULU) led the development of a scientific publication which exemplifies the shared research direction and reinforces FEDERATE's role as a coordination effort. Several newsletter articles were prepared and disseminated to support community outreach, in line with Objective 4.

Notably, a new requirement addressing training and skill management for building block usage and integration was identified and is currently under planning and early implementation. This effort aims to support sustainable knowledge transfer and reduce adoption barriers, further contributing to the formation of a vibrant European SDV community as outlined in Objective 5.

Finally, the FEDERATE initiative was presented at Embedded World 2025, where its vision and progress were presented and discussed with a broad community of industrial and academic stakeholders.

3.2.1 Summary of results achieved during reporting period

The results in this WP can be summarized as follows:

- Publication "*Towards European Software-Defined Vehicle of the Future: Vision and Challenges*" authored by: Peltonen, Ella; Acharya, Sarthak ; Bakhshi Zadi Mahmoodi, Alireza ; Basnayake, Vishaka; Hietala, Heidi; Kämä, Benjamin; Timonen, Olli; Xu, Yueqiang; Päivärinta, Tero; Lampe, Bastian; Hegerath, Lucas; Kampmann, Alexandru; Driussi, Mario; Priller, Peter; Kobiela, Karol; van Beusekom, Rutger; Viehl, Alexander ref. #: TOSEM-2025-0272
- Scientific Board Presentations:
  - Useblocks Sphinx-Needs - 10.10.2024
  - IAV – Post-quantum cryptography - 05.12.2024
  - "Kernkonzept" – Accelerating SDV Innovation with L4Re – 16.01.2025
  - Mecedes - Hardware Reference Platform in Open Source Ecosystems for SDVs – 13.02.2025
  - Cariad - from the CeCaS Project - "Data-centric SW Architecture for the SDV – 27.02.2025
  - WirelessCar - Open SDV Platform, from WirelessCar – "Connectivity for the SDV" – 13.03.2025
- Open TechTalk – XEN Hypervisor for Automotive, Real-Time and Safety – 10.02.2025
- Presentation FEDERATE at the Embedded World
- WP2 active contribution - joint coordination and further activities with 2Zero projects CODE4EV and TwinLoop, and Chips JU project HAL4SDV

The following deliverables have been submitted:

No deliverables were due in the reporting period.

Major risks and (if applicable) fallback solutions etc.:

Project risks have been identified and are continuously monitored and updated if required.

Deliverable D1.2: "Quality and Risk Management Plan" describes the risk management procedure put in place by the project- management team.
No increased risk is currently visible.

3.2.2 Key achievements during reporting period on task level

Task T2.1: High-level requirement solicitation (VIF) [M1-M36]
T2.1 organizes the open cross-project TechTalk series listed above.
Through collaboration in bi-weekly repository maintenance sessions, T2.1 contributes to the refinement of the GitHub structure. T2.1 also prepares continuous input to WP2 sessions for the architecture discussion with a focus on best practices, shared APIs, interfaces and patterns. Another activity was the skills and

training management for building blocks.

Task T2.2: SDV technology capturing, tracking, gap analysis, forecasts and glossary (UOULU)
T2.2 contributed on a scientific article "*Towards European Software-Defined Vehicle of the Future: Vision and Challenges*", submitted to TOSEM-2025-0272, as a continuation of SDV gap analysis and forecast work. The article captures updated technology trends and summarizes key challenges, some of them already defined and shared under deliverable D2.6. published through the FEDERATE website. Through an academic article on a high-level software engineering journal, we aim to achieve wider publicity and acceptance on international networks. T2.2 will continue with glossary definitions and a survey on future trends and technology analysis through WP2 scientific presentations, interviews to the ecosystems (completed together with SHIFT2SDV WP6 transformation path efforts), and survey articles for academic and industrial audiences.

3.2.3 Work carried out in this work package per beneficiary

BMW: Regular involvement in WP2 bi-weekly meetings supported ongoing dialogue on the development and organization of SDV building blocks. Several candidate building blocks were proposed. BMW also took part in the FEDERATE GA held in Graz on 11/2024, contributing to broader project alignment and knowledge exchange.
MBAG: Participation in regular WP2 bi-weekly meeting and discussion on building block collection and participation in general assembly meeting NOV-2024 in Graz. As well as suggestion of multiple building blocks and presentation of these building blocks.
AMPERE/RENAULT: Contributed in regular WP2 bi-weekly meeting with recommendations on the global SDV architecture and on specific building blocks/APIs definition. In addition, AMPERE/RENAULT supported alignmentbetween Eclipse S-CORE activities and FEDERATE to promote the development of relevant open-source building blocks.
CARIAD: TechTalk presentation from the CeCaS Project - "Data-centric SW Architecture for the SDV – 27.02.2025
CONTI: Participation in regular WP2 bi-weekly meeting. Online participation to the General Assembly year two meeting in Graz. Preparation and participation (remotely) of Year 1 Review meeting. Connecting Eclipse SCORE activities with FEDERATE. Decision to provide two assets to SCORE and which are also linked to FEDERATE.
CONTI-FR: Participation in regular WP2 bi-weekly meeting. Participation to the General Assembly year two meeting in Graz. Identification of Continental relevant BBs candidates for open-source documenting gaps toward GitHub middleware description (aimed to be release later in Eclipse SCORE project).
EB: EB participated in regular WP2 bi-weekly meeting; recommendations on the global SDV architecture
UOULU: Coordination and completion of the gap analysis and submission of the corresponding journal article. Ecosystem research initiated to collect wide-scale perspectives on SDV ecosystem in Europe by interviewing OEM and Tier1 representatives. Survey on creating coherent state of the art for glossary and SDV ecosystem has been established to define the transformation path towards SDV of the future.
RWTH: Discussion of Building Blocks to be included in proposed building blocks on GitHub (https://github.com/CSA-FEDERATE/Proposed-BuildingBlocks). Preparation of gap analysis and corresponding journal article describing academic and industrial perspectives on the key building blocks required to be completed to define, implement, and evaluate the SDV concept in practice.
TUM: Exploring the requirements related to usage of Generative Artificial Intelligence (GenAI) and automating for automating various aspects in automotive domain. In the reporting period, the focus was on Large Language Models (LLMs) and Vision Language Models (VLMs) and their utilization for requirements handling

(both textual and visual representations) in context of automotive hardware abstraction. Additionally, synergy with formally grounded tools relying on Model-Driven Engineering was considered.
VIF: Organization of Scientific Board Talks and open TechTalk series. Moderation of the WP2 meetings, active participation and maintenance of the CSA-FEDERATE GitHub Repo, initiation and participation in the architecture adaptation and harmonization with other projects. Presentation FEDERATE at the Embedded World. Writing several newsletter articles. Presentation WP2 year 1 review meeting.
FZI: Participation in regular WP2 meetings. Participation to Vienna SDV week and GA in Graz. Co-authoring of TOSEM Journal article on " Towards European Software-Defined Vehicle of the Future: Vision and Challenges". Organization of FEDERATE session for FZI Open House on Open Source for Software-defined vehicles. Moderation of session on Software-engineering for Software-defined Vehicles during the national German conference on “Research and technology for autonomous driving", Berlin. Taking over the lead of a state-level industry-driven (Baden-Württemberg) working group on "Software-defined Mobility Systems” in the scope of the e-mobil state agency for new mobility Baden-Württemberg.
VALEO: Contributed to the Y1 review preparation and meeting in Brussels. Key contributions included defining building blocks for the Communication Middleware Abstraction Layer and the Software Monitoring Tool.
VECTOR: Participation in regular WP2 bi-weekly meeting. Online participation to the General Assembly year two meeting in Graz. Preparation and participation (remotely) of Year 1 Review meeting. Connecting FEDERATE with AUTOSAR activities and Eclipse SDV activities.

3.2.4 Deviations from plan

None.

3.3 WP3 Common Understanding

Work Package 3 (WP3) within the FEDERATE project plays a critical role in the development of infrastructure for defining and linking to software building blocks essential for the advancement of Software-Defined Vehicles (SDVs), and the content created with that infrastructure.

As part of this mission, WP3 has engaged in a range of industry events, conferences, and trade shows, fostering collaboration with key stakeholders, including OEMs, Tier 1 suppliers, software developers, research institutions, and regulatory bodies. These outreach activities have been instrumental in promoting FEDERATE’s vision, increasing awareness, and driving the adoption of modular and standardized approaches for SDV software development.

This report section provides an overview of WP3’s contributions during M13 to M18, highlighting engagement activities, marketing efforts, and participation in key industry events and the activities concerning This report summarizes the consortium's work during months 13 to 18 of the project, focusing on the achievement of the project objectives. This report summarizes the consortium's work during months 13 to 18 of the project, focusing on the achievement of the project objectives. This BB repository has helped to solidify FEDERATE’s standing in the automotive and software industries.

3.3.1 Summary of results achieved during reporting period

- Actively participating in relevant industry gatherings
- Presentation at the Vehicle Electronics & Connected Services (VECS) 2025 (Gothenburg, Sweden, 17th March 2025)
- Participation at the VDA Mobility Innovation Summit 2025
- Presentation at the SIA CESA 2025; France, Versailles, 11th February 2025
- restructured the BB repository, to clearly separate ideation-level theoretical building blocks from those with real-world implementations

3.3.2 Key achievements during reporting period on task level

Task T3.1: Refine definition of modular building blocks and create prioritized backlog (ETAS)

A significant portion of the work in this period involved restructuring the repository to clearly separate ideation-level theoretical building blocks from those with real-world implementations. This restructuring provides clarity for contributors and users, making it easier to distinguish between conceptual proposals and established software components.

Additionally, we refined the categorization of building blocks, ensuring they follow a logical hierarchy that enhances usability and discoverability. This required moving various elements between folders, updating documentation, and aligning metadata structures.

Key PRs contributing to this effort:

- **Move BB_XENHypervisor from WIP to root** – Promoted key building blocks to a stable category.
- **Move BBs from WIP to main** – Further refined classification to distinguish theoretical and implemented blocks.
- **Rework BB creation template, change dropdowns to single select** – Improved usability for contributors when defining new blocks.
- **Remove old headings in BBs general** – Cleaned up outdated structures to improve readability.
- **Restored deleted files and updated structure** – Ensured consistency in the repository.
- **Finalize previous mergers, added Remotive Cloud from #24, and added RTPS-Types** – Integrated contributions from multiple sources into a stable version.

Standardization and Enhancements

To improve usability and maintainability, significant enhancements were made to standardize building blocks and improve descriptions.

A key aspect was ensuring a uniform structure for all building blocks, defining common metadata fields, and enforcing naming conventions. This effort improves interoperability and allows users to easily compare

different blocks.

Major improvements include:

- **Implement uniform BB style** – Standardized format and styling across all building blocks.
- **Additional BB fields** – Introduced new fields to capture essential metadata.
- **BB standardization** – Unified definitions to align with industry best practices.
- **Extend layer description BB enhancement** – Provided more detailed documentation on software layer interactions.
- **Fix Ankaios naming typos** – Ensured consistency in references and terminology.

These efforts ensure that the repository can be a reliable reference for developers and researchers working on SDV-related software components.

CSV and Excel Export Feature

A major functional addition in this period was the implementation of an automated CSV and Microsoft Excel export feature. This allows users to easily analyse repository data in spreadsheet tools, facilitating better usability and integration with other tools.

The CSV export includes key metadata for each building block, allowing external teams to quickly filter, search, and analyse components without navigating the GitHub repository. This feature has been particularly useful for stakeholders looking to align SDV components with their own frameworks.

Relevant PRs:

- **Add output file generator script enhancement** – Created a script that extracts building block metadata into a structured CSV format.
- **Add script to generate Excel-importable TSV report enhancement** – Extended the functionality to support additional formats.

This feature enhances accessibility for project stakeholders who prefer working with structured data formats outside of GitHub.

Addition of New Building Blocks

Several new building blocks were integrated into the repository, expanding the coverage of SDV-related software components. The new additions reflect ongoing efforts to consolidate and standardize SDV-related components across multiple organizations and initiatives.

- **Add new BB XenProject** – Introduced a key hypervisor component for SDVs.
- **New BB from projects and initiatives** – Merged contributions from various research projects.

- **Added Eclipse Foundation Test Design Tool SKyBT** – Extended coverage to include testing tools.
- **Update COVESA's contribution** – Incorporated updates from industry collaborations.
- **Add new BBs** – Ongoing work to expand the repository.

By continuously adding and refining building blocks, we enhance the repository's relevance for the broader SDV ecosystem.

Future Outlook

Looking ahead, WP3 aims to introduce a formal release process and workflow, incorporating versioning tags tied to XLS artifact generation. This will allow for:

- Periodic releases of structured building block descriptions
- Better traceability and version control
- Improved integration with external tools and platforms

Additionally, we plan to develop clearer contribution guidelines and improve documentation to support new collaborators in contributing effectively.

Increasing External Engagement and Maintaining Synchronization

One of the main challenges moving forward is increasing involvement from the projects and component teams that are referenced by the building blocks. Keeping the repository in sync with the latest developments in these external projects is difficult, as updates and improvements often happen independently.

Currently, there is no clear mechanism to ensure continuous alignment, and it remains an open question how best to incentivize these entities to actively maintain their referenced building blocks within the repository. Potential solutions could include:

- Establishing formal agreements or collaboration frameworks with key external contributors.
- Encouraging periodic reviews and updates by the respective project maintainers.
- Creating incentives, such as visibility in industry reports or technical showcases, to encourage engagement.
- Automating synchronization mechanisms where feasible, ensuring updates are reflected in the repository with minimal manual effort.

Developing a structured approach to ongoing catalogue maintenance and synchronization will be a key focus in the next phase of WP3's work.

Conclusion

During this reporting period, WP3 has made significant contributions to restructuring, standardization, automation, and expansion of the FEDERATE repository. These efforts strengthen the project's foundation for future development and collaboration in the domain of Software-Defined Vehicles.

The introduction of structured workflows, standardized metadata, and automation tools has not only improved repository management but also set the stage for sustainable long-term maintenance. The XLS export feature and the separation of conceptual and implemented building blocks have increased the repository's usability and accessibility.

However, challenges remain in ensuring active participation from external projects and component teams. Future work will focus on establishing mechanisms to keep contributions up to date, improving stakeholder engagement, and finalizing a robust release process with versioning support.

Through continued collaboration and refinement, WP3 aims to further enhance the impact of the FEDERATE project, ensuring that the repository remains a valuable resource for the SDV ecosystem.

Task T3.2: Alignment with running projects about implementation of building blocks (ETAS)

Ensuring that FEDERATE's objectives are effectively communicated to the broader automotive ecosystem is a crucial component of WP3's strategy. By actively participating in relevant industry gatherings, WP3 aims to not only showcase the project's progress but also to advertise for the open source-based building block collection**,** receive feedback, and influence the direction of SDV software development. Below is an overview of WP3's participation in key events during this reporting period.

Vehicle Electronics & Connected Services (VECS) 2025 (Gothenburg, Sweden, 17th March 2025)

- VECS 2025 is recognized as one of Europe's premier events (especially for Nordic companies) focused on connected, autonomous, and software-defined vehicle technologies. It serves as a platform for automotive industry professionals, technology providers, and research institutions to explore the latest innovations in vehicle software and electronics.
- WP3 representatives attended panel discussions, workshops, and networking sessions, where they engaged with industry leaders, regulatory bodies, and technology developers to present FEDERATE's ongoing work.
- Key talking points included the role of standardized software interfaces, modular software architectures, and best practices for software integration within SDVs.
- The WP3 team highlighted the GitHub repository (Proposed Building Blocks) as a valuable resource for developers looking to adopt the SDVoF vision.
- One-on-one meetings with potential industry partners facilitated discussions on future collaborations and integration pathways for FEDERATE's building blocks.

VDA Mobility Innovation Summit 2025 (Berlin, Germany, 24th March 2025)

- The VDA Mobility Innovation Summit is a highly anticipated gathering that focuses on disruptive trends and technological advancements in the mobility sector addressing the top management of the automotive industry. This year's summit puts particular emphasis on how software innovation is transforming automotive development.
- The WP3 team actively contributed to discussions on middleware development, interoperability challenges, and the evolution of SDV software architectures.
- WP3 representatives participated in roundtable discussions and expert panels, advocating for the adoption of standardized software frameworks to enable seamless integration of third-party software modules.
- Engagements with automotive OEMs, Tier 1 suppliers, and mobility technology firms were instrumental in reinforcing FEDERATE's vision and identifying potential areas of collaboration.

SIA CESA 2025 (France, Versailles, 11th February 2025)

- SIA CESA is a leading European conference dedicated to automotive electronics, embedded software, and cybersecurity. It serves as a strategic meeting point for experts in embedded systems, vehicle software architectures, and electronic control units (ECUs).
- WP3 leveraged this event to showcase FEDERATE's support activities for software standardization, open-source software development, and cross-industry collaboration.
- Technical discussions covered software-defined architectures, the role of AI in SDV software, and the importance of open-source frameworks for reducing development costs and accelerating innovation.
- WP3 representatives engaged with key industry players to discuss the integration of proposed building blocks described In FEDERATE's repository into existing SDV platforms.
- The event also provided an opportunity to explore synergies with EU-funded initiatives and identify new research collaboration opportunities.
- Discussions included challenges related to regulatory compliance, functional safety, and cybersecurity.

Impact of Participation

Through these extensive outreach activities, WP3 has successfully:

- Increased awareness of the FEDERATE project among key automotive and software industry players and their decision makers.
- Strengthened collaboration with OEMs, Tier 1 suppliers, fostering greater industry alignment on software standardization for SDVs.
- Promoted FEDERATE's standardization efforts and encouraged the adoption of the project's vision through presentations, direct engagements, and online references to the FEDERATE website.
- Expanded the network of contributors and adopters of FEDERATE's proposed software building blocks, paving the way for future cross-industry cooperation.
- Gathered critical industry feedback that will help refine SDVoF's approach, ensuring it meets real-world industry needs.

Conclusion and Next Steps

WP3 drives the **adoption of standardized SDV software infrastructures** through continued research, development, and industry engagement. Moving forward, the team aims to:

- Maintain an active presence at **leading automotive and technology conferences**, ensuring that FEDERATE's contributions continue to gain more industry recognition.
- Expand collaborations with EU-funded projects, and open-source development communities to further enhance software interoperability.
- Refine and disseminate software building blocks that support scalability and optimization in SDV architectures.
- Develop comprehensive best-practice guidelines and implementation toolkits to facilitate the widespread adoption of FEDERATE's standardized software methodologies.

By continuously engaging with industry leaders, promoting open innovation, and refining its methodologies, WP3 will continue to play a pivotal role in shaping the future of Software-Defined Vehicles.

Case Study – uProtocol Open-Source connection between FEDERATE and HAL4SDV

As a case study where FEDERATE crosses over with HAL4SDV in the form of actual Open-Source project work, we include excerpts from the project report of our uProtocol work over the last couple of months.

The following contributions have been made by ETAS in the uProtocol project:

[up-spec]
Recent project activity has focused on enhancing the OFT specification system, with three separate documentation PRs dedicated to adding specification items, definitions, and tags. The documentation effort has also extended to improving formal elements and adding support for filtering L1 requirements based on delivery method. On the functionality side, several bugs have been addressed, including fixing the specific identifier for response priority value breaking change, retaining sub-second granularity TTL values, and correcting requirements for preventing sender address spoofing. User experience improvements were also implemented, with a notable enhancement to visually highlight requirements for better clarity and navigation.

[up-rust]
The recent project activity demonstrates a substantial focus on improving CI/CD infrastructure, with nine PRs dedicated to optimizing automation workflows, including enhancements for OFT run patterns from environment files, fixing nightly execution of requirements tracing, properly utilizing OFT run's exit code, implementing shared Actions for Eclipse Dash Licenses tool, improving cargo deny checks, refining test execution jobs, replacing local workflows with standardized ones, and fixing repository checkout by adding submodule recursion. The codebase is preparing for a 0.5.0 release while making several technical improvements, including increasing the Minimum Supported Rust Version (MSRV), bumping the protobuf version, adding convenience functions for UMessage field access, and moving expiration checks to UAttributes (marked as a breaking change). Quality assurance efforts continue with bug fixes addressing OFT

specification item coverage and documentation improvements to fix typos, all while enhancing the capabilities of the OFT system to filter relevant specification items using tags.

[up-subscription-rust]
The Q1 period features a major enhancement with the implementation of subscription persistency capabilities, representing a substantial addition to the project's functionality that enables data retention across sessions. Two critical bug fixes were also merged: one addressing issues with zenoh integration to ensure proper communication protocols, and another establishing compatibility with up-rust 0.4, aligning the project with the latest version requirements of this dependency. Together, these changes significantly improve the project's reliability and feature set, with the subscription persistency implementation in particular marking an important milestone in the project's development roadmap.

[misc other]
Beyond the focal areas above, various smaller improvements and changes have been made to other uProtocol repositories. This includes evolution of the uProtocol MQTT adapters, or the uProtocol website.

Task 3.3: Identification of new standardization initiatives for successfully implemented building blocks (FZI) [M25- M36]
Not yet started.

The following deliverables have been submitted:
No deliverables were due in the reporting period

Major risks and (if applicable) fallback solutions etc.:
Continuous risk monitoring is established; no risk materialized

3.3.3 Work carried out in this work package per beneficiary

AVL: AVL collaborates with ETAS and VIF in bi-weekly meetings to discuss open issues and pull request sin the BB repository. AVL has also developed several python scripts available on GitHub to automate the maintenance of the repository (automatically creating README.md files as well as exporting content to Excel.
BMW: Participation in meetings and discussions within FEDERATE. Participation in panel discussions in SDV Europé in Frakfurt and CESA Congress in Versailles. BMW is actively promoting SDV and FEDERATE activities.
MBAG: Held a talk in the CESA Congress in Versailles regarding SDV and promoting future federate activities there.
AMPERE/RENAULT: Participation in regular meetings & discussions, sharing lessons learned from past and ongoing SDV development projects.
CARIAD: participated virtually at the GA meeting on 20-NOV-2024, providing OEM's perspective on the BB repository.
FORD: Participated in regular meetings & discussions.
Bosch: No activity.

CONTI: No activity.
CONTI-FR: No activity.
EB: No activity.
TAAG: TAAG co-hosted and supported the organization of the first networking event in Vienna at the TAAG premises and in conjunction with one of the largest events for SDV world-wide, "The Autonomous Main Event" (2024-09-23&24 in Vienna, https://www.tttech-auto.com/events/autonomous-main-event-2024).We visited several conferences (see also list in WP 5: OCX-open code experience, EFECS 2024, HIPEAC 2025, Convergence Conference) where we actively contributed to align and join forces for driving forward SDV topics in Europe with the aim of on the one hand supporting the goals and obligations of FEDERATE and on the other hand gaining insight for the HAL4SDV project. Both projects were promoted and presentations made at these events. At the Convergence Conference significant milestones towards cooperation with the named projects and organizations were laid.
TAAG also actively cooperated with the idea to "install" an "Ambassador for SDV" with the final goal of bringing an organization dedicated to support and bring forward SDV related topics both in public/politics and industry.
VALEO: Valeo contributed to BB-requirements and conducted the final review of 2.3_Glossary_FEDERATE_v0.4_MD. We contributed to the Y1 review preparation and meeting in Brussels. Key contributions included defining building blocks for the Communication Middleware Abstraction Layer and the Software Monitoring Tool.
ZF: Collaborated with AVL and VIF on BB inventory to identify reuseable components of ZF that can be reused across the industry. ZF also contributed to regular meetings within the project and exchanging ZF's position on SDV Ecosystem.
FSG: Forvia chaired the CESA Congress in Versailles and was instrumental in bringing relevant stakeholders from all across Europe to address SDV and associated electronic architecture topics.
IFAG: Participation in regular meetings & discussions, contributing with experience from past and ongoing research activities. Established the link to national funding project CeCaS (CentralCarServer: supercomputing platform for autonomous cars; 46 Mio. € funding from Federal Ministry of Research and Education) with an invited talk at 27.02.2025 to present the FEDERATE team their work regarding "Data-centric SW Architecture for the SDV". The presentation was carried out by CeCaS project partner CARIAD.
IFAG will host the European SDV Ecosystem Summit 2025 - an SDV Networking event by FEDERATE (https://lnkd.in/d--fUvVu) in Munich and is involved in discussions regarding the overall concept, speakers and the organization of the event.
ST: no activities
AVL-DE: The involvement of AVL-DE was moved to WP 4.
ETAS : By participating in key industry events, ETAS disseminated the project's progress, promoted the open-source building block collection, and gathered feedback to influence SDV software development. During VECS 2025 in Gothenburg, ETAS representatives engaged with industry leaders to discuss standardized software interfaces and modular architectures. At the VDA Mobility Innovation Summit in Berlin, they advocated for standardized software frameworks and explored collaboration opportunities with OEMs and suppliers. At SIA CESA 2025 in Versailles, ETAS highlighted support activities for software standardization and cross-industry collaboration. ETAS is also involved in the periodic BB repository maintainer meetings and activities.

VERUM:

- Active participation in meetings and discussions with a focus on scientific board meetings.
- Contributing to the preparation of an article on the topics of verification and validation: “Gap Analysis and Technology Forecast”.
- Visiting the FEDERATE network event in Vienna and in addition conducting workshops on the domain of “Toolchains for automotive”. Combined with attending the “Autonomous” event in Vienna.

VDIVDE:

- Promotion of relevant SDV events with relation to WP3 activities
- Raised the awareness of consortium members for certain events with high impact on the SDVoF community (e.g. SIA CESA)
- Cross promotion with the relevant events to raise the number of participants and experts
- Engagement of an ambassador to moderate the process to achieve a common understanding
- Presentation of the results at the Y1 review meeting on 30 January 2025 in Brussels, together with AVL-DE

ECL:

- Active participation in the SIA CESA as panel speaker
- Forster alignment among BB developed under the Eclipse SDV Working Group purview

3.3.4 Deviations from plan

No significant deviations were reported.

3.4 WP4 Strategic recommendation

The focus of WP4 is to identify research projects focusing on vehicular software architectures, HW/SW implementation-focused projects, and application-focused projects in CCAM and 2ZERO.

The main goals of this activity are to:

1) identify active and upcoming research projects on national and EU level
2) collect brief info per project (“one-pager”)
3) support collaborations (associated membership, mailing lists, ...)
4) align & advise future calls, standardization, etc.

3.4.1 Summary of results achieved during reporting period

The results in this WP can be summarized as follows:As a follow-up activity, an initial exploration of relevant projects and initiatives was conducted to map ongoing R&D efforts in the area of SDV (Software-Defined Vehicle) building blocks (BB). This included the identification and analysis of both European and national activities (e.g., from France, Germany, Austria, etc.) with a focus on their respective approaches.

The following deliverables have been submitted:

No deliverables of WP4 were due in the reporting period.

Major risks and (if applicable) fallback solutions etc.:

The main risk identified in WP4 is that no commitment from development projects to implement the identified Building Blocks can be achieved. As mitigation measure, WP4 is constantly aligning with major stakeholders to ensure their support and contribution.

3.4.2 Key achievements during reporting period on task level

Task T4.1: Orchestrated building block backlog (MBAG)

The orchestration of the building blocks, which are collected in WP2, then structured in WP3, is a continuous process working in two directions:
(i) pull, where required BB's are described in the "work in progress" part of the Federate GitHub repository. T4.1 works on mapping these BB's to appropriate implementation projects.
(ii) push, where BB which are available as implementation are described in the FEDERATE GitHub, will be matched by T4.1 to potential users (e.g. the S-CORE stack project).

Task T4.2: Alignment recommendations for future calls (CONTI)

D4.4 Strategic Roadmap (First Version) was delivered in M13 with small deviation due to final review process. T4.1 supported the Y1 review presentation with slides, and aligned with HAL4SDV project to prepare contribution to GitHub. WP4 organized and hosted the discussions with the 2Zero projects Twin-Loop and CODE4EV, to plan detailed BBs use or contribution from actual GitHub repo and SDV road map.

Task T4.3: Create and update roadmap for realization of vision of SDV Ecosystem program (VDIVDE)

The initial version of the vision and roadmap paper was published on 12th April 2024 after approval of the Sherpa Governance Group by written procedure. It was jointly worked out by the WP4 team. This vision and roadmap paper was further refined and released in M12 as D4.4 Strategic Roadmap - First Version. The consortium took up the recommendations of the project review meeting on 30. January 2025. The focus of the work in the reporting period was set on defining a clear timing and milestones of the projects and activities that are mentioned in the roadmap. Alignment calls with 2Zero projects and CCAM projects were executed during the reporting period, in order to identify the relevant activities and milestones. The second version of the roadmap will consider these insights. It will be published in M24.

3.4.3 Work carried out in this work package per beneficiary

AVL: contributed to the bi-weekly WP4 meetings with analysis of current calls and recently started RDI projects. AVL substitutes as meeting host in case BMW cannot join.
AVL-DE: Participation in the regular WP4 bi-weekly meeting for coordination purposes.
Connecting German SDV public founded projects that deliver open-source software (none identified by now).
Contribution to CCAM and 2ZERO alignment meeting to enable further update of FEDERATE road map.
BMW: Organization of the bi-weekly WP4 meetings, coordinating and promoting open-source activities in Eclipse SDV and COVESA.
MBAG: contributing to the BB Orchestration as a part of the bi-weekly WP4 meetings
AMPERE/RENAULT: Participation in regular meetings & discussions, sharing lessons learned from past and ongoing SDV development projects.
CARIAD: no activity in the reporting period.
CONTI: Participation in the regular WP4 bi-weekly meeting for coordination purposes. Approaching Code2EV

project lead to align on future collaboration with the aim to identify relevant building blocks. Final review of the deliverable D4.4 from task 4.2. Reviewing and considering the Y1-Feedback provided by the EC.
CONTI-FR: Participation to the regular WP4 bi-weekly meeting for coordination purposes. Final review of the deliverable D4.4 from task 4.2 and presentation of the results in the Graz General Assembly.
Connecting with the PFA to identify French SDV public founded project that deliver open-source software (none identified by now). Contribution to CCAM and 2ZERO alignment meeting to enable further update of FEDERATE road map.
EB: No activity.
FSG: Participation to the WP4 meetings.
VDIVDE: provides the technical hosting and moderation of a webinar series, promoting the CSA FEDERATE and the jointly worked-out vision and roadmap document. Additionally, also the alignment meetings with the related partnerships 2Zero and CCAM have been organized and led by VDIVDE, including the introduction meetings with the recently started 2Zero projects Code4EV and Twin-Loop. The goal of the alignment meetings was to derive a common understanding, capture the specific roadmaps, identify activity gaps, clarify the roles within the SDVoF Initiative, and to clarify the contribution process to the FEDERATE BB repository. VDIVDE continuously works on identifying interlinkages between the European SDVoF Initiative and German national activities and projects with relation to the SDV topic. VDIVDE has also taken over the temporary engagement of the SDV ambassador, participating in Sherpa Governance meetings, deriving strategic recommendations.

3.4.4 Deviations from plan

No significant deviations were reported.

3.5 WP5 Ecosystem building & dissemination

Work package meetings were continued on a bi-weekly basis. The team has proceeded working on the related tasks and has met all work package goals for the project phase considered. No major delays or other deviations have occurred. The focus in the reporting period (M13 – M18) was set on the analysis of the results of the FEDERATE Networking Event, which took place on 23 September 2024. The results were used to set the course for the second project year. Furthermore, the work package team successfully presented the results at the Y1 review meeting on 30 January 2025 in Brussels.

3.5.1 Summary of results achieved during reporting period

The results in this WP can be summarized as follows:

- The FEDERATE project website has been updated (https://federate-sdv.eu) - it now has an own category for the SDVoF Initiative and related projects
- The following newsletters were published between M13 and M18:
  - Newsletter #4 was sent out to 280 receivers on 25 October 2024
  - Newsletter #5 was sent out to 300 receivers on 4 February 2025
- A press release considering the Automotive Action Plan of the European Commission was published on 23. March 2025: https://idw-online.de/de/documentstats?document_type=press_release&document_id=849645

- weekly postings via the FEDERATE LinkedIn channel guarantee good visibility in the community
- The LinkedIn account had 965 followers by the End of M18
- Two webinars have been recorded and uploaded to the FEDERATE YouTube channel:
  - FEDERATE Webinar #1: SDVoF Introduction
  - FEDERATE Webinar #2: Vision & Roadmap of the SDVoF Initiative
- Results and knowledge from the FEDERATE Networking Event, which took place on 23 September 2024, have been discussed in the WP5 team and the Core Team
- The goals for the second project year were refined, accordingly
- The planning phase for the SDV conference in project year 2 has started – the conference is called now "European SDV Ecosystem Summit" and will be held back-to-back with the Automotive Software Strategies Conference in Munich on 20 May 2025
- The WP5 team has successfully presented the Y1 project results at the Y1 review meeting on 30 January 2025 in Brussels

The following deliverables have been submitted:

In the reporting period M13-M18, no further deliverables with relation to WP5 have been submitted.

In the previous reporting period, the following deliverables were submitted:
D5.1 Stakeholder Engagement Strategy (VDIVDE) submitted on 26 September 2024
D5.3 Dissemination plan (METIS) submitted on 28 March 2024
D5.5 First Dissemination and Communication Activities report M12 submitted on 30 September 2024
D5.8 Data Management Plan (VDIVDE) submitted on 28 March 2024
D5.9 First Year Data Management Report (VDIVDE) submitted on 26 September 2024

Major risks and (if applicable) fallback solutions etc.:

A limited stakeholder engagement has been identified as an anticipated risk[1]. The risk has not materialized, so far. The WP5 team is strongly promoting the CSA and the SDVoF Initiative through various channels, as an upfront measure to avoid the occurrence of the risk. Furthermore, the WP5 team got into an exchange with recently started projects of the 2Zero Initiative to team up with their communication and dissemination teams. This measure will increase the visibility of FEDERATE and the SDVoF Initiative. This report summarizes the consortium's work during months 13 to 18 of the project, focusing on the achievement of the project objectives. WP5 moreover makes consortium members aware of relevant upcoming events to address and engage relevant communities.

[1] Potential risks with an impact on work package 5 and the project have been recorded in the deliverable D1.2 "Quality and Risk Management Plan", risk response measures have been defined.

3.5.2 Key achievements during reporting period on task level

Task T5.1: Creation of an Open SDV Ecosystem Forum (VDIVDE)

An Open SDV Ecosystem Forum has been created. The website https://federate-sdv.eu/ acts as a central information and exchange platform. Publications that have been worked out within the consortium are continuously published on the project website in order to inform the community about the progress. By the end of M18 399 stakeholders have subscribed for the Ecosystem. Subscribers receive relevant event information, invitations to workshops, webinars and the FEDERATE Newsletter. Moreover, a FEDERATE Webinar series has been established. Two episodes have taken place, so far. Interested stakeholders can register on the FEDERATE website and participate. Q&A sessions are a solid component of all webinars to raise the level of interactivity and exchange. Above all, the FEDERATE website offers the possibility for interested organizations to become part of the project as an associated member. The project counted 28 associated members by the end of M18. The associated membership allows the partners to be part of the project and to receive access to all project information (except financial data), regular consortium meetings, workshops and events.

Task T5.2: Organization of community solicitation workshops (VDIVDE)

The project has taken various measures to organize community solicitation workshops. FEDERATE has organized and hosted the first FEDERATE Networking Event on 23 September 2024 in conjunction with the Autonomous Main event. Four interactive sessions / workshops were a key part of the SDV conference organized by FEDERATE. The workshops targeted the solicitation of the community considering the four topics software stack, cloud, toolchain and strategic considerations. Relevant stakeholders (e.g. SOAFEE, COVESA, CCAM, 2Zero, Eclipse etc.) presented their projects and discussed ambiguities. The results of the interactive sessions were taken to set the course for the project activities in the second project year.

Furthermore, FEDERATE was part of the Conference Board of the SDV conference “Open Community for Automotive (OCA)” which took place from 22 to 24 October 2024. Project partners from AVL and VDIVDE supported the organization team by setting the topic focus and selecting the most relevant abstracts. Moreover, the FEDERATE consortium encouraged relevant SDV stakeholders to submit abstracts and participate in the conference. The content and topics for further workshops, hackathons and ecosystem activities are currently being collected from the project partners.

The WP5 team has established a webinar series to inform stakeholders about main aspects of the SDVoF Initiative. Two episodes have taken place. Records of the webinars have been uploaded to the FEDERATE YouTube channel. Moreover, WP5 has supported WP2 in organizing the so-called TechTalks with a deeper technical focus for specialized experts. Stefano Stabellini from AMD presented the details of the XEN hypervisor in the first FEDERATE TechTalk on 19 February 2025.

Task T5.3: European SDV Conference (METIS)

During M13-M18 of the project, FEDERATE continued to play a central role in organizing and participating in key project SDV-related events, aimed at strengthening collaboration, showcasing European initiatives, and fostering open dialogue across the ecosystem.

a) *Open Community for Automotive (OCA)*

Date & Location: 22–24 October 2024 (co-located with Open Code Experience 2024 by Eclipse Foundation)

Focus: Engaging the open-source and developer communities with SDVoF's vision, architecture, and motivation

Audience: Developers, architects, researchers, and public officials

Contribution: FEDERATE showcased the SDVoF roadmap, key building blocks, and collected community input to strengthen open collaboration and technical alignment. Interesting talks held by representatives of major OEM's, Tiers and tool providers clearly indicated strong interest in industry. Multiple presentations by FEDERATE partners demonstrated the commitment, addressing challenges and exploring potential solutions to redefine the future of mobility.

2. Preparation of the 2025 European SDV Ecosystem Summit

From M12 to M18, preparation tasks for the next major SDV conference - "*European SDV Ecosystem Summit 2025 – an SDV Ecosystem Forum Networking Event by FEDERATE*" - were initiated for the event scheduled on 20 May 2025. Key milestones included:

- Event concept, host, date, and name of the event finalized
- Draft agenda with relevant topics developed and disseminated
- Invitations sent to selected speakers from both public and private sectors (OEMs, SDV projects and initiatives, developers)
- Invitee list created and segmented for targeted outreach
- Save-the-date (303 recipients) and official invitation (332 recipients) emails distributed
- Event announcement and registration form published on the FEDERATE website
- Catering and photography services contracted
- Professional moderator of the event contracted
- Merchandise and communication material (e.g. notebooks, name tags, leaflets) designed and prepped
- Ongoing promotion via FEDERATE social media channels and network partners

As of 7 April 2025, 43 participants have already registered to attend the event. Additional efforts are underway to reduce no-show rates and reach the target of 100 attendees.

Task T5.4: Organization of SDV Hackathons (ECL)

In November 2024, the Eclipse SDV Hackathon convened over 60 technologists, innovators, and enthusiasts in Karlsruhe, Germany. This inspiring three-day event focused on brainstorming, coding, and prototyping innovative solutions to address real-world challenges in areas such as fleet management, software orchestration, and vehicle safety. The hackathon showcased the transformative potential of Eclipse SDV technologies while emphasizing the importance of teamwork and collaboration.

The event aligned with the FEDERATE project's mission to cultivate an engaging and dynamic Open European SDV Ecosystem. It demonstrated the collaborative spirit essential for breaking down technological silos. Key initiatives, including the Eclipse SDV Working Group's Blueprints, along with projects such as Eclipse Kuksa and Eclipse uProtocol, facilitated seamless cross-community collaboration among participants.

The success of the hackathon underscores the crucial role of effective leadership in fostering precompetitive collaboration among European organizations. By establishing shared goals and forming partnerships, leaders are positioning Europe as a global frontrunner in Software-Defined Vehicle (SDV) innovation.

Task 5.5 Dissemination and communication activities, incl. tools and materials (METIS)

FEDERATE established a strong and consistent visual identity early in the project, including a project logo, color palette, and communication templates. A brandbook was developed by METIS in collaboration with project partners, outlining guidelines for logo usage, website concept, and brand attributes.

The project website (https://federate-sdv.eu) was launched at the beginning of the project implementation. The website includes information about the project, a link to GitHub for SDV building blocks, a newsletter subscription form, and an events registration system. The website had **2,700 users** in total during the 18-month period.

LinkedIn

During M13-M18, FEDERATE's LinkedIn account reached the number of **1000 followers** and achieved **3,829 page views** and **1,437 unique visitors** with posts reaching up to **122 924 impressions in total**. **18 posts and reposts** were shared for 6 months, coordinated using a Social Media Content Calendar that assigns weekly responsibilities to project partners.

Two project newsletters (in October 2024 and in February 2025) were prepared and sent to the FEDERATE subscribers, covering project updates, SDVoF vision, conference invitations, and links to media content. The total number of FEDERATE newsletter subscribers has increased up to **360** until M18 and is constantly growing.

3.5.2.1 Press Release

One press release[2] was announced in M18 and **1 project video** was created in M13, showing moments from the 1st FEDERATE Networking event (https://www.youtube.com/watch?v=bswRUSw7CEA).

[2] Press Release: *"FEDERATE Supports Implementation of the EU Industrial Action Plan for the European Automotive Sector"* published on 26th March 2025 (s https://idw-online.de/de/news849645)

What concerns other dissemination actions, **9 external events were attended** by project partners during M13–M18. The FEDERATE project has been prominently presented across several major events within the automotive and mobility innovation sectors, emphasizing its role in advancing the future of SDVs. The project's contributions were highlighted during discussions at key industry conferences such as the VDA Mobility Innovation Summit, VECS, and the FAME 3rd Stakeholder Workshop, where its focus on harmonizing SDV development and driving cross-border collaboration within European automotive ecosystems was key. These events provided platforms for stakeholders, including OEMs, technology providers, and regulatory bodies, to exchange insights and discuss the implementation of innovative automotive technologies and data-sharing frameworks central to Federate's SDV roadmap.

3.5.2.2 Attended Events

1. **OCX – Open Code Experience / OCA Automotive**

   - **Date:** 2024-10-21 to 2024-10-23
   - **Location:** Mainz
   - **Description:** Co-located FEDERATE SDV Conference with Eclipse SDV
   - **Target Audience:** developers, architects, researchers, politicians.

   - **Participating partners:** AVL, ECLIPSE, ETAS, CONTI, TTTECH

2. **EFFECS 2025**
   - **Date: 2024-12-04 to 06**
   - **Location: Gent, Belgium**
   - **Description: Large scale Chips-JU focussed event**
   - **Target Audience:** developers, architects, researchers, politicians.
   - Participating partners: AVL, TTTech, ...

3. **HiPEAC Conference 2025**

   - **Date:** 2025-01-22
   - **Location:** Barcelona, Spain
   - **Description:** Leading EU forum for embedded systems, architecture, cybersecurity, AI.
   - **Target Audience:** experts in computer architecture, developers, operating systems researchers, cybersecurity professionals, etc.
   - **Participating partner**: TTTECH

4. **International Congress: SIA CESA 2025**

   - **Date:** 2025-02-13
   - **Location:** Versailles, France

- **Description:** Biennial congress for electronics/software stakeholders. Focused on SDV and new electronic architectures.
- **Target Audience:** OEMs, suppliers, software/electronics experts
- **Participating partner:** ETAS, ECLIPSE

5. **Automotive Future of the European Software Defined Vehicles – Webinar**

- **Date:** 2025-02-21
- **Location:** Oulu University (Online)
- **Description:** Event by OULU dedicated to learn about FEDERATE and emerging SDV business/tech trends.
- **Target Audience:** automotive industry professionals, technology & software developers, academics & researchers
- **Participating partner:** OULU

6. **FZI Open House**

- **Date:** 2025-02-27
- **Location:** Karlsruhe, Germany
- **Description:** Panel discussion on FOSS in SDV.
- **Speakers:** Michael Paulweber, Detlef Zerfowski, Alexander Viehl
- **Target Audience:** SDV technology professionals, academic researchers, policy makers, public, etc.
- **Participating partners:** ETAS, AVL, FZI

7. **VDA Mobility Innovation Summit**

- **Date:** 2025-03-25
- **Location:** Berlin
- **Description:** presentation of FEDERATE.
- **Target Audience:** executives, engineers, and decision-makers from automotive manufacturers, suppliers, entrepreneurs and emerging companies showcasing new technologies, Journalists and analysts covering automotive innovations.
- **Participating partner:** ZF, ETAS

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8. **Embedded World**

- **Date:** 2025-03-13
- **Location:** Nürnberg, Germany
- **Description:** Largest embedded systems expo; showcased FEDERATE to embedded community.

- **Target Audience:** embedded system developers and engineers, product managers, industry leaders exploring advancements in real-time computing and embedded vision, start-ups, innovators, content creators, etc.
- **Participating partners:** VIF, ECLIPSE

9. **VECS – Vehicle Electronics & Connected Services**

- **Date:** 2025-03-19
- **Location:** Gothenburg, Sweden
- **Description:** Nordic SDV & mobility event. FEDERATE presented from TIER perspective.
- **Target audience:** technical specialists focusing on software and technology development, CTOs, CEOs and other decision-makers from OEMs, Tier 1 suppliers, Officials from transportation companies and city municipalities focusing on integrating connected services into urban mobility.
- **Participating partners:** ETAS

10. **FAME 3rd Stakeholder Workshop**

- **Date:** 2025-03-24
- **Location:** Brussels, Belgium
- **Description:** Lessons learned across projects. FEDERATE input shared among EU initiatives.
- **Target audience:** individuals from various CCAM projects, experts dealing with data sharing frameworks and vehicle technologies in CCAM.
- **Participating partners:** VDIVDE

11. **Convergence Conference**
    - **Date:** 2025-02-07
    - **Location:** Accenture, Munich, Germany
    - **Description:** Discussion between Projects (HAL4SDV, Shift2SDV, S-CORE, Autotec.agil, UniCar-agil, COVESA and French Project “cluster”, AUTOSAR, SofDCar
    - **Target Audience:** Invited organisations under the lead of FEDERATE and co-organized by European Commission DG-CNECT

    Participating Partners: AVL, BMW, Continental, TTTech

3.5.2.3 Online Webinars

2 online webinars were organized, introducing European driven SDVoF Initiative and Vision & Roadmap of the Software-Defined Vehicle of the Future Initiative (target audience: OEMs; supply chain industry; European industry associations & initiatives; policy makers, general public) with 92 registered participants in total. Organized by VDIVDE and AVL.

3.5.2.4 Live TechTalk Session

The first episode of the foreseen discussion series to share knowledge and advance the field of Software Defined Vehicles (target audience: OEMs; supply chain industry; European SDV industry associations & initiatives) had 107 participants at peak. Organized by VIF (WP2).

3.5.2.5 SDV Hackathon

Networking with senior developers and automotive industry leaders - engineers, architects, business and IT project leads (target audience: automotive software senior developers and top engineers; automotive software professionals, engineers and experts in the automotive and open source software industries). Organized by ECLIPSE.

3.5.2.6 Website

Finally, total of 15 project reports and deliverables were made publicly available through the FEDERATE website. The FEDERATE GitHub repository was actively promoted via FEDERATE website, newsletters, and LinkedIn posts. To further support SDV-related collaboration, the project **website was updated with a dedicated "SDVoF Initiative" section**, featuring key components such as the Action Plan, Manifesto, list of SDVoF supporters, and information on related SDV collaborations.

Task 5.6 Data management plan (VDIVDE)

A data management process has been established. Details of the data management process are described in the deliverable "D5.8_Data Management Plan_FEDERATE_v1.0", which has been submitted by the end of M6.
The data management plan states that the project partners will implement all mandatory open science practices and encourage the implementation of the recommended ones within the consortium as per Horizon Europe Programme Guide. FEDERATE will use open access publishing for all scientific publications resulting from the project. Documents will be provided preferably in pdf format or any other format that allows access to most users. This approach ensures high visibility and interoperability among FEDERATE members as well as the general public.
Project working data is accessible for FEDERATE members and associated members via the common SharePoint, hosted by AVL. Furthermore, an open-source backlog for requirements and the description of software building blocks has been created. The data repository is accessible via: https://github.com/CSA-FEDERATE/. The FEDERATE website (https://federate-sdv.eu/) is used for the publication of the project results, which are openly accessible.

Task 5.7 Quality assurance and consistency check for key reports (VDIVDE)

A quality assurance process has been established. Details are described in the deliverable "D1.2_Quality_and_Risk_Management_Plan_FEDERATE_v0.1", which has been submitted by the end of M6.
The quality assurance and consistency check are ensured by a peer-review process. Each deliverable or key report are reviewed by a separate project partner, preferably from another work package. Before submission, all key reports and deliverables are presented to the Core Team.

3.5.2.7 Work carried out in this work package per beneficiary

AVL: co-organizes the dissemination activities and participates at the major events and represents FEDERATE via posters or talks/presentations at the listed events. AVL presented the first two Webinars.
AMPERE/RENAULT: contributes through joint work with PFA to connect the European SDVoF Initiative and French national activities and projects dealing with the SDV topic. A major contribution is also through active participation at Sherpa Governance meetings, providing strategic recommendations, and at the CESA Congress in Versailles in February 2025, which brought together all relevant stakeholders across Europe to address SDV.
VDIVDE: leads WP5, organizes the bi-weekly WP5 meetings, and co-organizes of the annual SDV Networking Conference. VDIVDE also provides organization, moderation and technical hosting of the webinars. VDIVDE reported and presented WP5 results at Y1 review meeting on 30 January 2025 in Brussels.
ECL: participated in multiple events on behalf of FEDERATE and the Eclipse SDV projects: CESA 2025, Embedded World, SDV Networking Conference. ECL organized a 3 days OCX – Open Code Experience / OCA Automotive Conference and a 3 days SDV Hackathon.
FSG: Provided communication content around CESA 2025 Versailles congress
METIS: manages the communication and dissemination activities, including setting up and operating the web presence and posts on the project's social networks.

3.5.2.8 Deviations from plan

No significant deviations were reported.

4 Effort reported by partners

Reported efforts in PM (person months) spent in M13-M18
Notes

- At the beginning of the reporting period, partner NXP switched from "consortium member" to "associated partner". This is part of the ongoing grant agreement amendment #2 process. Therefore, no effort is shown for NXP in the following table
- Work from RENAULT has been fully transferred to AMPERE. This is also part of the ongoing grant agreement amendment #2 process. Therefore, no effort has been reported by RENAULT until the transfer process is fully agreed.

#	Partner Short Name	PM in WP 1	PM in WP 2	PM in WP 3	PM in WP 4	PM in WP 5	Total PM per Particip.
1	AVL (Coordinator)	3.0	0.0	0.5	1.2	0.5	5.2
2	BMW	0.0	0.0	0.6	0.6	0.0	1.2
3	MBAG	0.0	1.0	0.1	1.1	0.0	2.2
4	RENAULT						0.0

5	CARIAD		0.1	0.1			0.1
6	FORD			0.1			0.1
7	BOSCH			**0.0**			0.0
8	CONTI		0.2		0.1		0.2
9	CONTI-FR		0.1		0.1		0.1
10	EB		0.1				0.1
11	TTTECH			0.96			0.96
12	VALEO		0.2				0.2
13	ZF			0.3			0.3
14	FSG			0.1	0.1	0.1	0.3
15	IFAG			0.5			0.5
16	NXP						0.0
17	ST						0.0
18	AVL-DE				0.4		0.4
19	ETAS		0.5	1.0			1.5
20	VER			0.3			0.3
21	UOULU		1.3				0.0
22	RWTH		0.5				0.5
23	TUM		1.2				1.2
24	VIF		1.1				1.1
25	VDIVDE	0.6			0.1	**0.5**	1.2
26	ECL			0.3		0.4	0.7
27	METIS					1.1	1.1
28	FZI		0.5				0.5
29	VECTOR		0.3				0.3
	Total Person Months	**3.6**	**6.9**	**4.7**	**3.7**	**2.6**	**21.5**

Table 1: Definitions, Acronyms, Abbreviations

Definitions, Acronyms, Abbreviations	Meaning
AM	Associated Members
BB	Building Block
CCAM	Connected Collaborative Automated Mobility
CSA	Coordination Support Action
CI	Continuous Integration
CD	Continuous Deployment/Delivery
CVV	Continuous Verification & Validation
DevOps	Development (Dev) and IT Operations (Ops)
ECU	Electronic Control Unit
EdgeAI	AI running on edge devices
FEDERATE	Software-defined vehicle support and coordination project
GA	General Assembly
HPC	High-Performance Computing
HW	Hardware
NN	Neural Network
OEM	Original Equipment Manufacturer
OS	Operating System
OtA	Over the Air (Update/Upgrade)
PoC	Proof of Concept
RDI	Research Development Innovation
SOA	Service Oriented Architecture
SDV	Software-defined vehicle
SDV Ecosystem	Entirety of the corresponding technology layers (software and hardware) of a software-defined vehicle with its non-differentiating building blocks in a layered structure
SDV Ecosystem program	All RDI projects, which collaboratively work together to create hardware and software building blocks in a jointly agreed layer structure. The building blocks together with vendor

	specific components can (and will) be used to create OEM specific software stacks and HW platforms for software-defined vehicles
SDV RDI projects	Research, development and innovation projects in the context of the SDV Ecosystem program
SDV community	Entirety of people and institutions involved to create an SDV Ecosystem for software-defined vehicles
SW	Software
V2X	Vehicle to anything [communication]

5 List of Tables

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7 Conclusions

During the reporting period from month 13 to month 18, the FEDERATE project has made significant progress across all work packages. The consortium successfully achieved key milestones, including the feedback on repository and the expansion of the European SDV ecosystem. The development and refinement of the open repository, active participation in industry events, and strategic alignment with related projects have strengthened the project's foundation and visibility.

The collaborative efforts in organizing webinars, workshops, and conferences have fostered a vibrant community engagement, promoting the vision of Software-Defined Vehicles (SDVs) and encouraging contributions from diverse stakeholders.

Looking ahead, the project aims to continue its momentum by enhancing stakeholder engagement, refining the building block repository, and expanding the SDV ecosystem. The upcoming European SDV Ecosystem Summit and further dissemination activities will play a crucial role in maintaining the project's visibility and impact. The consortium remains committed to achieving the project's objectives and contributing to the advancement of SDV technologies in Europe.

8 Appendices

8.1 Building Blocks with Implementations

BB Name	BB Tags(s)	Functional Clusters	Layer	Known Implementation	Description
eCAL	BB-SC	Communication	MWLayer	https://github.com/eclipse-ecal/ecal	The enhanced Communication Abstraction Layer (eCAL) is a middleware that enables scalable, high performance interprocess communication on a single computer node or between different nodes in a computer network. eCAL provides publish - subscribe and server - client pattern to connect different nodes in the network with almost no configuration required.
KUKSA	BB-SC	Communication	MWLayer	https://github.com/eclipse-kuksa	The open Eclipse KUKSA™ project aims to provide shared building blocks for the Software Defined Vehicles that can be shared across the industry. One of the main features of KUKSA is abstracting vehicle data and interfaces to a common format based for example on the Vehicle Signal Specification. That way, all functions sitting on top of KUKSA can run on all enabled cars. KUKSA itself focusses

					on the adaptation of various Vehicle Interfaces into a basic basic interfaces using simple APIs. This enables you to add your preferred onboard or offboard techstack to new vehicle architectures more easily.
uServices	BB-SC	Communication	MWLayer	https://github.com/COVESA/uservices	uServices is a project that contains the definition of common vehicle services. It uses protobuf as the interface definition language, with custom extensions to extend protobuf with additional information required for automotive services.
uProtocol	BB-SC	Communication	MWLayer	https://github.com/eclipse-uprotocol	A communication protocol enabling developers to build apps and services that communicate seamlessly across one or multiple inter-connected messaging middleware. uProtocol provides a small number of communication patterns, exposed with a set of programming APIs available and consistent across the vehicle eco-system (in-vehicle ECUs, cloud and mobile). This approach enables seamless communication between applications and services, wherever they are hosted. Using uProtocol, application developers can focus on the functionality they need to develop, rather than the plumbing necessary to access the relevant services they require, and service providers develop their service once for all consumers, wherever they are hosted.
VISSR	BB-SC	Communication	MWLayer	https://github.com/COVESA/vissr	This project provides a reference implementation of the released COVESA VISSv2.0 specification on the v2.0 branch, and an ongoing development of a reference implementation of the VISSv3.0 specification on the master branch.
OpenDDS	BB-SC; BB-MU; BB-CSC; BB-CMU	Communication	MWLayer	https://github.com/OpenDDS/OpenDDS	OpenDDS is an open-source C++ implementation of the Object Management Group's specification "Data Distribution Service for Real-time Systems" (DDS), as well as some other related specifications. These standards define a set of interfaces and protocols for developing distributed applications based on the publish-subscribe and distributed cache models. Although OpenDDS is itself developed in C++, Java bindings are

					provided so that Java applications can use OpenDDS. OpenDDS also includes support for the DDS Security and XTypes specifications.
CycloneDDS	BB-SC; BB-MU; BB-CSC; BB-CMU	Communication	MWLayer	https://github.com/eclipse-cyclonedds/cyclonedds	Eclipse Cyclone DDS is a very performant and robust open-source implementation of the OMG DDS specification. Cyclone DDS is developed completely in the open as an Eclipse IoT project (see eclipse-cyclone-dds) with a growing list of adopters (if you're one of them, please add your logo). It is a tier-1 middleware for the Robot Operating System ROS 2.
Fast-DDS	BB-SC; BB-MU; BB-CSC; BB-CMU	Communication	MWLayer	https://github.com/eProsima/Fast-DDS	eprosima Fast DDS is a C++ implementation of the DDS (Data Distribution Service) standard of the OMG (Object Management Group). eProsima Fast DDS implements the RTPS (Real Time Publish Subscribe) protocol, which provides publisher-subscriber communications over unreliable transports such as UDP, as defined and maintained by the Object Management Group (OMG) consortium. RTPS is also the wire interoperability protocol defined for the Data Distribution Service (DDS) standard. eProsima Fast DDS expose an API to access directly the RTPS protocol, giving the user full access to the protocol internals.
vSOME/IP	BB-SC; BB-MU; BB-CSC; BB-CMU	Communication	MWLayer	[vSomeIP](https://github.com/COVESA/vsomeip)	SOME/IP is an abbreviation for "Scalable service-Oriented middlewarE over IP". This middleware was designed for typical automotive use cases and for being compatible with AUTOSAR (at least on the wire-format level). A publicly accessible specification is available [at](http://some-ip.com/). In this wiki we do not want to deepen further into the reasons for another middleware specification, but want to give a rough overview about the basic structures of the SOME/IP specification and its open source implementation vsomeip without any claim of completeness. [source](https://github.com/COVESA/vsomeip/wiki/vsomeip-in-10-minutes)

embedded RTPS - DDS for Ressource-constrained environments	BB-SC, BB-CSC, BB-MU, BB-CMU	Communication	MWLayer	Github repo: <https://github.com/embedded-software-laboratory/embeddedRTPS>	This repository contains source code for embeddedRTPS, a portable and open-source C++ implementation of the Real-Time Publish-Subscribe Protocol (RTPS) for embedded system. RTPS is based on the publish-subscribe mechanism and is at the core of the Data Distribution Service (DDS). DDS is used, among many other applications, in Robot Operating System 2 (ROS2) and is also part of the AUTOSAR Adaptive platform. embeddedRTPS allows to integrate Ethernet-capable microcontrollers into DDS-based systems as first-class participants. embeddedRTPS is portable, as it only consumes lightweightIP and FreeRTOS APIs, which are available for a large number of embedded systems. embeddedRTPS avoids dynamic memory allocation once endpoints are constructed possible. Please note that embeddedRTPS only implements rudimentary Quality-of-Service (QoS) policies and is far from a complete RTPS implementation.
XENProject	BB-SC; BB-CSC	HardwareAbstraction; Virtualisation; Type-1-Hypervisor	HWLayer	https://github.com/xen-project/xen	The Xen Project team is a global open source community that develops the Xen Project Hypervisor and its associated subprojects. Our mission is to advance virtualization technology across a wide range of commercial and open-source domains. Illustration of a computer monitor displaying bar charts with Xen Project Logo source: https://xenproject.org/
Ankaios	BB-SC	Virtualization	OSLayer	https://github.com/eclipse-ankaios/ankaios	Eclipse Ankaios provides workload and container orchestration for automotive High Performance Computing Software (HPCs). While it can be used for various fields of applications, it is developed from scratch for automotive use cases and provides a slim yet powerful solution to manage containerized applications.
Private Cross OEM Joint Compute for EV Charging	S-BB		MWLayer	https://covesa.global/project/private-cross-oem-joint-compute-for-ev-charging/	Publicly available, shared EV charging infrastructure is foundational for EV adoption. To build a reliable charging experience vehicle, charging stations and charging experience are critical to improve route recommendation and vehicle diagnostics. Sharing data between OEMs

					and suppliers can help build better experience and infrastructure.
Data Architecture Terminology	S-BB		MWLayer	https://covesa.global/project/data-architecture-terminology/	Definition of reusable common architectural terminology and patterns realized with technical implementations, and proofs of concept in order to drive understanding and adoption of COVESA specifications.
VSS	S-BB		MWLayer	https://github.com/covesa/vehicle_signal_specification	The overall goal of the Vehicle Signal Specification (VSS) is to create a common understanding of vehicle signals in order to reach a “common language” independent of the protocol or serialisation format.
Unified Push Notification	S-BB		MWLayer	https://covesa.global/project/unified-push-notifications/	Standardize 3rd party push notifications for automotive user experiences.
HIM	S-BB		MWLayer	https://github.com/COVESA/hierarchical_information_model	The HIM aims to provide a format for expressing a hierarchical representation of a domain.
InCar Wallet Payments and Orchestration	S-BB		MWLayer	https://covesa.global/project/in-car-wallet-payments-orchestration/	Secure and convenient payment system framework for vehicles.
EV Charging Event Data Aggregation	S-BB		MWLayer	https://covesa.global/project/ev-charging-event-data-aggregation/	Addressing standards for EV charging experiences by levaraging shared big data.
VSS	S-BB		MWLayer	https://covesa.global/project/common-vehicle-capabilities/	Enumerate and define common (commodity) vehicle capabilities and their interfaces in a technology-neutral manner.
VISS	S-BB	Communication	MWLayer	https://github.com/COVESA/vehicle-information-service-specification	Vehicle Information Service Specification (VISS) is an API for accessing the COVESA Vehicle Signal Specification (VSS) data. The work started at The World Wide Web Consortium (W3C) in collaboration with GENIVI and its successor COVESA. The W3C Automotive Working Group closed in February of 2024 and the work is continuing at COVESA.

Commercial Vehicle Information Specifications	S-BB	Generator		https://github.com/COVESA/commercial-vehicle-information-specifications	The Commercial Vehicle Information Specifications (CVIS) project is aiming at developing signal and service catalogues for commercial vehicles using the HIM rule set.
SKyBT	BB-EST, BB-CEST, BB-SC-TC, BB-CSC-TC	(Explanation: in which Functional Cluster the BB be located; if none of the existing fit new required)	MWLayer	Github repo: https://gitlab.eclipse.org/eclipse/skybt/skybt	With Eclipse SKyBT the test designers are able to describe the system under test as a model by using a defined syntax and keywords. The model includes the definition and selection of the needed interfaces, logical relations as a state machine and description of the logical objects with keyword sentences. Custom keywords can be defined as needed for the current project. Platform or communication definitions can be imported and then be used as keywords. The keyword and syntax management are embedded. Form these keyword-based models of the system under test the test designer is able to generate the needed test case using the test case generator. Of course, the user is also able to write classic test cases based on the syntax and keywords. The models and test cases can be combined with parameters and test data sets. As most of the test departments already have a working test management, test cases can be exported to the used application lifecycle management tools. Coming from the ALM tool the configured test suites can be executed in the used test automation. Since the test cases are based on keywords, there is no need to implement or update the test case. All test cases that are based on the already implemented keywords can be executed directly.
VELOCITAS	BB-EST	Build and Implementation		https://github.com/eclipse-velocitas	Eclipse Velocitas provides a development toolchain to create containerized in-vehicle applications (Vehicle Apps) that offers a comfortable, fast and efficient development experience to increase the velocity of a development team.
IFEX	BB-EST	Generator		https://github.com/COVESA/ifex	IFEX is a general interface description and transformation technology which started in the Vehicle Service Catalog (VSC) project. The project is a place to do

					difficult semantic mapping work. While doing so, it creates translating tools between formats and it results in a simple but powerful interface description format.
Autowrx	BB-EST	Testing		https://gitlab.eclipse.org/eclipse/autowrx/autowrx	Rapid prototyping environment to explore and validate ideas of a Vehicle App, implements Digital.Auto
OpenXilEnv	BB-EST	Testing		https://github.com/eclipse-openxilenv/openxilenv	SW in the loop solution for virtual validation, similar to Synopsis Silver Simulate ECU functions, includes parameter management, Scripting interface. With a Software In the Loop system it is possible to run and test embedded software without a target plattform and compiler. XilEnv is an environment to setup a SIL system on Windows or Linux host.
Central Data Service Playground	BB-EST	Testing		https://github.com/COVESA/cdsp	The Central Data Service Playground (CDSP) is a neutral, open playground for data services both within and outside the vehicle in the context of data-centric architectures. It enables investigation into the internals of these services and how they can be combined. Furthermore, the playground provides a means to publish and collaborate on such work in the open.
LEDA	BB-EST	Lifecycle-Management		https://github.com/eclipse-leda	Eclipse Leda provides an "SDV distribution" that pulls together individual contributor pieces from SDV and the larger OSS community, to deliver a functional and always-available Linux-based image/distribution.

8.2 Suggested Building Blocks

BB Name	BB Tags(s)	Functional Clusters	Layer	Known Implementation	Description
OTA Master	BB-SC	Configuration	MWLayer	'- AUTOSAR: UCS - but not OSS-usable - higher-level: Eclipse Ankaios, Eclipse Kanto, Eclipse	The OTA master is a central SWC to deploy OTA SW updates within the vehicle network. Besides the basic functionality of SW installation, it implements the necessary failsafe or failover behavior to ensure the robustness of the update process (such as backup and rollover

				Symphony, Eclipse BlueChi	mechanism). In addition, it must manage and verify the integrity of the installed SW after it has been transferred from the backend, potentially even before installing the SW. It also coordinates local OTA salves distributed in the vehicle, by self-contained interface and command control. As a prerequisite for a successful update, the update master has also to be capable to read the vehicle configuration and control reprogramming history.
Local Update Manager	BB-SC	Configuration		'- AUTOSAR: UCS - but not OSS-usable - higher-level: Eclipse Ankaios, Eclipse Kanto, Eclipse Symphony, Eclipse BlueChi	A Local update manager is a local instance of an (OTA) Update master. It is meant to be deployed and operated on distributed vehicle network nodes. It must provide a similar, but limited functionality compared to the OTA master. It shall be able to manage locally backup storage and rollback of software controlled by the OTA Master. The local update manager may become necessary as the OTA master will not or just with complex implementations (which may interfere with the network capabilities and the overall in-vehicle security) be able to deploy SW updates across the vehicle network within a zonal architecture. The Local update manager will deploy/install software in a dedicated local area of the vehicle network under control of the update master. It will ensure also local API for memory control and security services control.
Distributed Health Management	BB-SC	Platform Health Management	MWLayer	<https://opentelemetry.io>	Distributed health management like state management must be orchestrated in states through the SW Partitions, subsystems, and systems as well as the reaction to "unhealthiness" of the system. Define services and hierarchy of services to handled cascading of failure detection and recovery to easily integrate safety concept.
Watchdog	BB-SC	Platform Health Management	MWLayer		Extend the traditional concept of watchdog concept (stack for external chip regular activation, deadline monitoring, alive supervision, and logical program flow supervision) to inter ECU operation in conjunction to Health Management.

Intrusion Detection	BB-SC	Security	MWLayer		Define services to react on the events recorded by the Security event manager to security violations. IDS and IDPS (Intrusion detection and prevention system) are both considered here. Suggested for implementation in SHIFT2SDV block F1
Internet Protocol Security	BB-SC	Security	MWLayer		Define "IPSec" a protocol used for internet key exchange, authentication header and encapsulating security payload.
Crypto Service Manager	BB-SC	Security	MWLayer		Define the APIs and sequence routines for the security algorithms used by applications to access to low level hardware and/or software. Ensure that access of security routines can be run remotely.
Secure Onboard Communication	BB-SC	Security	MWLayer		Define secure communication between different ECU. This includes messages signed messages with a hash (CMAC) and a counter information to be able to detect security violations (like replay attacks etc.). These services need to applied for different communication protocol common at the vehicle level to be aligned for set of secure communication routines.
Security and Safety API	BB-SC	Security	MWLayer		Robust cybersecurity frameworks for real-time intrusion detection systems and continuous security monitoring. Suggested for implementation in SHIFT2SDV block F3
Anomaly Detection	BB-SC	Security	MWLayer		Advanced machine learning techniques for anomaly detection. Anomaly detection techniques that are robust to unknown events and have desirable characteristics that make them suitable for safe integration into critical systems will be designed and developed. The process will mostly revolve around i) crafting safety wrappers, ii) the quantification of the uncertainty in predictions, and iii) a resilient and robust design of classifiers themselves. Suggested for implementation in SHIFT2SDV block F2
Security Transport Layer	BB-SC		## BB Tags(s) BB-SC ## Functional Clusters Security		Define transport layer security and datagram transport layer security, as both part of the transport layer and therefore not visible on application layer (maybe except some detected security violations). Need to align all the standard.

			## Layer MWLAyer		Standardization could be used on which version of TLS/dTLS to be used and reactions on security violations.
Safety-Gateway	BB-SC	Security	MWLayer		
Security Event Manager	SC-BB	Security	MWLayer		Management of security related incidents (e.g. violations) and the according reaction for the overall vehicle. Define a catalogue of security events and standardize the message for security event distribution in the subsystem / system.
State Management	BB-SC	Runtime	MWLayer	Eclipse Piccolo	The State management is responsible for the start of the system "car" and the coordinated start and stop of sub systems and partitions depending on different operation modes of the vehicle. It is usually a multi-layer approach, where states are managed locally for each SW partition, for each sub system and for the complete vehicle system.
Diagnostic Services Applications	BB-SC	Runtime	MWLayer		Diagnostic service applications are interpreted as the diagnostic services according to ISO 14229. Some of the service implementations are application specific like routines, data identifiers and DTCs, but at least generic hook must be defined. This includes in future also the connection to the Offboard by service orientedVehicle Diagnostic (SOVD).
Power Management Coordination	BB-SC	Power Management	MWLayer		Control the handling of vehicle power in various ECU by provides generic services for handling power up and power down phases of the vehicles, to manage vehicle power transition phase and energy efficiency. It handles decision for power control based on electronic dependency and power cascading sequence. It is usually a multi-layer approach, where states are managed locally for each SW partition, for each sub system and for the complete vehicle system It is multi-layer approach For Linux systems, systemd and how it can help with this concern is probably a highly interesting topic to investigate for this BB.

Vehicle Logging and Recording	BB-SC	Storage	MWLayer	OpenTelemetry	A component in the vehicle which selects data of interest and uploads it to the cloud. It has access to most of the data in the car and selects by filters (AI based or rule based). Typically, the filters are modified by the cloud to enable campaigns in order to collect specific amount of data e.g. for monetization purposes. It shall support control of access services and access right
Vehicle Data Persistency	BB-SC	Storage	MWLayer		Services for management of distributed persistent data for compatible with the different operating system (AUTOSAR Classic, Adaptive, Linux, ...) Define a high-level service capable to be mapped to the low-level API existing of OS in use in automotive. Control of robustness and refresh of standard functionality according to hardware solution. It also includes supervision of consumption and resource control (to ensure reliability of the system)
Vehicle Data Collector	BB-SC	Storage	MWLayer	<https://github.com/eclipse-sdv-blueprints/insurance> <https://github.com/eclipse-sdv-blueprints/fleet-management>	A component in the vehicle which selects data of interest and uploads it to the cloud. It has access to most of the data in the car and selects by filters (AI based or rule based). Typically, the filters are modified by the cloud to enable campaigns in order to collect specific amount of data e.g. for monetization purposes. It shall support control of access services and access right
Time Service	BB-SC	Time	MWLayer		Define the source as a service, modulating software time based on local ECU physical Timer channel on the chip counting time even when vehicle is off. Control the system time as time between different SW Partitions, subsystems, and systems to have a *global* valid time (selection of most accurate over several source, including diagnosis, etc..) as well as the exchange of time information between subsystems
Onboard TSN scheduling Tool	BB-SC	Time	MWLayer		
Policy Manager	BB-SC	Diagnostics	MWLayer		Diagnostic service applications are interpreted as the diagnostic services according to ISO 14229. Define service at

					vehicle level to control different access level or different permission. Each level requires previous authentication, where authentication, can remain vehicle specific.
SOVD Reference implementation	BB-SC	Diagnostics	MWLayer		
Communication Protocol Abstraction	BB-SC	Communication	MWLayer		
Smart Charging Communication	BB-SC	Communication	MWLayer	<https://lfenergy.org/projects/everest/>	Implementation of protocols for the smart charging of EVs
Communication Server (S2S)	BB-SC	Communication			Define standard service for secured offboard communication
Onboard TSN configuration	BB-SC	Communication	MWLayer		
SecOS	BB-SC	Communication	MWLayer		Define standard service for secured onboard communication
Gateway Mirroring	BB-SC	Communication	MWLayer		Assumption is that the "traffic shadowing/mirroring concept" from microservices defined with the Gateway being mirrored instead of specific services necessary for micro services testing. Define standard service for replay of messages and hiding of message and mirroring for test purposes
TSN	BB-SC	Communication	MWLayer		
Standard Android VHAL	BB-SC	Communication	MWLayer		The standard Android VHAL implementation should be a building block enabling to seamlessly mapping of car data from underlying data middleware to Android Car API. The solution should be able to use any data middleware using VSS and standard transport protocols enabling get, set, sub, pub, e.g. MQTT, WS. All the standard properties defined by Google shall be reused. All missing properties shall be defined using vendor properties in a standard, cross-OEM way. It should enable VSS to VHAL Property mapping

					using and updatable mapping file enabling: a) definition and agreement of vendor mapping cross-OEM b) OTA updatability c) OEM specific mappings.
Network Management	BB-SC	Communication	MWLayer		The network management is responsible in connected systems to orchestrate states like startup and shut down through the system. Here the services cover the overall network manager layer but also services for starting/stopping communication of nodes within the systems compare to state management.
Key Management System	BB-SC	Tools and Methods	MWLayer		Define services for management of the keys for the ECU, subsystem, and system (secure storage, secure distribution, secure key handling). Keys have to be managed ECU local, subsystem wide and car system wide.
Automotive API Framework	BB-SC	API	AppLayer		The Eclipse Automotive API Framework provides a stable application-facing interface, thereby minimizing the prevalence of proprietary solutions throughout the automotive sector. A corresponding model allows configuration and offers the needed flexibility for the handling of vehicle variants and different E/E architectures. Such solution also creates a win-win situation for both suppliers and OEMs.
AOSP Push Notification Service	BB-SC	Communication	AppLayer	<https://novu.co> <https://unifiedpush.org/>	This work package aims to align on a common Android Open Source Project (AOSP) push notification service (PNS). Due to the heterogenous AOSP landscape, the solution shall be defined as a protocol that is designed in a decentralized way allowing implementing parties to choose between hosting their own PNS or using an existing one. To reduce fragmentation and to allow 3rd parties to build once and deploy anywhere, the protocol shall be guaranteed to work regardless of the underlying implementation. To help developers use the new standardized protocol, a reference implementation shall be provided.
ADAAA	BB-SC	Control	AppLayer		Adaptive Cruise Control Demo for adaptive AUTOSAR with the goal of providing examples and tutorials to build

					AUTOSAR expertise across the community.
SR VOSS	BB-SC	Virtualization	OSLayer		
Automotive Edge Runtime	BB-SC	Time	OSLayer	Eclipse Leda AutoSD (RHIVOS)	A runtime in the vehicle that executes workloads, typically defined by the cloud. The component can be orchestrated to manage workloads across multiple partitions or high-performance-computers. Scheduling can be static or dynamic (during runtime of the vehicle). Workloads are typically packaged as containers according to cloud native standards. There should be performance, check point analysis and means to control the container. It is recommended to applies it only for non-safety HPC partitions for non-safety functions. interesting things to look at: - web assembly (wasm) runtimes
Container-Abstraction	BB-SC	Container	OSLayer		
SOA	S-BB		MWLayer	Eclipse uProtocol	Service oriented communication allows services to communicate between ECUs with each other in the vehicle typically by publish-subscribe mechanism. Typically this is enabled by middleware framework implementing a service protocol (SOME/IP, DDS,..) and providing necessary interface connectors in various programming languages.
Stadardized HD maps formats and services	S-BB		MWLayer	[HERE](https://www.here.com)	
Standardized Data Description for Vehicle Sensors, Attributes, and Actuators	S-BB	None	MWLayer		for Vehicle Sensors, Attributes, and Actuators ## BB Tags(s) S-BB ## Functional Clusters None ## Layer MWLayer ## Known Implementation ## ID (unique name) ## Description Establishing a standardized framework for describing the data from vehicle sensors, attributes, and actuators within the automotive data architecture.

sSOA	S-BB		MWLayer		Framework services for service-oriented architecture allowing security by design with security mechanism tight to the services (i.e. authentication of allowed service users etc.) This needs to be tied in with the actual service mesh implementation - suggest that Eclipse uProtocol would be a good place for this topic.
Legally binding formats for data exchange	S-BB		MWLayer		
Standardized way for Reasoning on Data Streams	S-BB				This work package is dedicated to the development of a standardized framework for the analysis and reasoning of data streams within the knowledge layer of software-defined vehicles (SDVs). It aims to establish a unified approach for processing and interpreting the vast and continuous data generated by various vehicle sensors and systems. The framework is designed to enhance the efficiency and accuracy of data processing, ensuring that the knowledge layer effectively translates raw data into actionable insights. This is critical for real-time decision-making in SDVs, impacting areas such as autonomous driving, predictive maintenance, and adaptive system responses.
Standardized Data Conversion Tools for Info-Knowledge Layers	S-BB		s ## BB Tags(s) S-BB ## Functional Clusters ## Layer MWLayer		This package aims to develop and standardize tools for converting data between the information layer (focusing on raw data collection and storage) and the knowledge layer (centered on processing data into actionable insights), ensuring accuracy and efficiency in data transformation.
Standardized authentication of vehicle users	S-BB		MWLayer		
Standardized data formats for digital twins	S-BB		MWLayer		
Standardize cloud services to support international	S-BB		MWLayer		

roaming of vehicles					
Standardization of Vehicle API	S-BB		AppLayer		This work package aims to create a standardized application programming interface (API) for vehicles to facilitate consistent and efficient communication between different vehicle systems and external applications.
Standardized Architectural Patterns for Cross Platform Data Service Infrastructure	S-BB		AppLayer		This work package aims to develop standardized architectural patterns for a data service infrastructure that encompasses data storage, access, synchronization, and other related functionalities across different platforms.
Standardized Description of Data from Related Domains	S-BB		AppLayer		of Data from Related Domains ## BB Tags(s) S-BB ## Functional Clusters ## Layer AppLayer ## Known Implementation ## ID (unique name) ## Description This work package focuses on developing a standardized framework for describing data from varied domains like people and the environment, ensuring uniformity, interoperability, and enhanced analytical capabilities.
Fleet Management System	S-BB		AppLayer		Standardize data access
Standardized Procedure and Tooling for Combining Data from Different Domains	S-BB		AppLayer		This package aims to establish a standardized approach and develop tools for integrating and harmonizing data from diverse domains within the software-defined vehicle environment, ensuring effective data utilization and analysis.
Standardized Procedure and Tooling for Modelling Data from Different Domains	S-BB		AppLayer		Developing a standardized methodology and toolkit for data modeling in the software-defined vehicle domain, ensuring consistency, compatibility, and efficiency in data handling and analysis.
VAPI Stack Demonstrator	S-BB	API			
Shadowing	BB-SC-TC	Testing	MWLayer		A system working passively in the background that uses recorded data and input from sensors and cameras in the car to make its own hypothetical driving decisions. These hypothetical driving

					decisions are then compared to the decisions the (human) driver of the car makes. Both the recorded data and the comparison are used, amongst others, to discover unthought of edge and corner cases, and to evaluate and demonstrate the safety of autonomous functionalities. Proposal for standardization of recording services, comparison services, and process execution services are standardized in conjunction data collector and orchestrator. The rest seems to be added value of the functionality. A digital shadow mirrors the current state and behavior of a physical entity or system.
Car Simulator	BB-CEST	Not Specified	Not Specified	Eclipse SDV - kanto.auto (old) will be published under a new name Eclipse OpenDUT [Carla](https://carla.org/)	Based on the W3C VISSv2 standardized interface the car simulator can act as a car and simulate VISSv2 related interfaces. The simulator is able to create, provide and replay recorded data as well as simulate static data on the published VISSv2 based interfaces. The solution should be able to publish data via standard transport protocols supported by the VISSv2 standard enabling get, set, sub, pub, e.g. MQTT, WS. The car simulator offers an UI to configure data of the loaded VSS data model. Within the UI car related data can be manipulated or routes with changing data can be simulated. The car simulator should support the whole VSS data model and data types and the interfaces should support the W3C standard of VISSv2. The application should run locally as well as on a dedicated server based on newest web technologies
RemotiveCloud	BB-CEST; BB-CSC-TC	Diagnostics (could also be used for feeding vehicle data to emulators and other prototyping tools)	Not Specified	https://cloud.remotivelabs.com/	RemotiveCloud - for sharing vehicle recordings, both for debugging purposes as well as for prototyping (feed data into e.g. ProtoPie and Android AAOS / AOSP emulators). The recordings can be made with the RemotiveBroker or some other logging devices following standard formats.
Digital Twin proxy in cloud	BB-CMU	Not specified	Not specified	Eclipse Ditto	The digital twin is considered as a digital representation of a vehicle (or the vehicle's configuration) as prerequisite for

					validation and test of SW variants prior to their deployment to a live vehicle. Proposal for standardization are execution model with regard to simulation level (Prostep standardization <https://www.prostep.org/>), handling of distributed simulation, co-simulation bus and services for controller including services to extract and inject data, extract and inject algorithm dynamically (or static) during simulation, services to guarantee at least software alignment between digital and vehicle. Defines embed service services to ensure connection with digital twin. *** A digital twin is a virtual representation of real-world entities and processes, synchronized at a specified frequency and fidelity. - Digital twin systems transform business by accelerating holistic understanding, optimal decision-making, and effective action. - Digital twins use real-time and historical data to represent the past and present and simulate predicted futures. - Digital twins are motivated by outcomes, tailored to use cases, powered by integration, built on data, guided by domain knowledge, and implemented in IT/OT systems. The foundational elements of the definition are captured in the first sentence: the virtual representation, the real-world entities and processes it represents, and the mechanism by which the virtual and real-world entities are synchronized. Source: https://www.digitaltwinconsortium.org/2020/12/digital-twin-consortium-defines-digital-twin/ Digital Twin Consortium is part of the Object Management Group®.
Monitoring and tracing specific HW in vehicle	BB-CSC	Not specified	Not specified		To monitor, profile, collect HW-specific information to improve next-gen HW
App/Services store	BB-CSC	Not specified	Not specified		App/Services store with cross-vendor-support but independent of hyper scalers

Driver Monitor	BB-CSC	Not specified	Not specified		Monitors attention and potentially medical condiion of drivers
Data manager ensuring compliance with regulation	BB-CSC	Not specified	Not specified		EC data act, EC AI act,… Includes authentication, access control, reporting, potentially also data sharing "for money"
Cloud contaier and OS	BB-CSC	Not specified	Not specified	Blackberry QNX OxidOS Eclipse ThreadX RedHat In-Vehicle OS (announced)	Container and OS which support executing of mixed-criticality vehicle SW
Vehicle data streaming	BB-CSC	Not specified	Not specified		Stream info from vehicle displays (e.g. dashboard) to mobile devices
Vehicle monitor	BB-CSC	Not specified	Not specified		Monitors condition of components and parts of the vehicle to support. (e.g. predictive maintenance)
Extended accident data recorder	BB-CSC	Not specified	Not specified		(extending EDR = event data recorder) to better analyse accidents
End-to-end security for C2X	BB-CSC	Not specified	Not specified		End-to-end security for C2X consistent with global regulation
Active diagnostics and repair services	BB-CSC	Not specified	Not specified		
Data Spaces	BB-CSC	Not specified	Not specified	Catena-X	Data spaces supporting middleware components and APIs
Config and settings collector	BB-CSC	Not specified	Not specified		Collects config and settings data across different SW Apps and other BBs; to transfer it to a backup location (e.g. cloud)
Secure and privacy aware voice assistant	BB-CSC	Not specified	Not specified		Secure and privacy aware voice assistant
Driver authentication	BB-CSC	Not specified	Not specified		In-vehicle driver authentication without the need for a mobile device
Orchestration support for energy and mobility providers	BB-CSC	Not specified	Not specified		

Offboard Config Tool for TSN	BB-EST	Configuration-and-Calibration			
DocAsCode	BB-EST	Requirements	None	[Open Fast Trace](https://github.com/itsallcode/openfasttrace)	This BB aims to track and manage the software requirements of the different variants of the source code.
OpenDUT	BB-EST, BB-CEST, BB-SC-TC, BB-CSC-TC	(Explanation: in which Functional Cluster the BB be located; if none of the existing fit new required)	MWLayer	Github repo: https://github.com/eclipse-opendut/opendut	Eclipse openDuT provides an open framework to automate the testing and validation process for automotive software and applications in a reliable, repeatable and observable way. Eclipse openDuT is hardware-agnostic with respect to the execution environment and accompanies different hardware interfaces and standards regarding the usability of the framework. Thereby, it is supporting both on-premise installations and hosting in a cloud infrastructure. Eclipse openDuT considers an eventually distributed network of real (HIL) and virtual devices (SIL) under test. Eclipse openDuT reflects hardware capabilities and constraints along with the chosen test method. Test cases are not limited to a specific domain, but it especially realizes functional and explorative security tests.

9 References

n/a