



Agenda and General Overview of the Project

SAFER Project Result Day

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Public



This project has received funding from the ECSEL Joint Undertaking (JU) under grant agreement No 876852. The JU receives support from the European Union's Horizon 2020 research and innovation programme and Austria, Czech Republic, Germany, Ireland, Italy, Portugal, Spain, Sweden, Turkey.

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Overall Project Presentation



Project Consortium and Budget

- VALU3S was funded by **ECSEL JU** under Horizon 2020 Work Programme
- Start date: **01/05/2020** Ending date: **31/07/2023** Duration: **36 months**
- The consortium consisted of **41 partners** from **10 countries**
- The total VALU3S project cost was **25 620 958 €**

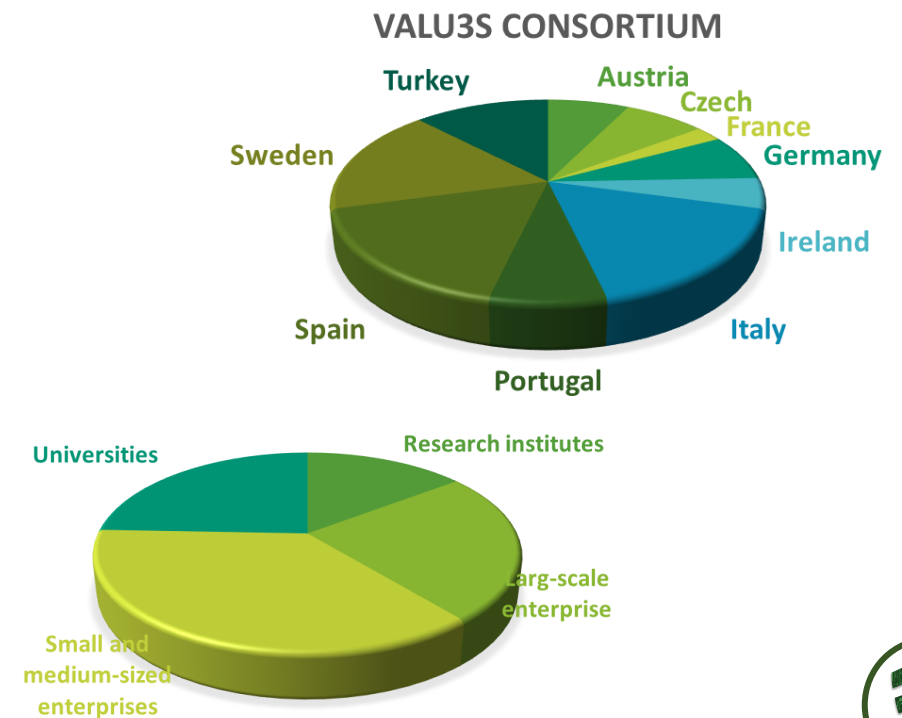
Countries



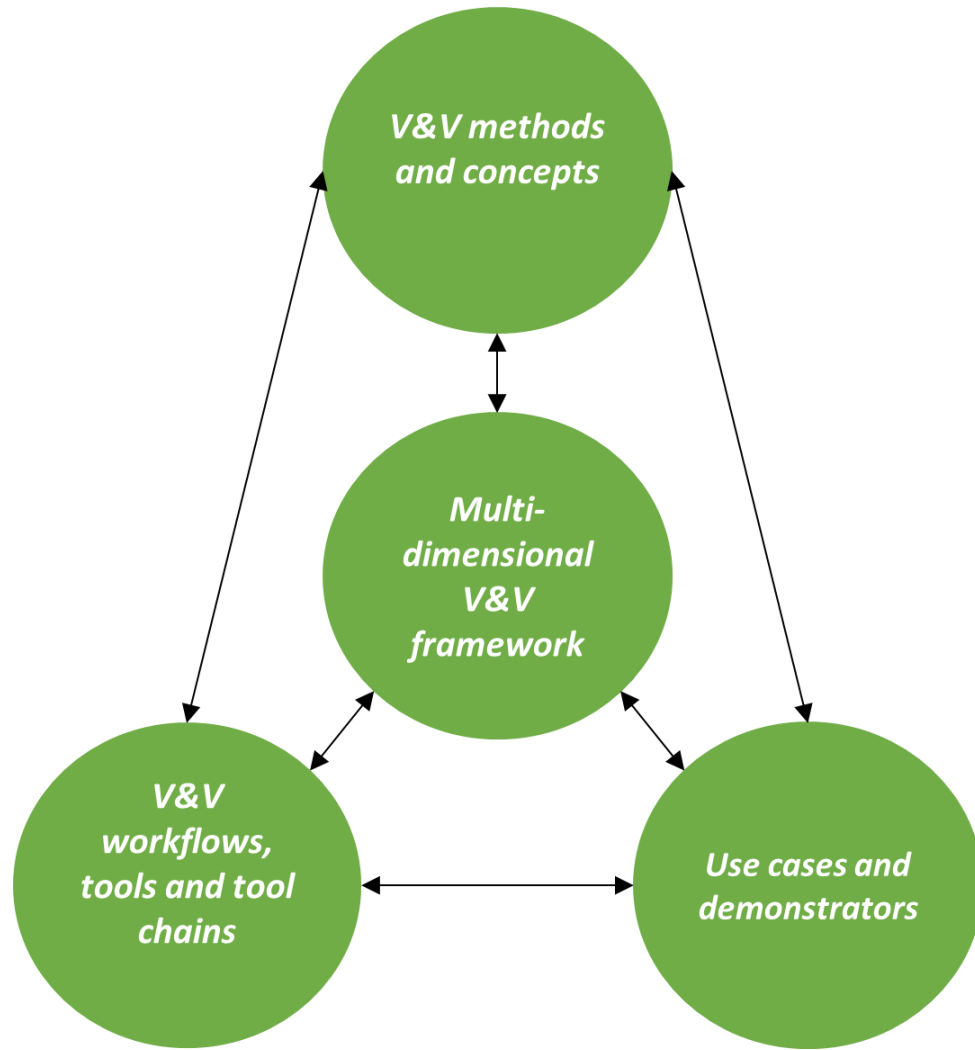
Industry



Academia



High-level Objective



Design, implement and evaluate state-of-the-art **methods and tools** that reduce the **time** and **cost** needed to verify and validate automated systems with respect to **Safety** and **Security** requirements

Project Use Cases

- In VALU3S, we demonstrated, verified and validated the usefulness and wider acceptance of the results in 13 realistic use cases and 22 demonstrators.



Automotive (3 UC)



Railway (2 UC)



Aerospace (1 UC)



Agriculture (1 UC)



Health (2 UC)

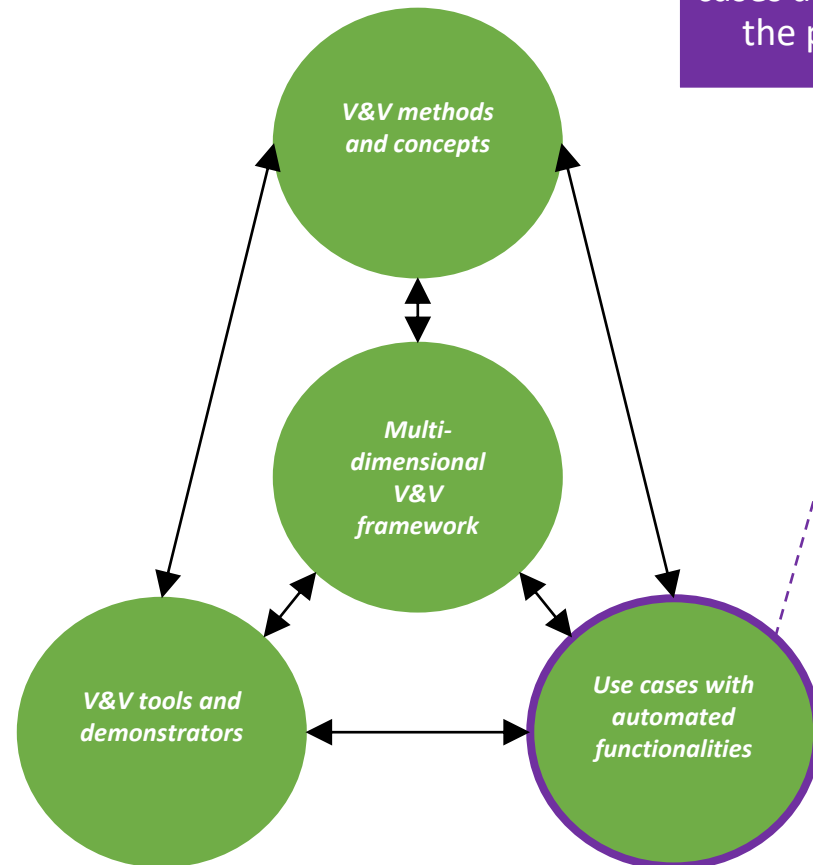
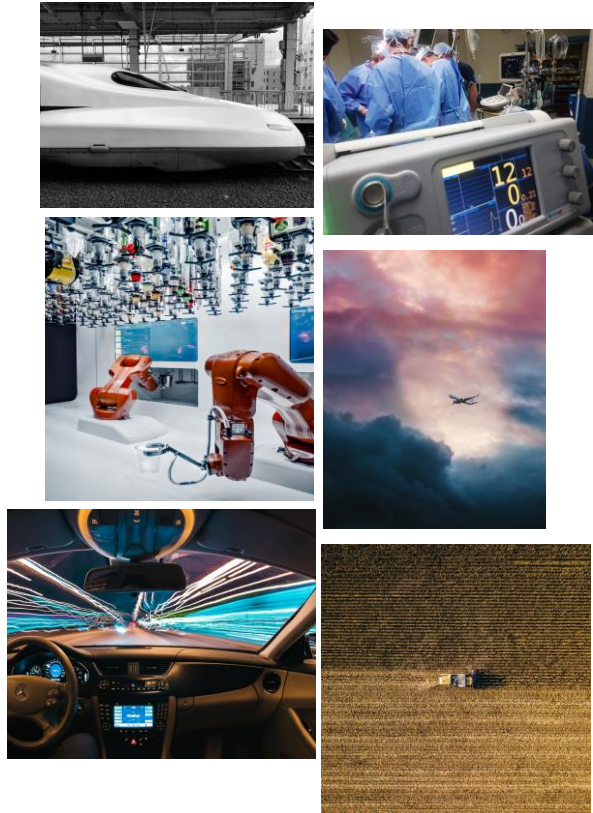


Industrial robotics (4 UC)

Project Highlights and Achievements



Project Highlights and Achievements



Identification and detailing of evaluation scenarios, requirements, and test cases as well as detailing of the project use cases.

Mapping of the test cases, requirements and scenarios to the V&V framework.

Conducting a commonality evaluation for the use cases and the associated scenarios, test cases and requirements.

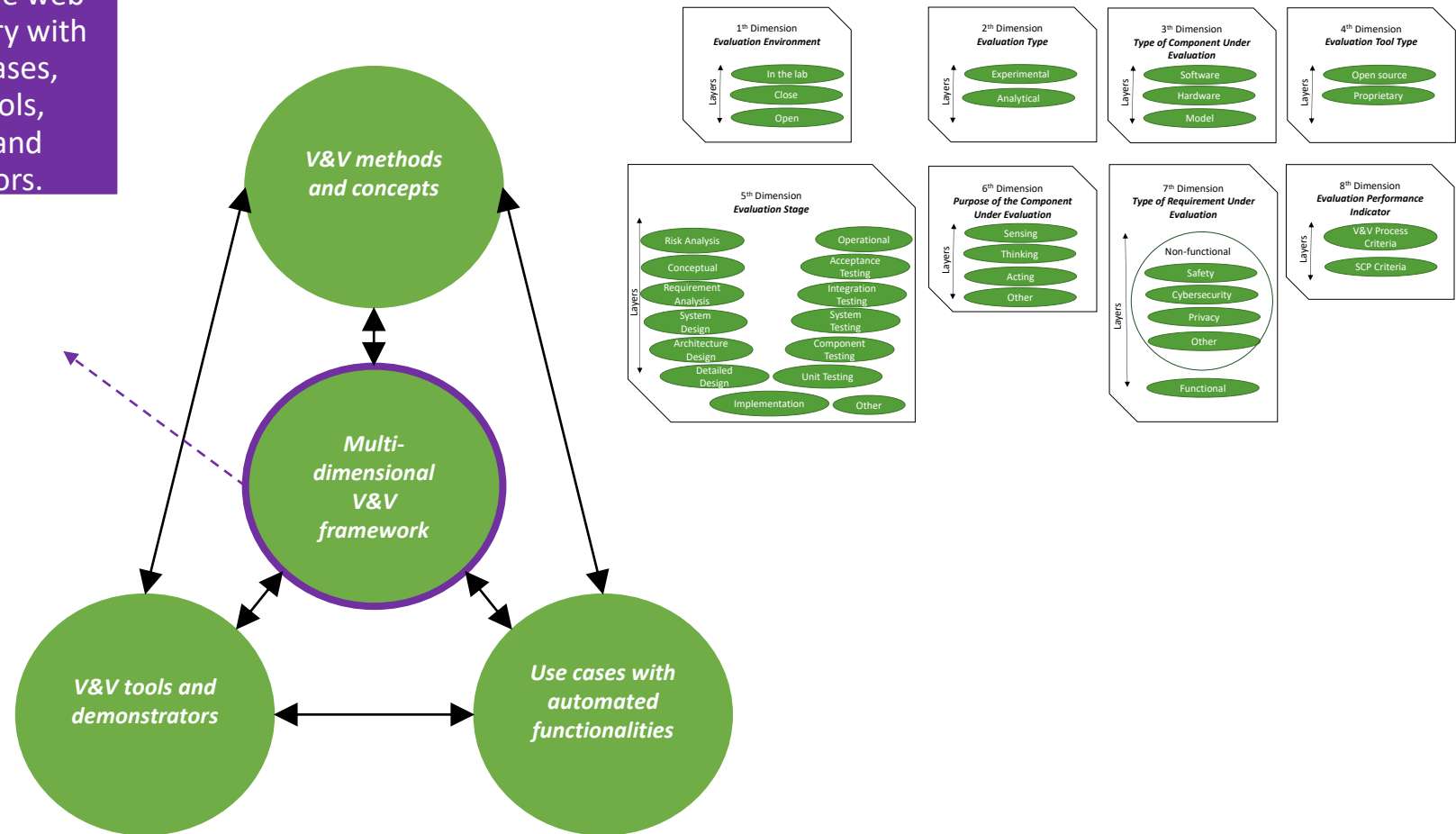


Project Highlights and Achievements

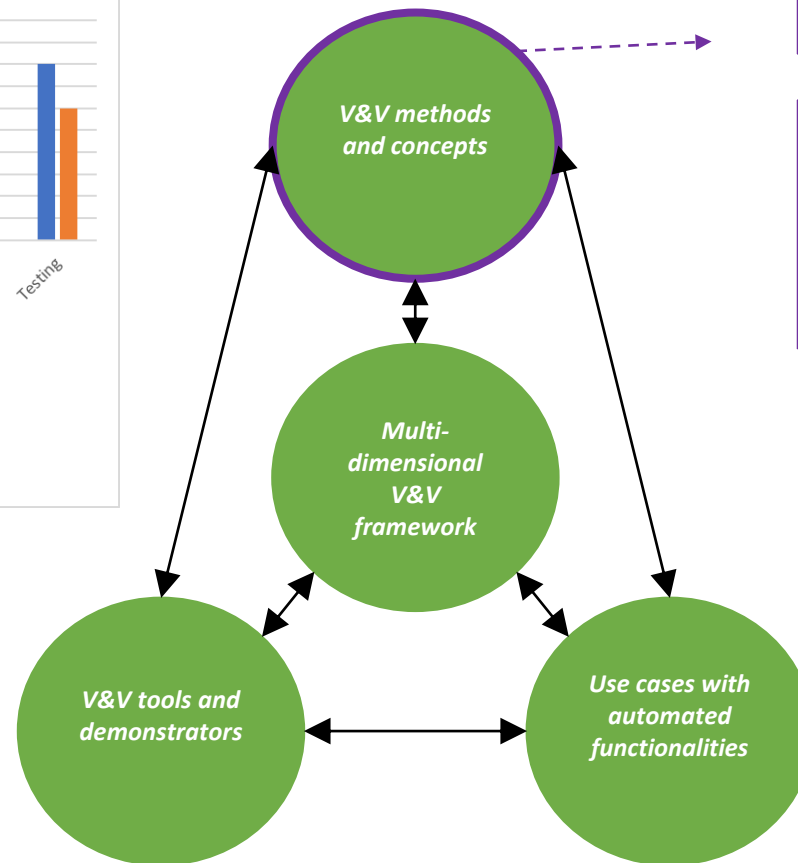
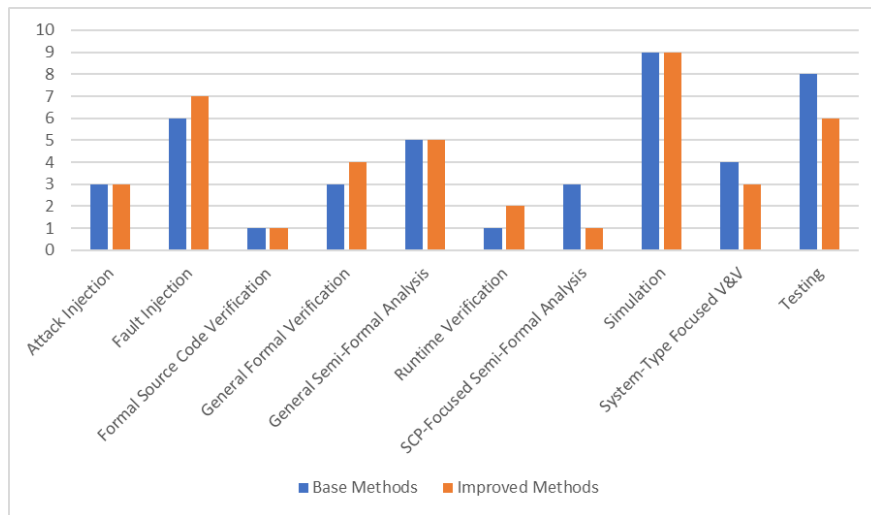
Creation of an 8-dimensional framework for classifying elements of V&V processes.

Population of the web-based repository with info on use cases, methods, tools, workflows, and demonstrators.

Public release of the web-based repository.



Project Highlights and Achievements



Identification and detailing of 43 V&V methods.

Identification and detailing of 41 improvements on the V&V methods.

Creation of 7 V&V method combinations.

Population of the web-based repository with details about the V&V methods identified.



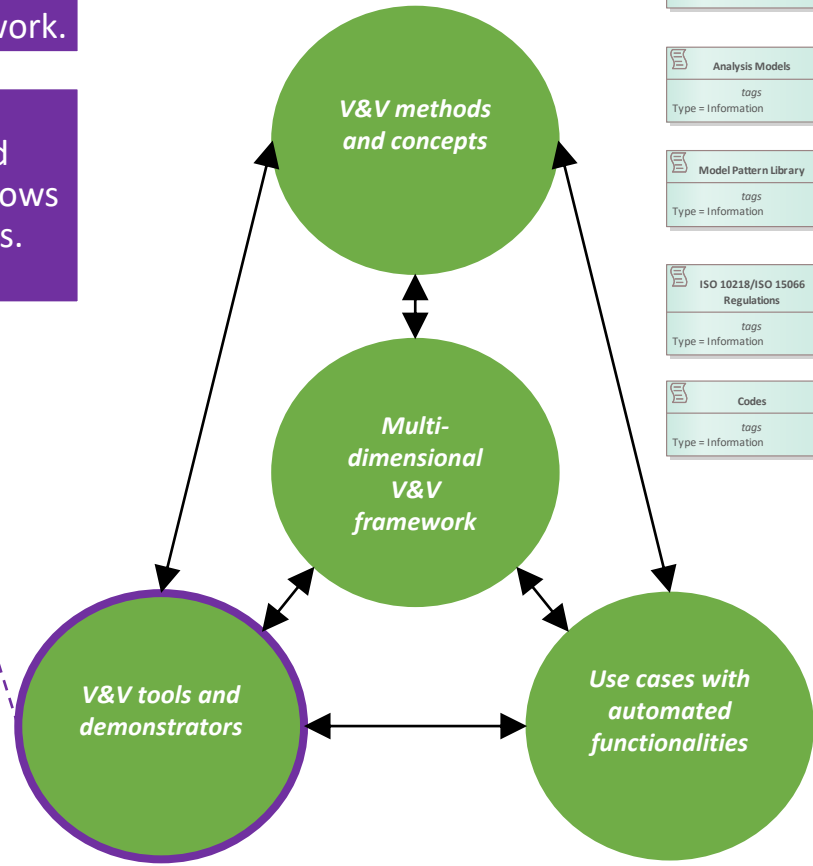
Creation of VVML
(verification and
validation modelling
language).

Adaptation of VVML
as a Plugin for the
Enterprise
Architecture
modelling framework.

Continuous
development and
enhancement of over
40 V&V tools.

Modelling and
improving workflows
for all use cases.

Documentation and
analyses of the
results on tooling for
virtual prototyping
and virtual validation.



System Requirements
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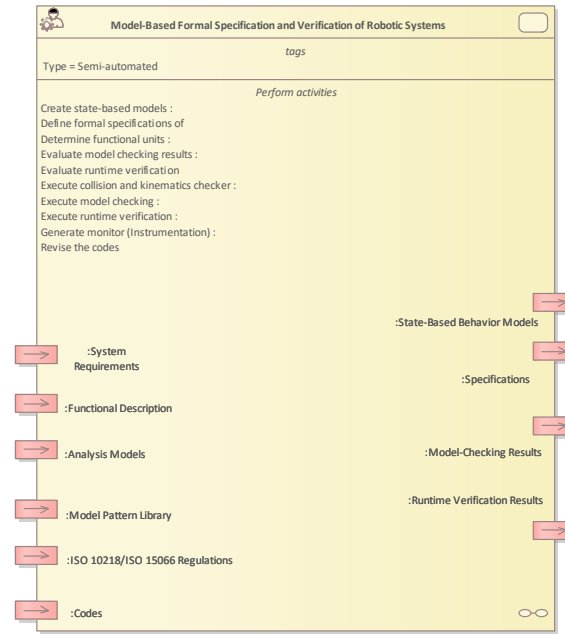
Functional Description
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Analysis Models
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Type = Information

Model Pattern Library
tags
Type = Information

ISO 10218/ISO 15066
Regulations
tags
Type = Information

Codes
tags
Type = Information



State-Based Behavior Models
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Specifications
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Model-Checking Results
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Runtime Verification Results
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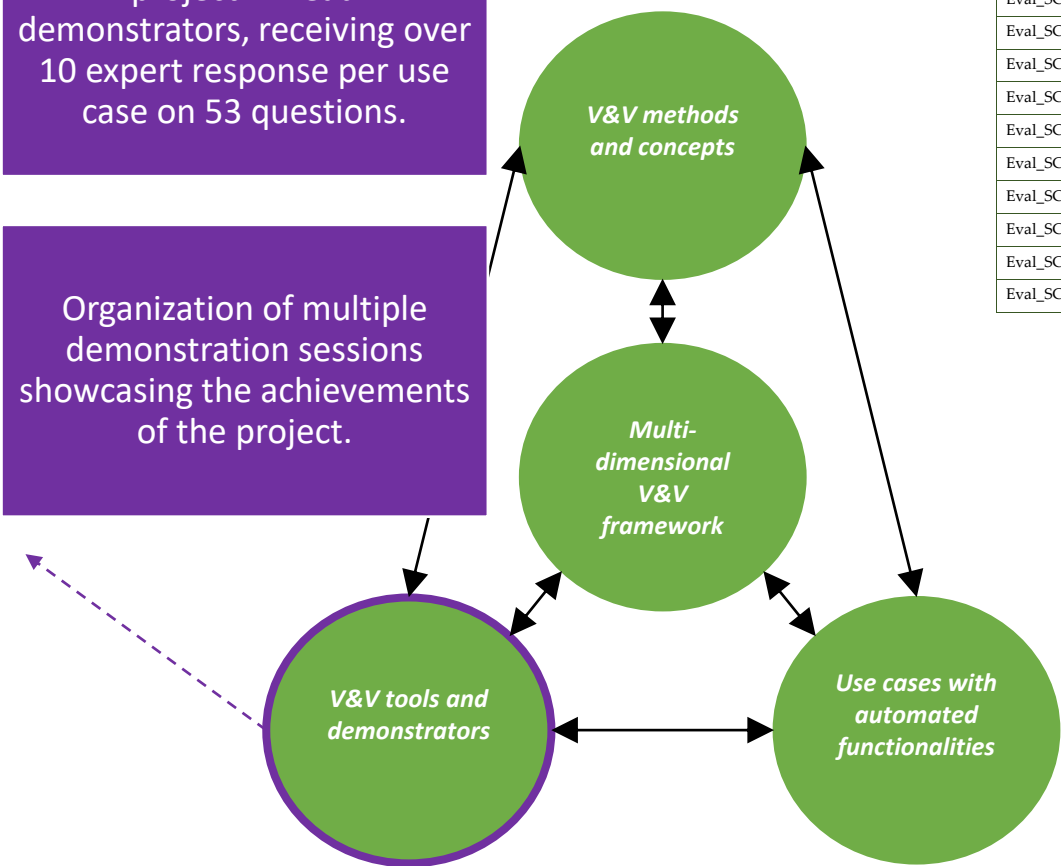


Identification and detailing of 15 SCP evaluation criteria and 13 V&V evaluation criteria suitable for measuring the level of improvement obtained in the V&V processes.

Quantitative evaluation of project demonstrators where 71 use of evaluation criteria is documented.

Qualitative evaluation of project 22 lead demonstrators, receiving over 10 expert response per use case on 53 questions.

Organization of multiple demonstration sessions showcasing the achievements of the project.



Identifier	Name
Eval_SCP_1	Error coverage
Eval_SCP_2	Number of safety/security requirement violations
Eval_SCP_3	Number of malicious attacks and faults detected
Eval_SCP_4	Metrics to evaluate AI (artificial intelligence) / ML (machine learning) algorithms
Eval_SCP_5	Potential impact of incidents and attacks
Eval_SCP_6	Metrics to evaluate cybersecurity
Eval_SCP_7	Number of prevented accidents
Eval_SCP_8	Authentication accuracy and time applied to human users and components
Eval_SCP_9	Randomness and cryptographic algorithm strength
Eval_SCP_10	Software fault tolerance robustness
Eval_SCP_11	Simulation-level system robustness
Eval_SCP_12	Number of attack/incident typologies examined
Eval_SCP_13	Accuracy of simulated sensor output
Eval_SCP_14	Simulator environment quality
Eval_SCP_15	Simulator environment functionality

Identifier	Name
Eval_VV_1	Time of test execution
Eval_VV_2	Coverage of test set
Eval_VV_3	Number of test cases
Eval_VV_4	Effort for test creation
Eval_VV_5	Joint management of SCP requirements
Eval_VV_6	Cost of finding and fixing a coding bug
Eval_VV_7	Development quality statistics
Eval_VV_8	Effort needed for test
Eval_VV_9	Service actions needed
Eval_VV_10	Reduced cost and time to work on certification process and functional safety
Eval_VV_11	Randomness and security assessment process performance
Eval_VV_12	Effort required by the user to prepare and run the tool
Eval_VV_13	Reliability measures of decisions

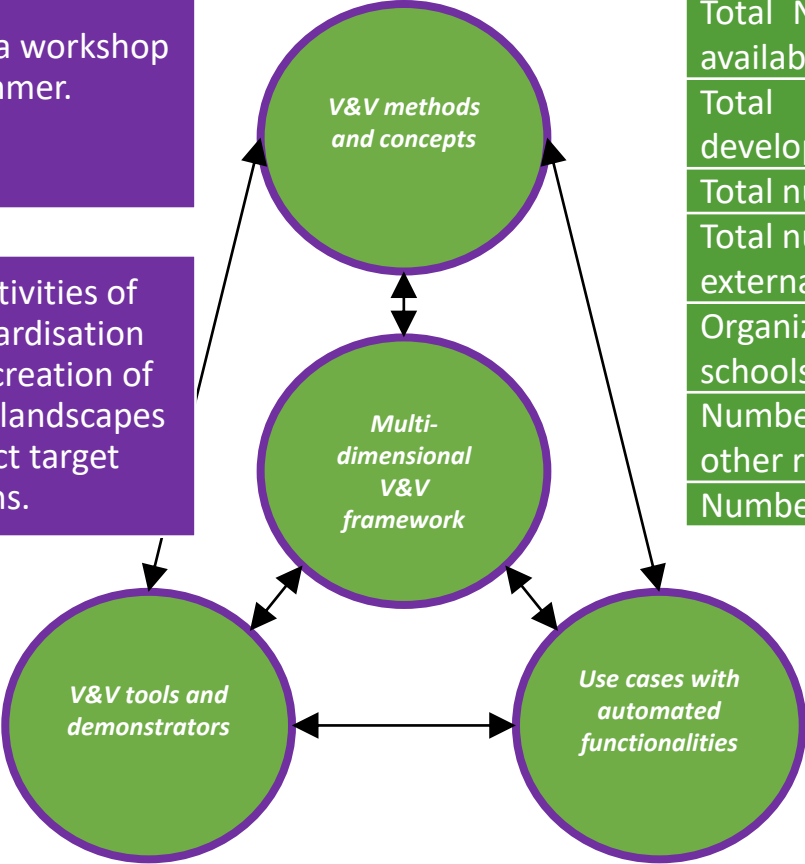


Organization of multiple internal training sessions and publications of a large set of scientific articles.

Organization of 2 press conferences where in the 2nd one we announced the public release of the repository.

Organisation of a workshop and a summer.

Monitoring activities of relevant standardisation initiatives and creation of standardisation landscapes for the project target domains.



Some dissemination and communication activities	Achievement
Total number of publications	94+
Total number of workshops organized or sponsored by VALU3S	8
Total Number of VALU3S results made available as open-source projects	16
Total number of training materials developed by the project	87
Total number of internal training sessions	18
Total number of training sessions open to external audience	13
Organization of summer or winter schools	1
Number of established liaisons with other related projects	15
Number of newsletters sent out	11

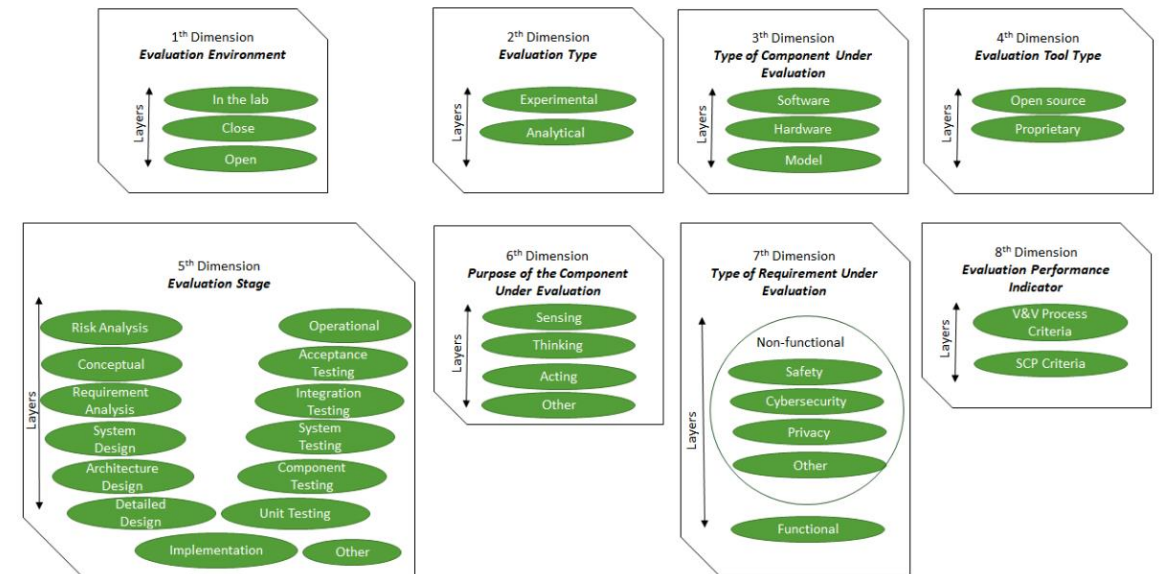


Mid to Long Term Expected Impacts of the Project



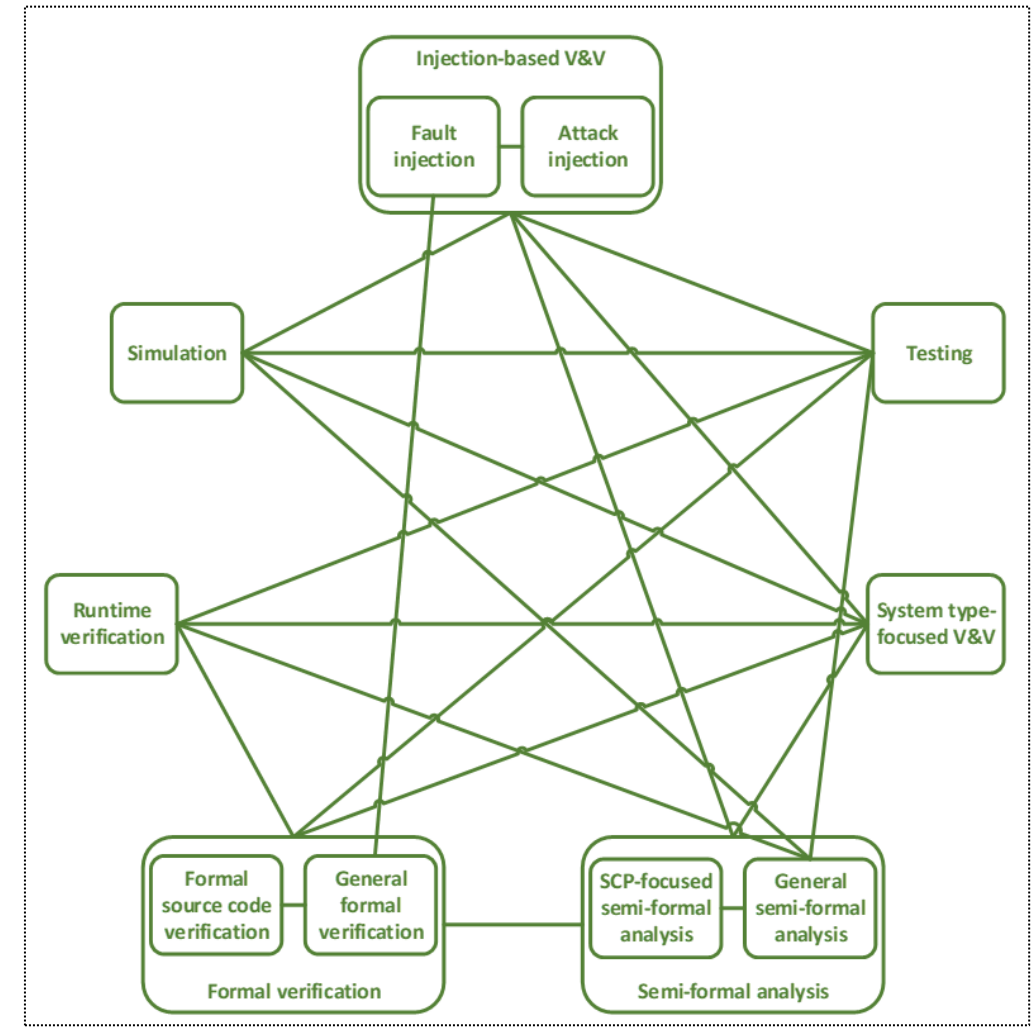
Open Science: Web-based Repository

- The web-based repository is reachable at <https://repo.valu3s.eu/>.
 - The repository has had over 14000 visits in the first 9 month of its public availability.
- The repository hosts pointers to the project's key results e.g.
 - Enhanced V&V methods and tools
 - Quantitative and qualitative evaluation results.
 - V&V workflow models generated using verification and validation modelling language (VVML).



Technological Impact: V&V Tools and the V&V Modelling Language

- Over 40 V&V tools were implemented, improved and evaluated. The tools:
 - Implemented state-of-the-art V&V methods.
 - Played a pivotal role in minimising the time and costs associated with V&V of automated systems concerning safety and cybersecurity requirements.
- A verification and validation modelling language (VVML) was created.
 - The language and V&V workflows generated by it could provide significant support to the V&V community.



Economic Impact: Exploitation Activities

- While the exploitation of the project results have already started, additional effort is needed to
 - Further improve V&V tools e.g., through state-of-the-art machine learning models.
 - Target eco-friendly practices in V&V activities.
 - Transform the VALU3S repository into a go-to platform for V&V stakeholders.
 - Contribute to the training of future engineers and practitioners in the domain.

<i>Some exploitation activities</i>	<i>Achievement</i>
Patents requested	2
Beta testing agreements	19
(Potential) agreements with early customers or stakeholders	39
Teaching and academic education activities	85
Web repository visits (August 2023)	14 200





<https://www.linkedin.com/company/valu3s-project/>



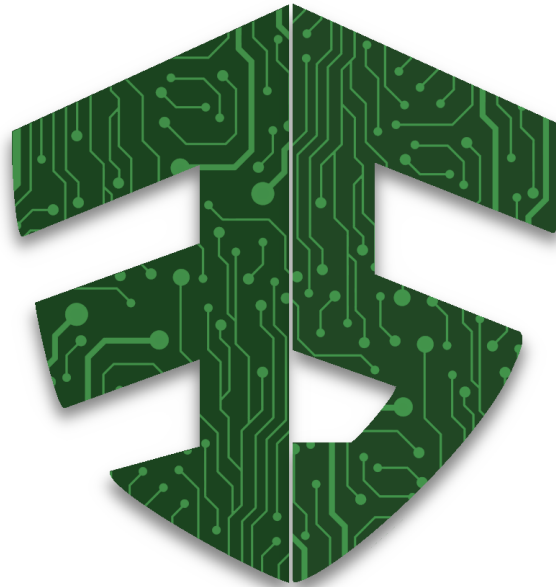
https://twitter.com/valu3s_project



<https://www.youtube.com/@valu3sproject513>



<https://valu3s.eu/>



VALU3S

Verification and Validation of Automated Systems' Safety and Security

www.valu3s.eu



ECSEL Joint Undertaking
Electronic Components and Systems for European Leadership



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Course on *resilient safety-critical computer systems*

- Part of the project results are included in a course I offer at RISE.
 - Dependable Cyber-Physical Systems (CPS)
 - Verification and Validation methods for evaluation of computer systems safety and security
 - Interplay Between Dependability and Security Attributes
- *Interested?* Next course is planned for **14-15 March 2024**.
- *More info:* <https://www.ri.se/en/education/fault-tolerant-computer-systems>

