

Welcome to **SUNRISE Webinar**



Relevant subsystems to validate Connected and Automated Mobility Systems

22 January 2024
13:00-14:00 CET



Funded by
the European Union

Agenda

- SUNRISE project introduction
- SUNRISE verification and validation (V&V) simulation framework for CCAM systems
- Relevant subsystems and requirements of a harmonised CCAM V&V simulation framework
- Q&A



Bernhard Hillbrand
Virtual Vehicle



Anders Thorsén
RISE Research
Institutes of Sweden AB

SUNRISE project introduction

22 January 2024

Bernhard Hillbrand – Virtual Vehicle



Goal: Develop a harmonized **CCAM*** Safety Assurance Framework

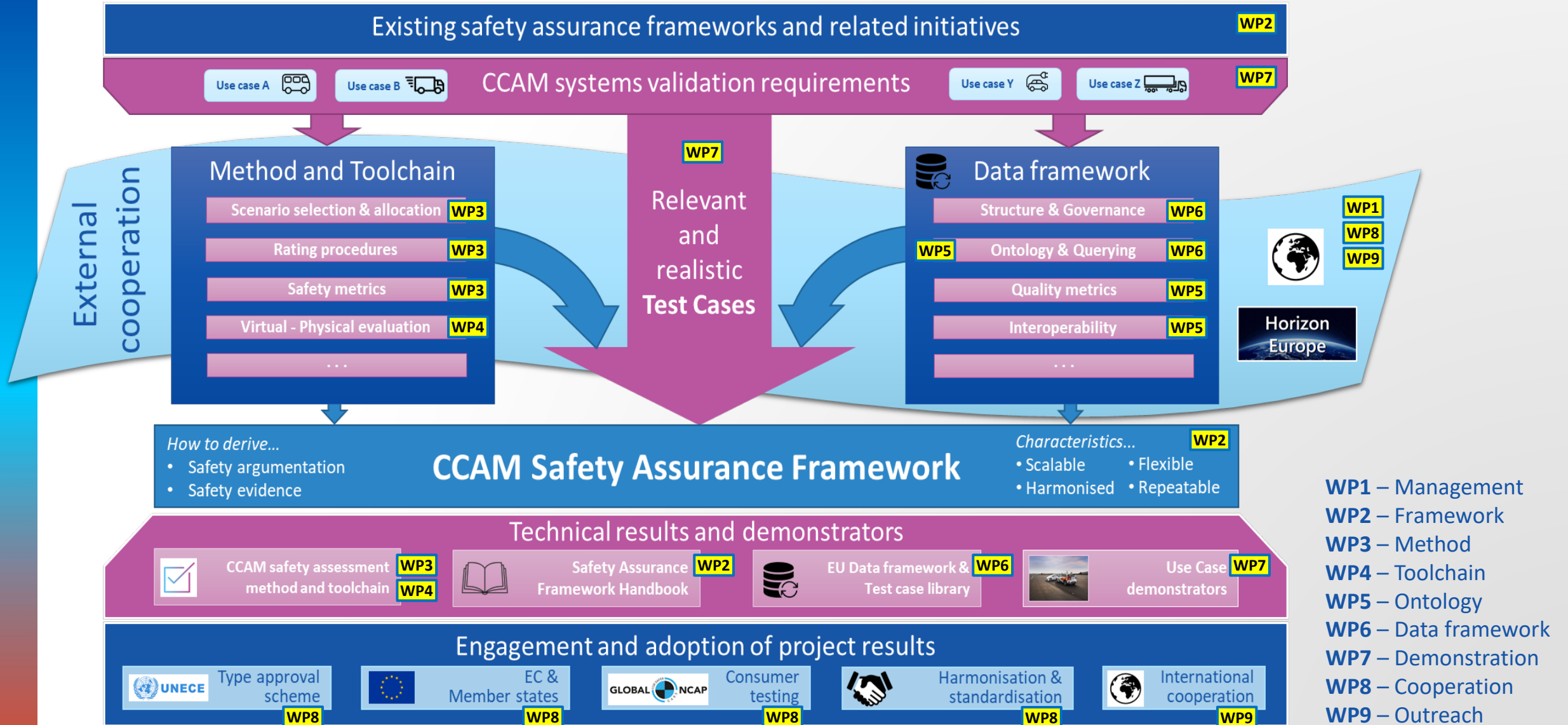
Run time Sep 2022 – Aug 2025
Budget 13.455.866,25 €



Safety Assurance Framework for Connected and Automated Mobility Systems

Funded by the European Union
Project No. 101069573

* CCAM = Cooperative, Connected and Automated Mobility



- WP1 – Management
- WP2 – Framework
- WP3 – Method
- WP4 – Toolchain
- WP5 – Ontology
- WP6 – Data framework
- WP7 – Demonstration
- WP8 – Cooperation
- WP9 – Outreach

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INSTITUT
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DU VÉHICULE DÉCARBONÉ ET
COMMUNICANT ET DE SA MOBILITÉ

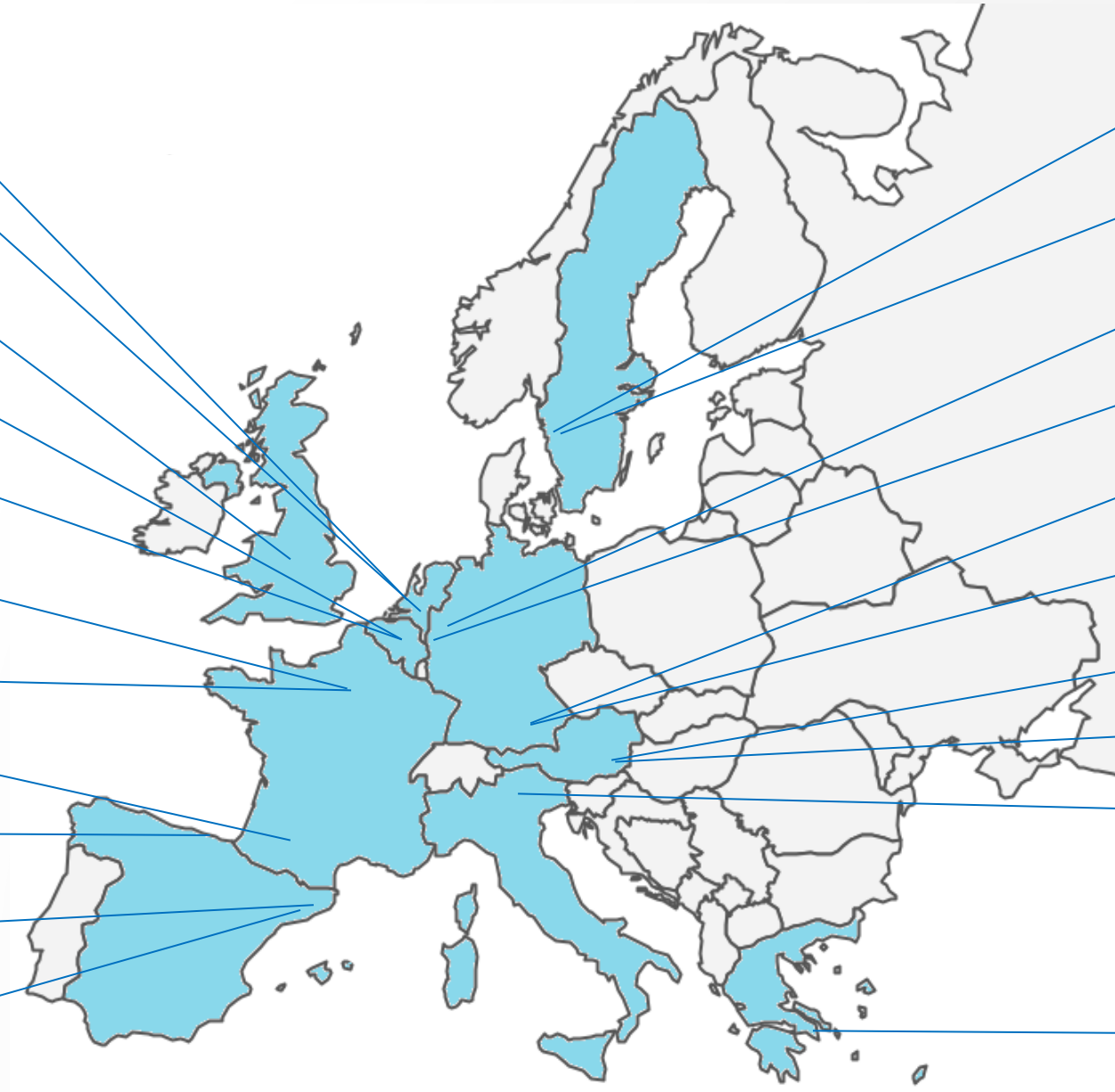
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*SUNRISE team members
General Assembly Athens Sep 2023*

CCAM V&V framework

Work Package 4

22 January 2024

Bernhard Hillbrand

Virtual Vehicle

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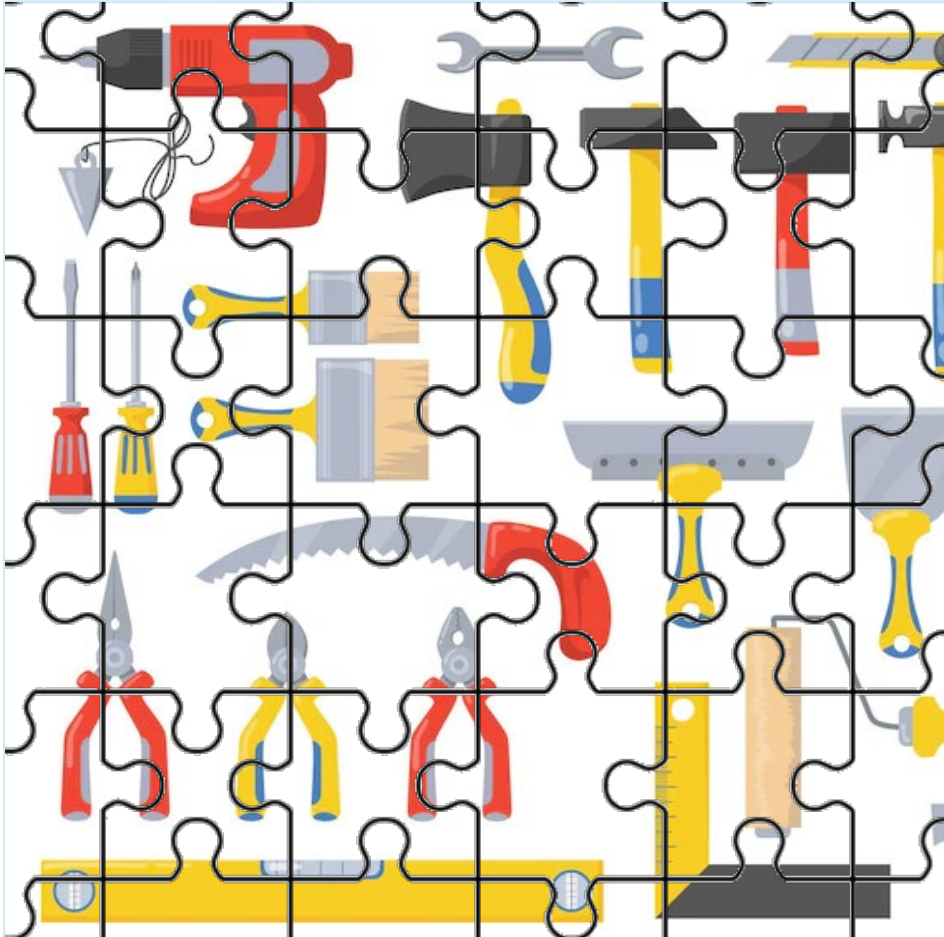


Work Package descriptions

WP4 – Toolchain

Effort
408 PM's (25%)

Full title: CCAM V&V framework



Objectives

1. **Define and validate a toolchain** containing:
 - A. V&V virtual **simulation architecture**
 - B. **Hybrid and real-world** testing, assessment and validation **approaches**
2. **Identify relevant subsystems**
3. **Specify subsystem requirements**

WP4 – Toolchain

Objectives

1. **Define** and **validate** a **toolchain** containing:
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3. **Specify** subsystem **requirements**

Achievements

1. WP4 identified all relevant subsystems as well as optional subsystems of the Toolchain. These are described in the SUNRISE deliverable D4.1 [**Objective 2**]
2. WP4 identified relevant Use Case requirements (coming from task T7.1), to map them onto specific subsystems (defined in task T4.1) [**Objective 3**]

Overview of results

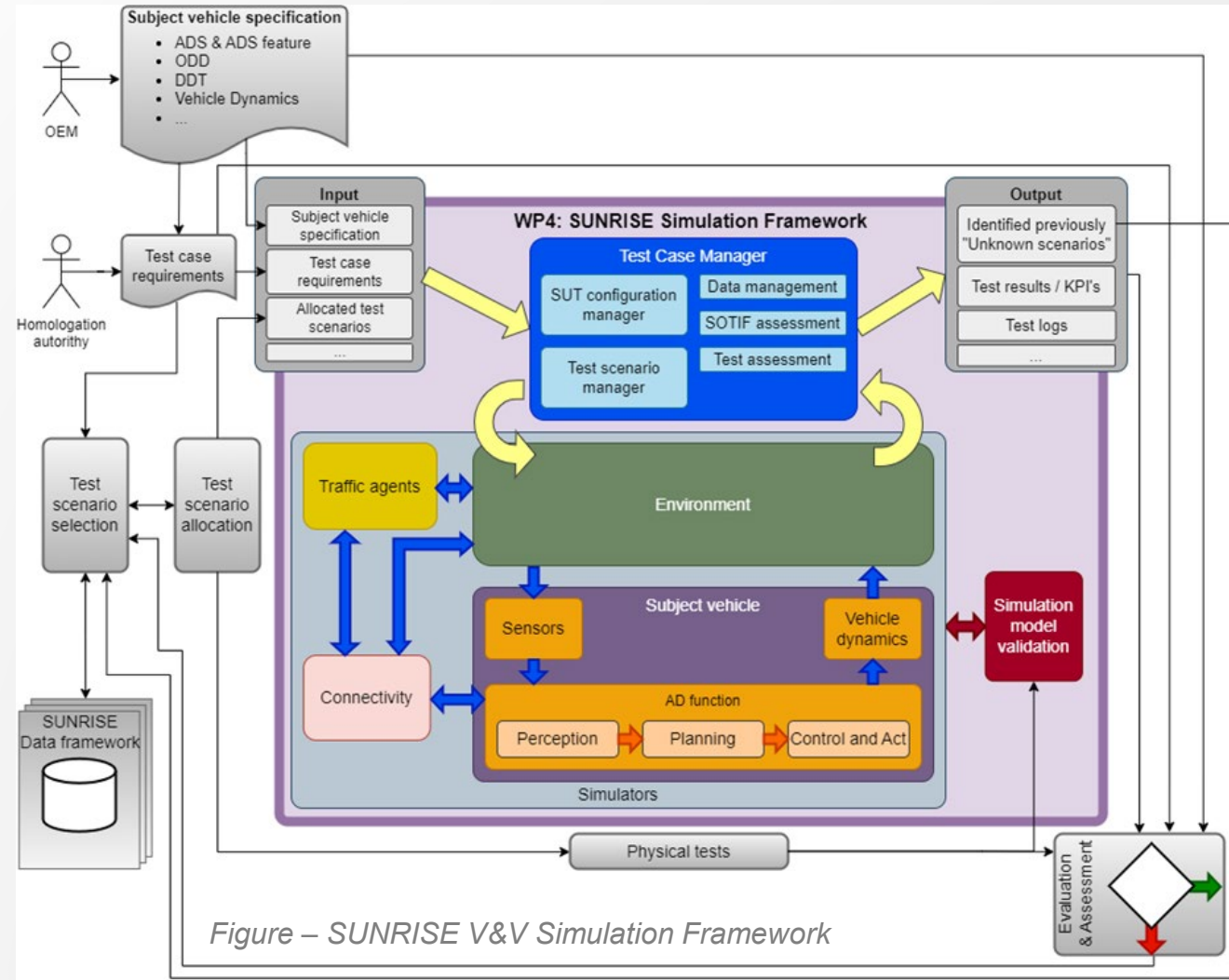
WP4 – Toolchain

T4.1 Identifying relevant subsystems

- Relevant subsystems have been identified to be included in a V&V simulation framework for virtual validation of CCAM systems

T4.2 Mapping of use case requirements to subsystems

- Mapped the use case requirements resulting from WP7, on subsystems identified in task T4.1.



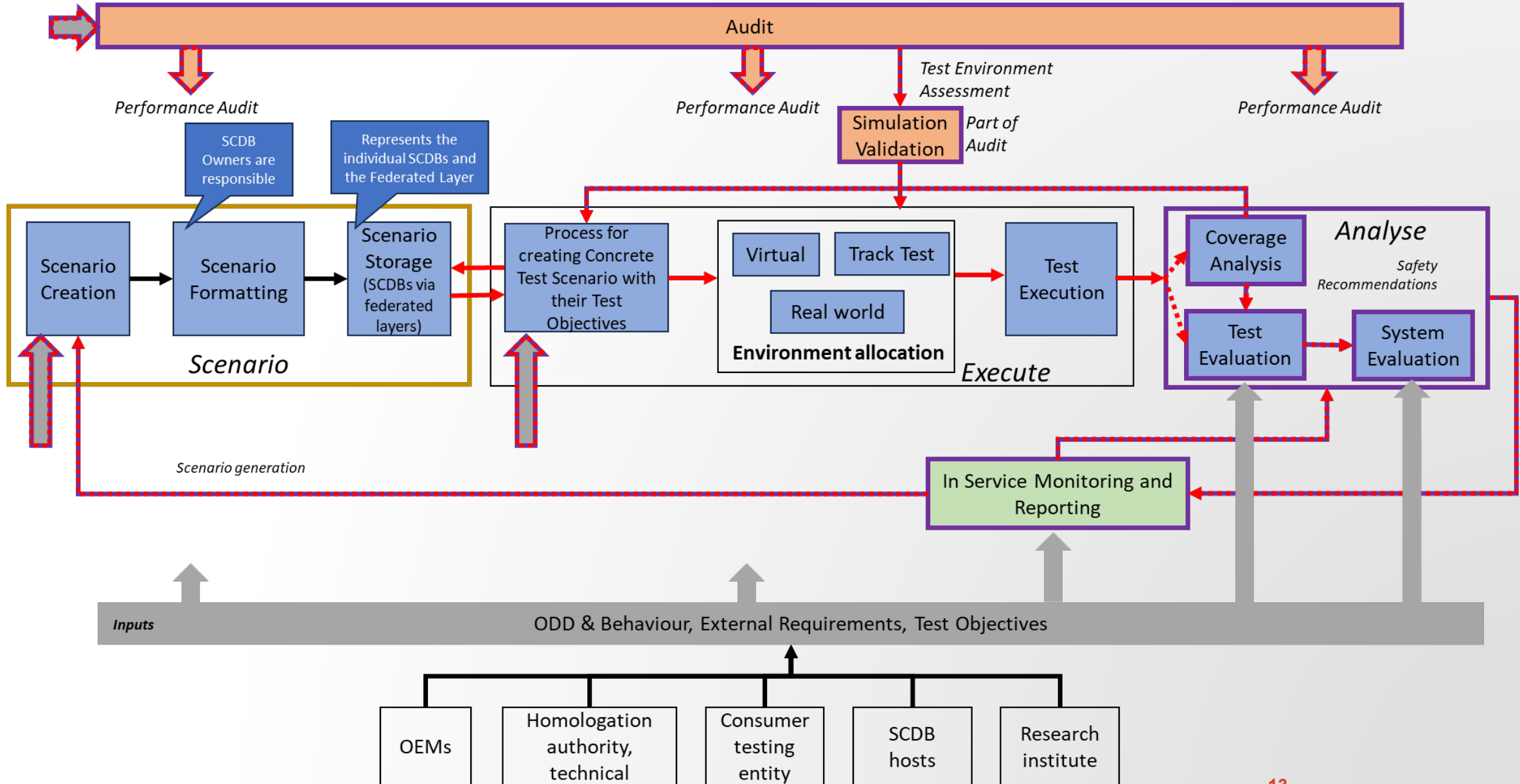
Relevant subsystems to validate CCAM systems

22 January 2024

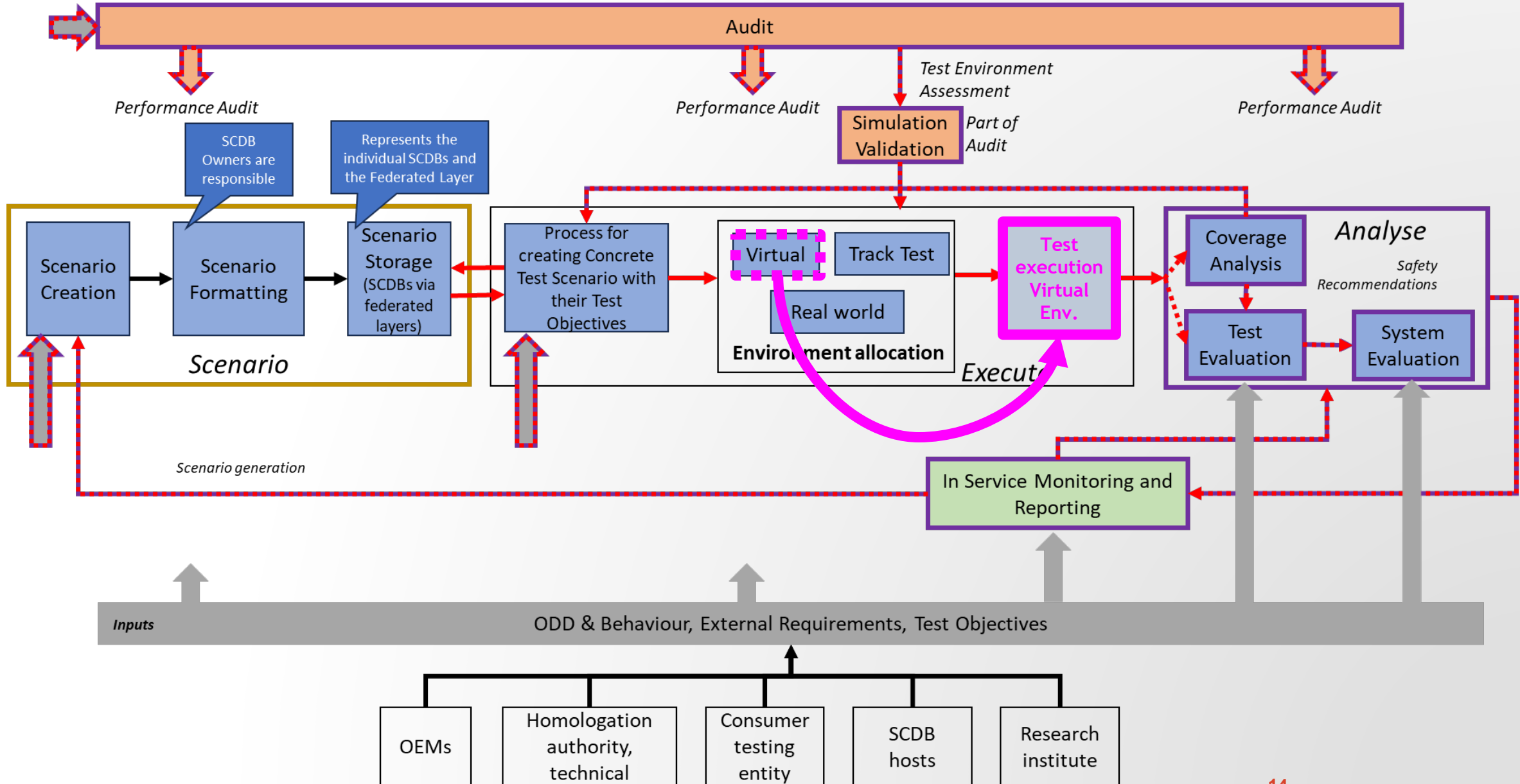
Anders Thorsén – RISE Research Institutes of Sweden



The SUNRISE Safety Assurance Framework (SAF) draft



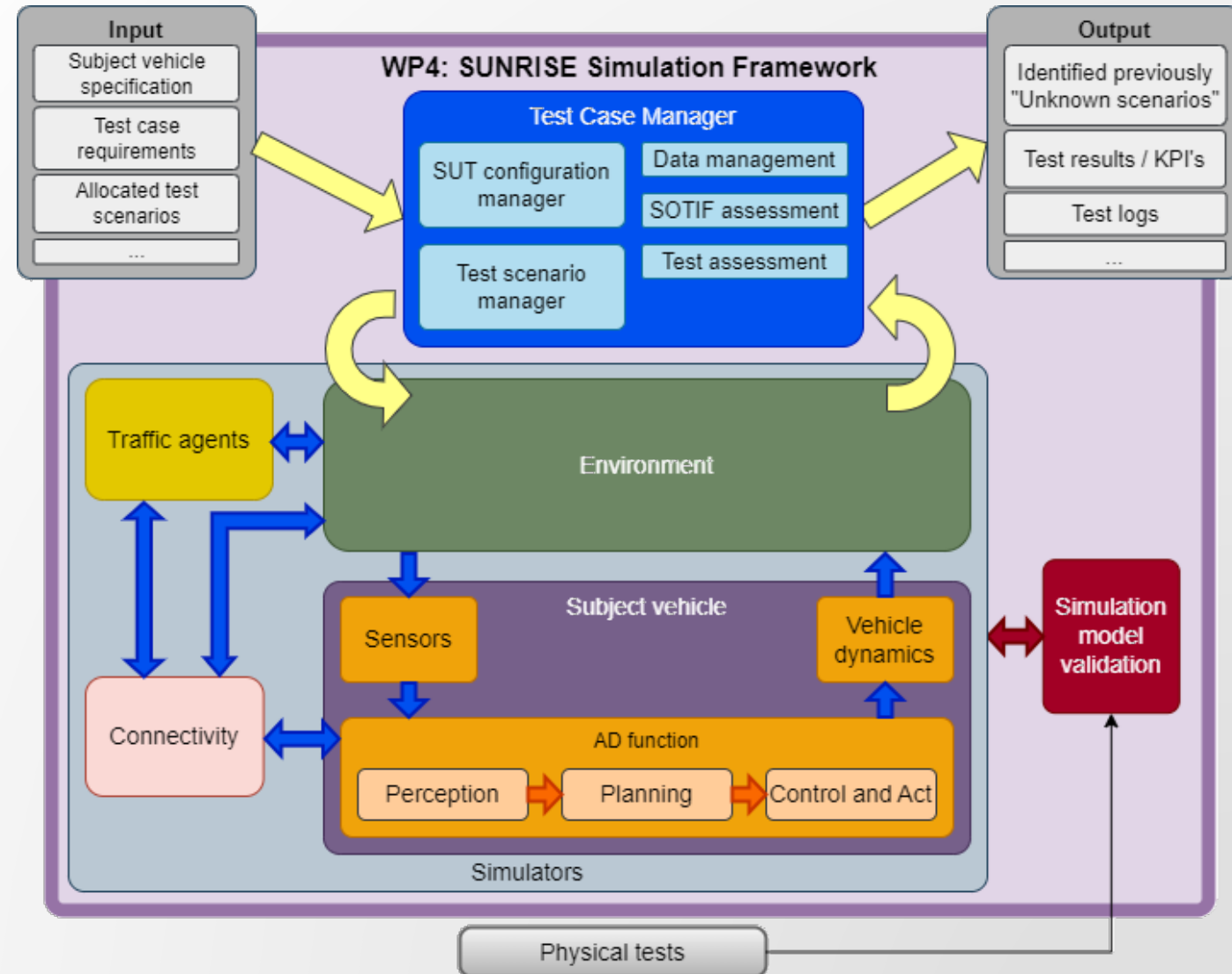
The SUNRISE Safety Assurance Framework (SAF) draft



Subsystem overview

“A subsystem is a part of a system, which is itself, a system”

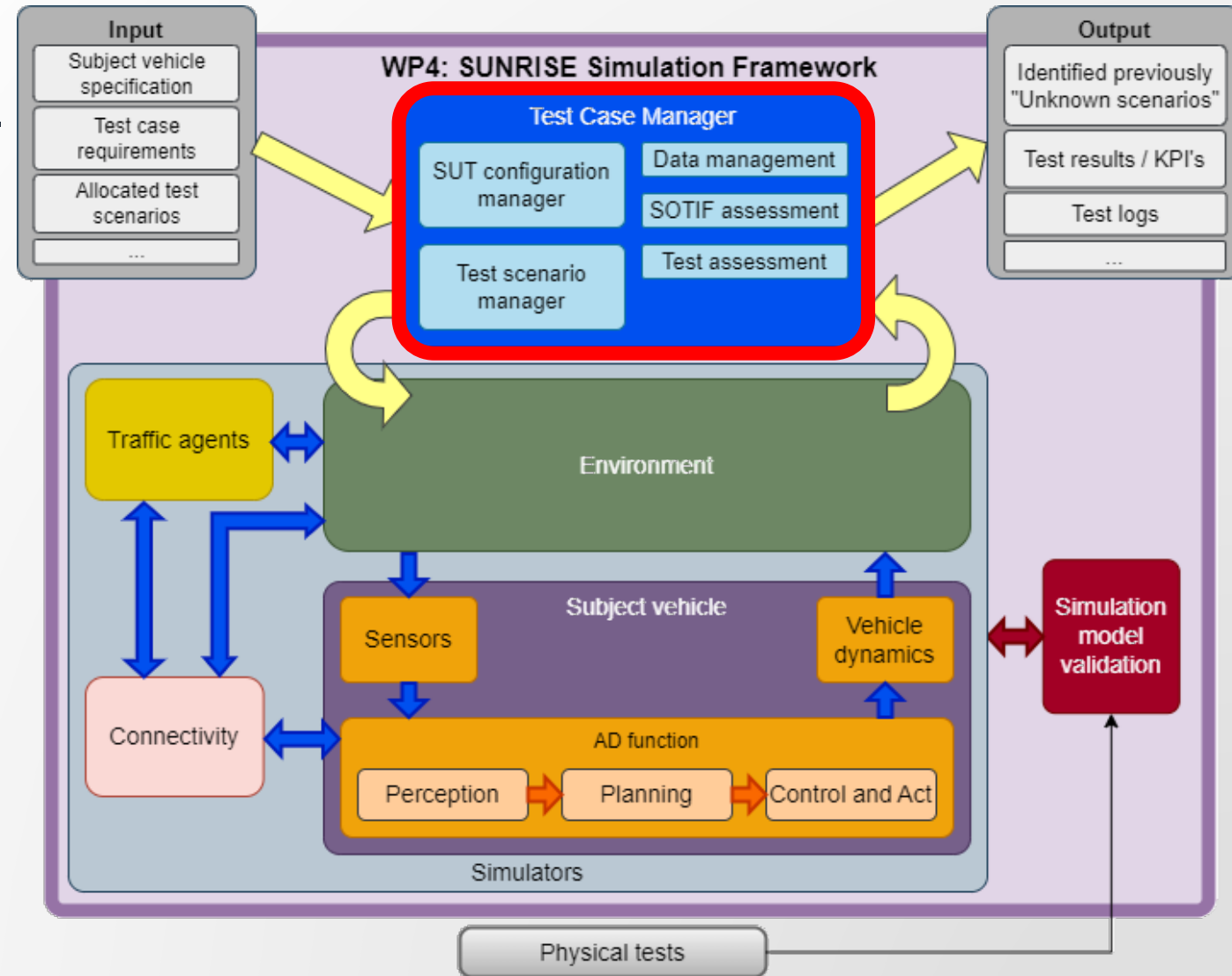
- Non-exclusive list
- Grey boxes not part of simulation framework
- Versatile and adoptable for future technology development



Test Case Manager

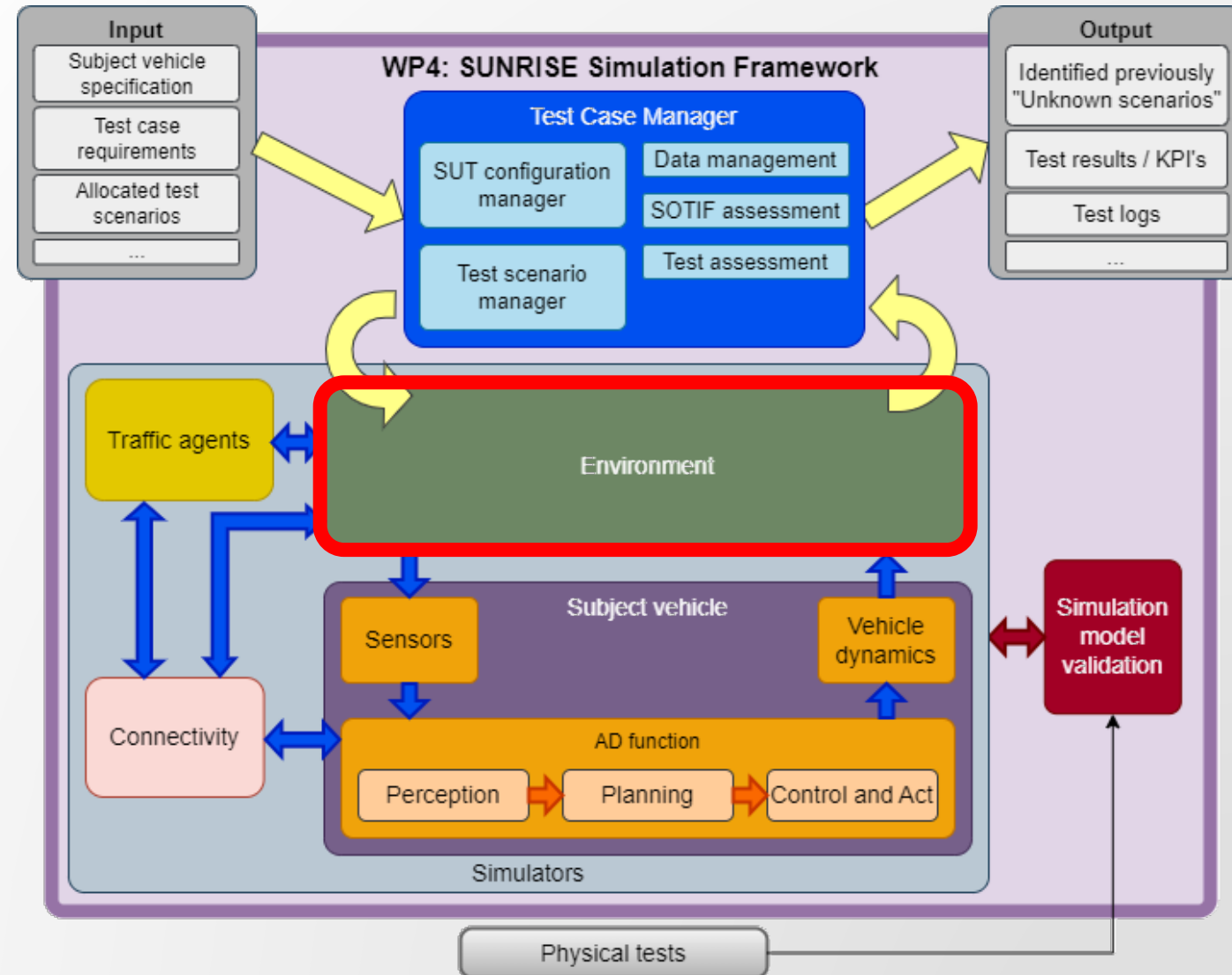
- Main function
 1. Interface with the rest of the SAF.
 2. Orchestrate execution of test scenarios.
 3. SOTIF assessment: Identify unknown scenarios.
 4. Compute KPIs and metrics.
 5. Checks correctly executed test cases.

- Composition
 1. Test scenario manager
 2. Data management
 3. Test assessment
 4. SOTIF assessment
 5. SUT configuration manager



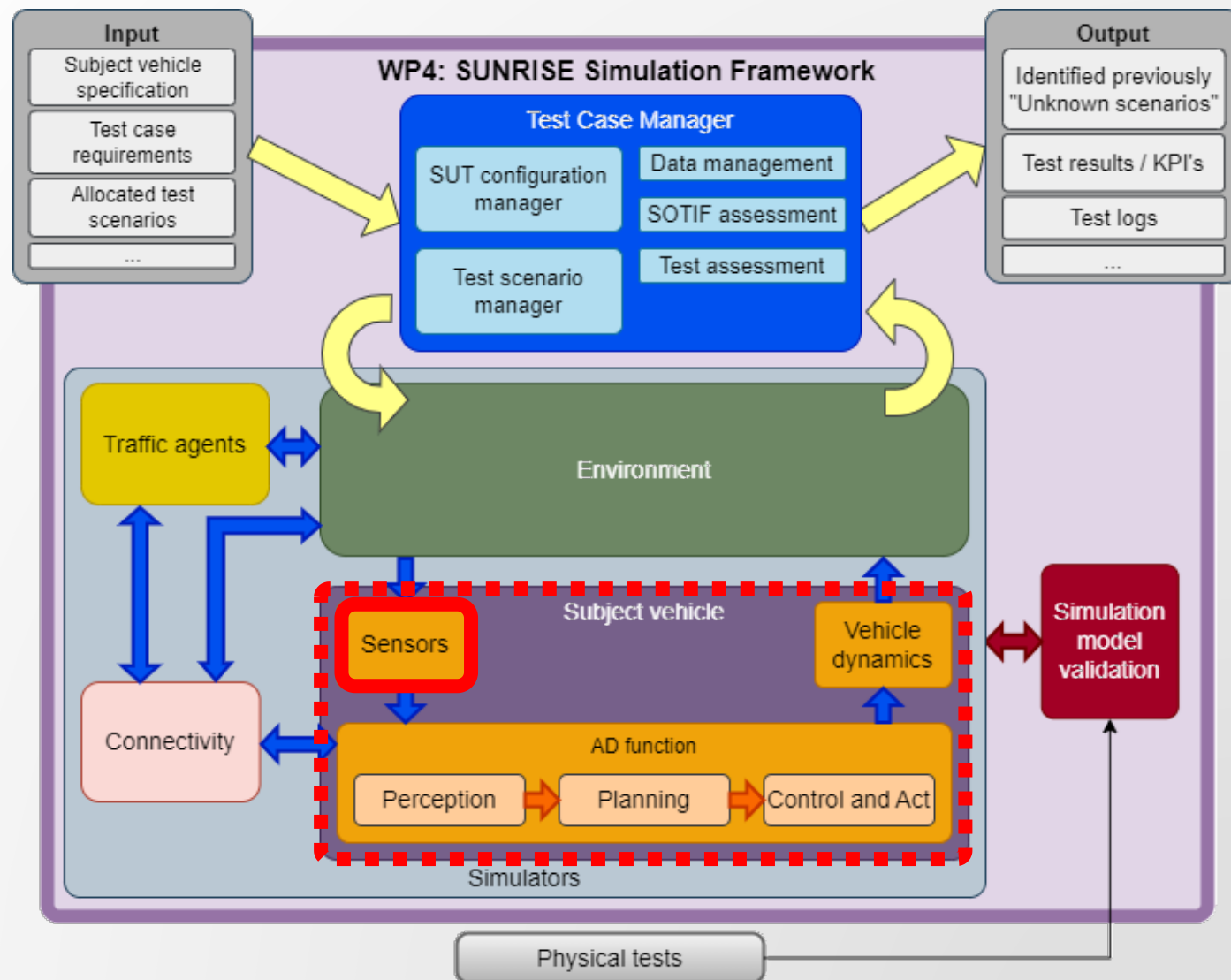
Environment

- Main function
 - Describes the environment.
 - Model the OD and ODD.
- Composition
 - Static environment
 - Dynamic elements
 - All movable elements of the ODD.
 - Behaviour is controlled by other subsystems



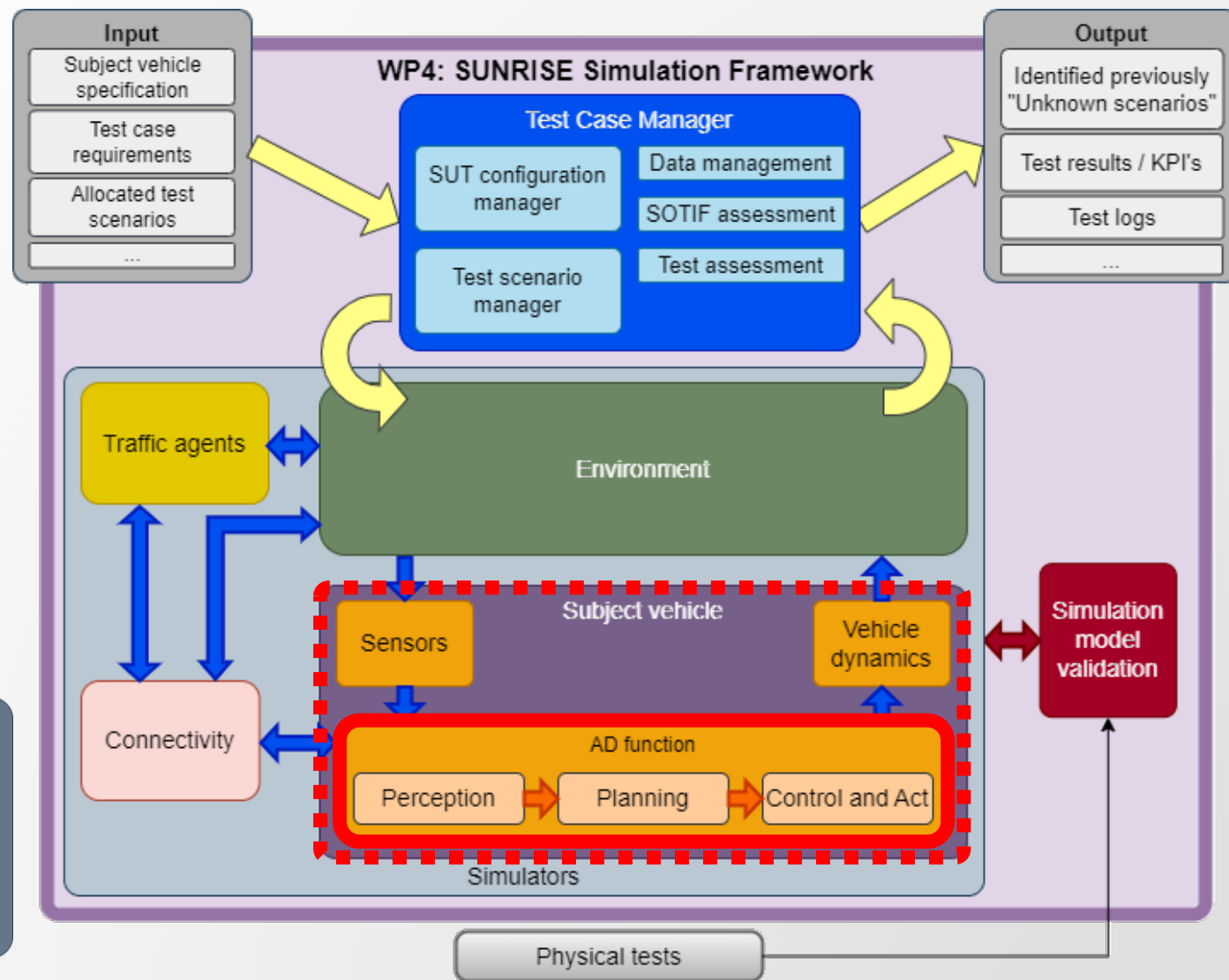
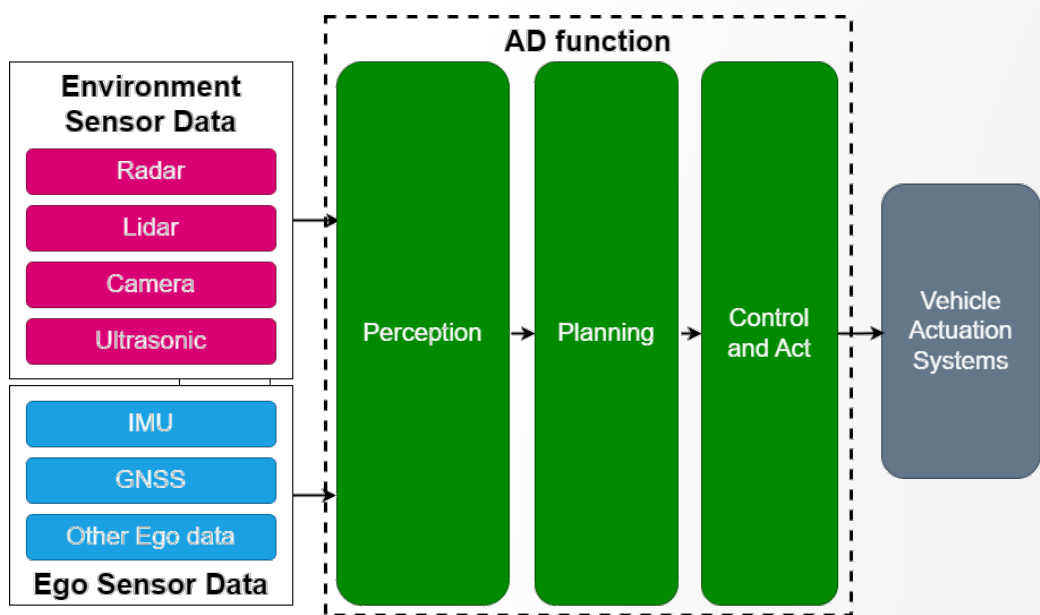
Subject vehicle: Sensors

- Main function
 - Models needed sensors.
- Composition
 - Different sensor modalities (radar, lidar, camera,...)
 - Different model fidelities



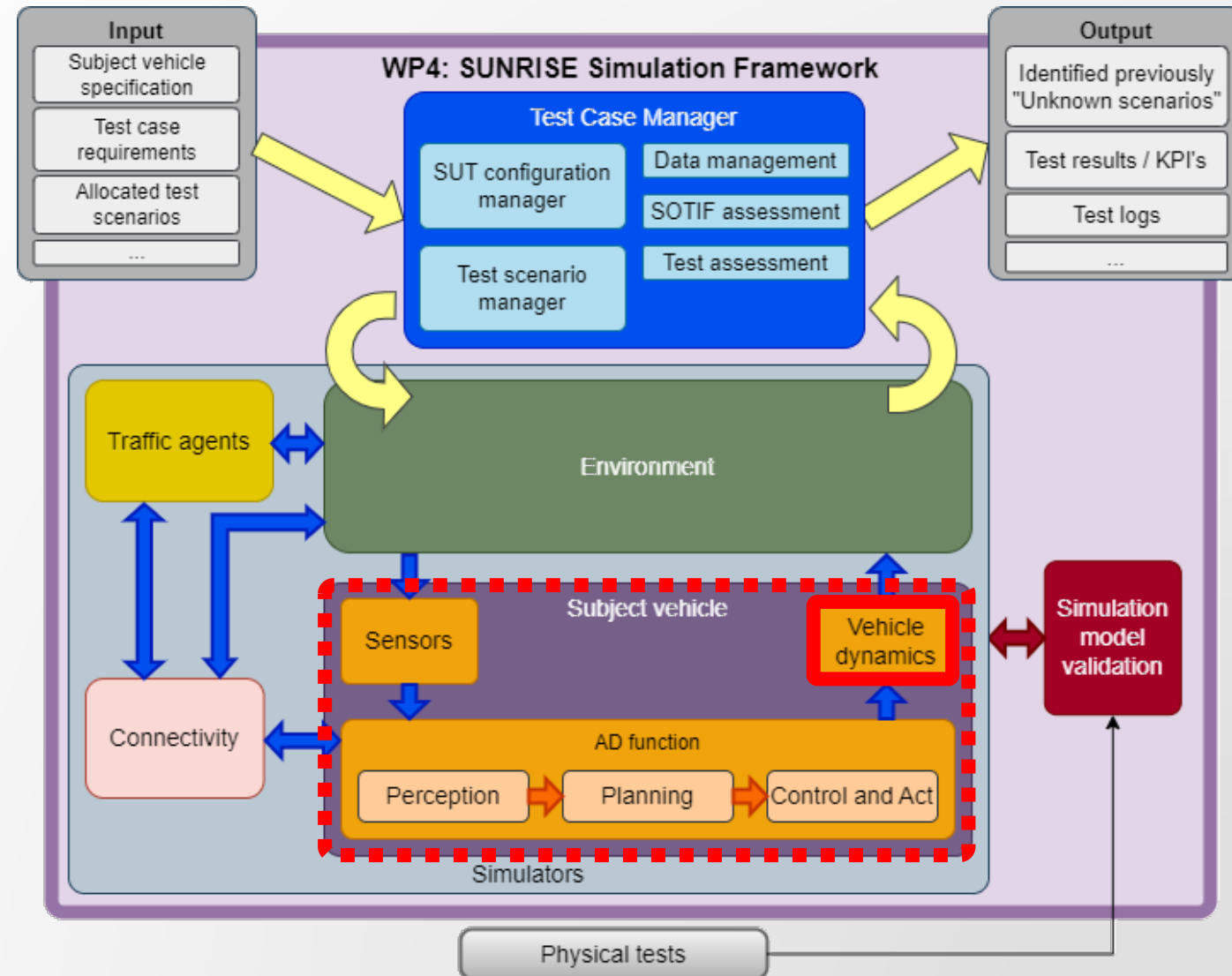
Subject vehicle: AD function

- Main function
 - Control the vehicle's response
- Composition
 - Commonly divided into:
 - Perception
 - Planning
 - Control and Act



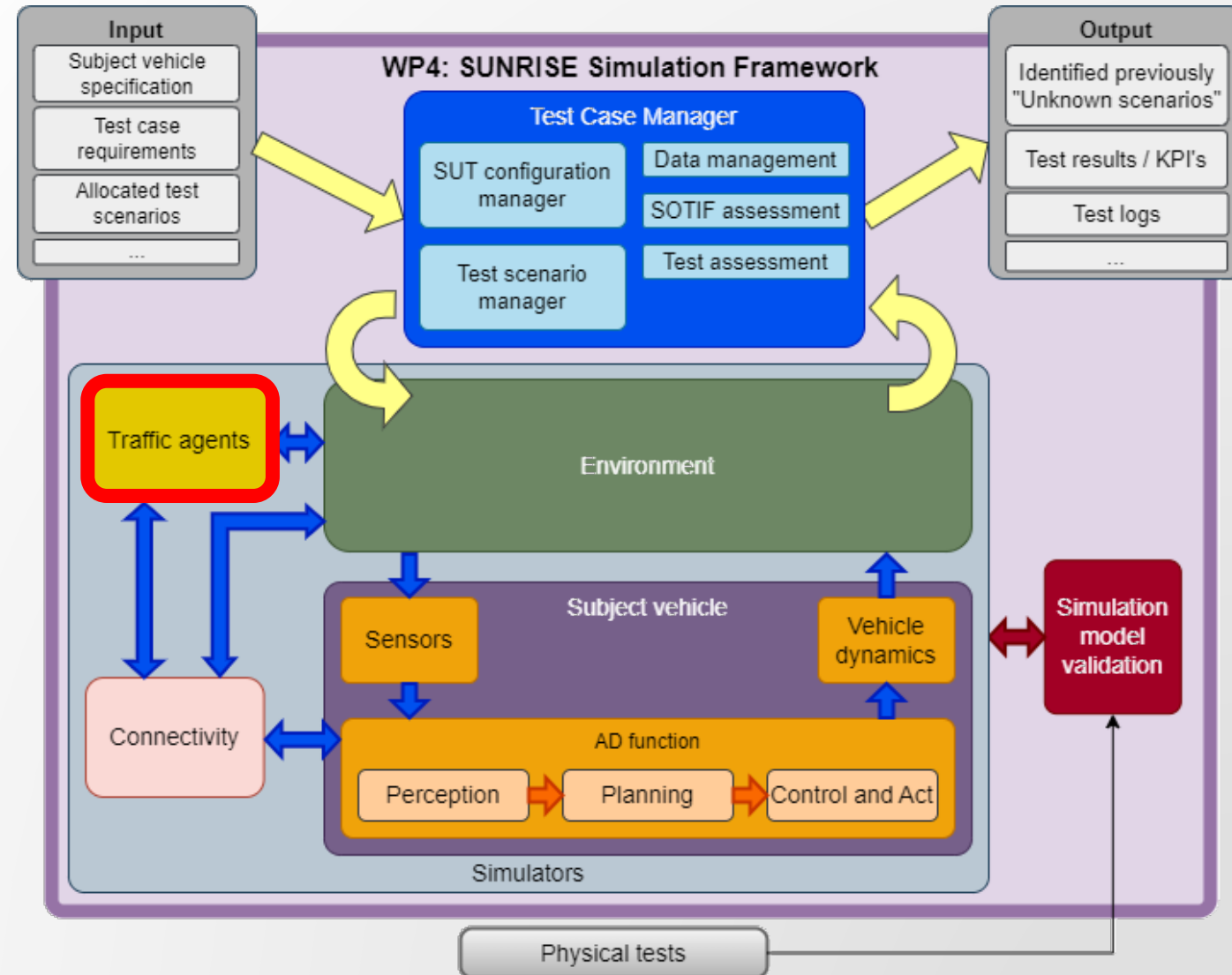
Subject vehicle: Vehicle dynamics

- Main function
 - Describes the motion of a vehicle
- Composition
 - Includes aspects like
 - tire and brake dynamics
 - engine and powertrain management
 - aerodynamics
 - suspension
 - steering, and
 - vehicle modelling.
 - Models with different fidelity.
 - Trade-off between realism and simplicity



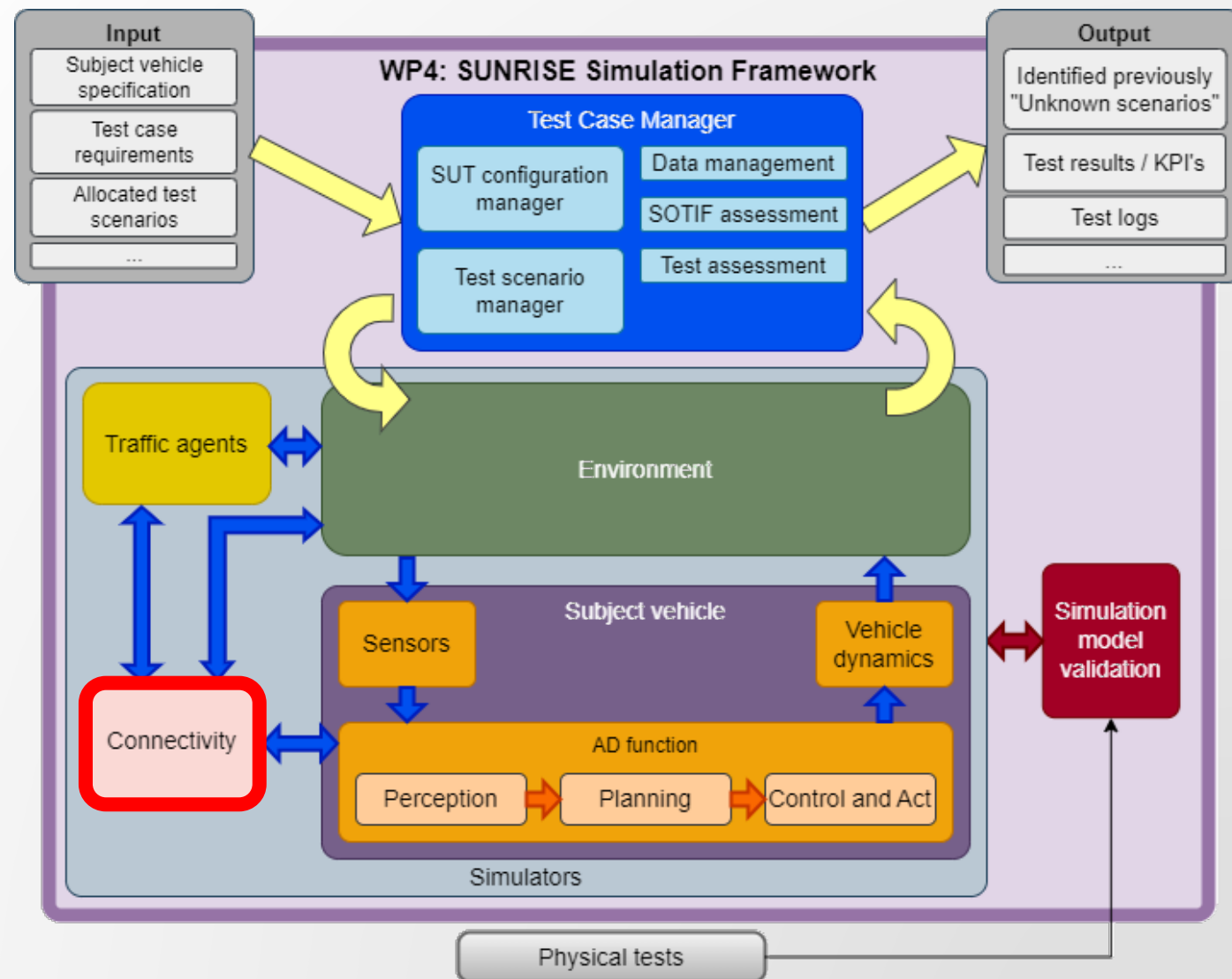
Traffic agents

- Main function
 - The behaviour of all dynamic elements except the subject vehicle.
- Composition
 - Described with behavioural models.
 - Relevant states communicated to the simulation environment.



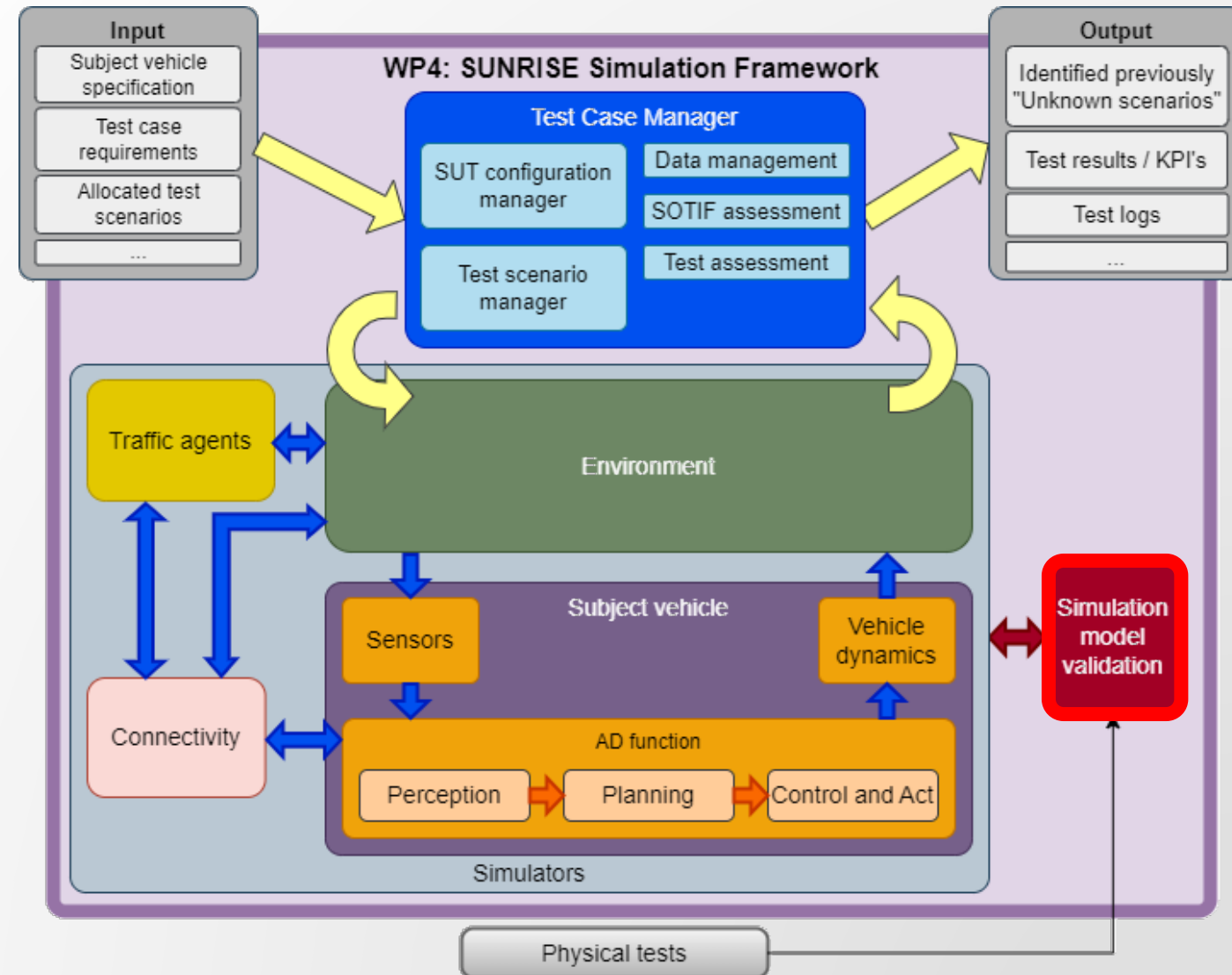
Connectivity

- Main function
 - Enables communication between subject vehicle and
 - other vehicles
 - pedestrians
 - cyclists
 - infrastructure elements, and
 - network services.
- Composition
 - Scenario Module
 - On-Board Units (OBUs)
 - Roadside Units (RSUs)
 - Communication Network



Simulation model validation

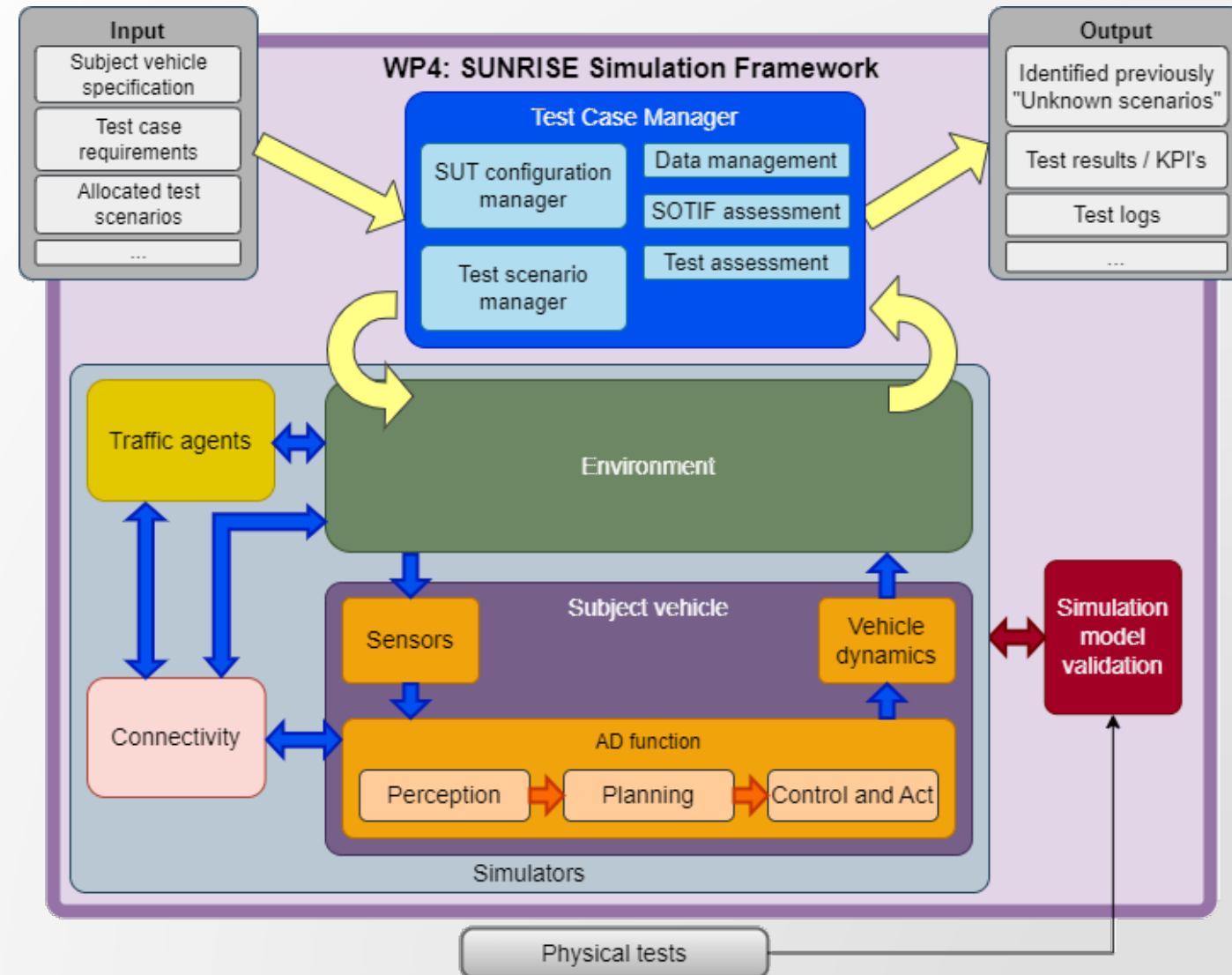
- Main function
 - Approve the quality of the simulation models
- Composition
 - Feed-back of results from correlation analysis.
 - Checks if additional physical tests or simulations are required.
 - Provide proof of simulation accuracy



Subsystems Requirements

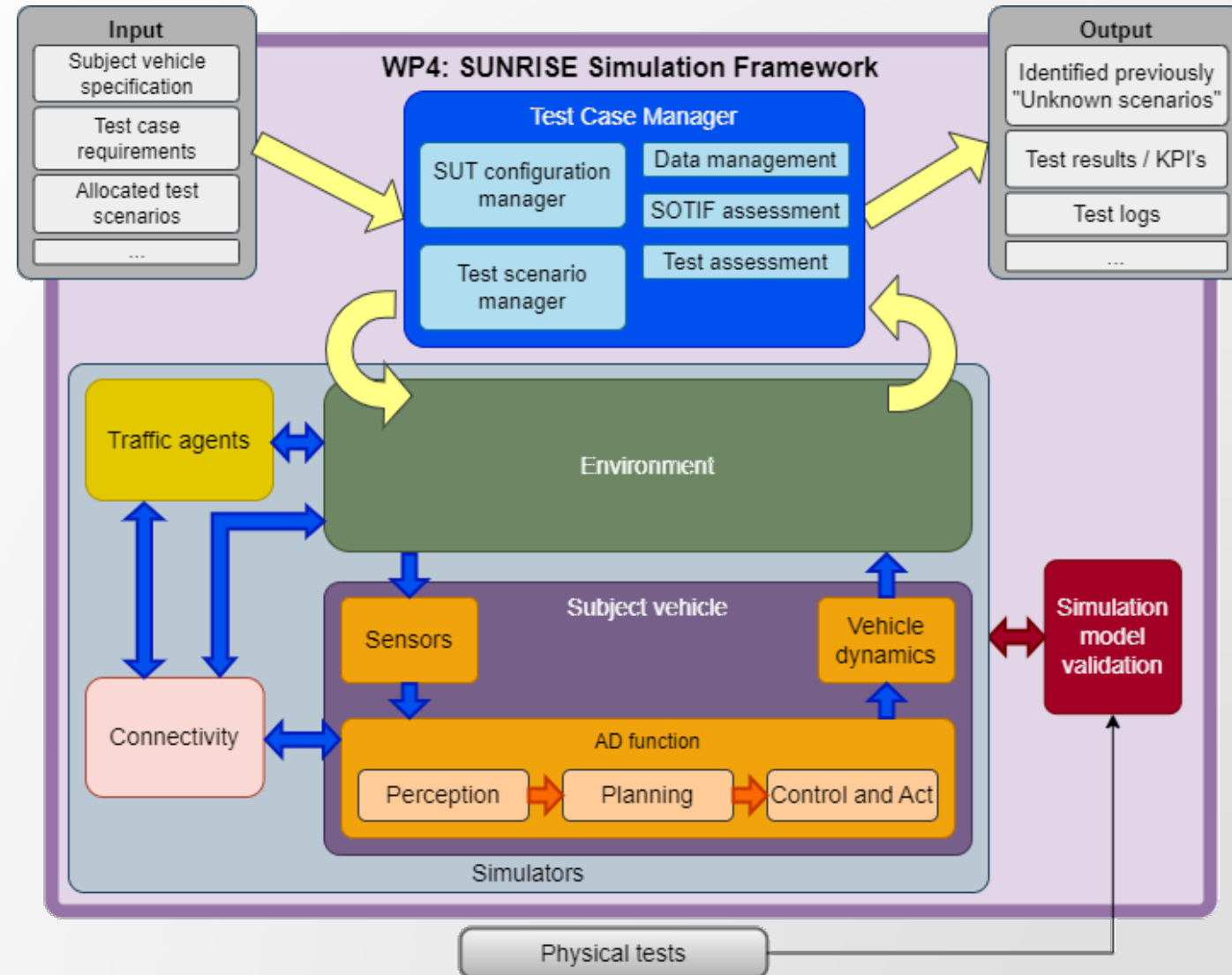
Simulation validity essential!

- Tool requirements:
 - Test automation tools needed.
 - Virtual models with needed realism.
- Compliance with safety standards!
 - Requirements management tools
 - Data management and analysis tools
 - Version control, Configuration Management and reporting tools
- Interface requirements:
 - Aiming for versatility.
 - Use of open standards.
- Fidelity requirements:
 - Appropriate degrees of fidelity needed.



Conclusions


- A non-exclusive list of subsystems are identified
- Focus on virtual simulation, but the SAF will also cover XiL tests.
- The work mainly theoretical though several participants are experienced in virtual simulation tools.



D4.1

Report on relevant subsystems to validate CCAM systems

- Draft version available on (Pending approval):
- <https://ccam-sunrise-project.eu/deliverable/d4-1-report-on-relevant-subsystems-to-validate-ccam-systems/>




SUNRISE
SAFETY ASSURANCE FRAMEWORK FOR CONNECTED, AUTOMATED MOBILITY SYSTEMS

D4.1
Report on relevant subsystems to validate CCAM systems

Project short name
SUNRISE

Project full name
Safety assurance framework for connected, automated mobility systems

Horizon Research and Innovation Actions | Project No.
101069573
Call HORIZON-CL5-2021-D6-01

 Funded by the European Union

ccam-sunrise-project.eu/



Thank you for your attention!

Next webinar:

7 March 2024

13:00-14:00 CET

Requirement for CCAM safety assessment data framework content

