Anritsu Advancing beyond

Automated Valet Parking Simulation

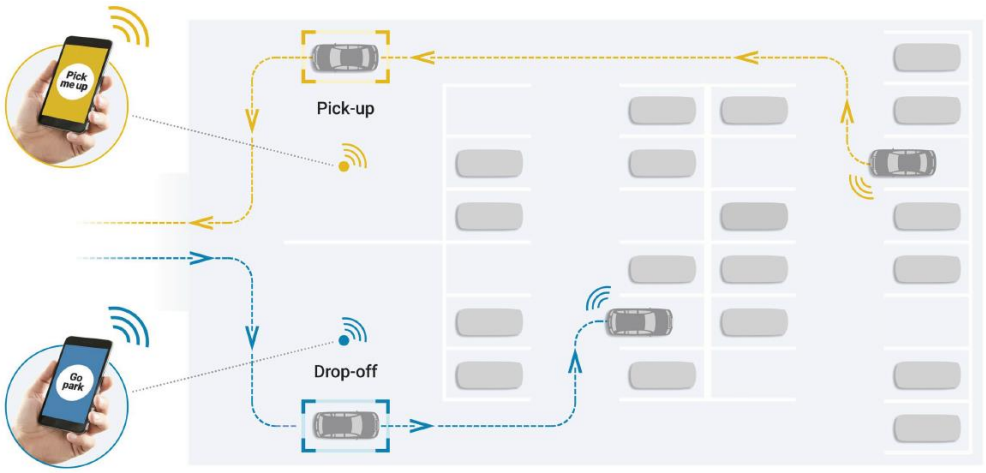
dSPACE

APPOSITE TECHNOLOGIES

Introduction

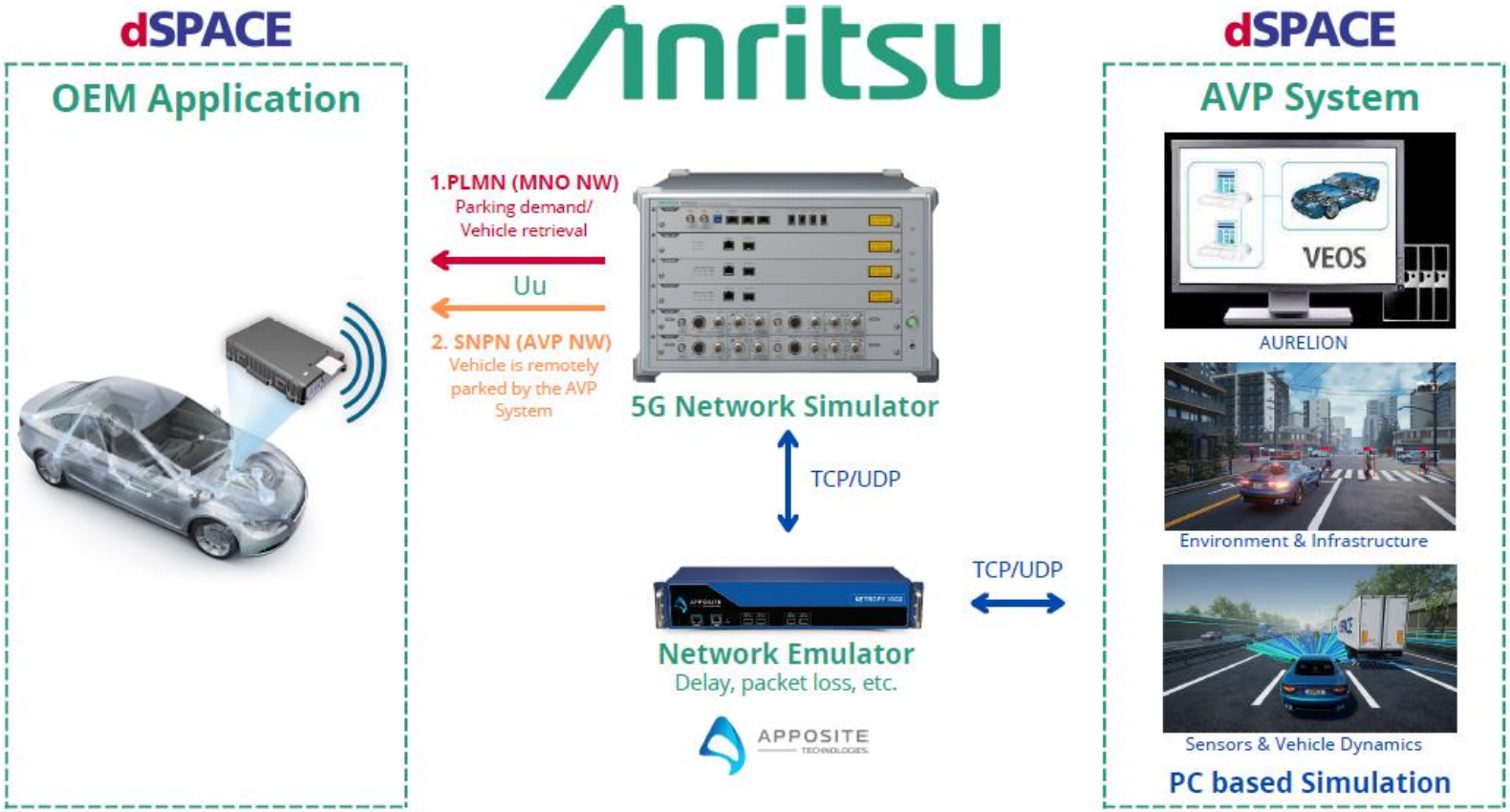
Valet parking is a service in which a professional parking attendant works on behalf of the driver when parking at large-scale parking facilities and commercial facilities mainly in Europe and the United States. AVP enables this parking to be done automatically, without any driver in the vehicle. AVP Technical Report Version 1.0 was released by 5GAA in June 2022, and a wireless communication (Type-2) operation scheme linked with parking garage infrastructure and user's smartphones was proposed. AVP is being actively developed as an autonomous driving use case which can be deployed in the short term. AVP Type-1 autonomous driving vehicles require expensive high-performance computing and sensing, but in comparison AVP Type-2 communication-cooperative vehicles do not require such installations, reducing vehicle costs and easing implementation.

Since AVP Type-2 requires reliability of the end to end communications, evaluation of QoS management and impairment effects in the IP layer are also important for a test system, as well as evaluation of the wireless connectivity environment. The test solution realizes a digital twin environment of virtual and real devices, enabling the system tests and certification required to improve the reliability of AVP Type-2 to be started before the actual devices are available.



Solution Outline

- The Anritsu 5G network simulator can reproduce various wireless propagation, such as weak signal strength and simulate wireless communication environments such as QoS management.
- dSPACE PC based simulation is capable of various simulations such as AVP environment / infrastructure / sensors / vehicles.
- APPOSITE WAN Emulator can reproduce IP impairments such as latency and packet drop.



Operation Sequence

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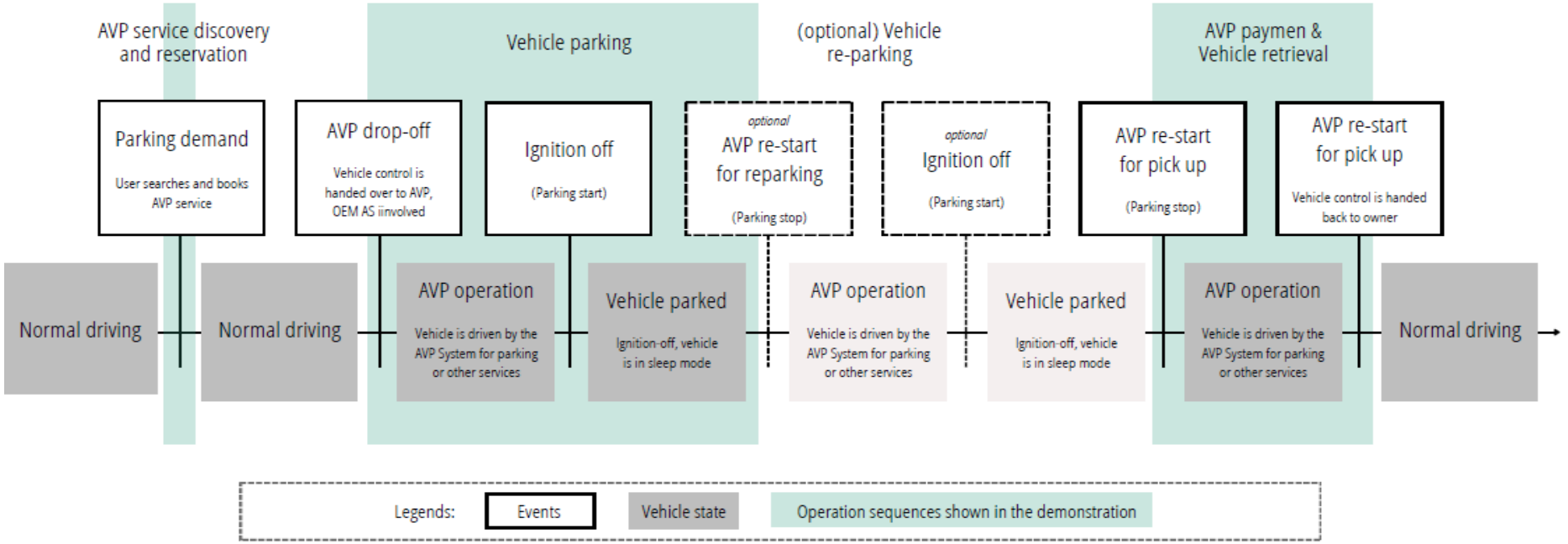
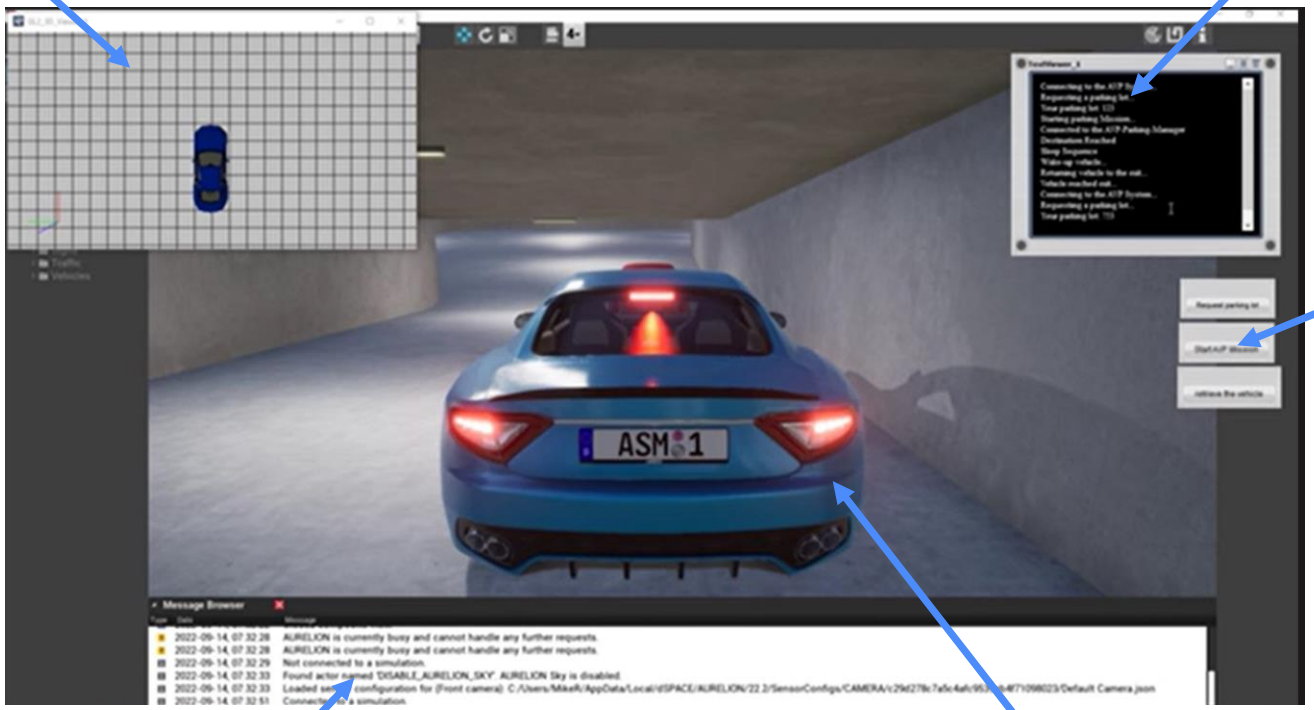
Automated Valet Parking (AVP) Type 2 is one of the actively discussed use cases of Connected Autonomous Vehicle (CAV). With wireless technology such as 5G, the parking request will be received by the AVP service. The vehicle will then be dropped off by the driver and automatically driven by the AVP system to its intended parking spot. Upon request of the owner, the vehicle is automatically retrieved.



UI Image

Received VMC plot
(detailed message protocol trace also available)

System message status



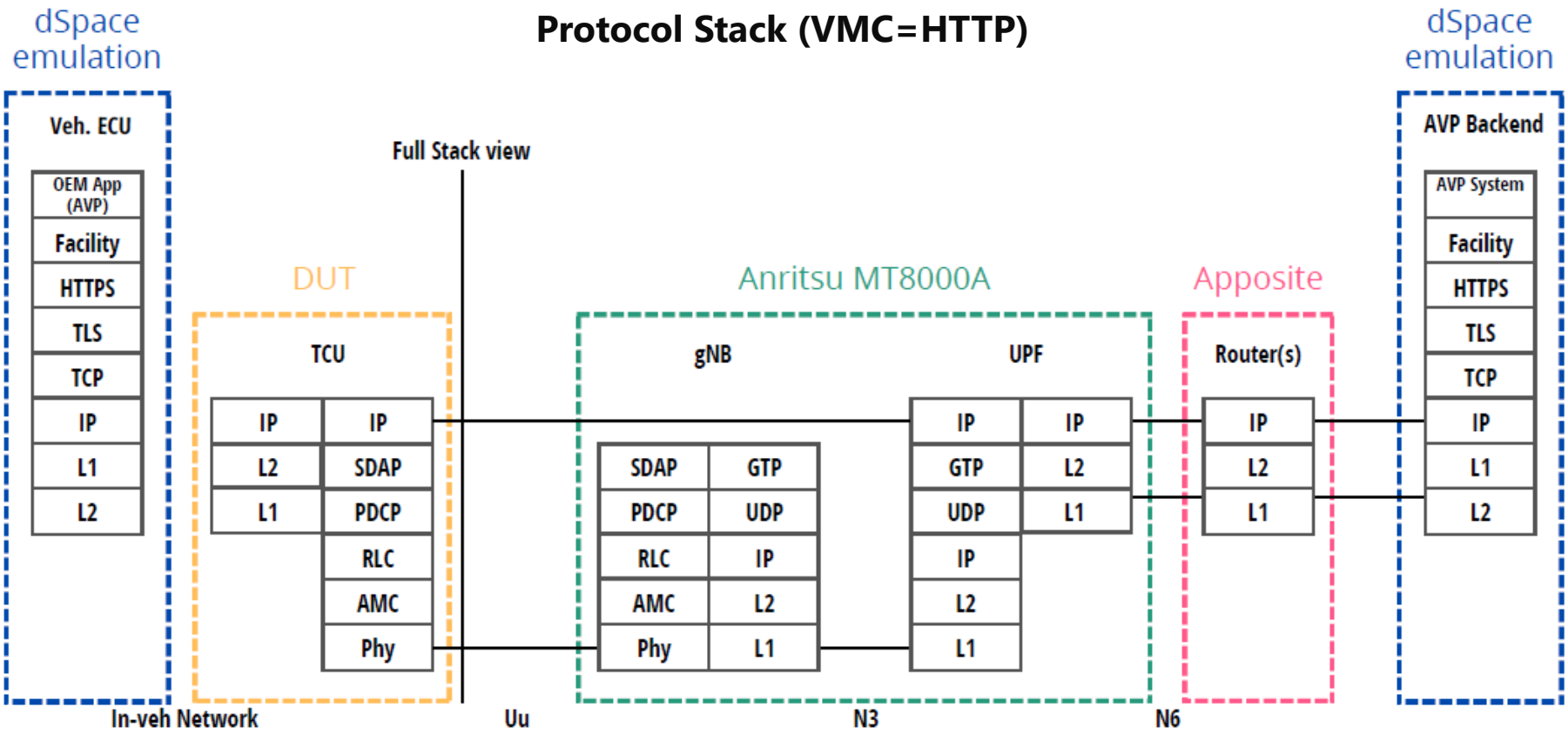
Controls.

Sequence log

Digital twin environment.
Vehicle driving through parking garage
according to VMC commands received.

Protocol Configuration

- The following protocol stacks describes the interaction needed for vehicle motion control. Information about vehicle movement is communicated through the Vehicle Motion Control (VMC) logical interface between the remote vehicle operation and the vehicle. This logical interface can be implemented via the OEM backend or without traversing the OEM AS.
- when a vehicle AVP OEM app (left) communicates with an AVP System backend server (right) over a 5G cellular system. A 4G cellular system or any system that can transfer IP and meet the performance requirements may also be used.



AVP Test Bench Image

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- A demonstration exhibition was held as part of the 5GAA Member Symposium event in Malaga, Spain on October 20th.
- Car manufactures, Tier 1 suppliers, and mobile network operators have shown great interest in the above event, and Anritsu will continue to develop this simulation environment and contribute to the realization of AVP through collaboration activity.

Summary

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- dSPACE, a leading vendor of vehicle models/HIL, and Anritsu, a leading vendor of network simulators, jointly developed a CAV (Connected Autonomous Vehicle) base AVP test system.
- The system enables building an evaluation environment that simulates “Wireless communication + Sensors + Vehicle" in an integrated manner.
- As a typical Connected-AVP, a test sequence referring to AVP Type-2 advocated by 5GAA has already been available, and this system is scheduled to be used as a reference test environment at the 5GAA Plugfest scheduled in early 2023.
- In addition to AVP Type-2 by 5GAA, it enables customizing each component of Wireless communication, Sensor, and Vehicle model according to customer requirements.
- The joint solution from Anritsu and dSPACE will provide consecutive enhancement for future use cases that are likely to be Autonomous Driving.

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