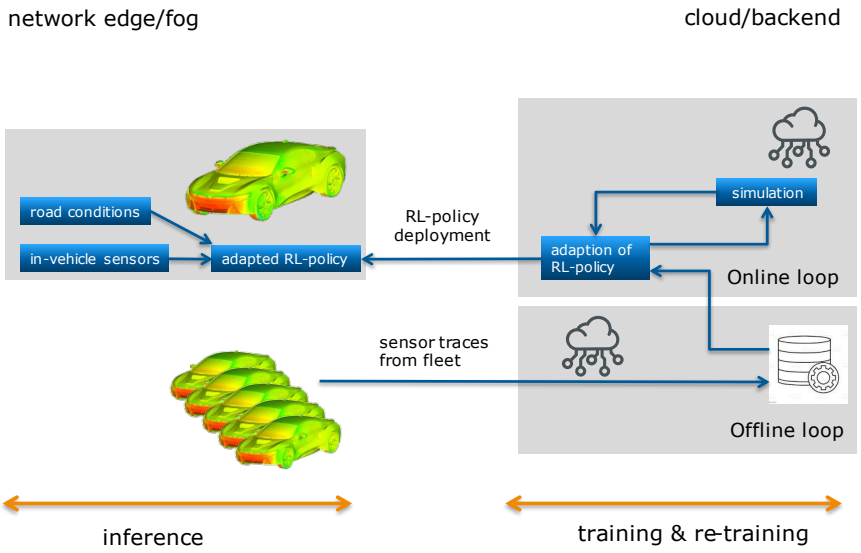
FRACTAL - A Cognitive Fractal and Secure Edge based on a unique Open-Safe-Reliable-Low Power Hardware Platform Node

The overall objective of the FRACTAL project was to create a cognitive edge computing node that can be qualified to work under different safety-related domains such as automotive, railway and smart cities to name a few. This computing node will be the basic building block of intelligent, scalable, and non-ergodic IoT (Internet of Things, ranging from low-energy computing to high-performance computing edge nodes). The cognitive skills will be enabled by an architecture that allows forecasting its internal state and the state of the surrounding world. This *node will have the capability of adapting to improve its behavior* (performance, safety, security, power efficiency, etc.) and *deliver new services against the uncertainty of the environment*.

AVL developed technological building blocks that enable *complex mechatronic systems* to *exhibit adaptive capabilities* and demonstrated the achievements of FRACTAL for *control systems* such as the *steering of the cabin temperature in battery electric vehicles (BEVs)*.



The vehicle control systems domain faces growing complexity due to factors like connected vehicles and automated driving, leading to *intricate calibration processes* and challenges in transferring control policies between different vehicle configurations. The proposed methodology utilizes AI, specifically *Reinforcement Learning (RL),* to enhance control strategy design for BEVs. *By leveraging simulation and big data, a cloud-based solution is presented for training, testing, and deploying thermal management control strategies efficiently*. *This approach enables faster design and more effective operation compared to traditional rule-based methods.*

The framework's application in cabin heating mode selection for BEVs *demonstrates superior performance* over the original control policy in energy efficiency and comfort metrics. Currently tested in a simulated vehicle fleet, the framework raises questions about direct transferability to real vehicles and the optimal combination of RL algorithms for enhanced telemetry data performance. The framework *extends the traditional V-model* by incorporating *DevOps and ML-Ops practices*, allowing *continuous improvement based on historic in-use data*.