Abstract 37th SafeTRANS Industrial Day

Title: Your Software Updated Overnight. Did Your Safety Case? – Germany's Research Path to Continuously Safe AI-enabled Transportation Systems

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Germany is entering the era of continuous safety assurance. As transportation systems become software-defined, AI-enabled and increasingly capable of evolving after deployment, safety engineering faces a fundamental challenge: How can we continuously justify that a system remains safe when the system, its operational environment and the available evidence keep changing? This talk traces how current and future German and European research is turning this question from a vision into an engineering discipline, and where that journey is heading next.

The story started from a simple realization: monitoring a system is not enough. We must also understand what observations from operation mean for the assumptions, evidence and claims on which its safety argument rests. The German **AutoDevSafeOps** project explored this idea by creating a basic architecture for closing the loop between development, safety assurance and field operation. Research emerging from this direction connected safety case uncertainties and claims with Safety Performance Indicators and operational evidence, laying important foundations for continuous safety assurance.

But closing this loop immediately exposes harder questions. Which uncertainties actually matter during operation? How can evidence collected from complex, open environments challenge an existing safety argument? And when something changes, how do we determine what must be reassessed rather than starting assurance from scratch?

These questions mark the transition from the original concept towards today's ongoing research. **CONTROL** advances the thinking towards uncertainty-aware assurance for complex automated transportation systems. And the next chapter is already beginning: the German **Mod2SDV** and European **AI4SDV** flagship projects address complementary pieces of a future in which changes, operational evidence, ODDs, safety arguments and engineering artifacts become much more tightly connected, while AI itself starts to support parts of the safety engineering process.

The talk connects these developments into one emerging roadmap for continuous safety assurance in Germany: from monitoring safety in the field, through understanding when assurance is challenged, towards systematically adapting the evidence and arguments supporting safety. Along this journey, we will separate what is already possible from what remains research, identify the missing building blocks, and explore the role AI can realistically play in finally making safety assurance evolve as continuously as the systems it assures.