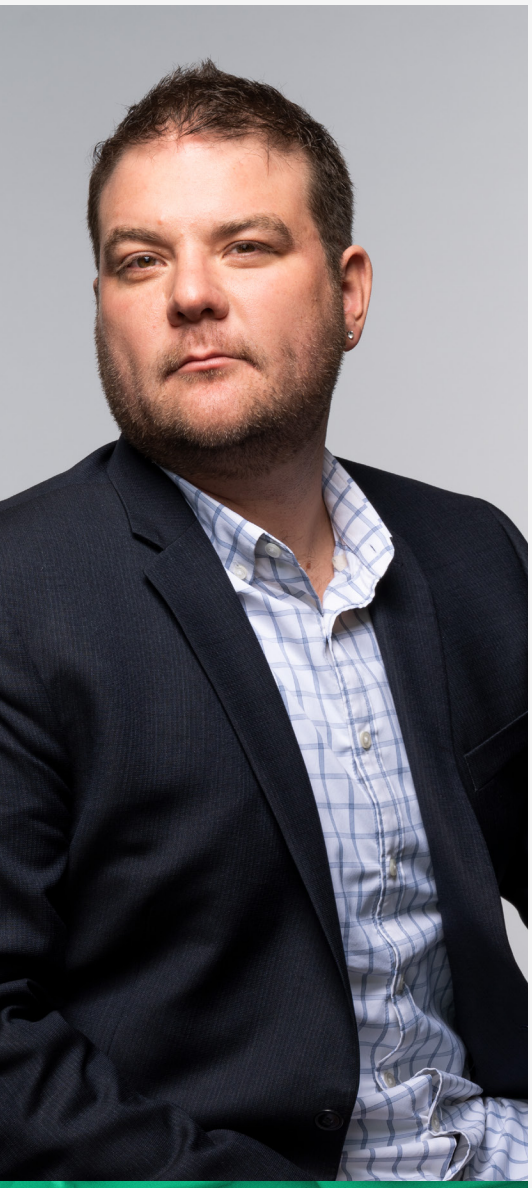

JEFFREY PHILLIPS
DIRECTOR, GO-TO-MARKET STRATEGY, TRANSPORTATION, NI

APPLICATION SPOTLIGHT

# A Connected ADAS and AD Workflow: No Longer a Dream

In the Q4 2021 *Automotive Journal*, we dived into how mastering the advanced driver assistance systems/autonomous driving (ADAS/AD) validation workflow relates a lot to solving puzzles, competing in sports, and participating in the rush for gold and oil (see "Solving the ADAS and AD Puzzle Together"). This is NI's view, but some of our strategic partners, Ansys, Foretellix, Konrad Technologies (KT), and Seagate Technology, are sharing their perspectives on this with us as well.

## JEFFREY PHILLIPS: WHO ARE YOU AND WHAT IS YOUR SUBJECT MATTER EXPERTISE?

**Eric Bantegnie:** Ansys is the global leader in engineering simulation. Through our strategy of Pervasive Engineering Simulation, we help the world's most innovative companies deliver radically better products to their customers. By offering the best and broadest portfolio of engineering simulation software, we help them solve the most complex design challenges and create products limited only by imagination. In my position as vice president, I am currently acting as a special adviser to the CEO and as CTO of Ansys Europe.

**Roy Fridman:** Foretellix provides a test management, verification, and validation platform for ADAS/AD systems. Our platform orchestrates, manages, and analyzes the massive scale of meaningful tests and edge cases required to ensure that these systems have been tested successfully in all the relevant scenarios. In my role as vice president of business development and sales, I help my team drive the company's growth from direct sales and partnerships such as ours with NI.

**Michael Konrad:** KT is a global supplier of automated test equipment in multiple markets including consumer electronics, automotive, medical, and aerospace/defense. We've been an NI Partner since 1996. I am the founder and CEO of the company.

**Melyssa Banda:** Seagate Technology is a world leader in mass-data storage infrastructure solutions. My role in leading our Lyve Mobile Solutions is to help businesses mobilize their massive data sets and maximize the value and insights they're able to gain from their data. This includes providing enterprises in the ADAS/AD space with in-vehicle storage capacity, modular edge solutions to off-load data and an agile, affordable, and secure architecture.

JP: WHAT TRENDS AND CHALLENGES DO YOU FORESEE IN ADAS/AD?

EB, Ansys: Products and systems are becoming increasingly complex, interconnected, and interdependent. Projects also run the risk of cost and schedule overruns and product failure while losing to the competition on superiority and time to market. To meet these challenges, there is a strong industry focus on implementing a model-based systems engineering (MBSE) approach that creates a digital thread that can be shared, continually improved, and managed throughout the product life cycle. MBSE enables our customers' digital transformation journeys with the digital thread providing the framework for continual feedback and incremental opportunities to model, simulate, refine, and validate throughout the product life cycle—from design and development through operation.

RF, Foretellix: Modern vehicles have become complex digital products, but their development and testing tools and methodologies have yet to undergo their own digital transformation. Most of the tools lack scale and automation and are not suitable to meet the challenges of these complex digital products. The industry is shifting to massive scale virtual testing, automation, and advanced analytics.

MK, KT: Key trends for the automotive market are the increasing adoption of ADAS/AD capabilities, a greater need for reliable test methods, and an ever-decreasing time to market for these new features. Primary challenges are evolving standards for ADAS/AD performance, new and evolving sensor capabilities, and an archaic and insufficient multiyear development process.

MB, Seagate: ADAS/AD customers are experiencing challenges with the explosion of data volume. Data collected from vehicles' sensors, including cameras and lidars, has seen a more than five-fold increase in just a few years, and will continue to grow exponentially. There is an increase in artificial intelligence (AI)-based algorithms involved in the perception systems. The validation of these ADAS/AD engine control units (ECUs) will be mandatory with each feature update—even when only a few lines of software code are changed. More and more data will be in the loop for testing. All this data needs to be captured, moved, and analyzed with workflows that control cost, quality, and time to data.

JP: WHAT'S YOUR PERSPECTIVE ON A DATA- AND SOFTWARE-CONNECTED WORKFLOW?

EB, Ansys: MBSE is a key driver for digital thread and digital transformation initiatives. Our customers, including large automotive, aerospace and defense, and high-tech OEMs, contractors, and Tier 1 suppliers, are switching to an MBSE methodology within the different life-cycle phases and functions, and will eventually expand to the digital thread that spans from design and development through operation.

RF, Foretellix: As cars become more digital, they depend on data, create data, and basically become data centers on wheels. This data can be utilized in many ways to drive new approaches to monetize the car, increase safety, and much more. It is our goal to provide a platform and tools that help development teams test these complex digital systems with advanced automation. We also offer strong analytics tools that help reduce cost, decrease time to market, and ensure safety.

MK, KT: A connected workflow is necessary to optimize designs at each step of the development process and share key attributes across these steps to reduce overall development time. Data-driven and analytics-based development efforts are necessary for successfully deploying safety-critical ADAS/AD functions, and a data- and software-connected workflow will offer such capability.

MB, Seagate: In recent years, we have seen a major disruption in the automotive software space. Due to the need to continually evolve the vehicles' perception and decision-making capabilities, the vehicle's software architecture has been altering. From AUTOSAR to real-time operating systems (RTOSs), this architecture expands into Linux, open-source software, and AI that enable the growth of the vehicle's code and capabilities, and data is essentially the fuel of this process. The more data captured in real-life scenarios, the better the vehicle's logic and decision-making capabilities will be.

JP: HOW DOES A DATA- AND SOFTWARE-CONNECTED WORKFLOW HELP ADDRESS THESE TRENDS AND CHALLENGES?

EB, Ansys: As AI systems in autonomous vehicles increase in design complexity, siloed tools for information sharing, such as paperwork and spreadsheets, break down. That's where MBSE comes in. It allows for work from end to end—from concept to certification—and starts to become the only way to handle autonomous vehicle development to safety-critical standards.

RF, Foretellix: The ability to collect, share, and analyze data at scale from physical and virtual sources (real

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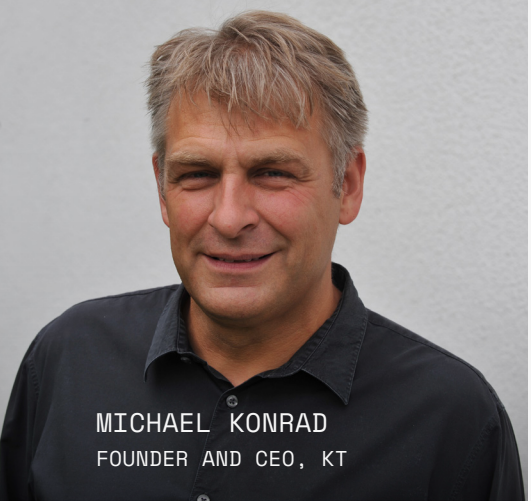

MICHAEL KONRAD
FOUNDER AND CEO, KT

driving, simulation, and so on) is key to properly testing and deploying ADAS/AD functionality. Companies such as NI and Foretellix drive data collection, generation, analytics, and insight.

MK, KT: A connected workflow will enable reuse of best practices and data at different phases to shorten development cycles and time to market. It will also provide incremental improvements in software design to accommodate developing standards and changing sensor specifications and create higher quality designs for prototype development.

MB, Seagate: We are helping the industry by enabling carmakers and suppliers to free their cash from storage and IT infrastructure and focus it on the goals that matter most to them: evolving and accelerating their novel technologies and IP around ADAS/AD and securely connected services. Together, NI and Seagate are providing an innovative ADAS record offering that allows OEMs and suppliers to modernize their data storage strategy from self-managed to storage as a service (StaaS). This leads to reduced costs and efficient storage throughout the entire data flow and accelerates customers' access to data and ability to innovate.

JP: HOW AND WHY DOES AN ECOSYSTEM OF SUBJECT MATTER EXPERTS MAKE A DIFFERENCE?

EB, Ansys: As MBSE becomes more prevalent, being able to connect simulations to physical hardware is of the utmost importance. Without this connection, true verification and validation of systems cannot take place. Due to this connection, Ansys and NI can shorten complex product development cycles and ensure that components behave as designed. Together, both companies will help solve the complex challenge of re-creating real-world simulations to validate sensors and inject data into software and hardware under test in real time. This shared focus will provide customers with critical insights into how products will perform in the market by bridging the worlds of simulated and physical test with more precise outcomes.

RF, Foretellix: The challenge of automated driving is an ecosystem challenge. No company can solve it alone. Alliances of companies providing best-in-class tools and methodologies to support safer ADAS/AD features are crucial for the broad deployment of these systems.

MK, KT: Working with subject matter experts and platform providers like NI ensures a consistent understanding of the challenges and a productive experience for our common users and partners in the ecosystem. For a smaller company, it also presents an opportunity to work on bigger projects within the automotive ecosystem.

MB, Seagate: To provide the best solutions for OEMs and suppliers, it takes the world's leaders in respective specialties. With NI's long-standing reputation and expertise in automotive testing, as well as Seagate's expertise in mass data storage, we are building a comprehensive portfolio of solutions, allowing OEMs to share data more efficiently among endpoint, edge, cloud, or any locations. With that, we help to reduce development time and cost.

JP: WHAT HAS BEEN THE FEEDBACK FROM CUSTOMERS SO FAR ABOUT THE COLLABORATIVE ECOSYSTEM WITH NI?

EB, Ansys: We have heard from customers at joint engagements that the openness of the collaborative

ecosystem compared with being locked into a unique solution by a vendor is very much appreciated. Some key benefits mentioned are ease of reuse and flexibility as well as the cost-effectiveness of the solution.

RF, Foretellix: We get a lot of positive feedback on the joint toolchain proposed by NI and Foretellix. Customers prefer strong alliances with companies that are able to work together and streamline the massive amounts of data needed to validate the ADAS/AD algorithms in an efficient way.

MK, KT: The feedback on offering new test capabilities and services to the automotive ecosystem has been positive and optimistic. It is seen as encouragement for Konrad Technologies to participate in a wider range of automotive applications.

MB, Seagate: Today's Level 3+ campaigns generate about 100 TB of data from each vehicle every day. Customers are running on at least three continents and requiring captured data to be validated and available in the cloud within days. We are talking about 1 PB that needs to flow into our customers' core (cloud) daily. This is no task for niche vendors. Seagate's Lyve Mobile Solutions are designed to help our customers rethink the entire data flow and find a new way to manage their data.

JP: THANK YOU FOR SHARING YOUR PERSPECTIVE. 2021 HAS BEEN A GREAT START TO ESTABLISHING ALL THESE STRATEGIC PARTNERSHIPS. IN 2022 AND BEYOND, WE ARE LOOKING TO EXTEND OUR COLLABORATION EFFORTS FURTHER WITH YOU. NO SINGLE ENTITY WILL ACHIEVE AUTONOMOUS DRIVING ALONE, BUT AN ECOSYSTEM WILL!