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The only way to master this complexity and to manage risk early instead of dealing with problems late in the development process is to establish processes, methodologies and tool-chains that address those challenges. Ralf Münzenberger, founder and managing director professional services of INCHRON and (right) Matthias Dörfel, founder and managing director R&D of INCHRON. Page 18

# The quest for bug-free software and hardware architecture

By: Jon Knox

**One of the biggest challenges for system developers and engineers is to assess the real-time behavior of their systems and networks in the face of increasing complexity – and the earlier this is done in the design cycle, the better.**

“Today’s automobiles have a number of interconnected systems which rely on each other for functionality. There are a number of factors that determine if the systems work together. What if the infotainment system affects the performance of the anti-lock brakes, or the timing of the airbag deployment? Automobile manufacturers and suppliers must understand the interactions and validate the functionality, timing and safety of their systems or face redesign and safety issues,” says Ralf Münzenberger, one of the founders of German-based embedded system design specialist INCHRON.

With clients like Audi, BMW, Continental Automotive, Daimler, General Motors, Johnson Controls, Robert Bosch and Volkswagen, the company’s best-known products are chronSIM and chronVAL. chronSIM helps predict real-time behavior in the early architecture phases, resulting in “robust architectures and making it easier to debug code later”. chronVAL is a real-time analysis

**Ralf Münzenberger, founder and managing director professional services, INCHRON.**



tool which enables designers to validate the worst case response times and real-time performance of distributed embedded systems using mathematical analysis methods.

**Automotive Industries spoke to Matthias Dörfel, founder and managing director R&D and Münzenberger.**

**AI: Tell us about INCHRON’s strategy to be a leader in the development of real-time critical software for embedded systems and networks.**

**Dörfel:** When we founded the company in 2003, we were sure that increasing complexity in embedded systems would sooner or later lead to a growing need for solutions to master the dynamic behavior of those systems. Starting as researchers at University Erlangen-Nuremberg and building on this expertise with Venture Capital investments, we have developed a variety of powerful technologies to master the different aspects of dynamic behavior in embedded systems. These developments are based on a solid IP strategy to secure our freedom to operate and support our competitive position.

**Münzenberger:** While in the beginning our strategy was driven by the technology developments and the IP strategy, we clearly see now that our experience with respect to processes, methodologies and tools is an asset just as important as our IP base. Customers are interested in complete solutions and that is what we can provide with our unique combination of tools and know-how.

**AI: What changes you have seen and expect to see in the development of automotive systems?**

**Münzenberger:** It may sound like a stereotype, but the major changes we have been seeing in the past and expect to see in the future are related to the explosion of complexity. This complexity arises not only on the product side, but on the development ecosystem as well. There is a definite trend towards higher integration of ECU (Electronic Control Units), and the integration of software modules of multiple vendors including the OEM. The only way to master this complexity and to manage risk early instead of dealing with problems late in the development process is to establish processes, methodologies and tool-chains that address those challenges. Our customers appreciate our unique combination of tools and know how in the area of dynamic real-time behavior.

**Dörfel:** From a product perspective, there are two aspects that we focus on. One is to constantly extend the capabilities and usability of our tool-suite. The ability to simulate and analyze multi-core architectures is an example but there are

# “At the end of the day all parties involved benefit from shorter time to market and reduced cost of quality.”

Dr. Ralf Münzenberger, founder and managing director professional services, INCHRON.

many more. In addition, we put a lot of effort in integrating our tools into larger tool-chains and providing interfaces – for example, for AUTOSAR.

**AI: Tell us about how INCHRON's solutions are helping automotive system engineers and architects.**

**Münzenberger:** Let me give you an example of a German OEM. In the past, they discovered timing errors rather late in the development process. Using our testing tools, they were able to find these errors that occurred only sporadically. Now that they are facing the complexity issues in both technology and collaboration, they have decided to use our solutions from project start and even before in the bidding phase. We have just started to establish processes and methodologies that ensure a proactive management of real-time risks from the beginning. This leads to a change that will benefit all parties involved. When we did the first project with several suppliers in the bidding phase of a domain ECU, the suppliers were skeptical. Very soon, however, they realized that they benefit as well from clearer requirements and specifications. We are proud to say that we have initiated that development that now ignited interest at other OEMs. At the end of the day all parties involved benefit from shorter time to market and reduced cost of quality.

**AI: What role has INCHRON played in the AUTOSAR partnership?**

**Dörfel:** When we decided to apply for premium membership in AUTOSAR, we were determined to provide know how in an area that had been neglected to some extent. We have been actively engaged in the timing workgroup and the architecture workgroup since early 2009. Obviously, that engagement has an impact on our product solutions as well. The same applies for our activities in the TIMMO project (TIMing MOdel).

**Münzenberger:** From a project perspective, it is vital to keep the edge in customer needs. That's why we engage our professional services engineers in the AUTOSAR workgroups and in TIMMO.

**AI: Tell us about the work INCHRON has done and is planning to do with IBM in developing tools and products for the automotive industry?**

**Dörfel:** Our cooperation with IBM Rational is an example where we develop integrations that cover various steps in the development process. Having an integration with DOORS is an attractive option for a lot of our customers. Model-based SW development in



Matthias Dörfel, founder and managing director R&D of INCHRON.

combination with Rational's Rhapsody or quality management with Rational's Quality Manager are other issues that we work on with IBM. With OSLC, IBM provides an open standard used in the jazz platform that makes our lives and even more customer's lives in integration a lot easier.

**AI: In July this year, INCHRON and ESG Elektroniksystem- und Logistik, an engineering service provider for electronics and IT systems, signed a partner agreement. What do you hope to achieve from this partnership?**

**Münzenberger:** It is the balanced combination of processes, methodologies and tools that ensure the success of electronics development. We just talked about AUTOSAR. Standards like SPICE, CMMI or ISO 26262 are just as important to ensure the level of quality that customers and regulatory institutions require. ESG provides a substantial scope in that area. ESG – and its customers - benefit from our know-how in the area of dynamic real-time behavior. We benefit from being integrated into a solution package that covers the big picture. **AI**



**THINK  
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## **INCHRON REAL-TIME SOLUTION**

Master dynamic behavior of embedded systems

- Model driven systems development with focus on timing
- Manage real-time requirements - and risks
- Combine simulation and analysis for precise system know-how and safety
- Master complexity of networked, distributed systems and multi-cores
- Optimize system and software architectures
- Discover, analyze and eliminate system timing problems – early



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