How Kontron is harnessing the technology behind driverless cars to launch the autonomous train revolution.

It seems not a day goes by without an autonomous vehicle (AV) story being featured in the news. A scan of today's headlines doesn't disappoint, with an article on how General Motors is planning to deploy thousands of self-driving electric cars in test fleets in partnership with ride-sharing affiliate Lyft. It is expected to be the largest test of fully autonomous vehicles by any major automaker before 2020 and is another example of the growing commitment from major automobile manufacturers to this nascent technology. We can see that car manufacturers are keen to engage with this technology but where does public transport fit into this? For UITP (the International Association of Public Transport) a fascinating report *from January this year makes clear the opportunity that these changes in urban mobility offers for public transport companies. But the report also highlights a significant threat, even a "dystopian future" of even more private car traffic on the road if AV's aren't integrated into an effective public transport network.*

The network question as a whole is a fascinating one. But what about the technology itself that is enabling autonomous vehicles and its role in the future of public transport? It seems they are a good fit, we already have driverless trains after all, what about autonomous trains? To learn more I decided to speak to an expert whose focus is currently on this area – **Valentin Scinteie**, Transportation Business Development Manager at **Kontron**, a global leader in embedded computing technology and an adviser to many in the transportation sector. Kontron offers a blend of best of class German and French engineering quality and Silicon Valley innovation. Val has worked in transit ITS (Intelligent Transportation Systems), rail security and communications and in vehicle ECT

(Embedded Computing Technologies) for over 20 years, 15 of which were spent at Alstom. Valentin is the perfect guide to this transformative technology.

With this article being featured in **Using data to enhance rail and metro operational performance** I wanted to open up by asking Valentin what he sees as at the heart of data driven transportation;

"For me it's two areas. Firstly, which is perhaps the more traditional definition, where we use on-board gateways and the Internet of Things (IoT) to collect data and to securely transfer it to a central location from where the data can be analyzed and actioned.

"The development of AV technology in rail is already being planned on lines around the world. In Australia's Pilbara region, global mining giant, Rio Tinto are looking at the world's first fully autonomous, heavy-haul, long-distance railway system."

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This analysis can be used across a number of areas including improving operational performance, developing further predictive maintenance, sharpening location accuracy and offering better passenger information. **Our TRACe™ product line** has been designed with built-in IoT connectivity to address the broadest range of modern, connected rolling-stock applications through easily customizable, EN50155 certified computer profiles, specifically designed to meet the requirements of video surveillance, passenger infotainment/entertainment, onboard Wi-Fi, train to ground communications, fleet management as well as safety critical platforms."

"But it's the new definitions that I want to focus on, I want to see where this area is going in 5-10 years. Here at Kontron, we have developed High Performance Embedded Computing platforms (HPEC) that has been driven by the AV market at an amazing speed. Essentially we now offer very powerful on-board computers that can operate independently of control rooms. They don't depend on large central computers and direct links to control rooms like CBTC or ERTMS does. And instead it offers trains the same platform as AV's and enables them to make decisions themselves using sensors, 3D maps and real time data. It's a hugely exciting area and one where we are looking for visionary partners."

The development of AV technology in rail is already being planned on lines around the world. In Australia's Pilbara region, global mining giant, Rio Tinto are looking at the world's first fully autonomous, heavy-haul, long-distance railway system – intended to transport iron ore. In the Netherlands, Prorail announced in 2016 it is planning to trial automated operation freight trains. And an operator that often leads the way in innovation, the CEO of German operator Deutsche Bahn, Rüdiger Grube, has **publically stated** they wish to introduce driverless trains by 2021.

These trains will be adapting the concepts used on AV cars and emerging SDN (Software Defined Networks) and NVF (Network Function Virtualization) Telecom technologies to create what Val calls "software defined trains (SDT)" and "train function virtualization (TFV)" that can use just one HPEC platform with built-in redundancy and are not reliant on infrastructure at all. These technologies when combined with IoT enabled Gateways and Fog/Cloud processing will also enable new business models such as TaaS (Transporation as a Service).

"The advantages of this kind of development are numerous, they reduce total cost of ownership for train operators and make smaller requirements on investment by eliminating many of the costly trackside infrastructure. The cost of technology like sensors is decreasing as well, so it becomes a more achievable opportunity." said Val.

Driverless trains are already operational, if you've travelled on the metro in Dubai, Singapore, Copenhagen or a host of other networks around the world there won't have been a driver controlling the train. But although automatic, they are not autonomous. Most of these trains use communications-based train control (CBTC), a technology invented by Thales over 30 years ago and widely used across the industry. Trains using CBTC are constantly sending and receiving data, the decisions are made collaboratively by on-board and

external wayside systems and control-room. The driving decisions are dependent on central systems and aren't made autonomously on-board where this is usually an attendant schooled in the basics of train operations should there be an emergency. CBTC has an excellent safety record. I asked Val if this was one of the barriers holding up the development of the autonomous train;
"Security is a key focus of our work, and we've actually been collaborating closely with our partners on developing new mechanisms in this area. Kontron Security Solution is a combined hardware and software solution that includes an embedded hardware security module on all Kontron products and a software framework to provide full protection for your application.

Kontron Approtect is a holistic hardware based security solution that provides customers with the ability to address security needs at the application layer. This cost effective and proven turn-key solution is integrated into every Kontron design. Customers can easily upgrade old systems or use an existing Kontron system. Customers may also customize the solution to meet their specific needs. The Approtect features include: copy protection, IP Protection and protection from reverse engineering and tampering. (For more information **click here**).

It's a very exciting development for the industry and as UITP noted in their review of the effect on AV's on transport network, the growth of the autonomous train offers great opportunities but also some challenges. As with driverless trains, passengers can be reluctant to accept autonomous technologies if they aren't convinced they are 100% safe. And as with all new technologies there can be teething-problems but Kontron is now at the forefront of what could be a new chapter in the rail industry.

"For the team working on this, we are focused on realizing this opportunity and taking a broad view both of the technology itself and how it will impact rail operation. We are currently trialing systems and aim in 6-12 months to have an off the shelf commercial offering. And we are looking for partners to come with us on this journey, so if you would like to find out more, or see how your rail operator could work with us, then we'd love to hear from you!"

If you'd like to find out more about this opportunity and this hugely exciting area for the industry, contact Valentin Scinteie via email at **Valentin.Scinteie@kontron.com**