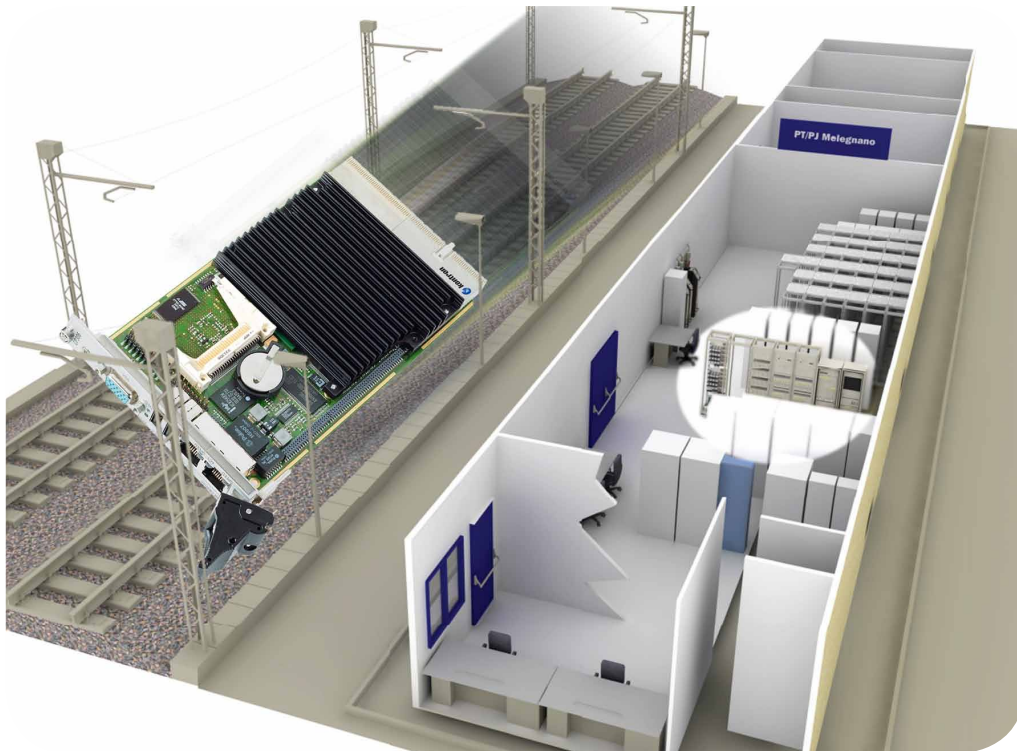


» Application Story «

CompactPCI in Transportation



Swift as an arrow: Italy's new CompactPCI-based railway control system

CompactPCI railway control system offers high efficiency, scalability and reliability



For Italy's new high speed/high capacity railway network, Ansaldo STS developed two scalable CompactPCI system platforms. These platforms include the central post unit for interlocking, alarm and reporting as well as the operator interface which is the key physical interface between the signaller and the central unit. For both systems, Ansaldo was looking for an embedded hardware platform that not only offered high performance and reliability but also cost efficiency and scalability. In the task of finding and tailoring the optimal platform, Ansaldo was supported by Sanval Electronic s.r.l. and the embedded hardware manufacturer Kontron.

Italy's new high-speed/high-capacity railway network is the most extensive project to be implemented in Italy since the post-war period. It consists of a new network of railway lines providing non-stop connection between Italy's largest cities. On the main national axis from Turin to Salerno, Italy's railways have already adopted the level 2 European Railway Traffic Management System/European Train Control System (ERTMS/ETCS). This system was entirely designed and developed in Italy and adopted by the E.U. as the common reference standard for new high-speed networks; eliminating the possibility of human error and ensuring continuous control over the train's movement. This resulted in the highest degree of safety at the fastest speeds, enabling a frequency of trains, which in turn, may run just a few minutes apart from one another. Italy has decided to install ERTMS Level 2 as the railway's only signalling system without any fallback system. This has allowed considerable cost savings because ERTMS Level 2 does not need lineside light signals and allows for a significant increase of traffic capacity.

Computer-based route management

As part of the supply of technology systems, Ansaldo STS is responsible for the route management system for the new HS/HC lines as well as other components. The route management system includes the signalling security functions and comprises, in its most recent form, a single central static apparatus located in the line's central post, which governs the peripheral posts located in the stations. The central post, linked to the service locations through a high-speed fibre-optic geographical network, enables the management of local operating interfaces and the distribution of diagnostic information to all technological sites of the line. Furthermore, Ansaldo developed the operator interface, the key "physical" interface between the operator and the central unit. The operator interface is comparable to the operator interface of a nuclear power plant, providing visual feedback on several display panels and enabling the operator to enter crucial commands if necessary.

The central post cabinet

The central post cabinet is designed as a scalable platform to be easily integrated into various setups and locations. Its cabinet comprises the interlocking, monitoring and diagnostics for the control area and consists of the Central Interlocking Unit (CIU), at least two redundant Alarm and Reporting Terminals (ART) with Man Machine Interfaces (MMI) and links to external monitoring sub-systems. The central post has a secure Local Area Network (LAN) on which the CIU and MMI are connected and an open LAN for the diagnostics and operational data. The CIU, also referred to as the safety nucleus, is the heart of the central post and handles interlocking and block control. The central post communicates with the operator (human and automatic intervention) and the peripheral posts, which command and control the field objects.

The ART subsystem is fully configurable depending on the installation typology and carries out server functions of the interlocking system. ART functions are called "non vital" as they don't involve safety functions typical of a station equipment, but are absolutely necessary running a railway station for system diagnosis, event recording, interfacing with signallers and the connection with the supervision system. ART functions belong to two typologies: basic functions and interface functions. Basic functions, which form the ART nucleus, are present in every installation for communication with the safety nucleus, data computing, alarm generation, statistical analysis, deterioration state computing, event recording and process monitoring. Interface functions with other subsystems can be present and customized if desired, depending on the installation typology.

THE CENTRAL POST CABINET IN DETAIL

Ansaldo's new CompactPCI-based QMR¹ safety nucleus comprises two redundant CompactPCI servers (one online, one backup), each of which are equipped with two Kontron CompactPCI processor boards, several communication boards, (managing the communication to external lines and controlling the data exchange to/from the CPU) and a vital watchdog. Due to safety requirements, which specify the use of different platform technologies, one of the processor boards is Intel® Pentium® M-based, while the other is AMD Geode-based. In the case of a disagreement between the results of the two processor boards, the vital watchdog disables the power supply to the subrack and allows the backup system to take over.

The ART subsystem comprises the same CompactPCI server housing, but in this case is equipped with two Intel® Pentium® M-based processor boards (online and backup), each of which are accompanied by a network switch board and a power supply board. The ART carries out alarm, recording, telecontrol functions (ART) and also optionally handles diagnostic, maintenance and segregation functions (DMS) via a second ART.

At the time this system was developed, Sanval made use of an Intel® Pentium® M-based CompactPCI processor board (Kontron CP306) offering Intel® Pentium® M performance up to 1.8 GHz, a maximum of 1 GB DDR SDRAM, an integrated 3D high performance VGA controller, 2x USB 2.0, 1x fast Ethernet and 1x Gigabit Ethernet. Today, fully compatible Intel® Atom™ based CompactPCI boards (Kontron CP305) could be used as an alternative, granting an even higher performance-per-watt ratio. The processor boards are accompanied by rear I/O-modules offering two additional USB 2.0 ports, one fast ethernet port, two COM ports, a VGA CRT interface and a primary EIDE port.

¹ Quadruple Modular Redundant (QMR) architectures use four functionally equivalent units to provide redundant backup. This approach is common in applications where the cost of failure is extremely high.

The operator interface

The operator interface, which was also deployed by Ansaldo STS, is the key “physical” interface between the operator and the central unit. There is a functional keyboard that is a vital subsystem available at each signaller’s desk to insert vital commands, or for normal control, instead of the operator interface. The vital commands enable the signaller to issue special controls to the system. The echo or display of the control is shown on the operator terminal interface, to allow the signaller to check the pressed keys. The system can also manage a set of auxiliary services and functions such as remote video surveillance, audio diffusion, notices to the travellers or meteo monitoring of the line.

THE OPERATOR INTERFACE IN DETAIL



The CompactPCI subrack housed in the central structure of the operator desk contains two redundant Kontron CP306 CompactPCI CPU modules accompanied with power supply modules, a net switch for the connection of the desk to the signalling network, and a watchdog circuit. In complex operating environments involving several signallers, wide-screen (46") display panels give information about the state of the line. The reproduction of the schematic plan associated to a graphic interface presented on the smaller (24") display panels allow the operator to keep the effect of the vital commands that are sent under observation.

High demands for both systems

The demands for both systems were primarily determined by three decisive factors: high efficiency, reliability and scalability. Long-term availability was another must to ensure the exceptionally long service life of railway equipment. Ansaldo STS also wanted a commercial-off-the-shelf (COTS)-available hardware platform to ensure easy logistics and cost efficiency. Furthermore, safety requirements specified a redundant hardware layout for both systems. In the case of the central post’s safety nucleus, safety requirements additionally specified the use of different platform technologies for the computing cores. Flexibility of the system platform was another demand, which was necessary to ensure that it can be easily adapted to any type of line. It should be installable regardless of the type of traction, line speed or track gauge and be able to control an indefinite number of stations and lines of any length. Boundaries of control should be placed only where the owner wants them for operational reasons, not where the system dictates. Additional demands for the operator interface were for a rugged, space saving design with multi-screen support for at least 4 display panels. Also, all the cabling should be connected at the rear end of the system. However, 3U graphics are not only rare on the market but also don’t offer rear I/O-support. Thus, a redesign of a graphics board was necessary, including an all new rear I/O transition module.

What hardware platform is the best fit?

For both systems, Ansaldo STS was looking for a standardized, long term available and cost-efficient platform, which was ideally COTS-available and suitable to be integrated into various use cases. In the search for the optimal solution, Ansaldo STS consulted their local business partner, Sanval Electronic s.r.l. The demands for both high bandwidth and high availability, as well as a scalable, rugged system concept, led to a platform layout with CompactPCI technology as the optimal fit. The PICMG-specified and broadly established CompactPCI standard offers a combination of PCI bus performance and a high availability, reliability, high performance and ease of maintenance and upgrades comparable to the proven VME-technology, but at lower costs. This is due to the fact that CompactPCI products are based on widely available silicon implementations produced in very high volume.

Finding the optimal hardware manufacturer

Because of the high demands placed on the hardware quality, not every hardware manufacturer was suitable. The ideal manufacturer should not only be able to deliver the best quality CompactPCI components conveniently pre-integrated in a 19" subrack but they should also offer different platform technologies for the CompactPCI CPU modules from a single source to relieve the burden on the project management. Importance was also placed on multi-screen support on the rear end of the operator interface's subrack. Since this requires some customization efforts including a complete redesign of a graphics controller board, the chosen hardware manufacturer also needed to offer extensive ODM (Original Design and Manufacturing) services. With Kontron, Sanval and Ansaldo found the optimal business partner for their hardware needs, because Kontron was not only able to offer a broad COTS hardware portfolio and design-in expertise for railway equipment, but could also handle the redesign needs. On top of this, Kontron offers the ease and time-efficiency of one-stop-shopping.



Picture 1: Kontron provided Sanval with the redundant CompactPCI-based server pre-integrated in a 19" subrack with two CompactPCI CPU modules, each with rear I/O modules and the associated wide voltage range power supplies.

AUTHOR



Ingrid Einsiedler,
Marketing Manager at
Kontron

About Ansaldo STS

As a full service provider Ansaldo STS designs, manufacture installs, commissions and maintains signalling and traffic control and supervision systems for railway and transit projects of all sizes.

About Sanval Electronic s.r.l.

Sanval Electronic s.r.l. was founded in 1991 by a staff with over 10 years experience in the electronic industry. It started its activities dealing with high technology electronic and electromechanical components, representing important manufacturer leaders in the market. In order to follow the market evolutions over the years the company became specialized in supplying fiber optic cabling, in projecting and supplying industrial Ethernet systems and providing custom solution in industrial computing. Thanks to the extensive experience in the foreign market the company is well positioned as a valid partner in searching for and supplying of hard to find part. The company works mainly in Process Automation in the industrial, shipping and railway field, in telecommunications and military market.

About Kontron

Kontron is a global leader in embedded computing technology. With more than 30% of its employees in R&D, Kontron creates many of the standards that drive the world's embedded computing platforms. Kontron's product longevity, local engineering, support, and value-added services helps to create a sustainable and viable embedded solution for OEMs and system integrators.

Kontron works closely with its customers on their embedded application ready platforms and customer solutions, enabling them to focus on their core competencies. The result is an accelerated time-to-market, reduced total-cost-of-ownership and improved overall application with leading-edge, highly-reliable embedded technology.

Kontron is listed on the German TecDAX stock exchanges under the symbol "KBC".

For more information, please visit: www.kontron.com

CORPORATE OFFICES

Europe, Middle East & Africa

Oskar-von-Miller-Str. 1
85386 Eching/Munich
Germany

Tel.: +49 (0)8165/ 77 777

Fax: +49 (0)8165/ 77 219

sales@kontron.com

North America

14118 Stowe Drive
Poway, CA 92064-7147
USA

Tel.: +1 888 294 4558

Fax: +1 858 677 0898

sales@us.kontron.com

Asia Pacific

17 Building,Block #1,ABP.
188 Southern West 4th Ring Road
Beijing 100070, P.R.China

Tel.: + 86 10 63751188

Fax: + 86 10 83682438

kcn@kontron.cn

