

# ► Kontron Solutions@Work

We create digital brains for a more intelligent world

Put to the Test: The CompactPCI Board in Digital Trunk Radio over IP

## ► In Use from Brazil to Siberia

„Our infrastructure systems for digital trunk radio operate in Siberian Yekaterinburg and in tropical Brazil,” explains Román Abadias with obvious pride. Román Abadias is the product manager for Spanish company Teltronic, with headquarters in Zaragoza ( Spain) and a staff of 245. With this statement he has summarized the challenges that his systems must meet: operating flawlessly under extreme climatic conditions and different environmental requirements. To guarantee these results, Teltronic



Román Abadias, Product Manager from Teltronic

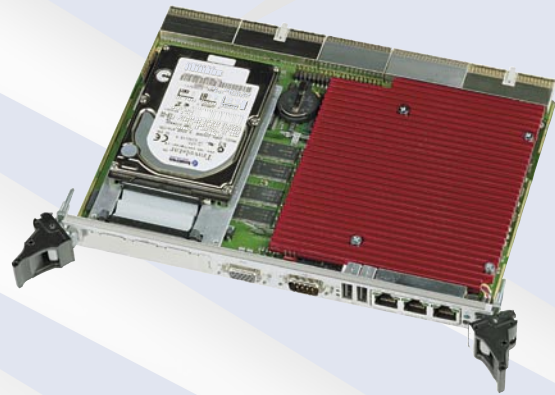
employs the 6U CompactPCI boards and systems from Kontron in its infrastructure components.

Teltronic, which has been offering professional radio communications solutions since 1974, is among the leading international infrastructure providers of digital trunk radio networks. Their technology is widely used throughout the world, and now their march to success, although somewhat delayed, has also begun in Germany. While several companies have already begun using digital radio in this country, for example the public transportation systems in Cologne and Berlin, the formal bid process for the development of the digital BOS radio system (BOS = Public Safety Authorities and Organizations) began in the spring of 2004. This was to have been in place by the world championship year of 2006, but this is no longer feasible. The contract for the construction

of the network will not be awarded until the spring of the championship year.

Along with the public safety authorities, other users of digital trunk radio include enterprises in transportation, commerce, construction or raw material mining. With it they are adapting their commercial radio networks (Private/Professional Mobile Radio, or PMR) for digital voice and data communications.

TETRA, or Terrestrial Trunked Radio is rapidly becoming the technical standard for digital radio. This mobile



radio system was developed under the auspices of the European Telecommunications Standards Institute (ETSI) and has since become recognized and employed worldwide. Approximately 80% of all digital trunk radio installations are presently operating according to this standard, estimates the Swiss National Communications Office. The future of the competing TETRAPOL technology seems less rosy. This standard, developed in the 1980's by Matra in France, has not attained the status of an open European standard. Teltronic has cast its lot in with the more promising TETRA technology.

## Professional Communications Solutions

Digital trunk radio is designed for professional communication within organizations and businesses. On the other hand, the well-known GSM networks of the large telecommunications providers are designed for the general public. Along with the "usual" functions of the mobile radio networks and the simultaneous transmission of voice and data, TETRA offers a few "specialties" which are of particular interest to public and commercial organizations.



With TETRA, subscribers can communicate in various ways: in normal telephone mode, in two-way radio mode, or in group communication mode. In this way, a subscriber can dial many parties at once - for example, in the case of an emergency call - or a pre-defined group can constantly monitor the network, with individual subscribers able to communicate individually at any time.

TETRA is substantially faster than GSM networks. It takes only 0.3 of a second (instead of 5 seconds) to complete a connection between two end stations. The data throughput is higher as well: instead of 9 kbits/sec, information passes over the TETRA network at a rate of 28.8 kbits/sec.

Since TETRA also offers packet data services, mobile sets can also access the public internet without difficulty if a corresponding connection to the World Wide Web exists at one point along the TETRA network.

As with a local area network (LAN), the subscribers use the internet service or even WAP without cost, as long as the user organization itself belongs to the net. Only the connection to the outside world must then be paid for.

The security functions that TETRA offers are especially important for public safety organizations. Conversations can never be listened to, since voice and data transmissions are encoded. In addition, the telecommunications data and subscriber identities are also protected by keys, so that neither movement patterns nor the subscriber identities of the communications partners can be analyzed. The users of trunk radio can take security one step further by using dynamic keys, the use of which is provided for by TETRA.

Police, fire departments and other "in-the-field" organizations can operate in areas where no radio cells are installed. In order to make communication possible in these areas, TETRA-handhelds operate over limited distances without base stations, similar to classic walkie-talkies.

### TETRA Infrastructure and Teltronic

TETRA networks consist of radio cells covering about 4 square miles each. A central computer directs the entire system which includes base stations, terminal devices, gateways and network management systems. It manages the radio channels and voice paths, the radio subscribers and the communications between the individual base stations. With Nebula, Teltronic offers the complete infrastructure for a TETRA network structured in this fashion. The system is already in use worldwide, from South America to Kazakhstan. The Madrid subway system, the Real Madrid stadium and the shipping port of Rotterdam can be found among Teltronic's stellar references. In addition, the buses in Gdansk (Poland), Nice, Bordeaux, Marseilles, Valenciennes (France), Barcelona and Lisbon operate using Teltronic technology.

A TETRA system also serves the following purpose: users can always rely on its fail-safe functionality. Interruptions in service can rapidly endanger the existence of an entire company or the security of a nation. Teltronic has carefully selected the technology and technology providers for its systems.

### **Nebula and CompactPCI**

As one of the first providers, Teltronic has developed and successfully distributed a trunk radio system with an Ethernet/IP-Backbone, called Nebula. Currently, most other infrastructure systems still use traditional circuit switching\* with the internet protocol instead of packet switching, which is now technically possible with the introduction of the Gigabit Ethernet. Ethernet makes trunk radio systems considerably faster than the prevailing circuit switching technology. With the Ethernet backbone, Nebula can also be easily and economically integrated into existing local area networks. In addition, the Teltronic system makes use of IP services for network management, for example software upgrades over FTP, system configuration over HTTP or system monitoring via SMTP.

“In the future, trunk radio and other mobile radio networks will be based on Ethernet/IP and packet switching. With Nebula, we have established ourselves as the technology leaders in this area,” says Romàn Abadías as he explains the fundamental product design of the Teltronic trunk radio infrastructure. “In order to use TCP/IP we integrate CompactPCI-based systems into our infrastructure equipment, since they give us the necessary performance and scalability, are very available, and at the same time make Nebula extremely robust,” he continues, explaining why Teltronic uses the robust version of the PCI bus. As described above, robustness is among the most important requirements demanded of a trunk radio infrastructure. “CompactPCI is the only technology that can guarantee the quality and stability which will ensure fail-safe operation under the extreme climatic conditions which prevail in the tropics or on the frozen steppes of Russia. And in the event that single components should fail, they can be exchanged during operation with the hot-swap function which Teltronic systems also support. If desired, Teltronic will increase protection against failure even further with redundant design of infrastructure components.

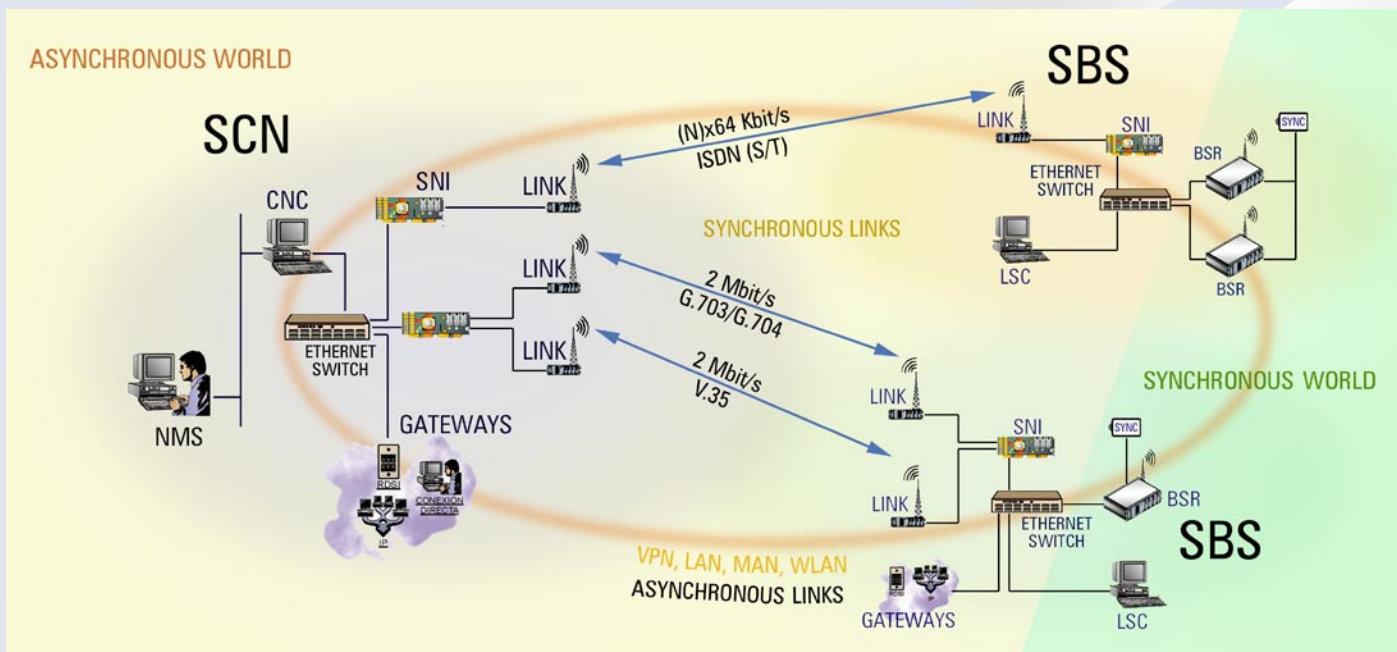
### **From CompactPCI to Kontron**

Teltronic had identified 15 potential suppliers worldwide which were able to deliver CompactPCI systems in the desired configuration. One preliminary requirement reduced the circle of providers: the prospective partners must be in Europe. Unsatisfactory experiences with Asian manufacturers led Teltronic to demand this as a selection criterion during the evaluation. In one installation in South America a Chinese-built component failed, and due to language, communication and cultural difficulties a replacement took three months to procure.

Of the four companies which remained on Romàn Abadías’ list after this selection, Kontron AG won the bid. First of all, Kontron’s technical offering was convincing; the market leader for embedded systems offers a complete CompactPCI portfolio that covers every requirement of this robust technology. Customers can obtain from a single source 3-U and 6-U single board computers with varying characteristics and all essential processors, tailored for cost or performance, with or without extended temperature range, and always robust.

With respect to the “geographical criterion”, Kontron also offered the optimum: the company, with worldwide operations, has its headquarters in the European city of Eching, and is present in the Asia-Pacific region, in Canada and in the USA with strategically placed offices and production facilities. In addition there are sales offices in twenty additional countries, among them Spain. Romàn Abadías thus has not only Spanish-speaking contacts on-site, he can also be sure that his clients worldwide can obtain rapid and direct support.

An additional important criterion was the fact that Kontron could guarantee delivery of the boards for a period of 10 years. Furthermore, Kontron was in a position to provide for Teltronic’s specific customization requirements. In this way, the Kontron boards and systems were given a customer-specific front panel which corresponds to the corporate design of the Spanish company



### Application of CP604 and CP605

Teltronic systems specifically use the CompactPCI boards CP604 and CP605. The CP604 operates in the central network controller (CNC) of the Teltronic TETRA infrastructure. As the central processor, the CNC is the "heart" of each trunk radio network installation. Each controller manages up to 256 base stations. It transmits user conversations within 2 milliseconds with absolute reliability in a temperature range from -22 ° C to 55° C. In the basic CNC there is a single CP604 Board, in the CNC-Pro there are four. The CP604 is a proven board for use under extreme conditions. As a processor, an Intel Low Power Pentium III at 700 MHz or 400 MHz is used, which uses 30% less energy than its desktop cousins. As a result of the decreased thermal output, it can operate at a case temperature of up to 85° C, a point which is especially important for Teltronic.

For RAM, up to 1 GB soldered PC100 SDRAM is available to the processor. On the board, a pre-mounted socket can accept a flash disk module or a 2.5-inch IDE-compatible hard drive. Available interfaces include four serial, one parallel, two USB and two fast Ethernet ports. The COM2 interface can also be exchanged for a VGA CRT or a VGA-LVDS port. Naturally the CP604 can be hot-swapped, a technology also used by Teltronic. For optimal system management, an optional Intelligent Platform Management Interface (IPMI) is

available, which Teltronic uses for remote maintenance of the CNC.

The CP605 provides the necessary computing power to the network management system (NMS) configured with the Nebula. It delivers the Intel Pentium 4 in a 478-pin microFCPGA housing from 2 GHz to 2.4 GHz, or with the power-saving M version from 1.2 GHz to 2.2 GHz. For RAM, up to 1 GB soldered PC266 DDR SDRAM is available to the processor. An additional gigabyte can be added as a DDR SODIMM via a 200-pin socket. The CP605 is also optimally configured for communication: two Gigabit Ethernet, one Fast Ethernet and five USB 2.0 ports are available, in addition to five serial ports.

### The future: CP6000

CP604 and CP605 are proven CompactPCI boards which have been on the market for a substantial time. Teltronic is currently evaluating the next generation of boards from Kontron for Nebula, and it is envisioned that the NMS will, in the future, operate with the CP6000. The CP6000 belongs to a two-pronged initiative which Kontron has recently introduced, and which will be complemented by the CP6011. While the CP6011 is uncompromisingly designed with performance in mind for broadband-intensive applications, the more economical CP6000 maintains a balance between price and performance.

Both boards are equipped with the Intel® Pentium® M Processor, operating at 1.1 GHz, 1.6 GHz or 1.8 GHz. The 1.8 GHz of the Pentium M corresponds to the performance of a conventional Pentium 4 at 2.6 GHz to 3.0 GHz. At 1.8 GHz, the Pentium M equals the performance of a conventional Pentium 4 at 2.6 to 3.0 GHz. From the perspective of energy consumption, the Pentium M provides the same performance with only half the power dissipation of a Pentium 4, thus emitting substantially less heat, requiring less cooling and tolerating higher operating temperatures.

The highly-integrated and compact CP6000 offers high-capacity PCI-X performance to the PMC slot, an optional 2.5 inch hard disk and Compact Flash on board. All these features are usable by the CP6000 at the same time. This is made possible by the Intel 6300ESB I/O controller hub, the newest I/O technology such as Serial-ATA150, USB2.0, and two PCI buses. USB 2.0 allows for data transfer rates 40 times greater than USB 1.0. Faster and more reliable RAM (ECC) delivers up to 2 GB SDRAM with PC333 on two 200-pin SODIMM sockets. The CP6000 with 1.1 GHz is also available for extended temperature ranges of -40°C to +85°C. With its integrated graphics controller, the 855GME chipset of the CP6000 produces high-resolution images and multimedia-quality videos. The controller with Intel's Extreme Graphics 2 Technology (2D/3D graphic accelerator) displays screen images with a resolution of 2048x1536x8bit/60Hz pixels. In addition to VGA, USB, and COM ports, the CP6000 has on its front panel a series of user-programmable LED's which can be used for debugging and diagnostic purposes.

### Conclusion

"Kontron's role is extremely important for market success. We entrust the functionality of the central infrastructure elements of our trunk radio system to our partner's CompactPCI boards," concludes Romàn Abadias, emphasizing the significance of Kontron for Teltronic. "Following our company's philosophy,

we are continually seeking new innovations in order to supply our clients with forward-looking solutions. And from this perspective as well, with its constantly expanding product line, Kontron is the right partner.



### \*Circuit Switching

Until today, almost all mobile radio networks have been based on circuit switching. Using this concept, a call is directed over a fixed route from point A to point B. During this time, nothing else can traverse this route. The data packets are sent one after the other and arrive at the addressee in a tidy sequence. With packet switching, used also by TCP/IP, the data packets travel to the receiver over different routes and are reconstructed only after being received. Since as much data as necessary can be underway at the same time, significantly more data can be transmitted than with circuit switching. It is not guaranteed, however, that the packets will arrive in the correct order. As a result, the receiver can never tell with precision when a call is complete. With data this is not a problem, but with voice transmissions it can be, since delays in the dialogue are possible. The problem has only been resolved with Fast- or Gigabit Ethernet. With these methods and with prioritization technology, call data are transmitted so fast that the quality of service - in this case voice quality - is absolutely sufficient. Teltronic operates therefore on the assumption that in the future, only TCP/IP-based radio networks will be produced.

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