CompactPCI comes through for XXVIII Summer Olympics

By Andrew Brown

At the XXVIII summer Olympic games, transportation won high marks. As Arizona Republic writer Dan Bickley, who covered the games, wrote, the predicted "transit nightmares never materialized."[1] In this article, Andrew describes the role that CompactPCI 3U boards played in informing and entertaining passengers riding the trams in Athens.

Technology in use – 3U CompactPCI

The merits of the CompactPCI open standard have always topped the wish list of automation and transportation applications, yet the initial investment cost tended to drive the trend towards the Industrial PC (IPC). However, due to the flimsy edge connectors associated with motherboard design and poor long-term availability, the IPC's days are numbered. This apparently cheap technology is proving too costly in the long run for OEMs emphasizing availability, reliability, and maintenance-free operation.

This past summer, 3U CompactPCI multimedia systems rode the trams of the Greek transportation network that links many Olympic sites with the center of the city. These passenger information and entertainment systems are based on the Multimedia Onboard Information System (MUBIS) computer system from Inova Computers and associated remotely connected display monitors. (See Figure 1).

The MUBIS servers are based on the 3U CompactPCI open standard, which combines the benefits of PC compatibility, such as readily available silicon and off-the-shelf software, with a small, extremely rugged form factor that can endure the extremes of temperature, shock, and vibration that are common in transportation applications. The transportation segment is just one arena where 3U CompactPCI is stacking up success after success.

Figure 1

In operation, the passenger infotainment screens display relevant track numbers, final destinations, stops, and connection information. In addition, passengers were kept up-to-date with round-the-clock news reports on the Olympic Games. Riders also used the screens to learn about local events, news bulletins, and weather reports as well as to view general advertising and enjoy entertainment.

The turnkey MUBIS servers installed in the Athenian trams (see Figure 2) are Inova 3U, 84HP CompactPCI systems with dedicated graphics boards based on the Radeon R7000 multimedia processor with hardware MPEG-2 decoding. These Inova multimedia platforms already enjoy a large installed base in more than 1,200 passenger-carrying vehicles worldwide. Based on an Intel Pentium M or Celeron M microprocessor, the latest version relies on the high-speed GigaSTAR serial interface for distributing multimedia data in real time across many display units simultaneously. GigaSTAR, being a purely digital transmission medium, is unique among the few alternatives for distributing multimedia in its ability to cost effectively cover large areas without signal degradation and without the need for repeaters. The system can also be equipped for video surveillance – in these times an agenda issue that pops up all too frequently on the public transport operators' wish list for improved passenger safety.

Archived information stored on the hard disk of the MUBIS server is output on the 15-inch, 17-inch, or 19-inch TFT screens for passenger entertainment. In real time, this content together with up-to-date news can be delivered wirelessly through a choice of transmission methods. The MUBIS server, in turn, wirelessly provides feedback on its actual status and other relevant data.

Figure 2

This up-to-date information is downloaded to the MUBIS server at a particular locale such as a tram station by means of a wireless LAN or is sent directly from a central location using the Digital Audio Broadcast/Digital Multimedia Broadcast (DAB/DMB) standards. These methods deliver large amounts of digital data, typically consisting of advertising spots and entertainment clips, across a wide broadcast area to trams and even fast-moving vehicles such as trains.

The main MUBIS server components

Encapsulating the entire electronic assembly of the Media Server is the 3U, 84HP (19-inch) *CoolBreeze* enclosure with its unique compartmentalized air-circulation cooling technology. A dedicated, 8+2 slot CompactPCI backplane for scalable configurations, including video surveillance, forms the necessary framework for an EN50155 certified, small-footprint yet rugged controller for operation aboard mobile platforms in harsh (temperature extreme) environments.

The MUBIS brain – 3U CompactPCI high performance CPU

Thanks to Intel's aggressive pricing strategy for processors within their embedded roadmap, and with help from the Inova CPU product line based on the Celeron M, Pentium M, and Pentium 4 processors, robust systems based on open standards are now available at prices typically reserved for the IPC. Considerable assistance was afforded here by Inova's low-cost strategy for enclosures and power supplies. For example, the power consumption of the Celeron M and Pentium M CompactPCI CPUs can be kept so low that fanless (silent) systems can be built even for applications demanding extended operating temperatures.

The philosophy of the Inova engineers is to be able to integrate a complete CPU family on a single 3U CompactPCI board, as the Inova Pentium 4, Pentium M, and Celeron M CPUs do. Thanks to modern design and manufacturing methods, the whole Intel processor line-up is supported on a single board. With more than 1,000 components, some 9,000 soldering points, and exceptionally high production yield, these processor boards satisfy even the most stringent quality standards, particularly for high-volume batches, and yet do not burden manufacturers with overwhelming production costs.

Very low-emission components and systems result from careful design planning and the intelligent use of EMI-optimized design methods such as the *central blocking strategy* – an absolute necessity for wide-band and high-precision instrumentation and transportation applications where certification is paramount.

In addition to an 8HP CPU version with integrated hard disk, mouse, keyboard, COM, and USB ports, a complete computing platform is available in single slot (4HP) format with CompactFlash socket for harsh embedded solutions (Figure 3). The particularly low power consuming modern Pentium M and Celeron M CPUs (just 9W for the ULV Celeron M clocked at 600 MHz) make it possible to engineer fanless systems destined for use in harsh environments or extremes of temperature. Being passively cooled and free of rotating parts improves the overall system reliability and MTBF, thereby securing the CompactPCI solution prime place in the embedded ranking order.

Able to host all (600 MHz to 2.2 GHz) Intel embedded processors on a single CPU design permits the system to be tailored to the performance requirements of a given application. All processor boards within the CPU family are shipped with an intelligent rear I/O switch fabric by default and high-speed RAM. USB 2.0, both Gigabit and Fast Ethernet, serial I/O, DVI, and mass storage interfaces are accessible through either front or rear CPU panels.

High-capacity 3U CompactPCI UPS module

In transportation applications, it is impossible for the cab driver or conductor to shut down all MUBIS servers in his vehicle, as one does on a daily basis with the ubiquitous desktop PC, before removing the power. However, failing to observe this *graceful* shutdown procedure can have serious consequences the next time the system is booted:

- Data could be corrupted.
- The operating system would need to perform a cleansing operation with its progress displayed on all the connected monitors for the passengers to observe.
- Hardware damage could result.

To avoid these problems, at the end of the day, the vehicle power is simply switched off, and a dedicated Uninterruptible Power Supply (UPS) 3U CompactPCI module takes over to protect the hardware and help ensure problem-free system start-ups.

Figure 3

This industry approved, Inova engineered, intelligent CompactPCI UPS module delivers backup power to the secondary side of any connected PSU. Regardless of selected input power (AC/DC), the universal design of the UPS with its small physical size still packs in all the features of a *full-blown* UPS. A microprocessor manages battery diagnostics and power management functions while a dedicated RS-232 channel handles communication via the CompactPCI bus to a host CPU. The deployment of such a UPS module eliminates all those problems directly attributable to sudden system shutdown:

- Voltage drops
- Brownouts
- Lightning strike and system start-up in all forms of mobile (transportation) applications and across all OS

Through its compact and robust construction, the Inova UPS provides much greater operational reliability and stability than any comparable commercially available device.

Studio software for the complete picture

The MUBIS Studio Framework

All media content and information pass through what is known as the MUBIS Studio Framework with its main component the MUBIS Transfer Server:

- Graphics
- Videos
- Passenger information
- Layout schedules
- Play lists
- Location-specific content
- Service and maintenance data for the vehicles

This allows external content providers or advertising agencies to supply auto-

mated content without any additional intervention from the transport operator. Alternatively, all or part of the content can be created locally with the help of a suite of software tools developed by Inova Multimedia. Naturally, to broadcast this information a transmission network infrastructure needs to be present with one main function – to broadcast information to the distributed MUBIS servers as quickly as possible. The simplest solution consists of one or more wireless LAN stations, whereas more sophisticated networks include digital transmitters (DAB/DMB, Digital Video Broadcast – terrestrial, also known as DVB-T), or even satellite transmission for large area coverage.

Whenever real-time information is required (such as the broadcasting of delay, timetable alterations, and other up-to-date passenger information), the MUBIS gateway is linked to an Operational Control Center (OCC) or the dispatcher responsible for maintaining passenger information. In a similar manner, a Security Control Center (SCC) retrieves surveillance information from the vehicle's installed cameras via removable hard disks, via wireless LAN, or in real-time via GSM.

No software would be complete without the necessary tools to monitor hardware status, vehicle particulars, or even application data. In this respect, several reports are generated by the MUBIS software that address servicing, error logging, and passenger counting.

Success story

Multimedia systems such as those based on the MUBIS are also proving their mettle on another part of the transportation scene in yet another success story for 3U CompactPCI. Outside the confines of public vehicles, they are applying the same computing and interconnect infrastructure to stationary applications at bus and railway stations, ports, and airports. Together, stationary and mobile passenger information systems can deliver a network of information servers that provide coordinated flight, rail, bus, and shipping information in real time to large metropolitan centers. This one time dream is becoming reality.

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[1] *Arizona Republic,* 30 August 2004, Section C, Page 1.