Compact MicroTCA systems conquer the industrial sector MicroTCA Standard

Although the MicroTCA specification agreed in July 2006 was developed with particular focus on the telecommunications market, there has also been very strong interest in MicroTCA in other market sectors from the outset, particularly in industry. Here, however, the requirements are fundamentally different from those of the telecommunications market. Industry does not demand 99.999 % failure security, so full redundancy is not necessary. Many of the system and shelf management functions defined in the MicroTCA standard are likewise surplus to requirements. The goal here, then, is the development of cost-optimized, simplified solutions based on MicroTCA.
Too expensive without modification

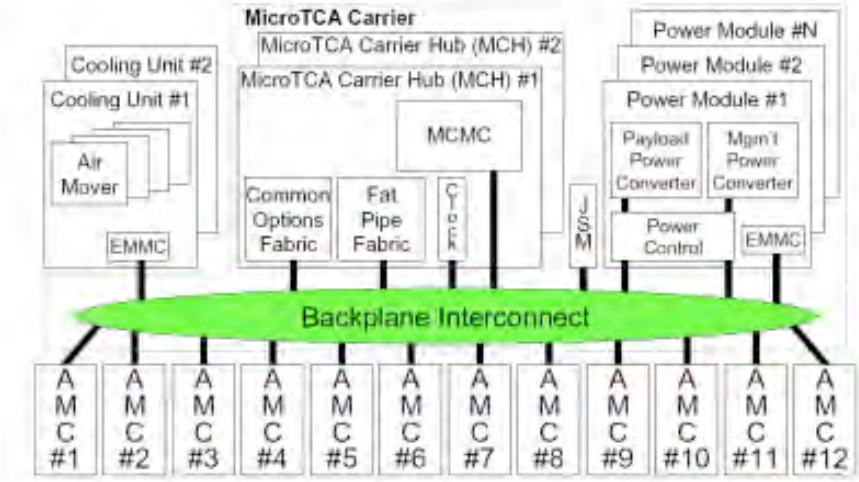

Fig. 1. Too expensive without modification: redundancy and management functions and a large number of system components drive up the cost of MicroTCA.

Streamlining management

The MicroTCA management concept contains a MicroTCA carrier hub (MCH) that on the one hand serves as a data switch, and on the other performs the management functions. It communicates, via an IPMI (Intelligent Platform Management Interface), with both the AdvancedMC modules and the power modules and fan (cooling) units. All AdvancedMC modules and power modules as well as cooling units thus have access to an IPMI controller. The nature of

the task in adapting MicroTCA systems for industrial application is now to reduce this sophisticated management to the minimum necessary components, while retaining the conformity required to allow the use of conventional AdvancedMC modules.

4 x single full-size or 6 x single mid-size

One solution is a MicroTCA cube: 150 mm high, 176 mm wide and 250 mm deep. Here is sufficient space for four single full-size AdvancedMC modules and an MCH (MicroTCA carrier hub). Data connections are star-configured, allowing all of the software protocols defined in the AdvancedMC sub specifications to be used, depending on which MCH and which AdvancedMC modules are fitted. In this solution, ventilation is not controlled. Instead of a MicroTCA power module, a 150 W open-frame power supply unit and AC inlet on the rear is used. The power supply with isolation for individual slots is integrated onto the rear of the backplane. Here also is an interface to which various controller boards for power management may be connected. The lowest-cost version is a time-delay board that ensures that the AdvancedMC slots are powered up only after the MCH slot is energized, so that the latter can boot first. The length of the time delay is adjustable. The delay board ensures the correct booting sequence in the system. The MicroTCA cube also includes two additional controller boards that contain reduced MicroTCA power management functionality. In its simplest form, power is supplied to the AdvancedMC slots only on a command from the MCH. The more complex solution also measures voltages and currents; it cannot, however, be operated by redundant voltage sources.

Fig. 2. Closer to standard: in its industrial MicroTCA system, Kontron has modified only the power supply and cooling concepts. System management is with standard MCHs.

A further solution based on the same chassis is currently being developed. This is based on six AdvancedMC single mid-size slots instead of four full-size slots. Power is supplied by a 300 W power supply unit with sufficient capacity to supply the 6 + 1 modules.

Power, data switch and management to the rear

Being originally developed for the telecommunications market, the MicroTCA specification was largely intended for application in 300 mm deep ETSI racks. The minimum system depth is therefore 197 mm and all components may be inserted from the front. Accordingly, the MCHs and power modules were also defined as modules in the board cage. Both modules are needed for a functioning system, yet they occupy valuable space that could be used for function modules. In industrial applications it is not necessary to conform to this fixed depth of 300 mm including front connections. It then clearly becomes possible to move the power supply unit, the data switch and the management into the rear system area. In a new system design, in addition to the power supply unit already moved to the rear, the functionality of the MCH will be built into a controller board slotted into the rear side of the backplane. The use of different case designs, such as a cube version or a 19" type with horizontally arranged AdvancedMC modules, will widen the possibilities for application.

The main advantage of this solution lies in its modularity. The various controller boards for the management and data switch can be easily adapted to the specific application. The software protocol is thus freely selectable, depending on the modules and switch employed, while the management may be implemented with complex or reduced functionality according to requirement. In this solution, a management card is also used for ventilation.

9 x single mid-size - horizontally

Another solution consists of 9 AdvancedMC single mid-size modules, horizontally arranged in a system 19" wide and 2 U high.

Ventilation is adapted to industrial applications. Two redundant fan units are positioned, left and right, in the board cage; air is sucked to the front right and then drawn back to the rear left. An open-frame power supply unit in the rear section powers the system. A mains power switch is fitted to the left of the front of the system.

This system dispenses with the MCH. Instead, an AdvancedMC slot is configured as a CPU slot. Consequently, ports 4 to 11 are implemented as fixed links to the other slots. A PCI Express x1 connection is made to each slot. Thus the switch functionality of the MCH is surplus to requirements. The carrier/shelf management of the MCH is accommodated in a special AdvancedMC module, the Simple MicroTCA support module (SSM). Power isolation is controlled by the SSM and located on the backplane. Powerbridge replaced the MicroTCA carrier hub with individual support modules

Fig. 3. High cost factor removed: Powerbridge replaced the MicroTCA carrier hub with individual support modules.

The case type and size of this system are only an example. The functionality can of course be integrated into various case designs, such as a cube or even a 19" system with 84 HP width. The major advantage of this system solution over MicroTCA compatible systems is that the power supply module is replaced by a lower-cost solution and no switch is required.

Advantage: Always standard AdvancedMC modules

The various solutions for MicroTCA industrial applications demonstrate that MicroTCA, with its own adaptations, is ideally suited to the industrial sector. The necessary modifications are limited to the omission of functionality that, while crucial to the telecommunications sector, is in an industrial environment either unnecessary or required only to a limited extent. Redundancy is often not required, system or shelf management likewise or only for

simple remote control. In most situations the high data bandwidth expected in telecommunications is not required. For a machine control system, 40 GB/s between two modules is far more than necessary. For such purposes the 2.5 GB/s of a PCI Express link is more than adequate.

Far more important is the fact that in all the system concepts discussed here, standard AdvancedMC modules may be used. Additionally, the flexibility of these solutions is of interest. The user has the choice: he can select either a streamlined system with minimum functionality or one containing one or another additional feature.

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