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Evaluation results of xTCA equipment for HEP experiments at CERN

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The MicroTCA and AdvancedTCA industry standards are candidate platforms for modular electronics for the upgrade of the current generation of high energy physics experiments. The PH-ESE group at CERN launched in 2011 the xTCA evaluation project with the aim of performing technical evaluations and eventually providing support for commercially available components. Different devices from different vendors have been acquired, evaluated and interoperability tests have been performed. This paper presents the test procedures and facilities that have been developed and focus is given to the evaluation results including electrical, thermal and interoperability aspects.

Summary

The Telecommunication Computing Architecture (xTCA) is a series of specifications defined by the PCI Industrial Computer Manufacturer Group (PICMG) including AdvancedTCA (ATCA), AdvancedMC (AMC) and MicroTCA (MTCA). These specifications define a modular standard architecture by establishing physical, electrical and functional specifications and ensuring interoperability. xTCA offers a wide range of form factors and allows different levels of redundancy for power architecture, cooling system and management. This makes xTCA an interesting platform for a wide range of applications such as Military/Aerospace, Communications, Medical and Industrial. In 2009 the PICMG consortium, driven by the physics research community, released the MTCA.4 standard as a complementary specification to the MicroTCA. This specification defines the guidelines for the implementation of Rear Transmission Modules (RTMs) and provides precision timing for data collection electronics. Several independent groups at CERN and in external institutes have started to develop ATCA and MTCA modules and the question arises to how these modules should eventually be housed. In this framework, the PH-ESE group at CERN launched the xTCA Evaluation Project with the goal of providing technical evaluation of xTCA systems with a clear focus on the infrastructure equipment such as shelves, power supplies, power modules, cooling modules etc. The project includes electrical evaluation of power modules, thermal characterization of crates and IPMI functionality tests. The electrical evaluation of the power modules includes static and dynamic regulation tests, efficiency and power factor measurements, ripple and noise characterization and overcurrent protection test. The thermal test aims to estimate the cooling unit efficiency and the airflow homogeneity inside a shelf. The IPMI functionalities of commercial equipment have been tested using a commercial fully automated test suite for testing the Hardware Platform Management Software and IPMC firmware implemented in xTCA based systems. A complete test setup for ATCA and MTCA architectures has been built in our lab. AMC and RTM load modules have been developed in-house for electrical and thermal tests. The control and monitoring of the equipment under test is based on a Labview interface developed to automate the test procedure. During the test phases, several interoperability problems and technical issues have been uncovered and addressed by working in close collaboration with the manufacturers. This allowed us to acquire knowledge and experience with these new architectures. For each component a detailed evaluation report has been written. A number of reports are already available and can be consulted by anyone in need of some recommendation baseline to build up an xTCA system. This paper shows the test procedures and facilities used and reports the evaluation results with a clear focus on the electrical, thermal and interoperability aspects of the tested xTCA equipment.

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