

AMC and MicroTCA as high-performance FPGA platforms

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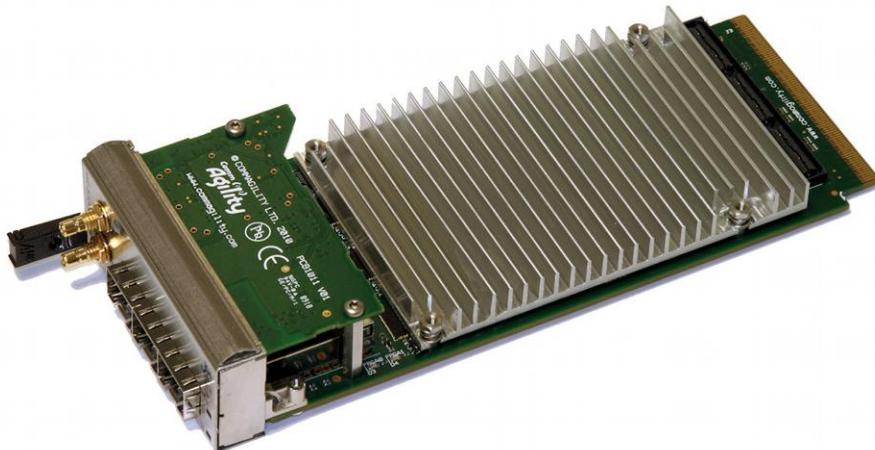
Today's FPGAs provide high processing performance, with the ability to process image or other data at bandwidths of 1GB/s or higher. This means that designers must choose a platform that can provide fast, flexible I/O – as well as meeting physical, cost and power constraints.

Two platforms that designers should consider are Advanced Mezzanine Card™ (AMC) modules and MicroTCA®. The latest MicroTCA.4 specification enables board and module suppliers to provide the high performance, flexible I/O that's needed, while keeping costs affordable. Whether the application is telecoms, mil/aero or anything else, AMC and MicroTCA are worthy of consideration.

MicroTCA platforms have now reached the performance levels needed to keep up with the latest FPGAs, and are smaller and more cost-effective than AdvancedTCA® (ATCA) solutions. MicroTCA.4 platforms support double-width AMCs at 148.8mm x 181.5mm, up to 160W per slot of power and 10GbE or 40GbE of bandwidth.

FPGA-based AMCs in practice

A good example of a current high-performance FPGA AMC is the CommAgility [AMC-V6](#) card. This is based on a Xilinx Virtex-6 FPGA with size options from LX240T up to LX550T, with two banks of DDR3 SDRAM for local data storage or enabling an embedded processor such as the MicroBlaze, which is fully supported in the Xilinx ISE tool suite.



CommAgility AMC-V6

A range of SFP or mini-SAS front panel I/O is provided for external connectivity, and integrated Gigabit Ethernet and Serial RapidIO switches provide maximum bandwidth connectivity to the MicroTCA backplane.

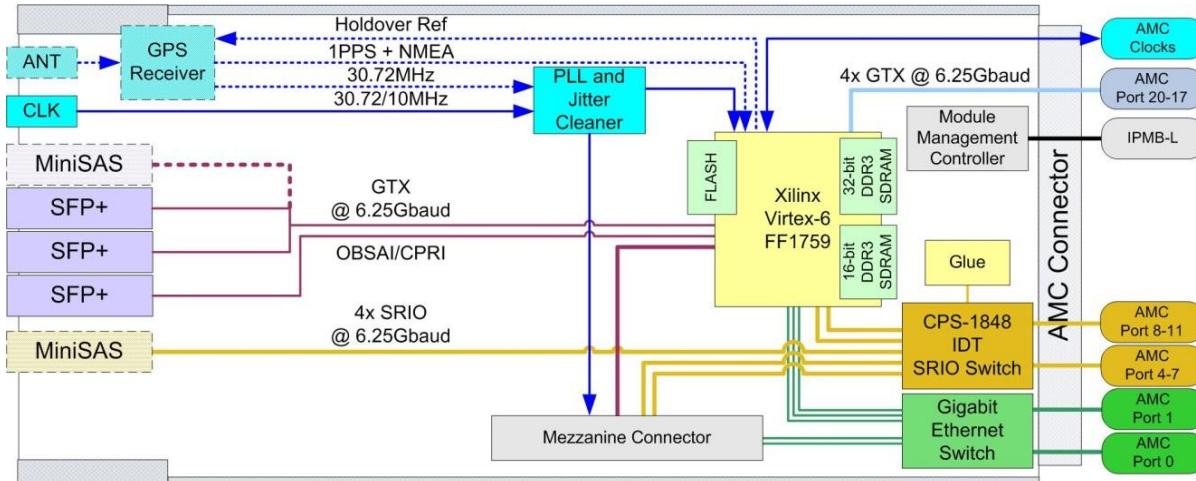


Figure 2: CommAgility AMC-V6 block diagram

The board also has a mezzanine connector allowing for additional expansion. CommAgility has used this kind of connector in its AMC-2C6670 and AMC-2C6678 AMC cards, which include mezzanines with two Texas Instruments Keystone architecture TMS320C6670A or TMS320C6678 DSPs. These, along with an optional GPS receiver, expand the capabilities into wireless processing and timing.

The AMC-V6, while providing enough FPGA performance and I/O capability for many applications, also demonstrates some of the capacity limitations of a standard single-width MicroTCA card. To further increase processing density and I/O flexibility, the advent of MicroTCA.4 allows a new approach to be taken to the architecture of FPGA AMCs. The rear transition module (RTM) allows separation of processing and I/O functionality, increasing flexibility, while the increased area and power handling on the front board allows a significant increase in the amount of FPGA logic which can be included in a product.

Figure 3 outlines an example architecture for a high end FPGA-based AMC card. The AMC front board focuses on maximising the FPGA processing logic available using four of the latest Xilinx Virtex-7 FPGAs, each with dedicated DDR3 SDRAM and FLASH storage. Fully meshed high-speed SERDES connections between the four FPGAs give maximum flexibility for data sharing and partition.

Two of the FPGAs also handle external I/O: one to the AMC backplane, allowing multiple RapidIO or 10Gb Ethernet channels, or x8 PCI Express; and one with 8 SERDES links to the RTM. These, combined with the mesh architecture between the FPGAs, allow the system designer to implement a wide range of different data partitioning or data flow architectures, or a combination of both. The main AMC front board also includes an Ethernet switch to distribute Gigabit Ethernet links to all FPGAs and the front panel for control and maintenance purposes, and distribution of timing and synchronisation from the RTM to all FPGAs.

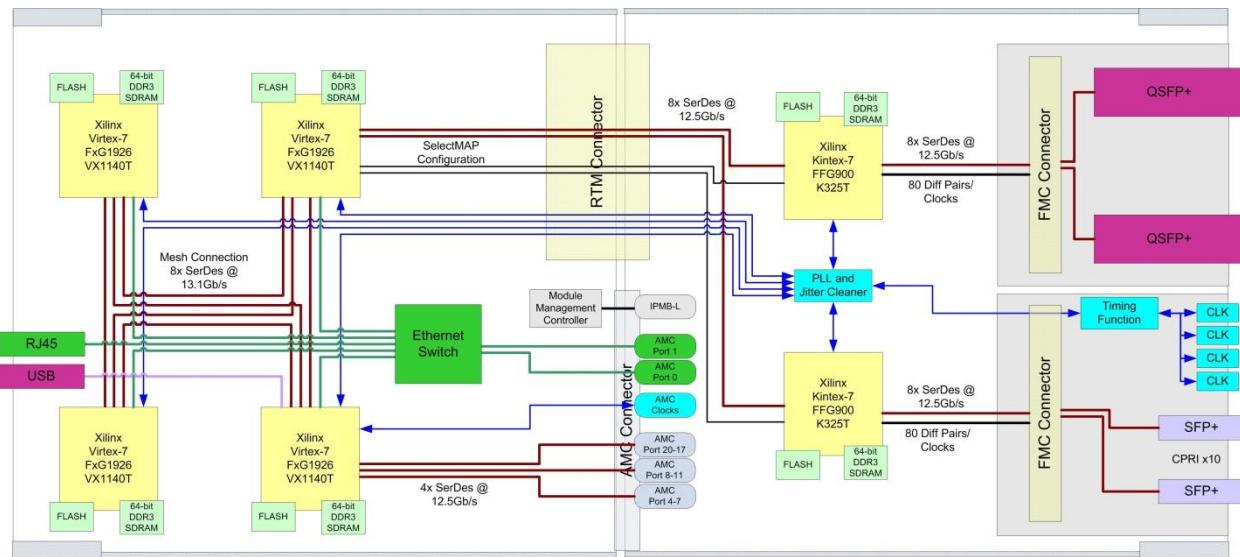


Figure 3: Example architecture for high end FPGA card

Turning to the RTM, the example architecture uses the FPGA mezzanine card (FMC) standard to allow a wide range of COTS analogue and digital I/O modules to be fitted. A Kintex-7 FPGA connected to each FMC site provides the high and low speed digital connections to the FMC and allows local management and control of the I/O, allowing the main FPGAs on the AMC to focus on the data processing. In addition, the RTM has a flexible PLL to manage timing and synchronisation between the I/O and the AMC front board.



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Conclusions

Choosing the right platform for an FPGA design is a critical decision. In today's environment, time-to-market and development costs are big factors, so COTS modules and boards can be the right choice.

For many applications, ATCA may be too large, older MicroTCA systems may be too small and VPX may be over-specified and hence costly. Newer MicroTCA.4 platforms and standard AMC modules will be the right solution for many designers – providing high processing density, excellent I/O and flexible configuration options, in a compact and affordable form factor.

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