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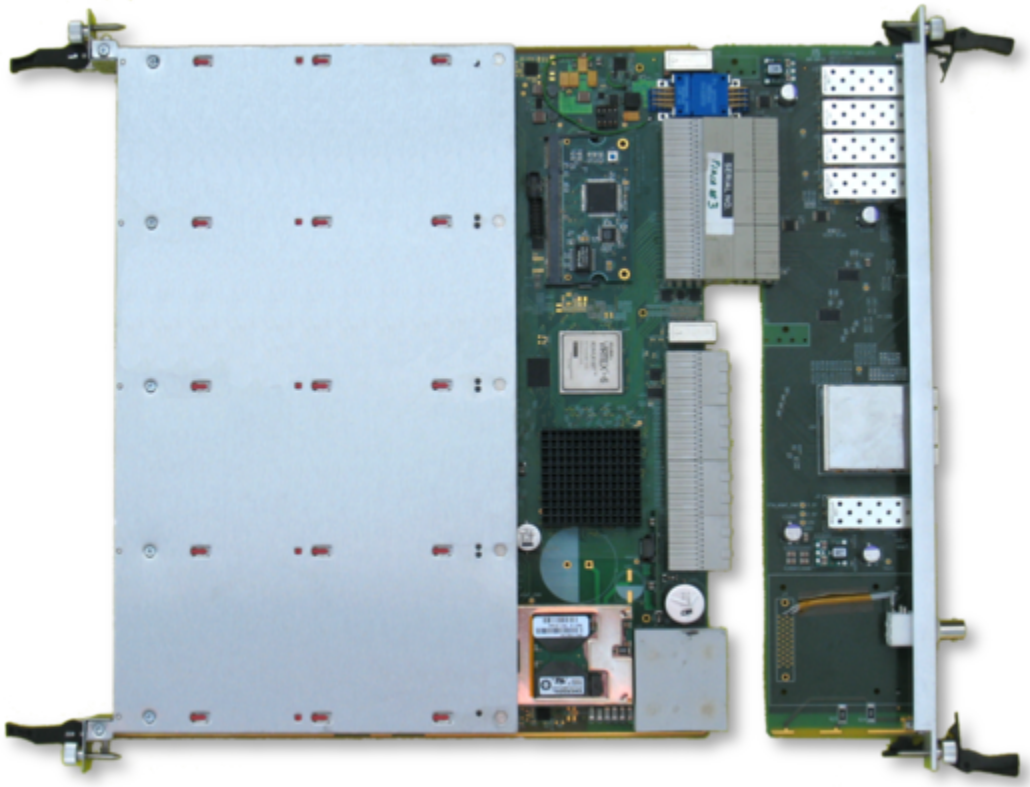
Development and production:

- Board Status

DATASHEET

The ATCA-PTSW-AMC4 board (Pcie and Timing SWitch with 4 AMC slots) is a cutaway quad-AMC module carrier, compliant with the ATCA (PICMG 3.0) specification and compatible with the ATCA extension for Physics (PICMG 3.8 ARTM). Most mid/full-size AMC modules available from industry can be installed in the board.



The AMC slots support a broad range of AMC module types, including Digitizers, Waveform Generators and Processor cards (up to Intel i7 or Xeon processors).

When a connection to an external computer is required, a COTS PCIe host adapter card (16x, 8x or 4x) shall be installed on the host computer and a PCIe Cable (up to 7 m) shall be connected from host to carrier. Alternatively, some manufacturers also supply PCIe 4x fibre optic cables, suitable for longer distances.

Multiple-processor configurations using virtual PCIe switches are also feasible:

1. ***n*** individual domains each with one root-complex processor (an example is shown in this page);
2. one domain with one root-complex processor and ***n*** non-transparent PCIe processors;
3. a mixture of both configurations.

Details of the ATCA-PTSW-AMC4 board can be found on the Technical User Manual.

The board main charateristics are summarized below.

PCI Express switch

PCIe data switching performed by a PLX PEX8696 (PCIe Gen 2), which interconnects:

- 13 fabric channels (×4 links), connecting up to the other 13 PCI Express (PICMG 3.4 R1.0) compliant modules
- 4 AMC modules (four ×4 PCIe links - AMC.1 R2.0)
- 1 RTM module (one ×16 PCIe link)
- Onboard FPGA (one ×4 PCIe link, PCI Express® External Cabling R1.0.)

Any of the PCIe links listed is settable as "upstream" (where the PCIe host is connected).

Clock/timing distribution crosspoint-switch

The ATCA, AMC and RTM timing/clock lines are managed and routed by a crosspoint-switch implemented on a Virtex-6 FPGA, which:

- Distributes clocking and synchronization signals to/from compliant AMC/RTM inserted modules.
- Interfaces to ATCA clock and synchronization bus: for clock distribution to compliant modules within the shelf.
- Routes any clock signal source from any of the AMCs, from the RTM, from the ATCA backplane or even locally generated in the FPGA, to any synchronization input.
- Other external synchronization signals may be input through the RMC module on the RTM card. Currently, IEEE-1588-2008 and standard TTL clock/trigger sync interfaces are available.

AMC/RTM clock lines	function	ATCA "clock & sync"
TCLKA (slot 2) or TCLKB (slot 1)	synchronization clock (100MHz)	CLK1A (slot 2) or CLK1B (slot 1)
TCLKC (slot 2) or TCLKD (slot 1)	absolute time (IRIG-B)	CLK2A (slot 2) or CLK2B (slot 1)
FCLKA	PCIe reference clock	CLK3A (slot 2) or CLK3B (slot 1)

(Correspondance between "ATCA clock and synchronization interface" and AMC/RTM clock lines and respective function (middle column). "slot 1" / "slot2" indicates that the particular signal is active when the ATCA-PTSW-AMC4 front board is inserted in slot 1 / slot 2.)

Rear Transmission Module

The rear transmission module is compatible with the PICMG 3.8 (ARTM, "Zone 3A") standard. The card provides digital connectivity on the back-panel of the ATCA shelf and contains the following interfaces:

- PCI Express over-cable iPass™ connector (16× or 8x or 4x links)
- Ethernet port on SFP connector (1× link) connected to the AMC1 slot .
- External Timing module mezzanine: such as RMC-TMG-1588 (IEEE-1588-2008 over Ethernet sync to an external Grand Master Clock).
- Four SFP connectors (x1 each), connected to the FPGA’s MGT transceivers; furthermore, 8 LVDS pairs from the FPGA are connected to the SFP transceiver control lines (2 pairs/SFP).

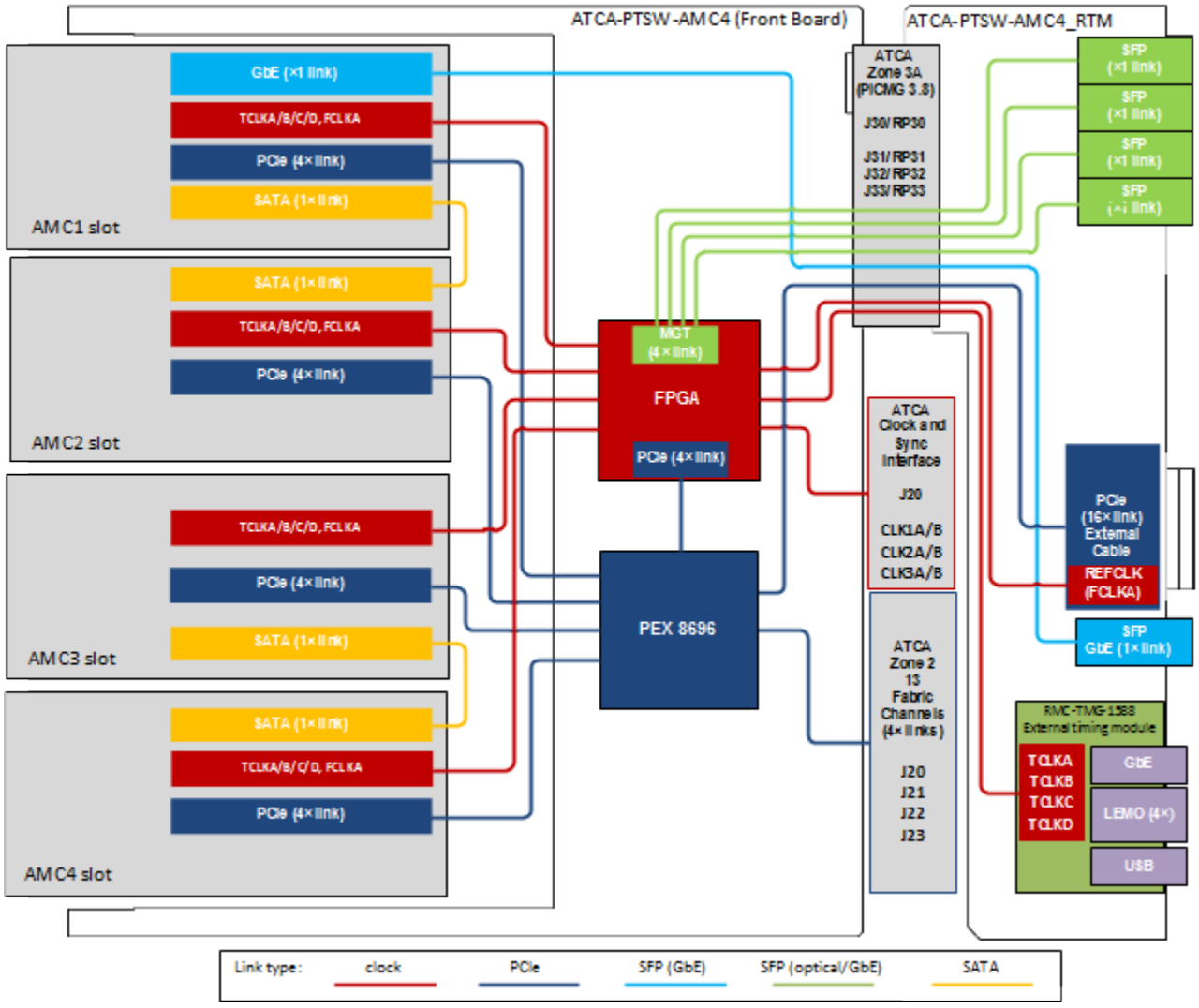
- One x4 RapidIO channel and 8 LVDS pairs connected to each AMC slot are also available for future expansion.

Two RTM cards for connecting to external PCs are currently available:
- ATCA-PTSW-AMC4_RTM
  (one PCIe cable x16 plug)
- ATCA-PTSW-AMC4_RTM844
  (one x8 + two x4 PCIe cable plugs)

Other interfaces

- CoreIPM OPMA2368 IPM Controller
- Serial EEPROM for PEX 8696 configuration

Figure 1 - Board interfaces.

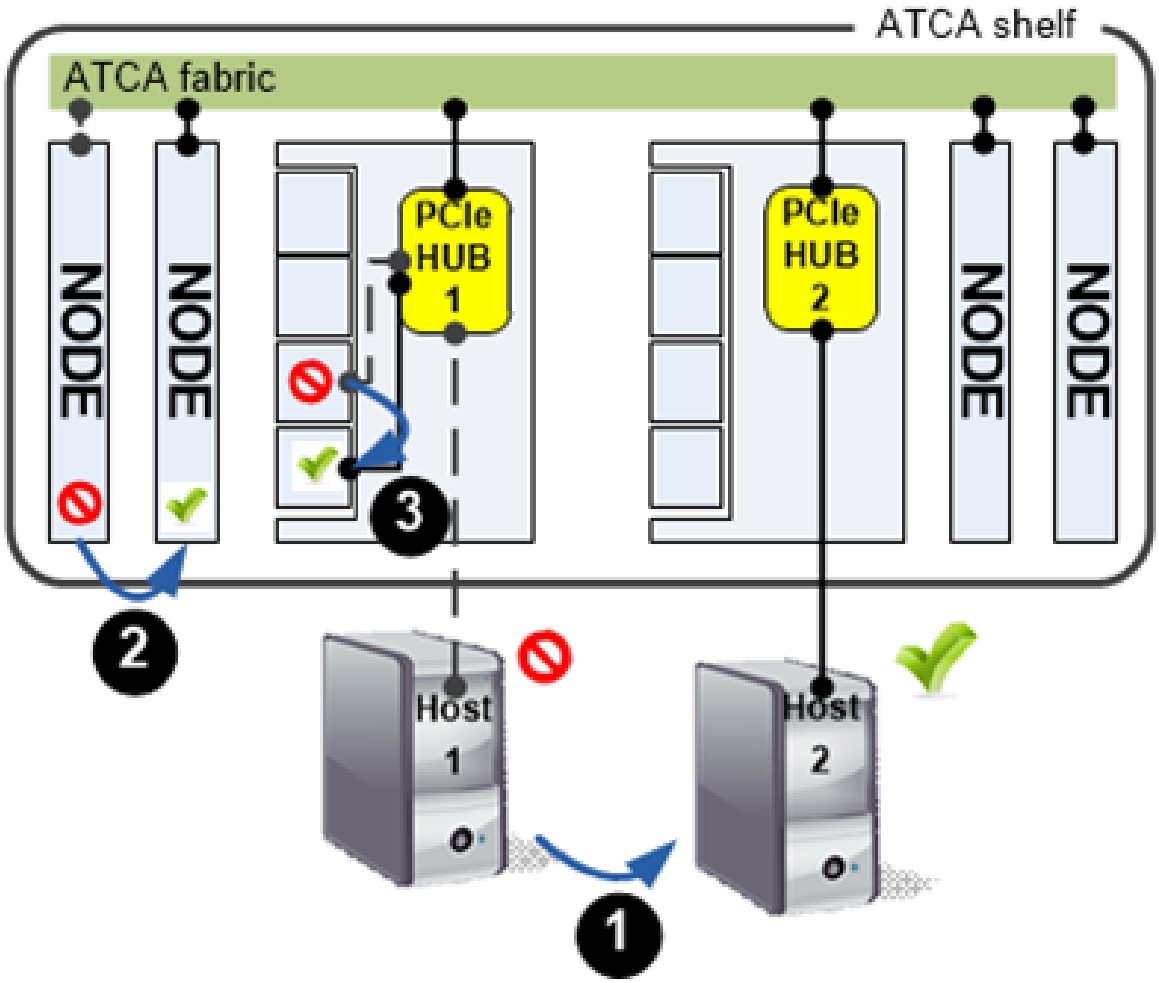


Multi-processor and redundant configurations

Redundancy schemes for High Availability

Several redundancy schemes can be implemented, supported by the ATCA IPM Controller/ Shelf Manager.

The flow of data is assigned to spare units upon fault detection:



1. Spare PCIe host stands in for faulty host (“active-standby” 1+1 host redundancy)
2. N+1 redundancy of node boards
3. N+1 redundancy of AMC cards

Multi-processor configuration

The following figure shows an example of a 5-domain multi-processor configuration where an ATCA-PTSW-AMC4 card is configured as 5-virtual-switch hub (SW-H).

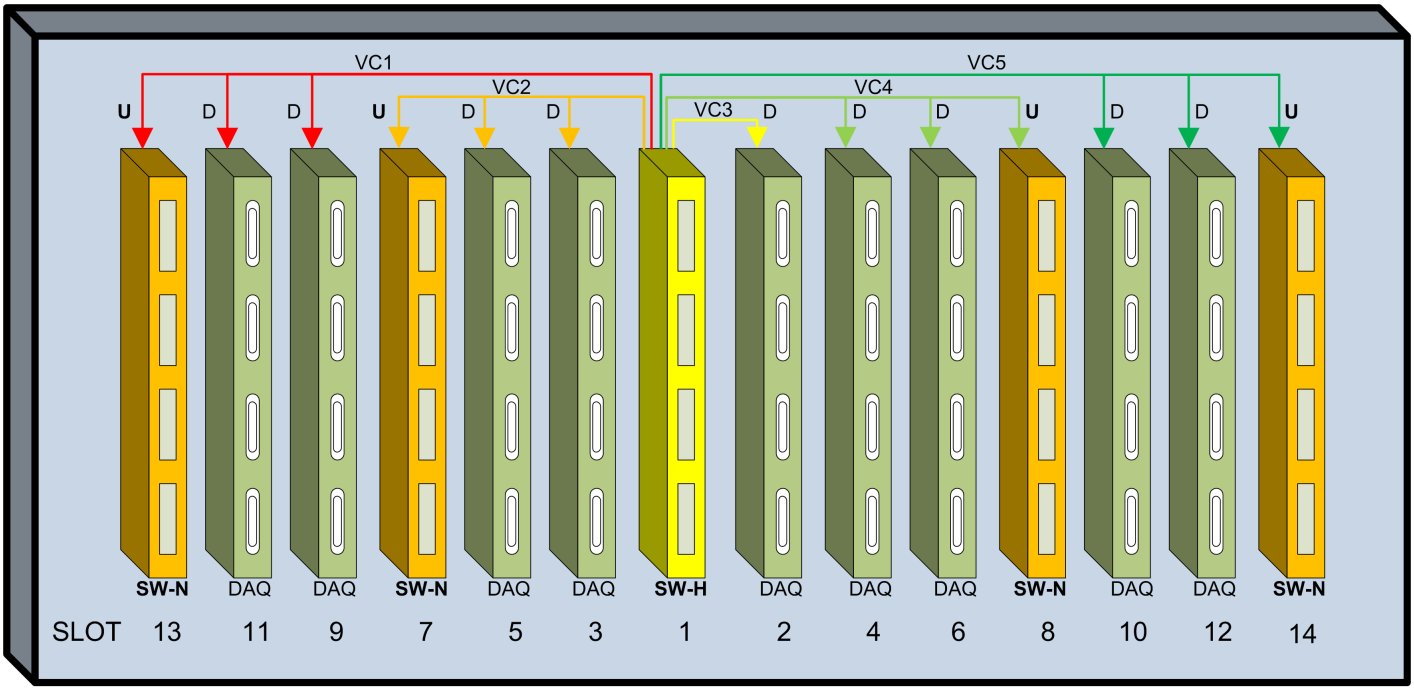
Each of the five PCIe virtual circuit of the SW-H card connects to upto three node cards:

- an ATCA-PTSW-AMC4 card configured as a processor carrier node card (SW-N) (on VC3 it's the SW-H card),
- up to two DAQ cards (except on VC3: just one DAQ card)

Upto 5 processors modules can be inserted in each ATCA-PTSW-AMC4 board (4 AMC and 1 external using PCIe Cable), only one of them configured as PCIe Upstream.

SW-H and SW-N cards will differ only on the PCIe switch settings (PLX PEX8696), which may be fixed (e.g. 2 different board types) or field programmed through the IPMC. No modifications to the DAQ cards are required.

Figure 2 - Five ATCA-PTSW-AMC4 cards using 5 PCIe switch virtual channels.

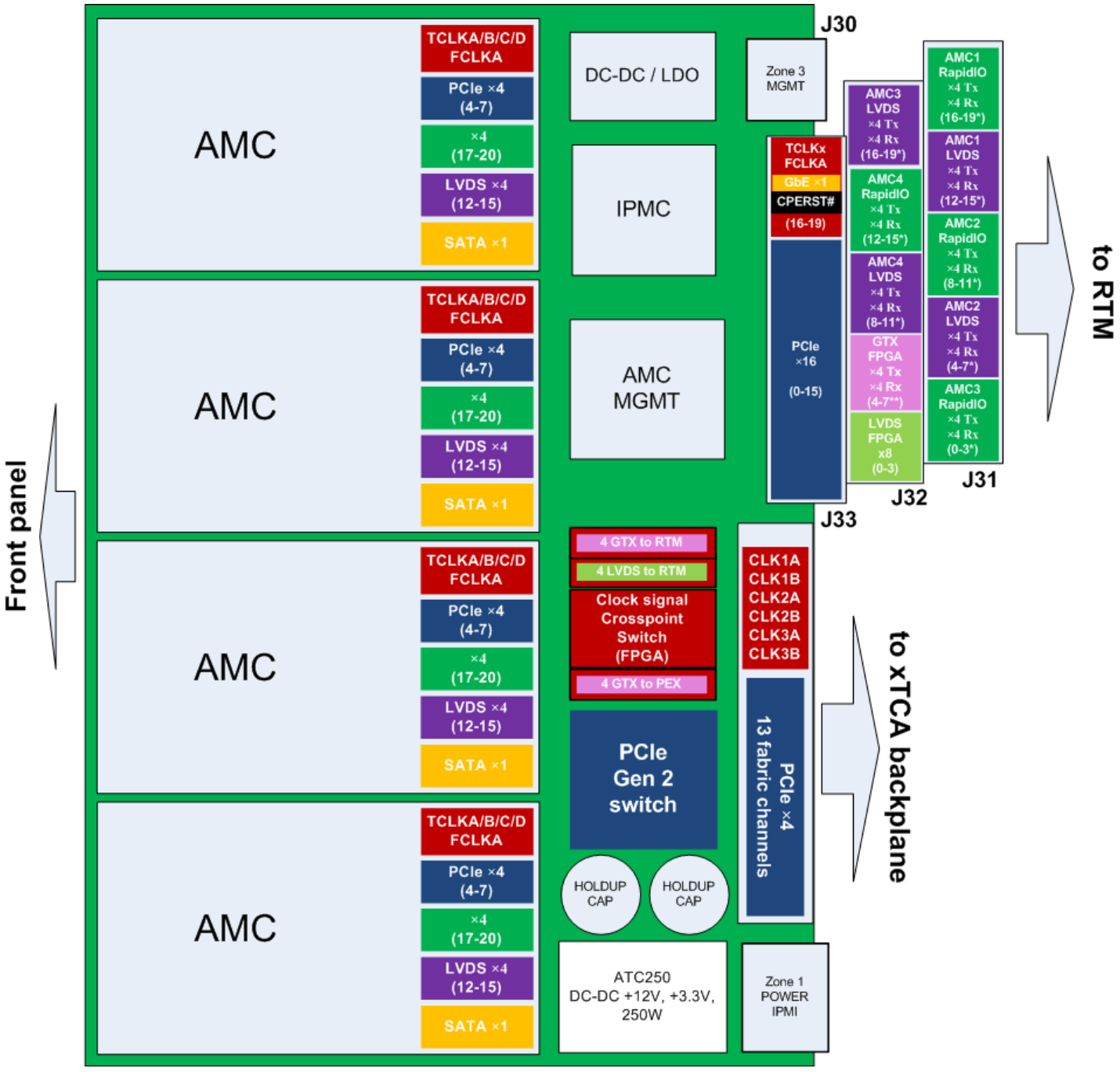


- SW-H – ATCA-PTSW-AMC4 PCIe switch/hub/carrier card configured as a virtual hub (5 virtual PCIe switches, 4 upstream channels, 9 downstream channels on the ATCA fabric interface).
- SW-N – ATCA-PTSW-AMC4 PCIe switch/hub/carrier card configured as a node (PCIe 4x on Channel 1 only). A version of this card with a PCIe 4x ports on Channel 1 and configurable LVDS/MGT ports on Channels 2-13 is being designed (allowing to implement a full-mesh of data and/or timing channels).
- DAQ – ATCA-IO-PROCESSOR data acquisition node card.
- VC1..5 – Five PCIe Virtual switch Circuits from SW-H; 3 channels per VC (1 on VC3).
- D – SW-H PCIe Downstream channel.
- U – SW-H PCIe Upstream channel.
- SLOT – Logical ATCA Slot.

Other possible configurations are:
- 7 virtual switches each with 7 x [1 PTSW + 1 DAQ card].
- 5 (4+1) virtual switches with 4 x [1 PTSW + 2 DAQ cards] and 1 x [1 PTSW + 1 DAQ cards].
- 3 (2+1) virtual switches with 2 x [1 PTSW + 4 DAQ cards] and 1 x [1 PTSW + 3 DAQ cards].

An alternative configuration:
- Use just 1 ATCA-PTSW-AMC4 card configured for 3 virtual switches on Slot 1.
- Insert 2 AMC processor cards + 1 external PCIe cable computer to the PTSW card.
- Each processor controls up to 4 DAQ cards for a grand total of 12.

Figure 3 - Block diagram of the board.



User Manual

View the User Manual of this board.