Status of the xTCA Common Project

Procurement Framework for ATCA Shelves, Power Supplies and IPMCs

CERN EP-ESE-BE

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Outline

- Overview
- MicroTCA Status
- AdvancedTCA Status
- CERN-IPMC
- Power supplies
Overview

- **xTCA Standards**: Micro and Advanced TCA

- **Goals**:
  - Powering the user blades
  - Cooling the system
  - Interconnecting the different cards

**Status of the xTCA Common Project**

- Up to 450W
- Up to 100Gbps (25Gbps / line)

Hardware monitoring
Status of the xTCA Common Project

Overview

Since 2011:
- User support (Controllers, use of the commercial modules)
- Contact with the manufacturers

<table>
<thead>
<tr>
<th>Year</th>
<th>Events</th>
</tr>
</thead>
</table>
| 2011 | - Project started  
      | - MMC v.1.0  
      | - MicroTCA evaluation  
      | - AC/DC evaluation |
| 2014-15 | - MMC v.2.0  
          | - MicroTCA  
          | - Price enquiry  
          | - Qualification  
          | - Procurement contracts  
          | - ATCA evaluation |
| 2017-18 | - 1st CERN-IPMC version  
            | - ATCA  
            | - Specification  
            | - Price enquiry  
            | - Qualification  
            | - Procurement contracts  
            | - AC/DC Power supplies  
            | - Specification  
            | - Price enquiry |
MicroTCA status

- **Usage of the purchase contract**
  - 65 microTCA crates over 103 (Schroff)
  - Mainly used by CMS
  - Contracts for shelves and DC Power modules

- **Rented at ePool: 3 systems**
  - 3 additional systems are coming soon
  - 3 systems are currently rented

### Components

**MCH:**
- Base module: uTCA standard control
- XAUI fat pipe: 12Gbe switch
- Clock switch
- SFP+: Optical module

**PM:**
- 600W AC/DC Power modules

**Shelves:**
- 12 slots full height / double width
- CMS backplane topology
- JTAG Switch interface

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26/04/2018

ACES 2018
Advanced TCA status

Specifications
- 14 ATCA slots (400W) with RTM (50W)
- Vertical or Horizontal cooling
- Dual Star or Full Mesh topology
- 40Gbps or 100Gbps backplane
- Bussed IPMB
- 1 Shelf man. included

Timescale

<table>
<thead>
<tr>
<th></th>
<th>Horizontal shelf</th>
<th>Vertical shelf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical specification</td>
<td>Q4 2016</td>
<td>Q4 2016</td>
</tr>
<tr>
<td>Technical evaluation</td>
<td>Q1-Q2 2017</td>
<td>NA</td>
</tr>
<tr>
<td>CERN price enquiry</td>
<td>Q2 2017</td>
<td>Q2 2017</td>
</tr>
<tr>
<td>Select contractor (pre-series)</td>
<td>NA</td>
<td>Q3 2017</td>
</tr>
<tr>
<td>Final qualification</td>
<td>NA</td>
<td>Q2 2018</td>
</tr>
</tbody>
</table>

- ATCA Shelf Procurement contract ready for purchase orders by Q2/Q3 2018
Advanced TCA Status: Selected crate

- Vertical airflow
  - Backplane modification: shelf manager slots
  - Perforated area in top and bottom covers
Advanced TCA Status: Selected crate

- Cooling qualification tests
  - Carried out using load blades (Up to 450W)
  - Measurement at the crate level (out of the racks)

**Average delta T. (450W / slots)**

- Delta T. = 35 deg. C (specs)

**Within the specification**

**Delta T VS Power/blade (max. Fan speed)**

- Temperature (°C) vs. Power / blade (W)
  - Temperature (°C) increases with power (W)
AdvancedTCA Status: Selected crate

- Blade level evaluation

- Fan at max. speed

![Thermal image](image1.png)  
33.4 °C

- 150W / zone

- 0W zone - delta T.

- 0W zone

- < 6 deg. C
Advanced TCA Status: Selected crate

- **Power distribution**
  - 6 inputs: max. current per branch of 35Amps
  - Fans are supplied by different branches

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**Bottom fans**

**Top fans**

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26/04/2018

ACES 2018
Advanced TCA Status: Selected crate

- Redundancy and voltage drop
  - Voltage drop measured at 450W
  
  Voltage drop -48V input

  < 300mv (at 48V)

  Redundancy and distribution successfully checked
Advanced TCA status

- Crate selection:
  - Qualification is ongoing
  - First crate was successfully validated (out of 3)
  - Purchase contract should be ready in late Q2 2018

- Rack evaluation is on going and was presented by Claudio Bortolin
  - Performed by the ATLAS technical coordination team
  - Presentation: [https://indico.cern.ch/event/681247/contributions/2929083/](https://indico.cern.ch/event/681247/contributions/2929083/)

- Advanced TCA at the Electronics pool
  - A set of 2 slots ATCA shelves are available for rental via the ePool.
    - Pentair reference: 11990-707

Crate qualification measurements will be presented in details during the xTCA interest group meeting.
CERN-IPMC

- Role of the Intelligent Controller for AdvancedTCA blades:
  - Monitoring sensors, Controlling the system and Ensuring proper operations

- Adaptation from the Pigeon Point solution
  - DIMM-DDR3 VLP form factor
  - Pinout compatible with the existing LAPP IPMC card
CERN-IPMC

- User customizable features (mainly header files):
  - FRU Information (Device ID, Manufacturer info., Product info.)
  - LAN (MAC address, Default IP, slot specific IP, Gateway, Netmask)
  - Modules (AMCs, iRTM/Non-intelligent RTM)
  - Sensors
  - E-Keying
  - Power sequencing

- Python tools to generate configuration files
CERN-IPMC

- NDA Document
  - Protect Pigeon point against extensive distribution
  - Required only for source code access

Diagram:

- CERN
  - NDA
  - Use condition
  - Git access

- Institute
  - Representative person
  - Developer

Original signature scheme
CERN-IPMC

- NDA Document
  - Protect Pigeon point against extensive distribution
  - Required only for source code access

- New signature scheme
  - Coming soon

- NDA and Use condition merged: simplify the signature process
CERN-IPMC

- Automatic tester and development kit
  - Python script to control the tester available on Gitlab

Diagram:

- Connectors
  - 9 AMC ports
  - 35 User I/Os + 16 IPM I/Os
  - Hardware address, handle switch, LED, etc.

- Shelf manager
  - IPMB-0
  - I2Cs

- IPMC slot
  - Serial, Ethernet, JTAG, JTAG Master

- MMC
- CPLD
- Mgt uC
CERN-IPMC

- Ready to be used
  - About 40 mezzanine cards available
  - Can be purchased and used without NDA signature
    - Not customized but operational

- Already used by a few developers (10 mezzanines sold)

- Fully documented: Hardware and Software guide, Pigeon Point documentations and NDA
  - Software user guide documented on Gitlab (access under NDA)

- 10 additional Tester/Evaluation kits in production
Power supplies

Specifications

- Min output power 11kW
- Max. height: 3RU
- Control module (Ethernet connection)
- N+1 redundancy capable
- 95% efficiency above 30% of the max. load
- Minimum 12 circuit breakers

Timescale

- Technical specification: Q4 2016
- Technical evaluation: NA
- CERN price enquiry: Q3 2017
- Select contractor (pre-series): Q3 2017
- Final qualification: Q1 2018

- Modules for qualification have not been delivered yet ...
  - Pre-series expected by the end of 2017
Power supplies

- **Alternative**
  - Eltek 2U rectifier system, Flatpacks, 7.2 kW (lead time: 12 weeks -> not evaluated yet)

- **Power supplies from the Electronics pool**
  - Delta El. power supply SM52-30, 1.5kW (23.-CHF/month)
  - Delta El. power supply SM60-100, 5kW (84.-CHF/month)

- **Single output module**
  - GE CP3500 1U rectifier system, 12kW (available via several distributors, not evaluated yet)
Summary

- **MicroTCA**
  - Equipments were selected and qualified
  - Purchase contracts are ready and used
  - CERN-MMC is released and used in several systems

- **AdvancedTCA**
  - Shelf manufacturer was selected and qualification is on-going
  - CERN-IPMC is released and start to be used by AdvancedTCA blade designers.

- **Power supplies**
  - The modules have not been delivered yet and alternative solutions are evaluated

- **Next steps**
  - Finalizing the AdvancedTCA qualification process
  - Qualify the 100G backplane for the selected ATCA chassis
  - Finalizing the Power supply selection process
  - Continue to provide user support on xTCA infrastructure and management equipment
Thank you

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Advanced TCA blade cooling

Talk from Francois:

- **A word of caution to backend board designers:**
  - Do not preselect your favorite on-board optics module
  - VL+ is presently considering freezing module type and giving you advance notice
  - Run your optics cool or make it replaceable
  - Running at elevated temperature is possible, but will affect life-time
    - Data from one supplier (T is heatsink temperature)
    - T<50degC will result in <1% wearout failures in 15 years (to which random failures will add ~3.7%)
    - T<57degC will result in <10%

Goal of the evaluation:
- Evaluate whether we can get a “cold” zone or not on an ATCA blade?

Impact of a heated zone on a not heated zone

Optics component shall be placed 2cm away from the FPGAs
Advanced TCA blade cooling

- Placement proposal:
Power supply

- **Guardian (UniPower)**
  - 14 kW max output pwr
  - 11 kW with N+1 redund.
  - Based on 5 pwr bricks
  - Up to 12 CB output
  - Ctrl module (SNMP over eth.)

- **Delta Electronics**
  - 3 Versions can be used:
    - 100Amps @48V (4.8kW) [ePool ref: SM60-100]
    - 30Amps @48V (1.4kW) [ePool ref: SM52-30]
    - 20Amps @48V (0.96kW) [ePool ref: SM60-20]