Status of MTCA Infrastructure

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Outline

• Infrastructure Hardware Evaluation
  – MTCA Carrier Hub
  – CPU Module
  – EVR
  – mTCA Shelf
  – Power Module

• Infrastructure Software
  – Operating System
  – Network/Computing Infrastructure
  – MTCA System Manager
  – Timing System Integration

• Infrastructure Task Progress and Future Plans
Overall System

- MCH
- CPU
- EVR
- Cooling Module
- Power Module
## Dimension Definition

<table>
<thead>
<tr>
<th></th>
<th>Compact-Size (3HP)</th>
<th>Mid-Size (4HP)</th>
<th>Full-Size (6HP)</th>
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<tbody>
<tr>
<td><strong>Single modules</strong></td>
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<td></td>
<td>73.8x13.88x181.5mm</td>
<td>73.8x18.96x181.5mm</td>
<td>73.8x28.95x181.5mm</td>
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<td><strong>Double modules</strong></td>
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<td>148.8x18.96x181.5mm</td>
<td>148.8x28.95x181.5mm</td>
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MTCA Carrier Hub Evaluation

• Vadatech UTC002
  – Currently manages the 6 and 12 slot shelves at SLAC
  – Strict MTCA specification implementation
    • Had compatibility issues, but it is now resolved
  – Front panel serial port, Ethernet ports
  – PCIe switching capability
  – Very powerful hardware, will keep exploring the features it offers
Vadatech UTC002
CPU Module Evaluation

- Currently using: ADLINK AMC1000
- Used in all MTCA system, and works well.
- Intel Core2 Duo 1GHz processor
- Front panel serial port
- No front panel Ethernet port is inconvenient
- VGA port, not needed for SLAC environment
- 2/5 hardware failures
- We are also evaluating other CPUs
CPU Module Evaluation

- Have ordered Kontron AM4020M
- Intel i7 processor 2.6GHz
- Dual Ethernet ports on the front panel
- Front panel serial port
- Also ordered Vadatech CPU AMC720, delayed due to silicon vendor delay
ADLINK AMC1000
Kontron AM4020M
EVR Evaluation

• MRF PMC based EVR with Vadatech AMC100 PMC Carrier
• Currently used in all of our MTCA systems
MTCA Shelf Evaluation

• 6 slot shelf vendors
  – Schroff
  – ELMA

• 12 slot shelf vendors
  – Schroff
  – ELMA
  – Performance Technology (Coming soon)
  – Vadatech (Later this year)
Six Slot MTCA Shelf Evaluation

- Available from Schroff and ELMA
- Designed for development; it is easy to use and helpful for development
- Not designed for field use
  - Lack of redundancy
  - Power module is not compatible with MTCA.0 spec
  - Cooling module is not modular
- Working with vendors to upgrade to MTCA.0 compatible for field use
ELMA 6 Slot Shelf
12 Slot MTCA Shelf Evaluation

Schroff
- Slots for redundant
  - Power module
  - Cooling module
  - MCH
- Marginal cooling design
  - Gen. 1 cooling module was non-intelligent
  - Gen. 2 less air flow at power module area
- Problems are resolved by vendor

ELMA (Gen.1)
- Slots for redundant
  - Power module
  - Cooling module
- Initial cooling test is satisfactory
- Had power management control issue
MTCA Shelf Future Work

• Evaluating new ELMA 12 slot shelf (arriving soon)
• New Schroff 5 fan cooling module, will evaluate when it comes out
• Vadatech 12 slot shelf MTCA.4 under development, will evaluate when it comes out
μBlade AC Power Module Evaluation

• μBlade PUMA 600W in Schroff 12 slot shelf
  – Over heats with Gen.1 cooling module
  – Stable in lab environment with Gen.2 cooling module
• μBlade PUMA 600W in ELMA 12 slot shelf
  – Stable with ELMA 12 slot in lab environment
• DESY reports too much RF noise
• Company filed for bankruptcy
• New sources are under development (Ray’s talk)
μBlade PUMA 600W Power Module
Power Module

- Power modules for 6 slot shelf (non-standard)

Schroff power module

ELMA power module
Infrastructure Software

- Operating System
- EPICS (R3.14.12)
- Network/Computing Infrastructure
- MTCA System Manager
- Timing System Integration
LinuxRT OS

• Assemble only what is needed for the system
  – Linux kernel 3.2.13 (RT_PREEMPT patch is available)
  – μClibc: “small” footprint C-library
  – Busybox: provides most standard unix commands
  – iPXE: provide diskless boot (netboot)

• Real-time bench mark
  – Max. interrupt delay time: \(~44 \mu s\)
  – Avg. interrupt delay time: \(~7.5 \mu s\)

• Able to handle 360Hz (2.7ms cycle time)
• Currently used in LI28-2 LLRF station
• Developed by T. Straumann
Network/Computing Infrastructure

• Develop and test network configuration:
  – DHCP
  – ntp
  – iPXE
  – TFTP
  – NFS
  – iocConsole

• Develop by ICD Software, and SLAC Computer Center
MTCA System Manager

• Uses IPMI protocol over RMCP

• Manager has ability to:
  – Monitor/control shelf power supply
  – Monitor/control shelf cooling module
  – Monitor shelf and module temperature
  – Monitor module online/offline status

• Development in progress (S. Hoobler)
MTCA System Manager Future Work

- Next version could include features like:
  - Faulty module automatic isolation
  - Module hotswap/power cycle
Timing System Integration

• Currently using PMC carrier with EVR, using B Hill’s Linux driver with modification done by K. Kim
• Current system is working but not ideal for the future
• Needs to distribute full 14 trigger/timing across backplane
• Develop EPICS driver/device support for AMC timing module
Infrastructure Hardware Future Plans

- PMC EVR trigger fan out board: initial dev phase (J. Dusatko/C. Xu)
- FPGA code for the AMC timing module: initial dev phase (J. Dusatko)
- New hardware integration compatibility tests (C. Xu)
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<td>Requirements</td>
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<td>EVR (AMC) development</td>
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<td>PMC Carrier Trigger Fanout Board (inhouse)</td>
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<td>EVR (AMC) port Firmware from SLAC to Stockholm U.</td>
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<tr>
<td>PMC Carrier Trigger Fanout Board</td>
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Conclusion

• MTCA.4 is a new specification and required extra work with vendors to achieve interoperability.
• We have succeeded to make a working general purpose infrastructure
• More effort is in progress to make our infrastructure into a fully featured and robust system
Thank You!