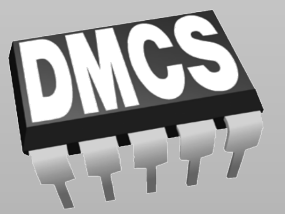

WU3 - IPMI EPICS Integration

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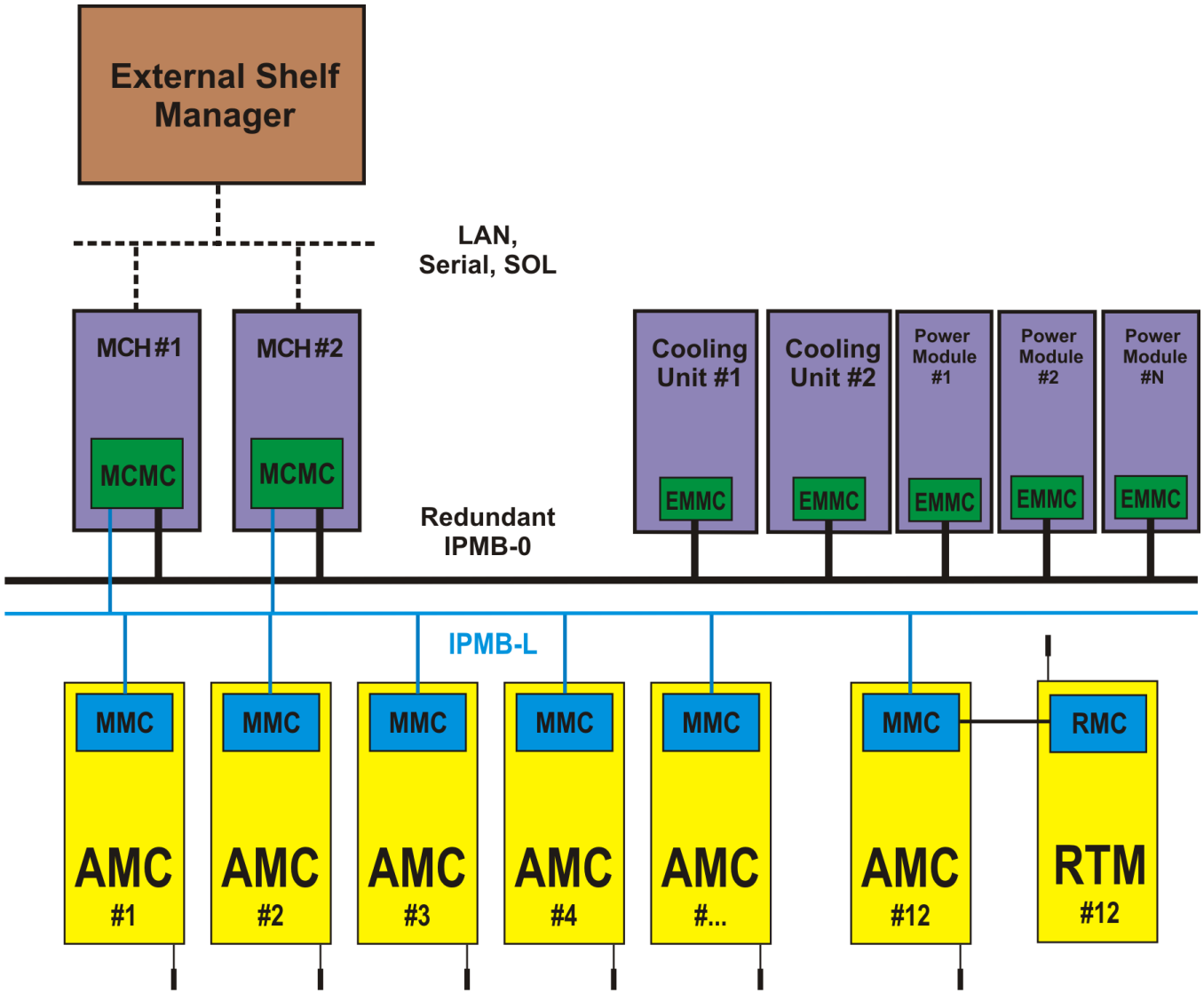
Lodz University of Technology, Poland

Lund, 22 March 2019

MTCA Management

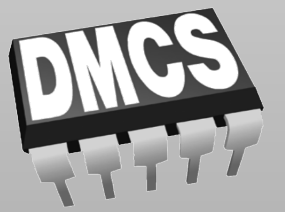


Department of Microelectronics
and Computer Science

IPMI

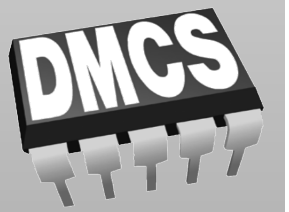
Intelligent Platform Management Interface (IPMI)

- standardized interface and protocol for an autonomous computer subsystem that provides management and monitoring capabilities independently of the host system's CPU, firmware (BIOS or UEFI) and operating system,
- published in 1998 and initially dedicated for out-of-band management of computer systems and monitoring of their operation,
- currently supported by more than 200 computer system vendors, such as Cisco, Dell, Hewlett-Packard, Intel, NEC Corporation, etc.,
- adapted by PICMG to be used as a management bus in the ATCA, AMC and MicroTCA standards.



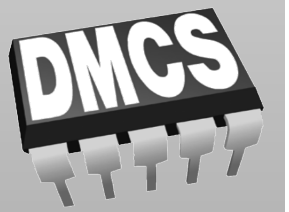
WU3 Scope

- Interface to read/write and monitor the MTCA system using EPICS
- Develop this into a scalable module that can be used for any number of MTCA modules
- Design this module in accordance to the ESS guidelines and to other designers in order to keep some level of homogeneity



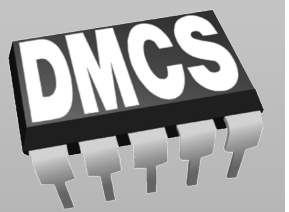
Functionality

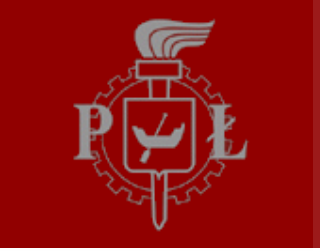
- Getting field replaceable unit (MCH, PM, CU, AMCs, backplane) info and device ID (could also be used for inventory purposes)
- Getting activation (hot-swap) states
- Getting sensor data record, sensor reading (including reading factors and hot swap handle) and provide human readable values
- Getting sensor thresholds
- Getting link capability and link status
- Setting activation (hot-swap) states (shutdown/remove or activate) FRU
- Setting sensor thresholds
- Receiving events (to be defined)
- Firmware remote update



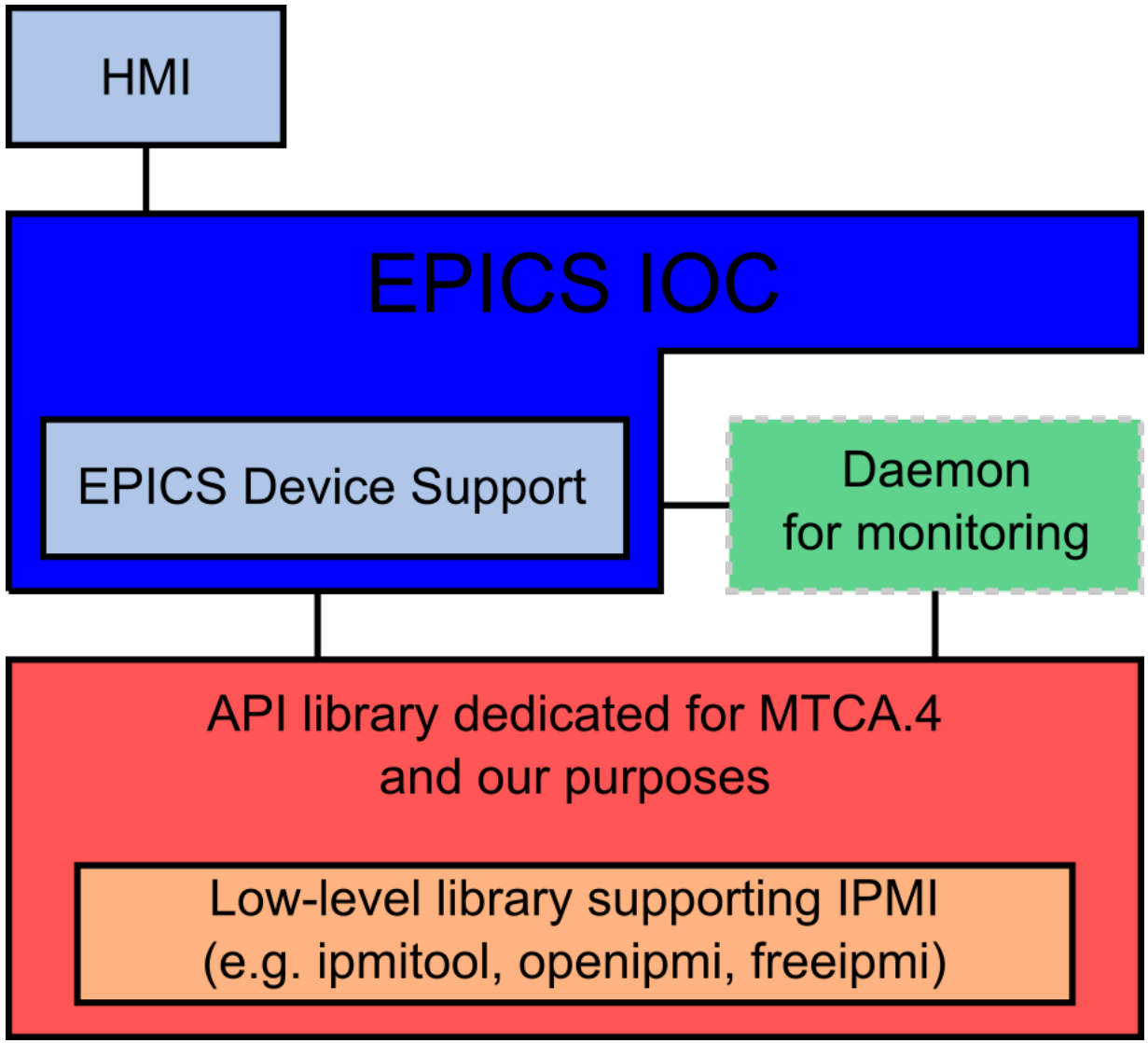
Assumptions

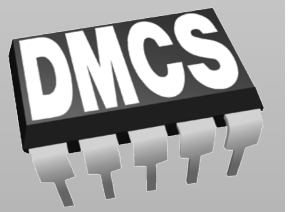
- We are providing the monitoring/control system for single MTCA chassis
  (1 chassis — 1 EPICS IOC)
- Complete EPICS monitoring system for the machine is out of scope of this contract
- Scalability — running separate EPICS IOC for every MTCA chassis in the accelerator
- Software should be fully compliant with NAT MCH — it will be used for development and tests
- Supported MicroTCA chassis types: 12 AMC (9U) and 6 AMC (3U)
- Supported modules: CCT AM 900/412, MRF EVR-300U, IFC14xx, SIS8300-KU, RTM Carrier AMC





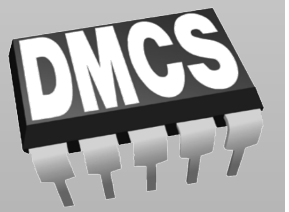
Initial Idea





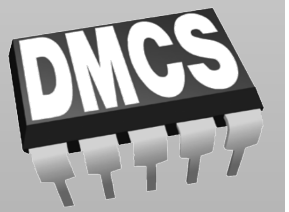
Available Solutions

- Low-level API:
  - ipmitool
    https://github.com/ipmitool/ipmitool
  - ipmiutil
    http://ipmiutil.sourceforge.net
    https://git.code.sf.net/p/ipmiutil/code-git
  - freeipmi
    https://www.gnu.org/software/freeipmi
    https://git.savannah.gnu.org/git/freeipmi.git
  - OpenIPMI
    http://openipmi.sourceforge.net
    https://git.code.sf.net/p/openipmi/code
  - OpenHPI
    http://openhpi.org
    https://github.com/open-hpi
- EPICS:
  - ipmiComm → e3-ipmiComm
    https://github.com/icshwi/e3-ipmiComm



Review of existing solutions

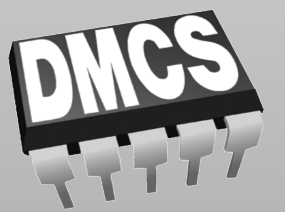
	ipmitool	ipmiutil	freeipmi	OpenIPMI	OpenHPI
License	BSD	BSD	GPL	GPL/LGPL	BSD
Last release	10/2016	09/2018	05/2018	04/2018	03/2018
Last commit	10/2018	09/2018	05/2018	10/2018	10/2018
Dynamic library	no	yes	yes	yes	yes



Review of existing solutions

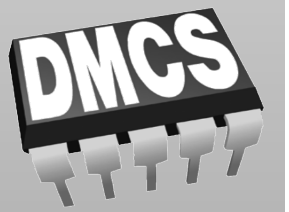
	ipmitool	ipmiutil*	freeipmi	OpenIPMI*	OpenHPI
FRU Listing	Yes	Yes	Yes	Yes	Yes
FRU Info	Yes	Yes	Yes	Yes	Yes
FRU M-State	Yes**	Yes	Yes	Yes	Yes
FRU Start/Stop	??	??	??	??	??
SDR reading	Yes	Yes***	Yes	Yes	Yes
Sensor reading	Yes	Yes***	Yes	Yes	Yes
Thr. reading	Yes	Yes***	Yes	Yes	Yes
Thr. writing	??	??	??	??	??
E-keying	??	??	??	??	??
Events	Yes	Yes	??	??	Yes
HPM.1	Yes****	Yes****	No****	No****	Yes****

* Bridging of IPMI messages seems to be not supported
** Significant overhead
*** All the information returned by single command - some filtering required
**** Information from documentation — not tested yet



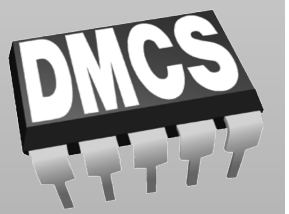
OpenHPI examples - FRU list


```
hpi_shell> ctrl
(001):Schroff uTCA CU:{S|RDR|INV|RST|FRU|CNT|RES}
(002):Schroff uTCA CU:{S|RDR|INV|RST|FRU|CNT|RES}
(003):AIES-MFMC:{S|RDR|INV|RST|FRU|CNT|RES}
(004):TAMC641:{S|RDR|INV|RST|FRU|CNT|RES}
(005):DMCS-PTPM:{S|RDR|INV|RST|FRU|CNT|RES}
(006):AIES-MPTM-1588:{S|RDR|INV|RST|FRU|CNT|RES}
(007):NAT-MCH-MCMC:{S|RDR|INV|RST|FRU|CNT|HS|RES}
(008):PM-AC1000:{S|RDR|INV|RST|FRU|CNT|RES}
(009):MCH-Clock:{S|RDR|INV|RST|FRU|CNT|RES}
(010):MCH-PCIe:{S|RDR|INV|RST|FRU|CNT|RES}
(011):PM-AC1000:{S|RDR|INV|RST|FRU|CNT|RES}
(012):NMCH-ShM:{S|RDR|ELOG|FRU|CNT|RES}
(013):Schroff uTCA CU:{S|RDR|INV|RST|FRU|CNT|RES}
(014):Schroff uTCA CU:{S|RDR|INV|RST|FRU|CNT|RES}
(015):AIES-MFMC:{S|RDR|INV|RST|FRU|CNT|RES}
(016):TAMC641:{S|RDR|INV|RST|FRU|CNT|RES}
(017):AIES-MPTM-1588:{S|RDR|INV|RST|FRU|CNT|RES}
(018):DMCS-PTPM:{S|RDR|INV|RST|FRU|CNT|RES}
(020):PM-AC1000:{S|RDR|INV|RST|FRU|CNT|RES}
(021):PM-AC1000:{S|RDR|INV|RST|FRU|CNT|RES}
(022):MCH-PCIe:{S|RDR|INV|RST|FRU|CNT|RES}
(023):MCH-Clock:{S|RDR|INV|RST|FRU|CNT|RES}
```



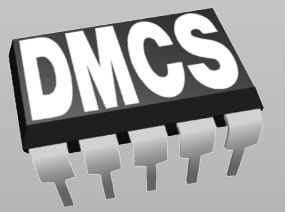
OpenHPI examples - FRU Info


```
inventory block ==> inv 005 011
Inventory: 11 Update count: 1 Read Only: TRUE Areas: 2
Area: 1 Type: OEM Read Only: TRUE Fields: 2
Field: 1 Type: CUSTOM Read Only: TRUE (BIN: 5A3100160028 (len=6))
Field: 2 Type: CUSTOM Read Only: TRUE (BIN:
5A31001900008002E0FFFFA498F300510000FC012F0000FD01230000FD01210000FD (len=34))
Area: 2 Type: PRODUCT_INFO Read Only: TRUE Fields: 7
Field: 1 Type: MANUFACTURER Read Only: TRUE (TEXT: ENGLISH: DMCS (len=4))
Field: 2 Type: PRODUCT_NAME Read Only: TRUE (TEXT: ENGLISH: PTPM (len=4))
Field: 3 Type: PART_NUMBER Read Only: TRUE (TEXT: ENGLISH: 1.0 (len=3))
Field: 4 Type: PRODUCT_VERSION Read Only: TRUE (TEXT: ENGLISH: 1.00 (len=4))
Field: 5 Type: SERIAL_NUMBER Read Only: TRUE (TEXT: ENGLISH: 000000631676 (len=12))
Field: 6 Type: ASSET_TAG Read Only: TRUE (TEXT: ENGLISH: -- (len=2))
Field: 7 Type: FILE_ID Read Only: TRUE (TEXT: ENGLISH: 21/12/2012 - P. Perek (len=21))
```



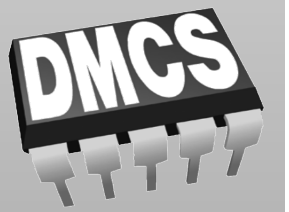
OpenHPI examples - Sensors List


```
(167): SENSOR_RDR ID=131239, Ctrl=0, EvtCtrl=RO, Tag=Hot Swap
(166): SENSOR_RDR ID=131238, Ctrl=1, EvtCtrl=WR, Tag=Ambient Temp 1
(165): SENSOR_RDR ID=131237, Ctrl=1, EvtCtrl=WR, Tag=Ambient Temp 2
(164): SENSOR_RDR ID=131236, Ctrl=1, EvtCtrl=WR, Tag=Ambient Temp 3
(163): SENSOR_RDR ID=131235, Ctrl=1, EvtCtrl=WR, Tag=VCC 1V2
(162): SENSOR_RDR ID=131234, Ctrl=1, EvtCtrl=WR, Tag=VCC 3V3
(161): SENSOR_RDR ID=131233, Ctrl=1, EvtCtrl=WR, Tag=VCC 12V PP
(145): SENSOR_RDR ID=131217, Ctrl=0, EvtCtrl=RO, Tag=Hot Swap
(144): SENSOR_RDR ID=131216, Ctrl=1, EvtCtrl=WR, Tag=TEMPERATURE
(143): SENSOR_RDR ID=131215, Ctrl=1, EvtCtrl=WR, Tag=VCC +12 VPP
(142): SENSOR_RDR ID=131214, Ctrl=1, EvtCtrl=WR, Tag=VCC +3.3 V MP
(141): SENSOR_RDR ID=131213, Ctrl=1, EvtCtrl=WR, Tag=VCC +1.2 V
(140): SENSOR_RDR ID=131212, Ctrl=1, EvtCtrl=WR, Tag=VCC +2.5 V
(139): SENSOR_RDR ID=131211, Ctrl=1, EvtCtrl=WR, Tag=VCC +3.3 V
(138): SENSOR_RDR ID=131210, Ctrl=1, EvtCtrl=RO, Tag=PCIE CABLE
(137): SENSOR_RDR ID=131209, Ctrl=1, EvtCtrl=RO, Tag=PCIE LANES
(136): SENSOR_RDR ID=131208, Ctrl=1, EvtCtrl=RO, Tag=PCIE GEN
```

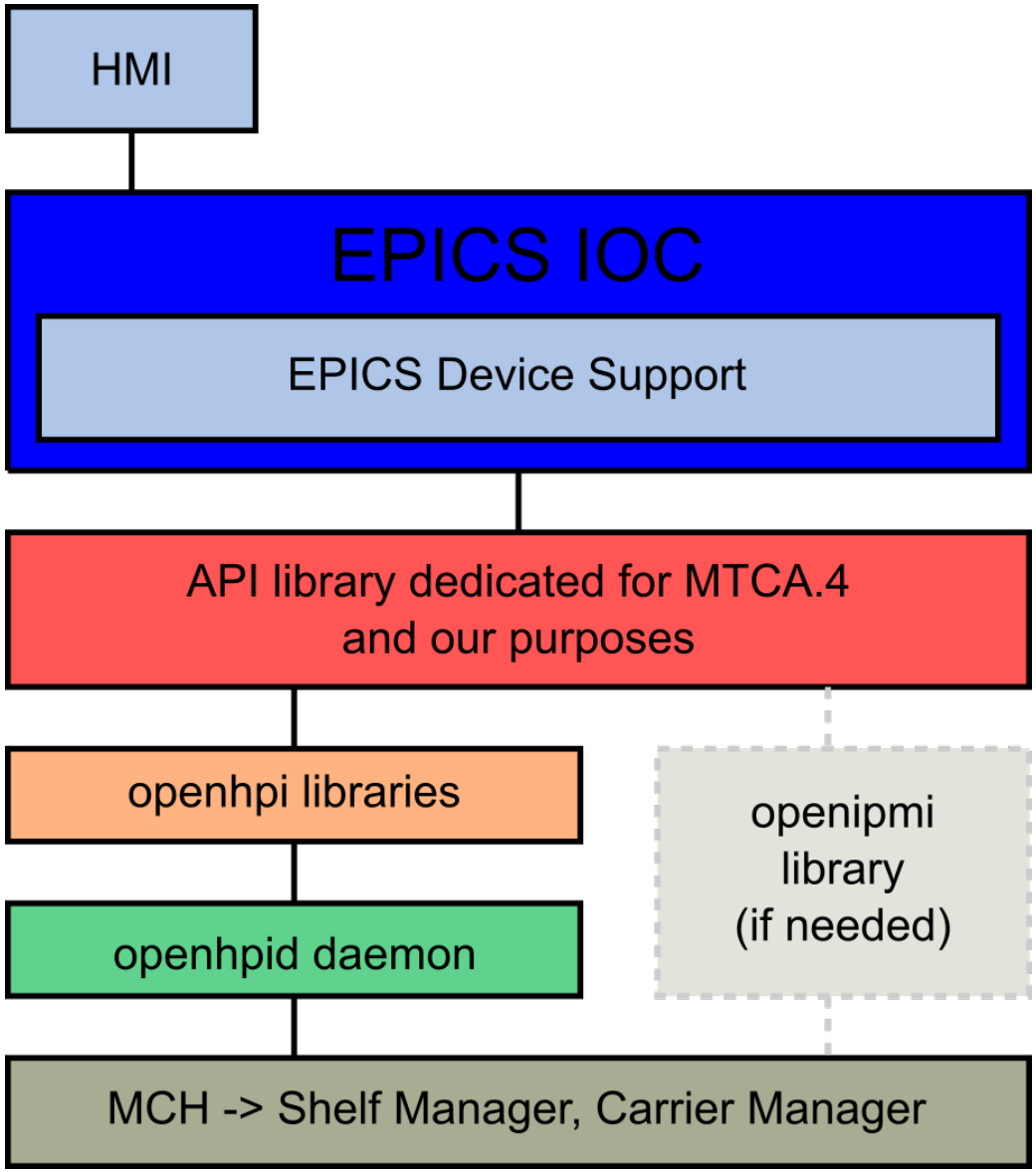


OpenHPI examples - Sensor Readout


```
Sensor(5/144) TEMPERATURE TEMPERATURE
Event states = 0x0
Reading Value = 33.000
Lower Minor Threshold(NA) 0.000
Lower Major Threshold(NA) -10.000
Lower Critical Threshold(NA) -20.000
Upper Minor Threshold(RW) 45.000
Upper Major Threshold(RW) 60.000
Upper Critical Threshold(RW) 70.000
Positive Threshold Hysteresis not supported.
Negative Threshold Hysteresis not supported.
```

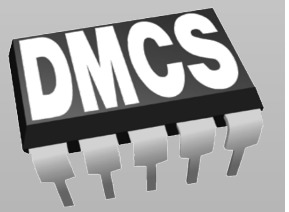


Proposed Software Architecture



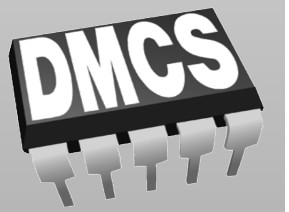
MTCA Example based on OpenHPI


```
 nat> show_fru
FRU Information:
---------------
FRU Device State Name
=============================================
0 MCH M4 NMCH-CM
3 mcmc1 M4 NAT-MCH-MCMC
6 AMC2 M4 DMCS-PTPM
7 AMC3 M4 TAMC641
9 AMC5 M4 AIES-MFMC
13 AMC9 M4 AIES-MPTM-1588
40 CU1 M4 Schroff uTCA CU
41 CU2 M4 Schroff uTCA CU
51 PM2 M4 PM-AC1000
53 PM4 M4 PM-AC1000
60 Clk1 M4 MCH-Clock
61 Hub1 M4 MCH-PCIe
64 RTM1 M4 AIES-MPCIE16
=============================================
```



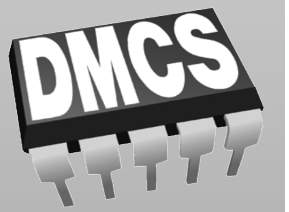
MTCA Example based on OpenHPI


```
 ==> RPT Entry ID: 0x3
Tag: DMCS-PTPM
Entity Path: {SYSTEM_CHASSIS,7}{SHELF_MANAGER,0}{AMC,2}
FRU ID: 6
==> RPT Entry ID: 0x1
Tag: Schroff uTCA CU
Entity Path: {SYSTEM_CHASSIS,7}{SHELF_MANAGER,0}{COOLING_UNIT,1}
FRU ID: 40
==> RPT Entry ID: 0x8
Tag: PM-AC1000
Entity Path: {SYSTEM_CHASSIS,7}{SHELF_MANAGER,0}{POWER_SUPPLY,4}
FRU ID: 53
==> RPT Entry ID: 0xC
Tag: NMCH-ShM
Entity Path: {SYSTEM_CHASSIS,7}{SHELF_MANAGER,0}{SWITCH_BLADE,0}
FRU ID: 0
```



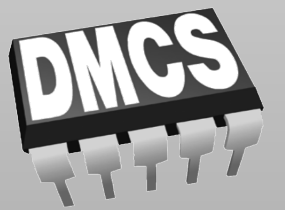
Last meeting - important question

- Can we monitor multiple MTCA crates with single CPU using OpenHPI?
  Yes, we can
  OpenHPI is flexible, we can:
  - run multiple daemons - one per chassis
  - run one daemon monitoring multiple chassis
  Can be decided later which version is better for us



Future plans

- Development of library dedicated for our purposes based on OpenHPI (and other libraries if really needed)
  - First step - support for all reading/monitoring features
  - Avoiding development of IPMI protocol from scratch
  - Providing some missing commands specific for MicroTCA.x
  - Check how to send configuration command using OpenHPI



Thank you for your attention