

Management in MTCA and ATCA systems

2nd MTCA/ATCA Workshop for Research and Industry
IHEP, Beijing
August 24th – 25th, 2021

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1

Agenda

- About N.A.T.
- From ATCA to MTCA - two well connected standards
- Why do we need management?
- What is behind the management?
- How does it work?
- What can you do?

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2

About N.A.T. – who we are

- Gesellschaft für **N**etzwerk- und **A**utomatisierungs-**T**echnologie mit beschränkter Haftung => **N.A.T.**
- Founded in 1990
- Proud to provide quality "made in Germany"
 - since more than 30 years by 25 highly professional employees
- Privately owned and owner lead business
- Own purpose-built building of more than 1,600m² (17,222ft²) with on-site centers for
 - hardware and software design
 - pre-manufacturing and test + repair



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3

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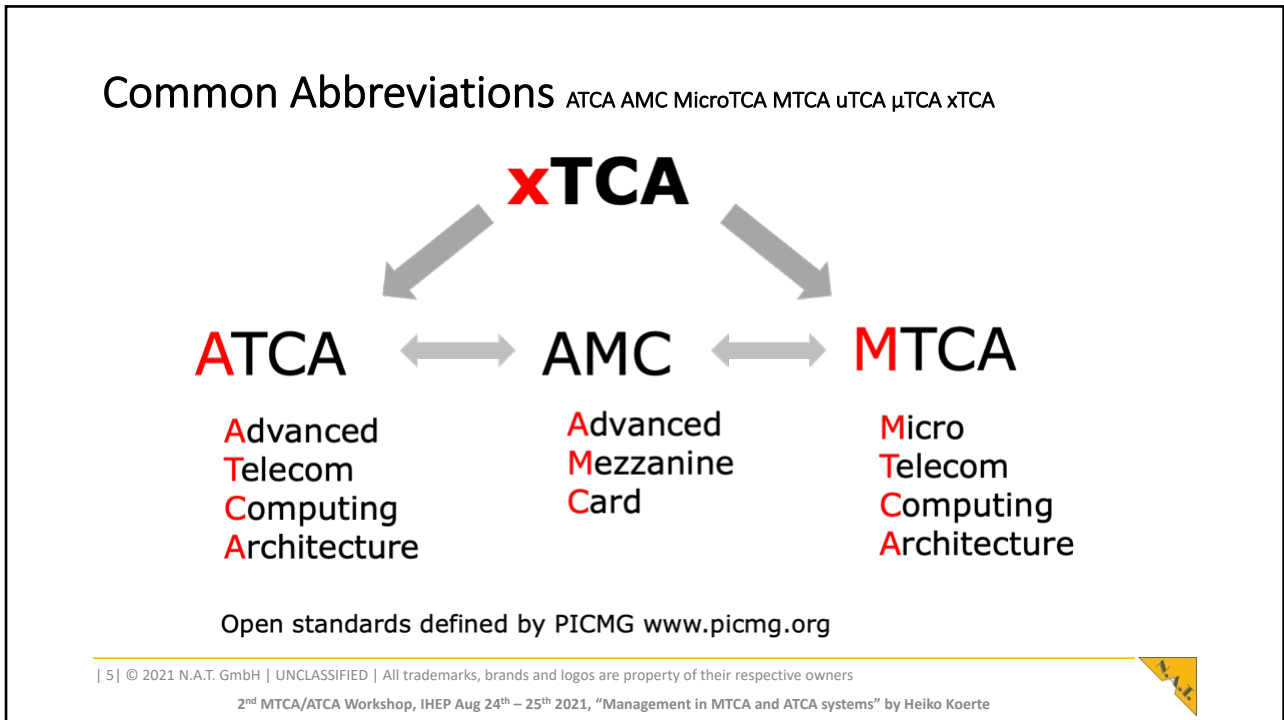
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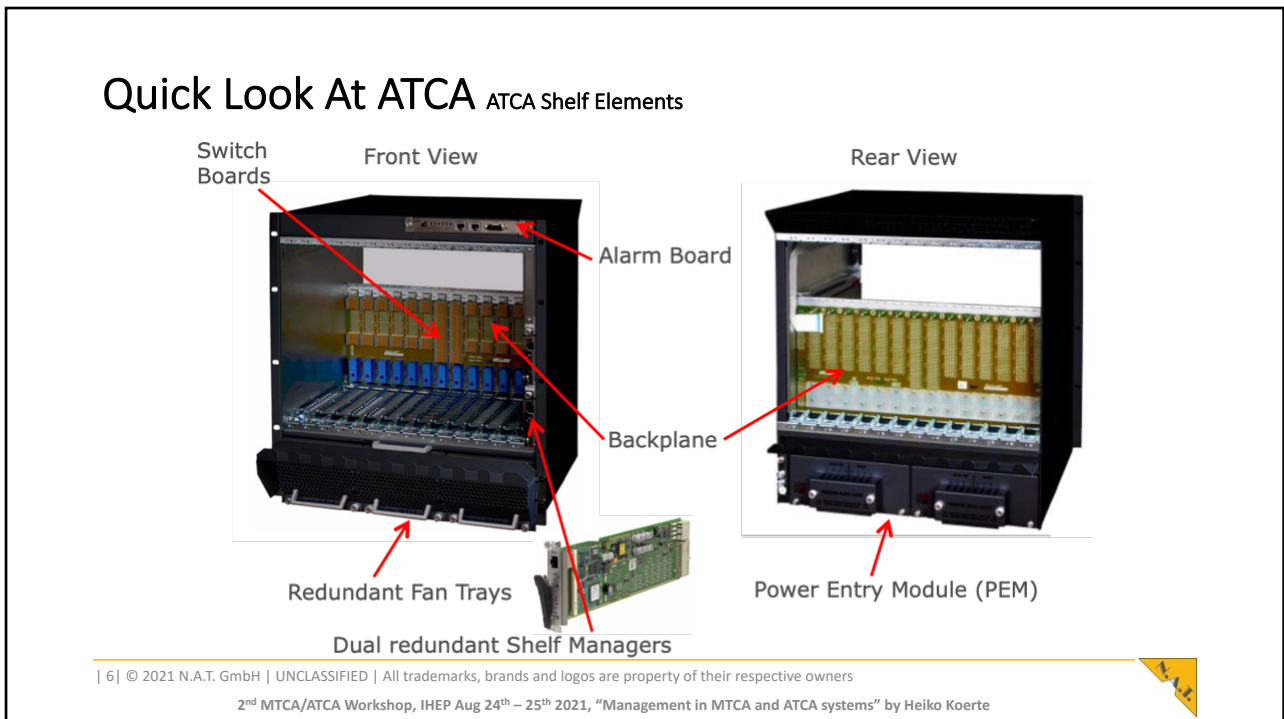
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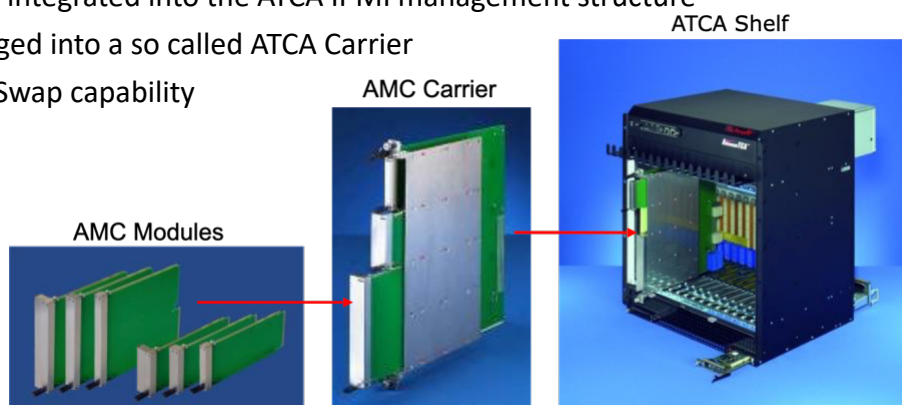
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6

Quick Look At ATCA AMC Modules

- Initially developed as function extension for ATCA Boards
- Fully integrated into the ATCA IPMI management structure
- Plugged into a so called ATCA Carrier
- Hot Swap capability



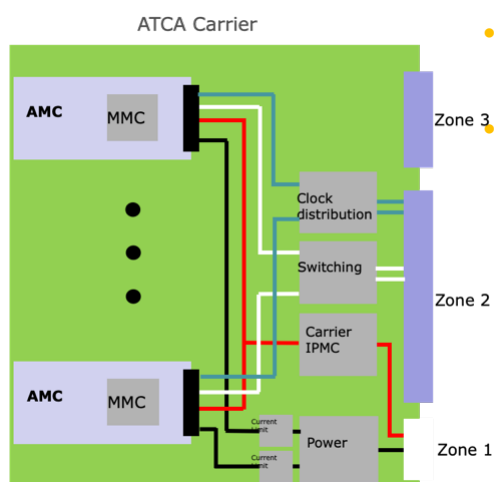
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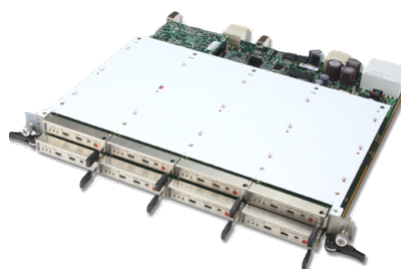


7

Quick Look At ATCA ATCA carrier – the environment an AMC module lives in



- Idea for MTCA: directly plug AMC onto backplane
- Requires "virtual carrier" providing
 - Power, management, CLK, Switching



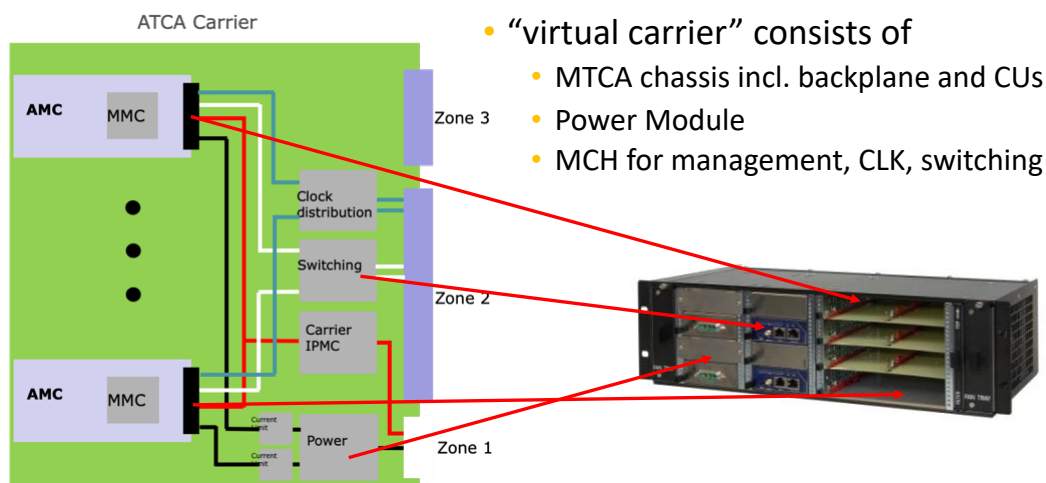
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8

Quick Look At ATCA How to migrate from ATCA to MTCA



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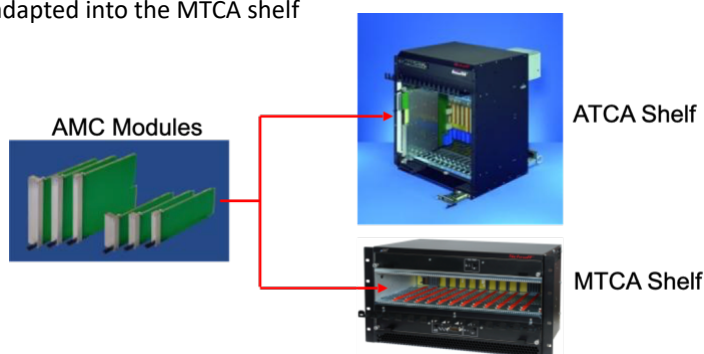
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9

Quick Look At ATCA How to migrate from ATCA to MTCA

- The basic idea of MTCA is to have a shelf that contains just AMC modules
- Backplane directly accepts AMC modules
- AMCs are interchangeable between ATCA and MTCA
- The infrastructure of a ATCA Carrier was adapted into the MTCA shelf (power management switching)
- power input and all outputs to the front



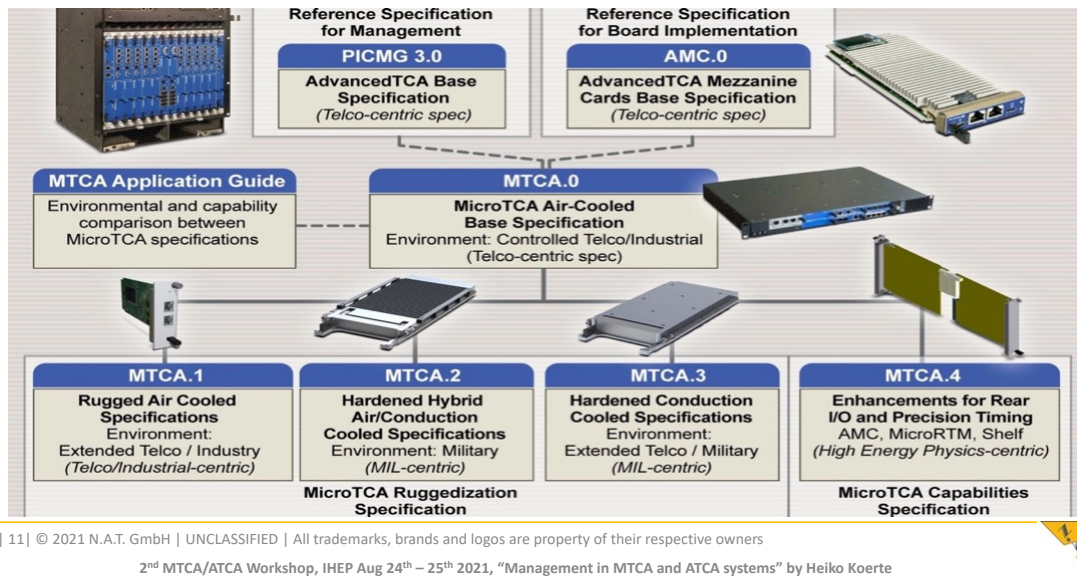
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10

ATCA and MTCA Specifications



11

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12

Management Why do we need it?

- “Who” is in my system?
 - i.e. list of devices (aka “FRU”)
- What capabilities does the FRU have?
 - i.e. active connections (AMCs) or RPMs (CUs)
- How healthy is my system?
 - i.e. sensors for current, voltage, temperature
 - i.e. events
- How can I talk to my FRUs?
 - i.e. manipulation of sensors
- How can I service my system?
 - i.e. hot-swap FRUs

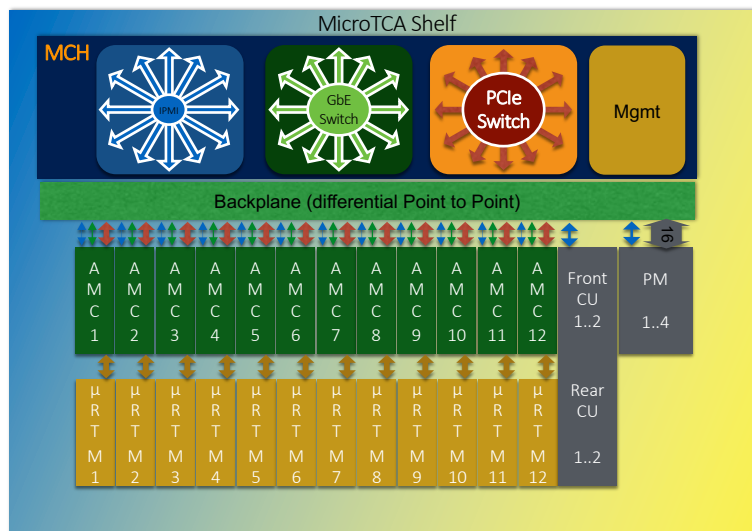
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MTCA.0.1.2.3.4 Infrastructure of a MTCA system



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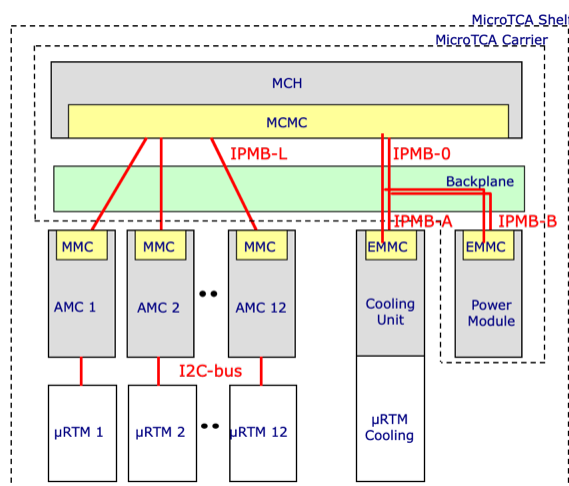
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14

Management in MTCA Physical Connections And Controllers

- IPMB-L
 - connects the MCMC on the MCH to the MMC on the AMC Modules
 - radial architecture
- IPMB-0 .1
 - connects the MCMC on the MCH to the EMMC on the PMs and CUs
 - bussed architecture
- I2C-bus
 - connects the AMC to its μ RTM
 - the μ RTM is treated as managed FRU of the AMC



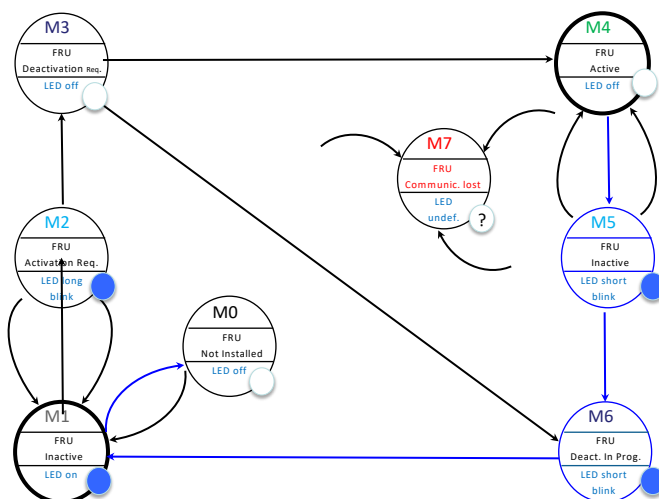
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15

Management in MTCA FRU M states

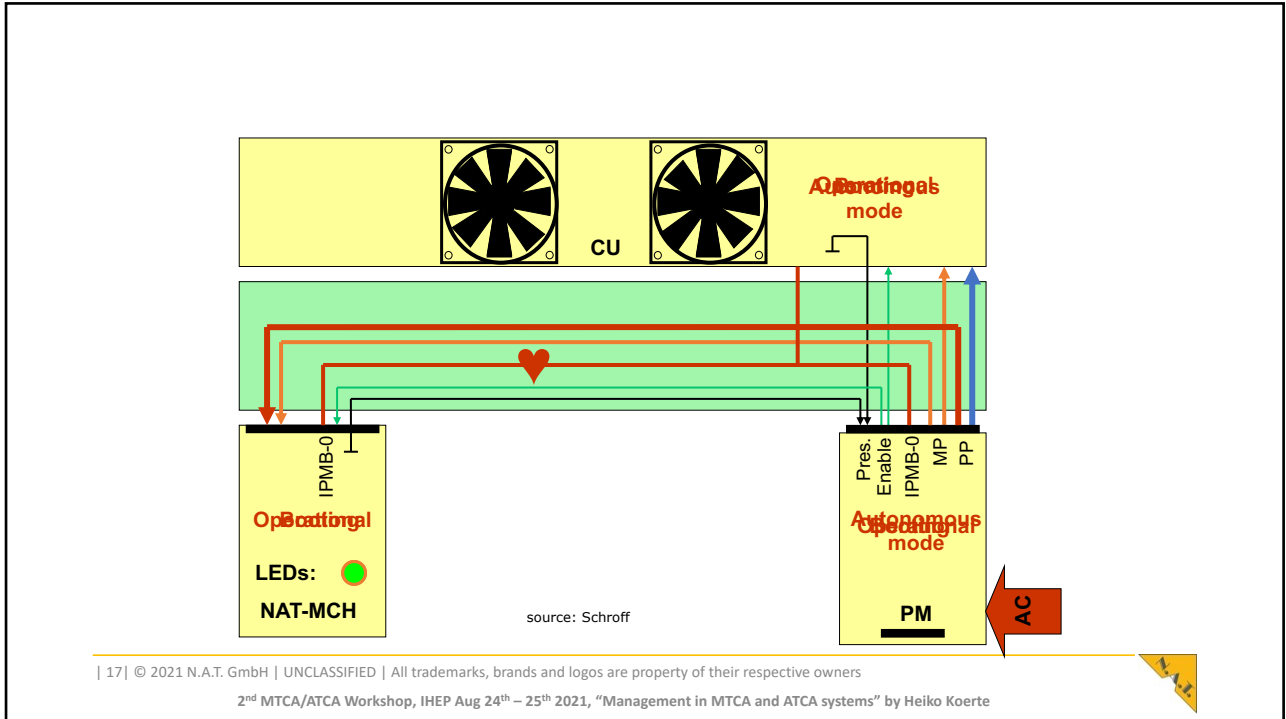
- PICMG 3.0 and AMC specifications define FRU states, aka „M states“
 - Activation
 - FRU proceeds to state M4
 - Deactivation
 - FRU proceeds to state M1
 - Error (coms lost)
 - FRU moves to state M7
- MCH decides if and when module can reach M4
- MMC uses a state machine to control hot-plug/swap procedure



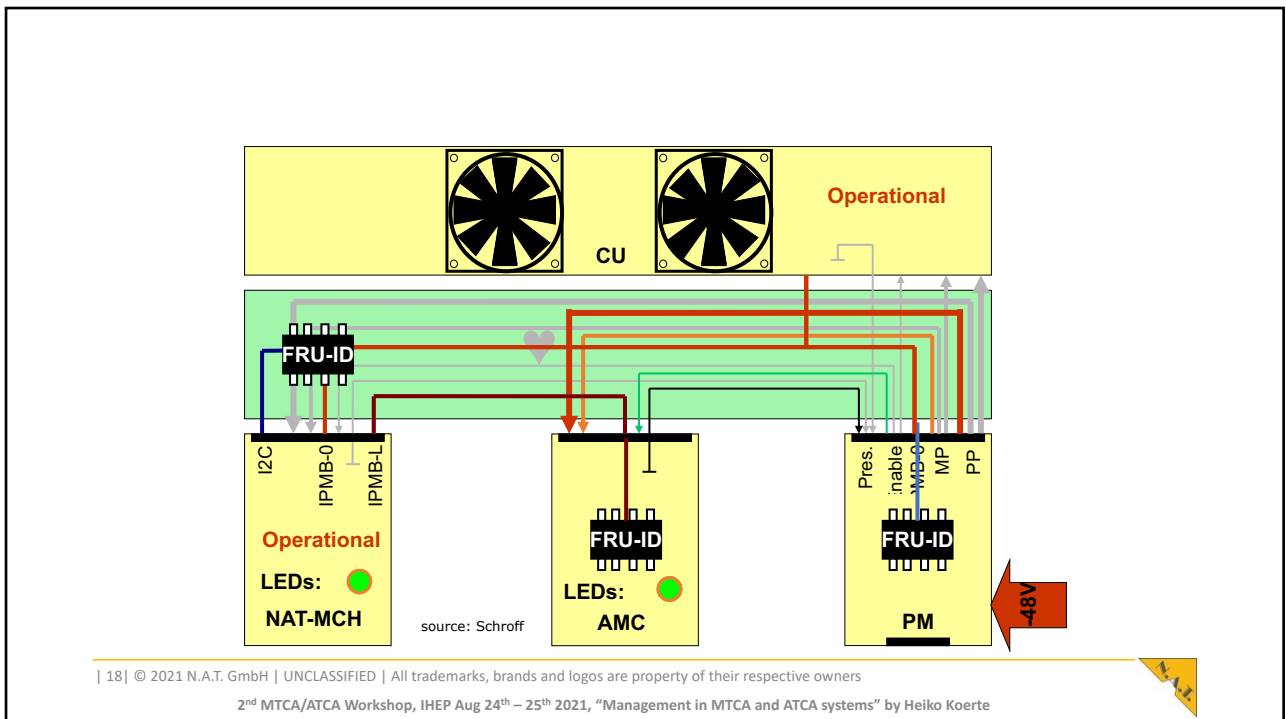
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16



17



18

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19

Management in xTCA What is behind

- Idea of management:
 - Hardware supervision by software (remote control and monitoring)
 - Intelligent handling of events and actions
 - Abstraction of hardware functionality
 - Operating system independent
- => IPMI (Intelligent Platform Management Interface)

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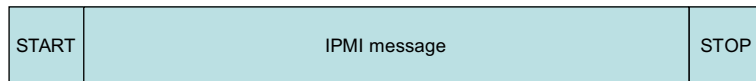
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20

Management in xTCA IPMI

- originally defined by Philips to operate on I²C (Inter Integrated Circuit) to attach low speed peripherals:
 - Two wire bus: clock and data
 - IPMB operates at 100 kHz
 - Implements message START and STOP conditions
 - Multi-master capable



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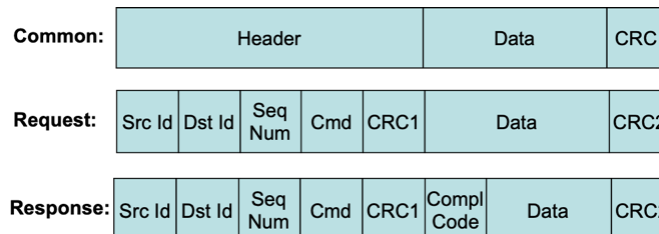
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21

Management in xTCA IPMI

- IPMI messages:
 - Embedded into physical layer protocol
 - Maximum length: 32 byte
 - Symmetrical protocol: request leads to response
 - Message verification by CRC
 - Message retry mechanism



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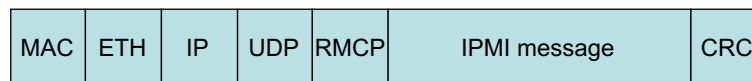
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Management in xTCA IPMI and RMCP

- IPMI can be easily embedded in other protocols, i.e. for transport over Ethernet networks:
-
- => RMCP (Remote Management Control Protocol)



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23

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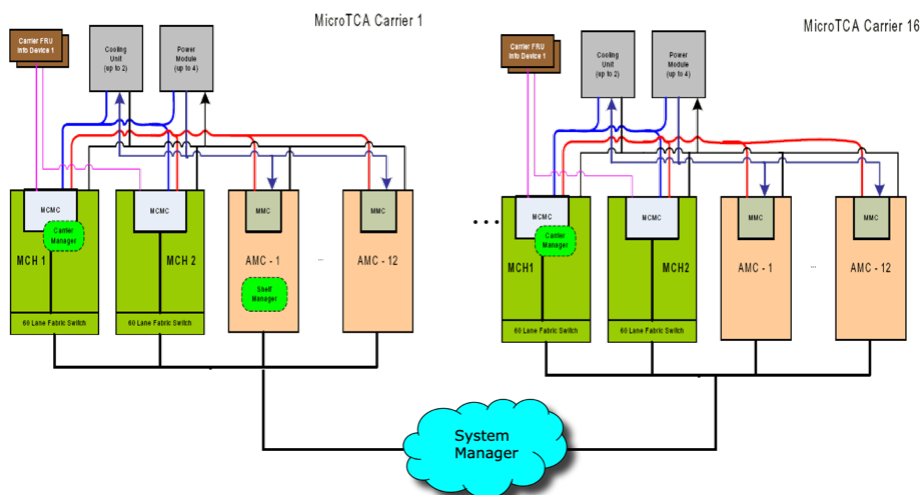
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24

Management in MTCA Management Structure



source: PICMG μTCA spec

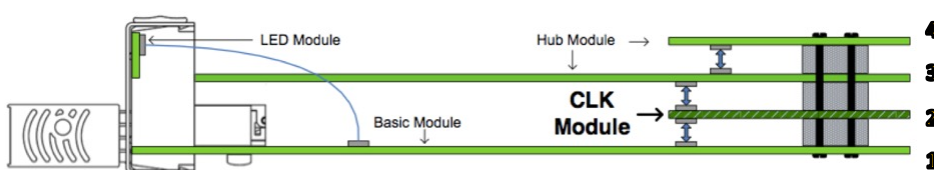
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25

MTCA Carrier Hub (MCH) Adaptable to application demands



1. Basic Module with GbE-Switch to all AMC slots and Management: carrier manager, shelf manager, system manager
2. Clock Module for CLK #1-3 to all AMC slots
3. Fat Pipe Hub Module for AMC slots #1-6
4. Fat Pipe signals for AMC slots #7-12

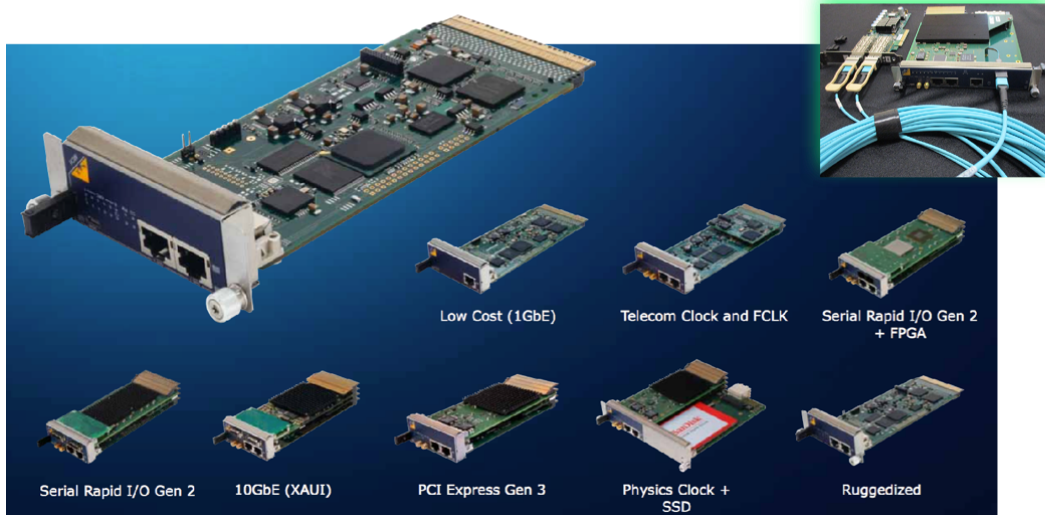
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MTCA Carrier Hub (MCH) Adaptable to application demands

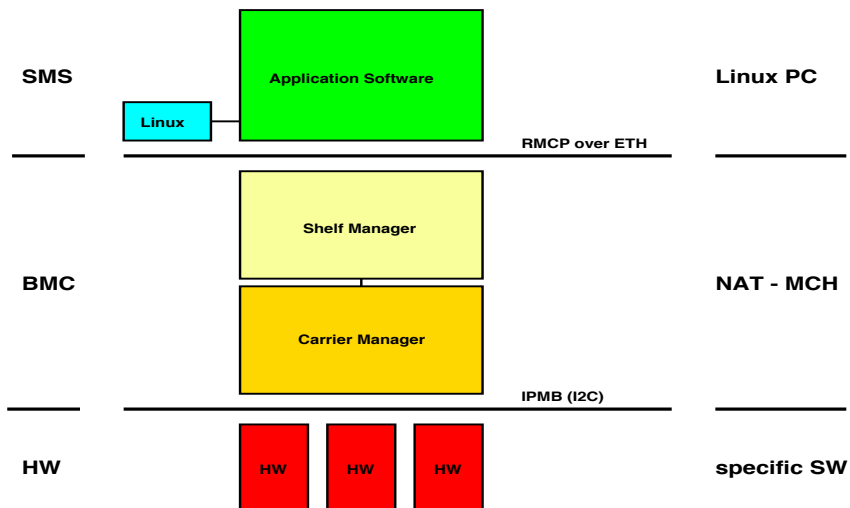


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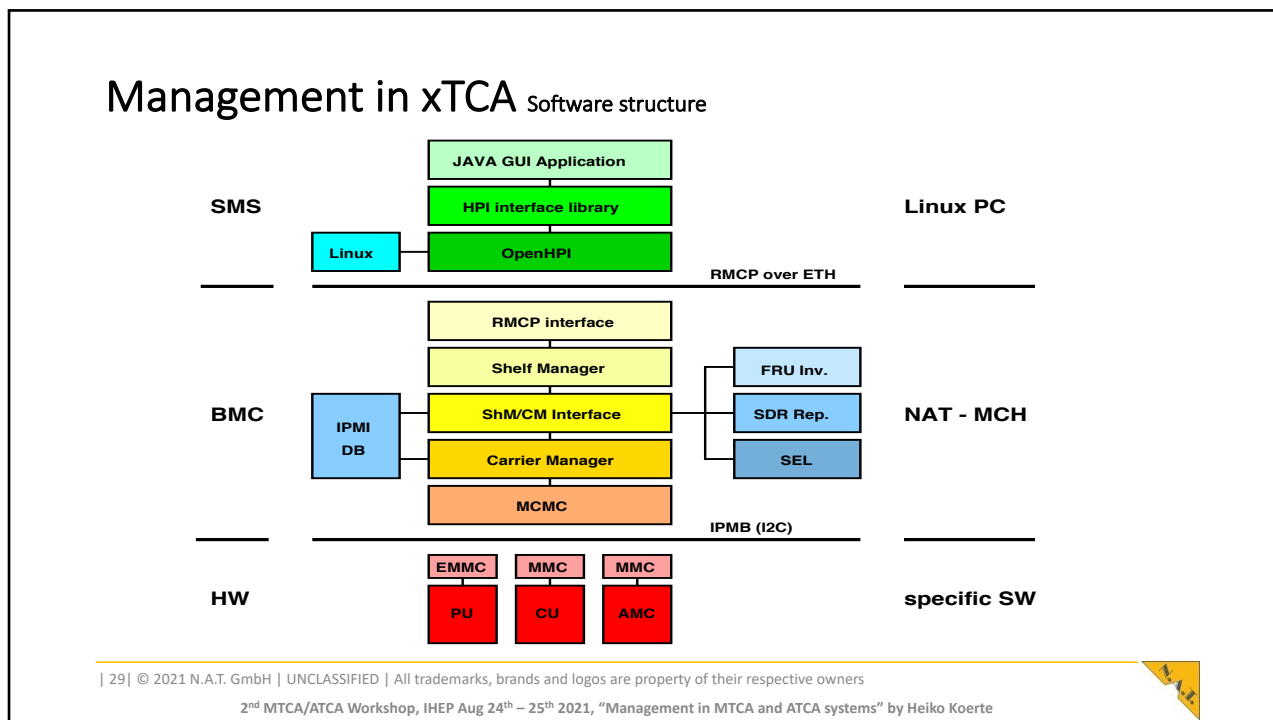
Management in xTCA Software structure



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29

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Management in xTCA What can you do?

- “Who” is in my system?
 - i.e. list of devices (aka “FRU”)
- What capabilities does the FRU have?
 - i.e. active connections (AMCs) or RPMs (CUs)
- How healthy is my system?
 - i.e. sensors for current, voltage, temperature
 - i.e. events
- How can I interfere with my FRUs?
 - i.e. manipulation of sensors
- How can I service my system?
 - i.e. hot-swap FRUs

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31

NATview Power Configuration Manager Redundancy

The screenshot shows the NATview Power Configuration Manager interface. At the top, it displays 'Status: OK'. Below this is a table with columns for power channels: 1 MCH1, 2 MCH2, 3 CU1, 4 CU2, 5 AMC1, 6 AMC2, 7 AMC3, 8 AMC4, 9 AMC5, 10 AMC6, 11 AMC7, 12 AMC8, 13 AMC9, 14 AMC10, 15 AMC11, and 16 AMC12. The table has two rows: 'Max. Power Output (mA):' and 'Required Power (mA):'. Below the table, there are four PM (Power Module) entries: PM1, PM2, PM3, and PM4. Each PM entry has a 'max:' value and a dropdown menu for 'primary' or 'secondary' selection. The PM1 and PM2 rows have green checkmarks in the columns corresponding to the power channels, indicating they are active. The PM3 and PM4 rows have empty checkboxes, indicating they are not active.

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32

NATview Power Configuration Manager n+1 Redundancy

Power Configuration Manager

Status: OK

Power Channel:	1 MCH1	2 MCH2	3 CU1	4 CU2	5 AMC1	6 AMC2	7 AMC3	8 AMC4	9 AMC5	10 AMC6	11 AMC7	12 AMC8	13 AMC9	14 AMC10	15 AMC11	16 AMC12
Max. Power Output (mA):	7000	7600	7600	7600	7200	7200	7200	7200	7200	7200	7200	7200	7200	7200	7200	7200
Required Power (mA):	3500	n/a	7600	7600	n/a	7200	n/a	n/a	n/a	800	n/a	n/a	5000	n/a	2000	n/a

PM1 enable

PM1 sum: 116200 mA
max: 50000 mA
primary (0)

PM2 sum: 116200 mA
max: 50000 mA
primary (0)

PM3 sum: 116200 mA
max: 50000 mA
primary (0)

PM4 sum: 116200 mA
max: 50000 mA
secondary (1)

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33

CLI commands of NAT-MCH example and excerpt

- **idb_info** - Print IPMI data base information
- **imsg_info** - IPMI message information
 - Prints the implementation status for the supported IPMI messages on the Host (RMCP) interface and can be used to print a list of IPMI messages that are supported by the MCH.
- **lshm_info** - Print local ShM information
- **sdrrep_info** - SDR repository information (Sensor Data Repository)
- **sel_info** - System Event Log information
- **session_info** – Status of currently active Sessions
- **show_ekey** - Show all activated connections
- **show_fru** - Show all FRUs
- **show_fruinfo** - fru_id FRU contents
- **show_cu** - Show cooling unit
- **show_pm** - Power Module Status
- **show_sensorinfo** fru_id - Show sensors for FRU
- **version** - Print firmware version information
- **ni** - Print network configuration
- **arp** - Manipulate the system ARP

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34

CLI commands of NAT-MCH examples and excerpt

- **ifconfig** - Print IP configuration
- ping IP address - Issue ICMP echo request
- Route -? Modify routing tables
- sw_mp - Ethernet switch management platform
- vlanp_cfg - Port based VLAN configuration
- vlanq_cfg - 802.1Q VLAN protocol configuration
- vlanx_cfg - 802.1x VLAN security protocol configuration
- qos_cfg - Quality of service menu:
- qos1p_cfg - 802.1p Quality of service configuration
- mirr_cfg - Ethernet port mirroring configuration
- mac_amc - Print MAC addresses for MAC slots
- show_xlinkinfo - Print information about XAUI ports
- show_xmact - Print XAUI MAC table
- diag - Menu driven diagnostic tool – service staff only
- **fan_ctl** - FAN control
- **shutdown fru_id/all** - Gracefull shutdown of FRU or all FRUs
- **fru_start fru_id** - Gracefull start for FRU

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35

Inventory: *show_fru*

- Infrastructure
 - 0, 3, 60, 61 MCH1 modules
 - 1, 4, 62, 63 MCH2 modules
 - 40-41 Cooling Unit 12
 - 50-53 Power Modules 1, 2, 3, 4
- Payloads
 - 5-16: AMC1-12
 - 64, 65: MCH-RTM
 - 90-101: µRTM1-12
 - 102-104: eRTM13, 14, 15

FRU	Device	State	Name
0	MCH	M4	NMCH-CM
3	mcmc1	M4	NAT-MCH-MCMC
5	AMC1	M4	CCT AM 902/411
6	AMC2	M4	X2TIMER
7	AMC3	M4	DAMC2V3
8	AMC4	M4	DAMC-TCK7
11	AMC7	M4	SIS8300L2 AMC
12	AMC8	M4	SIS8300L2 AMC
13	AMC9	M4	SIS8300L2 AMC
14	AMC10	M4	SIS8300L2 AMC
15	AMC11	M4	SIS8300L2 AMC
16	AMC12	M4	SIS8300L2 AMC
40	CU1	M4	Schroff uTCA CU
41	CU2	M4	Schroff uTCA CU
51	PM2	M4	PM-AC1000
60	Clock1	M4	MCH-Clock
61	HubMod1	M4	MCH-PCIE
64	MCH1-RTM	M4	MCH-RTM-ComEx
91	AMC2-RTM	M4	X2TIMERRTM
92	AMC3-RTM	M4	DAMC2RTM
93	AMC4-RTM	M4	DAMC-TCK7 RTM
96	AMC7-RTM	M1	SIS8300L2 RTM
97	AMC8-RTM	M1	SIS8300L2 RTM
98	AMC9-RTM	M1	SIS8300L2 RTM
99	AMC10-RTM	M1	SIS8300L2 RTM
100	AMC11-RTM	M1	SIS8300L2 RTM
101	AMC12-RTM	M1	SIS8300L2 RTM
104	eRTM15	M4	DRTM-LOG1300

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36

Useful numbers to remember FRU and I²C addresses

Device	Site No.	FRU ID	I ² C Addr.
MCH-CM (Carrier Mngt.)	1	0	0x20
MCMC 1	1	3	0x10
MCMC 2	2	4	0x12
AMC 1-12 AMC 13	1-12 13	5-16 29	0x72-0x88 0xa2
CU 1 CU 2	1 2	40 41	0xA8 0xAA
PM 1 PM 2 PM 3 PM 4	1 2 3 4	50 51 51 53	0xC2 0xC4 0xC6 0xC8
MCH-CLK 1	1	60	0x14
MCH-CLK 2	2	62	0x18
MCH-Hub 1 (PCIe SRIO XAUI)	1	61	0x16
MCH-Hub 2 (PCIe SRIO XAUI)	2	63	0x1a
MCH-RTM 1	1	64	0x1c
MCH-RTM 2	2	65	0x1e
OEM 1-19	1-19	60-78	0x42-0x66
μRTM 1-12		90-101	0x72 0x74-0x88
Carrier FRU (backplane FRU)	1	253	0xA4

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37

Useful numbers to remember FRU and I²C addresses

Device	Site No.	FRU ID	I ² C Addr.
AMC13 in MCH 1 slot	1	29	0xa2
AMC13 in MCH 2 slot	2	30	0xa4
Telco alarm Carrier Manager	1	79 0	- 0x20
physical Shelf FRU Info 1		1	
physical Shelf FRU Info 2		2	
Reserved for further AMCs		17-28	
Reserved for further RTMs		102-124	
Reserved		125-127	
Local Shelf Manager		128	
logical ShM (backplane FRU-Info)		254	
Implementation defined		80-89	
reserved for OEM modules		66-78	
reserved for PM		54-59	

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38

Summary

- About N.A.T.
- From ATCA to MTCA - two well connected standards
- Why do we need management?
- What is behind the management?
- How does it work?
- What can you do?

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39

Thank you for your attention !

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40