Slide 1

Heiko Körte
Director Sales & Marketing

Management System

in MicroTCA and AdvancedTCA

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UNCLASSIFIED

Slide 2

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?
- What is next?

Slide 3

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About N.A.T.
Network and Automation Technology

- Gesellschaft für **N**etzwerk- und **A**utomatisierungs-**T**echnologie mit beschränkter Haftung => **N.A.T.**
- proud to provide quality "made in Germany"
  - since 29 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
- ISO 9001:2015 certified
- fab-less due to qualified CMs for PCBs + assembly

About N.A.T.
Product portfolio: www.nateurope.com

- Standard product line
  - based on common open standards following MOSA approach
  - Board Level Products
    - network interfaces, communication and processing boards
    - intelligent switches and system controllers
    - carriers, converters, adapters and extenders, development kits
  - Software
    - board support packages, drivers, IP-cores
    - signaling stacks and protocols
    - applications and APIs
    - development kits
  - Systems
    - pre-validated platforms for development and rapid prototyping
    - turn-key solutions
  - Supported standards
    - **industrial:** VME, cPCI, PCI/PCIe, PMC, XMC, FMC, AMC, MTCA
   - **rugged:** XMC, FMC, AMC, MTCA, VPX

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Used Abbreviations
ATCA AMC MicroTCA MTCA uTCA µTCA xTCA

xTCA

ATCA ↔ **AMC** ↔ **MTCA**

ATCA	AMC	MTCA
Advanced **T**elecom **C**omputing **A**rchitecture	**A**dvanced **M**ezzanine **C**ard	**M**icro **T**elecom **C**omputing **A**rchitecture
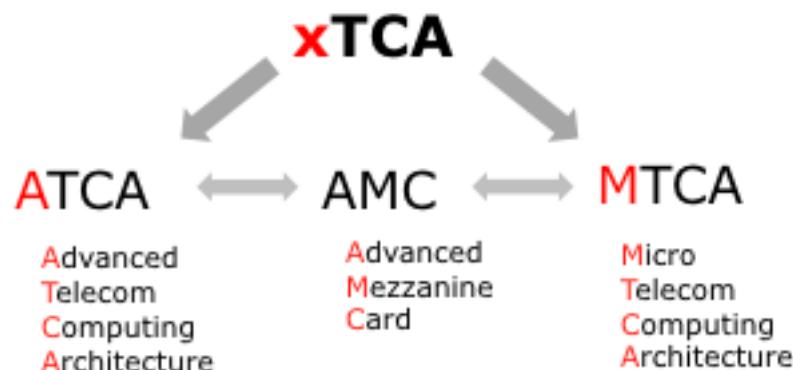
Open standards defined by PICMG www.picmg.org

Quick look at ATCA
ATCA Shelf Elements
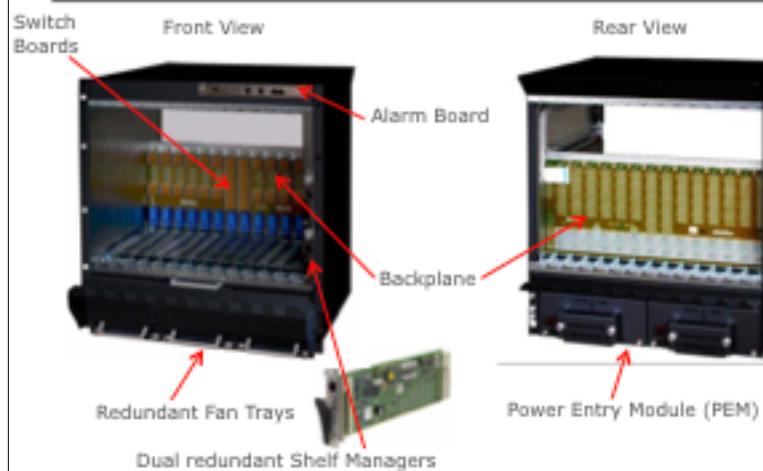
Front View — Rear View

Switch Boards — Alarm Board — Backplane — Redundant Fan Trays — Dual redundant Shelf Managers — Power Entry Module (PEM)

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
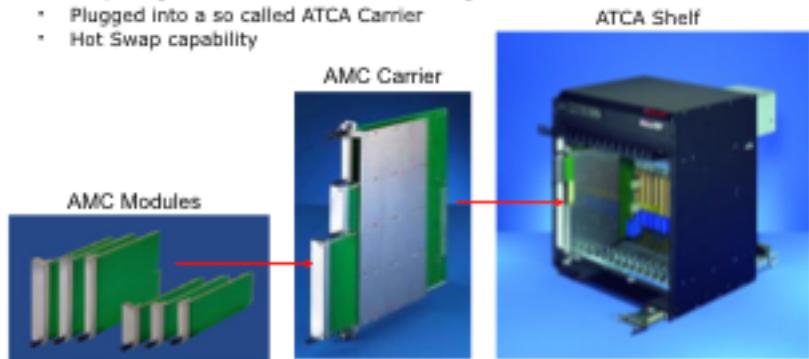
ATCA Shelf

AMC Carrier

AMC Modules

ATCA - AMC -
???

ATCA Carrier

- Plug AMC directly in Backplane
- Virtual Carrier board
  - Power
  - Management
  - Clock distribution
  - switching
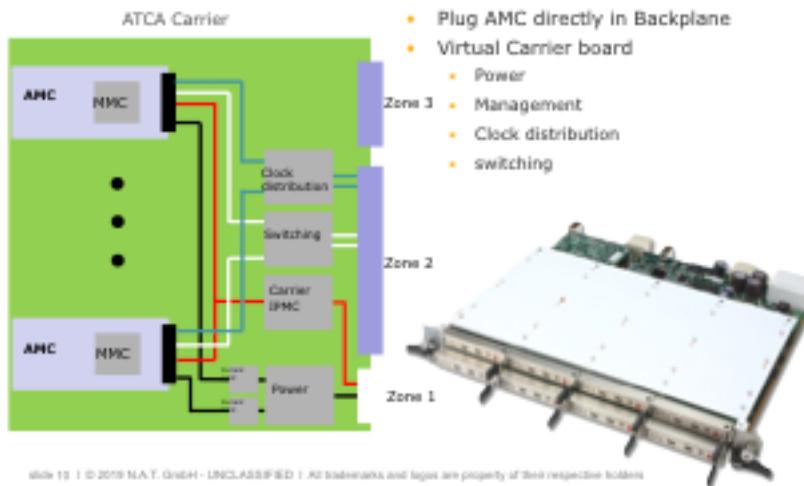
ATCA - AMC -
MTCA.0

ATCA Carrier

- MTCA Shelf
- Power Module
- MCH = MicroTCA Carrier Hub
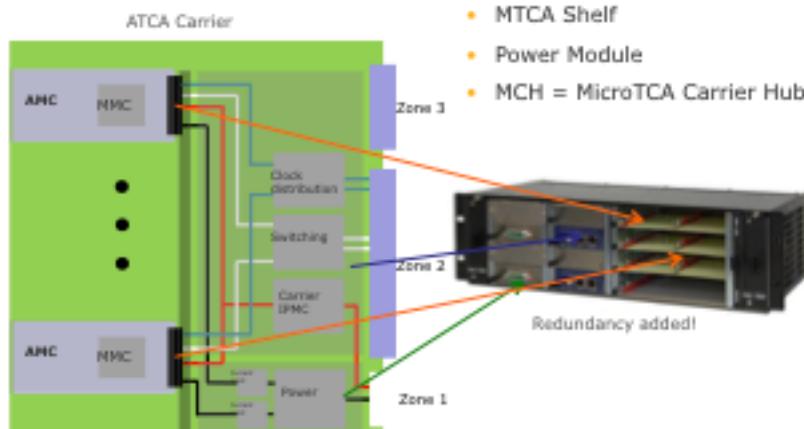
Redundancy added!

AMC
Pluggable in ATCA and MTCA Shelf

- 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)
- No rear I/O
- power input and all outputs to the front
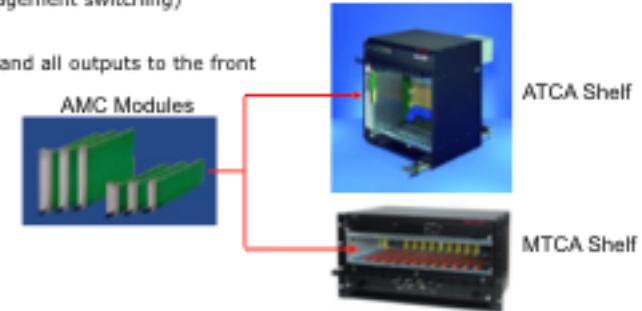
AMC Modules

ATCA Shelf

MTCA Shelf

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ATCA - MicroTCA
Overview

Slide 2

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# 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 interfere with my FRUs?
  - i.e. manipulation of sensors
- How can I service my system?
 - i.e. hot-swap FRUs

Slide 4

MTCA.0.1.2.3.4
Infrastructure of a MicroTCA system
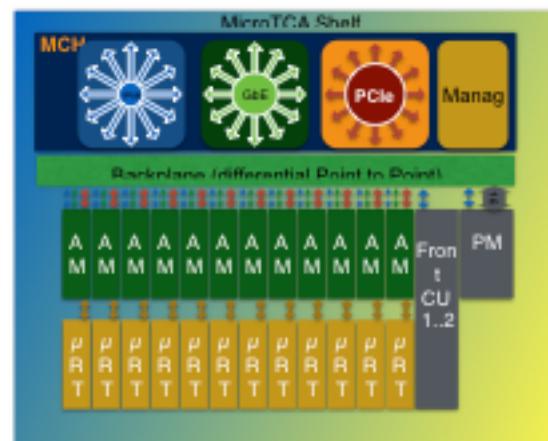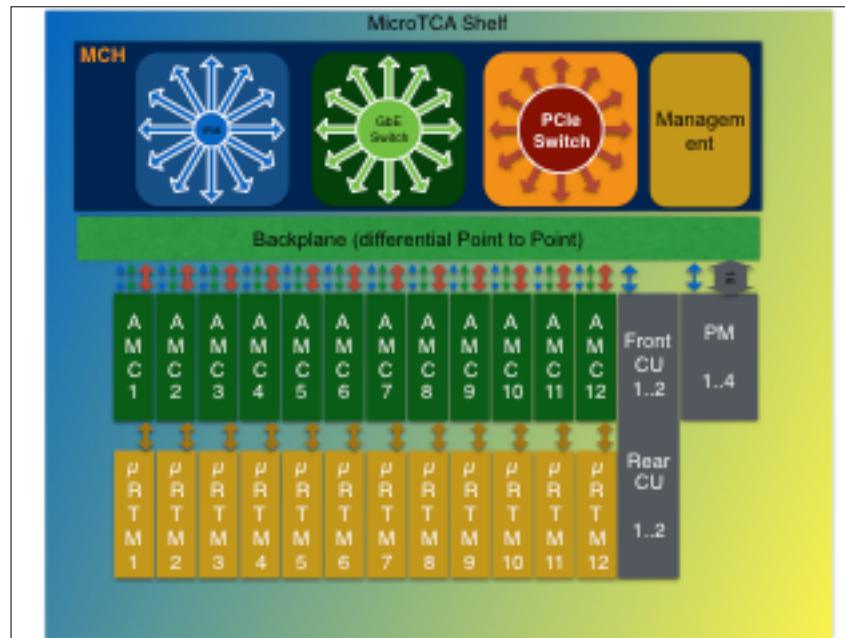
Management in MTCA
Physical Connections and Controllers

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 µRTM
- the µRTM is treated as managed FRU of the AMC
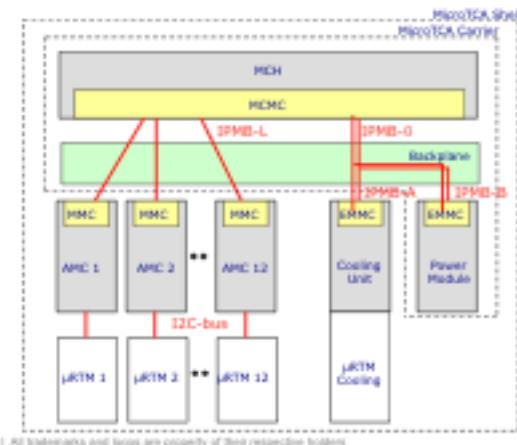
Management in xTCA
Module Activation and Deactivation

- PICMG 3.0 and AMC specifications define FRU states
- Activation pushes FRU into M4 state
- Deactivation moves FRU into M1 state
- If something wrong happen module goes into M7 state
- MCH decides if and when module can reach M4
- MMC uses a state machine to control hot-plug procedure
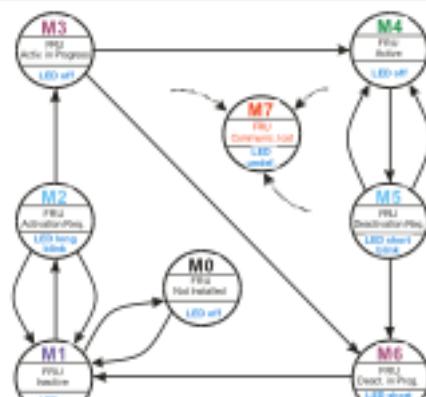
Management in MTCA
Bringing up the infrastructure
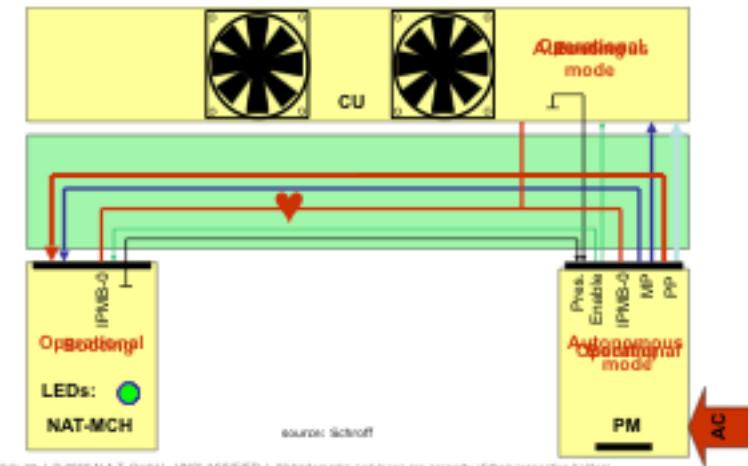
source: Schroff

Management in MTCA
Bringing up the payload
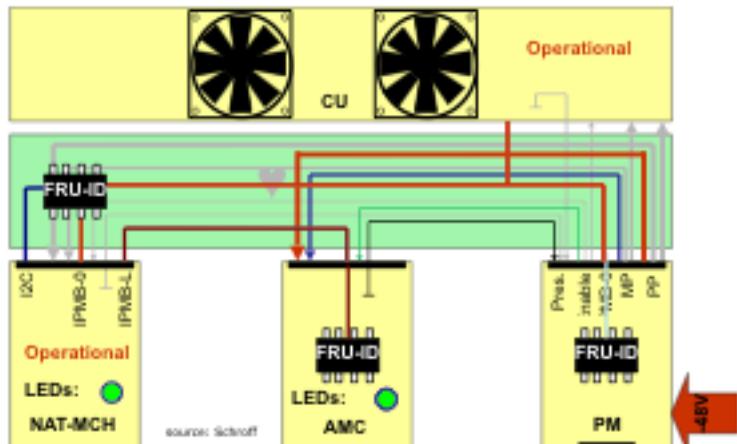
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Management in xTCA
What is behind

- 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)

Management in xTCA
IPMI

- originally defined by Philips to operate on I^2C (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

START	IPMI message	STOP

Management in xTCA
IPMI

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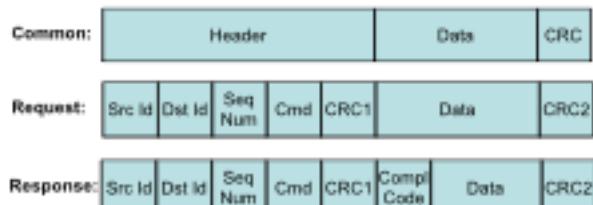
Common:	Header					Data		CRC

Request:	Src Id	Dst Id	Seq Num	Cmd	CRC1	Data		CRC2

| Response:	Src Id	Dst Id	Seq Num	Cmd	CRC1	Compl Code	Data	CRC2

Management in xTCA
IPMI

- IPMI can be easily embedded in other protocols, i.e. for transport over Ethernet networks:

  => RMCP (Remote Management Control Protocol)
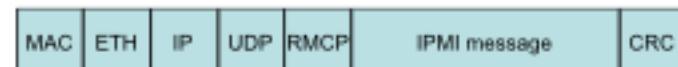
| MAC	ETH	IP	UDP	RMCP	IPMI message	CRC

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Management in MTCA
### Management Structure
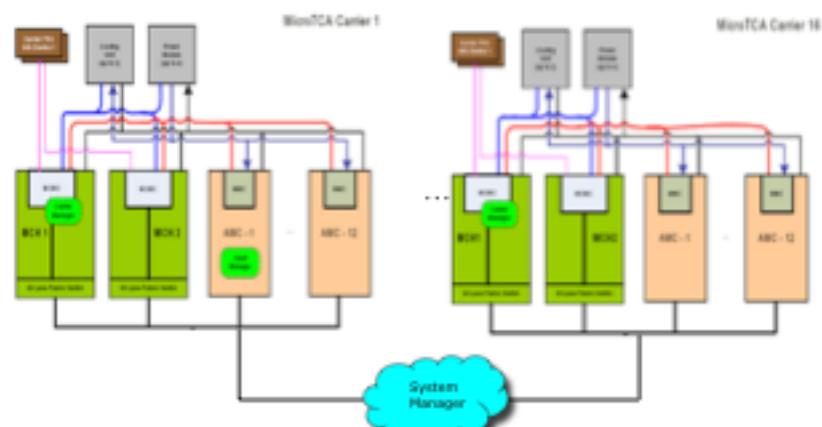
NAT-MCH SW structure – overview
System mangement and IPMI communication

- General µTCA management connections

  - management connection outside a µTCA shelf
    - system manager – shelf manager via ETH
    - shelf manager – carrier manager via ETH

  - management connections inside a µTCA shelf
    - AMCs – Carrier Manager (MCH) via IPMB-L
    - Carrier Manager – PMs + CUs via IPMB-0
    - MCMC (MCH) – Carrier Management FRU Information
            Device via I²C
    - Shelf Manager – remote Carrier Managers via ETH
    - MCMC (MCH) – redundant MCMC (MCH) via IPMB-L

Management in MTCA
System Components
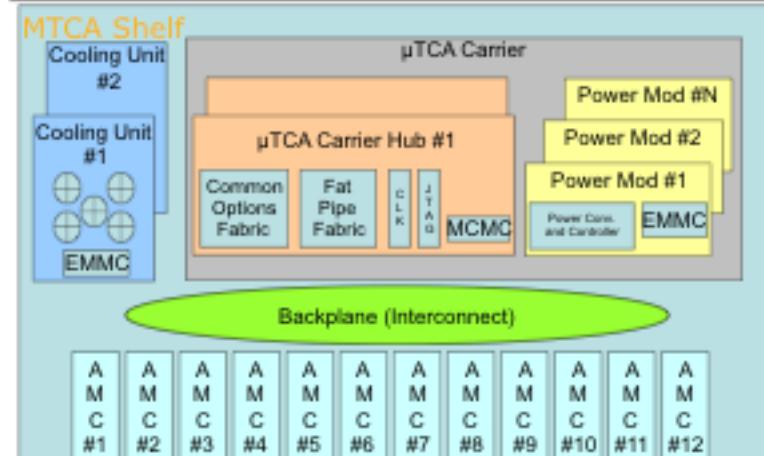
MicroTCA Carrier Hub
### Adaptable to Application Demand

1. Basic Module with GbE-Switch to all AMC slots and Management: Carrier- Shelf- System manager
2. Clock Module for Clk1-3 to all AMC slots
3. Hub Module for AMC Slot 1-6
4. Fat-Pipe for AMC Slot 7-12

MicroTCA Carrier Hub
Adaptable to Application Demand

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Management Software Structure
System management & IPMI communication

- SMS — Linux PC
- Application Software
- Linux
- RMCP over ETH
- BMC — NAT - MCH
- Shelf Manager
- Carrier Manager
- IPMB (I2C)
- HW — specific SW
- HW / HW / HW

Slide 2

Management Software Structure
System management & IPMI communication

- SMS — Linux PC
- JAVA GUI Application
- HPI interface library
- Linux
- OpenHPI
- RMCP over ETH
- BMC — NAT - MCH
- IPMI DB
- RMCP interface
- Shelf Manager
- ShM/CM interface
- Carrier Manager
- MCMC
- FRU Inv.
- SDR Rep.
- SEL
- IPMB (I2C)
- HW — specific SW
- EMMC / MMC / MMC
- PU / CU / AMC

Slide 3

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Management
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?
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  - 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

Slide 2

NATView Power Configuration Manager
Redundancy

Slide 3
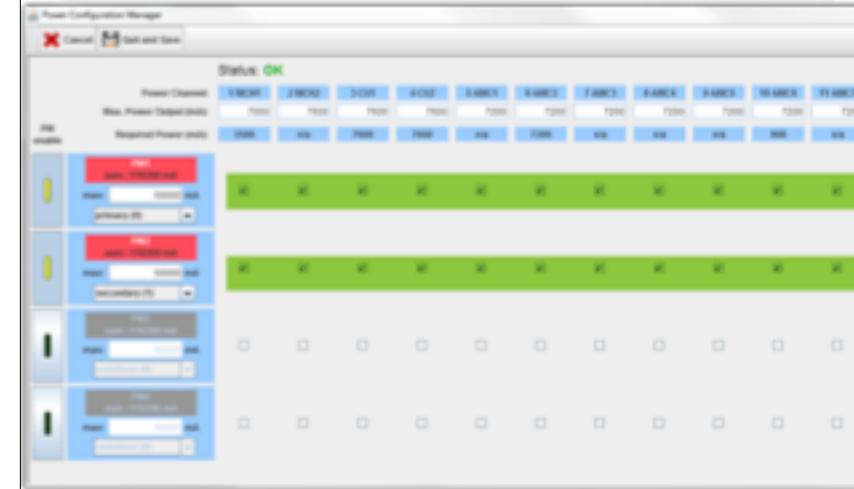
NATView PCM
n+1 Redundancy

Slide 4
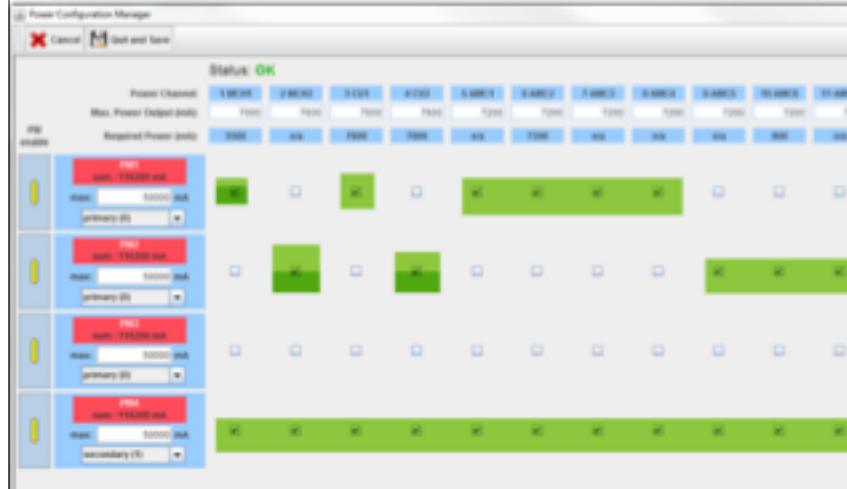
NAT-MCH: Important Commands
Command Line Interface

- 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

NAT-MCH: Important Commands
Command Line Interface

- dhcp_dbg - Configure DHCP client debug
- dhcp_info - Print DHCP client information
- **ifconfig - Print IP configuration**
- ping IP address - Issue ICMP echo request
- rdate - Set date from remote host
- 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**

Inventory: show_fru
MTCA.4.1 System

- 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	S12930012 AMC
12	AMC8	M4	S12930012 AMC
13	AMC9	M4	S12930012 AMC
14	AMC10	M4	S12930012 AMC
15	AMC11	M4	S12930012 AMC
16	AMC12	M4	S12930012 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	S12930012 RTM
97	AMC8-RTM	M1	S12930012 RTM
98	AMC9-RTM	M1	S12930012 RTM
99	AMC10-RTM	M1	S12930012 RTM
100	AMC11-RTM	M1	S12930012 RTM
101	AMC12-RTM	M1	S12930012 RTM
104	eRTM15	M4	ERTM-LO51000

Useful numbers
FRU and I2C addresses

Device	Site No.	FRU ID	I²C 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	1	253	0xA4

Useful numbers
FRU and I2C addresses

Device	Site No.	FRU ID	I²C Addr.
AMC13 in MCH 1 slot	1	29	0xa2
AMC13 in MCH 2 slot	2	30	0xa4
Telco alarm	1	79	-
Carrier Manager		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-Implementation defined		254	
		80-89	
reserved for OEM modules		66-78	
reserved for PM		54-59	

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What is next?
MTCA Training

- Attend an MTCA hands-on training course
  - frequently held at DESY, in-house possible as well
  - training done by N.A.T.
- Two courses, two days each
  - Basic Training
  - Advanced Training
- More information at **https://techlab.desy.de/services/training**

What is next?
MTCA Training - Basic Course

- What you will learn in the Basic Training Course
  - First of all ... Overview of Open Standard AMC MicroTCA
  - Pulling things together
  - Enabling and using the Management Plane
  - Installing the Data Plane
  - Enabling the Data Plane
  - Configuring the Data Plane
  - Operating the MTCA.4 system
  - Maintain/Update MTCA.4 system

What is next?
MTCA Training - Advanced Course

- What you will learn in the Advanced Training Course
  - Management via IPMI
  - System Maintenance
  - System Configuration
  - XILINX Vivado FPGA-Demo
  - PCIexpress: configuration and troubleshooting
  - Clock configuration
  - Operating the MTCA.4 system
  - Maintain/Update MTCA.4 system

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?

- What is next?

Thank you very much!
Questions?

Heiko Körte
Director Sales & Marketing
heiko.koerte@nateurope.com

Terry Manus
Business Development Manager North America
terry.manus@nat-us.com

N.A.T. GmbH
Konrad-Zuse-Platz 9
53227 Bonn, Germany

www.nateurope.com