MTCA Workshop for Industry and Research

How to setup/bring up a MicroTCA system

ONE TECHNOLOGY MULTIPLE SOLUTIONS

SOLUTIONS

FOR COMMUNICATION

MTCA Workshop for Industry and Research
The "How to": setting up a MicroTCA system

- Why you should be here and why we are here
- Who we are
- What you should learn today
  - First of all .... pulling things together
  - Enabling the Management Plane
  - Installing the Data Plane
  - Enabling the Data Plane
  - Configuring the Data Plane
  - Operating the MTCA.4 system
- What you can do as well
- What you (should) have learned today

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MTCA Workshop for Industry and Research
Why we are here and why you should be here

- 1 or 2 "big" standards in our work life
  - VME, PCI, cPCI ....
- MicroTCA and AMCs will be the next dominating standards for industrial systems
  - nothing real new but better and different
  - one standard meeting requirements of many different vertical markets

➔ **MicroTCA is important already !**

➔ **MicroTCA will become even more important in the future !**

MTCA Workshop for Industry and Research

Why we are here and why you should be here

Reference Specification for Management

PICMG 3.0

AdvancedTCA Base Specification
(Telco-centric spec)

Reference Specification for Board Implementation

AMC.0

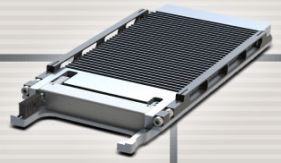
AdvancedTCA Mezzanine Cards Base Specification
(Telco-centric spec)

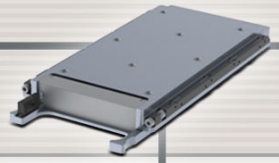
MTCA Application Guide

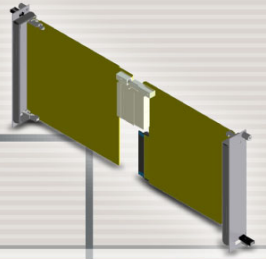
Environmental and capability comparison between MicroTCA specifications

MTCA.0

MicroTCA Air-Cooled Base Specification
Environment: Controlled Telco/Industrial
(Telco-centric spec)







MTCA.1

Rugged Air Cooled Specifications
Environment:
Extended Telco / Industry
(Telco/Industrial-centric)

MTCA.2

Hardened Hybrid Air/Conduction Cooled Specifications
Environment: Military
(MIL-centric)

MTCA.3

Hardened Conduction Cooled Specifications
Environment:
Extended Telco / Military
(MIL-centric)

MTCA.4

Enhancements for Rear I/O and Precision Timing
AMC, MicroRTM, Shelf
(High Energy Physics-centric)

MicroTCA Ruggedization Specification

MicroTCA Capabilities Specification

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About N.A.T.
Network and Automation Technology

- Dipl. Ing. Vollrath Dirksen and Dipl. Phys Heiko Körte
- Founded in 1990, privately owned
- Hard- and Software design and manufacturing
- Focus on innovation in communication
- international and worldwide operations
- Headquarters

  Konrad-Zuse-Platz 9

  53227 Bonn

  Germany

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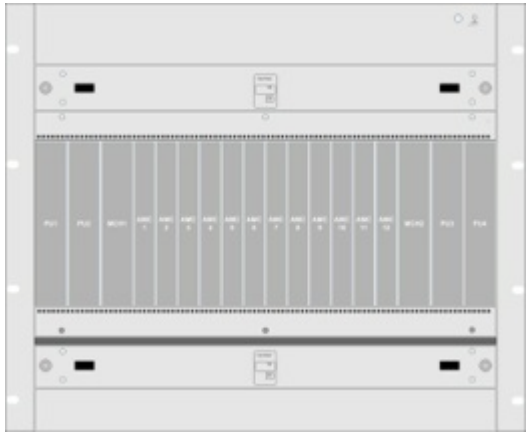
The "How to": setting up a MicroTCA system

First of all … pulling things together

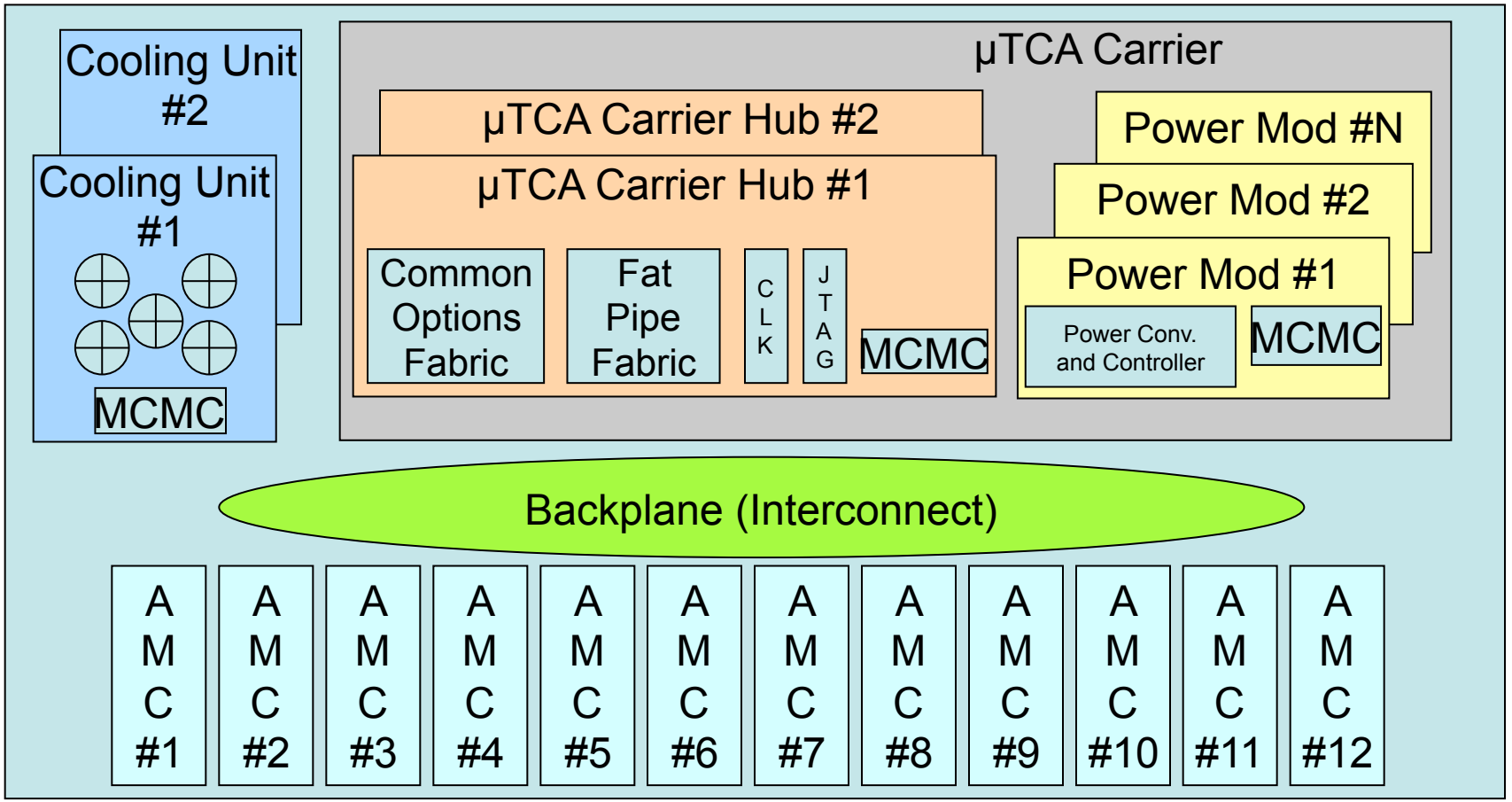
- What does " pulling things together" mean ?
- Selection of basic components: the "infrastructure"
  - Chassis and Cooling Unit(s)
    - use case determines geometry and air flow
    - air flow most important thing for operation
  - Power Modules
    - type: AC/DC vs. DC/DC, power-through vs. converter
    - efficiency: thermal loss
    - reserve
  - MicroTCA Carrier Hub (MCH)
    - management
    - CLK distribution and switching
    - switching: base fabric and fat pipe



The "How to": setting up a MicroTCA system

First of all … pulling things together

- Infrastructure of a MicroTCA system



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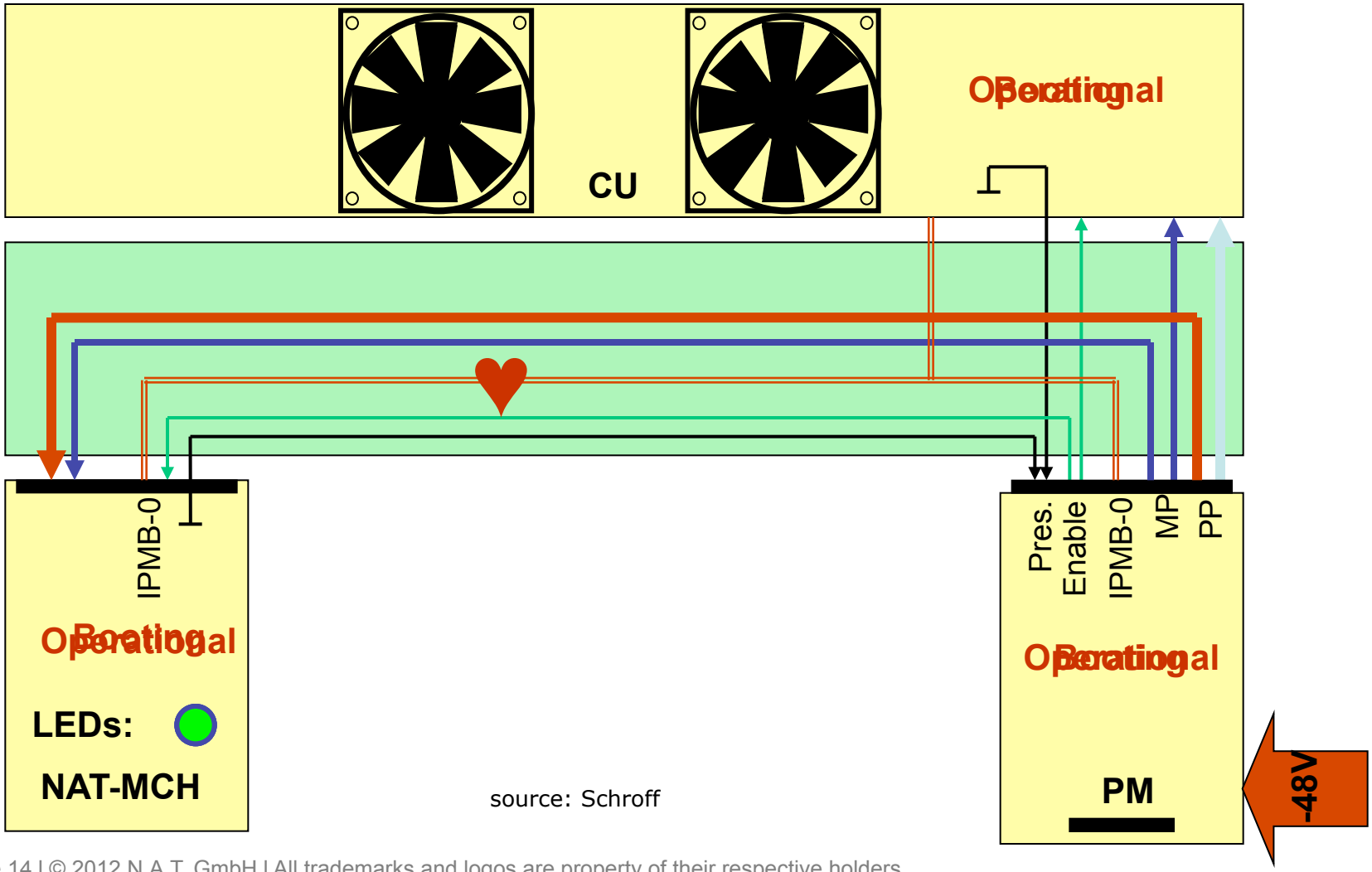
- What does "Enabling the Managment Plane" mean?
- Getting the infrastructure from the power-off state into the managed state
  - understand the expectation
  - put power to the system
  - check the basics and find out if the expected has happend
    - in theory
    - in practise

The "How to": setting up a MicroTCA system

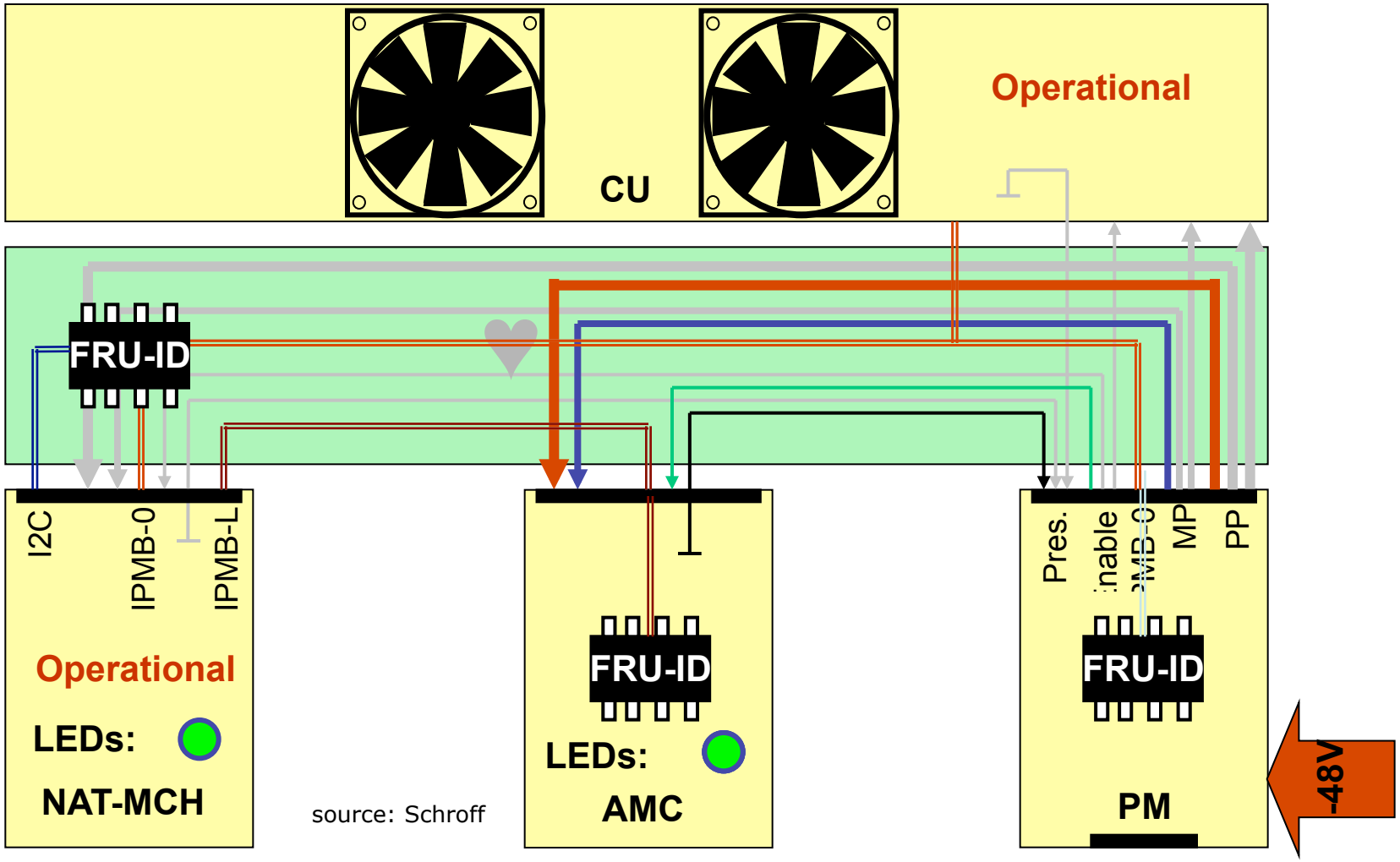
Enabling the Management Plane



source: Schroff

The "How to": setting up a MicroTCA system

Enabling the Management Plane



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The "How to": setting up a MicroTCA system

Enabling the Management Plane

Live

Demo

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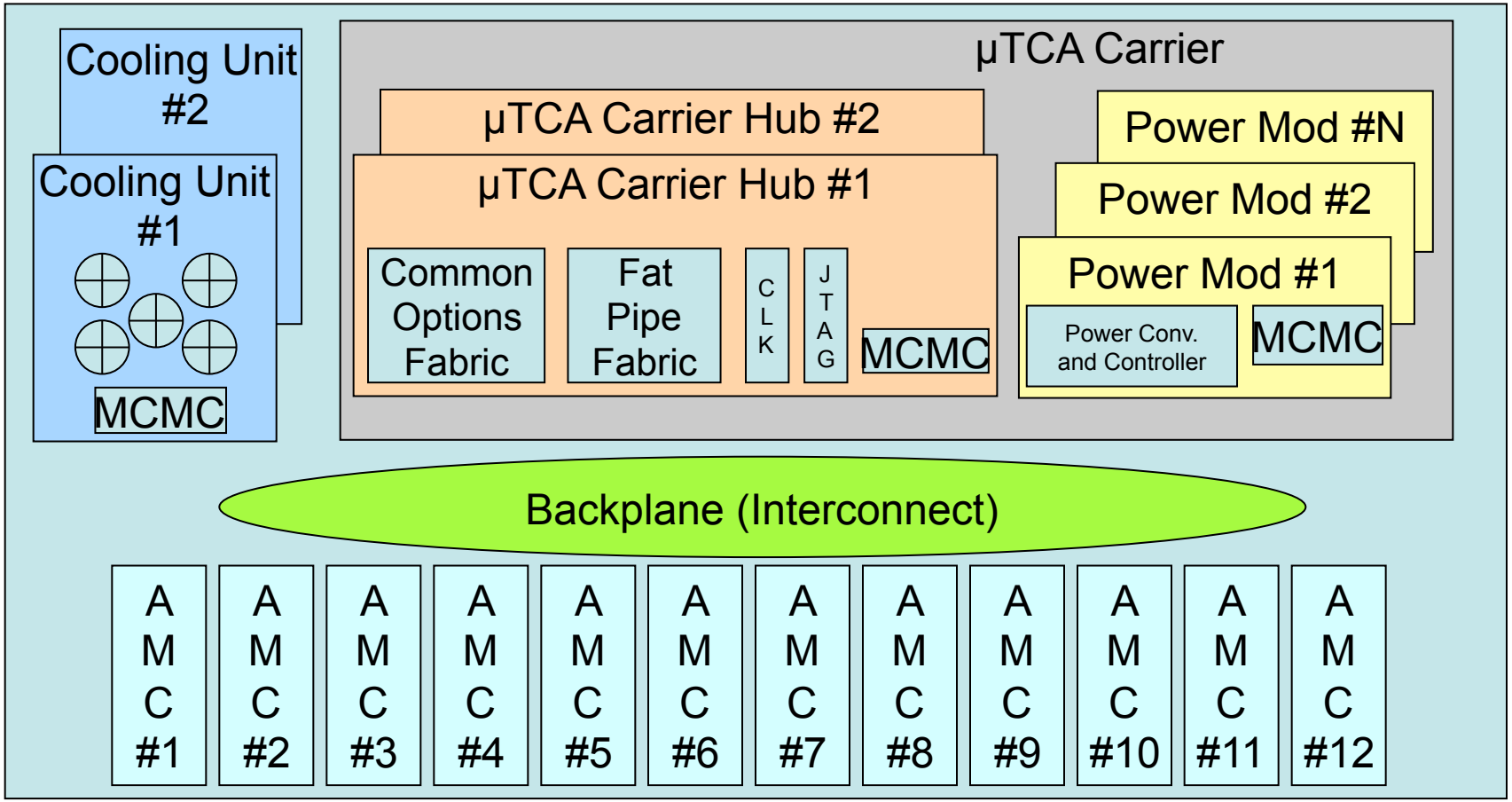
- Infrastructure of a MicroTCA system



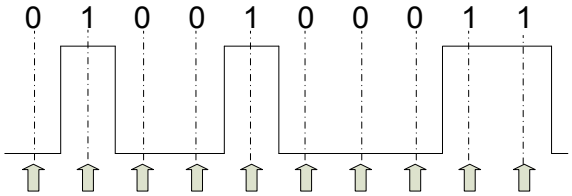
- What does "Installing the Data Plane" mean?
- Establishing the physical link between the AMCs and the MCH switches for the Base Fabric and the Fat Pipes
  - Base Fabric: MCH fabric A ⇔ AMC ports #0 and #1
  - Fat Pipe: MCH fabric D-G ⇔ AMC ports #4-7 and #8-11
  - understand the expectation
  - insert AMCs
  - check the basics and find out if the expected has happend
    - in theory
    - in practise using PCIe

The "How to": setting up a MicroTCA system

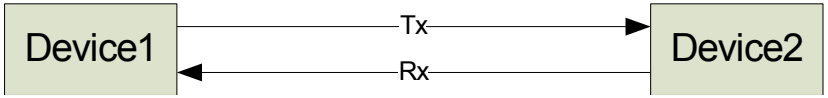
Installing the Data Plane – what is a Fat Pipe ?

- Bits are transmitted one after the other over single data line
- Every data byte (8bit) is transformed to 10bit symbol that contains enough transitions

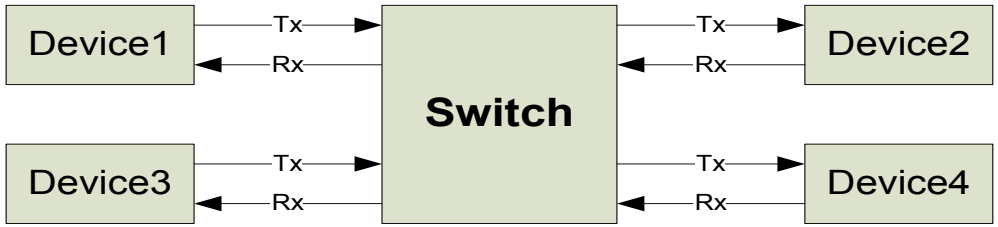
  → **8B/10B Coding**



- Clock is recovered from serial stream
- Bidirectional transmission via dedicated Tx and Rx lines
  - One Tx/Rx pair is called "**Lane**"



- Interconnect between multiple devices realized by **switches**



Installing the Data Plane – what is a Fat Pipe ?

- Very high frequencies: > 1Ghz
  - No per-cycle-relation to other signal needed
  - point-to-point connections only
- Differential Signaling
  - Better immunity to disturbances and interferences
- Bandwidth is determined/limited by:
  - Maximum frequency depends on chip technology and interconnect quality
  - Example: Harting MCH/AMC plugs and backplane connectors are specified with 6,25GHz
  - Multiple Lanes are used in parallel to increase bandwidth
- The whole signal path is important!

- Defined in PICMG AMC.x series (the "Fabrics"):
  - AMC.0 – Base Specification
  - AMC.1 – PCI Express (PCIe)
  - AMC.2 – Ethernet (1GbE and 10GbE/XAUI)
  - AMC.3 – Storage (SAS/SATA)
  - AMC.4 – Serial Rapid I/O (SRIO)

The "How to": setting up a MicroTCA system

Installing the Data Plane – what is a Fat Pipe ?

Protocol	PCIe	1GbE and 10 GbE	SRIO
Advantage	• Memory mapped access • Software compatible to PCI	• Not only for system internal connectivity • Data is ready for connect direct to LAN	• Hardware data integrity • Memory mapped access
Disadvantage	• Host centric architecture	• High Software Overhead	• ???
Typical Application	• Processing Blade • Next generation Industrial PC	• Media Gateway Network Convergence	• Distributed Data processing or Data Acquisition
Bandwidth per lane	• 2.5Gbps (Gen1) • 5.0Gbps (Gen2)	• 1.25Gbps (1GbE) • 3.125Gbps (XAUI)	• 3.125Gbps (Gen1) • 6.25Gbps (Gen2)

- Expectation when inserting AMCs
  - AMCs are recognized by MCH
  - AMCs and MCH exchange their capabilities ("e-keying process")
  - AMCs and MCH establish fabric links if e-keying successful

Live

Demo

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- What does "Enabling the Data Plane" mean?
- Establishing the logical link between the PCIe Root Complex and related AMCs
  - Enabling a certain AMC slot to host the Root Complex by configuring the upstream port of the PCIe switch on the MCH by using
    - either the CLI
    - or the web interface

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- What does "Configuring the Data Plane" mean?
- Using special capabilities of the fat pipe switch in order to achieve certain system functionalities
  - XAUI: i.e. port based or tagged VLAN, IGMP
  - SRIO: i.e. configuring peer matrix
  - PCIe: i.e. clustering
    - A "PCIe Cluster" is defined as a set of at least two PCIe end points with one of them acting as a Root Complex
      - i.e. a PrAMC and one or multiple I/O or DAC AMCs

Question: how to hide the different Clusters from each other?

Answer: use "virtual switches" and their "non-transparent upstream ports"

The "How to": setting up a MicroTCA system

Configuring the Data Plane

Select Host AMCs (Upstream) for each virtual switch that shall be enabled first.
Select Host AMCs (Non-Transparent Upstream) for each virtual switch that shall be enabled afterwards.
Select which AMCs shall be connected to each virtual switch as downstream in the end.

Virtual Switch	Upstream AMC	NT-Upstream AMC	AMC 1	AMC 2	AMC 3	AMC 4	AMC 5	AMC 6	AMC 7	AMC 8	AMC 9	AMC 10	AMC 11	AMC 12
none			○	○	○	○	○	○	○	○	○	○	○	○
Virtual Switch 0	AMC 1	- none -	◉	◉	◉	◉	○	○	○	○	○	○	○	○
Virtual Switch 1	AMC 5	- none -	○	○	○	○	◉	◉	◉	◉	○	○	○	○
Virtual Switch 2	AMC 9	- none -	○	○	○	○	○	○	○	○	◉	◉	◉	◉
Virtual Switch 3	- none -	- none -	○	○	○	○	○	○	○	○	○	○	○	○
Virtual Switch 4	- none -	- none -	○	○	○	○	○	○	○	○	○	○	○	○
Virtual Switch 5	- none -	- none -	○	○	○	○	○	○	○	○	○	○	○	○

Apply

You need to click apply to save your changes.

Save **current configuration to PCIe EEPROM**

Restore **current configuration from PCIe EEPROM**

Disable PCIe Virtual Switches

Disable

Live Demo

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- What will happen during "Operation of the MTCA.4" ?
- Sensors in the system will generate events
  - How to log these events ?
  - How are these events flagged/signalled ?
  - Can certain sensors be monitored ?

    - Live Demo using temperature events and hot-swap events as examples

Live

Demo

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The "How to": setting up a MicroTCA system

Operating the MTCA.4 system

- Most important:

  use vendors that guarantee interoperability of their Products with other MTCX.x and AMC.x compliant products from other vendors

  ➔ PICMG interoperability workshops ("IW")

- No need for redundancy or so many slots or RTMs?

  ➔ Use a smaller or different system !

- Need more AMC or RTMs slots?

  ➔ Use different system components,

  i.e. NAT-MCH-PHYS +RTM (Session 5 tomorrow at 3pm)

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- Summary:
  - MTCA is the coming standard for industrial embedded systems
  - When thinking about MTCA, think of N.A.T.

    Our credo: Talk to us, we care ...
  - We showed and demonstrated:
    - First of all .... pulling things together
    - Enabling the Management Plane
    - Installing the Data Plane
    - Enabling the Data Plane
    - Configuring the Data Plane
    - Operating the MTCA.4 system
    - Alternatives for some requirements

Thank you very much!
Questions?

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Further presentation:

Session 5 tomorrow at 3pm

or see us at the booth

