NAT-MCH

The N.A.T. MicroTCA Carrier Hub **NAT-MCH** is the central management and data switching engine for all MicroTCA systems.

The **NAT-MCH** is designed to provide any functionality as defined by the MicroTCA specification MTCA.0 R1.0, serving up to the maximum of 12 Advanced Mezzanine Cards (AMCs), 1-4 power units and two cooling subsystems.

Because of its scalable and flexible design the **NAT-MCH** can be used in any kind of MicroTCA system, supporting telecom and non-telecom environments as well as redundant and non-redundant architectures.

The mandatory carrier manager is realized utilizing the on-board Freescale ColdFire CPU . For MicroTCA systems operated in a detached or stand-alone mode a shelf manager as well as a system manager can be provided, too.

Serial Rapid I/O

10GigaBit(XAUI)
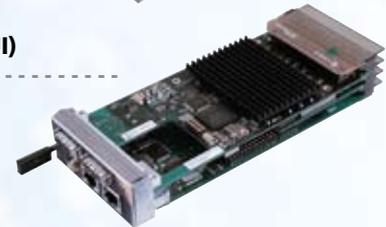
GigaBit Ethernet
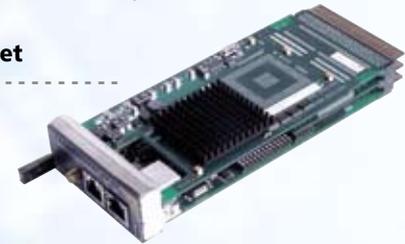
PCI Express

**Telecom clock and FCLK
Serial Attached SCSI**

Beside the intelligence the MCH base module incorporates a managed, non-blocking and low-latency Gigabit Ethernet L2 switch for base channel connectivity. Numerous options like a fabric switch module for PCI-Express (PCIe), Serial Rapid I/O (SRIO), 10 Gigabit Ethernet or a clock distribution module for telecom environments are available as mountable daughter boards.

Following the building block model the **NAT-MCH** can be individually arranged to meet the exact system requirements. A comprehensive software support like a Java based GUI interfacing to the Open HPI compliant top level API of the **NAT-MCH** completes the product and makes it an ideal choice for any AMC based MicroTCA solution.

NAT-MCH
– Block Diagram -
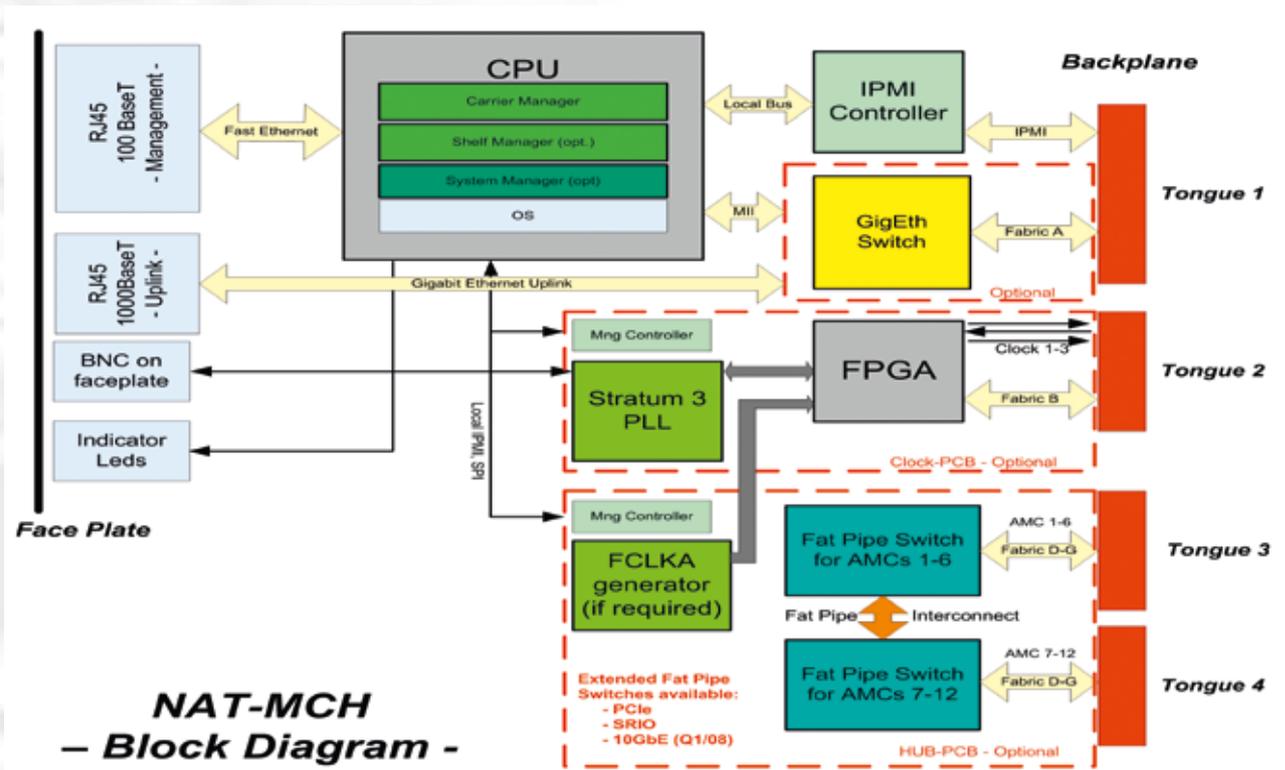
Overview and Purpose

The NAT-MCH is a MicroTCA (uTCA/MTCA) Carrier Hub in the form factor of a single width and mid size or full size Advanced Mezzanine Card (AMC). It provides the central management and data switching entity for all MicroTCA systems.

The NAT-MCH comprises of a base module and numerous optional daughter cards which can be mounted on the base module. The NAT-MCH is MicroTCA.0 R1.0 compliant and delivers switching and hub functionality for the various system fabrics as defined in the AMC.x standard series, i.e. 1Gigabit Ethernet, PCI-Express (PCIe), Serial Rapid I/O (SRIO), 10Gigabit Ethernet (XAUI) or Serial Attached SCSI (SAS). The NAT-MCH can also provide a centralized clock distribution to all AMCs in the system.

CPU, memory and O/S

The NAT-MCH base board is equipped with a CPU of the Freescale ColdFire family of processors. The CPU operates at core frequency of 200 MHz. The NAT-MCH provides 32/64MB SDRAM and 16/32/64MB FLASH memory. The operating system used with the NAT-MCH is OK1 or Linux.

Gigabit Ethernet Hub and Switch and 10GbE (XAUI) Support

The Gigabit Ethernet Switches incorporated in the NAT-MCH both provide a layer 2, non-blocking, low-latency Gigabit Ethernet switches, supporting VLAN as well as a port based rate control. The NAT-MCH supports Fabric A (1GbE) and Fabrics D-G (10GbE, XAUI) according to MicroTCA.0 R1.0 and PICMG SFP.1 R1.0, serving up to 12 AMCs as

well as the update channel from the second MCH in redundant environments. Also supported are uplink ports at the front panel of the NAT-MCH in order to interconnect to other carriers, shelves or systems.

PCI Express Hub and Switch

The PCI Express Switching option allows PCIe connectivity for up to 12 AMCs at PCIe rates from x1 to x4. The used PCIe chipsets provide a Quality of Service (QoS) module and are configurable in terms of a non-transparent port for multi-Host support. The PCIe option can optionally provide a PCIe clock by a Spread Spectrum Clock (100MHz mean) or a fixed 100MHz clock. The clock can be provided compliant to HCSL or MLVDS signaling levels. The PCIe hub provides clustering support for two independant clusters of 6 slots each.

SRIO Hub Module

Alternatively to PCIe or 10GbE (XAUI) the NAT-MCH can be equipped with a Serial Rapid I/O (SRIO) daughther board to support contention less point-to-point connectivity between up to 12 AMC modules. The SRIO hub supports x1 and X4 fat pipe transport density.

Clock Distribution

Besides the PCIe clock the NAT-MCH also offers a sophisticated clock distribution module for special requirements, i.e. as by comms applications. Thus the module allows a flexible selection of the telecom and non-telecom clocking structures as defined in MicroTCA.0 R1.0.

The on-board Stratum 3 type PLL sources its clock reference configurable from either any of the 12 AMCs or from an external clock via the front panel BNC type connector. With respect to the PCIe clock the NAT-MCH supports both signal levels, HSCL as required by PCI-SIG and MLVDS as requested by the MicroTCA.0 specification.

Management

The NAT-MCH incorporates a MicroTCA Carrier Management Controller (MCMC) which supports and manages up two 12 AMCs, 2 cooling units and 1-4 power units. Special care has been taken to support numerous aspects of system architectures, i.e. E-Keying, redundancy, load sharing, clocking, fail-over scenarios or system integrity. External system or shelf managers can connect to the NAT-MCH through and of the Ethernet front panel ports. For remote control and visualization N.A.T. holds its JAVA based application NATView available. Like any other remote management tool (i.e. ipmitool (open source) or any tool based on the HPI recommendation of the Service Availability Form (SAF)) NATView accesses the NAT-MCH via the Remote Management Control Protocol (RMCP) as requested by the MicroTCA.0 specification.

Configuration

The NAT-MCH can be configured comfortably by the included web interface using any standard web browser or by the command line interface via serial connection (RS232) or a Telnet connection.

NAT-MCH-Mezzanine Modules

Clock Mezzanine
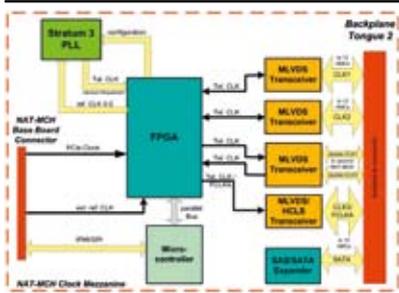
The Clock Mezzanine Module allows a flexible selection of the telecom and non-telecom clocking structures as defined in MicroTCA.0 R1.0. The on-board Stratum 3 type PLL sources its clock reference configurably from either any of the 12 AMCs or from an external clock via the front panel BNC type connector. In conjunction with the PCIe Hub module it provides a PCIe compliant fabric clock (FCLKA) to all AMC slots. This can be either a 100MHz fixed or 100MHz Spread Spectrum clock (SSC). The PCIe clock can be provided compliant to HCSL or MLVDS signaling levels.

Key Features:
- Support of AMC clocks CLK1, CLK2 and CLK3 for up to 12 AMCs
- Update clock for a second NAT-MCH in a redundant systems
- Reference clock In/Output on face plate
- Stratum 3 type PLL clock source for telecom applications
- Variable switching and distribution of clocks by onboard FPGA
- Reference for the Stratum 3 PLL can be either CLK1 or CLK2 from any AMC or sourced from the front panel
- PCI Express compliant clock signal can be distributed via FCLKA to all 12 AMCs (only supported with an installed PCI Express Hub-Module)

PCIe Hub Mezzanine
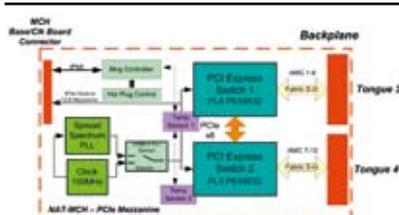
The PCI Express Switching Mezzanine is an AMC.1 compliant module for the NAT-MCH that enables users to add scalable high bandwidth, non-blocking interconnection to a wide variety of applications including servers, storage, video streaming, blade servers and embedded control products. The PCIe Hub module supports full non-transparent bridging functionality to allow implementation of multi-host systems and intelligent I/O modules in applications such as communications, storage and blade servers.

Key Features:
- support for 6 (option -X24) or 12 (option- X48) AMC modules, Fabrics D-G
- non-blocking switch fabric
- built of two PLX PEX 8532 chips (-X48)
- high density x8 interconnect between chips to prevent performance bottleneck
- upstream port configurable to any of the 12 AMC slots
- PCIe hot plug support for each AMC slot
- secondary (failover) host possible
- clustering support, two clusters of 6 AMC modules each can be operated individually, each having its own root complex
- supports x1 and x4 width ports to any AMC
- configuration option for Spread Spectrum Clock (SSC) or 100MHz fixed PCIe clock
- PCIe clock can be provided as Fabric Clock (FCLKA) to the AMC slots

SRIO Hub Mezzanine
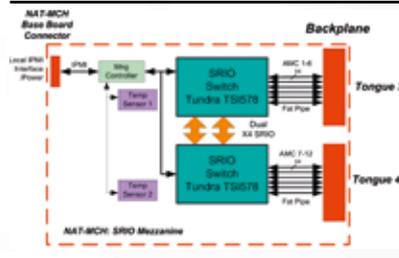
The SRIO Mezzanine module provides a non-blocking high performance data switching functionality for up to 12 AMCs. The non-hierarchical structure of SRIO allows for superior bandwidth data communication between each end point. Additonally, with SRIO data integrity and health checks are performed by hardware.

Key Features:
- flexible port width: X1 and X4
- 12.5 GBit/sec Bandwith per port (X4)
- 80 Gbit/s aggregate bandwidth
- operating baud rate per data lane 1.25 GBit/s, 2.5 GBit/s or 3.125 GBit/s
- transport layer error management
- low latency packet transport
- power down modes and routing capabilities per port
- decentralised communication model: per-to-per

10GbE (XAUI) Hub Mezzanine
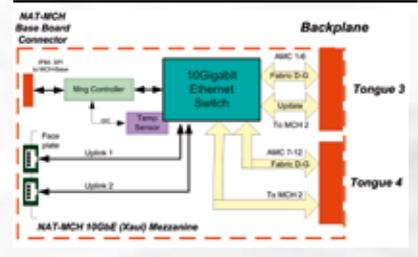
The NAT-MCH 10 GbE Hub Mezzanines provides high performance, low latency and robust Ethernet packet switching service for MTCA systems.

Key Features:
- 10GbE Ethernet port for 12 AMC slots
- 2 Uplink ports on faceplate
- per Port selction of:
  - XAUI - 10GBase-CX4
  - 2.5 GbE
  - 1 Gb
- Link Aggregation (802.3ad)
- 240 Gbps bandwidth

Security:
- MAC address security
- Port access control (802.1x)

### Layer 2 Bridging Features:
- Spanning Tree (802.1D,s,w)
- VLAN priority (802.1Q,P)
- Link Aggregation (802.3ad)
- Duplex Flow Control (802.3x)
- user defined monitoring and filter rules
- 2 Uplink ports on faceplate per Port selction of:
  - XAUI - 10GBase-CX4
  - 2.5 GbE
  - 1 Gb
- Link Aggregation (802.3ad)
- 240 Gbps bandwidth

Security:
- MAC address security
- Port access control (802.1x)
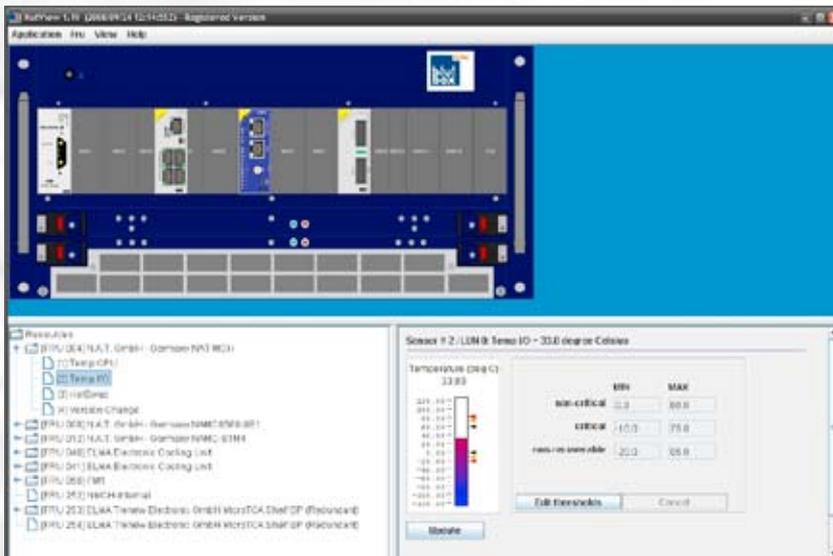
NATView

Overview and Purpose

NATView is an easy to use visualisation tool for any MicroTCA system that includes a NAT-MCH. NATView is operating system independent and runs on any host computer internal or external to the MicroTCA system. NATView allows the user to view at and manipulate the components of the MicroTCA system in a graphical way.

Operating System

NATView is a JAVA based tool and thus independent of any host operating system. NATView can run on an host CPU internal or external to the MicroTCA system if it can execute SUN JAVA 1.5.

Linking to the NAT-MCH

NATView connects to the NAT-MCH using RMCP (**R**emote **M**anagement **C**ontrol **P**rotocol) as requested by the MicroTCA specification. The host part of the RMCP is included in NATView, so no additional protocol support is required for the host.

Features

When connected to a NAT-MCH NATView retrieves any information about the MicroTCA system, i.e. components such as backplane, power modules, cooling units and payload cards and the information provided by these, i.e. manufacturer and product names, serial numbers, versions, sensors and actors and displays them in a photographical way:
The picture displayed is a photographic visualisation identical to the real MicroTCA system.
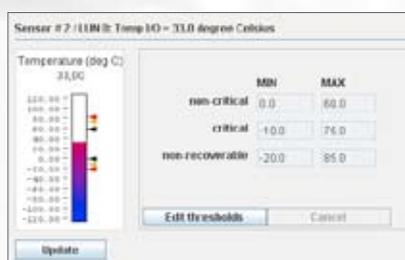
NATView then offers the user the following features:

– animation of hot-swap process of AMC modules
– tree structured representation of sensor and actor data including fans and temperatures
– sensor threshold setting
– intelligent alarm monitoring and prioritization
– logging of events, incidents and alarms
– access to the system event log
– viewing and editing Field Replaceable Unit (FRU) information via a FRU editor
– visual verification of correct FRU informations
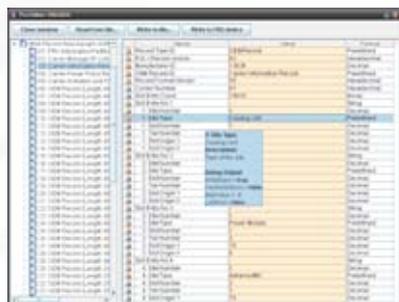
Customization

By default NATView supports any MicroTCA chassis, power modules, cooling units or AMCs the NAT-MCH has been validated with. However, support of any other component including custom designs can be easily integrated into NATView by providing a JPEG picture of that component in the correct naming convention (vendor ID required!).

► Technical Data NAT-MCH

CPU and memory
– Freescale ColdFire 547x @ 200MHz
– DRAM: 32/64MB
– FLASH: 16/32/64MB

IPMI and Compliance
– 12 AMCs,
– 2 cooling units
– 1-4 power units
– PICMG AMC.0 R1.0
– PICMG 2.9 R1.0

Supported Fabrics and Compliance
Fabric A: Gigabit Ethernet
- 12 AMCs
- PICMG AMC.2 R1.0
- PICMG SFP.1 R1.0

Fabric B: Serial Attached SCSI
- Serial ATA
- PICMG AMC.3 R1.0
- option available on request

Fabric D-G:
- PCI Express (PICMG AMC.1 R1.0)
- 12 AMCs, x1-x4 each
- Serial Rapid I/O (PICMG AMC.4)
- 10GbE (XAUI) (PICMG AMC.2)

Clock Distribution
– Telecom: Stratum 3 PLL with reference from either 1 of the 12 AMCs or external clock via front panel
– PCIe: Spread Spectrum Clock (100MHz mean) or oscillator (100MHz fixed), HCSL or MLVDS signaling

Carrier Manager
Management of up to 12 AMCs, 2 cooling units and 1-4 power units, supports redundant architectures and fail-over procedure

Shelf and System Manager
For detached or stand-alone operation both managers are available on-board, hook-in for external managers via 100BaseT or 1GbE port at front panel or backplane GbE

Operating System and API
– O/S: OK1, Linux
– API: HPI compliant

Indicator LEDs
– 4 standard AMC LEDs
– 12 bi-colour LEDs for AMC slot stati
– 2 bi-colour LEDs for cooling units
– 2 bi-colour LEDs for power units

Front Panel Connectors
– 100 BaseT management connection
– 1 GbE system up-link for Fabric A
– external clock reference (bi-directional)
– serial debug connector