Improving Performance of the MTCA System by use of PCI Express Non-Transparent Bridging and Point-To-Point PCI Express Transactions

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**PCI Express NTB**
- PCs have to have only one Root Complex
- PCIe Bus configuration and memory mapping
- NTB used to connect two independent address/Host domains
- A Non-Transparent bridge consist of two back-to-back PCIe endpoints, a Virtual and Link side endpoints.
- NTB isolates Address spaces of different Hosts by appearing as an endpoint to each side

**Key Elements of the NTB**
- BAR0/1 For configuration, visible from both sides of the NTB
- 8 Scratchpad Registers (BARs)
- One BAR is readable and writeable from both sides of NTB.
- 16 Doorbell Registers (BARs)
- The doorbell registers are used to send interrupts from one side of the NTB to the other.
- Up to 4 BARs. Individually disabled
- BAR2/5 are apertures into the address space on the far side of the other endpoint, provides address translation from one side to other

**Setting up the NTB**
1. Enable NTB on the Current port
2. Set up BARs
   - Enable BAR and set Size
3. Setup Address Translation Register for current BAR
4. Setup Requester ID Look Up Tables

**Different Use Cases**
- **Link Side server controls one of AMC Module**
- **Virtual Side server controls both modules**
  - One module send Data to Virtual Side
  - Other module sends Data to Link Side using PCIe Point 2 Point connections
  - Connect External CPU

**Different ways to enable NTB on MTCA**
- PCIe Switch on MCH configured to have 2 BARs on each NTB side with 1MB size
- Used Virtual and Link side NTB device drivers created on base of Universal driver
- Universal driver has information about all AMC PCIe endpoints
- Virtual/Link side Driver sets Address Translation Registers:
  - Link Side BAR2 address of SIS8300
  - Link Side BAR3 address of TAMC532
- Virtual Side Driver sets RD/LUT:
  - Virtual Side LUT: Root Complex
  - Virtual Side LUT: SIS8300
  - Virtual Side LUT: TAMC532
- Link side Driver sets RD/LUT
  - Link Side LUT: Root Complex

**STATUS**
- The source codes can be found on [https://github.com/MicroTCA](https://github.com/MicroTCA)
- The information and Linux packages can be found on a DOOCS web page [http://doocs.desy.de](http://doocs.desy.de)
- Mail: doocs@desy.de

**NTB Transactions**
- **Direct Address Translation**
  - for each enabled BAR on both sides
  - The content of the register could get in readable and writeable from both sides of NTB.
- **Requester ID conversion** (Bus Number, Device Number and Function Number) across NTB. Requester ID translation lookup tables

**Boot Time configuration**
- Done by MCH
- After boot the NTB ready for use on both sides.
- From each side the predefined number of BARs are visible

**Run Time Configuration**
- NTB Virtual and Link side device drivers communicate using Scratchpad Register and Doorbell Register to share the information.
- The drivers setup Address Translation Tables and Requester ID Look Up Tables.
- The drivers initiate PCIe Transactions.

**Transaction from Host2 to SIS8300 and TAMC532 are tested**