# Arm Coherent Mesh Network PMU

CMN-600 is a configurable mesh interconnect consisting of a rectangular grid of crosspoints (XPs), with each crosspoint supporting up to two device ports to which various AMBA CHI agents are attached.

CMN implements a distributed PMU design as part of its debug and trace functionality. This consists of a local monitor (DTM) at every XP, which counts up to 4 event signals from the connected device nodes and/or the XP itself. Overflow from these local counters is accumulated in up to 8 global counters implemented by the main controller (DTC), which provides overall PMU control and interrupts for global counter overflow.

## PMU events

The PMU driver registers a single PMU device for the whole interconnect, see /sys/bus/event_source/devices/arm_cmn_0. Multi-chip systems may link more than one CMN together via external CCIX links - in this situation, each mesh counts its own events entirely independently, and additional PMU devices will be named arm_cmn_{1..n}.

Most events are specified in a format based directly on the TRM definitions - "type" selects the respective node type, and "eventid" the event number. Some events require an additional occupancy ID, which is specified by "occupid".

- Since RN-D nodes do not have any distinct events from RN-I nodes, they are treated as the same type (0xa), and the common event templates are named "rnid_*".
- The cycle counter is treated as a synthetic event belonging to the DTC node ("type" == 0x3, "eventid" is ignored).
- XP events also encode the port and channel in the "eventid" field, to match the underlying pmu_event0_id encoding for the pmu_event_sel register. The event templates are named with prefixes to cover all permutations.

By default each event provides an aggregate count over all nodes of the given type. To target a specific node, "bynodeid" must be set to 1 and "nodeid" to the appropriate value derived from the CMN configuration (as defined in the "Node ID Mapping" section of the TRM).

## Watchpoints

The PMU can also count watchpoint events to monitor specific flit traffic. Watchpoints are treated as a synthetic event type, and like PMU events can be global or targeted with a particular XP's "nodeid" value. Since the watchpoint direction is otherwise implicit in the underlying register selection, separate events are provided for flit uploads and downloads.

The flit match value and mask are passed in config1 and config2 ("val" and "mask" respectively). "wp_dev_sel", "wp_chn_sel", "wp_grp" and "wp_exclusive" are specified per the TRM definitions for dtm_wp_config0. Where a watchpoint needs to match fields from both match groups on the REQ or SNP channel, it can be specified as two events - one for each group - with the same nonzero "combine" value. The count for such a pair of combined events will be attributed to the primary match. Watchpoint events with a "combine" value of 0 are considered independent and will count individually.