PortMaker®III Packet Traffic Management (PTM) Firmware

TSP3 Traffic Stream Processors

Packet Traffic Management for Next-generation IP/MPLS Packet Based Networks

PortMakerIII firmware provides proven, reliable, and fully supported binary applications for the TSP3 family of devices. This PortMakerIII packet traffic management (PTM) application is one of numerous off-the-shelf applications to run on the TSP3 hardware platform. It provides fine-grained packet traffic management at up to 2.5 Gbps throughput with a comprehensive set of features necessary for traffic engineering in packet-based networks. The PortMakerIII PTM application provides the foundation for Ethernet, POS, and next-generation SONET (e.g. GFP, LAPS) designs. The firmware is also available with a source code license to allow product differentiation and multi-service operation with other PortMakerIII or custom applications.

Traffic Shaping

Traffic shaping resources are available using either single or dual token bucket algorithms as defined within RFC2697 and RFC2698. Up to 256K shaping resources can be configured with committed (CIR) and excess (EIR) information rates and configurable burst sizes. The host initially selects the shaping parameters and priority at initialization time. Shaping resources can be applied subjectively at the CoS and CBQ levels in combination with schedulers to create unique hierarchical shaping schemes for sophisticated bandwidth management. Shaping rates are available from 64 Kbps to 2.5 Gbps, within 1 percent accuracy.

KEY FEATURES

- Runs across entire family of TSP3 devices
- Token bucket packet traffic shaping
- Shaping rates configurable from 64 kbps to 2.5 Gbps, within 1 percent accuracy
- Independent profiles for up to 256K connections
- Choice of queue admission policies (WRED, EPD, PPD)
- PWE2 transport of Layer2 frames over MPLS
- Multi-level scheduling policies (CBWFQ, WRR, SP, customized algorithms)
- Hierarchical shaping (CoS, CBQ, and port level shaping)
- Ingress classification
- Per-PHY (up to 64) and per-connection statistics
- PCI based EVM, PortBuilder™III host driver, and consulting services to accelerate time-to-market

Dedicated token bucket hardware resources are also available for port rate shaping (up to 64) when PHY backpressure is not desired or available.

Buffer Management

Two pools of buffers are supported: internal buffers and host buffers. Internal buffers occupy local SDRAM and are 128-bytes in length. Internal buffers are allocated to one of 16 buffer classes during initialization. Host buffers are configurable in size and can be placed either in local SDRAM or in host memory on the PCI bus. Host buffers are optionally used for packet output from the reassembler, when the shared memory mode of operation is used. Up to 256 Mbytes of local SDRAM are supported for both internal and host buffers.
Congestion Control
Queue admission is controlled by one of three methods, selected at open channel time: (1) weighted random early discard (WRED), (2) partial packet discard (PPD), and (3) early packet discard (EPD). The WRED algorithm discards packets in a manner that optimizes the overall network performance of TCP/IP connections. Up to 128 sets of WRED parameters are supported, selected on a per packet basis. Both the ingress and egress paths can provide per-buffer-class EPD when a configurable threshold is exceeded, and partial packet discard (PPD) when the buffer class is exhausted.

Scheduling Policies
Scheduling policies are based on class based queues (CBQ) where an arbitrary number of class of service (CoS) queues allow packets from each CoS queue to be multiplexed onto a single CBQ entity. The CoS queues within a CBQ are serviced using a scheduling algorithm as defined by the host. Scheduling algorithms are configurable on a per CBQ basis and include strict priority (SP), weighted round robin (WRR), class based weighted fair queuing (CBWFQ) with a low latency mode, and customized queuing algorithms. CBQs can also be cascaded together to create multi-level scheduling hierarchies. A maximum number of 64K CBQs and 256K CoS queues are supported.

Each CBQ itself can then be shaped using the available token bucket shaping resources. This allows proportional bandwidth sharing among the CoS queues. Shaping resources can be optionally applied to rate limit each individual CoS queue.

By doing so, each CoS queue is guaranteed both a maximum and minimum rate which restricts low priority CoS queues from consuming the entire bandwidth of the CBQ when high priority CoS queues are inactive.

Ingress Classification
A general purpose mechanism using the TSP3 multi-protocol programmable classification engine is used for mapping ingress traffic to a CoS queue. This provides a general means of selecting a class of service for ingress priority queuing. Example classifications include DiffServ Code Point (DSCP) / TOS for POS and 802.1P for 802.1Q VLAN tagged Ethernet frames.

Applications
The PortMakerIII PTM firmware is intended for use in enterprise, aggregation, edge and core routers, multi-service and Ethernet switches, optical edge equipment, DSLAMs, and fixed and mobile wireless equipment. A typical 2.5 Gbps application using two M27483 devices running PortMakerIII PTM is shown below.

The 2.5 Gbps system scales to a single device when fine-grained traffic management is required only on the egress path - ingress classification would be handled elsewhere in the system.

Figure 1: Bi-directional OC-48

Product Features

- Integrated buffer management
- Congestion control (WRED, EPD, PPD)
- Per CBQ scheduling (SP, WRR, CBWFQ, customized)
- Multi-level scheduling hierarchy
- Multi-protocol programmable classification for ingress processing

- Supports up to 64 PHYs at 64 different rates
- Host control via PCI bus
- Per-connection and per-port statistics

See the TSP3 traffic stream processor family data sheet for a description of the hardware interfaces, memory requirements, and device characteristics.