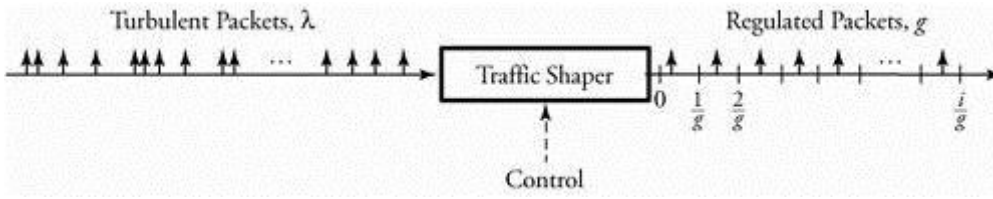
TRAFFIC SHAPING

Realistically, spacing between incoming packets has an irregular pattern, which in many cases causes congestion. The goal of traffic shaping in a communication network is to control access to available bandwidth to regulate incoming data to avoid congestion, and to control the delay incurred by packets

Turbulent packets at rate λ and with irregular arrival patterns are regulated in a traffic shaper over equal-sized 1/g intervals.

Figure 6.2.2. Traffic shaping to regulate any incoming turbulent traffic



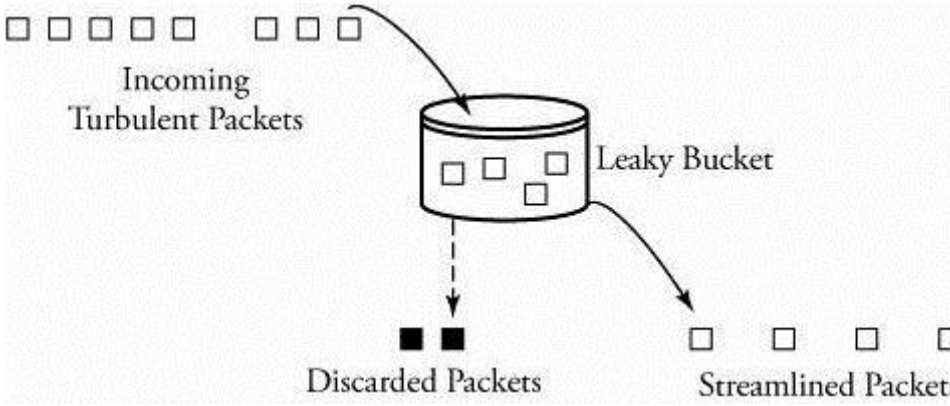
If a policy dictates that the packet rate cannot exceed a specified rate even though the network node's access rates might be higher, a mechanism is needed to smooth out the rate of traffic flow. If different traffic rates are applied to a network node, the traffic flow needs to be regulated. (Monitoring the traffic flow is called traffic policing.) Traffic shaping also prevents packet loss by preventing

the sudden increased usage of system bandwidth. The stochastic model of a traffic shaper consists of a system that converts any form of traffic to a deterministic one. Two of the most popular traffic-shaping algorithms are leaky bucket and token bucket.

Leaky-Bucket Traffic Shaping

This algorithm converts any turbulent incoming traffic into a smooth, regular stream of packets. Figure 12.3 shows how this algorithm works. A leaky-bucket interface is connected between a packet transmitter and the network. No matter at what rate packets enter the traffic shaper, the outflow is regulated at a constant rate, much like the flow of water from a leaky bucket. The implementation of a leaky-bucket algorithm is not difficult.

Figure 6.3. The leaky-bucket traffic-shaping algorithm



At the heart of this scheme is a finite queue. When a packet arrives, the interface decides whether that packet should be queued or discarded, depending on the capacity of the buffer. The number of packets that leave the interface depends on

the protocol. The packet-departure rate expresses the specified behavior of traffic and makes the incoming bursts conform to this behavior. Incoming packets are discarded once the bucket becomes full.

This method directly restricts the maximum size of a burst coming into the system. Packets are transmitted as either fixed-size packets or variable-size packets. In the fixed-size packet environment, a packet is transmitted at each clock tick. In the variable-size packet environment, a fixed-sized block of a packet is transmitted. Thus, this algorithm is used for networks with variable-length packets and also equal-sized packet protocols, such as ATM.

The leaky-bucket scheme is modeled by two main buffers, as shown in One buffer forms a queue of incoming packets, and the other one receives authorizations. The leaky-bucket traffic-shaper algorithm is summarized as follows.

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