



Optimizing Converged Cisco Networks (ONT)



Module 4: Implement the DiffServ QoS Model

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Module 4: Implement the DiffServ QoS Model



Lesson 4.7: Introducing Traffic Policing and Shaping

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Objectives

- Explain the purpose and function of traffic conditioning methods: policing and shaping.
- Compare and contrast traffic policing and traffic shaping.
- Give examples of how policing and shaping are used in typical network topologies.
- Describe the purpose and function of a token bucket.

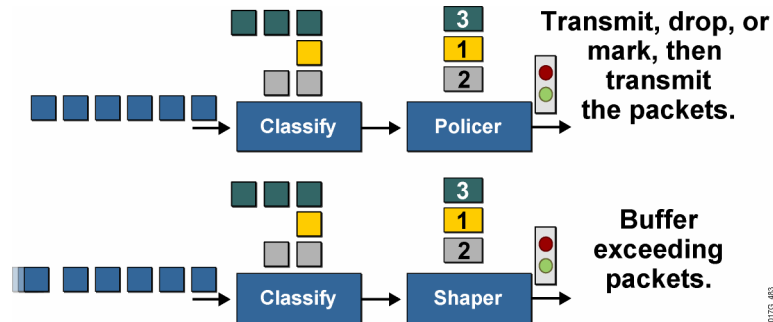
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Traffic Conditioners

- **Policing**
 - Limits bandwidth by discarding traffic.
 - Can re-mark excess traffic and attempt to send.
 - Should be used on higher-speed interfaces.
 - Can be applied inbound or outbound.
- **Shaping**
 - Limits excess traffic by buffering.
 - Buffering can lead to a delay.
 - Recommended for slower-speed interfaces.
 - Cannot re-mark traffic.
 - Can only be applied in the outbound direction.

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Traffic Policing and Shaping Overview



- These mechanisms must classify packets before policing or shaping the traffic rate.
- Traffic policing typically drops or marks excess traffic to stay within a traffic rate limit.
- Traffic shaping queues excess packets to stay within the desired traffic rate.

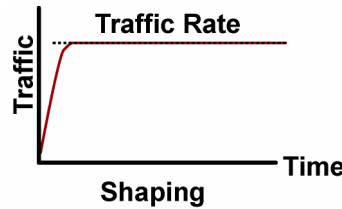
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Why Use Policing? Why Use Shaping?

- To limit access to resources when high-speed access is used but not desired (subrate access)
- To limit the traffic rate of certain applications or traffic classes
- To mark down (recolor) exceeding traffic at Layer 2 or Layer 3
- To prevent and manage congestion in ATM, Frame Relay, and Metro Ethernet networks, where asymmetric bandwidths are used along the traffic path
- To regulate the sending traffic rate to match the subscribed (committed) rate in ATM, Frame Relay, or Metro Ethernet networks
- To implement shaping at the network edge

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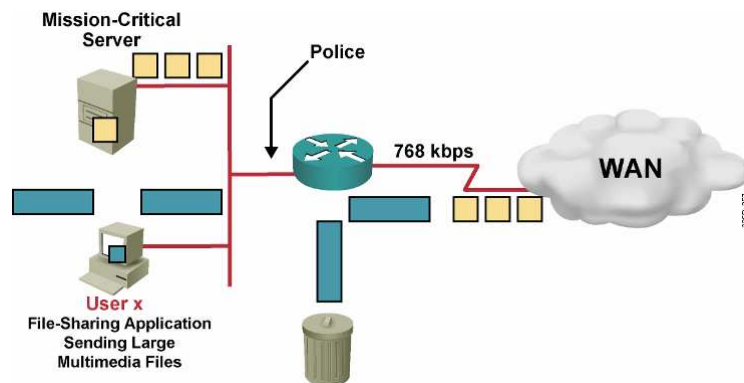
Policing Versus Shaping



- Incoming and outgoing directions.
- Out-of-profile packets are dropped.
- Dropping causes TCP retransmits.
- Policing supports packet marking or re-marking.
- Outgoing direction only.
- Out-of-profile packets are queued until a buffer gets full.
- Buffering minimizes TCP retransmits.
- Marking or re-marking not supported.
- Shaping supports interaction with Frame Relay congestion indication.

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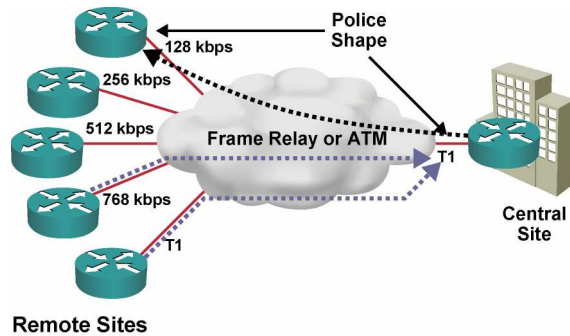
Traffic Policing Example



- Do not rate-limit traffic from mission-critical server.
- Rate-limit file-sharing application traffic to 56 kbps.

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Traffic Policing and Shaping Example



- Central to remote site **speed mismatch**
- Remote to central site **oversubscription**
- **Both** situations result in buffering and in delayed or dropped packets.

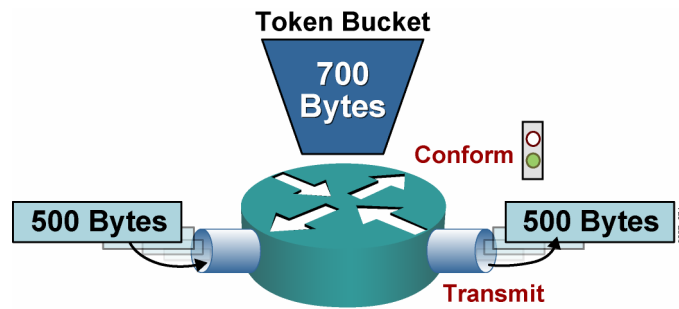
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Token Bucket

- Mathematical model used by routers and switches to regulate traffic flow.
- Tokens represent permission to send a number of bits into the network.
- Tokens are put into the bucket at a certain rate by IOS.
- Token bucket holds tokens.
- Tokens are removed from the bucket when packets are forwarded.
- If there are not enough tokens in the bucket to send the packet, traffic conditioning is invoked (shaping or policing).

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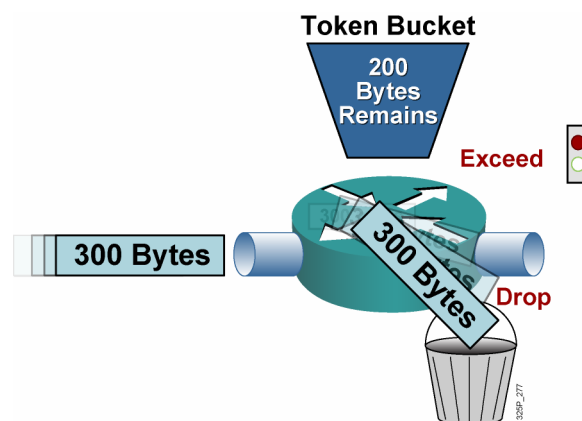
Single Token Bucket



- If sufficient tokens are available (conform action):
Tokens equivalent to the packet size are removed from the bucket.
The packet is transmitted.

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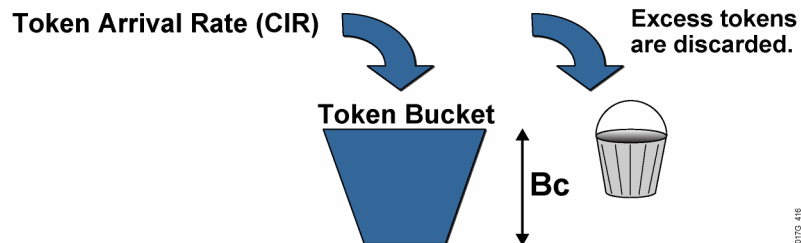
Single Token Bucket Exceed Action



- If sufficient tokens are not available (exceed action):
Drop (or mark) the packet.

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Single Token Bucket Class-Based Policing



Bc is normal burst size.
 Tc is the time interval.
 CIR is the committed information rate.
 $CIR = Bc / Tc$

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Cisco IOS Traffic-Policing Mechanism

	Class-Based Policing
Enable method	Enabled in policy map
Conditions	Conform, exceed, violate
Actions	Drop, set, transmit
Implementations	Single or dual token bucket, single- or dual-rate policing, multiactions

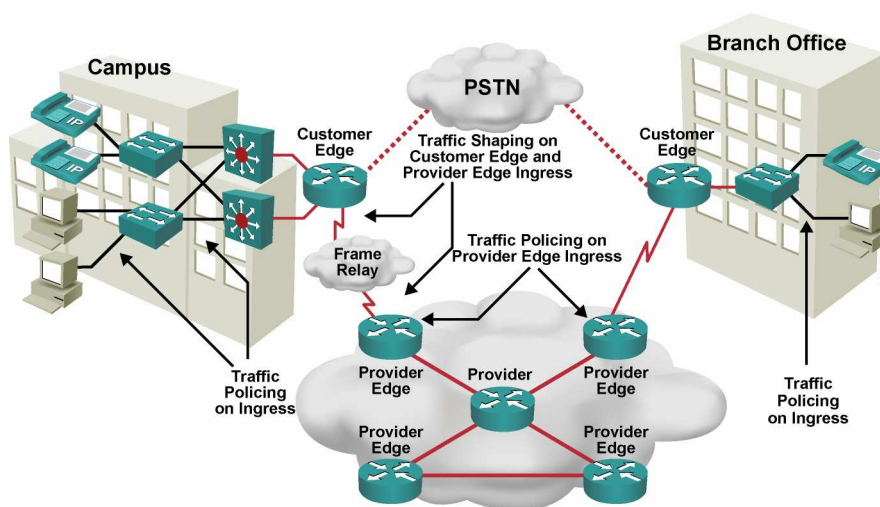
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Cisco IOS Traffic-Shaping Mechanisms

	Class-Based Shaping	FRTS
Restriction	Shaper for any subinterface	Shaper for Frame Relay only
Classification	Class-based	Per DLCI or subinterface
Link fragmentation and interleaving	No support for FRF.12	Supports FRF.12
Frame Relay Support	Understands BECN and FECN	Understands BECN and FECN
Configuration	Supported via MQC	Supported via MQC

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Applying Rate Limiting



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Summary

- Traffic conditioners are QoS mechanisms that limit bandwidth, and include policing and shaping. Both of these approaches limit bandwidth, but each has different characteristics.
- Policing typically limits bandwidth by discarding traffic that exceeds a specified rate.
- Shaping limits excess traffic, not by dropping it but by buffering it.
- The token bucket is used to determine if traffic flow exceeds or conforms to predetermined rates.

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