Vanguard Managed Solutions

Vanguard Applications Ware
IP and LAN Feature Protocols

Protocol Priority

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Part No. T0100-09, Rev H
Publication Code: DS
First Printing: November 1998

Manual is current for Release 6.2 of Vanguard Applications Ware.

To comment on this manual, please send e-mail to LGEN031@vanguardms.com

Overview

Introduction

This document describes how to configure and use the Protocol Priority feature on the Vanguard products.

In This Manual

Protocol Priority

What Is Protocol Priority?

The Protocol Priority feature provides prioritization for the following protocol traffic so that WAN bandwidth is shared effectively between them:

- IP
- IPX
- Protocols and Applications within IP and IPX
- Appletalk
- Transparent Bridging

Protocol Priority allows you to classify and service different traffic streams over a WAN link/connection by assigning a priority level and percentage of bandwidth.

Features of Protocol Priority

The Vanguard Protocol Priority feature supports:

- bandwidth sharing among different classes of traffic
- prioritization of one traffic class over another
- prioritization of traffic as high while sharing bandwidth among the lower priority classes in the absence of higher priority traffic
- prioritization of Voice over IP (VoIP) traffic to receive FAST PATH service
- end-to-end Quality of Service (QoS) indication and control

Why Use Protocol Priority?

The WAN bandwidth required for processing high-speed LAN traffic is ever increasing. While there are various mechanisms for increasing WAN bandwidth, there is a limit to how much it can increase. Adding more bandwidth is expensive. Therefore, it is important to use WAN bandwidth effectively.

All traffic transmitted onto a WAN link is not of equal significance. Consider the following scenarios:

- If you transmit traffic in the order in which it arrives, a low significance application that generates large amounts of traffic and uses a large packet size at a high rate will slow down other traffic.
- An application that generates a small amount of traffic and uses a small packet size at a slow rate can time-out and result in poor performance. For example, a large FTP transfer can result in poor response of a TELNET session.

It is important how the applications share the available bandwidth irrespective of their burstiness. It is also important that you classify and treat traffic streams on a WAN connection depending on their need.

What is Traffic Priority?

Traffic Priority allows priority of one data stream over another at the link. Packets are tagged at the access port or WAN adapter (LCON) for a decision at the Egress port. The existing Vanguard Traffic Priority feature, described in *Bandwidth Management Manual*, is compatible with the Vanguard Protocol Priority feature.

Where Protocol Priority Occurs

The Protocol Priority feature allows for application level prioritization within a protocol suite, for example, TCP/IP Telnet over FTP. Packets are tagged at Bridge and Router Forwarders for protocol decisions at the WAN adapter (LCON).

It adds prioritization at the LCON level and is configurable for all supported protocols. LAN protocols now have two levels of prioritization with SVC ports:

- Protocol Priority at the WAN Adapter
- Traffic Priority at the SVC ports

With the Protocol Priority feature, IP prioritization is configurable based on protocol number, source and destination port number, and source and destination IP address and/or subnet. IPX prioritization is configurable based on packet type, socket number, destination network, and destination node.

Platform Support

Protocol Priority is supported on all Vanguard products except the Vanguard 100 and Vanguard 200.

Protocols Supported

Supported traffic streams include:

- IP
- IPX
- APPLETALK
- TB (Transparent Bridge)
- IP Traffic Within TB
- Voice over IP

Compatibility With Other Features

Protocol Priority is also compatible with supported Vanguard data compression and voice features.

Limitations

This section describes the limitations that apply to the Protocol Priority feature:

- Protocol Priority is supported only for LAN traffic.
- For X.25 or Frame Relay Annex G, this feature is available only on a per-connection basis (both SVC and PVC) and is not supported for multiple connections and parallel SVCs.
- For Frame Relay Bypass, this feature is available only on a per-DLCI basis and is not supported on multiple DLCIs.
- For PPP, Protocol Priority works best with a single PPP link but may not be efficient on multi-link PPP.
- Protocol Priority does not work with parallel SVCs and Bandwidth On Demand
- FAST PATH Service for voice traffic works best on a Frame Relay Bypass or Annex G link and may not be efficient on a PPP link.

Protocol Priority is not supported for SNA and Serial Traffic. If these traffic types are present on same connection or link, the feature may not be efficient.

How Protocol Priority Works

Introduction

Protocol Priority allows you to assign the percentage of WAN bandwidth used by protocols and applications. The WAN bandwidth is shared among these protocols and applications based on certain configurable parameters. Prioritization occurs by separating traffic into separate queues and then scanning those queues according to the configured priority. By assigning a higher percentage to a protocol/application, or to a group of protocols and applications (by putting them in a single traffic class), traffic belonging to one protocol/application or group can be prioritized over another.

What are Protocol Priority Profiles?

The Protocol Priority Profile Table defines configurable parameters, traffic flows, their classes, and percentage bandwidth.

The Protocol Priority feature supports configuration of up to three protocol priority profiles. The table below shows the corresponding number of traffic flows and number of classes supported with increasing protocol priority profile.

Number of Profiles	Number of Traffic Flow	Number of Classes
1	9	5
2	18	10
3	27	15

Protocol Priority profiles are prioritized in the order they are configured. For example, if you configure three profiles, 5, 3, and 7, priority will be assigned in that order. Profile 5 will have higher priority over Profile 3, which in turn has higher priority over Profile 7.

Types of Traffic Flows

For each profile, you can prioritize nine different traffic streams over a WAN link/ connection (X.25, Frame Relay and PPP). These include IP, IPX, Transparent Bridging, IP traffic with Transparent Bridging, Appletalk, IPX RIP, IP RIP, OSPF and IPX SAP. Prioritization criteria can be applied to prioritize traffic of the same traffic flow type. For more information refer to “Traffic Classification” section on page 14.

Classes

Each traffic flow can be classified by five classes of prioritization: EXPEDITE, HIGH, MEDIUM, LOW, and DEFAULT. EXPEDITE has the highest priority and DEFAULT has the lowest priority.Classification depends the traffic flow type as defined in the table below.

■ **Note**

The traffic flows that are not classified as EXPEDITE, HIGH, MEDIUM, LOW, fall into the DEFAULT class of the last profile configured.

■ **Note**

RIP, OPSF and SAP traffic are classified as EXPEDITE of the first profile configured.

Step	Traffic Flow Types	Class Priority
1	IP	Expedite High Medium Low Default
2	IPX	Expedite High Medium Low Default
3	Transparent Bridging	Expedite High Medium Low Default
4	IP Traffic within Transparent Bridging	Expedite High Medium Low Default
5	Appletalk	Expedite High Medium Low Default
6	IPX RIP	Expedite
7	IP RIP	Expedite
8	OSPF	Expedite
9	IPX SAP	Expedite

FAST PATH Service for Voice over IP Traffic

Voice over IP traffic has the highest class and priority over all other traffic flows and classes. Voice traffic receives FAST PATH service and any voice packets are immediately sent to the WAN port link without class servicing or queuing.

As shown in Figure 1, voice traffic receives the highest priority and is immediately sent to the WAN port link. EXPEDITE traffic of Profile 1 is the next highest priority, followed by HIGH traffic of Profile 1, MEDIUM traffic of Profile 1, and so on. The DEFAULT class of Profile 3 has the lowest priority. As mentioned in “What are Protocol Priority Profiles?” section on page 4, higher priority is given in the order in which the protocol priority profile is configure. In this example, Profile 1 has the highest priority and Profile 3 the lowest priority.

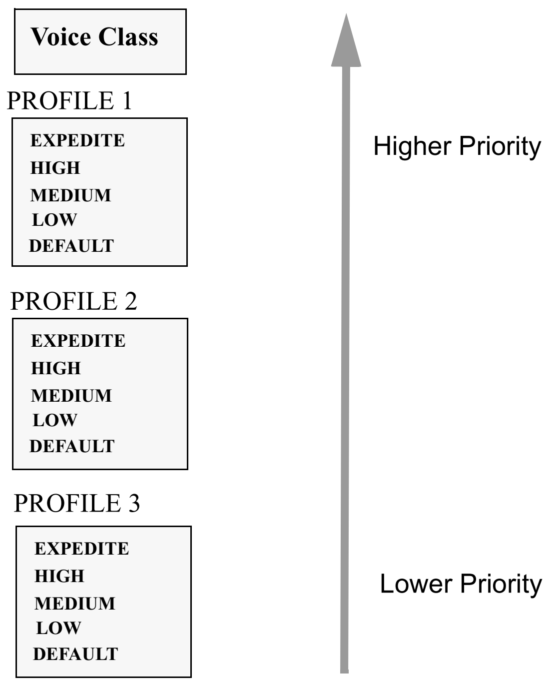


Figure 1. Priority Level

Bandwidth Assignments

You can assign each of the classes (EXPEDITE, HIGH, MEDIUM, LOW, and DEFAULT) a percentage of WAN bandwidth from 0 to 100%. Traffic flow from the classes is forwarded to the WAN link/connection depending on the configured percentages and priority level.

These considerations apply to the division and transmission of traffic in the assigned classes:

Percentage	Service Type	Description
0%	Best Effort	There is no guarantee of service for classes assigned 0% bandwidth. Classes with 0% bandwidth are serviced only when there are no non-zero classes. If two or more classes are configured for 0%, servicing is based on class level. For example, the Vanguard services a MEDIUM class with 0% before servicing a LOW class with 0%.
1-99%	Bandwidth Allocation/Sharing	Traffic classes assigned less than 100% share the bandwidth depending on the assigned percentages and are transmitted only in the absence of those with 100% bandwidth. The total percentage of these traffic classes cannot exceed 100%. If the total percentage of these classes does not total 100%, the remaining traffic is assigned to the DEFAULT traffic class.
100%	Priority Based Service	If you assign a traffic class 100 percent bandwidth, all packets belonging to this class receive 100% bandwidth prioritization, as long as there is no higher class also configured at 100%. Assignment of 100% overrides all the classes configured for less than 100% and all the packets from this class are forwarded before forwarding any packets from classes configured at 1ess than 100%. If more than one class is configured for 100%, the priority level of the class determines forwarding and all higher priority traffic is forwarded before lower priority traffic. Traffic assigned 100% prioritization blocks the transmission of all other traffic configured at a lower percentage or configured in a lower class. For example, if both HIGH and MEDIUM traffic classes are assigned 100%, all traffic in the HIGH class is transmitted first, using the whole bandwidth if necessary. Only in the absence of the HIGH class traffic can the MEDIUM class traffic be transmitted.

■ **Note**

The total percentage of non Priority Based Service types, for all profiles specified, should add up to 100%. If the total percentage is less than 100%, the remaining amount will be assigned to the DEFAULT class of the last profile. If the total percentage exceeds 100%, all non Priority Service classes will be normalized to 100% and a warning message will be generated. Refer to the protocol priority statistics on page 42.

Traffic Forwarding

Introduction

Forwarding of traffic over a WAN link/connection is based on the assigned percentages and the priority level of the traffic classes. Using the priority level for forwarding allows critical traffic streams to use the complete WAN bandwidth and override all others. The Protocol Priority feature efficiently uses the WAN bandwidth by allowing classes configured for less than 100 percent to exceed that assigned percentage when other classes are not using their share or are absent.

The Protocol Priority feature tracks of the history of usage for classes of less than 100 percent. Under-used classes use this history to acquire the bandwidth from over-used classes. A class configured for less than 100 percent may use 100 percent WAN bandwidth in the absence of other traffic, but will temporarily (if needed) give up its share to others when they are present. If a traffic class has under used (or has not used) its assigned bandwidth (due to a long absence), it may use full WAN bandwidth for a short period when there is a large burst.

Traffic Forwarding Types

There are three traffic forwarding types:

Forwarding Type	*Description*
FAST PATH Service	FAST PATH service is reserved for Voice traffic only. All voice traffic received on the LAN port are immediately sent over the WAN without queuing or traffic prioritization. FAST PATH service can be implemented throughout the network by configuring IP Precedence parameter for all Vanguard nodes supporting voice traffic.
Priority Based Forwarding	Priority Based Forwarding is used for traffic classes assigned 100% bandwidth. Priority Based Forwarding overrides Credit Based Wait & Forward when either expedite or high traffic classes are present. If more than one traffic class are assigned 100% bandwidth, traffic is forwarded based on the highest traffic class first. For example, 100% EXPEDITE traffic is forwarded before 100% HIGH traffic; 100% HIGH traffic is forwarded before 100% MEDIUM and so on. Lower priority 100% traffic and less than 100% traffic is forwarded only in the absence of higher priority traffic.
Bandwidth Allocation and Sharing or Credit-Based Wait and Forward	Use for traffic classes assigned less than 100% bandwidth.

Priority Based Forwarding and Bandwidth Allocation and Sharing schemes can be simultaneously active depending on the configuration.

Example of Traffic Forwarding

Figure 2 illustrates an example of traffic forwarding with protocol priority. The examples show two profiles each with five queues.

All other packets are queued and serviced according to profile, traffic class, and bandwidth application. Traffic shown in Figure 2 is forwarded in this order:

- Voice traffic receives FAST PATH service and is immediately sent to the WAN Port.
- Traffic in Profile 5 is forwarded next and in this order, EXPEDITE, HIGH, MEDIUM, LOW, and DEFAULT.
- Lastly, traffic in Profile 2 is forwarded according to the bandwidth percentage assignment.

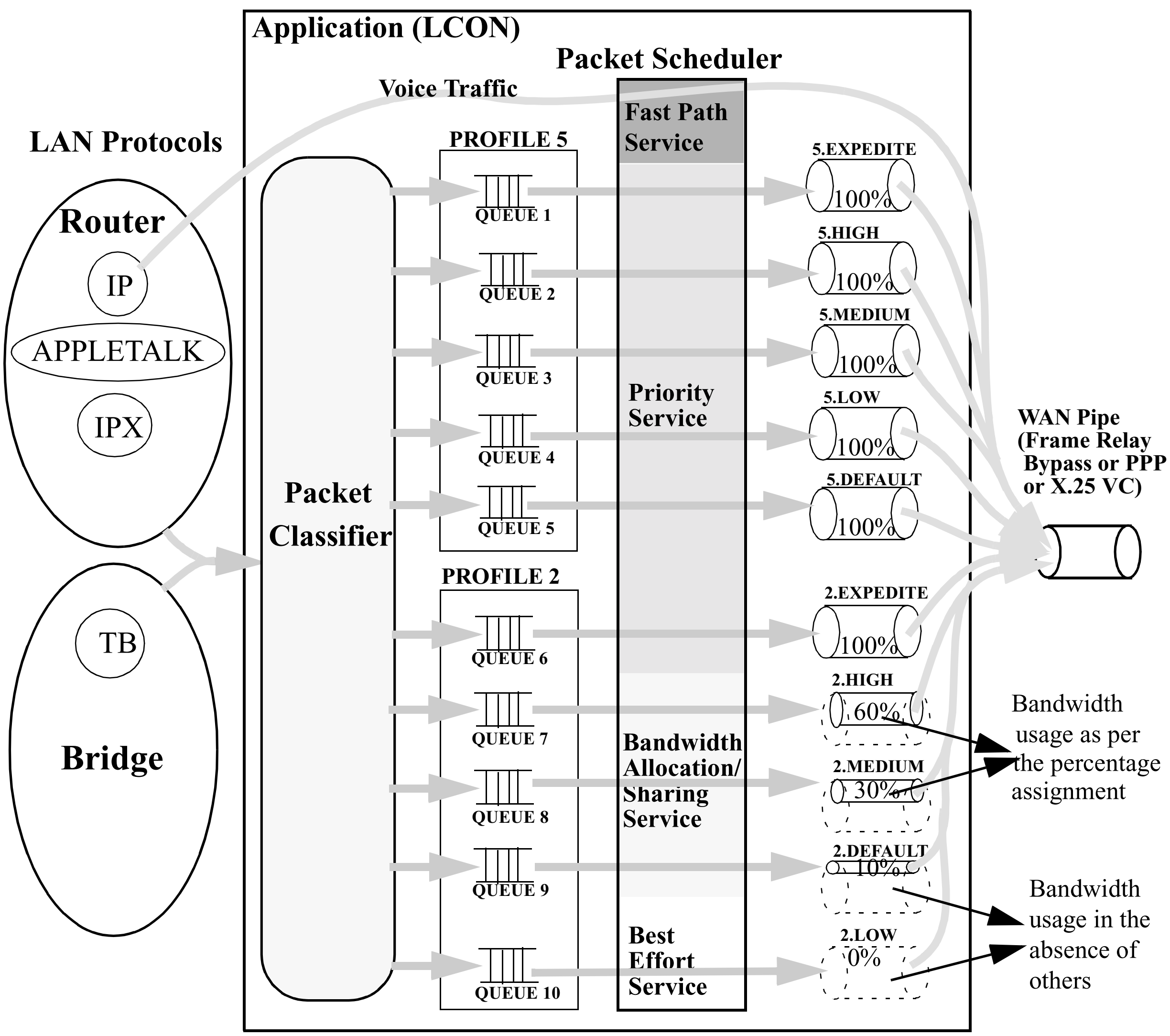


Figure 2. Traffic Forwarding

Credit-Based Wait and Forward

Introduction

The Credit-Based Wait and Forward algorithm forwards traffic in classes configured for less than 100 percent. These traffic classes share the WAN pipe in the absence of classes configured for 100 percent. Forwarding is based on the percentages configured. The Credit Cycle is the basis for Credit Based Wait and Forward algorithm and is defined as a block of byte transfer in kilobytes (KBytes) within which each class has its share depending on its assigned percentage and on its usage in previous blocks.

How It Works?

This process describes how Credit-Based Wait and Forward functions:

1) To start with each class has a base credit that is its assigned percentage of one credit cycle (that is, Credit Cycle multiplied by the assigned percentage for the class). For example, if the credit cycle is 10 Kbytes, the respective base credits for the classes in Profile 2 of Figure 2 are
- MEDIUM - 6000 Bytes (60% of 10 KBytes)
- LOW - 3000 Bytes (30% of 10 KBytes)
- DEFAULT - 1000 Bytes (10% of 10 KBytes)

2) Credits for each of the classes are examined packet by packet and the packet that belongs to the class with highest credit is forwarded first. This is known as Credit Based Forwarding.

3) When more than one traffic class has the same credit, the packet is forwarded from the class with higher priority level.

4) When a packet is forwarded from a class, its credit is decreased by the number of bytes in the packet.

5) In the beginning of each credit cycle,
- Each traffic class earns a credit, equivalent to its base credit, depending on its usage in previous cycles.
- Each traffic class has a minimum credit equivalent to its base credit, but can accumulate more if it has not used its share in earlier cycles.
- A traffic class can accumulate a maximum of four credit cycles of traffic, plus its base credit. So, if the MEDIUM class has not used its share for a long time, it would have accumulated a credit up to 46000 Bytes.

6) When the packets from these classes cannot be forwarded either to due congestion or due to a burst of packets belonging to higher priority classes (assigned 100 percent), they get queued in the respective queues.

7) When the credit of a traffic class becomes zero, further packets from this class get queued in the respective queue.

8) Any unused portion in the same credit cycle is used for the classes that have used up their share that still have packets to forward. These classes wait for a few new packet to arrive (assuming that the packets of other classes are behind) and then the packets from these classes are forwarded based on their assigned percentage, usage in previous cycles (usage history), and queue depth (Wait and Forward).

9) The Wait and Forward mechanism makes sure that the bandwidth is efficiently used and adds the capability of “bandwidth borrowing.”

10) By tracking usage history and allowing a class to accumulate credit you can steal bandwidth from over-used classes.

How to Choose a Value for the Credit Cycle

The value for credit cycle should be appropriately chosen depending on the WAN connection rate and delay requirements of the classes. Note that setting a low value for high speed connections might reduce the overall performance.

Prioritization happens before the packets are encapsulated into Frame Relay. The Frame Relay WAN ports sends the packets in the order they are received from applications (LCON). So the credit cycle plays an important role in how the flow of packets from application (LCON) to Frame Relay WAN Port is controlled.

Consider for example, that the WAN port is Frame Relay with a port speed of 256 Kbits and the credit cycle is 4 KBytes (or 32 Kbits). The LCON application will queue 32/256 Kbits or 125ms worth of traffic onto Frame Relay and can cause 125 ms of delay between the classes.

The delay between classes can be explained by another example. Suppose that traffic coming into the node from the LAN port is 8 KBytes of LOW class traffic followed by 2 KBytes of HIGH class traffic. As the credit cycle is 4 KBytes, the maximum amount of LOW traffic that may be sent out of the Frame Relay WAN port is 4 KBytes. This 4 KBytes of LOW traffic sent out before HIGH traffic causes a equivalent of 125 ms delay for HIGH traffic.

If the credit cycle is 8 KBytes and the maximum LOW traffic is 8 KBytes (or 64 Kbits), this causes a 250 ms delay for HIGH traffic as calculated below:

delay = (64/256 Kbits) = 0.250 s or 250 ms

If 100% class traffic arrives after non-100% class traffic, it may have to wait for a maximum of 125 ms (equivalent to 4KBytes credit cycle on 256 K link).

Quality of Service Indication and Control

Overview

With release 5.3, Protocol Priority supports classification of IP packet and traffic using the IP Precedence bit in the Type of Service Field. For IP packets, Type of Service provides various parameters that can be configured to indicate and control the end-to-end Quality of Service (QoS) desired for transmitting a packet in a particular network. The benefits include:

- reduced management and processing required for classifying and servicing IP packets
- more appropriate classes of service offered for IP applications

What is IP Precedence?

The IP precedence bit in the Type of Service field allows classification of high precedence traffic to be more important than other traffic.

Figure 3 illustrates the Type of Service Field as defined by RFC 791.

IP Precedence Bits 0 - 2	Type of Service Field Bits 3 to 7

Figure 3. Type of Service (TOS) Field

How is IP Precedence Used?

The IP Precedence bit can be configured to provide the eight different classes of service indicated in the table:

IP Precedence Bit 0 to 2	***Description***
111	Network Control
110	Internetwork Control
101	CRITIC/ECP
100	Flash Override
011	Flash
010	Immediate
001	Priority
000	Routine

Two profiles can be specified and a percentage bandwidth allocated as described in "Bandwidth Assignments" section on page 7.

Configuring IP Precedence

The Protocol Priority feature allows you to

- configure the IP Precedence for the IP packets
- ignore the IP Precedence
- override the IP Precedence

IP Precedence and FAST PATH Service

To implement FAST PATH service throughout a network, configure the same IP Precedence for all Vanguard nodes supporting voice traffic. Using the same IP Precedence throughout the network, allows an end-to-end FAST PATH set up for the voice traffic. All packets classified as voice traffic are immediately forwarded to the WAN port.

Traffic Classification

Introduction

In addition to classifying traffic flow types (IP, IPX, TB) as EXPEDITE, HIGH, MEDIUM, LOW, or default, you can apply filter criteria and an order of match to traffic flow types. This section describes criteria for each traffic flow type.

IP Traffic

IP traffic classification is based on :

- IP Precedence bits in the Type of Service field
- combination of source address and mask, destination address and mask, protocol and TCP/UDP source and destination port numbers

The sharing and prioritization of bandwidth for IP traffic is based on:

- Source Address and Source Address Mask - This is similar to using a wildcard to specify a subnet or a range of source addresses.
- Destination Address and Destination Address Mask - This is similar to using a wildcard to specify a subnet or range of destination addresses.
- Protocol Number - For example, 1 - ICMP, 6 - TCP, 17 - UDP.
- Source Port Number(s) - This can be single or a range (23 - TELNET, 21 - FTP, or the range 2000 to 2020)
- Destination Port Number(s) - This can be single or a range (23 - TELNET, 21 - FTP, or the range 2000 to 2020)
- Different combinations of all the above
- Order of Match - This is used for matching the configured IP entries. An IP packet can match with more than one IP entries.

Voice Traffic

At the access Vanguard node, where the voice equipment (PBX or phone) is attached, the voice modules in the node will classify the voice traffic as voice class. If this voice traffic is carried over an IP network, an IP Precedence can be set in the originating node so that the intermediate Vanguard routers can classify the voice traffic based on this precedence.

IPX Traffic

IPX traffic classification is based on:

- Destination Network
- Destination Node
- Packet Type
- Socket Number
- Different combinations of all the above
- Order of Match (used for matching the configured IPX entries - An IPX packet can match with more than one IPX entries)

TB Traffic

Transparent bridge traffic classification is based on:

- IP traffic within TB and the rest of TB traffic
- Only IP traffic within TB
- All TB traffic

Example

This section provides an example on how the traffic classification criteria can be used to classify the traffic. The more parameters you configure, the more filtering criteria the packet must match before being assigned to a traffic class. Consider this example:

Protocol # 1 IP	***Protocol # 2 IP***
Source Address: 0.0.0.0	Source Address: 172.168.1.24
Source Mask: 0.0.0.0	Source Mask: 255.255.255.255
Destination Address: 0.0.0.0	Destination Address: 0.0.0.0
Destination Mask: 0.0.0.0	Destination Mask:0.0.0.0
Protocol Number: 6	Protocol Number: 6
Source Port: 23	Source Port: 23
Destination Port: 23	Destination Port: 0
Order of Match: 4	Order of Match: 3
Traffic Class: MEDIUM	Traffic Class: HIGH

In this example, if you configure a profile as above, any packet with a source and destination port of 23 (Telnet) is assigned to a Medium queue, but only packets with a source address of 172.168.1.24 with a source port of 23 can be assigned to High. The order of match is important in this type of configuration.

If you instead made the Protocol #1 Order of Match equal to 1 and Protocol #2 Order of Match equal to 2, then all Telnet packets are assigned to the Medium queue.

Typical Applications

Prioritizing and Protecting TELNET Traffic

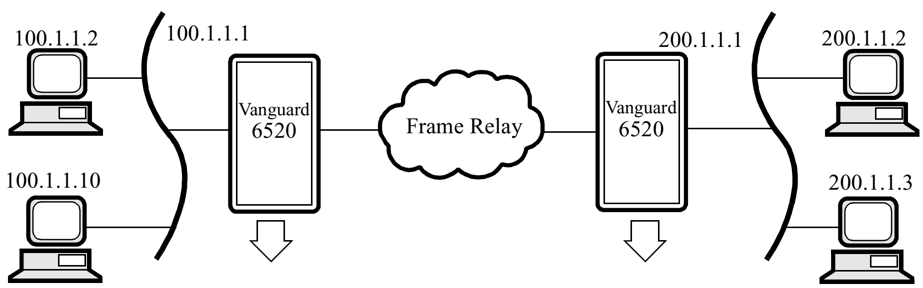
TELNET traffic with the following criteria is protected and prioritized with the configuration shown in Figure 4:

- Average TELNET traffic is 250 Bytes per second
- Delay requirement of 125 ms
- Credit Cycle of 1 Kbytes (1000 Bytes)
- Frame Relay port speed of 64000 bps

The percentage of WAN bandwidth usage for TELNET traffic is:

= Average Telnet Traffic / Credit Cycle * 100%

= (250/1000 Bytes) * 100% = 25%



LAN Connection Configuration Table	
LCON Queue Limit:	16000
Traffic Priority:	HIGH-AND-PROTOCOL
Profile Table Entry:	1/
Credit Cycle:	1/
IP Precedence for Voice Traffic	0

Protocol Priority Profile Configuration Table	
#1 Protocol Type:	IP
#1 IP Precedence Option:	None
#1 Source IP Address:	(Blank)
#1 Source IP Address Mask:	(Blank)
#1 Destination IP Address Mask:	(Blank)
#1 Protocol Number:	6
#1 Source Port Number(s):	23
#1 Destination Port Number(s):	0
#1 Order of Match:	1
#1 Traffic Class:	HIGH
#2 Protocol Type:	IP
#2 IP Precedence Option:	None
#2 Source IP Address:	(Blank)
#2 Source IP Address Mask:	(Blank)
#2 Destination IP Address Mask:	(Blank)
#2 Protocol Number:	6
#2 Source Port Number(s):	0
#2 Destination Port Number(s):	23
#2 Order of Match:	1
#2 Traffic Class:	HIGH
% of Expedite Class Traffic:	100
% of High Class Traffic:	25
% of Default Class Traffic:	75

Figure 4. Typical Application - Telnet Traffic

Traffic Transmission Example

This table gives the transmission of TELNET traffic with respect to other (Default) traffic in a cycle of 1000 bytes transmitted. If TELNET, along with other (Default), traffic is present all the time, a cycle of 1000 bytes transmitted allots 250 bytes to TELNET traffic and 750 bytes to other (Default) traffic.

If TELNET traffic is absent for a long time and there is continuous burst of TELNET traffic, the transmission of TELNET traffic with respect to other (Default) traffic is shown in shaded portion of the table (cycles n+1 to n+7).

Cycle of 1000 Bytes	*Traffic*	*Credit at the beginning of cycle*	*Bytes Transmitted*	*Credit at the end of cycle*
1	TELNET = 250 Other (Default) >= 1000	250 750	250 750	0 0
2	TELNET = 0 Other (Default) >= 1000	250 750	0 1000	250 0
3	TELNET = 400 Other (Default) >= 1000	500 750	400 600	100 150
4	TELNET = 0 Other (Default) >= 1000	350 750	0 1000	350 0
5	TELNET = 0 Other (Default) >= 1000	600 750	0 1000	600 0
. .	. .	. .	. .	. .
n	TELNET = 0 Other (Default) >= 1000	4250 750	0 1000	4250 0
n+1	TELNET >= 1000 Other (Default) >= 1000	4250 750	1000 0	3250 750
n+2	TELNET >= 1000 Other (Default) >= 1000	3500 750	1000 0	2500 750
. .	. .	. .	. .	. .
n+5	TELNET >= 1000 Other (Default) >= 1000	1250 750	750 250	500 500
n+6	TELNET = 500 Other (Default) >= 1000	750 750	500 500	250 250

Prioritization of Traffic From a Specific Source

The following example shows that all TCP traffic between Server 1 and clients on subnets 2, 3, and 4 is prioritized over the rest. The Protocol Priority Table for Router 1 is configured with the filter criteria of Source IP Address. When Router 1 receives a packet with Source IP Address of 100.1.1.1 (Server 1) it will prioritize the packet with HIGH priority. Similarly, the Protocol Priority Tables for Router 2, 3, and 4 are set with the filter criteria of Destination IP Address. All packets received at Router 2, 3, or 4 destined for the Destination IP Address 100.1.1.1 (Server 1) will be prioritized and receive HIGH priority.

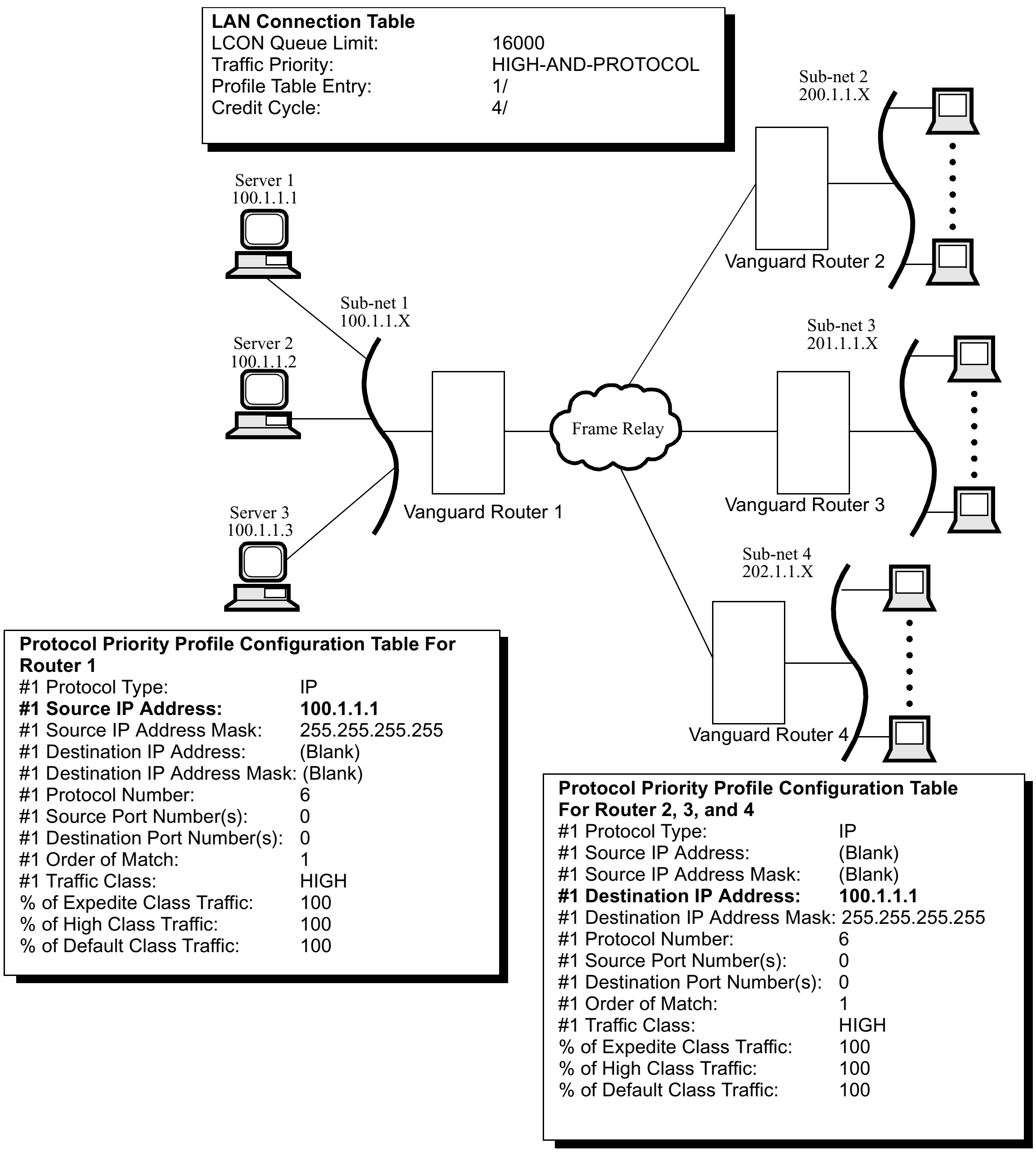
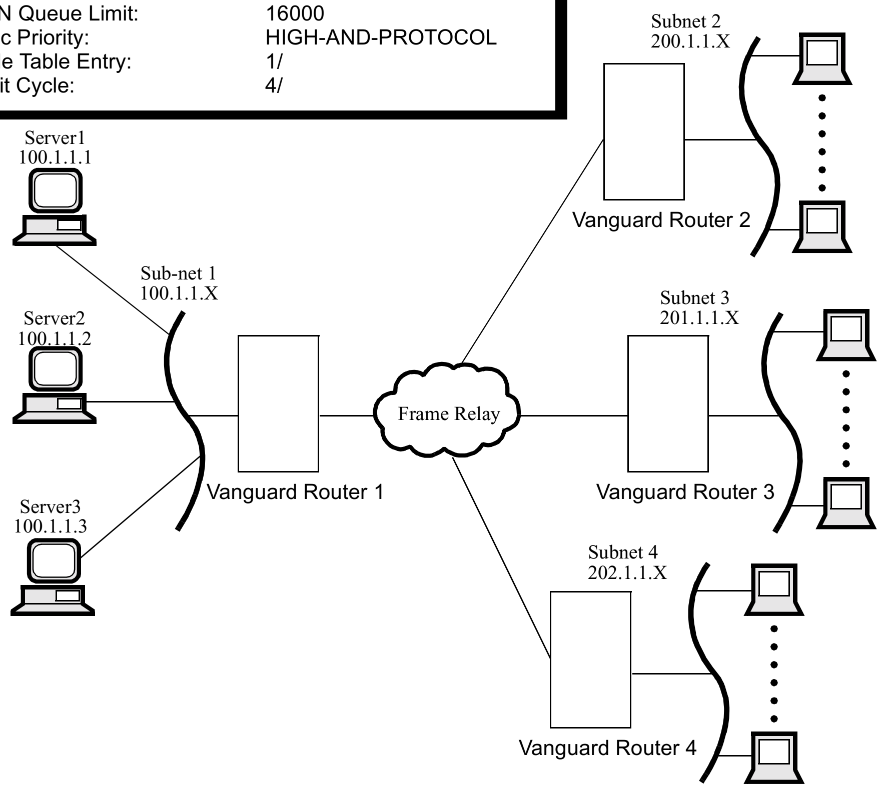


Figure 5. Typical Application - TCP Traffic

Prioritization of Traffic from Specific Application

In this example, Router 1 and Router 2 are configured to prioritize UDP traffic between Server 1 and Hosts on subnet 3 in the port range 1520-1540. The key parameters are highlighted in bold in the parameter tables in Figure 6.

LAN Connection Table	
LCON Queue Limit:	16000
Traffic Priority:	HIGH-AND-PROTOCOL
Profile Table Entry:	1/
Credit Cycle:	4/



Protocol Priority Profile Configuration Table For Router 1	
#1 Protocol Type:	IP
#1 Source IP Address:	**100.1.1.1**
#1 Source IP Address Mask:	255.255.255.255
#1 Destination IP Address:	**201.1.1.0**
#1 Destination IP Address Mask:	255.255.255.0
#1 Protocol Number:	17
#1 Source Port Number(s):	**1520-1540**
#1 Destination Port Number(s):	**1520-1540**
#1 Order of Match:	**1**
#1 Traffic Class:	HIGH
% of Expedite Class Traffic:	100
% of High Class Traffic:	100
% of Default Class Traffic:	100

Protocol Priority Profile Configuration Table For Router 3	
#1 Protocol Type:	IP
#1 Source IP Address:	**201.1.1.0**
#1 Source IP Address Mask:	255.255.255.0
#1 Destination IP Address:	**100.1.1.1**
#1 Destination IP Address Mask:	255.255.255.255
#1 Protocol Number:	17
#1 Source Port Number(s):	**1520-1540**
#1 Destination Port Number(s):	**1520-1540**
#1 Order of Match:	**1**
#1 Traffic Class:	HIGH
% of Expedite Class Traffic:	100
% of High Class Traffic:	100
% of Default ClassTraffic:	100

Figure 6. Typical Application - UDP Traffic

End-to-End Quality of Service Indication and Control Example

Figure 7 illustrates an enterprise network utilizing Vanguard products to provide traffic prioritization for key applications.

Line 1 indicates FAST PATH Service for Voice Over IP (VoIP) traffic provided by configuring the same IP Precedence at the end nodes (Vanguard 320 and Vanguard 6560). Intermediate nodes use the IP Precedence to classify and service the voice traffic. In this configuration example, an IP Precedence of 7 (Network Control) is used for all voice traffic in the network.

Line 2 indicates business critical traffic between the small office and the enterprise headquarter. IP Precedence is configured at the small office’s Vanguard 300.

Line 3 shows traffic between small and regional offices. IP Precedence is set by applications running in the small and regional offices. The applications use an IP Precedence of 5 and 2 to request the class of service needed by the applications.

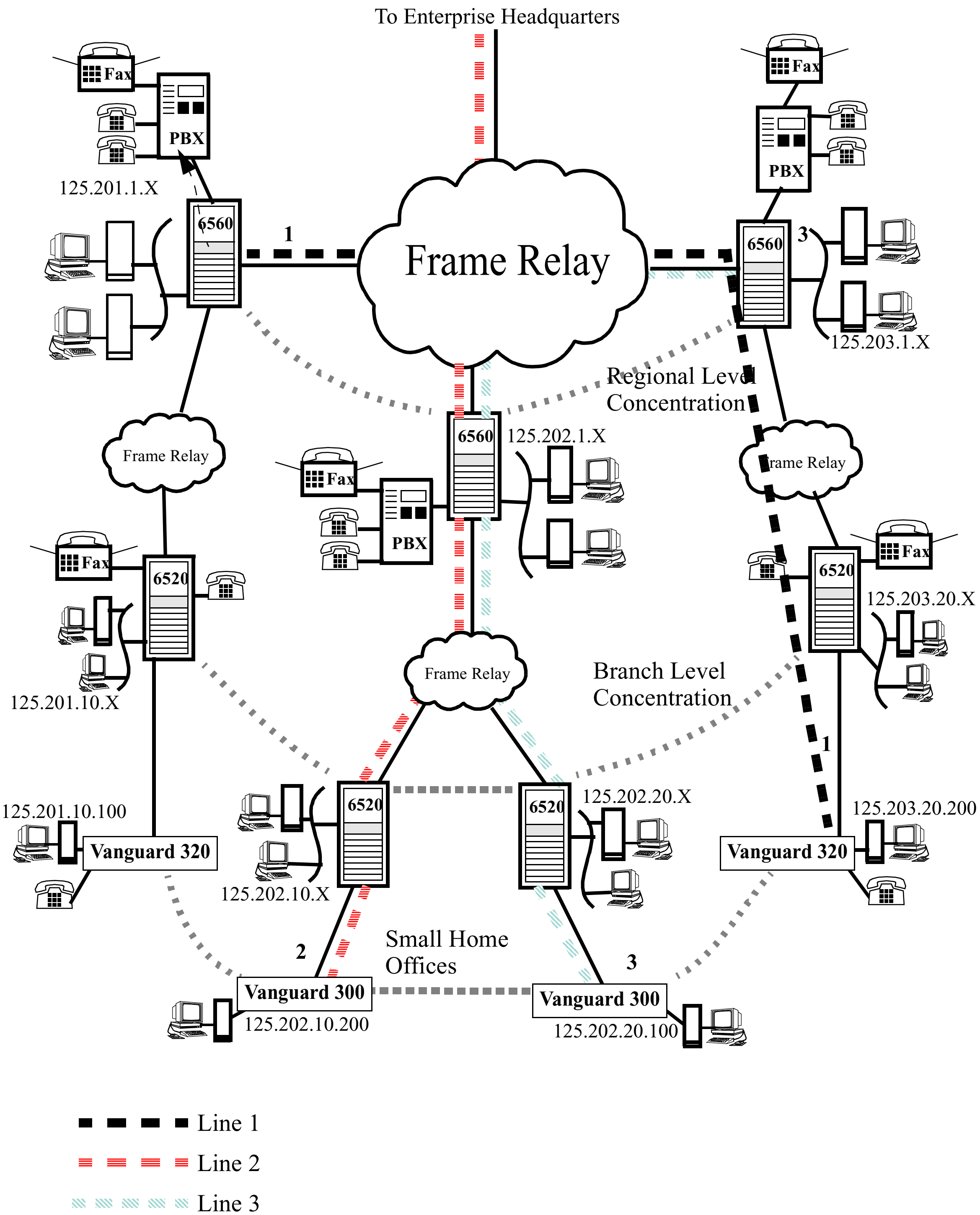


Figure 7. Enterprise Network

Configuration Tables

The table below lists parameters for the configuration example shown in Figure 7.

<table>
<tr><th>For all Vanguard 320 and Vanguard 300</th><th>For all Vanguard 6560 and Vanguard 6520</th></tr>
<tr><td>LAN Connection Table
Entry Number: 1
[1] Lan Connection Type: PT_TO_PT
[1] *Router Interface Number: 5
[1] Encapsulation Type: CODEX
[1] Autocall Mnemonic: (blank)
[1] LCON Queue Limit: 16000
[1] Billing Records: OFF
[1] Traffic Priority: HIGH-AND-PROTOCOL
[1] Profile Table Entries: 1
[1] Credit Cycle: 1
[1] IP Precedence for Voice Traffic: 7</td><td>LAN Connection Table
Entry Number: 1
[1] Lan Connection Type: PT_TO_PT
[1] *Router Interface Number: 5
[1] Encapsulation Type: CODEX
[1] Autocall Mnemonic: (blank)
[1] LCON Queue Limit: 16000
[1] Billing Records: OFF
[1] Traffic Priority: HIGH-AND-PROTOCOL
[1] Profile Table Entries: 1,2
[1] Credit Cycle: 1
[1] IP Precedence for Voice Traffic: 7</td></tr>
<tr><td>Protocol Priority Profile Table Configuration
Entry Number: 1
[1] #1 Protocol Type: IP
[1] #1 IP Precedence Option: MATCH
[1] #1 Incoming IP Precedence: 5
[1] #1 Traffic Class: HIGH
[1] #2 Protocol Type: IP
[1] #2 IP Precedence Option: MATCH
[1] #2 Incoming IP Precedence: 2
[1] #2 Traffic Class: MEDIUM
[1] #3 Protocol Type: IP
[1] #3 IP Precedence Option: SET
[1] #3 Outgoing IP Precedence: 1
[1] #3 Source IP Address: 125.202.20.200
[1] #3 Source IP Address Mask: 255.255.255.255
[1] #3 Destination IP Address: 125.202.1.1
[1] #3 Destination IP Address Mask: 255.255.0.0
[1] #3 Protocol Number: 6
[1] #3 Source Port Number(s): 23
[1] #3 Destination Port Number(s): 0
[1] #3 Order of Match: 1
[1] #3 Traffic Class: LOW
[1] #4 Protocol Type: IP
[1] #4 IP Precedence Option: SET
[1] #4 Outgoing IP Precedence: 1
[1] #4 Source IP Address: 125.202.20.200
[1] #4 Source IP Address Mask: 255.255.255.255
[1] #4 Destination IP Address: 125.202.1.1
[1] #4 Destination IP Address Mask: 255.255.0.0
[1] #4 Protocol Number: 6
[1] #4 Source Port Number(s): 0
[1] #4 Destination Port Number(s): 23
[1] #4 Order of Match: 1
[1] #4 Traffic Class: LOW
[1] % of Expedite Class Traffic: 100
[1] % of High Class Traffic: 100
[1] % of Medium Class Traffic: 40
[1] % of Low Class Traffic: 40
[1] % of Default Traffic Class Packets: 20</td><td>Protocol Priority Profile Table Configuration
Entry Number: 1
[1] #1 Protocol Type: IP
[1] #1 IP Precedence Option: MATCH
[1] #1 Incoming IP Precedence: 6
[1] #1 Traffic Class: EXPEDITE
[1] #2 Protocol Type: IP
[1] #2 IP Precedence Option: MATCH
[1] #2 Incoming IP Precedence: 5
[1] #2 Traffic Class: HIGH
[1] #3 Protocol Type: IP
[1] #3 IP Precedence Option: MATCH-AND-SET
[1] #3 Incoming IP Precedence: 4
[1] #3 Outgoing IP Precedence: 3
[1] #3 Traffic Class: MEDIUM
[1] #4 Protocol Type: IP
[1] #4 IP Precedence Option: MATCH
[1] #4 Incoming IP Precedence: 3
[1] #4 Traffic Class: LOW
[1] #4 Protocol Type: IP
[1] #5 IP Precedence Option: SET
[1] #5 Outgoing IP Precedence: 2
[1] #5 Source IP Address: 125.202.1.1
[1] #5 Source IP Address Mask: 255.255.0.0
[1] #5 Destination IP Address: 125.202.1.1
[1] #5 Destination IP Address Mask: 255.255.0.0
[1] #5 Protocol Number: 17
[1] #5 Source Port Number(s): 2000-2020
[1] #5 Destination Port Number(s): 2000-2020
[1] #5 Order of Match: 1
[1] #5 Traffic Class: DEFAULT
[1] % of Expedite Class Traffic: 100
[1] % of High Class Traffic: 100
[1] % of Medium Class Traffic: 100
[1] % of Low Class Traffic: 40
[1] % of Default Traffic Class Packets: 30</td></tr>
</table>

For all Vanguard 320 and Vanguard 300	For all Vanguard 6560 and Vanguard 6520
	Entry Number: 2 [2] #1 Protocol Type: IP [2] #1 IP Precedence Option: MATCH [2] #1 Incoming IP Precedence: 1 [2] #1 Traffic Class: HIGH [2] #2 Protocol Type: IP [2] #2 IP Precedence Option: SET [2] #2 Outgoing IP Precedence: 1 [2] #2 Source IP Address: 125.202.1.1 [2] #2 Source IP Address Mask: 255.255.0.0 [2] #2 Destination IP Address: 125.202.1.1 [2] #2 Destination IP Address Mask: 255.255.0.0 [2] #2 Protocol Number: 6 [2] #2 Source Port Number(s): 23 [2] #2 Destination Port Number(s): 0 [2] #2 Order of Match: 1 [2] #2 Traffic Class: HIGH [2] #3 Protocol Type: IP [2] #3 IP Precedence Option: SET [2] #3 Outgoing IP Precedence: 1 [2] #3 Source IP Address: 125.202.1.1 [2] #3 Source IP Address Mask: 255.255.0.0 [2] #3 Destination IP Address: 125.202.1.1 [2] #3 Destination IP Address Mask: 255.255.0.0 [2] #3 Protocol Number: 6 [2] #3 Source Port Number(s): 0 [2] #3 Destination Port Number(s): 23 [2] #3 Order of Match: 1 [2] #3 Traffic Class: HIGH [2] % of High Class Traffic: 20 [2] % of Default Traffic Class Packets: 10

Configuring Protocol Priority

Introduction

This section describes the steps, screens, and parameters you use to configure Protocol Priority.

You can enable each LCON individually for Protocol Priority. You configure the protocols/applications and the percentage of bandwidth usage for each LCON through the Protocol Priority Profile Table under Network Services. Configure the Profile Table entry number in the LCON.

Configuration Procedure

Perform the steps in the following table to configure Protocol Priority:

Step	***Action***
1	Access the Quality of Service Table by selecting **Configure Network Services -> Configure QoS**.
2	Access the Protocol Priority Profile Table by selecting **Configure Network Services -> Protocol Priority Profile Table**.
3	Configure the Protocol Type and configure the parameters associated with the protocol type. The parameters for each are listed below.
	For IP: • IP Precedence Option • Outgoing IP Precedence Option • Source IP Address • Source IP Address Mask • Destination IP Address • Destination IP Address Mask • Protocol Number • Source Port Number(s) • Destination Port Number(s) • Order of Match • Traffic Class
	For IPX: • IPX Destination Network • IPX Destination Node • IPX Packet Type • IPX Socket Number • Order of Match • Traffic Class
	For APPLETALK • All APPLETALK Traffic

Step	**Action** *(continued)*
3 (Cont.)	For TB • All TB Traffic • Higher Layer Protocol For IP Traffic Within TB • Same as With IP Traffic
4	Configure the percent bandwidth parameters for each traffic class.
5	Access the LAN Connection Table by selecting **Configure LAN Connections -> LAN Connection Table**
6	Configure the LAN Connection Table parameters: • Traffic Priority • Profile Table Entry • Credit Cycle • IP Precedence for Voice Traffic
7	Boot the LAN Connection.

Configuration Considerations and Alarms

Consider the following when configuring Protocol Priority:

- Duplicate protocol configuration is not allowed in the Profile Table Record. For example, you cannot configure the Appletalk protocol twice in the same Profile Table Record. This results in the CTP error message: **Duplicate Protocols Configured.**
- Storing an empty Profile Table Record results in the following CTP error message: **No protocols configured.**
- If the total percentages of all traffic classes is less than 100%, unused bandwidth is assigned to the DEFAULT traffic class through a CTP warning prompt: **Total priority configured is less than 100%. Default percentage are changed from XXX to XXX. Proceed?**.
- The CTP prompt for the percentage of DEFAULT traffic class always appears on the screen and its default value is 10%. However, the Priority prompt for any other traffic class appears only if you configure at least one protocol type with that traffic class. For example if you configure Protocol Type SR as traffic class HIGH, then the prompt for percentage of High class traffic packets appears on the screen with a default value of 0 percent.

Configuring Quality of Service

Introduction

This section describes configuration of the Quality of Service Table.

Accessing the Table

From the Configure menu, select **Configure Network Services-> Configure QOS**. Figure 8 shows the Quality of Service Table.

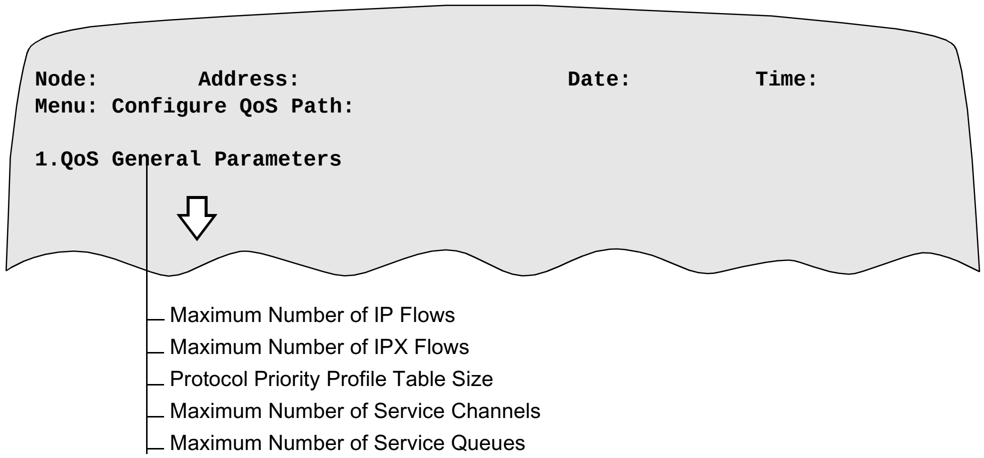


Figure 8. Quality of Service Table

Simple Network Management Protocol functionality

Simple Network Management Protocol (SNMP) support for Vanguard products provide SNMP functionality to Quality of Service configuration and statistics parameters. Refer to the *SNMP/MIB Management Manual* (Part Number T0106-04) for information on SNMP.

Parameters

You can configure the following Quality of Service parameters required for operation of the protocol priority feature.

■ **Note**

Changes to these parameter require a Node boot to take effect.

Maximum Number of IP Flows

Range	1 to 1000
Default	100
Description	Specifies the maximum number of IP flows allowed for the node across all configured protocol priority profiles. For example, if the flow is set to 100, the total number of classes across all profiles cannot exceed 100. If exceeded, the Protocol Priority feature will not operate for excess IP flows.

Maximum Number of IPX Flows

Range	1 to 1000
Default	10
Description	Specifies the maximum number of IPX flows allowed for the node across all configured protocol priority profiles. For example, if the flow is set to 10, the total number of classes across all profiles cannot exceed 10. If exceeded, the protocol priority feature will not operate for excess IPX flows.

Protocol Priority Profile Table Size

Range	1 to 100
Default	10
Description	This parameter specifies the size of protocol priority profile table. For example, if set to 10, you may only configure 10 profiles.

Maximum Number of Service Channels

Range	1 to 100
Default	10
Description	Specifies the maximum number of service channels allowed for the node. Each LCON will be associated with a service channel. For example, for 10 service channels configured, 10 LCONs are enabled for protocol priority. If there are more than 10 LCONs enabled and only 10 service channels, only 10 LCONs will have protocol priority enabled.

Maximum Number of Service Queues

Range	1 to 1000
Default	100
Description	Specifies the maximum number of service queues allowed for the node. Each LCON will be associated with a service queue. The total number of classes across all protocol priority profiles must not exceed the configured service queue value otherwise protocol priority will not operate as configured for some LCONs.

Configuring the Protocol Priority Profile Table

Introduction

This section describes configuration of the Protocol Priority Profile Table. You can specify a maximum of nine protocol/applications with a class of EXPEDITE, HIGH, or MEDIUM, LOW, or DEFAULT.

Accessing the Table

From the Configure menu, select **Configure Network Services -> Protocol Priority Profile Table**.

Parameters

These parameters in the protocol priority profile table are configurable for each profile table entry. Protocol type specific parameters are listed in the next section.

■ **Note**

Changes to these parameter require an LAN Connection Boot to take effect.

Entry Number

Range	1 to 10
Default	1
Description	Entry number used to reference this record. ■ **Note** The range of this entry number depends on the value entered Priority Profile Table Size. If the protocol priority table parameter is set to 100, the range for this entry number will be 100. For more information refer to the Protocol Priority Profile Table Size parameter description in the “Configuring Quality of Service” section on page 26.

Protocol Type

Range	NONE, TB, IP, IPX, Appletalk
Default	NONE
Description	Specifies the Protocol type to be prioritized over the WAN link. ■ **Note** If you configure TB or APPLETALK for this parameter, you are only prompted for the Traffic Class parameter.

Traffic Class

Range	EXPEDITE, HIGH, MEDIUM, LOW, DEFAULT
Default	MEDIUM
Description	Specifies the class of the traffic stream.

% Of Expedite Traffic Class Packets

Range	0 to 100
Default	100
Description	Identifies the percentage of bandwidth allocated for this traffic class. • 0 - Best Effort Service. • 1 to 99 - Divides WAN bandwidth between classes according to configured percentages in the absence classes configured at 100 percent. • 100 - Uses all the bandwidth in the absence of higher priority traffic classes that are configured for 100%. All remaining traffic classes share the bandwidth depending on their configuration.

% Of HIGH Traffic Class Packets

Range	0 to 100
Default	0
Description	Identifies the percentage of bandwidth allocated for this traffic class. • 0 - Best Effort Service. • 1 to 99 - Divides WAN bandwidth between classes according to configured percentages in the absence classes configured at 100 percent. • 100 - Uses all the bandwidth in the absence of higher priority traffic classes that are configured for 100%. All remaining traffic classes share the bandwidth depending on their configuration.

% Of Medium Traffic Class Packets

Range	0 to 100
Default	0
Description	Identifies the percentage of bandwidth allocated for this traffic class. • 0 - Best Effort Service. • 1 to 99 - Divides WAN bandwidth between classes according to configured percentages in the absence of classes configured at 100 percent. • 100 - Uses all the bandwidth in the absence of higher priority traffic classes that are configured for 100%. All remaining traffic classes share the bandwidth depending on their configuration.

% Of Low Traffic Class Packets

Range	0 to 100
Default	0
Description	Identifies the percentage of bandwidth allocated for this traffic class. • 0 - Best Effort Service. • 1 to 99 - Divides WAN bandwidth between classes according to configured percentages in the absence of classes configured at 100 percent. • 100 - Uses all the bandwidth in the absence of higher priority traffic classes that are configured for 100%. All remaining traffic classes share the bandwidth depending on their configuration.

% Of Default Traffic Class Packets

Range	0 to 100
Default	0
Description	Identifies the percentage of bandwidth allocated for this traffic class. • 0 - Best Effort Service. • 1 to 99 - Divides WAN bandwidth between classes according to configured percentages in the absence of classes configured at 100 percent. • 100 - Uses all the bandwidth in the absence of higher priority traffic classes that are configured for 100%. All remaining traffic classes share the bandwidth depending on their configuration.

IP-Specific Parameters

If you configure the Protocol Type parameter as IP, these parameters appear.

IP Precedence Option

Range	NONE, SET, MATCH, MATCH-AND-SET
Default	NONE
Description	Specifies how IP precedence should be treated. The following conditions apply for each option: • NONE - Ignore IP precedence • SET - Set IP precedence to the configured value • MATCH - Use the IP precedence in the incoming IP packet • MATCH-AND-SET - Use the IP precedence in the incoming IP packet and set the value

Outgoing IP Precedence (Applicable for SET or MATCH-AND-SET)

Range	0
Default	0 to 7
Description	Specifies the IP Precedence to be set in the outgoing IP packet after it is serviced. 0 - Routine 1 - Priority 2 - Immediate 3 - Flash 4 - Flash Override 5- Critical/ECP 6 - Internetwork Control 7 - Network Control

Incoming IP Precedence ((Applicable for MATCH or MATCH-AND-SET)

Range	0
Default	0 to 7
Description	Specifies the IP Precedence to be matched to the incoming IP packet. 0 - Routine 1 - Priority 2 - Immediate 3 - Flash 4 - Flash Override 5- Critical/ECP 6 - Internetwork Control 7 - Network Control

Source IP Address

Range	A valid IP address in dotted notation
Default	Blank
Description	Specifies the IP source address in the IP header.

Source IP Address Mask

Range	A valid IP address in dotted notation
Default	Blank
Description	Specifies the source IP address mask to be applied to an incoming packet's source IP address. An address is logically AND-ed with the mask and is compared with the configured source address. For example, a mask of 255.0.0.0 with an address of 129.122.3.26 is equivalent to 129.*.*.*, where * is a wild card. A mask of 255.255.255.255 with an address of 129.122.3.26 matches only with the address 129.122.3.26.

Destination IP Address

Range	A valid IP address in dotted notation
Default	Blank
Description	Specifies the IP destination address in the IP header.

Destination IP Address Mask

Range	A valid IP address in dotted notation
Default	Blank
Description	Specifies the Destination IP address mask to be applied to an incoming packet's destination IP address. An address is logically AND-ed with the mask and is compared with the configured destination address. For example, a mask of 0.255.255.0 with an address of 130.25.2.10 is equivalent to *.25.2.*, where * is a wild card. A mask of 255.255.255.0 with an address of 130.25.2.10 is equivalent to a subnet of address 130.25.2.*.

Protocol Number

Range	0 to 255
Default	0
Description	Specifies the protocol number in the IP header (for example, 1 - ICMP, 6 - TCP, 17 - UDP). See IP RFCs for assigned numbers.

Source Port Number(s)

Range	0 to 65535
Default	0
Description	Specifies a specific or range of port numbers to be matched with that of the incoming packet (for example, 23 - Telnet, 21 - FTP, 1500 to 1540 - range). See the Assigned Number RFC for a complete list.

Destination Port Number(s)

Range	0 to 65535
Default	0
Description	Specifies a specific or range of destination port numbers to be matched with the incoming packet (for example, 23 - Telnet, 21 - FTP, 1500 to 1540 - range).

Order of Match

Range	1 to 12
Default	1
Description	Specifies the order of searching for configured IP entries in the same profile to find a match. The first match decides the traffic class to which the packet belongs. For a newly configured profile entry, it shows the system-defined value depending on the configured parameters (for example, 1 - High, 12 - Low). ■ **Note** Note that a packet can belong to more than one protocol within the profile.

IPX-Specific Parameters

If you configure the Protocol Type parameter as IPX, the following parameters appear.

IPX Packet Type

Range	0 to 255
Default	0
Description	Specifies the type of service offered or required by the IPX packet. • 0 or 4 - IPX-based packet or communications • 5 - SPX-based packet or communications • 17 - NCP-based packet or communications

IPX Destination Network

Range	00000000 to FFFFFFFF hexadecimal
Default	00000000
Description	Specifies the network number of the network to which the destination node belongs. Use the internal address if the destination is a server. ■ **Note** 0 is a wildcard for any network.

IPX Destination Node

Range	1 to 12 hexadecimal digits
Default	0
Description	Specifies the physical address of the destination node. ■ **Note** 0 is a wildcard for any node at a destination network.

IPX Socket Number

Range	0000 to FFFF hexadecimal
Default	0000
Description	Specifies the socket address of the packet’s destination and source address.

Order of Match

Range	1 to 8
Default	1
Description	Specifies the order of searching for the configured IPX entries in the same profile to find a match. The first match determines to which traffic class the packet belongs. For a newly configured profile entry, it shows the system-defined value depending on the configured parameters (for example, 1 - High, and 8 - Low).

TB-Specific Parameter

If you configure the Protocol Type parameter as TB (Transparent Bridging), this parameter appears:

Higher Layer Protocol

Range	NONE, IP
Default	NONE
Description	Specifies the traffic streams to be prioritized within TB. Corresponding protocol profile entries are used for prioritization. ■ **Note** If you configure IP, the IP entries in the same profile table require a minimum of one IP entry. The Traffic Class is not prompted for with the protocol type TB, when a higher layer protocol is configured as IP.

Valid IP Configuration Combinations

Introduction

You can configure IP packets based on the attributes: Order of Match, Protocol Number, Port Number, Destination Address, and Source Address. This produces twelve different combinations. The following table lists system-defined values for the order of match. depending on the IP parameters you configure, the entry gets a value as listed in the table, unless you specify otherwise.

■ **Note**

If you configure the same value for two entries in the same profile table, the one that occurs first is the first entry to match.

Valid Attribute Combinations

For IP Protocol Priority Profile Table configuration, the valid combinations are as follows:

Order of Match	*Protocol Number*	*Port Number*	*Destination Address*	*Source Address*
1	Configured	Configured	Configured	Configured
2	Configured	Configured	Configured	Not Configured
3	Configured	Configured	Not Configured	Configured
4	Configured	Configured	Not Configured	Not Configured
5	Configured	Not Configured	Configured	Configured
6	Configured	Not Configured	Configured	Not Configured
7	Configured	Not Configured	Not Configured	Configured
8	Configured	Not Configured	Not Configured	Not Configured
9	Not Configured	Not Configured	Configured	Configured
10	Not Configured	Not Configured	Configured	Not Configured
11	Not Configured	Not Configured	Not Configured	Configured
12	Not Configured	Not Configured	Not Configured	Not Configured

Valid IPX Configuration Combinations

Introduction

For IPX Protocol Priority Profile Table configuration, the valid combinations are as follows. This table list the system-defined values for Order of Match. Depending on the configuration of IPX parameters, the entry gets a value as listed in the table unless you specify otherwise. If you configure the same value for two entries in the same profile table, the one occurring first is the first entry to match.

Order of Match	Packet Type	Destination Network	Destination Node	Socket Number
1	Configured	Configured	Configured	Configured
2	Configured	Configured	Configured	Not Configured
3	Configured	Configured	Not Configured	Not Configured
4	Configured	Not Configured	Not Configured	Not Configured
5	Not Configured	Configured	Configured	Configured
6	Not Configured	Configured	Configured	Not Configured
7	Not Configured	Configured	Not Configured	Not Configured
8	Not Configured	Not Configured	Not Configured	Not Configured

Configuring the LAN Connection Table

Introduction

This section describes configuration of the LAN Connection Table.

Accessing the Table

From the Configure menu, select **Configure LAN Connections -> LAN Connection Table**. Figure 9 shows the LAN Connection Table.

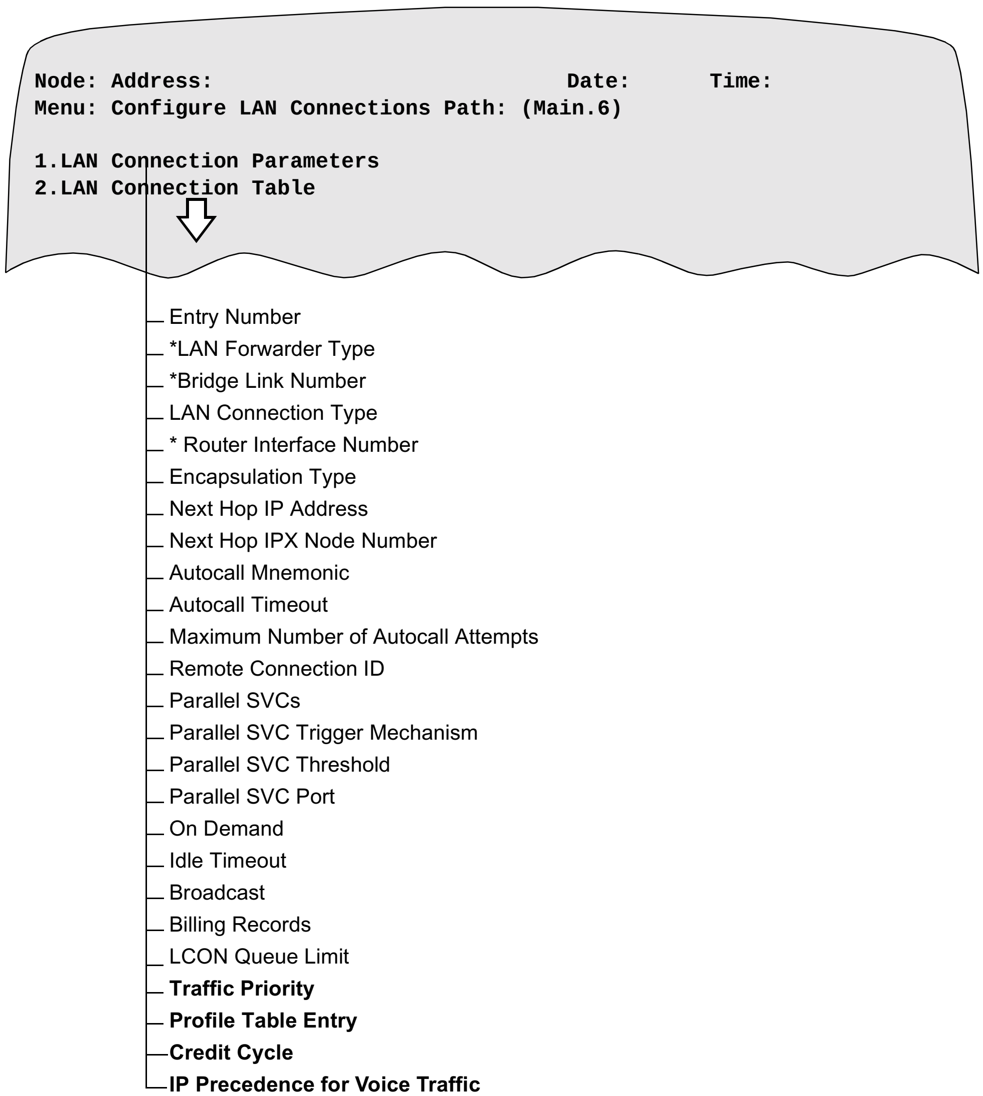


Figure 9. LAN Connection Table

Parameters

You use the following parameters to configure Protocol Priority at the LCON.

■Note
Changes to these parameter require an LAN Connection Boot to take effect.

Traffic Priority

Range	• LOW - Low Priority • MED - Medium Priority • HIGH - High Priority • EXP - Expedite Priority • LOW-AND-PROTOCOL - Low Priority with Protocol priority enabled • MED-AND-PROTOCOL - Medium Priority with Protocol priority enabled • HIGH-AND-PROTOCOL - High Priority with Protocol priority enabled • EXP-AND-PROTOCOL - Expedite Priority with Protocol priority enabled
Default	HIGH
Description	Specifies the Traffic Priority of this LAN Connection and also enables Protocol Priority depending on the option configured.

Profile Priority Profiles

Range	1 to 100
Default	1
Description	You can specify up to three protocol priority profiles. Enter the profiles separated by a comma (,) as shown: 1, 2 or 1 , 2 , 3 These profiles correspond to the entry numbers of the protocol priority profile table configured under Network Services. The order in which the profiles are specified indicates the order of priority among the profiles. These profiles are used for classifying and servicing the traffic flows depending on the class and bandwidth assignments configured.

Credit Cycle

Range	1 to 200
Default	4
Description	Specifies the granularity of traffic forwarding in KBytes. This is the block of byte transfer within which each class has its share depending on its assigned percentage and is used for the bandwidth allocation for each traffic class as configured in the Protocol Priority Profile Table. (For example, If port speed or CIR equals 64000 Kbits, credit cycle equals: 64,000/8 2

IP Precedence for Voice Traffic

Default	0
Range	0-7 0 - Routine 1 - Priority 2 - Immediate 3 - Flash 4 - Flash Override 5- Critical/ECP 6 - Internetwork Control 7 - Network Control
Description	Specifies the IP Precedence for provided FAST PATH service for voice packets. Enter a non-zero value to enable. If the voice module in the Vanguard has already classified an incoming packet as voice class, the IP precedence in the packet will be set to the configured IP precedence value. If the incoming packet has not been classified, the IP precedence in the packet will be compared against the configured IP precedence value. If the values match, then the incoming packet is classified as voice class and receives FAST PATH service.

Statistics

Introduction

The Protocol Priority statistics screen is available under the LCON stats menu. Note that this screen appears only if you enable Protocol Priority by configuring the Traffic Priority parameter in the LAN Connection Table with one of these four values:

- HIGH-AND-PROTOCOL
- MEDIUM-AND-PROTOCOL
- LOW-AND-PROTOCOL
- EXPEDITE-AND-PROTOCOL

Figure 10 shows the Protocol Priority statistics screen.

```
Node:          Address:           Date:               Time:
Detailed Statistics: LCON-1       Page:  4 of  5
Protocol Priority Statistics:
Frame Statistics :
======================================================================
Traffic   % of       Total numbers of frames        Average  Average
Class     bandwidth   Forwarded Discarded Frame      Frame    frames/s
                                                     Size
======================================================================
Expedite   100        127              0                80          5
High       100        5345             0                68          8
Medium     60         4560             5               175          7
Low        30         3278            10               220         12
Default    10         6892            68               326         10

Queue Statistics :
======================================================================
Traffic  Class     Current  Q  Length              Maximum  Q  Length
======================================================================
Expedite                0          1 at Time 12-Dec-1997 10:52:50
High                    12         98 at Time 12-Dec-1997 10:12:10
Medium                  25         120 at Time 12-Dec-1997 10:22:20
Low                     46         175 at Time 12-Dec-1997 10:32:30
Default                 78         212 at Time 12-Dec-1997 10:42:40
```

Figure 10. Protocol Priority Statistics

Description of Terms

Protocol Priority statistics terms are described in this table:

Term	Description
Traffic Class	Specifies the class of traffic to which the statistics listed in each row on this screen apply.
% of Bandwidth Configured	Specifies the percentage of bandwidth configured for a traffic class.
No. of Frames Discarded (Congestion)	Specifies the number of frames for a traffic class that are discarded due to congestion.
Average Frame Size	Specifies the size of the average frame in a traffic class.
Average Frames/Sec	Specifies the average number of frames transmitted per second.
Max Q Length	Specifies the maximum number of frames queued in the corresponding traffic class queue along with the date and time.

Index