



Session V

IPX, AppleTalk, Voice, and QOS



3304
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IPX

- **Addressing**
- **Encapsulation Types**
- **Routing and Service Advertisement**
- **Access Lists**
- **Filtering**
- **Useful IPX Commands**

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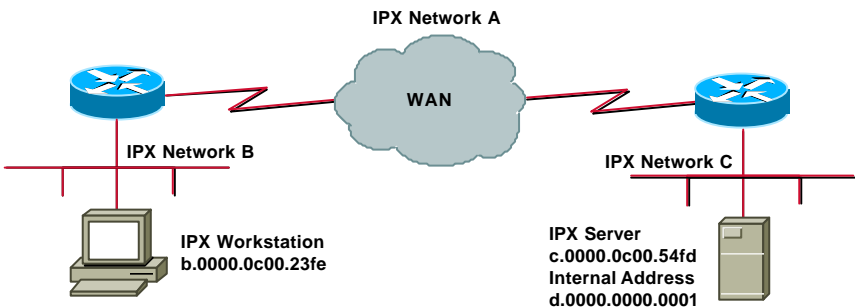
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IPX Addressing

- ***network.node*** format in hexadecimal
Ex: c5c0.4445.5354.0000
- **32-bit network number**
- **48-bit node number**
- **Novell 3.x and 4.x servers use internal network number**
Ex: aa01.0000.0000.0001

IPX Addressing Example



IPX Encapsulation Types

Ethernet 802.3 ----- novell-ether
Ethernet 803.2 ----- sap
Ethernet_II ----- arpa
Ethernet_SNAP ----- snap
Token-Ring ----- sap
Token-Ring_SNAP --- snap

IPX Routing and Service Advertisement

- **RIP - Routing Information Protocol**
- **NLSP - NetWare Link State Protocol**
- **EIGRP - Enhanced Interior Gateway Routing Protocol**
- **SAP - Service Advertisement Protocol**

IPX Access Lists

- **800-899 - Standard**
- **900-999 - Extended**
- **1000-1099 - SAP**
- **1200-1299 - NLSP**

IPX Filtering

- **Input SAP filter**

`ipx input-sap-filter {access-list | name}`

Limits SAPs being added to the router's SAP table from an interface

- **Output SAP filter**

`ipx output-sap-filter {access-list | name}`

Limits SAPs being sent out an interface

IPX Filtering (Cont.)

- **GNS Filter**

ipx output-gns-filter {*access-list* | *name*}

Controls servers included in GNS responses out an interface

ipx gns-reply-disable

Disable responses to GNS queries on an interface

IPX Filtering (Cont.)

- **Input Network Filter**

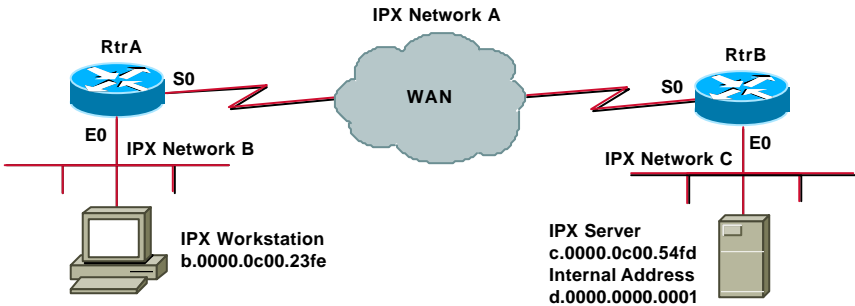
ipx input-network-filter {*access-list* | *name*}

Controls networks added to the routing table

- **Output Network Filter**

ipx output-network-filter {*access-list* | *name*}

IPX Filtering Example (Input-SAP-Filter)



If the configuration to the right is applied to RtrB, the SAP from the IPX server will never be accepted. The result is that RtrA will never notify the workstation of the server's existence.

```
access-list 1000 deny d.0000.0000.0001
access-list 1000 permit -1
interface ethernet 0
 ipx network c
 ipx input-sap-filter 1000
```

Useful IPX Commands

- debug ipx packet

```
Router# debug ipx packet
```

```
IPX: src=160.0260.8c4c.4f22, dst=1.0000.0000.0001, packet received
IPX: src=160.0260.8c4c.4f22, dst=1.0000.0000.0001, gw=183.0000.0c01.5d85,
sending packet
```

Useful IPX Commands (Cont.)

- **show ipx cache**

```
Router# show ipx cache
```

```
Novell routing cache version is 9
```

Destination	Interface	MAC Header
*1006A	Ethernet 0	00000C0062E600000C003EB0064
*14BB	Ethernet 1	00000C003E2A00000C003EB0064

Useful IPX Commands (Cont.)

- **show ipx interface [type [#]]**

```
Router# show ipx interface ethernet 1
```

```
Ethernet1 is up, line protocol is up
```

```
IPX address is C03.0000.0c05.6030, NOVELL-ETHER [up] line-up, RIPPQ: 0, SAPPQ: 0
```

```
Delay of this Novell network, in ticks is 1
```

```
IPXWAN processing not enabled on this interface.
```

```
IPX SAP update interval is 1 minute(s)
```

```
IPX type 20 propagation packet forwarding is disabled
```

```
Outgoing access list is not set
```

```
IPX Helper access list is not set
```

```
SAP Input filter list is not set
```

```
SAP Output filter list is not set
```

```
SAP Router filter list is not set
```

```
SAP GNS output filter list is not set
```

```
Input filter list is not set
```

```
Output filter list is not set
```

```
Router filter list is not set
```

```
Netbios Input host access list is not set
```

```
Netbios Input bytes access list is not set
```

```
Netbios Output host access list is not set
```

```
Netbios Output bytes access list is not set
```

```
Update time is 60 seconds
```

```
IPX accounting is enabled
```

```
IPX fast switching is configured (enabled)
```

```
IPX SSE switching is disabled
```

Useful IPX Commands (Cont.)

- **show ipx route [network] [default] [detailed]**

Router# show ipx route

Codes: C - Connected primary network, c - Connected secondary network
S - Static, F - Floating static, L - Local (internal), W - IPXWAN
R - RIP, E - EIGRP, N - NLSP, X - External, A - Aggregate
s - seconds, u - uses

8 Total IPX routes. Up to 1 parallel paths and 16 hops allowed.

No default route known.

```
L      D40 is the internal network
C      100 (NOVELL-ETHER), Et1
C      7000 (TUNNEL), Tu1
S      200 via 7000.0000.0c05.6023, Tu1
R      300 [02/01] via 100.0260.8c8d.e748, 19s, Et1
S      2008 via 7000.0000.0c05.6023, Tu1
R      CC0001 [02/01] via 100.0260.8c8d.e748, 19s, Et1
```

Useful IPX Commands (Cont.)

- **show ipx servers [unsorted | [sorted [name | net | type]] [regexp name]**

Router# show ipx servers

Codes: S - Static, P - Periodic, E - EIGRP, N - NLSP, H - Holddown, + = detail

9 Total IPX Servers

Table ordering is based on routing and server info

Type	Name	Net	Address	Port	Route	Hops	Itf
N+	4 MERLIN1-VIA-E03	E03E03.0002.0004.0006	0451	4/03	4	Et0	
N+	4 merlin	E03E03.0002.0004.0006	0451	4/03	3	Et0	
N+	4 merlin 123456789012345	E03E03.0002.0004.0006	0451	4/03	3	Et0	
S	4 WIZARD1--VIA-E0	E0.0002.0004.0006	0451	none	2		
N+	4 dtp-15-AB	E002.0002.0004.0006	0451	none	4	Et0	
N+	4 dtp-15-ABC	E002.0002.0004.0006	0451	none	4	Et0	
N+	4 dtp-15-ABCD	E002.0002.0004.0006	0451	none	4	Et0	
N+	4 merlin	E03E03.0002.0004.0006	0451	4/03	3	Et0	
N+	4 dtp-15-ABC	E002.0002.0004.0006	0451	none	4	Et0	

Useful IPX Commands (Cont.)

- **show ipx traffic**

Router> show ipx traffic

```
Rcvd: 593135 total, 38792 format errors, 0 checksum errors, 0 bad hop count,
      21542 packets pitched, 295493 local destination, 0 multicast
Bcast: 295465 received, 346725 sent
Sent: 429393 generated, 276100 forwarded
      0 encapsulation failed, 0 no route
SAP: 124 Total SAP requests, 124 Total SAP replies, 4 servers
      5 SAP general requests, 5 replies
      110 SAP Get Nearest Server requests, 110 replies
          5 SAP Nearest Name requests, 5 replies
          4 SAP General Name requests, 4 replies
          27 SAP advertisements received, 103 sent
          4 SAP flash updates sent, 0 SAP format errors
RIP: 4676 RIP requests, 336 RIP replies, 18 routes
      87274 RIP advertisements received, 69438 sent
      74 RIP flash updates sent, 0 RIP format errors
Echo: Rcvd 0 requests, 0 replies
      Sent 0 requests, 0 replies
      7648 unknown: 0 no socket, 0 filtered, 7648 no helper
      0 SAPs throttled, freed NDB len 0
Watchdog:
      0 packets received, 0 replies spoofed
```

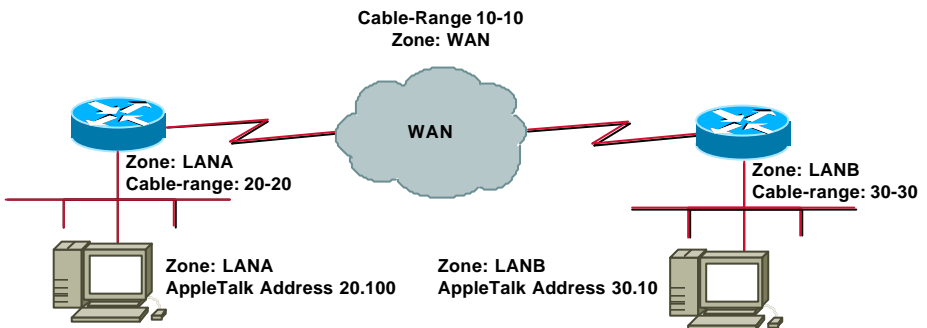
AppleTalk

- **Addressing**
- **Routing**
- **Access Lists / Filtering**
- **Useful AppleTalk Commands**

AppleTalk Addressing

- **network.node decimal format**
Ex: 200.10
- **16-bit network number**
- **8-bit node number**
- **Dynamic by default**
- **Loopbacks DO NOT support AppleTalk**

AppleTalk Addressing Example



AppleTalk Routing

- **RTMP - Routing Table Maintenance Protocol**
DO NOT disable on LANs with end nodes
- **EIGRP - Enhanced Interior Gateway Routing Protocol**
Process-ID needs to be unique
- **AURP - AppleTalk Update Routing Protocol**

AppleTalk Access Lists / Filtering

- **Access lists 600-699**
- **Access list options**
network *zone*
cable-range *within*
includes *other-nbps*
nbp *other-access*
additional-zones

AppleTalk Access Lists / Filtering (Cont.)

- **GetZoneList Filter**

`appletalk getzonelist-filter access-list`

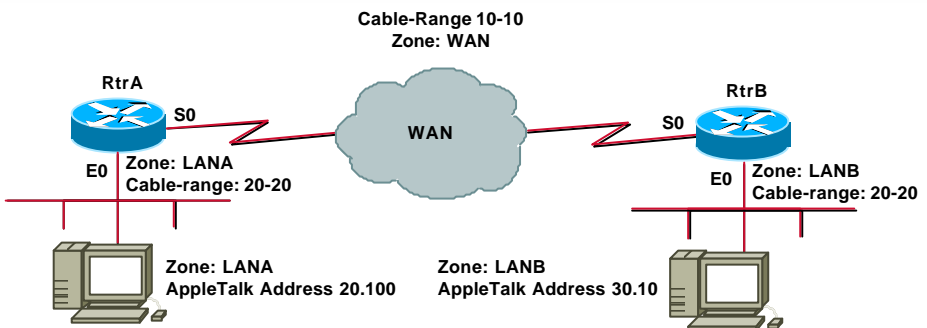
Limits responses to ZIP GZL queries

- **ZIP Reply Filter**

`appletalk zipreply-filter access-list`

Controls zones and cable ranges included in router updates

AppleTalk Filtering Example (GetZoneList-Filter)



If the configuration to the right is applied to RtrA, the LANB zone will not be visible via the Chooser of the Macintosh in LANA.

```
access-list 650 deny zone LANB
access-list 650 permit t additional-zones
access-list 650 permit other-access
interface ethernet 0
appletalk getzonelist-filter 650
```


Useful AppleTalk Commands (Cont.)

- **show appletalk route** [*network* | *type* [#]]

```
Router# show appletalk route
```

```
Codes: R - RTMP derived, E - EIGRP derived, C - connected, A - AURP
```

```
P - proxy, S - static
```

```
5 routes in internet
```

```
C Net 258 directly connected, 1431 uses, Ethernet0, zone Twilight
```

```
R Net 6 [1/G] via 258.179, 8 sec, 0 uses, Ethernet0, zone The 0
```

```
C Net 11 directly connected, 472 uses, Ethernet1, zone No Parking
```

```
R Net 2154 [1/G] via 258.179, 8 sec, 6892 uses, Ethernet0, zone LocalTalk
```

```
S Net 1111 via 258.144, 0 uses, Ethernet0, no zone set
```

```
[hops/state] state can be one of G: Good, S: Suspect, B: Bad
```

Useful AppleTalk Commands (Cont.)

- **show appletalk traffic**

```
Router# show appletalk traffic
```

```
AppleTalk statistics:
```

```
Rcvd: 357471 total, 0 checksum errors, 264 bad hop count
```

```
321006 local destination, 0 access denied
```

```
0 for MacIP, 0 bad MacIP, 0 no client
```

```
13510 port disabled, 2437 no listener
```

```
0 ignored, 0 martians
```

```
Bcast: 191881 received, 270406 sent
```

```
Sent: 550293 generated, 66495 forwarded, 1840 fast forwarded, 0 loopback
```

```
0 forwarded from MacIP, 0 MacIP failures
```

```
436 encapsulation failed, 0 no route, 0 no source
```

```
DDP: 387265 long, 0 short, 0 macip, 0 bad size
```

```
NBP: 302779 received, 0 invalid, 0 proxies
```

```
57875 replies sent, 59947 forwards, 418674 lookups, 432 failures
```

```
RTMP: 108454 received, 0 requests, 0 invalid, 40189 ignored
```

```
90170 sent, 0 replies
```

```
EIGRP: 0 received, 0 hellos, 0 updates, 0 replies, 0 queries
```

```
0 sent, 0 hellos, 0 updates, 0 replies, 0 queries
```

```
0 invalid, 0 ignored
```

```
AURP: 0 Open Requests, 0 Router Downs
```

```
0 Routing Information sent, 0 Routing Information received
```

```
0 Zone Information sent, 0 Zone Information received
```

```
0 Get Zone Nets sent, 0 Get Zone Nets received
```

```
0 Get Domain Zone List sent, 0 Get Domain Zone List received
```

Useful AppleTalk Commands (Cont.)

- **show appletalk zone [zone-name]**

Router# show appletalk zone

Name	Network(s)
Engineering	3 29-29 4042-4042
customer eng	19-19
CISCO IP	4140-4140
Dave's House	3876 3924 5007
Narrow Beam	4013-4013 4023-4023 4037-4037 4038-4038
Low End SW Lab	6160 4172-4172 9555-9555 4160-4160
Tir'n na'Og	199-199
Mt. View 1	7010-7010 7122 7142 7020-7020 7040-7040 7060-7060
Mt. View 2	7152 7050-7050
UDP	1112-12
Empty Guf	69-69
Light	80
europe	2010 3010 3034 5004
Bldg-13	4032 5026 61669 3012 3025 3032 5025 5027
Bldg-17	3004 3024 5002 5006

Voice

- **Voice Ports**
- **Configuring Voice Ports**
- **Incoming Dial-peers**
- **Outgoing Dial-peers**
- **Compression**
- **Miscellaneous**
- **Useful Commands**

Voice Ports

- **FXO - Foreign Exchange Office**

Connects to PSTN's central office or local PBX

Typically used for off-premise extension applications

- **FXS - Foreign Exchange Station**

Connects to telephone equipment, keysets and PBXs

Supplies ring voltage and dialtone

Configuring Voice Ports - FXO / FXS

- **Dial type (FXO only)**

dial-type {dtmf | pulse}

- **Signal type**

signal {loop-start | ground-start}

- **Call progress tone**

cptone *country*

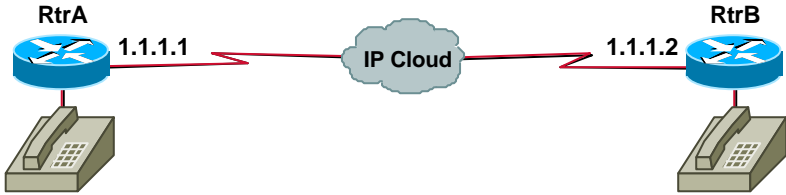
Configuring Voice Ports - FXO / FXS (Cont.)

- **Ring frequency (FXS only)**
ring frequency {25 | 50}
- **Ring number (FXO only)**
ring number *number*
- **PLAR connection mode (optional)**
connection plar *number*

Configuring Voice Ports - FXO / FXS (Cont.)

- **Music threshold (optional)**
music-threshold *decibels*
- **Description (optional)**
description *string*
- **Comfort noise (optional, w/ VAD)**
comfort-noise

VoIP Dial-peer Example



Incoming Dial-peers

- **Define dial-peer**
dial-peer voice *number* pots
- **Telephone number for this dial-peer**
destination-pattern *string*
- **Voice port for this dial-peer**
port *slot-number/subunit-number/port*

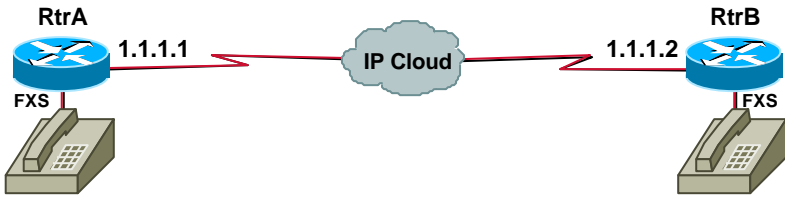
Outgoing Dial-peers

- **Define dial-peer**
dial-peer voice *number* voip
- **Telephone number for this dial-peer**
destination-pattern *string*
- **IP Address for this dial-peer**
session target {ipv4:*address* | dns:*host-name*}

Compression

- **Configured by dial-peer on 3600**
- **Available types**
 - g711alaw - G711 A-Law (64kbps)
 - g711ulaw - G711 μ -Law (64kbps)
 - g729r8 - G729 (8kbps) - default
- **Dial-peers on each end MUST match**

VoIP Dial-peer Example



RtrA

```
dial-peer voice 1 pots
destination-pattern 14085551111
port 1/0/0
```

```
dial-peer voice 2 voip
destination-pattern 19195552222
session target ipv4:1.1.1.2
```

RtrB

```
dial-peer voice 1 pots
destination-pattern 19195552222
port 1/0/0
```

```
dial-peer voice 2 voip
destination-pattern 14085551111
session target ipv4:1.1.1.1
```

Miscellaneous

- **Number Expansion**
`num-exp extension extension-string`
- **Direct Inward Dial (POTS peers)**
`direct-inward-dial`
- **IP Precedence**
`ip precedence {1|2|3|4|5}`

Useful Voice Commands

- **show voice port *slot-number/subunit-number/port***

```
Router# show voice port 1/0/0
E&M Slot is 1, Sub-unit is 0, Port is 0
Type of VoicePort is E&M
Operation State is unknown
Administrative State is unknown
The Interface Down Failure Cause is 0
Alias is NULL
Noise Regeneration is disabled
Non Linear Processing is disabled
Music On Hold Threshold is Set to 0 dBm
In Gain is Set to 0 dB
Out Attenuation is Set to 0 dB
Echo Cancellation is disabled
Echo Cancel Coverage is set to 16ms
Connection Mode is Normal
Connection Number is
Initial Time Out is set to 0 s
Interdigit Time Out is set to 0 s
Analog Info Follows:
Region Tone is set for northamerica
Currently processing none
Maintenance Mode Set to None (not in mtc mode)
Number of signaling protocol errors are 0
```

Useful Voice Commands (Cont.)

- **show voice port *slot-number/subunit-number/port***

```
Voice card specific Info Follows:
Signal Type is wink-start
Operation Type is 2-wire
Impedance is set to 600r 0hm
E&M Type is unknown
Dial Type is dtmf
In Seizure is inactive
Out Seizure is inactive
Digit Duration Timing is set to 0 ms
InterDigit Duration Timing is set to 0 ms
Pulse Rate Timing is set to 0 pulses/second
InterDigit Pulse Duration Timing is set to 0 ms
Clear Wait Duration Timing is set to 0 ms
Wink Wait Duration Timing is set to 0 ms
Wink Duration Timing is set to 0 ms
Delay Start Timing is set to 0 ms
Delay Duration Timing is set to 0 ms
```

Useful Voice Commands (Cont.)

- **show num-exp** [*dialed-number*]

```
Router# show num-exp
Dest Digit Pattern = '0...'      Translation = '+14085270...'
Dest Digit Pattern = '1...'      Translation = '+14085271...'
Dest Digit Pattern = '3...'      Translation = '+140852703...'
Dest Digit Pattern = '4...'      Translation = '+140852804...'
Dest Digit Pattern = '5...'      Translation = '+140852805...'
Dest Digit Pattern = '6...'      Translation = '+1408526...'
Dest Digit Pattern = '7...'      Translation = '+1408527...'
Dest Digit Pattern = '8...'      Translation = '+14085288...'
```

Useful Voice Commands (Cont.)

- **show dialplan number** *dial-string*

```
Router# show dialplan number 51234

Macro Exp.: 14085551234
VoiceOverIpPeer1004
    tag = 1004, destination-pattern = \Q+1408555...',
    answer-address = \Q',
    group = 1004, Admin state is up, Operation state is up
    type = voip, session-target = \Qipv4:1.13.24.0',
    ip precedence: 0      UDP checksum = disabled
    session-protocol = cisco, req-qos = best-effort,
    acc-qos = best-effort,
    fax-rate = voice, codec = g729r8,
    Expect factor = 10, Icpif = 30,
    VAD = enabled, Poor QoV Trap = disabled
    Connect Time = 0, Charged Units = 0
    Successful Calls = 0, Failed Calls = 0
    Accepted Calls = 0, Refused Calls = 0
    Last Disconnect Cause is ""
    Last Disconnect Text is ""
    Last Setup Time = 0
Matched: +14085551234 Digits: 7
Target: ipv4: 172.13.24.0
```

QOS - Quality of Service

- **Weighted Fair Queueing**
- **Priority Queueing**
- **Custom Queueing**
- **Frame-Relay Traffic Shaping**

Weighted Fair Queueing

- **This method queues traffic by flow. A flow is a conversation between a source and a destination. It is configured on the interface.**

Weighted Fair Queueing Configuration

- Enable WFQ and define parameters

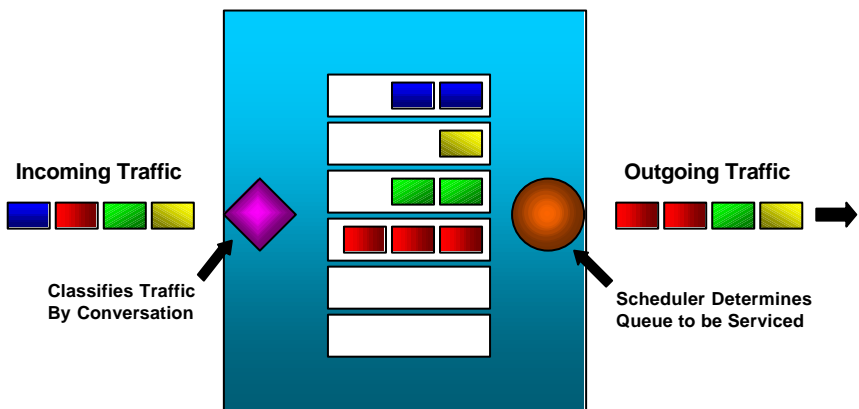
```
fair-queue [congestive-discard-threshold  
[dynamic-queues [reservable-queues]]]
```

congestive-discard-threshold = queue depth

dynamic-queues = number of queues

reservable-queues = queues available for reserved conversations (i.e. RSVP)

Weighted Fair Queueing Chart



Priority Queueing

- This Queueing method uses traffic priority. Traffic is put into *high*, *medium*, *normal*, and *low* priority queues. Note: Priority Queueing may result in lower priority traffic not getting serviced.

Priority Queueing Configuration

- Assign packets to queues

**priority-list *list-number* protocol
protocol-name {high | medium | normal |
low} *queue-keyword* *keyword-value***

**priority-list *list-number* interface
interface-type *interface-number* {high |
medium | normal | low}**

**priority-list *list-number* default {high |
medium | normal | low}**

Priority Queueing Configuration (Cont.)

- Specify queue depth for each queue (Optional)

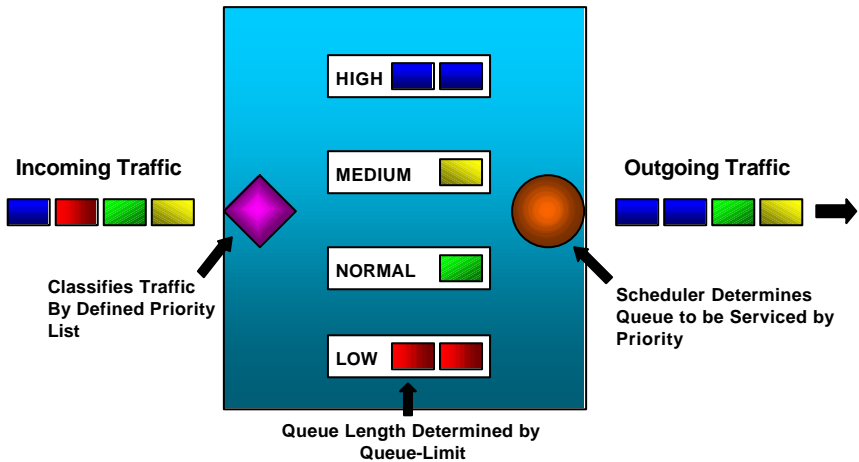
```
priority-list list-number queue-limit [high-limit [medium-limit [normal-limit [low-limit]]]
```

Default queue depths for high, medium, normal, and low are 20, 40, 60, and 80.

Priority Queueing Configuration (Cont.)

- Assign the priority list to an interface
`priority-group list-number`

Priority Queueing Chart



Custom Queueing

- The method of Queueing allows the user to specify the amount of traffic serviced from each queue before moving to the next. If all queues are taken into account, it can be said that each has a percentage of the bandwidth available.

Custom Queueing Configuration

- Assign packets to queues

queue-list list-number protocol protocol-name queue-number queue-keyword keyword-value

queue-list list-number interface interface-type interface-number queue-number

queue-list list-number default queue-number

Custom Queueing Configuration (Cont.)

- Specify queue depth and byte-count

queue-list list-number queue queue-number limit limit-number

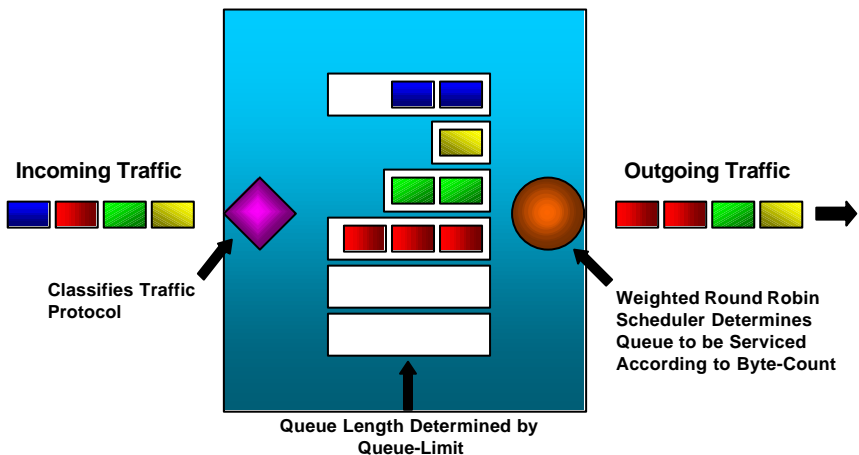
queue-list list-number queue queue-number byte-count byte-count-number

Custom Queueing Configuration (Cont.)

- Assign the custom queue list to an interface

`custom-queue-list list`

Custom Queueing Chart



Useful Queuing Commands

- **show queue [type [#]]**

```
Router# show queue serial 1
```

```
Input queue: 0/75/0 (size/max/drops); Total output drops: 303628  
Queuing strategy: weighted fair
```

```
Output queue: 64/1000/64/303628 (size/max total/threshold/drops)  
Conversations 2/2/256 (active/max active/max total)  
Reserved Conversations 0/0 (allocated/max allocated)
```

```
(depth/weight/discards/tail drops/interleaves) 45/4096/1123/0/0
```

```
Conversation 244, linktype: ip, length: 50
```

```
source: 55.1.1.1, destination: 66.1.1.2, id: 0x0000, ttl: 59,  
TOS: 0 prot: 6, source port 55, destination port 55
```

```
(depth/weight/discards/tail drops/interleaves) 19/4096/302541/0/0
```

```
Conversation 185, linktype: ip, length: 118
```

```
source: 55.1.1.1, destination: 66.1.1.2, id: 0x0000, ttl: 59,  
TOS: 0 prot: 17, source port 20, destination port 20
```

Useful Queuing Commands (Cont.)

- **show queueing [custom | fair | priority | red]**

```
Router# show queueing custom
```

```
Current custom queue configuration:
```

List	Queue	Args
3	10	default
3	3	interface Tunnel3
3	3	protocol ip
3	3	byte-count 444 limit 3

Frame-Relay Traffic Shaping

- **Dynamic traffic throttling on a per-VC basis. This allows the amount of traffic output to be adjusted for amount of congestion being experienced in the network.**

Frame-Relay Traffic Shaping Terms

- **Tc - Committed Rate Measurement Interval (Bc/CIR)**
- **Bc - Committed Burst Size**
- **Be - Excess Burst Size**
- **CIR - Committed Information Rate**
- **MinCIR - Minimum Committed Information Rate**

Frame-Relay Traffic Shaping Configuration

- **Enable FRTS**

frame-relay traffic-shaping

- **Define a map-class**

map-class frame-relay *map-class-name*

Frame-Relay Traffic Shaping Configuration (Cont.)

- **Define map-class parameters**

frame-relay custom-queue-list *list-number*

frame-relay priority-group *list-number*

frame-relay adaptive-shaping [beecn | foresight]

frame-relay cir [in | out] *bps*

Frame-Relay Traffic Shaping Configuration (Cont.)

frame-relay mincir [in | out] *bps*

frame-relay bc [in | out] *bits*

frame-relay be [in | out] *bits*

frame-relay idle-timer *duration*

frame-relay traffic-rate *average* [*peak*]

Frame-Relay Traffic Shaping Configuration (Cont.)

- **Apply map-class to an interface or vc**

frame-relay class *map-class-name*

class *map-class-name*

Frame-Relay Traffic Shaping Example

Port Speed: 64000 kbps

CIR : 32000 kbps (Average rate of traffic without congestion)

MinCIR: 16000 kbps (Average rate of traffic with congestion)

Bc: 4000 kbps (Amount of data sent per interval)

Be: 32000 kbps (Amount of excess allowed to be sent once credit has built up)

Configuration for physical interface:

```
interface Serial0
  ip address 10.10.10.1 255.255.255.0
  encapsulation frame-relay
  no ip mroute-cache
  frame-relay traffic-shaping
  frame-relay class ccie
```

```
map-class frame-relay ccie
  frame-relay adaptive-shaping becn
  frame-relay cir 32000
  frame-relay mincir 16000
  frame-relay bc 4000
  frame-relay be 32000
```



Questions?