

# Johannesburg Stock Exchange

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## Trading and Information Solution

### JSE Specification Document Volume B - Trading and Information Network Configuration Guide

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# 1 DOCUMENT CONTROL

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## 1.2 Document Information

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## 1.3 Revision History

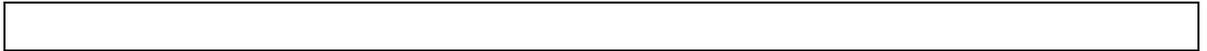
Date	Version	Sections	Description
29 February 2012	1.00		Initial Draft
01 March 2012	1.00	All	Business review comments
01 August 2016	3.00	All	User guide updated as part of the Integrated Trading and Clearing (ITaC) project. Version aligned to all other specs issued for ITaC as version 3.00
<a href="#">4 July 2017</a>	<a href="#">3.01</a>	<a href="#">All</a>	<a href="#">User guide updated to include revisions for Integrated Trading and Clearing (ITaC) Project 1b (Equity Derivatives) and Project 1c (Currency Derivatives).</a>

## 1.4 References

None

## 1.5 Contact Details

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Glossary of Terms	
Border Gateway Protocol (BGP)	Border Gateway Protocol (BGP) is a standardized exterior gateway protocol designed to exchange routing and reachability information among autonomous systems (as) on the internet. The protocol is often classified as a path vector protocol but is sometimes also classed as a distance-vector routing protocol.
Rendezvous Point (RP)	A Rendezvous Point (RP) is a router in a multicast network domain that acts as a shared root for a multicast shared tree. Any number of routers can be configured to work as RPs and they can be configured to cover different group ranges.

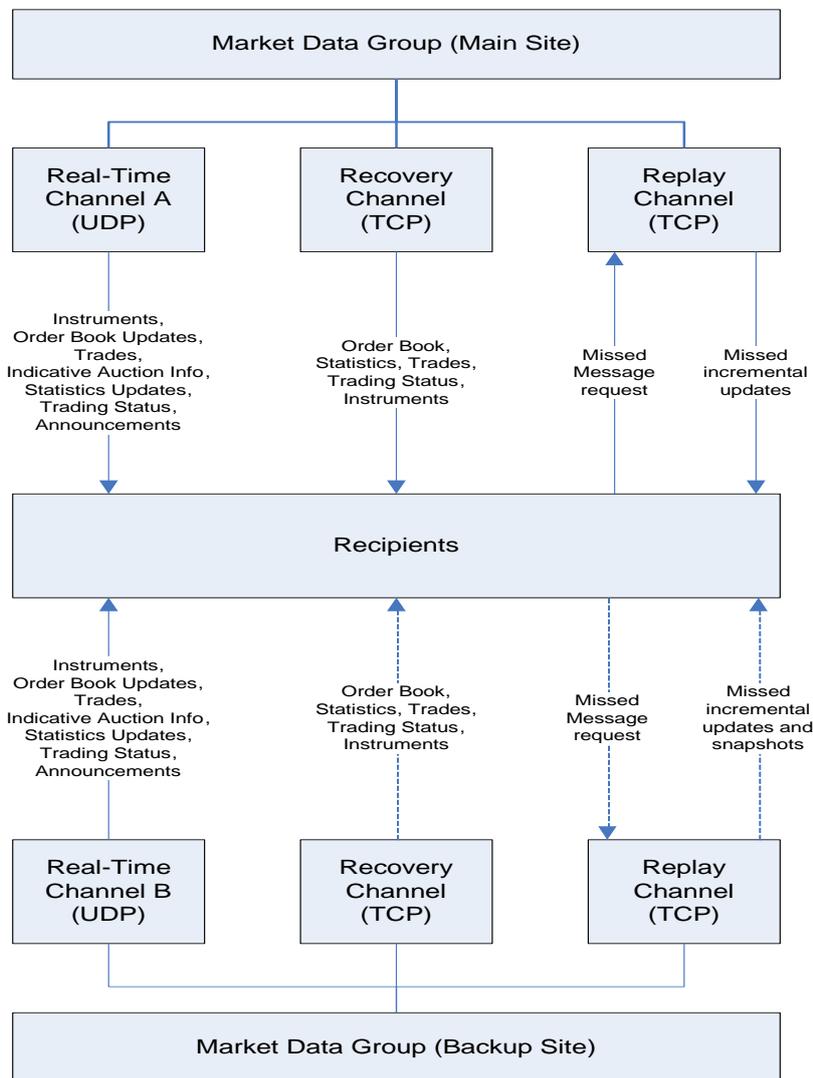
## **2 OVERVIEW**

This document provides guidance of the network configuration required by clients for connecting and subscribing to the services of new Equity Market Trading and Information Solution.

### 3 SOLUTION TRANSPORT MECHANISM

The new Equity Trading and Information Solution delivers private order and trade data to clients via TCP. The transport mechanism for Market Data is via UDP Multicast. The Market Data is accessed via two identically sequenced Real-Time feeds: one from the main feed (**Feed-A**) and one from the backup feed (**Feed-B**). It is recommended that client applications use both feeds and arbitrate between them to minimise the probability of a data loss.

The routing process is governed by the BGP protocol which allows automatic re-routing of traffic in the event of a connection failure.



### 4 HARDWARE REQUIREMENTS

The JSE recommends the following as a minimum for hardware for connecting to the new Equity Market Trading and Information system:

- Cisco 3900 series router.

## 5 SAMPLE CONFIGURATIONS FOR PRODUCTION

### 5.1 Two Separate Links on Two Separate Routers

#### ***Router-A (Feed-A)***

##### ***Setup route to the Feed-A RP***

IP route 196.216.152.98 255.255.255.255 next-hop-to-JSE\_interface

##### ***Setup access-list to bind to Feed-A RP***

```
IP access-list standard 12
Remark allow pre-prod feed-a
Permit host 224.0.112.30
Permit host 224.0.112.32
Permit host 224.0.112.34
Permit host 224.0.112.38
Permit host 224.0.112.40
Permit host 224.0.112.42
Permit host 224.0.112.44
Permit host 224.0.112.46
```

##### ***Setup the RP for Feed-A with the above access-list bound***

IP pim rp-address 196.216.152.98 12

##### ***Create a static mroute for feed-A multicast source – (this static mroute is an interim requirement only until the new JSE Trading NW is in place)***

IP mroute 10.10.22.10 255.255.255.255 next-hop-to-JSE\_interface

##### ***Create static IGMP joins on the LAN facing (server facing) interface***

```
IP IGMP static-group 224.0.112.30
IP IGMP static-group 224.0.112.32
IP IGMP static-group 224.0.112.34
IP IGMP static-group 224.0.112.38
IP IGMP static-group 224.0.112.40
IP IGMP static-group 224.0.112.42
IP IGMP static-group 224.0.112.44
IP IGMP static-group 224.0.112.46
```

#### ***Router-B (Feed-B)***

##### ***Setup route to the Feed-B RP***

IP route 196.216.152.97 255.255.255.255 next-hop-to-JSE\_interface

##### ***Setup access-list to bind to Feed-B RP***

```
IP access-list standard 13
Remark allow pre-prod feed-b
Permit host 224.0.112.31
Permit host 224.0.112.33
Permit host 224.0.112.35
Permit host 224.0.112.39
Permit host 224.0.112.41
Permit host 224.0.112.43
Permit host 224.0.112.45
Permit host 224.0.112.47
```

##### ***Setup the RP for Feed-B with the above access-list bound***

IP pim rp-address 196.216.152.97 13

**Create a static mroute for Feed-B multicast source - (this static mroute is an interim requirement only until the new JSE Trading NW is in place)**

**IP mroute 10.10.22.11 255.255.255.255 next-hop-to-JSE interface**

**Create static IGMP joins on the LAN facing (server facing) interface**

IP IGMP static-group 224.0.112.31  
IP IGMP static-group 224.0.112.33  
IP IGMP static-group 224.0.112.35  
IP IGMP static-group 224.0.112.39  
IP IGMP static-group 224.0.112.41  
IP IGMP static-group 224.0.112.43  
IP IGMP static-group 224.0.112.45  
IP IGMP static-group 224.0.112.47

## 5.2 Two Separate Links on One Single Router

**Interface-x (Feed-A)**

**Setup route to the Feed-A RP**

IP route 196.216.152.98 255.255.255.255 next-hop-to-JSE interface

**Setup access-list to bind to Feed-A RP**

IP access-list standard 12  
Remark allow pre-prod feed-a  
Permit host 224.0.112.30  
Permit host 224.0.112.32  
Permit host 224.0.112.34  
Permit host 224.0.112.38  
Permit host 224.0.112.40  
Permit host 224.0.112.42  
Permit host 224.0.112.44  
Permit host 224.0.112.46

**Setup the RP for Feed-A with the above access-list bound**

IP pim rp-address 196.216.152.98 12

**Create a static mroute for Feed-A multicast source - (this static mroute is an interim requirement only until the new JSE Trading NW is in place)**

**IP mroute 10.10.22.10 255.255.255.255 next-hop-to-JSE interface**

**Create static IGMP joins on the LAN facing (server facing) interface**

IP IGMP static-group 224.0.112.30  
IP IGMP static-group 224.0.112.32  
IP IGMP static-group 224.0.112.34  
IP IGMP static-group 224.0.112.38  
IP IGMP static-group 224.0.112.40  
IP IGMP static-group 224.0.112.42  
IP IGMP static-group 224.0.112.44  
IP IGMP static-group 224.0.112.46

**Interface-y (Feed-B)**

**Setup route to the Feed-A RP**

IP route 196.216.152.97 255.255.255.255 next-hop-to-JSE interface

**Setup access-list to bind to Feed-B RP**

IP access-list standard 13  
Remark allow pre-prod feed-b  
Permit host 224.0.112.31  
Permit host 224.0.112.33  
Permit host 224.0.112.35

Permit host 224.0.112.39  
Permit host 224.0.112.41  
Permit host 224.0.112.43  
Permit host 224.0.112.45  
Permit host 224.0.112.47

**Setup the RP for Feed-B with the above access-list bound**

IP pim rp-address 196.216.152.97 13

**Create a static mroute for Feed-B multicast source - (this static mroute is an interim requirement only until the new JSE Trading NW is in place)**

IP mroute 10.10.22.11 255.255.255.255 next-hop-to-JSE interface

**Create static IGMP joins on the LAN facing (server facing) interface**

IP IGMP static-group 224.0.112.31  
IP IGMP static-group 224.0.112.33  
IP IGMP static-group 224.0.112.35  
IP IGMP static-group 224.0.112.39  
IP IGMP static-group 224.0.112.41  
IP IGMP static-group 224.0.112.43  
IP IGMP static-group 224.0.112.45  
IP IGMP static-group 224.0.112.47

### 5.3 One Link with One Router

**Router (Feed-A+Feed-B)**

**Setup route to the Feed-A RP**

IP route 196.216.152.98 255.255.255.255 next-hop-to-JSE interface

**Setup route to the Feed-A RP**

IP route 196.216.152.97 255.255.255.255 next-hop-to-JSE interface

**Setup access-list to bind to Feed-A RP**

IP access-list standard 12  
Remark allow pre-prod feed-a  
Permit host 224.0.112.30  
Permit host 224.0.112.32  
Permit host 224.0.112.34  
Permit host 224.0.112.38  
Permit host 224.0.112.40  
Permit host 224.0.112.42  
Permit host 224.0.112.44  
Permit host 224.0.112.46

**Setup access-list to bind to Feed-B RP**

IP access-list standard 13  
Remark allow pre-prod feed-b  
Permit host 224.0.112.31  
Permit host 224.0.112.33  
Permit host 224.0.112.35  
Permit host 224.0.112.39  
Permit host 224.0.112.41  
Permit host 224.0.112.43  
Permit host 224.0.112.45  
Permit host 224.0.112.47

**Setup the RP for Feed-A with the above access-list bound**

IP pim rp-address 196.216.152.98 12

**Setup the RP for Feed-B with the above access-list bound**

IP pim rp-address 196.216.152.97 13

**Create a static mroute for feed-A multicast source**

IP mroute 10.10.22.10 255.255.255.255 next-hop-to-JSE interface

**Create a static mroute for feed-B multicast source (this static mroute is an interim requirement only until the new JSE Trading NW is in place)**

IP mroute 10.10.22.11 255.255.255.255 next-hop-to-JSE interface

**Create static IGMP joins on the LAN facing (server facing) interface**

IP IGMP static-group 224.0.112.30  
IP IGMP static-group 224.0.112.32  
IP IGMP static-group 224.0.112.34  
IP IGMP static-group 224.0.112.38  
IP IGMP static-group 224.0.112.40  
IP IGMP static-group 224.0.112.42  
IP IGMP static-group 224.0.112.44  
IP IGMP static-group 224.0.112.46

**Create static IGMP joins on the LAN facing (server facing) interface**

IP IGMP static-group 224.0.112.31  
IP IGMP static-group 224.0.112.33  
IP IGMP static-group 224.0.112.35  
IP IGMP static-group 224.0.112.39  
IP IGMP static-group 224.0.112.41  
IP IGMP static-group 224.0.112.43  
IP IGMP static-group 224.0.112.45  
IP IGMP static-group 224.0.112.47

ITaC multicast groups and RP's [for CTS](#)

Feed-A ITaC groups

IP route 196.216.153.95 255.255.255.255 next-hop-to-JSE interface

IP IGMP static-group 224.0.112.131  
IP IGMP static-group 224.0.112.133  
IP IGMP static-group 224.0.112.135  
IP IGMP static-group 224.0.112.137  
IP IGMP static-group 224.0.112.139  
IP IGMP static-group 224.0.112.141  
IP IGMP static-group 224.0.112.143  
IP IGMP static-group 224.0.112.145  
IP IGMP static-group 224.0.112.147  
IP IGMP static-group 224.0.112.149  
IP IGMP static-group 224.0.112.151  
IP IGMP static-group 224.0.112.153  
IP IGMP static-group 224.0.112.155  
IP IGMP static-group 224.0.112.157  
IP IGMP static-group 224.0.112.159  
IP IGMP static-group 224.0.112.161  
IP IGMP static-group 224.0.112.163  
IP IGMP static-group 224.0.112.165

Feed-B ITaC groups [for CTS](#)

IP route 196.216.153.96 255.255.255.255 next-hop-to-JSE interface

IP IGMP static-group 224.0.112.132  
IP IGMP static-group 224.0.112.134  
IP IGMP static-group 224.0.112.136  
IP IGMP static-group 224.0.112.138  
IP IGMP static-group 224.0.112.140  
IP IGMP static-group 224.0.112.142  
IP IGMP static-group 224.0.112.144  
IP IGMP static-group 224.0.112.146  
IP IGMP static-group 224.0.112.148  
IP IGMP static-group 224.0.112.150  
IP IGMP static-group 224.0.112.152  
IP IGMP static-group 224.0.112.154  
IP IGMP static-group 224.0.112.156  
IP IGMP static-group 224.0.112.158  
IP IGMP static-group 224.0.112.160  
IP IGMP static-group 224.0.112.162  
IP IGMP static-group 224.0.112.164  
IP IGMP static-group 224.0.112.166  
IP IGMP static-group 224.0.112.168

[ITaC - "B" Prod going live](#)

[224.0.112.50](#)

[224.0.112.51](#)

[224.0.112.52](#)

[224.0.112.53](#)

[224.0.112.56](#)

[224.0.112.57](#)

[224.0.112.58](#)

[224.0.112.59](#)

[224.0.112.62](#)

[224.0.112.63](#)

[224.0.112.64](#)

[224.0.112.65](#)

[ITaC - "C" Prod going live](#)

[224.0.112.48](#)

[224.0.112.49](#)

[224.0.112.54](#)

[224.0.112.55](#)

[224.0.112.60](#)

[224.0.112.61](#)

## 5.4 Multicast Data Recommendations and Guidelines

The following are recommendations and guidelines for configuring routers and switches for multicast data.

Enable Cisco Express Forwarding (CEF) globally. Ensure that there is no “no IP route-cache” on any of the interfaces.

- Multicast fast switching must be enabled (enabled with the “IP mroute-cache” command on the relevant interfaces, again you should not have a “no IP mroute-cache” command on a multicast enabled interface).

- Remove all unnecessary “IP IGMP join-group” commands. They should only be on the interface closest to the servers and are not needed at all if the application is sending the joins for the multicast groups.
  - If join’s on the network devices are necessary they should be changed to “IP IGMP static-group” commands and not be “IP IGMP join-group” commands. (Multicast fast switching cannot happen on an interface with “join-group” commands on it.
  - Only use sparse-mode and not dense-mode configurations where possible.
- [http://www.cisco.com/en/US/tech/tk828/technologies\\_tech\\_note09186a0080094b55.shtml](http://www.cisco.com/en/US/tech/tk828/technologies_tech_note09186a0080094b55.shtml)

#### 5.4.1 Troubleshooting Multicast Data

There are a number of helpful tools and commands that can assist a client in troubleshooting multicast data on their routers and networks. The following is only a guide for troubleshooting multicast traffic on the broker router / network.

\*\*\* The commands to be executed are in italics, with a sample output beneath\*\*\*

In addition to the below, a strategically placed network sniffer (PC with Wireshark installed, listening to a span port off the router or switch closest to the router), can assist greatly in troubleshooting

- Confirm routing to Pre-Prod multicast RP’s
- Confirm RPF checks to multicast sources
- Check the ‘IP mroute’ table
- Check multicast packet count

### 5.5 Confirm Routing to Multicast RP’s

```
sh IP route 196.216.152.98
Routing entry for 196.216.152.98/32
Known via "static", distance 1, metric 0
Routing Descriptor Blocks:
* JSE-next-hop, from JSE-next-hop,
  Route metric is 1, traffic share count is 1
```

```
sh IP route 196.216.152.97
Routing entry for 196.216.152.97/32
Known via "static", distance 1, metric 0
Routing Descriptor Blocks:
* JSE-next-hop, from JSE-next-hop,
  Route metric is 1, traffic share count is 1
```

### 5.6 Confirm Routing to Multicast RP’s

```
sh IP rpf 10.10.22.10
RPF information for? (10.10.22.10)
RPF interface: next-hop-to-JSE
RPF neighbor:? (next-hop-to-JSE)
RPF route/mask: 10.10.22.10/32
RPF type: multicast (static)
Doing distance-preferred lookups across tables
```

RPF topology: ipv4 multicast base

```
sh IP rpf 10.10.22.11
RPF information for? (10.10.22.11)
RPF interface: next-hop-to-JSE
RPF neighbor:? (next-hop-to-JSE)
RPF route/mask: 10.10.22.11/32
RPF type: multicast (static)
Doing distance-preferred lookups across tables
RPF topology: ipv4 multicast base
```

## 5.7 Check the IP Mroute Table

```
sh IP mroute 224.0.112.30
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
      L - Local, P - Pruned, R - RP-bit set, F - Register flag,
      T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
      X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
      U - URD, I - Received Source Specific Host Report,
      Z - Multicast Tunnel, z - MDT-data group sender,
      Y - Joined MDT-data group, y - Sending to MDT-data group,
      V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
Timers: Uptime/Expires
Interface state: Interface, Next-Hop or VCD, State/Mode
```

```
(* , 224.0.112.30), 1w5d/stopped, RP 196.216.152.98, flags: SJCL
Incoming interface: nbr next-hop-to JSE, RPF nbr next-hop-to JSE, Mroute
Outgoing interface list:
  GigabitEthernet9/7, Forward/Sparse, 1w5d/00:02:31
```

```
(10.10.22.10, 224.0.112.30), 02:46:13/00:02:37, flags: LJT
Incoming interface: nbr next-hop-to JSE, RPF nbr next-hop-to JSE, Mroute
Outgoing interface list:
  GigabitEthernet9/7, Forward/Sparse, 02:46:13/00:02:31
```

```
sh IP mroute 224.0.112.31
IP Multicast Routing Table
Flags: D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
      L - Local, P - Pruned, R - RP-bit set, F - Register flag,
      T - SPT-bit set, J - Join SPT, M - MSDP created entry, E - Extranet,
      X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
      U - URD, I - Received Source Specific Host Report,
      Z - Multicast Tunnel, z - MDT-data group sender,
      Y - Joined MDT-data group, y - Sending to MDT-data group,
      V - RD & Vector, v - Vector
Outgoing interface flags: H - Hardware switched, A - Assert winner
Timers: Uptime/Expires
Interface state: Interface, Next-Hop or VCD, State/Mode
```

```
(* , 224.0.112.31), 1w5d/stopped, RP 196.216.152.98, flags: SJCL
Incoming interface: nbr next-hop-to JSE, RPF nbr next-hop-to JSE, Mroute
Outgoing interface list:
  GigabitEthernet9/7, Forward/Sparse, 1w5d/00:02:31
```

```
(10.10.22.11, 224.0.112.31), 02:46:13/00:02:37, flags: LJT
Incoming interface: nbr next-hop-to JSE, RPF nbr next-hop-to JSE, Mroute
```

Outgoing interface list:  
GigabitEthernet9/7, Forward/Sparse, 02:46:13/00:02:31

## 5.8 Check Multicast Packet Count

```
sh IP mroute 224.0.112.30 count
```

Use "show IP mfib count" to get better response time for a large number of Mroutes

IP Multicast Statistics

211 routes using 262236 bytes of memory

126 groups, 0.67 average sources per group

Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kilobits per second

Other counts: Total/RPF failed/Other drops (OIF-null, rate-limit etc)

Group: 224.0.112.30, Source count: 1, Packets forwarded: **56544**, Packets received: **56544**

RP-tree: Forwarding: 33045/0/93/0, Other: 33045/0/0

Source: 10.10.22.10/32, Forwarding: **23499/10/100/8**, Other: **23499/0/0**

### Confirm that the packets are incrementing

```
sh IP mroute 224.0.112.31 count
```

Use "show IP mfib count" to get better response time for a large number of Mroutes.

IP Multicast Statistics

205 routes using 257940 bytes of memory

126 groups, 0.62 average sources per group

Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kilobits per second

Other counts: Total/RPF failed/Other drops (OIF-null, rate-limit etc)

Group: 224.0.112.31, Source count: 1, Packets forwarded: **23983**, Packets received: **23984**

RP-tree: Forwarding: 243/0/83/0, Other: 243/0/0

Source: 10.10.22.11/32, Forwarding: **23740/0/100/0**, Other: **23741/0/1**

## 5.9 Confirm Line Errors and Discards

Confirm that there are no errors or discards on the line. Errors could indicate line or circuit issues, while drops and discards could indicate over utilization on the line.

```
JSE_Router#sh int s1
```

```
Serial1/0/6 is up, line protocol is up
```

```
Hardware is Serial
```

```
Description: Primary JSE Feed A
```

```
Internet address is x.x.x.x/y
```

```
MTU 1500 bytes, BW 2047 Kbit/sec, DLY 20000 usec,
```

```
reliability 255/255, txload 1/255, rxload 1/255
```

```
Encapsulation HDLC, crc 16, loopback not set
```

```
Keepalive set (10 sec)
```

```
Last input 00:00:01, output 00:00:05, output hang never
```

```
Last clearing of "show interface" counters 01:45:22
```

```
Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 23
```

```
Queuing strategy: Class-based queuing
```

```
Output queue: 0/40 (size/max)
```

```
5 minute input rate 0 bits/sec, 0 packets/sec
```

```
5 minute output rate 0 bits/sec, 0 packets/sec
```

```
7370 packets input, 437149 bytes, 0 no buffer
```

Received 737 broadcasts (0 IP multicasts)  
0 runts, 0 giants, 0 throttles  
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort  
56769 packets output, 7907264 bytes, 0 underruns  
23 packets late drop, 31299 bytes late drop  
0 output errors, 0 collisions, 0 interface resets  
0 unknown protocol drops  
0 output buffer failures, 0 output buffers swapped out  
0 carrier transitions  
RTS up, CTS up, DTR up, DCD up, DSR up