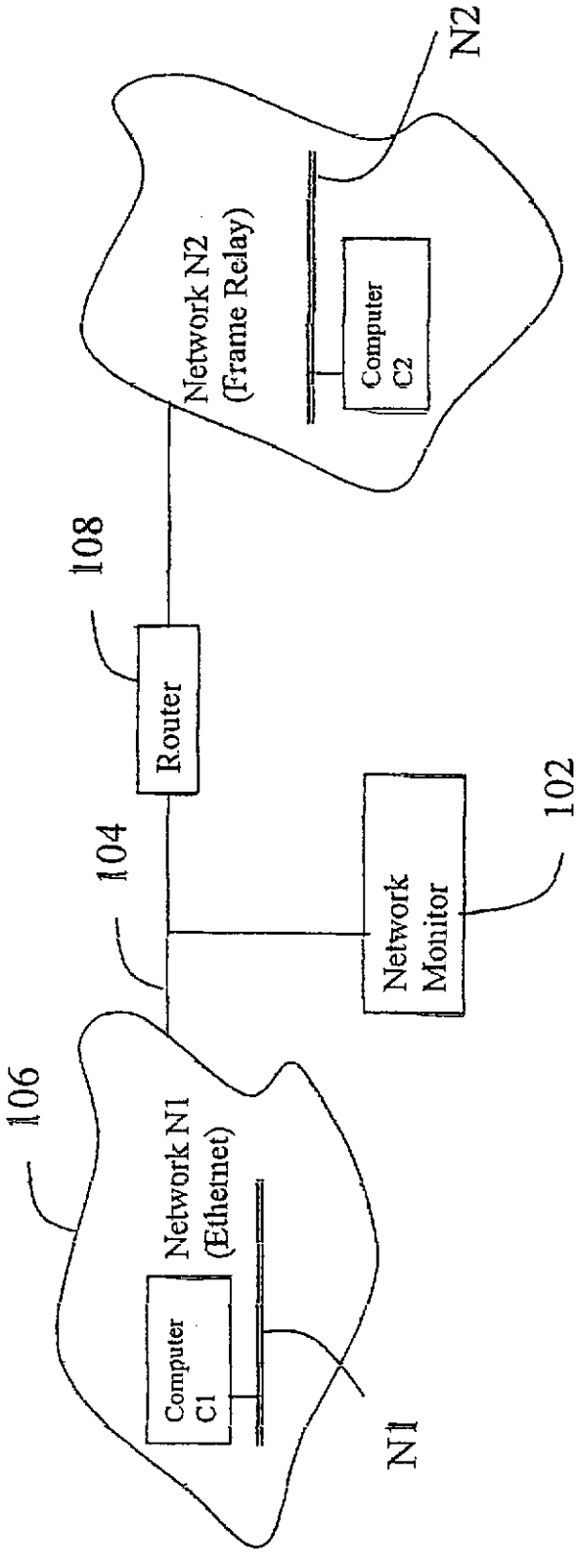

N2
Network N2
(Frame Relay)
Computer
C2
108
Router
104
Network
Monitor
102
106
Network N1
(Ethernet)
Computer
C1
N1

FIG. 1

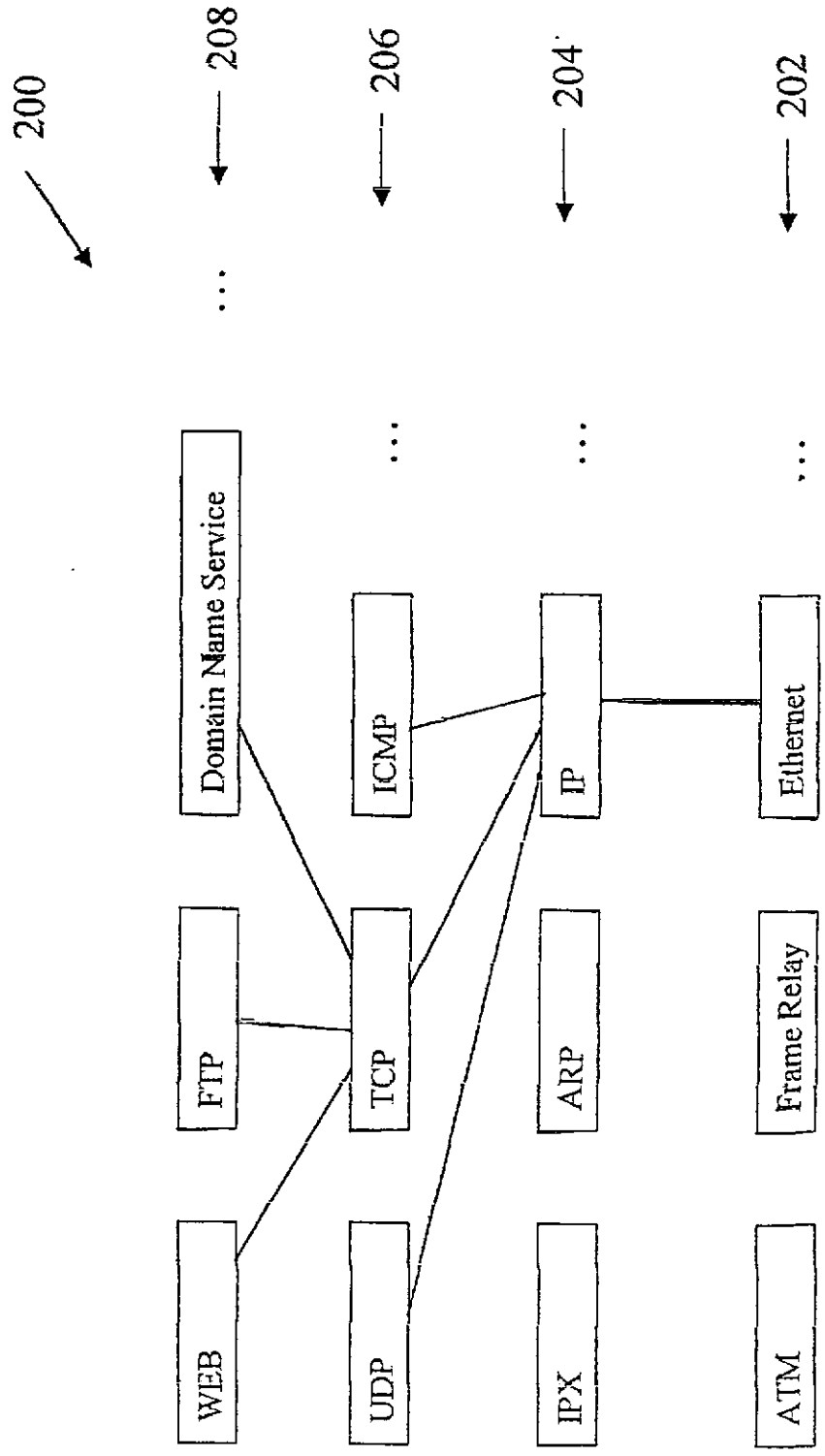

200
208
206
204
202
Domain Name Service
ICMP
IP
Ethernet
FTP
TCP
ARP
Frame Relay
WEB
UDP
IPX
ATM

FIG. 2

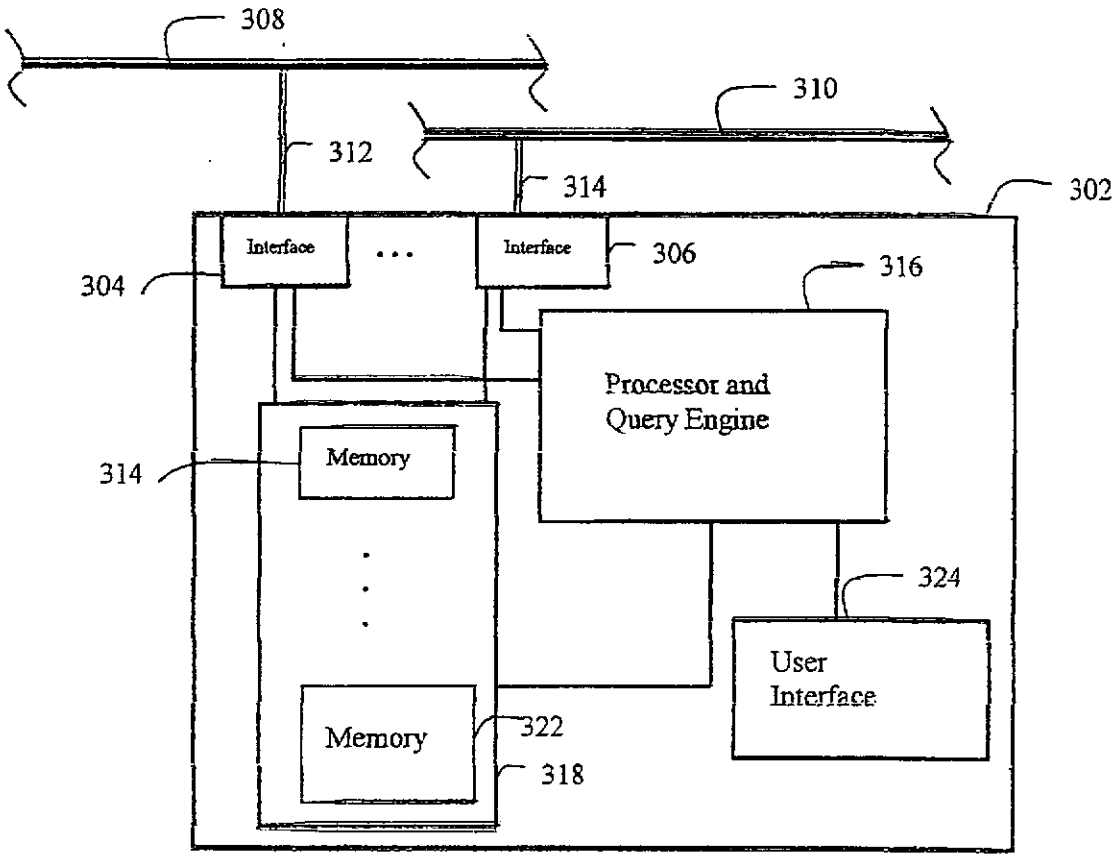
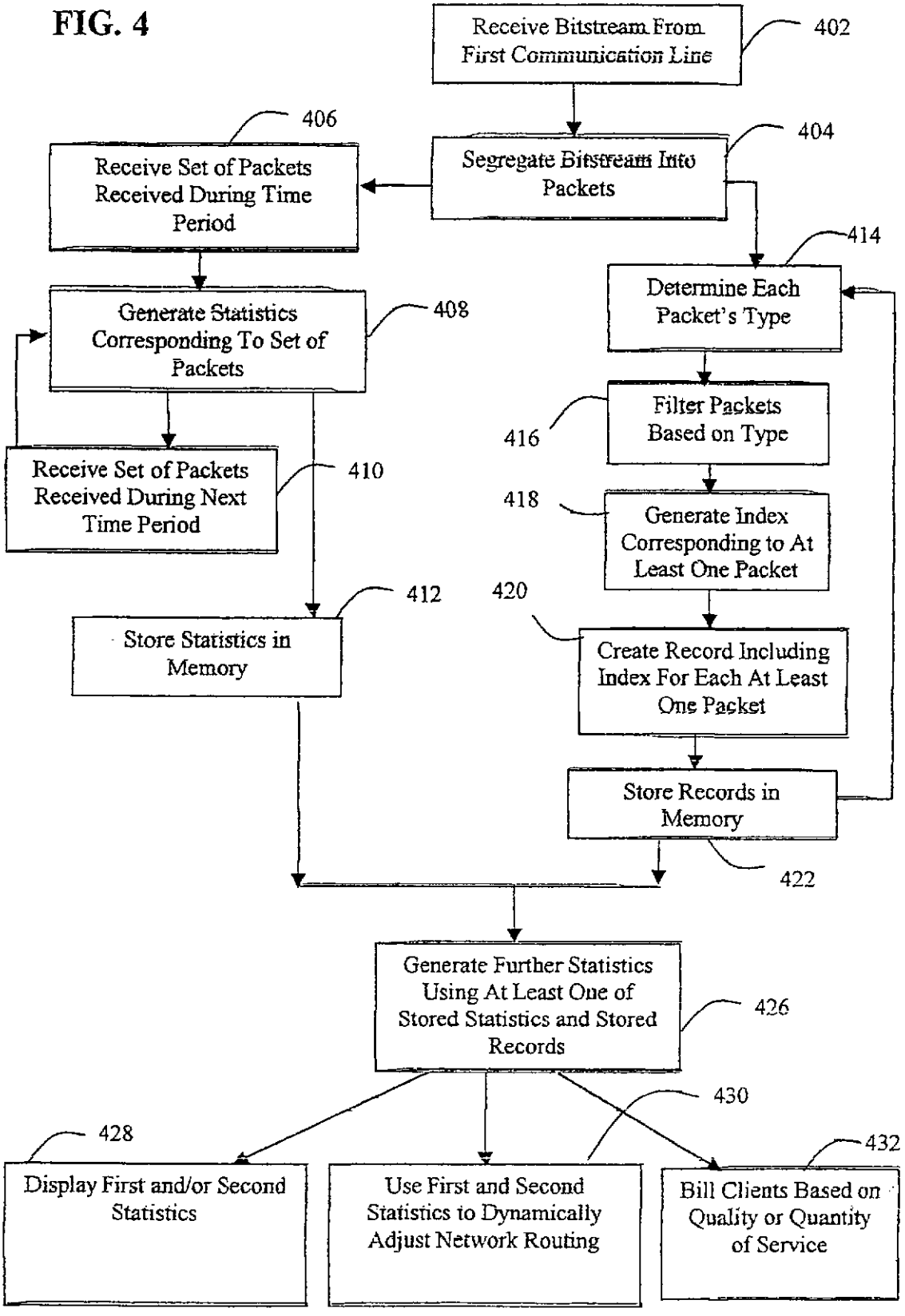

308
310
312
314
302
Interface
Interface
306
304
316
Processor and
Query Engine
314
Memory
324
User
Interface
Memory
322
318

FIG. 3

FIG. 4


Receive Bitstream From First Communication Line
402
Segregate Bitstream Into Packets
404
Receive Set of Packets Received During Time Period
406
Generate Statistics Corresponding To Set of Packets
408
Receive Set of Packets Received During Next Time Period
410
Store Statistics in Memory
412
Determine Each Packet's Type
414
Filter Packets Based on Type
416
Generate Index Corresponding to At Least One Packet
418
Create Record Including Index For Each At Least One Packet
420
Store Records in Memory
422
Generate Further Statistics Using At Least One of Stored Statistics and Stored Records
426
Display First and/or Second Statistics
428
Use First and Second Statistics to Dynamically Adjust Network Routing
430
Bill Clients Based on Quality or Quantity of Service
432

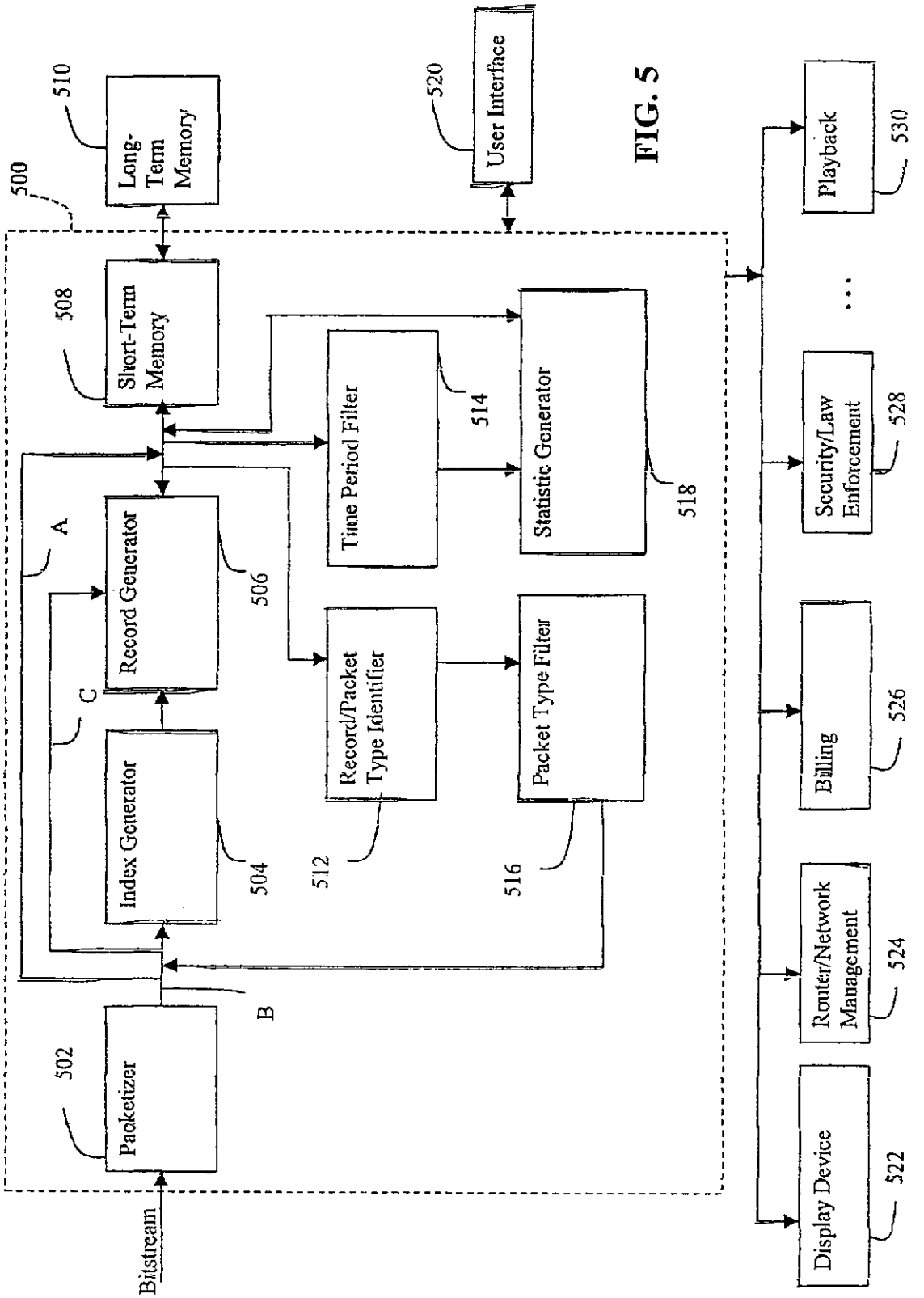

Bitstream
Packetizer
502
Index Generator
504
Record Generator
506
Short-Term Memory
508
Long-Term Memory
510
Record/Packet Type Identifier
512
Time Period Filter
514
Packet Type Filter
516
Statistic Generator
518
User Interface
520
Display Device
522
Router/Network Management
524
Billing
526
Security/Law Enforcement
528
Playback
530
A
B
C
500

FIG. 5

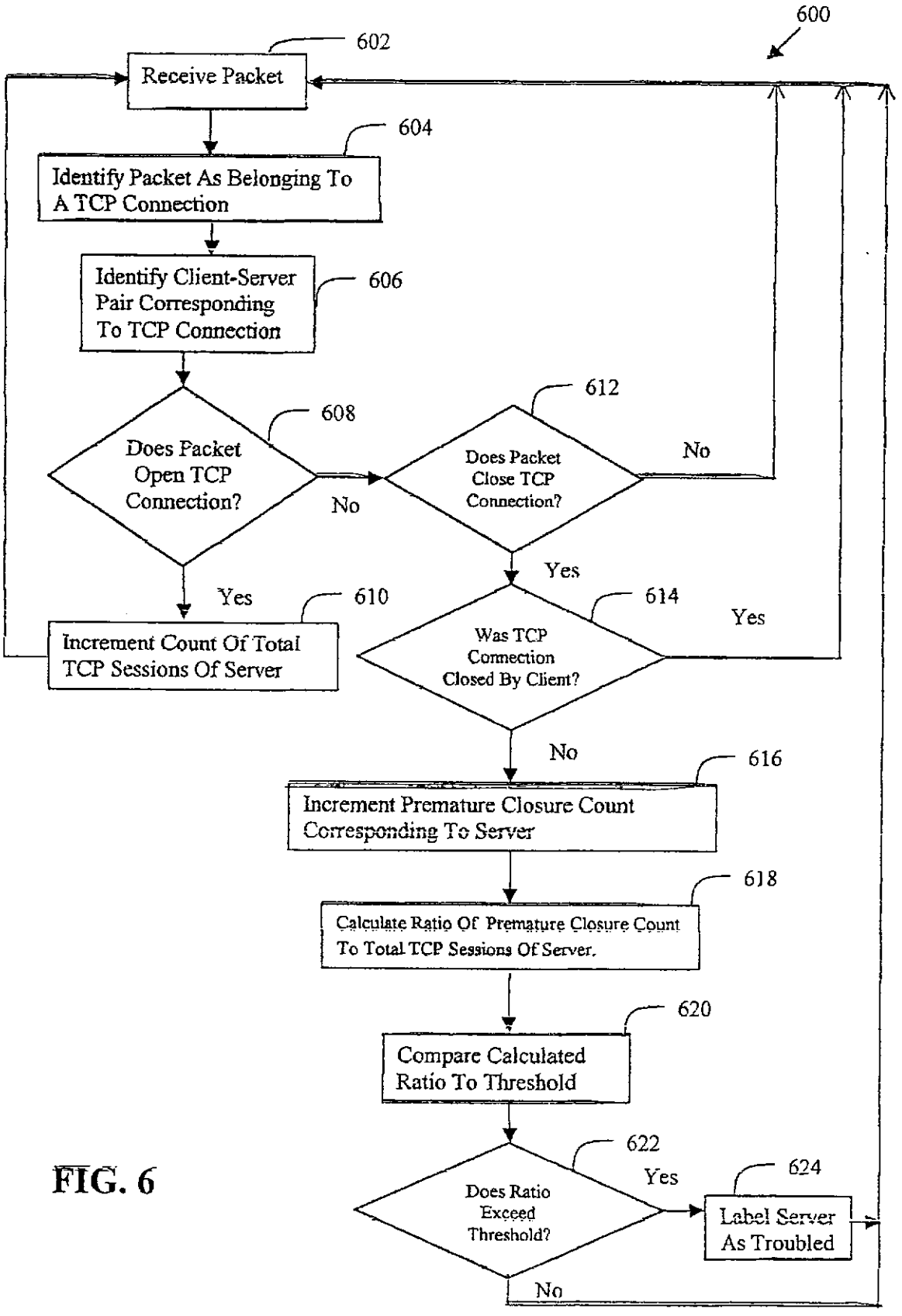

600
602
Receive Packet
604
Identify Packet As Belonging To A TCP Connection
606
Identify Client-Server Pair Corresponding To TCP Connection
608
Does Packet Open TCP Connection?
No
612
Does Packet Close TCP Connection?
No
Yes
Yes
610
Increment Count Of Total TCP Sessions Of Server
614
Was TCP Connection Closed By Client?
Yes
No
616
Increment Premature Closure Count Corresponding To Server
618
Calculate Ratio Of Premature Closure Count To Total TCP Sessions Of Server.
620
Compare Calculated Ratio To Threshold
622
Does Ratio Exceed Threshold?
Yes
624
Label Server As Troubled
No

FIG. 6

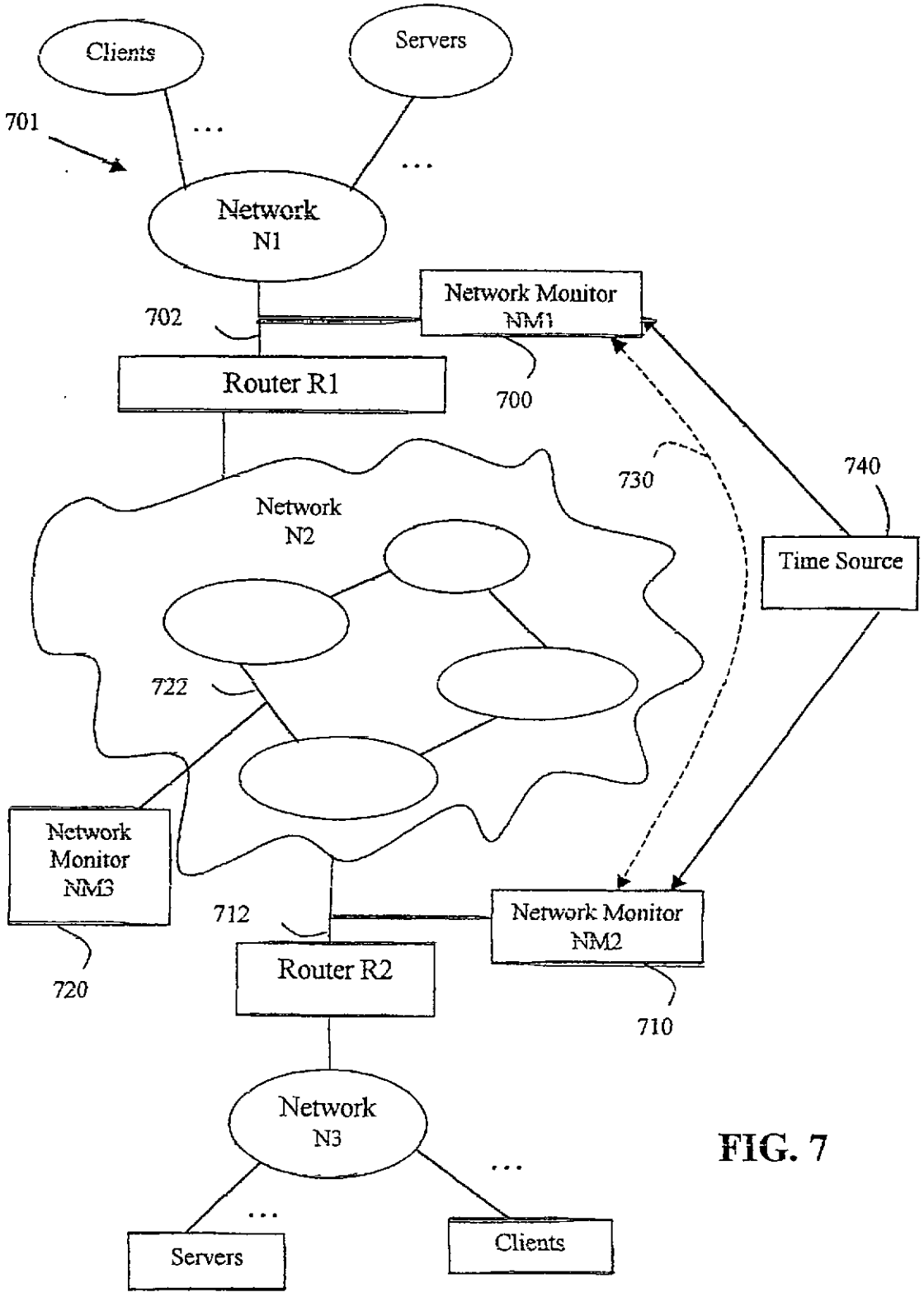

Clients
Servers
701
Network
N1
Network Monitor
NM1
702
Router R1
700
730
740
Network
N2
Time Source
722
Network
Monitor
NM3
712
Network Monitor
NM2
Router R2
720
710
Network
N3
Servers
Clients

FIG. 7

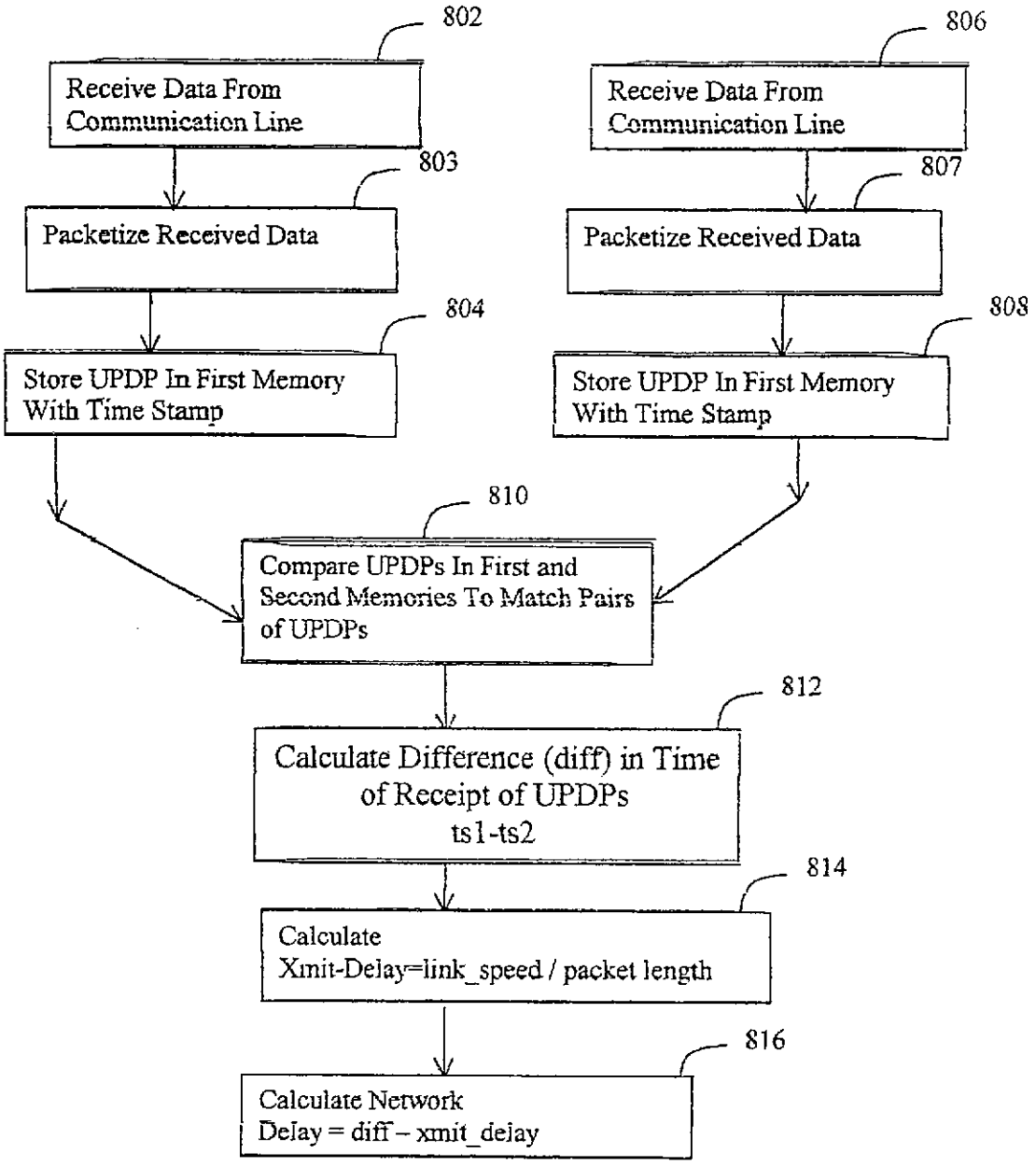

802
Receive Data From Communication Line
803
Packetize Received Data
804
Store UPDP In First Memory With Time Stamp
806
Receive Data From Communication Line
807
Packetize Received Data
808
Store UPDP In First Memory With Time Stamp
810
Compare UPDPs In First and Second Memories To Match Pairs of UPDPs
812
Calculate Difference (diff) in Time of Receipt of UPDPs ts1-ts2
814
Calculate Xmit-Delay=link_speed / packet length
816
Calculate Network Delay = diff – xmit_delay

FIG. 8

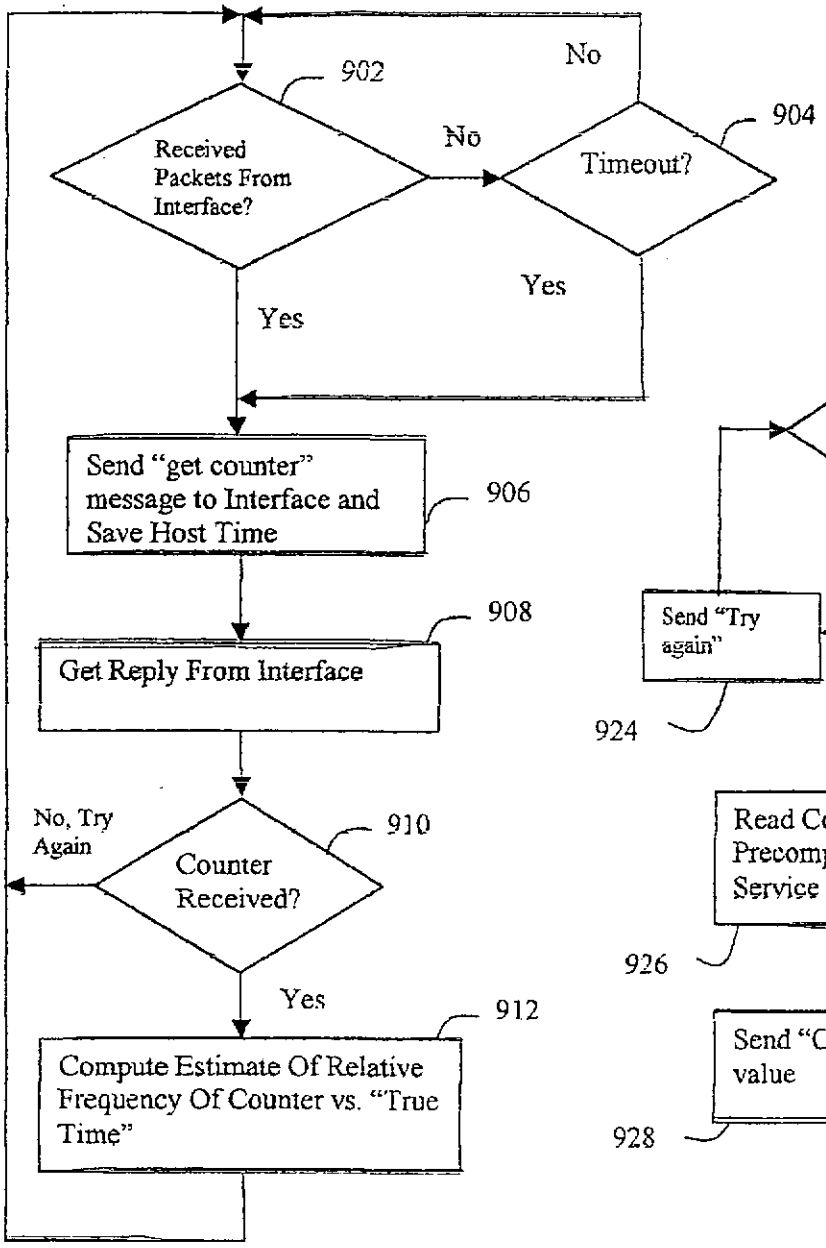

902
Received Packets From Interface?
No
904
Timeout?
No
Yes
Yes
Send "get counter" message to Interface and Save Host Time
906
908
Get Reply From Interface
No, Try Again
910
Counter Received?
Yes
912
Compute Estimate Of Relative Frequency Of Counter vs. "True Time"

FIG. 9A

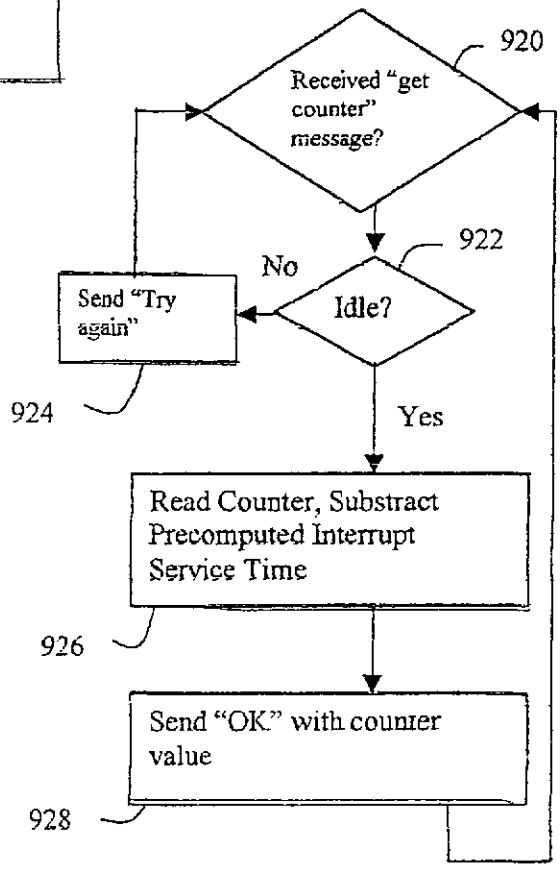

920
Received "get counter" message?
922
No
Idle?
Send "Try again"
924
Yes
Read Counter, Substract Precomputed Interrupt Service Time
926
Send "OK" with counter value
928

FIG. 9B

FIGURE 10

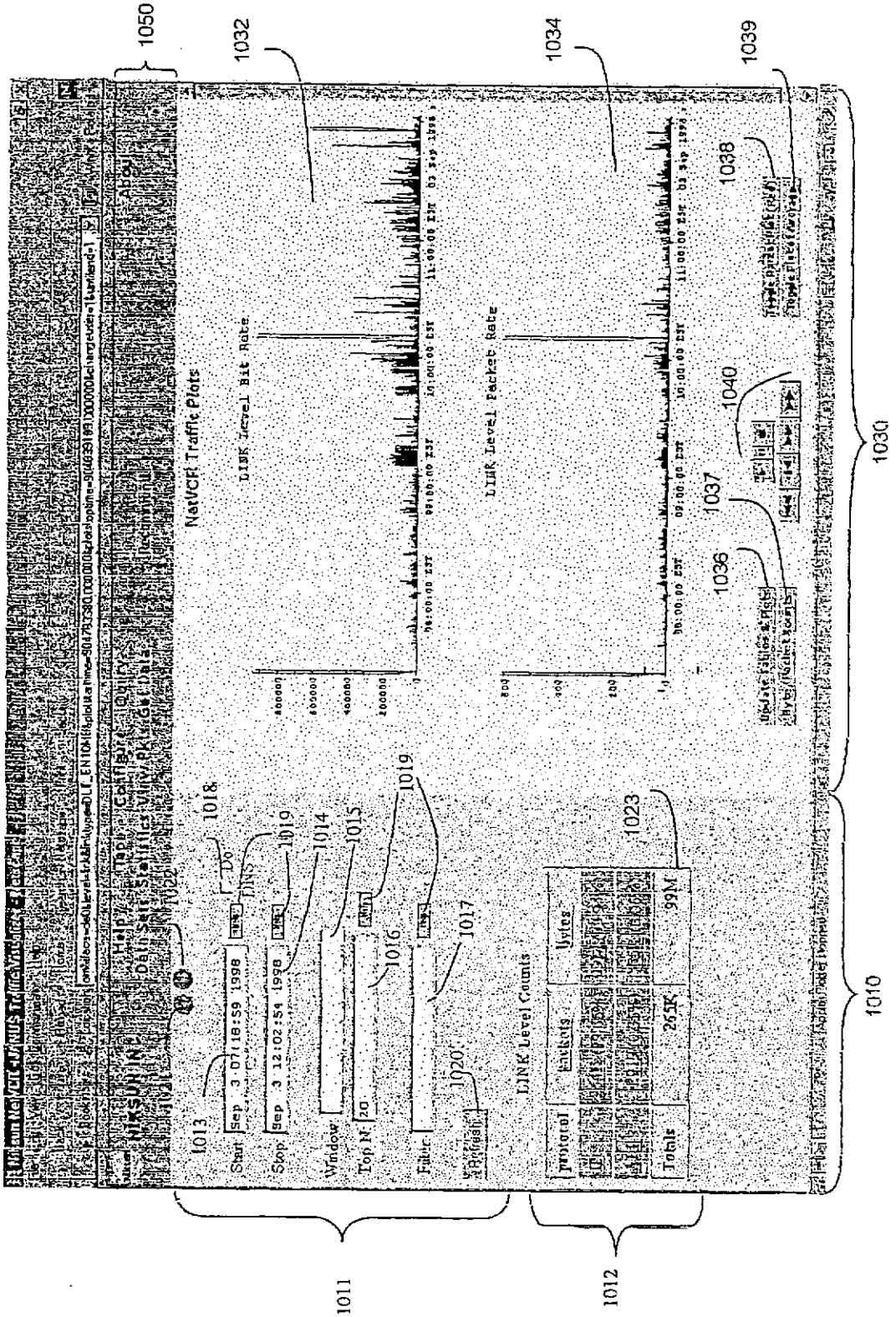

1050
1032
1034
1039
1038
1040
1037
1036
1030
1010
1011
1012
1013
1014
1015
1016
1017
1018
1019
1020
1023
NetVCR Traffic Plots
LINK level Bit Rate
LINK level Packet Rate
LINK Level Counts
Start
Stop
Window
Trgt N
Filter
Program
protocol
Packets
bytes
Totals
265K
99M

FIGURE 11

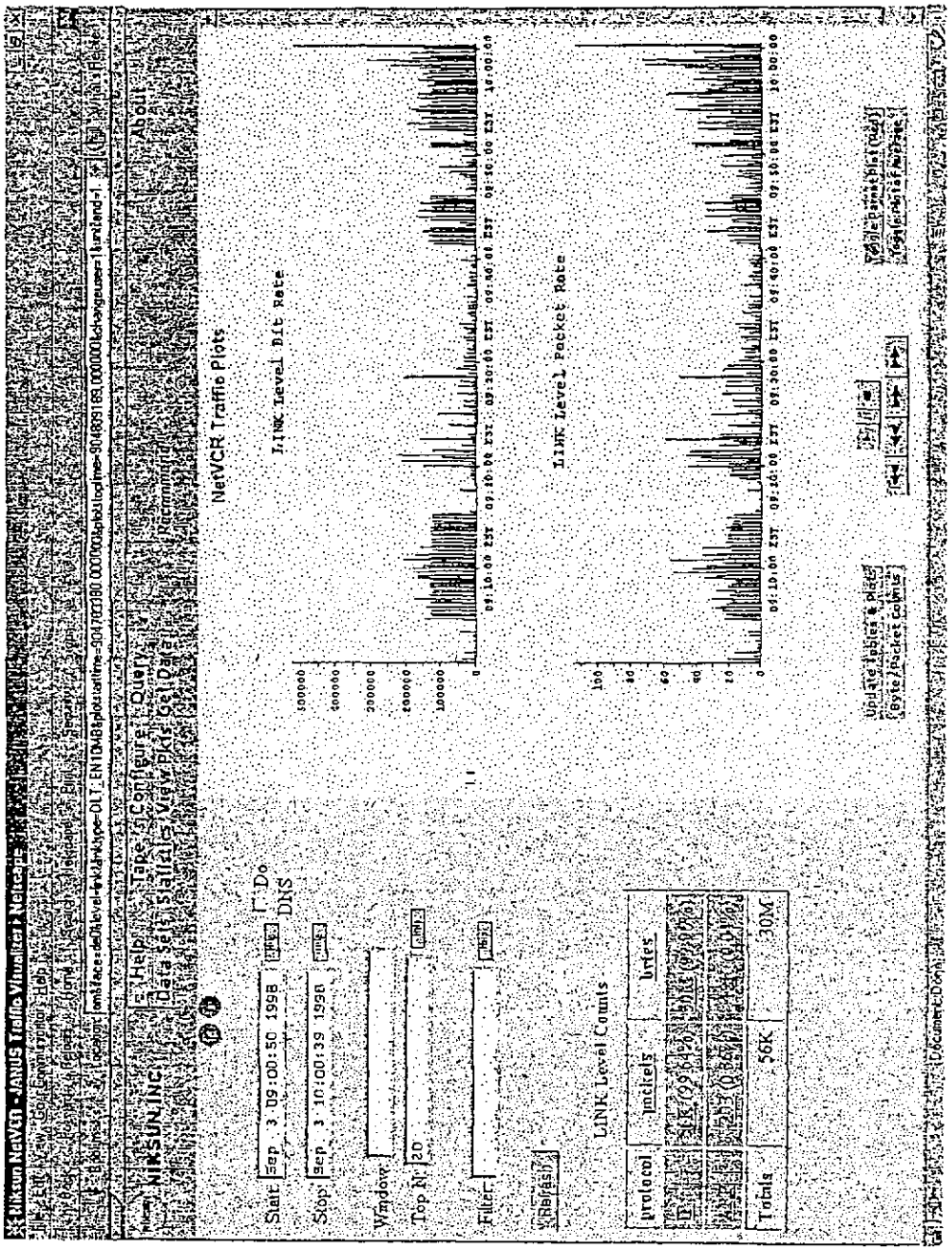

NetVCR Traffic Plots
Link Level Bit Rate
Link Level Packet Rate
LINK Level Counts
Start
Stop
Window
Top N
Filter
protocol
packets
bytes
Totals
56K
30M

FIGURE 12

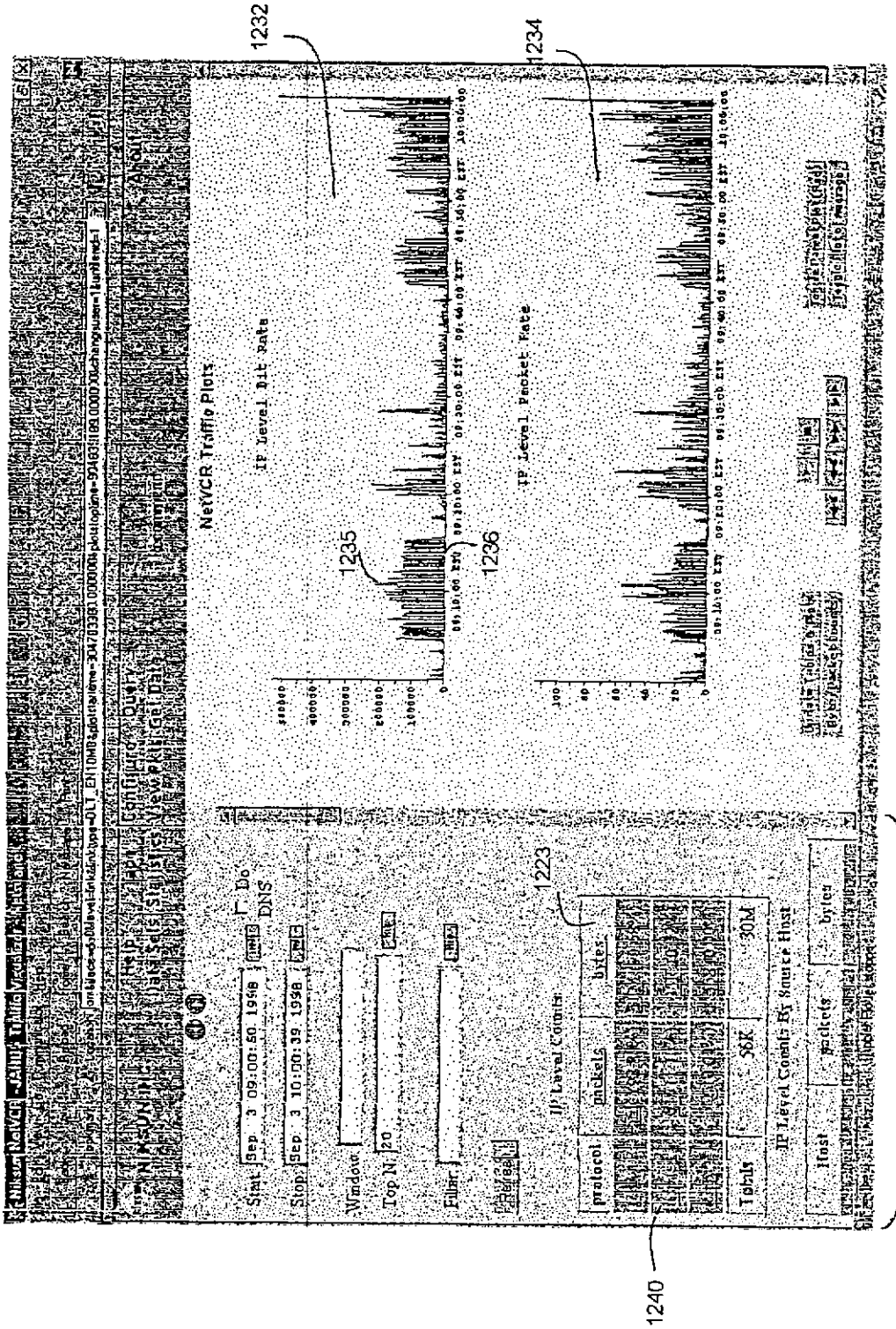

1232
1234
1235
1236
1223
1240
1210
NetVCR Traffic Plots
IP Level Bit Rate
IP Level Packet Rate
IP Level Counts
protocol
packets
bytes
Start
Stop
Window
Top N
Filter
Refresh
Tables
IP Level Counts By Source Host
Host
packets
bytes

FIGURE 13

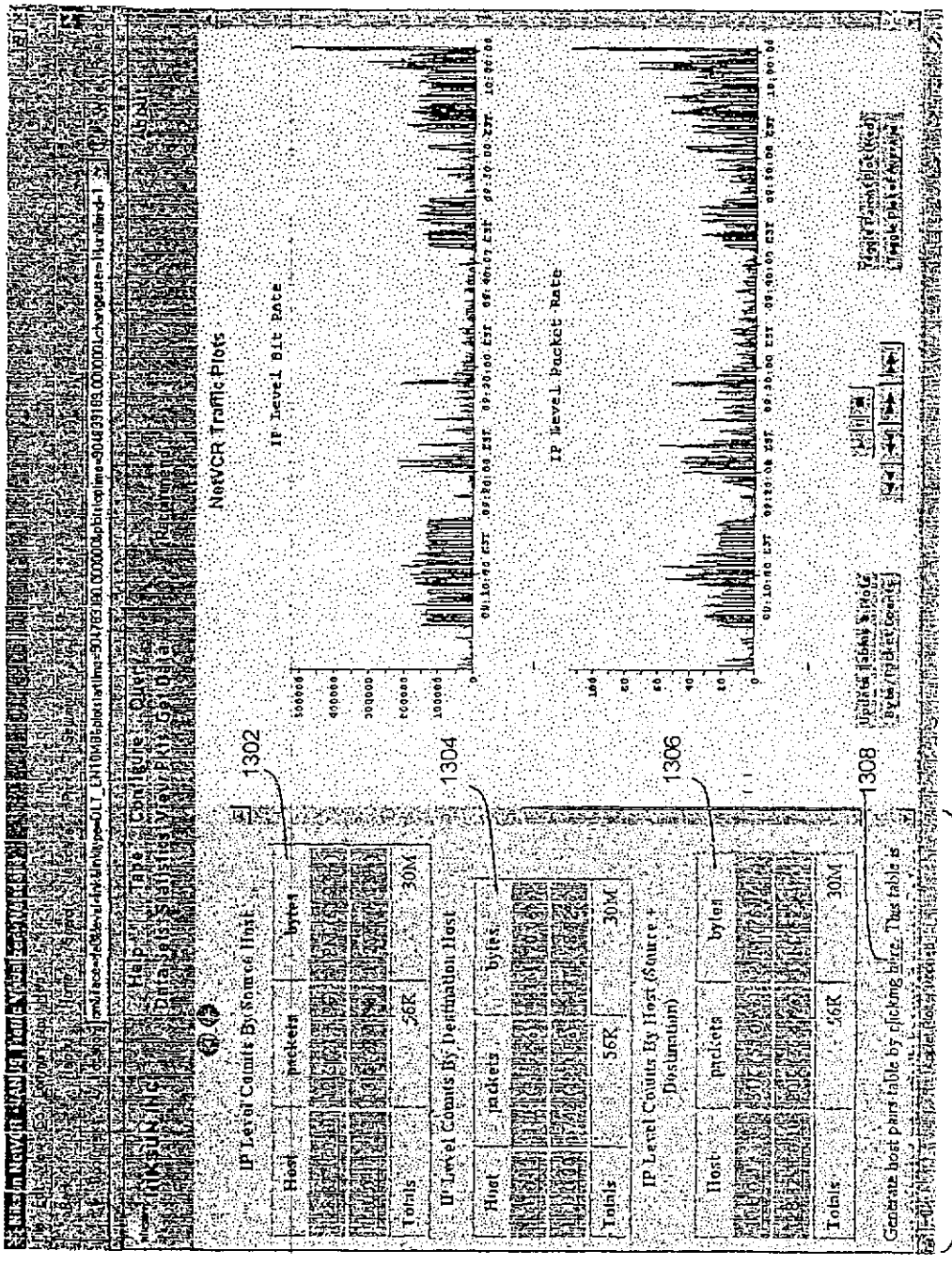

NetVCR Traffic Plots
IP Level Counts By Source Host
IP Level Bit Rate
IP Level Packet Rate
IP Level Counts By Host (Source + Destination)
1302
1304
1306
1308
1310

FIGURE 14

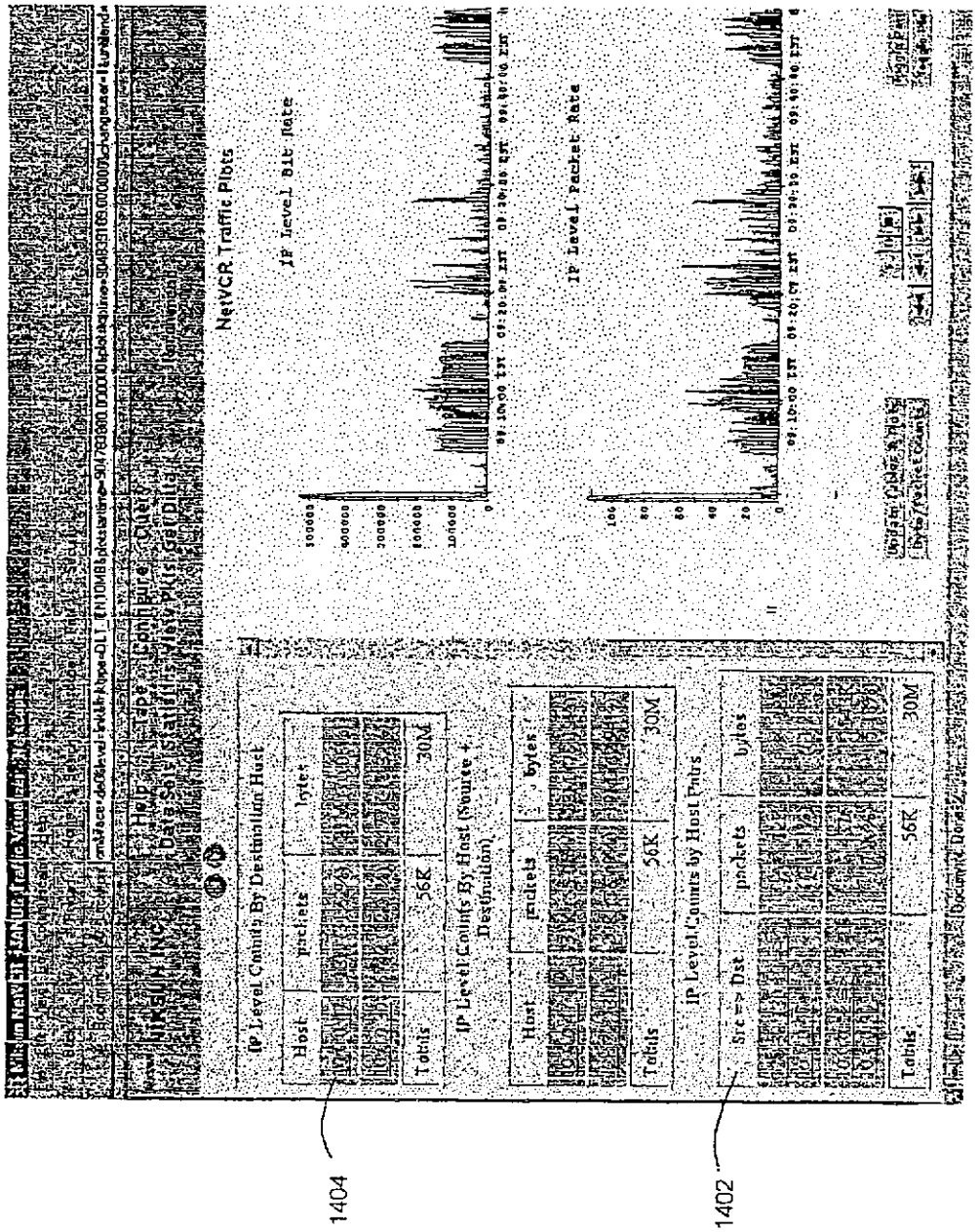

NetVCR Traffic Plots
IP Level Bit Rate
IP Level Packet Rate
IP Level Counts By Destination Host
IP Level Counts By Host (Source + Destination)
IP Level Counts by Host Pairs
1404
1402

FIGURE 15

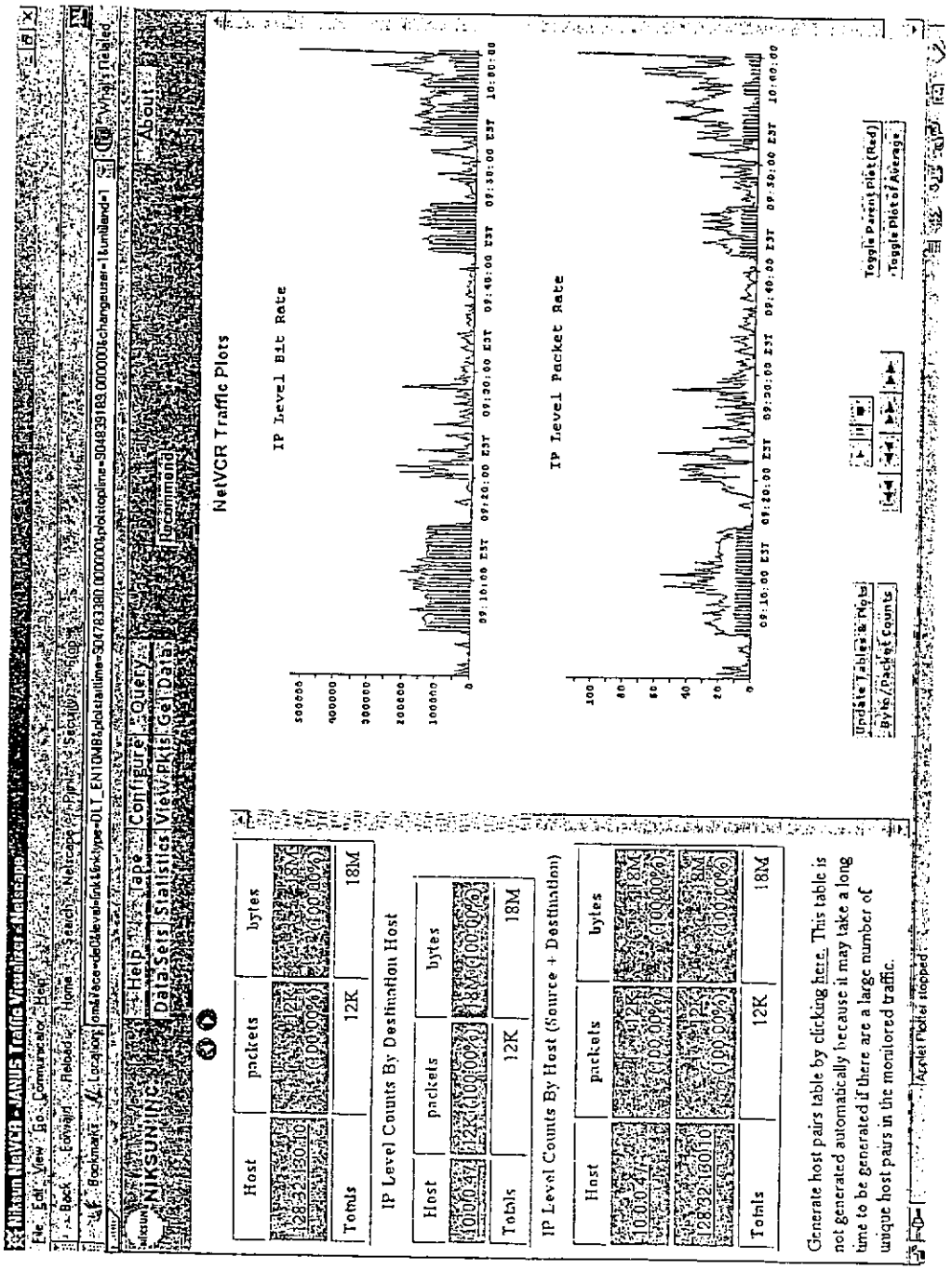

Niksun NetVCR - JANUS Traffic Visualizer - Netscape
NetVCR Traffic Plots
IP Level Bit Rate
IP Level Packet Rate
IP Level Counts By Destination Host
IP Level Counts By Host (Source + Destination)
Host
packets
bytes
Totals
12K
18M
Generate host pairs table by clicking here. This table is not generated automatically because it may take a long time to be generated if there are a large number of unique host pairs in the monitored traffic.
Update Tables & Plots
Bytes/Packet Counts
Toggle Parent Plot (Red)
Toggle Plot of Average

FIGURE 16

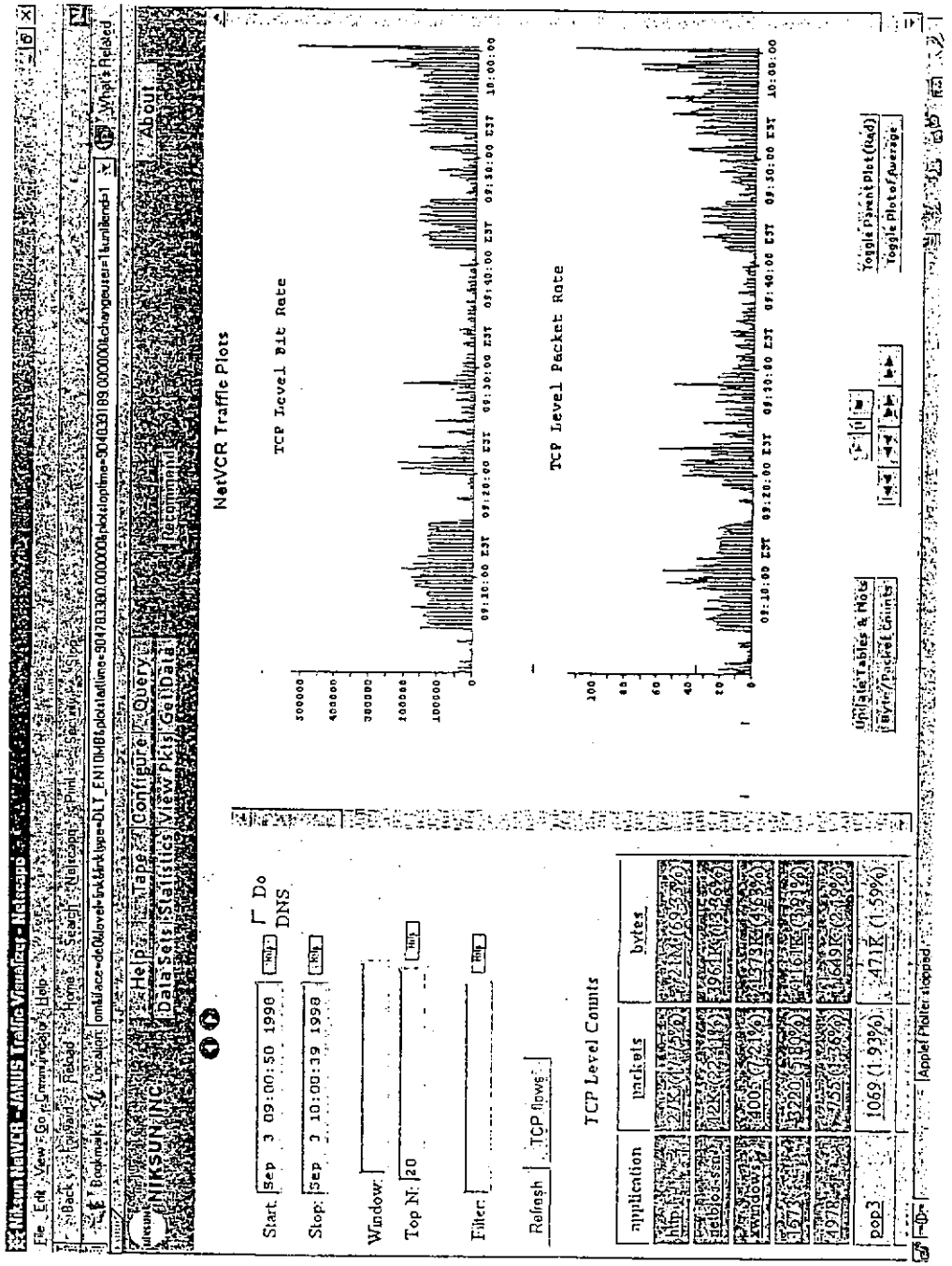
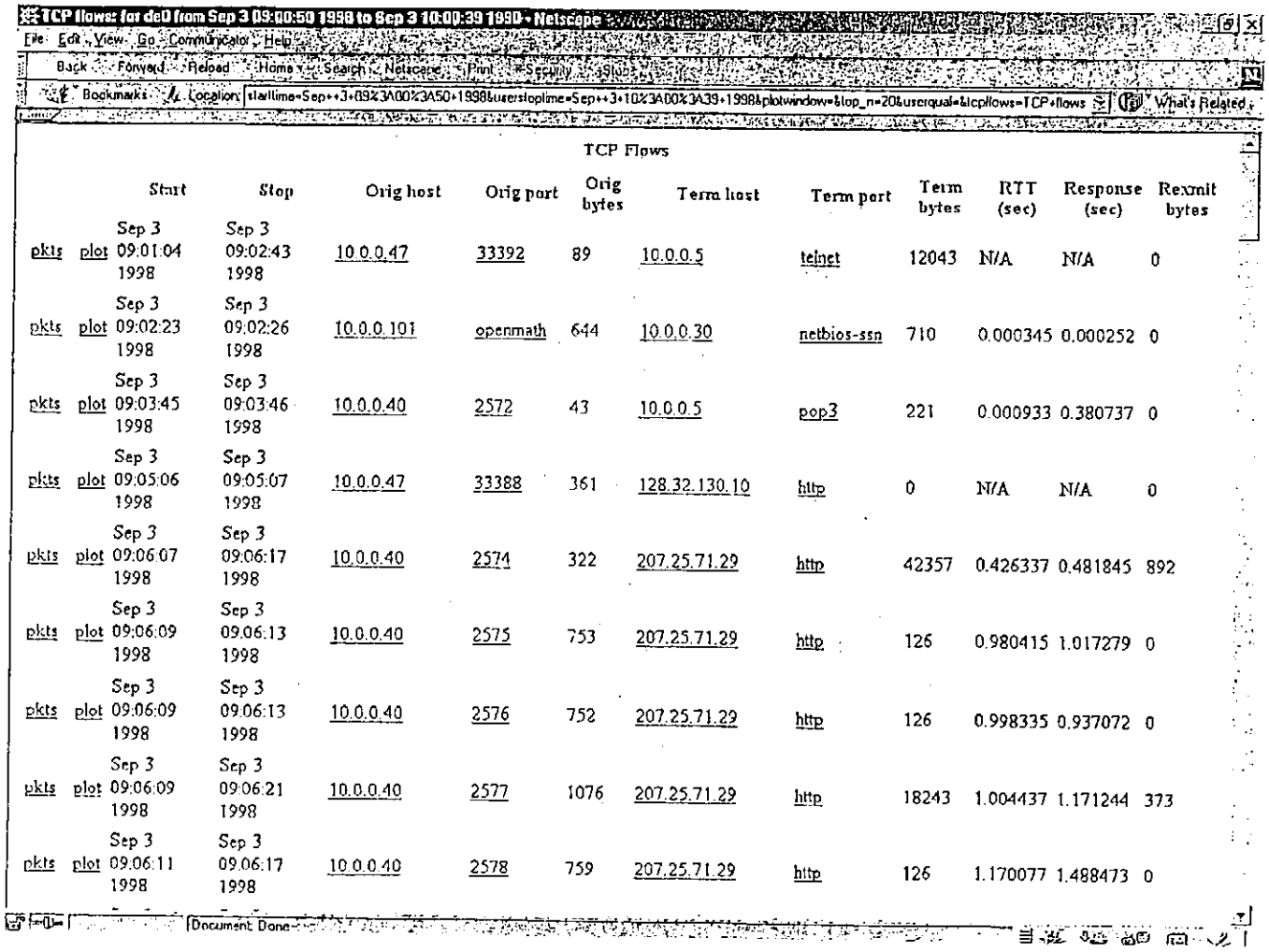

NetVCR Traffic Plots
TCP Level Bit Rate
TCP Level Packet Rate
TCP Level Counts
application
packets
bytes
Start:
Stop:
Window:
Top N:
Filter:
Refresh
TCP flows
DNS
Toggle Plots of Average

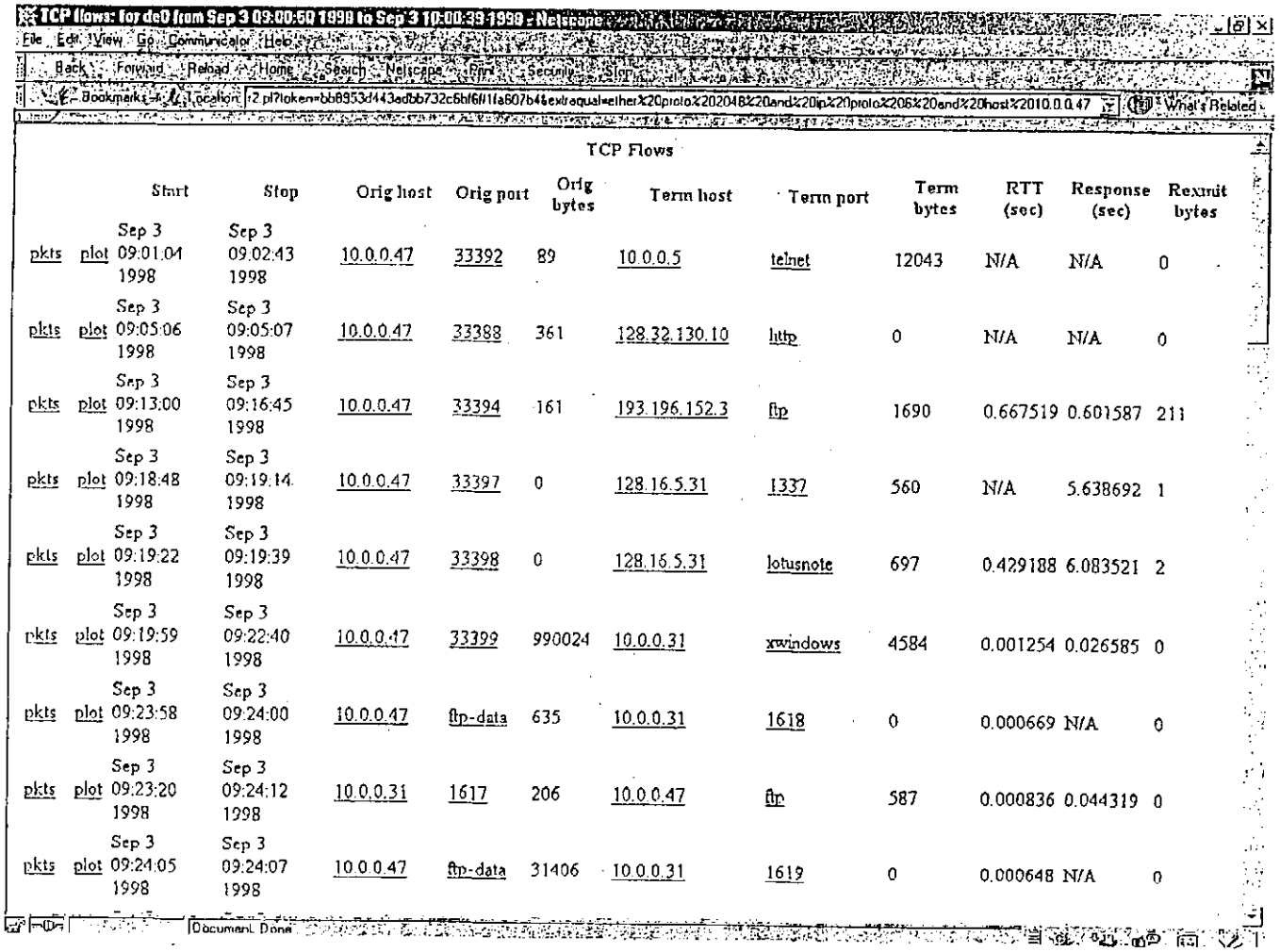
FIGURE 17



TCP Flows

		Start	Stop	Orig host	Orig port	Orig bytes	Term host	Term port	Term bytes	RTT (sec)	Response (sec)	Rexmit bytes
pkts	plot	Sep 3 09:01:04 1998	Sep 3 09:02:43 1998	10.0.0.47	33392	89	10.0.0.5	telnet	12043	N/A	N/A	0
pkts	plot	Sep 3 09:02:23 1998	Sep 3 09:02:26 1998	10.0.0.101	openmath	644	10.0.0.30	netbios-ssn	710	0.000345	0.000252	0
pkts	plot	Sep 3 09:03:45 1998	Sep 3 09:03:46 1998	10.0.0.40	2572	43	10.0.0.5	pop3	221	0.000933	0.380737	0
pkts	plot	Sep 3 09:05:06 1998	Sep 3 09:05:07 1998	10.0.0.47	33388	361	128.32.130.10	http	0	N/A	N/A	0
pkts	plot	Sep 3 09:06:07 1998	Sep 3 09:06:17 1998	10.0.0.40	2574	322	207.25.71.29	http	42357	0.426337	0.481845	892
pkts	plot	Sep 3 09:06:09 1998	Sep 3 09:06:13 1998	10.0.0.40	2575	753	207.25.71.29	http	126	0.980415	1.017279	0
pkts	plot	Sep 3 09:06:09 1998	Sep 3 09:06:13 1998	10.0.0.40	2576	752	207.25.71.29	http	126	0.998335	0.937072	0
pkts	plot	Sep 3 09:06:09 1998	Sep 3 09:06:21 1998	10.0.0.40	2577	1076	207.25.71.29	http	18243	1.004437	1.171244	373
pkts	plot	Sep 3 09:06:11 1998	Sep 3 09:06:17 1998	10.0.0.40	2578	759	207.25.71.29	http	126	1.170077	1.488473	0

FIGURE 18



TCP Flows

		Start	Stop	Orig host	Orig port	Orig bytes	Term host	Term port	Term bytes	RTT (sec)	Response (sec)	Rexmit bytes
pkts	plot	Sep 3 09:01:04 1998	Sep 3 09:02:43 1998	10.0.0.47	33392	89	10.0.0.5	telnet	12043	N/A	N/A	0
pkts	plot	Sep 3 09:05:06 1998	Sep 3 09:05:07 1998	10.0.0.47	33388	361	128.32.130.10	http	0	N/A	N/A	0
pkts	plot	Sep 3 09:13:00 1998	Sep 3 09:16:45 1998	10.0.0.47	33394	161	193.196.152.3	ftp	1690	0.667519	0.601587	211
pkts	plot	Sep 3 09:18:48 1998	Sep 3 09:19:14 1998	10.0.0.47	33397	0	128.16.5.31	1337	560	N/A	5.638692	1
pkts	plot	Sep 3 09:19:22 1998	Sep 3 09:19:39 1998	10.0.0.47	33398	0	128.16.5.31	lotusnote	697	0.429188	6.083521	2
pkts	plot	Sep 3 09:19:59 1998	Sep 3 09:22:40 1998	10.0.0.47	33399	990024	10.0.0.31	xwindows	4584	0.001254	0.026585	0
pkts	plot	Sep 3 09:23:58 1998	Sep 3 09:24:00 1998	10.0.0.47	ftp-data	635	10.0.0.31	1618	0	0.000669	N/A	0
pkts	plot	Sep 3 09:23:20 1998	Sep 3 09:24:12 1998	10.0.0.31	1617	206	10.0.0.47	ftp	587	0.000836	0.044319	0
pkts	plot	Sep 3 09:24:05 1998	Sep 3 09:24:07 1998	10.0.0.47	ftp-data	31406	10.0.0.31	1619	0	0.000648	N/A	0

FIGURE 19

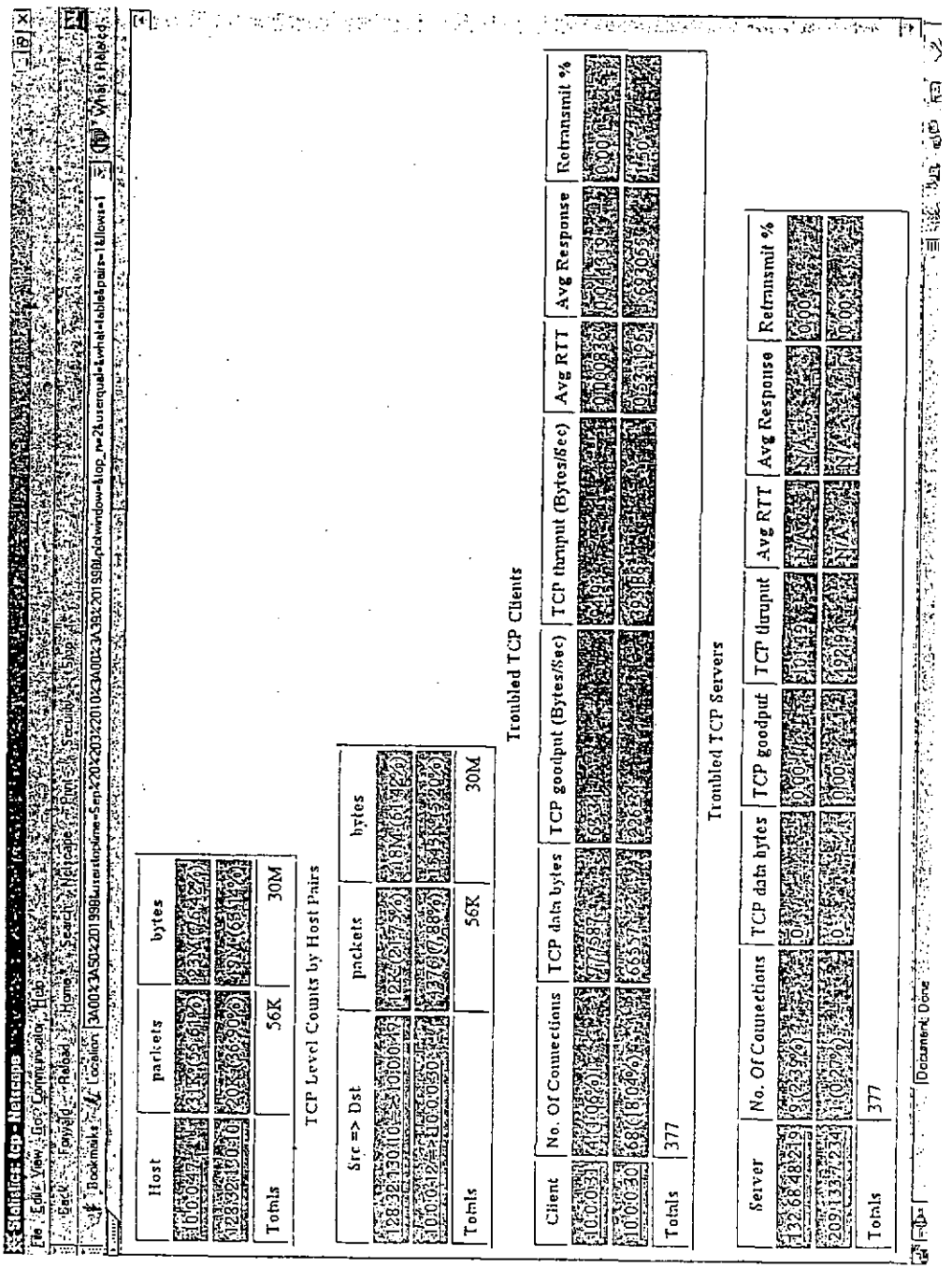

Statistics: tcp - Netscape
File Edit View Go Communicator Help
Back Forward Reload Home Search Netscape Print Security Shop Stop
Bookmarks Location 3A00%3A50%3A2001998&interstopTime=Sep%20%2033%20%2010%3A00%3A38%3A2001998&plotwindow=&top_n=2&userqual=&what=&tablepairs=1&flows=1 What's Related
Host packets bytes
Totals 56K 30M
TCP Level Counts by Host Pairs
Src => Dst packets bytes
Totals 56K 30M
Troubled TCP Clients
Client No. Of Connections TCP data bytes TCP goodput (Bytes/Sec) TCP thruput (Bytes/Sec) Avg RTT Avg Response Retransmit %
Totals 377
Troubled TCP Servers
Server No. Of Connections TCP data bytes TCP goodput TCP thruput Avg RTT Avg Response Retransmit %
Totals 377
Document: Done

FIGURE 20

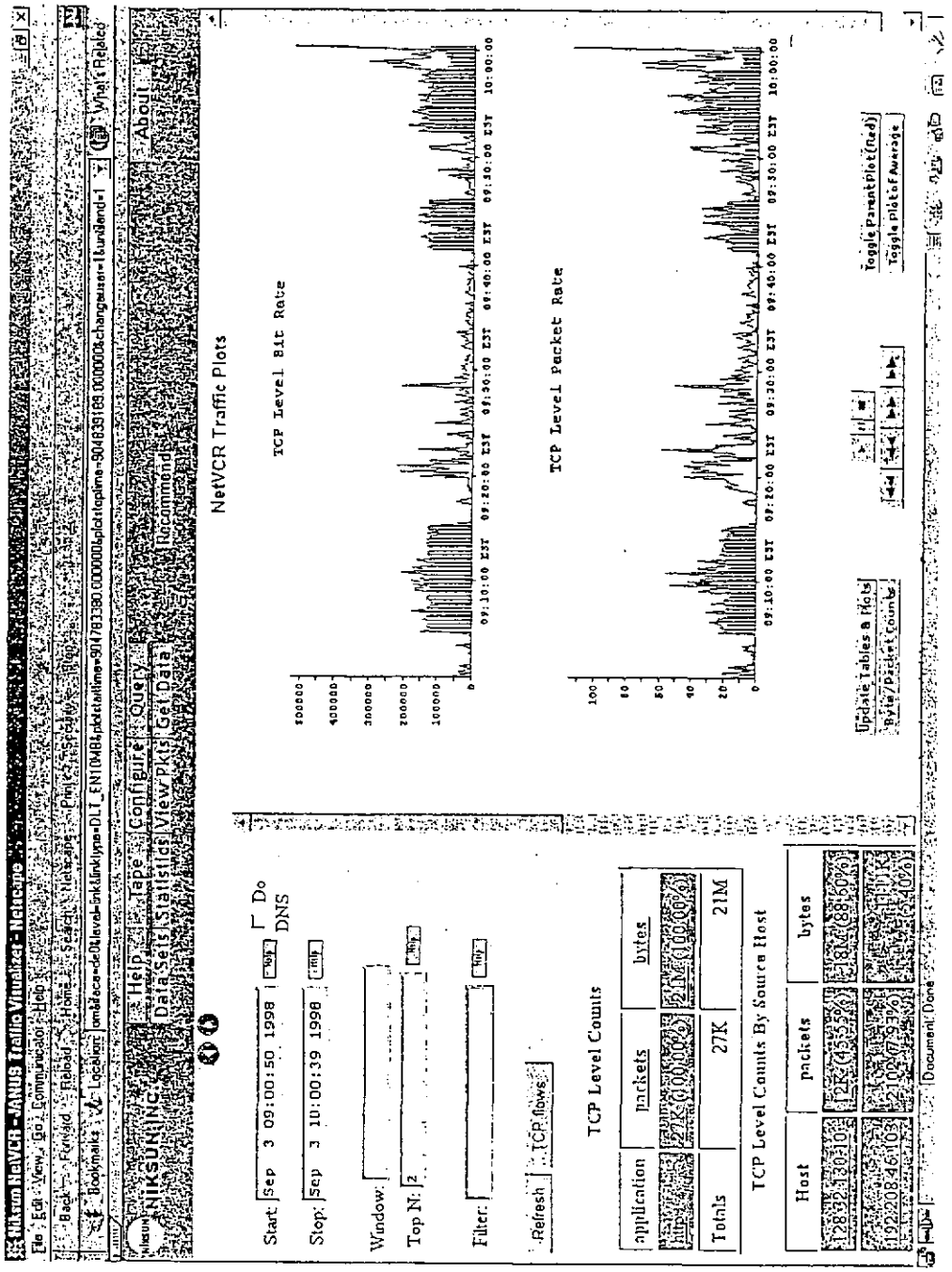

NetVCR Traffic Plots
TCP Level Bit Rate
TCP Level Packet Rate
TCP Level Counts
TCP Level Counts By Source Host
Start: Sep 3 09:00:50 1998
Stop: Sep 3 10:00:39 1998
Window:
Top N: 2
Filter:
Refresh
TCP flows
DNS
application
packets
bytes
Totals
27K
21M
Host
packets
bytes
Update Tables & Plots
Byte/Packet counts
Toggle ParentPlot(Med)
Toggle Plots/Average

FIGURE 21

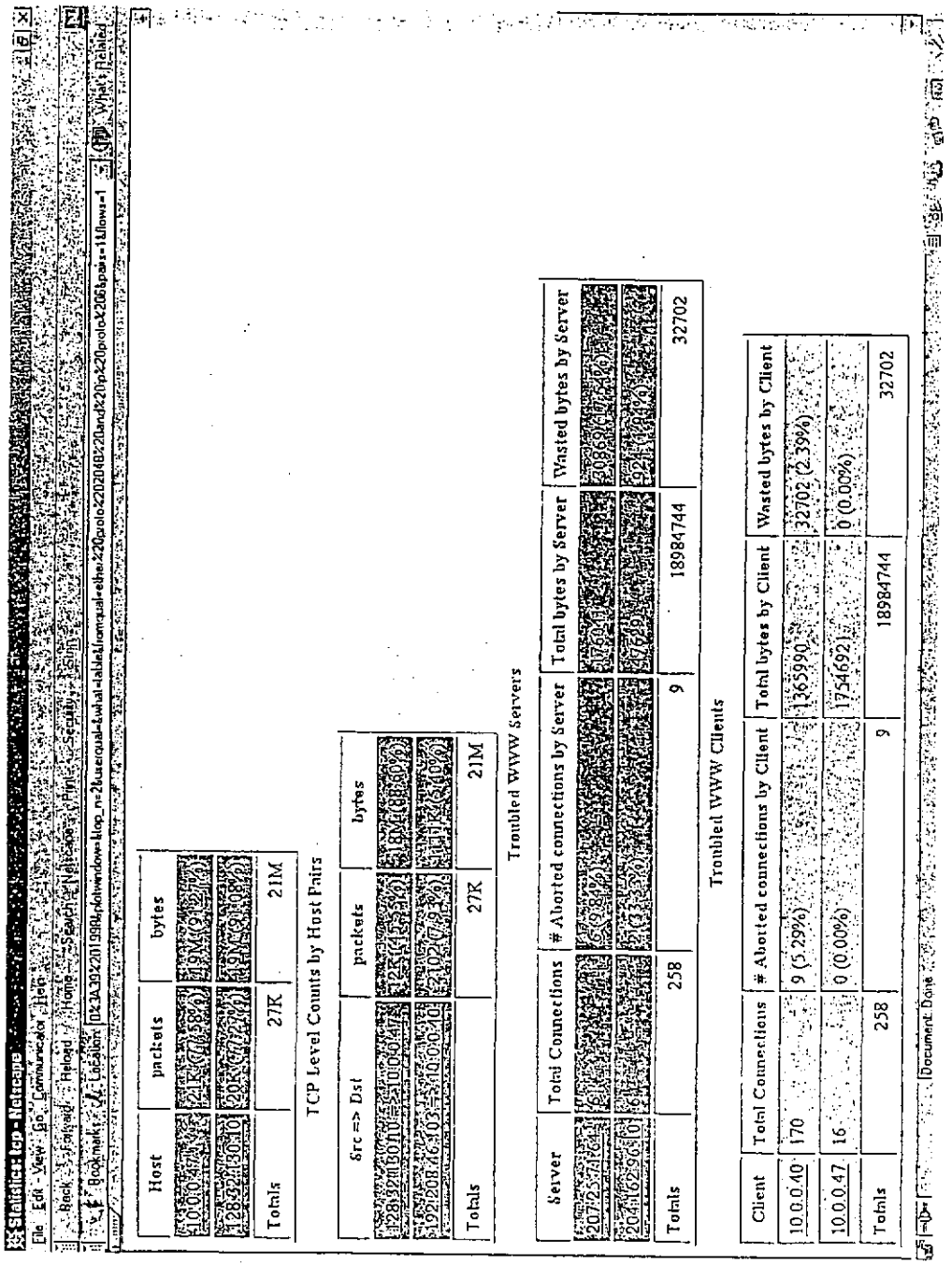

Statistics tcp - Netscape
File Edit View Go Communicator Help
Back Forward Reload Home Search Netscape Print Security Shop Stop
Bookmarks Location
Host packets bytes
Totals 27K 21M
TCP Level Counts by Host Pairs
Src => Dst packets bytes
Totals 27K 21M
Troubled WWW Servers
Server Total Connections # Aborted connections by Server Total bytes by Server Wasted bytes by Server
Totals 258 9 18984744 32702
Troubled WWW Clients
Client Total Connections # Aborted connections by Client Total bytes by Client Wasted bytes by Client
10.0.0.40 170 9 (5.29%) 1365990 32702 (2.39%)
10.0.0.47 16 0 (0.00%) 1754692 0 (0.00%)
Totals 258 9 18984744 32702
Document Done

FIGURE 22

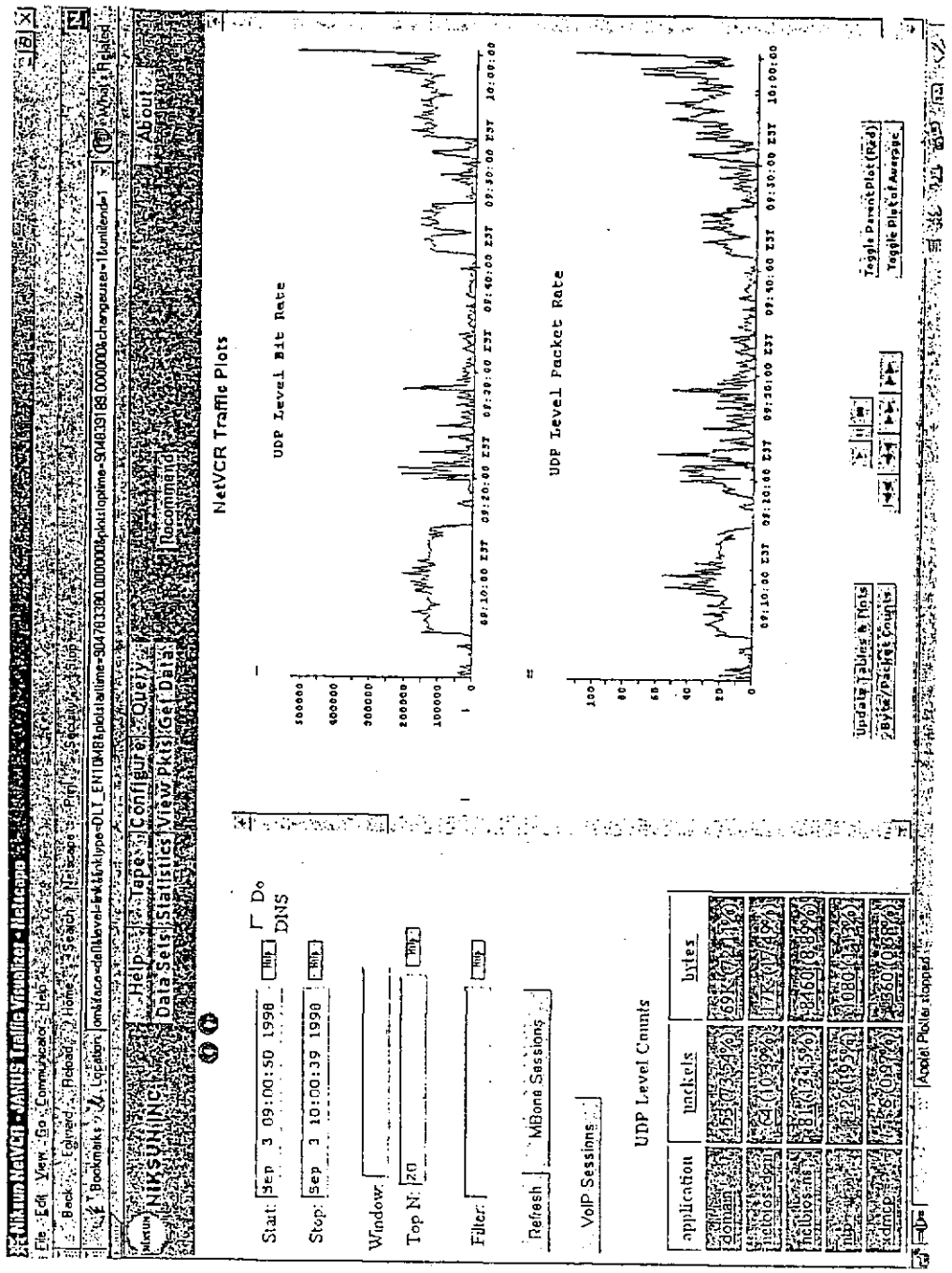

NetVCR Traffic Plots
UDP Level Bit Rate
UDP Level Packet Rate
UDP Level Counts
Start: Sep 3 09:00:50 1998
Stop: Sep 3 10:00:39 1998
Window:
Top N: 20
Filter:
Refresh
MBone Sessions
VoIP Sessions
Do DNS
Help
Tape
Configure
Query
Data Sets
Statistics
View Pkts
Get Data
About
Recommend
application
packets
bytes
Updating Tables & Plots
Toggle Parent Plot (Red)
Toggle Plot of Average

FIGURE 23

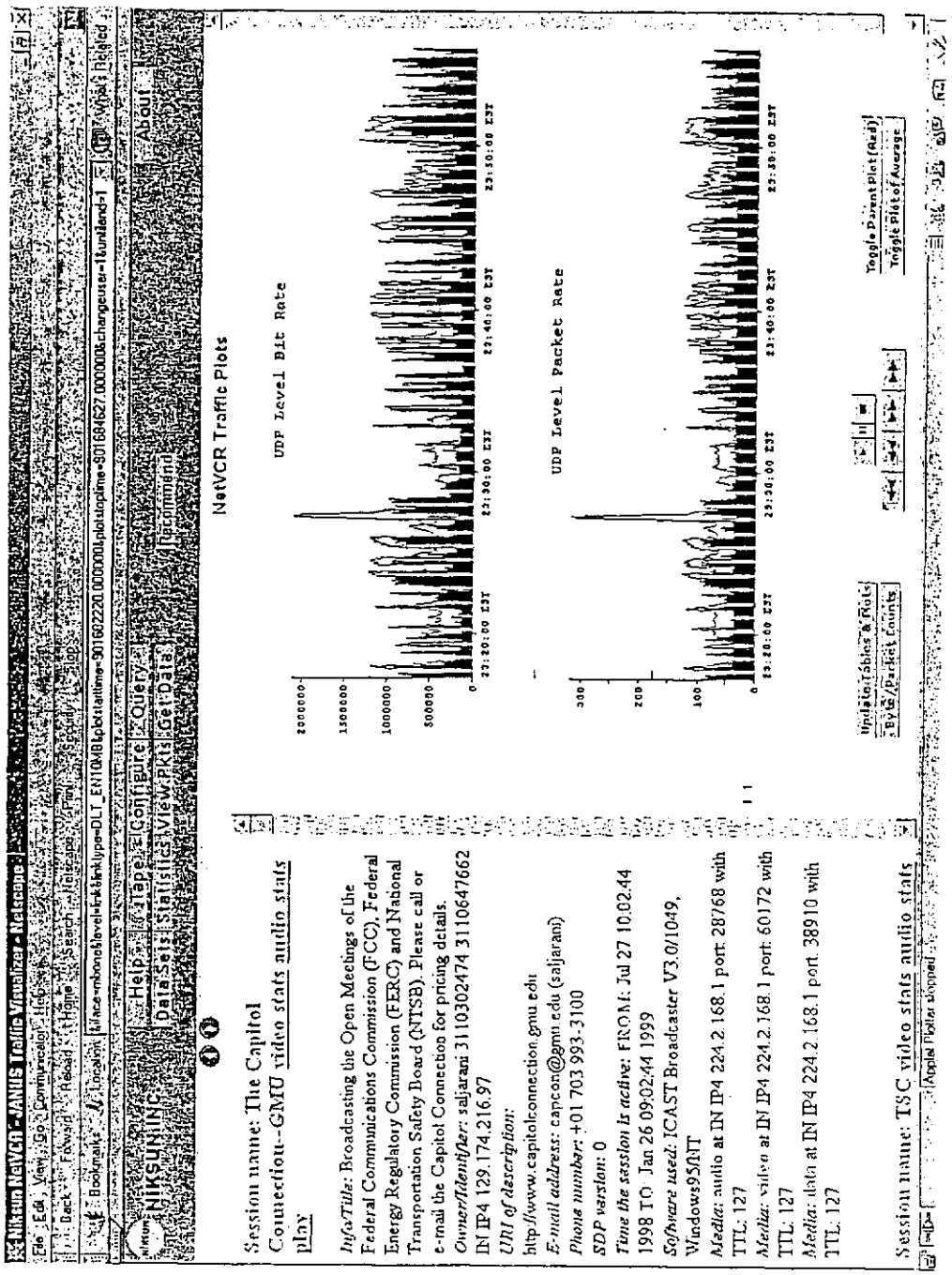

NetVCR Traffic Plots
UDP Level Bit Rate
UDP Level Packet Rate
Session name: The Capitol
Connection--GMU video stats audio stats
play
Session name: TSC video stats audio stats

FIGURE 24

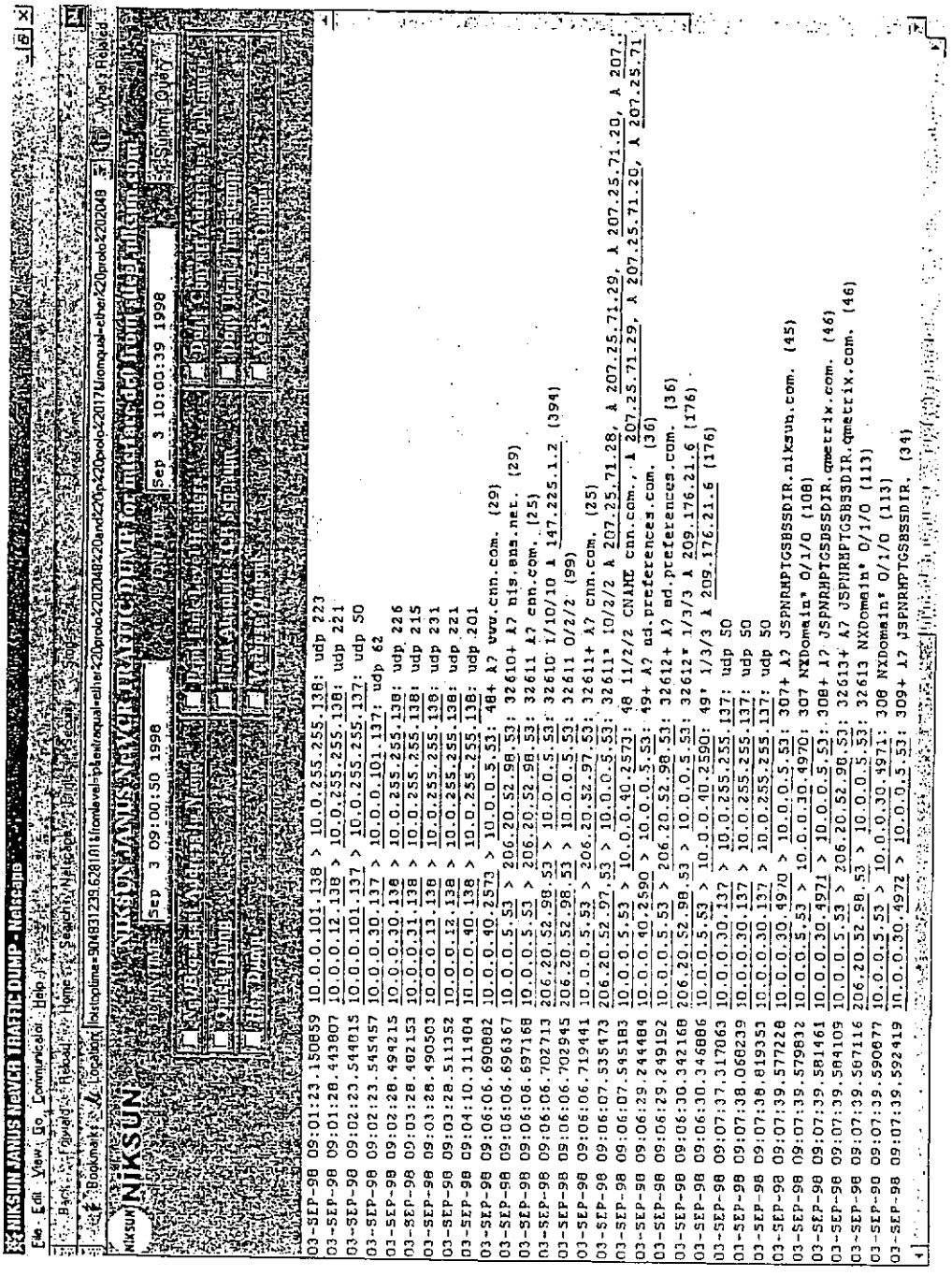

NIKSUN NAVIGATOR TRAFFIC DUMP - Netscape
NIKSUN
Sep 3 09:00:30 1998
Sep 3 10:00:39 1998
03-SEP-98 09:01:23.150859 10.0.0.101.138 > 10.0.0.255.255.138: udp 223
03-SEP-98 09:01:28.443907 10.0.0.12.138 > 10.0.0.255.255.138: udp 221
03-SEP-98 09:02:23.544015 10.0.0.101.137 > 10.0.0.255.255.137: udp 50
03-SEP-98 09:02:23.545457 10.0.0.30.137 > 10.0.0.101.137: udp 62
03-SEP-98 09:02:28.494215 10.0.0.30.138 > 10.0.0.255.255.138: udp 226
03-SEP-98 09:03:28.482153 10.0.0.31.138 > 10.0.0.255.255.138: udp 215
03-SEP-98 09:03:28.490503 10.0.0.13.138 > 10.0.0.255.255.138: udp 231
03-SEP-98 09:03:28.511352 10.0.0.12.138 > 10.0.0.255.255.138: udp 221
03-SEP-98 09:04:10.311404 10.0.0.40.138 > 10.0.0.255.255.138: udp 201
03-SEP-98 09:06:06.690882 10.0.0.40.2573 > 10.0.0.5.53: 48+ A? www.cnn.com. (29)
03-SEP-98 09:06:06.696367 10.0.0.5.53 > 206.20.52.98.53: 32610+ A? nis.ans.net. (29)
03-SEP-98 09:06:06.697168 10.0.0.5.53 > 206.20.52.98.53: 32611 A? cnn.com. (25)
03-SEP-98 09:06:06.702713 206.20.52.98.53 > 10.0.0.5.53: 32610 1/10/10 A 147.225.1.2 (394)
03-SEP-98 09:06:06.702945 206.20.52.98.53 > 10.0.0.5.53: 32611 0/2/2 (99)
03-SEP-98 09:06:06.719441 10.0.0.5.53 > 206.20.52.97.53: 32611+ A? cnn.com. (25)
03-SEP-98 09:06:07.535473 206.20.52.97.53 > 10.0.0.5.53: 32611* 10/2/2 A 207.25.71.28, A 207.25.71.29, A 207.25.71.20, A 207.
03-SEP-98 09:06:07.595183 10.0.0.5.53 > 10.0.0.40.2573: 48 11/2/2 CNAME cnn.com., A 207.25.71.29, A 207.25.71.20, A 207.25.71.
03-SEP-98 09:06:29.244489 10.0.0.40.2590 > 10.0.0.5.53: 49+ A? ad.preferences.com. (36)
03-SEP-98 09:06:29.249192 10.0.0.5.53 > 206.20.52.98.53: 32612+ A? ad.preferences.com. (36)
03-SEP-98 09:06:30.342168 206.20.52.98.53 > 10.0.0.5.53: 32612* 1/3/3 A 209.176.21.6 (176)
03-SEP-98 09:06:30.346886 10.0.0.5.53 > 10.0.0.40.2590: 49* 1/3/3 A 209.176.21.6 (176)
03-SEP-98 09:07:37.317063 10.0.0.30.137 > 10.0.0.255.255.137: udp 50
03-SEP-98 09:07:38.068239 10.0.0.30.137 > 10.0.0.255.255.137: udp 50
03-SEP-98 09:07:38.819353 10.0.0.30.137 > 10.0.0.255.255.137: udp 50
03-SEP-98 09:07:39.577228 10.0.0.30.4970 > 10.0.0.5.53: 307+ A? JSPNRMPTGSBSSDIR.niksun.com. (45)
03-SEP-98 09:07:39.579832 10.0.0.5.53 > 10.0.0.30.4970: 307 NXDomain* 0/1/0 (108)
03-SEP-98 09:07:39.581461 10.0.0.30.4971 > 10.0.0.5.53: 308+ A? JSPNRMPTGSBSSDIR.qmetrix.com. (46)
03-SEP-98 09:07:39.584109 10.0.0.5.53 > 206.20.52.98.53: 32613+ A? JSPNRMPTGSBSSDIR.qmetrix.com. (46)
03-SEP-98 09:07:39.587116 206.20.52.98.53 > 10.0.0.5.53: 32613 NXDomain* 0/1/0 (113)
03-SEP-98 09:07:39.590677 10.0.0.5.53 > 10.0.0.30.4971: 308 NXDomain* 0/1/0 (113)
03-SEP-98 09:07:39.592419 10.0.0.30.4972 > 10.0.0.5.53: 309+ A? JSPNRMPTGSBSSDIR. (34)

FIGURE 25

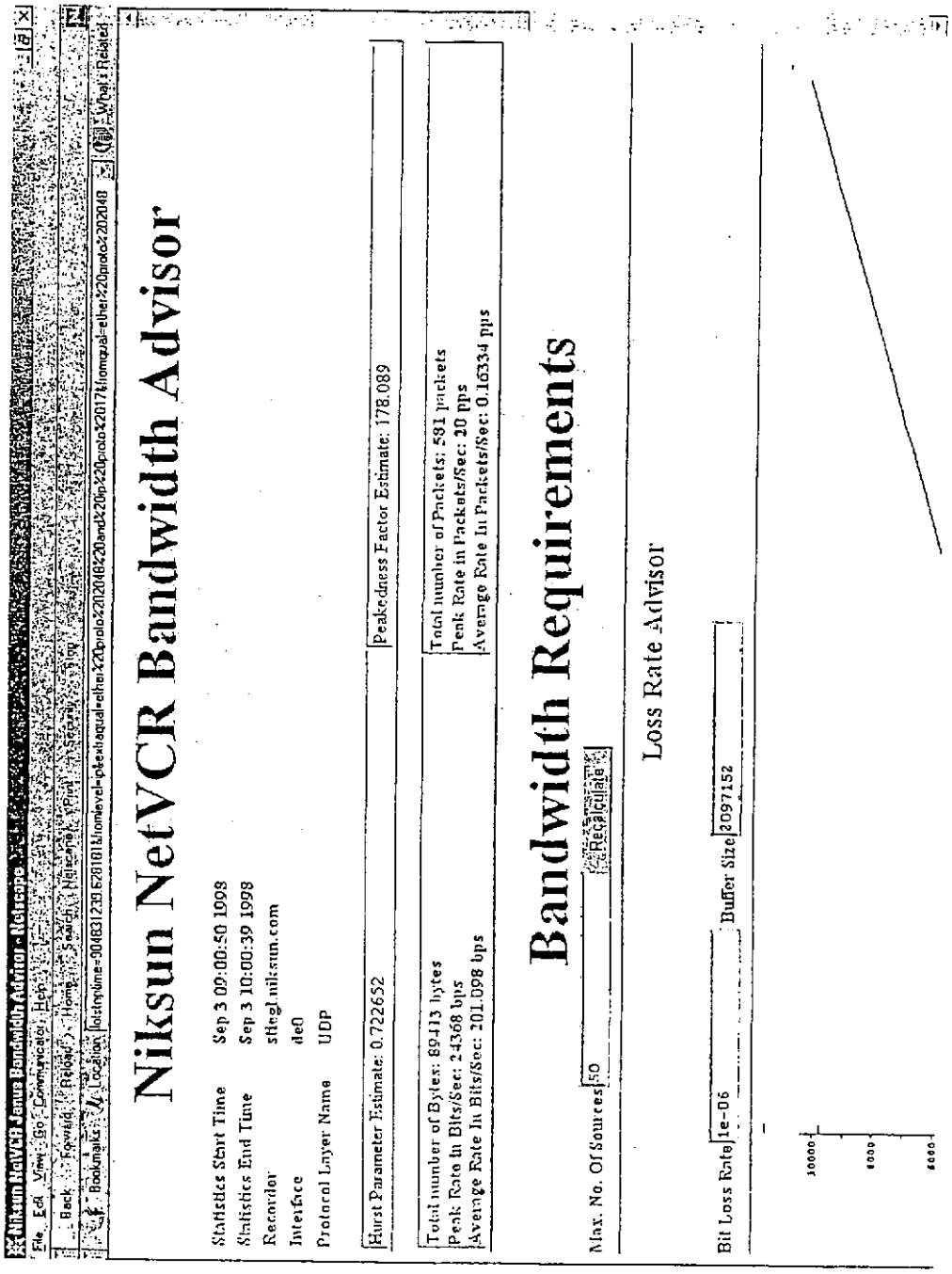

Nikstun NetVCR Bandwidth Advisor - Netscape
File Edit View Go Communicator Help
Back Forward Reload Home Search Netscape Print Security Shop Stop
Bookmarks Location
Nikstun NetVCR Bandwidth Advisor
Statistics Start Time Sep 3 09:00:50 1998
Statistics End Time Sep 3 10:00:39 1998
Recorder stiegl.niksun.com
Interface de0
Protocol Layer Name UDP
Hurst Parameter Estimate: 0.722652
Peakedness Factor Estimate: 178.089
Total number of Bytes: 89413 bytes
Peak Rate in Bits/Sec: 24368 bps
Average Rate in Bits/Sec: 201.098 bps
Total number of Packets: 581 packets
Peak Rate in Packets/Sec: 10 pps
Average Rate in Packets/Sec: 0.16334 pps
Bandwidth Requirements
Max. No. Of Sources 50
Recalculate
Loss Rate Advisor
Bit Loss Rate 1e-06
Buffer Size 2097152
10000
8000
6000

FIGURE 26

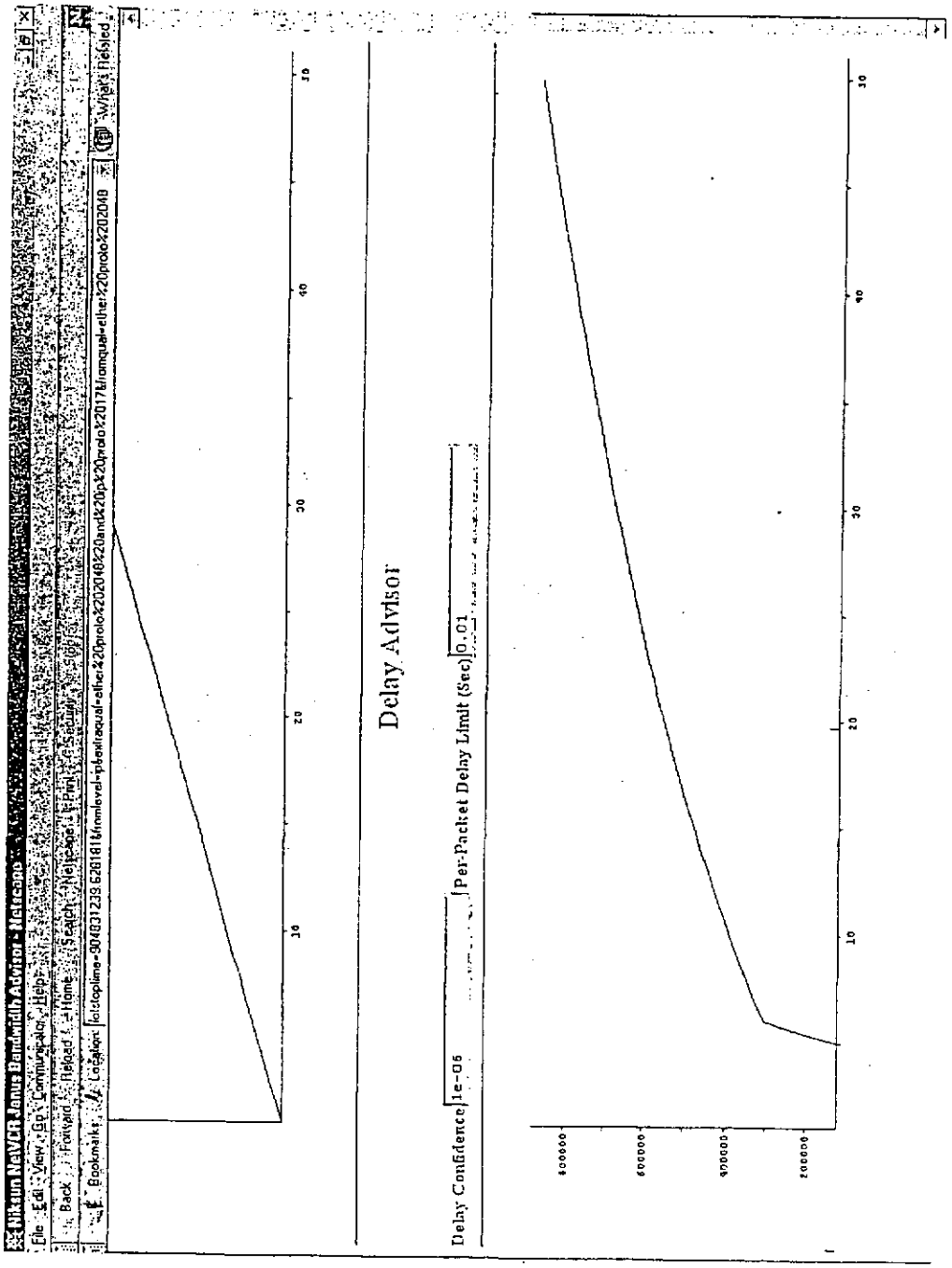

Delay Advisor
Delay Confidence 1e-05
Per-Packet Delay Limit (Sec) 0.01

FIGURE 27

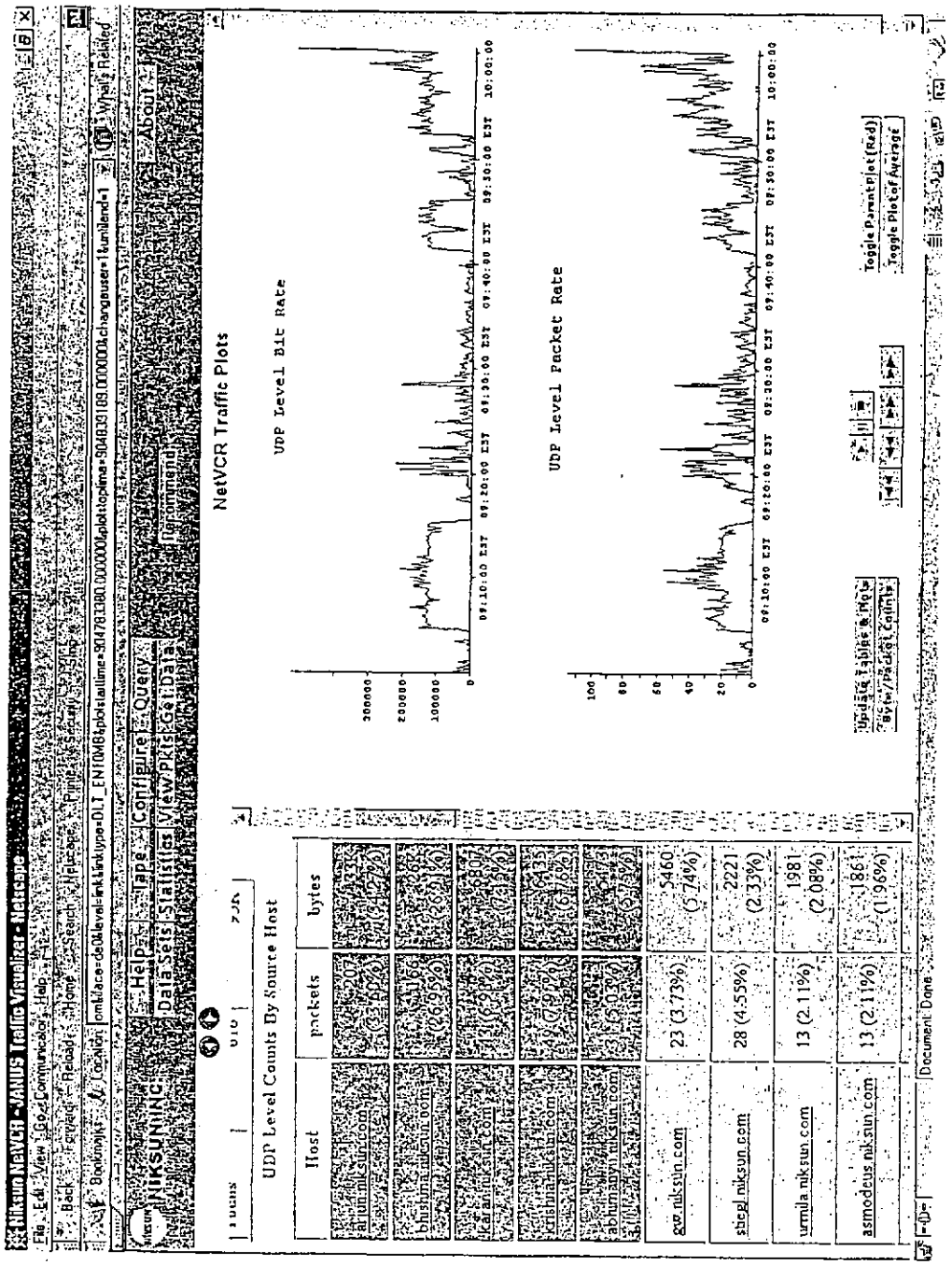

NetVCR Traffic Plots
UDP Level Bit Rate
UDP Level Packet Rate
UDP Level Counts By Source Host
Host
packets
bytes
gsr.niksun.com
23 (3.73%)
5460 (5.74%)
shegl.niksun.com
28 (4.55%)
2221 (2.33%)
urmila.niksun.com
13 (2.11%)
1981 (2.08%)
asmodeus.niksun.com
13 (2.11%)
1861 (1.96%)
Update Tables & Plots
Toggle Packet/Bit (Red)
Toggle Plot of Average

FIGURE 28

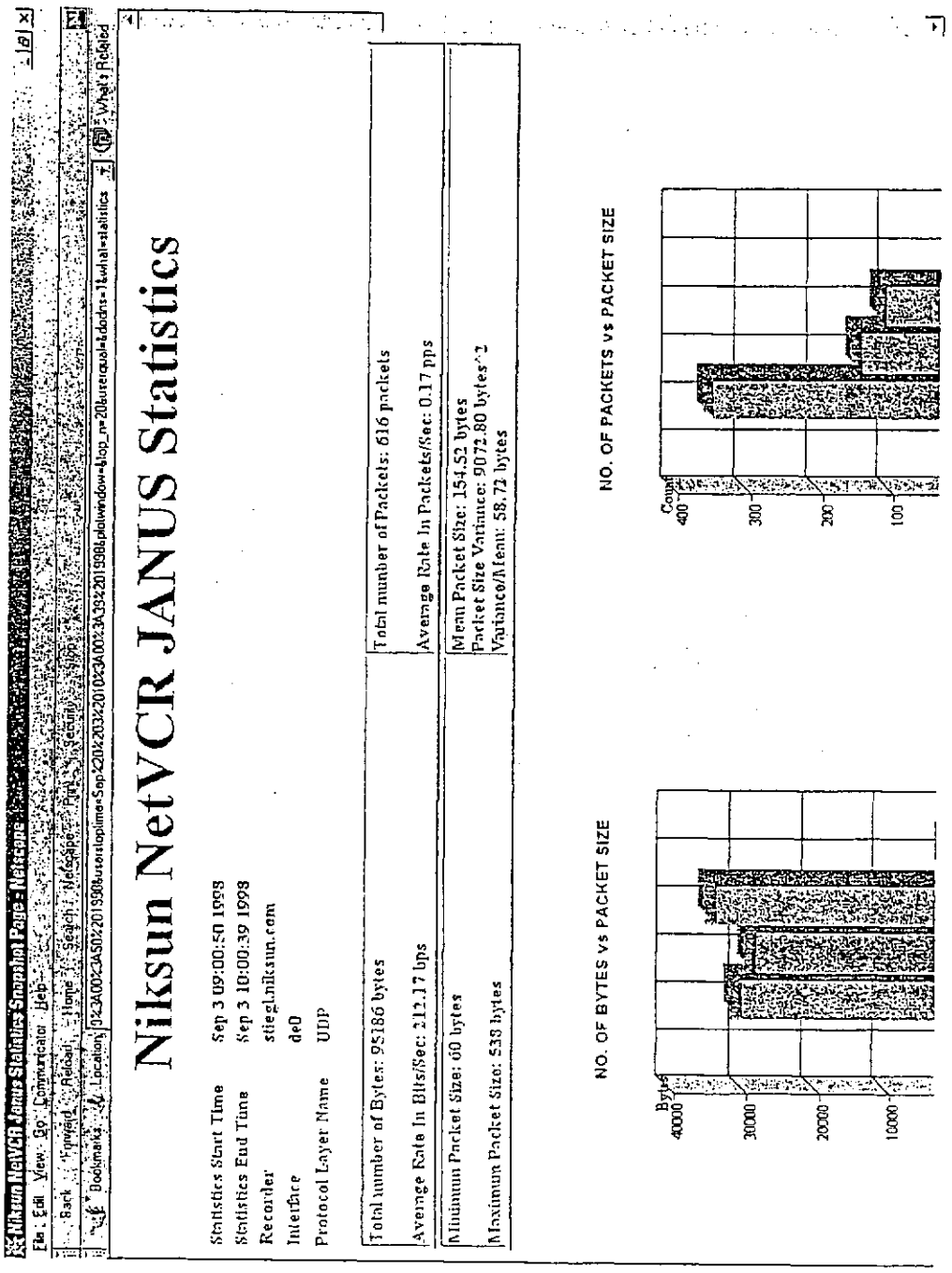

Niksun NetVCR JANUS Statistics
Statistics Start Time Sep 3 09:00:50 1998
Statistics End Time Sep 3 10:00:39 1998
Recorder stiegl.niksun.com
Interface de0
Protocol Layer Name UDP
Total number of Bytes: 95186 bytes
Average Rate In Bits/Sec: 212.17 bps
Total number of Packets: 616 packets
Average Rate In Packets/Sec: 0.17 pps
Minimum Packet Size: 60 bytes
Maximum Packet Size: 535 bytes
Mean Packet Size: 154.52 bytes
Packet Size Variance: 9072.80 bytes^2
Variance/Mean: 58.72 bytes
NO. OF BYTES vs PACKET SIZE
Bytes
40000
30000
20000
10000
NO. OF PACKETS vs PACKET SIZE
Count
400
300
200
100

FIG. 29

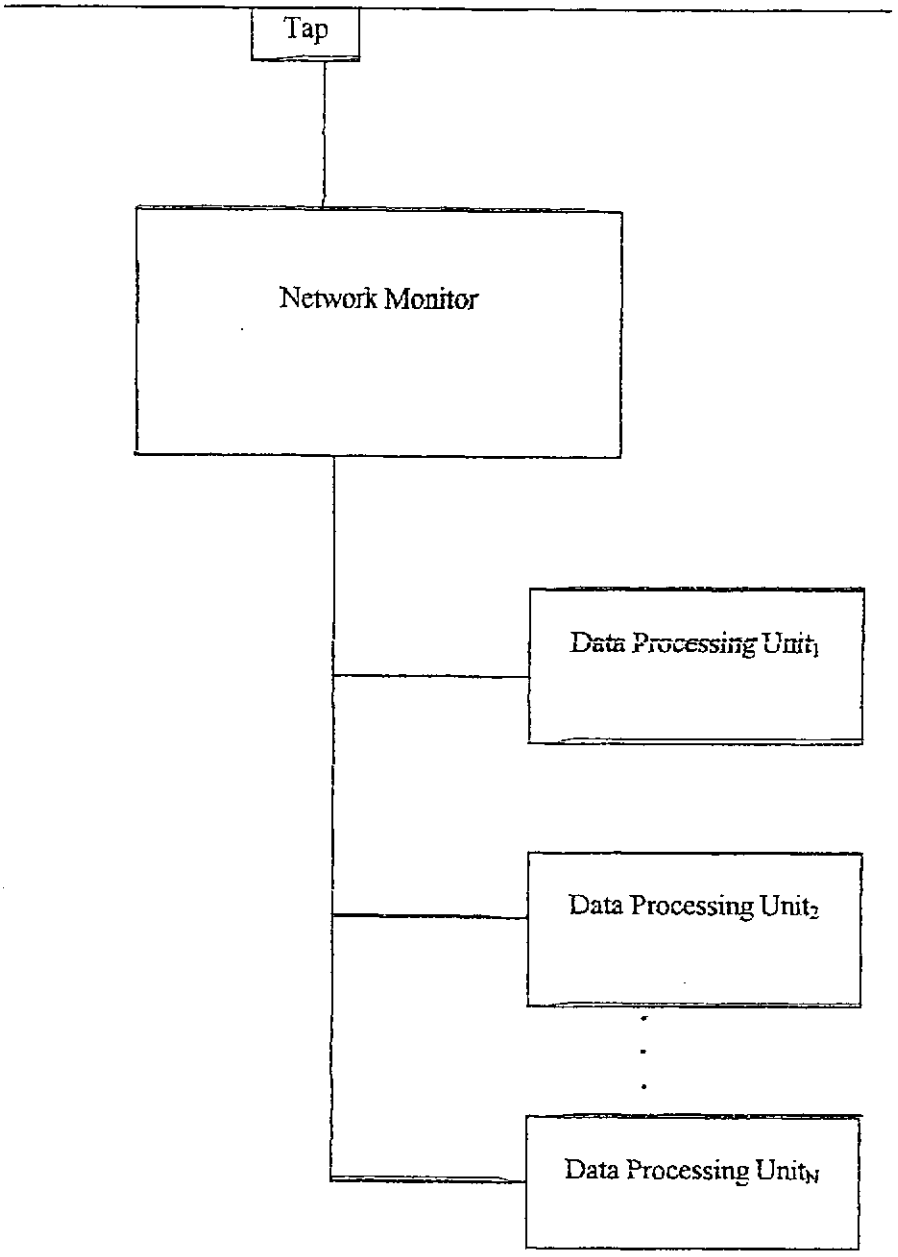
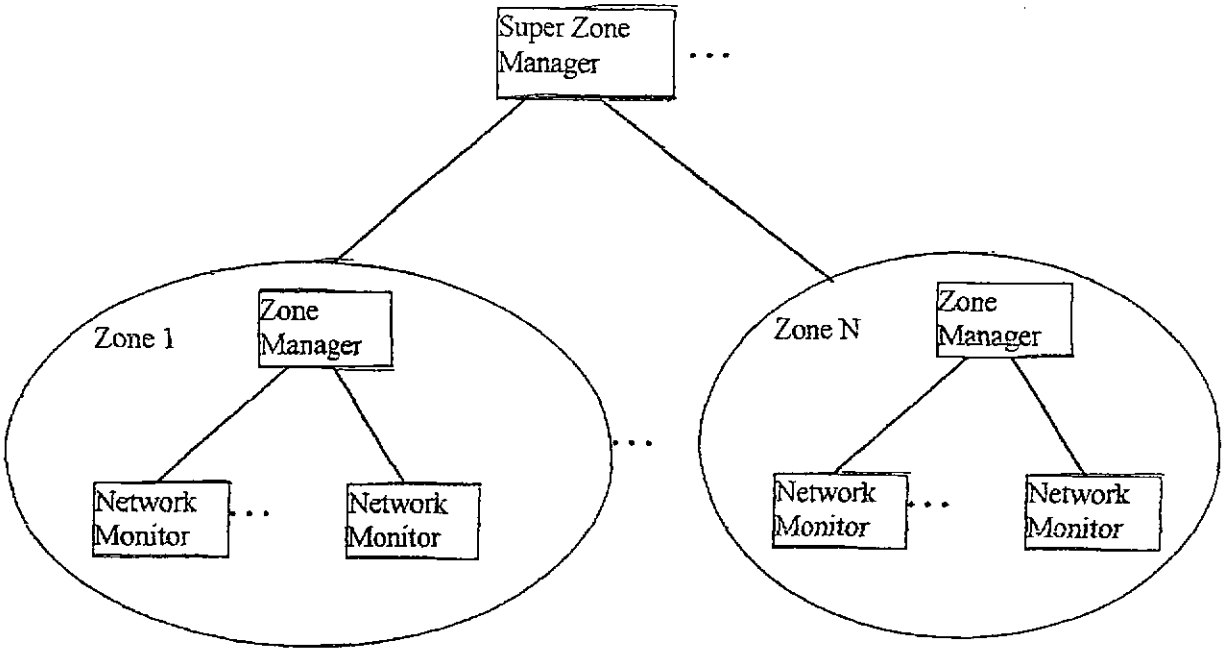

Tap
Network Monitor
Data Processing Unit1
Data Processing Unit2
Data Processing UnitN

FIG. 30


Super Zone Manager
Zone 1
Zone Manager
Network Monitor
Network Monitor
Zone N
Zone Manager
Network Monitor
Network Monitor

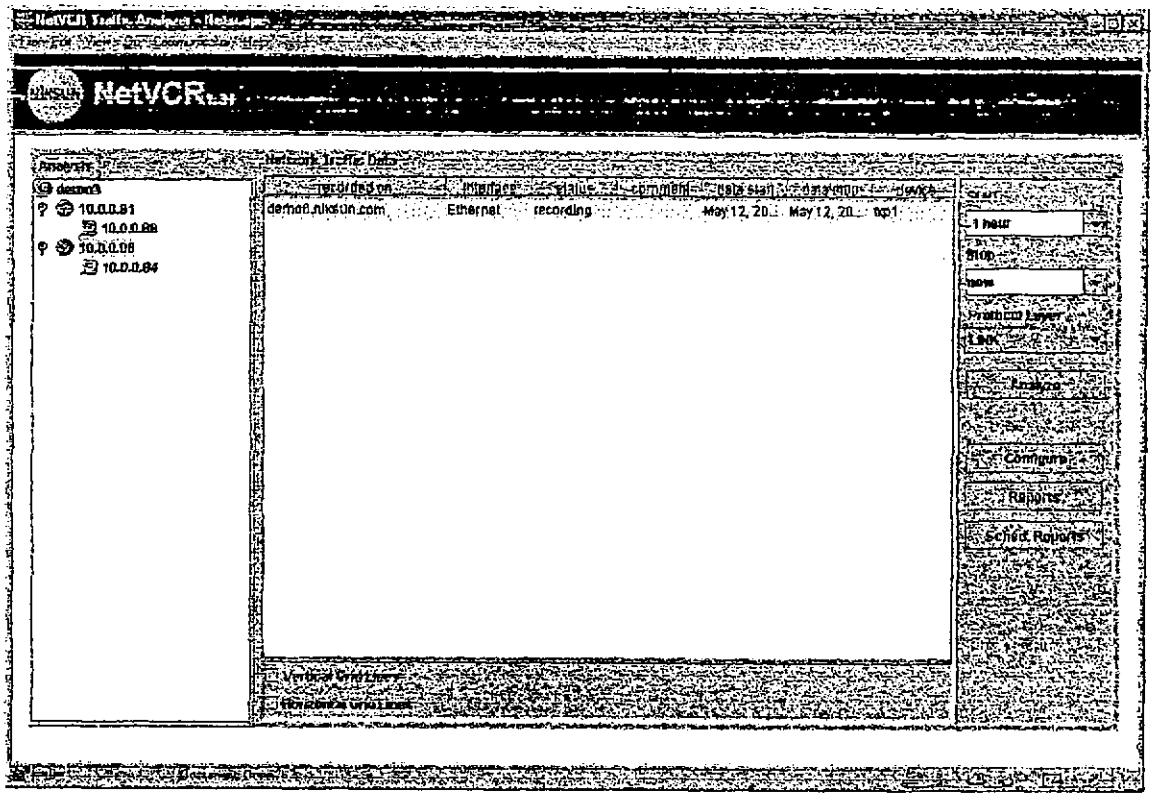

NetVCR
recorded on
Interface
status
comment
data start
data stop
device
demo6.nikosin.com
Ethernet
recording
May 12, 20...
May 12, 20...
tcp1
1 hour
Stop
Configure
Reports
Schedule Reports

FIG. 31

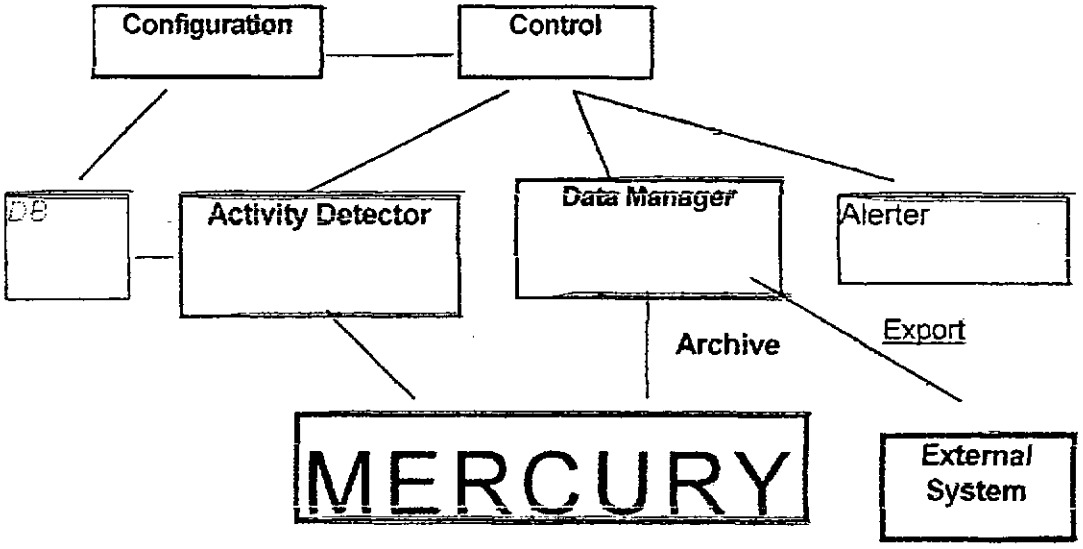

Configuration
Control
DB
Activity Detector
Data Manager
Alerter
Archive
Export
MERCURY
External System

FIG. 32