



Avaya Solution & Interoperability Test Lab

Application Notes for the ADTRAN NetVanta 3205 Access Router and Avaya IP Office Using PPP - Issue 1.0

Abstract

These Application Notes describe a sample configuration of Voice over IP (VoIP) over a Point-to-Point (PPP) link between an Avaya IP Office 406V2, Avaya IP Office 412 and an ADTRAN NetVanta 3205 Access Router. QoS based on Layer 3 Differentiated Services was implemented across the network to prioritize voice traffic. Emphasis was placed on verifying good voice quality in a converged network. Testing was conducted at the Avaya Solution and Interoperability Test Lab.

1. Introduction

As illustrated in **Figure 1**, the Avaya IP Office 406V2 (Site 1) was connected to the ADTRAN NetVanta 3205 Access Router via the T1 connection using PPP. The ADTRAN NetVanta 3205 Access Router is connected to the Avaya IP Office IP412 via the LAN1 interface. For VoIP calls, QoS based on Layer 3 Differentiated Services (DiffServ) was configured on the WAN interfaces of the Avaya IP Office 406V2 and the ADTRAN NetVanta 3205 Access Router. Before the Avaya IP Office 406V2 and ADTRAN Access Router can enforce QoS, they must be able to distinguish between low and high priority traffic. This requires that the IP Office 406V2 and IP telephones mark the voice signaling and media packets with DiffServ Control Point (DSCP) values so that the WAN access routers can identify the high priority VoIP packets and prioritize them accordingly.

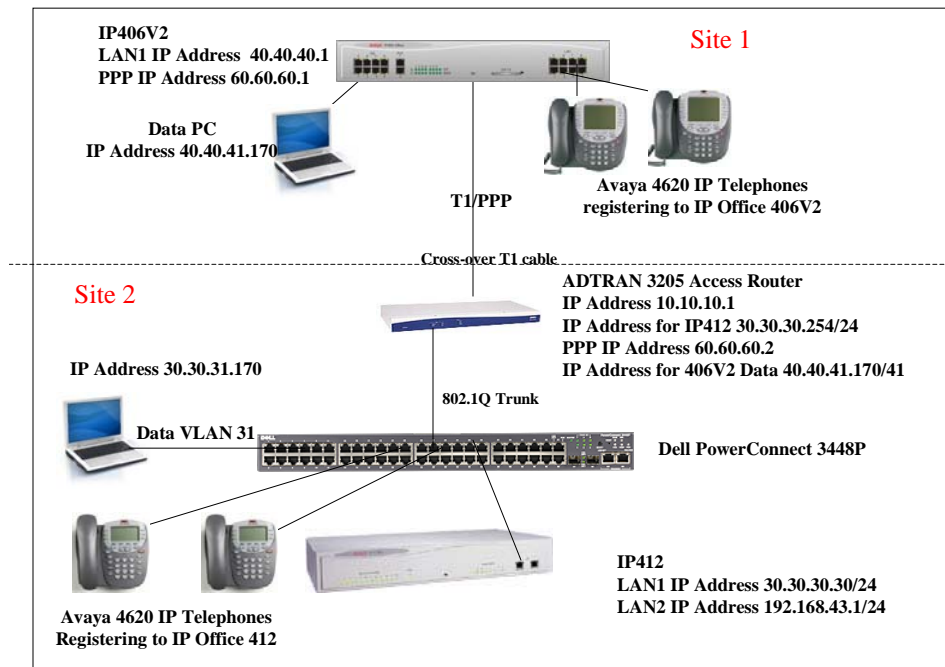


Figure 1: IP Office 406V2 connected to ADTRAN 3205 NetVanta Access Router via PPP

2. Equipment and Software Validated

The following equipment and software/firmware were used for the sample configuration provided:

Equipment	Software/Firmware
Avaya IP Office IP406V2	3.1(42)
Avaya IP Office IP412	3.1(42)
Avaya 4610 IP Telephones	2.1.3
Avaya 4620 IP Telephones	2.1.3
Dell PowerConnect™ 3448P switch	1.0.0.112
ADTRAN NetVanta 3205 Access Router	OS version 10.02.00.E Boot Rom 09.01.00

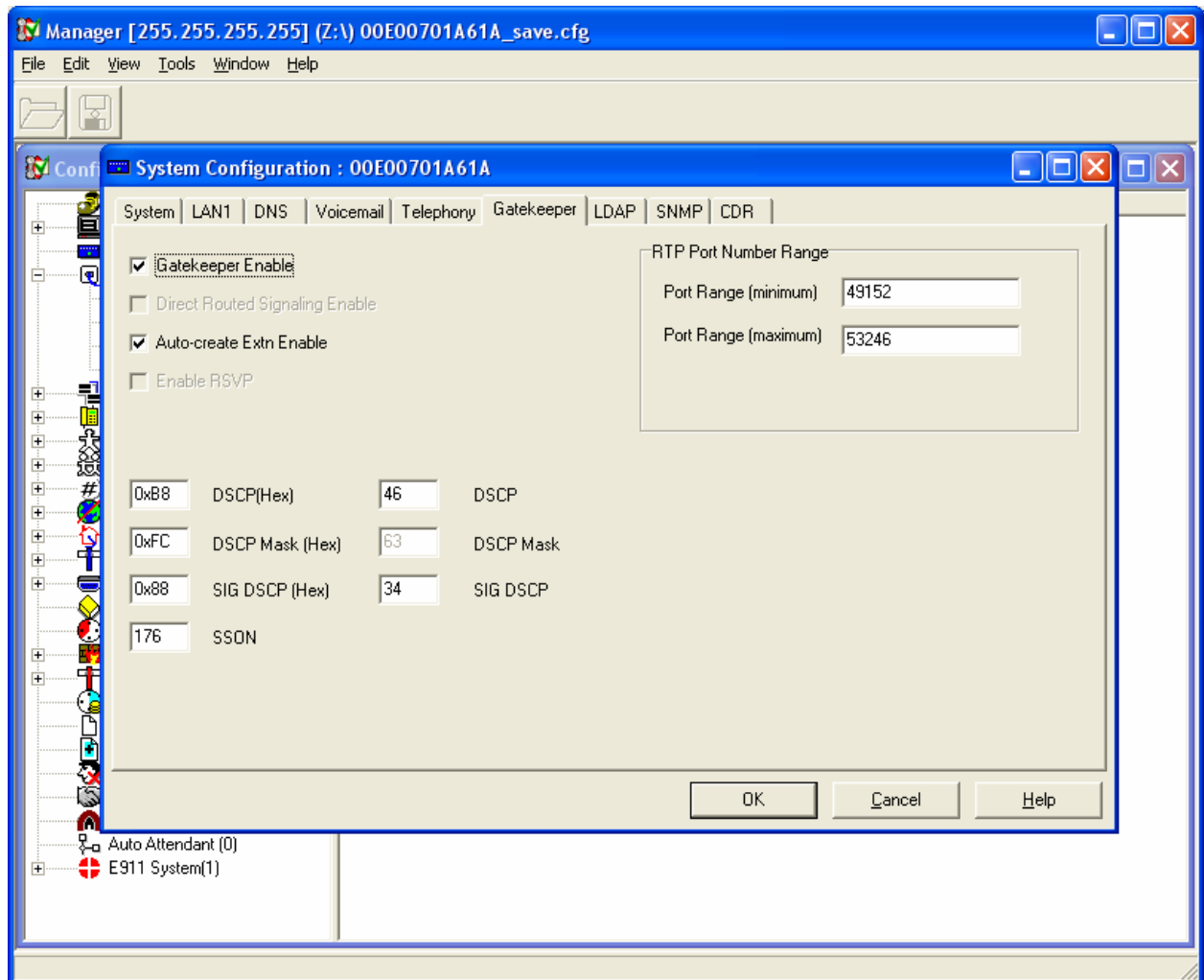
3. Configure IP Office at Site 1

This section describes the IP Office configuration at Site 1. This includes configuring:

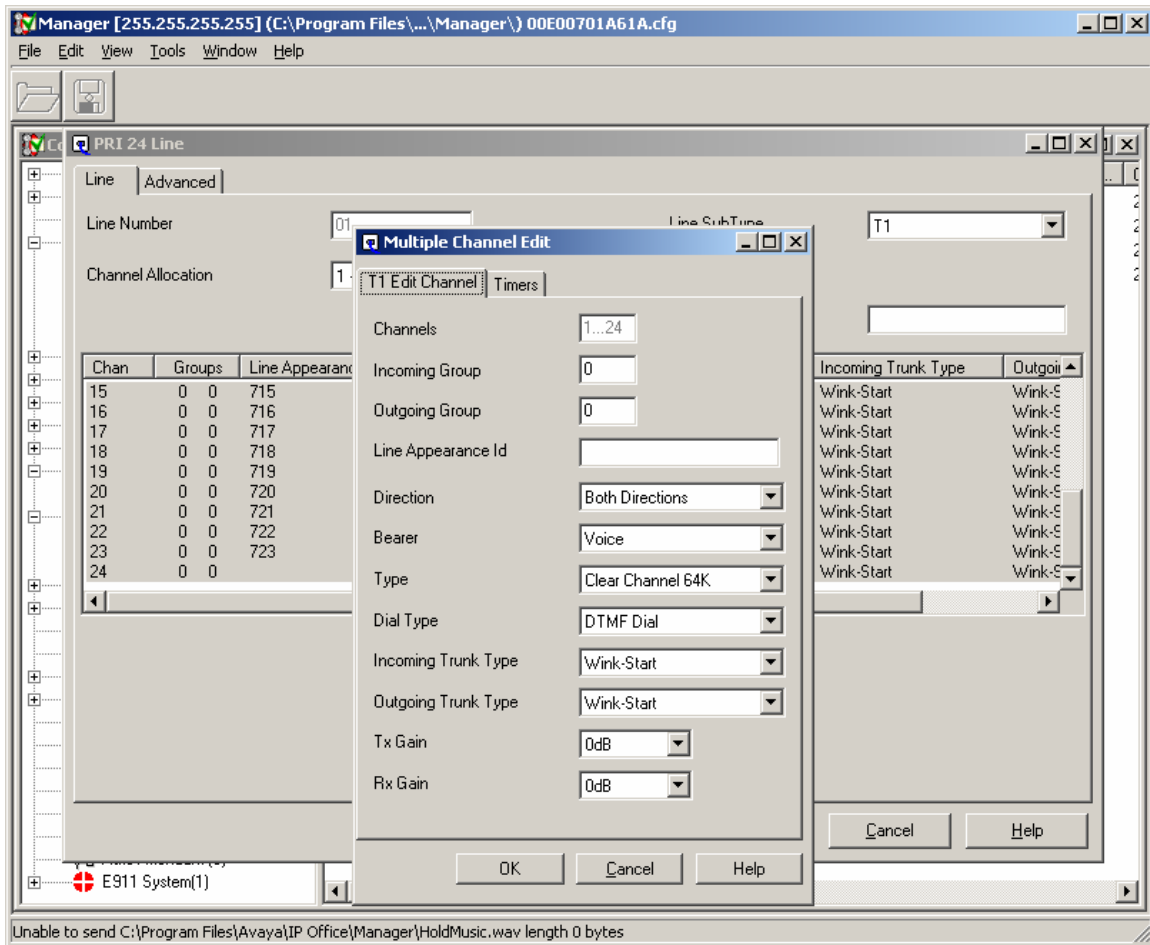
- Gatekeeper parameters
- T1 parameters
- A Service for the T1
- A Remote Access Service for the T1 port
- A virtual WAN port for the T1
- An IP Route to route traffic out over the T1
- An IP Line for the connection to Site 2

The IP Office is configured via the Manager Program (available via the IP Office Administration CD). Start Manager by going under **Start→Programs→IP Office→Manager**.

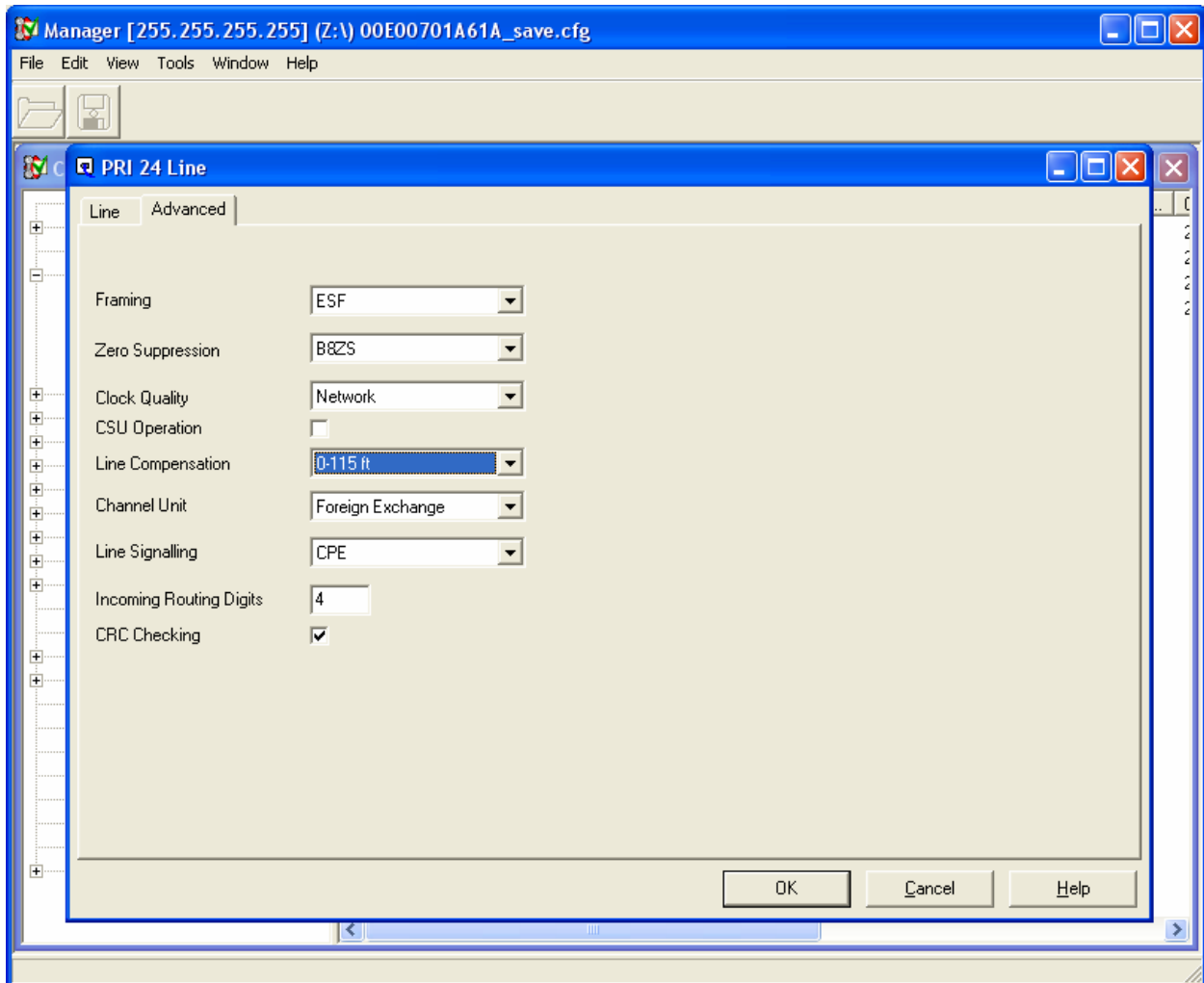
1. *Configure the Gatekeeper settings.* In Manager, double click on System in the left panel. Select the **Gatekeeper** Tab. Modify the **SIG DSCP** and **DSCP** values as illustrated below. Click the **OK** button.



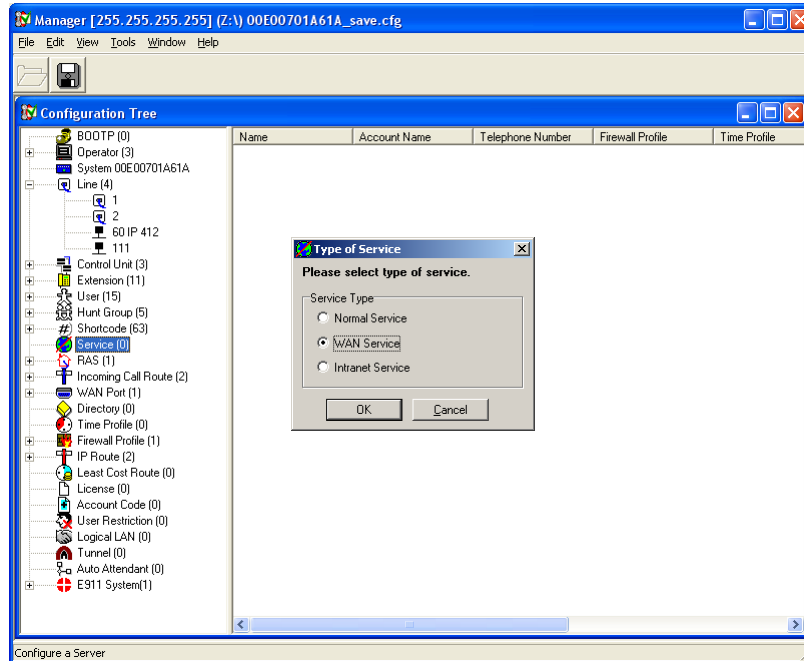
2. *Configure the T1.* In Manager, select **Line** in the left panel. Select the T1 used for the PPP link line in the right panel. Select the channels that will be used for the link (Multiple channels can be selected via the shift or ctrl keys). Change the **Type** to **Clear Channel 64K**. Click the **OK** button.



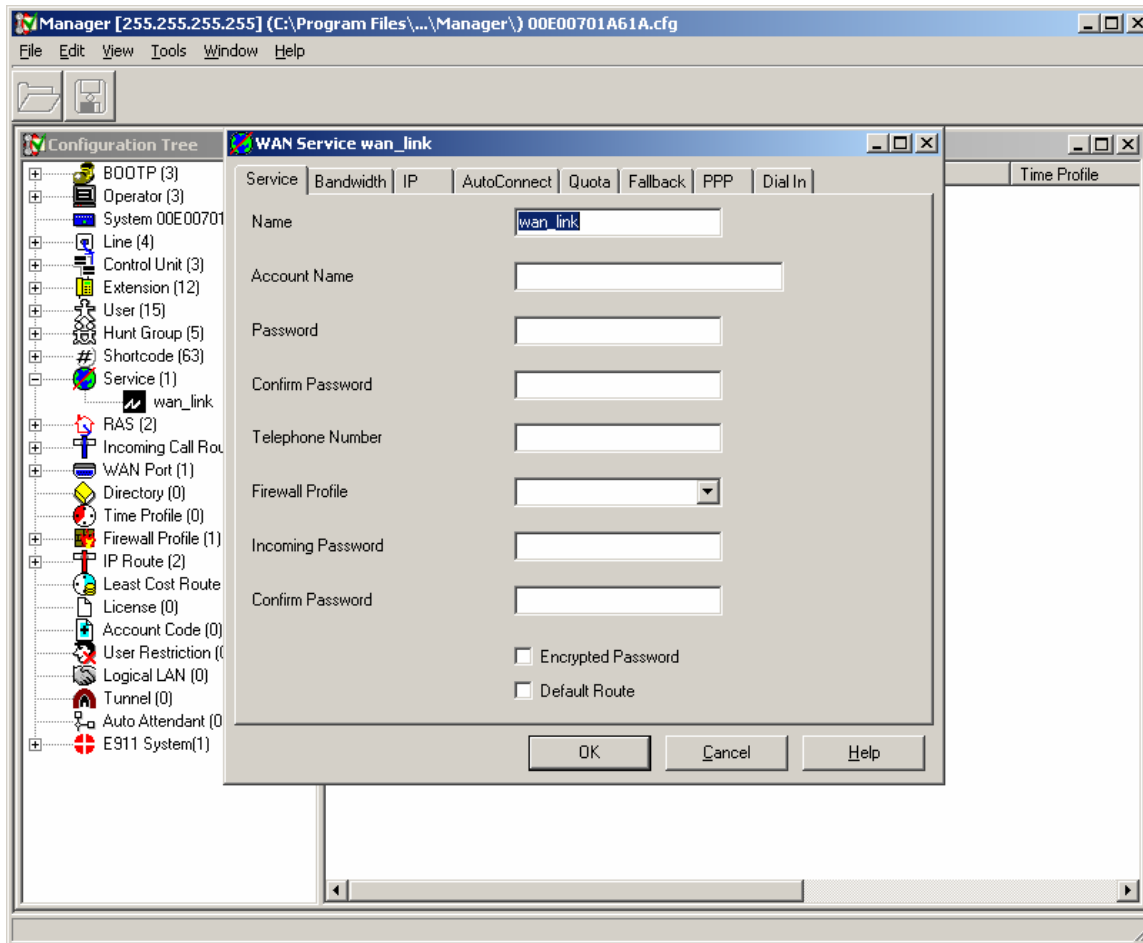
3. *Modify the Framing and Zero Suppression.* Select the **Advanced** Tab. Choose the appropriate values for **Framing** and **Zero Suppression** (as illustrated below). These values must match what is administered on the ADTRAN 3205 Access Router (see Step 2 in the “ADTRAN NetVanta 3205 Access Router Configuration of Connection to Site 1” section). Click the **OK** button.



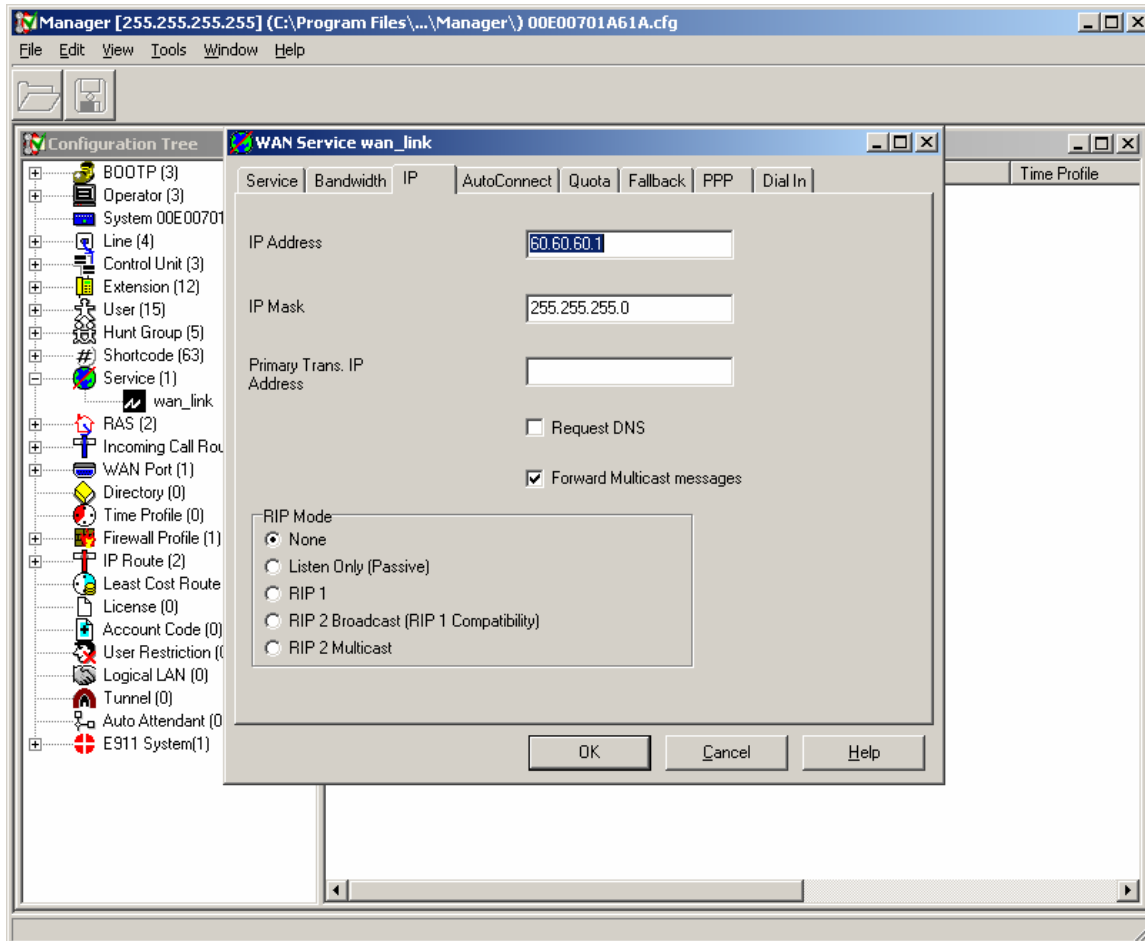
4. *Create a Service.* Select **Service** in the left panel. Right click in the right panel and select **New**. Select **Wan Service** (Note: This is not the default). Click the **OK** button.



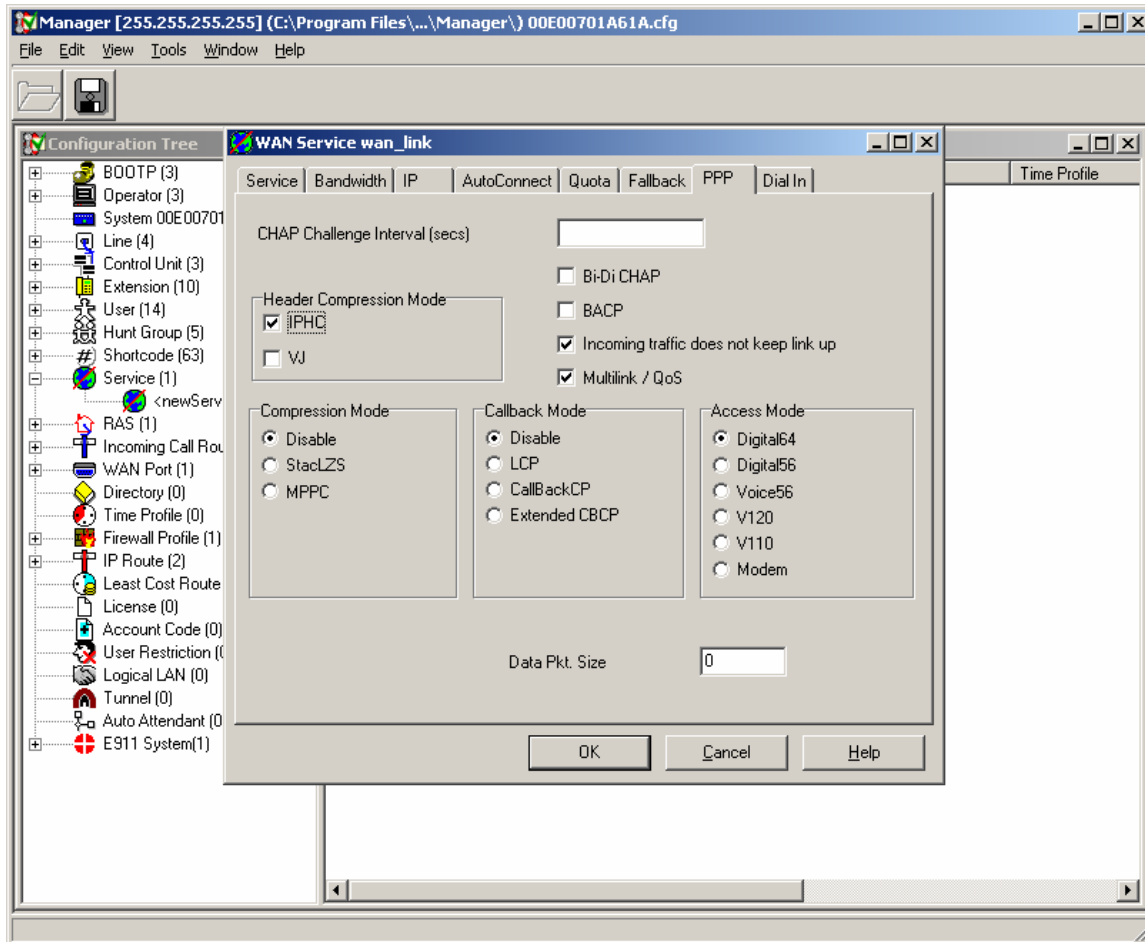
5. Name the Service **wan_link**. No other items on this tab need to be changed.



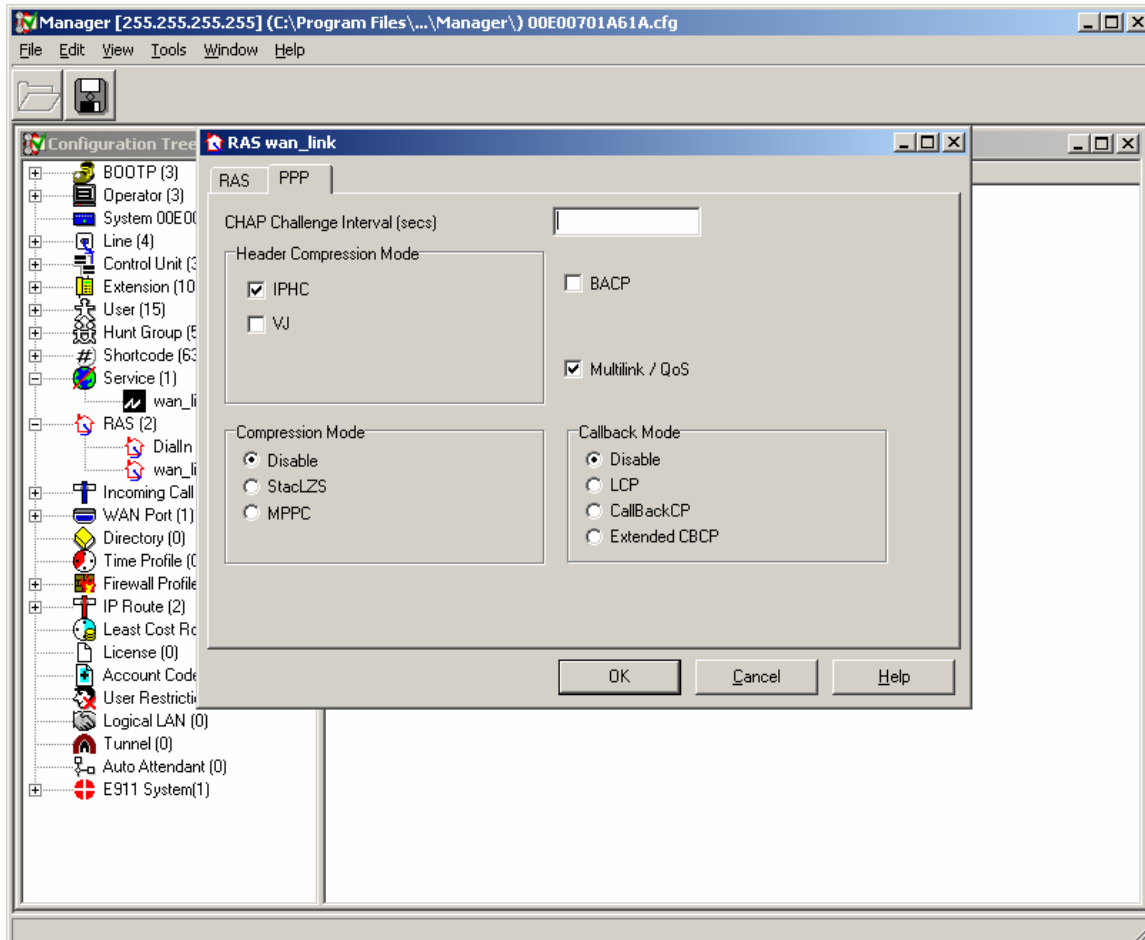
6. *Configure an IP Address and Subnet Mask for the service.* Select the **IP Tab** and enter the **IP Address** and **IP Mask**. Ensure that the IP Address is on the same subnet as the ADTRAN NetVanta 3205 Access Router PPP IP Address (see Step 5 in the “ADTRAN NetVanta 3205 Access Router Configuration of Connection to Site 1” section).



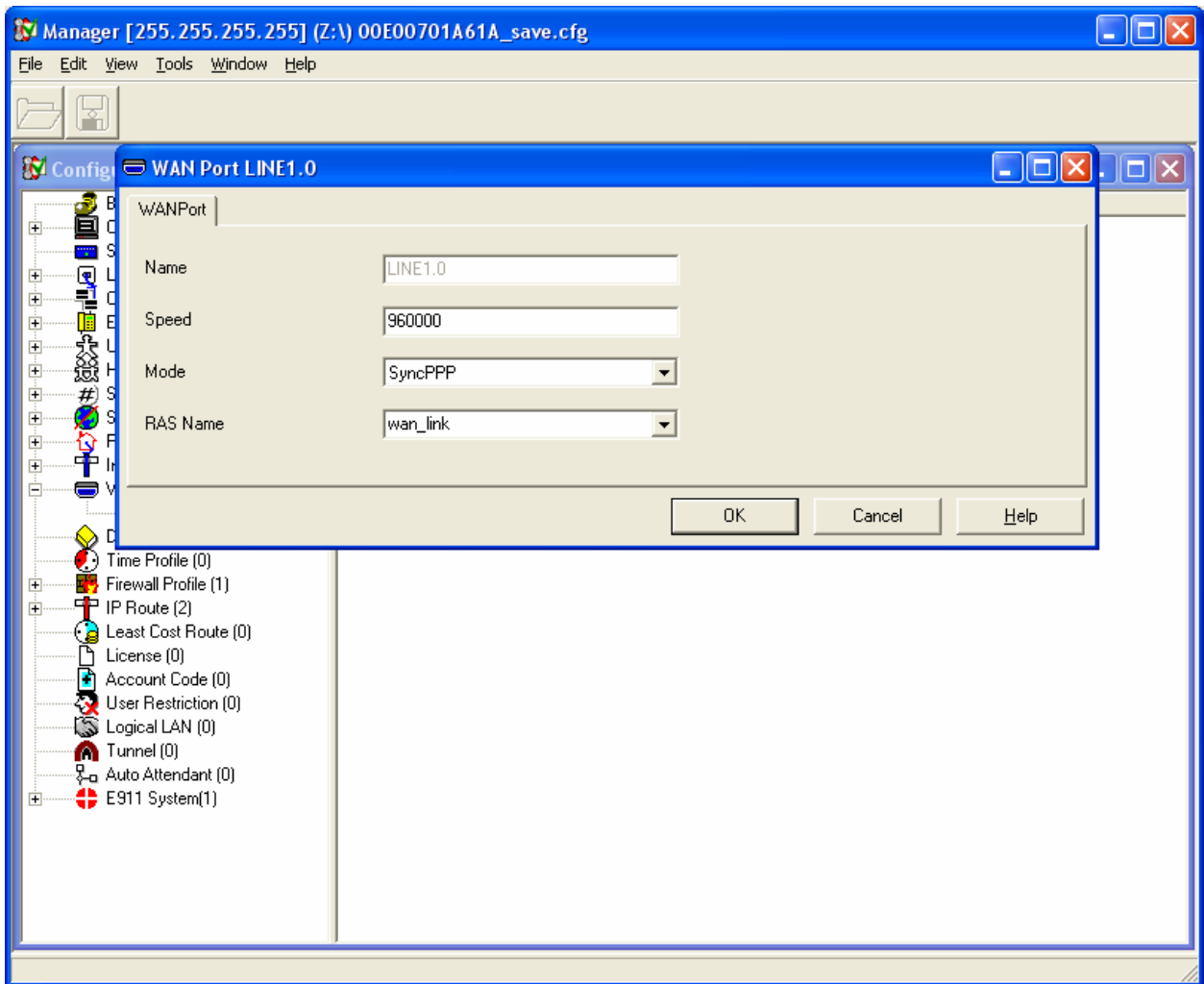
7. *Configure the Service to be Multilink with IP Header Compression.* Select the **PPP** Tab. Check the **IPHC** box under **Header Compression Mode** and check the **Multilink/QoS** option. **Disable** the **Compression Mode** and **Callback Mode**, and select the **Access Mode** to be **Digital64**. Retain the default values for the remaining fields. Click the **OK** button. A Remote Access Service (with the same name) is automatically created.



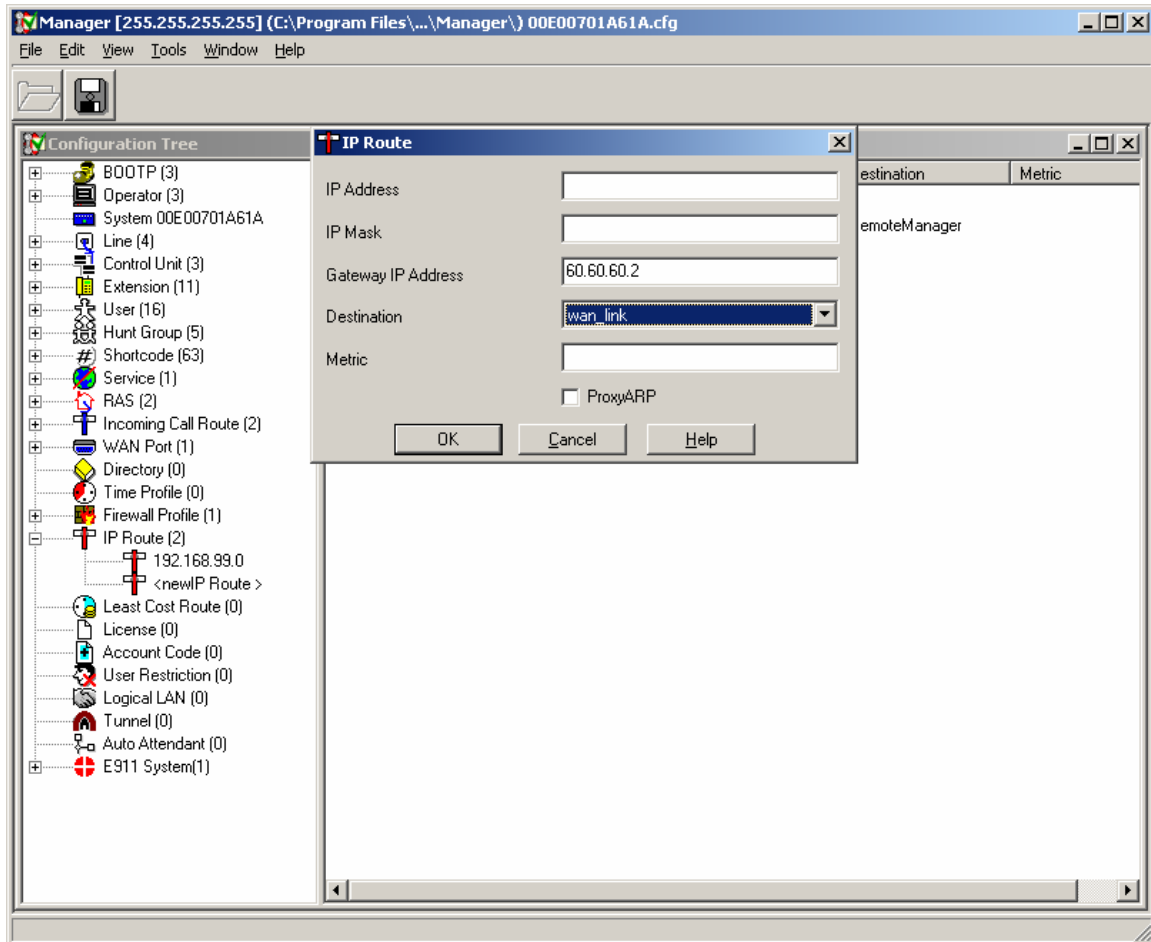
8. *Configure the Remote Access Service to be Multilink with IP Header Compression.* Select **RAS** in the left panel. In the right panel, select the RAS that was created in step 7. Select the **PPP** Tab. Check the **IPHC** box under **Header Compression Mode** and check the **Multilink/QoS** option. **Disable** the **Compression Mode** and **Callback Mode**. Retain the default values for the remaining fields. Click the **OK** button.



9. *Create a WAN port for the T1 Line.* Select **WAN Port** in the left panel. Right click in the right panel and select **New**. Name the port **LINEX.Y** where X is the **Line Number** from the T1 Line form (see Step 2 in this section) and Y is the first channel that is used for data on the line (note that the channel numbers start with 0). Configure the **Speed** to be 64000 multiplied by the number of channels used. Select the **Mode** to be **SyncPPP**. The **RAS Name** is the one created in the previous step. Click the **OK** button.



10. Create an IP Route that will use the ADTRAN NetVanta 3205 Access Router (via the PPP link) as the Default Gateway. Select **IP Route** in the left panel. Right click in the right panel and select **New**. Enter the PPP IP Address on the ADTRAN NetVanta 3205 Access Router in the **Gateway IP Address** field and set the **Destination** to be the Service created in Step 5 of this section. Click the **OK** button.



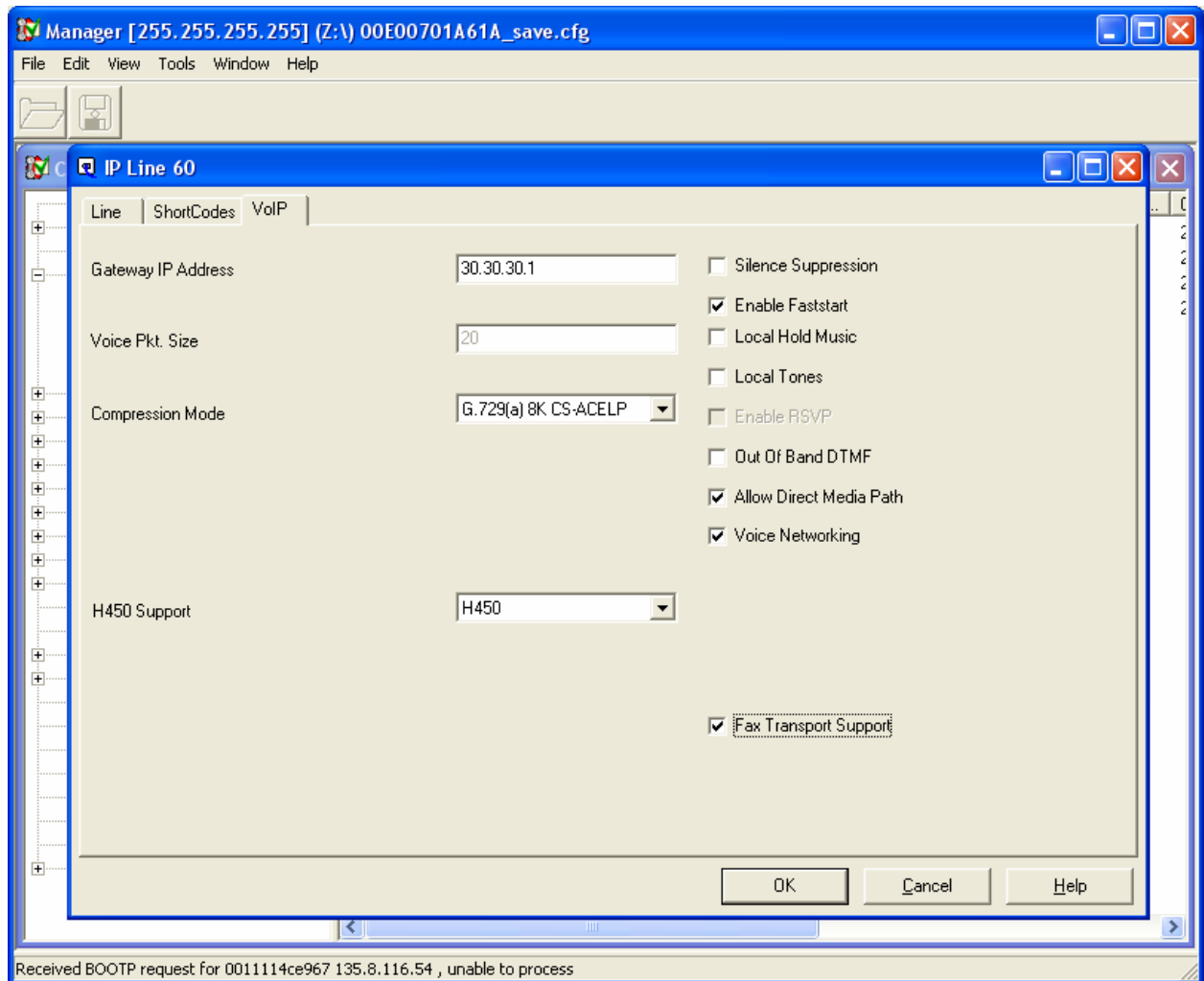
11. *Create an IP Line for Site 2.* Select **Line** in the left panel. Right click in the right panel and select **New**. Set the **Line Number** to be an unused number. Set the **Incoming** and **Outgoing Group ID** to be an unused number. Retain the default values for the remaining fields.

The screenshot shows a software window titled "Manager [255.255.255.255] (E:\) 00E00701A61A.cfg" with a menu bar (File, Edit, View, Tools, Window, Help) and a toolbar. A sub-window titled "IP Line 60" is open, displaying a configuration form. The form has three tabs: "Line", "ShortCodes", and "VoIP", with "Line" selected. The form contains the following fields:

Field	Value
Line Number	60
Telephone Number	IP 412
Outgoing Channels	20
Voice Channels	20
Incoming Group ID	60
Outgoing Group ID	60
Number Of Channels	20
Prefix	
Data Channels	20
TEI	0
National Prefix	0
International Prefix	00

At the bottom of the "IP Line 60" window are three buttons: "OK", "Cancel", and "Help".

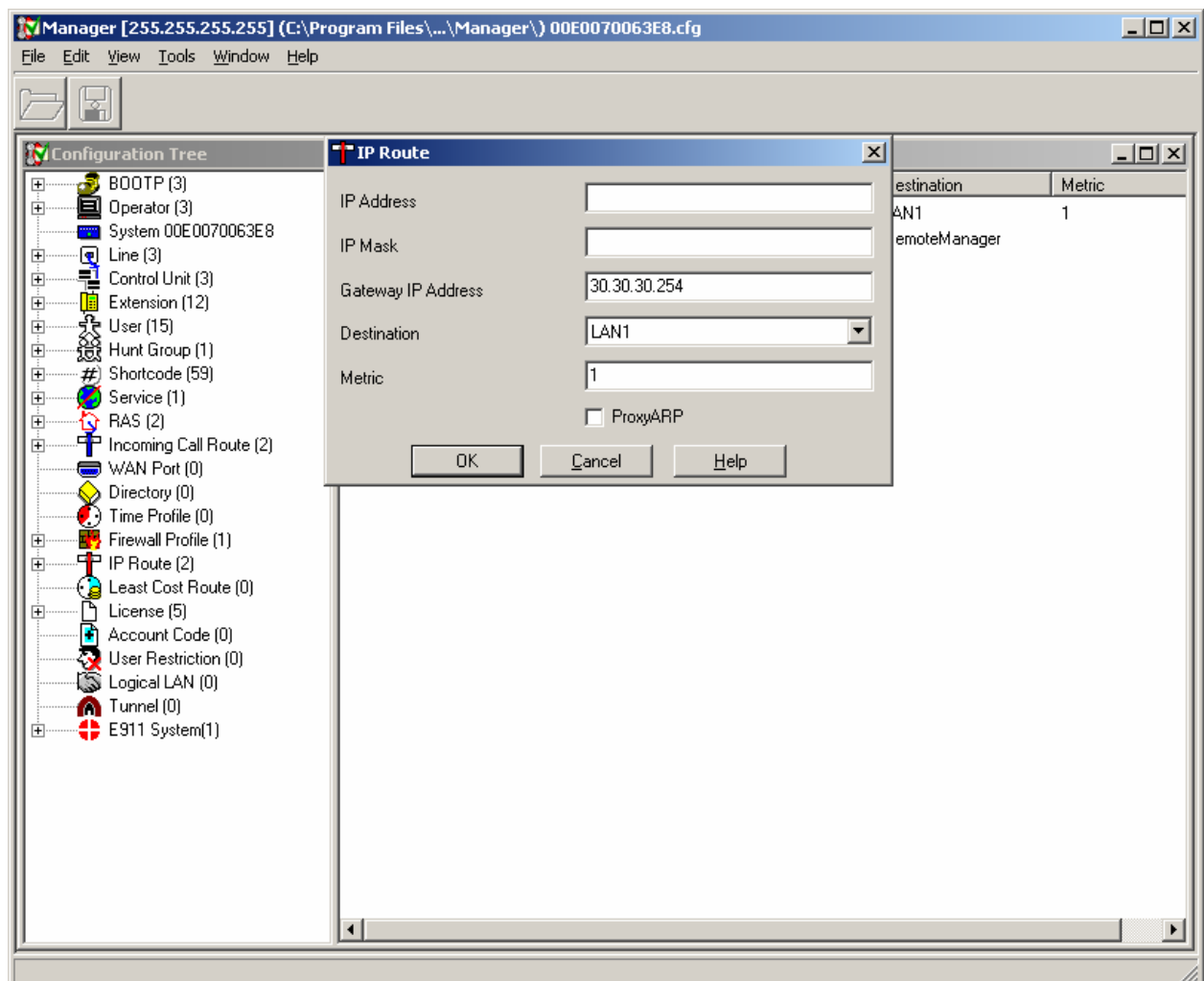
12. *Configure the IP settings for the line.* Select the **VoIP** tab. Set the **Gateway IP Address** to be the IP Office 406V2 (at Site 2) LAN1 IP Address. Set the **Compression Mode** to be the same as the VoIP line created on Site 2 (See Step 3 of the section “Configure IP Office at Site 2”). Check the **Enable Faststart**, **Allow Direct Media Path**, **Voice Networking** and **Fax Transport Support** options. Retain the default values for the remaining fields. Click the **OK** button.



4. Configure IP Office at Site 2

This section describes the IP Office configuration at Site 2. This includes configuring:

- An IP Route to route traffic through the router
 - An IP Line for Site 1
1. *Create an IP Route that will use the ADTRAN 3205 Access Router Ethernet IP Address as the Default Gateway. Select **IP Route** in the left panel. Right click in the right panel and select **New**. Enter the ADTRAN NetVanta 3205 Access Router Ethernet IP Address in the **Gateway IP Address** field and set the **Destination** as **LAN1**. Retain the default values for the remaining fields. Click the **OK** button.*

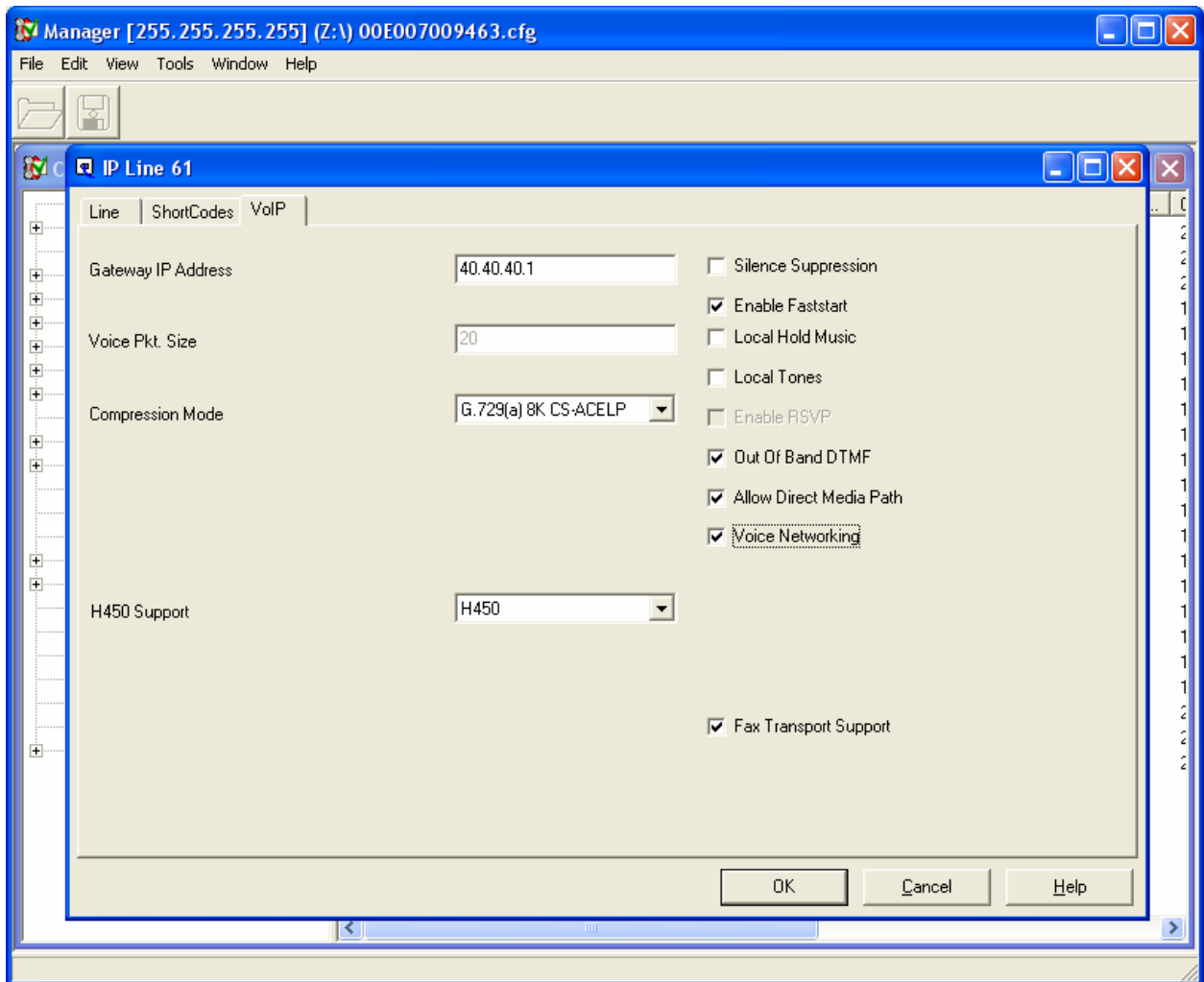


2. Create an IP Line for Site 1. Select **Line** in the left panel. Right click in the right panel and select **New**. Set the **Line Number** to be an used number. Set the **Incoming** and **Outgoing Group ID** to be an unused number. Retain the default values for the remaining fields.

The screenshot shows a Windows-style application window titled "Manager [255.255.255.255] (E:\) 00E007009463.cfg". The window has a menu bar with "File", "Edit", "View", "Tools", "Window", and "Help". Below the menu bar is a toolbar with icons for file operations. The main area of the window displays a configuration dialog for "IP Line 61". The dialog has a left sidebar with a tree view showing a hierarchy of nodes, with "Line" selected. The main panel of the dialog is divided into two columns of fields. The left column contains "Line Number" (set to 61), "Telephone Number" (empty), "Outgoing Channels" (set to 20), "Voice Channels" (set to 20), "Incoming Group ID" (set to 61), and "Outgoing Group ID" (set to 61). The right column contains "Number Of Channels" (set to 20), "Prefix" (empty), "Data Channels" (set to 20), "TEI" (set to 0), "National Prefix" (set to 0), and "International Prefix" (set to 00). At the bottom of the dialog are three buttons: "OK", "Cancel", and "Help".

Field	Value
Line Number	61
Telephone Number	
Outgoing Channels	20
Voice Channels	20
Incoming Group ID	61
Outgoing Group ID	61
Number Of Channels	20
Prefix	
Data Channels	20
TEI	0
National Prefix	0
International Prefix	00

13. *Configure the IP settings for the line.* Select the **VoIP** tab. Set the **Gateway IP Address** to be the IP Office 412 (at Site 1) LAN1 IP Address. Set the **Compression Mode** to be the same as the Site 1 VoIP Line. Check the **Enable Faststart**, **Allow Direct Media Path**, **Voice Networking** and **Fax Transport Support** options. Retain the default values for the remaining fields. Click the **OK** button.



5. Configure the ADTRAN NetVanta 3205 Access Router

This section describes the configuration for the ADTRAN NetVanta 3205. The ADTRAN resides at Site 2 where there is an Ethernet connection to the IP Office 412. The connection to the IP Office 406V2 is a PPP over T1.

5.1. ADTRAN NetVanta 3205 Access Router Configuration of Connection to Site 2

The following are the steps needed to configure the Ethernet port for the connection to the IP Office 412 at Site 2. This includes:

- Forwarding DHCP messages
 - Changing the Ethernet port to be a 802.1 trunk
 - Configuring an interface for the voice VLAN
 - Configuring an interface for the data VLAN
 - Creating an IP Route
1. *Connect to the ADTRAN NetVanta 3205 Access Router with its serial cable. Run a terminal emulator, such as HyperTerminal with settings of 9600Kb/s, 8 data bits, 1 stop bit and no parity. Set the flow control to none and change the emulation mode to VT100.*
 2. *Allow forwarding of DHCP broadcast messages.*

```
Router>enable  
Password:  
Router#configure  
Configuring from terminal, memory, or network? [terminal]  
Router(config)#ip forward-protocol udp bootps
```

3. *Configure the Ethernet port to be an 802.1 trunk.*

```
Router(config)#interface Ethernet 0/1  
Router(config-eth 0/1) encapsulation 802.1q
```

4. *Configure a sub-interface to be on the Voice VLAN with the same subnet as the IP412.*

```
Router(config)#interface Ethernet 0/1.30  
Router(config-eth 0/1.30) VLAN-id 24  
Router(config-eth 0/1.30) ip address 30.30.30.254 255.255.255.0
```

5. *Configure a sub-interface to be on the Data VLAN for Site 2.*

```
Router(config)#interface Ethernet 0/1.31  
Router(config-eth 0/1.31) VLAN-id 31  
Router(config-eth 0/1.31) ip address 30.30.31.170 255.255.255.0
```

6. *Create an IP route (default IP Address of the router is **10.10.10.1**),*

```
Router(config)#ip route 0.0.0.0 0.0.0.0 10.10.10.1
```

5.2. ADTRAN NetVanta 3205 Access Router Configuration of Connection to Site 1

The connection to Site 1 via the T1 to the IP Office 406V2 includes the following steps:

1. *Configure a policy for Quality of Service (in this example VOICE). The policy has two map entries. The first entry corresponds to the **SIG DSCP** value on IP Office and the second corresponds to the **DSCP** value on IP Office. These values can both be found on the **Gatekeeper** tab of the **System** form in IP Office Manager (see Step 1 in the “Configure IP Office at Site 1” section). For both entries, the priority will be unlimited.*

```
Router#enable  
Password:  
Router#configure  
Configuring from terminal, memory, or network? [terminal]  
Router(config)#qos map VOICE 10  
Router(config-qos-map)#match dscp 34  
Router(config-qos-map)#priority unlimited  
Router(config-qos-map)#qos map VOICE 20  
Router(config-qos-map)#match dscp 46  
Router(config-qos-map)#priority unlimited
```

2. *Configure the T1 to match the parameters on IP Office 406V2. The T1 parameters in IP Office can be found on the **Advanced** tab of the **T1 Line** form (see Step 3 in the “Configure IP Office at Site 1” section).*

```
Router(config)# interface t1 1/1  
Router(config-t1 1/1)#coding b8zs  
Router(config-t1 1/1)#framing esf
```

3. *Configure the channels on the T1 to be in the first tdm group.* The speed of the channels is 64K. This corresponds to the IP Office **Clear Channel 64** selection on the **Channel Dialog** of the **T1 Line** form (see Step 2 in the “Configure IP Office at Site 1” section). The timeslots are the channels on the T1 that are used for IP traffic. Note: The number of channels on the T1 cannot exceed the total number of data channels in the IP Office.

```
Router(config-t1 1/1)#tdm-group 1 timeslots 1-15 speed 64
```

4. *Configure a PPP interface.* This interface will be multilink with fragmentation and have an IP address and subnet mask. Enter a name for this PPP (executed via the **description** command). Assign the QoS policy that was created in Step 1 of this section. Assign the PPP connection to the T1 line. This is done via the **cross-connect** command. The first parameter is the number of the cross-connect interface. The second parameter is the T1 interface. The third parameter is the tdm-group created in Step 3 and the last parameter is the PPP interface number.

```
Router(config)# interface ppp 1  
Router(config-ppp1)#description 406V2  
Router(config-ppp1)#qos-policy VOICE  
Router(config-ppp1)#ip address 60.60.60.2 255.255.255.0  
Router(config-ppp1)#ppp multilink fragmentation  
Router(config-ppp1)#ppp multilink interleave  
Router(config-ppp1)#cross-connect 1 t1 1/1 1 ppp 1
```

5. *Create an IP Route that will route all traffic destined for the IP Office 406V2 out over the PPP link.* Use the IP address of the service on IP Office that corresponds to the PPP link (see Step 6 in Section “Configure IP Office at Site 1”).

```
Router(config)#ip route 40.40.40.0 255.255.255.0 60.60.60.1
```

6. *Configure a sub-interface to be on the Data VLAN for Site 1*

```
Router(config)#interface Ethernet 0/1.41  
Router(config-eth 0/1.31) VLAN-id 41  
Router(config-eth 0/1.31) ip address 40.40.41.170 255.255.255.0
```

6. Testing

The interoperability testing focused on verifying interoperability between the ADTRAN NetVanta 3205 Access Router and Avaya IP Office.

6.1. General Test Approach

The general test approach was to connect the ADTRAN NetVanta 3205 Access Router to the IP Offices as described in Figure 1. Calls were placed to and from Site 1 and 2 and talkpath was verified. Data traffic was then generated going to and from Site 1 and Site 2. Priority of voice over data traffic was checked.

6.2. Test Results

All tests passed successfully. All products operated as expected.

7. Verification and Troubleshooting

7.1. ADTRAN NetVanta 3205 Access Router Troubleshooting

First check to see that all of the cables are connected to the appropriate ports on the ADTRAN NetVanta 3205 Access Router and IP Office.

Check to see if the interfaces are up on the ADTRAN NetVanta 3205 Access Router. The **show interfaces** command provides detailed information about the administered Ethernet, T1 and PPP interface. Check the following:

- The T1 line protocol is up.
- The T1 is tied to the PPP interface that was administered.
- The Ethernet port is up and acting as a trunk (indicated by 802.1 encapsulation).
- The Ethernet sub-interface is on the correct VLAN and has an IP Address that matches the subnet of the IP Office.
- There is an administered PPP interface that is linked to the T1 port. The PPP interface has an IP address and subnet mask.

```
Router>show interfaces
```

```
Displaying interfaces...
```

```
t1 1/1 is UP
```

```
Description: to 406v2
```

```
Receiver has no alarms
```

```
T1 coding is B8ZS, framing is ESF
```

```
Clock source is line, FDL type is ANSI
```

```
Line build-out is 0dB
```

```
No remote loopbacks, No network loopbacks
```

```
Acceptance of remote loopback requests enabled
```

```
Tx Alarm Enable: rai
```

```
Last clearing of counters never
```

loss of frame : 3, last occurred 03:44:54
loss of signal : 3, last occurred 03:44:53
AIS alarm : 0
Remote alarm : 0

DS0 Status: 123456789012345678901234
NNNNNNNNNNNNNNNNNNDDDDDDDDDD
Status Legend: '-' = DS0 is unallocated
'N' = DS0 is dedicated (nailed)
'D' = DS0 is allocated to DSX port

Line Status: -- No Alarms --

5 minute input rate 216 bits/sec, 1 packets/sec
5 minute output rate 816 bits/sec, 2 packets/sec
Current Performance Statistics:
0 Errored Seconds, 0 Bursty Errored Seconds
0 Severely Errored Seconds, 0 Severely Errored Frame Seconds
0 Unavailable Seconds, 0 Path Code Violations
0 Line Code Violations, 0 Controlled Slip Seconds
0 Line Errored Seconds, 0 Degraded Minutes

TDM group 1, line protocol is UP

Encapsulation PPP (ppp 1)

14624 packets input, 861052 bytes, 0 no buffer
0 runts, 3 giants, 0 throttles
13898 input errors, 26 CRC, 11422 frame
2450 abort, 0 discards, 0 overruns
42112 packets output, 2063577 bytes, 0 underruns

eth 0/1 is UP, line protocol is UP

Hardware address is 00:A0:C8:19:01:C1

Running 802.1Q Encapsulation

100Mb/s, negotiated full-duplex, configured full-duplex
5 minute input rate 1536 bits/sec, 3 packets/sec
5 minute output rate 232 bits/sec, 0 packets/sec
63639 packets input, 4215765 bytes
37483 unicasts, 26156 broadcasts, 0 multicasts input
0 unknown protocol, 0 symbol errors, 0 discards
0 input errors, 0 runts, 0 giants
0 no buffer, 0 overruns, 0 internal receive errors
0 alignment errors, 0 crc errors
7641 packets output, 819190 bytes
0 unicasts, 0 broadcasts, 0 multicasts output
0 output errors, 0 deferred, 0 discards
0 single, 0 multiple, 0 late collisions

0 excessive collisions, 0 underruns
0 internal transmit errors, 0 carrier sense errors
0 resets, 0 throttles

eth 0/1.30 is UP, line protocol is UP

VLAN Id is 60

Hardware address is 00:A0:C8:19:01:C1
Ip address is 30.30.30.254, netmask is 255.255.255.0
MTU is 1500 bytes, BW is 100000 Kbit
100Mb/s, negotiated full-duplex, configured full-duplex
ARP type: ARPA; ARP timeout is 20 minutes
5 minute input rate 1536 bits/sec, 3 packets/sec
5 minute output rate 232 bits/sec, 0 packets/sec

eth 0/1.31 is UP, line protocol is UP

VLAN Id is 31

Hardware address is 00:A0:C8:19:01:C1
Ip address is 30.30.31.170, netmask is 255.255.255.0
MTU is 1500 bytes, BW is 100000 Kbit
100Mb/s, negotiated full-duplex, configured full-duplex
ARP type: ARPA; ARP timeout is 20 minutes
5 minute input rate 1536 bits/sec, 3 packets/sec
5 minute output rate 232 bits/sec, 0 packets/sec

ppp 1 is UP

Configuration:

Keep-alive is set (10 sec.)

Multilink

MTU = 1500, MRRU = 1520

Multilink Interleave

Multilink Fragmentation

No authentication

IP is configured

60.60.60.2 255.255.255.0

Link thru t1 1/1 is UP; LCP state is OPENED, negotiated MTU is 1500

Receive: bytes=861052, pkts=14624, errors=0

Transmit: bytes=2128397, pkts=47501, errors=0

5 minute input rate 216 bits/sec, 1 packets/sec

5 minute output rate 816 bits/sec, 2 packets/sec

Bundle information

Queueing method: weighted fair

HDLC tx ring limit: 2

Output queue: 0/1/428/64/0 (size/highest/max total/threshold/drops)

Conversations 0/1/256 (active/max active/max total)

Available Bandwidth 960 kilobits/sec

IP is UP, IPCP state is OPENED

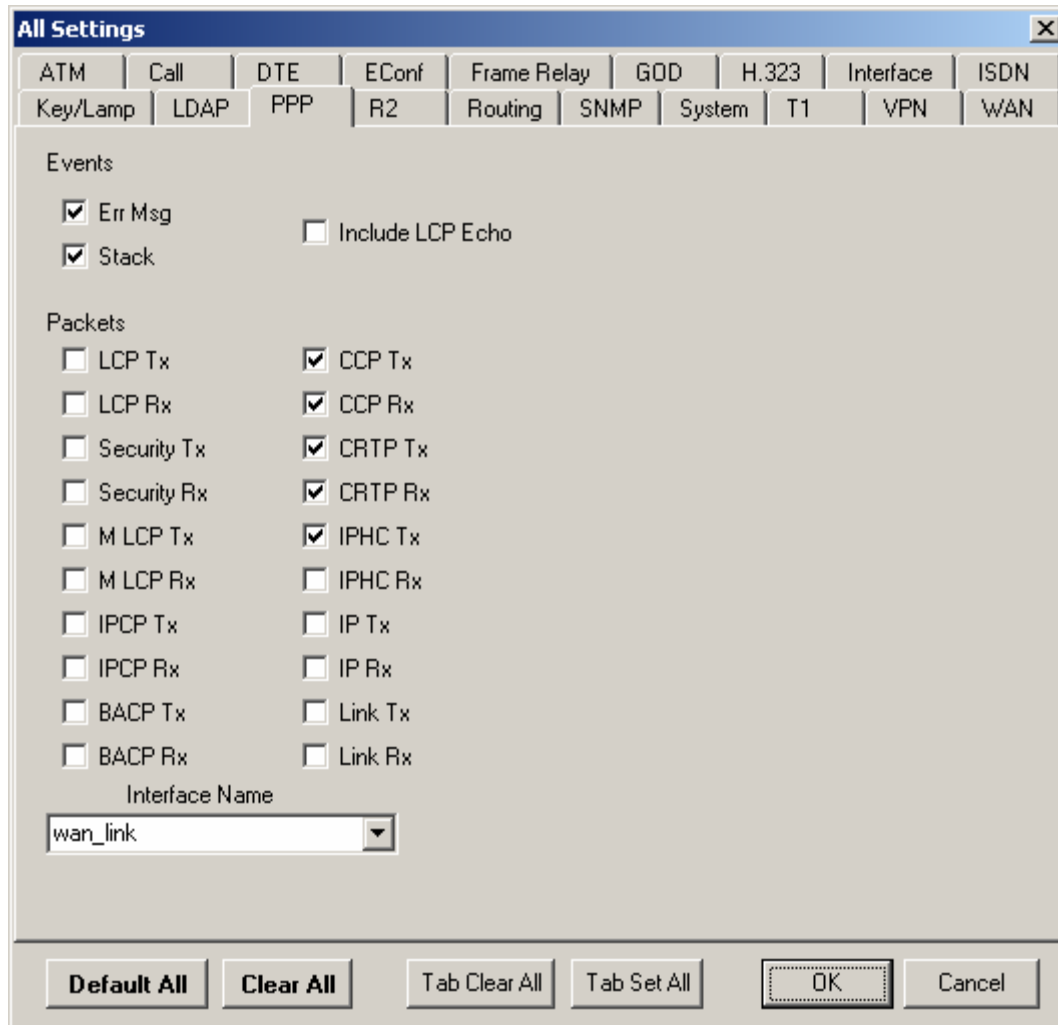
Address=60.60.60.2 Mask=255.255.255.0

Peer address=60.60.60.1

IP MTU=1500, Bandwidth=1280 Kbps

7.2. IP Office Troubleshooting

The System Monitor (available via the IP Office Administration CD) application is started via Start->Programs->IP Office->Monitor. It provides information about the interfaces. To see the PPP information, select **Trace Options** under the **Filters** Menu. Select the **PPP** tab as shown below.



When the system is configured correctly, the following messages (both Transmit and Receive Tx and Rx) are displayed for the PPP interface.

```
275001mS Interface Tx: v=wan_link WAN
      IP Header info - Dst=30.30.30.78 Src=40.40.40.78 vl=0x45 tos=0x00 len=48
id=0xa012
      ttl=127 flg=0x02 off=0x0000 pcol=6(TCP) sum=0xcd3
      TCP Header info - DstPort=1064 SrcPort=3811 Seq=1797827039 Ack=0
Code=0x02 (SYN )
      Header=7 Window=16384 Sum=0x8e2a Urgent=0
Options:      0000 02 04 05 b4 01 01 04 02 61 22
.....a"
275001mS IPO-SNet: EVENT IFACE_OPERATIONAL clients=0 ptr=ffe8d838
```

```
275462mS RES: Thu 23/2/2006 15:04:26 FreeMem=4615848(16) CMMsg=5 (6) Buff=100 535
498 560 5 Links=10124 Elements=61
278949mS Interface Rx: v=wan_link WAN
      EtherType=0x82cc
      0000 01 02 00 04
282940mS Interface Rx: v=wan_link WAN
      EtherType=0x82cc
      0000 01 03 00 04
```

8. Conclusion

These Application Notes describe the steps for configuring the ADTRAN NetVanta 3205 Access Router to IP Office via the PPP protocol.

9. Additional References

- Product documentation for Avaya IP Office may be found at:
<http://marketingtools.avaya.com/knowledgebase/>.
- “TECHNICAL SUPPORT NOTE NetVanta 320X Configuring Point to Point Protocol (PPP) Featuring NetVanta 3200 & 3205” can be found at:
<http://www.adtran.com>

©2006 Avaya Inc. All Rights Reserved.

Avaya and the Avaya Logo are trademarks of Avaya Inc. All trademarks identified by ® and ™ are registered trademarks or trademarks, respectively, of Avaya Inc. All other trademarks are the property of their respective owners. The information provided in these Application Notes is subject to change without notice. The configurations, technical data, and recommendations provided in these Application Notes are believed to be accurate and dependable, but are presented without express or implied warranty. Users are responsible for their application of any products specified in these Application Notes.