INDeX IPNC Cassette

Administration Manual

38DHB0002UKDD – Issue 7 (22/11/02)

Contents

Introduction

Making Your System Secure

It is vital to your business that your system is secured. There are different aspects of security that your System Administrator should consider. This is particularly important for any system that supports dialled access and Internet connection. The IP Networking Cassette (IPNC) includes several security features to help prevent unauthorised access and it is recommended that you implement them as a priority.

It is your responsibility to provide additional security for your network and any sensitive information.

It is recommended that the System Administrator take the following steps:

1. Change the system passwords immediately after handover.
   See Changing Operator Profile Passwords on page 21.
2. Change the default password for user 'RemoteManager'.
   See Remote Operation on page 31.
3. Ensure that he or she and all users change their passwords on a regular basis, at least every 90 days.
4. Change all passwords if there is any doubt as to the integrity of the system or existing passwords.
5. Delete the user profile for members of staff who leave the company.
   See User Configuration on page 44 and the details for any data services which are removed.
6. Implement the Firewall facility
   See Firewall Configuration on page 58.
7. Carry out security checks on a regular basis.

It is also important to safeguard all software supplied with the IPNC. The software CD should be kept in a safe place and you should transfer your most recent configuration file to suitable media for safekeeping.

See Configuration Files on page 23.

Use of this Manual

This manual covers the installation/upgrading of an Avaya ™ IP Networking Cassette (IPNC) operating on software Level 3.2 and an INDeX system operating software Level 10.0+ or higher.

This manual basically consists of four parts as follows:

Part 1: Installation and Software Upgrades
Part 2: The Manager Application, Configuration Tree menus; their contents and use.
Part 3: A set of worked example in a **How do I?** section.
Part 4: Appendixes containing General Information/Concepts, an Overview of IP Routing plus port and cable details.

For installation of IPNCs operating a Level 2.0+, refer to issue 6 of this manual.

This guide is intended for use by installers who are familiar with the INDeX system and have successfully completed the appropriate INDeX training courses.

Ensure that you have read and understood this Guide before beginning installation.

The IP Networking Cassette Introduction

The INDeX offers the advantages of integrated voice and data communications to small and medium sized organisations. An IPNC provides a wide range of facilities and can support many applications, both at a single site and at dispersed locations. The IPNC provides fast flexible Internet access, implements e-commerce strategies, Remote Access Solutions and Voice over IP.

The IPNC Voice-over-IP solution can fully utilise all of the available bandwidth, providing significant line rental savings. The IPNC utilises voice compression techniques to optimise speech quality against cost and has up to 20 compressed voice channels (to G.723.1 / G.729a standards).

The IPNC is designed to provide a custom solution that is both easy to use and easy to manage, with secure data transmissions. Principal features of the products are:

- Secure Internet access and data services.
- Intranet / wide area capability.
- Dynamic addressing with an integrated DHCP server.
- TCP/IP routing.
- Dynamic bandwidth management for data services.
- Voice-over-IP (VoIP).
- Network Address Translation, for added Internet security and local IP addressing flexibility.
- Firewall to protect against intrusion from the Internet, the wide area, and by dial-in access.
- Remote Access Server (RAS) for custom dial-in data services.
- Remotely Manageable.
- Timebands - to restrict access to when, and only when, it is needed and authorised.
- Encrypted Passwords - to allow access only by authorised users. All data service activity is password-controlled.

The IPNC Hardware

The IP Networking Cassette is available as six variants as follows:

IPNC : Suitable for Internet Access only solutions.
All IPNCs are equipped with a minimum of two 64K B channels, an X.21/V35/V24 lease line port, one 10BaseT Ethernet port plus one auto-sensing 10/100BaseT Ethernet port.

IPNC-VC5: An IPNC with a 5 Channel voice compression module. Suitable for Internet Access or, if used with the LIC-IPNC32 Licence, remote access from TAs and Routers, and Voice over IP applications.

IPNC-VC: An IPNC with a 20 Channel voice compression module. Suitable for Internet Access or, if used with the LIC-IPNC32 Licence, Remote Access from TAs and Routers, and Voice over IP applications.

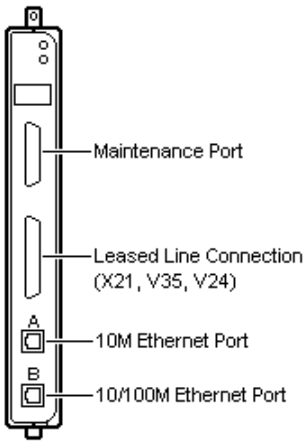
IPNC-M : An IPNC suitable for Internet Access and Remote LAN Access (includes four V.90 modems).

IPNC-M-VC5: IPNC with four V.90 Modems and a 5 Channel voice compression module. Suitable for Internet Access or, if used with the LIC-IPNC32 Licence, Voice over IP applications and Remote Access from TAs Routers, and Modems.

IPNC-M-VC: An IPNC with four V.90 Modems and a 20 Channel voice compression module. Suitable for Internet Access or, if used with the LIC-IPNC32 Licence, Voice over IP applications and Remote Access from TAs Routers, and Modems.

INDeX Licence Key (LIC-IPNC32)

An optional INDeX Licence Key (**LIC-IPNC32**) is available to upgrade from the basic two B channels to the full thirty-two 64K Channels. Required whenever there is a requirement for more than two simultaneous calls.



Each IPNC is supplied with a LAN Cable and Administration software on CD (CD-IPNC-ADMIN) containing:

- Installation Wizard – for easy initial configuration of system and Internet parameters.
- Upgrade Wizard – for upgrading operating software.
- The Manager - for configuration/administration of the system and its features.
- The Monitor - to display an on-line, time-stamped log of all call processing events, for all calls or selectively.
- An electronic manual.

The Boot Process

The boot process is shown in the diagram below. When reset the IPNC first checks for any directly connected Leased lines. It then checks its configuration, which is stored in “flash memory”.

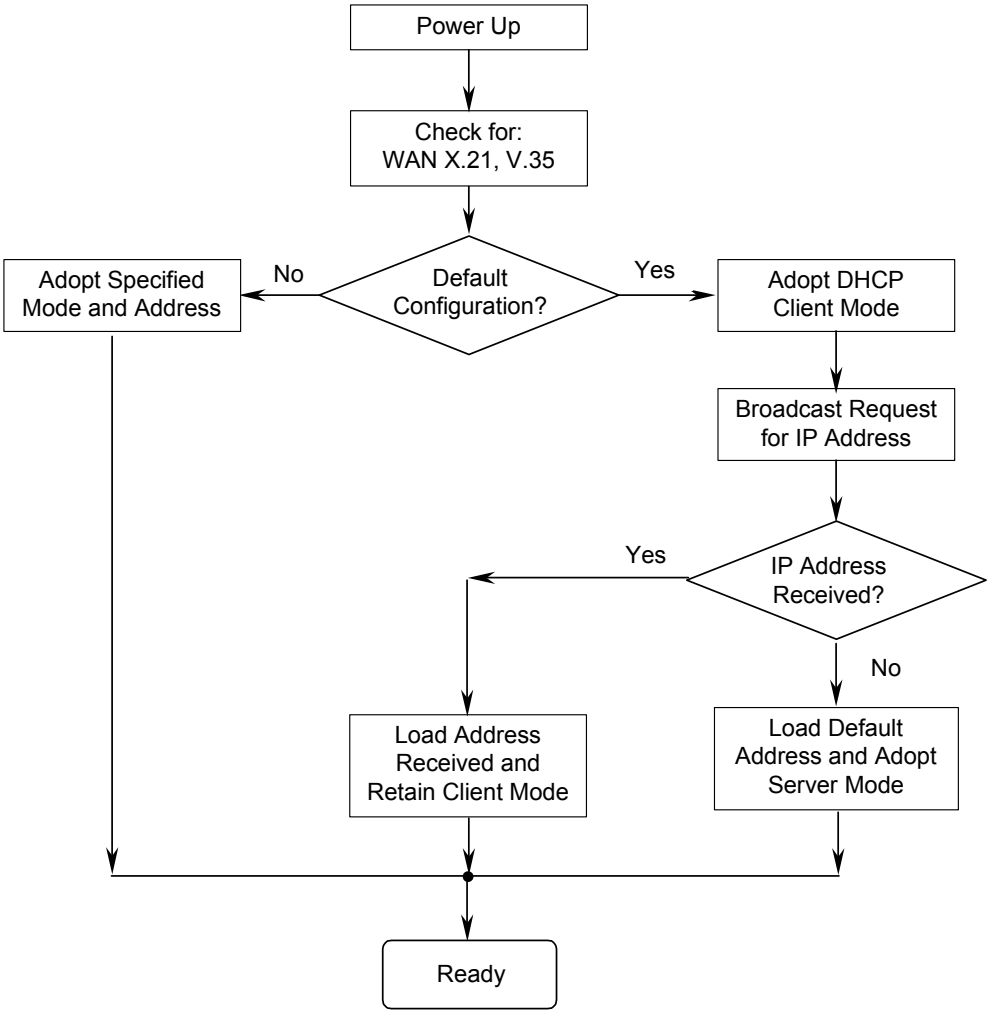
When first installed, the IPNC has a default configuration, which includes an IP address and specifies DHCP server operation. After initial configuration and subsequent changes, the flash memory may contain a different mode of operation and a new address.

Note: It is critical that any configuration changes *must* have been downloaded to the flash memory in order for them to be implemented at start-up. See Configuration Files on page 23.

If the IPNC has a non-default configuration and address value, it simply adopts the defined mode and address.

Alternatively, if the IPNC is in the configuration mode, it first adopts DHCP Client mode and broadcasts a request for an address. If it receives one, it assumes another server is present and adopts Client mode. If it does not receive an address, it adopts the role of a DHCP Server and will provide IP addresses to clients when they are requested as shown in the following diagram:-

The Start up Process



Installation into the INDeX

Overview

An IPNC (software Level 3.2) only runs on an INDeX system with Level 9.0+ or higher software. However, software Level 3.2 running on INDeX level 10.0+ are required to support IPNC tunnelled INDeX DT protocol for VoIP homeworking. The IPNC installs in much the same way as any other INDeX device cassette. Refer to the INDeX Installation & Maintenance and INDeX System Programming Manuals for details. The following is an overview of a typical installation procedure and should only be used for guidance.

1. Use the INDeX Administration/System/Switch Licence menus to enter the IPNC licence key (only required when using more than two channels, see page 6).
   – It is important to do this before inserting the IPNC to ensure the correct number of channels are allocated by the INDeX. If upgrading an IPNC (see page 9), it may be necessary to de-allocate the cassette before entering the new licence key and reinserting the cassette.
2. Insert the IPNC cassette. The INDeX will allocate directory numbers to the IPNC channels automatically. At default on INDeX level 10, the trunk interface is 'T' type.
   Use the INDeX Administration/Linecard Information menu to view and note the directory numbers.
3. Connect the IPNC cassette to the LAN.
4. The remainder of set-up is done through installing the IPNC software on a manager PC, see page 8.

Modem Set-up

The modem units within the IPNC cassette do not require any set-up for incoming calls. They operate using auto-detection of modem traffic on any IPNC channel. For outgoing calls, the use of the modem port is specified under the Service Configuration menu (see The PPP Tab on page 52).

Software Upgrading and Installation

Introduction

The installation Wizard installs the IPNC Manager application on the Administration PC.

Notes: 1. The Configuration Wizard is contained on the Administration Software CD (which can also be accessed by running Setup.exe). The CD will auto run unless this feature has been disabled on the PC.

2. The IPNC Manager application is common to both INDeX IPNC and Avaya IP Office systems. However, the IPNC Manager application **must not be** installed on a PC being used to administer an Avaya Alchemy system.

Installing Software Upgrade

The following details the steps necessary to upgrade an IPNC 2.2 to 3.2 software.

To do this, it is necessary to first load IPNC 2.2 (1076) software to update the IPNC loader firmware to version 1.7, which is required in order to load IPNC 3.2 software.

CAUTION: Before upgrading to 3.2 software, **you must make a hard copy** of the existing 2.2 configuration. This is necessary because, once the 3.2 software has been loaded, it is not possible to reload an existing 2.2 configuration file. The existing 2.2 configuration can then be re-typed into the 3.2 Manager application.

Notes: 1. In the following, all commands in bold type are case sensitive and should be entered as specified.

2. In the following, it is assumed that the CD is in Drive D.

Upgrade Steps	Explanation
Step 1 Connect a terminal to the IPNC's DTE maintenance port (see page 6). Open HyperTerminal (or similar) to communicate with the IPNC. Type **at** to test the connection. The IPNC should return, 'OK' if the terminal is correctly configured.	In order to access the DTE port the HyperTerminal must be configured to operate as follows:- 38400, 8, N, 1
Step 2 Save the current IPNC 2.2 configurations files to a new folder. Make a hard copy of the existing 2.2 configurations.	In case it is necessary to abort the upgrade and return to the 2.2 build, you will need the configuration files. This hard copy will be needed for re-typing into the new 3.2 Manger application.

Upgrade Steps	Explanation
Step 3 Uninstall the existing IPNC 2.2 Manager software from the PC. Install the new IP Office Admin Suite 3.2 from the CD, see page 13.	Failure to un-install the 2.2 build will result in software clashes. The installation procedure is similar to installing a new system.
Step 4 Open the IPNC Manager from Program Files\Avaya\IP Office Admin Suite. (Administrator default password is *Administrator*.) From File|Change Working Directory ensure that the working directory is set as: C:\Program Files\Avaya\IP Office\Manager.	**Note:** This may have been set to: C:\Program Files\Alchemy\Manager by default.
Step 5 In the directory C:\Program Files\Avaya\IP Office\Manager rename the file *nadrcii.bin* file to *nadrciiold.bin*. This is the 3.2(19) software. Use Explorer to copy the nadrcii.bin file from the D:\bin\2.2(1076) directory on the new CD to the directory C:\Program Files\Avaya\IP Office\Manager. This is the 2.2(1076) software.	The original nadrcii.bin (now called nadrciiold.bin) file will need to be renamed to nadrcii.bin to upgrade to 3.2 firmware described later in Step 13
Step 6 From the IPNC Manger, open UpgradeWiz (File|Advanced|Upgrade). Right click in the UpgradeWiz window and Select Directory as D:\bin\2.2 (1076). Select the nadrcii.bin file, click **OK**. In UpgradeWiz, 2.2 (1076) will appear as Available. Click **Upgrade** to load the 2.2 (1076) firmware image to the IPNC. **Note:** It is preferable to use a static IP address from the PC configured to the IPNC subnet.	The IPNC 2.2 (1076) build is only required to upgrade the IPNC Boot Loader from version 1.3 to 1.7. Boot Loader 1.7 is required to support IPNC 3.x firmware. **IPNC 2.2 (1076) firmware must not be used operationally. It is for upgrade purposes only.**

Step 7
When the IPNC reboots and is operational with IPNC 2.2(1076) firmware, type the following command on the DTE maintenance port (see Step 1).
at-debug
This will return the following prompt
`<DRC Manager Version 0.1>`
`Tue 27/8/2002 11:18:51, Hello>`
	When the IPNC is operational the Green status LED should be 'on' and Red status LED should be 'off'.
	The upgrade, via UpgradeWiz, shows the rebooting sequence. If the upgrade process finishes and says it has failed, ignore and press **OK**.

Upgrade Steps	Explanation
Step 8 At the debug prompt type the following command: **ipoffice**	

Step 9
If the previous steps have been followed correctly and the upgrade is successful thus far to loader version 1076, an output similar to the following will be shown.
`Tue 27/8/2002 11:30:28, Hello>ipoffice`
This is irreversible. Continue (Y/N)?
Press **Y** on the keyboard.
	If the previous steps have been followed correctly and the upgrade to 1076 is successful the following output will be shown.
	`New Boot Sector process`
	`Checking new loader code`
	`New loader code checksum = 0x2EABEEAC, (wanted 0x2EABEEAC)`
	`Saving current feature table`
	`Mac address is 00E007005C27`
	`**********`
	`ERASING and PROGRAMMING LOADER`
	`**********`
	`**********`
	`DONE`
	`**********`
	`Tue 27/8/2002 11:31:28, Hello>`

Step 10 Reboot the IPNC by typing the following command at the debug prompt. **reboot** e.g. `Tue 27/8/2002 11:31:28, Hello>` **reboot**	
Step 11 When the IPNC has finished the boot sequence and the green LED comes on and the Red LED is off, unplug the IPNC from the INDeX.	

Step 12
In order to confirm the IPNC is running the 1.7 Loader image, plug in the IPNC and press 'Esc' on the keyboard within 3 seconds.
The following output will be shown indicating the upgrade procedure is successful.
`P5 Loader 1.7 (2MB-2xF800 Flash-120nS SDRAM-10)`
`CPU Revision 0x0502`
To quit this mode and continue at the prompt sequence type: **atf**
	Pressing the 'Esc' in this way causes the IPNC to stop the image load to allow direct access to the loader mode.

Upgrade Steps	Explanation
Step 13 Once the IPNC has been restarted load the IPNC 3.x firmware using the Manger UpgradeWize (File|Advanced|Upgrade). In step 2, the nadrcii.bin was renamed nadrcii.old. For the 3.2 version of IPNC firmware this **must be** renamed back from nadrcii.old to nadrcii.bin. The 2.2(1076) bin file can be renamed appropriately.	**Note:** Loader v1.7 is compatible with IPNC 2.2 or 3.2 software for operational use. If IPNC 3.2 is to be loaded then the loader must be v1.7. When the upgrade via the wizard shows the rebooting sequence. If the upgrade process finishes and says it has failed, ignore and press **OK**.
Step 14 Check the firmware variant by opening the upgrade wizard again and see the Unit build number (3.2/19)	To prove that upgrade is successful use the Refresh button on the Upgrade Wizard to update the display. Confirm that the version shown in the Version column is the same as that shown in the Available column.
Step 15 Restart the IPNC with 3.2 software and ensure that it is defaulted to factory settings as follows: Using IPNC Manager: Open File|Advanced|eraseConfig (factory Default). **Or** Using HyperTerminal: Unplug the IPNC. Plug in the IPNC and press the 'Ecs' key every second until the Loader message appears. Enter **AT** return Enter **AT-X2** return Enter **AT-X3** return Unplug the IPNC and plug in again.	When connecting for the first time via the Manager after defaulting, please check that the DHCP Server address range is 200 to LAN 1 and LAN 2. If these are blank then DHCP will fail.

Installation of a New System

At initial start up or reset, the IPNC searches for an IP address from any available DHCP server. If an IP address is found, the IPNC adopts a DHCP client mode and accepts the address. Alternatively, an IP address is not found, the default IP address is loaded and the IPNC adopts DHCP server mode. See The Boot Process on page 7.

The IPNC may be connected, via a hub, to an existing LAN that uses either static or dynamic addressing.

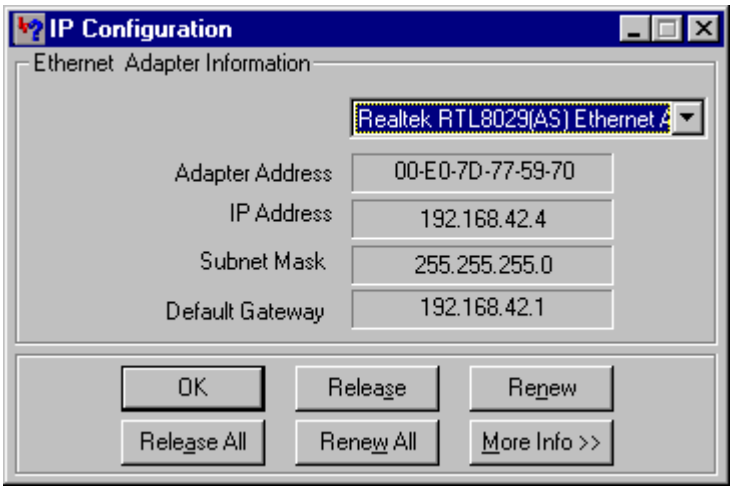
It is simpler to ensure that the manager PC is set to automatic IP addressing (using DHCP) before proceeding. See Dynamic IP Addressing on page 14 and Addressing on the Local Subnet on page 33.

Static IP Addressing

The following paragraphs detail the configuration requirements for static IP addressing of the Administration PC which will be used to configure the IPNC.

To examine the IP configuration, use Start/Run/winipcfg (Windows 95/98). On win 2000/NT/XP use the DOS command ipconfig; this command is used to control IP address allocation/status.

A screen similar to the following example will be displayed:



For an explanation of the IP terms used in this and other menus, see Appendix C: Overview of IP Routing on page 125.

In the example shown above, the Release and Renew buttons are inactive as static IP addressing is in force. If the Manager PC is connected to a network with static addressing, make a note of the IP address as you will need it later during the configuration procedure.

A PC with static addressing will fail to communicate with the IPNC if it has been configured for a different network. If your PC fails to communicate with the IPNC at the beginning of the procedure, check that it is set to automatic addressing (see page 14).

Dynamic IP Addressing

The following paragraphs detail the configuration requirements for dynamic IP addressing of the Administration PC which will be used to configure the IPNC.

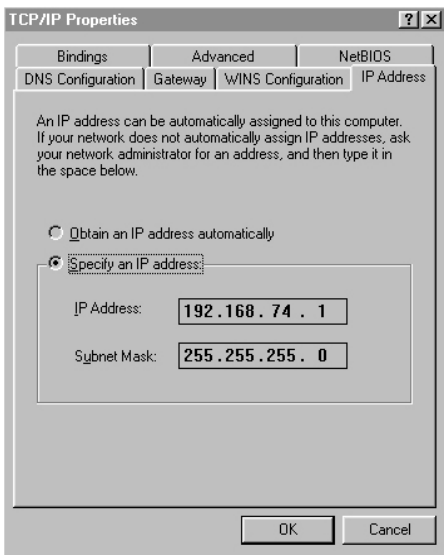
To examine the IP configuration, use Start/Run/winipcfg (Windows 95/98). On win 2000/NT/XP use the DOS command ipconfig; this command is used

To change to DHCP/automatic addressing either:

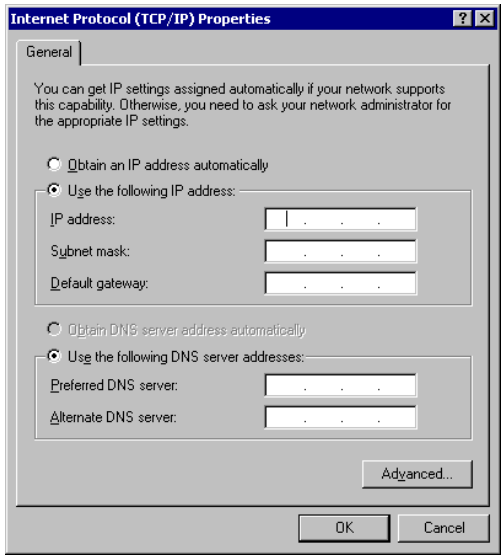
For Windows 95/98: Right-click on the Network Neighbourhood icon or use *Start |Settings |Control Panel* and double-click on the Network icon. From the Network Configuration panel, select the TCP/IP protocol and click on Properties. In the Properties panel, shown below, click on **Obtain IP Address Automatically**. It may then be necessary to re-boot the PC to implement the change.
Or
For Win 2000/NT/XP: Use *Start |Settings |Control Panel* and double click on the Network and Dial-up Connections icon. Select the Local Area Connections icon, right click and select Properties. Highlight the Internet Protocol icon and select Properties again.

In the Properties panel, shown below, click on **Obtain IP Address Automatically**. It may then be necessary to re-boot the PC to implement the change.

Win 95/98



Win 2000/NT/XP



For a dynamic addressing/DHCP network, the winipcfg *Release All* and *Renew All* buttons can be used to change the adapter's IP address, (without the need to re-boot). For Windows NT, at the system prompt, use IPConfig /Release and IPConfig/Renew instead of Winipcfg.

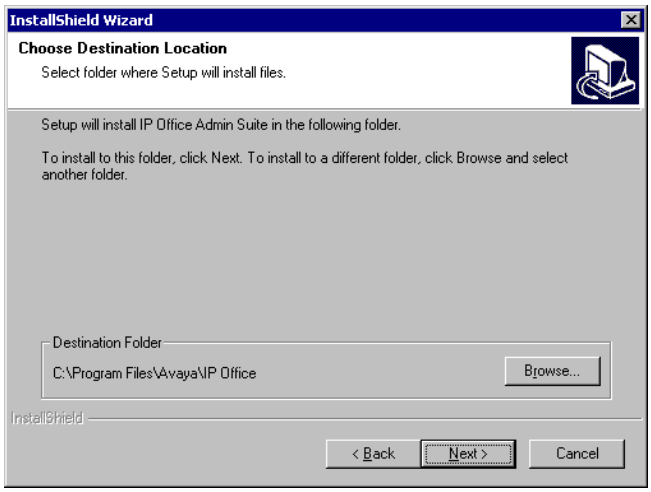
Installation Procedure

The following details the procedures for installation of a **new** system using the Configuration Wizard found on the Administration CD. Alternatively, if you are upgrading the software on an existing IPNC, see page 9.

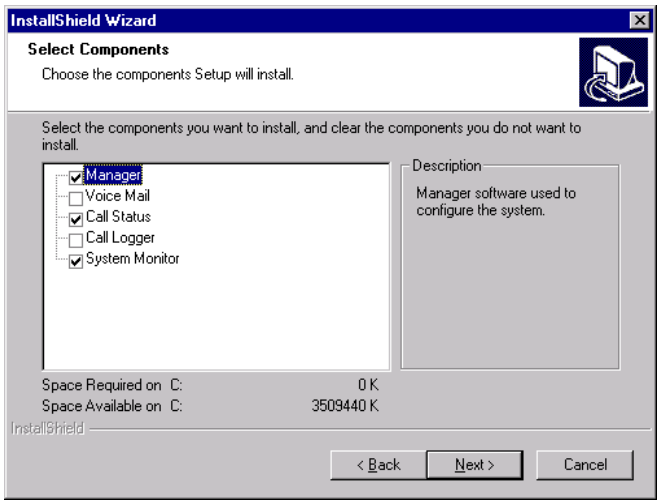
CAUTION: When upgrading an IPNC to level 3.2, the IPNC must be returned to it's factory default settings. Hence it is strongly recommended that, when upgrading a previously configured system (see Installing Software Upgrade on page 9), a hard copy of the system's operational configuration settings is made.

Perform the following instructions for installation of a **new** system:

1. Insert the Admin Software CD (which should self start unless this feature has been disabled on the PC). Read the Welcome screen and use the **Next** button to proceed.
2. The Choose Destination Location menu is displayed. Either accept the default location, by clicking on **Next**, or click on **Browse**, enter your own location and then click on **Next**.



3. At the Select Components menu, tick either **Manager**, **Call Status** and/or **System Monitor** boxes only.



Click **Next**. The Select Program Folder menu is displayed. Either, click **Next** to accept the default, or change the Program Folder and then Click **Next**.

4. The Setup Status menu runs and when completed click **Finish** to exit the Installation Wizard.

The Manager Application

Introduction

The Manager Application is the configuration and management tool for all functions of the IPNC. Since the Manager is common to other Avaya products (e.g. the Alchemy range) some fields are redundant, these will be clearly identified in subsequent sections.

Each operator has a profile that defines the range of tasks he/she is permitted to carry out. All profiles are password protected. This Section explains:

– How to start the Manager and obtain a configuration file to edit
– The general use of the Manager
– Defining operator profiles
– Using the Manager's File menu.

Also included are useful maintenance procedures, such as the remote use of the Admin PC, enable/disable DCHP, etc.

Note: The Manager Help also runs from CD and can be accessed directly.

Starting the Manager

To start the Manager application perform the following:

1. Use Start | Programs | IP Office | Manager.
   The Operator Name and Password prompts are displayed.

Note for New Installations
A valid operator name and its associated password is required to start the Manager application. The default conditions are:

Operator name : *Administrator* **Password :** *Administrator*

The Administrator has full access to all configuration menus and is the only operator who can create, delete and edit operators' profiles.

When an operator logs on to the Manager and opens a file, only their permitted functions are displayed.

If you are starting the Manager for the first time, log on as 'Administrator'. For security reasons, you **must alter the password**, and ideally create new profiles (see Changing Operator Profile Passwords on page 21).

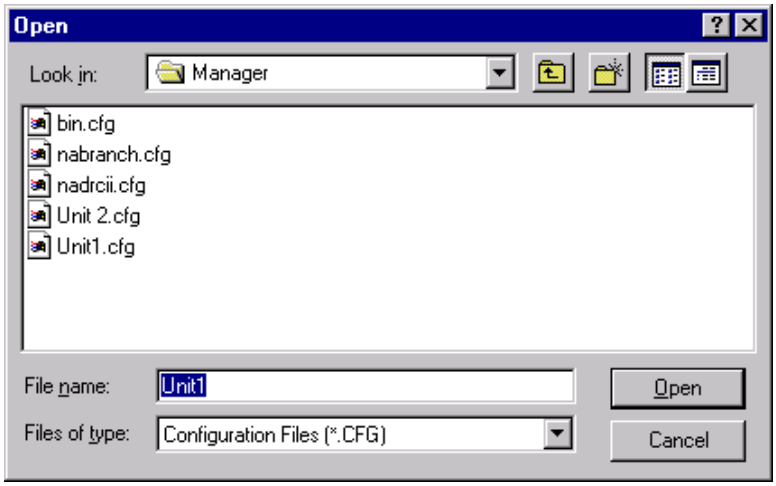
2. Enter the operator name and password, and click on OK.
   The Manager is then opened. Use the **File** menu to open a configuration file for editing or viewing.
   There are two ways of doing this:

3. **File/Open** (or click on the **File** icon in the task bar)
   This will retrieve the currently-active configuration file from the IPNC once the password has been entered, by default 'password'. If you do not receive this menu, see Installation of a New System on page 13.

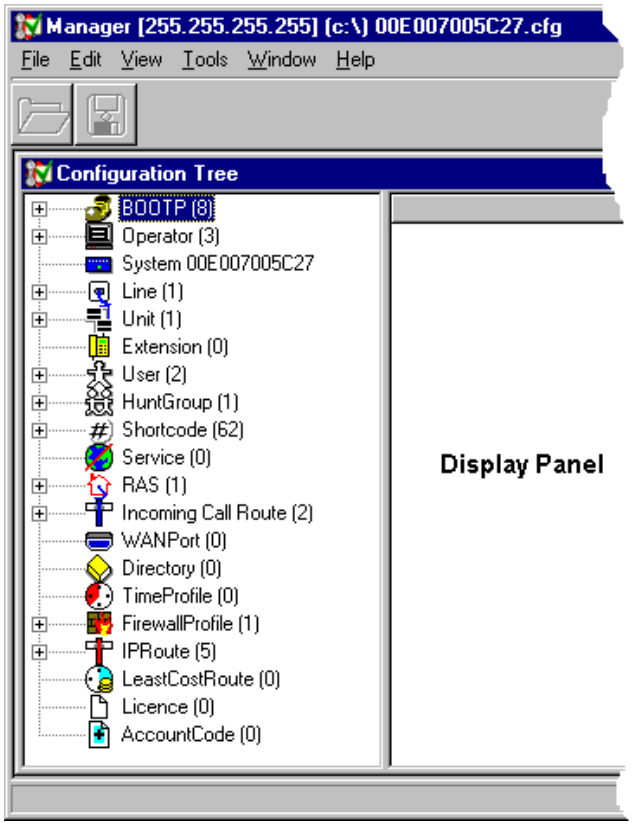
   Proceed from step 4.

4. **File/Offline/Open File**
   Permits changes to be made to a non-operational file.
   Proceed from next step.
   Configuration Files on page 23 gives more details about the **File** menu.

5. If you have just installed a new IPNC, you must first extract the configuration file from the system to transfer it to the Manager folder, as follows:
   a) **File | Offline | RecvConfig** (the default file name is shown with the extension .cfg.)
   b) Enter the local access password (see Changing Operator Profile Passwords on page 21)
   c) Either, click on the file icon or use **File | Offline | Open File**, to open the required file.
   Alternativilty, if changes are to be made off-line, select **File | Offline | Open | File**. The Manager then lists the configuration files (with the extension *.cfg*). Select the required file and click **Open**.



6. The Configuration Tree for the file is then displayed as shown below.



Each of the “branches” represents a different Manager function. In the example shown, the Administrator has logged on and all functions are displayed. By clicking on a function icon a summery list for that function is shown in the Display Panel.

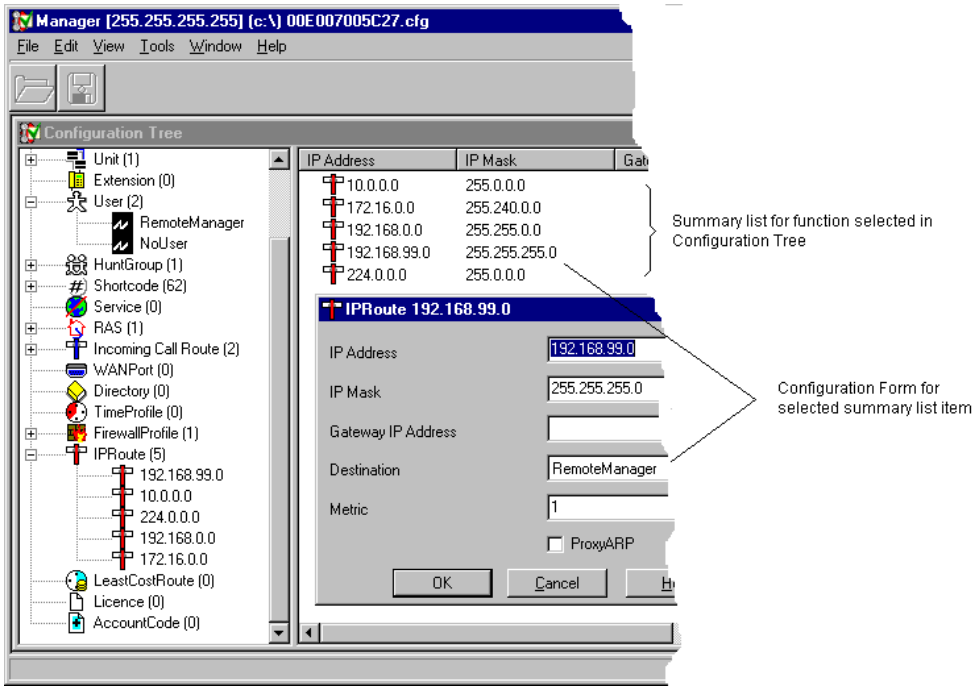
General Use of the Manager

The list of items in the Manager's Configuration Tree corresponds to the access rights of the operator who is currently logged on, i.e. whose name and password has been entered.

CAUTION: Operators should always log off at the end of a session, to prevent unauthorised use of the system (see Configuration Files on page 23).

In the example of the Configuration Tree shown below, the operator has full access rights. Clicking on any one of the items in the Configuration Tree produces the summary list for that function in the Display Panel.

To edit an item in the summary list, highlight the item's icon and right click the mouse button. Select **Edit** from the menu (double-clicking on an item will also display the menu). The Configuration Form for that item will be displayed (see The Configuration Forms on page 20). In the example shown, **Edit** has been selected to review/change the definition of the IP route for 192.168.0.0 (Remote Manager).

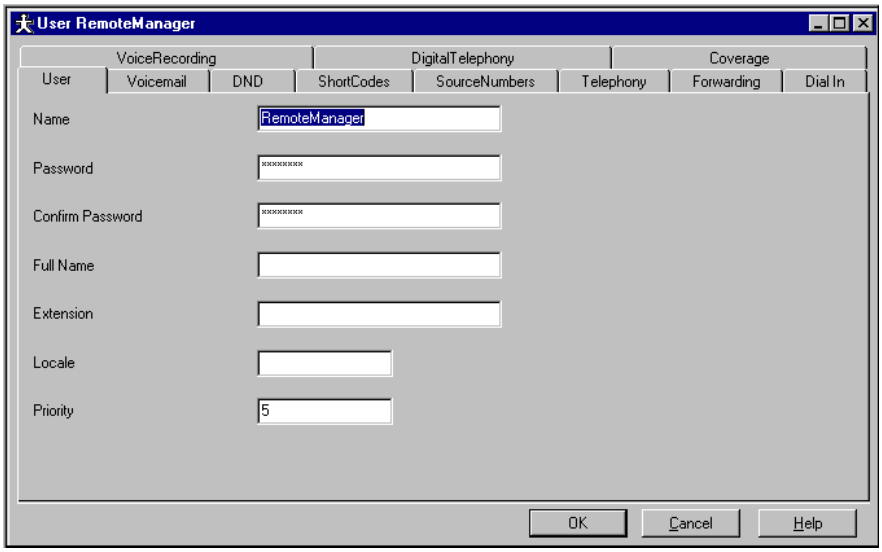


If a Configuration Tree function contains no entries, i.e., there is no summary list, click the right mouse button in any part of the Display Panel to obtain the toolbox. Select **New** to create a new item.

The Display Panel has scroll bars so that the selected summary list can be viewed in full. Also, by clicking on the name in the sort bar, the display order is changed (this is a toggle function).

The Configuration Forms

For any item in a function's summary list (see General Use of the Manager on page 19) configuration values are specified by completing forms. There may be one or more forms to complete, depending on the function concerned.
A Configuration Form consists of a series of fields in which the correct value(s) must be entered. Click on a field to enter a value into it. Use the mouse or the tab key to move from field to field.

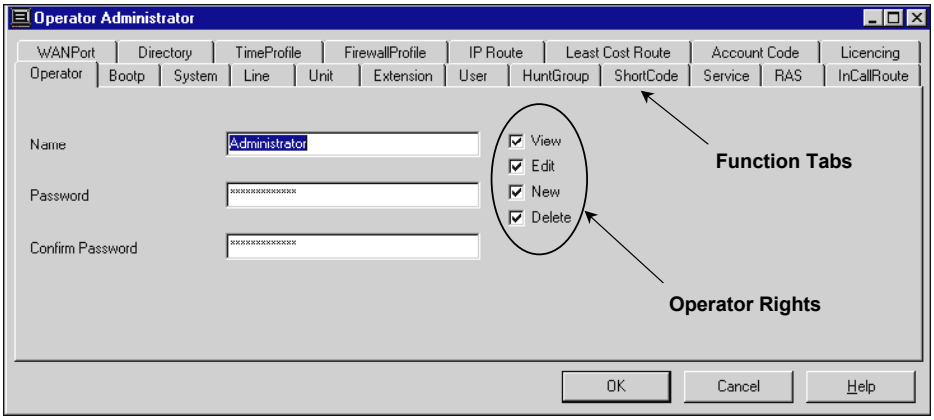


The example above shows a User Configuration Form (also see page 44). In this case, several forms are needed to make a complete user profile. Click on the tabs to move through the ones you need to complete or change and enter the necessary details. Click on **OK** when you have completed the last one. The changes you have made are then reflected in the summary list.

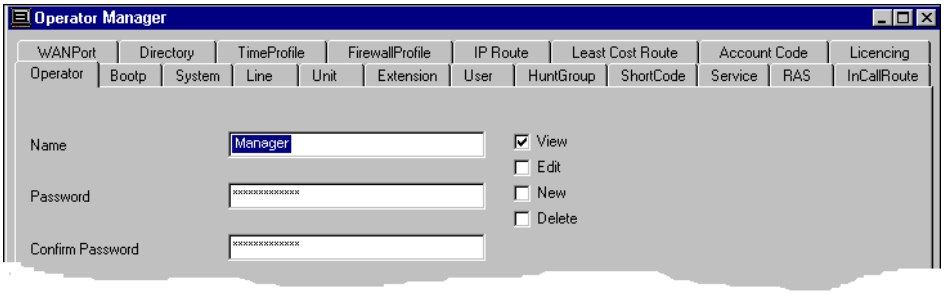
When a configuration has been changed *it must be saved and sent to the* IPNC before it is implemented (see Configuration Files on page 23).

Operator Profiles

In order to safeguard the security of the system, it is strongly recommended that the Administrator creates a suitable set of operator profiles that are granted only the access rights they need. In the default configuration, only the Administrator can create or alter operators. Hence you must change the Administrator's password, but **do no**t make changes to the profile unless you are sure you have created another with full rights. The default Administrator's profile is shown below:-



The default profiles are for Administrator, Operator and Manager. The latter two only have the right to *View* and not to *Edit,* create *New* or *Delete* a profile as shown below:

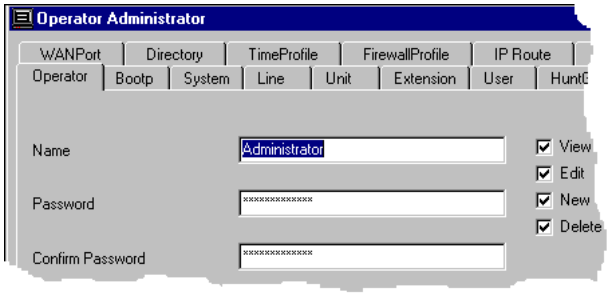


The functions tabs, across the top of each profile menu, reflect the functions listed in the Configuration Tree. However, there are some tabs (functions) that are not pertinent to IPNC. This is because the Manager application is common to both the IPNC and the IP Office platform. It is recommended that, when creating new operator profiles, you delete unnecessary tabs (see page 22 for details), e.g. Incoming Call Route.

Changing Operator Profile Passwords

Passwords can be changed locally, at the Admin PC, without the need to re-boot the IPNC. To change the password:

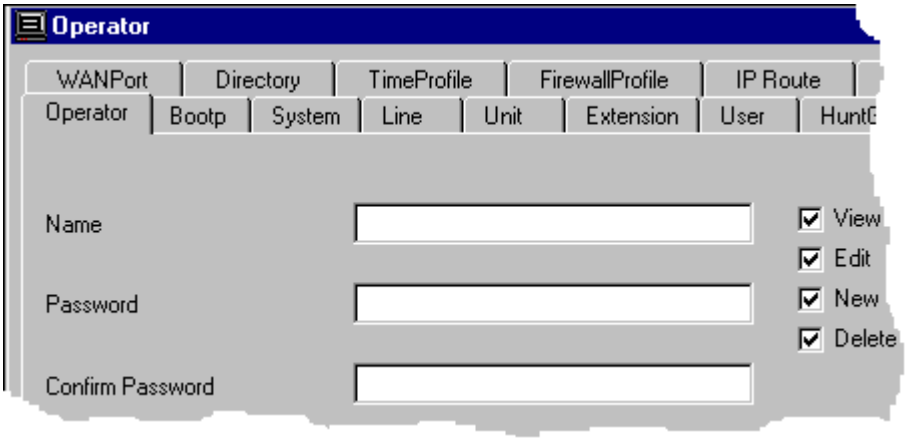
1. Log on with the existing operator name and password, and select **Change Password** from the **File** menu:



2. Click in the Password box and enter the new password.
3. Click in the Confirm Password box and enter it again.
4. Click on **OK**.

To Create an Operator Profile

1. Log on with operator name and password *Administrator* (the default name and password which must be changed at the ealiest opportunity (see Changing Operator Profile Passwords on page 21).
2. In the Configuration Tree, click on **Operator** and then right click in the Display panel and select **New** from the menu. The following blank profile is displayed:



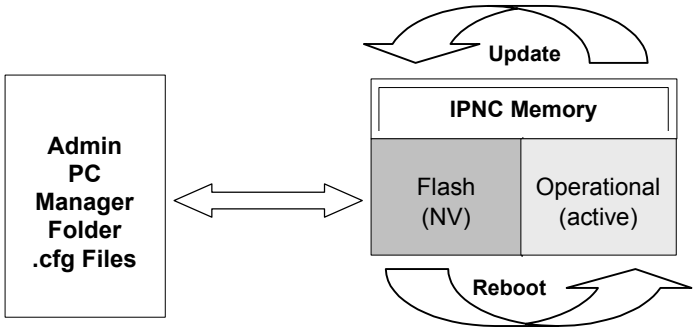
3. Click the Operator tab, enter the operator's name and a **new** password. Repeat the new password in the Confirmation box.
4. Tick the boxes according to the rights the new operator is to have. E.g. if only **View** is ticked, then this new operator is not allowed to make changes to any profiles.
5. Move through the other tab functions (the operator's rights are in the boxes on the left and the facilities that they apply to are on the right) and select the appropriate rights.
6. There are some tabs (functions) that are not pertinent to IPNC. This is because the Manager application is common to both the IPNC and the IP Office platform. It is recommended that, when creating new operator profiles, you delete the following unnecessary tabs.
   Directory/Least Cost Route/Account Code/Licencing/ Extension/HuntGroup//InCallRoute.
   To delete a fuctional tab from view, ensure that the **View** box is not ticked. Hence, when you log off and then log on* again with this operator profile, these functional tabs will not be displayed.
   * Use **File | Offline | Open File** and then acces the new .cfg file from Avay/IP Office/Manager when logging on again.
7. Press **OK** when the profile set up is complete.
8. Use **File | Log Off** to close the configuration file.
   Notes:
   1. Ensure that the operator knows his or her password and appreciates the need to keep it secret.
   2. A View-only operator can save changes to the configuration file locally (at the Admin PC) but cannot send a configuration to the system. An "Access Denied" message is displayed if an unauthorised attempt is made.
   3. Do not leave the Admin PC unattended whilst logged on - especially if you are an administrator.
9. Always use **File | Offline | Send Config** to implement changes to operator profiles. If a new operator is created "offline", they can log on immediately, but access restrictions are not in place until **Send Config** is used to reboot the IPNC and hence implement the changes (see page 27).

Configuration Files

The operational configuration files (with the extension .cfg) for the IPNC are stored:

- On the Admin PC in the Manager folder
- In the IPNC's Non-Volatile flash memory
- As the active file in the IPNC's Operational memory.

For management of the .cfg files, the IPNC can be viewed as having two memory areas as follows:



The IPNC Operational memory contains the **active** .cfg file. This active file can be updated by the IPNC itself (with changes made by users, softphones, etc.). The IPNC updates it's flash memory in two ways:

1. At midnight, provided that the IPNC is idle.
2. When an *Immediate* or *When Free* reboot is requested on a **Save** or **SendConfig** instruction from the Manager (see pages 25 and 27).

Most functions, within the .cfg files, that are sent from the PC to the IPNC's flash memory only become active when the IPNC is re-booted. However, when the **Merge** option is used, some become immediately operational. These are shown in the following table:

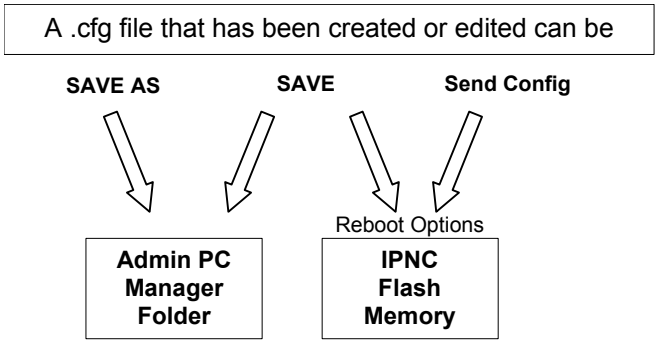
Configuration Tree Functions	Mergeable
System	No
Line	No
Unit	No
User	Partial
Shortcodes	Yes
Service	Yes
RAS	No
WAN Port	No
Time Profile	No
Firewall	No
IP Route	Yes
Least Cost Route	Yes

Opening/Saving Configurations Files Overview

Configuration files can be **opened** in different ways as follows:

- Retrieve the current .cfg file **from the IPNC**'s flash memory and **open** it in the Manager application. The Configuration Tree for the current .cfg file will be displayed (see page 25). This file can then be edited but will not become fully operational until the IPNC is rebooted (see page 25).
- Receive the current .cfg file **from the IPNC**'s flash memory and **store** it in the Manager application. The Configuration Tree for the current .cfg file will **not be** displayed (see page 27) until the file is **Open**ed (see page 27). When the file is opened it can be edited but will not become fully operational until the IPNC is rebooted (see page 25).
- Select and **open** any of the .cfg files stored **within the Manager** application. The Configuration Tree for the select .cfg file will be displayed (see page 27). This file can then be edited but will not become fully operational until the IPNC is rebooted (see page 25).

Configuration files that have been created/edited can be **saved** in different ways as follows:



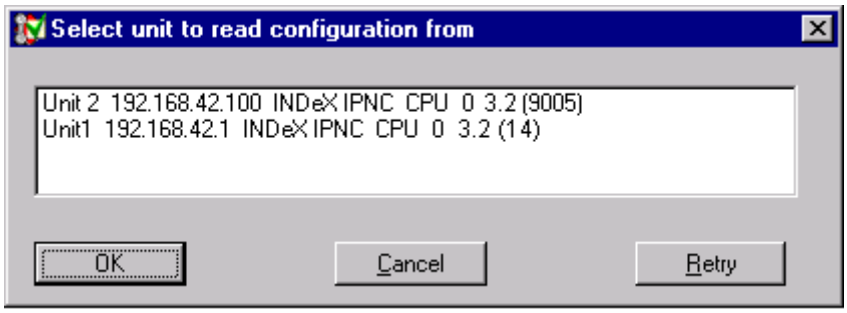
- The **Save As** option will only save the .cfg file in the Manager folder on the Admin PC and will not become operation until sent to the IPNC and the IPNC is rebooted (see page 27).
- The **Save** option will store the .cfg file in **both** the IPNC's flash memory and the Manager folder on the Admin PC. This file will not become fully operational until the IPNC is rebooted. You are then given options as to when you wish to reboot (see page 25).
- The **Send Config** option will store the .cfg file in **both** the IPNC's flash memory and the Manager folder on the Admin PC. This file will not become fully operational until the IPNC is rebooted. You are then given options as to when you wish to reboot (see page 27)

Note: The **Save** option is useful for retaining configuration files which are in the process of being changed.
If substantial changes have been made to a configuration file, it is advisable to save the existing configuration under a different name, as a fallback (use **File** | **Save As**). A back-up should also be made of the current configuration, to a suitable archive medium, and stored in a safe place.

The File Menu

Open

This option (alternatively, you can use the file icon) extracts the currently operational configuration file(s) from the IPNC's flash memory (see page 23). If there are multiple IPNCs, then the window shown below is displayed. Select the required IPNC and then click **OK**. In all cases you are then requested to enter the local access password.

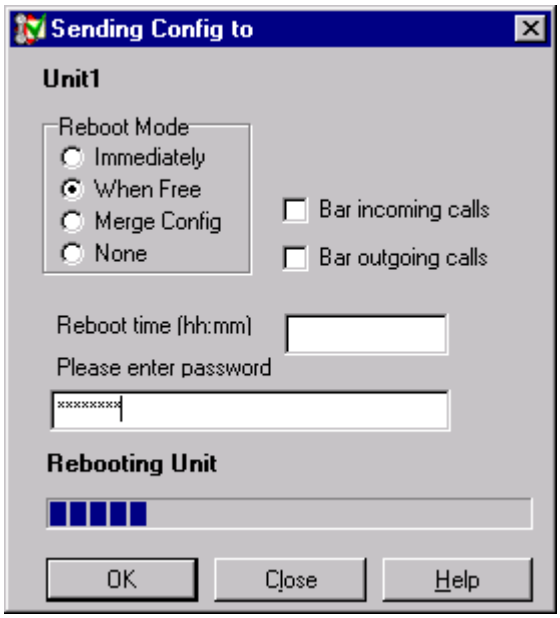


Close

This closes the current configuration file. If not already saved, you will be asked to save the file (see **Save** and **Save As** below).

Save

This option (alternatively, you can use the disk icon) saves an open configuration. When working locally, the file is saved in both the Managers working directory (see **Change Working Directory**) and in the IPNC. (If you are still using the default passwords, you will receive a warning.) When **Save** is selected locally, you are asked when you wish to reboot as follows:



The new .cfg file is activated only when the IPNC has been re-booted. You can choose to re-boot **Immediately**, which may disrupt service, **When Free**, or by **Merging Config**. Merging is only available for certain parameters and avoids the need to reboot (see page 23).

Note: The options to reboot the IPNC are also given when you send an edited .cfg file to the IPNC (see **File | Offline | Send Config** on page 27).

Save As

This option allows you to name and save a file (with a .cfg extension). When working locally, the file is saved to both in the working directory (see **Change Working Directory**) and in the IPNC. (If you are still using the default passwords, you will receive a warning.) When **Save As** is selected locally, you are asked when you wish to reboot (as show above in **Save)**.

When **Save As** is selected offline, the edited file is only saved to the working directory of the Manager on the Administration PC. **Save As** does not send the file to the IPNC for implementation until the IPNC is rebooted (see **File | Offline | Send Config** on page 27).

Change Working Directory

This option allows you to change the working directory from the default C:\Program Files\Avaya\IP Office\Manager by browsing through your folders in the usual way.

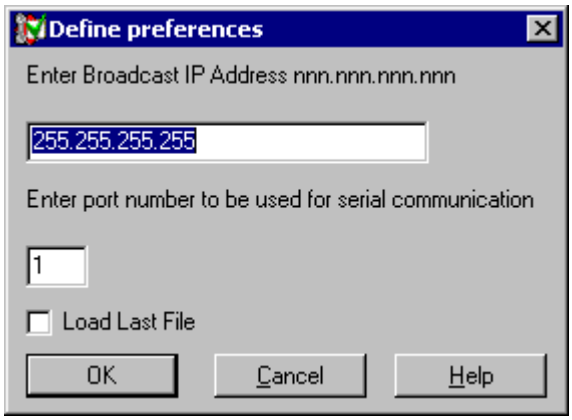
Change Password

This allows the operator who is currently logged on to change their password as described in the Changing Operator Profile Passwords on page 21.

Preferences | Edit

This option allows you to specify:

– A specific IP Address can be specified for remote access to a customers' sites or left as the Default 255.255.255.255 for local access
– The serial comms port number (Default 1) of the Admin PC.



Offline

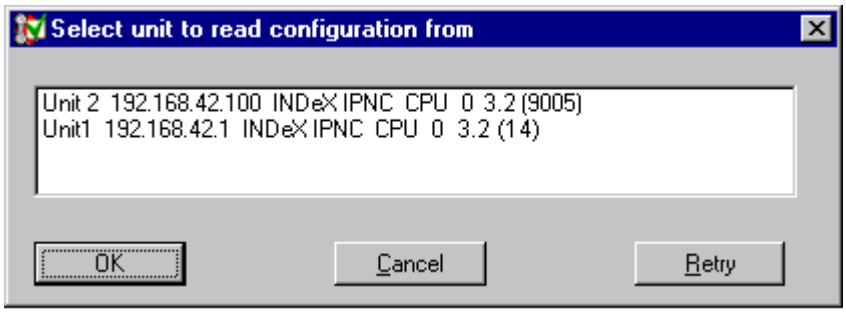
This produces three further options that can be used to edit and save a configuration file that has previously been extracted from the IPNC. Used when configuration is to be carried out off line:

Open File

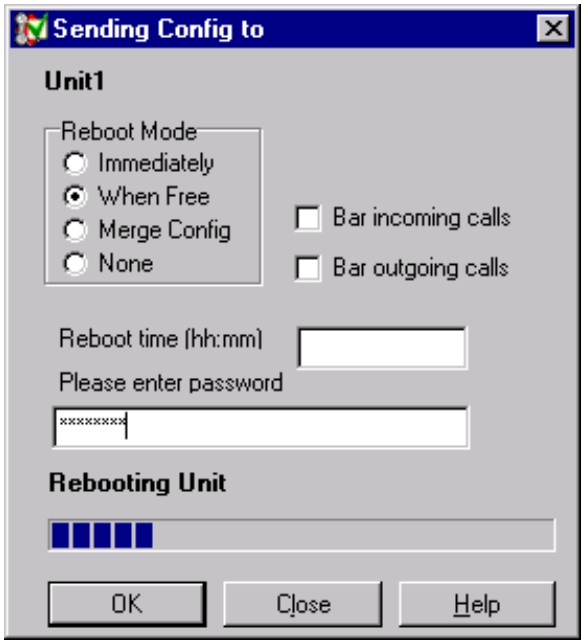
This opens a configuration file menu held in the Manager folder of your PC. When **Open File** is clicked, use Avay/IP Office/Manager and select, from the list of .cfg file in the Manager folder, the required configuration file and click on **Open** (also see page 25).

SendConfig

1. Where multiple INPCs are in use, your IPNC's identity is displayed in the "Who Is" window. Select the required IPNC and then click **OK**. The **Send Config to** screen is displayed (see the next step).



2. Where a single IPNC is in use, the **Send Config to** screen is then displayed. The new .cfg file is activated only when the IPNC has been re-booted. You can choose to re-boot **Immediately**, which may disrupt service, **When Free**, or by **Merging Config**. Merging is only available for certain parameters and avoids the need to reboot (see page 23).



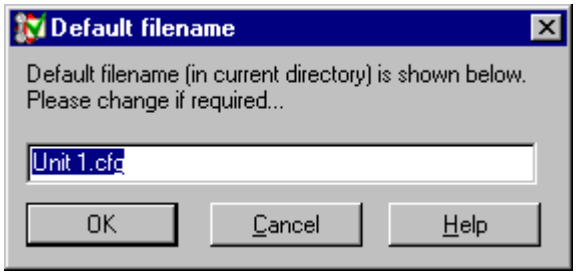
Enter the password and click OK.

Note: The **View** menu **TFTP log** gives a list of all transactions when sending a new configuration file or rebooting and can be used to monitor the process.

RecvConfig

This option extracts the currently active configuration file from the IPNC's flash memory and sends it to the Manager's working directory on your PC. This guarantees that you have the current file to work on.

1. Where multiple INPCs are in use, the "Who Is" Screen (see ***SendConf*** above) is displayed first. Highlight the required IPNC, click on **OK** and proceed from step 2.
2. You are prompted to confirm or change the target filename.



3. Click **OK** and at the "Continue?" message click **Yes**.
4. Enter the passcode, click **OK** and the file is transferred.
5. Use **File | Offline | Open File** (see above) to display the configuration.

Advanced

Selecting this produces three options:

Erase Config

This restores the configuration in the units flash memory to the factory default and should only be used under the direction of an INDeX Business Partner.

Selecting this option produces the “Who Is” window followed by a request to enter the local access password. The erase request is then sent and a confirmation message appears at the bottom of the screen.

Note: Always make a copy of your current configuration file to a back-up folder on the Admin PC, as well as making a separately-stored archive, to allow a quick recovery - see Backup/Restore below.

Restoring the default configuration also restores default passwords - the local access default is “password” and the remote access default is “thepword” as configured against the RemoteManager user.

If, for some reason, LAN connections are lost, the serial port can be used for this procedure as described in Appendix 1.

Reboot

This option produces the Reboot windows described in SendConfig on page 27. In normal operating circumstances it should not be necessary to reboot your system and this should only be carried out on the advice of an INDeX Business Partner.

Upgrade

CAUTION: This option is only used to load new versions of software above Level 3.2. To upgrade from 2.2 to 3.2, only use the proceedure listed in Software Upgrading and Installation on page 9.

Software upgrades are available from the Avaya web site (http://www.avaya.com).

The new files have .bin extensions. Upgrades can only be loaded from an Admin PC connected to the local subnet, i.e., not by remote access.

Selecting this option produces theUpgradeWiz which, in this case, lists all the configured units associated with your IPNC. Select the one you wish to upgrade. When the password window is displayed, enter the local access password and check that the file shown is correct. Use Browse to locate another if necessary.

Backup/Restore

This option contains two choices:

Backup
This allows you to create a back-up of a configuration (.cfg and.bin files) to a selected directory. Note that there is no confirmation when the process is complete.

Important Note: Users should always keep a back-up copy of the current configuration in a safe place, in accordance with their local disaster recovery procedures - also keep a back-up in another directory on the Admin PC for a quick re-start, if necessary. Before making substantial changes to an existing configuration, it is good practice to check that there is a working copy of the existing configuration as a fallback. Backup copies should be checked routinely to ensure that the files are readable.

Restore
This allows you to select the directory in which your backup files are held (the files are not listed when the directory is selected - use Explorer or similar to check) and copy them to the current working directory.

File/Import/Export Directory

This menu is not used by the IPNC.

Log Off

This logs off the present operator, closes the currently open configuration file, and produces the Password entry window so that another operator can log on. You should always log off when you have completed your Manager session or if you leave the Admin PC unattended.

Exit

This closes the Manager application.

Remote Operation

The Manager can be used to remotely configure multiple sites from a central location. This facility is a valuable engineering tool for off-site support and maintenance, enabling the configuration to be received, edited and sent back. The INDeX environment must also be configured. By default, the IPNC is configured with a remote manager dial in facility. It is necessary to set up the off-site Admin PC to gain access to the remote system.

The Remote System

The default settings are shown in the table below. If any of these have been changed from the defaults, it is necessary to know the changes made and to change the settings at the off-site Manager PC accordingly.

CAUTION: The customer's password and default IP Address should always be changed from the default value to prevent illegal access.

Default Dial In Access Settings

Profile	Field	Value
User	Name	RemoteManager
	Password	thepword
	Dial In On	Ticked
RAS	Name	DialIn
IP Route	IP Address	192.168.99.0
	IP Mask	255.255.255.0
	Destination	RemoteManager

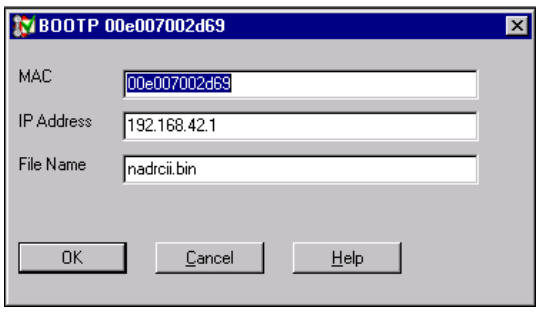
The Off-Site Manager

To gain access to your remote system it is necessary to have a method for dialling into the system. Typically this will be a PC/IPNC system configured as follows:

1. Create a Service on the local IPNC with the following values:
   - Name - a suitable exclusive name for the customer
   - Account Name – RemoteManager
   - Password – thepword
   - Telephone Number - the customer's number
   - Save configuration and upload to IPNC.
2. Use **File | Preferences** to enter the address of the remote system, i.e. 192.168.42.1
3. Proceed to configure the remote system as if locally connected.

Bootp

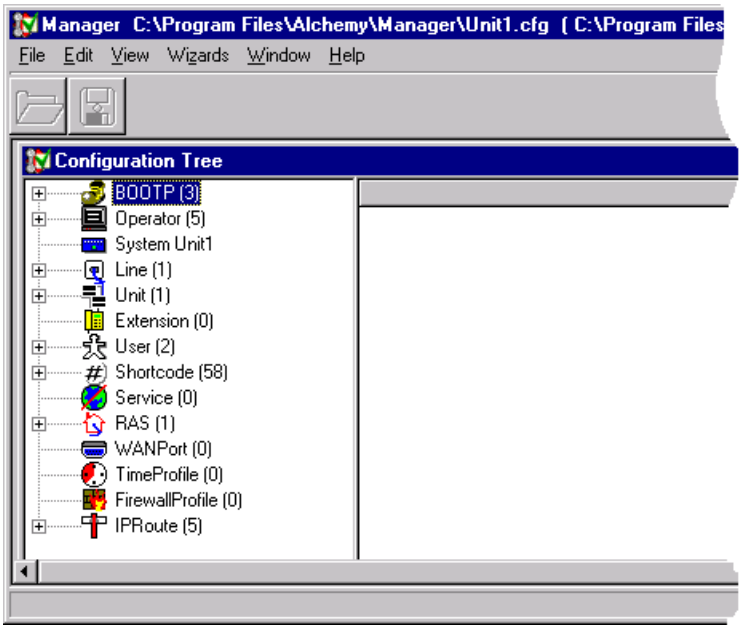
The first item in the Configuration tree is **Bootp,** which is normally only used to recover faulty unit (see Boot Protocol (BOOTP) on page 127). The Manager application acts as a Bootp server and is used to reload the operational software to the IPNC's flash memory.



The Configuration Tree Functions

Introduction

This Section describes each of the Configuration Tree functions in turn, explaining the meaning and purpose of all of the fields in the function definition. A full Configuration Tree will be similar to the following:



Before carrying out changes to a configuration file, be sure to take a back-up. After completing the changes, remember to download them to your system's flash memory. See The Manager Application on page 16 for instructions.

Certain options can be changed and merged into the active configuration file (see page 23). This avoids the need to reboot the system after each edit. The following modifications can be merged:

– **User** : Edit.
– **IPRoute** : Edit/New/Delete.
– **Short Code** : Edit/New/Delete.

The System Configuration Menu

The **System Configuration** menu is used to specify various system parameters, including:

– System passwords
– IP address information for the IPNC.

It should seldom be necessary to alter the **System** function values. Firstly, they are set up at installation by means of the Configuration Manager (see Software Upgrading and Installation on page 9). Secondly, they are concerned with basic aspects of the IPNC, such as network type and operation modes that are unlikely to change. However, you are strongly advised to **change the system passwords.**

Note: After editing the **System Configuration** it is advisable to reboot the IPNC (changes to the IP address are not effective until after a reboot – see pages 25 and 27).

Addressing on the Local Subnet

Before completing the **System Configuration** menu, the operation of the local subnet must be considered. This may consist entirely of the devices connected to the IPNC via a hub, with the IPNC handling all addressing as a Dynamic Host Configuration Protocol (DHCP) server. In this case, the configuration is minimal. In other cases, the IPNC may be connected to an external hub or router and hence is part of a larger network that may use either dynamic or static addressing.

CAUTION: It is critical to set up all IP addresses correctly to avoid contention.

A DHCP server assigns IP addresses to clients automatically as they boot up on a TCP/IP network. In default, when started, the IPNC sends a request for a DHCP address to the local network. If none is received, the IPNC assumes the role of a DHCP server and manages all addressing for both LAN devices and dial-in users. When operating as a DHCP server the IPNC uses it's own address as the starting address from which it will allocate new addresses to registering devices. See DHCP mode selection in The LAN1/2 Tab on page 35. If the IPNC is configured as part of an existing subnet that already uses another DHCP server, the mode can be set to Client, in order to leave control of the addressing with the existing server.

Note: On start up, the IPNC automatically becomes a client if it receives an address, e.g. if the IPNC finds a DHCP server already present on the network.

The DHCP mode can be also set to Dial In. In this mode, the IPNC manages DHCP addressing for users with dialled access whilst the existing server manages addressing on the subnet. Addresses are allocated to dial-in users as they log on in the usual way, but the maximum number of addresses allowed must be specified.

WARNINGS

1. **IP addresses must not be in a range used by other DHCP servers.**
2. **In order for the IPNC's DHCP detection status to operate correctly, the IPNC must be connected to the LAN BEFORE being powered up (inserted into the INDeX). If this is not done there is the potential of having TWO DHCPs on the same LAN!**

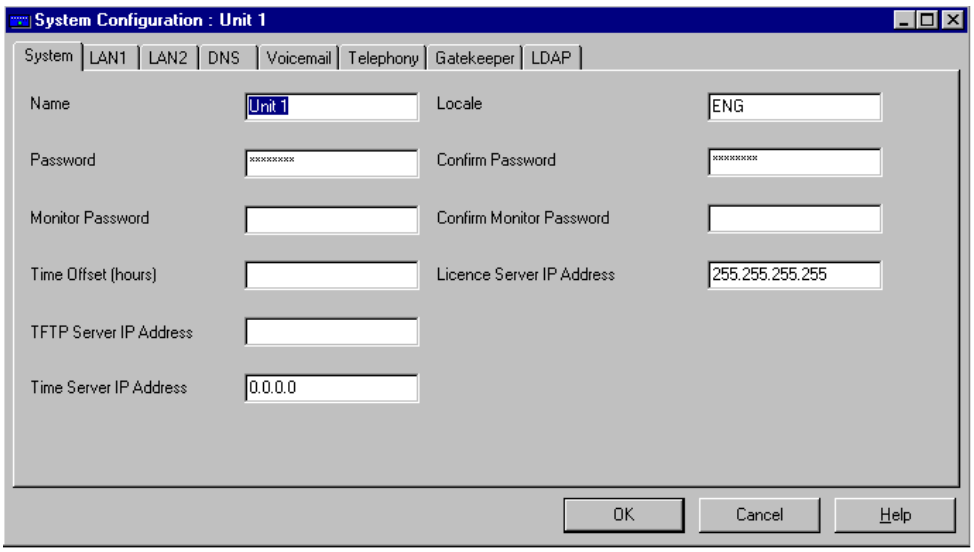
If the lLocal network uses static IP addressing, DHCP must be either set to Dial In or Disabled. In this case, the system must be given an IP address within the local subnet range and not in use elsewhere on the network. The addresses for dial-in users follow in sequence from the IPNC's allocated address. For example, if the current subnet address range ends at 123.234.21.10:

– 123.234.21.11 - Is the address of the IPNC
– 123.234.21.12 - Is the first address given to a dial-in user
– 123.234.21.13 - Is the second address given to a dial-in user, and so on.

The System Configuration

After editing the **System Configuration** it is advisable to reboot the IPNC (changes to the IP address are not effective until after a reboot – see pages 25 and 27).

Note: The Voicemail, Telephony and LDAP tabs are currently not used by IPNC (reserved for use by IP Office).



Name: A name, for reference only, given to the system, such as a company name or location.

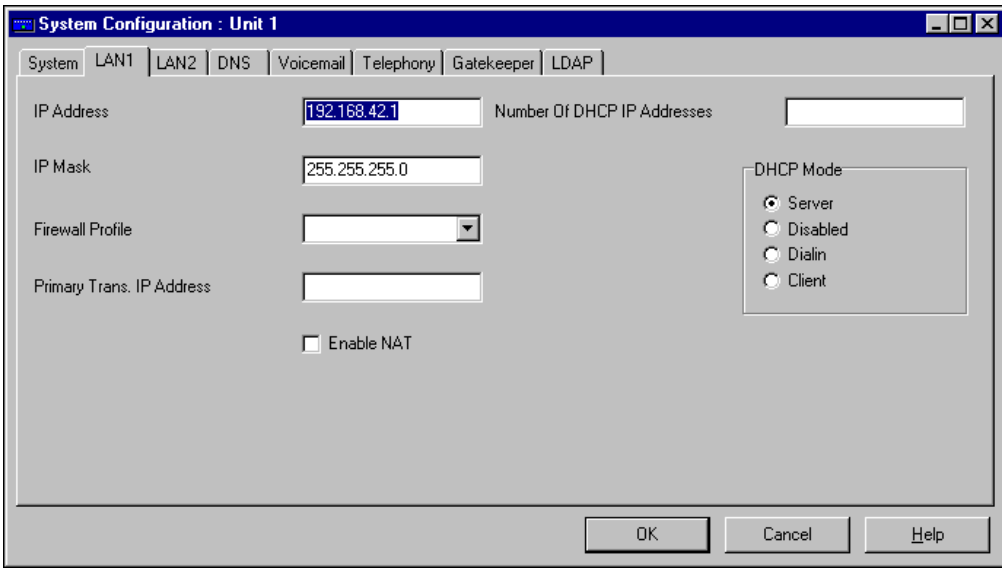
Password: The password required to enable you to send/receive configurations to/from the IPNC, to carry out upgrades and to re-boot the unit. The default value is *password*. You are strongly advised to change this password.

Monitor Password: This is the password that controls access to the Monitor application (if installed). If the field is left blank, the password defaults to the system password above. You are strongly advised to change this password.

Locale: This option sets (automatically from PC setttings) country variations, e.g. UK = eng, Netherlands = nld, Germany = deu

Time Offset (hours): By default the main unit will receive it's time from the PC running the Manager application. However, the unit can also synchronise it's time to an external timeserver. External time servers provide time in GMT. Thus this value must be set to the number of hours that your site is ahead or behind (negative) GMT.

The LAN1/2 Tab



IP Address: The IP address of the IPNC. For static addressing (DHCP disabled), this is the actual address. For dynamic addressing, this is the start address from which the client address sequence starts. For DHCP server mode any legitimate IP address can be entered. You can accept the default or you may wish to change it. For DHCP Client mode, the field should be blank. For DHCP Dial-In mode, where the IPNC acts as a DHCP server for dial-in access, the address should be the next address in the local address series (see page 33 for details).

DHCP Mode: One of the radio buttons must be selected according to the operating mode as follows:

Server:	The IPNC acts as a DHCP server and allocates addresses to other network devices and also allows dial-in access. This can also be used under Windows networking.
Disabled:	If the local network uses static addressing or already has a Non-DHCP name server other than a WINS.
Dial-In:	If the IPNC acts as a DHCP server only for dial-in access.
Client:	If the local network already has a DHCP server.

IP Mask: This is used if the IPNC is acting as a DHCP server or has a static address. A subnet mask is the part of the address that defines the network, rather than devices connected to it. E.g., in the IP address 192.168.42.1, the 192.168.42 part defines the network and the final.1 digit defines the device, and the associated mask is 255.255.255.0. See IP Addresses & Subnets on page 125 for details.

Number of DCHP IP Addresses: The number of addresses allowed for users (default 200). This is only applicable to DHCP Server and Dial In modes.

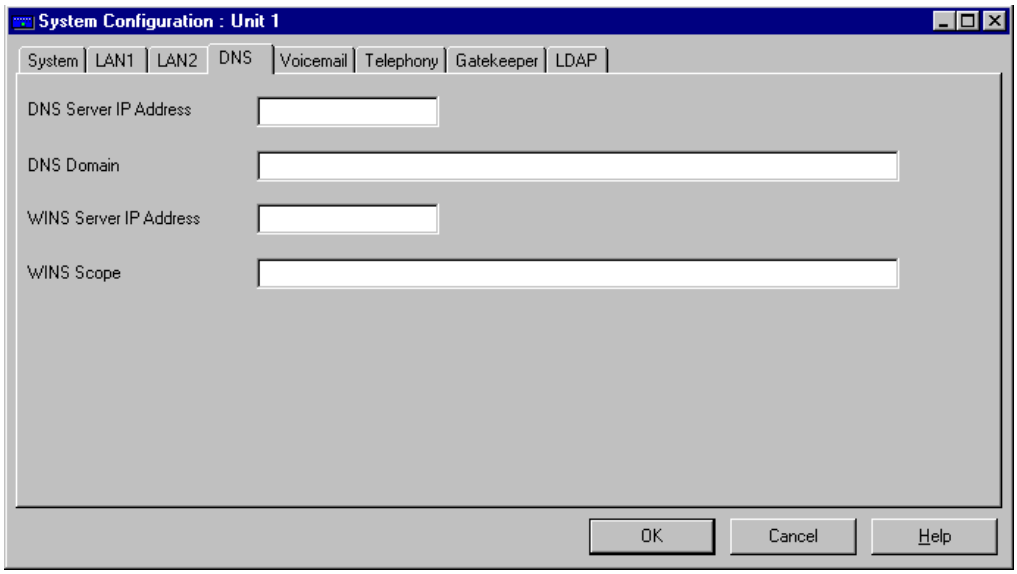
Firewall Profile: Currently not supported, reserved for future use.

Primary Trans. IP Address: Currently not supported, reserved for future use.

Enable NAT: Determines if NAT should be used for services where the IP address is different from the LAN 1 address.

The DNS Tab

This configuration form is used to enter the DNS and WINS information that will be given to each host on LAN1 and LAN2 when the main unit is acting as the DHCP server on either or both LANs.



DNS Server IP Address: This is the IP address of the Domain Name Server (DNS) of the Internet Service Provider (ISP) for the system. The field is populated from the value found on IP Configuration form of the Administration PC. If this is subsequently changed, the Ethernet Adapter in the PC's IP configuration must be "renewed". See Static IP Addressing on page 13. Where the system is operating in an intranet environment or there is a local DNS, consult the Network Administrator for the address to enter here.

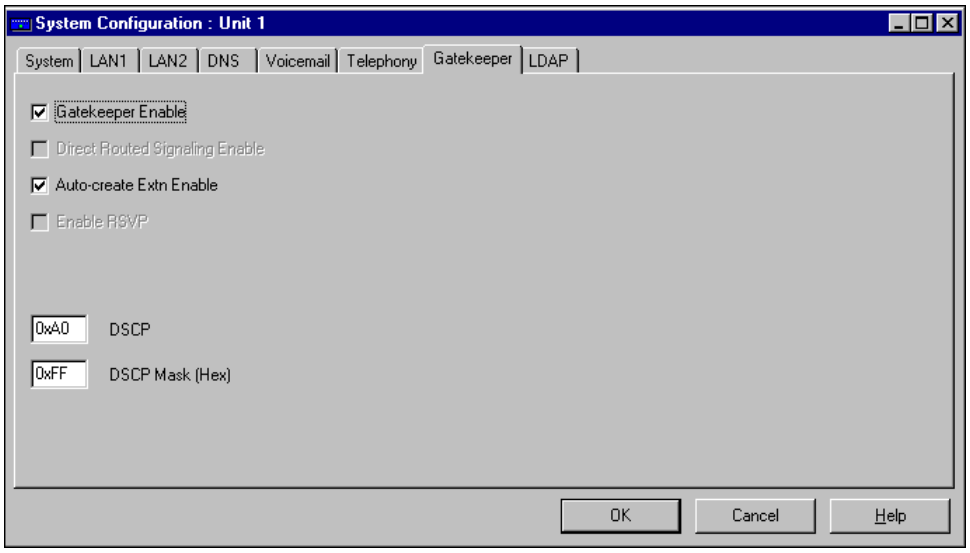
DNS Domain: This is the name of the local Domain Name Service (DNS). This can also be used under Windows networking.

WINS Server IP Address: This is the IP address of the Windows Naming Server (WINS) if present. WINS provides a lookup service converting NetBios names to IP addresses.

WINS Scope: Only devices with the same WINS Scope can communicate with each other on a WINS network. It is an optional WINS value. If the local subnet uses scopes, the correct one must be specified here.

The Gatekeeper Tab

Gatekeeper is an H.323 entity that provides address translation, control access, and sometimes bandwidth management to the LAN for H.323 terminals, Gateways, and Multipoint Control Units.



Gatekeeper Enable: This option will enable the internal Gatekeeper.

Direct Routed Signalling Enable: If selected H.323 terminals will send audio data directly rather than via the main unit.

Auto-create Extn Enable: If selected H.323 terminals will automatically register themselves with the Gatekeeper thus creating a Extension in the configuration.

Enable RSVP: Currently not supported, reserved for future use.

DSCP: TOS byte on the IP Header and is used to indicate VoIP traffic.

DSCP Mask (Hex): Allows a mask to be applied to packets for the DSCP value.

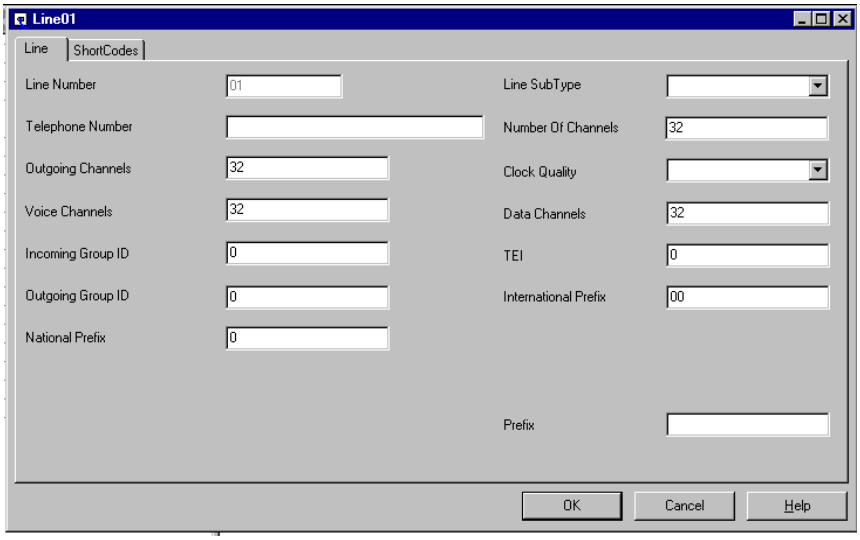
Line Functions

There are two categories of line function, ISDN Lines and Virtual Private Network (VPN) lines. The ISDN line function allows different lines to be allocated to voice and data calls, if required, and for lines to be made members of a group for incoming call routing purposes. The ISDN line is also the means by which the IPNC communicates with the INDeX. The IPNC's VPN facility additionally allows “transparent” connection to an IP address at a remote site over the wide area, via a leased line. This enables a leased circuit to be configured as a number of virtual circuits which can be used for either data or Voice-over-IP

Short Codes are configured against ISDN lines to translate the dialled digits and define which VPN line should be used (see "The ShortCode Function" on page 42).

ISDN Lines

This configuration form is used to configure the use of channels available on the IPNC. Highlight the required ISDN Line in the Configuration tree and double click in the Display Panel.



Line Number: This parameter is not configurable, it is allocated by the IPNC**.**

Telephone Number: Used to remember the telephone number of this line. This entry is for information only.

Outgoing Channels: Defines the number of channels that are available on this line. Normally be the same as The Number Of Channels field, but can be reduced to ensure that incoming calls cannot be blocked by outgoing calls.

Voice Channels: Controls the number of channels available for voice.

Incoming/Outgoing Group ID: One group can contain multiple lines. Short Codes and Incoming Call Routes use these numbers to indicate which line they are to use.

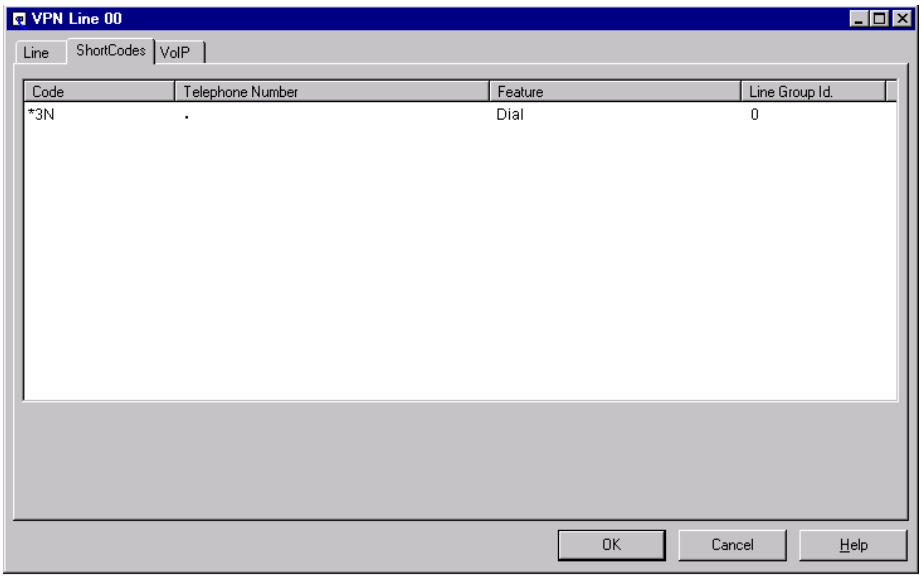
Number Of Channels: Defines the number of operational channels that are available on this line. Always set to 32 for IPNC.

Data Channels: Controls the number of channels available for data use. If left blank the value will be 0.

TEI: Terminal Equipment Identifier. For VPN lines, this should always be set to zero. Not applicable to the IPNC.

National Prefix/International Prefix/Prefix: Not applicable.

Short Codes Tab



Code – this field is used to match the received digits (in MSN format) to determine which line is used to complete the call. Short Codes fields can be up to eight digits long and can contain special characters. **Only use the Short Code characters listed below.**

N Is used to match against any sequence of dialled digits. It will also act as a container for those dialled digits should they need to be sent to the remote system (see Telephone Number below).

? This tells the IPNC what to do if the received number is not recognised i.e. it matches any number not configured on the IPNC.

Telephone Number - this is the number to be presented to the system at the distant end of the IP trunk. It can include the special characters:

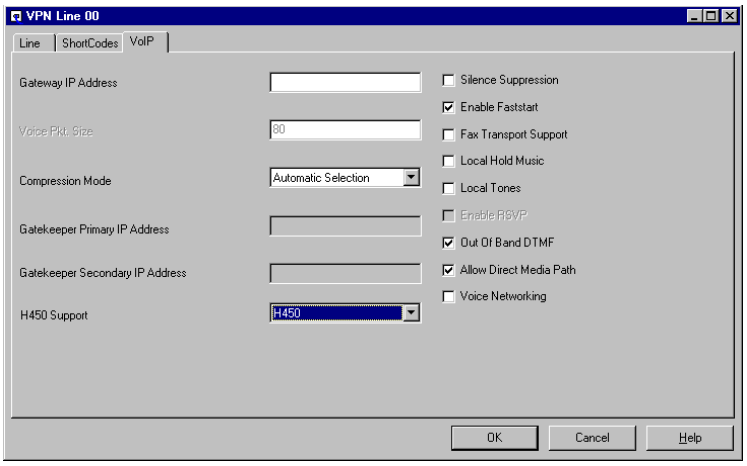
N Sends the digits contained within **N** (see ShortCode above).

. The full stop/period mark inserts the complete string of received digits as the called number.

Feature – this should be set to Dial or Dialled Speech, no other options are currently used

Line Group ID – this is the VPN line group (IP trunk) or the number used to identify the ISDN line that this call will be sent on.

The Voice over IP Tab



Gateway IP Address: Enter the IP address of the remote system.
Voice Pkt. Size: This is the number of data bytes contained in a Voice Packet.
Compression Mode: This defines the type of compression which is to be used on any Voice call on this Line. Amongst the options available, the recommended options are :-

Automatic Selection:
The most appropriate compression mode will be automatically selected for the hardware (default setting)

G.711 ALAW 64K:
Each voice call is converted from analogue to digital and uncompressed at 64kbps.

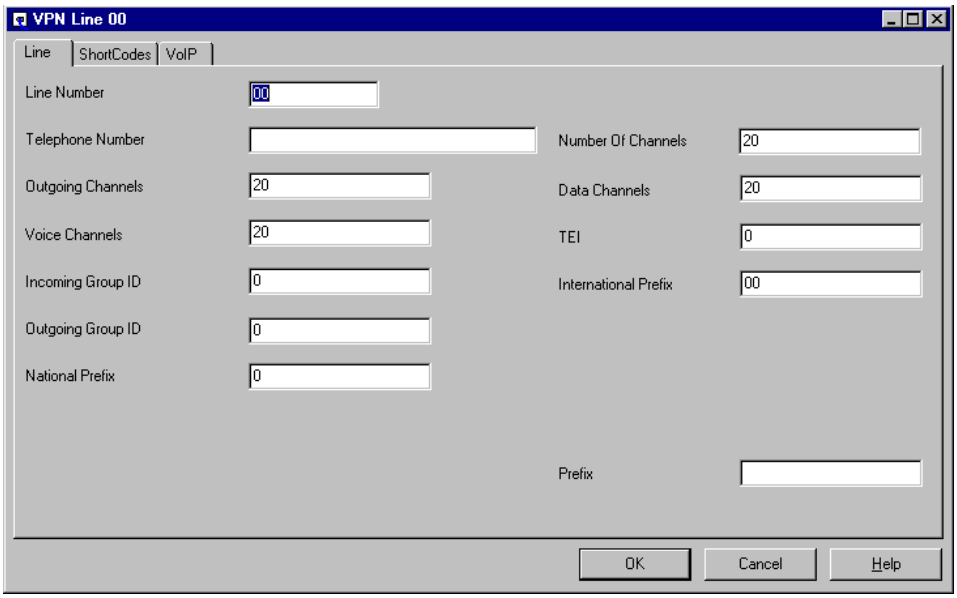
G.729(a) 8K CS-ACELP:
A standard ITU-T coding algorithm used for speech compression. Reduces voice to 8kbps, resulting in the bandwidth utilasion of 29.6kbps across the Lan and 12.4kbps across the WAN.

G.723.1 6K3 MP-MLQ:
A standard ITU-T coding algorithm used for speech compression. Reduces voice to 6.3kbps, resulting in the bandwidth utilasion of 20.8kbps across the Lan and 9.333kbps across the WAN.

Gatekeeper Primary IP Address: For future use.
Gatekeeper Secondary IP Address: For future use.
H450 Support: Selects the supplementary service signalling method for use across H232 connections. Options are **None**, **Qsig** or **H450**.**Silence Suppression:** When selected, voice traffic will be automatically reduced during pauses in conversation. This is useful when optimising data traffic across the WAN.
Enable FastStart: A fast connect procedure. Reduces the number of messages that need to be exchanged before audio channel is created.
Fax Transport Support: If selected this option will provide support for faxing over a H.323 connection.
Local Hold Music: When selected H.323 terminals will, were applicable, use their own hold music.
Local Tones: When selected H.323 terminals will use their own ringing tones.
Enable RSVP: For future use.
Out of Band DTMF: If selected DTMF will be suppressed and a message is sent instead to create the DTMF at the remote end.
Allow Direct Media Lines: Not used.
Voice Networking: This option enables extension number sharing with the remote system. Extensions on the remote system can then be dialled from the local system. This requires that extension numbers and names on the two systems are unique. Line and group extension numbers are not shared. Remote extension numbers cannot be included in local groups.

VPN Lines

VPN lines can be added by right-clicking in the Display Panel and clicking **New**.



Line Number: The line number you wish to use - it must be unique.

Telephone Number: Used to remember the telephone number of this line. This entry is for information only.

Outgoing Channels: Defines the number of channels that are available on this line. Normally be the same as The Number Of Channels field, but can be reduced to ensure that incoming calls cannot be blocked by outgoing calls..

Voice Channels: The number of channels to be made available for voice use over the VPN.

Incoming/Outgoing Group ID: One group can contain multiple lines. Short Codes and Incoming Call Routes use these numbers to indicate which line they are to use

Data Channels: Not used under normal operation.

Number Of Channels: The total number of channels to be made available on the wide area network, i.e., effectively dividing it into several “virtual circuits” for different purposes. Each channel is equivalent to one call.

TEI: Terminal Equipment Identifier. For VPN lines, this should always be set to zero.

National Prefix: Not applicable.

Prefix: Not applicable.

International Prefix: Not applicable.

See page 39 for the Short Codes Tab.

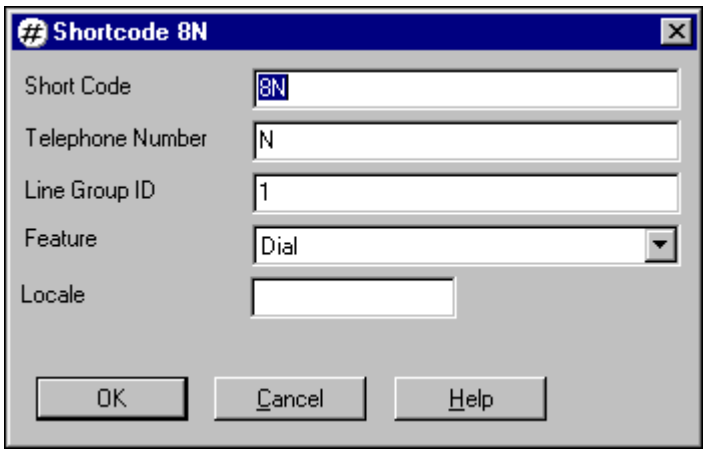
The ShortCode Function

The IPNC uses ShortCodes to control ISDN Line facilities and allow manipulation of MSN strings and ISDN Line selection. Short codes can be set up for global usage, against individual lines and/or users.

ShortCodes operate in a similar manner to the INDeX core function of Automatic Route Selection, but within the domain of IPNC.

Any dialled number that is presented to the IPNC must be resolved to a destination. The IPNC will attempt to match the dialled number to a ShortCodes in the order specified below:
1. Line Received (User, ISDN or VPN Line).
2. ShortCode List.

To edit/add/delete a ShortCode:
Highlight ShortCode in the Configeration Tree and right click in the display Panel. Select **View/Edit/New** as appropriate. The following typical menu is displayed:



The fields are identical to those in the VPN Short Code tab (see page 41).

Examples of System Codes

1. Using the ShortCode to strip off the leading digit

To define any call beginning with 8 that is presented over the VPN line (IP Trunk) that has a line group of 01, by striping off the digit 8 i.e. when 8400 is received, 400 is sent over line group 01.

Short Code	8N
Telephone Number	N
Line Group	01
Feature	Dial

2. Using ShortCode to send digits as dialled

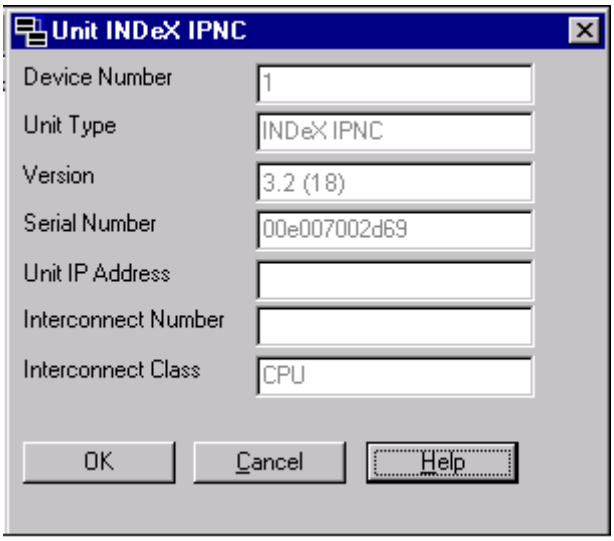
To define any call beginning with the digit 8 that is presented as dialled over the VPN line (IP Trunk) that has a line group ID of 02 i.e. when 8400 is received, 8400 is sent over line group 02.

Note the full stop/period mark in the telephone number field. This dictates that the number sent should be the MSN digits received.

Short Code	8N
Telephone Number	.
Line Group	02
Feature	Dial

The Unit Function

The function lists all details of the IPNC and any connected WAN units. The information is detected by the system and cannot be altered.



Device Number: The IPNCs device number is always 1

Unit Type: The type of unit, INDeX IPNC

Version: The version of software in the device's flash memory.

Serial Number: This is the MAC address of the IPNC and the Device Number for any attached WAN unit.

Unit IP Address: IPNC assigned address.

ICON (Interconnect Number): Not applicable

Interconnect Class: CPU

Extension Configuration

Although available on the Configuration Tree, this facility will be supported in future developments. Only to be used under the guidance of Avaya.

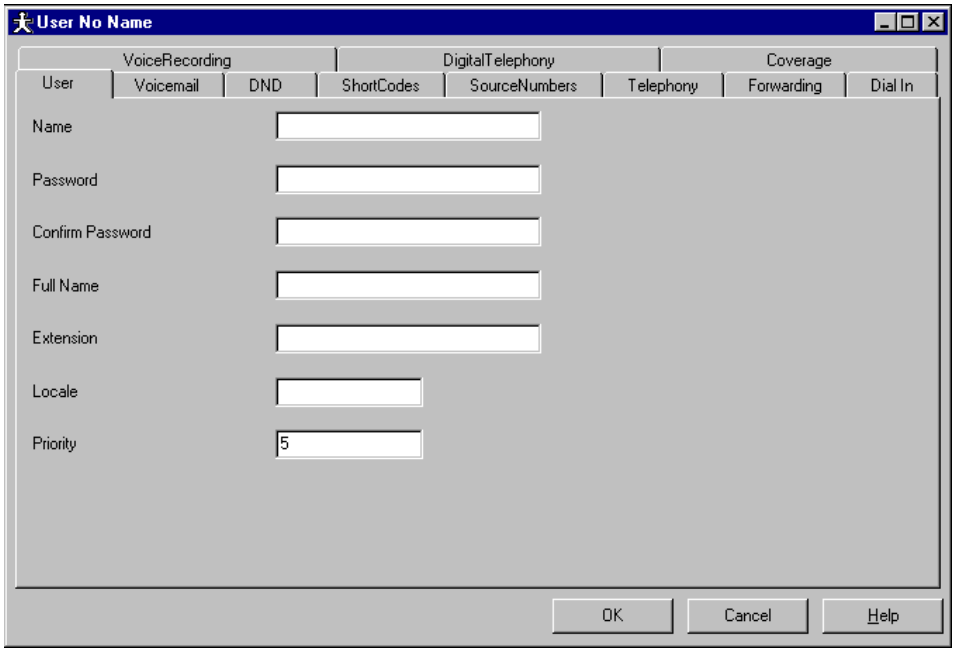
User Configuration

Each system User has a unique name and a profile defining its facilities. The User Configuration form is used to set-up these profiles. See SendConfig on page 27.

Notes:

1. Changes to configured Users can be merged, additions and deletions require a reboot.
2. The Voicemail, DND, Telephony, Forwarding, VoiceRecording, DigitalTelephony and Coverage tabs are currently not supported by IPNC (reserved for use by IP Office).
3. See The ShortCode Function on page 42 for details of the ShortCodes tab.

The User Tab



Name: The name is an unique set of alphanumeric characters (up to 16), it is case-sensitive and symbols should not be used. This is the account name for PPP authentication.

Password: A password must be entered if the user is enabled with access to RAS services (see RAS Configuration on page 55). The password is used for PPP authentication, i.e. PAP or CHAP.

Full Name: This is used for information only and may be used to provide a fuller name or description.

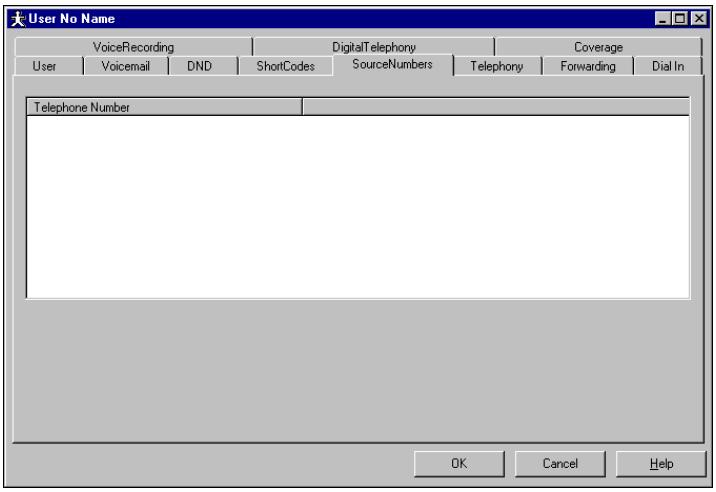
Extension: Not Used.

Locale: Not Used.

Priority: Not Used.

The Source Numbers Tab

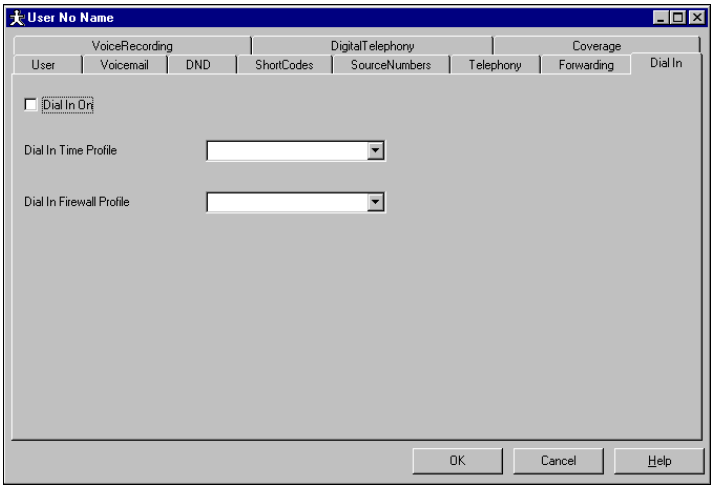
The Source Numbers tab allows "trusted" originating phone numbers to be specified for a user. Calls from these numbers are accepted without verification, allowing direct access to data services. Typical source numbers are a user's home phone number and mobile phone number.



Right click within the Telephone Number box to add a source number. To restrict calls from the source number to RAS data services, prefix the number with "R", e.g. R01711231234

The Dial In Tab

Use this menu to enable dial in access for a User.



Dial In On: This must be ticked to give the user dial in access to use data services.

Dial In Time Profile: Time profiles can be used to specify time bands during which dial-in access is permitted. A previously-defined profile (see Time Profiles on page72) can be selected from the drop-down list. Leaving the field blank means that no time restrictions are applied to dial in access for this user.

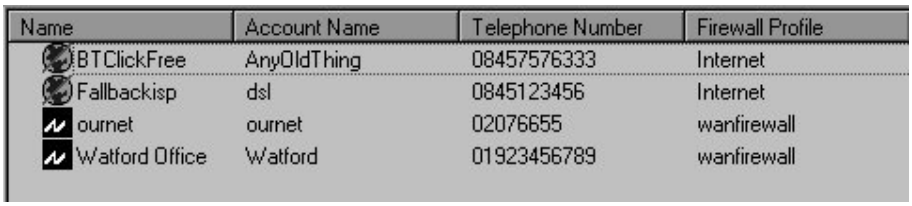
Dial In Firewall Profile: Firewalls restrict access according to the type of data service (by protocol). A previously-defined profile (see Firewall Configuration on page 74) can be selected from the drop-down list. Leaving the field blank means that no protocol restrictions are applied to dial in access for this user.

Dial In Source Numbers are specified in the Source Number tab, described above.

Service Configuration

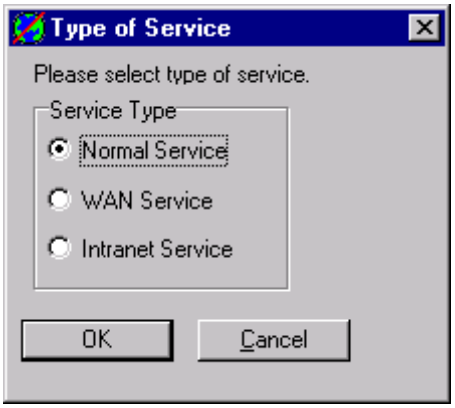
The Service tabs are used to set up details for external services to which local users have dialled access. Such services may be, for example, Internet services and applications at remote offices. Note that in establishing a fully-operational service, for instance, between two customer sites, also involves setting up the associated IP routing, RAS and user profiles. See "Internet Access" on page 109 and "Data Routing" on page 112 for examples of the complete process.

The Service's menu lists all currently configured services. Normal (Internet) services are indicated by a globe symbol and Intranet/WAN services by a wide area symbol. Intranet and WAN services are set up in the same way as Normal (Internet) services. These services also provide access to menus on which the user can define passwords, Users, RAS, etc.



Name	Account Name	Telephone Number	Firewall Profile
BTClickFree	AnyOldThing	08457576333	Internet
Fallbackisp	dsl	0845123456	Internet
ournet	ournet	02076655	wanfirewall
Watford Office	Watford	01923456789	wanfirewall

Right-click in the summary area to add a service and select the type of service you wish to set up.

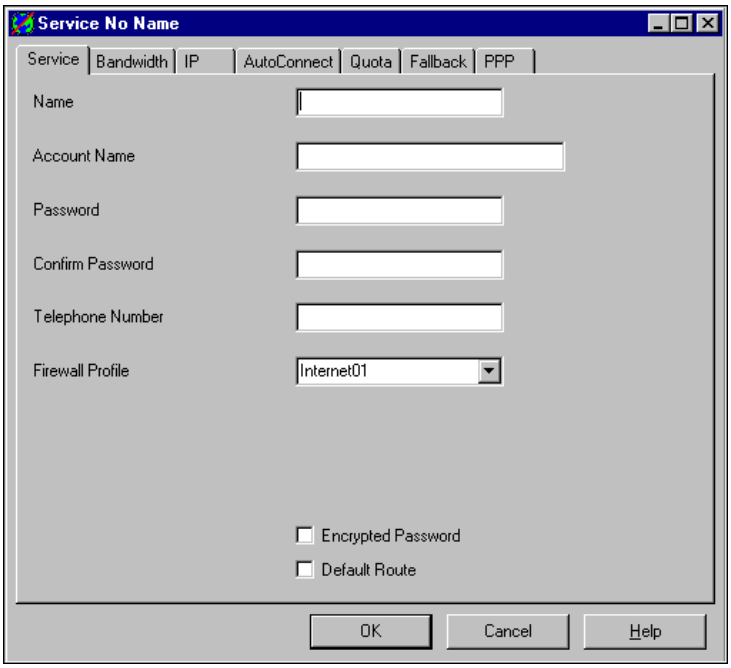


The types of service are defined as follows:

Normal	Service (see page 47)
WAN	Service, User, RAS (see page 48)
Intranet	Service and User (see page 48)

The Service Tab

The Service tab for Normal (Internet) services, shown below, allows you to set up the details for your account with your ISP.



Name: The name of the service to be accessed.

Account Name: The name used to log on to the service. For an Internet service, this is your ISP-supplied account name.

Password/Confirm Password: The password is used by the destination to verify the user accessing the service. You must also confirm your password.

Telephone Number: The outgoing number dialled to access the Internet service (an access prefix digit must be added).

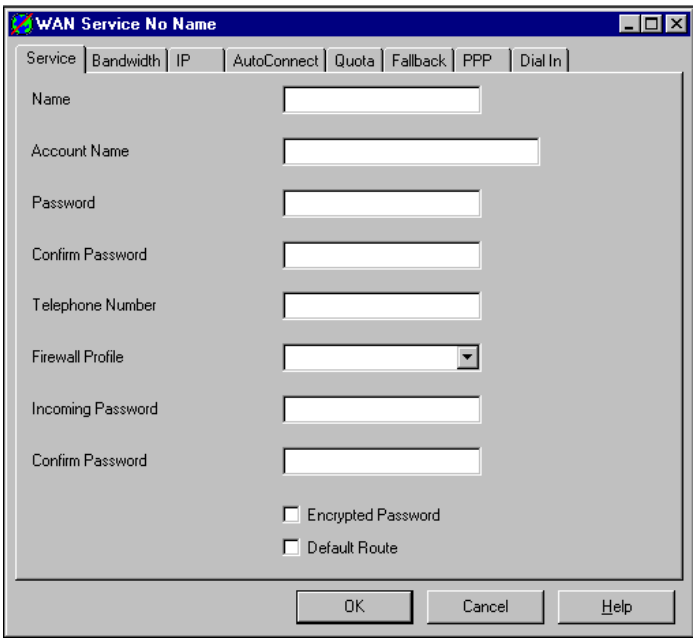
Firewall Profile: This is a list of all the currently-configured firewall profiles for the system, from which the most suitable one can be selected (see Firewall Configuration on page 58).

Encrypted Password: Tick this box if your ISP provides CHAP password authentication.

Default Route: Tick if this is to be your primary Internet service, see The Fallback Tab on page 52 for details of how to specify an alternative service.

The Service form for WAN and Intranet

For WAN and Normal (Intranet) services. The WAN Service tab also allows a password to be specified for incoming access, as shown below.



The tab is the same in other respects as for Internet services. Points to note are:

Name: The name of the service to be accessed. If setting up for a WAN a RAS configuration with the same name will be automatically generated (se "RAS Configuration" on page 55).

Account Name: The name used to log on to the service, i.e., the name of the associated user at the remote site.

Password/Confirm Password: The password is used by the destination to verify the user accessing the service. You must also confirm your password.

Telephone Number: The outgoing number dialled to access the Internet service (an access prefix digit must be added).

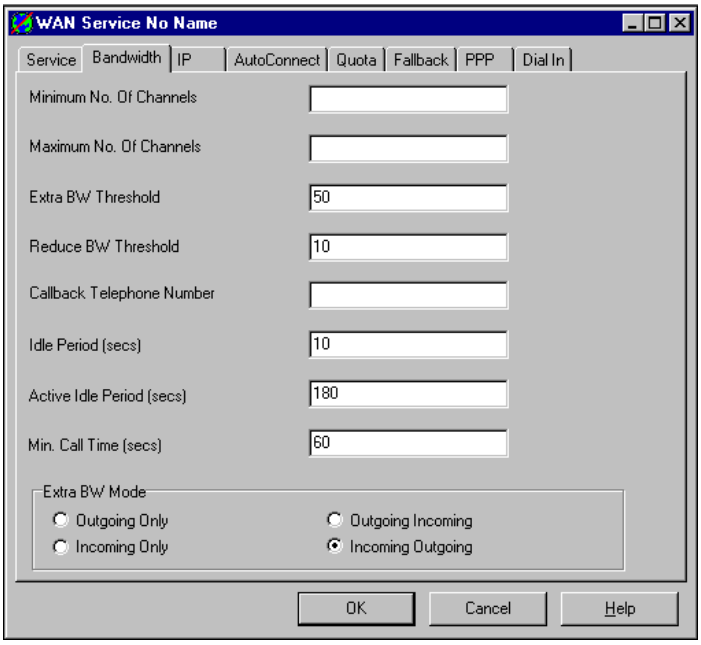
Firewall Profile: This is a list of all the currently-configured firewall profiles for the system, from which the most suitable one can be selected (see Firewall Configuration on page 58).

Encrypted Password: If the box is ticked, CHAP password authentication is used. If not, PAP is used. Both ends of a service link should use the same method.

Default Route: Tick if this is to be your primary Internet service, see The Fallback Tab on page 52 for details of how to specify an alternative service.

The Bandwidth Tab

The IPNC provides both Multi-link and Bandwidth Allocation Control Protocol (BACP). Multi-link enables connection of multiple B-channels between routers. When configuring top-up bandwidth or ISDN fallback, Multi-link must be enabled by the PPP tab (see page 52).



Minimum No. Of Channels: The number of channels used to connect to the service. The default is one channel (a blank field). Additional channels may be used, up to the maximum specified (see below) if either or both of Multilink or BACP is enabled on the PPP form.

Maximum No. Of Channels: The top limit to the number of channels to be made available to the service. This must be set to 2 or more and must obviously be greater than the minimum value. If the field is left blank, the system assumes that the maximum and minimum values are the same, i.e., a fixed number of channels applies.

Extra BW Threshold: This is defined as a percentage channel utilisation. If one channel is connected, and its usage threshold is reached, another channel is added. If utilisation across the aggregate of the two channels is then reached, another is added, and so on, up to the maximum.

Reduce BW Threshold: This is the utilisation percentage at which channels are dropped. The utilisation is calculated across all channels currently active, as for extra bandwidth. The last channel is only dropped if usage is zero for the idle period.

Callback Telephone Number: For BACP, this is the number the remote end dials to gain extra bandwidth.

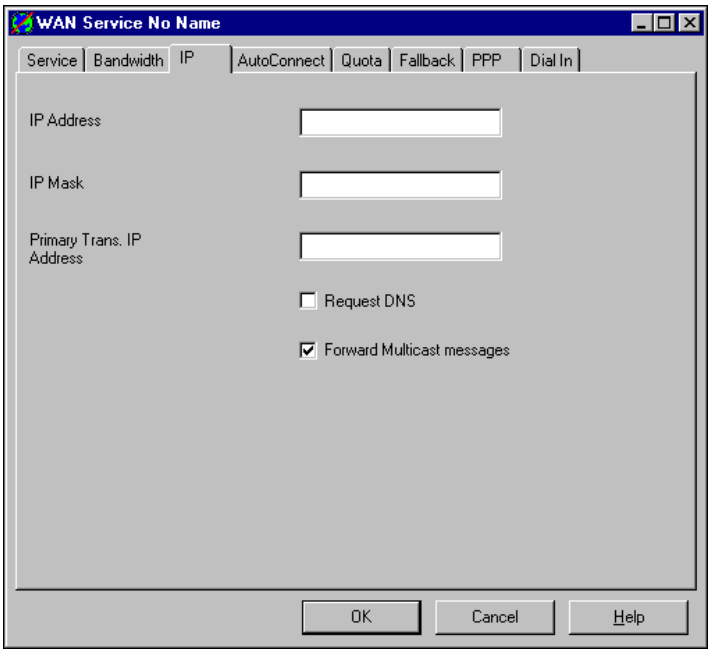
Idle Period (secs): The time in seconds after which a call is closed if no traffic has been sent / received.

Active Idle Period (secs): The time-out in seconds that applies if there is no traffic but a session is still in progress. After the idle period time-out, the system starts this timer.

Min. Call Time (secs): Once a call has been set up, it is held for this period, even if there is no traffic, i.e., time-outs are not effective. It is sensible to set this value to the maximum time allowed by your supplier's minimum call charge and set the idle periods to low values.

Extra BW Mode: This section allows additional channel bandwidth to be made available to either outgoing calls or incoming calls only. This can also be used to specify that outgoing calls are given priority over incoming calls, and vice versa.

The IP Tab



IP Address: This is the local device's (IPNC's interface) IP address. Leaving the field blank or entering 0.0.0.0 means that the local device (the client) is assigned a dynamic address by the remote end (the server). Normally ISPs provide you with an IP address upon connection and therefore the field should be left blank for Internet services. The field can also be left blank if there is an associated IP route.

IP Mask: Set this to 255.255.255.255 to force Network Address Translation (see page 129). Leave it blank to enable NAT when the remote end allocates the IP Address. Any other value disables NAT. The translation is between the IP address assigned by the remote system and the local address specified in the System tab.

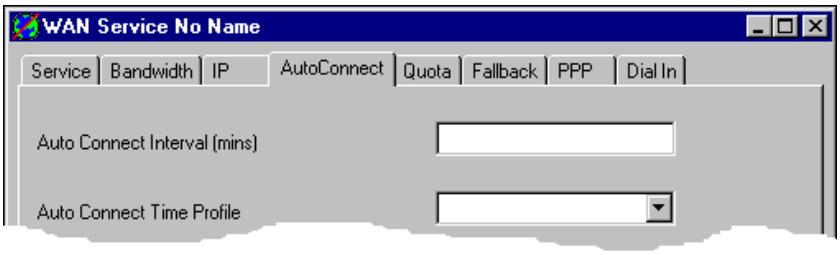
Primary IP Translation Address: Only applicable when running NAT. This is the address which unsolicited received data packets will be directed to. It may be, for example, the address of the local email or Web server.

Request DNS: By ticking this option, DNS information is automatically obtained from the remote end, usually your ISP. (The DNS Server IP Address field in the System DHCP tab must be blank.)

Forward multicast messages: At default this option is on. Multicasting allows bandwidth to be maximised through the reduction of traffic that needs to be passed between sites.

The AutoConnect Tab

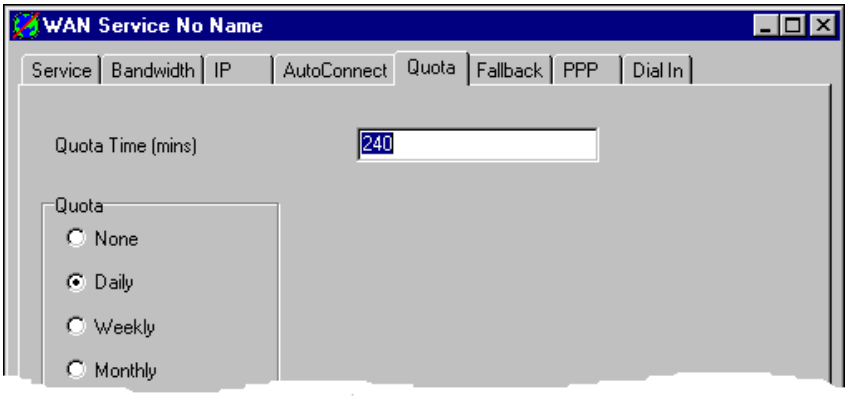
The AutoConnect tab sets up the system to make regular calls at a specified interval to a remote service. E.g., to regularly contact an Internet service for email. The system does not make a call if there is already a connection to the service, or one has been made and the interval has not yet elapsed. A time profile can be specified, to prevent calls being made, for instance, outside working hours.



Auto Connect Time: This is the time interval, in minutes, that the destination service is regularly called, if no other calls are made to the service. If polling is not required, leave the field blank.

Auto Connect Time Profile: A time profile (see "Time Profile Function" on page 57) can be applied to auto-connected (polled) calls by selecting it from the drop-down list. Polling starts immediately when the time profile becomes active, i.e., the first call is made straight away.

The Quota Tab



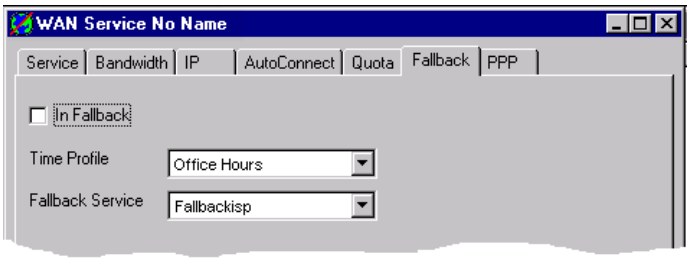
Quota Time (Minutes): This is the total time allowed for access to this service per day, week or month. The field may be left blank if no quota is required, but this facility is useful in preventing, for example, extended surfing.

If you do not wish to impose a quota leave the Quota Time field blank.

CAUTION: If you specify a Quota Time, then one of the Quota radio buttons must be selected otherwise no further calls will be allowed once the Quota Time has expired.

Quota: If you specify a Quota Time (see above), then the Quota radio buttons allow you to specify the frequency of the quota time.

The Fallback Tab

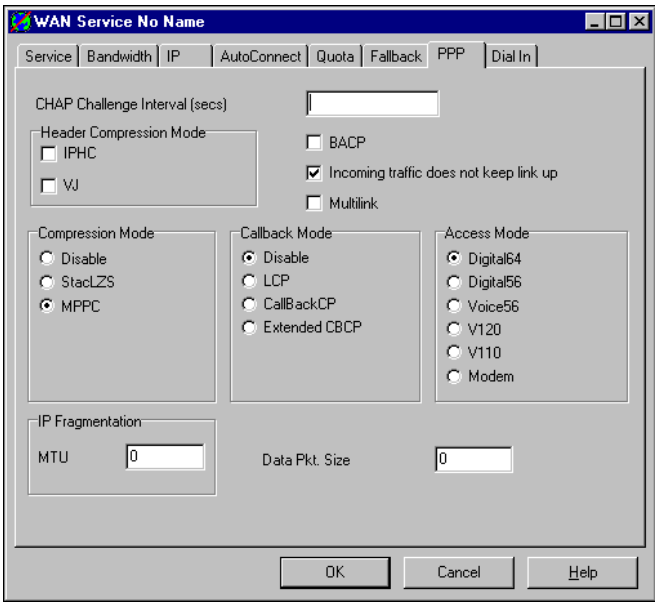


The Fallback tab enables you to switch to another service, either automatically, as defined by a time profile, or manually. In this way you can take advantage of, say, a cheaper off-peak service provider or change quickly to a standby service provider should your own be out of service.

The Time Profile and Fallback Service are selected from drop-down lists showing all those currently configured for the system. Ticking the In Fallback box immediately switches to the Fallback service.

The PPP Tab

Point-to-Point Protocol (PPP) is a protocol used with various host-to-client and router-to-router dialled service applications. It offers a number of facilities, such as PAP/CHAP password authentication, compression, and dynamic bandwidth allocation.



Header Compression Mode: Enables the negotiation and use of IP Header Compression. Supported modes are IPHC and VJ.

CHAP Challenge Interval (Seconds): The period between successive CHAP challenges ("Handshakes"). Some applications, such as Windows 95 Dial-Up Networking, do not support this facility. In these cases, the field must be left blank or set to zero.

Incoming traffic does not keep link up:
When selected then, if connected to the Internet and nothing is being sent by IPNC, the call will be dropped after a pre-set time (idle time).

Van Jacobson Header Compression: Used to reduce PPP header size and hence improve bandwidth utilization.

Multilink: Enables negotiation and use of the Multilink protocol (MPPC) on the link(s) into this service. Multilink must be enabled if there is more than one channel that is allowed to be Bundled/Multilinked to this RAS service.

BACP: This selects BACP dynamic bandwidth allocation.
Note that the Maximum Channels on the Bandwidth tab (see page 49) must be set to 2 or more if this option is selected.

Compression Mode: The Compression mode can be either disabled or chosen as one of two proprietary methods, either StacLZS (STAC Mode 3 compression) or Microsoft MPPC compression.

Callback Mode: The Callback mode can be either disabled or selected from the following:

LCP (Link Control Protocol) - after authentication the incoming call is dropped and an outgoing call to the number configured in the Service will be made to re-establish the link.

Callback CP (Microsoft's Callback Control Protocol) - after acceptance from both ends the incoming call is dropped and an outgoing call to the number configured in the Service will be made to re-establish the link.

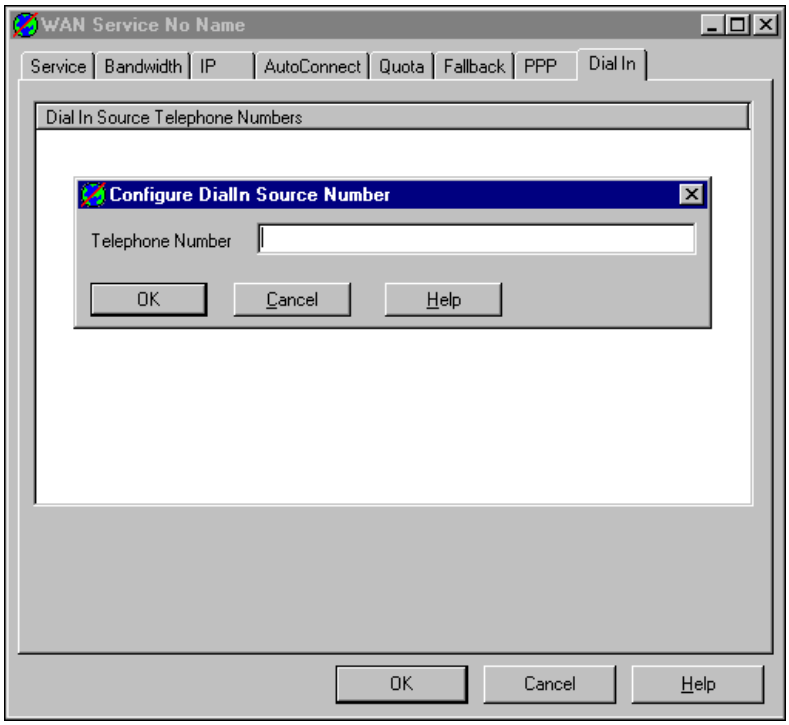
Extended CBCP (Extended Callback Control Protocol) - similar to Callback CP however the Microsoft application at the remote end will prompt for a telephone number. An outgoing call will then be made to that number to re-establish the link (the line access prefix digit must be added).

Access Mode: Select the type most suited to the service. The options are described in the table below.

Service Access Modes

Mode	Protocol	Speed	Notes
Digital 64	Sync PPP	64 kbps	Protocol set to Sync PPP, rate 64000 bps, call is presented to local exchange as 'Data Call'
Digital 56	Sync PPP	56 kbps	As above but for 56000 bps
Voice 56	Sync PPP	56 kbps	As above, but call is presented to local exchange as 'Voice Call'.
V120	Async PPP	Rate Adapted up to 56 kbps	Allows both ends to operate at different speeds for, e.g., some bulletin boards
V110	Async PPP	Rate Adapted 9600 bps	For GSM mobile phones and some bulletin boards
Modem	Async PPP		Allows the use of an auto-adapting modem (if available) and makes an analogue call.

The Dial-In Tab



The Dial-In tab only applies to WAN and Intranet services. It allows you to specify the source (incoming) numbers that are to be permitted to dial in to the service. Right-click in the Dial-In area to add numbers in the usual way.

RAS Configuration

A Remote Access Service (RAS) is used to support dial-in services. Service access can be either digital / ISDN or by modem. The IPNC detects the incoming call type. The RAS is the “destination” of a service as defined in the "The Service Tab" on page 47 and the associated IP routing defined in "IP Routing" on page 62.

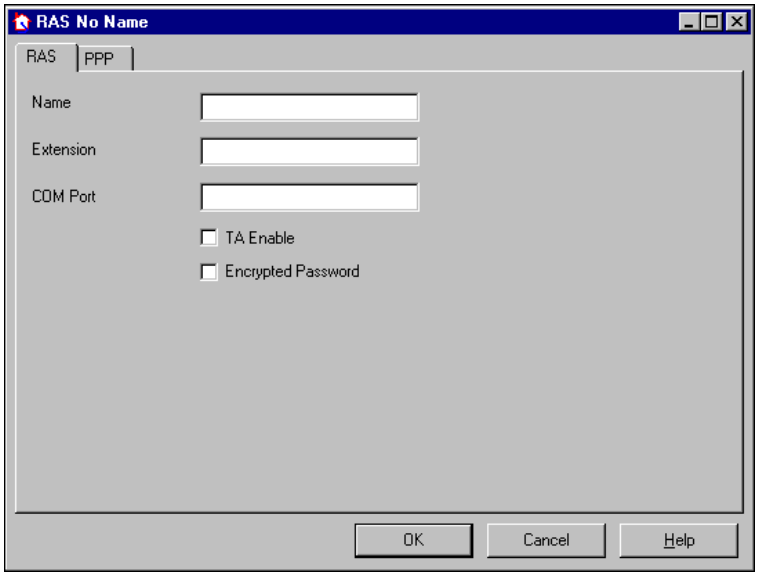
The received MSN/Dialled digits are matched to the extension field in the RAS form to establish which RAS entry should be used.

Note that the system default configuration includes a RAS, with the name DialIn. This should not be deleted or changed as it permits remote configuration.

A corresponding user profile must be set up (see "User Configuration" on page 44) with dial-in access and containing the password for the remote end Service. The RAS compares the two for verification.

Any WAN service specified for the IPNC (see "WAN Configuration" on page 56) is automatically added as a RAS, with the same tabs.

The RAS Tab



Name: The given name of the RAS and the one to be used in a corresponding Service configuration form.

Extension: The MSN/dialled digits used to access this RAS.

COM Port: Not used by the IPNC, leave blank.

TA Enable: Not used by the IPNC, leave blank

Encrypted Password: Tick this box if CHAP password authentication is required.

The PPP Tab

The PPP section of the form is identical to the PPP profile for a Service (see 52) - both RAS and Service must be set up in the same way. The system does this automatically for WAN services.

WAN Configuration

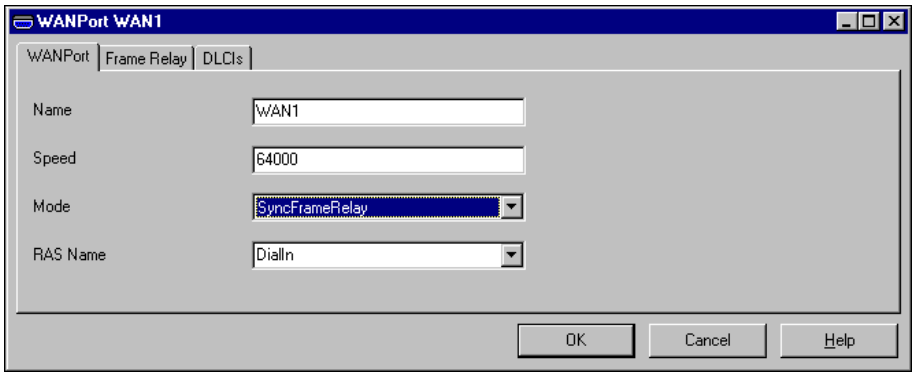
A WAN port is used to connect one end of a leased line, i.e., a high-speed, permanent circuit. The configuration is simple as the IPNC automatically senses the line's interface type (V24, V35 and X21).

CAUTION: In order to configure the WAN interface, the WAN cable must be attached at boot up.

Before configuring the WAN link:

1. Connect the WAN cable.
2. Re-boot the Cassette.
3. Receive the configuration from the IPNC (see page 23).

The link is now detected by the system and ready to configure.



Name: This is allocated by the IPNC.

Speed: Enter the leased line speed, i.e. the operational speed quoted by the carrier. It is important that this is correct as it is used in the calculation of bandwidth allocation.

Mode: Select the protocol required:

- SyncPPP - for a data link
- SyncFrameRelay - for a link supporting Frame Relay

Notes:

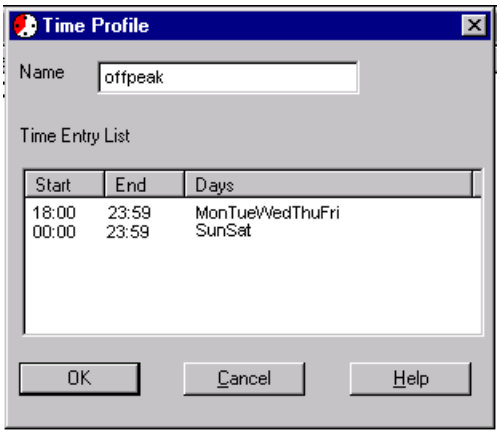
1. When *SyncFrameRelay* is selected (only), the Frame Relay and DLCIs tabs are shown.
2. On the Frame Relay tab, enter the **Frame Management Type** (available from your Service Provider) and accept the default parameters for basic Frame Relay connection.
3. On the DLCI tab, enter the **DLCI** network setting as specified by your network provided, set **Link Type** to PPP and the **RAS Name** to the name specified on the WAN Port menu.

RAS Name: Select the name of the RAS the link is to use, from the drop-down list.

Time Profile Function

A series of Time Profiles can be defined and made available to the system. One of these can then be selected for inclusion in profiles for users and services, to specify, for example, when a user is permitted dial-in access to a RAS. The system Time Profiles are made available as a drop-down list in the associated configuration tabs.

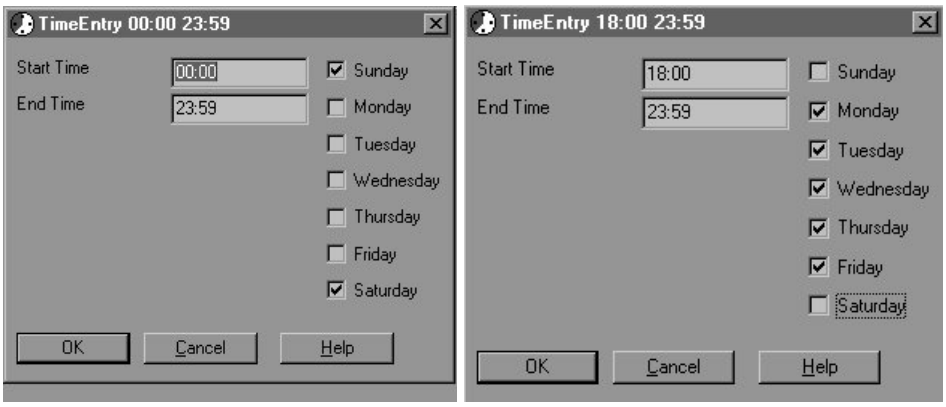
Right-click in the summary area to add or change a profile. Note that, in the summary list, the first time entry is shown, i.e., in this case the weekday timebands but not the weekend ones.



Name: The Time Profile must be given a unique, meaningful name, so that its purpose is obvious in a drop-down list.

Time Entry List: Right-click in the Time Entry List area to specify a cycle of start and end times. Note that the hours:minutes separator is a colon (:) and to span midnight it is necessary to make two entries, one to the end of the day and one from the start of the day, eg, 10 pm to 2 am is defined as 22:00 to 23:59 plus 00:00 to 02:00. Days of the week are specified by ticking the appropriate boxes. New time entries are added to the top of list and the first entry is shown in the main Time Profile list.

In the example above, since the timeband is different at weekends, it is necessary to make two time entries.

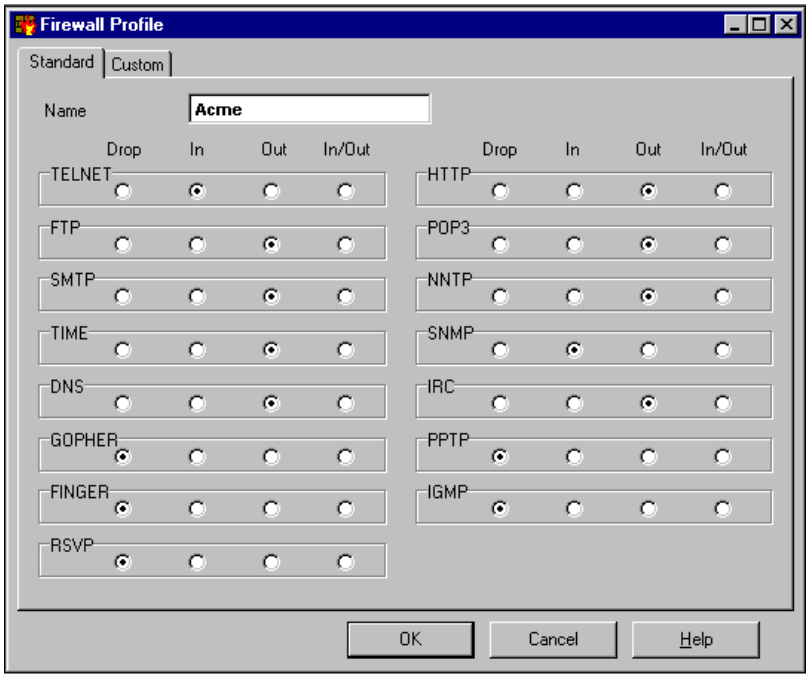


Firewall Configuration

A firewall is a means of restricting dialled access to and from a network, particularly at its interface with the Internet. The IPNC has a firewall with default settings that allow local users access to the outside world using most TCP/IP protocols, but stops any unsolicited access from the outside world to your subnet. When a permitted outgoing session starts it punches a hole in the firewall. This then allows traffic to flow in both directions. When the session ends the hole is sealed. A firewall can be specified for both User and Service profiles.

The Standard Firewall Tab

Use the following menu to set up the required firewall profile.



Name: The name of every firewall profile is made available in a drop-down list for Users and Services.

The Protocol radio buttons: A firewall can be configured to allow individual protocol sessions access as follows:

Drop: No sessions via selected protocol will be allowed through the firewall.

In: An incoming session can punch a hole in the firewall to allow traffic in both directions.

Out: An outgoing session can punch a hole in the firewall to allow traffic in both directions.

Bothway: Both incoming and outgoing sessions can punch a hole in the firewall to allow traffic in both directions

The protocols that can be managed in this way are:

File Transfer Protocol (FTP) - a TCP/IP application used for transferring files from one system to another

Telnet– used for remote access for diagnostic purposes.

Simple Mail Transfer Protocol (SMTP) – an email application.

Time Update Protocol (Time) – used to take the time of day from the Internet**.**
DNS (Domain Name Server) – translates public names to IP Addresses

Gopher – the predecessor of HTTP.

Finger – an application that, given an email address, can be used to obtain information about users currently logged on to a host system.

Resource Reservation Setup Protocol (RSVP) – an Internet protocol developed to enable the Internet to support specified Qualities-of-Service (QoS's). Using RSVP, an application will be able to reserve resources along a route from source to destination. RSVP-enabled routers will then schedule and prioritise packets to fulfil the QoS.

HyperText Transfer Protocol (HTTP) - the part of the TCP/IP protocol suite that transmits web pages over the Internet.

POP3 (Post Office Protocol) - the TCP/IP standard for mail transmission between server and client. POP3 is the current version.

Network News Transfer Protocol (NNTP) – used to set up local Internet news groups.

SNMP (Simple Network Management Protocol) - the part of the TCP/IP protocol suite that deals with the transmission of network information for system administration and monitoring.

Internet Relay Chart (IRC) – a real-time, multi-user chat application.

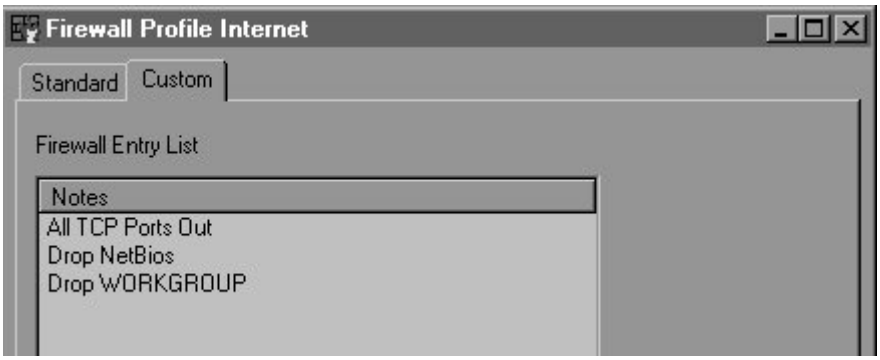
Point-to-Point Tunnelling Protocol (PPTP) – used to establish a Virtual Private Network (VPN) over the Internet.

Internet Group Management Protocol (IGMP) – is defined in RFC 1112 as the standard for IP multicasting in the Internet. It is used to establish host memberships in particular multicast groups on a single network. The mechanisms of the protocol allow a host to inform its local router, using Host Membership Reports, that it wants to receive messages addressed to a specific multicast group.

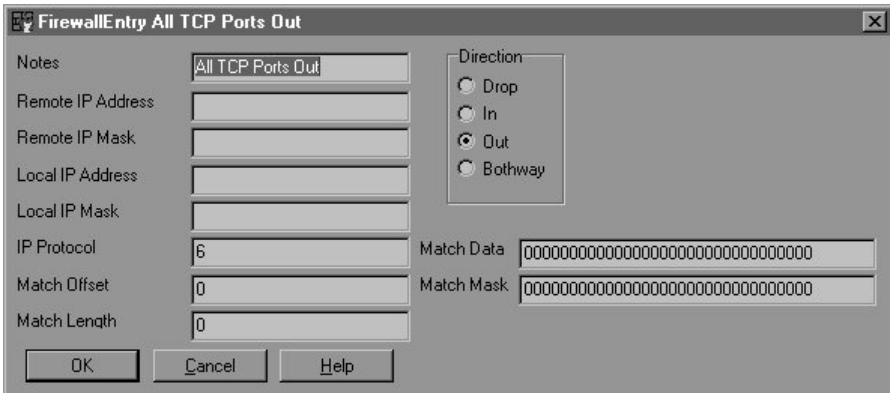
H323 – Not used.

The Custom Firewall Tab

The Custom tab is used to include specific filters in a Firewall profile. Each filter can allow new a session to be created for a specific address and protocol or it can be used to drop specific packets from passing across the link. Note that the first filter entry is displayed against the firewall name in the summary list.



To add a filter, right-click within the Firewall Entry List to obtain the configuration form as shown below.



Notes: This allows you to enter a brief description of your filter specification. If the field is left empty the word “Entry” is inserted so that you are aware that a filter has been applied.

Remote IP Address: This can be used to specify the IP address of the device at the far end of the link or left blank to include packets destined for all IP addresses.

Remote IP Mask: Packets can be checked against a destination’s IP Address Mask. If the field is left blank then the default all-inclusive value 255.255.255.255 applies.

Local IP Address: This can be used to specify the IP address of a local device or left blank to include packets originated by all local devices.

Local IP Mask: Packets can be checked against the local IP Address Mask. If the field is left blank then the default all-inclusive value 255.255.255.255 applies.

IP Protocol: The IP port number to be matched. Port numbers define the IP applications. e.g. 1 for ICMP, 6 for TCP, 17 for UDP or 47 for GRE.

Match Offset: The offset in bytes (0 is the first byte of an IP packet) where checking for a specific port number, a range of port numbers, or data begins.

Match Length: The number of bytes to be checked, from the Match Offset point, against the Match Data and Match Mask settings (see below).

Match Data: The required resultant value of the Match Mask calculation below. Note that the system pads the field with zeroes.

Match Mask: This is a byte pattern that is logically ANDed with the data filtered from the packet. The result is compared against the contents of the Match Data field.

Direction: This is the direction in which a session may be started if the filter finds a match:

– Drop - no session permitted
– In - allow new sessions to be started from outside the local subnet only
– Out - allow sessions to be started only from the local subnet
– Bothway - allow sessions either way.

Note that the Monitor program can be used to identify which packets are being blocked by the Firewall.

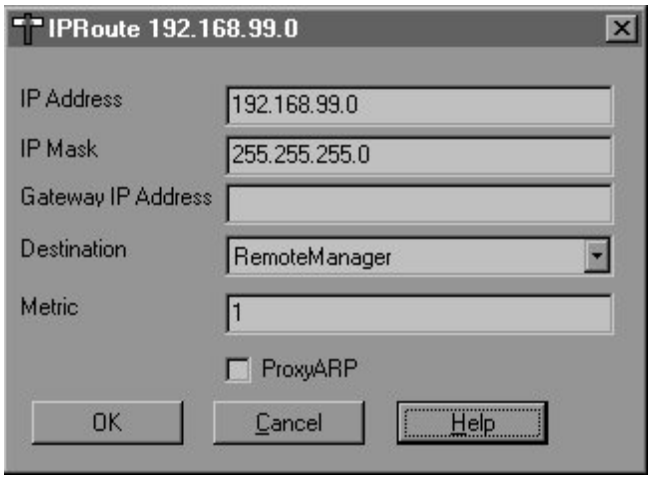
Examples

Note: All TCP/UDP applications are assigned an individual “port” number, used to identify the type of service one system is requesting from another. The Internet Assigned Numbers Authority publishes a list of these.

1. To access a web page that uses TCP Port 8000 instead of the more usual Port 80, use the following:
   – IP Protocol = 6 (TCP)
   – Match Offset = 22
   – Match Length = 2
   – Match Data = 1F40 (8000 in hex)
   – Match Mask = FFFF (FFFF.AND.filtered data = 1F40)
   – Direction = Out
   – Notes = Port 8000 Out
2. To allow all ports out (this also solves the problem in Example 1 but risks the making of unintentional data calls):
   – IP Protocol = 6 (TCP)
   – Match Offset = 0
   – Match Length = 0
   – Match Data = 0
   – Match Mask = 0
   – Direction = Out
   – Notes = All TCP Ports Out
3. To avoid Windows95 calling your ISP’s DNS to resolve local names:
   – IP Protocol = 17 (UDP)
   – Match Offset = 20
   – Match Length = 4
   – Match Data = 00890035
   – Match Mask = FFFFFFFF
   – Direction = Drop
   – Notes = Drop NetBIOS to DNS

IP Routing

The IP Routing Form is used for setting-up routing for the IP network. When a user sets up a call to an external service, data on the local subnet for the remote IP Address must be correctly routed to the particular Service. A series of values can be specified against which the addresses of data packets are compared. Data are routed to a specified Destination if a match is found, the Destination being one of a list of configured services or a default of LAN1, the local subnet - this is used for packets with no address match, i.e. to confine internal traffic to the local subnet.



IP Address: Either a specific IP address or, if left blank, the broadcast address 255.255.255.255. If a particular address is specified, any packets with a destination address matching this are delivered to the selected Destination. If the broadcast address is used, the system sends all packets to the chosen Destination. Any other addresses are checked in turn against the Mask and Gateway addresses to see if they match.

IP Mask: An IP Address Mask can be specified. Any incoming packets within the mask are then routed to the selected Destination.

Gateway IP Address: Used to specify a Gateway on the local LAN, i.e., another router, its IP Address can be specified here and all matching packets are sent to it (see also **Metric** below).

Destination: This allows a Service name to be selected from a pull-down list of all defined Services. There is a default destination, LAN1 (the local LAN), which means that any packets with no address matches remain on the local subnet.

Metric: A numeric value (default 1) indicating the number of “hops” in the route. Each time a data packet passes through a router, the “hop” count is incremented by 1. Some protocols impose a maximum hop count, after which the packet is discarded. The default value need only be increased if the ultimate destination involves additional routers.

Proxy ARP: If the box is ticked, the system acts as an Address Resolution Protocol (ARP) server, and can respond to ARP requests for the specified network. ARP resolves the IP address of a host device into the physical address of it's network adapter.

How Do I?

Within this How Do I ? section, full configuration guidelines are given for networking INDeX systems to provide IP connectivity and VoIP with proven INDeX telephony features.

To aid clarity, the configuration procedure for VoIP as been separated from general IP connectivity and therefore the How Do I ? section is divided into two parts as follows:-

Part 1 IP Connectivity: Highlights a number of ways to use the IPNC to provide IP connectivity (see page 64).

Part 2 VoIP: Discusses VoIP implementation and configuration on the INDeX platform. VoIP deployment issues are discussed and step-by-step examples are given for VoIP configuration (see page 89).

The organisation of the How Do I ? section is such that the advanced INDeX administrator may chose to go directly to the VoIP section.

Part 1 IP Connectivity

Introduction

This section provides a number of IP connectivity examples for the IPNC. Most, but not, all of the following examples are suitable for VoIP traffic; the suitability of a given configuration to support VoIP is shown. The examples for VoIP (see page 89) provide the procedural steps, but for VoIP considerations and basic concepts, refer to Appendix A and B (see pages 118 and 123 respectively).

There is no real disadvantage in configuring a network for support of VoIP, even if it is not the intention to currently deploy VoIP. In fact the mandatory requirement to use IPHC protocols will significantly improve the throughput of non-voice traffic over a slow speed WAN link in the absence of voice traffic.

Each example consists of a network diagram, a listing of configuration requirements plus a set of step-by-step instructions. These instructions specify the minimum requirements to complete the configuration tasks. The Instructions assume configuration from default. Similarly, unless explicitly referenced, all other values are at their default

Examples are given for the following:

IP Connectivity

- Internet Access using ISDN Dial-up Services, see page 65
- Dial-in Access for PC Modem/ TA with Callback, see page 67
- Digital Services, see page 69
- IP connectivity DPNSS/QSIG/PRI/BRI, see page 69
- Home Office / Small Office (With IP Office), see page 75
- Quick WAN set-up, see page 78
- Advanced WAN set-up, see page 80
- Frame Relay, see page 83
- LAN – with VPN ROUTERS, see page 85
- LAN –Two INDeX System - Single Site, see page 87
- QoS over WAN between IPNC & 3rd Party Router, see page 88.

Voice over IP

- Six step procedure, see page 89
- INDeX Net, see page 92
- Configuring VoIP, see page 106
- Test end-to-end Voice and Data, see page 103.

Remote Access

The IPNC can be configured to provide Remote Access for both Dial-up and Dial-in IP connectivity. An example of both of these types of remote access is discussed in this section.

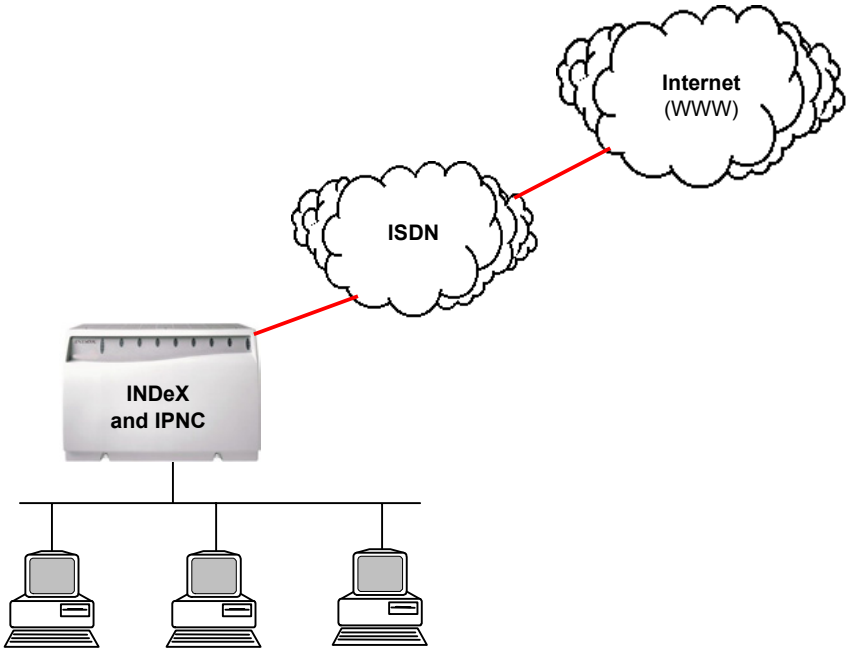
Dial-up Services
Internet Access using ISDN Dial-up Service

Dial-in Access
Dial-in Access for PC Modem/ TA using Callback

Internet Access using ISDN Dial-up Services

The following configuration provides a simple example for Internet access. Using this configuration it will be possible to provide access to the Internet for any number of PCs attached to either LAN1 or LAN2 of the IPNC.

Because this example configuration uses the NAT functionality of the IPNC it is not suitable for VoIP.



Local Area Network PCs

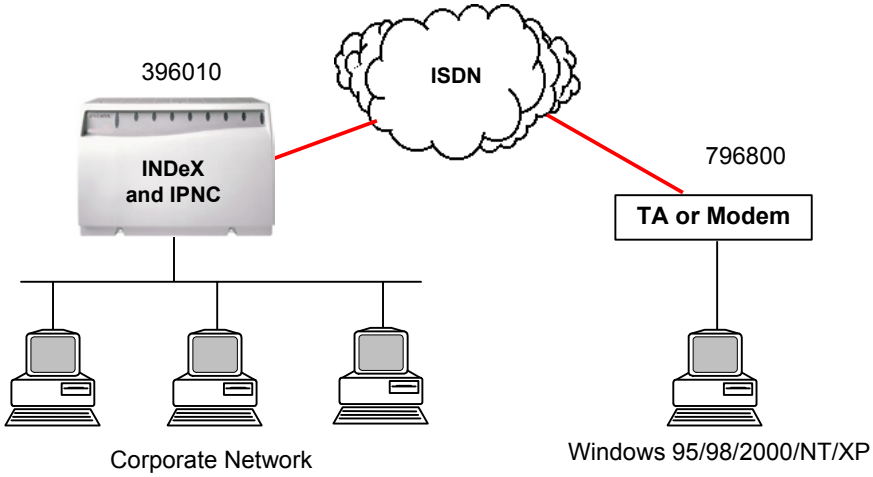
The configuration makes the following assumptions.

1. There is not an existing DNS server on the Network.
2. The IPNC is configured as DHCP server and there is not another DHCP Server on the LAN.
3. All PCs on the LAN are running in DHCP client mode
4. No IP addresses (including DNS server) have been supplied by the ISP
5. The following Information has been supplied by the ISP
   - An Account Name
   - Account Password
   - Telephone Number
6. To access the resources on the Local LAN (internal) from the Internet (external) additional configuration for the Primary Address Translation (see page 129) is required. This is because this configuration utilises the Network Address Translation (NAT) function of the IPNC.

Task	*Description*
Step 1 Configure INDeX environment. Refer to the INDeX Programming Manuals for details.	Program the INDeX to access the external line in the normal way.
Step 2 Obtain configuration file	The configuration file must first be obtained, modified and then submitted to the IPNC.
Step 3 Create a Normal Service and assign a unique name to this New Service.	The Name of a Normal Service is not used in the authentication procedure and is used only to identify the Service configuration. The name will be used in the IP Route configuration.
Step 4 Add the following parameters to the new Service • Name = Internet • Account Name = Username • Password = password • Telephone Number Move on to the next step without clicking OK.	The Account Name and password are the username and password supplied by the ISP. The Account name must not be confused with the Name parameter of a Service. The Name parameter on a Normal Service simply identifies the Services in the system.
Step 5 Select the following option within the new Service and submit configuration to IPNC • Default Route • Request DNS.	Default Route is on the Service tab Request DNS is on the IP tab
Step 6 Renew IP parameters on all PCs on the Local network.	Use WINIPCFG for Windows 95/98/ME Use IPCONFIG /renew for Windows NT
Step 7 Test configuration	PING an address on the Internet and observe the Monitor Application output. While the PING is maintained select Call events and ensure that the IPNC dials the number configured in (Step 4). If it can be determined that the IPNC dial connects and then immediately disconnects but the PING is unsuccessful, then use the Monitor application and select PPP to check LCP TX/RX and Security TX/RX. This will show whether the call is cleared as result of a bad password and/or incompatible PPP parameters.

Dial-in Access for PC Modem/ TA with Callback

Using either an ISDN Terminal Adaptor (TA) or a analogue modem the remote PC will be configured to access resources on the Corporate network. With the callback option selected on the IPNC, the initial call from the Windows PC will be dropped and return call made to establish IP connectivity.



The configuration makes the following assumptions:

1. The Home Worker is using MS Dialup Networking PC which is configured to allow IP parameters to be allocated on connection. This example assumes networking parameters WIN Server and DNS are required.
2. This configuration supports a single Windows PC.

Task	*Description*
Step 1 Configure INDEX environment using either the (T) or (S) interface (see pages 90 and 91). The configuration must ensure the DDI digits <396010> are presented to the IPNC line card.	Program the INDeX to route the incoming call to the IPNC line card group. The DDI digits will be configured as per the Extension field entered in the RAS menu (see page 55).
Step 2 Test INDeX configuration	Use the Monitor application, select Call and enable Call events. Point the Monitor application to the local IPNC and dial the Group number configured in Step one from an on-switch extension. The Call event on the Monitor Application must indicate the call is presented to the local IPNC. The result tone returned by the On-switch extension (i.e. engaged or busy) is not significant. It is only important that the call is presented to the IPNC.
Step 3 Modify the Extension field of the default RAS (Dial-in) as shown below: Extension = 396010	The RAS allows the IPNC router to identify which incoming calls are to be associated to data routing.

Task	Description
Step 4 If callback is required miss this step and proceed to the next step Create a new User Assign the following parameters to the user tab. • Name = Username • Password = password • Confirm = password • tick the "Dial In On" option on Dial In tab.	The user account name and password that will check against that supplied by the user on connection.
Step 5(optional - callback) This step is only required if configuring callback operation; go to step 8 if call back is not required. Create a new Intranet Service and assign the following parameters: • Name = Username • Password = password • Account Name =Username • Incoming Password =password Set the following parameter on the PPP tab of the new intranet service if an analogue modem is used to facilitate the callback. Service PPP • Access Mode = Modem	An Intranet service type combines a User and Service configuration form and allows callback, options to be specified. Selecting "Modem" access mode forces the IPNC to use the optional integral modems to return the callback. For incoming calls the IPNC will automatically determine the correct access mode. The default access mode is Digital64 which is appropriate when using an ISDN Terminal Adaptor (TA).
Step 6 (optional - callback) This step is only required if configuring callback operation; go step 7 if call back is not required. • Callback Mode= extended CBCP	Selecting this option allows Callback to be negotiated between the IPNC and the Dial-in PC. If Callback is not required then this option must not be selected. With extended CBCP Callback operation, the Dial in user (once authenticated) will receive a prompt for a telephone number. The IPNC will then terminate the call and place a new call to the specified number to re-establish the link. If the "9" is used to prefix external calls then the user would precede the number with the access digit(s) for an external line e.g. (9796800)
Step 7 System/DNS tab configure optional MS-Windows networking TCP/IP parameters. • DNS Service IP Address • WINS Server IP Address • WINS Scope	Windows Dial Up Networking is normally configured with DNS or Wins for name resolution
Step 8 Configure Windows dialup network on the Homeworker's PC	Configure Windows Dial Up Networking using the Username/password configured in step 3.

Digital Services

Two examples for digital services are proved as follows:

- IP connectivity DPNSS/QSIG/PRI/BRI
- Homeworking/ Small Office (With IP Office).

IP connectivity DPNSS/QSIG/PRI/BRI

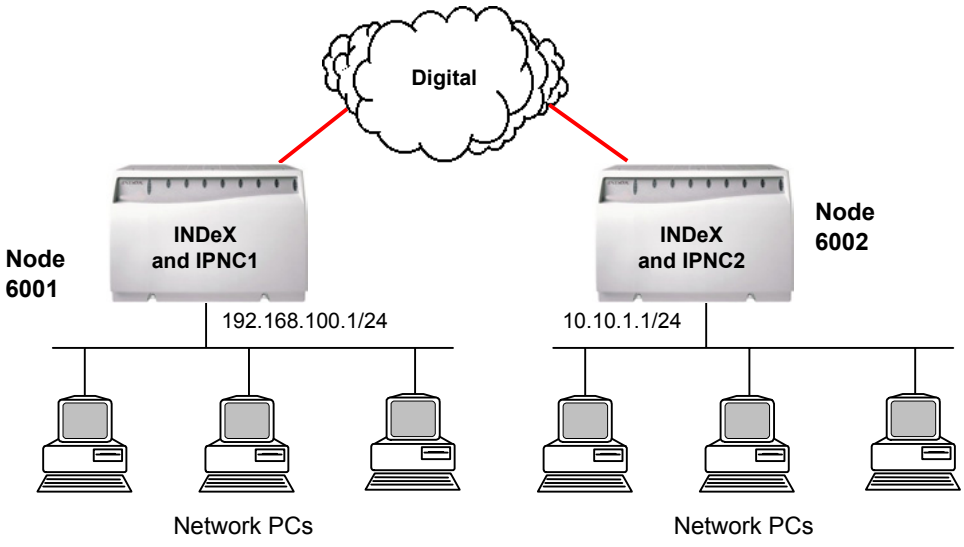
This configuration allows IP connectivity over Private Digital bearer services. PC's are networked in order to access shared resources between two locations. Once routable Inter-site traffic is present, the IPNC will dial and establish the specified number of bearer channels. The INDEX system will establish the bearer channels over the configured Digital link. This configuration provides for the support of VoIP over "bundled" ISDN bearer channels.

The configuration example is divided into two sections:

Section 1: Details the INDeX environment configuration of the IPNC data call (establishing IP connectivity) for either the Trunk or Subscriber IPNC channel types (T and S). The (T) configuration is used if VoIP is to be deployed (this allows User to User messages to be exchanged between the INDeX systems at call setup). The use of (S) Type channels is recommended for it simplicity in the absence of VoIP requirements.

The configuration of the INDeX environment for the VoIP telephony is detailed in Part 2 VoIP (see page 89).

Section 2: Details the IPNC configuration in support of IP connectivity over the DPNSS or Qsig. In addition, see Part 2 Voice Over IP on page 89 for the for details of the INDeX VoIP environment configuration using T or S type IPNC interfaces.



The following considerations should be made when using this configuration:

1. A maximum of 30 channels can be bundled on a single Digital Link
2. The IPNC can be configured for dynamic operation; meaning that in the absence of Inter-Site IP traffic the link will be idled
3. G711 VoIP compression is not supported for this application
4. Only the LAN1 will be used (LAN cable must be plugged in to Port A on both IPNCs).

Section One - INDeX Environment for IPNC Data call

Multi Subscriber Numbering (MSN) cannot be used to route the inbound digits when INDeX is used in configuration with DPNSS or Qsig. Care must be taken when setting up INDeX as DPNSS and Qsig **do not** adhering to ARS entries. Therefore INDeX Pilot numbers must be employed to allow IPNC data calls across Qsig and DPNSS. Ultimately the Pilot number controls the call set up to the IPNC via its associated INDeX Call Control plan.

INDeX Environment (T) Type –Data Call

The following procedure should be used for the IPNC data call set up across DPNSS or Qsig link using an IPNC 'T' type interface. The configuration assumes the node 6001 is called by remote node 6002 from the diagram above and uses the Pilot number 6200.

Steps 1 to 3 detail the configuration on the INDeX2 to allow digits to be routed to the IPNC2 (when received from the calling end INDeX1 via Qsig or DPNSS).

Steps 4 to 6 detail the outbound data call handling configuration for the calling INDeX1. This must be applied to both ends if two-way data calls are required. It is recommended that calling is initially configured in one direction only.

For details on creating Pilot numbers, Call Control Plans, etc. on the INDeX, refer to the INDeX Programming Manual.

Task	*Description*
Step 1 On INDeX2 (Called node) Create a Pilot number, e.g. 6200. This Pilot number will now have an associated Call Control Plan (by default=1)	This Pilot should be a unique number that will not interfere with the existing operational INDeX programming. This Pilot number is used to configure the routing to IPNC2 when called from IPNC1.
Step 2 On INDeX2 (Called node) The Call Control Plan associated to the Pilot number uses a Speed-dial against the First Day and Night service ringing dispositions. Make the Speed-dial number 6200.	This Speed dial number will be ARS matched that will allow routing the digits to the IPNC2.
Step 3 On INDeX2 (Called node) In ARS enter 6200 in String Analysis. Let this string use a Route List, which has the IPNC2 Trunk Group associated to it. Set the **Class of Service to 1,2,3.** Make this Route List use a Network Translation of '**Replace with.**'.'	This will send the number of 6200 into the IPNC2. This number 6200 will be associated to a RAS entry, which IPNC2 will use to establish the data call

Task	*Description*
Step 4 On INDeX1(Calling node) Assuming the remote node is 6002, and the Pilot is 6200 as configured above. In ARS enter String 60026200 to use a Route List. Program the Route List to have the Qsig or DPNSS Trunk Group and set this route list to 'Send Digits as Dialled'	The digits to route must be set in this way because if the INDeX function of *'Prefix with Node Number'* is used then number 6200 will not be routed to IPNC2. This is because the 'Connect-Ack' Message on the connection happens after the node numbers are exchanged during call setup. By utilising the route list to send digits as dialled it will forward all the digits to the remote end IPNC2.
Step 5 On INDeX1(Calling node) Configure IPNC1. The IPNC's service controlling the connection to the far end IPNC2 must be set as follows. In the number field of the Service input 60026200. This number set within the service of IPNC1 will rely on the default IPNC1 "?" shortcode.	The IPNC1 will be dialling the number 60026200 as configured above from its service. When the digits 60026200 are received on INDeX2 the node number (6002) is removed before sending 6200 to the Pilot number configured in steps 1-3 above. This number set within the service of IPNC1 will rely on the default IPNC1 "?" shortcode. Alternatively, the Shortcode field must then have 60026200 to 'dial' to the default IPNC group 0 which will send this to the INDeX back plane.

INDeX Environment (S) Type – Data Call

The following procedure should be used for the IPNC data call set up across DPNSS or Qsig link when using the IPNC S type interface.

Because of this the configuration of the S type interface is more straightforward than that of T type interface.

S type configuration requires the IPNC channels be placed in a group. The remote INDEX is then configured to call this group over DPNSS.

For details on configuring the INDeX for S type signalling over DPNSS, etc., refer to the INDeX Programming Manual.

Task	*Description*
Step 1 Configure INDEX environment for DPNSS signalling over an S type interface.	Use the S type for simplicity if inter-site VoIP is not required
Step 2 Configure an IPNC subscriber group with the IPNC channels on both INDeX systems. Then use the normal DPNSS configuration to route calls between these configured groups over DPNSS.	When the IPNC2 channel group is called from IPNC1 the called number (i.e. the IPNC2 channel group) is forwarded to IPNC2. The called number must be configured on the RAS extension of IPNC2. The called number must also be configured on the Calling IPNC1. This is set in the Number field of the Configured Service
Step 3 Test Configuration	If the INDeX environment is configured correctly then when the IPNC channel group is dialled the call should be routed to the IPNC. Use the IPNC Monitor application, select Call and enable Call events. Point the Monitor application to the local IPNC and dial the Group number configured above. Use an on-switch extension to call both a local and remote INDEX. You should see the number dialled in the called field of the ISDN Layer 3 message. The resultant tone returned by the on-switch extension (i.e. engaged or busy) is NOT significant at this point. It is only important that the call is presented to the IPNC.

Section Two –IPNC Configuration

This section details the configuration of the IPNC1 and IPNC2.

<table>
<tr><th>Task</th><th>Description</th></tr>
<tr><td>Step 1
Configure INDEX environment using the (T) type interface option</td><td>See INDeX Environment for IPNC Data call (page 70).</td></tr>
<tr><td>Step 2
Test INDeX configuration for both Units.</td><td>Use the Monitor application, select Call and enable Call events. Point the Monitor application to the local IPNC and dial the ARS routed number configured in Step 1 from an on-switch extension. The Call event on the Monitor Application must indicate the call is presented to the local IPNC. The resultant tone returned by the on-switch extension (i.e. engaged or busy) is NOT significant at this stage. It is only important that the call is presented to the IPNC.</td></tr>
<tr><td>Step 3
Obtain the configuration files for IPNC1 and IPNC2. Create an Intranet Service type using the Service parameters set out below.
<table>
<tr><th>Services Parameter</th><th>IPNC1</th><th>IPNC2</th></tr>
<tr><td>Name</td><td>IPNC2</td><td>IPNC1</td></tr>
<tr><td>Account Name</td><td>IPNC1</td><td>IPNC2</td></tr>
<tr><td>Password</td><td>password1</td><td>password2</td></tr>
<tr><td>Incoming Password</td><td>password2</td><td>password1</td></tr>
</table></td><td>For quick set-up, avoiding the use of separate incoming and outgoing account names. Use a common Service Name and Service Account Name.

For example, on the IPNC1 set both the Name and Account Name to ISDN_link and set both the Service Password and Service Incoming Password to a unique password that is common to both sites. Then configure IPNC2 using these identical parameters.</td></tr>
<tr><td>Step 4
On the IPNC1 Service form, configure the Telephone number to access the IPNC2.

• Service/Number = <called number></td><td>The <called number> is dependant on whether T type or the S type IPNC interface option is used.
• For S type see Step 2- INDeX Environment S type (page 72)
• For T type see Steps 4& 5 - INDeX Environment T type (page 70)
It is good practice to initially configure dial up operation in one direction only.</td></tr>
<tr><td>Step 5
In the Extension field of the default RAS (Dial In) on the IPNC2 add the number to match the Incoming call.

(See Step 3 INDeX T type configuration as detailed on page 70)</td><td>The <called number> is dependant on whether T type or the S type IPNC interface option is used.
• For S type see Step 2- INDeX Environment S type (page 72)
• For T type see Step 1 - INDeX Environment T type (page 70)
The RAS allows the IPNC router to identify which incoming number are to be associated to data routing. The RAS Extension field is use for this purpose and by default the match is made from right to left.</td></tr>
<tr><td>Step 6
For the IPNC1 and the IPNC2 apply the parameters on the PPP tab of Intranet service type (created previously) as described in the table below
<table>
<tr><th>Parameter</th><th>IPNC1</th><th>IPNC2</th></tr>
<tr><td>Service/PPP
1. Multilink
2. IPHC</td><td>Yes</td><td>Yes</td></tr>
<tr><td>RAS/PPP
1. Multilink</td><td>Yes</td><td>Yes</td></tr>
</table></td><td>The Multilink protocol is imperative for the correct operation of bundled channels over digital services and VoIP. IPHC is mandatory for the support of QoS for VOIP.

(See The RAS Tab on page 55)</td></tr>
</table>

<table>
<tr><th>Task</th><th>Description</th></tr>
<tr><td>Step 7 (optional)
This step is optional and is only required if more than two ISDN bearer channels are required. Proceed to the next step if a single bearer channel is to be used. Apply the parameter to the IPNC1
<table>
<tr><th>Parameter</th><th>IPNC1</th><th>IPNC2</th></tr>
<tr><td>Service /Bandwidth
• Max Number Channel</td><td>10</td><td><blank></td></tr>
<tr><td>Service /Bandwidth
• Extra BW Threshold</td><td>50</td><td><blank></td></tr>
</table></td><td>The IPNC can be configured to use up to 32 digital bearer channels to provide IP connectivity. The IPNC can typically route five G729 VoIP calls over a single DPNSS channel, with each call requiring one IPNC channel. So for example, if two DPNSS channels are used to provide data connectivity this would allow ten VoIP calls.

G711 compression cannot be used on digital bearer circuits for VoIP</td></tr>
<tr><td>Step 8
Add an IP route entry to support the connection.
IPNC1
• IP Address = 10.10.1.1
• IP Mask = 255.255.255.0
• Gateway = <blank>
• Destination = IPNC2
IPNC2
• IP Address = 192.168.100.1
• IP Mask = 255.255.255.0
• Gateway = <blank>
• Destination = IPNC1</td><td>A routing entry must be added to allow access between the two networks.</td></tr>
<tr><td>Step 9
Submit and test Configuration</td><td>Use the repeat Ping option (-t) to a device on the remote location and observe the Monitor Application. While the Ping is maintained, select Call events and ensure that the IPNC2 dials the number configured in Step 6.
If IPNC2 fails to dial then this is usually due to IP route configuration.

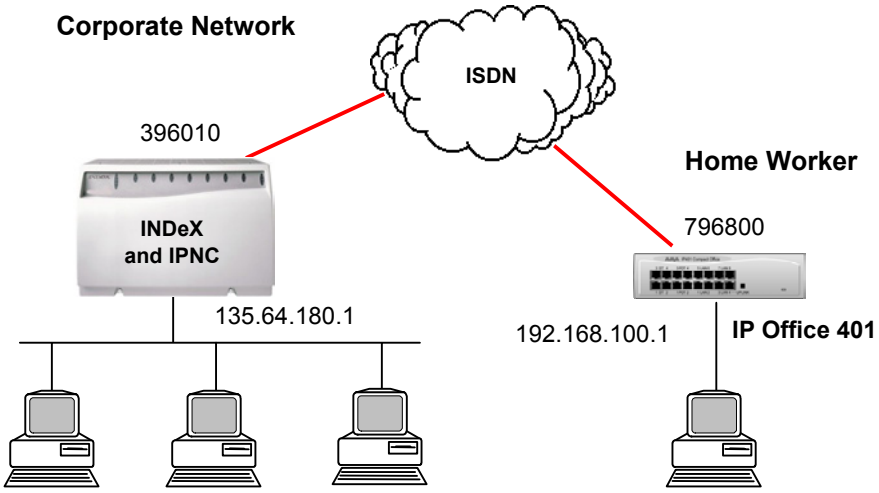
If the IPNC2 dials, connects and then immediately disconnects and the Pings are unsuccessful then this could be due PPP error, i.e. bad password, incompatible PPP parameters or a RAS configuration.
Use the Monitor application and select PPP to check LCP TX/RX and Security TX/RX.

Use both the ISDN Events Layer 3 and the ISDN Packets Layer 3 Send and Receive to determine if the call gets connected. If the call fails to connect check the RAS and environment configuration for the INDEX data call.</td></tr>
</table>

Home Office / Small Office (With IP Office)

This application example details the configuration for a Home Worker using an IP Office system to access the corporate network for computing resources. In addition, this configuration forms the basis of Avaya's Remote Log-on virtual terminal feature. From INDeX software Level 10.0, Digital Terminals (20xx/DT series) attached to an Avaya IP Office system can be configured to appear as virtual extensions of an INDeX system (see page 92).

To aid clarity, this configuration example does not detail the specific requirements for the VoIP elements of this application, (see page 89).



The following points are to be noted with respect to this configuration procedure.

1. The Remote Log feature require minimum software levels of IP Office 1.2(14), INDeX level 10 and IPNC 3.2 (see page 89).
2. The following procedure details the optional configuration in support of the Homeworker (ignore these steps if this feature is required
   - NAT to the corporate LAN
   - Multiple ISDN (bundled) channels

<table>
<tr><th>Task</th><th>Description</th></tr>
<tr><td>Step 1
Configure INDEX environment using the (T) type interface option (see page 70).</td><td>The configuration must ensure the DDI digits <396010> are routed to the IPNC line card.</td></tr>
<tr><td>Step 2
Test INDeX configuration for both Units.</td><td>Use the Monitor application, select Call and enable Call events. Point the Monitor application to the local IPNC and dial the ARS routed number configured in Step 1 from an on-switch extension. The Call event on the Monitor Application must indicate the call is presented to the local IPNC.
The resultant tone returned by the on-switch extension (i.e. engaged or busy) is NOT significant at this stage. It is only important that the call is presented to the IPNC.</td></tr>
<tr><td>Step 3
Obtain the configuration file for the IP401 and the IPNC. Create an Intranet Service type using the Service parameters set out below.
<table>
<tr><th>Services Parameter</th><th>IPNC</th><th>IP401</th></tr>
<tr><td>Name</td><td>IP401</td><td>IPNC</td></tr>
<tr><td>Account Name</td><td>IPNC</td><td>IP401</td></tr>
<tr><td>Password</td><td>password1</td><td>password2</td></tr>
<tr><td>Incoming Password</td><td>password2</td><td>password1</td></tr>
</table></td><td>For quick set-up, avoiding the use of separate incoming and outgoing account names, use a common Service Name and Service Account Name.
For example, on the IPNC set both the Name and Account Name to ISDN_link and set both the Service Password and Service Incoming Password to a unique password that is common to both sites. Then configure the IP401 using these identical parameters.
(See Service Configuration on page 46)</td></tr>
<tr><td>Step 4
On the IP401 Service form, configure the Telephone number to access the IPNC on the Corporate network.
• Telephone number 396010</td><td>It is good practice to initially configure dial up operation in one direction only. If a 9 is used to access the external line then this must precede the number to be dialled.</td></tr>
<tr><td>Step 5
In the Extension field of the default RAS (Dial In) on the IPNC add the number to match the Incoming call (DDI).</td><td>The RAS allows the router to identify which incoming number are to be associated to data routing. The RAS Extension field is use for this purpose and by default the match is made from right to left.</td></tr>
<tr><td>Step 6
For the IP401 and the IPNC apply the parameters on the PPP tab of Intranet service type (created previously) as described in the table below
<table>
<tr><th>Parameter</th><th>IPNC</th><th>IP401</th></tr>
<tr><td>Service/PPP
1. Multilink
2. IPHC</td><td>Yes</td><td>Yes</td></tr>
<tr><td>RAS/PPP
1. Multilink</td><td>Yes</td><td>Yes</td></tr>
</table></td><td>This configuration is suitable for VoIP with any compression mode other than G711.
(See The PPP Tab on page 52)</td></tr>
</table>

<table>
<tr><th>Task</th><th>Description</th></tr>
<tr><td>Step 7 (optional)
This step is optional and is only required if two ISDN bearer channels are required. Proceed to the next step if a single bearer channel is to be used. Apply the parameter to the IP401
<table>
<tr><th>Parameter</th><th>IPNC</th><th>IP401</th></tr>
<tr><td>Service /Bandwidth
• Max Number Channel</td><td><blank></td><td>2</td></tr>
<tr><td>Service /Bandwidth
• Extra BW Threshold</td><td><blank></td><td>20*</td></tr>
</table></td><td>This optional configuration allows the IP401 to dial a second ISDN bearer channel when bandwidth utilisation exceeds 25% on the first channel (100% = 64Kbps).

*Optional:
With a value of 20 the second bearer channel is established when a send voice call is made. Increase or decease this value relative to requirements.</td></tr>
<tr><td>Step 8 (optional)
This step is optional and is only required if the NAT functionality is required. Proceed to the next step if NAT is not required.

Apply the following configuration to the IPNC

System/LAN1
• NAT = selected</td><td>With this option selected the IPNC will NAT source IP addresses from the Homeworker’s network to the LAN1 IP address of the IPNC. This feature is most useful when the Homeworker requires Internet access via the Corporate network and Internet compliant IP addresses are in short supply.
Because the NAT process is only applied to IP packets leaving through the LAN1 interface, this configuration is suitable for VoIP. It would not be permissible to enable NAT on the IP401as this would effect the suitability of the application to support VoIP.</td></tr>
<tr><td>Step 9
Add an IP route entry to support the connection.
IPNC
• IP Address = 192.168.100.0
• IP Mask = 255.255.255.0
• Gateway = <blank>
• Destination = IP401
IP401
• IP Address = 135.64.180.0
• IP Mask = 255.255.255.0
• Gateway = <Blank>
• Destination = IPNC</td><td>A routing entry must be added to allow access between the two networks.

Note: You can optionally configure the System/DNS tab on the IP401 for DNS, WINS, WINS Scope.</td></tr>
<tr><td>Step 10
Submit and test Configuration</td><td>Use the repeat Ping option (-t) to a device on the remote location and observe the Monitor Application. While the Ping is maintained, select Call Events and ensure that the IP401 dials the number configured in Step 6.
If the IP401 dials, connects and then immediately disconnects but the Pings are unsuccessful, use the Monitor application and select PPP to check LCP TX/RX and Security TX/RX. This will show whether the call is cleared as result of a bad password and/or incompatible PPP parameters.</td></tr>
</table>

WAN with Lease Lines

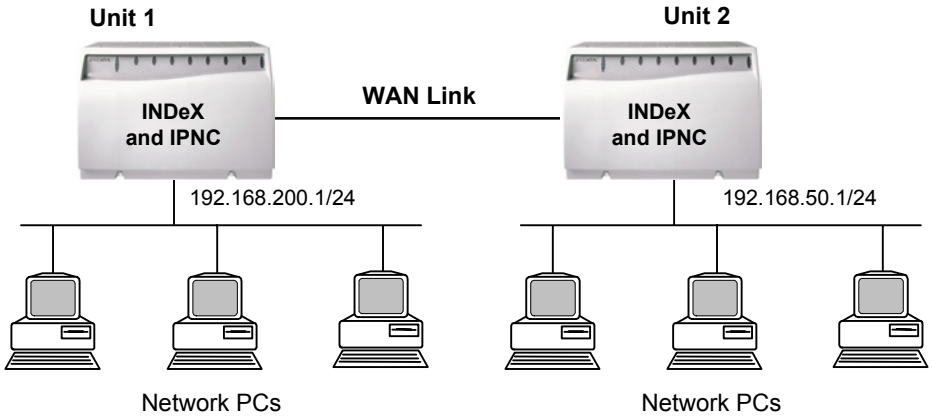
These configuration examples provide for IP connectivity between two sites using X21, V34 lease line point-to-point circuits. Two examples are given:-

- Quick WAN Set-up (No Authentication)
- Advance WAN set-up (CHAP Authentication)

The Quick and Advance WAN examples provide the same level of IP connectivity that may be modified to interoperate with 3rd party routers (see page 88). Both examples are suitable for VoIP (see page 89 for more information on VoIP configuration).

Quick WAN set-up

The quick set-up avoids the use of separate incoming/outgoing account names and password. Use a common Service Name, Service Account Name and passwords on both Unit 1 and Unit 2.



Task	*Description*
Step 1 Attach the WAN cable to Unit1 and Unit2 and reboot.	It is important that, when a new WAN device is created in the configuration, the IPNC is re-booted with the WAN cable attached. **Note:** Do not attempt to manually create a WAN device.
Step 2 Obtain configuration files	Obtain configuration file only after the IPNC has been rebooted with WAN cable attached (see The File Menu on page 25).
Step 3 Configure the System/LAN1 with the IP address of Unit1 and Unit2 as follows: Unit 1 System/LAN1 • IP Address = 192.168.200.1 • IP Mask = 255.255.255.0 Unit 2 System/LAN1 • IP Address = 192.168.50.1 • IP Mask = 255.255.255.0	See The System Configuration on page 35.

<table>
<tr><th>Task</th><th>Description</th></tr>
<tr><td>Step 4
For both Unit1 and Unit 2 create a new WAN Service type and add the following:
<table>
<tr><td>Parameter</td><td>Unit 1</td><td>Unit2</td></tr>
<tr><td>Name</td><td>wan_link</td><td>wan_link</td></tr>
<tr><td>Account Name</td><td>wan_link</td><td>wan_link</td></tr>
</table></td><td>This configuration does not require a password

See The Service Tab WAN and Intranet on page 47.</td></tr>
<tr><td>Step 5
For both Unit1 and Unit2 modify the WAN device and add the following parameters.
• Speed = as specified
• Mode sync = PPP
• RAS Name = wan_link</td><td>When using VoIP the accurate configuration of the WAN speed is a mandatory requirement for the correct operation of QoS but rely also on PPP multilink and IPHC options having been enabled on the link (see QoS on page 88 for details)
The Speed of the link should be obtained from the provider. The Speed must be specified in bits per second e.g. 128000.</td></tr>
<tr><td>Step 6
For both Unit1 and Unit2 add the following configuration using the PPP tab of the WAN Service.
• Multilink = selected
• IPHC = selected</td><td>Selection of the PPP Multilink and IPHC protocols are mandatory requirements for the correct operation of the QoS over a WAN link. The WAN speed must also be accurately configured (see QoS on page 88)</td></tr>
<tr><td>Step 7
Add the following routing entries
Unit1
• IP Address = 192.168.50.0
• IP mask = 255.255.255.0
• Destination = wan_link
Unit2
• IP Address = 192.168.200.0
• IP mask = 255.255.255.0
• Destination = wan_link</td><td>A Routing entry must be configured to allow the IP packets to be routed to the correct destination (see IP Routing on page 62).</td></tr>
<tr><td>Step 8
Submit configuration and Test.</td><td>Use the Monitor Application and select PPP Security TX/RX and LCP TX/RX.
PPP Security TX/RX will show whether the call is cleared as result of bad password.
If PPP echo Requests/Replies are observed then this shows the link is established.
If Echo Requests/Replies are observed, yet it is not possible to Ping the remote host, then check the IP Routing Table configuration.</td></tr>
</table>

Advanced WAN set-up

The advanced WAN configuration detailed below provides the same connectivity as the previous example (Quick WAN set-up). This example allows the connection to be authenticated in both directions using CHAP. The Outgoing Service Name and Password are matched against the Account name and Incoming Password.

Whilst the example details the configuration of WAN service it does not use the WAN service type configuration that was used in the Quick WAN set-up. With a WAN service type set to a Normal service type, the User and RAS items are created and combined into a single entity. This configuration example will detail the manual steps for creating the items which will be combined into a single item equivalent to a WAN type service.

Although the WAN service type used in the previous example (Quick WAN set-up) can be used for CHAP authentication between IPNC systems, the configuration here demonstrates the flexibility of the authentication mechanism. The flexibility of the IPNC means it may be configured to interoperate with the many varied requirements of 3rd party routers.

Task	*Description*
Step 1 Attach the WAN cable to the unit and reboot	It is important that, when a new WAN device is created in the configuration, the IPNC is re-booted with the WAN cable attached. **Note:** Do not attempt to manually create a WAN device
Step 2 Obtain configuration file for Unit1 and perform the following tasks: 1. Create a Normal Service type • Name = unit1 • Account name = unit2 • Password = password2 • Encrypted Password = selected 2. Create a User • Name = unit1 • Password = password1 • On the Dial-In Tab select Dial-In **On** 3. Create a RAS • Name = unit2 4. Modify the WAN device and add the following parameters • Speed = as specified • Mode = SyncPPP • RAS Name = unit2	Once these tasks are completed successfully select the newly created User/ Service and confirm details are as shown below, If not check spelling of Names/Account Names. **Parameter** **Value** Name (Outgoing) unit2 Account Name (Incoming) unit1 Password (Outgoing) password2 Incoming Password password1 **Notes:** 1. Passwords are encrypted in the Manager display and are not displayed. 2. The Speed of the WAN link should be obtained from the provider. Selection of the Encrypted Password option causes the IPNC to seek to authenticate the remote peer (i.e. the IPNC will issue a CHAP Challenge). It should be noted that with this option unselected the IPNC will agree to be authenticated and respond to CHAP but will not issue a CHAP Challenge This behaviour should be noted when interoperating CHAP authentication with 3rd party routers.

<table>
<tr><th>Task</th><th>Description</th></tr>
<tr><td>Step 3
Obtain configuration file for Unit2 and perform the following tasks:
1. Create a Normal service type
• Name = unit2
• Account name = unit1
• Password = password1
• Encrypted Password = selected

2. Create a User
• Name = unit1
• Password = password2
• On the Dial-In Tab select Dial-In On

3. Create a RAS
• Name = unit1

4. Modify the WAN device and add the following parameters.
• Speed = as specified
• Mode = SyncPPP
• RAS Name = unit1</td><td>Once these tasks are completed successfully select the newly created User/ Service and confirm details are as shown below. If not check spelling of Names/Account Names.

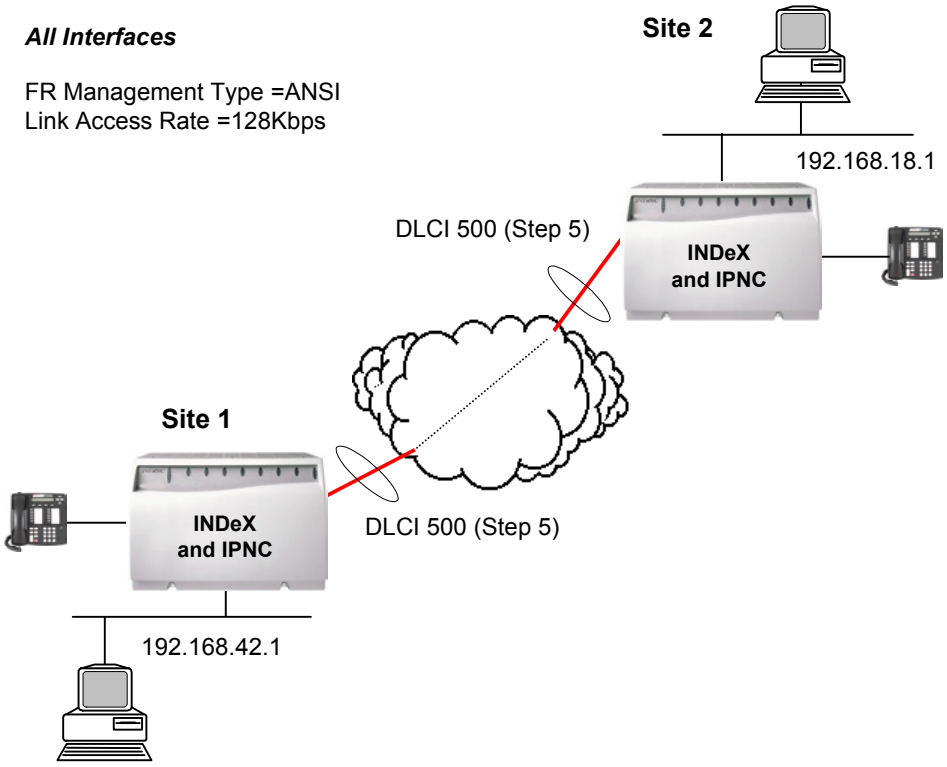
Parameter Value
Name (Outgoing) unit1
Account Name (Incoming) unit2
Password (Outgoing) password1
Incoming Password password2</td></tr>
<tr><td>Step 4
For both Unit1 and Unit2 add the following configuration using the PPP tab of the WAN Service.
• Multilink= selected
• IPHC = selected</td><td>Selection of the PPP Multilink and IPHC protocols are mandatory requirements for the correct operation of the QoS over a WAN link. The WAN speed must also be accurately configured (See QoS on page 98.)</td></tr>
</table>

Task	*Description*
Step 5 Add the following routing entries. Unit1 • IP Address = 192.168.50.0 • IP mask = 255.255.255.0 • Destination = wan_link Unit2 • IP Address = 192.168.200.0 • IP mask = 255.255.255.0 • Destination = wan_link	A Routing entry must be configured to allow the IP packets to be routed to the correct destination (see IP Routing on page 62).
Step 6 Submit configuration and Test Configuration	Use the Monitor application and select PPP and check LCP Tx/Rx and Security Tx/Rx. This will show whether the call is cleared as result of bad password. If PPP echo Request/Reply are observed then this is shows the link is established. If Echo Request/Reply is observer yet it is not possible to PING the remote check the IP routing configuration.

Note: The IPNC setup for 'Remote Terminal Users' is identical to that given for VoIP trunking in the example above except that the numbers used will be the 'Reserved Number' (default 18) for the rquired number of terminals. Refer to the INDeX Programming Manual for details.

Frame Relay

This example demonstrates the procedure for the configuration of the IPNC software Level 3.2 for operation on a Frame Relay Network. The configuration uses PPP encapsulation and is suitable for VoIP traffic (see page 89) and interoperation with 3rd Party routers (see page 88)



The example uses a PPP encapsulation to provide for inter-site and VoIP traffic between Site 1 and Site 2 and uses DLCI 500 and ANSI management

Task	*Description*
Step 1 Attach WAN cable, reboot unit and obtain configuration.	In order to configure the WAN interface IPNC requires the WAN cable to be attached at boot up.
Step 2 Create a WAN Service type • Name = FR_link • Account name = FR_link • All password fields = blank	Selection of the PPP Multilink and IPHC protocols are mandatory requirements for the correct operation of the QoS over a WAN link when using PPP encapsulation. Multilink and IPNC do apply when using RFC1490 encapsulation. The WAN speed (Access Rate) must also be accurately configured (see QoS on page 88)
Step 3 Perform the following tasks on the WAN port form • Mode = syncFrameRelay • Speed = Link Access rate (128000)	Do **NOT** configure a RAS name on the top level of the WAN port configuration; the RAS name should be set to the default RAS name of “Dialln”; the RAS name on this tab is reserved for future use. The RAS name configured in Step 2 will be used in step 5 below.
Step 4 On the Frame Relay tab set the following • FR Management type =ANSI • Frame Learn Mode = None	All the default parameters (except Frame Management type) on this tab are appropriate for a basic Frame Relay connection. Frame Management Types Q933 AnnexA 0393, Ansi AnnexD and FRFLMI are supported by the IPNC (see page 56):
Step 5 On the DLCI tab set the following • Frame Link Type = PPP • DLCI = 500 • RAS name = FR_link	The Frame Link Type parameter controls the Frame relay encapsulations type. The encapsulation is transparent to the FR network but must be matched at both ends of the links.PPP encapsulation is mandatory for VoIP operation over a FR link (see page 56). The DLCI as specified by the network provider RAS from WAN Service type configured in configured in Step 2.
Step 6 Add the IP route entries to support the connection. Site 1 • IP Address = 192.168.18.0 • IP Mask = 255.255.255.0 • Gateway = <blank> • Destination = FR_link Site 2 • IP Address = 192.168.42.0 • IP Mask = 255.255.255.0 • Gateway = <Blank> • Destination = FR_link	A routing entry must be added to allow access between the two networks.
Step 7 Apply above settings (Steps 1-6) for the remote IPNC.	The configuration detailed in this table should be applied to both ends of the FR link.

LAN

When using an indirectly connected WAN or VPN router these devices should be capable of handling marked traffic at a priority to ensure prompt handling of voice traffic. Alternatively, over supplying the available bandwidth will ensure that all packets, voice and data, are handled quickly.

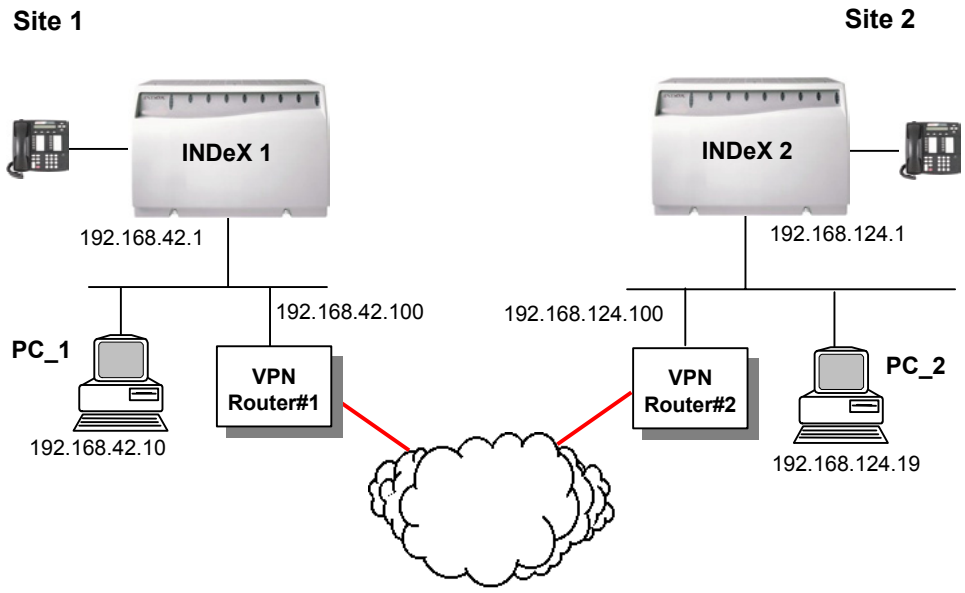
The VPN Line should be used to set the maximum number of simultaneous voice call and the System/Gatekeeper tab (see page 37) should be used to specify the DSCP (TOS or Diffserv) value for the VoIP traffic type.

See Configure VPN Line on page 99 and QoS over WAN between IPNC & 3rd Party Router on page 88 for details.

LAN – with VPN ROUTERS

This application example is suitable for VoIP between Site 1 and Site 2. All inter-site traffic is handled and routed by the VPN router. When using an indirectly connected slow speed link, all routers should be capable of handling marked traffic at a priority to ensure prompt handling of voice traffic.

Voice packets transmitted by the IPNC have the DSCP field marked to indicate it's priority (Diffserv).

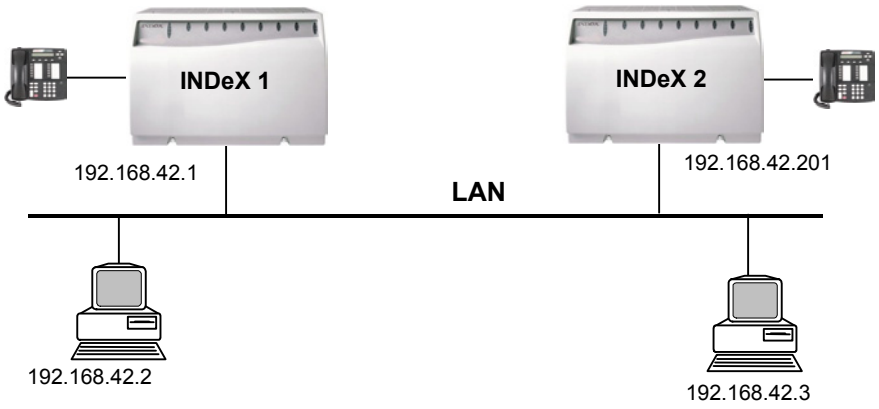


Task	*Description*
Step 1 Configure PC_1 and PC_2 networking as shown Site 1 • IP Address = 192.168.42.10 • IP Mask = 255.255.255.0 • Gateway = 192.168.42.100 Site 2 • IP Address = 192.168.124.19 • IP Mask = 255.255.255.0 • Gateway = 192.168.124.100	The IPNC will always present itself as the default router when allocating IP parameters via the DHCP. For this reason the DHCP server option should not be used as the IPNC is not the default router for the networks in this application example.

Task	*Description*
Step 2 Obtain configuration file and apply the following settings to the LAN1 interface of the IPNC systems on both Sites 1 and 2: Site 1 • LAN1 IP address Site 1 = 192.168.42.1 • IP Mask = 255.255.255.0 • DHCP Mode = Disable Site 2 • LAN1 IP address Site 2 = 192.168. 124.1 • IP Mask = 255.255.255.0 • DHCP Mode = Disable	Using the configured mask and IP address the IPNC is able to derive the network address of the interface; it is not necessary to add a routing entry in support of the configured LAN1 or LAN2 network address. See The System Configuration Menu on page 32.
Step 2 Add an IP route for the remote network on both sites: **Site 1** • IP Address = 192.168.124.0 • IP Mask = 255.255.255.0 • Gateway = 192.168.42.100 • Destination = LAN1 **Site 2** • IP Address = 192.168.42.0 • IP Mask = 255.255.255.0 • Gateway = 192.168.124.100 • Destination = LAN1	These routing entries will allow the IPNC to forward traffic destined for the remote network to the local VPN router.
Step 2 Test IP connectivity	If the IPNC systems are configured correctly it will be possible to PING INDeX 1 from Site 2 and INDeX 2 from Site 1.

LAN –Two INDeX System - Single Site

The configuration outline below provides the VoIP connectivity for an extended Ethernet LAN operating at 10/100Mbs. This application does not provide any connectivity for non-voice traffic. The IPNC is deployed purely to facilitate VoIP operation between the two INDeX systems. The configuration is ideal for INDeX to INDeX VoIP telephony testing.



Notes:
1. Both INDeX systems are connected to the LAN via the LAN interface an there are no routers between the two systems.
2. INDeX 1 System will allocate VoIP parameters. There are no other DHCP servers on the network
3. The IPNC VoIP Gateway function resides solely on the LAN1interface. The IPNC listens for VoIP Gateway connection on the LAN1 interface IP address only. This does not preclude the use of LAN2 interface for the VoIP transmission. An appropriate routing entry, on both IPNCs, would be required to allow the IPNC to route via LAN2 and access the LAN1 subnet of the partnering INDeX (a similar method is used in the next example).

Task	*Description*
Step 1 Obtain the configuration file for INDeX 1 and perform the following tasks: • Unique System Name • Assign the appropriate IP address to the LAN1 interface.	Using the configured mask and IP address the IPNC is able to derive the network address of the interface. It is not necessary to add a routing entry in support of the configured LAN1 or LAN2 network address. See The System Configuration Menu on page 32.
Step 2 Obtain configuration file for INDeX 2 and perform the following tasks. • Unique System Name • Assign the appropriate IP address to the LAN interface • Disable the DHCP Server	Notice that the IP address for INDeX 2 IPNC falls outside the IPNC default DHCP scope (200). The DHCP server must be disabled on this unit so as not to conflict with the DHCP server configured in the previous step of INDeX 1. See The System Configuration Menu on page 32.
Step 3 Test Connection	A common mistake with this configuration is to assign IP addresses to INDeX 1 and INDeX 2 such that they reside on different subnets. The IPNC is configured correctly if both INDeX1 and INDeX 2 respond to a PING for the PC attached to LAN.

Note: The IPNC setup for 'Remote Terminal Users' is identical to that given for VoIP trunking in the example above, except that the numbers used will be for 'Reserved Number' (default 18) for the required number of terminals. Refer to the INDeX Programming Manual for details.

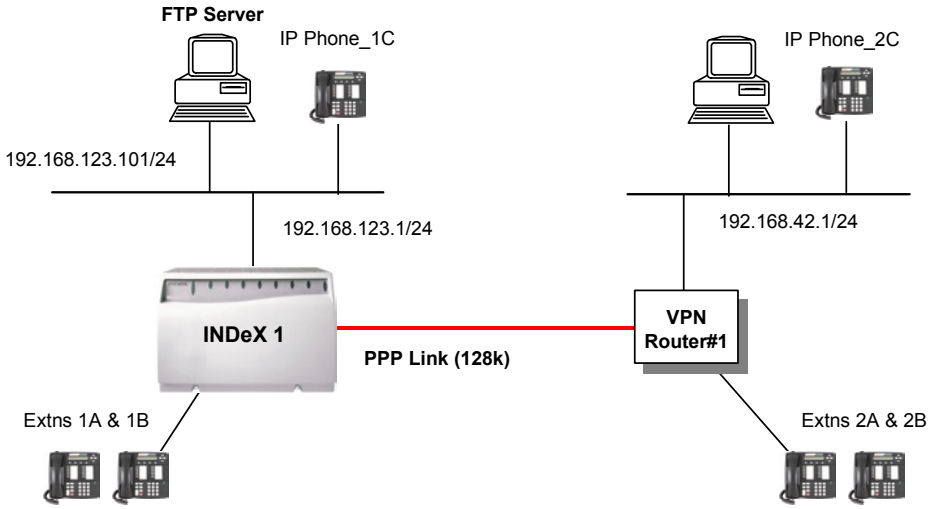
QoS over WAN between IPNC & 3rd Party Router

IPNC QoS is fully compliant with 3rd party router manufacturers that support Link fragmentation using PPP Multilink and IP Header compression (IPHC) (RFC 2507 and RFC 2508). This interoperation applies to both point to point and Frame Relay links using PPP encapsulation (see page 83).

All vendors that support a QoS mechanism on their routers will present their own method of voice traffic prioritisation to slow speed WAN links. The operation of such QoS mechanisms is “local” to a system but require that the enabling PPP protocols be negotiated on the link. IPNC will interoperate with any vendors QoS as long as the “enabling protocols” are agreed on the established link.

The “enabling protocols” for low speed WAN links are the PPP options for IP Header Compression (RFC 2508) and PPP Multilink (RFC1990). As long as these options are agreed on the PPP link (see The PPP Tab on page 52) then each router will “locally” apply QoS to their respective end of the link.

3rd party router interoperation relies on the successful negotiation of PPP protocol options (IPHC and Multilink). Once the PPP protocol options are agreed on the link both routers are then able to apply QoS polices to their respective ends of the link using fragmentation interleave and IP Header compression.



To configure QoS on an IPNC there are four mandatory parameters as shown below:

1. IP Header Compression set on the Service.
2. Multilink set on the service.
3. The WAN link configured for the WAN port speed.
4. An appropriate DSCP value system/gatekeeper tab

The IPNC 3.2 software has the following operating characteristics with respects to VoIP.

Description	Value
Voice UDP port numbers range	OxC000 to 0xCFFF
Signalling TCP port number	1720
DSCP (TOS/Diffserv) value	0xA0

The Configuration of the IPNC is dependant on the 3rd party router functionality. Use the quick WAN example as the basis for the configuration of interoperation and use the IPNC Monitor application to debug the PPP protocol exchange.

Part 2 Voice Over IP

Introduction

When configuring VoIP it is recommended that the task is broken into the following 6 steps. Approaching the configuration in this way allows the configuration to be tested and proved phase by phase.

Step 1 - Configure the INDeX environment, see page 90.

Step 2 - Test INDEX environment, see page 96.

Step 3 - Configure IP connectivity, see page 97.

Step 4 - Test IP connectivity, see page 98.

Step 5 - Configure VPN line, see page 99.

Step 6 - Test End-to-end VoIP and data, see page 103.

Use this section to understand and find related information for the successful completion of these steps. The final part of this section includes a VoIP configuration example which utilise this 6-step method.

Both the novice and advance INDeX administrator will benefit for taking this 6-step procedure. The advance INDeX administrator may choose however to proceed to the example VoIP application where references are given for the configuration of VoIP.

Further background information is provided in Appendix A: General Information on page 118 and Appendix B: Concepts on page 123

Step 1- INDeX environment

This step details the requirements for setting-up INDeX to INDeX telephony.

IPNC channel type

From INDeX software Level 10.0+ the IPNC channels can be optionally configured as either Trunk (T type) or Subscriber (S type).

(T) Type

Operating as (T) type, IPNC offers full INDeX to INDeX feature transparencies. This is achieved by tunnelling the User-to-User information within the layer 3 call setup exchanges. For advanced INDeX Administrators the T type channel is the same as that for a DPNSS trunk. Use T type channels when linking two INDeX systems for VoIP.

Refer to the INDeX Programming Manual for details on programming Trunk numbers, Sequential groups, etc.

Task	*Description*
Step 1 Ensure that INDeX has IPNC license (see page 6).	This allows an IPNC (one license per IPNC) to have 32 channels on the INDeX backplane providing 2048K Bandwidth.
Step 2 From INDeX programming, ensure that the next *TRUNK* number is correct.	This is to ensure that when the IPNC starts the trunk field allocated to each channel (32 with license) increments numerically. This ultimately makes programming of the INDeX easier.
Step 3 Create a new group on the INDeX. Ensure that this new group is a *Trunk Sequential* group.	This group is used in the INDeX Network Routing Tables when configuring the INDeX when setting up the DPNSS activity.
Step 4 From INDeX programming, program the 32 IPNC trunks into the *Trunk* group created above.	
Step 5 Program the INDeX *Network Routing Tables* to have the remote INDeX node number and to use the Trunk group created above. This Node number should then use a VPN number. This VPN is used by the IPNC to set up the VoIP call.	When the extension number dialled across DPNSS is called, the node number will prefix it automatically by INDeX via programming. The VPN number is sent to the IPNC cassette via the trunk group containing the IPNC channels. The IPNC acts on the VPN number matched in it's Shortcodes.
Step 6 Within INDeX programming, enter the remote users numbers which will be on the INDeX node number set up in the previous steps.	Dialled remote users need to be prefixed by the node number. This programming step ensure that this is done automatically.
Step 7 Repeat the process from steps 1-6 on the remote INDeX but ensure the remote users (step 6) are that of the original INDeX node.	This should now leave the two INDeX node network at a point where the IPNC needs to be configured to allow the call to proceed across the packet network.

(S) Type

The IPNC S type interface must be used in the case where there are IP Endpoints directly attached to the LAN interface of the IPNC. The S type channels can also be used to provide IP connectivity between INDeX systems when simple call features or non-voice IP connectivity is required.

Refer to the INDeX Programming Manual for details on programming Subcriber numbers, Sequential groups, etc.

Configuration Task	*Description*
Step 1 Ensure that INDeX has IPNC license (see page 6).	This allows an IPNC (one license per IPNC) to have 32 channels on the INDeX backplane providing 2048K Bandwidth.
Step 2 From INDeX programming, ensure that the next *Subscriber* number is correct. Refer to the INDeX Programming Manual for details.	This is to ensure that when the IPNC starts the Subscriber channels allocated to each channel (32 with a license) increments numerically. This ultimately makes programming of the INDeX easier.
Step 3 Create a new group on the INDeX. Ensure that this new group is a *Terminal Sequential* group.	This group is used in the INDeX Network Routing Tables when configuring the INDeX when setting up the DPNSS activity.
Step 4 Program the IPNC subscriber channels into the *Terminal Sequential* group created above.	Assign IPNC channels to a Group
Step 5 Assign the numbers that are accessible via the IPNC group (*Assign VoIP Number*) From the diagram on page 99, Gateway1 would be configured with numbers 3000-3100.	The Assign VoIP Number at the remote end allows the remote extensions, which are accessible via the IPNC, to be routed to the IPNC channel group. In some respects this configuration is similar to the number at remote node.
Step 6 Repeat the process from steps 1-5 on the remote INDeX.	This should now leave the two INDeX node networks at a point where the IPNC needs to be configured to allow the call to proceed across the packet network.

INDeX Net

INDeX-Net is required to support user to user across INDeX systems and currently provides the following features.

- Busy Lamp Field (BLF) Presentation over the Network
- Networked Groups
- Hot Desking Across the Network

For the INDeX-Net operation an interchange of information over TCP/IP between the participating nodes is required. This can be provided by either the IPNC or a 3rd party router. Apart from IP connectivity no special consideration is needed for the IPNC configuration. It is recommended that MPPC compression is applied over slow speed WAN links.

Refer to the INDeX Programming Manual for detail of the configuration.

INDeX environment for Home Office /Small Office

From INDeX software Level 10.0, Digital Terminals (DT) that are attached to an Avaya IP Office system can be configured to appear as virtual extensions of an INDeX system. By this means all the normal INDeX Digital Terminal (DT) extension features and facilities are made available to the Remote Homeworker.

The Remote User first dials the number which allows the corporate INDeX to present the DT logon menu and authenticate the user. Once the Remote User log is successful the remote extension appears as a normal extension to the corporate network and the Remote user.

The following rules apply to the Remote Logon feature:

1. The G711 compression mode is not supported.
2. The T type Interface option must be used on the INDeX for the IPNC.
3. In support of the Remote Log feature minimum software levels must be:-
   IP Office 1.2 (14)
   INDeX level 10.0
   CCM Server level 3.1 (accounting)
4. Only Avaya's Digital Terminal (DT/20xx) types can be used for remote logon.
5. INDeX Remote Logon is supported for VPN routers (LAN) ISDN and WAN connections.
6. When using digital services (ISDN) the IPNC uses one channel to establish IP connectivity and one for VoIP/Logon. Subsequent calls for the user (once logged on) do not require additional channels. Each new user that is logged on will consume one IPNC channel.
7. All activity on the remote terminal will be controlled via the INDeX, e.g. call barring, ARS routing, pickup, paging, conferencing, etc. The Time and Date does not update remotely, this is a function of the IP Office (set by the administering PC).

Configuration

The following procedure details the configuration of the INDeX for VoIP support of the Home worker. The configuration should be used in conjunction with the example shown on page 75. This procedure assumes IP connectivity has been correctly established between the corporate network and the Homeworker. There are two parts to this procedure:

Part 1: IPNC installation and INDeX routing

Part 2: IPNC and IP401 VPN Line configuration.

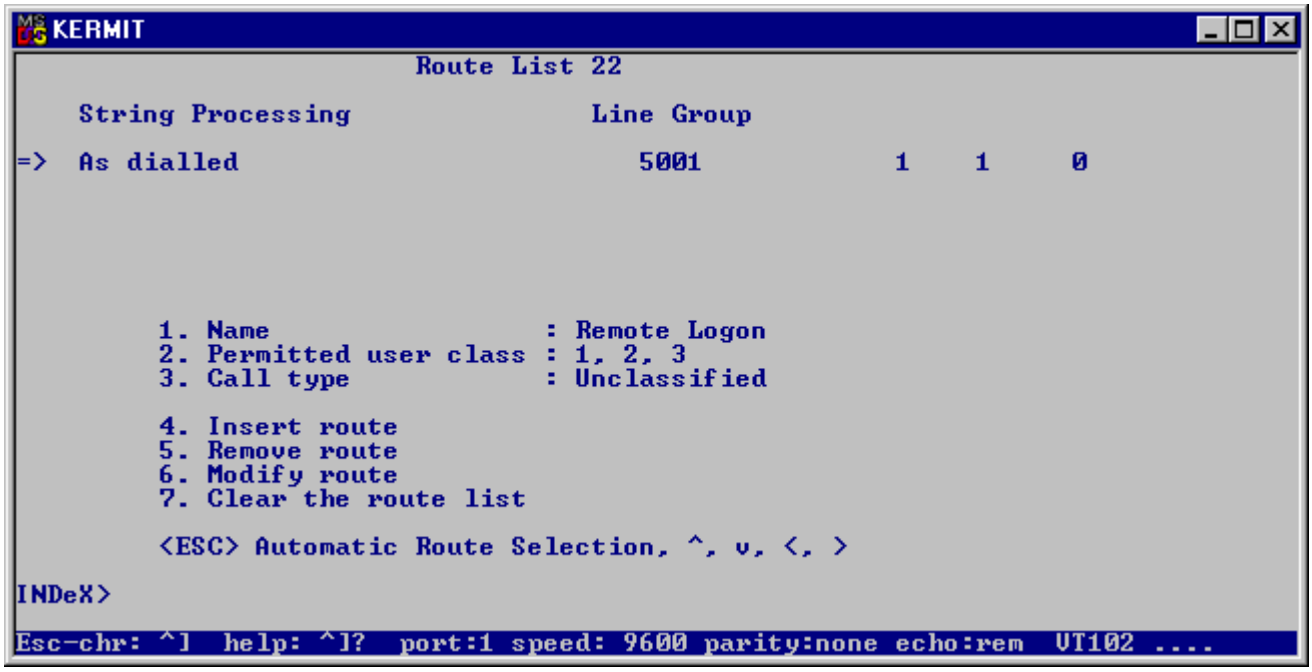
Part 1- IPNC installation and INDeX routing

This procedure describes the INDeX routing configuration using ARS.

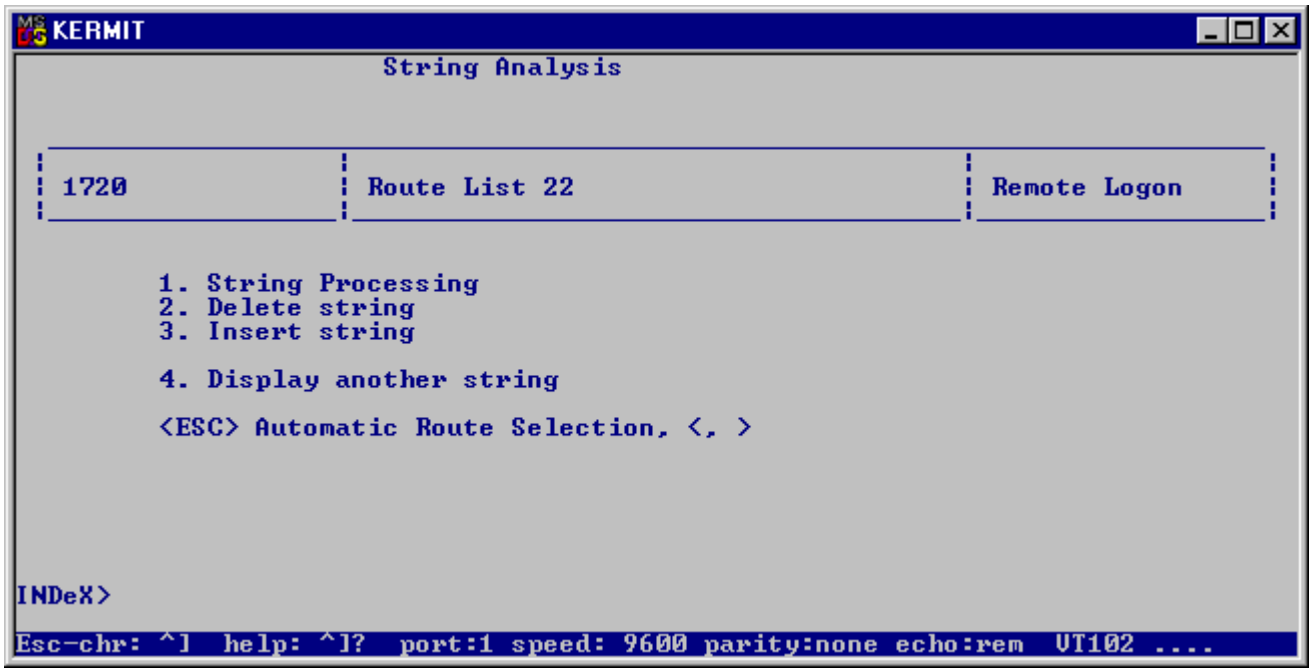
Refer to the INDeX Programming Manual for details programming Next trunk numbers, Sequential groups, etc.

Task	*Description*
Step 1 Before installing the IPNC line card into the INDeX system ensure that the INDeX has the required license (see page 6).	This allows per (1) license each IPNC to have 32 channels on the INDeX.
Step 2 From INDeX programming, ensure that the *Next trunk number* setting will allow a contiguous range of channel numbers to be assigned to the IPNC. • Install the IPNC cassette into the INDeX Ensure the correct indications are shown on the IPNC then proceed to the next step.	Having a contiguous range of channel numbers is good INDeX programming practice.
Step 3 Create a new group on the INDeX. Ensure that this new group is a *Trunk Sequential* group. Program the IPNC trunks (viewed in Linecard Information) into the *Trunk* group created above.	This group is used in the INDeX Network Routing Tables.
Step 4 Program a free route list from *Automatic Route Selection/Route List*. 1. Name = Remote Logon 2. Permitted =1,2,3	
Step 5 For the route list created above select *Insert Route* and set as follows:- • String processing = As Dialled • Line Group = IPNC channel group (created previously)	More than one route can be configured for a route list
Step 6 Configure *String Analysis* to the route list created previously	Enter the DDI digits (string)
Step 7 Create a *Reserve User Number*.	A Remote User can log-on using any number that is assigned as a Reserved User Number.

The screen shot below shows an INDeX Route list configuration form created from the instructions in the table above.



The screen shot below shows an INDeX String Analysis configuration form created from the instructions in the table above



Part 2- IPNC and IP401 VPN line configuration

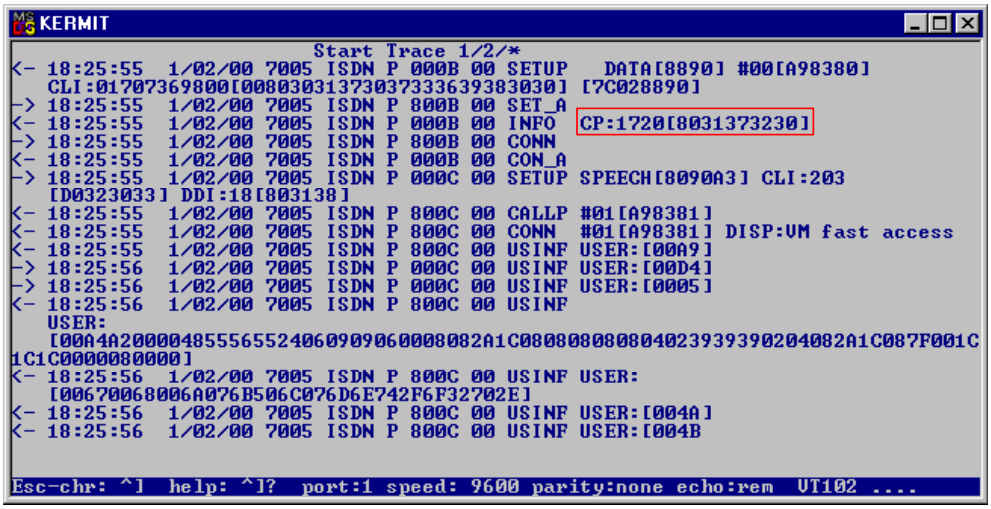
To complete the configuration for Remote logon a VPN Line is required on the IPNC and the IP401 (see page 99 for details on VPN line configuration). The VPN Line controls and establishes the initial Logon procedure and VoIP call routing once the Remote user is logged on successfully.

Configuration *Task*	*Description*
Step 1 On the IP401 create a VPN line and apply the following parameters. • Line Number = 2 • OutGoing Group ID = 2 • Gateway IP Address = < IP address of IPNC > • Compression mode = G729 • Local Tones = Yes	When this VPN line group is accessed it will seek to establish a connection to the configured VoIP Gateway. This will in turn invokes the configured Intranet service and establish IP connectivity. **Refer to the IP Office Manager Manual for details.**
Step 2 On the IP401 create a Shortcode using these parameters • Short Code = 18 • Telephone Number =. <full stop> • Line Group ID = 2 • Feature = Dial	The Shortcode invokes the VPN Line 2 which in turn invokes the configured Intranet Service. If not already connected the Intranet service establish IP connectivity. The Remote Use initiates the process by dialling digits “18” From INDeX level 10.0, a new Reserved Number “18” is created from default on the INDeX system. Hence the Remote Log-in number should be 18.
Step 3 On the IP401, apply these setting to the User form for the Remote logon user. ***User/Telephony*** • Remote Home Worker / Agent ticked = yes	The DT/20xx digital handset on the IP-Office utilising home working should have ‘Remote Home Worker / Agent ticked’. This is found in the user’s details under the ‘Telephony’ tab. This option causes the DT/20xx digital handset to display ‘Local User’ when idle and not logged on to the INDeX.
Step 4 On the IPNC create a VPN line (see page 41) and apply these parameters. • IPNC Line Number = 2 • OutGoing Group ID = 2 • Gateway IP Address = < IP address of IP401> • Compression mode = G729 • Local Tones = yes	The VPN Line is associated to IP401.
Step 5 On IPNC and the IP401 the following shortcode must also be configured on the system. • Short Code = ? • Telephone Number =. <full stop> • Line Group ID = 0 • Feature = Dial The ISDN line must be set as shown (this is the default) • Line Group ID = 0	This shortcode is created on the IP401 and the IPNC from default but can be edited. Ensure this shortcode is consistent with the details shown here. The number configured on the Intranet service (e.g. 396010) will be dialled on the ISDN Line 0 (see The ShortCode Function on page 42)

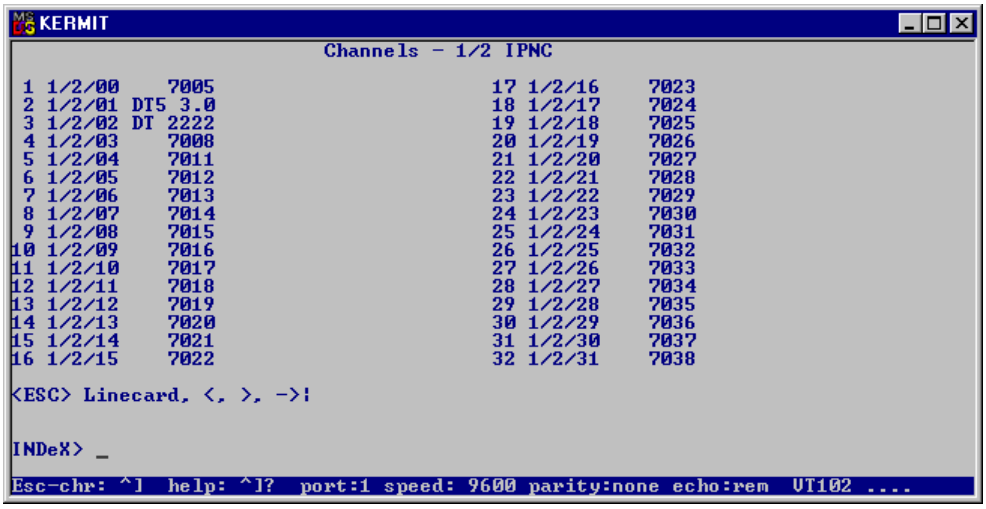
Configuration *Task*	*Description*
Step 6 How to login remotely The configuration described above uses the default Remote Login number 18. After the Homework dials 18, the INDeX logon DT menu is offered. The Homeworker must then enter his Extension number and password	If the Homeworker is configured to access the corporate network through the IP401/IPNC then ensure while accessing the corporate network that speech quality is not impacted. See page 103 if there are problems with speech quality.

Step 2 - Test Index environment

The following screenshot shows a call has been presented to the INDeX under the ARS configuration described on page 93. The display show that the digits “1720” are presented to the IPNC line card (4th Line preceded with the letters CP:)



The following screenshot shows the INDeX Line-card information of the IPNC with one agent logged (2222) on remotely using ISDN dialup.



Step 3 - Configure IP Connectivity

Configure the IPNC for the appropriate IP connectivity option.

IP Connectivity Options

LAN 10/100 Ethernet

The IPNC transmitted VoIP packets to LAN are distinguish with the TOS field setting. In this case it would be the function of other systems on the LAN to ensure that voice traffic is protected from delay.

Lease line (PPP)

Avaya QoS for Slow Speed WAN links ensure that non-voice traffic does not adversely affect the delay sensitive VoIP stream. The Avaya QoS can also be configured to interoperate with a 3rd party router over a WAN link.

Frame Relay

Using Frame Relay with PPP encapsulation it is possible to provide VoIP over Frame Relay between two INDeX systems.

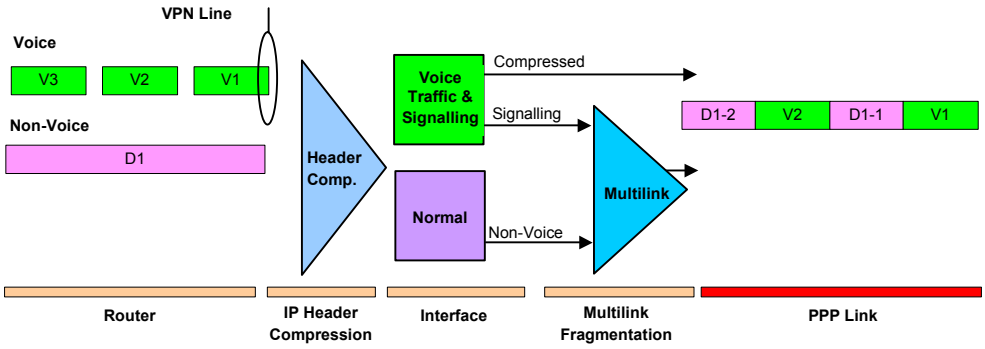
Digital services

The term Digital service to refers to QSIG, DPNSS ISDN-ePRI, ISDN-2e. The IPNC can be configured to provide VoIP over single or multiple (bundled) bearer channels. A single ISDN bearer channel, for example, can be used to support up to 5 concurrent VoIP calls. The bandwidth of a G711 VoIP call is equal to the bandwidth of a single bearer channel. Hence G711 compression is not supported for this connectivity type.

QoS

Operation

The diagram below illustrates the operation of Avaya's IPNC QoS mechanism for slow speed WAN links.



Voice packets are transmitted with a fixed length and intervals (1x20ms) and must not be delayed through the interface.

The illustration shows voice packets (V1, V2 and V3) and non-voice packet D1 arriving at the PPP interface. The non-voice packet D1 is made to fit into the interval between successive voice packets. This is accomplished by processing large non-voice packets through PPP Multilink. The Multilink process "fragments" the larger non-voice packet (D1) into smaller components (D1-1 and D1-2) for serialization to the PPP link. Voice packets are not fragmented in this way. Layer 3 (call control) packets are fragmented and inserted when bandwidth is available in the same way as non-voice packets.

Configuration

The following configuration task list details the necessary steps to enable QoS configuration and IPNC systems. QoS interoperation with Third party router relies on the successful negotiation of the PPP protocol options.

Task	*Description*
Step 1 Configure the IPNC link to provide the appropriate IP connectivity	Several examples of IP connectivity options are detailed in the preceding chapters.
Step 2 On the PPP tab of the service configured in the previous step select the following configuration Items. • Header Compression Mode using IPHC • Multilink	This is not required in the case were the IPNC forward VoIP over a LAN. See the PPP tab on page 55.
Step 3 On the WAN port form (see page 56) configure the operational speed of the WAN link in bits/per second. E.g. Speed = 128000	IPNC uses the configured WAN speed to dynamically calculate PPP link fragment size for non-voice traffic.

QoS interoperation with 3rd Party routers

IPNC 3.2 software has the following operating characteristics

Description	**Value**
Voice UDP port numbers range	0xC000 to 0xCFFF
Signalling TCP port number	1720
DSCP (TOS/Diffserv) value	0xA0

The “enabling protocols” for low speed WAN links is the PPP options for IP Header Compression (RFC 2508) and PPP Multilink (RFC1990). As long as these options are agreed on the PPP link then each router can “locally” apply QoS to their respective end of the link.

The DSCP value is configured on the system/gatekeeper tab and the PPP multilink and IPHC option is configurable under the Service/PPP tab.

Step 4 - Test IP Connectivity

The IPNC Monitor Tool is a powerful debugging and diagnostic tool. Using the IPNC System Monitor application options, it is possible to debug all aspects of the IPNC's functions and features. Generally, outputs are associated directly to any related standard. E.g. PPP monitor outputs will reference RFC terms relating to the PPP protocol.

The section IPNC debugging contains details on further monitor options useful for debugging QoS, call setup and protocol negotiations issues on IPNC.

Step 5 - Configure VPN Line

The VPN Line Group ID is an absolute reference to VPN line. It is permissible for 2 VPN lines to share the same Line ID in case where redundancy is required.

VoIP Gateway Options

Call Routing - When an extension number dialled from one INDeX to another, the transmitted number is prefixed with the node number of the other INDeX. The VPN number is sent to the IPNC cassette via the trunk group containing the IPNC channels. The IPNC acts on the VPN number matched in its Shortcodes.

Silence Suppression

Further Bandwidth can be saved by enabling silence suppression on the link. This can reduce the required bandwidth by over 50% during period of silence but carries a QoS penalty in that the conversation can feel unnatural.

FAX support

Fax is supported (the configuration for FoIP transport).

Compression Types

The Following Compression types are supported

G711 – Offer the best quality speech but uses the highest bandwidth. G711 should be used on LAN or WAN links were bandwidth availability is not an issue.

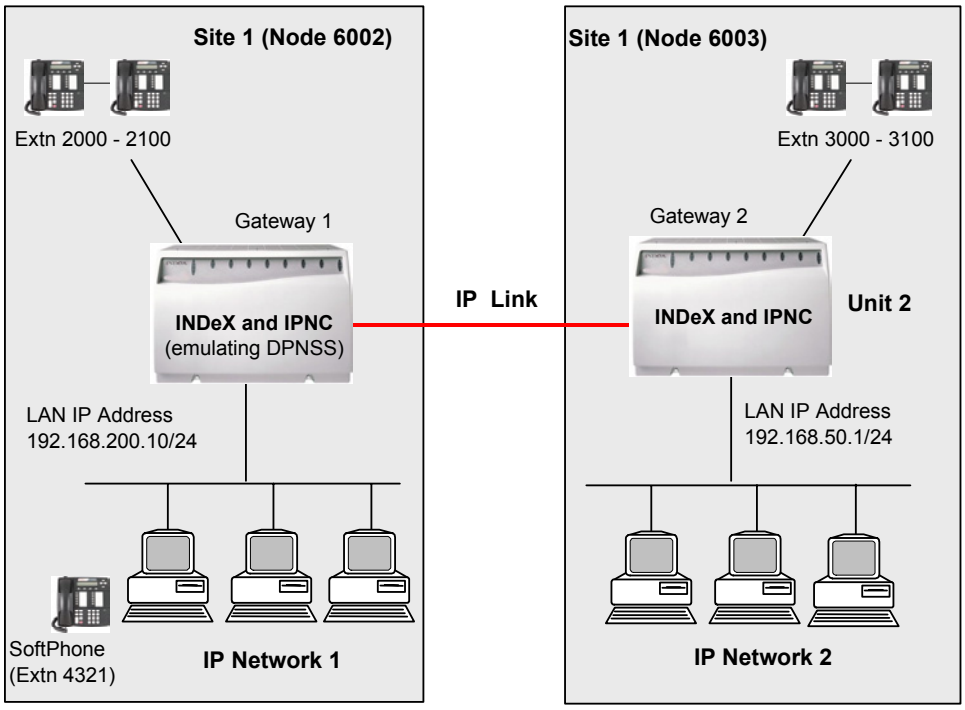
G729 and 723 Ultra low voice compression allows optimum use of slow speed WAN links.

VPN line control

VPN Line is used to control the amount of concurrent calls that are allowed to occupy the link (see page 41).

VPN line Configuration

In order to demonstrate how the VPN line is used for call routing and control a simple VoIP example is shown below:



Configuration *Task*	*Description*
Step 1 At Site 1, define a VPN line (see page 41) and assign VPN Line number to remote node number. Repeat process for Site 2. • Site 1 Line Number = 2 • Site 2 Line Number = 3	The VPN line number provides discriminator to other line Groups. No two Line Groups can share the same VPN line Number The VPN line number must not exceed 240
Step 2 Set the VPN Incoming and OutGoing Group ID. • For Site 1 OutGoing Group ID = 2 • For Site 2 OutGoing Group ID = 3 Repeat process for Site 2.	The Line group ID as an absolute reference to VPN line. It is permissible for 2 VPN lines to share the same Line ID in case where redundancy is required.
Step 3 Apply the bandwidth restrictions and Line Control parameters as appropriate.	
Step 4 For Site 1, on the VoIP tab of the VPN line set the destination VoIP Gateway to the IP address of the LAN 1 interface of the IPNC on Site 2. • For Site 1 destination VoIP Gateway = 192.168.50.1 • For Site 2 destination VoIP Gateway = 192.168.200.10	The IPNC VoIP Gateway function resides solely on it's LAN1 interface; the IPNC listens for VoIP Gateway connections only on the LAN1 interface IP address. This does not preclude the LAN2 interface been used for the VoIP transmission.
Step 3 Select the required VoIP options (ensure that optional parameters are matched for Site 1 and Site 2) • FAX transport • Silence Suppression • VoIP compression Type	
Step 4 Add Short-codes (see page 39) as follows:. For Site 1 • Short Code = 6003N • Telephone Number =. <full stop> • Line Group ID = 2 • Feature = Dial For Site 2 • Short Code = 6002N • Telephone Number =. <full stop> • Line Group ID = 3 • Feature = Dial	Shortcodes define the rules and sets the condition under which the IPNC will invoke the Line.

Bandwidth Requirements Calculations

When considering the deployment of VoIP, establish the goals for data and voice integration and determine the main traffic types the integrated network is expected to support. Determine if baseline data networking requirements can be met when the INDeX solution is in place on the network. Within this section the calculation to determine to load of VoIP call is given.

In a correctly designed network, VOIP traffic is prioritised over non-voice traffic. The bandwidth for VOIP must be available in the networking, when congestion occurs non-voice traffic will be dropped in favour of voice traffic. The TCP/IP protocol will handle the re transmission of non-voice packets. In the absence of VoIP traffic non-voice traffic will have full occupancy of the link. Congestion mainly occurs on slow speed WAN links. Ethernet switches can be used to ensure congestion does not occur on the LAN.

The Bandwidth used by a given compression type can be calculated using the formula shown below.

(Layer2 Header + IP_ header + UDP_header + RTP_Header + Payload) X Num_Sample_per_sec X 8

The variables in this formula are detailed in the proceeding table.

Variable	***Description***	**Value**	
Layer2_Header	VoIP may be encapsulated using Ethernet or PPP.	Type	Bytes
		LAN	14
		PPP	4
IP_Header		20 bytes	
UDP_header		8 bytes	
RTP_Header		12 bytes	
Payload		Type	Size
		G711	160
		G729	20
		G723	24
num_Sample_per_sec	The IPNC generates one sample (payload) either every 20ms (50 per sec.) or 30ms (33 per sec.).	G711/729 50 per sec.	G723 33 per sec.

Notes:
1. Multiplication factor of 8 (i.e. X 8) is used to convert the calculation to bits per seconds. Transmission speed is expressed in bits per second or Kbps).
2. The effect of running IPHC is to reduce the total byte size of the IP, UDP and RTP headers. For the purposes of general calculations when running IPHC a nominal value of 7 bytes should be used to represent the sum of IP, UDP and RTP headers.
3. The LAN calculation does not include the 4-byte CRC of the Ethernet frame.

Examples

Calculation for G729 without Header compression on a PPP link:

((4 + 20 + 8 + 12 + 20)* 50 * 8) = 64 * 50 * 8 = 25600

Calculation for G729 with Header compression on a PPP link:

((4 + 7 + 20)* 50 * 8) = 31 * 50 * 8 = 12400

The table below provides a quick reference for these calculations.

Compression Type	Payload (bytes)	Bandwidth bits per sec (single call)		
		LAN	PPP without IPHC	PPP with IPHC
729	20	29600	25600	12400
711	160	85600	81600	68400
723	24	20592	17952	9240

The table shows there is a significant reduction in bandwidth requirements when running IPHC. Use the table to determine the bandwidth that will be used for each VoIP call. The number of VoIP calls that can occupy a link is directly related to the bandwidth /speed oO that the link. As General rule 75/80 % of the WAN bandwidth should be used for VoIP traffic; use the VPN line to restrict the number of calls the IPNC will allow to occupy the link.

Note: IPHC implementation on the IPNC is such that for speeds above 1024Kbps IPHC compression is not applied to either non-voice or voice streams. In this way the effect of latency on the speech quality is reduced.

Step 6 - Test end-to-end Voice and Data

Once IP connectivity and VoIP have been configured, it is now important to prove the configuration. If the configuration is successful, there must not be any reduction in VoIP quality when VoIP and non-voice traffic are mixed on the link. Establish one or more VoIP calls on the line and begin a data transfer between two PC's (establish as near to the maximum number of allowed calls as possible see VPN Line configuration page 99). When performing this test it is recommend that ping is not used to simulate non-voice traffic; copy a file using FTP or Windows networking as this will ensure that the QoS configuration is correctly exercised.

Using the IPNC System Monitor application options, it is possible to debug all aspects of the IPNC's functions and features. Generally, outputs are associated directly to any related standard. E.g. PPP monitor outputs will reference RFC terms relating to the PPP protocol.

The following table describes monitor options that may be useful for debugging QoS issues on IPNC. The table details the how to debug the following elements.

- Queue drops
- Multilink Fragmentation
- VPN line
- Header compression (IPHC)

In an operational environment, use the Monitor application with caution when remotely monitoring over slow speed WAN link. Ensure only the minimum options are set before remotely monitoring, for example monitor Interface packets in one direction at a time.

Function	***Method***
Queue drops	Default monitor option shows the Voice and non-voice queue drops 15604mS PRN: Discards – Norm 2 Voice 0 16601mS PRN: Discards – Norm 2 Voice 0 17619mS PRN: Discards – Norm 2 Voice 0 Norm = drops from the non-voice queue Voice = drops from the voice queue **Notes:** 1. A well designed network should not experience any voice packets drops. 2. The message is generated only when there are discards to the link.

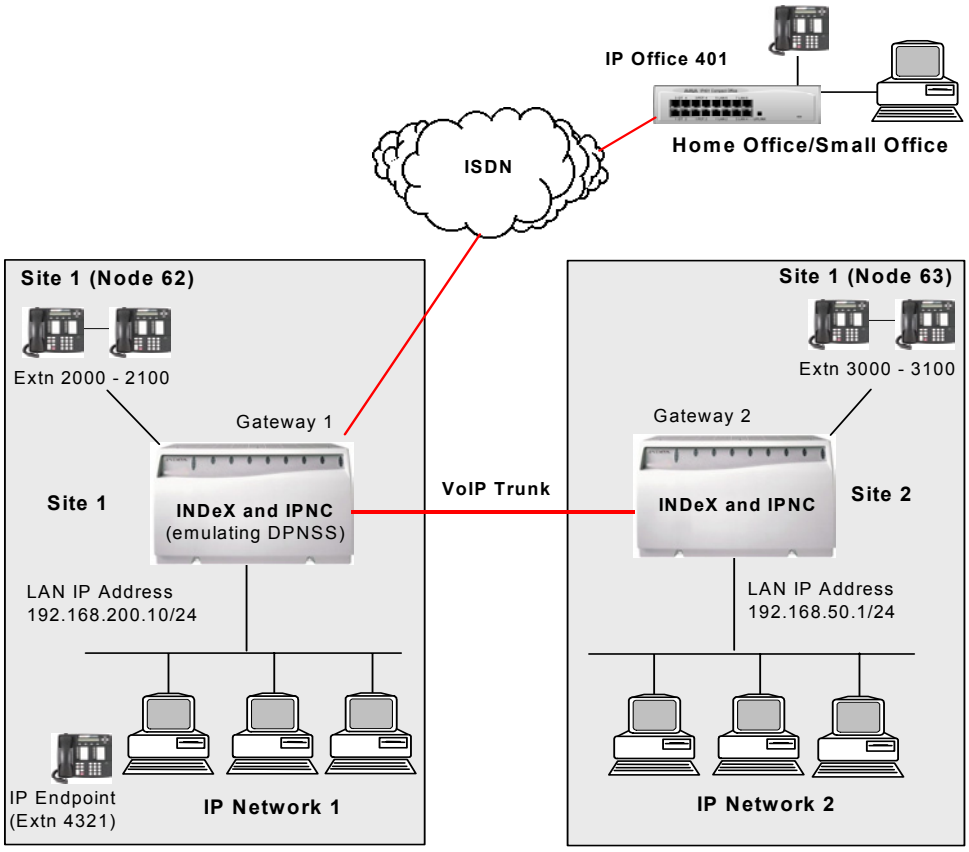
Multilink Fragmentation	The output shown is taken using the following Monitor option
	
	• PPP/LCP Tx
	• PPP/LCP Rx
	
	The highlighted text indicates the PPP Multilink option; e.g. the negotiation is successful
	
	`5885mS PPP LCP Rx: v=wan_link_A1`
	`PPP LCP Config-Req(1) id=1 len=31`
	`MagicNum=0003709c`
	`Protocol field compression`
	`MRRU=1500`
	`ShortSeq`
	`EndPointDiscrim=mac 00e0070045aa`
	`MultiClass=6 Classes=4`
	`5885mS PPP LCP Tx: v=wan_link_A1`

Function	Method
	PPP LCP **Config-Ack(2)** id=1 len=31 MagicNum=0003709c Protocol field compression MRRU=1500 ShortSeq **EndPointDiscrim=mac 00e0070045aa** **MultiClass=6 Classes=4** 8733mS PPP LCP Tx: v=wan_link_A1 PPP LCP Config-Req(1) id=2 len=31 MagicNum=00005895 Protocol field compression MRRU=1500 ShortSeq EndPointDiscrim=mac 00e00700443a MultiClass=6 Classes=4 8758mS PPP LCP Rx: v=wan_link_A1 PPP LCP **Config-Ack(2)** id=2 len=31 MagicNum=00005895 Protocol field compression MRRU=1500 ShortSeq **EndPointDiscrim=mac 00e00700443a** **MultiClass=6 Classes=4**
VPN line	The following options are useful for debugging call setup issue. Call/Line Send Call/Line Receive Call/Targetting The Highlighted text from the CMTARGET output shows the number received on ISDN line (5) is resolved to Line 2 (GROUP 2). The CMLine TX=2 is the resulting call setup on a VPN Line 2. These output show the negotiated UDP port numbers: 29505mS CMLineRx: v=5 CMSetup Line: type=Q931Line 5 Call: lid=5 id=6 in=2 **Called[8400]** Type=SubscriberNumber (4) Calling[01442404001] Type=SubscriberNumber (4) BC: CMTC=Speech CMTM=Circuit CMTR=64 CMST=Default CMU1=Alaw Bchan: slot=0 chan=2 29506mS CMTARGET: LOOKUP CALL ROUTE:41872 type=4 called_party=8400 sub= calling=01442404001 in=2 complete=0 29507mS CMTARGET: ADD TARGET:41872 number=8400 type=4 depth=1 nobar=1 setorig=1 29508mS CMTARGET: SYS SC:41872 8400 2 400 **sc=type=31 code=8N, num=.** 29508mS CMTARGET: DIAL LINE:41872 **GROUP=2 SUCCESS=1** 29508mS CMTARGET: LOOKUP CALL ROUTE:41872 returned 1 29511mS **CMLineTx: v=2** CMSetup Line: type=VPN 2 Call: lid=0 id=42875 in=0 Called[8400] Type=SubscriberNumber (4) Calling[01442404001] Type=SubscriberNumber (4) BC: CMTC=Speech CMTM=Circuit CMTR=64 CMST=Default CMU1=Alaw Bchan: slot=250 chan=9868 IE CMIETxChannelAudio (1) comptype=G729A8K (6) pktsize=20 ipaddr=192.168.42.99 port=0 IE CMIERxChannelAudio (2) comptype=G729A8K (6) pktsize=20 ipaddr=192.168.123.98 port=51138 Display [01442404001] Cause=16, Normal Locale: eng 29680mS CMLineRx: v=2 CMProceeding Line: type=VPN 2 Call: lid=0 id=42875 in=0 Bchan: slot=250 chan=9868 IE CMIETxChannelAudio (1) comptype=G729A8K (6) pktsize=20 ipaddr=192.168.42.99 port=49178 IE CMIERxChannelAudio (2) comptype=G729A8K (6) pktsize=20 ipaddr=192.168.123.98 port=51138 Display [400] 29681mS CMLineTx: v=5 CMProceeding Line: type=Q931Line 5 Call: lid=5 id=6 in=2

Function	Method
	Called[8400] Type=SubscriberNumber (4) Bchan: slot=0 chan=2 IE CMIETxChannelAudio (1) comptype=G729A8K (6) pktsize=20 ipaddr=192.168.42.99 port=49178 IE CMIERxChannelAudio (2) comptype=G729A8K (6) pktsize=20 ipaddr=192.168.123.98 port=51138 Display [8400] 30785mS CMLineRx: v=2 CMConnect Line: type=VPN 2 Call: lid=0 id=42875 in=0 BC: CMTC=Speech CMTM=Circuit CMTR=64 CMST=Default CMU1=Alaw Display [400] 30787mS CMLineTx: v=5 CMConnect Line: type=Q931Line 5 Call: lid=5 id=6 in=2 Called[8400] Type=SubscriberNumber (4) BC: CMTC=Speech CMTM=Circuit CMTR=64 CMST=Default CMU1=Alaw Bchan: slot=0 chan=2 Display [8400] 30815mS CMLineRx: v=5 CMConnectAck Line: type=Q931Line 5 Call: lid=5 id=6 in=2
Header compression (IPHC)	This output is taken using the following Monitor option PPP/IPCP Tx PPP/IPCP Rx The output shows the successful negotiation of an IP address 192.168.168.100 by the remote and the IPHC. The IPHC is negotiation is accepted by both local and remote. (Config-Ack received and transmitted) 47458mS PRN: stack start NetworkControlProtocols 47459mS PPP IPCP Tx: v=wan_link PPP IPCP Config-Req(1) id=1 len1=20 IPHC 0000 00 10 00 10 01 00 00 05 00 a8 01 02..... 47473mS PPP IPCP Rx: v=wan_link PPP IPCP Config-Req(1) id=14 len1=26 IPHC 0000 00 10 00 14 01 00 00 05 00 a8 01 02..... IP-Address 192.168.168.100 47473mS PPP IPCP Tx: v=wan_link **PPP IPCP Config-Ack(2) id=14 len1=26** IPHC 0000 00 10 00 14 01 00 00 05 00 a8 01 02..... IP-Address 192.168.168.100 47847mS PRN: Wed 5/6/2002 11:09:19 FreeMem=7084108 CMMsg=3 (3) Buff=100 554 500 1392 48337mS PRN: Wed 5/6/2002 11:09:19 FreeMem=7085224 CMMsg=3 (3) Buff=100 555 500 1391 50464mS PPP IPCP Tx: v=wan_link PPP IPCP Config-Req(1) id=2 len1=20 IPHC 0000 00 10 00 14 01 00 00 05 00 a8 01 02..... 50474mS PPP IPCP Rx: v=wan_link **PPP IPCP Config-Ack(2) id=2 len1=20** IPHC 0000 00 10 00 14 01 00 00 05 00 a8 01 02

Configuring VoIP

The following example of a VoIP network features INDeX to INDeX as well as a Home Office / Small Office. This allows VoIP calls to support 'user to user' features that are normally specific to DPNSS.



INDeX to INDeX VoIP Trunking

The INDeX IP Networking cassette (IPNC) allows the use of the data Wide Area Network to make desk to desk voice calls between INDeX's. Since leased lines typically have a fixed cost, voice traffic essentially travels for free, courtesy of the data infrastructure. The IPNC uses voice compression technology to make the most of available network capacity. Using industry standard compression (G. 723.1 and G.729a) up to 20 voice calls can be made simultaneously.

Recent releases of INDeX software introduce the ability to packetise our DPNSS and INDeX-Net feature set over an IP trunk. This means that VoIP no longer has to be lacking in functionality with nearly 30 facilities available over an IP trunk. This positions INDeX in a very strong networking position with the ability to network over traditional private voice circuits, dial up, ISDN circuits and now IP circuits.

VoIP can be implemented either by connecting the leased line directly to the INDeX, or by using existing leased line routers. Connecting the leased line directly to the INDeX is the simplest and most secure solution - the IPNC takes IP data from the LAN and combines it with INDeX voice traffic for delivery over the leased line. Each leased line can operate at speeds of up to 2Mbps.

Use the following step by step procedure to configure the network shown above. Refer to the appropriate sections for details of the configuration tasks.

Task	Where to go ?
Step 1 Configure INDeX environment for INDeX1 and INDEX 2.	(1) Use the T type configuration. See INDeX environment on page 90. (2) See INDeX Net on page 92 for details on the optional INDeX Networking features.
Step 2 Test INDeX environment	See page 96.
Step 3 Configure IP Connectivity with QoS Configure the WAN link between INDeX1 and INDeX2.	(1) Ensure QoS parameters are configured on both IPNC systems. Use the quick WAN set-up example described on page 77. (2) See the QoS configuration on page 88.
Step 4 Test IPNC Connectivity	Refer final step the quick WAN set-up example described on page 78.
Step 5 Configure VPN Line between INDeX1 and INDeX2.	(1) See VPN configuration on page 99. (2) For this example the link is running at 128kbps. Following the 75/80% rule with a WAN link speed of 128Kbps of the available bandwidth for VoIP is 96 Kbps (75%). Using G727 compression this would allow 7 -8 concurrent VoIP calls. For details see Bandwidth Requirements Calculations on page 101)
Step 6 Test end to end voice and data	See Step 6 - Test end-to-end Voice and Data103.

Home Office / Small Office

This new technology not only benefits business expansion, it also facilitates work force mobility. Navigating ourselves to the office incurs a cost not just in our time and our transportation costs, but also impacts the environment and our ability to work if the journey to the office is stressful.

- IPNC used to deliver calls via VoIP to the Home Worker
- Handset signalling packetised alongside voice.
- Call distribution (Group membership, re-route to voicemail etc.)
- All the features you have in the office, available to you at the home!

INDeX's interoperability with its 'sister product' IP Office delivers the remote user with a fully featured 20 series handset at the home.

The table below details the configuration of the Homeworker shown in the diagram above. Refer to the appropriate sections for details of the configuration tasks.

Task	Where to go ?
Step 1 Configure the INDeX environment for the Home worker.	See INDeX environment for Home Worker on page 92.
Step 2 Test and check INDeX environment	See page 96.
Step 3 Configure IP Connectivity using digital services example for the Home Office/Small Office.	Use the Home Office/Small Office IP connectivity example on page 75.
Step 4 Test IPNC Connectivity	See the finals step of the Home Office /Small Office example on page 75.
Step 5 Configure VPN Line between INDeX1 and the Homeworker	(1) See Part 2 - IPNC and IP401 VPN line Configuration on page 99 (2) When using ISDN dialup in support of the Home worker the bandwidth of the link is determined by the number of bundled ISDN channels. See step 7 of the Home Office/Small Office on page 75. (For details on see Bandwidth Requirements Calculation on page 101). (3) Please note G711 Compression is not support when using Digital services to provide IP connectivity; use G729 or G723.
Step 6 Test end to end voice and data.	See Test end-to-end Voice and Data on page 103.

Appendix A: General Information

Internet Access

Internet access offers a number of business benefits - email and the exchange of multimedia information, access to all kinds of services and information, and the opportunity to create a global presence with your own web site. The role of your system in providing Internet Access is shown in the diagram below. The Internet Service Provider (ISP) provides you with a gateway to the global network which is the Internet. The ISP has:

– a Remote Access Server (RAS), for you to dial in to

– a Domain Name Server (DNS), which converts your “public” name (e.g., www.Avaya.com) into the unique Internet Protocol (IP) address by which you are recognised on the global network

– a Mail Server, for collection and delivery of your mail

– a Web server, to provide you with space for your own web pages

– switches and routers - the equivalent of the Internet’s telephone exchanges - which send and receive data packets across the network. The Internet itself is like a mesh with these devices at each of its nodes.

You can access the Internet in two ways:
By dialling in via the public phone network (the usual method) **or**
Over a permanent leased line (the IPNC can support this by means of its Wide Area Network (WAN) port).

For ISDN dial-in Internet access, your system has a “bandwidth on demand” facility, that uses additional ISDN channels when and if they are needed. This is very cost-effective way to manage call costs as there is no wastage and also no restriction on user access. By means of Network Address Translation (NAT), many users can access the Internet at the same time.

When you set up an account with an ISP, you are given the details you need to set up your system for Internet access. One Internet service is set up as part of the basic configuration and you may add others as new Services (see Data Routing below).

The World Wide Web (WWW) is the user interface to Internet services and information. To access this, you need a browser, such as Netscape. You also need a search engine, such as Yahoo, to look for information when you have not been given a specific address. These applications are installed on PC’s for users with Internet access. To use email, you need an email server on your Local Area Network (LAN) and the corresponding software on each user’s PC for mail collection.

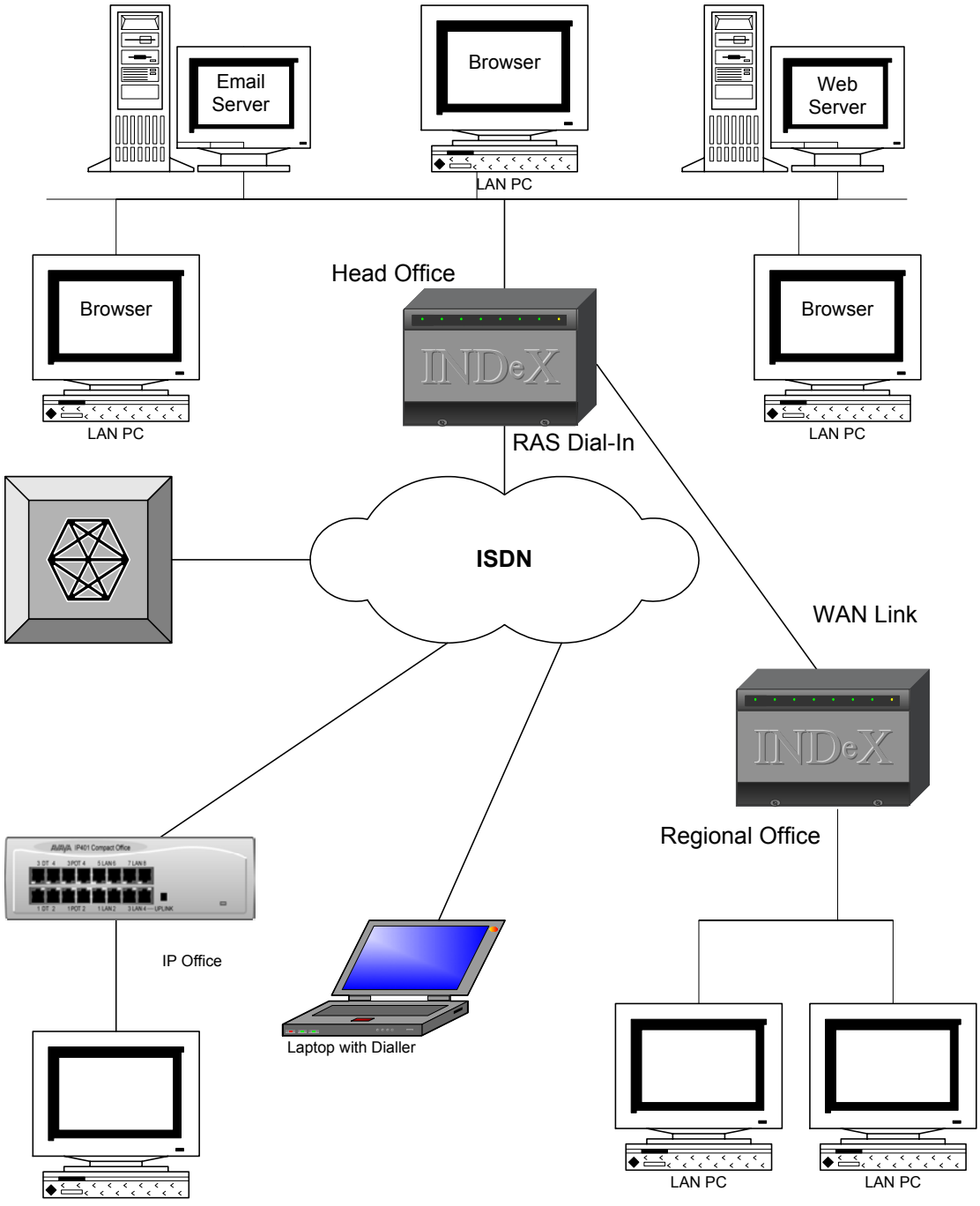
The Corporate Intranet

Intranets offer a number of business benefits:

- Dispersed locations can be connected, flexibly and cost-effectively
- Resources can be centrally provided and managed
- Information can be made instantly available, company-wide
- Changes are easy to implement
- New sites, services and users can be easily added.

Because the IPNC includes RAS, Data Service, WAN and IP routing facilities, they can be used to build an intranet spread across multiple locations. All users, regardless of location, have access to centralised applications, data and services, and additional information and services can be provided by means of a local web server, that can be browsed in the same way as a public web site.

An example of an intranet is illustrated in the diagram below.



The company's headquarters is the main platform. The INDeX provides a WAN link to a regional office. Smaller sites use ISDN dial-in access and an Avaya IP Office for access as and when required. Finally, staff on the move, such as the sales team, can dial in from residential, hotel or mobile phones.

Many features support effective data service operation:

– Bandwidth-on-demand. Extra ISDN channels are automatically added (or dropped) when data traffic reaches (or falls below) user-specified threshold levels
– Password authentication
– Transparent WAN and ISDN operation between platforms.

The system RAS facility handles incoming calls from external users dialling in to local services. Similarly, the Service facility manages calls to outside services. Network Address Translation (NAT) provides simultaneous user-connectivity and DHCP caters automatically for addressing on the local network, for both network PCs and dial-in users.

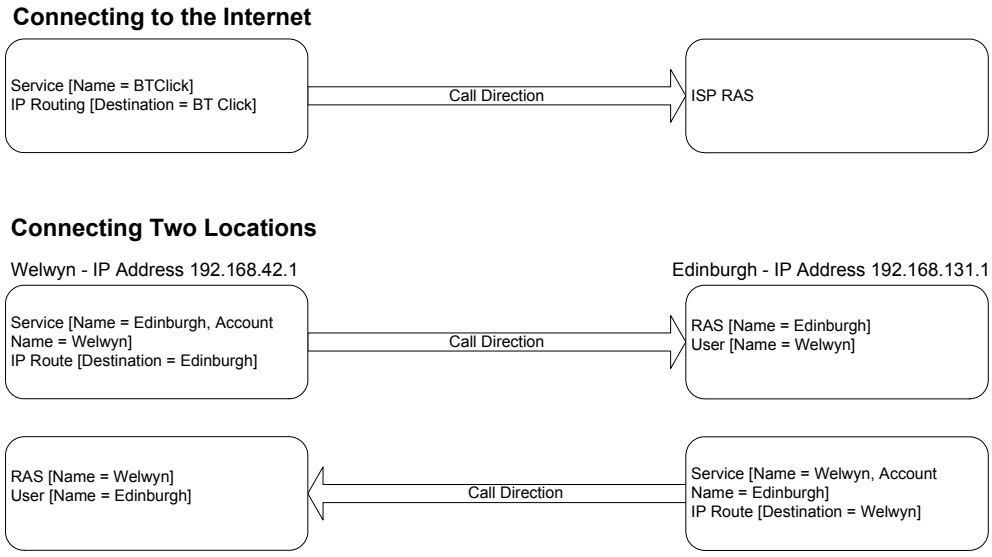
There are also a number of security features for controlling access to data services, see pages 22, 31 and 115.

Data Routing

Two examples of data services are shown in the figure below.

In the first example, to specify a destination for data sent back from the Internet, it is only necessary to define a Service for the outgoing call and its associated IP routing. In this case, the IP Address specified in the Service profile is the destination. Hence the IP routing is set up by simply selecting the Service as the destination.

Data Routing



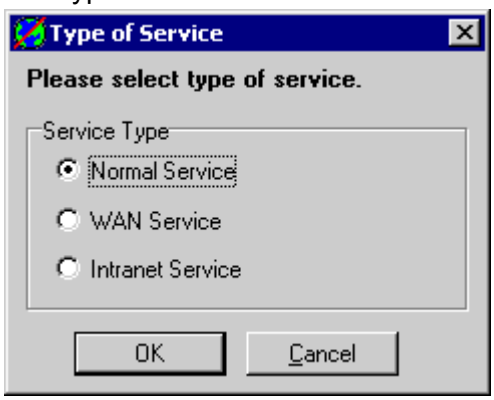
In the second example, two different locations are to be provided with dialled access to each other. Both must have a RAS (to permit dialling in) and a Service (to permit dialling out) together with their associated IP routing. In addition, a user profile must exist at each end, set up for dial-in access, and containing the password to be sent to the RAS from the other end. The RAS then compares the password it receives in the incoming call with the one in the local user profile. The User Name at the RAS end must be the same as the Account Name specified for the calling service.

The IP route for the service is set up to direct all data traffic addressed to the distant end to the appropriate Service for onward transmission. That is, at Edinburgh, any packets for the Welwyn IP Address are routed to the Welwyn service.

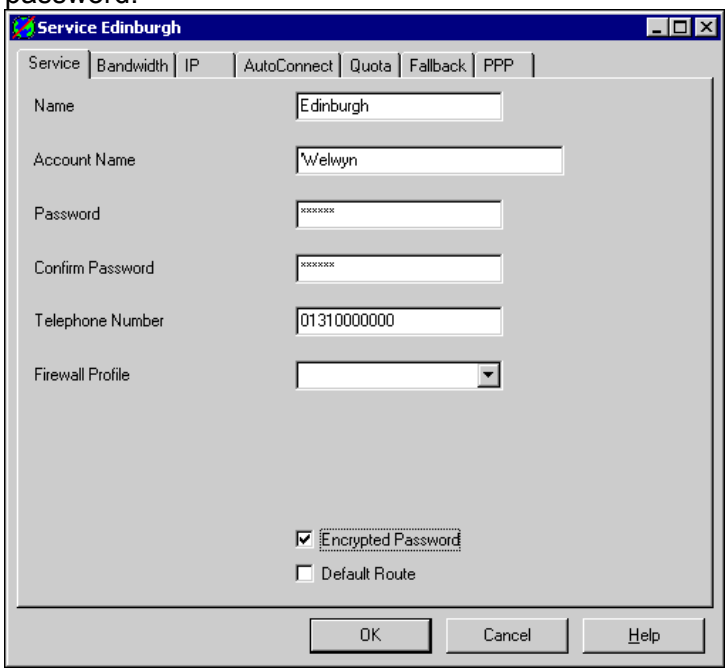
Example

To set up the Service at Welwyn and the corresponding RAS at Edinburgh, it is assumed that the service is to operate as an ISDN service rather than a WAN or Intranet service:

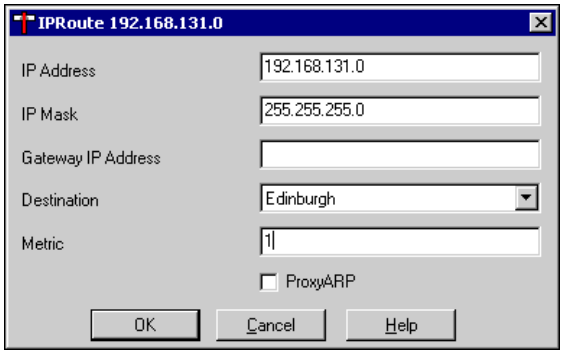
1. Define the Type of Service at Welwyn. Select **Service** from the Configuration Tree and right-click in the summary area. Select **New** from the toolbox and the Type of Service as Normal.



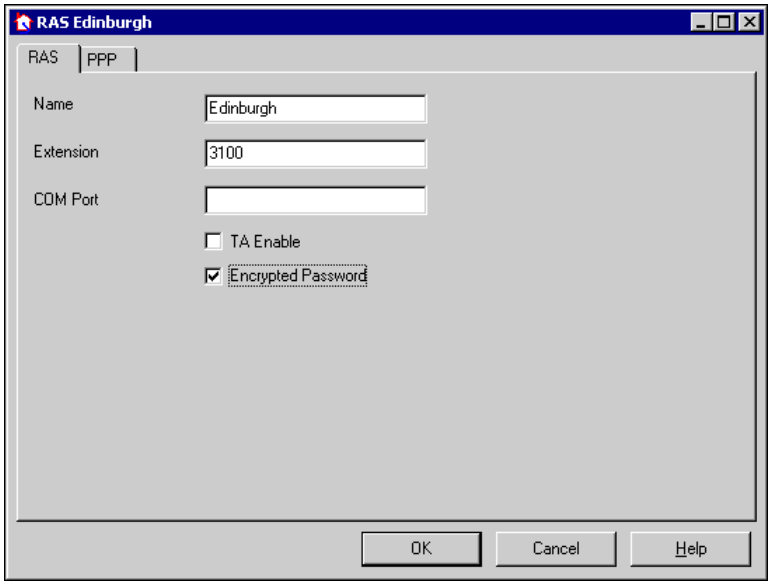
2. Specify the Service details. The Account Name is the name of the corresponding User profile at Edinburgh. Both must have the same password.



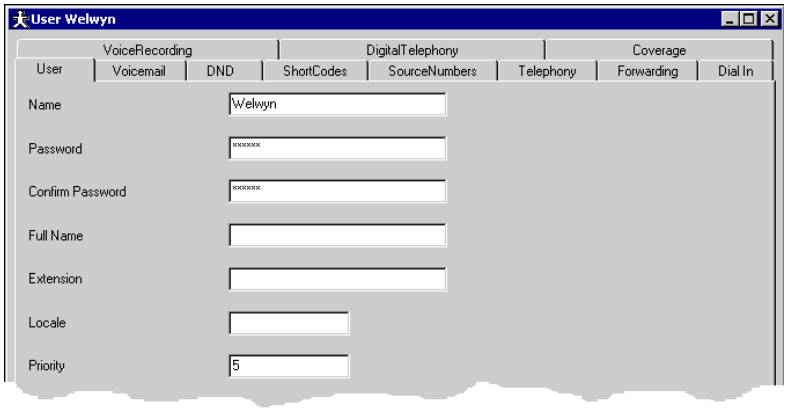
3. Select **IP Routing** from the ConfigurationTree. Right-click in the summary area and select **New** from the toolbox. Set up the IP Route at Welwyn, with the Destination Edinburgh:



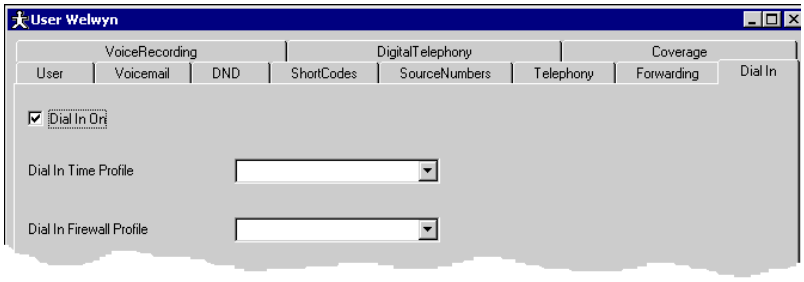
4. Set Up the RAS at Edinburgh. Select **RAS** from the Configuration Tree. Right-click in the summary area and select **New** from the toolbox. Enter the MSN digits that identify this RAS into the Extension Field.



5. Select **User** from the Configuration Tree. Right-click in the summary area and select **New** from the toolbox. Set up the User profile at Edinburgh first. The Name and Password, the Name of the user is the Account Name of the Welwyn Service, and both the passwords must be the same:



6. Select the **Dial-In tab** and enable dial-in:



Note: For a service type of WAN or Intranet, a user profile is automatically created, with dial-in access and the correct name and password.

Security

The IPNC provides a number of measures for the protection of your data and systems against intrusion – either unintentional or malicious – from both the Internet and unauthorised dial-in users. These include:

– A Firewall.
– Encrypted Passwords.
– CLI.
– Time Profiles.
– NAT / Proxy Server.

In essence, a firewall creates a barrier between your subnet and the outside world, and controls who leaves and who enters, according to one or all of several criteria. Anyone who fails the test is prevented from entering or leaving, i.e., starting a session with an internal or external application. The main criteria can be defined as:

1. All common TCP/IP protocols can be restricted to incoming or outgoing only. This means that, for example, your network administrator alone could be permitted to use diagnostic and management protocols, and further restrict his use of them to incoming access only.
2. Access to and from services with specific IP addresses and masks can be prevented.
3. Filters can be defined to search for specific data patterns. Traffic containing a match can then be allowed through the firewall or not, as required.

The systems security features can be combined for maximum protection. For example, the network administrator's restrictions can include a time profile, limiting access to outside normal working hours, and a user profile set up to check that the CLI of the incoming call matches the number of his home or mobile phone. This gives full coverage for an out-of-hours emergency with maximum protection in normal circumstances.

For Internet services, the system includes a proxy server providing NAT / IP masquerading to conceal your local addresses from other Internet users. Password protection, with optional password encryption, is available for all services, including dial-in services.

The importance of security cannot be over-emphasised and the part users play cannot be under-estimated. Just as you take care of your credit cards, you must be mindful of security issues. No matter how powerful a password verification technique is, it is no use if the password is written on a note stuck to your PC. Your system's security is ultimately your own responsibility. You must:

– Store back-ups and all system information securely, for both security and disaster recovery purposes
– Change all passwords regularly
– Change the default start IP address of your system
– Install a reliable virus protection program and keep it up to date
– Ensure that all members of your staff are aware of security issues.

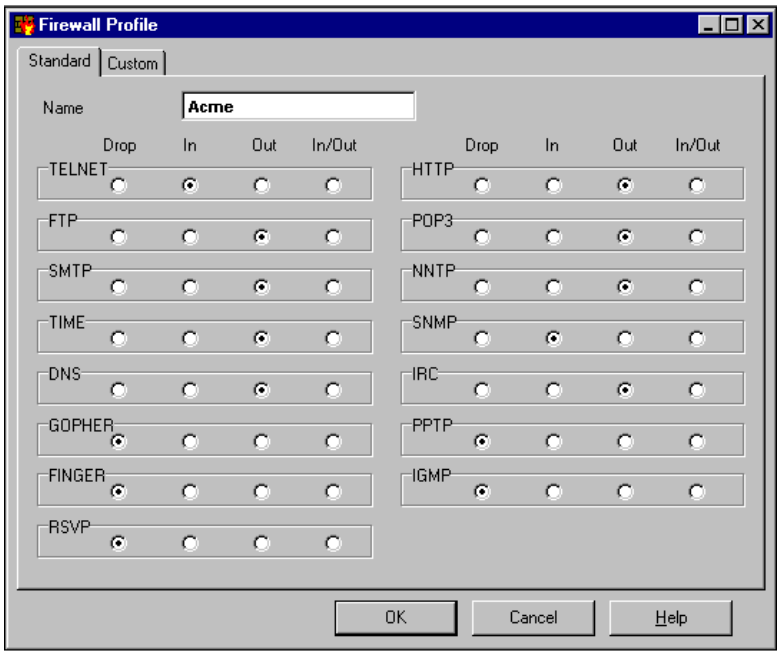
We recommend that you utilise your default firewall by naming it and including it's user and service profiles where appropriate. Punch additional holes in the firewall only as and when experience shows they are needed.

YOU MUST CHANGE YOUR REMOTE ACCESS PASSWORD.

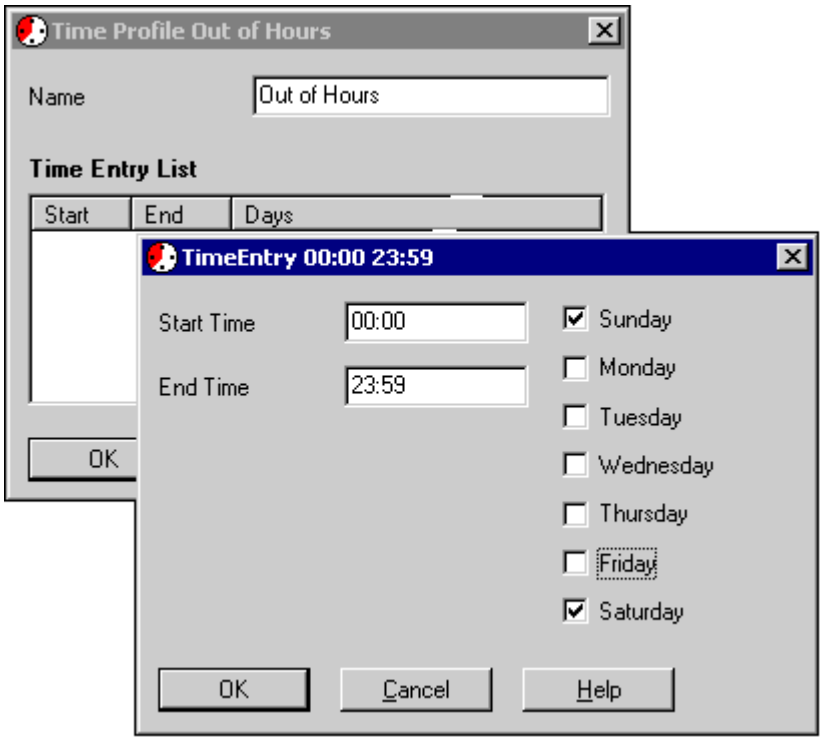
Security Implementation - A Dial-In User

To illustrate a straightforward but effective security implementation, the worked example that follows is the case of a network administrator who is on call to provide network support at weekends. He is permitted to use Telnet and SNMP when he dials in from his home phone. Access is restricted to weekends only.

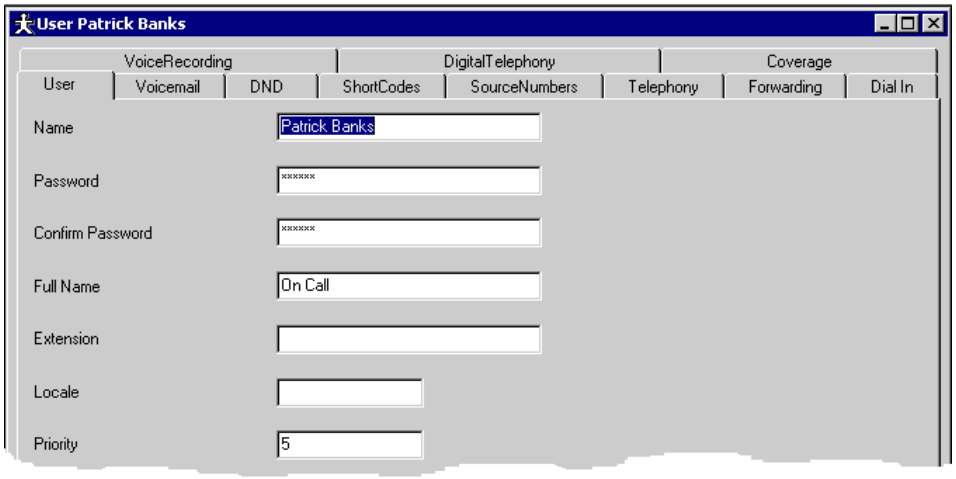
1. To set up the Firewall Profile, select the Firewall function from the Configuration Tree, right-click in the summary are and select New from the toolbox. Tick the In boxes for Telnet and SNMP.



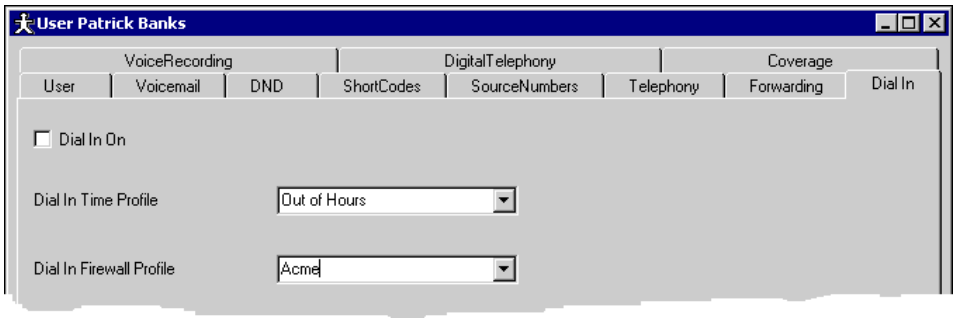
2. Select Time Profile from the Tree. Right-click in the summary area and select New. Name the profile and right-click in the Time Entry List. Accept the default 24-hour period and untick the Monday to Friday boxes. The time profile specifies the 48-hour weekend on-call rota period.



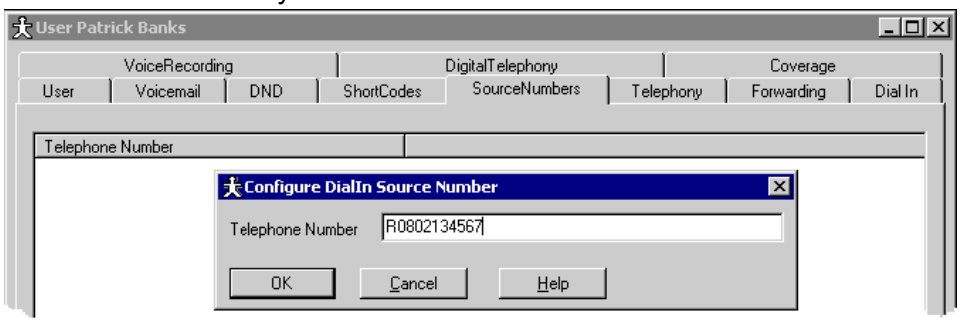
3. To set up the User profile, select **User** from the Configuration Tree and right-click in the summary area. Select Add from the toolbox.
Enter the user's Name and a descriptive Full Name for reference.



4. Click on the Dial In tab and select the Time and Firewall profiles from the drop-down lists.



5. Click on the Source Numbers tab. Enter the user's home phone number, preceded by the letter "R". This permits access to a data service *without* password verification. If the prefix is omitted, you must enter a password in the User tab or, to allow the user access from any phone, enter a password but do not include any source numbers.



Voice-Over-IP

The IPNCs Voice-over-IP (VoIP) technology enables a data network to carry voice traffic along with data. Support of compression, Quality of Service (QoS) and echo cancellation technology ensures that speech quality is optimised. Voice compression is supported on four variants of the IPNC (IPNC-VC, IPNC-M-VC, IPNC-VC5 and IPNC-M-VC5). Each IPNC is capable of compressing either 5 or 20 simultaneous calls using a choice of industry standard algorithms.

The IPNC can implement QoS for digital serveices on all INDeX line types, including point-to-point, WAN linkls, Frame, Relay, DPNss, Sig and BRI. However, where density of calls is a **prime** requirement and IP (data) connectivity is not, then it may be more appropriate to use the INDeX Voice Compression Cassette (VCC).

Implementation Considerations

Bandwidth Requirements

There are two methods of connecting INDeXs using VoIP:
1) Using a directly connected Wide Area Network
2) Using an indirectly connected Wide Area Network.

See Bandwidth Requirements Calculations on page101 for details.

Voice Prioritisation

Each voice packet transmitted by the IPNC has the TOS field marked to indicate its priority (Diffserv). When using an indirectly connected WAN all devices should be capable of handling marked traffic at a priority to ensure prompt handling of voice calls. Alternatively, over supplying the available bandwidth can ensure all packets, voice and data, are handled quickly. The IPNC can also set the maximum number of simultaneous voice calls. In a directly connected WAN, this coupled with Diffserv has the effect of managing bandwidth, i.e. if there are no voice calls in progress data will be allowed to occupy the full capacity of the link. Each voice call initiated will then push back the data occupancy up to the maximum allowed number of voice connections. In this manner it is possible to guarantee the bandwidth available to voice and data.

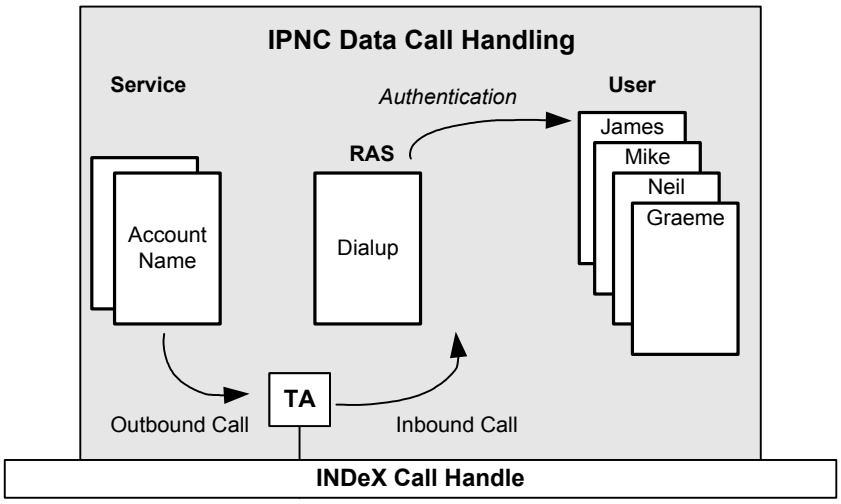
Sending Voice over an Ethernet Connection

Whenever voice calls are sent over an Ethernet connection, as in the indirectly connected WAN scenario and IP Extensions, consideration should be given to Ethernet collisions. If there are too many devices sharing a segment collisions can cause interruption to voice traffic. This can be simply addressed by allocating the IPNC LAN port and the WAN routers a dedicated port on a LAN Switch.

Appendix B: Concepts

Configuring data routing on the IPNC

The diagram below shows the basic concept of inbound and outbound data call configuration on the IPNC.



Note: The RAS must be configured with the DDI for the incoming call

For Dial in data calls the RAS configuration serves as an intermediate incoming call handler and allows the first level of PPP call negotiation to be performed. During the first level of PPP call negotiation the method of authentication i.e. PAP or CHAP and optional PPP parameters such as BACP, Multi-link Compression type, or Callback are negotiated.

After the authentication method is determined, the IPNC completes the authentication process by associating the received PAP or CHAP response against a Dial in enabled User. By identifying and associating the incoming call to a particular User the IPNC is then able to check the password held in the User configuration.

In order for the RAS process to receive the incoming data call the called number (MSN) must be assigned. This is done in the RAS - Extensions field.

Dial Up or outbound calls are configured using the Service form. Within this configuration form all aspects of the outbound call are configured. These include PPP authentication name password and the ISDN capabilities. The Service configuration form also allows ISDN bandwidth control parameters to be assigned using the Service-Advance button.

Callback

The following table shows the supported IPNC Callback types.

Callback Option	*Description*
Disable (Default)	Callback is not enabled
LCP Link Control Protocol	After authentication the incoming call is dropped and an outgoing call to the number configured in the Service will be made to re-establish the link.
Callback CP Microsoft's Callback Control Protocol	After acceptance from both ends the incoming call is dropped and an outgoing call to the number configured in the Service will be made to re-establish the link.
Extended CBCP Extended Callback Control Protocol	Similar to Callback CP however the Microsoft application at the remote end will prompt for a telephone number. An outgoing call will then be made to that number to re-establish the link.

The following points must be noted for Callback functionality

- Callback for an incoming call is configured on a RAS and for an outgoing is configured on the Service.
- For an incoming call the Callback option need NOT be set on the Service. Setting Callback on a Service allows the IPNC to negotiate Callback when *initiating* the call.
- For all Callback types an intranet service type must be used.
- To support a mixed environment where some incoming calls do not require Callback a separate RAS'es must be configured (with a unique DDI) with and without Callback enabled.
- Certain Callback types maybe configured to circumnavigate Time profile restrictions.

IP Routing

A routing entry must exist to support an inbound / outbound connection. The following are the routing entry types that are found on the IPNC. System-Hidden routes are present in the system but are not visible in the configuration.

Route Type	*System-Hidden*	*Description*
Dynamic	Yes	A route is dynamically added to support an incoming connection if the IP address is allocated from one of the DHCP pool.
Service-Default-Route	Yes A service with this option selected is denoted (at the top level of the service configuration) by a green arrow (→)	A “default route” check box” on the Service form allows the Service to be selected as the default gateway. In this way the default route may be dynamically assigned using the Fallback service configuration; deactivated service will relinquish the default route to an active service.
Static	No	Routes can be manually added using the IP route form.
System-Hard-Coded	Yes	Added by the system on initialisation and cannot be deleted. Apart from the RemoteManager route these routes if modified will be recreated on reboot. See Table below
LAN1/LAN2 Interface	Yes	A Route entry is automatically added in support of the IP address and subnet configured LAN1 and LAN interfaces. These routes are not shown in the configuration file The defaults, which are associate with the default LAN1/LAN2 system IP address. 192.168.42.0(LAN1) 192.168.43.0 (LAN2)

Dynamic IP parameter allocation

The IPNC's mode of operation for the DHCP Server is configured in the System Configuration form box.

With Server selected, IP addresses are allocated both to the LAN using DHCP and to dial in users during PPP link establishment. With Dial-In selected IP addresses are allocated only to dial in users

Dial– In users are allocated address from the LAN1 pool until all addresses are exhausted, at which point addresses from the LAN2 pool will be used.

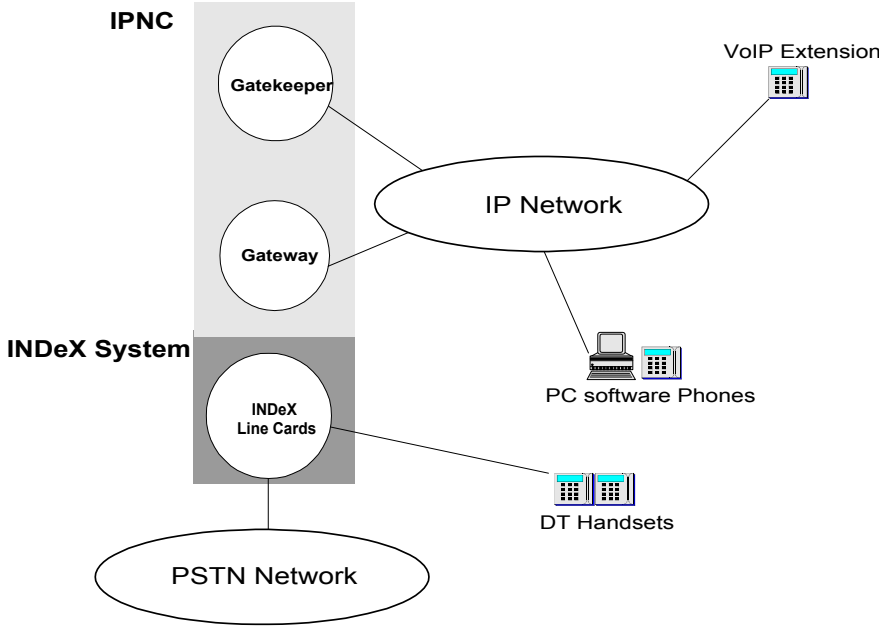
DHCP Option	Notes
IP address and Mask	**Note 1**
Router	System- IP Address (for LAN1) System – IP Address 100Mbps (for LAN2) **Note 2**
DNS Server Address	System/DNS **Note 3**
DNS Domain	System/DNS
WINS Server IP Address	System/DNS
WINs Scope	System/DNS

Notes:

1. The IPNC uses its system address+1 for the first IP address allocation (i.e. System IP address is 192.168.42.1 then the first IP address will be 192.168.42.2).
   For dial in uses the IPNC allocates the top address as governed by the number set in the Number Of Address on the System Configuration DHCP tab. (i.e. System IP address is 192.168.42.1 and Number Of Address is 200 then the first IP address will be 192.168.42.200)
2. The IPNC offers either the LAN 1 or LAN2 IP address as the router dependant on which interfaces the request is made from.
3. This is typically the IP address of an external DNS Server. If this is left blank, the IPNC will offer itself as a DNS server (within DHCP) and will forward DNS requests. The IPNC forward DNS request to the IP address of the DNS server learned in PPP link establishment. This option is controlled in the Service Configuration.

Voice Over IP Basics

The diagram below shows the components in a H323 network and shows the IPNC and the INDeX platform offering the components of a VoIP network.



Gateway

The gateways are the devices that communicate between the telephone signals and the IP endpoint. The gateways usually perform the following six functions:

- Search function
- When an IP gateway is used to place a call across an IP network, it receives a called party phone number. It converts it into the IP address of the far end gateway, possibly through a table lookup in the originating gateway or in a centralized directory server.
- Connection Function
- The originating gateway establishes a connection to the destination gateway, exchanges call setup, compatibility information and performs any option negotiation and security handshake.
- Digitising function
- Analogue telephone signals coming into a trunk on the gateway are digitised by the gateway into a format useful to the gateway. This requires the gateway to interface to a variety of Telephone-signalling conventions.
- Demodulation functions
- With some gateways the gateway trunk can accept only a voice signal or a fax signal but not both. But sophisticated gateways handle both. When the signal is a fax, it is demodulated by the DSP back into the original 2.4-14.4 kbps digital format. This is then put into the IP packets for transmission. The demodulated information is remodulated back to the original analog fax signal by the remote gateway, for delivery to the remote fax machine.
- Compression functions
- When the signal is determined to be voice, it is usually compressed by a DSP from 64K PCM to a 6.4 Kbps signal, which is the G.723.1 standard.
- Decompression and Remodulation functions.

At the same time that the gateway performs steps 1-5, it is also receiving packets. Hence this function is required

Gatekeeper

Terminals are the LAN client endpoints that provide real time two way communications. When an endpoint is switched on, it performs a multicast discovery for a gatekeeper and registers with it. Thus the gatekeeper knows how many users are connected and where they are located. The collection of a gatekeeper and its registered endpoints is called as a **zone**. A gatekeeper is required to perform the following functions:

- Address translation
  Translation of an alias address to a Transport Address using a table updated via Registration messages.
- Admissions control
  Authorization of LAN access, using Admissions Requests or Confirm and Reject (ARQ/ARC/ARJ) messages. Access is based on call authorization, bandwidth or some other criteria.
- Bandwidth management
  Support for Bandwidth Request, Confirm and Reject messages, or a null function that accepts all requests for bandwidth changes.
- Zone management
  The Gatekeeper provides the above functions for terminals, MCUs, and Gateways, which are registered in its Zone of control.

SoftPhone

The term SoftPhone refers to a IP extension, a dedicated LAN attached H323 compliant device, or a Software programme running on a multi-media PC. An example of a H323 software phone is MS- Netmeeting (3.x).

Appendix C: Overview of IP Routing

IP Addresses & Subnets

Each computer/host is given a unique number or “IP Address”. The address is 32 bits long e.g. 11000000101010000010101000000001.

This is represented by splitting it into 4 groups of 8 bits and convert them from binary into decimal numbers

```
Thus 11000000101010000010101000000001
becomes 11000000 10101000 00101010 00000001
becomes 192 168 42 1
```

We then add dots between the numbers to make them easily recognisable as an IP address, e.g.. 192.168.42.1.

The computers or hosts communicate by putting data into packets and labelling them with the source and destination IP addresses. When computers communicate they do not care where the destination is their task is simply to pass the packet to the next machine and then forget about it. To keep life simple all the computers/hosts in an office are given similar numbers e.g. 192.168.42.1, 192.168.42.2, 192.168.42.3, etc. The Router is the “gateway” to the rest of the world and its job is to cope with that traffic. This makes it easy for each computer to decide whether to send the packet either directly to another local machine or the “gateway” using the subnet mask.

A computer uses the subnet mask, i.e. 255.255.255.0, to decide if a packet is for the router or the LAN.

The computer does a binary AND with its own address and the subnet mask then the destination AND the subnet mask if the result is not the same then the packet is for the router.

For example: You have a Router 192.168.42.1, and the following PCs are communicating with each other:

- **PC 'A':** 192.168.42.201.
- **PC 'B':** 192.168.42.202.
- **PC 'C':** 158.152.1.43.
- **PC 'A' to PC 'B':**
  Source IP address 192.168.42.201, subnet mask 255.255.255.0 ANDing gives 192.168.42.0. Destination 192.168.42.202, subnet mask 255.255.255.0 ANDing gives 192.168.42.0 which is the same so both computers are on same LAN
- **PC 'A' to PC 'C':** Source IP address 192.168.42.201, subnet mask 255.255.255.0 ANDing gives 192.168.42.0. Destination 158.152.1.43, subnet mask 255.255.255.0 ANDing gives 158.152.1.0 which is different so the packet is sent to the router.

So for basic operation of a computer you need

- **An IP address:** e.g.. 192.168.42.201
- **An subnet mask:** e.g.. 255.255.255.0
- **A Gateway address:** the IP address of the router, e.g.: 192.168.42.1.

There are special IP addresses called broadcast addresses which are seen by all computers on a LAN e.g. 255.255.255.255 or 192.168.42.255

Domain Name System (DNS)

This is the system used on the Internet to match computer/host names to IP addresses. Each host on the Internet has an IP address, rather than having to remember these IP addresses we use names like www.sat.dundee.ac.uk to refer to a specific host. We then send these names to a Domain Name Server which converts the name to an IP address which the computers then use to pass data between them.

If you wish to connect to the Internet you will need to know the IP address of the DNS server.

Dynamic Host Configuration Protocol (DHCP)

In days of old, IP addresses were allocated to each computer/host/machine by administrators and details recorded on paper. A protocol called Dynamic Host Configuration Protocol (DHCP) can now do this automatically. When a computer is switched on it sends out a broadcast on the LAN asking for an IP address, a DHCP server will reply and allocate the machine a valid address, thus simplifying the allocation process.

Addresses can be permanently allocated in this manner or leased for a specified amount of time e.g. 3 days. A Windows NT computer can act as a very good and complex DHCP server, the *IPNC* can act as a simple DHCP server. A major benefit of a DHCP server is that if a PC is set for “Obtain IP address automatically” then it can be plugged into any LAN, switched on and it will automatically be correctly configured without any messing. There should only be one DHCP server on any LAN.

When started (with the default configuration) the *IPNC* can get its IP address from a DHCP server. If it gets no response to a request for an address, it takes the address 192.168.42.1 and becomes a DHCP server.

By default it has 200 addresses and can thus allocate 192.168.42.2, 3, 4…198, 199, and 200. If you wish to give static addresses to other computers start at 201.

If you wish the *IPNC* to have an address other than 192.168.42.1 but don’t have a DHCP server on your LAN, you need to establish communications with it by having a PC configured with a specified IP address, e.g. 192.168.42.201 and use that to configure the *IPNC* with the real IP address you wish it to have.

It is also possible to arrange for one of the existing PC’s to see network 192.168.42.0 by adding a route to it's table. Open MS-DOS prompt, enter “route” or “route print” or “route add”.

Note: When allocating IP addresses to Dial In users the IPNC will always use the 10M DHCP pool in preference to the 100M pool. To use the 100M pool disable the 10M DHCP server.

Address ranges

The following addresses will never appear on the Internet and are thus free for use in your private network.

– 10.0.0.0
– 172.16.0.0 through 172.32.0.0
– 192.168.0.0 through 192.168.255.0

If you pick one of these you should have no address problems with the internet.

Boot Protocol (BOOTP)

This protocol was invented when it was expensive to store software or configurations in small units (and even more expensive to upgrade them) so when the unit was switched on it would ask (broadcast) on the LAN for its software. A machine with a disk would reply and send it. Typically a BOOTP Server would send a file to the unit using Trivial File Transfer Protocol (TFTP). The *IPNC* uses BOOTP to obtain new versions of its operational software (which it stores in its flash memory). It also uses TFTP to send and receive configuration files.

The manager program also acts as a BOOTP server. Using the File menu, and selecting BootP, it is possible to configure the IP Address to be given to the *IPNC* and the software filename to be sent (typically nadicii.bin). Normally this table is configured automatically by other actions in the manager. The BootP server recognizes the *IPNC* by its MAC address this is a hardware address built into the unit at manufacture. It is in the form 00e007xxxxxx. The TFTP log in the manager may give clues when you are having problems sending new software to a unit.

Firewall Rules

1. The default behaviour for incoming session is to block, unless a specific entry exists to forward the session.
2. ICMP are blocked for incoming sessions by default may not be forwarded
3. Non-default protocols are forwarded for outgoing connection unless a specific entry exists to drop the session
4. When an Entry match offset is set to 0 all data in IP header is matched (effectively this don't care mechanism)
5. When an Entry is configured with the protocols set to 0 all protocols are matched (effectively this is a don't care)
6. The firewall engine searches the entry list only until the first match is found.
7. To aid the efficiency of the firewall engine matches are not performed on entries that have the same action as the generic. For example, if FTP is to be dropped and a further entry exists, that entry will not be checked before the packet is dropped.
8. If a packet contains an unauthorised request such as a banned Web site, the IPNC immediately replies to the packet's originator with a protocol exchange that terminates the transaction, effectively blocking the request.
9. The Action are outgoing (Out), incoming (In), Bothway or not at all (Drop). The default protocols that can be easily configured this way are:-

Generic Protocol	***Description***
FTP	File Transfer Protocol
Telnet 23/tcp	Remote Terminal Login
SMTP 25/udp	Email delivery
POP3	Email reception
DNS	Domain Name Server
Time	Time update protocol
Gopher	
Finger 79	
HTTP dec 80	Web Access
NNTP	Network News
SNMP	Management
IRC	Internet Relay Chat
PPTP	Point-to Point-Tunnelling Protocol

10. Multiple firewall profiles may be created, a profile may be assigned to a service for outgoing call or for User incoming calls. A firewall configuration may be assigned to one or may services or user configuration.

Network Address Translation (NAT)

NAT is a mechanism that allows IP addressing scheme to be hidden from any TCP/IP network to which TCP/IP traffic is routed. For example, an established network may be using a numbering scheme that is not consistent (non-compliant) with the Internet. There are many cost-effective ISP but they want you to use a different IP address. By using NAT between your machine and their network everyone is satisfied, and no need to renumber your network. An additional benefit is that all your machines can use the NAT facility and access the Internet via the one address.

The IPNC Network Address Translation (NAT) functionality allows an IP address or network (Internal) to be translated to single globally unique IP address (external). In this way non-compliant addressing schemes may be used in conjunction with Internet access.

– **Single IP Address Internet connectivity**. Multiple-PC can simultaneously access the Internet via a single ISP account.
– **Network address translation (NAT)** allows an existing TCP/IP network-addressing scheme to be used for connection to the Internet.

NAT is automatically enabled on the IPNC under the following connection scenarios:

Condition	NAT status
Service / Advanced IP Mask = 255.255.255.255	On
The IPNC is offered and accepts an IP address during the IPCP stage of PPP link establishment. Service / Advanced IP Address = Blank	On
A mask other than 32-bit is assigned to the Service.	Disabled.
A Service is configured with the same name as a User	Disabled.

Appendix D: Use Of The Serial Port

Introduction

The serial port is used, in an emergency, to erase the IPNC configuration or the operational software. For example, if the system is continually rebooting (indicators flashing every 10 seconds), it may be possible to recover the unit from the serial port. It may also be used to erase the customer's configuration if the password has been forgotten.

An asynchronous terminal, such as Windows HyperTerminal is required, configured for a serial (COM) port as follows:

Speed (bps)	38,400
Data bits	8
Parity	None
Stop bits	1
Flow control	None
Emulation	TTY

Erasing the Configuration

To erase the configuration area of flash memory, i.e., return it to its factory default:

1. Open HyperTerminal on the PC. Attach a serial cable between the PC acting as the terminal and the IPNC.
2. Reboot the IPNC from the INDeX Admin or by removing it and reinserting it.
3. Hit the Escape key [Esc] every second until the Loader message appears.
4. Type AT[Enter] and wait for an OK.
5. Type AT-X2[Enter] and wait for a response.
6. Type AT-X3[Enter] and wait for a response.
7. Power the unit off and on again.

Erasing a Configuration from Flash Memory

```
Loader 1.3 DualFlash (2MB-2xF800 Flash-120nS DRAM-70nS EDO)
at
OK
P5 Loader 1.7 (2MB-2xF800 Flash-120nS SDRAM-10)
CPU Revision 0x0020
at
OK
AT-X2
0xef00C000H Erase
OK
AT-X3
0xef010000H Erase
OK
ATF
Expanding MPPC image...
```

Note: An alternative method is:

```
AT
OK
at-debug< Manager Version 0.1>
Mon 25/8/1997 00:00:00, Hello>eraseconfig
Mon 25/8/1997 00:00:00, Hello>erasenvconfig
Mon 25/8/1997 00:00:00, Hello>abort
```

Erasing/Re-Installing Operational Software

It may be necessary to carry out this procedure because the software is corrupted.

Note: A replacement copy of software is installed from the Manager PC via the LAN, so ensure that the PC is connected and the Manager is running.

Proceed as Steps 1 and 2 above, type AT-X[Enter] and wait whilst the memory is erased and the new software loaded, as shown below.

Replacing the Operational Software in Flash Memory

```
Loader 1.1 DualFlash (2MB-2xF800 Flash-120nS DRAM-70nS EDO)
AT
OK
AT-X
Multi-Sector Erase
OK
Received BOOTP Response :C0.A8.2A.01 IPNC.bin
TFTP Load Start
TFTP Load complete
```

Note: The command View/TFTP Log used immediately after the AT-X command shows the BootP request sent to the Manager and the progress of the download:

```
: Received BOOTP request for 00e007000123 192.168.42.1 IPNC.bin
: Sending BOOTP response for 00e007000123 192.168.42.1 IPNC.bin
: Sending IPNC.bin length 654321 bytes to 192.168.42.1
: Sent 10% of IPNC.bin
: Sent 20% of IPNC.bin
: Sent 30% of IPNC.bin
: Sent 40% of IPNC.bin
: Sent 50% of IPNC.bin
: Sent 60% of IPNC.bin
: Sent 70% of IPNC.bin
: Sent 80% of IPNC.bin
: Sent 90% of IPNC.bin
: Sent 100% of IPNC.bin
: Sent IPNC.bin length 654321 bytes
```

Troubleshooting

If the response fails because the configuration file is unavailable, e.g.:

```
: Received BOOTP request for 00e007000123 192.168.42.1 IPNC.bin
: Sending BOOTP response for 00e007000123 192.168.42.1 IPNC.bin
: Unable to send IPNC.bin length 0 bytes
```

Copy the IPNC.bin file from the Admin CD \bin folder into the Manager's folder (that folder shown on the Manager's title line) and then power the base unit off and on again.

If the response fails because the identity details are incorrect, e.g.:

```
: Received BOOTP request for 00e007000123 192.168.42.1 IPNC.bin, unable
to process
```

Use File/Bootp and add or edit an existing entry with the MAC and IP address details displayed. (This form is normally completed automatically when a unit is upgraded from the Manager.)

Example of serial port traces as the base unit boots are as follows.
1. Factory default configuration

```
Factory Test Status ffffffff
Product Variation Status ffffffff
NVConfiguration:: No NV Stored default..
ISDN PRI Added
Dual-Modem fitted
Route::Attempting DHCP...
TDMLink 2 Online
Route::No DHCP defaulting IP Address c0a82a01 ffffff00
RouteSystem::Starting DHCP Server...
RouteSystem::RouteSystem LAN1 ipaddr=c0a82a01 ipmask=ffffff00
Configuration::Attempting to read from FLASH...
Configuration::Using Default...
No System IPADDR using DISCOVERED Values
No System IPADDR 2 using DISCOVERED Values
Platform::Discover TDM Attached Units...
Platform::Discover Possible LAN Attached Units...
Configuration::WARNING Unit IPNC is not configured – adding
Adding RemoteManager route to 192.168.99.0
Configuration::AddDeadRoute 0a000000 ff000000 00000000
Configuration::AddDeadRoute e0000000 ff000000 00000000
Configuration::AddDeadRoute c0a80000 ffff0000 00000000
Configuration::AddDeadRoute ac100000 fff00000 00000000
Configuration::Complete
CallSystem::NEW LINE Detected 1
SNMP::Starting SNMP Server...
MIBII::Creating MIBII base...
Initialisation complete starting TA
```

2. Actual configuration

```
Factory Test Status ffffffff
Product Variation Status ffffffff
Dual-Modem fitted
RouteSystem::Starting DHCP Server...
RouteSystem::RouteSystem LAN1 ipaddr=c0a82a01 ipmask=ffffff00
Configuration::Attempting to read from FLASH...
No System IPADDR 2 using DISCOVERED Values
Platform::Discover Possible LAN Attached Units...
Configuration::Complete
SNMP::Starting SNMP Server...
MIBII::Creating MIBII base...
Initialisation complete starting TA
```

Appendix E: Cables

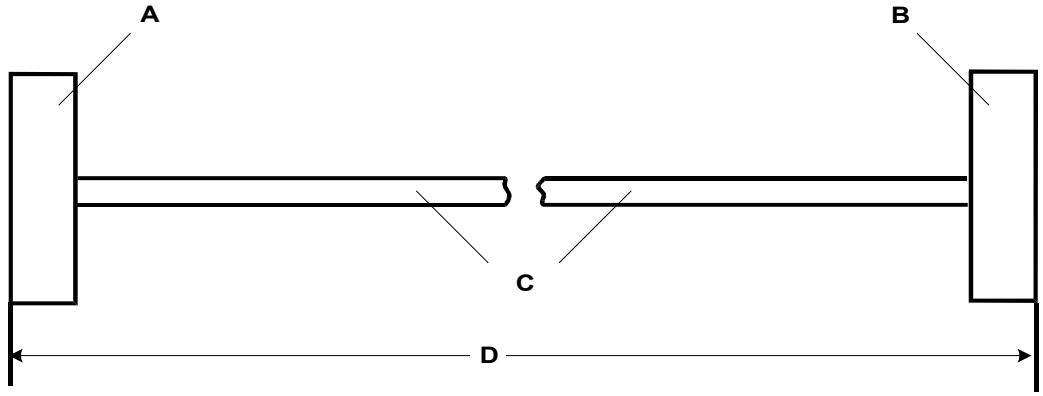
This section provides information about the cables that are used with IPNC.

All of the following cables are for internal use only.

All structured cabling/site wiring **must** conform to all local regulations.

CAUTION: All ISDN and WAN cables should not be longer than 5 meters in length.

DTE Cable



A 25 Way (or 9 Way on IP412) D-Type Plug with UNC 4-40 locking screws.

B 9 Way D-Type Socket with UNC 4-40 locking screws.

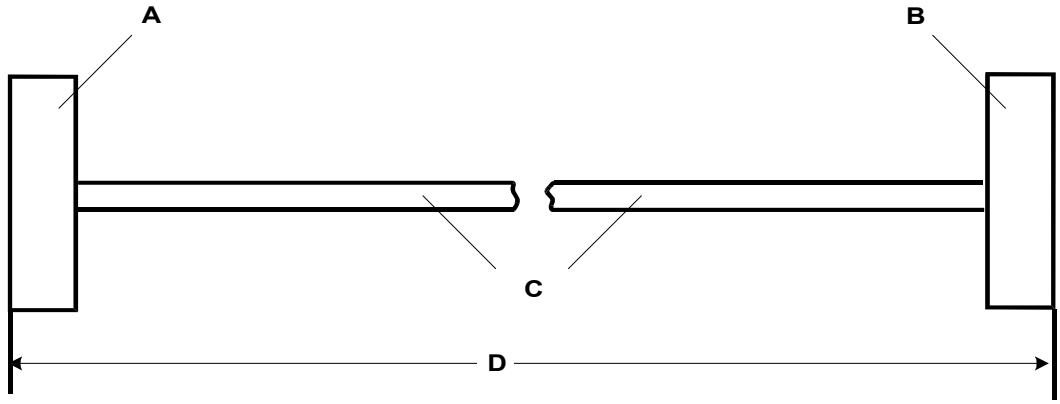
C 12 core screened cable - each core is 7/0.203mm (24 AWG) tinned copper stranded wire, nominal capacitance of 95pF/m, resistance of 92 Ω/km, screened with tinned copper braid, maximum working voltage of 440V rms and a Maximum current per core of 1A rms

D 2 meters.

Pin Connections

End A (25 Way)	End A (9 Way)	Name	End B
2	3	Receive data	3
3	2	Transmit Data	2
4	7	RTS (Request To Send)	7
5	8	CTS (Clear To Send)	8
6	6	DSR (Data Set Ready)	6
7	5	Ground	5
8	1	DCD (Data Carrier Detect)	1
20	4	DTR (Data Terminal Ready)	4
22	9	RI (Ring Indicator)	9

LAN Cable



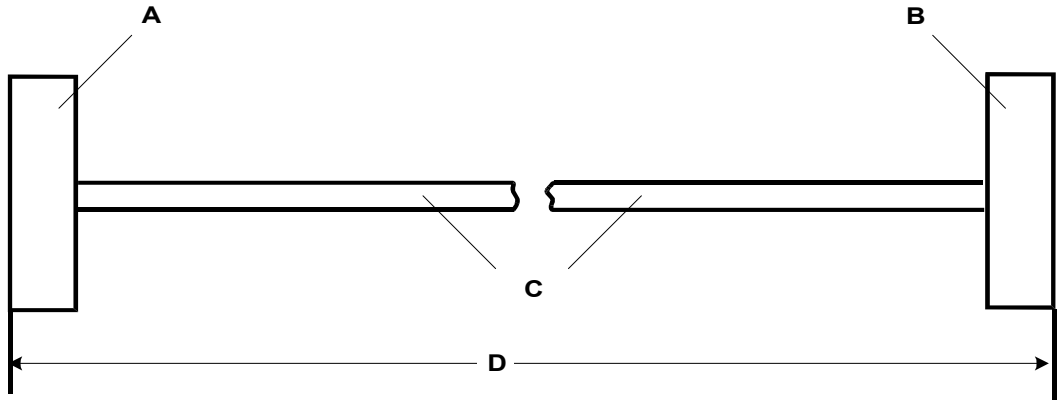
A RJ45 Plug.
B RJ45 Plug.
C Cat 5 UTP cable - **GREY**.
D 3 meters.

Pin Connections

End A	Color	Cable Notes	End B
1	White/Orange	Twisted Pair	1
2	Orange/White		2
3	White/Green	Twisted Pair	3
6	Green/White		6
4	Blue/White	Twisted Pair	4
5	White/Blue		5
7	White/Brown	Twisted Pair	7
8	Brown/White		8

Pins 4, 5, 7 and 8 are through connected for ease of construction. They are not actually used.

LAN Crossover Cable



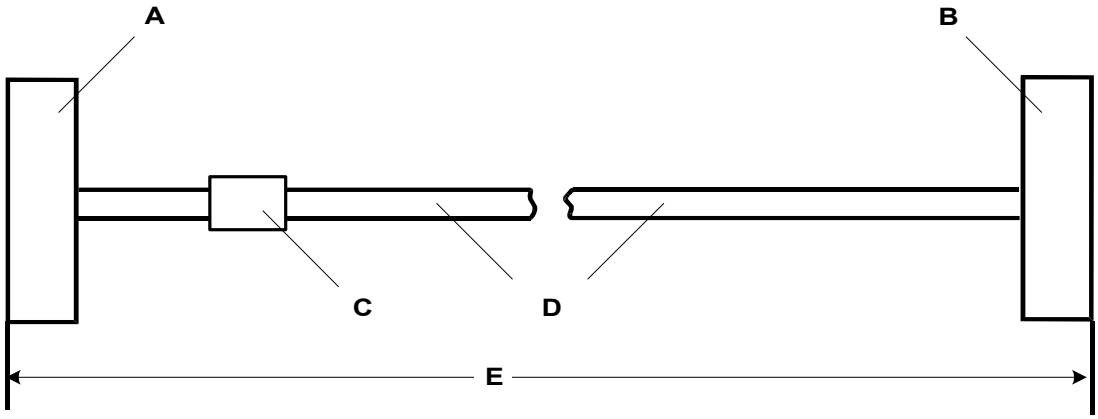
A RJ45 Plug.
B RJ45 Plug.
C Cat 5 UTP cable - **BLACK**.
D 3 meters.

Pin Connections

End A	Color	Cable Notes	End B
1	White/Orange	Twisted Pair	3
2	Orange/White		6
3	White/Green	Twisted Pair	1
6	Green/White		2

STP Cable Drain Wire.

V.24/V.28 WAN Cable



A 37 Way D-Type Plug with UNC 4-40 locking screws.

B 25 Way D-Type Plug with UNC 4-40 locking screws.

C Label

D 12 core screened cable - each core is 7/0.203mm (24 AWG) tinned copper stranded wire, nominal capacitance of 95pF/m, resistance of 92 Ω/km, screened with tinned copper braid, maximum working voltage of 440V rms and a Maximum current per core of 1A rms

E 3 meters.

Pin Connections

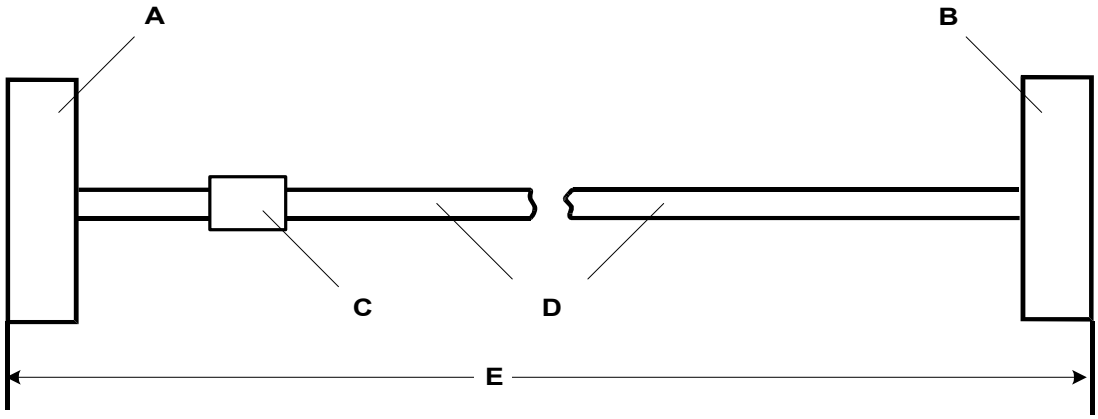
End A	Name	End B
6	Ground	7
8	DTR (Data Terminal Ready)	20
9	Receive Data	3
10	Transmit Clock	15
11	DCD (Data Carrier Detect)	8
12	CTS (Clear To Send)	5
26	Transmit Data	2
27	RTS (Request To Send)	4
28	Receive Clock	17
29	RI (Ring Indicator)	22
30	DSR (Data Set Ready)	6

▶ Connect pin 25 to pin 6 at End A **only**.

Pin 19 at end A is connected to the Screened Cable Drain Wire.

The maximum core to core capacitance must not exceed 800pF.

X.21 WAN Cable



A 37 Way D-Type Plug with UNC 4-40 locking screws.
B 15 Way D-Type Plug with M3 locking screws.
C Label
D 6 twisted pair screened cable - each core is 7/0.203mm (24 AWG) tinned copper stranded wire, nominal capacitance of 98pF/m, impedance of 77 Ω at 1MHz, screened with aluminized tape and a tinned copper wire drain.
E 3 meters.

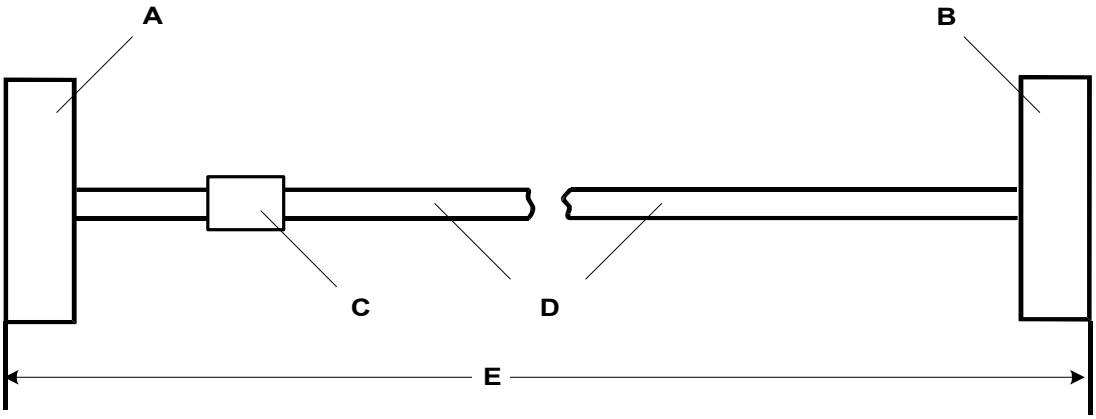
Pin Connections

End A	Name	Cable Notes	End B
1	Receive (Rx-B)	Twisted Pair	11
20	Receive (Rx-A)		4
4	Transmit (Tx-A)	Twisted Pair	2
23	Transmit (Tx-B)		9
24	Control (Ctl-A)	Twisted Pair	3
5	Control (Ctl-B)		10
2	Indicate (Ind-A)	Twisted Pair	5
21	Indicate (Ind-B)		12
3	SE-Timing (S-A)	Twisted Pair	6
22	SE-Timing (S-B)		13
6	Ground	------	8

▶ Connect pin 7 to pin 6 at End A **only**.

Pin 19 at end A is connected to the Screened Cable Drain Wire.

V.35 WAN Cable



A 37 Way D-Type Plug with UNC 4-40 locking screws.
B 34 Way MRAC Plug.
C Label
D 10 twisted pair screened cable - each core is 7/0.203mm (24 AWG) tinned copper stranded wire, nominal capacitance of 98pF/m, impedance of 80 Ω ± 10% at 1MHz, screened with aluminized tape and a tinned copper wire drain.
E 3 meters.

Pin Connections

End A	Name	Cable Notes	End B
8	DTR (Data Terminal Ready)	-----	H
11	DCD (Data Carrier Detect)	-----	F
12	CTS (Clear To Send)	-----	D
27	RTS (Request To Send)	-----	C
29	RI (Ring Indicator)	-----	J
30	DSR (Data Set Ready)	-----	E
32	Transmit Data - A	Twisted Pair	P
14	Transmit Data - B		S
35	Receive Data - A	Twisted Pair	R
16	Receive Data - B		T
36	Transmit Clock - A	Twisted Pair	Y
17	Transmit Clock - B		AA
37	Receive Clock - A	Twisted Pair	V
18	Receive Clock - B		X
33	External Clock - A	Twisted Pair	U
15	External Clock - B		W
34	Ground	-----	B

▶ Connect pins 7 and 25 to pin 6 at End A **only**.

Pin 19 at end A is connected to the Screened Cable Drain Wire.

The maximum core to core capacitance **must not** exceed 800pF.

Glossary

BACP Bandwidth Allocation Control Protocol is a dynamic bandwidth allocation technique that enables, if utilisation of the channels already present exceeds a specified threshold value, the connection of additional channels.

BOOTP Boot Protocol. A TCP/IP protocol, which allows an internet node to discover certain start-up information such as its IP address

BRI Basic Rate Interface. An ISDN subscriber “interface”. Consists of 2 bearer B-channels at 64 kilobits per second and a data D-channel at 16 kilobits per second. B-channels designed for voice and D-channel for the data i.e. receiving information about the incoming call and taking out information about outgoing call.

CHAP Challenge-Handshake Authentication Protocol. An authentication scheme used by PPP servers to validate the identity of the originator of a connection, upon or during connection. The server can request the connected party to send a new challenge message at any time. Because CHAP identifiers are changed frequently and because authentication can be requested by the server at any time, CHAP provides more security than PAP.

CLI/CLID Calling Number Identification.

DDI Direct Dialling Inward. A service where a call made to a DDI number arrives direct, without the intervention of an organisation’s operator, at an extension or group of extensions

DHCP Dynamic Host Configuration Protocol. Allows a server to automatically give out IP addresses to workstations. Can also provide subnet mask, default gateway, WINS server and DNS server addresses etc. A DHCP server verifies the device’s identification, “leases” an IP address for a predetermined amount of time and reclaims the address at the end of period for reassignment.

DNS Domain Name System. System used on the Internet to translate Internet domain names (i.e. www.networkalchemy.co.uk) into IP addresses. This means you can use the internet without having to remember IP addresses. Domain Name Service is an Internet utility that implements the Domain Name System. DNS servers maintain databases containing the addresses and are accessed transparently to the user.

DPNSS Digital Private Network Signalling system. A UK standard that enables PBXs from different manufacturers to be tied together with E-1 lines and pass call transparently between them. International version called Q.SIG/Q.931, which is Euro-ISDN.

DTE Data Terminal Equipment. The DTE port on the Argent unit is used as a diagnostic aid.

DTMF Dual Tone Multi-Frequency. Describing push button or Touchtone dialling. When you touch a button on a push button pad, it makes a tone, a combination of two tones - one high frequency and one low frequency. Thus the name Dual Tone Multi Frequency.

Finger An Internet utility, originally limited to UNIX but now available on many other platforms, that enables a user to obtain information on other users who may be at other sites (if those sites permit access by finger). Given an e-mail address, finger returns the user’s full name, and indication of whether or not the user is currently logged on, and any other information the users has chosen to supply as a profile. Given a first or last name, finger returns the logon names of users whose first or last names match.

Glossary (Cont.)

Flash Completely delineated, flash is a solid-state, non-volatile, re-writable memory. Much like RAM (Random Access Memory) flash uses memory cells to store electronic bits of data, but flash differs from RAM in two respects. First, flash is non-volatile, unlike DRAM and SRAM which must have constant power to retain data. Second, flash differs from RAM in the way the read/write process works, since flash can only write data to a previously erased block of memory. Some types of flash have a random-read feature like RAM, while others read data sequentially, similar to a disk drive.

This combination of features makes flash well-suited both for file storage applications - particularly portable or removable storage - and for XIP (eXecute In Place) and code-storage applications.

FTP File Transfer Protocol (FTP). To download files from or upload files to remote computer systems, via the Internet's File Transfer Protocol. The user needs an FTP client to transfer files to and from the remote system, which must have an FTP server. Generally, the user also needs to establish an account on the remote system to FTP files, although many FTP sites permit the use of anonymous FTP.

Gopher An Internet utility for finding textual information and presenting it to the user in the form of hierarchical menus, from which the user selects submenus or files that can be downloaded and displayed. One Gopher client may access all available Gopher servers, so the user accesses a common "Gopherspace". The name of the program is a three-way pun. It is designed to go for desired information, it tunnels through the Internet and digs the information up, and was developed at the University of Minnesota (whose athletic teams are named the Golden Gophers). Gopher is being subsumed by the World Wide Web.

H.323 A standard approved by the International Telecommunication Union (ITU) that defines how audiovisual conferencing data is transmitted across networks. H.323 should enable users to participate in the same conference even though they are using different videoconferencing applications.

HTTP Hypertext Transfer Protocol. The client/server protocol used to access information on the World Wide Web.

HyperTerminal

Allows you to connect two computers with a modem so you can send and receive files, or connect to computer bulletin boards and other information programs. For example, you can use HyperTerminal to connect to an online service and to download files from a bulletin board on that service. You can also use HyperTerminal to connect a computer directly to another computer, such as a debugging terminal.

Internet Group Management Protocol (IGMP)

The standard for IP multicasting in the Internet. It is used to establish host memberships in particular multicast groups on a single network. The mechanisms of the protocol allow a host to inform its local router, using Host Membership Reports, that it wants to receive messages addressed to a specific multicast group.

IP Header Compression (IPHC - RFC 2507 and RFC 2508)

IPHC reduces the IP/UDP/RTP headers to two bytes for most packets in the case where no UDP checksums are being sent, or four bytes with checksums. IPHC therefore significantly reduces WAN bandwidth requirements per voice call.
IP Office applies IPHC to all traffic types i.e. voice signalling/traffic and data. However, some IP protocols yield a better compression ratio.
IPHC imposes process overheads which can become counter-productive at higher WAN speeds. It is for this reason that IP Office will not perform IP Header compression at speeds above 1024Kbps.

Glossary (Cont.)

IRC Internet Relay Chat. A service that enables an Internet users to participate in a conversation on line in real time with other users. An IRC channel, maintained by an IRC server, transmits the text typed by each user who has joined the channel to all other users who have joined the channel. Generally, a channel is dedicated to a particular topic, which may be reflected in the channel's name. An IRC client shows the names of currently active channels enables the user to join a channel, and then displays the other participants' words on individual lines so that the user can respond.

MAPI Messaging Application Programming Interface. A Microsoft's Windows application which is part of WOSA (Windows Open Services Architecture). MAPI is a set of API functions and a OLE interface that lets messaging clients, such as Microsoft Outlook, interact with various message service providers, such as Microsoft Exchange Server and various computer telephony servers running under Windows NT server. Overall, MAPI helps Exchange manage stored messages and defines the purpose and content of messages – with the objective that most end users will never know.

MSN Multiple Subscriber Numbering

NAT Network Address Translation. The process of converting between IP addresses used within an intranet or other private network and Internet IP addresses. This approach makes it possible to use a large number of addresses within the stub domain without depleting the limited number of available numeric Internet IP addresses.

NNTP Network News Transfer Protocol. The Internet protocol that governs the transmission of newsgroups.

POP3 Post Office Protocol 3. A protocol for servers on the Internet that receive, store, and transmit e-mail and for clients on computers that connect to these servers to download and upload e-mail.

PAP Password Authentication Protocol. A method for verifying the identity of a user attempting to log on to a PPP server. Passwords are sent without encryption and the originator can make repeated attempts to gain access. This authentication method must be used if encryption is not supported at the remote end.

PPP Point to Point Protocol. A protocol which allows a PC to connect as a TCP/IP host to a network through an asynchronous port. PPP is commonly used for connection across the PSTN from a PC to an ISP for purposes of Internet access. PPP includes error detection and data protection features.

PPTP Point-to-Point Tunnelling Protocol. A specification for virtual private networks in which some nodes of a local area network are connected through the Internet.

Q.Sig See DPNSS

PRI Primary Rate Interface. Provides 30B+D running at 1.544 megabits per second and 2.048 megabits respectively.

RAS Remote Access Services. A feature built into Windows NT that enables users to log into an NT-based LAN using a modem, X.25 connection or WAN link. RAS works with several major network protocols, including TCP/IP, IPX, and Netbeui. To use RAS from a remote node, you need a RAS client program, which is built into most versions of Windows, or any PPP client software. For example, most remote control programs work with RAS.

MAC Address The physical address of the hardware device. (Identified at the Media Access Control layer in the network architecture.)

RSVP Resource Reservation Setup Protocol. An Internet protocol developed to enable the Internet to support specified Qualities-of-Service (QoS's). Using RSVP, an application will be able to reserve resources along a route from source to destination. RSVP-enabled routers will then schedule and prioritise packets to fulfil the QoS.

Glossary (Cont.)

Router An interface between two networks. A Route is the path a packet takes over a network. It is the responsibility of the router to find the best route between two networks.

Router based firewall
This is a packet filtering firewall. Only authorised incoming and outgoing packets can pass through.

SMTP Simple Mail Transfer Protocol. A TCP/IP protocol for sending messages from one computer to another on a network. This protocol is used on the Internet to route e-mail.

SNMP Simple Network Management Protocol. The network management protocol of TCP/IP. In SNMP, agents, which can be hardware as well as software, monitor the activity in the various devices on the network and report to the network console workstation. Control information about each device is maintained in a structure known as a management information block.

Subaddressing
A name for an ISDN service which enables many different types of terminals – phones, fax machines, PCs etc – to be connected to the ISDN user interface and uniquely identified during a call request

Telnet A protocol that enables an Internet user to log on to and enter commands on a remote computer linked to the Internet, as if the user were using a text-based terminal directly attached to that computer. Telnet is part of the TCP/IP suite of protocols.

Time Time Update Protocol. Used to take the time of day from the Internet

TFTP Trivial File Transfer Protocol. A simplified version of FTP that transfer files but does not provide password protection or user-directory capability. It is associated with the TCP/IP family of protocols. TFTP depends on the connectionless datagram delivery service, UDP.

Virtual Network
A part of a network that appears to a user to be a network of its own. For example, an Internet service provider can set up multiple domains on a single HTTP server so that each one can be addressed with its company's registered domain name.

WINS Windows Internet Name Service. This Windows service will resolve NetBIOS computer names to IP addresses. The WINS server, which is a Windows NT Server, will automatically register computer names and their IP addresses in its database. This information will be used to match a computer name to its IP address when requested by a client. Used to reduced broadcast traffic.

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