Teldat Router

Voice over IP

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Chapter 1
Introduction

1. Introduction to H.323 Configuration

1.1. Voice codification

The VoIP motherboard permits transmission of voice and fax via an Internet Network. There are two models: basic telephony and ISDN telephony (Integrated Services Digital Network). The basic telephony motherboard can be connected to telephones, switchboards, faxes, and traditional telephone lines, while the ISDN motherboard connects to ISDN switchboard behaving as the Network termination (NT). The device itself detects the type of motherboard it is connected to and sets the appropriate parameters by default for each type of motherboard where no previous configuration exists.

The voice signals that are introduced in these motherboards are in digital format if the motherboard is ISDN (encoded according to the G.711 A law) and analog format if the motherboard is traditional telephony. In this latter case, the motherboard itself carries out the Analog-Digital (A/D) and the Digital-Analog (D/A) conversion. The digital signals are processed and dealt with by a digital processor from the signal (Digital Signal Processor -DSP-), which carries out the following operations:

Compression: With the aim of reducing the bandwidth, the digital signal undergoes a compression process complying with different standards (codecs). In the case of the VoxNet motherboard this can be G.729 or G.723.1.

The two codecs provide an agreement between quality and speed. The best quality is obtained with the G.729 which operates at 8 Kbps. G723.1 can operate at 6.4 and 5.3 Kbps and provides a slightly lower quality of voice compared with the G.729.

Packaging: Once the voice is compressed, it is sent to the main CPU in fixed length sequential frames. The length and cadence of these packets depending on the standard used are:

G.729: 10 octets each 10 ms.

G.723.1 to 6,4 Kbps: 24 octets each 30 ms.

G.723.1 to 5,3 Kbps: 20 octets each 30 ms.

Subsequently it is the main CPU that transports the voice frames over the IP stack. Each packet can contain one or more voice frames, i.e. configurable. If you encapsulate more than one voice frame in an IP packet, the required bandwidth for the voice flow is lower as the various voice frames share the RTP/UD/IP header. It may not be worth saving bandwidth if you are using compressed algorithm headers such as CRTP.

In order to achieve adequate voice quality, these packets should be delivered at the destination in the same order and throughput as generated at source.

With the aim of minimizing the possible loss of any of these voice samples, the compression algorithms use interpolation techniques in order to regenerate the lost samples.

In the same way and given that the propagation time of a datagram by the network is not set (the opposite to a switched circuit network), the packets are stored in a small buffer and subsequently are sequentially delivered in the most similar way possible to how they were generated (each 10ms or 30 ms, depending on the codec used). This produces a certain delay in the voice, which is always tolerable within some limits, but permits compensating the delays introduced by the network and the jitter (a variation of this delay).

1.2. H.323 Recommendation

With the aim of transporting real time multimedia information over switched packets networks, the UIT has defined a series of standards grouped under the H.323 Recommendation.

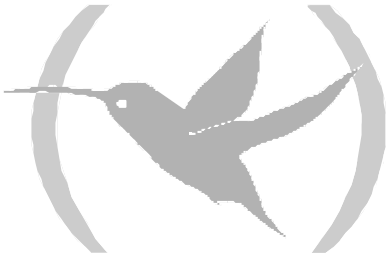
The H.323 Recommendation describes another series of elements in addition to the terminals, such as the gateway and gatekeepers.

The gateways permit interconnecting the H.323 systems with other conference systems such as ISDN, analog telephony (Plain Old Telephone Service -POTS-), etc., and the gatekeepers provide admission and address translation mechanisms between the different terminals.

The H.323 Recommendation refers to other standards as follows:

- H.225.0: Describes the means by which the audio, video, data and control are associated, encoded and packaged for transport between H.323 terminals in a network without a guaranteed quality of service; and between H.323 terminals and H.323 gateways. H.225.0 specifies the protocols and the message format used in RTP (Real Time Protocol), RTCP (Real Time control Protocol), Q931 and RAS (Register Admission Status).
- Q.931: A connections establishment procedure is used derived from this standard in a similar way to ISDN. The Q.931 messages are sent encapsulated within TCP/IP sessions.
- RTP: Carries out the framing, numeration sequences, Timestamp, payload type and source identification functions.
- RTCP: This is associated to the RTP and provides information on the status and presentations of the communication.
- H.245: Defines the capacity exchange, channel negotiation and flow control procedures.

Chapter 2
Configuration



1. Configuration commands

Enter the H.323 Protocol configuration (Voice over IP) from the main menu as follows:

1. At the prompt (*), enter PROCESS 4 (or P4).
2. At the configuration prompt (Config>), enter PROTOCOL H323 or PROTOCOL 4, or P 4.
3. At the H.323 protocol configuration prompt (H323 Config>), use the configuration commands described in this chapter in order to configure the parameters for the said Protocol.

In this chapter, the H.323 configuration commands are enumerated and described. All of the H.323 configuration commands must be entered at the H.323 prompt (H323 Config>).

If you wish to delete all the H323 configuration without losing the remaining device configuration, you can use the **CLEAR H323** command from the Config> prompt:

```
Config>CLEAR H323
Config of H323 will be DELETED
Continue clearing? (Yes/No)? y
Config>
```

1.1. ? (HELP)

Displays a list of available commands or their options.

Syntax:

```
H323 Config>?
```

Example:

```
H323 Config>?
APPLY                       Make some of the parameters immediately activate
CODEC-CLASS                 Codec class for use depending on the called number
DESTINATION                 Telephone numbers assignation table to IP address
FAST-CONNECT                Speed up the H323 calls starting process
LINE                        Line configuration options
LIST                        View the different configured parameters
LOCAL-CALL-EXPANSIONS       Translations or expansions apply to internal calls
MATCH-DIALING               Numbers must fit with the prefix table
MOVE                        This moves the entries in the different tables used
NO
PORT                        Associate a telephone number (or prefix) to a line
PREFIX                      Define the length of the number dialed
PROPIETARY-MODE             propietary fast-start mode
REGISTER-E164               Communicate the E.164 identifiers to the gk
SET                         Configure several parameters
TRANSLATION                 Translation for use in both outgoing/incoming calls
EXIT
H323 Config>
```

1.2. APPLY

This command makes some of the configured parameters immediately activate.

The newly configured parameters will not be active until you execute this command, with exception to those relative to volume gain. These automatically activate on configuration, with the aim of simplifying adjustment.

The parameters that dynamically activate when executing the **APPLY** command are:

- The assignment of telephones numbers to addresses table.
- Prefixes table.
- The assignment of telephone numbers to lines table.

- Tone timers.
- Voice activity detection.

Syntax:

```
H323 Config>APPLY
```

1.3. CODEC-CLASS

This permits defining a codec class for use depending on the called telephone number (see the **DESTINATION** command). A codec class comprises of a codec type, a VAD configuration (voice activity detector) and a NOB (number of voice frames per RTP packet). Default is no defined codec class.

Syntax:

```
H323 Config>CODEC-CLASS <codec-class>
Codec-type                type of codec (G723, G729)
        g7235k3                 g723 codec at 5.3 Kbps
        g7236k4                 g723 codec at 6.4 Kbps
        g729                    g729 codec at 8.0 Kbps

default                 create a default codec class

no
        vad       voice activity detector on

frames-per-packet       number of codec frames per RTP packet

vad                     voice activity detector on

line                    use line configuration parameters
        vad                     voice activity detector on
        codec-type              type of codec (G723, G729)
```

Codec-class	Identifier of the codec class to be used. Admits values between 1 and 255.
Codec- type	Type of codec to be used. Those available will appear on requesting the data.
Frames-per-packet	NOB. Number of voice packets that you wish to send in each RTP frame. Increasing the said value signifies lowering the required bandwidth in order to send voice data but increases the delay between the packets. Admitted values are between 1 and 6. The –1 vale indicates the NOB configured in the line by default is used.
VAD	Use of the automatic voice detector. This can be enabled or disabled. On enabling it you decrease the required bandwidth as you only transmit RTP packets when there is voice, not when there are silences.
Line vad	Uses the vad configured in the line by default.
Line codec-type	Uses the codec configured in the line by default.

If the list is already defined or the class identifier is erroneous, an error message is produced.

The available codec classes' list is displayed using the **LIST CODEC-CLASS** command. You can delete entries with the **NO CODEC-CLASS** command.

Examples:

Example 1. Creating a codec class code, with identifier number 3 (an attempt was first made with number 2 but it was already defined in the earlier example). This class will employ a G723 codec at 6.4 Kbps, NOB 1 with the VAD enabled.

```
H323 Config>CODEC-CLASS 3 codec-type g7236k4
H323 Config>
```

The result can be checked through the **LIST CODEC-CLASS** command.

```
H323 Config>LIST CODEC-CLASS
Id     Codec      frm/pkt (bytes)  VAD

  2  G723 6.4Kbps      2 ( 48)      E
  3  G723 6.4Kbps      1 ( 24)      E

H323 Config>
```

Example 2. Creation of three codec classes with identifiers 10, 20 and 30 and using one or another depending on the destination of the call.

The class 10 uses a smaller bandwidth than the 20 or 30, resulting in a lower quality of voice. Class 30 uses a higher bandwidth, but obtains better quality and class 20 provides a compromise between both.

```
H323 Config> CODEC 10 frames-per-packet 3
H323 Config> CODEC 20 codec-type g7236k4
H323 Config> CODEC 30 codec-type g729 no vad
H323 Config>
H323 Config>LIST CODEC
Id     Codec      frm/pkt (bytes)  VAD

10   G723 5.3Kbps      3 ( 60)      E
20   G723 6.4Kbps      1 ( 24)      E
30   G729A 8Kbps       1 ( 10)      D

H323 Config>
```

Subsequently you need to configure the addresses table (see the **DESTINATION** command) in order to use one class or another depending on the telephone number that you are calling at each point. Just as the addresses table subsequently appears, the class 10 is used for calls whose destination telephone number begins with 1, class 20 for calls whose destination telephone begins with 2 and class 30 for calls whose destination telephone begins with 3.

```
H323 Config> LIST TABLE DESTINATION
Entry:   1                Telephone: 1                Strip prefix: 0
Codec class: 10           IP Addr: 172.1.2.1          Dial-Out Pref:
Tech Prefix:              Num. type: unknown          Translation: --
Local IP: 0.0.0.0

Entry:   2                Telephone: 2                Strip prefix: 0
Codec class: 20           IP Addr: 172.1.2.2          Dial-Out Pref:
Tech Prefix:              Num. type: unknown          Translation: --
Local IP: 0.0.0.0

Entry:   3                Telephone: 3                Strip prefix: 0
Codec class: --           IP Addr: 172.1.2.3          Dial-Out Pref:
Tech Prefix:              Num. type: unknown          Translation: --
Local IP: 0.0.0.0

H323 Config>
```

With this configuration a higher bandwidth is used for voice transmission in calls with a 172.1.2.3 destination and a smaller bandwidth in communications with a 172.1.2.1 destination.

Example 3. Creation of a codec class with identifier number 40, using G729 with VAD, but employs the NOB that the line has configured, which is used to carry out the call.

```
H323 Config>CODEC 40 codec-type g729 frames-per-packet -1
H323 Config>LIST CODEC
Id     Codec      frm/pkt (bytes)  VAD

40   G729A 8Kbps       - (--)      E
H323 Config>
```

1.4. DESTINATION

This permits you to add an entry to the telephone numbers assignation (or prefixes) to IP addresses table. You use this in order to know how to access a remote telephone number.

Once you have selected the entry depending on the called destination number, you can apply (in this order) translations over the called telephone number or the caller as well as compressions (digits to strip) and expansions (dial-out prefix) over the remote telephone E.164 identifier. Also you are permitted to choose the codec type, VAD and NOB to be used (grouped through a codec class) and use a technological prefix (only useful in environments controlled by a gatekeeper). By default there are no defined entries.

For more information on the translations operation mode, consult the **TRANSLATION**, **NO TRANSLATION**, **LIST TRANSLATION** and **SET TRANSLATION** commands.

The appearance order in the table is important as processing is carried out in compliance with this: once an entry is found that matches the called telephone number, the checking of the rest of the numbers stops. The entries that are added with this command are placed at the end of the table; if you wish them to occupy another position, use the **MOVE DESTINATION** command.

Syntax:

```
H323 Config>DESTINATION <telephone-number> <ip-address>
default           assign a called telephone number to an IP

local-ip          Local IP address (0.0.0.0 default)

codec-class       codec-class Id

number-type       number type

translation       translation identifier to be used
        called-number      apply the translation to the called number
        caller-number      apply the translation to the calling number
        id                 translation id to use

strip-digits      Digits to strip

dial-out          Dial-out prefix

tech-prefix       Tech-prefix
```

With this configuration example, on calling 243000, the call is carried out to the 10.1.1.2 address using the codec, by default VAD and NOB from the line. The called telephone number results in first applying translation 3 if required and subsequently applying delete and insertion; in this way if the translation is not applicable, the called number will be 90014300.

Telephone-number	Digits over which you choose an IP address. This can be a complete telephone number or only the first digits in agreement with a given numeration plan (i.e. a prefix). A maximum of 15 digits (0 to 9) are accepted.
IP-address	IP address that the call is carried out to.
local-ip	Local IP address used as source IP address in all IP packets related to the call. 0.0.0.0 is configured by default therefore the IP local address is the internal device address.

codec-class	Codec class identifier to be used with this destination. This class defines the codec, use of the call VAD and NOB. For more information, see the **CODEC-CLASS** command. Values between 0 and 255 are admitted. The value zero omits the use of codec classes.
number-type	Type of numeration that by default follows the calling and called number within the UIT-T Q.931 standard. This information appears in the *Calling Address* and *Called Address* information elements from the Q.931 SETUP and INFO messages. In cases where the call originates in an ISDN voice line, the type of numeration is taken from the voice ISDN Q.931 messages. This admits values between 0 and 7 with the exception of 5.
translation id	Translation identifier to be used. You apply this before deleting and inserting digits. For more information, consult the **TRANSLATION** command. This admits values between 0 and 127. The zero value omits the use of a translation. If the translation does not exist, the use of the said translation is omitted.
translation called-number	Translation is applied over the called number.
translation caller-number	Translation is applied over the caller number.
strip-digits	Number of digits of a received telephone number which are deleted, beginning on the left hand side (prefixes). This admits values between 0 and 15.
dial-out	Digits that are applied as prefix for the resulting number after applying the deletion of a prior field over the requested telephone number. The admitted values are 15 digits (0 to 9).
tech-Prefix	Technological prefix used to carry out the call. This field is only significant when the device operates under the control of the gatekeeper. If this is not specified, the prefix associated to the gateway is used by default. Maximum character string length admitted is 11. Longer strings are cut to 11 characters.

Values outside the established margins give rise to an error message and the operation terminates. If two entries are included that have the same IP address and telephone number, this will give rise to an error message. Contrariwise you are permitted to add a second entry which exactly coincides with the telephone number: In this case the second entry is used as an alternative IP address in order to access the remote telephone in case you cannot access the first.

If the device operates under the control of a gatekeeper (for this you must configure the gatekeeper IP address) it doesn't make sense to use these entries, as the destination addresses have to be obtained from the gatekeeper. However, if you wish to carry out compression and/or numerical expansions, use the codec classes and technological prefixes. This should include entries with a 0.0.0.0 IP address.

On receiving the calls these entries are also checked: if the caller IP address corresponds with that configured, it is considered to be a direct call and does not contact the gatekeeper.

Examples:

Example 1. Entry in order to call telephone numbers beginning with 6 and that are found accessible in the voice gateway with IP address 172.1.1.1, in such a way that the line default parameters are used (codec, vad, NOB). You do not need to carry out any additional operation over the implicated telephone numbers: the caller does not provide information in this case; the telephone called can be used as is. The configured internal IP address is used as the local IP address. This is the minimum configuration required in order to add an entry.

```
H323 Config>DESTINATION 6 172.1.1.1 default
H323 Config>
```

Example 2. Entry in order to call telephone numbers beginning with 8 and that are found accessible in the voice gateway with IP address 172.1.1.2, in such a way that the line default parameters are used (codec, vad, NOB). You need to modify the called telephone number as the numeration plan that sees the person who is calling and that used by the remote device do not coincide: the person who calls dials two digit numbers (with the 8x format) that in the remote device corresponds with extensions with the 38x format.

```
H323 Config>DESTINATION 8 172.1.1.2 dial-out 3
H323 Config>
```

Example 3. Entry in order to call telephone numbers beginning with 4 and that are found accessible in the voice gateway with IP address 172.1.1.3, in such a way that the line default parameters are used (codec, vad, NOB). You must modify the called telephone as the numeration plan that sees the person who called and that used by remote device do not coincide: the person who calls dials three digit numbers (with the 44x format) that in the remote device corresponds with extensions with 60x format.

```
H323 Config>DESTINATION 4 172.1.1.3 dial-out 60 strip-digits 2
H323 Config>
```

In this case delete the first two digits of the call (the 44) and add 2 (a 60) to the remainder.

Example 4. Entry in order to call telephone numbers beginning with 6 and that are found accessible in the voice gateway with IP address 172.1.1.4. This entry is used as an alternative in case of failure in the 172.1.1.1 voice gateway (example 1). You continue to use the line default parameters (codec, vad, NOB). You do not need to carry out any other additional operations over the implicated telephone numbers (neither caller or called).

```
H323 Config>DESTINATION 6 172.1.1.4 default
H323 Config>
```

So that an address is alternative, it must have a higher order. The order of an entry is displayed with the **LIST TABLE DESTINATION** command.

```
H323 Config>LIST TABLE DESTINATION
Entry:   1               Telephone: 6               Strip prefix: 0
Codec class: --          IP Addr: 172.1.1.1         Dial-Out Pref:
Tech Prefix:             Num. type: unknown         Translation: --
Local IP: 0.0.0.0

Entry:   2               Telephone: 8               Strip prefix: 0
Codec class: --          IP Addr: 172.1.1.2         Dial-Out Pref: 3
Tech Prefix:             Num. type: unknown         Translation: --
Local IP: 0.0.0.0

Entry:   3               Telephone: 4               Strip prefix: 2
Codec class: --          IP Addr: 172.1.1.3         Dial-Out Pref: 60
Tech Prefix:             Num. type: unknown         Translation: --
Local IP: 0.0.0.0

Entry:   4               Telephone: 6               Strip prefix: 0
Codec class: --          IP Addr: 172.1.1.4         Dial-Out Pref:
Tech Prefix:             Num. type: unknown         Translation: --
Local IP: 0.0.0.0
```

```
Entry:   5                Telephone: 10              Strip prefix: 0
Codec class: 10           IP Addr: 172.1.1.5         Dial-Out Pref:
Tech Prefix:              Num. type: unknown         Translation: --
Local IP: 0.0.0.0

ATLAS H323 Config>
```

Example 5. Entry in order to call telephone numbers beginning with 10 and that are found accessible in the voice gateway with IP address 172.1.1.5. This device is accessible through a path that recommends improving the use of the bandwidth (increasing the NOB and using VAD). However, the device should access other gateways where this consideration is not applied. It is not necessary to carry out any additional operations over the implicated telephone (neither caller or called).

```
H323 Config>DESTINATION 10 172.1.1.5 codec-class 10
H323 Config>
```

In this case it is imperative you use a codec class for this destination, as identified by number 10. These parameters can be viewed through the **LIST CODEC-CLASS** command.

```
H323 Config>LIST CODEC-CLASS

Id     Codec      frm/pkt (bytes)  VAD

 10  G723 5.3Kbps      5   (100)    E
 11  G729A 8Kbps       1   ( 10)    E
  4  G729A 8Kbps       3   ( 30)    D

H323 Config>
```

Example 6. Entry in order to call telephone numbers beginning with 11 and that are found accessible in the voice gateway with IP address 172.1.1.7. Both voice gateways are found in a zone controlled by a gatekeeper. This device is accessible through a path (for example LAN) that permits using a better codec than that configured by default. You must modify the calling telephone number as in the called, depending on this data, different rates are applied.

```
H323 Config>DESTINATION 11 0.0.0.0 codec-class 11 translation id 3
H323 Config>
```

As you carry out a call through a gatekeeper control, the IP address is 0.0.0.0. As you are required to change the voice encoding parameters and you must use a codec class, such as that identified by the number 11 (see the above example in order to view the parameters for this class). Lastly, you need to modify the calling telephone number that has to use a translation. In this case use translation 3 over the caller. To consult the rules that apply to the said translation, use the **LIST TRANSLATION** command.

Example 7 Entry in order to call telephone numbers beginning with 9 and that are found accessible in the voice gateway with IP address 172.1.1.9. Additionally the local IP address to be used is the device Frame Relay interface address (1.1.2.1) instead of the internal.

```
H323 Config>DESTINATION 9 172.1.1.9 local-ip 1.1.2.1
H323 Config>DESTINATION 9 172.1.1.9 codec-class 4 translation id 3
H323 Config>
```

As the voice encoding parameters require changing you need to use a codec class, that identified by number 4 (see the above example to view the parameters for this class). Lastly, as you need to modify the calling number you need to use a translation. In this case you use translation 3 over the call. For further information on the local IP, please see example 2-e.

1.5. FAST-CONNECT

Enables the fast connection procedures that speed up the H323 calls starting process. By default the fast-connect procedure is disabled.

Example:

```
H323 Config>FAST-CONNECT
H323 Config>
```

The Fax service is not available when the fast connection is enabled.

1.6. LINE

Permits you to configure the parameters independently per line.

Syntax:

```
H323 Config>LINE <line-number>
active                  line can receive and make calls

codec                   defines the encoder to be used in the line
               g7235k3      g723 codec at 5.3 Kbps
               g7236k4      g723 codec at 6.4 Kbps
               g729         g729 codec at 8.0 Kbps

default                 create a default codec class

direct-dialing          call is automatically carried out to this number

h245-dtmf-relay         dtmf digits are send in the h245 connection

identifier              sets a H.323 identifier to the line

mic-gain                indicates the line input gain

interface-type          indicates the line type fxs/fxo
        fxs      line is connected to a telephone (FXS, Foreign eXchange Station)
        fxo      line is connected to a trunk line (FXO, Foreign eXchange Office)

no
        active                line can receive and make calls
        h245-dtmf-relay       dtmf digits are send in the h245 connection
        suspend-mode          lines in FXS mode permit suspended behavior mode
        vad                   enables voice activity detection
        frames-per-packet     Voice frames that will be sent in each RTP packet

priority                priority receiving calls

speaker-gain            indicates the line output gain

suspend-mode            lines in FXS mode permit suspended behavior mode

telephone-number        configures the telephone number associated to the line

tone-level              volume gain with which you generate the DTMF digits

vad                     enables voice activity detection
```

line-number	This is the line number to which the telephone number will be assigned. Values between 1 and the number of lines the device has are admitted.
active	Enables a line to receive calls.
codec g7235k3	Uses the G723-1 encoder at 5.3 Kbps.
codec g7236k4	Uses the G723-1 encoder at 6.4 Kbps.
codec g729	Uses the G729A encoder at 8.0 Kbps.
default	Sets a line to the default values.

direct-dialing	This permits you to configure direct dialing for a telephone number. If you configure this field, a call is automatically carried out to this number once the time indicated by the second parameter has timed out. Up to 15 digits (0 – 9) are admitted and between 0 and 3 seconds as wait time. By default this parameter is not configured and the wait time is three seconds.
h245-dtmf-relay	Configures the DTMG digits relay mode between the remote ends connected by a voice call such as H.245 data (i.e. as an IP packet), in which case the ends should detect and generate the tone. By default this is configured to send in band (no h245-dtmf-relay).
identifier	Assigns an H.323 identifier to the line. Up to 18 characters are admitted. If you exceed the size, the name is cut short. To delete the said parameter press "intro" without writing anything. By default the device does not have identifiers configured.
mic-gain	Indicates the line input gain. These values can vary between –31 and 31 or the character + and – in order to increase or decrease the value by a unit. By default this takes a value of 10 dB.
interface-type fxs	The line is connected to a telephone (FXS, Foreign eXchange Station). The lines are configured as FXS by default.
interface-type fxo	The line is connected to a telephone (FXO, Foreign eXchange Office).
priority	Line priority is used when assigning an incoming call to a line in two situations: when the called telephone number does not fit any of the numbers configured in the lines table or when the requested line is busy and a free line needs to be searched for in order to assign the call. This can take values between 0 and 9 (0 being the maximum priority). Lines with priorities from 5 to 9 admit calls assigned to lines that at the time are busy. Lines priorities from 0 to 4 do not admit call jumping. By default this has the value 9 (the lowest priority).
speaker-gain	This is the volume gain applied on reception. This can vary between –31 and 31 or character + and – in order to increase or decrease the value by a unit. By default this takes a value of 0 dB.
suspend-mode	Lines configured in FXS mode when receiving a call permit suspended behavior mode. This mode permits you to hang up on the called number without hanging up the established call and resume the conversation just by picking up the called telephone. This mode is maintained up to 30 seconds, once this times out the call is considered as terminated. This command allows you to activate this mode. By default the device operates in suspended mode.
telephone-number	Configures the telephone number associated to the line. This is the caller telephone (ANI) that exits in the call packets. Up to 15 digits are admitted (0 to 9).
tone-level	This is the volume gain with which you generate the DTMF digits and the level (in dBm) through which the DTMF digits are detected. This can vary between –31 and 0 or characters + and – in order to increase or decrease the value by a unit. By default this takes a value of 0 dB.
vad	Enables VAD (Voice Activity Detector). The usefulness of this is that on detecting silences in conversation (when there is no voice) it eliminates the audio frames being sent, reducing the necessary bandwidth. During a silent situation, the hardware generates what is known as "comfort noise", an example of the noise level presented when there is voice in order that the listener does not have the sensation that communication line has been cut off. By default the VAD is enabled.

Example:

Configuring the device so that the calls executed from line 1 have caller number 123 and suspended mode in the said line is disabled.

```
H323 Config>LINE 1 telephone-number 123 no suspend-mode
H323 Config>
```

1.7. LIST

This command is used to view the different configured parameters.

Syntax:

```
H323 Config>LIST ?
ALL              View all the information
CODEC-CLASS      Codec class for use depending on the called number
GW               Displays the gateway parameters
LINE             Displays line parameters
PARAMETERS       Displays the parameters associated to the telephone numbers
TABLE            Content of the different tables used by the device
TRANSLATION      Displays one or all the translations configured in the device
```

a) LIST ALL

This is used to view all the information which corresponds to the remaining parameters from the **LIST** command. In cases of ISDN telephony motherboard, certain parameters are not significant and therefore do not appear on the list.

Example:

```
H323 Config>LIST ALL


 GATEWAY PARAMETERS

Gateway internal address: 130.0.0.2
Fast Connect: Enabled                Q931 port: 1720
H323 call mode: Compatible           UDP  port: 20000

Gatekeeper address 130.0.0.10        Gateway name: Teldat-Gw
Gatekeeper zone: MyGatekeeper        Tech-Prefix : 7#
                                     Register E.164: Disabled

RAS port: 1719                       RAS time to live: 60
RAS timeout: 20                      RAS Connection attempt fail:  10

Enable Service Addr 0.0.0.0          Type of Service Disable: Play Voice Msg 1


 VOICE PARAMETRES

Dial tone frequency:      425      Ring tone activity: 15
Dial voice message:                Ring tone silence:  30

Alerting tone frequency:  425      Busy tone frequency: 425
Alerting tone activity:    15      Busy tone activity:  2
Alerting tone silence:     30      Busy tone silence:   2
Alerting voice message:            Busy voice message:

Error tone frequency:     425      Error tone silence 1: 2
Error tone activity:        2      Error tone silence 2: 6
Error voice message:

DTMF tones timeout:  10            Error Timeout: 30
Maximum delay: 300
```

```
 LINE 1 PARAMETERS

Telephone number: 33                  Interface type: FXS/ns
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 9

Codec: G723 5.3Kbps                   VAD: Disabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : in band

Speaker gain: 0   dB        Tone level: 0 dB
Mic gain: 10 dB


LINE 2 PARAMETERS

Telephone number: 44                  Interface type: FXS


Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 9

Codec: G723 5.3Kbps                   VAD: Disabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : in band

Speaker gain: 0   dB       Tone level: 0 dB
Mic gain: 10 dB

LINE 3 PARAMETERS

Telephone number: 55                  Interface type: FXS
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 9

Codec: G723 5.3Kbps                   VAD: Disabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : in band

Speaker gain: 0   dB       Tone level: 0 dB
Mic gain: 10 dB


 LINE 4 PARAMETERS

Telephone number: 77                  Interface type: FXS
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 9

Codec: G723 5.3Kbps                   VAD: Disabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : in band

Speaker gain: 0   dB       Tone level: 0 dB
Mic gain: 10 dB


Order LINE      TELEPHONE  STRIP-PREFIX DIAL-OUT-PREFIX

  1      1             33       0
  2      2             44       0
  3      3             55       0
  4      4             77       0

Incoming Translation: 3/called

Entry:   1               Telephone: 1               Strip prefix: 0
Codec class: 10          IP Addr: 172.1.2.1         Dial-Out Pref:
Tech Prefix:             Num. type: unknown         Translation: --
Local IP: 0.0.0.0

Entry:   2               Telephone: 2               Strip prefix: 0
Codec class: 20          IP Addr: 172.1.2.2         Dial-Out Pref:
Tech Prefix:             Num. type: unknown         Translation: --
Local IP: 0.0.0.0
```

```
Entry:   3                Telephone: 6               Strip prefix: 0
Codec class: --           IP Addr: 172.1.2.6         Dial-Out Pref:
Tech Prefix:              Num. type: unknown         Translation: --
Local IP: 0.0.0.0

Match Dialing Plan: Disabled

Order  PREFIX         LENGTH

  1     6               3
  2     2               2

Id     Codec      frm/pkt (bytes)  VAD

  1  G723 5.3Kbps      1 ( 20)      E
  4  G729A 8Kbps       3 ( 30)      D

H323 Config>
```

b) LIST CODEC-CLASS

Displays the defined codec classes. This displays for each class the selected codec, the number of voice frames per RTP packet and the selected VAD configuration. Default is no defined class.

Example:

```
H323 Config>LIST CODEC-CLASS

Id     Codec      frm/pkt (bytes)  VAD

  1  G723 5.3Kbps      1 ( 20)      E
  4  G729A 8Kbps       3 ( 30)      D

H323 Config>
```

In order to add and delete codec classes execute the **CODEC-CLASS** and **NO CODEC-CLASS** commands.

c) LIST GW

Displays the gateway parameters.

Example:

```
H323 Config>LIST GW

Gateway internal address: 130.0.0.2
Fast Connect: Enabled                Q931 port: 1720
H323 call mode: Compatible           UDP  port: 20000

Gatekeeper address 0.0.0.0           Gateway name:
Gatekeeper zone:                     Tech-Prefix :
                                     Register E.164: Enabled

RAS port: 1719                       RAS time to live: 60
RAS timeout: 20                      RAS Connection attempt fail:  10

Enable Service Addr 0.0.0.0          Type of Service Disable: Disable Lines

H323 Config>
```

d) LIST LINE

Displays line parameters.

Example:

```
H323 Config>LIST LINE
Line?[1]?1
```

```
Telephone number: 33                    Interface type: FXS
Direct dialing:                         State: Enabled
Identifier H323:                        Priority: 9

Codec: G723 5.3Kbps                     VAD: Disabled
Frames H323/packet RTP: 1 ( 20 bytes)   DTMF relay : in band

Speaker gain: 0   dB       Tone level: 0 dB
Mic gain: 10 dB

H323 Config>
```

e) LIST PARAMETERS

Displays the parameters associated to the telephone numbers. In the case of the motherboard being ISDN telephony, certain parameters have no significance and for this reason do not appear on the list.

Example:

```
H323 Config>LIST PARAMETERS

Dial tone frequency:      425      Ring tone activity: 15
Dial voice message:                Ring tone silence:  30

Alerting tone frequency:  425      Busy tone frequency: 425
Alerting tone activity:    15      Busy tone activity:  2
Alerting tone silence:     30      Busy tone silence:   2
Alerting voice message:            Busy voice message:

Error tone frequency:     425      Error tone silence 1: 2
Error tone activity:        2      Error tone silence 2: 6
Error voice message:

DTMF tones timeout:  10            Error Timeout: 30
Maximum delay: 300

H323 Config>
```

f) LIST TABLE

This displays the content of the different tables used by the device to carry out calls through the IP network, to assign incoming calls (calls originating from a remote end in the IP network as well as those originating through another line in the device) or to define the numeration plan. By default the tables do not contain any entries.

Syntax:

```
H323 Config>LIST TABLE ?
DESTINATION      Telephone numbers assignation table to IP address
PORT             Associate a telephone number (or prefix) to a line
PREFIX           Define the length of the number dialed
```

LIST TABLE DESTINATION

This lists the telephone number assignation to IP addresses table. By default, there are no defined entries in this table.

Example:

```
H323 Config>LIST TABLE DESTINATION
Entry:   1               Telephone: 1               Strip prefix: 0
Codec class: 10          IP Addr: 172.1.2.1         Dial-Out Pref:
Tech Prefix:             Num. type: unknown         Translation: --
Local IP: 0.0.0.0

Entry:   2               Telephone: 2               Strip prefix: 0
Codec class: 20          IP Addr: 172.1.2.2         Dial-Out Pref:
Tech Prefix:             Num. type: unknown         Translation: --
Local IP: 0.0.0.0
```

```
Entry:   3                Telephone: 3              Strip prefix: 0
Codec class: --           IP Addr: 172.1.2.3        Dial-Out Pref:
Tech Prefix:              Num. type: unknown        Translation: --
Local IP: 0.0.0.0
H323 Config>
```

In order to add, delete and move entries use the **DESTINATION**, **NO DESTINATION** and **MOVE DESTINATION** commands respectively.

LIST TABLE PORT

Lists the numbers assignment to lines table and the compressions and expansions to be carried out in each case.

If you have configured a translation in order to apply it to the incoming calls, the translation identifier and the number over which this is applied is displayed (caller or called). By default there is no defined entry in this table and the translation is not applied over any of the incoming calls.

Example:

```
H323 Config>LIST TABLE PORT

Order  LINE      TELEPHONE  STRIP-PREFIX DIAL-OUT-PREFIX

  1      1          916101       0
  2      2          916102       2
  3      3          916103       0
  4      4               8       0            8001

Incoming Translation: 3/caller
H323 Config>
```

To add, delete and move lines, use the **PORT**, **NO PORT** and **MOVE PORT** commands respectively.

LIST TABLE PREFIX

Displays the table defining the numeration plan supported. For each entry the prefix with which a group of given telephone numbers start with will appear and the number of digits that these telephone numbers contain.

The number of digits the prefix contains and the order is important: as with the initial digits, the most restrictive is chosen (the prefix with the most digits); as with the prefix length, the entry with the lowest order is chosen.

The behavior mode is also displayed for dialing that does not match any entry: these can be rejected (match dialing plan enabled) or admitted (disabled). In cases of rejection, an error situation arises.

By default there are no defined entries in this table.

Example:

If you define the following numeration plan.

telephones	***prefix***	***length***
091 xxx xx xx	091	10
093 xxx xx xx	093	10
201 a 250	2	3
2001 a 2009	200	4

The configuration will be:

```
H323 Config>LIST TABLE PREFIX

Match Dialing Plan: Disabled

Order  PREFIX        LENGTH

  1     09               10
  3     2                3
  4     200              4

H323 Config>
```

In the case of the example, when you dial telephone numbers that begin with 200, the 4 entry and not the 3 is applied although it has greater priority, entry 4 is more restrictive than entry 3.

To add, delete and move the entries execute the **PREFIX**, **NO PREFIX** and **MOVE PREFIX** commands.

g) LIST TRANSLATION

This displays one or all the translations configured in the device. A translation is a transformation that can be applied over one of the telephone numbers that intervenes in a call (caller or called), as well as over the type of associated numeration.

This admits identifiers between 1 and 127 or the –1 value in order to display all of them. By default there is no defined translation.

Example:

```
H323 Config>LIST TRANSLATION
Translation ID[0]? -1
Translation 3
 Rule  2: 2 any -> 15112 network

Translation 5

H323 Config>
```

If you give an identifier outside of the permitted range or the translation does not exist, an error message will be produced.

Commands related with translation creation, deletion and edition are **TRANSLATION**, **NO TRANSLATION** and **SET TRANSLATION**.

1.8. LOCAL-CALL-EXPANSIONS

If you enable this option for the internal calls, the translations or expansions configured in the lines table will be applied. Contrariwise, no modification to the telephone numbers in the internal calls will be applied. By default expansions and translations in internal calls are not executed.

Example:

```
H323 Config>LOCAL-CALL-EXPANSIONS
H323 Config>H323 Config>
```

In order to see if this option is enabled, simply enter:

```
H323 Config>LIST TABLE PORT


Order LINE      TELEPHONE  STRIP-PREFIX DIAL-OUT-PREFIX

  1      1               1       0
  2      2               2       0
```

```
  3      3               3       0
  4      4               4       0

Local Call Expansions Enabled

H323 Config>
```

1.9. MATCH-DIALING

This prevents carrying out calls to numbers that do not fit in the numeration plan described in the prefixes table. When the numbers do not fit, they pass to an error situation. The use of the # key on the telephone leads to an immediate error situation in this case.

We recommend enabling this option as when erroneous numbers are dialed, the voice lines are released more quickly and consequently are more quickly available in order to call new numbers.

By default you are permitted to dial numbers without restrictions given by numeration plan. For more information, please consult the **PREFIX** command.

Example:

```
H323 Config>MATCH-DIALING
H323 Config>
```

1.10. MOVE

This moves the entries in the different tables used by the device. These are used to carry out calls through the IP network, to assign incoming calls (both for those originating at some remote end of the IP network as well as those originated by another line from the device) or in order to define the numeration plan. The order in which they appear is relevant because it is sometimes necessary to relocate them. By default the tables do not contain any entries.

Example:

```
H323 Config>MOVE ?
DESTINATION      This moves the elements in the IP destination table
PORT             Moves the ports table elements
PREFIX           Moves the prefixes table elements
H323 Config>
```

a) MOVE DESTINATION

This moves the elements in the IP addresses table. This table is used to identify the address of the remote end in the IP network.

Example:

```
H323 Config>MOVE DESTINATION
Entry to move[1]? 1
Insertion point[1]? 3
H323 Config>
```

Entry to move	Index of the entry you wish to move. This index is obtained through the **LIST TABLE DESTINATION** command. This admits values between 1 and the highest index that appears with the **LIST TABLE DESTINATION** command.
Insertion point	Index of the entry before which the entry is going to be inserted. This admits values between 1 and the highest index that appears with the **LIST TABLE DESTINATION** command.

If you give an index outside of the permitted range, an error message will be produced.
Commands related with address creation and deletion are **DESTINATION** and **NO DESTINATION**.

b) MOVE PORT

Moves the lines table elements. This table is used to assign the incoming calls (both those originating at some remote end of the IP network as well as those originated by another line from the device).

Example:

```
H323 Config>MOVE PORT
Entry to move[1]? 1
Instertion point[1]? 3
H323 Config>
```

Entry to move — Index of the entry you wish to move. This index is obtained through the **LIST TABLE PORT** command.
This admits values between 1 and the highest index that appears with the **LIST TABLE PORT** command.

Insertion point — Index of the entry before which the entry is going to be inserted. This admits values between 1 and the highest index that appears with the **LIST TABLE PORT** command.

If you give an index outside the permitted range, an error message will be produced.
Commands related with line creation and deletion are **PORT** and **NO PORT**.

c) MOVE PREFIX

Moves the prefixes table elements. This table is used to define the numeration plan supported by the device.

Example:

```
H323 Config>MOVE PREFIX
Entry to move[1]? 1
Insertion point[1]? 3
H323 Config>
```

Entry to move — Index of the entry you wish to move. This index is obtained through the **LIST TABLE PREFIX** command.
This admits values between 1 and the highest index that appears with the **LIST TABLE PREFIX** command.

Insertion point — Index of the entry before which the entry is going to be inserted. This admits values between 1 and the highest index that appears with the **LIST TABLE PREFIX** command.

If you give an index outside the permitted range, an error message will be produced.
Commands related with prefix creation and deletion are **PREFIX** and **NO PREFIX.**

1.11. NO

This permits you to delete elements from the distinct tables or from the distinct configuration lists.

Syntax:

```
H323 Config>NO ?
CODEC-CLASS                Codec class for use depending on the called number
DESTINATION                Telephone numbers assignation table to IP address
FAST-CONNECT               Speed up the H323 calls starting process
LOCAL-CALL-EXPANSIONS      Translations or expansions apply to internal calls
MATCH-DIALING              Numbers must fit with the prefix table
PORT                       Associate a telephone number (or prefix) to a line
PREFIX                     Define the length of the number dialed
PROPIETARY-MODE            propietary fast-start mode
REGISTER-E164              Communicate the E.164 identifiers to the gk
TABLE                      Completely deletes an assignments table
TRANSLATION                Translation for use in both outgoing/incoming calls
```

a) NO CODEC-CLASS

Deletes an element from the codec class table. This requests the class identifier. Values are admitted between 1 and 255. If the class is not found a notification message will be seen.

Syntax:

```
H323 Config>NO CODEC-CLASS
Codec-class Id[0]? 2
Class not found

H323 Config>NO CODEC
Codec-class Id[0]? 3
H323 Config>
```

Values outside the permitted margin will give rise to an error message. The result of the operation can be checked through the **LIST CODEC-CLASS** command.

b) NO DESTINATION

Deletes an element from the telephone numbers assignment table or prefixes to IP addresses. This requests the entry depending on the telephone number and the IP address. If this exact data is not found, no operation is carried out.

Syntax:

```
H323 Config>NO DESTINATION
Telephone number ? 1
IP address?: [192.6.1.131]?
H323 Config>
```

Incorrect values will give rise to an error message. The result of the operation can be checked through the **LIST TABLE DESTINATION** command.

c) NO FAST-CONNECT

Disables the fast connection procedures that speed up the starting process of the H323 calls. By default the fast-connect procedure is disabled.

Syntax:

```
H323 Config>NO FAST-CONNECT
H323 Config>
```

d) NO LOCAL-CALL-EXPANSIONS

If you execute this command, neither expansions nor translations over the telephone numbers in internal calls will be carried out. By default expansions and translations are not carried out over internal calls.

Syntax:

```
H323 Config>NO LOCAL-CALL-EXPANSIONS
H323 Config>
```

e) NO MATCH-DIALING

This permits you to carry out calls to numbers that do not fit in the numeration plan described through the prefixes table. This is possible by using the # key to indicate when you have finished dialing.

By default, you are permitted to dial numbers without any restrictions imposed by the numeration plan. For more information, please consult the **PREFIX** command.

Syntax:

```
H323 Config>NO MATCH-DIALING
H323 Config>
```

f) NO PORT

Deletes all the elements from the number assignment to lines table that specifically coincide with the telephone number (or prefix) supplied. This requests the entry depending on the telephone number. If you do not find an entry that matches, no operations are carried out.

Syntax:

```
H323 Config>NO PORT
Telephone number ?
H323 Config>
```

Incorrect values will give rise to an error message. The result of the operation can be checked through the **LIST TABLE PORT** command.

g) NO PREFIX

Deletes an element from the prefixes table. This requests the entry depending on the telephone number. If you do not find an entry that specifically matches, no operations are carried out.

Syntax:

```
H323 Config>NO PREFIX
Prefix ?
H323 Config>
```

Incorrect values will give rise to an error message. The result of the operation can be checked through the **LIST TABLE PREFIX** command.

h) NO PROPIETARY-MODE

Configures the voice gateway operation mode when executing calls in compatible mode. By default this is configured in compatible mode. This field is automatically set to compatible on enabling the fast-connect procedure.

Example:

```
H323 Config>NO PROPIETARY-MODE
H323 Config>
```

i) NO REGISTER-E164

The device, on registering in the gatekeeper (message RRQ from RAS), can include information on the extensions it has. This information can be expressed in many ways and one of them is the E.164 format. With this command you prevent the gatekeeper from knowing the E.164 identifiers that the lines have. This command is useful when you want the gatekeeper to admit calls depending on a different type of information that is not E.164 identifiers. By default the E.164 extension registers are enabled.

Syntax:

```
H323 Config>NO REGISTER-E164
H323 Config>
```

j) NO TABLE

Completely deletes an assignments table.

Syntax:

```
H323 Config>NO TABLE ?
DESTINATION      Telephone numbers assignation table to IP address
PORT             Associate a telephone number (or prefix) to a line
PREFIX           Define the length of the number dialed
```

NO TABLE DESTINATION

Deletes the telephone numbers assignment to IP addresses table.

Syntax:

```
H323 Config>NO TABLE DESTINATION
H323 Config>
```

NO TABLE PORT

Deletes the numbers assignment to lines table.

Syntax:

```
H323 Config>NO TABLE PORT
H323 Config>
```

NO TABLE PREFIX

Deletes the prefixes length table.

Syntax:

```
H323 Config>NO TABLE PREFIX
H323 Config>
```

k) NO TRANSLATION

Deletes the indicated translation. A translation is a transformation that can be applied over one of the telephone numbers that intervenes in a call (calling or called) as well as over the type of numeration you have associated.

This admits values between 1 and 127. By default translation is not defined.

Syntax:

```
H323 Config>NO TRANSLATION
Translation ID[0]? 3
H323 Config>
```

If you give an identifier outside of the permitted range or if the translation does not exist, this will give rise to an error message.

The configured translation can be viewed with the **LIST TRANSLATION** command. Commands related to the creation and edition of translations are **TRANSLATION** and **SET TRANSLATION**.

1.12. PORT

Adds an entry to the lines table. These entries associate a telephone number (or prefix) to a physical line from the device. On receiving a call the line is searched for starting from the called number and if it is found in the table the call is routed towards this line. In cases where it is not found, it is busy or disabled, a free line is searched for concurring with the configured priorities.

In some cases (when the line type is FXO or the interface is ISDN) a number is dialed in PSTN or the switchboard (PABX or PBX depending). In these situations, it is useful to be able to dial a different number to the original H323 calling number. For this purpose when you assign telephone numbers to lines you can specify compressions (digits to strip) or numerical expansions (dial-out prefix). By default there are no defined entries.

The appearance order in the table is important as processing conforms to the order: once an input is found that matches, it stops checking the rest. The entries that are added with this command are put at the end of the table; if you wish these to occupy a different position, use the **MOVE PORT** command.

Syntax:

```
H323 Config>PORT <line> <telephone-number>
default           assign a calling telephone number to a line
dial-out          Dial-out prefix
strip-digits      Digits to strip
H323 Config>
```

line This is the number of the line the telephone number is assigned to. Admitted values are between 1 and the number of device lines.

telephone-number Digits over which you select a line. This can be a complete telephone number assigned to this line or only a prefix.
A maximum of 15 digits is accepted (0 to 9).

dial-out Number of digits from a received telephone number which are deleted, beginning on the left hand side (prefixes). Admits values between 0 and 15.

strip-digits Digits used as prefix of the number resulting from applying the deletion indicated by the previous field over the received telephone number. Up to 15 digits are admitted (0 to 9).

An error message is produced if the given values do not fit the ranges that it has or if there is already an entry with the same line number and telephone number.

The entry list can be viewed with the **LIST TABLE PORT** command. You can delete entries with the **NO PORT** command.

Examples:

Example 1. If you wish the calls directed to telephones that begin with 10 are routed through line 1 of the device, those that begin with 20 through line 2 and those that begin with 30 through line 3. The called telephone number is passed through the PABX as is.

```
H323 Config>PORT 1 10 default
H323 Config>PORT 2 20 default
H323 Config>
H323 Config>PORT 3 30 default
H323 Config>
```

The result can be checked through the **LIST TABLE PORT** command.

```
H323 Config>LIST TABLE PORT

Order LINE      TELEPHONE  STRIP-PREFIX DIAL-OUT-PREFIX

  1      1             10       0
  2      2             20       0
  3      3             30       0

H323 Config>
```

Example 2. If you wish to configure the router so that all the telephones that begin with 9 put zero first, and they will be diverted to line 1 in such a way that any telephone with the 9xxxx pattern is converted to 09xxxx.

This is achieved by adding a entry in the lines table that associates the physical line number 1 with all the telephones that begin with 9 and setting the Dial-Out Prefix with a 0 value.

```
H323 Config>PORT 1 9 dial-out 0
H323 Config>
```

This is a typical case for a FXO line that connects the router with the extension from a switchboard. To make calls to the exterior from an extension, you typically have to dial 0 first; with this configuration this becomes unnecessary. The router automatically adds the 0 when the telephone called begins with 9.

Example 3. You wish all called numbers that have the 8xxx pattern to be converted into numbers with the 61xxx pattern and be diverted to the device line 1.

```
H323 Config>PORT 1 8 dial-out 61 strip-digits 1
H323 Config>
```

One scenario where this configuration is useful is when the caller dials 8XX type numbers directed to FXO type line 1 connected to a switchboard extension, but the extensions of this switchboard are 61XX type. With this configuration, line 1 deletes the first digit (the 8), and subsequently adds 61.

For example, with this configuration, number 871 will be converted to 6171 corresponding to a switchboard extension.

1.13. PREFIX

This permits adding an entry to the prefixes table. These entries define the numeration plan used in such a way that depending on the first digits dialed, the length of the number dialed is decided and the moment from which the call process is initiated is indicated. By default there are no defined entries.

The number of digits that make up a prefix is relevant since in the case of a conflict between two entries, the most restrictive will prevail i.e. the entry that specifies the most prefix digits. The appearance order in the table is also important as processing is carried out concurring with this: once an input is found that matches the called telephone number, it stops checking the rest.

The entries that are added with this command are placed at the end of the table; if you wish these to occupy a different position use the **MOVE PREFIX** command.

Syntax:

```
H323 Config>PREFIX
Prefix:? 6
Length:[0]? 3
H323 Config>
```

With this example entry you specify the telephone numbers beginning with 6 and that have a length of 3 digits, i.e. according to the 6xx pattern.

Prefix	Digits over which the decision is carried out. This can be a complete number or a common prefix for a group of telephone numbers. Up to 15 digits are admitted (0 to 9).
Length	Length assigned to this prefix. Admits values between 1 and 15.

An error message will appear on exceeding the field limits.

The configured prefixes can be viewed with the **LIST TABLE PREFIX** command. You can delete entries with the **NO PREFIX** command.

These entries can be evaded by using the # key on the telephone: when the user decides he has dialed the complete number, he needs to dial # to begin the call process. In this way you are permitted to dial numbers that do not match in the numeration plan. If you wish to prevent this behavior, execute the **MATCH-DIALING** command: in this way the numbers that do not match the numeration plan produce an error situation.

If you use direct dialing (configurable through the **LINE** command), the configured numbers are not contrasted with these entries, which means it is irrelevant whether they match the numeration plan that is defined by these entries.

Examples:

Example 1. The entry that defines telephone numbers beginning with 0 such as numbers corresponding to a public telephone network. In this case the telephone numbers adjust to the 0 xx xxx xx xx pattern and consequently have a total of 10 digits.

```
H323 Config>PREFIX
Prefix:? 0
Length:[0]? 10
H323 Config>
```

Example 2. Entries that specify all telephone numbers beginning with 2 have 3 figures (2xx pattern) with the exception of those beginning with 20 which have a length of 4 (20xx pattern).

```
H323 Config>PREFIX
Prefix:? 2
Length:[0]? 3
H323 Config>PREFIX
Prefix:? 20
Length:[0]? 4
H323 Config>
```

In this case, the order has no influence as the size of the prefixes versus the position of these prevails.

The result of the examples can be checked through the **LIST TABLE PREFIX** command.

```
H323 Config>LIST TABLE PREFIX

Match Dialing Plan: Disabled

Order  PREFIX        LENGTH

  1     6               3
  2     0               10
  3     2               3
  4     20              4

H323 Config>
```

1.14. PROPIETARY-MODE

Configures the voice gateway operation mode when executing calls in propietary mode, which means that the call establishment time will be less although incompatible with a voice gateway in compatible mode where the call mechanism adjusts to the H.323 standard. By default this is configured in compatible mode. This field is automatically set to compatible on enabling the fast-connect procedure.

Example:

```
H323 Config>PROPIETARY-MODE
H323 Config>
```

1.15. REGISTER-E164

The device, on registering in the gatekeeper (message RRQ from RAS), can include information on the extensions it has. This information can be expressed in many ways and one of them is the E.164 format. With this command you can communicate the E.164 identifiers that the lines have to the gatekeeper. By default the E.164 extensions register is enabled.

Example:

```
H323 Config>REGISTER-E164
```

1.16. SET

This command is used to configure different parameters.

Syntax:

```
H323 Config>SET ?
ADDRESS                      Disables VoIP if the IP address cannot be reached
DELAY                        Maximum delay admissible in a communication
DISABLE-TYPE-OF-SERVICE      Disable type of service n -> play loc n
GATEKEEPER                   Configure parameters associated to the gatekeeper
GW                           Parameters associated to the voice gateway
INCOMING-TRANSLATION         Translation that is applied over the incoming calls
```

```
PORT                          TCP and UDP port values
RAS                           Configure parameters associated to the RAS protocol
RING-SIGNAL                   Configure the call signal (ring) parameters
TONES                         Parameters relative to the different tones
TRANSLATION                   Transformation that can be applied over one number
```

a) SET ADDRESS

Syntax:

```
H323 Config>SET ADDRESS ?
AVAILABLE-SERVICE
```

SET ADDRESS AVAILABLE-SERVICE

If you are configuring (value distinct to 0.0.0.0) the router checks that the configured IP address is accessible from the router and disables the VoIP service if the IP address cannot be reached. The service can be disabled by activating a voice message or by simply disabling the lines (this will be explained further on). By default this is configured as 0.0.0.0.

Example:

```
H323 Config>SET ADDRESS AVAILABLE-SERVICE
IP Enable Service Address? [0.0.0.0]? 138.100.23.19
H323 Config>
```

If you give an erroneous IP address, you will be prompted for the address until it is correct. The availability of the voice service can be checked through the **LIST STATISTICS GW** monitoring command. The moment when one state passes to another can be obtained through the H323.007 event.

Example:

```
*P 2
02/21/01 17:06:50  H323.007 Ev Service Disabled
02/21/01 17:09:40  H323.007 Ev Service Enabled
```

b) SET DELAY

This configures the maximum delay admissible in a communication. During the frames reception process, the admitted delay is continuously computed and updated for the correct reproduction of the voice frames. This computation is carried out depending on the delay with which each voice frame arrives. The correction of the admissible delay is carried out until it exceeds the maximum configured admissible delay. In any case, any frame that arrives with a delay greater than that permitted is discarded. This admits values between 60 and 1000. The default value is 300 msecs.

Example:

```
H323 Config>SET DELAY
Maximum delay?[300]? 400
H323 Config>
```

Values outside the permitted range will give rise to an error message.

c) SET DISABLE-TYPE-OF-SERVICE

Configures the action that will be taken to disable the service when the available service configured IP address cannot be reached. Possible actions are: Disable Lines or play a voice message. Only the disable option exists where there is an ISDN telephone board. Admits values between 1 and 9 for voice messages and 0 in order to disable the service. The lines are disabled by default.

Example:

```
H323 Config>SET DISABLE-TYPE-OF-SERVICE
Type of Service Disable[0: Disable Lines N:Play Voice Message N]: [1]? 1
H323 Config>
```

If a value is set outside of the permitted range, an error message will appear.

d) SET GATEKEEPER

Permits you to configure parameters associated to the gatekeeper under which the voice device is contained.

Syntax:

```
H323 Config>SET GATEKEEPER ?
ADDRESS      Gatekeeper's IP address where the gateway will be registered
ZONE         Zone identifier that has to be used in order to register in the gk
```

SET GATEKEEPER ADDRESS

Configures the gatekeeper's IP address where the Gateway will be registered. By default the device does not register in any gatekeeper and this parameter is configured as 0.0.0.0.

Example:

```
H323 Config>SET GATEKEEPER ADDRESS
IP Gatekeeper Address? [0.0.0.0]? 1.1.1.1
H323 Config>
```

If you give an erroneous IP address, you will be prompted for the address until it is correct.

SET GATEKEEPER ZONE

Configures the zone identifier that has to be used in order to register in the configured Gateway. This admits up to 18 characters. If you exceed this size the text will be cut short. To delete the said parameter press intro without writing anything. By default the device does not register in any gatekeeper and no zone is configured.

Example:

```
H323 Config>SET GATEKEEPER ZONE
Zone[]? My-Gatekeeper
H323 Config>
```

e) SET GW

Permits you to configure parameters associated to the voice gateway.

Syntax:

```
H323 Config>SET GW ?
ADDRESS          Voice gateway internal IP address
NAME             Name with which the gateway registers in the gatekeeper
TECH-PREFIX      Technological prefix that defines the device
```

SET GW ADDRESS

Configures the voice gateway internal IP address. This is the source IP address used in all the frames related with Voice over IP (establishing call, capacities, voice and voice channel control frames). This is the same as the one configured as the IP internal address configuration from the IP configuration menu. By default the value is 0.0.0.0.

Example:

```
H323 Config>SET GW ADDRESS
Internal IP address [192.168.1.132]? 1.1.1.2
H323 Config>
```

If you give an erroneous IP address, you will be asked for the address until it is correct.

SET GW NAME

Configures the name with which the gateway registers in the gatekeeper. This admits a name of up to 18 characters. If you exceed this size, the name is cut short. To delete the said parameter, press intro without writing anything. By default the device does not register in any gatekeeper and no name is configured.

Example:

```
H323 Config> SET GW NAME
Gateway Name?[]? Teldat-IPFON
H323 Config>
```

SET GW TECH-PREFIX

Configures the technological prefix that defines the device in an environment controlled by a gatekeeper. Admits a text containing a maximum of 11 characters. If you exceed this size, the prefix is cut short. To delete the said parameter, press intro without writing anything. By default the device does not register in any gatekeeper and no technological prefix is configured. This prefix is the one used if there aren't any configured in the addresses table.

Example:

```
H323 Config>SET GW TECH-PREFIX
Tech-prefix[]? 78#
H323 Config>
```

f) SET INCOMING-TRANSLATION

This configures the translation that is applied over the incoming calls. This translation can be applied over the caller telephone number or over the call of the incoming call. This is only applied if any of the rules making up the translation are complied with. For further information on the translation and how it operates, consult the **SET TRANSLATION** command.

Admits identifiers between 1 and 127 or 0 value where no translation is applied. If you select a non-existent translation, nothing is applied. By default there are no defined translations.

Example:

```
H323 Config>SET INCOMING-TRANSLATION
Translation ID[0]? 3
Upon (0 caller, 1 called num)[0]? 0
H323 Config>
```

If you give an identifier outside the permitted range or the translation does not exist, an error message will be produced.

g) SET PORT

Permits you to configure the port TCP and UDP values used in establishing protocols, management and the transport of call data.

Syntax:

```
H323 Config>SET PORT ?
Q931      TCP port through which the Q931 transactions are carried out
RAS       UDP port through which the RAS transactions are carried out
UDP       Base number for the UDP ports that are used to send the RTP
```

SET PORT Q931

Configures the TCP port through which the Q931 transactions are carried out. This admits values between 0 and 65535. By default this is 1720.

Example:

```
H323 Config>SET PORT Q931
Q931 port?[1720]? 1800
H323 Config>
```

If you give a value outside the permitted range, an error message is produced.

SET PORT RAS

Configures the UDP port through which the RAS transactions are carried out. This admits values between 0 and 65535. By default this is 1719.

Example:

```
H323 Config>SET PORT RAS
RAS port?[1719]? 1900
H323 Config>
```

If you give a value outside the permitted range, an error message is produced.

SET PORT UDP

This is the base number for the UDP ports that are used to send the RTP (Real Time Protocol) and RTCP (Real Time Control Protocol) voice and fax packets. This port should be an even number; if you configure an odd number the value will be immediately rounded off to a lower number. This admits values between 0 and 65535. The default value is 20000.

Example:

```
H323 Config>SET PORT UDP
Port:[20000]?15000
H323 Config>
```

If you give a value outside the permitted range, an error message is produced.

h) SET RAS

Permits you to configure parameters associated to the H.323 RAS protocol.

Syntax:

```
H323 Config>SET RAS ?
PORT         UDP port through which the RAS transactions are carried out
RETRIES      Maximum number of retries in a RAS transaction
TIMEOUT      Maximum wait time (in seconds) for a RAS transaction response
TTL          interval, in seconds, with which the gateway will send the RRQ
```

SET RAS PORT

Configures the UDP port through which the RAS transactions are carried out in the same way as the **SET PORT RAS** command.

SET RAS RETRIES

This is the maximum number of retries in a RAS transaction. When this number of retries is reached, the transaction is considered as failed. This admits values between 0 and 100. By default, this value is 10.

Example:

```
H323 Config>SET RAS RETRIES
RAS retries?[10]?
H323 Config>
```

If you give a value outside the permitted range, an error message is produced.

SET RAS TIMEOUT

Configures the maximum wait time (in seconds) for an RAS transaction response from the configured gatekeeper. After this time has expired, the RAS petition is resent. This is repeated the number of times configured in the previous parameter. This admits values between 0 and 600 seconds. By default this value is 20 seconds.

Example:

```
H323 Config>SET RAS TIMEOUT
RAS timeout?[20]? 10
H323 Config>
```

If you give a value outside the permitted range, an error message is produced.

SET RAS TTL

This configures the interval, in seconds, with which the gateway will send the RRQ messages with the field keepAlive=TRUE to the gatekeeper. This admits values between 0 and 600. By default this value is 60 seconds.

Example:

```
H323 Config>SET RAS TTL
RAS timeout?[20]? 10
H323 Config>
```

If you give a value outside the permitted range, an error message is produced.

i) SET RING-SIGNAL

Permits you to configure the call signal (ring) parameters that the telephone gives on receiving a call. These commands are not available in the case of an ISDN telephony card.

Syntax:

```
H323 Config>SET RING-SIGNAL ?
ACTIVITY      Time, in tenths of seconds, during which the tone is active
SILENCE       Tenths of seconds, during which the tone is inactive
```

SET RING-SIGNAL ACTIVITY

This configures the time, in tenths of seconds, during which the call signal is maintained active. This command does not exist in cases of an ISDN telephony card. This admits values between 1 and 25. By default this value is 15 tenths of a second.

Example:

```
H323 Config>SET RING-SIGNAL ACTIVITY
Activity time?:[15]? 20
H323 Config>
```

If you give a value outside the permitted range, an error message is produced.

SET RING-SIGNAL SILENCE

This configures the time, in tenths of seconds, during which the call signal is maintained silent. This command does not exist in cases of an ISDN telephony card. This admits values between 1 and 30. By default this value is 30 tenths of a second.

Example:

```
H323 Config>SET RING-SIGNAL SILENCE
Silence time?:[30]? 40
H323 Config>
```

If you give a value outside the permitted range, an error message is produced.

j) SET TONE

Permits you to configure the parameters relative to the different tones that can be heard as an indication of different situations.

Syntax:

```
H323 Config>SET TONE ?
ALERT             Configures the parameters relative to the alert tone
BUSY              Configures the parameters relative to the busy tone
DIAL              Configures the parameters relative to the dialing tone
DTMF-TIMEOUT      Time from having received a DTMF until dialing completes
ERR-TIMEOUT       Maximum time until the error state has passed
ERROR             Configures the parameters relative to the error tone
```

SET TONE ALERT

Configures the parameters relative to the alert tone.

Syntax:

```
H323 Config>SET TONE ALERT ?
ACTIVITY           Time, in tenths of seconds, during which the tone is active
FREQUENCY          Tone frequency
SILENCE            Tenths of seconds, during which the tone is inactive
VOICE-MESSAGE      Permits substituting the tone for voice message
```

SET TONE ALERT ACTIVITY

This configures the time, in tenths of seconds, during which the alert tone is maintained active. This command does not exist in cases of an ISDN telephony card. This admits values between 1 and 20. By default this value is 15 tenths of a second.

Example:

```
H323 Config>SET TONE ALERT ACTIVITY
Activity time?[15]? 20
H323 Config>
```

If you give a value outside the permitted range, an error message is produced.

SET TONE ALERT FREQUENCY

Configures the tone alert frequency to the remote terminal. This command does not exist in cases of an ISDN telephony card. This admits values between 0 and 4000 Hz. By default this value is 425 Hz.

Example:

```
H323 Config>SET TONE ALERT FRECUENCY
Frequency?[425]?450
H323 Config>
```

If you give a value outside the permitted range, an error message is produced.

SET TONE ALERT SILENCE

This configures the time, in tenths of seconds, during which the alert tone is maintained inactive. This command does not exist in cases of an ISDN telephony card. This admits values between 1 and 30. By default this value is 30 tenths of a second.

Example:

```
H323 Config>SET TONE ALERT SILENCE
Silence time?[30]? 40
H323 Config>
```

If you give a value outside the permitted range, an error message is produced.

SET TONE ALERT VOICE

Permits substituting the dial tone for voice message. This command does not exist in cases of an ISDN telephony card. This admits values between 1 and 9. By default there is no voice message configured.

Example:

```
H323 Config>SET TONE ALERT VOICE-MESSAGE
Use voice message (Yes/No)? Y
Voice message?:[0]? 1
H323 Config>
```

If you give a value outside the permitted range, an error message is produced.

SET TONE BUSY

Configures the parameters relative to the busy tone.

Syntax:

```
H323 Config>SET TONE BUSY ?
ACTIVITY           Time, in tenths of seconds, during which the tone is active
FREQUENCY          Tone frequency
SILENCE            Tenths of seconds, during which the tone is inactive
VOICE-MESSAGE      Permits substituting the tone for voice message
```

SET TONE BUSY ACTIVITY

This configures the time, in tenths of seconds, during which the busy tone is maintained active. This command does not exist in cases of an ISDN telephony card. This admits values between 1 and 20. By default this value is 2 tenths of a second.

Example:

```
H323 Config>SET TONE BUSY ACTIVITY
Activity time?[2]? 3
H323 Config>
```

If you give a value outside the permitted range, an error message is produced.

SET TONE BUSY FRECUENCY

Configures the tone frequency in hertzs that indicates that the remote terminal is busy. This command does not exist in cases of an ISDN telephony card. This admits values between 0 and 4000 Hz. By default this value is 425 Hz.

Example:

```
H323 Config>SET TONE BUSY FREQUENCY
Frequency?[425]?450
H323 Config>
```

If you give a value outside the permitted range, an error message is produced.

SET TONE BUSY SILENCE

This configures the time, in tenths of seconds, during which the busy tone is maintained inactive. This command does not exist in cases of an ISDN telephony card. This admits values between 1 and 20. By default this value is 2 tenths of a second.

Example:

```
H323 Config>SET TONE BUSY SILENCE
Silence time?:[2]? 3
H323 Config>
```

If you give a value outside the permitted range, an error message is produced.

SET TONE BUSY VOICE-MESSAGE

Permits substituting the busy tone for a voice message. This command does not exist in cases of an ISDN telephony card. This admits values between 1 and 9. By default there is no voice message configured.

Example:

```
H323 Config>SET TONE BUSY VOICE-MESSAGE
Use voice message (Yes/No)? Y
Voice message?:[0]? 1
H323 Config>
```

If you give a value outside the permitted range, an error message is produced.

SET TONE DIAL

Configures the parameters relative to the dialing tone.

Syntax:

```
H323 Config>SET TONE DIAL ?
FREQUENCY          Tone frequency
VOICE-MESSAGE      Permits substituting the tone for voice message
```

SET TONE DIAL FREQUENCY

This sets the dialing tone frequency. This command does not exist in cases of an ISDN telephony card. This admits values between 0 and 4000 Hz. By default this value is 425 Hz.

Example:

```
H323 Config>SET TONE DIAL FREQUENCY
Frequency?[425]?450
H323 Config>
```

If you give a value outside the permitted range, an error message is produced.

SET TONE DIAL VOICE-MESSAGE

Permits substituting the dialing tone for a voice message. This command does not exist in cases of an ISDN telephony card. This admits values between 1 and 9. By default there is no voice message configured.

Example:

```
H323 Config>SET TONE DIAL VOICE-MESSAGE
Use voice message(Yes/No)? Y
Voice message?:[0]? 1
H323 Config>
```

If you give a value outside the permitted range, an error message is produced.

SET TONE DTMF-TIMEOUT

This configures the maximum wait time from having received a DTMF tone until dialing has been completed. This admits values between 1 and 30 seconds. By default this value is 10 seconds.

Example:

```
H323 Config>SET TONE DTMF-TIMEOUT
DTMF tones lapse:[10]? 20
H323 Config>
```

If you give a value outside the permitted range, an error message is produced.

SET TONE ERR-TIMEOUT

This configures the maximum time until the error state has passed, for example if you pick up the telephone and you do not dial any number. This command does not exist in cases of an ISDN telephony card. Admits values between 1 and 60 seconds. By default this value is 30 seconds.

Example:

```
H323 Config>SET TONE ERR-TIMEOUT
Error timer:[30]? 20
H323 Config>
```

If you give a value outside the permitted range, an error message is produced.

SET TONE ERROR

Configures the parameters relative to the error tone. The error tone is made up of the following elements sequence: tone, silence 1, tone, silence 1, tone, silence 2. This sequence is continuously repeated.

Syntax:

```
H323 Config>SET TONE ERROR ?
ACTIVITY           Time, in tenths of seconds, during which the tone is active
FREQUENCY          Tone frequency
SILENCE1           Tenths of seconds, during which the tone is active
SILENCE2           Tenths of sc. during which the tone is actv each three tones
VOICE-MESSAGE      Permits substituting the tone for voice message
```

SET TONE ERROR ACTIVITY

This configures the time, in tenths of seconds, during which the error tone is maintained active. This command does not exist in cases of an ISDN telephony card. This admits values between 1 and 20. By default this value is 2 tenths of a second.

Example:

```
H323 Config>SET TONE ERROR ACTIVITY
Activity time?[2]? 3
H323 Config>
```

If you give a value outside the permitted range, an error message is produced.

SET TONE ERROR FREQUENCY

Configures the error tone frequency in hertzs. This command does not exist in cases of an ISDN telephony card. This admits values between 0 and 4000 Hz. By default this value is 425 Hz.

Example:

```
H323 Config>SET TONE ERROR FREQUENCY
Frequency?[425]?450
H323 Config>
```

If you give a value outside the permitted range, an error message is produced.

SET TONE ERROR SILENCE1

This configures the time, in tenths of seconds, during which the silence in the error tone is maintained. This command does not exist in cases of an ISDN telephony card. This admits values between 1 and 20. By default this value is 2 tenths of a second.

Example:

```
H323 Config>SET TONE ERROR SILENCE1
Silence time[2]? 3
H323 Config>
```

If you give a value outside the permitted range, an error message is produced.

SET TONE ERROR SILENCE2

This configures the time, in tenths of seconds, during which the silence in the error tone is maintained each three-error tones. This command does not exist in cases of an ISDN telephony card. This admits values between 1 and 20. By default this value is 6 tenths of a second.

Example:

```
H323 Config>SET TONE ERROR SILENCE2
Silence time[6]? 8
H323 Config>
```

If you give a value outside the permitted range, an error message is produced.

SET TONE ERROR VOICE-MESSAGE

Permits substituting the error tone for a voice message. This command does not exist in cases of an ISDN telephony card. This admits values between 1 and 9. By default there is no voice message configured.

Example:

```
H323 Config>SET TONE ERROR VOICE-MESSAGE
Use voice message (Yes/No)? Y
H323 Config>
```

k) SET TRANSLATION

A translation is a transformation that can be applied over one of the telephone numbers that intervenes in a call (caller or called), as well as over the type of numeration you have associated.

A translation is identified by a number between 1 and 127 and is made up of different rules. At the same time each of the rules is made up of a search pattern and some elements to insert should the pattern match the entry data. The rules will be applied in order of priority until one of them is verified. For more information on the construction of the rules, consult the **RULE** command in this chapter.

For incoming calls you can apply a single translation (consult **SET INCOMING-TRANSLATION** command), while for outgoing calls you can use different translations depending on the call destination (consult the **DESTINATION** command). The translations are always applied before applying the expansions (dial-out-prefix) and numerical compressions (strip-prefix).

To configure a translation, the identifier of the said translation is requested. This admits values between 1 and 127. From this moment you pass to a translation configuration menu. By default there is no translation defined in the device.

Syntax:

```
H323 Config>SET TRANSLATION
Translation ID[0]? 1
TRNL config>?
RULE
NO RULE
LIST
TEST
EXIT
TRNL config>
```

If the translation does not exist, an error message is produced. To create the translation, consult the **TRANSLATION** command.

· *RULE*

Adds a rule to the active translation with a given priority.

The rules are made up of a search pattern and a change to apply in the case of finding a sequence that matches the pattern. At the same time, the pattern being searched for is made up of a regular expression of digits and type of numeration and the change is made up of a string of digits and a new type of numeration.

The rule application mode is as follows: You apply the regular expression over the telephone number and if a sequence of digits complying with this is found and at the same time the type of telephone numeration coincides together with that of the rule, the change is applied. The change consists of substituting the digit sequence that matches the regular expression for a new digit sequence and substitute the type of numeration for that indicated in the change. If the resulting telephone number after applying the translation is higher than 15 digits, the translation is not carried out.

The rules are applied in order of priority until one of them is complied with. The rules with a smaller order have the most priority. This is only applied once in the incoming telephone call.

A regular expression of a rule consists in a digit sequence (0 to 9) and you can also include symbols.

.	Represents a single character.
*	Suffix, i.e. it does not operate alone but as a suffix of a simple or composed element. This represents the simple or composed element that follows 0 or multiple times.
+	Suffix. This represents the simple or composed element that follows 1 or multiple times.
?	Suffix. This represents the simple or composed element that follows 0 or 1 time.
[ ]	'Defines a composed element that begins with the character '[' and ends with the ']' character. This permits you to include ranges of elements by using the '-' character between the start and end elements.
[^]	Located at the beginning of the square brackets that operate over the composed element and complementing it. This behavior is not applicable if it is not located immediately after the '['.
^	Prefix. This represents the preceding simple or composed element only if it is found at the beginning of the entry string.
$	Suffix. This represents the simple or composed element that only follows if it is found at the end of the entry string.
|	Defines an alternative between two regular expressions.
( )	Groups elements with various purposes: grouping alternatives for other expressions and grouping complex expressions for use with the '*', '+' and '?' suffixes.

Examples:

a) The expression 3.5 adjusts to 385 and 305.
b) The expression 48* adjusts to 4, 48, 4888 etc.
c) The expression 47+0 adjusts to 470, 47770 but not to 40.
d) The expression 45?0 only adjusts to 40 and 450.
e) The expression [12-4] adjusts to 12, 13 and 14 but not to 15, 16 etc.
f) The expression [^6-9]0 adjusts to numbers that do not have the 60, 70, 80 or 90 sequence.
g) The expression ^091 adjusts to telephone numbers that begin with 091.
h) The expression 3$ adjusts to telephone numbers that end in 3.
i) The expression 91/93 searches for the 91 or 93 sequences in a telephone number.
j) The expression 0(91/93) searches for sequences 091 or 093 in a telephone number.
k) The expression 0(91/93) adjusts to 0, 091 and 093 sequences.

The types of numeration come defined by the ITU-T Q.931 standards and are as follows.

Unknown	Network
International	Subscriber
National	Abbreviated
	Reserved

You can define a maximum of 7 rules per translation. By default there is no defined rule. You can check the result of this command through the **LIST** command in this menu.

Syntax:

```
TRNL config>RULE
Rule ID[0]? 3
Digits pattern[]? ^91
Number type (0 unknown,1 international,2 national,3 network,4 subscriber,
                        6 abbreviated,7 reserved,-1 any)[0]? -1
New digit sequence[]? 091
New number type (0 unknown,1 international,2 national,3 network,4 subscriber,
                        6 abbreviated,7 reserved)[0]? 2
TRNL config>
```

With this configuration example you change the telephone numbers that begin with 91 and that have any type of numeration to telephone numbers that begin with 091 and have a numeration type known as national.

Rule ID — The rule identifier. This defines the priority of the rule in such a way that a lower order implies a higher priority. This admits values between 1 and 255.

Digits pattern — Regular expression that is applied over a telephone number. This is made up of digits (0 to 9) and the special characters indicated above. This admits a sequence of up to 60 characters, longer strings are shortened.

Number type — Type of numeration a telephone number must have in order for the translation to take place, i.e. for the application of the second part of the rule. This admits values between –1 and 7 with the exception of the value 5.

New digit sequence	Digit sequence (0 to 9) to insert in cases of finding a sequence that matches the rule pattern. Up to 15 digits are admitted. Longer sequences are shortened.
New number type	Type of numeration the telephone number has resulting from the application of the translation. This admits values between 0 and 7 excepting value 5.

If you give a value outside the permitted margins or you try to add more rules than can be supported, an error message is produced and the command is cancelled.

Examples:

Example 1. A rule that changes the numbers ending in 85 or 87 for the numbers ending in 00.

The type of entry numeration is unknown and left the same.

```
TRNL config>RULE
Rule ID[0]? 1
Digits pattern[]? (85|87)$
Number type (0 unknown,1 international,2 national,3 network,4 subscriber,
                        6 abbreviated,7 reserved,-1 any)[0]? 0
New digit sequence[]? 00
New number type (0 unknown,1 international,2 national,3 network,4 subscriber,
                        6 abbreviated,7 reserved)[0]? 0
TRNL config>
```

Example 2. The rule only changes the numeration type, from network type to international type.

```
TRNL config>RULE
Rule ID[0]? 10
Digits pattern[]?
Number type (0 unknown,1 international,2 national,3 network,4 subscriber,
                        6 abbreviated,7 reserved,-1 any)[0]? 3
New digit sequence[]?
New number type (0 unknown,1 international,2 national,3 network,4 subscriber,
                        6 abbreviated,7 reserved)[0]? 1
TRNL config>
```

Example 3. The rule changes the 6x6 prefixes for 99902 prefixes. The numeration type must always be national.

```
TRNL config>RULE
Rule ID[0]? 20
Digits pattern[]? ^6.6
Number type (0 unknown,1 international,2 national,3 network,4 subscriber,
                        6 abbreviated,7 reserved,-1 any)[0]? -1
New digit sequence[]? 99902
New number type (0 unknown,1 international,2 national,3 network,4 subscriber,
                        6 abbreviated,7 reserved)[0]? 2
TRNL config>
```

· *NO RULE*

Deletes the rule identified by its order number. This admits values between 1 and 255. You can check the operation through the **LIST** command from this menu.

Syntax:

```
TRNL config>NO RULE
Rule ID[0]? 2
TRNL config>
```

If you give an identifier outside of the permitted range or the rule is nonexistent, an error message is produced.

· LIST

Displays the rules that make up the active translation. This does not require any parameters.

The rules appear according to their number order, one per line. On each line the following appears: the regular expression and the pattern numeration type to search for, an arrow and the digit sequence to be inserted and the new numeration type in case of finding a sequence that matches the pattern.

Syntax:

```
TRNL config>LIST
Translation 3
 Rule  1: (85|87)$ unknown -> 00 unknown
 Rule 10:  network ->  international
 Rule 20: ^6.6 any -> 99902 national
TRNL config>
```

· TEST

Permits you to test the current translation to check if the rules that make up the translation adequately define its behavior.

Request a telephone number and a numeration type, and if there is a rule that matches this data, the resulting display is applied to the rule; if there is nothing that fits the rule nothing is displayed. The telephone number admits a digit sequence (0 to 9) up to 15.

Syntax:

```
TRNL config>TEST
Test input[]? 918076565
New number type (0 unknown,1 international,2 national,3 network,4 subscriber,
                         6 abbreviated,7 reserved)[0]?
        0918076565 (national)
TRNL config>
```

Examples:

In this case you are going to check the defined rules as an example in the **RULE** command from this menu.

```
TRNL config>TEST 8522222299 0
TRNL config>TEST 8522222285 0
        8522222200 (unknown)
TRNL config>TEST 8522222287 0
        8522222200 (unknown)
TRNL config>TEST 8522222288 0
TRNL config>TEST 932530222 3
        932530222 (international)
TRNL config>TEST 932530222 2
TRNL config>TEST
Test input[]? 616900200
New number type (0 unknown,1 international,2 national,3 network,4 subscriber,
                         6 abbreviated,7 reserved)[0]? 0
        99902900200 (national)
TRNL config>TEST 918076169 0
TRNL config>
```

If you give a value outside of the permitted ranges, an error message is produced.

1.17. TRANSLATION

Creates a translation for use in both outgoing and incoming calls. A translation is a transformation that can be applied over one of the telephone numbers that intervenes in a call (calling and called), as well as the type of numeration associated.

This is identified by a number between 1 and 127. By default there are no defined translations.

Syntax:

```
H323 Config>TRANSLATION
Translation ID[0]? 4
H323 Config>
```

If you give an identifier outside the permitted range or the translation already exists, an error message is produced.

The configured translations can be viewed with the **LIST TRANSLATION** command. Commands related to the translation delete and edition are **NO TRANSLATION** and **SET TRANSLATION**. To edit a translation you need to first create it.

1.18. EXIT

Use the **EXIT** command to return to the previous prompt.

Syntax:

```
H323 Config>EXIT
```

Example:

```
H323 Config>EXIT
Config>
```

1.19. CONFIGURATON COMMANDS TREE

APPLY

CODEC-CLASS

DESTINATION

FAST-CONNECT

LINE

LIST

- ALL
- CODEC-CLASS
- GW
- LINE
- PARAMETERS
- TABLE
  - *DESTINATION*
  - *PORT*
  - *PREFIX*
- TRANSLATION

LOCAL-CALL-EXPANSIONS

MATCH-DIALING

MOVE

- DESTINATION
- PORT
- PREFIX

NO

- CODEC-CLASS
- DESTINATION
- FAST-CONNECT
- LOCAL-CALL-EXPANSIONS
- MATCH-DIALING
- PORT

PREFIX
PROPIETARY-MODE
REGISTER-E164
TABLE
DESTINATION
PORT
PREFIX
TRANSLATION

PORT

PREFIX

PROPIETARY-MODE

REGISTER-E164

SET

ADDRESS
AVAILABLE-SERVICE
DELAY
DISABLE-TYPE-OF-SERVICE
GATEKEEPER
ADDRESS
ZONE
GW
ADDRESS
NAME
TECH-PREFIX
INCOMING TRANSLATION
PORT
Q931
RAS
UDP
RAS
PORT
RETRIES
TIMEOUT
TTL
RING-SIGNAL
ACTIVITY
SILENCE
TONES
ALERT
ACTIVITY
FREQUENCY
SILENCE
VOICE-MESSAGE
BUSY
ACTIVITY
FREQUENCY
SILENCE
VOICE-MESSAGE
DIAL
FREQUENCY
VOICE-MESSAGE
DTMF-TIMEOUT
ERR-TIMEOUT
ERROR
ACTIVITY
FREQUENCY
SILENCE1

SILENCE2
VOICE-MESSAGE
TRANSLATION
RULE
NO RULE
LIST
TEST
TRANSLATION
EXIT

2. Voice message recording

The voice gateway permits reproduction of voice messages instead of the corresponding alert, error tones, etc. (see the commands within the SET TONE group). The aim of this is so the user can better identify the situation in question.

To record voice messages, you need a telephone directly connected to the device, on any line. The line should be previously configured in FXS mode to carry this out. The recording mechanism is as follows:

- Pick up the receiver and you will hear the continuous dialing tone.
- Press the * key to start the recording process. You will no longer hear the tone and you will hear two small beeps that indicate the beginning of the recording. After this you may begin to speak.
- To end the recording, press the voice message number (from 1 to 9) with which you wish to record the voice. You can record a maximum of 15 seconds for G723.1 at 6.4 Kbps, 18 seconds for G723.1 at 5.3 Kpbs, or 12 seconds for G729.
- When pressing the digit you should hear another two small beeps that indicate the end of the recording and after this time the voice message is recorded onto the disk. If everything is carried out correctly this will be reproduced once the voice message has been recorded and you will again hear the dialing tone (or the corresponding configured voice message).

  If you have not pressed any digit and you have not been able to correctly record onto the disk (i.e. there was no disk, or the disk is protected against writing, no space etc.) you will hear an error tone.
- Hang up the receiver if you do not wish to carry out any calls.

The admitted numbers are from 1 to 9. If the said voice message already exists, it is written over. The voice messages are stored in the application disk with the name LOC*x*.LOC where *x* is a number from 1 to 9.

It is important to take into account that a voice message will only reproduce in lines that are configured to use the same encoder which was used to make the recording, i.e. a line with G.729 cannot reproduce a voice message with G.723.1 and vice versa. The formats G.723.1 at 5.3 Kbps and G.723.1 at 6.4 Kbps are completely compatible between each other. In this way a line with a G.723.1 at 5.3 Kbps encoder can reproduce a voice message with G.723.1 at 6.4 Kbps and vice versa.

Chapter 3
Monitoring

1. Monitoring commands

To enter to the H.323 Protocol monitoring (Voice over IP), access this from the main menu in the following way:

1. At the (*) prompt, enter PROCESS 3 (or P 3).
2. At the monitoring prompt (+), enter PROTOCOL 4 or PROTOCOL H323 or P 4.
3. At the H.323 monitoring prompt (H.323 Mon>), use the monitoring commands that are described in this chapter to monitor the said Protocol parameters.

Below you will find the H.323 monitoring commands numbered and described. All the H323 monitoring commands should be introduced at the H.322 prompt (H323 Mon>). The letters written in **bold** are the minimum number of characters that must be entered in order to activate the command.

Command	**Functions**
? (HELP)	Lists the available commands or their options.
CLEAR	Deletes buffers.
DISPLAY	Permits you to view the status and statistics.
LIST	Lists calls (active or released), statistics or traces.
REGISTER	Sends a register request RAS packet (RRQ).
UNREGISTER	Sends an unregister request RAS packet (URQ).
TRACE	Permits carrying out traces for debugging.
EXIT	Returns to the previous prompt.

1.1. ? (HELP)

Displays a list of the available commands or their options.

Syntax:

```
H323 Mon>?
CLEAR
DISPLAY
LIST
REGISTER
UNREGISTER
TRACE
EXIT
```

1.2. CLEAR

Permits you to delete frame statistics, error counters, etc. as well as the register of the executed calls.

Syntax:

```
H323 Mon>CLEAR ?
RELEASED calls
STATISTICS
```

a) CLEAR RELEASED

Deletes all the released calls register.

Example:

```
H323 Mon>CLEAR RELEASED
H323 Mon>
```

b) CLEAR STATISTICS

Deletes the frame statistics, error counters, etc.

Example:

```
H323 Mon>CLEAR STATISTICS
H323 Mon>
```

1.3. DISPLAY

Dynamically displays the status of the distinct voice lines and the various additional parameters.

Syntax:

```
H323 Mon>DISPLAY ?
CAUSE
LINE
RAS
VOICE-MSG
```

a) DISPLAY CAUSE

Displays the meaning of the codes used as release cause in the calls (Q931) and the end of the RAS protocol transactions.

Syntax:

```
H323 Mon>DISPLAY CAUSE ?
RELEASE
RAS
```

DISPLAY CAUSE RELEASE

Displays the meaning of the codes used as the call release cause (Q931). The cause of the release of a call is displayed with the **LIST RELEASE** command.

Example:

```
H323 Mon>DISPLAY CAUSE RELEASE
Cause code [0]? 5
Cause (5):  Local

H323 Mon>
```

DISPLAY CAUSE RAS

Displays the meaning of the codes used as the release cause in the rejection of RAS transactions. The rejection cause is displayed with the **DISPLAY RAS** command.

Example:

```
H323 Mon>DISPLAY CAUSE RAS
Cause code [0]? 1
Cause (1):  Insufficient Resources

H323 Mon>
```

b) DISPLAY LINE

This permits you to view the status of a line. If the line does not have any conversation, the encoded voice parameters are displayed (codec, NOB and VAD) that you have currently associated to the line

(values given by the configuration), the total frames and bytes received and transmitted in the line and finally the total of lost frames and the discarded frames and the maximum variance reached in the line.

If the line has a call established this also facilitates the frames and bytes received and transmitted, the telephone numbers that intervene (only if the said information was available), the type of call (voice or fax) and the call establishment mode, delay statistics, lost frames, discarded frames and finally the duration of the call in seconds. In this situation the codec, NOB and VAD in use is displayed; this can differ from the default configuration in the line due to negotiation issues and to the use of the codec classes.

If the motherboard is ISDN telephony, the ISDN call status, the status of the link levels (LAPD) and the physical ISDN line is also displayed as well as the number of drops in these.

Example (Basic Telephony Motherboard):

```
H323 Mon>DISPLAY LINE 1
State: CALL ESTABLISHED
Codec: G723 6.4Kbps           Total Rx frames:    21116
Frames/RTP pkt: 1 ( 24 bytes) Total Rx bytes:    592196
VAD :  Enabled                Total Tx frames:    29242
                              Total Tx bytes:    992172

Absolute max variance:  82    Total lost frames:         0
                              Total discarded frm:       3

Called:  606                  Type: Voice
Calling: 931                  Fast-Start: True
Tech-prefix:

Rx frames:      21116         Tx frames:    29242
Rx bytes:      592196         Tx bytes:    992208

Delay:  60                    Variance:   0
Minimum delay:  30            Minimum variance: 160
Maximum delay:  90            Maximum variance:   0

Lost frames:        0         Discarded frames: 12
Missed frames percent:  0%

Conversation time:    267 sec.

H323 Mon>
```

Example (ISDN Telephony Motherboard):

```
H323 Mon>DISPLAY LINE
Line [1-4] :[1]? 1
State: CALL ESTABLISHED
Codec: G723 6.4Kbps           Total Rx frames:   344551
Frames/RTP pkt: 1 ( 24 bytes) Total Rx bytes:  11954316
VAD :  Enabled                Total Tx frames:   240833
                              Total Tx bytes:   6989788

Absolute max variance:  83    Total lost frames:          0
                              Total discarded frm:       67

Called:  606                  Type: Voice
Calling: 931                  Fast-Start: True
Tech-prefix:

Rx frames:      31274         Tx frames:    22363
Rx bytes:     1061724         Tx bytes:    622408

Delay:  60                    Variance:   0
Minimum delay:  30            Minimum variance: 150
Maximum delay: 150            Maximum variance:   0

Lost frames:        0         Discarded frames: 19
```

```
Missed frames percent:  0%

Conversation time:    297 sec.

Physical State : G3           Physical Link Failures : 3
Lapd : Established            LAPD Link Failures : 90
Q931 State : N10
H323 Mon>
```

c) DISPLAY RAS

Permits you to view the status, the last rejection cause and the RAS statistics.

Example:

```
H323 Mon>DISPLAY RAS
RAS state: Gateway  has been registered
Last ARJ cause:           10

Gatekeeper Confirms:      3
Gatekeeper Rejects:       1
Registration Confirms:    1
Registration Rejects:     0
Unregistration Confirms:  0
Admission Confirms:       2
Admission Rejects:        1
Disengage Confirms:       0
Info Request Responses:   0
Non Standard Messages:    0
Unknown Messages:         0

H323 Mon>
```

d) DISPLAY VOICE-MSG

Permits you to view the voice messages present in the router's RAM memory. A voice message is loaded in the memory on restarting the router if it has been configured as an error tone, busy, etc., or if once the device has been started, a voice message is recorded on the disk.

This also displays information on the size in bytes, the codec the voice message was recorded with and the version of the used format (the current version is 2).

Example:

```
H323 Mon>DISPLAY VOICE-MSG

LOC number    Size    Codec   Version
----------    -----   -----   -------
    1         3770    G729       2
    2         7992    G723       1
    3         3648    G723       2
    4         5550    G729       2
H323 Mon>
```

1.4. LIST

Syntax:

```
H323 Mon>LIST ?
ACTIVE calls
RELEASED calls
STATISTICS
TRACE
```

a) LIST ACTIVE

Lists all the active calls at this point. The associated line, the caller and the called (only if they are available), the time and the start date, the call address and finally the type of call are displayed.

On listing the called telephone number, information is displayed as the result of applying the configured numerical expansions, both in the incoming and the outgoing calls. The called address takes the values: I (input), for incoming calls or calls carried out from another voice terminal at some point in the IP network, and the value 0 (output) for outgoing calls or calls carried out from this voice gateway to another device at some point in the IP network. The type of call takes the values: I (internal) for a call between two device lines and E (external) for cases of a call between one device line and a remote.

Example:

```
H323 Mon>LIST ACTIVE
LINE    CALLED ADDRESS     ST. TIME  ST. DATE  DIRECTION  TYPE
        CALLING ADDRESS

  2     0                  13:15:25  06:05:99  O          E
        091
H323 Mon>
```

b) LIST RELEASED

Lists the last 100 released calls. The associated line is displayed together with the caller and the called (only if they are available), the start and end time and date, the called address and the type of call, and finally the termination cause for the said call.

On listing the called telephone number, information is displayed as the result of applying the configured numerical expansions, both in the incoming and the outgoing calls. The called address takes the values: I (input), for incoming calls or calls carried out from another voice terminal at some point in the IP network, and the value 0 (output) for outgoing calls or calls carried out from this voice gateway to another device at some point in the IP network. The type of call takes the values: I (internal) for a call between two device lines and E (external) for cases of a call between one device line and a remote. The release cause appears encoded; for further information on the meaning of this, use the **DISPLAY CAUSE RELEASE** command.

Example:

```
H323 Mon>LIST RELEASED
LINE  CALLED ADDRESS    ST.TIME    ST.DATE      DIRECTION  TYPE  CAUSE
      CALLING ADDRESS   E.TIME     E.DATE

  3   931               15:49:37   05:05:99     O          E     3
      915073            15:49:38   05:05:99

  2   931               17:11:52   05:05:99     O          E     3
      091               17:11:52   05:05:99

  3   931               17:12:41   05:05:99     O          E     3
      915073            17:12:41   05:05:99

  2   931               17:15:32   05:05:99     O          E     3
      091               17:15:32   05:05:99

  3   931               18:15:42   05:05:99     O          E     3
      915073            18:15:42   05:05:99

H323 Mon>
```

c) LIST STATISTICS

Lists the various statistics relative both to the device as well as the last calls carried out by each line.

Syntax:

```
H323 Mon>LIST STATISTICS ?
GW
LAST
```

LIST STATISTICS GW

Lists the statistics common to all the device lines. The date and start time of the system and whether the voice service is available or not is displayed. Additionally, the total number of calls carried out appears from the beginning, the number of active calls and the possible calls. Finally the average duration of a call is displayed.

Example:

```
H323 Mon>LIST STATISTICS GW

Startup time: 16:01:27          10/ 5/99
Voice Service: disabled
Total calls: 0 (0)
Active calls: 0
Possible additional calls: 4
Conversation mean time: 0 seconds.

H323 Mon>
```

LIST STATISTICS LAST

Displays the parameters and statistics of the last call carried out by the indicated line. This by and largely displays the same information as displayed with the DISPLAY LINE command. In this way the encoded voice parameters appear (codec, NOB and VAD), the frames and bytes received and transmitted, the telephone numbers that have intervened (only if the said information was available), delay statistics, lost and discarded frames and finally the duration of the call in seconds.

Example:

```
H323 Mon>LIST STATISTICS LAST
Line [1-4] : [1]? 1
Codec: G723 6.4Kbps           Rx frames:       70
Frames/RTP pkt: 1 ( 24 bytes) Rx bytes:      1380
VAD :  Enabled                Tx frames:      234
                              Tx bytes:         0

Called:  581                  Type: Voice
Calling: 931                  Fast-Start: True
Minimum delay:  90            Minimum variance: 160
Maximum delay:  90            Maximum variance:   0

Lost frames:        0         Discarded frames: 0
Missed frames percent:  0%

Conversation time:    358 sec.

H323 Mon>
```

1.5. REGISTER

Sends a request register RAS packet (RRQ) to the configured gatekeeper.

Syntax:

```
H323 Mon>REGISTER
```

Example:

```
H323 Mon>REGISTER
H323 Mon>
```

1.6. UNREGISTER

Sends an RAS packet request to unregister (URQ) to the gatekeeper

Syntax:

```
H323 Mon>UNREGISTER
```

Example:

```
H323 Mon>UNREGISTER
H323 Mon>
```

1.7. TRACE

This displays information through the router's events logging system (ELS) over the events relative to the voice over IP produced both at the TCP level as well as the UDP level. The event used is the H323.008; therefore you must have this event enabled in order to view the traces.

Since the resulting traces are too extensive in the majority of cases and implies a heavy load for normal device operations, there is a series of options available in order to eliminate unwanted information thus speeding up the process.

To disable the traces, modify the debugging level to the 0 value with the **TRACE LEVEL** command.

Given the computational cost involved, it is recommended to enable the traces only during use and disabled them once the analysis process has finished.

Syntax:

```
H323 Mon>TRACE ?
DISABLE opt
ENABLE opt
LEVEL
LIST opt
RCD
SCKT
TCP
UDP
H323 Mon>
```

a) TRACE DISABLE

Disables a viewing option. Previously a list with all the possible options will be displayed and you will be asked to choose which one you wish to disable.

Example:

```
H323 Mon>TRACE DISABLE
Trace level: 0
1> Show Binary  DISABLED
2> Show Spaces  ENABLED
3> Show <node>  DISABLED
4> Show Header  ENABLED
5> Show levels  DISABLED
6> Cut line     DISABLED
7> Show Types   DISABLED
Select option(0 all,-1 none)[0]? 1
H323 Mon>
```

The available options are as follows:

1- Show Binary: Displays the messages in hexadecimal format that are exchanged between the devices at the time of negotiating a call. By default this is disabled.

2- Show Spaces:	Tabulates through spaces the events produced according to the level they belong to. If the terminal that is used does not permit using more than 80 columns we do not recommend enabling it. By default this is disabled.
3- Show <node>:	Debugging information for Teldat's own use. By default this is disabled.
4- Show Header:	Displays a header that indicates the H323 subsystem pertaining to the event that has been produced (TCP/UDP). By default this is enabled.
5- Show levels:	This provides information through an event detail level number. By default this is disabled.
6- Cut line:	Limits the line length to the number of characters as indicated. By default this is disabled.
7- Show Types:	This provides information on the type of each variable (string, whole, etc.). By default this is disabled.

The more options that are activated, the greater the amount of information displayed, however this can overload the device and studying this will be more difficult. By default only option 4 (Show Header) is activated.

Example:

Message that provides information on the calling device address with all the options disabled:

```
H323.008 Local Address:
H323.008 TransportAddress = (0)
H323.008 ipAddress = (-555)
H323.008 ip = (4) '....' =0x0f01010a <15.1.1.10>
H323.008 port = (3015)
```

The same message as above but in this case all the options are enabled:

```
H323.008 TCPc      : Local Address:
H323.008 TCPc      :  0> <4584> TransportAddress = (0) .  <864> CHOICE ...
H323.008 TCPc      :  1>  <4817> ipAddress = (-555) .  <861> SEQUENCE
H323.008 TCPc      :  2>   <4818> ip = (4) '....' =0x0f01010a <15.1.1.10> .  <846>
OCTET STRING (4..4)
H323.008 TCPc      :  2>   <4820> port = (3017) .  <762> INTEGER (0..65535)
```

b) TRACE ENABLE

Enables a debugging operation. Consult the **TRACE DISABLE** section for a detailed description of the available options and their meanings. By default only option 4 (Show Header) is activated.

Example:

```
H323 Mon>TRACE ENABLE
Trace level: 0
1> Show Binary  DISABLED
2> Show Spaces  ENABLED
3> Show <node>  DISABLED
4> Show Header  ENABLED
5> Show levels  DISABLED
6> Cut line     DISABLED
7> Show Types   DISABLED
Select option(0 all,-1 none)[0]? 1
H323 Mon>
```

c) TRACE LEVEL

Sets the debugging level (detailed) that you wish for the traces. This can vary between 0 (the event is not displayed) to 3 (displays all the possible events). By default the debugging level is 0 which means the traces are disabled.

Example:

```
H323 Mon>TRACE LEVEL
Select trace level 0-3[0]? 1
H323 Mon>
```

For debugging levels 2 and 3, the events buffer requires to have at least 700 or 1000 lines respectively, since without them you cannot correctly view the traces. If this is not carried out in this way, the router will set the debugging level to 1. For more information on how to change the number of lines available in the events buffer consult the **SET EV-BUFFER** configuration command from the Config> prompt.

Example:

Below, two examples of call establishment are presented, one with a trace level set to one and the other with a trace level set to three. In both cases the viewing options are activated except the 6, 3 and 7, which are deactivated (see the previous section).

In both cases you can view both the Q.931 messages that are exchanged by both devices in order to establish a call as well as the H.245 messages where the capacities are exchanged (codec type, master/slave determination…).

The trace obtained with **TRACE LEVEL** at 3 is:

```
H323 Mon>TRACE TCP
Select trace level 0-3[0]? 3
H323 Mon> TRACE LIST
Trace level: 3
1> Show Binary  DISABLED
2> Show Spaces  ENABLED
3> Show <node>  DISABLED
4> Show Header  ENABLED
5> Show levels  DISABLED
6> Cut line     DISABLED
7> Show Types   DISABLED
H323 Mon> TRACE ENABLE 0
H323 Mon> TRACE DISABLE 7
H323 Mon> TRACE DISABLE 3
H323 Mon>
*P 2
 H323.002 State OFF THE HOOK ln 1
 H323.002 State DIALING ln 1
 H323.002 State CALLING ln 1
 H323.008 TCPc      : Opening channel 4 (size=2)
 H323.008 TCPc      : Local Address:
 H323.008 TCPc      :  0> TransportAddress = (0)
 H323.008 TCPc      :  1>  ipAddress = (-555)
 H323.008 TCPc      :  2>   ip = (4) '....' =0x0f010102 <15.1.1.2>
 H323.008 TCPc      :  2>   port = (3012)
 H323.008 TCPc      : Connecting channel 4
 H323.008 TCPc      : Remote Address:
 H323.008 TCPc      :  0> TransportAddress = (0)
 H323.008 TCPc      :  1>  ipAddress = (-555)
 H323.008 TCPc      :  2>   ip = (4) '....' =0x0f010101 <15.1.1.1>
 H323.008 TCPc      :  2>   port = (1720)
 H323.008 TCPc      : Connected channel 4
 H323.008 TCPc      : Listen on channel 5 (size=3)
 H323.008 TCPc      : Address:
 H323.008 TCPc      :  0> TransportAddress = (0)
 H323.008 TCPc      :  1>  ipAddress = (-555)
 H323.008 TCPc      :  2>   ip = (4) '....' =0x0f010102 <15.1.1.2>
 H323.008 TCPc      :  2>   port = (3013)
 H323.003 Est Dialtone md  ln 1
 H323.008 TCPc      : New message (channel 4) sent --> setup:
 H323.008 TCPc      : Message:
 H323.008 TCPc      :  0> Q931Message = (-555)
 H323.008 TCPc      :  1>  protocolDiscriminator = (8)
 H323.008 TCPc      :  1>  callReferenceValue = (-555)
 H323.008 TCPc      :  2>   twoBytes = (15854)
 H323.008 TCPc      :  1>  message = (-555)
```

```
H323.008 TCPc      :  2>   setup = (-555)
H323.008 TCPc      :  3>    bearerCapability = (-555)
H323.008 TCPc      :  4>     octet3 = (-555)
H323.008 TCPc      :  5>      codingStandard = (0)
H323.008 TCPc      :  5>      informationTransferCapability = (8)
H323.008 TCPc      :  4>     octet4 = (-555)
H323.008 TCPc      :  5>      transferMode = (0)
H323.008 TCPc      :  5>      informationTransferRate = (16)
H323.008 TCPc      :  4>     octet5 = (-555)
H323.008 TCPc      :  5>      layer1Ident = (1)
H323.008 TCPc      :  5>      userInformationLayer1Protocol = (5)
H323.008 TCPc      :  3>    display = (21) 'Nucleox Plus - VoxNet' =0x4e75636c656f7820506c7573202d20566f
H323.008 TCPc      :  3>    callingPartyNumber = (-555)
H323.008 TCPc      :  4>     octet3 = (-555)
H323.008 TCPc      :  5>      typeOfNumber = (4)
H323.008 TCPc      :  5>      numberingPlanIdentification = (1)
H323.008 TCPc      :  4>     numberDigits = (6) '151121' =0x313531313231
H323.008 TCPc      :  3>    calledPartyNumber = (-555)
H323.008 TCPc      :  4>     octet3 = (-555)
H323.008 TCPc      :  5>      typeOfNumber = (6)
H323.008 TCPc      :  5>      numberingPlanIdentification = (1)
H323.008 TCPc      :  4>     numberDigits = (6) '151113' =0x313531313133
H323.008 TCPc      :  3>    userUser = (-555)
H323.008 TCPc      :  4>     protocolDiscriminator = (5)
H323.008 TCPc      :  4>     h323-UserInformation = (-555)
H323.008 TCPc      :  5>      h323-uu-pdu = (-555)
H323.008 TCPc      :  6>       h323-message-body = (-555)
H323.008 TCPc      :  7>        setup = (-555)
H323.008 TCPc      :  8>         protocolIdentifier = (6)  { itu-t recommendation h 2250 0 2 }
H323.008 TCPc      :  8>         h245Address = (0)
H323.008 TCPc      :  9>          ipAddress = (-555)
H323.008 TCPc      : 10>           ip = (4) '....' =0x0f010102 <15.1.1.2>
H323.008 TCPc      : 10>           port = (3013)
H323.008 TCPc      :  8>         sourceAddress = (0)
H323.008 TCPc      :  9>          * = (0)
H323.008 TCPc      : 10>           e164 = (6) '151121' =0x313531313231
H323.008 TCPc      :  8>         sourceInfo = (0)
H323.008 TCPc      :  9>          vendor = (0)
H323.008 TCPc      : 10>           vendor = (0)
H323.008 TCPc      : 11>            t35CountryCode = (11)
H323.008 TCPc      : 11>            t35Extension = (11)
H323.008 TCPc      : 11>            manufacturerCode = (11)
H323.008 TCPc      : 10>           productId = (7) 'Voip Gw' =0x566f6970204777
H323.008 TCPc      : 10>           versionId = (6) 'Teldat' =0x54656c646174
H323.008 TCPc      :  9>          gateway = (0)
H323.008 TCPc      : 10>           protocol = (0)
H323.008 TCPc      : 11>            * = (0)
H323.008 TCPc      : 12>             voice = (0)
H323.008 TCPc      : 13>              supportedPrefixes = (0)
H323.008 TCPc      :  9>          mc = (0)
H323.008 TCPc      :  9>          undefinedNode = (0)
H323.008 TCPc      :  8>         destinationAddress = (0)
H323.008 TCPc      :  9>          * = (0)
H323.008 TCPc      : 10>           e164 = (6) '151113' =0x313531313133
H323.008 TCPc      :  8>         destCallSignalAddress = (0)
H323.008 TCPc      :  9>          ipAddress = (-555)
H323.008 TCPc      : 10>           ip = (4) '....' =0x0f010101 <15.1.1.1>
H323.008 TCPc      : 10>           port = (1720)
H323.008 TCPc      :  8>         activeMC = (0)
H323.008 TCPc      :  8>         conferenceID = (16) 'V4444...'.so]...' =0x5634343434ef050027e1736f5d028b06
H323.008 TCPc      :  8>         conferenceGoal = (-555)
H323.008 TCPc      :  9>          create = (-555)
H323.008 TCPc      :  8>         callType = (-555)
H323.008 TCPc      :  9>          pointToPoint = (-555)
H323.008 TCPc      :  8>         sourceCallSignalAddress = (0)
H323.008 TCPc      :  9>          ipAddress = (-555)
H323.008 TCPc      : 10>           ip = (4) '....' =0x0f010102 <15.1.1.2>
H323.008 TCPc      : 10>           port = (3012)
H323.008 TCPc      :  8>         callIdentifier = (-555)
H323.008 TCPc      :  9>          guid = (16) 'V4444...'.so\...' =0x5634343434ef040027e1736f5cfd08d5
H323.008 TCPc      :  8>         mediaWaitForConnect = (0)
H323.008 TCPc      :  8>         canOverlapSend = (0)
H323.008 TCPc      :  6>       h245Tunneling = (0)
H323.008 TCPc      :  5>      user-data = (-555)
H323.008 TCPc      :  6>       protocol-discriminator = (5)
H323.008 TCPc      :  6>       user-information = (7) 'Teldat.' =0x54656c64617400
H323.008 TCPc      : Binary:
H323.008 TCPc      : 00000   08 02 3d ee 05 04 03 88 90 a5 28 15 4e 75 63 6c    |..=î...ˆ•¥(.Nucl|
H323.008 TCPc      : 00016   65 6f 78 20 50 6c 75 73 20 2d 20 56 6f 78 4e 65    |eox Plus - VoxNe|
H323.008 TCPc      : 00032   74 6c 07 c1 31 35 31 31 32 31 70 07 e1 31 35 31    |tl.Á151121p.á151|
H323.008 TCPc      : 00048   31 31 33 7e 00 80 05 60 f8 06 00 08 91 4a 00 02    |113~.€.`ø...‘J..|
H323.008 TCPc      : 00064   00 0f 01 01 02 0b c5 01 02 80 48 44 54 28 c0 0b    |......Å..€HDT(À.|
H323.008 TCPc      : 00080   0b 00 0b 06 56 6f 69 70 20 47 77 05 54 65 6c 64    |....Voip Gw.Teld|
H323.008 TCPc      : 00096   61 74 40 01 3c 05 01 00 00 01 02 80 48 44 46 00    |at@.<......€HDF.|
H323.008 TCPc      : 00112   0f 01 01 01 06 b8 00 56 34 34 34 34 ef 05 00 27    |.....¸.V4444ï..'|
H323.008 TCPc      : 00128   e1 73 6f 5d 02 8b 06 00 45 0c 07 00 0f 01 01 02    |áso].‹..E.......|
H323.008 TCPc      : 00144   0b c4 11 00 56 34 34 34 34 ef 04 00 27 e1 73 6f    |.Ä..V4444ï..'áso|
H323.008 TCPc      : 00160   5c fd 08 d5 01 00 01 00 06 80 01 00 00 05 06 54    |\ý.Õ.....€.....T|
H323.008 TCPc      : 00176   65 6c 64 61 74 00                                 |eldat.|
H323.008 TCPc      : New message (channel 4) recv <-- callProceeding:
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H323.008 TCPc      : Binary:
H323.008 TCPc      : 00000   08 02 bd ee 02 7e 00 38 05 21 80 06 00 08 91 4a    |..½î.~.8.!€...‘J|
H323.008 TCPc      : 00016   00 02 28 c0 0b 0b 00 0b 06 56 6f 69 70 20 47 77    |..(À.....Voip Gw|
H323.008 TCPc      : 00032   05 54 65 6c 64 61 74 00 48 00 11 00 56 34 34 34    |.Teldat.H...V444|
H323.008 TCPc      : 00048   34 ef 04 00 27 e1 73 6f 5c fd 08 d5 06 80 01 00    |4ï..'áso\ý.Õ.€..|
H323.008 TCPc      : Message:
H323.008 TCPc      :  0> Q931Message = (3)
H323.008 TCPc      :  1>  protocolDiscriminator = (8)
H323.008 TCPc      :  1>  callReferenceValue = (5245)
H323.008 TCPc      :  2>   twoBytes = (48622)
H323.008 TCPc      :  1>  message = (1087)
H323.008 TCPc      :  2>   callProceeding = (1)
H323.008 TCPc      :  3>    userUser = (2)
H323.008 TCPc      :  4>     protocolDiscriminator = (5)
H323.008 TCPc      :  4>     h323-UserInformation = (-111)
H323.008 TCPc      :  5>      h323-uu-pdu = (-111)
H323.008 TCPc      :  6>       h323-message-body = (1087)
H323.008 TCPc      :  7>        callProceeding = (-111)
H323.008 TCPc      :  8>         protocolIdentifier = (6)  { itu-t recommendation h 2250 0 2 }
H323.008 TCPc      :  8>         destinationInfo = (-111)
H323.008 TCPc      :  9>          vendor = (-111)
H323.008 TCPc      : 10>           vendor = (-111)
H323.008 TCPc      : 11>            t35CountryCode = (11)
H323.008 TCPc      : 11>            t35Extension = (11)
H323.008 TCPc      : 11>            manufacturerCode = (11)
H323.008 TCPc      : 10>           productId = (7) 'Voip Gw' =0x566f6970204777
H323.008 TCPc      : 10>           versionId = (6) 'Teldat' =0x54656c646174
H323.008 TCPc      :  9>          gateway = (-111)
H323.008 TCPc      :  9>          mc = (0)
H323.008 TCPc      :  9>          undefinedNode = (0)
H323.008 TCPc      :  8>         callIdentifier = (-111)
H323.008 TCPc      :  9>          guid = (16) 'V4444...'.so\...' =0x5634343434ef040027e1736f5cfd08d5
H323.008 TCPc      :  6>       h245Tunneling = (0)
H323.003 Est Dialtone md  ln 1
H323.008 TCPc      : New message (channel 4) recv <-- alerting:
H323.008 TCPc      : Binary:
H323.008 TCPc      : 00000   08 02 bd ee 01 7e 00 3f 05 23 c0 06 00 08 91 4a    |..½î.~.?.#À...‘J|
H323.008 TCPc      : 00016   00 02 28 c0 0b 0b 00 0b 06 56 6f 69 70 20 47 77    |..(À.....Voip Gw|
H323.008 TCPc      : 00032   05 54 65 6c 64 61 74 00 00 0f 01 01 01 0c 1f 09    |.Teldat.........|
H323.008 TCPc      : 00048   00 11 00 56 34 34 34 34 ef 04 00 27 e1 73 6f 5c    |...V4444ï..'áso\|
H323.008 TCPc      : 00064   fd 08 d5 06 80 01 00                               |ý.Õ.€..|
H323.008 TCPc      : Message:
H323.008 TCPc      :  0> Q931Message = (3)
H323.008 TCPc      :  1>  protocolDiscriminator = (8)
H323.008 TCPc      :  1>  callReferenceValue = (5245)
H323.008 TCPc      :  2>   twoBytes = (48622)
H323.008 TCPc      :  1>  message = (8840)
H323.008 TCPc      :  2>   alerting = (1)
H323.008 TCPc      :  3>    userUser = (2)
H323.008 TCPc      :  4>     protocolDiscriminator = (5)
H323.008 TCPc      :  4>     h323-UserInformation = (-111)
H323.008 TCPc      :  5>      h323-uu-pdu = (-111)
H323.008 TCPc      :  6>       h323-message-body = (8840)
H323.008 TCPc      :  7>        alerting = (-111)
H323.008 TCPc      :  8>         protocolIdentifier = (6)  { itu-t recommendation h 2250 0 2 }
H323.008 TCPc      :  8>         destinationInfo = (-111)
H323.008 TCPc      :  9>          vendor = (-111)
H323.008 TCPc      : 10>           vendor = (-111)
H323.008 TCPc      : 11>            t35CountryCode = (11)
H323.008 TCPc      : 11>            t35Extension = (11)
H323.008 TCPc      : 11>            manufacturerCode = (11)
H323.008 TCPc      : 10>           productId = (7) 'Voip Gw' =0x566f6970204777
H323.008 TCPc      : 10>           versionId = (6) 'Teldat' =0x54656c646174
H323.008 TCPc      :  9>          gateway = (-111)
H323.008 TCPc      :  9>          mc = (0)
H323.008 TCPc      :  9>          undefinedNode = (0)
H323.008 TCPc      :  8>         h245Address = (7441)
H323.008 TCPc      :  9>          ipAddress = (-111)
H323.008 TCPc      : 10>           ip = (4) '....' =0x0f010101 <15.1.1.1>
H323.008 TCPc      : 10>           port = (3103)
H323.008 TCPc      :  8>         callIdentifier = (-111)
H323.008 TCPc      :  9>          guid = (16) 'V4444...'.so\...' =0x5634343434ef040027e1736f5cfd08d5
H323.008 TCPc      :  6>       h245Tunneling = (0)
H323.003 Est Proceeding md  ln 1
H323.008 TCPc      : Connecting channel 6 (size=4)
H323.008 TCPc      : Remote Address:
H323.008 TCPc      :  0> TransportAddress = (0)
H323.008 TCPc      :  1>  ipAddress = (-555)
H323.008 TCPc      :  2>   ip = (4) '....' =0x0f010101 <15.1.1.1>
H323.008 TCPc      :  2>   port = (3103)
H323.008 TCPc      : New message (channel 4) recv <-- connect:
H323.008 TCPc      : Binary:
H323.008 TCPc      : 00000   08 02 bd ee 07 28 08 76 6e 65 74 2d 66 78 6f 7e    |..½î.(.vnet-fxo~|
H323.008 TCPc      : 00016   00 4f 05 22 c0 06 00 08 91 4a 00 02 00 0f 01 01    |.O."À...‘J......|
H323.008 TCPc      : 00032   01 0c 1f 28 c0 0b 0b 00 0b 06 56 6f 69 70 20 47    |...(À.....Voip G|
H323.008 TCPc      : 00048   77 05 54 65 6c 64 61 74 00 56 34 34 34 34 ef 05    |w.Teldat.V4444ï.|
H323.008 TCPc      : 00064   00 27 e1 73 6f 5d 02 8b 06 09 00 11 00 56 34 34    |.'áso].‹.....V44|
H323.008 TCPc      : 00080   34 34 ef 04 00 27 e1 73 6f 5c fd 08 d5 06 80 01    |44ï..'áso\ý.Õ.€.|
H323.008 TCPc      : 00096   00                                                  |.|
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H323.008 TCPc      : Message:
H323.008 TCPc      :  0> Q931Message = (3)
H323.008 TCPc      :  1>  protocolDiscriminator = (8)
H323.008 TCPc      :  1>  callReferenceValue = (5245)
H323.008 TCPc      :  2>   twoBytes = (48622)
H323.008 TCPc      :  1>  message = (4696)
H323.008 TCPc      :  2>   connect = (2)
H323.008 TCPc      :  3>    display = (8) 'vnet-fxo' =0x766e65742d66786f
H323.008 TCPc      :  3>    userUser = (2)
H323.008 TCPc      :  4>     protocolDiscriminator = (5)
H323.008 TCPc      :  4>     h323-UserInformation = (-111)
H323.008 TCPc      :  5>      h323-uu-pdu = (-111)
H323.008 TCPc      :  6>       h323-message-body = (4696)
H323.008 TCPc      :  7>        connect = (-111)
H323.008 TCPc      :  8>         protocolIdentifier = (6)  { itu-t recommendation h 2250 0 2 }
H323.008 TCPc      :  8>         h245Address = (7441)
H323.008 TCPc      :  9>          ipAddress = (-111)
H323.008 TCPc      : 10>           ip = (4) '....' =0x0f010101 <15.1.1.1>
H323.008 TCPc      : 10>           port = (3103)
H323.008 TCPc      :  8>         destinationInfo = (-111)
H323.008 TCPc      :  9>          vendor = (-111)
H323.008 TCPc      : 10>           vendor = (-111)
H323.008 TCPc      : 11>            t35CountryCode = (11)
H323.008 TCPc      : 11>            t35Extension = (11)
H323.008 TCPc      : 11>            manufacturerCode = (11)
H323.008 TCPc      : 10>           productId = (7) 'Voip Gw' =0x566f6970204777
H323.008 TCPc      : 10>           versionId = (6) 'Teldat' =0x54656c646174
H323.008 TCPc      :  9>          gateway = (-111)
H323.008 TCPc      :  9>          mc = (0)
H323.008 TCPc      :  9>          undefinedNode = (0)
H323.008 TCPc      :  8>         conferenceID = (16) 'V4444...'.so]...' =0x5634343434ef050027e1736f5d028b06
H323.008 TCPc      :  8>         callIdentifier = (-111)
H323.008 TCPc      :  9>          guid = (16) 'V4444...'.so\...' =0x5634343434ef040027e1736f5cfd08d5
H323.008 TCPc      :  6>       h245Tunneling = (0)
H323.003 Est Connected md ConnectedCallSetup ln 1
H323.002 State REMOTE ALERTED ln 1
H323.008 TCPc      : Connected channel 6
H323.008 TCPc      : New message (channel 6) sent --> terminalCapabilitySet:
H323.008 TCPc      : Message:
H323.008 TCPc      :  0> MultimediaSystemControlMessage = (0)
H323.008 TCPc      :  1>  request = (-555)
H323.008 TCPc      :  2>   terminalCapabilitySet = (0)
H323.008 TCPc      :  3>    sequenceNumber = (1)
H323.008 TCPc      :  3>    protocolIdentifier = (6)  { itu-t recommendation h 245 0 3 }
H323.008 TCPc      :  3>    capabilityTable = (0)
H323.008 TCPc      :  4>     * = (-556)
H323.008 TCPc      :  5>      capabilityTableEntryNumber = (1)
H323.008 TCPc      :  5>      capability = (1)
H323.008 TCPc      :  6>       receiveAndTransmitAudioCapability = (0)
H323.008 TCPc      :  7>        g7231 = (0)
H323.008 TCPc      :  8>         maxAl-sduAudioFrames = (8)
H323.008 TCPc      :  8>         silenceSuppression = (0)
H323.008 TCPc      :  4>     * = (-556)
H323.008 TCPc      :  5>      capabilityTableEntryNumber = (2)
H323.008 TCPc      :  5>      capability = (2)
H323.008 TCPc      :  6>       receiveAndTransmitAudioCapability = (0)
H323.008 TCPc      :  7>        g729 = (1)
H323.008 TCPc      :  4>     * = (-556)
H323.008 TCPc      :  5>      capabilityTableEntryNumber = (3)
H323.008 TCPc      :  5>      capability = (3)
H323.008 TCPc      :  6>       receiveAndTransmitAudioCapability = (0)
H323.008 TCPc      :  7>        g729wAnnexB = (1)
H323.008 TCPc      :  3>    capabilityDescriptors = (0)
H323.008 TCPc      :  4>     * = (-556)
H323.008 TCPc      :  5>      capabilityDescriptorNumber = (0)
H323.008 TCPc      :  5>      simultaneousCapabilities = (0)
H323.008 TCPc      :  6>       * = (-556)
H323.008 TCPc      :  7>        * = (1)
H323.008 TCPc      :  7>        * = (2)
H323.008 TCPc      :  7>        * = (3)
H323.008 TCPc      : Binary:
H323.008 TCPc      : 00000   02 30 01 06 00 08 81 75 00 03 02 80 00 00 32 00    |.0....•u...€..2.|
H323.008 TCPc      : 00016   07 40 00 01 32 80 00 80 00 02 34 00 01 00 00 80    |.@..2€.€..4....€|
H323.008 TCPc      : 00032   00 00 02 00 00 00 01 00 02                        |.........|
H323.008 TCPc      : New message (channel 6) sent --> masterSlaveDetermination:
H323.008 TCPc      : Message:
H323.008 TCPc      :  0> MultimediaSystemControlMessage = (0)
H323.008 TCPc      :  1>  request = (-555)
H323.008 TCPc      :  2>   masterSlaveDetermination = (-555)
H323.008 TCPc      :  3>    terminalType = (60)
H323.008 TCPc      :  3>    statusDeterminationNumber = (1333775)
H323.008 TCPc      : Binary:
H323.008 TCPc      : 00000   01 00 3c 80 14 5a 0f                              |..<€.Z.|
H323.008 TCPc      : New message (channel 6) recv <-- masterSlaveDetermination:
H323.008 TCPc      : Binary:
H323.008 TCPc      : 00000   01 00 3c 80 23 9d 7e                              |..<€# ~|
H323.008 TCPc      : Message:
H323.008 TCPc      :  0> MultimediaSystemControlMessage = (5936)
H323.008 TCPc      :  1>  request = (4166)
```

```
H323.008 TCPc      :  2>   masterSlaveDetermination = (-111)
H323.008 TCPc      :  3>    terminalType = (60)
H323.008 TCPc      :  3>    statusDeterminationNumber = (2334078)
H323.008 TCPc      : New message (channel 6) sent --> masterSlaveDeterminationAck:
H323.008 TCPc      : Message:
H323.008 TCPc      :  0> MultimediaSystemControlMessage = (0)
H323.008 TCPc      :  1>  response = (-555)
H323.008 TCPc      :  2>   masterSlaveDeterminationAck = (-555)
H323.008 TCPc      :  3>    decision = (-555)
H323.008 TCPc      :  4>     slave = (0)
H323.008 TCPc      : Binary:
H323.008 TCPc      : 00000   20 a0                                              |  |
H323.008 TCPc      : New message (channel 6) recv <-- terminalCapabilitySet:
H323.008 TCPc      : Binary:
H323.008 TCPc      : 00000   02 30 01 06 00 08 81 75 00 03 03 80 00 00 32 00    |.0.....•u...€..2.|
H323.008 TCPc      : 00016   07 40 00 01 32 80 00 80 00 02 34 00 01 00 80 00    |.@..2€.€..4...€.|
H323.008 TCPc      : 00032   03 48 30 60 01 00 40 33 f4 00 80 00 01 02 00 00    |.H0`..@3ô.€.....|
H323.008 TCPc      : 00048   00 01 00 02 00 00 03                               |.......|
H323.008 TCPc      : Message:
H323.008 TCPc      :  0> MultimediaSystemControlMessage = (5936)
H323.008 TCPc      :  1>  request = (23819)
H323.008 TCPc      :  2>   terminalCapabilitySet = (-111)
H323.008 TCPc      :  3>    sequenceNumber = (1)
H323.008 TCPc      :  3>    protocolIdentifier = (6)  { itu-t recommendation h 245 0 3 }
H323.008 TCPc      :  3>    capabilityTable = (4)
H323.008 TCPc      :  4>     * = (-111)
H323.008 TCPc      :  5>      capabilityTableEntryNumber = (1)
H323.008 TCPc      :  5>      capability = (598)
H323.008 TCPc      :  6>       receiveAndTransmitAudioCapability = (12257)
H323.008 TCPc      :  7>        g7231 = (-111)
H323.008 TCPc      :  8>         maxAl-sduAudioFrames = (8)
H323.008 TCPc      :  8>         silenceSuppression = (0)
H323.008 TCPc      :  4>     * = (-111)
H323.008 TCPc      :  5>      capabilityTableEntryNumber = (2)
H323.008 TCPc      :  5>      capability = (598)
H323.008 TCPc      :  6>       receiveAndTransmitAudioCapability = (6335)
H323.008 TCPc      :  7>        g729 = (1)
H323.008 TCPc      :  4>     * = (-111)
H323.008 TCPc      :  5>      capabilityTableEntryNumber = (3)
H323.008 TCPc      :  5>      capability = (598)
H323.008 TCPc      :  6>       receiveAndTransmitAudioCapability = (13157)
H323.008 TCPc      :  7>        g729wAnnexB = (1)
H323.008 TCPc      :  4>     * = (-111)
H323.008 TCPc      :  5>      capabilityTableEntryNumber = (4)
H323.008 TCPc      :  5>      capability = (10689)
H323.008 TCPc      :  6>       receiveAndTransmitDataApplicationCapability = (-111)
H323.008 TCPc      :  7>        application = (5273)
H323.008 TCPc      :  8>         t120 = (9097)
H323.008 TCPc      :  9>          separateLANStack = (-123)
H323.008 TCPc      :  7>         maxBitRate = (13300)
H323.008 TCPc      :  3>    capabilityDescriptors = (1)
H323.008 TCPc      :  4>     * = (-111)
H323.008 TCPc      :  5>      capabilityDescriptorNumber = (0)
H323.008 TCPc      :  5>      simultaneousCapabilities = (2)
H323.008 TCPc      :  6>       * = (3)
H323.008 TCPc      :  7>        * = (1)
H323.008 TCPc      :  7>        * = (2)
H323.008 TCPc      :  7>        * = (3)
H323.008 TCPc      :  6>       * = (1)
H323.008 TCPc      :  7>        * = (4)
H323.008 TCPc      : New message (channel 6) sent --> terminalCapabilitySetAck:
H323.008 TCPc      : Message:
H323.008 TCPc      :  0> MultimediaSystemControlMessage = (0)
H323.008 TCPc      :  1>  response = (-555)
H323.008 TCPc      :  2>   terminalCapabilitySetAck = (-555)
H323.008 TCPc      :  3>    sequenceNumber = (1)
H323.008 TCPc      : Binary:
H323.008 TCPc      : 00000   21 80 01                                           |!€.|
H323.008 TCPc      : New message (channel 6) recv <-- terminalCapabilitySetAck:
H323.008 TCPc      : Binary:
H323.008 TCPc      : 00000   21 80 01                                           |!€.|
H323.008 TCPc      : Message:
H323.008 TCPc      :  0> MultimediaSystemControlMessage = (11951)
H323.008 TCPc      :  1>  response = (9889)
H323.008 TCPc      :  2>   terminalCapabilitySetAck = (-111)
H323.008 TCPc      :  3>    sequenceNumber = (1)
H323.008 TCPc      : New message (channel 6) recv <-- masterSlaveDeterminationAck:
H323.008 TCPc      : Binary:
H323.008 TCPc      : 00000   20 80                                              | €|
H323.008 TCPc      : Message:
H323.008 TCPc      :  0> MultimediaSystemControlMessage = (11951)
H323.008 TCPc      :  1>  response = (16356)
H323.008 TCPc      :  2>   masterSlaveDeterminationAck = (-111)
H323.008 TCPc      :  3>    decision = (15251)
H323.008 TCPc      :  4>     master = (-123)
H323.003 Est Connected md ConnectedCall ln 1
H323.008 TCPc      : New message (channel 6) sent --> openLogicalChannel:
H323.008 TCPc      : Message:
H323.008 TCPc      :  0> MultimediaSystemControlMessage = (0)
```

```
H323.008 TCPc      :  1>  request = (-555)
H323.008 TCPc      :  2>   openLogicalChannel = (-555)
H323.008 TCPc      :  3>    forwardLogicalChannelNumber = (1)
H323.008 TCPc      :  3>    forwardLogicalChannelParameters = (-555)
H323.008 TCPc      :  4>     dataType = (0)
H323.008 TCPc      :  5>      audioData = (0)
H323.008 TCPc      :  6>       g7231 = (0)
H323.008 TCPc      :  7>        maxAl-sduAudioFrames = (8)
H323.008 TCPc      :  7>        silenceSuppression = (0)
H323.008 TCPc      :  4>     multiplexParameters = (-555)
H323.008 TCPc      :  5>      h2250LogicalChannelParameters = (-555)
H323.008 TCPc      :  6>       sessionID = (1)
H323.008 TCPc      :  6>       mediaControlChannel = (0)
H323.008 TCPc      :  7>        unicastAddress = (0)
H323.008 TCPc      :  8>         iPAddress = (0)
H323.008 TCPc      :  9>          network = (4) '....' =0x0f010102 <15.1.1.2>
H323.008 TCPc      :  9>          tsapIdentifier = (20001)
H323.008 TCPc      :  6>       dynamicRTPPayloadType = (97)
H323.008 TCPc      : Binary:
H323.008 TCPc      : 00000   03 00 00 00 0d 00 07 40 00 0b 04 40 01 00 0f 01    |.......@...@....|
H323.008 TCPc      : 00016   01 02 4e 21 08                                     |..N!.|
H323.008 TCPc      : New message (channel 6) recv <-- openLogicalChannel:
H323.008 TCPc      : Binary:
H323.008 TCPc      : 00000   03 00 00 00 0d 00 07 40 00 0b 04 40 01 00 0f 01    |.......@...@....|
H323.008 TCPc      : 00016   01 01 4e 29 10                                     |..N).|
H323.008 TCPc      : Message:
H323.008 TCPc      :  0> MultimediaSystemControlMessage = (5936)
H323.008 TCPc      :  1>  request = (27148)
H323.008 TCPc      :  2>   openLogicalChannel = (-111)
H323.008 TCPc      :  3>    forwardLogicalChannelNumber = (1)
H323.008 TCPc      :  3>    forwardLogicalChannelParameters = (-111)
H323.008 TCPc      :  4>     dataType = (3061)
H323.008 TCPc      :  5>      audioData = (12257)
H323.008 TCPc      :  6>       g7231 = (-111)
H323.008 TCPc      :  7>        maxAl-sduAudioFrames = (8)
H323.008 TCPc      :  7>        silenceSuppression = (0)
H323.008 TCPc      :  4>     multiplexParameters = (22243)
H323.008 TCPc      :  5>      h2250LogicalChannelParameters = (-111)
H323.008 TCPc      :  6>       sessionID = (1)
H323.008 TCPc      :  6>       mediaControlChannel = (7356)
H323.008 TCPc      :  7>        unicastAddress = (27104)
H323.008 TCPc      :  8>         iPAddress = (-111)
H323.008 TCPc      :  9>          network = (4) '....' =0x0f010101 <15.1.1.1>
H323.008 TCPc      :  9>          tsapIdentifier = (20009)
H323.008 TCPc      :  6>       dynamicRTPPayloadType = (98)
H323.008 TCPc      : New message (channel 6) sent --> openLogicalChannelAck:
H323.008 TCPc      : Message:
H323.008 TCPc      :  0> MultimediaSystemControlMessage = (0)
H323.008 TCPc      :  1>  response = (-555)
H323.008 TCPc      :  2>   openLogicalChannelAck = (-555)
H323.008 TCPc      :  3>    forwardLogicalChannelNumber = (1)
H323.008 TCPc      :  3>    forwardMultiplexAckParameters = (-555)
H323.008 TCPc      :  4>     h2250LogicalChannelAckParameters = (-555)
H323.008 TCPc      :  5>      sessionID = (1)
H323.008 TCPc      :  5>      mediaChannel = (0)
H323.008 TCPc      :  6>       unicastAddress = (0)
H323.008 TCPc      :  7>        iPAddress = (0)
H323.008 TCPc      :  8>         network = (4) '....' =0x0f010102 <15.1.1.2>
H323.008 TCPc      :  8>         tsapIdentifier = (20002)
H323.008 TCPc      :  5>      mediaControlChannel = (0)
H323.008 TCPc      :  6>       unicastAddress = (0)
H323.008 TCPc      :  7>        iPAddress = (0)
H323.008 TCPc      :  8>         network = (4) '....' =0x0f010102 <15.1.1.2>
H323.008 TCPc      :  8>         tsapIdentifier = (20001)
H323.008 TCPc      :  5>      dynamicRTPPayloadType = (99)
H323.008 TCPc      : Binary:
H323.008 TCPc      : 00000   22 c0 00 00 04 80 11 1e 00 00 0f 01 01 02 4e 22    |"À...€........N"|
H323.008 TCPc      : 00016   00 0f 01 01 02 4e 21 18                            |.....N!.|
H323.008 TCPc      : New message (channel 6) recv <-- openLogicalChannel:
H323.008 TCPc      : Binary:
H323.008 TCPc      : 00000   03 c0 00 01 10 18 30 01 00 40 33 f4 80 03 00 00    |.À....0..@3ô€...|
H323.008 TCPc      : 00016   00 50 18 30 01 00 40 33 f4 80 03 00 00 00 03 00    |.P.0..@3ô€......|
H323.008 TCPc      : 00032   12 62 00 0f 01 01 01 4e 35 03 80 43 61 6c 6c 69    |.b.....N5.€Calli|
H323.008 TCPc      : 00048   6e 67 00                                           |ng.|
H323.008 TCPc      : Message:
H323.008 TCPc      :  0> MultimediaSystemControlMessage = (5936)
H323.008 TCPc      :  1>  request = (27148)
H323.008 TCPc      :  2>   openLogicalChannel = (-111)
H323.008 TCPc      :  3>    forwardLogicalChannelNumber = (2)
H323.008 TCPc      :  3>    forwardLogicalChannelParameters = (-111)
H323.008 TCPc      :  4>     dataType = (3621)
H323.008 TCPc      :  5>      data = (-111)
H323.008 TCPc      :  6>       application = (5273)
H323.008 TCPc      :  7>        t120 = (9097)
H323.008 TCPc      :  8>         separateLANStack = (-123)
H323.008 TCPc      :  6>       maxBitRate = (13300)
H323.008 TCPc      :  4>     multiplexParameters = (22243)
H323.008 TCPc      :  5>      h2250LogicalChannelParameters = (-111)
H323.008 TCPc      :  6>       sessionID = (0)
```

```
H323.008 TCPc      :  3>    reverseLogicalChannelParameters = (-111)
H323.008 TCPc      :  4>     dataType = (3621)
H323.008 TCPc      :  5>      data = (-111)
H323.008 TCPc      :  6>       application = (5273)
H323.008 TCPc      :  7>        t120 = (9097)
H323.008 TCPc      :  8>         separateLANStack = (-123)
H323.008 TCPc      :  6>       maxBitRate = (13300)
H323.008 TCPc      :  4>     multiplexParameters = (22243)
H323.008 TCPc      :  5>      h2250LogicalChannelParameters = (-111)
H323.008 TCPc      :  6>       sessionID = (0)
H323.008 TCPc      :  3>    separateStack = (-111)
H323.008 TCPc      :  4>     distribution = (3302)
H323.008 TCPc      :  5>      unicast = (-123)
H323.008 TCPc      :  4>     networkAddress = (14812)
H323.008 TCPc      :  5>      localAreaAddress = (7356)
H323.008 TCPc      :  6>       unicastAddress = (27104)
H323.008 TCPc      :  7>        iPAddress = (-111)
H323.008 TCPc      :  8>         network = (4) '....' =0x0f010101 <15.1.1.1>
H323.008 TCPc      :  8>         tsapIdentifier = (20021)
H323.008 TCPc      :  4>     associateConference = (0)
H323.008 TCPc      :  4>     externalReference = (8) 'Calling.' =0x43616c6c696e6700
H323.008 TCPc      : New message (channel 6) sent --> openLogicalChannelAck:
H323.008 TCPc      : Message:
H323.008 TCPc      :  0> MultimediaSystemControlMessage = (0)
H323.008 TCPc      :  1>  response = (-555)
H323.008 TCPc      :  2>   openLogicalChannelAck = (-555)
H323.008 TCPc      :  3>    forwardLogicalChannelNumber = (2)
H323.008 TCPc      :  3>    reverseLogicalChannelParameters = (-555)
H323.008 TCPc      :  4>     reverseLogicalChannelNumber = (2)
H323.008 TCPc      :  3>    separateStack = (0)
H323.008 TCPc      :  4>     distribution = (-555)
H323.008 TCPc      :  5>      unicast = (0)
H323.008 TCPc      :  4>     networkAddress = (-555)
H323.008 TCPc      :  5>      localAreaAddress = (0)
H323.008 TCPc      :  6>       unicastAddress = (0)
H323.008 TCPc      :  7>        iPAddress = (0)
H323.008 TCPc      :  8>         network = (4) '....' =0x0f010102 <15.1.1.2>
H323.008 TCPc      :  8>         tsapIdentifier = (20017)
H323.008 TCPc      :  4>     associateConference = (0)
H323.008 TCPc      :  4>     externalReference = (7) 'Answer.' =0x416e7377657200
H323.008 TCPc      : Binary:
H323.008 TCPc      : 00000   22 e0 00 01 00 00 01 05 00 11 62 00 0f 01 01 02    |"à........b.....|
H323.008 TCPc      : 00016   4e 31 03 00 41 6e 73 77 65 72 00                   |N1..Answer.|
H323.008 TCPc      : New message (channel 6) recv <-- openLogicalChannelAck:
H323.008 TCPc      : Binary:
H323.008 TCPc      : 00000   22 c0 00 00 04 80 11 1e 00 00 0f 01 01 01 4e 2a    |"À...€........N*|
H323.008 TCPc      : 00016   00 0f 01 01 01 4e 29 10                           |.....N).|
H323.008 TCPc      : Message:
H323.008 TCPc      :  0> MultimediaSystemControlMessage = (11951)
H323.008 TCPc      :  1>  response = (4525)
H323.008 TCPc      :  2>   openLogicalChannelAck = (-111)
H323.008 TCPc      :  3>    forwardLogicalChannelNumber = (1)
H323.008 TCPc      :  3>    forwardMultiplexAckParameters = (10856)
H323.008 TCPc      :  4>     h2250LogicalChannelAckParameters = (-111)
H323.008 TCPc      :  5>      sessionID = (1)
H323.008 TCPc      :  5>      mediaChannel = (7356)
H323.008 TCPc      :  6>       unicastAddress = (27104)
H323.008 TCPc      :  7>        iPAddress = (-111)
H323.008 TCPc      :  8>         network = (4) '....' =0x0f010101 <15.1.1.1>
H323.008 TCPc      :  8>         tsapIdentifier = (20010)
H323.008 TCPc      :  5>      mediaControlChannel = (7356)
H323.008 TCPc      :  6>       unicastAddress = (27104)
H323.008 TCPc      :  7>        iPAddress = (-111)
H323.008 TCPc      :  8>         network = (4) '....' =0x0f010101 <15.1.1.1>
H323.008 TCPc      :  8>         tsapIdentifier = (20009)
H323.008 TCPc      :  5>      dynamicRTPPayloadType = (98)
H323.008 TCPc      : New message (channel 6) recv <-- openLogicalChannelConfirm:
H323.008 TCPc      : Binary:
H323.008 TCPc      : 00000   64 00 00 01                                       |d...|
H323.008 TCPc      : Message:
H323.008 TCPc      :  0> MultimediaSystemControlMessage = (18884)
H323.008 TCPc      :  1>  indication = (15930)
H323.008 TCPc      :  2>   openLogicalChannelConfirm = (-111)
H323.008 TCPc      :  3>    forwardLogicalChannelNumber = (2)
H323.002 State CALL ESTABLISHED ln 1
```

Below, the results obtained if you set the trace level to 1 are displayed:

```
H323 Mon>TRACE TCP
Select trace level 0-3[0]? 1
H323 Mon>
* P 2
 H323.002 State OFF THE HOOK ln 1
 H323.002 State DIALING ln 1
 H323.002 State CALLING ln 1
 H323.008 TCPc      : Opening channel 7 (size=2)
 H323.008 TCPc      : Connecting channel 7
 H323.008 TCPc      : Connected channel 7
 H323.008 TCPc      : Listen on channel 8 (size=3)
 H323.003 Est Dialtone md  ln 1
 H323.008 TCPc      : New message (channel 7) sent --> setup:
 H323.008 TCPc      : New message (channel 7) recv <-- callProceeding:
 H323.003 Est Dialtone md  ln 1
 H323.008 TCPc      : New message (channel 7) recv <-- alerting:
 H323.003 Est Proceeding md  ln 1
 H323.008 TCPc      : Connecting channel 9 (size=4)
 H323.008 TCPc      : New message (channel 7) recv <-- connect:
 H323.003 Est Connected md ConnectedCallSetup ln 1
 H323.002 State REMOTE ALERTED ln 1
 H323.008 TCPc      : Connected channel 9
 H323.008 TCPc      : New message (channel 9) sent --> terminalCapabilitySet:
 H323.008 TCPc      : New message (channel 9) sent --> masterSlaveDetermination:
 H323.008 TCPc      : New message (channel 9) recv <-- masterSlaveDetermination:
 H323.008 TCPc      : New message (channel 9) sent --> masterSlaveDeterminationAck:
 H323.008 TCPc      : New message (channel 9) recv <-- terminalCapabilitySet:
 H323.008 TCPc      : New message (channel 9) sent --> terminalCapabilitySetAck:
 H323.008 TCPc      : New message (channel 9) recv <-- terminalCapabilitySetAck:
 H323.008 TCPc      : New message (channel 9) recv <-- masterSlaveDeterminationAck:
 H323.003 Est Connected md ConnectedCall ln 1
 H323.008 TCPc      : New message (channel 9) sent --> openLogicalChannel:
 H323.008 TCPc      : New message (channel 9) recv <-- openLogicalChannel:
 H323.008 TCPc      : New message (channel 9) sent --> openLogicalChannelAck:
 H323.008 TCPc      : New message (channel 9) recv <-- openLogicalChannel:
 H323.008 TCPc      : New message (channel 9) sent --> openLogicalChannelAck:
 H323.008 TCPc      : New message (channel 9) recv <-- openLogicalChannelAck:
 H323.008 TCPc      : New message (channel 9) recv <-- openLogicalChannelConfirm:
 H323.002 State CALL ESTABLISHED ln 1
```

d) TRACE LIST

Displays the current debugging level and the current status of the viewing options.

Example:

```
H323 Mon>TRACE LIST
Trace level: 1
1> Show Binary  ENABLED
2> Show Spaces  ENABLED
3> Show <node>  ENABLED
4> Show Header  ENABLED
5> Show levels  ENABLED
6> Cut line     DISABLED
7> Show Types   ENABLED
H323 Mon>
```

e) TRACE RCD

Debugging command for Teldat's own use. This should only be used by Teldat's Technical Support personnel.

f) TRACE SCKT

Debugging command for Teldat's own use. This should only be used by Teldat's Technical Support personnel.

g) TRACE TCP

Activates the H323 events related with TCP. This includes both the call establishment and release process with Q.931 as well as the devices capacity negotiation (codec type, fax …) with H.245. This requests the debugging level. If this value cannot be supported due to the size of the events buffer, adjust the debugging level to 1. For further information consult the **TRACE LEVEL** command. By default the TCP traces are disabled.

Example:

```
H323 Mon>TRACE TCP
Select trace level 0-3[0]? 3
H323 Mon>
```

To disable the traces, modify the debugging level to the 0 value with the **TRACE LEVEL** command.

h) TRACE UDP

Activates the H323 events related to UDP. In this case only that related to RAS is displayed. By default the UDP traces are disabled.

Example:

```
H323 Mon>TRACE UDP
Select trace level 0-3[0]? 1
```

To disable the traces, modify the debugging level to the 0 value with the **TRACE LEVEL** command.

1.8. EXIT

Use the **EXIT** command to return to the previous prompt.

Syntax:

```
H323 Mon>EXIT
```

Example:

```
H323 Mon>EXIT
+
```

1.9. TREE COMMANDS MONITORING

CLEAR
- RELEASED calls
- STATISTICS

DISPLAY
- CAUSE
  - *RELEASED*
  - *RAS*
  - *VOICE-MSG*
- LINE
- RAS

LIST
- ACTIVE calls
- RELEASED calls
- STATISTICS
  - *GW*
  - *LAST call*
- TRACE

REGISTER

UNREGISTER

TRACE
- DISABLE
- ENABLE
- LEVEL
- LIST
- RCD
- SCKT
- TCP
- UDP

EXIT

2. Echo compensation

In some Voice over IP installations where analogical Voice Kits are used (i.e. with FXS/FXO interfaces) echoes can be produced. This is due to the fact that a conversion from two to four wires is executed through a hybrid coil where the impedance adjustment is not perfect. The source of the echo is displayed in Figure 1.

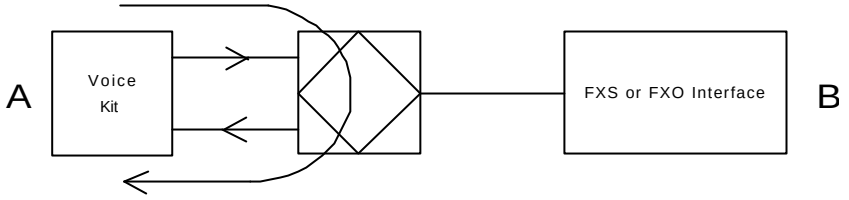

Figure 1: Appearance of the echo on passing from two to four wires.

Our device incorporates an echo canceller that reduces the said echo. However it is only capable of operating effectively when the Signal to Echo ratio is higher or equal to 6dB. In this case the signal is the output signal from the voice kit towards the hybrid.

The only configuration parameter that affects the echo is the microphone gain in such a way that less gain better signal to echo ratio and therefore a better performance from the canceller. (The speaker gain has no influence as this is applied to both the signal as well as the echo).

If the echo is perceived at the A end of the conversion, the microphone gain parameter should be adjusted at the other B end. This is due to the fact that the echo produced at the A end as shown in Figure 1 is encoded and transmitted by IP to the other end in such a way that it arrives with an appreciable temporary difference with respect to the original signal and therefore manifests as a perceptible echo.

Chapter 4
Examples

1. Description

This chapter includes a series of examples which display the possibilities of Teldat's voice gateway in different scenarios and use conditions.

They are organized firstly by the presence or absence of a gatekeeper that supervises and controls a given zone and secondly by the type of connection interface of the voice devices.

In each case the description is proposed in customer terms (what you wish it to do, the proposed numeration plan, the assembly it has, etc) and an assembly diagram is displayed with all the relevant parameters to carry out the assembly of Voice over IP. Subsequently a description is given on how to broach the implementation from the point of view of a consultant who knows the Teldat devices and with all the real configuration of the device. Finally, the set of tests that require carrying out is enumerated and the obtained results.

2. EVIRONMENTS WITHOUT GATEKEEPER

2.1. Two voice gateways connected by LAN

Description:

A company has two offices connected to each other through a point-to-point line at 64 Kbps, and you wish to install a voice service between them without having to replace the existing routers. The proposed numeration plan consists of 2 digit telephone numbers in such a way that office A begins with 1 and office B begins with 2.

The connection between the two offices is carried out through a WAN line at 64 Kbps, with one office having IP addresses 172.1.1.x (class C) and the other IP addresses IP 172.1.2.x (class C).

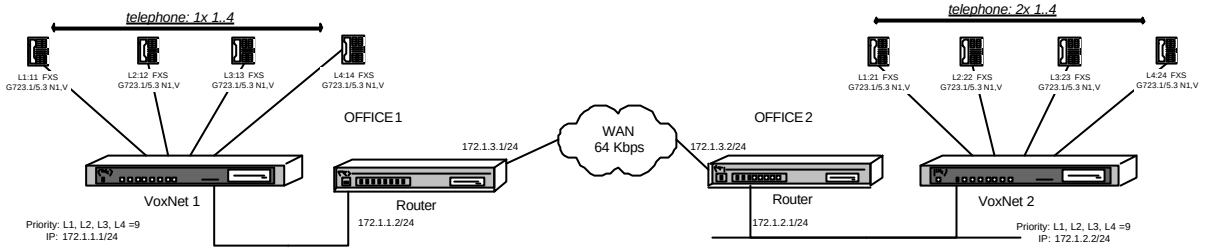

Figure 2.

Proposed Configuration:

The telephone numbers of the lines connected to the VoxNet 1 gateway will have a 1x pattern, where x counts between 1 and 4 (from now on this will be know as 1..4) and the telephone numbers of lines connected to the VoxNet 2 gateway will have a 2x pattern, where x is in the range of 1..4.

The VoxNet 1 gateway will have address 172.1.1.1/24 and the VoxNet 2 address 1721.2.2/24.

All the parameters will be left as default, and you only set the telephone numbers of the lines, which will be added to the lines table and an entry in the address table for each gateway. In the case of the VoxNet 1, this routes all telephone numbers that begin with 2 towards IP address 172.1.2.2/24 and in the case of VoxNet 2, routes all telephone numbers beginning with 1 towards IP address 172.1.1.1/24.

Two entries are added to the prefixes table in both gateways that assign a length of 2 digits to all numbers beginning with 1 or 2. As another type of dialing does not make sense, the number dialed must adjust to these entries through the **MATCH-DIALING** command.

By default all the called telephones permit hanging up the call, i.e. this permits hanging up the telephone without ending the call in such a way that you can pick up the receiver again and continue the call. In this case this behavior is considered useful and is not disabled.

An important aspect in this environment is the quality of service. So that this operates correctly, you need to make sure that the voice traffic has a minimum LAN and WAN availability expressed in terms of bandwidth and access time. Problems will appear in both interfaces if the lines in question have a lot of traffic or have very high peaks of traffic. To resolve this in the case of the WAN line, you can apply fragmentation mechanisms (to decrease the delay of the voice frames) and bandwidth reservation mechanisms and traffic priority. In the case of the LAN, the use of switches is recommended. These separate the traffic and improve the use of the LAN bandwidth. In this example these problems are not taken into account and assumes the availability of the lines is that required.

Configurations:

VoxNet 1:

H323:

```
voxnet 1 H323 Config>LIST ALL

 GATEWAY PARAMETERS

Gateway internal address: 172.1.1.1
Fast Connect: Disabled                Q931 port: 1720
H323 call mode: Compatible            UDP  port: 20000

Gatekeeper address 0.0.0.0            Gateway name:
Gatekeeper zone:                      Tech-Prefix :
                                      Register E.164: Enabled

RAS port: 1719                        RAS time to live: 60
RAS timeout: 20                       RAS Connection attempt fail:  10

Enable Service Addr 0.0.0.0           Type of Service Disable: Disable Lines

VOICE PARAMETRES

Dial tone frequency:      425      Ring tone activity: 15
Dial voice message:                Ring tone silence:  30

Alerting tone frequency:  425      Busy tone frequency: 425
Alerting tone activity:    15      Busy tone activity:  2
Alerting tone silence:     30      Busy tone silence:   2
Alerting voice message:            Busy voice message:

Error tone frequency:     425      Error tone silence 1: 2
Error tone activity:        2      Error tone silence 2: 6
Error voice message:

DTMF tones timeout:  10            Error Timeout: 30
Maximum delay: 300
Silent timeout for Releasing a Call in FXO: 0 Secs

 LINE 1 PARAMETERS

Telephone number: 11                   Interface type: FXS
Direct dialing:                        State: Enabled
Identifier H323:                       Priority: 9

Codec: G723 5.3Kbps                    VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : in band

Speaker gain: 0   dB                   Tone level: 0 dB
Mic gain: 10 dB

 LINE 2 PARAMETERS

Telephone number: 12                   Interface type: FXS
Direct dialing:                        State: Enabled
Identifier H323:                       Priority: 9

Codec: G723 5.3Kbps                    VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : in band

Speaker gain: 0   dB                   Tone level: 0 dB
Mic gain: 10 dB


 LINE 3 PARAMETERS

Telephone number: 13                   Interface type: FXS
Direct dialing:                        State: Enabled
Identifier H323:                       Priority: 9

Codec: G723 5.3Kbps                    VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : in band
```

```
Speaker gain: 0   dB                    Tone level: 0 dB
Mic gain: 10 dB


 LINE 4 PARAMETERS

Telephone number: 14                    Interface type: FXS
Direct dialing:                         State: Enabled
Identifier H323:                        Priority: 9

Codec: G723 5.3Kbps                     VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)   DTMF relay : in band

Speaker gain: 0   dB                    Tone level: 0 dB
Mic gain: 10 dB

Order LINE      TELEPHONE  STRIP-PREFIX DIAL-OUT-PREFIX

  1      1              11       0
  2      2              12       0
  3      3              13       0
  4      4              14       0

Entry:   1              Telephone: 2                Strip prefix: 0
Codec class: --         IP Addr: 172.1.2.2          Dial-Out Pref:
Tech Prefix:            Num. type: unknown          Translation: --
Local IP: 0.0.0.0

Match Dialing Plan: Enabled

Order  PREFIX         LENGTH

  1     1               2
  2     2               2

Id     Codec      frm/pkt (bytes)  VAD


voxnet 1 H323 Config>
```

Configuration:

```
voxnet 1 Config>SHOW CONFIG
; Showing System Configuration ...
; Gateway VOXNET 2 14 Version x.x.x

set hostname voxnet 1
protocol ip
; -- Internet protocol user configuration --
   internal-ip-address 172.1.1.1
;
   address  ethernet0/0     172.1.1.1        255.255.255.0
;
;
   route 172.1.2.0       255.255.255.0   172.1.1.2       1
;
exit
;
protocol h323
;
   destination 2 172.1.1.2 default
;
   port 1 11 default
;
   port 2 12 default
;
   port 3 13 default
;
   port 4 14 default
;
   match-dialing
```

```
   prefix 1 2
   prefix 2 2
   line 1 telephone-number 11
;
   line 2 telephone-number 12
;
   line 3 telephone-number 13
;
   line 4 telephone-number 14
;
exit
;
voxnet 1 Config>
```

VoxNet 2:

H323:

```
voxnet 2 H323 Config>LIST ALL

 GATEWAY PARAMETERS

Gateway internal address: 172.1.2.2
Fast Connect: Disabled               Q931 port: 1720
H323 call mode: Compatible           UDP  port: 20000

Gatekeeper address 0.0.0.0           Gateway name:
Gatekeeper zone:                     Tech-Prefix :
                                     Register E.164: Enabled

RAS port: 1719                       RAS time to live: 60
RAS timeout: 20                      RAS Connection attempt fail:  10

Enable Service Addr 0.0.0.0          Type of Service Disable: Disable Lines

 VOICE PARAMETRES

Dial tone frequency:      425      Ring tone activity: 15
Dial voice message:                Ring tone silence:  30

Alerting tone frequency:  425      Busy tone frequency: 425
Alerting tone activity:    15      Busy tone activity:  2
Alerting tone silence:     30      Busy tone silence:   2
Alerting voice message:            Busy voice message:

Error tone frequency:     425      Error tone silence 1: 2
Error tone activity:        2      Error tone silence 2: 6
Error voice message:

DTMF tones timeout:  10            Error Timeout: 30
Maximum delay: 300
Silent timeout for Releasing a Call in FXO: 0 Secs

 LINE 1 PARAMETERS

Telephone number: 21                   Interface type: FXS
Direct dialing:                        State: Enabled
Identifier H323:                       Priority: 9

Codec: G723 5.3Kbps                    VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : in band

Speaker gain: 0   dB                   Tone level: 0 dB
Mic gain: 10 dB


LINE 2 PARAMETERS

Telephone number: 22                   Interface type: FXS
Direct dialing:                        State: Enabled
Identifier H323:                       Priority: 9
```

```
Codec: G723 5.3Kbps                    VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : in band

Speaker gain: 0   dB                   Tone level: 0 dB
Mic gain: 10 dB


 LINE 3 PARAMETERS

Telephone number: 23                   Interface type: FXS
Direct dialing:                        State: Enabled
Identifier H323:                       Priority: 9

Codec: G723 5.3Kbps                    VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : in band

Speaker gain: 0   dB                   Tone level: 0 dB
Mic gain: 10 dB


LINE 4 PARAMETERS

Telephone number: 24                   Interface type: FXS
Direct dialing:                        State: Enabled
Identifier H323:                       Priority: 9

Codec: G723 5.3Kbps                    VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : in band

Speaker gain: 0   dB                   Tone level: 0 dB
Mic gain: 10 dB


Order LINE      TELEPHONE  STRIP-PREFIX DIAL-OUT-PREFIX

  1      1              21       0
  2      2              22       0
  3      3              23       0
  4      4              24       0

Entry:   1              Telephone: 1               Strip prefix: 0
Codec class: --         IP Addr: 172.1.1.1         Dial-Out Pref:
Tech Prefix:            Num. type: unknown         Translation: --
Local IP: 0.0.0.0

Match Dialing Plan: Enabled

Order  PREFIX         LENGTH

  1     2               2
  2     1               2

Id     Codec      frm/pkt (bytes)  VAD


voxnet 2 H323 Config>
```

Configuration:

```
voxnet 2 Config>SHOW CONFIG
; Showing System Configuration ...
; Gateway VOXNET 2 14 Version x.x.x

set hostname voxnet 2
protocol ip
; -- Internet protocol user configuration --
   internal-ip-address 172.1.2.2
;
   address  ethernet0/0     172.1.2.2        255.255.255.0
;
;
```

```
   route 172.1.1.0       255.255.255.0   172.1.2.1       1
;
exit
;
protocol h323
;
   destination 1 172.1.1.1 default
;
   port 1 21 default
;
   port 2 22 default
;
   port 3 23 default
;
   port 4 24 default
;
   match-dialing
   prefix 1 2
   prefix 2 2
   line 1 telephone-number 21
;
   line 2 telephone-number 22
;
   line 3 telephone-number 23
;
   line 4 telephone-number 24
;
exit
;
voxnet 2 Config>
```

Tests:

Calls from an office telephone to a telephone located in the other office:

Pick up a telephone receiver connected to the VoxNet 1 and dial 21. The telephone connected to the VoxNet 2 line 1 will begin to ring. When the call is answered, a brief silence is produced after which you can speak. Contrariwise simply pick up the telephone connected to VoxNet 2 and dial 11; subsequently the telephone connected to the VoxNet 1 line 1 will begin to ring.

In order to have audio as soon as you pick up the receiver, you must have the FAST-CONNECT option enabled in both gateways. However in this case the codec used in the lines that intervene in the call must be the same.

The entire process can be monitored by activating the H323.001 and H323.002 events. In this way, on the caller side you can see how on picking up this line passes to a HOOK OFF state and on dialing the first digit, passes to DIALING. When dialing is complete, the call is carried out, passing to the CALLING status. When the remote end has been advised and the telephone begins to ring, the line takes the REMOTE ALERTED state finally passing to CALL ESTABLISHED when the user picks up the receiver.

```
02/14/01 11:02:32  H323.001 Ev HOOK OFF  ln 3
02/14/01 11:02:32  H323.002 State OFF THE HOOK ln 3
02/14/01 11:02:35  H323.001 Ev DTMF RCV 2 ln 3
02/14/01 11:02:35  H323.002 State DIALING ln 3
02/14/01 11:02:35  H323.001 Ev DTMF RCV 1 ln 3
02/14/01 11:02:35  H323.002 State CALLING ln 3
02/14/01 11:02:35  H323.001 Ev ALERTING  ln 3
02/14/01 11:02:35  H323.002 State REMOTE ALERTED ln 3
02/14/01 11:02:35  H323.001 Ev ESTABLISH  ln 3
02/14/01 11:02:36  H323.002 State CALL ESTABLISHED ln 3
```

On hanging up a line, it first takes the WTG IDLE state, indicating that it is proceeding to release the call and finally finishes in the IDLE state when the release is complete.

```
02/14/01 11:18:29  H323.001 Ev HOOK ON  ln 1
02/14/01 11:18:29  H323.002 State WTG IDLE ln 1
02/14/01 11:18:30  H323.001 Ev RELEASE  ln 1
02/14/01 11:18:30  H323.002 State IDDLE ln 1
```

On the called side the line passes to an ALERTING state and the telephone begins to ring. On picking up this line takes the CALL ESTABLISHED state.

```
02/14/01 11:20:48  H323.001 Ev INCOMMING CALL  ln 1
02/14/01 11:20:48  H323.002 State ALERTING ln 1
02/14/01 11:20:49  H323.001 Ev HOOK OFF  ln 1
02/14/01 11:20:50  H323.002 State CALL ESTABLISHED ln 1
```

If the remote end hangs up, the line passes to an ERROR state until you hang up the telephone, at which time it passes to an IDLE state.

```
02/14/01 11:21:02  H323.002 State ERROR ln 1
02/14/01 11:21:04  H323.001 Ev HOOK ON  ln 1
02/14/01 11:21:04  H323.002 State IDDLE ln 1
```

If in the CALL ESTABLISHED state the called telephone hangs up, the line passes to the SUSPEND state and if some time has passed and the call is not picked up, it is released and the line passes the IDLE state.

```
02/14/01 11:24:46  H323.001 Ev HOOK ON  ln 1
02/14/01 11:24:46  H323.002 State CALL SUSPENDED ln 1
02/14/01 11:25:16  H323.002 State WTG IDLE ln 1
02/14/01 11:25:16  H323.001 Ev RELEASE  ln 1
02/14/01 11:25:16  H323.002 State IDDLE ln 1
```

Calls between telephones in the same office:

Pick up the telephone connected to the VoxNet 1 line 1 and dial 12. The telephone connected to the VoxNet 1 line 2 will begin to ring. Simply pick up the receiver in order to have audio. In cases where the caller is internal to the device and the H323 protocol methods are not used to establish the call, the response is immediate.

To check the VoxNet 2 functionality, pick up the telephone connected to line 1 of this gateway and dial 22. Subsequently the telephone connected to line 2 will begin to ring.

Calls from an office telephone to a busy telephone located in the other office:

Pick up the telephone connected to the VoxNet 2 line 1. Subsequently call this telephone (21) from one connected to VoxNet 1. You will see how as line 1 is busy, the call is diverted to line 2 (telephone 22). In order to avoid calls being diverted to a line, simply set its priority to 0 through the SET LINE PRIORITY command.

2.2. A voice gateway connected with a H323 terminal (Netmeeting)

A company wishes to have voice service between its central that has a switchboard and one of its offices that does not have a switchboard. Furthermore they want two of the PCs that are installed in the central to be able to make and receive calls from an office telephone as well as from an extension from the central. To carry this out, install the Microsoft NetMeeting program in each PC. You do not want access to non-corporate telephones through voice over IP.

The extensions from the switchboard located in the company's headquarters follow the 6xx pattern. The office telephones will follow the 2x pattern where x takes values between 1 and 4 (from this point known as 1..4). The telephone numbers 801 and 802 will be arbitrarily assigned to the PCs.

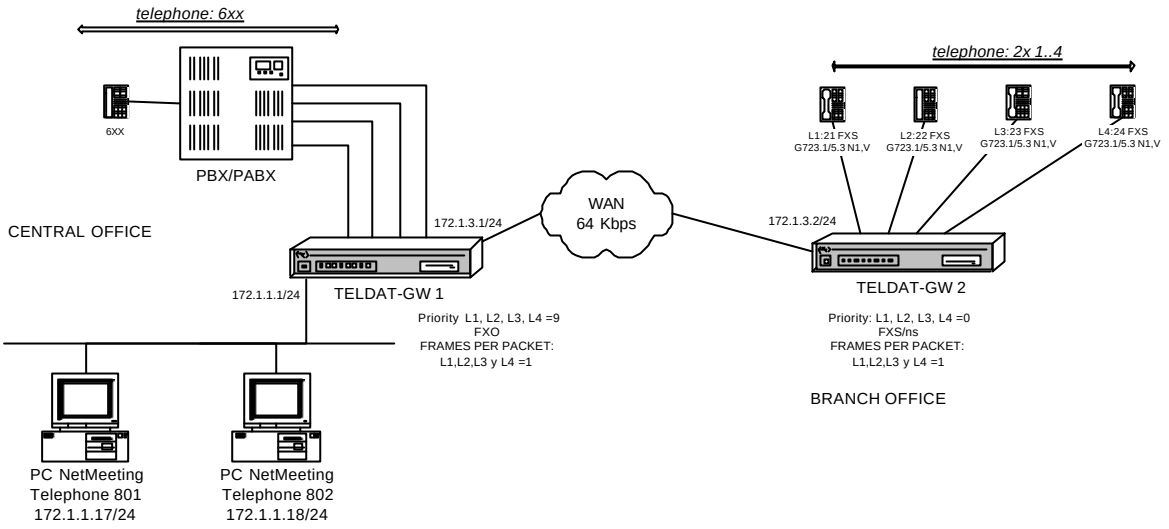

Figure 3.

Proposed Configuration:

Numeration plan:

In both routers you must add an entry to the addresses table that associates telephone 801 to the IP address of the first PC (172.1.1.17/24) and the telephone 802 to the address of the second PC (172.1.1.18/24). Additionally you must add an entry in the Teldat-GW 2 router that associates the telephone numbers beginning with 6 to IP address 172.1.1.1/24 and an entry in the Teldat-GW 1 router that associates the telephone numbers beginning with 2 with IP address 172.1.3.2/24.

With the aim of being able to carry out internal calls, you configure the Teldat-GW 2 router lines with telephone numbers 21, 22, 23 and 24, adding these numbers to the lines table.

Enable the MATCH-DIALING options in both routers, in such a way that if the users dial a number that does not adjust to the number specified in the prefixes table the line will automatically pass to an error state, thus increasing the line availability. This occurs because the line directly passes from the DIALING state to the ERROR state preventing the user to carry on dialing an erroneous number.

Lines Configuration:

All the Teldat-GW 1 router lines are configured as FXO, since they will be connected to the switchboard extensions. Contrariwise, the Teldat-GW 2 router lines are maintained in FXS mode since they will be connected to telephones.

So that the central extensions only have to know a single access telephone number for the branch, you need to configure a capture group in the switchboard. In this way, if you choose extension 601 in order to access the branch you must configure extensions 601, 602, 603 and 604 as a capture group, therefore if extension 601 is busy the call is automatically passed to extension 602.

All the FXS lines are configured in non-suspended mode (FXS/ns) in the Teldat-GW 2 router (office) with the aim that the release of a call is carried out as quickly as possible. If this is not configured as such, the calls originating from a switchboard extension directed to an office line will not be released immediately after the users hang up, they will remain blocked until the Teldat-GW 1 router (central) FXO line detects the switchboard has hung up and this strongly depends on the model of switchboard. This is time where despite the fact there is no conversation between the users, the router maintains the call as established thus preventing other users from using the line.

The priority in the Teldat-GW 2 router lines is set to zero in such a way that if a telephone that is busy receives a call, the call is not redirected to any of the other three telephones. The priority in the Teldat-GW 1 is maintained at 9 thus permitting the calls to be switched to free lines.

The remaining parameters take the default values.

NetMeeting:

In the Windows NetMeeting program you must configure the link port for access to the Teldat-GW 1 gateway. This is carried out in the options screen that is obtained through the tools menu (see figure 4). The link port determines the voice gateway is capable of receiving the voice call. In cases of calling a central extension, this link port is 127.1.1.1/24, however if you wish to call an office telephone number, the link port is 172.1.3.2/24.

You should also add an entry in the PC routes table that indicates how to arrive to the rest of the gateways. In this case a route to IP addresses 172.1.3.x. through the 172.1.1.1 gateway.

If the program permits enabling DirectSound, we recommend this be carried out. This option is found in the tools menu, options submenu and in the audio screen.

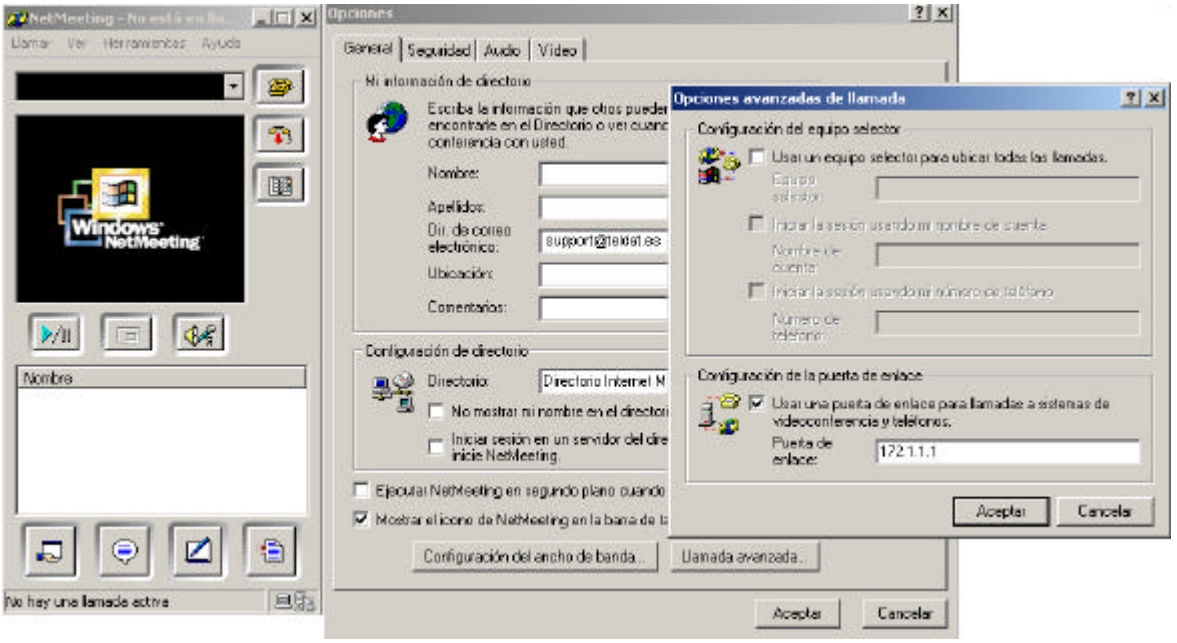

Figure 4.

At the time of making a call from the NetMeeting, you only need to indicate the telephone number and the operation is carried out as if dealing with a normal telephone.

In the following figure you can appreciate how to call telephone 610. On doing this you call switchboard extension 610 located in the central.

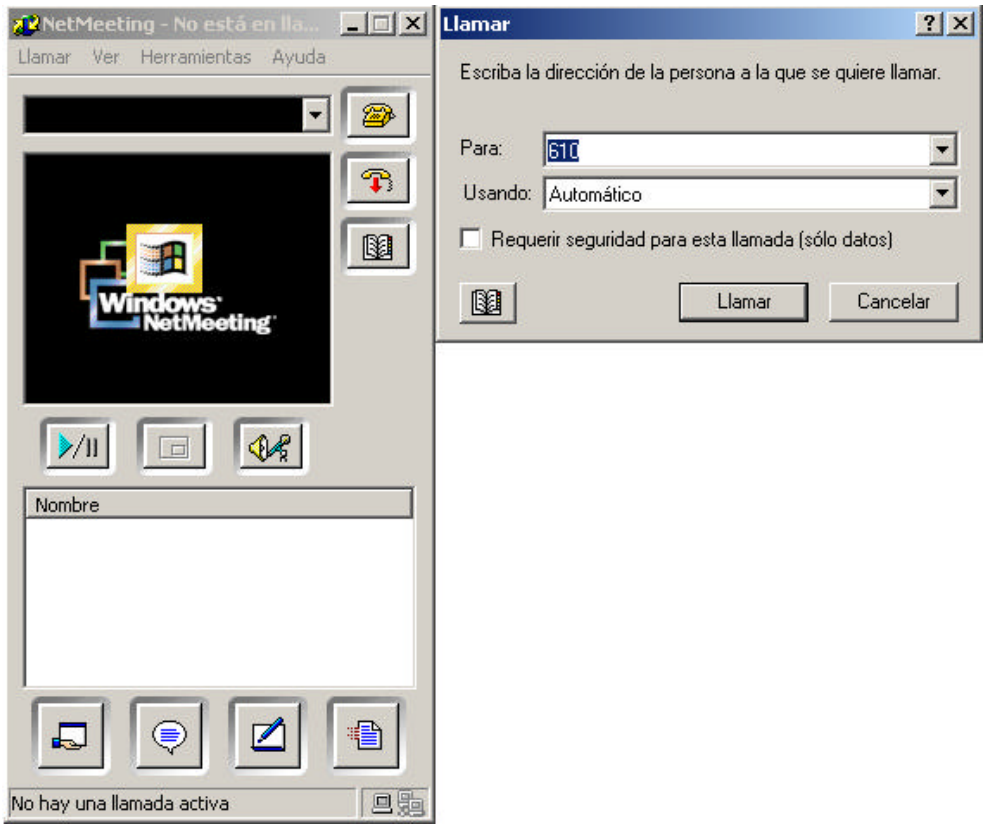

Figure 5.

Problem solving:

If in a call between a voice gateway and NetMeeting there is audio in one direction but not in the other, you must configure the gateway so that the number of RTP packets for each UDP frame are three.

You should also check the codec used by the NetMeeting; this must be G723.1. This can be checked by selecting the Options submenu in the Tools menu. From there select the Audio tab and subsequently the Advanced option.

Configurations:

Teldat-Gw 1 (central):

H323:

```
Teldat-1 H323 Config>LIST ALL

 GATEWAY PARAMETERS

Gateway internal address: 172.1.1.1
Fast Connect: Disabled                Q931 port: 1720
H323 call mode: Compatible            UDP  port: 20000

Gatekeeper address 0.0.0.0            Gateway name:
Gatekeeper zone:                      Tech-Prefix :
                                      Register E.164: Enabled

RAS port: 1719                        RAS time to live: 60
RAS timeout: 20                       RAS Connection attempt fail:  10

Enable Service Addr 0.0.0.0           Type of Service Disable: Disable Lines
```

```
 VOICE PARAMETRES

Dial tone frequency:      425      Ring tone activity: 15
Dial voice message:                Ring tone silence:  30

Alerting tone frequency:  425      Busy tone frequency: 425
Alerting tone activity:    15      Busy tone activity:  2
Alerting tone silence:     30      Busy tone silence:   2
Alerting voice message:            Busy voice message:

Error tone frequency:     425      Error tone silence 1: 2
Error tone activity:        2      Error tone silence 2: 6
Error voice message:

DTMF tones timeout:  10            Error Timeout: 30
Maximum delay: 300

 LINE 1 PARAMETERS

Telephone number: 601                 Interface type: FXO
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 9

Codec: G723 6.4Kbps                   VAD: Enabled
Frames H323/packet RTP: 3 ( 72 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB


 LINE 2 PARAMETERS

Telephone number: 602                 Interface type: FXO
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 9

Codec: G723 6.4Kbps                   VAD: Enabled
Frames H323/packet RTP: 3 ( 72 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB


 LINE 3 PARAMETERS

Telephone number: 603                 Interface type: FXO
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 9

Codec: G723 6.4Kbps                   VAD: Enabled
Frames H323/packet RTP: 3 ( 72 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB


 LINE 4 PARAMETERS

Telephone number: 604                 Interface type: FXO
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 9

Codec: G723 6.4Kbps                   VAD: Enabled
Frames H323/packet RTP: 3 ( 72 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB
```

```
Order LINE      TELEPHONE  STRIP-PREFIX DIAL-OUT-PREFIX


Entry:   1                Telephone: 801              Strip prefix: 0
Codec class: --           IP Addr: 172.1.1.17         Dial-Out Pref:
Tech Prefix:              Num. type: unknown          Translation: --
Local IP: 0.0.0.0

Entry:   2                Telephone: 802              Strip prefix: 0
Codec class: --           IP Addr: 172.1.1.18         Dial-Out Pref:
Tech Prefix:              Num. type: unknown          Translation: --
Local IP: 0.0.0.0

Entry:   3                Telephone: 2                Strip prefix: 0
Codec class: --           IP Addr: 172.1.3.2          Dial-Out Pref:
Tech Prefix:              Num. type: unknown          Translation: --
Local IP: 0.0.0.0

Match Dialing Plan: Enabled

Order  PREFIX         LENGTH

  1     8               3
  2     2               2
  3     6               3

Id     Codec      frm/pkt (bytes)  VAD


Teldat-1 H323 Config>
```

Configuration:

```
Teldat-1 Config>SHOW CONFIG
; Showing System Configuration ...
; Router ATLAS 2 8 Version x.x.x

set data-link frame-relay serial0/0
set data-link frame-relay serial0/1
set data-link frame-relay serial0/2
set hostname Teldat-1
protocol ip
; -- Internet protocol user configuration --
   internal-ip-address 172.1.1.1
;
   address  ethernet0/0     172.1.1.1        255.255.255.0
   address  serial0/1       172.1.3.1        255.255.255.0
   address  x25-node        192.168.252.1    255.255.255.0
;
exit
;
protocol h323
;
   line 1 frames-per-packet 3
   line 1 telephone-number 601
   line 1 interface-type fxo
   line 1 codec g7236k4
;
   line 2 frames-per-packet 3
   line 2 telephone-number 602
   line 2 interface-type fxo
   line 2 codec g7236k4
;
   line 3 frames-per-packet 3
   line 3 telephone-number 603
   line 3 interface-type fxo
   line 3 codec g7236k4
;
   line 4 frames-per-packet 3
   line 4 telephone-number 604
```

```
   line 4 interface-type fxo
   line 4 codec g7236k4
;
   match-dialing
   prefix 8 3
   prefix 2 2
   prefix 6 3
   destination 801 172.1.1.17 default
;
   destination 802 172.1.1.18 default
;
   destination 2 172.1.3.2 default
;
exit
;
Teldat-1 Config>
```

Teldat-Gw 2 (office):

H323:

```
Teldat-2 H323 Config>LIST ALL

 GATEWAY PARAMETERS

Gateway internal address: 172.1.3.2
Fast Connect: Disabled                Q931 port: 1720
H323 call mode: Compatible            UDP  port: 20000

Gatekeeper address 0.0.0.0            Gateway name:
Gatekeeper zone:                      Tech-Prefix :
                                      Register E.164: Enabled

RAS port: 1719                        RAS time to live: 60
RAS timeout: 20                       RAS Connection attempt fail:  10

Enable Service Addr 0.0.0.0           Type of Service Disable: Disable Lines


 VOICE PARAMETRES

Dial tone frequency:      425      Ring tone activity: 15
Dial voice message:                Ring tone silence:  30

Alerting tone frequency:  425      Busy tone frequency: 425
Alerting tone activity:    15      Busy tone activity:  2
Alerting tone silence:     30      Busy tone silence:   2
Alerting voice message:            Busy voice message:

Error tone frequency:     425      Error tone silence 1: 2
Error tone activity:        2      Error tone silence 2: 6
Error voice message:

DTMF tones timeout:  10            Error Timeout: 30
Maximum delay: 300

 LINE 1 PARAMETERS

Telephone number: 21                   Interface type: FXS/ns
Direct dialing:                        State: Enabled
Identifier H323:                       Priority: 0

Codec: G723 5.3Kbps                    VAD: Enabled
Frames H323/packet RTP: 2 ( 40 bytes)  DTMF relay : in band

Speaker gain: 0   dB                   Tone level: 0 dB
Mic gain: 10 dB
```

```
 LINE 2 PARAMETERS

Telephone number: 22                  Interface type: FXS/ns
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 0

Codec: G723 5.3Kbps                   VAD: Enabled
Frames H323/packet RTP: 2 ( 40 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB


 LINE 3 PARAMETERS

Telephone number: 23                  Interface type: FXS/ns
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 0

Codec: G723 5.3Kbps                   VAD: Enabled
Frames H323/packet RTP: 2 ( 40 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB


 LINE 4 PARAMETERS

Telephone number: 24                  Interface type: FXS/ns
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 0

Codec: G723 5.3Kbps                   VAD: Enabled
Frames H323/packet RTP: 2 ( 40 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB



Order LINE      TELEPHONE  STRIP-PREFIX DIAL-OUT-PREFIX

  1      1              21       0
  2      2              22       0
  3      3              23       0
  4      4              24       0

Entry:   1               Telephone: 801             Strip prefix: 0
Codec class: --          IP Addr: 172.1.1.17        Dial-Out Pref:
Tech Prefix:             Num. type: unknown         Translation: --
Local IP: 0.0.0.0

Entry:   2               Telephone: 802             Strip prefix: 0
Codec class: --          IP Addr: 172.1.1.18        Dial-Out Pref:
Tech Prefix:             Num. type: unknown         Translation: --
Local IP: 0.0.0.0

Entry:   3               Telephone: 6               Strip prefix: 0
Codec class: --          IP Addr: 172.1.1.1         Dial-Out Pref:
Tech Prefix:             Num. type: unknown         Translation: --
Local IP: 0.0.0.0

Match Dialing Plan: Enabled

Order  PREFIX         LENGTH

  1     8               3
  2     2               2
  3     6               3
```

```
Id     Codec      frm/pkt (bytes)  VAD


Teldat-2 H323 Config>
```

Configuration:

```
Teldat-2 Config>SHOW CONFIG
; Showing System Configuration ...
; Router ATLAS 2 8 Version 10.0.0

set data-link frame-relay serial0/0
set data-link frame-relay serial0/1
set data-link frame-relay serial0/2
set hostname Teldat-2
protocol ip
; -- Internet protocol user configuration --
   internal-ip-address 172.1.3.2
;
   address  serial0/1       172.1.3.2        255.255.255.0
   address  x25-node        192.168.252.1    255.255.255.0
;
;
   route 172.1.1.0       255.255.255.0   172.1.3.1       1
;
exit
;
protocol h323
;
   line 1 frames-per-packet 2
   line 1 telephone-number 21
   line 1 no suspend-mode
   line 1 priority 0
;
   line 2 frames-per-packet 2
   line 2 telephone-number 22
   line 2 no suspend-mode
   line 2 priority 0
;
   line 3 frames-per-packet 2
   line 3 telephone-number 23
   line 3 no suspend-mode
   line 3 priority 0
;
   line 4 frames-per-packet 2
   line 4 telephone-number 24
   line 4 no suspend-mode
   line 4 priority 0
;
   match-dialing
   prefix 8 3
   prefix 2 2
   prefix 6 3
   destination 801 172.1.1.17 default
;
   destination 802 172.1.1.18 default
;
   destination 6 172.1.1.1 default
;
   port 1 21 default
;
   port 2 22 default
;
   port 3 23 default
;
   port 4 24 default
;
exit
;
Teldat-2 Config>
```

Tests:

Calls from a PC to a switchboard:

To make a call from a PC to a switchboard extension, in the NetMeeting you have to indicate the extension to be called in the field as seen in Figure 5 (in the example, this is 610). The telephone connected to this extension should begin to ring and the call is established normally. To carry out this call, the link port will be 172.1.1.1.

Call from a PC to an office telephone:

To make a call from a PC to an office telephone, you need to indicate in the NetMeeting the office telephone number you wish to speak to (for example 21). The telephone connected to this line should start to ring and the call is established normally. To carry out this call, the link port will be 172.1.3.2.

As you can see, as soon as the communication is established, there is a brief period of some two seconds where the speakers cannot hear. This is due to the fact that in this period the capacities between the NetMeeting terminal and the gateway are being negotiated. As the NetMeeting does not support the Fast-Start mode it is impossible to eliminate this period of silence.

Calls from a switchboard extension to a PC:

Dial one of the switchboard extensions connected to the voice gateway or that assigned as the access to the capture group. When you hear the dialing tone from the router, dial the number associated to the requested PC (801 or 802).

As you can see, as soon as the communication is established, there is a brief period of some two seconds where the speakers cannot hear. This is due to the fact that in this period the capacities between the NetMeeting terminal and the gateway are being negotiated. As the NetMeeting does not support the Fast-Start mode it is impossible to eliminate this period of silence.

Calls from an office telephone to a PC:

Pick up the receiver and dial the number you want, 801 or 802. The call is established normally.

As you can see, as soon as the communication is established, there is a brief period of some two seconds where the speakers cannot hear. This is due to the fact that in this period the capacities between the NetMeeting terminal and the gateway are being negotiated. As the NetMeeting does not support the Fast-Start mode it is impossible to eliminate this period of silence.

2.3. Two voice gateways connected through WAN

a) Connected by FR

Description:

A company wishes to have voice and data service between its central and one of its branches through a Frame Relay link at 64 Kbps using IP addresses pertaining to subnet 172.1.1.0 (C class).

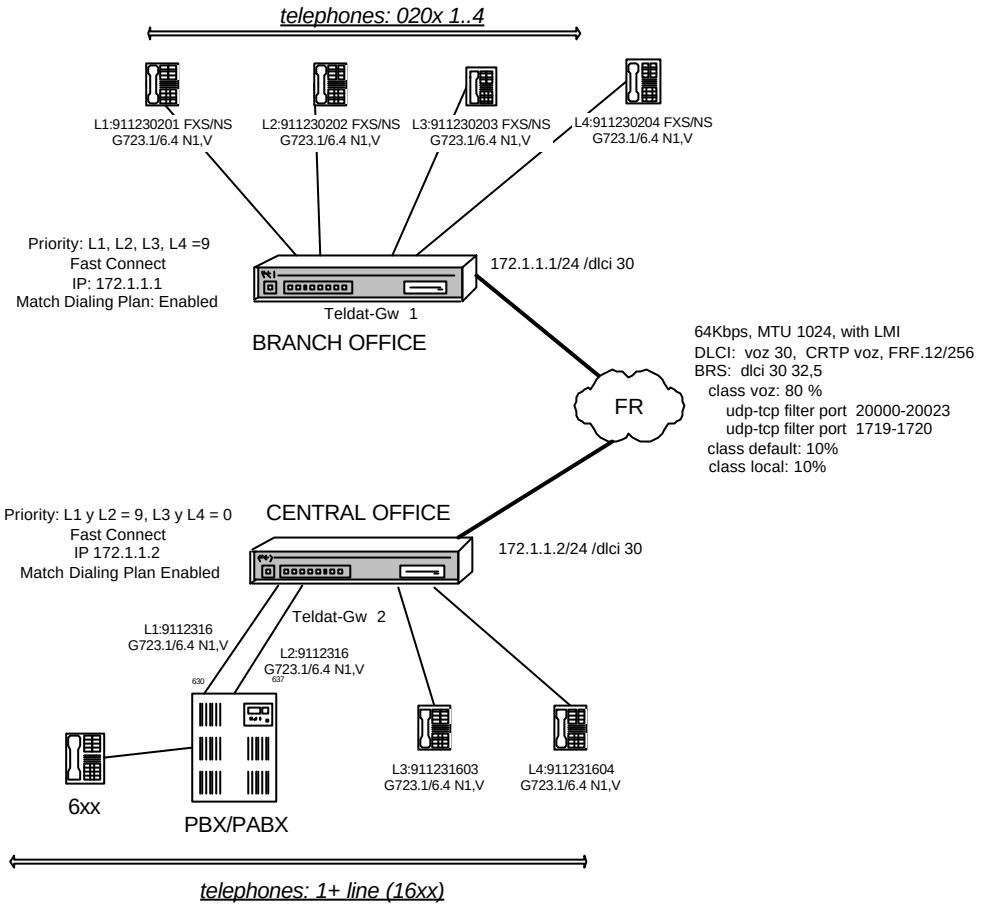

Figure 6.

The central has a switchboard with various extensions, that are adjusted to the 6xx pattern and the company wants all of them to have the possibility of calling the branch. The company would also like to have two lines that have access to the branch at any given time. The branch on the other hand, does not have a switchboard and the company wishes to install four telephone lines with access to the central.

The numeration plan proposed by the company indicates that the telephones installed in the branch should be able to call any extension located in the central by dialing the number 1 + the extension (follow the 16xx pattern). To call in the opposite direction, i.e. from the central to the branch you should dial the numbers with the 02 + the extension pattern (i.e. following the 02xx pattern).

The telephones installed in the branch can make calls to each other by simply dialing the last two digits of the number, this being 01, 02, 03 and 04.

The telephones directly connected to the Teldat Gw-2 router must be able to call any switchboard extension by simply dialing 1 followed by the extension number (16xx).

Proposed Configuration:

Frame Relay:

In order to transmit the data, the Frame Relay interface dlci number 30 is used, assigned by the carrier providing the service. The line speed is 64 Kbps. The RTP (CRTP) header compression is enabled without the inclusion of the UDP checksum with the aim of saving bandwidth in voice transmission. Fragmentation is also enabled, in packets of 256 bytes, in order to avoid large packets appropriating the interface and causing delays in the voice packets.

Bandwidth Reservation:

To prevent cut outs in the voice when there is a lot of traffic, you must prioritize voice traffic versus data. To do this use the BRS, reserving at least 80 % of the bandwidth for voice traffic. This voice

traffic is characterized by using UDP ports that are between 20000 to 20023 (RTP and RTCP traffic) as well as 1719 (RAS) and the TCP 1720 port (signaling). A 32 element tail will be used when there is little load reducing this to 5 when there is heavy traffic.

Numeration plan:

With the aim of simplifying future amplifications in the network it has been decided to place 91123 in front of all the numbers proposed by the company. In this way the branch telephones follow the 9112302xx pattern and those from the central the 9112316xx pattern.

With the aim of making this prefix transparent to the user, 91123 is automatically added to any dialed number, therefore if the user wishes to call the central from a branch or vice versa, he/she only needs to dial four digits, 1 extension (16xx) in the branch and 02 + extension (02xx) in the central. This is obtained by configuring a translation over the called number, which the branch substitutes any number with the sequence 16 with 9112316. On the central side, this substitutes the sequence 02 with 9112302. This can also be carried out by including a prefix (dial-out-prefix) but for didactic reasons this method has been chosen.

So that the central extensions only have to know a single access telephone number for the branch, you should configure a capture group in the switchboard. In this way if you choose extension 630 to access the branch, you need to configure extensions 630 and 637 as a capture group. In this way if extension 630 is busy the call is automatically passed to extension 637.

So that the telephones connected to the Teldat Gw-2 router can call the switchboard extensions, you must configure two entries in this router's lines table which divert telephone 1 to the router lines 1 or 2 previously eliminating the first digit (strip-prefix equal to 1). Additionally you must configure another entry in the prefixes table so that everything beginning with 1 has length 1 (i.e. the router understands that dialing is finished when the 1 is received and can see that this is an internal call for lines 1 or 2). Because these are internal calls, you need to execute the "LOCAL-CALL Expansions" command so that the translations and expansions are carried out as the router default behavior is not to execute either number expansions or compressions in internal calls therefore not removing the first digit.

Additionally, you need to enable the MATCH-DIALING option in both routers so that if the users dial a number that does not adjust to the number specified the prefixes table, the line will automatically pass to an error state, increasing the availability of the line. This is due to the fact that the line will pass directly from the DIALING state to the ERROR state, preventing the user to continue erroneous dialing.

Configuring lines:

The branch does not have a switchboard therefore the four router lines are configured as FXS and are connected to the telephones. As you are able to attend both remote and internal calls to the device, you must add an entry for each telephone denomination: from the exterior the telephone number is known as 9xxxxxxxx, and from the branch this is known as 0x where x varies between 1 and 4.

The central has a switchboard and two extensions of the said switchboard (630 and 637) will be connected to two router lines configured as FXO. The other two router lines are configured as FXS and will be connected to the telephones.

Since the switchboard extensions follow the 6xx pattern and the received numbers have the 911231+extensión (9112316xx) pattern, you must delete the first 6 digits corresponding to the 911231 sequence.

In all the lines, both from the central as well as the branch, the G723 codec at 6.4 Kbps with VAD will be used, sending an RTP packet in each UDP frame. With this speed you obtain good voice quality, with little delay without needing a large bandwidth.

As all the lines have the same configuration and you do not wish to use fax, the FAST-CONNECT mode is used. This is done in such a way that the connection is established as quickly as possible thus avoiding the first instances of silence which are produced on picking up the call when FAST-CONNECT is not used.

All the FXS lines are configured in non-suspended mode (FXS/ns) in the Teldat-Gw 1 router (office) with the aim that the release of a call is carried out as quickly as possible. If this is not configured as

such, the calls originating from a switchboard extension directed to an office line will not be released immediately after the users hang up, they will remain blocked until the Teldat-Gw 2 router (central) FXO line detects the switchboard has hung up and this strongly depends on the model of switchboard. This is time where despite the fact there is no conversation between the users, the router maintains the call as established thus preventing other users from using the line.

For the same reasons, the two FXS lines from the Teldat-Gw 2 router will be configured in non-suspended mode.

The priority in the Teldat-Gw 2 router lines is set at zero, so that if a busy telephone receives a call, this is not redirected to any of the other three telephones.

Contrariwise, in the Teldat-Gw 1 router, the priority is set at nine, since if the line is busy the call is carried out through another extension.

The remaining parameters take the default value.

Configurations:

Teldat-Gw 1 (branch):

H323:

```
Teldat-1 H323 Config>LIST ALL

 GATEWAY PARAMETERS

Gateway internal address: 172.1.1.1
Fast Connect: Enabled                Q931 port: 1720
H323 call mode: Compatible           UDP  port: 20000

Gatekeeper address 0.0.0.0           Gateway name:
Gatekeeper zone:                     Tech-Prefix :
                                     Register E.164: Enabled

RAS port: 1719                       RAS time to live: 60
RAS timeout: 20                      RAS Connection attempt fail:  10

Enable Service Addr 0.0.0.0          Type of Service Disable: Disable Lines


 VOICE PARAMETRES

Dial tone frequency:      425      Ring tone activity: 15
Dial voice message:                Ring tone silence:  30

Alerting tone frequency:  425      Busy tone frequency: 425
Alerting tone activity:    15      Busy tone activity:  2
Alerting tone silence:     30      Busy tone silence:   2
Alerting voice message:            Busy voice message:

Error tone frequency:     425      Error tone silence 1: 2
Error tone activity:        2      Error tone silence 2: 6
Error voice message:

DTMF tones timeout:  10            Error Timeout: 30
Maximum delay: 300

 LINE 1 PARAMETERS

Telephone number: 911230201           Interface type: FXS/ns
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 9

Codec: G723 6.4Kbps                   VAD: Enabled
Frames H323/packet RTP: 1 ( 24 bytes)  DTMF relay : in band
Speaker gain: 0   dB                  Tone level: 0 dB

Mic gain: 10 dB
```

```
 LINE 2 PARAMETERS

Telephone number: 911230202           Interface type: FXS/ns
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 9

Codec: G723 6.4Kbps                   VAD: Enabled
Frames H323/packet RTP: 1 ( 24 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB


 LINE 3 PARAMETERS

Telephone number: 911230203           Interface type: FXS/ns
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 9

Codec: G723 6.4Kbps                   VAD: Enabled
Frames H323/packet RTP: 1 ( 24 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB


 LINE 4 PARAMETERS

Telephone number: 911230204           Interface type: FXS/ns
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 9

Codec: G723 6.4Kbps                   VAD: Enabled
Frames H323/packet RTP: 1 ( 24 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB



Order LINE      TELEPHONE  STRIP-PREFIX DIAL-OUT-PREFIX

  1      1       911230201       0
  2      2       911230202       0
  3      3       911230203       0
  4      4       911230204       0
  5      1              01       0
  6      2              02       0
  7      3              03       0
  8      4              04       0

Entry:   1               Telephone: 16              Strip prefix: 0
Codec class: --          IP Addr: 172.1.1.2         Dial-Out Pref:
Tech Prefix:             Num. type: unknown         Translation: 1/called
Local IP: 0.0.0.0

Match Dialing Plan: Enabled

Order  PREFIX         LENGTH

  1     16              4
  2     0               2

Id     Codec      frm/pkt (bytes)  VAD


Teldat-1 H323 Config>SET TRANSLATION 1
Teldat-1 TRNL config>LIST ALL
Translation 1
```

```
 Rule  1: 16 unknown -> 9112316 unknown

Teldat-1 TRNL config>
```

CONFIGURATION:

```
Teldat-1 Config>SHOW CONFIG
; Showing System Configuration ...
; Router ATLAS 2 8 Version 10.0.0

set data-link frame-relay serial0/0
set data-link x25 serial0/1
set data-link x25 serial0/2
set hostname Teldat-1
network serial0/0
; -- Frame Relay user configuration --
   pvc 30 default
   pvc 30 fragmentation-size 256
   pvc 30 name voz
   pvc 30 compression crtp without-udp-checksum
;
   protocol-address 172.1.1.2 30
   set frame-size 1024
exit
;
protocol ip
; -- Internet protocol user configuration --
   internal-ip-address 172.1.1.1
;
   address  serial0/0       172.1.1.1        255.255.255.0
   address  x25-node        192.168.252.1    255.255.255.0
;
exit
;
protocol h323
;
   line 1 telephone-number 911230201
   line 1 no suspend-mode
   line 1 codec g7236k4
;
   line 2 telephone-number 911230202
   line 2 no suspend-mode
   line 2 codec g7236k4
;
   line 3 telephone-number 911230203
   line 3 no suspend-mode
   line 3 codec g7236k4
;
   line 4 telephone-number 911230204
   line 4 no suspend-mode
   line 4 codec g7236k4
;
   match-dialing
   prefix 16 4
   prefix 0 2
   destination 16 172.1.1.2 default
   destination 16 172.1.1.2 translation id 1
   destination 16 172.1.1.2 translation called-number
;
   port 1 911230201 default
;
   port 2 911230202 default
;
   port 3 911230203 default
;
   port 4 911230204 default
;
   port 1 01 default
;
```

```
   port 2 02 default
;
   port 3 03 default
;
   port 4 04 default
;
   translation 1
   fast-connect
   set translation 1
;
;     RULE Id, Digits pattern, Number type, New digit sequence, New number type
      rule 1 16 0 9112316 0
   exit
;
exit
;
feature bandwidth-reservation
; -- Bandwidth Reservation user configuration --
   network serial0/0
;
      enable
      circuit 30
;
         enable
         class DEFAULT 10
         class VOIP 80
         ip-filter 0 lower source-port 1719 higher source-port 1720
         ip-filter 0 lower destination-port 1719 higher destination-port 1720
;
         ip-filter 1 lower source-port 20000 higher source-port 20023
         ip-filter 1 lower destination-port 20000 higher destination-port 20023
;
         assign FILTER0 VOIP NORMAL
         assign FILTER1 VOIP NORMAL
         queue-length 32 5
      exit
;
   exit
;
exit
;
Teldat-1 Config>
```

Teldat-Gw 2 (central):

H323:

```
Teldat-2 H323 Config>LIST ALL

GATEWAY PARAMETERS

Gateway internal address: 172.1.1.2
Fast Connect: Enabled                 Q931 port: 1720
H323 call mode: Compatible            UDP  port: 20000

Gatekeeper address 0.0.0.0            Gateway name:
Gatekeeper zone:                      Tech-Prefix :
                                      Register E.164: Enabled

RAS port: 1719                        RAS time to live: 60
RAS timeout: 20                       RAS Connection attempt fail:  10

Enable Service Addr 0.0.0.0           Type of Service Disable: Disable Lines


 VOICE PARAMETRES

DTMF tones timeout:  10            Error Timeout: 30
```

```
Maximum delay: 300

 LINE 1 PARAMETERS

Telephone number: 637                 Interface type: ISDN-NT
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 9

Codec: G723 6.4Kbps                   VAD: Enabled
Frames H323/packet RTP: 1 ( 24 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB


 LINE 2 PARAMETERS

Telephone number: 630                 Interface type: ISDN-NT
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 9

Codec: G723 6.4Kbps                   VAD: Enabled
Frames H323/packet RTP: 1 ( 24 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB


 LINE 3 PARAMETERS

Telephone number: 911231603           Interface type: ISDN-NT
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 0

Codec: G723 6.4Kbps                   VAD: Enabled
Frames H323/packet RTP: 1 ( 24 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB


 LINE 4 PARAMETERS

Telephone number: 911231604           Interface type: ISDN-NT
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 0

Codec: G723 6.4Kbps                   VAD: Enabled
Frames H323/packet RTP: 1 ( 24 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB



Order LINE      TELEPHONE  STRIP-PREFIX DIAL-OUT-PREFIX

  1      3       911231603       0
  2      4       911231604       0
  3      1         9112316       6
  4      2         9112316       6
  5      1               1       1
  6      2               1       1

Local Call Expansions Enabled

Entry:   1               Telephone: 02              Strip prefix: 0
Codec class: --          IP Addr: 172.1.1.1         Dial-Out Pref:
Tech Prefix:             Num. type: unknown         Translation: 1/called
Local IP: 0.0.0.0
```

```
Match Dialing Plan: Enabled

Order  PREFIX         LENGTH

  1     1               1
  2     02              4

Id     Codec      frm/pkt (bytes)  VAD


Teldat-2 H323 Config>
```

CONFIGURATION:

```
Teldat-2 Config>SHOW CONFIG
; Showing System Configuration ...
; Router ATLAS 2 8 Version 10.0.0

set data-link frame-relay serial0/0
set data-link x25 serial0/1
set data-link x25 serial0/2
set hostname Teldat-2
network serial0/0
; -- Frame Relay user configuration --
   pvc 30 default
   pvc 30 fragmentation-size 256
   pvc 30 name voip
   pvc 30 compression crtp without-udp-checksum
;
   protocol-address 172.1.1.1 30
   set frame-size 1024
exit
;
protocol ip
; -- Internet protocol user configuration --
   internal-ip-address 172.1.1.2
;
   address  serial0/0       172.1.1.2        255.255.255.0
   address  x25-node        192.168.252.1    255.255.255.0
;
exit
;
protocol h323
;
   line 1 telephone-number 637
   line 1 interface-type fxo
   line 1 codec g7236k4
;
   line 2 telephone-number 630
   line 2 interface-type fxo
   line 2 codec g7236k4
;
   line 3 telephone-number 911231603
   line 3 no suspend-mode
   line 3 priority 0
   line 3 codec g7236k4
;
   line 4 telephone-number 911231604
   line 4 no suspend-mode
   line 4 priority 0
   line 4 codec g7236k4
;
   match-dialing
   prefix 1 1
   prefix 02 4
   destination 02 172.1.1.1 default
   destination 02 172.1.1.1 translation id 1
   destination 02 172.1.1.1 translation called-number
```

```
;
   port 3 911231603 default
;
   port 4 911231604 default
;
   port 1 9112316 default
   port 1 9112316 strip-digits 6
;
   port 2 9112316 default
   port 2 9112316 strip-digits 6
;
   port 1 1 default
   port 1 1 strip-digits 1
;
   port 2 1 default
   port 2 1 strip-digits 1
;
   translation 1
   fast-connect
   local-call-expansions
   set translation 1
;
;     RULE Id, Digits pattern, Number type, New digit sequence, New number type
      rule 1 02 0 9112302 0
   exit
;
exit
;
feature bandwidth-reservation
; -- Bandwidth Reservation user configuration --
   network serial0/0
;
      enable
      circuit 30
;
         enable
         class DEFAULT 10
         class VOIP 80
         ip-filter 0 lower source-port 1719 higher source-port 1720
         ip-filter 0 lower destination-port 1719 higher destination-port 1720
;
         ip-filter 1 lower source-port 20000 higher source-port 20023
         ip-filter 1 lower destination-port 20000 higher destination-port 20023
;
         assign FILTER0 VOIP NORMAL
         assign FILTER1 VOIP NORMAL
         queue-length 32 5
      exit
;
   exit
;
exit
;
Teldat-2 Config>
```

Tests:

Calls from a switchboard extension to a branch telephone:

To make a call from a switchboard extension, the user must dial 630, corresponding to Teldat-Gw 2 router lines 1 and 2 respectively through a capture group.

If neither of the two lines is free you cannot carry out the call from the switchboard extension. You must then use one of the two telephones which are connected directly to the Teldat-Gw 2 router.

When the users hears the dial tone from the router he should dial 02 + the extension. When the fourth digit dialed is detected, the router will begin to call placing 91123 before the number dialed by the user.

For example, if the user dials 0203, the Teldat-Gw 1 router line 3 will ring with number 911230203.

Calls from a telephone directly connected to the Teldat-Gw 2 router in the central directed to a branch telephone:

In this case you only need to pick up the telephone and dial 02 + the extension. The translation transforms this number to 9112302 + the extension.

Call from a telephone directly connected to the Teldat-Gw 2 router in the central directed to a switchboard extension:

To make these calls you must configure two entries in the Teldat-Gw 2 router lines table so that all the telephone numbers beginning with 1 are sent to line 1 or line 2 eliminating digit 1. You must also add an entry in the prefixes table, assigning a length of 1 to all the numbers that begin with 1.

With this configuration the user must dial 1 and the router will check that this is an internal call and diverts it to lines 1 or 2, eliminating the first digit (1). Subsequently, the user should dial the switchboard 6xx extension.

Calls from a branch telephone directed to a telephone directly connected to the Teldat-Gw 2 router in the central:

In this case you only need to pick up the telephone and dial 16 + the extension. The translation configured in the router will transform this number to 9112316 + the extension.

Call from a branch telephone directed to a switchboard extension:

Pick up the telephone and dial 1 + the extension (16xx). The translation will transform this number to 911231 + the extension (9112316xx). This number will be received by the FXO line that will delete the first six digits to finally dial over the switchboard the number 6 + the extension.

Please note that for the user, there is no difference between this case and the case given above.

b) *Connected by PPP serial line*

Description:

A company wants to provide voice and data service between the central and one of its new branches through a PPP link over serial line at 64 Kbps.

Both the branch and the central have switchboards and the company wants all the branch's extensions to be able to call all the central extensions and vice versa.

The company also wants the branch to have telephone access outside the corporation without needing to contract any line in the new branch. I.e. the calls directed to the exterior should be sent to the central through voice over IP so that at the end the central lines are used to carry out exterior dialing.

The numeration plan proposed by the company is as follows:

- The central extensions are 5xx type and the branch is type 6xx.
- The non-corporate telephones can be set with the 9xxxxxxxx pattern or mobiles with the 6xxxxxxxx pattern.

To make an outside call from the central it is first necessary to put a zero before the desired number, as the switchboard is configured as such. However this should be transparent for the branch extensions, which can exit by simply dialing the desired number without putting zero first.

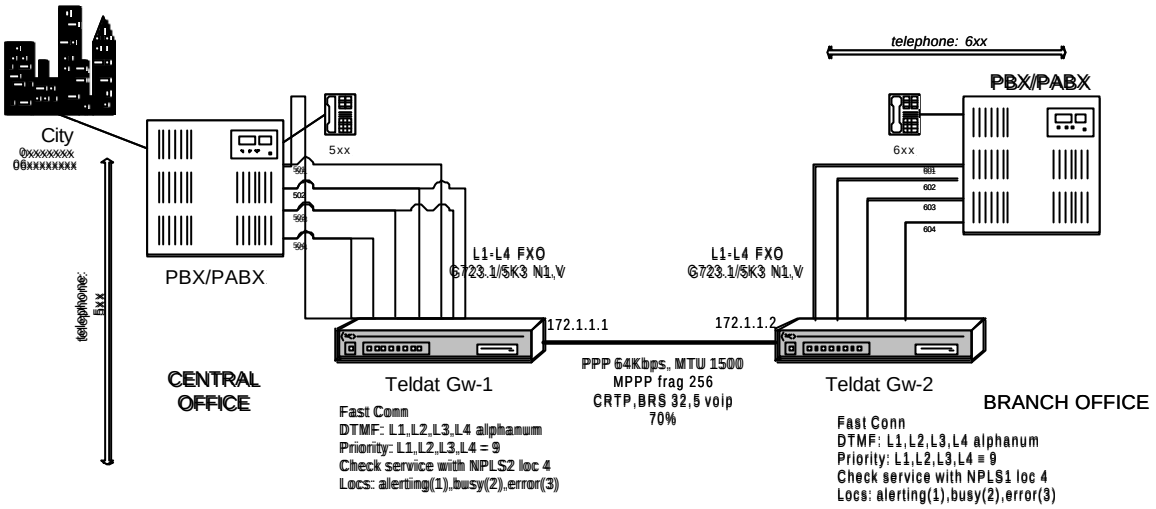

Figure 7.

Proposed configuration:

PPP serial line:

To transmit data, the PPP protocol is used over a serial line, with a line speed of 64 Kbps. The RTP (CRTP) header compression is enabled without including the UDP checksum. This is done with the aim of saving bandwidth in the voice transmission. To decrease the delay of the voice packets, fragmentation is also enabled in packets of 256 bytes.

Bandwidth Reservation:

With the aim of preventing cut outs in the voice when there is a lot of traffic, you must prioritize voice traffic versus data. To do this use the BRS, reserving at least 70 % of the bandwidth for voice traffic. This voice traffic is characterized by using UDP ports that are between 20000 to 20023 (RTP and RTCP traffic) as well as 1719 (RAS) and the TCP 1720 port (signaling). A 32 element tail will be used when there is little load reducing this to 5 when there is heavy traffic.

Numeration plan:

To make a call from the branch to a central extension you must first call one of the extensions connected to the Teldat-Gw 2 router (601 to 604) and when you hear the dial tone from the router, dial the extension you wish (with the 5xx pattern).

If you wish to make a call from the central to a branch extension, you must first call one of the extensions connected to the Teldat-Gw 1 router (501 to 504) and when you hear the dial tone from the router, dial the extension you wish (with the 6xx pattern).

So that the central extensions only have to know a single access telephone number for the branch, you should configure a capture group in the switchboard. In this way if you choose extension 501 to access the branch, you need to configure extensions 501, 502, 503 and 504 as a capture group. In this way if one is busy the call is automatically passed to any of the other three extensions. For the same reason you should configure another capture group in the branch switchboard with extensions 601, 602, 603 and 604.

To access an exterior telephone from the branch, the user must first call one of the switchboard extensions connected to the Teldat-Gw 2 router and then dial numbers with the 9xxxxxxxx or 6xxxxxxxx pattern (9 digits in total). These numbers will be diverted to one of the four Teldat-Gw 1 router lines which will dial over the line to which this is connected and automatically placing a zero beforehand as a DIAL-OUT PREFIX has already been configured for these types of numbers.

The MATCH-DIALING option is enabled in both routers so that if the users dial a number that does not adjust to the number specified the prefixes table, the line will automatically pass to an error state, increasing the availability of the line.

Lines Configuration:

All the lines from both the Teldat-Gw 1 router as well as the Teldat-Gw 2 are configured in FXO mode and will be connected to the extensions of their respective switchboards.

In the Teldat-Gw 1 router, belonging to the central, eight entries will be configured in the lines table, 2 for each physical line. These entries specify that all numbers beginning with 9 or 6 have a zero placed before them so they are routed to the outside.

For calls to extensions, in this case it is not necessary to have any entries for various reasons: the called number can be directly used in the switchboard as all the lines are being used in the same way and are not able to jump to undesired lines and because an available line is searched for in order to route the call in any case. This is carried out in this manner in the central. However in the branch, entries are added depending on the prefix simply for didactic purposes.

In all the lines, both from the central as well as the branch, the G723 codec at 5.3 Kbps with VAD will be used, sending an RTP packet in each UDP frame. With this speed you obtain good voice quality, with little delay without needing a large bandwidth.

However all the calls that are carried out from the branch to the outside will use another codec class, G723.1 at 6.4 Kbps, so that the voice quality in outside calls is a little higher than in calls between corporate telephones. This is not really necessary since the quality at 5.3 Kbps is good, but this is configured for didactic purposes.

Since all the lines have the same configuration (please note that both G723.1 speeds are fully compatible) and you do not wish to use the fax, FAST-CONNECT mode will be used.

The service testing is also enabled so that if you cannot access address 172.1.1.2 (Teldat-Gw 2 router address) from the Teldat-Gw 1 router, you will not hear the dialing tone but a voice message, which will give the information that the service is not available. In the Teldat-Gw 2 router does exactly the same thing but the check address is 172.1.1.1 (Teldat-Gw 1 router address).

Configurations:

Teldat-Gw1 (central):

H323:

```
Teldat-1 H323 Config>LIST ALL

 GATEWAY PARAMETERS

Gateway internal address: 172.1.1.1
Fast Connect: Enabled                Q931 port: 1720
H323 call mode: Compatible           UDP  port: 20000

Gatekeeper address 0.0.0.0           Gateway name:
Gatekeeper zone:                     Tech-Prefix :
                                     Register E.164: Enabled

RAS port: 1719                       RAS time to live: 60
RAS timeout: 20                      RAS Connection attempt fail:  10

Enable Service Addr 172.1.1.2        Type of Service Disable: Play Voice Msg 1


 VOICE PARAMETRES

Dial tone frequency:      425      Ring tone activity: 15
Dial voice message:                Ring tone silence:  30

Alerting tone frequency:  425      Busy tone frequency: 425
Alerting tone activity:    15      Busy tone activity:  2
Alerting tone silence:     30      Busy tone silence:   2
Alerting voice message:            Busy voice message:

Error tone frequency:     425      Error tone silence 1: 2
Error tone activity:        2      Error tone silence 2: 6
```

```
Error voice message:

DTMF tones timeout:  10            Error Timeout: 30
Maximum delay: 300

 LINE 1 PARAMETERS

Telephone number: 501                  Interface type: FXO
Direct dialing:                        State: Enabled
Identifier H323:                       Priority: 9

Codec: G723 5.3Kbps                    VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : H.245 alphanumeric

Speaker gain: 0   dB                   Tone level: 0 dB
Mic gain: 10 dB


 LINE 2 PARAMETERS

Telephone number: 502                  Interface type: FXO
Direct dialing:                        State: Enabled
Identifier H323:                       Priority: 9

Codec: G723 5.3Kbps                    VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : H.245 alphanumeric

Speaker gain: 0   dB                   Tone level: 0 dB
Mic gain: 10 dB


 LINE 3 PARAMETERS

Telephone number: 503                  Interface type: FXO
Direct dialing:                        State: Enabled
Identifier H323:                       Priority: 9

Codec: G723 5.3Kbps                    VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : H.245 alphanumeric

Speaker gain: 0   dB                   Tone level: 0 dB
Mic gain: 10 dB


 LINE 4 PARAMETERS

Telephone number: 504                  Interface type: FXO
Direct dialing:                        State: Enabled
Identifier H323:                       Priority: 9

Codec: G723 5.3Kbps                    VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : H.245 alphanumeric

Speaker gain: 0   dB                   Tone level: 0 dB
Mic gain: 10 dB



Order LINE      TELEPHONE  STRIP-PREFIX DIAL-OUT-PREFIX

  1      1              9       0                   0
  2      2              9       0                   0
  3      3              9       0                   0
  4      4              9       0                   0
  5      1              6       0                   0
  6      2              6       0                   0
  7      3              6       0                   0
  8      4              6       0                   0
```

```
Entry:   1                Telephone: 6                Strip prefix: 0
Codec class: --           IP Addr: 172.1.1.2          Dial-Out Pref:
Tech Prefix:              Num. type: unknown          Translation: --
Local IP: 0.0.0.0

Match Dialing Plan: Enabled

Order  PREFIX         LENGTH

  1     6               3

Id     Codec      frm/pkt (bytes)  VAD


Teldat-1 H323 Config>
```

CONFIGURATION:

```
Teldat-1 Config>SHOW CONFIG
; Showing System Configuration ...
; Router ATLAS 2 8 Version 10.0.0

add device ppp 1
set data-link sync serial0/0
set data-link x25 serial0/1
set data-link x25 serial0/2
set hostname Teldat-1
global-profiles ppp
; -- PPP Profiles Configuration --
   facilities 1 default
   facilities 1 mppp
   facilities 1 crtp without-checksum
;
   multilink 1 default
   multilink 1 endpoint ip 172.1.1.1
   multilink 1 fragmentation 256
;
   ppp 1 default
   ppp 1 facilities-profile 1
   ppp 1 mppp-profile 1
;
exit
;
network serial0/0
; -- Interface Synchronous Serial Line. Configuration --
   set frame-size 1500
exit
;
network ppp1
; -- Generic PPP User Configuration --
   ppp
; -- PPP Configuration --
      profile 1
   exit
;
   base-interface
; -- Base Interface Configuration --
      base-interface serial0/0 link
;
   exit
;
exit
;
protocol ip
; -- Internet protocol user configuration --
   internal-ip-address 172.1.1.1
;
   address  x25-node        192.168.252.1    255.255.255.0
   address  ppp1            172.1.1.1        255.255.255.0
;
```

```
exit
;
protocol h323
;
   line 1 telephone-number 501
   line 1 interface-type fxo
   line 1 h245-dtmf-relay
;
   line 2 telephone-number 502
   line 2 interface-type fxo
   line 2 h245-dtmf-relay
;
   line 3 telephone-number 503
   line 3 interface-type fxo
   line 3 h245-dtmf-relay
;
   line 4 telephone-number 504
   line 4 interface-type fxo
   line 4 h245-dtmf-relay
;
   match-dialing
   prefix 6 3
   destination 6 172.1.1.2 default
;
   port 1 9 default
   port 1 9 dial-out 0
;
   port 2 9 default
   port 2 9 dial-out 0
;
   port 3 9 default
   port 3 9 dial-out 0
;
   port 4 9 default
   port 4 9 dial-out 0
;
   port 1 6 default
   port 1 6 dial-out 0
;
   port 2 6 default
   port 2 6 dial-out 0
;
   port 3 6 default
   port 3 6 dial-out 0
;
   port 4 6 default
   port 4 6 dial-out 0
;
   fast-connect
   set address available-service 172.1.1.2
   set disable-type-of-service 1
exit
;
feature bandwidth-reservation
; -- Bandwidth Reservation user configuration --
   network ppp1
;
      enable
      class DEFAULT 10
      class VOIP 80
      ip-filter 0 lower source-port 20000 higher source-port 20023
      ip-filter 0 lower destination-port 20000 higher destination-port 20023
;
      assign FILTER0 VOIP NORMAL
      queue-length 32 5
   exit
;
exit
;
Teldat-1 Config>
```

Teldat-Gw2 (branch):

H323:

```
Teldat-2 H323 Config>LIST ALL

 GATEWAY PARAMETERS

Gateway internal address: 172.1.1.2
Fast Connect: Enabled                Q931 port: 1720
H323 call mode: Compatible           UDP  port: 20000

Gatekeeper address 0.0.0.0           Gateway name:
Gatekeeper zone:                     Tech-Prefix :
                                     Register E.164: Enabled

RAS port: 1719                       RAS time to live: 60
RAS timeout: 20                      RAS Connection attempt fail:  10

Enable Service Addr 172.1.1.1       Type of Service Disable: Play Voice Msg 1


 VOICE PARAMETRES

Dial tone frequency:      425      Ring tone activity: 15
Dial voice message:                Ring tone silence:  30

Alerting tone frequency:  425      Busy tone frequency: 425
Alerting tone activity:    15      Busy tone activity:  2
Alerting tone silence:     30      Busy tone silence:   2
Alerting voice message:            Busy voice message:

Error tone frequency:     425      Error tone silence 1: 2
Error tone activity:        2      Error tone silence 2: 6
Error voice message:

DTMF tones timeout:  10            Error Timeout: 30
Maximum delay: 300

LINE 1 PARAMETERS

Telephone number: 601                  Interface type: FXO
Direct dialing:                        State: Enabled
Identifier H323:                       Priority: 9

Codec: G723 5.3Kbps                    VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : H.245 alphanumeric

Speaker gain: 0   dB                   Tone level: 0 dB
Mic gain: 10 dB


 LINE 2 PARAMETERS

Telephone number: 601                  Interface type: FXO
Direct dialing:                        State: Enabled
Identifier H323:                       Priority: 9

Codec: G723 5.3Kbps                    VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : H.245 alphanumeric

Speaker gain: 0   dB                   Tone level: 0 dB
Mic gain: 10 dB


 LINE 3 PARAMETERS

Telephone number: 601                  Interface type: FXO
Direct dialing:                        State: Enabled
Identifier H323:                       Priority: 9

Codec: G723 5.3Kbps                    VAD: Enabled
```

```
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : H.245 alphanumeric

Speaker gain: 0   dB                   Tone level: 0 dB
Mic gain: 10 dB


 LINE 4 PARAMETERS

Telephone number: 601                  Interface type: FXO
Direct dialing:                        State: Enabled
Identifier H323:                       Priority: 9

Codec: G723 5.3Kbps                    VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : H.245 alphanumeric

Speaker gain: 0   dB                   Tone level: 0 dB
Mic gain: 10 dB



Order LINE      TELEPHONE  STRIP-PREFIX DIAL-OUT-PREFIX

  1      1              6       0
  2      2              6       0
  3      3              6       0
  4      4              6       0

Entry:   1               Telephone: 5               Strip prefix: 0
Codec class: --          IP Addr: 172.1.1.1         Dial-Out Pref:
Tech Prefix:             Num. type: unknown         Translation: --
Local IP: 0.0.0.0

Entry:   2               Telephone: 6               Strip prefix: 0
Codec class: 1           IP Addr: 172.1.1.1         Dial-Out Pref:
Tech Prefix:             Num. type: unknown         Translation: --
Local IP: 0.0.0.0

Entry:   3               Telephone: 9               Strip prefix: 0
Codec class: 1           IP Addr: 172.1.1.1         Dial-Out Pref:
Tech Prefix:             Num. type: unknown         Translation: --
Local IP: 0.0.0.0

Match Dialing Plan: Enabled

Order  PREFIX         LENGTH

  1     6               9
  2     5               3
  3     9               9

Id     Codec      frm/pkt (bytes)  VAD

1    G723 6.4Kbps      1 ( 24)      E

Teldat-2 H323 Config>
```

CONFIGURATION:

```
Teldat-2 Config>SHOW CONFIG
; Showing System Configuration ...
; Router ATLAS 2 8 Version 10.0.0

add device ppp 1
set data-link sync serial0/0
set data-link x25 serial0/1
set data-link x25 serial0/2
set hostname Teldat-2
global-profiles ppp
; -- PPP Profiles Configuration --
   facilities 1 default
```

```
   facilities 1 mppp
   facilities 1 crtp without-checksum
;
   ipcp 1 default
;
   multilink 1 default
   multilink 1 endpoint ip 172.1.1.1
   multilink 1 fragmentation 256
;
   ppp 1 default
   ppp 1 facilities-profile 1
   ppp 1 mppp-profile 1
;
exit
;
network serial0/0
; -- Interface Synchronous Serial Line. Configuration --
   set frame-size 1500
exit
;
network ppp1
; -- Generic PPP User Configuration --
   ppp
; -- PPP Configuration --
      profile 1
   exit
;
   base-interface
; -- Base Interface Configuration --
      base-interface serial0/0 link
;
   exit
;
exit
;
protocol ip
; -- Internet protocol user configuration --
   internal-ip-address 172.1.1.2
;
   address  x25-node        192.168.252.1    255.255.255.0
   address  ppp1            172.1.1.2        255.255.255.0
;
exit
;
protocol h323
;
   line 1 telephone-number 601
   line 1 interface-type fxo
   line 1 h245-dtmf-relay
;
   line 2 telephone-number 601
   line 2 interface-type fxo
   line 2 h245-dtmf-relay
;
   line 3 telephone-number 601
   line 3 interface-type fxo
   line 3 h245-dtmf-relay
;
   line 4 telephone-number 601
   line 4 interface-type fxo
   line 4 h245-dtmf-relay
;
   match-dialing
   prefix 6 9
   prefix 5 3
   prefix 9 9
   codec-class 1 default
   codec-class 1 codec-type g7236k4
;
   destination 5 172.1.1.1 default
;
```

```
   destination 6 172.1.1.1 default
   destination 6 172.1.1.1 codec-class 1
;
   destination 9 172.1.1.1 default
   destination 9 172.1.1.1 codec-class 1
;
   port 1 6 default
;
   port 2 6 default
;
   port 3 6 default
;
   port 4 6 default
;
   fast-connect
   set address available-service 172.1.1.1
   set disable-type-of-service 1
exit
;
feature bandwidth-reservation
; -- Bandwidth Reservation user configuration --
   network ppp1
;
      enable
      class DEFAULT 10
      class VOIP 80
      ip-filter 0 lower source-port 20000 higher source-port 20023
      ip-filter 0 lower destination-port 20000 higher destination-port 20023
;
      assign FILTER0 VOIP NORMAL
      queue-length 32 5
   exit
;
exit
;
Teldat-2 Config>
```

Tests:

Calls from a central extension to a branch extension:

To make a call to the branch you must dial 501 so that the central switchboard calls a line that is configured as a capture group and is free. When the dial tone from the Teldat-Gw 1 router is heard, you need to dial the extension (6xx pattern).

Calls from a branch extension to a central extension:

To make a call to the central you must dial 601 so that the branch switchboard calls a line that is configured as a capture group and is free. When the dial tone from the Teldat-Gw 2 router is heard, you need to dial the extension (5xx pattern).

Calls from a branch extension to a non-corporate fixed telephone:

To make a call from the branch to the outside, you need to first dial 601 so that the branch switchboard calls a line that is configured as a capture group and is free. When the dial tone from the Teldat-Gw 2 router is heard, you need to dial the number (9xxxxxxxx pattern). Subsequently the Teldat-Gw 1 router FXO line will automatically place the prefix 0 in front of the number, in this way the call exits to the outside through the central switchboard.

You can see how the codec used for these calls is G723.1 at 6.4 Kbps, while the internal calls use a codec at 5.3 Kbps.

Calls from a branch extension to a non-corporate mobile telephone:

Similar to above but on hearing the dial tone from the Teldat-Gw 2 router you should dial the mobile number (6xxxxxxxx pattern).

Checking the service:

To check that when the connection drops an error message is produced instead of a dialing tone, you need to record a voice message and configure this as the voice to be reproduced when the configured

IP address to enable the service is inaccessible. Subsequently you are able to test the connection, for example by disconnecting it at the other end and checking that the voice reproduction is actually reproduced when calling one of the lines.

You can also check that the service is disabled through the H323.007 event and through the LIST STATISTICS GW monitoring command.

c) *Connected via PPP over ISDN*

Description:

A company wants to provide voice and data service between two of its branches, located in Barcelona and Madrid and one of its offices located in Santander.

The link between Santander and Barcelona is carried out through an ISDN basic access and the link between Madrid and Santander is carried out through a point-to-point line. The PPP protocol is configured over both links.

Both branches have a switchboard with an output to the exterior. The office does not have a switchboard and you wish all calls to the outside destined for Madrid are carried out through Voice over IP to the Madrid router so that it is the Madrid branch switchboard that carries out the outside call. In the same way, the calls destined for Barcelona should be carried out through voice over IP to the Barcelona branch. If for any reason a link between the office and one of the branches is not available, you must divert the outside calls to the other branch, as a call between Madrid and Barcelona is cheaper for the company than a call between Santander and Madrid or between Santander and Barcelona.

Calls between a Barcelona extension directed to a non-corporate telephone in Madrid, must be routed through voice over IP to the Madrid switchboard in such a way that to all billing effects it is this switchboard making the call. In the same way, calls from a Madrid extension directed to an outside telephone in Barcelona must be routed through voice over IP to the Barcelona switchboard so it is this latter switchboard making the outside call.

Additionally, there is an ISDN line between Madrid and Barcelona over which the operator has guaranteed that this will be used in cases of important calls between company directors but not for normal calls or calls to the outside.

The numeration plan proposed for the company is as follows:

The Madrid switchboard extensions follow the 6xx pattern and those for the Barcelona switchboard the 5xx pattern. The telephones in the Santander office will follow the 20x pattern (x= 1…4).

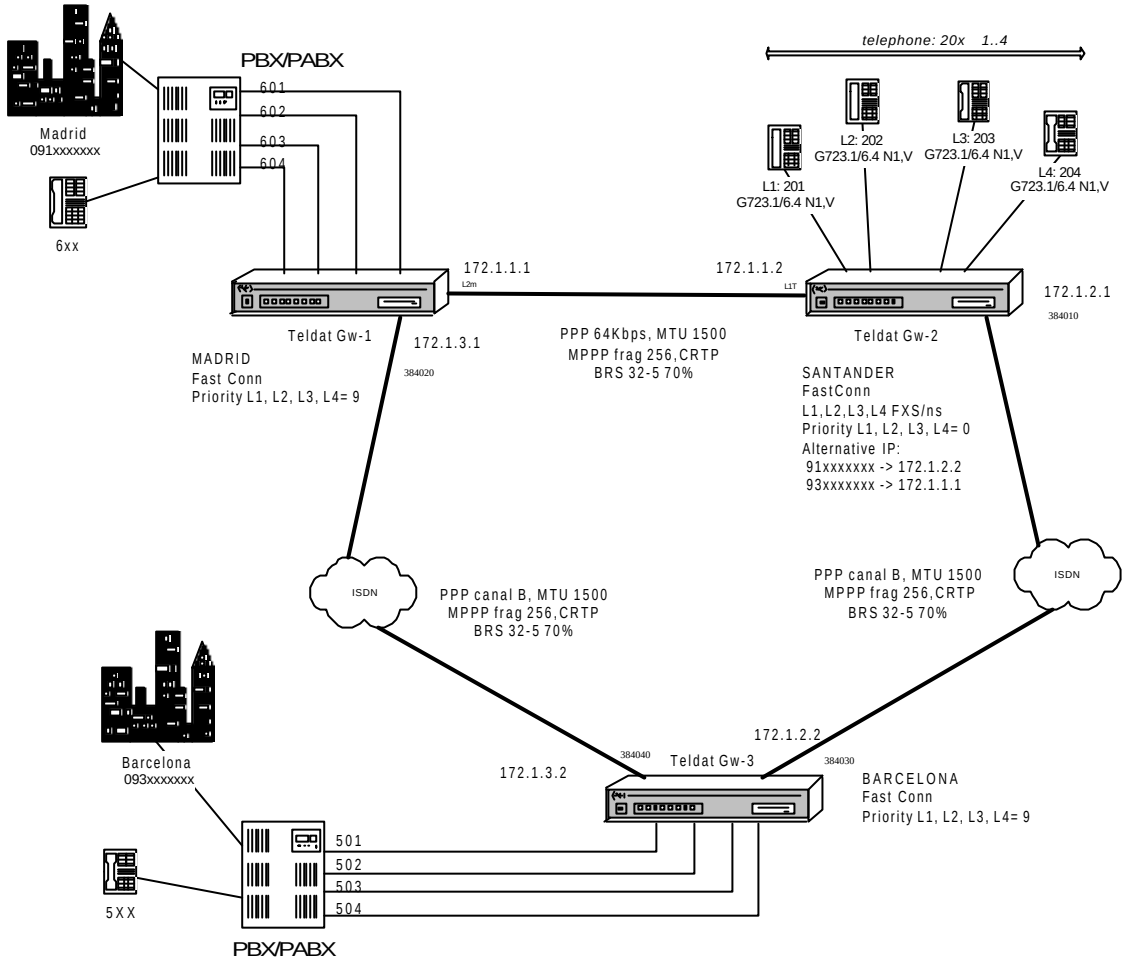

Figure 8.

To make a call from an extension of either of the two switchboards to the outside, a zero needs to be placed before the desired number, as the switchboards are configured as such. However this should be transparent for the office telephones which are able to call an outside number in Madrid or Barcelona by simply dialing the desired number without dialing zero first.

Confidential calls between the Madrid and Barcelona managers must begin with 7 followed by the extension required (76xx to call Madrid and 75xx to cal Barcelona). This line should not be used for outside calls i.e. calls to 791xxxxxxx or 793xxxxxxx numbers are not permitted.

Proposed configuration:

PPP serial line (Madrid-Santander):

To transmit data, the PPP protocol is used over a serial line, with a line speed of 64 Kbps. The RTP (CRTP) header compression is enabled without including the UDP checksum. This is done with the aim of saving bandwidth in the voice transmission. Fragmentation is also enabled in packets of 256 bytes.

The Madrid router interface is configured with IP address 172.1.1.1 (C class) and the Santander interface with IP address 172.1.1.2.

PPP over ISDN (Santander-Barcelona):

The Barcelona router interface is configured with IP address 172.1.2.2 (C class) and the Santander interface with IP address 172.1.2.1.

The Barcelona router is configured as caller, enabling outgoing calls and disabling incoming calls. Additionally, the address of the other router must be configured in the PPP protocol as the destination

address. The Santander router is configured as call receptor, disabling the outgoing calls and enabling the incoming.

PPP over ISDN (Madrid-Barcelona):

The Barcelona router interface is configured with IP address 172.1.3.2 (C class) and the Madrid interface with IP address 172.1.3.1.

The Barcelona router is configured as caller, enabling outgoing calls and disabling incoming calls. Additionally, the address of the other router must be configured in the PPP protocol as the destination address. The Madrid router is configured as the ISDN call receptor, disabling the outgoing calls and enabling the incoming.

Bandwidth Reservation:

With the aim of preventing cut outs in the voice when there is a lot of traffic, you must prioritize voice traffic versus data. To do this use the BRS, reserving at least 70 % of the bandwidth for voice traffic. This voice traffic is characterized by using UDP ports that are between 20000 to 20023 (RTP and RTCP traffic) as well as 1719 (RAS) and the TCP 1720 port (signaling). A 32 element tail will be used when there is little load reducing this to 5 when there is heavy traffic.

Numeration plan:

So that the Madrid extensions only have to know a single access telephone number for the branch, you should configure a capture group in the switchboard. In this way if you choose extension 601 to access the branch, you need to configure extensions 601, 602, 603 and 604 as a capture group. In this way if extension 601 is busy the call is automatically passed to extension 602. For the same reason in Barcelona, you should configure a capture group with extensions 501, 502, 503 and 504.

To call Barcelona from Santander, simply dial the extension (5xx pattern). If you call from Madrid, you need to execute a double dialing by first dialing 601 and when you hear the dial tone from the router, dial the extension (5xx pattern) or the non-corporative number (93xxxxxxx pattern) without placing a 0 before the number as this will be automatically added. If you wish to make a confidential call, you need to dial a 7 before dialing the extension required so that the Teldat-Gw 3 router routes the call over the ISDN line joining Madrid to Barcelona.

To call Santander from Madrid or Barcelona, you need to execute a double dialing by first dialing the extension connected to the router (601 in Madrid and 501 in Barcelona). When you hear the dial tone from the router, dial the Santander number you wish to call (20x pattern).

You wish to call Madrid from Santander, simply dial the extension (6xx pattern). If you call from Barcelona, you need to execute a double dialing by first dialing 501 and when you hear the dial tone from the router, dial the extension (6xx pattern) or the non-corporative number (91xxxxxxx pattern) without placing a 0 before the number as this will be automatically added. If you wish to make a confidential call, you need to dial a 7 before dialing the extension required so that the Teldat-Gw 3 router routes the call over the ISDN line joining Madrid to Barcelona.

Two possible IP addresses are configured in the Teldat-Gw 2 router for the telephones that begin with 93. First the address for the Teldat-Gw 3 router and subsequently that for the Teldat-Gw 1 router. For telephones that begin with 91, two other addresses are configured, first that for the Teldat-Gw 1 and subsequently that for the Teldat-Gw 3 router. This ensures that if a certain time period has lapsed and the first address does not respond to the call, the second address is called. This wait time has a default value of 30 seconds but can be configured through the SET TONE ERROR-TIMEOUT command. If you have an alternative address enabled, it is advisable to reduce the wait time so the user does not have to wait 30 seconds for the second call to be executed.

Additionally, you need to enable the MATCH-DIALING option in both routers so that if the users dial a number that does not adjust to the number specified the prefixes table, the line will automatically pass to an error state, increasing the availability of the line.

This is due to the fact that the line will pass directly from the DIALING state to the ERROR state, preventing the user to continue erroneous dialing.

Lines configuration:

All the lines both from the Teldat-Gw 1 router as well as the Teldat-Gw 3 router are configured in FXO mode and are connected to their respective switchboard extensions. All the Teldat-Gw 2 router lines are configured in FXS in non-suspended mode (FXS/ns) with the aim that the release of a call is carried out as quickly as possible. If this is not configured as such, the calls originating from a switchboard extension directed to an office line will not be released immediately after the users hang up, they will remain blocked until the Teldat-Gw 1 router (central) FXO line detects the switchboard has hung up and this strongly depends on the model of switchboard. This is time where despite the fact there is no conversation between the users, the router maintains the call as established thus preventing other users from using the line.

In the Teldat-Gw 1 router, four entries in the lines table are configured. These entries specify that all the numbers beginning with 9 have a 0 placed before them so that they are routed to the outside. As it is not necessary to make any modifications to the rest of the called numbers and the line the call is assigned to is indifferent, no more entries are added. In the same way, another four entries are configured so that all numbers beginning with 7 have this digit eliminated.

In the Teldat-Gw 2 router pertaining to the central four entries in the lines table are configured so that line 1 is associated to number 201, line 2 to 202 etc. All the lines will have priority 0, so that any call directed to a busy telephone is not diverted to another telephone.

In the Teldat-Gw 3 router pertaining to the central, four entries in the lines table are configured in order for all numbers beginning with 9 have a 0 placed before them so they are routed to the outside. In the same way, another four entries are configured so that all numbers beginning with 7 have this digit eliminated.

The G723.1 codec at 5.3 Kbps with VAD will be used in all the lines, sending an RTP packet in each UDP frame. With this speed you obtain good voice quality, with little delay without needing a large bandwidth.

However all the calls that are carried out to the outside will use another codec class, G723.1 at 6.4 Kbps, so that the voice quality in outside calls is a little higher than in calls between corporate telephones.

As all the lines have the same configuration and you do not wish to use the fax, the FAST-CONNECT mode is used.

Configurations:

Teldat-Gw1 (Madrid):

H323:

```
madrid H323 Config>LIST ALL

 GATEWAY PARAMETERS

Gateway internal address: 172.1.1.1
Fast Connect: Enabled                Q931 port: 1720
H323 call mode: Compatible           UDP  port: 20000

Gatekeeper address 0.0.0.0           Gateway name:
Gatekeeper zone:                     Tech-Prefix :
                                     Register E.164: Enabled

RAS port: 1719                       RAS time to live: 60
RAS timeout: 20                      RAS Connection attempt fail:  10

Enable Service Addr 0.0.0.0          Type of Service Disable: Disable Lines


 VOICE PARAMETRES

Dial tone frequency:      425      Ring tone activity: 15
Dial voice message:                Ring tone silence:  30

Alerting tone frequency:  425      Busy tone frequency: 425
```

```
Alerting tone activity:    15      Busy tone activity:  2
Alerting tone silence:     30      Busy tone silence:   2
Alerting voice message:            Busy voice message:

Error tone frequency:     425      Error tone silence 1: 2
Error tone activity:        2      Error tone silence 2: 6
Error voice message:

DTMF tones timeout:  10            Error Timeout: 30
Maximum delay: 300

 LINE 1 PARAMETERS

Telephone number: 601                 Interface type: FXO
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 9

Codec: G723 5.3Kbps                   VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB


 LINE 2 PARAMETERS

Telephone number: 602                 Interface type: FXO
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 9

Codec: G723 5.3Kbps                   VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB


 LINE 3 PARAMETERS

Telephone number: 603                 Interface type: FXO
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 9

Codec: G723 5.3Kbps                   VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB


 LINE 4 PARAMETERS

Telephone number: 604                 Interface type: FXO
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 9

Codec: G723 5.3Kbps                   VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB



Order LINE      TELEPHONE  STRIP-PREFIX DIAL-OUT-PREFIX

  1      1              9       0                   0
  2      2              9       0                   0
  3      3              9       0                   0
  4      4              9       0                   0
```

```
  5      1               7       1                   0
  6      2               7       1                   0
  7      3               7       1                   0
  8      4               7       1                   0

Entry:   1                Telephone: 5                Strip prefix: 0
Codec class: --           IP Addr: 172.1.2.2          Dial-Out Pref:
Tech Prefix:              Num. type: unknown          Translation: --
Local IP: 0.0.0.0

Entry:   2                Telephone: 2                Strip prefix: 0
Codec class: --           IP Addr: 172.1.1.2          Dial-Out Pref:
Tech Prefix:              Num. type: unknown          Translation: --
Local IP: 0.0.0.0

Entry:   3                Telephone: 93               Strip prefix: 0
Codec class: 1            IP Addr: 172.1.2.2          Dial-Out Pref:
Tech Prefix:              Num. type: unknown          Translation: --
Local IP: 0.0.0.0

Entry:   4                Telephone: 75               Strip prefix: 0
Codec class: 1            IP Addr: 172.1.3.2          Dial-Out Pref:
Tech Prefix:              Num. type: unknown          Translation: --
Local IP: 172.1.3.1

Match Dialing Plan: Enabled

Order  PREFIX         LENGTH

  1     93               9
  2     5                3
  3     2                3
  4     7                4

Id     Codec      frm/pkt (bytes)  VAD

1    G723 6.4Kbps      1 ( 24)      E

madrid H323 Config>
```

CONFIGURATION:

```
madrid Config>SHOW CONFIG
; Showing System Configuration ...
; Router ATLAS 2 8 Version 10.0.0

add device ppp 1
add device ppp 2
set data-link sync serial0/0
set data-link x25 serial0/1
set data-link x25 serial0/2
set hostname madrid
global-profiles ppp
; -- PPP Profiles Configuration --
   facilities 1 default
   facilities 1 mppp
   facilities 1 crtp without-checksum
;
   facilities 2 default
   facilities 2 mppp
   facilities 2 crtp without-checksum
;
   multilink 1 default
   multilink 1 endpoint ip 172.1.1.1
   multilink 1 fragmentation 256
;
   multilink 2 default
   multilink 2 endpoint ip 172.1.1.1
```

```
   multilink 2 fragmentation 256
;
   ppp 1 default
   ppp 1 facilities-profile 1
   ppp 1 mppp-profile 1
;
   ppp 2 default
   ppp 2 facilities-profile 2
   ppp 2 mppp-profile 2
;
exit
;
network serial0/0
; -- Interface Synchronous Serial Line. Configuration --
   set frame-size 1500
exit
;
network ppp1
; -- Generic PPP User Configuration --
   ppp
; -- PPP Configuration --
      profile 1
   exit
;
   base-interface
; -- Base Interface Configuration --
      base-interface serial0/0 link
;
   exit
;
exit
;
network ppp2
; -- Generic PPP User Configuration --
   ppp
; -- PPP Configuration --
      profile 2
   exit
;
   base-interface
; -- Base Interface Configuration --
      base-interface bri0/0 255 link
      base-interface bri0/0 255 profile isdn_dial_barna
;
   exit
;
exit
;
set dial-profile
; -- DIAL PROFILE CONFIGURATION --
   profile isdn_dial_barna default
   profile isdn_dial_barna no outbound
;
exit
;
protocol ip
; -- Internet protocol user configuration --
   internal-ip-address 172.1.1.1
;
   address  x25-node        192.168.252.1    255.255.255.0
   address  ppp1            172.1.1.1        255.255.255.0
   address  ppp2            172.1.3.1        255.255.255.0
;
exit
;
protocol h323
;
   line 1 telephone-number 601
   line 1 interface-type fxo
;
   line 2 telephone-number 602
```

```
   line 2 interface-type fxo
;
   line 3 telephone-number 603
   line 3 interface-type fxo
;
   line 4 telephone-number 604
   line 4 interface-type fxo
;
   match-dialing
   prefix 93 9
   prefix 5 3
   prefix 2 3
   prefix 7 4
   codec-class 1 default
   codec-class 1 codec-type g7236k4
;
   destination 5 172.1.2.2 default
;
   destination 2 172.1.1.2 default
;
   destination 93 172.1.2.2 default
   destination 93 172.1.2.2 codec-class 1
;
   destination 75 172.1.3.2 default
   destination 75 172.1.3.2 local-ip 172.1.3.1
   destination 75 172.1.3.2 codec-class 1
;
   port 1 9 default
   port 1 9 dial-out 0
;
   port 2 9 default
   port 2 9 dial-out 0
;
   port 3 9 default
   port 3 9 dial-out 0
;
   port 4 9 default
   port 4 9 dial-out 0
;
   port 1 7 default
   port 1 7 strip-digits 1
   port 1 7 dial-out 0
;
   port 2 7 default
   port 2 7 strip-digits 1
   port 2 7 dial-out 0
;
   port 3 7 default
   port 3 7 strip-digits 1
   port 3 7 dial-out 0
;
   port 4 7 default
   port 4 7 strip-digits 1
   port 4 7 dial-out 0
;
   fast-connect
exit
;
feature bandwidth-reservation
; -- Bandwidth Reservation user configuration --
   network ppp1
;
      enable
      class DEFAULT 10
      class VOIP 80
      ip-filter 0 lower source-port 20000 higher source-port 20023
      ip-filter 0 lower destination-port 20000 higher destination-port 20023
;
      assign FILTER0 VOIP NORMAL
      queue-length 32 5
   exit
```

```
;
   network ppp2
;
      enable
      class DEFAULT 10
      class VOIP 80
      ip-filter 0 lower source-port 20000 higher source-port 20023
      ip-filter 0 lower destination-port 20000 higher destination-port 20023
;
      assign FILTER0 VOIP NORMAL
      queue-length 32 5
   exit
;
exit
;
```

Teldat-Gw2 (Santander):

H323:

```
santand H323 Config>LIST ALL

 GATEWAY PARAMETERS

Gateway internal address: 172.1.1.2
Fast Connect: Enabled                Q931 port: 1720
H323 call mode: Compatible           UDP  port: 20000

Gatekeeper address 0.0.0.0           Gateway name:
Gatekeeper zone:                     Tech-Prefix :
                                     Register E.164: Enabled

RAS port: 1719                       RAS time to live: 60
RAS timeout: 20                      RAS Connection attempt fail:  10

Enable Service Addr 0.0.0.0          Type of Service Disable: Disable Lines


 VOICE PARAMETRES

Dial tone frequency:      425      Ring tone activity: 15
Dial voice message:                Ring tone silence:  30

Alerting tone frequency:  425      Busy tone frequency: 425
Alerting tone activity:    15      Busy tone activity:  2
Alerting tone silence:     30      Busy tone silence:   2
Alerting voice message:            Busy voice message:

Error tone frequency:     425      Error tone silence 1: 2
Error tone activity:        2      Error tone silence 2: 6
Error voice message:

DTMF tones timeout:  10            Error Timeout: 30
Maximum delay: 300

 LINE 1 PARAMETERS

Telephone number: 201                  Interface type: FXS/ns
Direct dialing:                        State: Enabled
Identifier H323:                       Priority: 9

Codec: G723 5.3Kbps                    VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : in band

Speaker gain: 0   dB                   Tone level: 0 Db
Mic gain: 10 dB


 LINE 2 PARAMETERS

Telephone number: 202                  Interface type: FXS/ns
```

```
Direct dialing:                          State: Enabled
Identifier H323:                         Priority: 9

Codec: G723 5.3Kbps                      VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)    DTMF relay : in band

Speaker gain: 0   dB                     Tone level: 0 dB
Mic gain: 10 dB


 LINE 3 PARAMETERS

Telephone number: 203                    Interface type: FXS/ns
Direct dialing:                          State: Enabled
Identifier H323:                         Priority: 9

Codec: G723 5.3Kbps                      VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)    DTMF relay : in band

Speaker gain: 0   dB                     Tone level: 0 dB
Mic gain: 10 dB


 LINE 4 PARAMETERS

Telephone number: 204                    Interface type: FXS/ns
Direct dialing:                          State: Enabled
Identifier H323:                         Priority: 9

Codec: G723 5.3Kbps                      VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)    DTMF relay : in band

Speaker gain: 0   dB                     Tone level: 0 dB
Mic gain: 10 dB



Order LINE      TELEPHONE  STRIP-PREFIX DIAL-OUT-PREFIX

  1      1             201       0
  2      2             202       0
  3      3             203       0
  4      4             204       0

Entry:   1               Telephone: 6              Strip prefix: 0
Codec class: --          IP Addr: 172.1.1.1        Dial-Out Pref:
Tech Prefix:             Num. type: unknown        Translation: --
Local IP: 0.0.0.0

Entry:   2               Telephone: 5              Strip prefix: 0
Codec class: --          IP Addr: 172.1.2.2        Dial-Out Pref:
Tech Prefix:             Num. type: unknown        Translation: --
Local IP: 0.0.0.0

Entry:   3               Telephone: 93             Strip prefix: 0
Codec class: 1           IP Addr: 172.1.2.2        Dial-Out Pref:
Tech Prefix:             Num. type: unknown        Translation: --
Local IP: 0.0.0.0

Entry:   4               Telephone: 93             Strip prefix: 0
Codec class: 1           IP Addr: 172.1.1.1        Dial-Out Pref:
Tech Prefix:             Num. type: unknown        Translation: --
Local IP: 0.0.0.0

Entry:   5               Telephone: 91             Strip prefix: 0
Codec class: 1           IP Addr: 172.1.1.1        Dial-Out Pref:
Tech Prefix:             Num. type: unknown        Translation: --
Local IP: 0.0.0.0

Entry:   6               Telephone: 91             Strip prefix: 0
Codec class: 1           IP Addr: 172.1.2.2        Dial-Out Pref:
```

```
Tech Prefix:              Num. type: unknown          Translation: --
Local IP: 0.0.0.0

Match Dialing Plan: Enabled

Order  PREFIX         LENGTH

  1     9                9
  2     5                3
  3     2                3
  4     6                3

Id     Codec      frm/pkt (bytes)  VAD

1    G723 6.4Kbps      1 ( 24)      E

santand H323 Config>
```

CONFIGURATION:

```
santand Config>SHOW CONFIG
; Showing System Configuration ...
; Router ATLAS 2 8 Version 10.0.0

add device ppp 1
add device ppp 2
set data-link sync serial0/0
set data-link x25 serial0/1
set data-link x25 serial0/2
set hostname santand
global-profiles ppp
; -- PPP Profiles Configuration --
   facilities 1 default
   facilities 1 mppp
   facilities 1 crtp without-checksum
;
   facilities 2 default
   facilities 2 mppp
   facilities 2 crtp without-checksum
;
   multilink 1 default
   multilink 1 endpoint ip 172.1.1.2
   multilink 1 fragmentation 256
;
   multilink 2 default
   multilink 2 endpoint ip 172.1.1.2
   multilink 2 fragmentation 256
;
   ppp 1 default
   ppp 1 facilities-profile 1
   ppp 1 mppp-profile 1
;
   ppp 2 default
   ppp 2 facilities-profile 2
   ppp 2 mppp-profile 2
;
exit
;
network serial0/0
; -- Interface Synchronous Serial Line. Configuration --
   set frame-size 1500
exit
;
network ppp1
; -- Generic PPP User Configuration –
   ppp
; -- PPP Configuration --
      profile 1
   exit
```

```
;
   base-interface
; -- Base Interface Configuration –
      base-interface serial0/0 link
;
   exit
;
exit
;
network ppp2
; -- Generic PPP User Configuration --
   ppp
; -- PPP Configuration --
      profile 2
   exit
;
   base-interface
; -- Base Interface Configuration --
      base-interface bri0/0 255 link
      base-interface bri0/0 255 profile isdn_dial_barna
;
   exit
;
exit
;
set dial-profile
; -- DIAL PROFILE CONFIGURATION --
   profile isdn_dial_barna default
   profile isdn_dial_barna no outbound
;
exit
;
protocol ip
; -- Internet protocol user configuration --
   internal-ip-address 172.1.1.2
;
   address  x25-node        192.168.252.1    255.255.255.0
   address  ppp1            172.1.1.2        255.255.255.0
   address  ppp2            172.1.2.1        255.255.255.0
;
exit
;
protocol h323
;
   line 1 telephone-number 201
   line 1 no suspend-mode
;
   line 2 telephone-number 202
   line 2 no suspend-mode
;
   line 3 telephone-number 203
   line 3 no suspend-mode
;
   line 4 telephone-number 204
   line 4 no suspend-mode
;
   match-dialing
   prefix 9 9
   prefix 5 3
   prefix 2 3
   prefix 6 3
   codec-class 1 default
   codec-class 1 codec-type g7236k4
;
   destination 6 172.1.1.1 default
;
   destination 5 172.1.2.2 default
;
   destination 93 172.1.2.2 default
   destination 93 172.1.2.2 codec-class 1
```

```
;
   destination 93 172.1.1.1 default
   destination 93 172.1.1.1 codec-class 1
;
   destination 91 172.1.1.1 default
   destination 91 172.1.1.1 codec-class 1
;
   destination 91 172.1.2.2 default
   destination 91 172.1.2.2 codec-class 1
;
   port 1 201 default
;
   port 2 202 default
;
   port 3 203 default
;
   port 4 204 default
;
   fast-connect
exit
;
feature bandwidth-reservation
; -- Bandwidth Reservation user configuration --
   network ppp1
;
      enable
      class DEFAULT 10
      class VOIP 80
      ip-filter 0 lower source-port 20000 higher source-port 20023
      ip-filter 0 lower destination-port 20000 higher destination-port 20023
;
      assign FILTER0 VOIP NORMAL
      queue-length 32 5
   exit
;
   network ppp2
;
      enable
      class DEFAULT 10
      class VOIP 80
      ip-filter 0 lower source-port 20000 higher source-port 20023
      ip-filter 0 lower destination-port 20000 higher destination-port 20023
;
      assign FILTER0 VOIP NORMAL
      queue-length 32 5
   exit
;
exit
;
santand Config>
```

Teldat-Gw 3 (Barcelona):

H323:

```
barna H323 Config>LIST ALL

 GATEWAY PARAMETERS

Gateway internal address: 172.1.2.2
Fast Connect: Enabled                Q931 port: 1720
H323 call mode: Compatible           UDP  port: 20000

Gatekeeper address 0.0.0.0           Gateway name:
Gatekeeper zone:                     Tech-Prefix :
                                     Register E.164: Enabled

RAS port: 1719                       RAS time to live: 60
RAS timeout: 20                      RAS Connection attempt fail:  10
```

```
Enable Service Addr 0.0.0.0          Type of Service Disable: Disable Lines


VOICE PARAMETRES

Dial tone frequency:      425      Ring tone activity: 15
Dial voice message:                Ring tone silence:  30

Alerting tone frequency:  425      Busy tone frequency: 425
Alerting tone activity:    15      Busy tone activity:  2
Alerting tone silence:     30      Busy tone silence:   2
Alerting voice message:            Busy voice message:

Error tone frequency:     425      Error tone silence 1: 2
Error tone activity:        2      Error tone silence 2: 6
Error voice message:

DTMF tones timeout:  10            Error Timeout: 30
Maximum delay: 300

 LINE 1 PARAMETERS

Telephone number: 501                 Interface type: FXO
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 9

Codec: G723 5.3Kbps                   VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB


 LINE 2 PARAMETERS

Telephone number: 502                 Interface type: FXO
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 9

Codec: G723 5.3Kbps                   VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB


 LINE 3 PARAMETERS

Telephone number: 503                 Interface type: FXO
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 9

Codec: G723 5.3Kbps                   VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB


 LINE 4 PARAMETERS

Telephone number: 504                 Interface type: FXO
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 9

Codec: G723 5.3Kbps                   VAD: Enabled
Frames H323/packet RTP: 1 ( 20 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
```

```
Mic gain: 10 dB



Order LINE      TELEPHONE  STRIP-PREFIX DIAL-OUT-PREFIX

  1      1               9       0                   0
  2      2               9       0                   0
  3      3               9       0                   0
  4      4               9       0                   0
  5      1               7       1                   0
  6      2               7       1                   0
  7      3               7       1                   0
  8      4               7       1                   0

Entry:   1                Telephone: 6               Strip prefix: 0
Codec class: --           IP Addr: 172.1.1.1         Dial-Out Pref:
Tech Prefix:              Num. type: unknown         Translation: --
Local IP: 0.0.0.0

Entry:   2                Telephone: 2               Strip prefix: 0
Codec class: --           IP Addr: 172.1.2.1         Dial-Out Pref:
Tech Prefix:              Num. type: unknown         Translation: --
Local IP: 0.0.0.0

Entry:   3                Telephone: 91              Strip prefix: 0
Codec class: 1            IP Addr: 172.1.1.1         Dial-Out Pref:
Tech Prefix:              Num. type: unknown         Translation: --
Local IP: 0.0.0.0

Entry:   4                Telephone: 76              Strip prefix: 0
Codec class: --           IP Addr: 172.1.3.1         Dial-Out Pref:
Tech Prefix:              Num. type: unknown         Translation: --
Local IP: 172.1.3.2

Match Dialing Plan: Enabled

Order  PREFIX         LENGTH

  1     9               9
  2     2               3
  3     6               3
  4     7               4

Id     Codec      frm/pkt (bytes)  VAD

1    G723 6.4Kbps      1 ( 24)      E

barna H323 Config>
```

CONFIGURATION:

```
barna Config>SHOW CONFIG
; Showing System Configuration ...
; Router ATLAS 2 8 Version 10.0.0

add device ppp 1
add device ppp 2
set data-link x25 serial0/0
set data-link x25 serial0/1
set data-link x25 serial0/2
set hostname barna
global-profiles ppp
; -- PPP Profiles Configuration --
   facilities 1 default
   facilities 1 mppp
   facilities 1 crtp without-checksum
;
```

```
   facilities 2 default
   facilities 2 mppp
   facilities 2 crtp without-checksum
;
   multilink 1 default
   multilink 1 endpoint ip 172.1.3.2
   multilink 1 fragmentation 256
;
   multilink 2 default
   multilink 2 endpoint ip 172.1.3.2
   multilink 2 fragmentation 256
;
   ppp 1 default
   ppp 1 facilities-profile 1
   ppp 1 mppp-profile 1
;
   ppp 2 default
   ppp 2 facilities-profile 2
   ppp 2 mppp-profile 2
;
exit
;
network ppp1
; -- Generic PPP User Configuration --
   ppp
; -- PPP Configuration --
      profile 2
   exit
;
   base-interface
; -- Base Interface Configuration --
      base-interface bri0/0 255 link
      base-interface bri0/0 255 profile isdn_dial_san
;
   exit
;
exit
;
network ppp2
; -- Generic PPP User Configuration --
   ppp
; -- PPP Configuration --
      profile 2
   exit
;
   base-interface
; -- Base Interface Configuration --
      base-interface bri0/0 255 link
      base-interface bri0/0 255 profile isdn_dial_mad
;
   exit
;
exit
;
set dial-profile
; -- DIAL PROFILE CONFIGURATION --
   profile isdn_dial_san default
   profile isdn_dial_san local-address 384810
   profile isdn_dial_san no outbound
;
   profile isdn_dial_mad default
   profile isdn_dial_mad local-address 384830
   profile isdn_dial_mad no outbound
;
exit
;
protocol ip
; -- Internet protocol user configuration --
   internal-ip-address 172.1.2.2
;
   address  x25-node        192.168.252.1    255.255.255.0
```

```
   address  ppp1            172.1.2.2        255.255.255.0
   address  ppp2            172.1.3.2        255.255.255.0
;
exit
;
protocol h323
;
   line 1 telephone-number 501
   line 1 interface-type fxo
;
   line 2 telephone-number 502
   line 2 interface-type fxo
;
   line 3 telephone-number 503
   line 3 interface-type fxo
;
   line 4 telephone-number 504
   line 4 interface-type fxo
;
   match-dialing
   prefix 9 9
   prefix 2 3
   prefix 6 3
   prefix 7 4
   codec-class 1 default
   codec-class 1 codec-type g7236k4
;
   destination 6 172.1.1.1 default
;
   destination 2 172.1.2.1 default
;
   destination 91 172.1.1.1 default
   destination 91 172.1.1.1 codec-class 1
;
   destination 76 172.1.3.1 default
   destination 76 172.1.3.1 local-ip 172.1.3.2
;
   port 1 9 default
   port 1 9 dial-out 0
;
   port 2 9 default
   port 2 9 dial-out 0
;
   port 3 9 default
   port 3 9 dial-out 0
;
   port 4 9 default
   port 4 9 dial-out 0
;
   port 1 7 default
   port 1 7 strip-digits 1
   port 1 7 dial-out 0
;
   port 2 7 default
   port 2 7 strip-digits 1
   port 2 7 dial-out 0
;
   port 3 7 default
   port 3 7 strip-digits 1
   port 3 7 dial-out 0
;
   port 4 7 default
   port 4 7 strip-digits 1
   port 4 7 dial-out 0
;
   fast-connect
exit
;
feature bandwidth-reservation
; -- Bandwidth Reservation user configuration --
   network ppp1
```

```
;
      enable
      class DEFAULT 10
      class VOIP 80
      ip-filter 0 lower source-port 20000 higher source-port 20023
      ip-filter 0 lower destination-port 20000 higher destination-port 20023
;
      assign FILTER0 VOIP NORMAL
      queue-length 32 5
   exit
;
   network ppp2
;
      enable
      class DEFAULT 10
      class VOIP 80
      ip-filter 0 lower source-port 20000 higher source-port 20023
      ip-filter 0 lower destination-port 20000 higher destination-port 20023
;
      assign FILTER0 VOIP NORMAL
      queue-length 32 5
   exit
;
exit
;
barna Config>
```

Tests:

Calls from an extension in Madrid to an extension in Barcelona:

To make a call from an extension in Madrid to an extension in Barcelona, dial 601 so that the Madrid switchboard calls a line that is configured as a capture group and is free. When you hear the dial tone from the Teldat-Gw 1 router, you need to dial the extension in Barcelona you wish to call (5xx pattern).

Calls from an extension in Barcelona to an extension in Madrid:

To make a call from Barcelona to an extension in Madrid, dial 501 so that the Barcelona switchboard calls a line that is configured as a capture group and is free. When you hear the dial tone from the Teldat-Gw 2 router, you need to dial the extension in Madrid you wish to call (6xx pattern).

Calls from an extension in Madrid to a non-corporate fixed telephone in Barcelona:

To make a call to a non-corporate telephone in Barcelona from a Madrid switchboard extension, dial 601 so that the switchboard in Madrid calls a line that is configured as a capture group and is free. When you hear the dial tone from the Teldat-Gw 1 router, dial the number (93xxxxxxx), and the call will be routed to the Teldat-Gw 3 router. Subsequently the Teldat-Gw 3 router FXO line will automatically place a 0 in front of this number so the call is routed to the outside through the Barcelona switchboard.

You can see how the codec that is used for these calls is G723.1 at 6.4 Kbps, while the internal calls use a codec at 5.3 Kbps.

Calls from a Barcelona extension to a non-corporate fixed telephone in Madrid:

To make a call to a non-corporate telephone in Madrid from a Barcelona switchboard extension, dial 501 so that the switchboard in Barcelona calls a line that is configured as a capture group and is free. When you hear the dial tone from the Teldat-Gw 3 router, dial the number (91xxxxxxx), and the call will be routed to the Teldat-Gw 1 router. Subsequently the Teldat-Gw 1 router FXO line will automatically place a 0 in front of this number so the call is routed to the outside through the Madrid switchboard.

You can see how the codec that is used for these calls is G723.1 at 6.4 Kbps, while the internal calls use a codec at 5.3 Kbps.

Calls from a telephone in Santander to an extension in Madrid or Barcelona:

Simply pick the telephone and dial the extension number.

Call from a telephone in Santander to a non-corporate telephone in Madrid or Barcelona:

Dial the number and check that if the number begins with 91, it is diverted to Madrid and if it begins with 93 it is diverted to Barcelona.

Using the alternative address:

On making a call from Santander to a non-corporate telephone in Madrid, you should check that if the call has not been carried out correctly, either because the link between Santander and Madrid is down or because all the Teldat-Gw 1 router lines are busy, the call is diverted to Barcelona. Contrariwise, a call directed to Barcelona must be diverted to Madrid if the Teldat-Gw 3 router cannot attend it. This call retry is produced if after a determined period of time you are unable to contact the first of the destinations, by default the time is 30 seconds, however this is configurable through the **SET TIME-OUT ERROR** command. If you foresee that this situation could frequently occur, it is advisable to reduce this time so that the user does not have to wait 30 seconds before carrying out a new call attempt.

d) *Implementation of PABX remote extensions*

Description:

A company that has a central office with a switchboard and is considering extending its business in another city by acquiring a small office, where a maximum of four people will be employed. The company would like the employees working in this office to have the same numeration plan as the employees in the central office, i.e. they have the feeling of being one more extension in the switchboard. The company also wants one of the four telephones to be able to carry out calls to the other three telephones.

The link between the office and the central is carried out through a Frame-Relay line, using the DLCI number 30. The central IP address will be 172.1.1.1 and the office address 172.1.1.2.

The proposed numeration plan for the company is as follows:

The switchboard extensions follow the 6xx pattern, the extensions reserved for the new office telephones being 621, 622, 623 and 624.

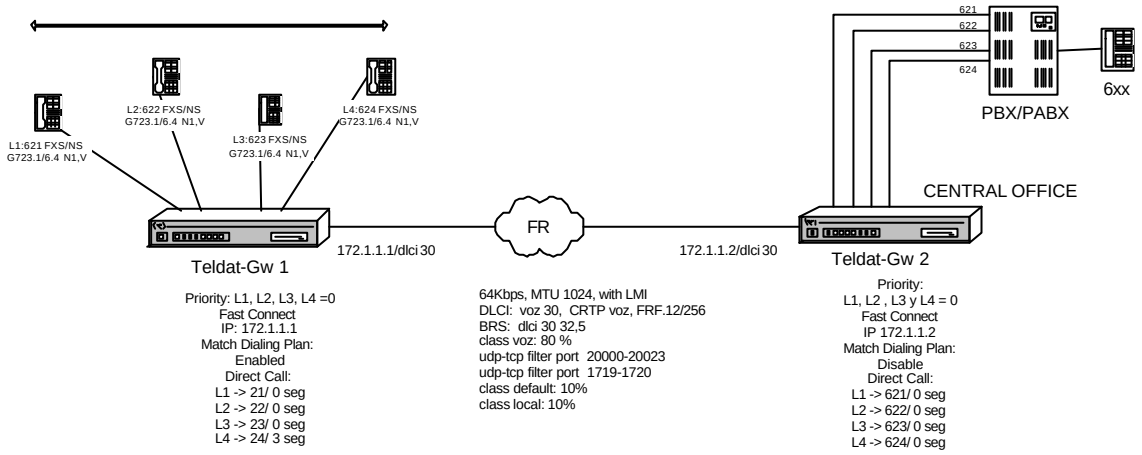

Figure 9.

Proposed configuration:

Frame Relay:

The configuration is identical to the Frame-Relay 2.3.a example.

Bandwidth Reservation:

The configuration is identical to the Frame-Relay 2.3.a example.

Numeration plan:

The numeration plan is unique for the entire setup: the switchboard extensions 621, 622, 623 and 624 are reserved for the office's four telephones; the remaining extensions are for the central office.

In this way in order to call the branch extensions you add an entry that sends all the calls to the Teldat-Gw 1. As these are direct calls, no entry is required in the prefix table nor does MATCH-DIALING require enabling.

Since 62x extensions are found at both the ends of the VOIP network, in order to make calls from the Teldat-Gw 1 to the central other numbers are used (2x pattern). These numbers are only used internally to establish calls from the Teldat-Gw 1 to the Teldat-Gw 2. With this aim in mind, add an entry in the addresses table that routes all the calls directed to the 2x telephones to the Teldat-Gw 2 gateway IP address.

One telephone in the branch can make calls, therefore an entry in the prefixes table is added and the MATCH-DIALING is enabled. In this way, if the users dial a number that does not adjust to that specified in the prefixes table, the line automatically passes to an error state thus increasing the line availability.

This is due to the fact that the line will pass directly from the DIALING state to the ERROR state, preventing the user to continue erroneous dialing.

Lines configuration:

The lines from the Teldat-Gw 2 router are configured in FXO mode, as they will be connected to extensions in the switchboard.

All the FXS lines are configured in non-suspended mode (FXS/ns) in the Teldat-Gw 1 router with the aim that the release of a call is carried out as quickly as possible. If this is not configured as such, the calls originating from a switchboard extension directed to an office line will not be released immediately after the users hang up, they will remain blocked until the Teldat-Gw 2 router (central) FXO line detects the switchboard has hung up and this strongly depends on the model of switchboard.

This is time where despite the fact there is no conversation between the users, the router maintains the call as established thus preventing other users from using the line.

Direct dialing is configured in the Teldat-Gw 1 router lines 1, 2, and 3 so that as soon as you pick up the receiver, the extension corresponding to the switchboard is called. In line 4 however there is a wait time of 3 seconds before dialing is carried out, in order to provide the possibility of executing internal calls to the other three lines. With direct dialing, the device carries out the call to the central equipment, which on picking up the FXO line permits you to hear the central switchboard dialing tone. At this point you can dial any number as if you were directly connected to the extension, without needing to execute double dialing.

Direct dialing is also configured from any Teldat-Gw 2 router line to its corresponding line in the Teldat-Gw 1 router. Therefore if you call an extension connected to the Teldat-Gw 2 router, this will directly call the corresponding office telephone.

You must take two important details into account: the first is that the number used to carry out direct dialing in the Teldat-Gw 1 router cannot be configured in this router's lines table since the call would be considered internal; the second important point is that the digits reaching the FXO line from the direct dialing must be deleted, otherwise these will be dialed over the switchboard and an error will be produced (a line configured in FXO mode re-dials all the received digits to the outside).

For this example, we have chosen to configure the lines with numbers 621, 622, 623, 624, and configure as direct dialing in the Teldat-Gw 1 router the numbers 21, 22, 23, 24. In the Teldat-Gw 2 router four entries in the lines table are configured in order to divert number 21 to line 1, number 22 to line 2 etc., and to delete the first two digits (i.e. the entire number).

To make the support task easier, we recommend giving the central device lines a telephone number. These number are used as calling numbers and do not influence the functionality of the device. However, at the time of monitoring the active and released calls in the branch device, this provides the information on the line used in the call. The numbers assigned are 2621 to 2624.

All of the lines will use the G732.1 codec at 6.4 Kbps with VAD, sending an RTP packet in each UDP frame.

In order to have audio as soon as you pick up the receiver, and as all the lines have the same configuration and you do not wish to use the fax, the FAST-CONNECT option is enabled in both gateways.

Configurations:

The Frame-Relay, IP and BRS configurations are identical to the 2.3.a example, therefore only the H323 configurations are given.

Teldat-Gw 1 (branch):

H323:

```
Teldat-1 H323 Config>LIST ALL

 GATEWAY PARAMETERS

Gateway internal address: 172.1.1.1
Fast Connect: Enabled                Q931 port: 1720
H323 call mode: Compatible           UDP  port: 20000

Gatekeeper address 0.0.0.0           Gateway name:
Gatekeeper zone:                     Tech-Prefix :
                                     Register E.164: Enabled

RAS port: 1719                       RAS time to live: 60
RAS timeout: 20                      RAS Connection attempt fail:  10

Enable Service Addr 0.0.0.0          Type of Service Disable: Disable Lines


 VOICE PARAMETRES

Dial tone frequency:      425      Ring tone activity: 15
Dial voice message:                Ring tone silence:  30

Alerting tone frequency:  425      Busy tone frequency: 425
Alerting tone activity:    15      Busy tone activity:  2
Alerting tone silence:     30      Busy tone silence:   2
Alerting voice message:            Busy voice message:

Error tone frequency:     425      Error tone silence 1: 2
Error tone activity:        2      Error tone silence 2: 6
Error voice message:

DTMF tones timeout:  10            Error Timeout: 30
Maximum delay: 300

 LINE 1 PARAMETERS

Telephone number: 621                  Interface type: FXS/ns
Direct dialing:   21 /0                State: Enabled
Identifier H323:                       Priority: 0

Codec: G723 6.4Kbps                    VAD: Enabled
Frames H323/packet RTP: 1 ( 24 bytes)  DTMF relay : in band

Speaker gain: 0   dB                   Tone level: 0 dB
Mic gain: 10 dB


LINE 2 PARAMETERS

Telephone number: 621                  Interface type: FXS/ns
Direct dialing:   22 /0                State: Enabled
Identifier H323:                       Priority: 0
```

```
Codec: G723 6.4Kbps                     VAD: Enabled
Frames H323/packet RTP: 1 ( 24 bytes)  DTMF relay : in band

Speaker gain: 0   dB                    Tone level: 0 dB
Mic gain: 10 dB


 LINE 3 PARAMETERS

Telephone number: 621                   Interface type: FXS/ns
Direct dialing:   23 /0                 State: Enabled
Identifier H323:                        Priority: 0

Codec: G723 6.4Kbps                     VAD: Enabled
Frames H323/packet RTP: 1 ( 24 bytes)  DTMF relay : in band

Speaker gain: 0   dB                    Tone level: 0 dB
Mic gain: 10 dB


 LINE 4 PARAMETERS

Telephone number: 621                   Interface type: FXS/ns
Direct dialing:   24 /3                 State: Enabled
Identifier H323:                        Priority: 0

Codec: G723 6.4Kbps                     VAD: Enabled
Frames H323/packet RTP: 1 ( 24 bytes)  DTMF relay : in band

Speaker gain: 0   dB                    Tone level: 0 dB
Mic gain: 10 dB



Order LINE      TELEPHONE  STRIP-PREFIX DIAL-OUT-PREFIX

  1      1             621       0
  2      2             621       0
  3      3             621       0
  4      4             621       0

Entry:   1               Telephone: 2               Strip prefix: 0
Codec class: --          IP Addr: 172.1.1.2         Dial-Out Pref:
Tech Prefix:             Num. type: unknown         Translation: --
Local IP: 0.0.0.0

Match Dialing Plan: Enabled

Order  PREFIX         LENGTH

  1     2               2
  2     6               3

Id     Codec      frm/pkt (bytes)  VAD

Teldat-1 H323 Config>
```

CONFIGURATION:

```
Teldat-1 Config>SHOW CONFIG
; Showing System Configuration ...
; Router ATLAS 2 8 Version 10.0.0

set data-link frame-relay serial0/0
set data-link x25 serial0/1
set data-link x25 serial0/2
set hostname Teldat-1
network serial0/0
; -- Frame Relay user configuration --
   pvc 30 default
```

```
   pvc 30 fragmentation-size 256
   pvc 30 name voz
   pvc 30 compression crtp without-udp-checksum
;
   protocol-address 172.1.1.2 30
   set frame-size 1024
exit
;
protocol ip
; -- Internet protocol user configuration --
   internal-ip-address 172.1.1.1
;
   address  serial0/0       172.1.1.1        255.255.255.0
   address  x25-node        192.168.252.1    255.255.255.0
;
exit
;
protocol h323
;
   line 1 telephone-number 621
   line 1 no suspend-mode
   line 1 direct-dialing 21 0
   line 1 priority 0
   line 1 codec g7236k4
;
   line 2 telephone-number 621
   line 2 no suspend-mode
   line 2 direct-dialing 22 0
   line 2 priority 0
   line 2 codec g7236k4
;
   line 3 telephone-number 621
   line 3 no suspend-mode
   line 3 direct-dialing 23 0
   line 3 priority 0
   line 3 codec g7236k4
;
   line 4 telephone-number 621
   line 4 no suspend-mode
   line 4 direct-dialing 24 3
   line 4 priority 0
   line 4 codec g7236k4
;
   match-dialing
   prefix 2 2
   prefix 6 3
   destination 2 172.1.1.2 default
;
   port 1 621 default
;
   port 2 621 default
;
   port 3 621 default
;
   port 4 621 default
;
   fast-connect
exit
;
feature bandwidth-reservation
; -- Bandwidth Reservation user configuration --
   network serial0/0
;
      enable
      circuit 30
;
         enable
         class DEFAULT 10
         class VOIP 80
         ip-filter 0 lower source-port 1719 higher source-port 1720
         ip-filter 0 lower destination-port 1719 higher destination-port 1720
```

```
;
         ip-filter 1 lower source-port 20000 higher source-port 20023
         ip-filter 1 lower destination-port 20000 higher destination-port 20023
;
         assign FILTER0 VOIP NORMAL
         assign FILTER1 VOIP NORMAL
         queue-length 32 5
      exit
;
   exit
;
exit
;
Teldat-1 Config>
```

Teldat-Gw 2 (central):

H323:

```
Teldat-2 H323 Config>LIST ALL

 GATEWAY PARAMETERS

Gateway internal address: 172.1.1.2
Fast Connect: Enabled                Q931 port: 1720
H323 call mode: Compatible           UDP  port: 20000

Gatekeeper address 0.0.0.0           Gateway name:
Gatekeeper zone:                     Tech-Prefix :
                                     Register E.164: Enabled

RAS port: 1719                       RAS time to live: 60
RAS timeout: 20                      RAS Connection attempt fail:  10

Enable Service Addr 0.0.0.0          Type of Service Disable: Disable Lines


 VOICE PARAMETRES

Dial tone frequency:      425      Ring tone activity: 15
Dial voice message:                Ring tone silence:  30

Alerting tone frequency:  425      Busy tone frequency: 425
Alerting tone activity:    15      Busy tone activity:  2
Alerting tone silence:     30      Busy tone silence:   2
Alerting voice message:            Busy voice message:

Error tone frequency:     425      Error tone silence 1: 2
Error tone activity:        2      Error tone silence 2: 6
Error voice message:

DTMF tones timeout:  10            Error Timeout: 30
Maximum delay: 300

 LINE 1 PARAMETERS

Telephone number: 2621                Interface type: FXO
Direct dialing:   621 /0              State: Enabled
Identifier H323:                      Priority: 0

Codec: G723 6.4Kbps                   VAD: Enabled
Frames H323/packet RTP: 1 ( 24 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB


 LINE 2 PARAMETERS

Telephone number: 2622                Interface type: FXO
```

```
Direct dialing:   622 /0                State: Enabled
Identifier H323:                        Priority: 0

Codec: G723 6.4Kbps                     VAD: Enabled
Frames H323/packet RTP: 1 ( 24 bytes)   DTMF relay : in band

Speaker gain: 0   dB                    Tone level: 0 dB
Mic gain: 10 dB


 LINE 3 PARAMETERS

Telephone number: 2623                  Interface type: FXO
Direct dialing:   623 /0                State: Enabled
Identifier H323:                        Priority: 0

Codec: G723 6.4Kbps                     VAD: Enabled
Frames H323/packet RTP: 1 ( 24 bytes)   DTMF relay : in band

Speaker gain: 0   dB                    Tone level: 0 dB
Mic gain: 10 dB


 LINE 4 PARAMETERS

Telephone number: 2624                  Interface type: FXO
Direct dialing:   624 /0                State: Enabled
Identifier H323:                        Priority: 0

Codec: G723 6.4Kbps                     VAD: Enabled
Frames H323/packet RTP: 1 ( 24 bytes)   DTMF relay : in band

Speaker gain: 0   dB                    Tone level: 0 dB
Mic gain: 10 dB



Order LINE      TELEPHONE  STRIP-PREFIX DIAL-OUT-PREFIX

  1      1              21       2
  2      2              22       2
  3      3              23       2
  4      4              24       2

Entry:   1                Telephone: 6                Strip prefix: 0
Codec class: --           IP Addr: 172.1.1.1          Dial-Out Pref:
Tech Prefix:              Num. type: unknown          Translation: --
Local IP: 0.0.0.0

Match Dialing Plan: Disabled

Order  PREFIX         LENGTH


Id     Codec      frm/pkt (bytes)  VAD


Teldat-2 H323 Config>
```

CONFIGURATION:

```
Teldat-2 Config>SHOW CONFIG
; Showing System Configuration ...
; Router ATLAS 2 8 Version 10.0.0

set data-link frame-relay serial0/0
set data-link x25 serial0/1
set data-link x25 serial0/2
set hostname Teldat-2
network serial0/0
```

```
; -- Frame Relay user configuration --
   pvc 30 default
   pvc 30 fragmentation-size 256
   pvc 30 name voip
   pvc 30 compression crtp without-udp-checksum
;
   protocol-address 172.1.1.1 30
   set frame-size 1024
exit
;
protocol ip
; -- Internet protocol user configuration --
   internal-ip-address 172.1.1.2
;
   address  serial0/0       172.1.1.2        255.255.255.0
   address  x25-node        192.168.252.1    255.255.255.0
;
exit
;
protocol h323
;
   line 1 telephone-number 2621
   line 1 interface-type fxo
   line 1 direct-dialing 621 0
   line 1 priority 0
   line 1 codec g7236k4
;
   line 2 telephone-number 2622
   line 2 interface-type fxo
   line 2 direct-dialing 622 0
   line 2 priority 0
   line 2 codec g7236k4
;
   line 3 telephone-number 2623
   line 3 interface-type fxo
   line 3 direct-dialing 623 0
   line 3 priority 0
   line 3 codec g7236k4
;
   line 4 telephone-number 2624
   line 4 interface-type fxo
   line 4 direct-dialing 624 0
   line 4 priority 0
   line 4 codec g7236k4
;
   destination 6 172.1.1.1 default
;
   port 1 21 default
   port 1 21 strip-digits 2
;
   port 2 22 default
   port 2 22 strip-digits 2
;
   port 3 23 default
   port 3 23 strip-digits 2
;
   port 4 24 default
   port 4 24 strip-digits 2
;
   fast-connect
exit
;
feature bandwidth-reservation
; -- Bandwidth Reservation user configuration --
   network serial0/0
;
      enable
      circuit 30
;
         enable
```

```
         class DEFAULT 10
         class VOIP 80
         ip-filter 0 lower source-port 1719 higher source-port 1720
         ip-filter 0 lower destination-port 1719 higher destination-port 1720
;
         ip-filter 1 lower source-port 20000 higher source-port 20023
         ip-filter 1 lower destination-port 20000 higher destination-port 20023
;
         assign FILTER0 VOIP NORMAL
         assign FILTER1 VOIP NORMAL
         queue-length 32 5
      exit
;
   exit
;
exit
;
Teldat-2 Config>
```

Tests:

Calls from a central extension to an office telephone:

You should check that you only need to call the extension you wish (621, 622, 623 or 624) in order for the office telephone to ring. Double dialing is not necessary.

Call from an office telephone to an extension in the central:

Simply pick up the receiver so the Teldat-Gw 2 router is called. Once you hear the dial tone from the switchboard, you then proceed to dial the extension you want. In the case of line 4, the call to the Teldat-Gw 2 router takes three seconds to be carried out therefore the process is a little slower.

Calls from the office line 4 to a telephone in the office:

Simply pick up the receiver and dial 621, 622 or 623 depending on which office telephone you wish to call. You must dial the first digit within the space of three seconds; otherwise the Teldat-Gw 1 router will proceed with the direct dialing to the Teldat-Gw 2 router.

3. ENVIRONMENTS WITH GATEKEEPER

Description:

A company wishes to provide voice service for its headquarters and therefore contracts the services of a VoIP supplier. This supplier has a gatekeeper where all the VoIP devices installed in the company headquarters must be registered.

This environment consists of a Nucleox Plus gateway that provides support for four telephones and the WAN output to connect to the gatekeeper and to various PCs which execute the Microsoft NetMeeting program.

The telephones connected to the Nucleox-Plus will have telephone numbers 201, 202, 203 and 204. The PCs will have the 8xxx pattern telephone numbers where the last three digits of the telephone number correspond with the last three digits of the IP address. As this is a class C subnet, the situation of two PCs using the same telephone number is avoided.

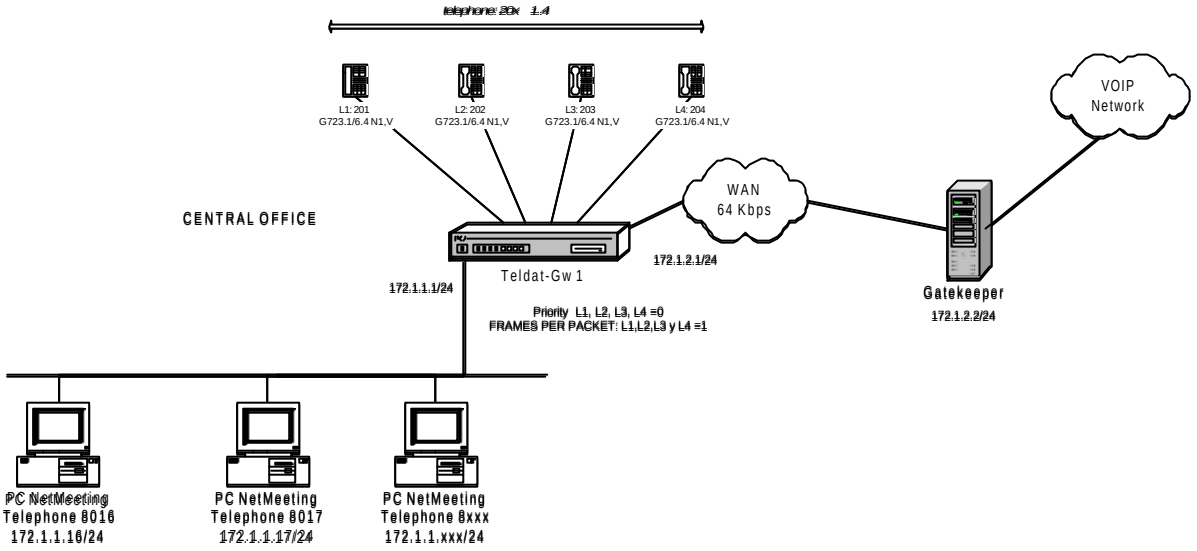

Figure 10.

Proposed configuration:

Numeration plan:

In the Teldat-Gw 1 gateway, address 172.1.2.2 is established as the gatekeeper address and two entries in the prefixes table are added. One specifying that all the numbers beginning with 2 have a length of three digits and the second specifying that all the numbers beginning with 8 have a length of four digits.

It is not necessary to add any other entry in the addresses table, as the gateway will ask the gatekeeper in which IP address the telephone number to dial can be found. The gatekeeper will answer with the IP address if it knows it and if not the FXS line passes to an error state.

Lines configuration:

The Teldat-Gw 1 router lines are configured in FXS mode, as they will be connected to four telephones.

All the lines use the G723.1 codec at 6.4 Kbps with VAD sending an RTP packet in each UDP frame.

The lines telephone numbers are added to the lines tables and priority for all the lines is set to zero. Therefore calls made to a busy telephone will not be diverted to another telephone.

The default configuration is used for the rest of the parameters.

NetMeeting:

In the Windows NetMeeting program you need to configure the gatekeeper in which you register and the telephone number. This is done in the Options screen obtained through the Tools menu and by selecting the Advanced Calling option (see figure 11). In order for the gatekeeper to be accessible, you must add a route in the PC to the 172.1.2.0 subnet through the 172.1.1.1 router.

If the program permits you to enable DirectSound, we recommend this be carried out. This option is found in the Tools menu, Options submenu and in the Audio screen.

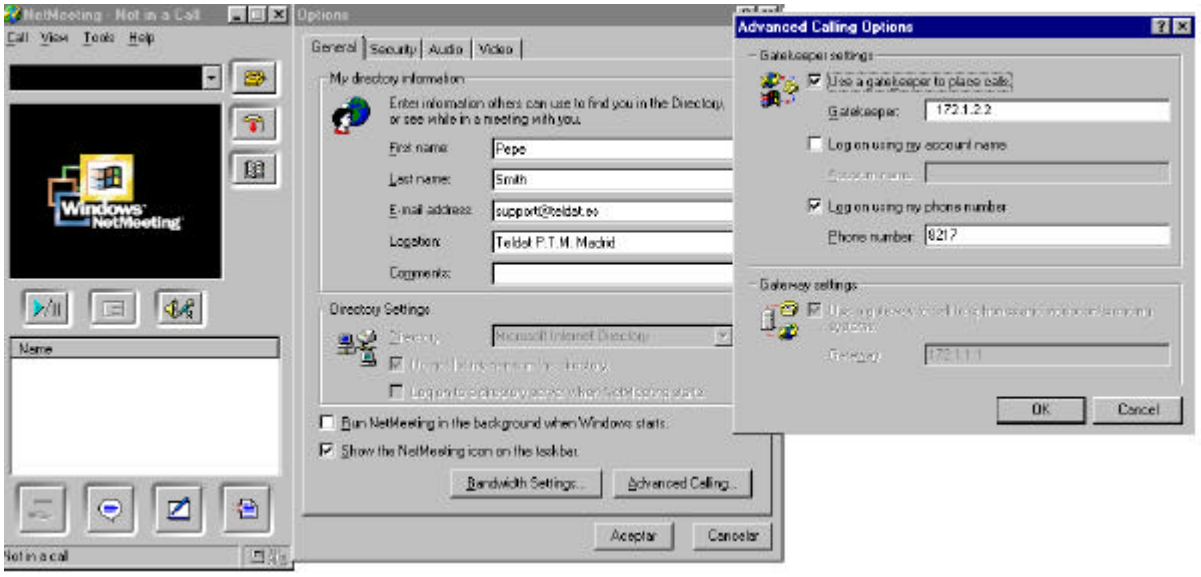

Figure 11.

Configurations:

Teldat-Gw1:

H323:

```
Teldat-1 H323 Config>LIST ALL

 GATEWAY PARAMETERS

Gateway internal address: 172.1.1.1
Fast Connect: Disabled                Q931 port: 1720
H323 call mode: Compatible            UDP  port: 20000

Gatekeeper address 172.1.2.2          Gateway name:
Gatekeeper zone: kkdlvc               Tech-Prefix :
                                      Register E.164: Enabled

RAS port: 1719                        RAS time to live: 60
RAS timeout: 20                       RAS Connection attempt fail:  10

Enable Service Addr 0.0.0.0           Type of Service Disable: Disable Lines


 VOICE PARAMETRES

Dial tone frequency:      425      Ring tone activity: 15
Dial voice message:                Ring tone silence:  30

Alerting tone frequency:  425      Busy tone frequency: 425
Alerting tone activity:    15      Busy tone activity:  2
Alerting tone silence:     30      Busy tone silence:   2
```

```
Alerting voice message:            Busy voice message:

Error tone frequency:     425      Error tone silence 1: 2
Error tone activity:        2      Error tone silence 2: 6
Error voice message:

DTMF tones timeout:  10            Error Timeout: 30
Maximum delay: 300

 LINE 1 PARAMETERS

Telephone number: 201                 Interface type: FXS
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 0

Codec: G723 6.4Kbps                   VAD: Enabled
Frames H323/packet RTP: 1 ( 24 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB


 LINE 2 PARAMETERS

Telephone number: 202                 Interface type: FXS
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 0

Codec: G723 6.4Kbps                   VAD: Enabled
Frames H323/packet RTP: 1 ( 24 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB


 LINE 3 PARAMETERS

Telephone number: 203                 Interface type: FXS
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 0

Codec: G723 6.4Kbps                   VAD: Enabled
Frames H323/packet RTP: 1 ( 24 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB


 LINE 4 PARAMETERS

Telephone number: 204                 Interface type: FXS
Direct dialing:                       State: Enabled
Identifier H323:                      Priority: 0

Codec: G723 6.4Kbps                   VAD: Enabled
Frames H323/packet RTP: 1 ( 24 bytes)  DTMF relay : in band

Speaker gain: 0   dB                  Tone level: 0 dB
Mic gain: 10 dB



Order LINE      TELEPHONE  STRIP-PREFIX DIAL-OUT-PREFIX

  1      1            201       0
  2      2            202       0
  3      3            203       0
  4      4            204       0

Match Dialing Plan: Disabled
```

```
Order  PREFIX         LENGTH

  1     8               4
  2     2               2

Id     Codec      frm/pkt (bytes)  VAD


Teldat-1 H323 Config>
```

CONFIGURATION:

```
Teldat-1 Config>SHOW CONFIG
; Showing System Configuration ...
; Router ATLAS 2 8 Version 10.0.0

set data-link frame-relay serial0/0
set data-link x25 serial0/1
set data-link x25 serial0/2
set hostname Teldat-1
network serial0/0
; -- Frame Relay user configuration --
   pvc 30 default
   pvc 30 fragmentation-size 256
   pvc 30 name voz
   pvc 30 compression crtp without-udp-checksum
;
   protocol-address 172.1.1.2 30
   set frame-size 1024
exit
;
protocol ip
; -- Internet protocol user configuration --
   internal-ip-address 172.1.1.1
;
   address  serial0/0       172.1.1.1        255.255.255.0
   address  x25-node        192.168.252.1    255.255.255.0
;
exit
;
protocol h323
;
   line 1 telephone-number 201
   line 1 priority 0
   line 1 codec g7236k4
;
   line 2 telephone-number 202
   line 2 priority 0
   line 2 codec g7236k4
;
   line 3 telephone-number 203
   line 3 priority 0
   line 3 codec g7236k4
;
   line 4 telephone-number 204
   line 4 priority 0
   line 4 codec g7236k4
;
   prefix 8 4
   prefix 2 2
   port 1 201 default
;
   port 2 202 default
;
   port 3 203 default
;
   port 4 204 default
;
   set gatekeeper address 172.1.2.2
```

```
   set gatekeeper zone kkdlvc
exit
;
feature bandwidth-reservation
; -- Bandwidth Reservation user configuration --
   network serial0/0
;
      enable
      circuit 30
;
         enable
         class DEFAULT 10
         class VOIP 80
         ip-filter 0 lower source-port 1719 higher source-port 1720
         ip-filter 0 lower destination-port 1719 higher destination-port 1720
;
         ip-filter 1 lower source-port 20000 higher source-port 20023
         ip-filter 1 lower destination-port 20000 higher destination-port 20023
;
         assign FILTER0 VOIP NORMAL
         assign FILTER1 VOIP NORMAL
         queue-length 32 5
      exit
;
   exit
;
exit
;
Teldat-1 Config>
```

Tests:

Calls from a telephone connected to the gateway to a PC with NetMeeting:

Dial the number corresponding to the PC you wish to call (8xxx pattern). At this time the line will pass to a CALLING state and if the called PC has the NetMeeting running, the user is informed of an incoming call. You only need to accept the call to establish the connection.

This is the UDP trace with level 3 that appears when the gateway is registered in the gatekeeper (you must enable H323 event number 8):

```
03/01/01 16:45:10  H323.008 UDPc      : New message (channel 0)  sent --> registrationRequest:
03/01/01 16:45:10  H323.008 UDPc      : Address:
03/01/01 16:45:10  H323.008 UDPc      : TransportAddress = (0)
03/01/01 16:45:10  H323.008 UDPc      :  ipAddress = (0)
03/01/01 16:45:10  H323.008 UDPc      :   ip = (4) '..3.' =0xac010202 <172.1.2.2>
03/01/01 16:45:10  H323.008 UDPc      :   port = (1719)
03/01/01 16:45:10  H323.008 UDPc      : Message:
03/01/01 16:45:10  H323.008 UDPc      : RasMessage = (0)
03/01/01 16:45:10  H323.008 UDPc      :  registrationRequest = (-555)
03/01/01 16:45:10  H323.008 UDPc      :   requestSeqNum = (4409)
03/01/01 16:45:10  H323.008 UDPc      :   protocolIdentifier = (6)  { itu-t recommendation h
2250 0 2 }
03/01/01 16:45:10  H323.008 UDPc      :   discoveryComplete = (0)
03/01/01 16:45:10  H323.008 UDPc      :   callSignalAddress = (48)
03/01/01 16:45:10  H323.008 UDPc      :    * = (0)
03/01/01 16:45:10  H323.008 UDPc      :     ipAddress = (-555)
03/01/01 16:45:10  H323.008 UDPc      :      ip = (4) '..3D' =0xac010101 <172.1.1.1>
03/01/01 16:45:10  H323.008 UDPc      :      port = (1720)
03/01/01 16:45:10  H323.008 UDPc      :   rasAddress = (48)
03/01/01 16:45:10  H323.008 UDPc      :    * = (0)
03/01/01 16:45:10  H323.008 UDPc      :     ipAddress = (-555)
03/01/01 16:45:10  H323.008 UDPc      :      ip = (4) '..3D' =0xac010101 <172.1.1.1>
03/01/01 16:45:10  H323.008 UDPc      :      port = (1719)
03/01/01 16:45:10  H323.008 UDPc      :   terminalType = (0)
03/01/01 16:45:10  H323.008 UDPc      :    vendor = (0)
03/01/01 16:45:10  H323.008 UDPc      :     vendor = (0)
03/01/01 16:45:10  H323.008 UDPc      :      t35CountryCode = (11)
03/01/01 16:45:10  H323.008 UDPc      :      t35Extension = (11)
03/01/01 16:45:10  H323.008 UDPc      :      manufacturerCode = (11)
03/01/01 16:45:10  H323.008 UDPc      :     productId = (7) 'Voip Gw' =0x566f6970204777
03/01/01 16:45:10  H323.008 UDPc      :     versionId = (6) 'Teldat' =0x54656c646174
03/01/01 16:45:10  H323.008 UDPc      :    gateway = (0)
```

```
03/01/01 16:45:10  H323.008 UDPc      :     protocol = (64)
03/01/01 16:45:10  H323.008 UDPc      :      * = (0)
03/01/01 16:45:10  H323.008 UDPc      :       voice = (0)
03/01/01 16:45:10  H323.008 UDPc      :        supportedPrefixes = (0)
03/01/01 16:45:10  H323.008 UDPc      :    mc = (0)
03/01/01 16:45:10  H323.008 UDPc      :    undefinedNode = (0)
03/01/01 16:45:10  H323.008 UDPc      :   terminalAlias = (0)
03/01/01 16:45:10  H323.008 UDPc      :    * = (0)
03/01/01 16:45:10  H323.008 UDPc      :     e164 = (3) '201' =0x323031
03/01/01 16:45:10  H323.008 UDPc      :    * = (0)
03/01/01 16:45:10  H323.008 UDPc      :     e164 = (3) '202' =0x323032
03/01/01 16:45:10  H323.008 UDPc      :    * = (0)
03/01/01 16:45:10  H323.008 UDPc      :     e164 = (3) '203' =0x323033
03/01/01 16:45:10  H323.008 UDPc      :    * = (0)
03/01/01 16:45:10  H323.008 UDPc      :     e164 = (3) '204' =0x323034
03/01/01 16:45:10  H323.008 UDPc      :   gatekeeperIdentifier = (20) '.Z.o.n.a.R.a.d.V.G.K'
=0x005a006f006e006100520061006400560 0
03/01/01 16:45:10  H323.008 UDPc      :   endpointVendor = (524)
03/01/01 16:45:10  H323.008 UDPc      :    vendor = (0)
03/01/01 16:45:10  H323.008 UDPc      :     t35CountryCode = (0)
03/01/01 16:45:10  H323.008 UDPc      :     t35Extension = (0)
03/01/01 16:45:10  H323.008 UDPc      :     manufacturerCode = (24)
03/01/01 16:45:10  H323.008 UDPc      :    productId = (34) '.N.u.c.l.e.o.x. .P.l.u.s. .H.3.2.3'
=0x004e00750063006c0065006f0078002000
03/01/01 16:45:10  H323.008 UDPc      :    versionId = (22) '.V.e.r.s.i.o.n. .1...0'
=0x0056006500720073006900 6f006e002000
03/01/01 16:45:10  H323.008 UDPc      :   timeToLive = (60)
03/01/01 16:45:10  H323.008 UDPc      :   keepAlive = (1)
03/01/01 16:45:10  H323.008 UDPc      :   endpointIdentifier = (82)
'.0.0.0.0.0.0.2.5.1.8.9.9.0.1.3.8.9.2.2.4.6.2.0.1.7.2.0.1.1.4.4.1.9.9.3.4.0.1.7.1.9'
=0x0030003000300030003000300032003500
03/01/01 16:45:10  H323.008 UDPc      :   willSupplyUUIEs = (0)
03/01/01 16:45:11  H323.008 UDPc      : New message (channel 0) recv <-- registrationConfirm:
03/01/01 16:45:11  H323.008 UDPc      : Address:
03/01/01 16:45:11  H323.008 UDPc      : TransportAddress = (0)
03/01/01 16:45:11  H323.008 UDPc      :  ipAddress = (-555)
03/01/01 16:45:11  H323.008 UDPc      :   ip = (4) '..3.' =0xac010202 <172.1.2.2>
03/01/01 16:45:11  H323.008 UDPc      :   port = (1719)
03/01/01 16:45:11  H323.008 UDPc      : Message:
03/01/01 16:45:11  H323.008 UDPc      : RasMessage = (5654)
03/01/01 16:45:11  H323.008 UDPc      :  registrationConfirm = (-111)
03/01/01 16:45:11  H323.008 UDPc      :   requestSeqNum = (4409)
03/01/01 16:45:11  H323.008 UDPc      :   protocolIdentifier = (6)  { itu-t recommendation h
2250 0 2 }
03/01/01 16:45:11  H323.008 UDPc      :   callSignalAddress = (1)
03/01/01 16:45:11  H323.008 UDPc      :    * = (7441)
03/01/01 16:45:11  H323.008 UDPc      :     ipAddress = (-111)
03/01/01 16:45:11  H323.008 UDPc      :      ip = (4) '..3.' =0xac010202 <172.1.2.2>
03/01/01 16:45:11  H323.008 UDPc      :      port = (1720)
03/01/01 16:45:11  H323.008 UDPc      :   terminalAlias = (4)
03/01/01 16:45:11  H323.008 UDPc      :    * = (3898)
03/01/01 16:45:11  H323.008 UDPc      :     e164 = (3) '204' =0x323034
03/01/01 16:45:11  H323.008 UDPc      :    * = (3898)
03/01/01 16:45:11  H323.008 UDPc      :     e164 = (3) '203' =0x323033
03/01/01 16:45:11  H323.008 UDPc      :    * = (3898)
03/01/01 16:45:11  H323.008 UDPc      :     e164 = (3) '202' =0x323032
03/01/01 16:45:11  H323.008 UDPc      :    * = (3898)
03/01/01 16:45:11  H323.008 UDPc      :     e164 = (3) '201' =0x323031
03/01/01 16:45:11  H323.008 UDPc      :   gatekeeperIdentifier = (20) '.Z.o.n.a.R.a.d.V.G.K'
=0x005a006f006e006100520061006400560 0
03/01/01 16:45:11  H323.008 UDPc      :   endpointIdentifier = (82)
'.0.0.0.0.0.0.2.5.1.8.9.9.0.1.3.8.9.2.2.4.6.2.0.1.7.2.0.1.1.4.4.1.9.9.3.4.0.1.7.1.9'
=0x0030003000300030003000300032003500
03/01/01 16:45:11  H323.008 UDPc      :   timeToLive = (60)
03/01/01 16:45:11  H323.008 UDPc      :   willRespondToIRR = (0)
```

These are the events that should be observed in the call process (you must enable H323 event number 4):

```
03/01/01 16:52:52  H323.001 Ev HOOK OFF  ln 1
03/01/01 16:52:52  H323.002 State OFF THE HOOK ln 1
03/01/01 16:52:52  H323.001 Ev DTMF RCV 8 ln 1
03/01/01 16:52:52  H323.002 State DIALING ln 1
03/01/01 16:52:52  H323.001 Ev DTMF RCV 2 ln 1
```

```
03/01/01 16:52:52  H323.001 Ev DTMF RCV 1 ln 1
03/01/01 16:52:52  H323.001 Ev DTMF RCV 7 ln 1
03/01/01 16:52:52  H323.002 State CALLING ln 1
03/01/01 16:52:53  H323.004 RAS ev Tx ARQ - Admission Request
03/01/01 16:52:53  H323.004 RAS ev Rx ACF - Admission Confirm
03/01/01 16:52:53  H323.003 Est Dialtone md  ln 1
03/01/01 16:52:54  H323.003 Est Proceeding md  ln 1
03/01/01 16:52:54  H323.001 Ev ALERTING  ln 1
03/01/01 16:52:54  H323.002 State REMOTE ALERTED ln 1
03/01/01 16:52:56  H323.003 Est Connected md ConnectedCallSetup ln 1
03/01/01 16:52:58  H323.003 Est Connected md ConnectedCall ln 1
03/01/01 16:52:59  H323.001 Ev ESTABLISH  ln 1
03/01/01 16:52:59  H323.002 State CALL ESTABLISHED ln 1
```

These are the events associated to the release of the call:

```
03/01/01 16:54:33  H323.003 Est Disconnected md DisconnectedLocal ln 1
03/01/01 16:54:33  H323.004 RAS ev Tx DRQ - Disengage Request
03/01/01 16:54:34  H323.003 Est Idle md  ln 1
03/01/01 16:54:34  H323.004 RAS ev Rx DCF - Disengage Confirm
03/01/01 16:54:34  H323.001 Ev RELEASE  ln 1
03/01/01 16:54:34  H323.002 State IDDLE ln 1
```

Calls from PC connected to the gateway directed to a telephone connected to the gateway:

From a NetMeeting where the gatekeeper has been suitably configured, call the telephone connected to the gateway you wish. The telephone will begin to ring and you only need to pick up the telephone to establish communication.

These are the events you observe in the call reception process (you must enable H323 event 4).

```
3/01/01 16:54:01  H323.004 RAS ev Tx ARQ - Admission Request
03/01/01 16:54:02  H323.003 Est Offering md  ln 1
03/01/01 16:54:02  H323.004 RAS ev Rx ACF - Admission Confirm
03/01/01 16:54:02  H323.001 Ev INCOMMING CALL  ln 1
03/01/01 16:54:02  H323.002 State ALERTING ln 1
03/01/01 16:54:02  H323.001 Ev HOOK OFF  ln 1
03/01/01 16:54:03  H323.003 Est Connected md ConnectedCallSetup ln 1
03/01/01 16:54:03  H323.002 State CALL ESTABLISHED ln 1
```

Calls between two connected gateway telephones:

On picking up the receiver, dial the telephone number you wish (20x pattern). When the other user picks up the telephone, an internal call is established that does not occupy bandwidth as the exchange of voice frames is carried out within the gateway.