Teldat Router

Frame Relay Backup

configuration using ISDN

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Chapter 1
Frame Relay Backup

1. Introduction

This chapter describes how the Frame Relay backup operates using the ISDN basic access B channels.

The information contained in this chapter is divided into the following sections:

- WAN Backup.
- ISDN base Interface.
- Frame Relay Backup Interface.
- Main Frame Relay Interface Association.

2. WAN Backup

The WAN backup feature permits an alternative route to forward data from a link series in case of failures produced not only in the network nodes, but also in the network access. The backed up link (i.e. the one normally in operation) is the **primary link** and the link which backs up is the **secondary link.** The backup process implicates the following:

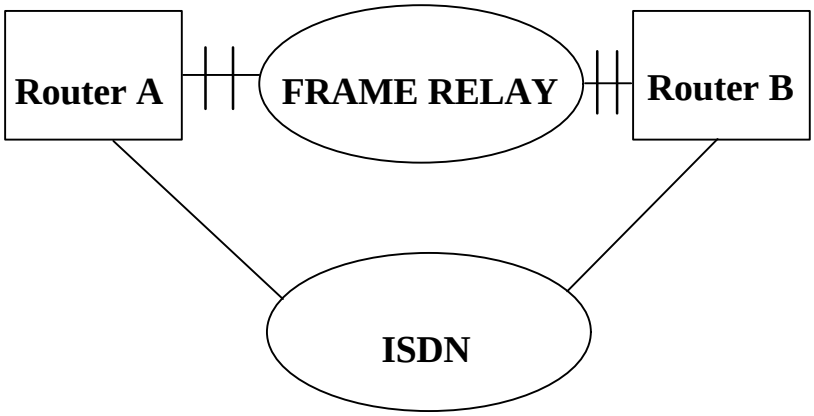
1. Detects the main link failure.
2. Switches to secondary link.
3. Detects main link recovery.
4. Switches back to main link.

The backup process is transparent to superior level protocols except for possible delays or changes in the speed of a secondary link with less capacity. All the routing information, protocol connections etc. remain the same.

As a secondary link an on demand ISDN circuit should be used.

WAN Backup example

In the following figure you can see that Router A is connected to Router B through a Frame Relay network. If the Frame Relay network fails, then the secondary link (the ISDN link on demand) links the two routers. When the Frame Relay connection is recovered then the secondary link automatically disconnects. The time delay for disconnection is configurable.



3. Backup of Frame Relay Interfaces over ISDN

Frame Relay interfaces over ISDN can also be backed up through ISDN. These interfaces are true Frame Relay interfaces, equivalent to Frame Relay over serial line and in the same way support LMI. Normally a Frame Relay interface over ISDN transmits data through an ISDN B channel. However it is also possible to additionally associate them to a secondary backup link (also through ISDN) so that there is an alternative data route should the main link fail.

Generally switch to backup occurs due to; the LMI being down, a circuit (configured with the *Back-ISDN always* option) becomes inactive or is eliminated, the ISDN call needed for the Frame Relay interface over ISDN operation could not be established. In any of the above cases, the data is routed through the secondary link, establishing the call if the basic ISDN interface is not configured as semi-permanent. The basic ISDN interface can be any of those available, i.e. it can be the same as the one used by the Frame Relay over ISDN or not.

The backup configuration within the Frame Relay interface is carried out in exactly the same way as the Frame Relay interfaces over a serial line. Similarly, you must have previously associated the main link with a secondary link (*FEATURE WRS-BACKUP-WAN* command).

4. ISDN base Interface

The ISDN base interface allows you to interconnect routers using the ISDN. The ISDN interface can be configured as a dedicated link with a permanent connection established; or as an on demand circuit in those connections that are automatically established by request for data transmission or because of a failure in the primary link which it backs up.

An ISDN base interface is a basic access which consists of 2 64kbps B channels for transparent transmission of data and a D channel of 16kbps. The B channels are used to transmit HDLC frames in the router at 64kbps. The D channel is only used to request calls. (In the device node, the D channel is also used to transmit X.25 packets).

The ISDN base interface establishes connections with the remote router through ISDN. This initiates or accepts connections if the on demand connection interfaces indicate they should. In this case these are Frame Relay backup interfaces.

5. Frame Relay Backup Interface

The Frame Relay backup interface is one of the types of connection interfaces on demand which act as ISDN base interfaces users. This deals with a logical interface without its own physical connection. A Frame Relay backup interface should be added for each calls potential destination. Various Frame Relay backup interfaces can be configured over a single ISDN base interface.

Addressing

To make a call you need to know the destination address. In order to permit the configuration of various distinct destination addresses it is necessary to unlink this from the ISDN base interface. The call destination address depends on the connection interface on demand which requests the call.

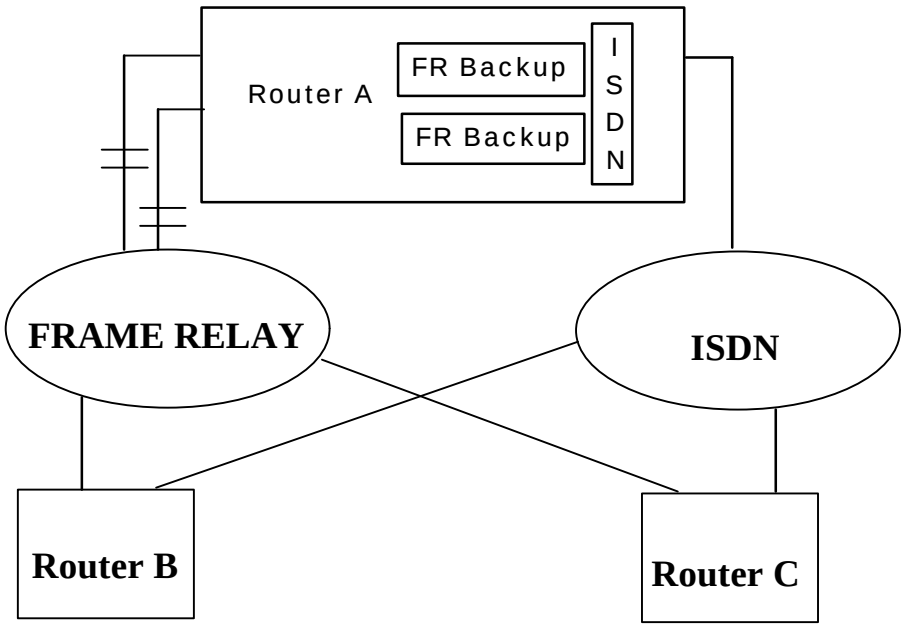
In order to accept calls from different routers it is necessary to know the possible callers who are authorized to request calls. Each on demand connection interface should have a different remote caller address.

Circuit Content

Each ISDN base interface has a maximum of two simultaneously activated calls associated. If both calls are in process in a determined ISDN interface and another on demand connection interface requests a new connection, this will not be established. Packets sent via this third interface on demand are discarded by the router.

Example

In the below example figure you can see that Router **A** is connected via both links to the two remote routers **B** and **C** through a Frame Relay network. Over the ISDN base interface two Frame Relay interfaces are configured. Each of these has a distinct destination address corresponding to each of the remote routers.



6. Main Frame Relay Interface Association

In order to carry out backup of a Frame Relay interface, the interface must be associated to a Frame Relay backup interface.

Regarding to the previous example. Each Frame Relay interface has its own Frame Relay backup interface associated. In this way, when the primary Frame Relay interface fails, the ISDN calls are carried out through Router **B**'s address, associated to the primary Frame Relay backup interface. The ISDN calls are managed in the same way when switching to backup due to errors in the second Frame Relay interface, only here they are addressed to Router **C**.

If the remote routers initiate the calls, the ISDN base interface distributes them to one or other of the Frame Relay backup interfaces depending on the calling number which appears in the request call.

Chapter 2
Frame Relay Backup Configuration

1. Introduction

This chapter describes the Frame Relay backup configuration commands using the ISDN basic access B channels.

The information in this unit are divided into the following sections:

- Backup Interfaces creation.
- ISDN base Interface configuration.
- Frame Relay Backup Interface configuration.
- Association commands with the main Frame Relay interface.

For further information on the operation of Frame Relay backup, please consult chapter 1.

2. Backup Interfaces creation

Initially the ISDN base interfaces are not linked to the router part unless another backup circuit has previously configured over them. The moment you create the Frame Relay backup interface is when you associate the chosen basic access to the router and eliminate the micronode part

For example, following the configuration process of a Frame Relay line backup. You can assume that the Frame Relay link has already been assigned to a device line.

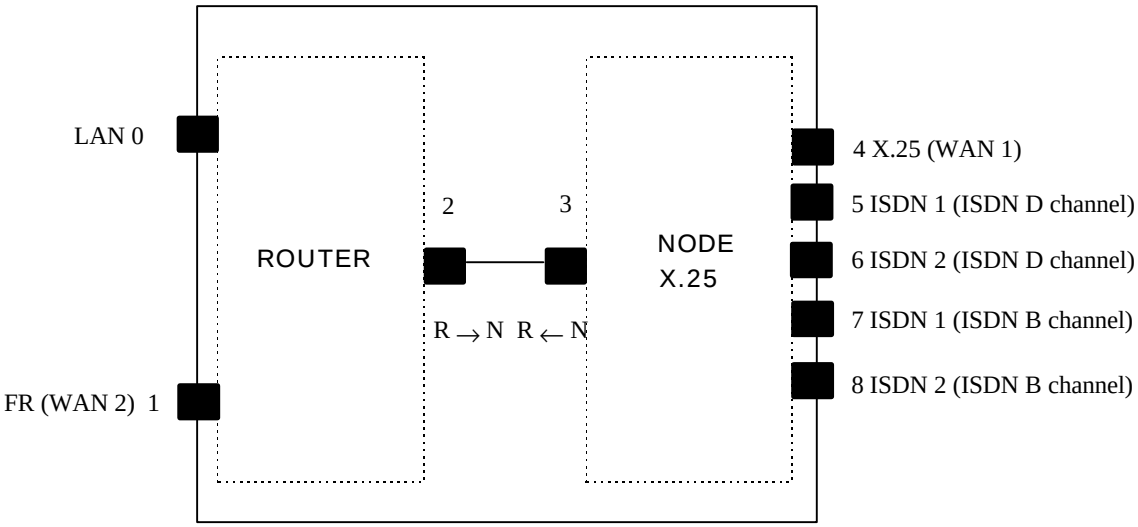
The configuration process is accessed by introducing the following:

```
*P 4
User configuration
Config>
```

Through the **LIST DEVICES** command in the configuration process you can obtain the interface identifiers table. Subsequently the output of those commands in a device which has WAN 2 associated to the Frame Relay protocol associated is shown:

```
Config> LIST DEVICES

Con     Ifc  Type of interface  CSR       CSR2      int
---     2    Router->Node       0                   0
---     3    Node->Router       0                   0
LAN     0    Ethernet           9000000             1C
WAN1    4    X25                F001600   F000C00   9E
WAN2    1    Frame Relay        F001620   F000D00   9D(Disable)
ISDN 1  5    ISDN D channel     A000000             1B(Disable)
ISDN 1  7    ISDN B channel     F001640   F000E00   9C(Disable)
ISDN 2  6    ISDN D channel     A200000             1B(Disable)
ISDN 2  8    ISDN B channel     F001660   F000F00   9B
Config>
```



As you can see, the ISDN information appears by default in the node part of the device.

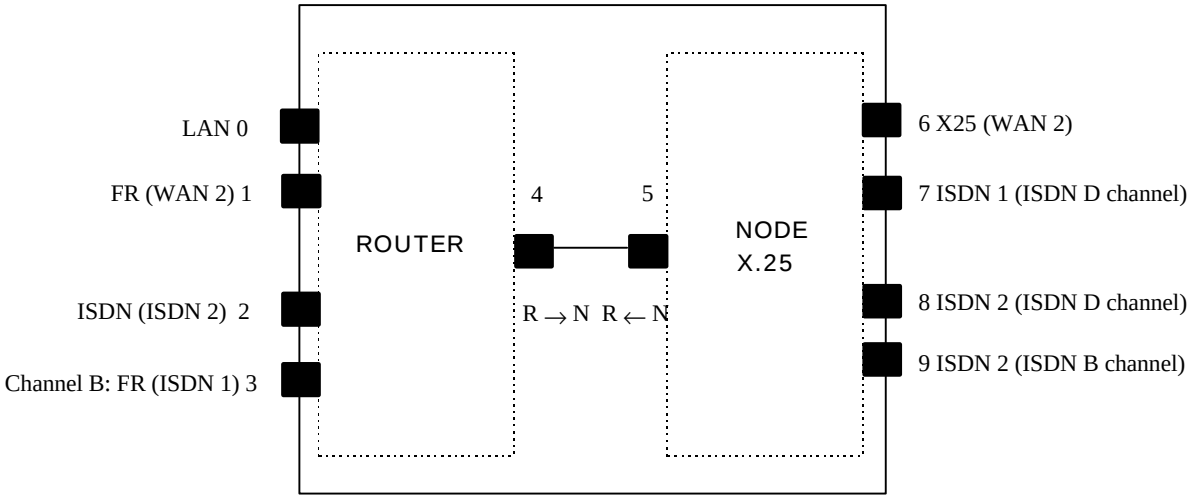
In order to use for example the number 1 basic access in Frame Relay backup operations, you need to introduce in the cursor:

```
Config> ADD DEVICE FR-DIAL
Type basic access ISDN [2]: 1
Ifc number to delete: 7

If you are going to config more than two ISDN interfaces, you must config what
they have CSR:F011640 and CSR:F011660 over the ISDN 2 connector.
Added FR-DIAL interface with num: 3
Config>
```

```
Config> LIST DEVICES

Con       Ifc   Type of interface  CSR       CSR2      int
---       4     Router->Node       0                   0
---       5     Node->Router       0                   0
LAN       0     Ethernet           9000000             1C
WAN1      6     X25                F001600   F000C00   9E
WAN2      1     Frame Relay        F001620   F000D00   9D(Disabled)
ISDN 1    2     ISDN               F001640   F000E00   9C
ISDN 1    3     Channel B: FR      0         0         0
ISDN 1    7     ISDN D channel     A000000             1B(Disabled)
ISDN 2    8     ISDN D channel     A200000             1B(Disabled)
ISDN 2    9     ISDN B channel     F001660   F000F00   9B
Config>
```



As can be seen, two new interfaces have been created: The ISDN base interface with the number 2 associated to the basic access number 1 connector and the logical interface of the Frame Relay backup with number 3. On the other side the interface that was associated to the B channel: X.25 in the node part of the device disappears.

The same basic access cannot be used simultaneously for ISDN backup and X.25 transport.

Successive Frame Relay backup interfaces can be created over the same ISDN base interface:

NOTE: Generally there exists the possibility to add more ISDN interfaces to the same basic access in the Teldat Routers. You can also add a single interface by answering NO to the following question which appears on the screen: **`Do you wish to add another ISDN interface to this basic access?`**

```
Config> ADD DEVICE FR-DIAL
Type basic access ISDN [2] : 1
Do you wish to add another ISDN interface to this basic access? NO

Added FR-DIAL interface with num:4
Config>
```

```
Config> LIST DEVICES

Con      Ifc   Type of interface  CSR       CSR2      int
---      5     Router->Node       0                   0
---      6     Node->Router       0                   0
LAN      0     Ethernet           9000000             1C
WAN1     7     X25                F001600   F000C00   9E
WAN2     1    Frame Relay         F001620   F000D00   9D(Disabled)
ISDN 1   2    ISDN                F001640   F000E00   9C
ISDN 1   3    ISDN B channel      0         0         0
ISDN 1   4    Channel B: FR       0         0         0
ISDN 1   8    ISDN D channel      A000000             1B(Disabled)
ISDN 2   9    ISDN D channel      A200000             1B(Disabled)
ISDN 2   10   ISDN B channel      F001660   F000F00   9B
Config>
```

As can be observed, on adding interfaces for Frame Relay backup, a change in the numbers assigned to the interfaces is produced. This can lead to configuration errors.

It is strongly recommended that interfaces associated to Frame Relay backup functions should be added or eliminated in the first stages of configuration in order to avoid inconsistencies in the data.

3. ISDN base Interface configuration

In order to configure the parameters associated to an ISDN base interface, you have to introduce the **NETWORK** command in the configuration *Config>* prompt followed by the number of the ISDN base interface which needs to be configured.

In the previous example:

```
Config> NETWORK 2
ISDN Config
Config ISDN>
```

The parameters that can be configured by the user can be seen by listing the parameters:

```
Config ISDN> LIST ?
Local destination:
Maximum frame size:2048
ISDN Connection Type:  Switched
Config ISDN>
```

The meaning of each parameter is described in the subsequent paragraphs:

Local destination

This is the basic access address. Any call offered in the basic access whose destination number does not coincide with the programmed address is rejected.

NOTE: this has no effect in the case of a permanent connection.

```
Config ISDN> SET LOCAL-ADDRESS
Local destination []?XXXXXXX
Config ISDN>
```

Maximum frame size

The maximum frame size through the interface is configured through this parameter. The permitted values are 1.024, 2.048 and 4.096 bytes. The default value is 2.048 bytes.

```
Config ISDN> SET MAXIMUM-FRAME-SIZE
Maximum Frame Size(1024,2048,4096)[2048]?XXXX
Config ISDN>
```

ISDN Connection Type

The type of ISDN connection, switched or permanent, can be configured through this parameter. If it is permanent the link is available without the need to make a call. It is necessary to specify which B channel access is to be used if the connections are permanent.

```
Config ISDN> SET CONNECTION-TYPE
ISDN Connection Type : 0 Switched. 1 Permanent B1. 2 Permanent B2. : [0]? 1
Config ISDN>
```

In order to return to the Config> prompt, you enter the **EXIT** command in the Config ISDN> prompt.

4. Frame Relay Backup Interface configuration

In order to configure the parameters associated to an ISDN Frame Relay backup interface, you need to enter the **NETWORK** command in the configuration prompt Config> followed by the number of the Frame Relay backup interface to be configured.

In the previous example:

```
Config> NETWORK 3
Circuit Config
Circuit Config>
```

The parameters which can be configured by the user can be displayed by listing the parameters:

```
Circuit Config> LIST ?
Base interface: 2
Destination address:
Inactive time:60
Permitted caller:
Circuit name:
Outgoing calls allowed: Yes
Incoming calls allowed: No
Enabled Access Control: No
Circuit Config>
```

NOTE: If this is a permanent connection, the majority of the above can be ignored.

The meaning of each of the parameters is described as follows:

Base Interface

The base Interface refers to the ISDN interface number over which the PPP link is established. There are two available.

```
Circuit Config> SET BASE-INTERFACE 1
Circuit Config>
```

Destination address

This determines the ISDN address which carries out the ISDN calls from the Frame Relay backup interface.

```
Circuit Config> SET DESTINATION-ADDRESS
Destination address[]?XXXXXXX
Circuit Config>
```

Inactive Time

If there is no exchange of frames through the interface during a period of time pre configured in this parameter, the ISDN call is released. The range of values are between 0 and 65.535 seconds. A zero value maintains a permanently established connection even if there is no transmission of data. The default value is 60 seconds.

```
Circuit Config> SET INACTIVE-TIME
Inactive time (0: always active)(0-65535)[60]?XX
Circuit Config>
```

Permitted caller

This determines the source ISDN address whose calls are routed to this Frame Relay backup interface. By default all ISDN calls are accepted. This parameter is useful when you configure more than one Frame Relay backup interface over the same ISDN base interface in order to route incoming calls.

```
Circuit Config> SET PERMITTED-CALLER
Permitted caller[]?XXXXXXX
Circuit Config>
```

Circuit name

This allows you to assign a name to the circuit. The name can contain a maximum of 15 ASCII characters.

```
Circuit Config> SET NAME-CIRCUIT
Assign circuit name []?XXXXX
Circuit Config>
```

Outgoing calls allowed

This allows or prevents a device from carrying out outgoing calls.

To enable

```
Circuit Config> ENABLE OUTGOING
Circuit Config>
```

To disable

```
Circuit Config> DISABLE OUTGOING
Circuit Config>
```

The outgoing calls are enabled by default.

Incoming calls allowed

This allows the device to accept or reject incoming calls.
To enable

```
Circuit Config> ENABLE INCOMING
Circuit Config>
```

To disable

```
Circuit Config> DISABLE INCOMING
Circuit Config>
```

The incoming calls are disabled by default.

Access Control

Enables or disables the Access Control.
To enable

```
Circuit Config> ENABLE ACCESS
Circuit Config>
```

To disable

```
Circuit Config> DISABLE ACCESS
Circuit Config>
```

The Access control is disabled by default.
Enter the **EXIT** command in the Circuit Config> prompt in order to return to the Config> prompt.

5. Association commands with the main Frame Relay interface

In order to associate a primary Frame Relay interface to a secondary Frame Relay backup link, you must introduce the following in the configuration prompt.

```
Config> FEATURE WRS-BACKUP-WAN
WAN Back-up User Configuration
Back-up WAN>
```

Following this you need to configure the association between the primary interface and the backup:

```
Back-up WAN> ADD
Primary Interface:
Secondary Interface:
Recovery Time:
Back-up WAN>
```

The primary interface should be the Frame Relay interface number which you wish to backup i.e. it is through this the data is transmitted in normal operating mode. The secondary interface should be the number of the Frame Relay backup interface. It is through this that the ISDN calls are carried out in case of primary link failure.

Applying the previous sections to the example.

```
Back-up WAN> ADD
Primary Interface:1
Secondary Interface:3
Recovery Time:2
Back-up WAN>
```

The association appears by introducing the **LIST** command:

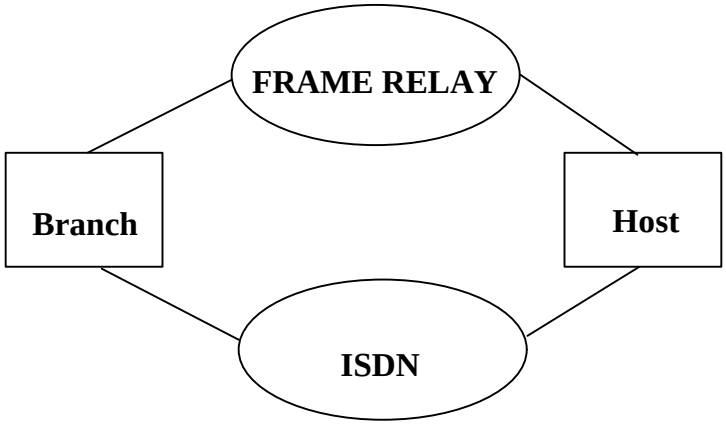
```
Back-up WAN> LIST ?
Num Int Primary   Num Int Secondary  Recovery Time
1   FRAME RELAY   3 FR DIAL          2 Seconds
Back-up WAN>
```

Enter **EXIT** command in the Backup WAN> prompt in order to return to the Config> prompt.

Chapter 3
Example

1. Configuration practical example

Let's take a normal working environment where the remote center needs to communicate with the data processing center through a Frame Relay network, using ISDN as the backup network.



The default configuration of a **Teldat Router** with 6 WAN ports is the following:

```
Config> LIST DEVICES
Con      Ifc  Type of interface  CSR       CSR2     int
---      1    Router->Node       0                  0
---      2    Node->Router       0                  0
LAN      0    Ethernet           9000000            1C
WAN1     3    X25                F001600   F000C00  9E
WAN2     4    X25                F001620   F000D00  9D
WAN3     5    X25                F011600   F010C00  BE
WAN4     6    X25                F011620   F010D00  BD
WAN5     7    X25                F011640   F010E00  BC
WAN6     8    X25                F011660   F010F00  BB
ISDN 1   9    ISDN D channel     A000000            1B
ISDN 1   11   ISDN B channel     F001640   F000E00  9C
ISDN 2   10   ISDN D channel     A200000            1B
ISDN 2   12   ISDN B channel     F001660   F000F00  9B
Config>
```

Firstly the necessary interfaces should be configured. Subsequently you can begin to assign the Frame Relay link to line 1.

```
Config> SET DATA-LINK FRAME-RELAY
Which port will be changed [0]? 1
Config>
```

The interfaces should then look like this:

```
Config> LIST DEVICES
Con      Ifc   Type of interface  CSR       CSR2     int
```

```
---      2     Router->Node       0                0
---      3     Node->Router       0                0
LAN      0     Ethernet           9000000          1C
WAN1     1     Frame Relay        F001600   F000C00 9E
WAN2     4     X25                F001620   F000D00 9D
WAN3     5     X25                F011600   F010C00 BE
WAN4     6     X25                F011620   F010D00 BD
WAN5     7     X25                F011640   F010E00 BC
WAN6     8     X25                F011660   F010F00 BB
ISDN 1   9     ISDN D channel     A000000           1B
ISDN 1   1     ISDN B channel     F001640   F000E00 9C
ISDN 2   10    ISDN D channel     A200000           1B
ISDN 2   12    ISDN B channel     F001660   F000F00 9B
Config>
```

The ISDN basic access function must be changed in order to transport Frame Relay instead of X.25 (value appears by default).

```
Config> ADD INTERFACE FR-DIAL
Write basic access ISDN [2]: 1
Ifc number to delete: 11

If you are going to config more than two ISDN interfaces, you must config what
they have CSR:F011640 and CSR:F011660 over the ISDN 2 connector.
Added FR-DIAL interface with num: 3
Config>
```

The interfaces should then look like this:

```
Config> LIST DEVICES
Con      Ifc   Type of interface  CSR       CSR2      int
---      4     Router->Node       0                   0
---      5     Node->Router       0                   0
LAN      0     Ethernet           9000000             1C
WAN1     1     Frame Relay        F001600   F000C00   9E
WAN2     6     X25                F001620   F000D00   9D
WAN3     7     X25                F011600   F010C00   BE
WAN4     8     X25                F011620   F010D00   BD
WAN5     9     X25                F011640   F010E00   BC
WAN6     10    X25                F011660   F010F00   BB
ISDN 1   2     ISDN               F001640   F000E00   9C
ISDN 1   3     Channel B: FR      0                   0
ISDN 1   11    ISDN D channel     A000000             1B
ISDN 2   12    ISDN D channel     A200000             1B
ISDN 2   13    ISDN B channel     F001660   F000F00   9B
Config>
```

NOTE: Generally there exists the possibility to add more ISDN interfaces to the same basic access in the Teldat Routers. You can also add a single interface by answering NO to the following question which appears on the screen: **`Do you wish to add another ISDN interface to this basic access?`**

The configuration is then saved and the device restarted. This is in order to create the data structures which correspond to the parameters of the newly created interfaces.

```
Config> SAVE
Save the config [y/n]?Y
Saving the config ...OK
Config>        enter (Control + p)
*RESTART
Are you sure to restart the system (Yes/No)?Y
Disk configuration read
Initializing
Teldat S.A.          (c)1996, 97, 98, 99
Router model NUCLEOX-PLUS  CPU M68360      N/S: 0200/01060
1 LAN, 6 WAN Lines, 2 ISDN Lines
*P 4
Config>
```

Firstly the Frame Relay interface must be configured. In order to do that you need to access the interface's corresponding menus:

```
Config> NETWORK 1
Frame Relay user configuration
FR config>
```

Then you need to create the Permanent Virtual Circuits (PVC) that you wish to have available:

```
FR config> ADD PVC-PERMANENT-CIRCUIT
Circuit number [16]? 16
Committed Information Rate (CIR) in bps[16000]? 16000
Committed Burst Size (Bc) in bits[16000]? 16000
Excess Burst Size (Be) in bits[0]? 0
Encrypt information? [No]: (Yes/No)?Y
Assign circuit name[]?C16
FR config>
```

The created circuit's configuration can be viewed:

```
FR config> LIST CIRCUITS
Maximum PVCs allowable  =   64
Total PVCs configured   =    1
Circuit  Circuit  Circuit    CIR       Burst  Excess
Name     Number   Type       in bps    Size   Burst   Encrypt
-------------------------------------------------------------
c16      16       Permanent  16000     16000  0       No
No SVCs configured
FR config>
```

In order to see all the backup possibilities available in the **Teldat Router**, three circuits are used. These are added as previously shown resulting in the following configuration:

```
FR config> LIST CIRCUITS
Maximum PVCs allowable  =   64
Total PVCs configured   =    3
Circuit  Circuit  Circuit     CIR        Burst   Excess
Name     Number   Type        in bps     Size    Burst    Encrypt
-----------------------------------------------------------------
c16      16       Permanent   16000      16000   0        Yes
c17      17       Permanent   16000      16000   0        Yes
c18      18       Permanent   16000      16000   0        No
No SVCs configured
FR config>
```

The need to create the previous three circuits is due to the two types of traffic over Frame Relay: IP and SNA. The circuits 16 and 17 are used to transport SNA traffic while 18 transports IP. The circuits assigned to SNA are configured with a YES in the encoding option. This means that the device has a corresponding encryption card available, the content of the Frame Relay frame field will be encrypted. The password is configured in the following way:

```
FR config> SET ENCRYPTION-KEY
New password (8 characters): ********
Rewrite New Password: ********
Password changed
FR config>
```

At this point there is nothing configured in relation to the two possible types of backup: PVC to PVC (in the same Frame Relay interface), and Frame Relay to ISDN. This can be seen as the current configuration status of the backup circuits is the following:

```
FR config> LIST BACK-UP
Maximum PVCs allowable  =   64
Total PVCs configured   =    3
Name      Circuit   Circ.     Circ.         Back-ISDN    Encrypt
Circuit   Main      Back-FR   Back-ISDN     always       Back-ISDN
-----------------------------------------------------------------
c16       16        0         0             No           Yes
c17       17        0         0             No           Yes
c18       18        0         0             No           Yes
FR config>
```

With the above you have the necessary elements configured in the Frame Relay interface to subsequently configure the backup.

You can now configure the ISDN interface:

```
FR config> EXIT
Config> NETWORK 3
Circuit Config
Circuit Config>
```

You need to check the current configuration status:

```
Circuit Config> LIST ?
Base interface: 2
Destination address:
Inactive time: 60
Permitted caller:
Circuit name:
Outgoing calls allowed: Yes
Incoming calls allowed: No
Enabled Access Control: No
Circuit Config>
```

You need to add the value of the destination address (telephone called):

```
Circuit Config> SET DESTINATION-ADDRESS
Destination address[]? 7654321
Circuit Config>
```

Now you have:

```
Circuit Config> LIST
Base interface: 2
Destination address: 7654321
Inactive time: 60
Permitted caller:
Circuit name:
Outgoing calls allowed: Yes
Incoming calls allowed: No
Enabled Access Control Acces: No
Circuit Config>
```

Once you have these two interfaces configured it is necessary to connect them. This is to ensure that the ISDN interface is the backup network for the Frame Relay interface

```
Circuit Config> EXIT
Config>
```

The backup features are used for this:

```
Config> FEATURE WRS-BACKUP-WAN
WAN Back-up User Configuration
Back-up WAN>
```

The interconnection of the networks is then added:

```
Back-up WAN> ADD
Primary Interface: 1
Secondary Interface: 3
Recovery Time: 2
Back-up WAN>
```

and you need to check that the configuration is:

```
Back-up WAN> LIST
Num Int Primary      Num Int Secondary    Recovery Time
1   FRAME RELAY      3  FR DIAL           2 Seconds
Back-up WAN>
```

Once you have an ISDN network assigned which allows you to carry out Frame Relay interface backup, you can configure the PVC's values that you wish to use in order to route the backup traffic. This is carried out in the following way:

```
Back-up WAN> EXIT
Config> NETWORK 1
Frame Relay user configuration
FR config>
```

Firstly you configure the main circuit.

```
FR config> SET CIRCUITS-BACK-UP
Circuit number[16]?16
Frame Relay Back Up circuit number[17]?17
ISDN Back Up circuit number[17]?20
Always Back Up to RDSI? [No]:(Yes/No)?Y
Encrypt Back up information? [No]:(Yes/No)?Y
FR config>
```

Then configure the second one.

```
FR config> SET CIRCUITS-BACK-UP
Circuit number[16]? 18
Frame Relay Back Up circuit number[17]? 0
ISDN Back Up to ISDN[17]? 25
Always Back Up to ISDN? [No]:(Yes/No)? N
Encrypt Back up information? [No]:(Yes/No)? Y
FR config>
```

The configuration should look like this:

```
FR config> LIST BACK-UP
Maximum PVCs allowable  =   64
Total PVCs configured   =    3
Name     Circuit  Circ.     Circ.      Back-ISDN   Encrypt
Circuit  Main     Back-FR   Back-ISDN  always      Back-ISDN
-------------------------------------------------------------------------------
c16      16       17        20         Yes         Yes
c17      17       0         0          No          Yes
c18      18       0         25         No          Yes
FR config>
```

The meaning of the previous configuration will be commented on here. For the principal circuit 16, a backup circuit PVC to PVC was assigned with a value of 17. If for any reason the network informs you (through LMI messages) that circuit 16 has been eliminated or become inactive, traffic destined to this circuit will be transferred to circuit 17.

If both circuits 16 and 17 are inaccessible (due to elimination or inactivity) then there exists the possibility to transmit the data over ISDN. To do this you can configure a circuit or DLCI where you want to receive the data. It is not necessary that this circuit (it has a value of 20 in the example) is previously configured. If the *Back-ISDN always* option is set on YES, then ISDN backup occurs if the 2 configured circuits (the main and the Frame Relay backup) are not functioning. Of course it will always provide backup should the Frame Relay interface fail. If this option is set on NO the ISDN backup will only take place when the Frame Relay interface fails. However while this interface is active and the circuits are unavailable, ISDN backup will not take place.