Teldat Router

Frame Relay Backup Configuration using ISDN

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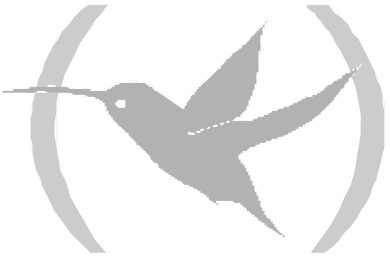
INDEX

Chapter 1
Frame Relay Backup



1. Introduction

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

The backed up link (i.e. the one normally in operation) is the known as **primary link** and the link which provides back up 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 (speed changes occur for example when the secondary link has less capacity than the primary link). All the routing information, protocol connections etc. remain the same.

Teldat Routers can provide backup for both the Frame Relay links over a serial WAN line as well as FR links over ISDN (known as Generic FR). The secondary link, depending on the ISDN base interface configuration, operates over the switched or semipermanent B channels. It's also possible, by grouping the channels, to provide backup over both B channels at the same time, therefore achieving an information transfer rate of 128 Kbps (only over semipermanent channels and provided the ISDN access supports this).

Therefore, the primary link can be either an FR interface over a WAN line or a Generic FR interface over ISDN BRI. The following table displays the two possible combinations for the primary and secondary interfaces:

Primary Interface	Secondary Interface
Frame Relay (WAN)	Generic FR (over ISDN BRI)
Generic FR (over ISDN BRI)	Generic FR (over ISDN BRI)

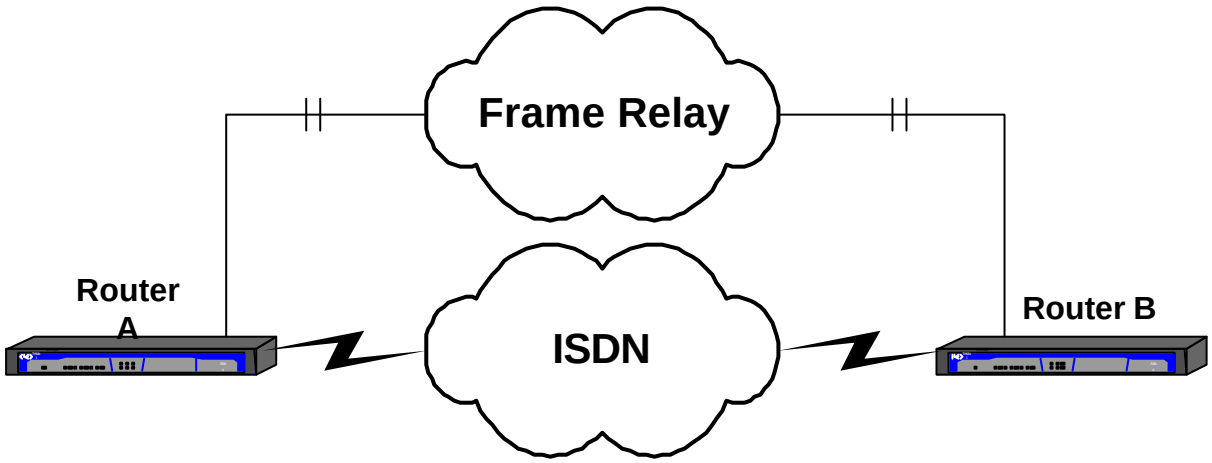
2. WAN network Backup

The WAN backup facility permits alternative routing of serial link data in cases of link failure. Backup protects against errors produced in the network nodes or in the access network itself. A Generic FR interface is used as the secondary link backup which runs over ISDN.

When the device detects the need to switch to backup, it makes an ISDN call (ISDN with switched B channels) and begins to transmit over the B channel assigned by the Network during the call set up process. If the ISDN has semipermanent channels available, the data is directly transmitted through the configured B channel.

WAN network 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 has recovered then the secondary link automatically disconnects. The time delay for disconnection is configurable.



3. Generic FR interface Backup

Generic FR interfaces over ISDN BRI 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 also support LMI.

Normally a Generic FR interface over ISDN BRI transmits data through an ISDN B channel. However it is also possible to additionally associate this to a secondary backup link (also over ISDN) so that there is an alternative data route should the primary 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, or when the ISDN call needed for the Generic FR interface over ISDN BRI operation could not be established. In any of the above cases, the data is routed through the secondary link, establishing the call if the ISDN basic interface (ISDN BRI) is not configured as semi-permanent. The ISDN basic interface can be any of those available, i.e. it can be the same as the one used by the main Frame Relay or not.

The backup configuration within the Generic FR 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 primary link with the secondary link (**FEATURE WRS-BACKUP-WAN** command). This is described in the following sections.

4. ISDN basic Interface

An ISDN basic interface (known as *ISDN Basic Rate Int* in the **Teldat Routers**) is a basic access consisting of two 64 Kbps B channels for transparent data transmission, and a 16 Kbps D channel. The router's B channels are used to transport HDLC frames at 64 Kbps. The router's D channel is only used to request calls.

The ISDN basic 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 for those connections that are automatically established when data transmission is requested or due to a drop in the primary link which it backs up.

The ISDN basic 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 particular case these are Frame Relay backup interfaces.

5. Frame Relay Backup Interface

The Frame Relay backup interface (Generic FR) is one of the types of connection interfaces on demand which act as ISDN basic interface users (*ISDN Basic Rate Int*). This deals with a logical interface without a physical connection. Various Frame Relay backup interfaces can be configured over a single ISDN BRI base interface.

Addressing

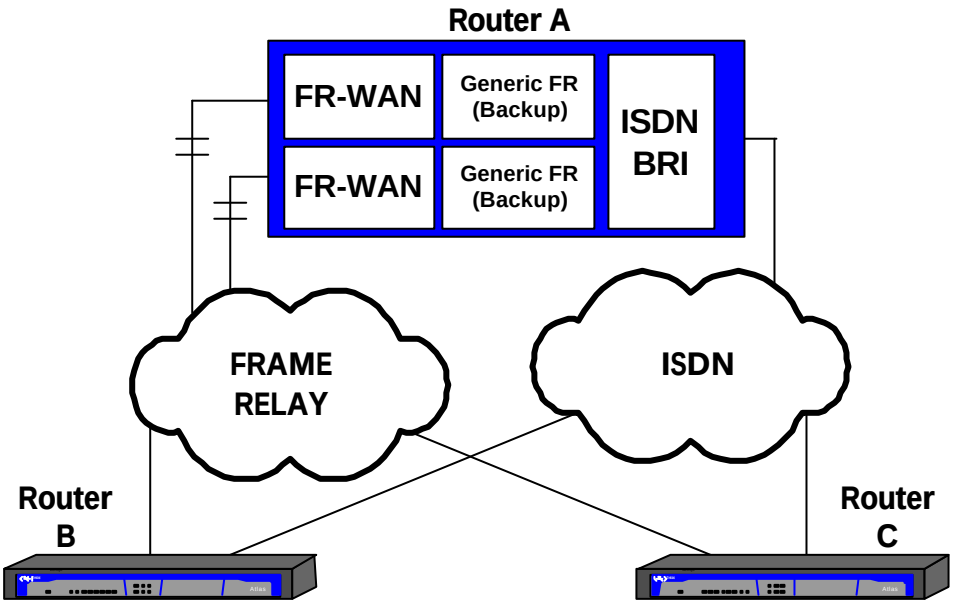
To make a call you need to know the destination address. The destination address is configured in a dial profile. For further information on Dial Profiles, please see manual Dm732-I "Dial Profiles". In order to accept calls from different routers you need to know the possible callers who are authorized to request calls. Each on demand connection interface can have several different remote caller address which, like the destination address, is configured within the dial profile.

Circuit Content

Each ISDN BRI base interface admits a maximum of two simultaneously activated calls. If both calls are in process in an ISDN BRI interface and another on demand connection interface requests a new connection, this will not be established. Packets that should be routed via this third on demand interface 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 backup interfaces are configured. Each of these has a distinct destination address corresponding to each of the remote routers.



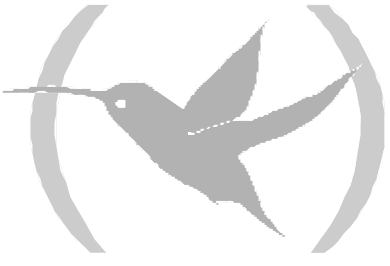
Association to the primary Frame Relay interface

Logically, in order to carry out backup of a Frame Relay interface, the primary 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 calls are managed in the same way when provoked by errors in the second Frame Relay interface, only this time they are sent towards 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 call request. This calling number is compared with that configured in each dial profile so that the call is assigned to the correct interface.

Chapter 2
Configuring Frame Relay Backup



1. Introduction

This chapter describes the Frame Relay backup configuration process. This process is required in order to achieve backup for Frame Relay interfaces using the ISDN basic access B channels.

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

- Creating the backup interface.
- Configuring the Frame Relay Backup Interface.
- Configuring the dial profile.
- Configuring the ISDN base Interface.
- Association commands with the primary Frame Relay interface.
- Configuring backup in the primary Frame Relay interface.

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

2. Creating the backup interface

Frame Relay backup is available both for the interfaces over a serial line as well as for interfaces over ISDN (Generic FR). In either of the two cases, the backup interface will be a Generic FR. However, the configuration screens that will appear assume that this is providing backup service to a previously configured FR interface over a serial line. I.e. only one of the two cases will be explained as really the configuration of the backup is the same for both.

The configuration process is accessed by introducing the following:

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

Through the configuration process **LIST DEVICES** command you can obtain the list of interfaces available in the device. Subsequently, the output of the said command is displayed in a device where line 1 is a Frame Relay interface over a serial line:

```
Config> LIST DEVICES

 Interface       Con    Type of interface             CSR     CSR2  int
 ethernet0/0     LAN1   Fast Ethernet interface   fa200e00             27
 serial0/0       WAN1   Frame Relay               fa200a00 fa203c00   5e
 serial0/1       WAN2   X25                       fa200a20 fa203d00   5d
 serial0/2       WAN3   X25                       fa200a60 fa203f00   5b
 bri0/0          ISDN1  ISDN Basic Rate Int       fa200a40 fa203e00   5c
 x25-node        ---    Router->Node                     0              0
Config>
```

Firstly we are going to create the backup interface:

```
Config> ADD DEVICE FR
Interface Id[9999-1]? 1
Added FR interface fr1
Config> LIST DEVICES
 Interface       Con    Type of interface             CSR     CSR2  int
 ethernet0/0     LAN1   Fast Ethernet interface   fa200e00             27
 serial0/0       WAN1   Frame Relay               fa200a00 fa203c00   5e
 serial0/1       WAN2   X25                       fa200a20 fa203d00   5d
 serial0/2       WAN3   X25                       fa200a60 fa203f00   5b
 bri0/0          ISDN1  ISDN Basic Rate Int       fa200a40 fa203e00   5c
 x25-node        ---    Router->Node                     0              0
 fr1             ---    Generic FR                       0              0
Config>
```

As you can see, a new Generic FR interface (fr1) has been created. This interface acts as an ISDN BRI interface user and handles the ISDN basic access. You can configure as many Generic FRs as you wish over an ISDN BRI. The defined Generic FRs share the available resources. E.g. if the ISDN BRI has two switched B channels, only a maximum of two Generic FRs can have simultaneous calls established.

NOTE: You need to save the configuration and restart the device so the new interfaces configuration becomes active.

In the next section, we will be showing how to associate a Generic RF to its ISDN BRI base interface.

3. Configuring the FR backup interface

In order to configure the parameters associated to an ISDN Frame Relay backup interface, you have to introduce the **NETWORK** command at the configuration *Config>* prompt followed by the Frame Relay backup interface to be configured.

In the previous example:

```
Config> NETWORK fr1

-- Generic FR User Configuration --
GenFR config>
```

Once you have entered the interface configuration, you can access two distinct menus:

```
GenFR config> ?
BASE-INTERFACE
FR
EXIT
GenFR config>
```

The first menu is related to the base interface (ISDN BRI) and the second to the Frame Relay's own parameters. When the Generic FR provides backup services to another interface, you do not have to configure any parameter in the Frame Relay menu as the configuration of the DLCIs, IP-DLCI address mapping and IP address is taken from the primary interface being backed up. In reality, the backup interface substitutes the primary interface when this requires backup and the change is imperceptible at the IP level.

NOTE: If you configure the Frame Relay's own parameters in a Generic FR interface that provides backup, these will be ignored as the values of the primary Frame Relay interface are always used.

BASE-INTERFACE

You need to relate the Generic FR interface with its corresponding ISDN BRI base interface. Firstly you need to access the base interface configuration menu:

```
GenFR config> BASE-INTERFACE

-- Base Interface Configuration --
Base IFC config>
```

The available options are as follows:

```
Base IFC config> ?
BASE-INTERFACE
LIST
NO
EXIT
Base IFC config>
```

a) BASE-INTERFACE

The **BASE-INTERFACE** permits you to specify the associated ISDN BRI interface, the number of the B channel through which you wish to establish the FR link (only used in cases

of semipermanent) and the name of the dial profile you wish to associate. Once this command has been executed, the Generic FR interface providing backup is associated to the base interface.

```
Base IFC config> BASE-INTERFACE
Base interface: [ethernet0/0]? bri0/0
Base circuit id:[255]?
link         add this interface to the dial group
profile      dial profile to use with this interface
Type an option [link]? profile
Assign profile name []? prueba
Base IFC config>
```

The *link* option simply establishes the BRI ISDN interface and the B channel number indicated as the FR Generic interface base. The *profile* option also permits you to associate the call profile which is used in the backup connection.

NOTE: The channel number (Base circuit id) is only significant in cases of FR connections over SEMIPERMANENT channels as in the case of switched channels, the channel is assigned when the call is carried out (this value must be configured to 255). Value 255 indicates that no channel is associated therefore if you are dealing with semipermanent connections, the link will be inoperative.

In situations where the two B channels have been grouped in the ISDN BRI base interface, in order to configure the link over the said grouping, you can indicate either of the two channels pertaining to the group. However, as a general rule we recommend that you assign the lowest numbered channel in the group i.e. number 1.

The *Dial Profile* permits you to associate the link with the profile indicated (this contains data such as the type of permitted calls, outbound calls destinations, type of permitted inbound calls, idle time etc.). The link cannot be established if there is no dial profile associated.

For further information on Dial Profiles, please consult manual Dm732-I "Dial Profiles".

b) NO

The **NO** command is used to carry out delete operations or to disable options or establish default values. In this particular menu, the **NO** command is only used to delete associations with the base interfaces.

```
Base IFC config> NO ?
BASE-INTERFACE
Base IFC config>
```

NO BASE-INTERFACE

The **NO BASE-INTERFACE** command permits you to delete the existing association with a base interface. The number of the associated ISDN BRI interface and the assigned channel number must be specified as parameters.

```
Base IFC config> NO BASE-INTERFACE
Base interface: [ethernet0/0]? bri0/0
Base circuit id:[0]? 255
Base IFC config>
```

c) LIST

Permits you view the options configured in the base interface.

```
Base IFC config> LIST

      Base Interface        Profile Name     Base Circuit Id  Number of circuits
--------------------------  ------------     ---------------  ------------------

         bri0/0      bri/0    prueba                 255                1

Base IFC config>
```

Enter the **EXIT** command as many times as necessary in order to return to the Config> prompt.

4. Configuring the dial profile

Once the Generic FR backup interface has been created and configured, you need to create a dial profile for it. In the dial profile you need to configure the following; the destination number to call in order to establish the backup connection through ISDN, the permitted connection interval, the idle time that must lapse in order to release the call and other parameters that, depending on the type of configuration, may be significant or not.

In cases of backup interfaces, the most common configurations only permit outbound calls to a remote number. Additionally, it makes sense for example to set a connection interval so backup is only carried out during specific hours.

For a more detailed explanation on dial profile configuration, please see manual Dm732-I *"Dial Profiles*".

5. Configuring the ISDN base interface

Teldat Routers provide the possibility of configuring the ISDN BRI base interface. Generally, the parameters configured in this interface permit the router to adapt to the peculiarities of the distinct ISDN standards that exist. However, in the vast majority of cases, the default configuration is valid and you do not need to configure any parameters within the ISDN BRI interface.

However, so that a backup FR link over an ISDN BRI interface with semipermanent B channels operates correctly, you need to correctly configure certain ISDN BRI interface parameters. The possibilities presented are as follows:

a) Backup Generic FR over an ISDN BRI semipermanent channel

You need to configure the channel over which you wish to establish the FR connection as semipermanent (PERM).

b) Backup Generic FR over an ISDN BRI Switched channel

You need to configure one of the ISDN BRI base interface channels as switched (SW). Both the B channels are configured as switched in the default configuration.

The type of B channel is configured through the **SET CIRCUIT TYPE** command. Firstly you need to enter the ISDN BRI interface configuration menu:

```
Config> NETWORK bri0/0

-- BRI ISDN Configuration --
BRI config>
```

The options given in the ISDN BRI interface configuration menu are as follows:

```
BRI config> ?
JOIN B1+B2       Associates B channels in a single pipeline at 128 Kbps
LEAVE B1+B2      Separates B channels that were previously associated
LIST             Displays the interface configuration information
SET              Configures interface parameters
EXIT
BRI config>
```

You can now configure the B channels. The two options are semipermanent (PERMANENT) or switched (SWITCHED).

```
BRI config> SET CIRCUIT TYPE ?
PERMANENT      Permanent connection type (Not Q.931 signalling)
SWITCHED       Switched connection type
BRI config>
```

Example:

```
BRI config> SET CIRCUIT TYPE SWITCHED
Enter circuit (1-2)[1]?
BRI config>
```

or

```
BRI config> SET CIRCUIT TYPE PERMANENT
Enter circuit (1-2)[1]?
BRI config>
```

In addition to the type of B channel, there is also the possibility of configuring the maximum frame size (MTU) to be used in the interface, the maximum frame size for each channel and the grouping of the two B channels so that the total binary rate passes to 128 Kbps (only where the Network supports this). Other parameters related to the ISDN are also configurable such as for example the numeration plan, standard used etc. Further information on how to configure these parameters can be found in manual Dm729-I "ISDN BRI Interface".

6. Association with the primary FR interface

In order to associate a primary Frame Relay interface (be it over a serial line or ISDN) to a backup Frame Relay link through ISDN, you need to enter the WRS backup facility configuration menu:

```
Config> FEATURE WRS-BACKUP-WAN

-- WAN Back-up user configuration --
Back-up WAN>
```

The available options are as follows:

```
Back-up WAN> ?
PAIR        Adds a back-up pair
NO          Deletes a back-up pair
LIST        Lists back-up configuration
EXIT
Back-up WAN>
```

a) PAIR

The **PAIR** command permits you to add a new association between a primary Frame Relay interface (*Primary Interface*) and its corresponding backup Generic FR (*Secondary Interface*).

```
Back-up WAN> PAIR
Primary Interface:  [ethernet0/0]? serial0/0
Secondary Interface:  [ethernet0/0]? fr1
Back-up WAN>
```

It is possible to configure the return from backup time: this is the period of time waited from the moment the primary link is detected as available until the secondary connection is no longer used and data is once more being transmitted over the primary link. In the above example, as the value of the said parameter has not been expressly indicated, the default value has been configured which is 1 second. If when creating an association or a pair you wish configure a different value for this parameter, you need to use the *recovery-time* configuration option.

Example:

```
Back-up WAN> PAIR serial0/0 fr1 ?
recovery-time      configures time to return from backup to principal connection
Type an option [recovery-time]?
Recovery Time : [1]? 2
Back-up WAN>
```

Or:

```
Back-up WAN> PAIR serial0/0 fr1 recovery-time 2
Back-up WAN>
```

Once an association has been created, the component parameters cannot be varied (including the time to return from backup) therefore the only way to modify this is to delete it and reconfigure.

b) NO

The **NO** command is used to carry out delete operations or to disable options or establish default values. In this particular menu, the **NO** command is only used to delete backup associations (pairs).

```
Base IFC config> NO ?
PAIR      Deletes a back-up pair
Back-up WAN>
```

NO PAIR

The **NO PAIR** command permits you to delete an association previously set up between a primary Frame Relay interface and its corresponding backup Generic FR interface (*Secondary Interface*).

```
Back-up WAN> NO PAIR
Primary Interface:  [ethernet0/0]? serial0/0
Secondary Interface:  [ethernet0/0]? fr1
Back-up WAN>
```

c) LIST

The **LIST** command presents all the associations configured in the device on the screen.

```
Back-up WAN> LIST

Primary Interface Secondary Interface Recovery Time
----------------- -------------------- -------------
serial0/0         fr1                  2

Back-up WAN>
```

d) EXIT

The **EXIT** command permits you to exit the configuration menu.

```
Back-up WAN> EXIT
Config>
```

7. Configuring backup in the primary Frame Relay interface

Once the backup interface has been created and configured, and you have assigned a dial profile and associated the primary interface with the backup interface through the WRS-BACKUP-WAN facility, you need to configure some parameters found within the primary interface. This can, for example, be DLCI to be used in the backup connection and also the possibility of switching to backup when a circuit becomes inactive or only when the whole interface is down. These parameters are configured in the same way as in FR interfaces over a serial WAN line and FR over ISDN (Generic FR interfaces). Please see manual Dm703-I "*Frame Relay*" for a more in-depth description.

To configure the backup in the primary interface, first enter its configuration menu. In the screens that appear below, the primary interface is FR over serial WAN line and only PVC 16 is configured.

```
Config> LIST DEVICES

 Interface       Con    Type of interface            CSR     CSR2  int
 ethernet0/0     LAN1   Fast Ethernet interface   fa200e00            27
 serial0/0       WAN1   Frame Relay               fa200a00 fa203c00   5e
 serial0/1       WAN2   X25                       fa200a20 fa203d00   5d
 serial0/2       WAN3   X25                       fa200a60 fa203f00   5b
 bri0/0          ISDN1  ISDN Basic Rate Int       fa200a40 fa203e00   5c
 x25-node        ---    Router->Node                     0             0
 fr1             ---    Generic FR                       0             0
Config>
```

Enter the primary Frame Relay interface configuration menu:

```
Config> NETWORK serial0/0

-- Frame Relay user configuration --
FR config>
```

a) PVC circuit_number BACKUP

In order to configure backup, use the *backup* option found in the PVC command. This command permits you to configure diverse PVC parameters (or create one with the default values). Specifically, the *backup* option is used to associate the backup circuits to the main circuit whose number is indicated. Within the said *backup* option you can also see two other options: the *dlci* option, to configure the backup PVC for PVC to PVC in cases where you want the backup to be within the primary interface itself and not through ISDN, and the *isdn-dlci* option, to configure the PVC to be used when the device switches to backup through ISDN.

```
FR config> PVC
Circuit number[16]?
backup                  configures several backup parameters
Bc                      Outgoing Committed Burst Size
Be                      outgoing excess burst size
CIR                     outgoing committed information rate
compression             enable/disable compression for this circuit
default                 creates the virtual circuit
encrypt                 enable/disable encryption
no
fragmentation-size      forced fragmentation size
inverse-arp             inverse-arp configuration for this dlci
name                    sets the virtual circuit name
Type an option [default]? backup
dlci           sets a frame-relay dlci to backup
isdn-dlci      sets an isdn frame-relay dlci to backup
Type an option [dlci]?
Frame Relay Back Up circuit number[17]? 0
FR config> PVC 16 backup isdn-dlci
ISDN Back Up circuit number[17]?
FR config>
```

Circuit number — Number corresponding to a configured primary PVC.

Frame Relay Back Up circuit number — Number corresponding to the backup PVC for the configured PVC to PVC. If this value is set to zero, then the primary circuit does not have a PVC-to-PVC backup circuit associated. This backup is in the primary interface itself, not over ISDN.

ISDN Back Up circuit number — Number corresponding to the PVC used when the device switches to backup through ISDN. This can be the same DLCI used in the primary interface or a different one. If the value is set to zero then the primary circuit does not have an associated ISDN backup circuit.

In cases where you have configured an DLCI to carry out backup though ISDN, you can configure a series of options applicable to the backup circuit.

```
FR config> PVC 16 backup
dlci           sets a frame-relay dlci to backup
isdn-dlci      sets an isdn frame-relay dlci to backup
always         always backup to the isdn dlci
encrypt        encrypt data through the isdn backup
Type an option [dlci]? always
FR config> PVC 16 backup encrypt
FR config>
```

always — Configure this option then provided both the Frame Relay circuits (primary and secondary) are inactive, transmission is carried out through the backup circuit via ISDN. If this option is not selected then backup is only carried out through the ISDN circuit if the interface is down.

encrypt — On selecting this option, data transmitted through the ISDN backup circuit is encrypted.

By default, these latter two options (*always* and *encrypt*) are disabled. If they have been enabled and you wish to disable them once more, this is carried out through the *no* option found in the PVC command:

```
FR config> PVC 16
backup                  configures several backup parameters
Bc                      Outgoing Committed Burst Size
Be                      outgoing excess burst size
CIR                     outgoing committed information rate
compression             enable/disable compression for this circuit
default                 creates the virtual circuit
encrypt                 enable/disable encryption
no
fragmentation-size      forced fragmentation size
inverse-arp             inverse-arp configuration for this dlci
name                    sets the virtual circuit name
Type an option [default]? no
compression             enable/disable compression for this circuit
encrypt                 enable/disable encryption
fragmentation-size      forced fragmentation size
backup                  configures several backup parameters
Type an option [compression]? backup
dlci           sets a frame-relay dlci to backup
isdn-dlci      sets an isdn frame-relay dlci to backup
always         always backup to the isdn dlci
encrypt        encrypt data through the isdn backup
Type an option [dlci]? always
FR config> PVC 16 no backup encrypt
FR config>
```

b) LIST BACK-UP

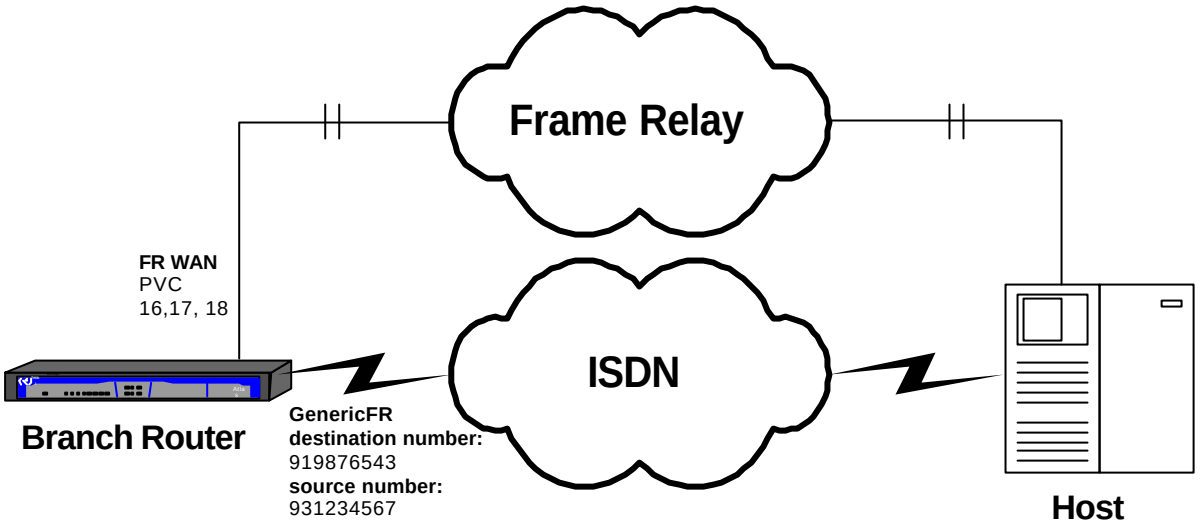
Displays information on all the PVCs configured in the Frame Relay interface and their associated backup circuits.

```
FR config> LIST BACK-UP

  Maximum PVCs allowed  =   64
  Total PVCs configured =    1

        Name                Circuit   Circ.   Circ.    Back-ISDN Encrypt
      Circuit                Main    Back-FR Back-ISDN  always   Back-ISDN
  ----------------------- --------- ------- --------- --------- ---------
  Unassigned                   16        0        17      No        No

FR config>
```

Chapter 3
Example

1. Practical configuration 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. We are going to configure PVCs 16, 17 and 18 on the primary FR line. The DLCIs used for backup through ISDN are 20 and 25.



1.1. Configuring the interfaces

Add the FR interface over serial WAN and the FR interface over ISDN (Generic FR). This is taken from the default configuration.

```
Teldat              (c)2001-2002

Router model XXXXX 2 6 CPU MPC860      S/N: 0403/00110
1 LAN, 3 WAN Lines, 1 ISDN Line


*p 4


Config> SET DATA-LINK FRAME-RELAY serial0/0
Config>
Config> ADD DEVICE FR 1
Added FR interface fr1
Config> LIST DEVICES

 Interface       Con    Type of interface             CSR     CSR2  int
 ethernet0/0     LAN1   Fast Ethernet interface   fa200e00            27
 serial0/0       WAN1   Frame Relay               fa200a00 fa203c00   5e
 serial0/1       WAN2   X25                       fa200a20 fa203d00   5d
 serial0/2       WAN3   X25                       fa200a60 fa203f00   5b
 bri0/0          ISDN1  ISDN Basic Rate Int       fa200a40 fa203e00   5c
 x25-node        ---    Router->Node                     0             0
 fr1             ---    Generic FR                       0             0
Config>
```

1.2. Configuring the FR WAN Interface

First configure the Frame Relay interface. To do this, access the menus corresponding to the said interface.

```
Config> NETWORK serial0/0

-- Frame Relay user configuration --
FR config>
```

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

```
FR config> PVC
Circuit number[16]? 16
backup                  configures several backup parameters
Bc                      Outgoing Committed Burst Size
Be                      outgoing excess burst size
CIR                     outgoing committed information rate
compression             enable/disable compression for this circuit
default                 creates the virtual circuit
encrypt                 enable/disable encryption
no
fragmentation-size      forced fragmentation size
inverse-arp             inverse-arp configuration for this dlci
name                    sets the virtual circuit name
Type an option [default]?
FR config> PVC 16 encrypt
FR config> PVC 16 name
Assign circuit name []? C16
FR config>
```

You can now see the configuration for the created circuit:

```
FR config> LIST CIRCUITS

  Maximum PVCs allowed  =   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   Yes
Inverse ARP: default

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 allowed  =   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
Inverse ARP: default
  C17                          17   Permanent    16000   16000       0   Yes
Inverse ARP: default
  C18                          18   Permanent    16000   16000       0    No
Inverse ARP: default

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. Circuits 16 and 17 are used to transport SNA traffic while 18 transports IP. The circuits assigned to SNA are configured with the *encrypt* option. This means that providing the device has a corresponding encryption card available, the content of the Frame Relay frame data field will be encrypted. The password is configured in the following way:

```
FR config> SET ENCRYPTION

User Password? ******
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 verified by listing the current state of the backup configuration:

```
FR config> LIST BACK-UP

  Maximum PVCs allowed  =   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        No
  C17                          17        0         0      No        No
  C18                          18        0         0      No        No
FR config>
```

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

1.3. Configuring the Frame Relay backup interface

You need to configure the profile you wish to use for this interface and also the associated ISDN BRI base interface. The channel is set to 255 as the ISDN interface in the example is switched i.e. the channel is assigned by the Network during the call set up process.

```
Config> NETWORK fr1

-- Generic FR User Configuration --
GenFR config> BASE-INTERFACE

-- Base Interface Configuration --
Base IFC config> BASE-INTERFACE
Base interface: [ethernet0/0]? bri0/0
Base circuit id:[255]? 255
link         add this interface to the dial group
profile      dial profile to use with this interface
Type an option [link]? profile
Assign profile name []? fr_prueba
Base IFC config>
Base IFC config> LIST

      Base Interface        Profile Name     Base Circuit Id  Number of circuits
-------------------------  ------------     ---------------  ------------------

         bri0/0      bri/0    fr_prueba              255                1

Base IFC config> EXIT
GenFR config> EXIT
Config>
```

1.4. Configuring the Dial Profile

This is where you configure the parameters to be used to make and receive calls. Introduce a name chosen for the profile, the local and remote number, and the release time due to absence of data.

```
Config> SET DIAL-PROFILE

-- DIAL PROFILE CONFIGURATION --
DIALPROF config>
DIALPROF config> PROFILE
Profile Name []? fr_prueba
auth-caller              authorized caller (incoming calls)
alternative-address      alternative remote address
callback                 callback
call-list                access list to allow calls
call-retry               call retry options
code                     teldat propietary code
default                  create a new profile
delete                   delete this profile
dial-access              enable access control (parameters check)
idle-time                idle time
inbound                  allow inbound calls
isdn-class               isdn class (64kbps or 56kbps)
local-address            local number
no
outbound                 allow outbound calls
remote-address           remote number
shutdown                 allow shutdown
Type an option [default]?
DIALPROF config> PROFILE fr_prueba local-address
Local Address[]? 931234567
DIALPROF config> PROFILE fr_prueba remote-address
Remote Address[]? 919876543
DIALPROF config> PROFILE fr_prueba idle-time
Idle Time(s)[0]? 60
DIALPROF config> PROFILE fr_prueba no inbound
DIALPROF config> LIST
DIAL PROFILE..: fr_prueba
Local Address.: 931234567
Remote Address: 919876543            Alternative Remote:
Permissions...: Outbound
Idle Time.....: 60                   Access Control: Yes
Shutdown Calls: Yes
Callback......: None
ISDN Class....: 64 Kbps
Call Retry....: Disabled
Call List.....: No

DIALPROF config>
```

1.5. Configuring the ISDN base interface

You do not need to configure any parameters as we are going to use the switched circuits with MTU 2048 without channel grouping, i.e. the default configuration. It is also unnecessary to configure a local address, as this is not mandatory.

```
Config> NETWORK bri0/0

-- BRI ISDN Configuration --
BRI config> LIST

ISDN Standard            : EURO-ISDN
Type of number           : Unknown
Numbering Plan Identific : Unknown
Sending Complete         : Enabled
Alerting incoming calls  : Disabled
Calling number presentat : Allowed
TEI Negotiation option   : First Call
Local address            :
SPID Value for B1        :
SPID Value for B2        :
Maximum frame length     : 2048

             B1   B2
---------- ---- ----
MTU        2048 2048
Type         SW   SW
B1+B2

BRI config> EXIT
Config>
```

1.6. Associating the primary FR with the backup interface

You need to associate the primary FR interface with the backup interface via ISDN. The backup facilities are used for this:

```
Config> FEATURE WRS-BACKUP-WAN

-- WAN Back-up user configuration --
Back-up WAN>
```

Networks interconnection is then added:

```
Back-up WAN> PAIR serial0/0 fr1 recovery-time 2
```

Check that the configuration is as expected:

```
Back-up WAN> LIST

Primary Interface Secondary Interface Recovery Time
----------------- -------------------- -------------
serial0/0         fr1                  2

Back-up WAN>
```

1.7. Configuring backup in the primary FR interface

Once the primary interface is associated to the backup one, you can configure the parameters related to backup within the primary Frame Relay interface. This is carried out in the following way:

```
Back-up WAN> EXIT
Config> NETWORK serial0/0

-- Frame Relay user configuration --
FR config>
```

Firstly you configure the main circuit.

```
FR config> PVC 16 backup dlci
Frame Relay Back Up circuit number[17]? 17
FR config> PVC 16 backup isdn-dlci
ISDN Back Up circuit number[17]? 20
FR config> PVC 16 backup always
FR config> PVC 16 backup encrypt
FR config>
```

Then configure the second one.

```
FR config> PVC 18 backup dlci 0
FR config> PVC 18 backup isdn-dlci 25
FR config> PVC 18 no backup always
FR config> PVC 18 backup encrypt
FR config>
```

The configuration should look like this:

```
FR config> LIST BACK-UP

  Maximum PVCs allowed  =   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        No
  C18                         18        0        25      No       Yes
FR config>
```

For the primary circuit 16, a backup circuit PVC to PVC (within the serial WAN interface itself) is 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 the interface will switch to backup over ISDN. The DLCI used in the backup is 20. This circuit does not have to be previously configured. As the *Back-ISDN always* option is enabled the switch to backup occurs when the interface is down or when the two circuits are unavailable. If the *Back-ISDN always* option is not enabled, switch to backup only occurs when the interface fails completely.

Finally, circuit 18 does not have PVC-to-PVC backup configured but it does have backup through ISDN. Additionally in this case, the *Back-ISDN always* option is not enabled as this circuit only switches to backup when faced with a complete drop in the primary interface. The DLCI used in backup over ISDN is 25.

If a situation arises where circuits 16 and 17 are inactive but circuit 18 is active, traffic from circuits 16 and 17 will exit through backup over ISDN. Traffic from circuit 18 will exit through the primary interface as it is perfectly possible that some circuits leave through ISDN and others, those that are still active, continue through the main interface.

Once everything indicated has been configured, you need to save the configuration and restart the device.

```
Config> SAVE
Save configuration [n]? y

Saving configuration...OK on Flash
Config><CONTROL+P>
*RESTART
Are you sure to restart the system(Yes/No)? y
Restarting. Please wait ..............................................
```

1.8. Configuring the example in text mode

If you execute a **SHOW CONFIG** command at the **P4**> prompt once the previous steps have been executed, the following is obtained:

```
Config> SHOW CONFIG
; Showing System Configuration ...
; Router ATLAS 2 6 Version 10.0.0

add device fr 1
set data-link frame-relay serial0/0
set data-link x25 serial0/1
set data-link x25 serial0/2
network serial0/0
; -- Frame Relay user configuration --
   pvc 16 default
   pvc 16 encrypt
   pvc 16 backup dlci 17
   pvc 16 backup isdn-dlci 20
   pvc 16 backup always
   pvc 16 backup encrypt
   pvc 16 name C16
;
   pvc 17 default
   pvc 17 encrypt
   pvc 17 name C17
;
   pvc 18 default
   pvc 18 backup isdn-dlci 25
   pvc 18 backup encrypt
   pvc 18 name C18
;
exit
;
network fr1
; -- Generic FR User Configuration --
   base-interface
; -- Base Interface Configuration --
      base-interface bri0/0 255 link
      base-interface bri0/0 255 profile fr_prueba
;
   exit
;
exit
;
set dial-profile
; -- DIAL PROFILE CONFIGURATION --
   profile fr_prueba default
   profile fr_prueba remote-address 919876543
   profile fr_prueba local-address 931234567
   profile fr_prueba no inbound
   profile fr_prueba idle-time 60
;
exit
;
;
protocol ip
; -- Internet protocol user configuration --
   address  serial0/0       1.0.0.1          255.0.0.0
;
exit
;
feature wrs-backup-wan
; -- WAN Back-up user configuration --
   pair serial0/0 fr1 recovery-time 2
exit
;
Config>
```