Backup WAN Reroute (WRR)

Teldat-Dm 727-I

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Chapter 1 Introduction

1.1 Introduction

This chapter describes the operation of the backup by rerouting *(Backup WAN Reroute* , WRR) process.

The backup WRR is another means of adding fault tolerance. This mechanism can provide an alternative path for forwarding data to a destination when a link, interface, etc., is not working properly or at all. In broad terms, the mechanism works by enabling new links in an attempt to find an alternative path (hence the rerouting), if possible, to carry traffic from a primary link that is no longer active.

As well as its standard functionality, whereby the secondary interface is activated when the primary is down, WRR can also be used as a backup mechanism with the secondary interface being activated when a route is dropped or disappears. In this latter case, you can also specify an output interface for the route to be monitored so that the backup is triggered, in the case of multipath routes, if all paths going through that interface are lost (even if another path of the route is still active).

To provide the feature with more flexibility, two operating modes have been implemented: direct mode and inverse mode. Direct mode is typically used in backup scenarios: the secondary interface is activated when the main interface or route fails. Inverse mode is used in scenarios that require a particular interface (secondary) to track the state of another interface (main): the secondary interface is activated when the main interface is activated, and deactivated when the main interface goes down.

The following section describes how the *Backup WRR* works.

1.2 Backup through Rerouting

It is called *Backup WAN Reroute* (WRR) because the traffic that is backed up when the primary link fails is rerouted through an alternative link. From the point of view of the layer 3 protocols, it is a non-transparent backup. It is called non-transparent because the link is apparently not the same once the back up has taken place (as is the case with other backups, such as WRS WAN Restoral).

The backup by rerouting philosophy implies the following steps:

(1) Detection of main link failure.

(2) Rerouting of traffic through an alternative link.

(3) Detection of main link recovery.

(4) Rerouting of traffic through the primary link.

1.2.1 Primary Link

Primary or *main* link refer to any kind of interface or route that we want to track.

- When the *primary link* is an *interface*, tracking is performed based on the state of the interface. At the very least, the interface must support the states *up* and *down*. Examples of the supported interfaces include *Ethernet*, *Token Ring* , *Point-to-Point* and any kind of *virtual interface*. The *circuit* command can be used to to keep track of a switch port.
- When the *primary link* is a route, tracking is performed based on the presence or absence of the route in the *IP Routing Table* . The primary link will only be *up* when a route is *active*. Routes can be filtered according to the *output interface* or *VRF* to which they belong.

Warning

The state of the primary link is **never** modified by the *Backup WRR*; only the secondary link is managed by this feature.

Traffic should go through the *primary link* under *normal* operating conditions and is only rerouted through an alternative link when abnormalities are detected or when the *primary link* is inactive. When both links (primary and secondary) are active at the same time, the *primary link* has priority and traffic is routed through that link.

If an interface supports multiple subinterfaces, for example *Frame Relay* , you can establish one of the subinterfaces as the *primary link*.

Warning

An *X.25* interface **cannot** be a *primary link*. An *NRI* can be a subinterface.

1.2.2 Secondary Link

When the *primary link* is down, traffic is rerouted through the *secondary* or *alternative* link. The state of that interface is directly controlled by the *Backup WRR* feature.

The behavior will vary depending on the configuration mode chosen for the *secondary link*: in *direct mode*, the *secondary link* is enabled only when the primary is *down*, and in *inverse mode*, when it is *up*.

Warning

Special care must be taken when configuring a subinterface as the *secondary link*: if the *primary link* is the base interface of the subinterface, the *secondary* will always be *down* when *direct mode* is chosen.

The secondary link is usually a *switch interface*, such as a *Dial PPP*, a *PPP link* over *AT* commands, a *Frame Relay* over *ISDN* etc., although you can also establish a permanent interface as mentioned in the previous section (except in the case of subinterfaces).

In *inverse* mode, the alternative link is only active when the main link is active. When abnormalities are detected or the main link fails, the alternative link becomes inactive and changes to an available state.

1.2.3 Function

The *Backup WRR* feature has two different modes of operation. When *direct mode* is configured:

An association is established between a primary and a secondary link to specify which interface will become the backup interface when the primary is down. Multiple primary links can be backed up through the same secondary interface. If one of the primary links fails, the secondary interface becomes active and doesn't deactivate until **all** the primary links have recovered.

Similarly, you can configure multiple secondary interfaces as backup interfaces for a primary link. In this case, all secondary links programmed in such a way activate when the primary link fails.

When *inverse mode* is configured:

With this configuration the secondary link follows the state of the primary link. If the primary goes down, so does the secondary. When the primary link comes back up, the secondary link exits the previous state and tries to activate as well.

1.2.3.1 Link Status

At any given time, a link (primary or secondary) may be in any of the following states:

- *Not present*, route or interface is not present.
- *Not supported*, interface is not supported.
- *Active*, route is active or interface is up.
- *Inactive*, route is inactive or interface is down.
- *Performing test*, interface is performing a self-test.
- *Disabled*, interface is disabled through configuration.

The state of the *secondary* interface can also be:

- *Available*, the secondary interface is monitoring the state of the primary interface or the availability of a particular route.

Under normal conditions, the primary interface is in an *active* state and traffic is routed through it (where appropriate). The secondary interface remains in an *available* state monitoring the state of the primary interface.

In the case of tracking routes, under normal conditions the route in question is active, so traffic is routed through the primary link while the secondary route remains in an *available* state.

1.2.3.2 Events

Several events can cause changes in system status:

- *Primary Link Up (PriUp)*, a primary link paired with a secondary one has announced the recovery of the link.
- *Primary Link Down (PriDwn)*, one of the primary links paired with the secondary link has announced a link failure.
- *First Stabilization Time expired;* the first stabilization period timer has expired. **The First Stabilization Time** is the amount of time that the primary interface must be down before the secondary one becomes active (to perform the backup).
- *Stabilization Time expired,* the stabilization period timer has expired. **The Stabilization Time** is the minimum amount of time during which the primary interface must be active before the secondary deactivates (returns to its initial state from backup).
- *Unknown (Unk),* no event has been produced yet, or the event is unknown.

1.2.3.3 State of Backup WRR

The backup WRR process can have various states. Each of these states and their variations according to the occurrence of particular events are indicated below:

When WRR is in direct mode:

- **Disabled (---)**, when no association is enabled or the WRR is disabled globally.
- **Initial (Pri:INI)**, state of the device on start up. The secondary interface is *available*. If the *Primary Up* event occurs, the interface changes to an **Up** state, if the *Primary Down* event occurs it changes from **Up** -> **Down**.
- **Up (Pri:UP)**, the secondary interface is *available* because all the primary links that are controlled by it are *active*.
- **Up -> Down (Pri:U -> D)**, when the secondary link is *available* but has received a *Primary Down* event from one of the primaries associated with it. The *First Stabilization Time* counter is started.
- **Down (Pri:DWN),** when the *First Stabilization Time expired* event occurs, causing the secondary interface to perform a self-test in order to activate.
- **Down -> Up (Pri:D -> U)**, all the main links have reported *Primary Activation*. The *Stabilization Time* counter is started.

When WRR is in inverse mode:

- **Disabled (---)**, when no association is enabled or the WRR is disabled globally.
- **Initial (Pri:INI)**, state of the device on start up. The secondary interface is executing *test*; if the *Primary Down* event occurs, the interface changes to **Up -> Down** state. If the *Primary Activating* event occurs then it changes to **Up** without waiting for *Stabilization Time*.
- **Up (Pri:UP)**, the secondary changes to *executing self-test and then active or down* because all the primary links that are controlled by it have reported *active* states and the *Stabilization Time* has expired.
- **Up->Down (Pri:U -> D)**, when the secondary is *unavailable* but has received a *Primary Down* event from one of the primaries associated with it. The *First Stabilization Time* counter is started.
- **Down (Pri:D)**, when the *First Stabilization Time expired* event occurs, causing the secondary interfaces to become *available*.
- **Down -> Up (Pri:D -> U)**, all the main links have reported *Primary Activation*. The *Stabilization Time* counter is started.

1.2.3.4 Backup WRR process

With WRR in non-inverse mode (direct mode)

The backup process initiates when a *Primary Down* event occurs and the secondary is *available*. The WRR then changes to a *Pri:U -> D* state before changing to a *Pri:D* state after waiting the minimum amount of time during which the

primary has to be down (*First Stabilization Time*) and ensuring that the secondary is actually working. In this state, the secondary exits the *available* state and tries to activate.

When the secondary link is *active* (i.e., forwarding traffic that is usually sent through the primary link) with the backup in a *Pri:D* state and the primary that it is monitoring recovers (producing a *Primary Up* event), it changes to a *Pri:D -> U* state if that primary is the last of the failed links that are configured with this link as the secondary link. After waiting the minimum amount of time during which the primary link must be active (*Stabilization Time*), the primary link reactivates and the secondary is deactivated (in the case of Dial secondary links that require a call for connection, the call is released). The backup changes to a *Pri:U* state.

With WRR in inverse mode:

The state monitoring process starts when a *Primary Down* event occurs when the secondary is in a state other than *available*. The WRR then changes to a Pri:U -> D state and after waiting the minimum amount of time during which the primary has to be down (First Stabilization Time) and ensuring that the WRR is working, the secondary changes to an available state (in the case of Dial secondary links that require a call for connection, the call is released) and the WRR reports a Pri:D state.

When the secondary link is *available* with the WRR in a *Pri:D* state and the primary that it monitors recovers (producing the *Primary Activation* event), it changes to *Pri:D -> U* if the primary is the last of the failed links that have this link configured as secondary. After waiting the minimum amount of time during which the primary link must be active (Stabilization Time), the primary link activates once again and the secondary link exits the *available* state. The WRR changes to a *Pri:U* state.

1.2.4 Example of backup through rerouting (WRR)

The user environment consists of:

- A device in which the WRR feature is configured in direct mode with an association where the primary link is a DLCI (16) and the secondary, a Dial-PPP channel.
- A device at the remote end of the FR link.
- A device functioning as a PPP server.

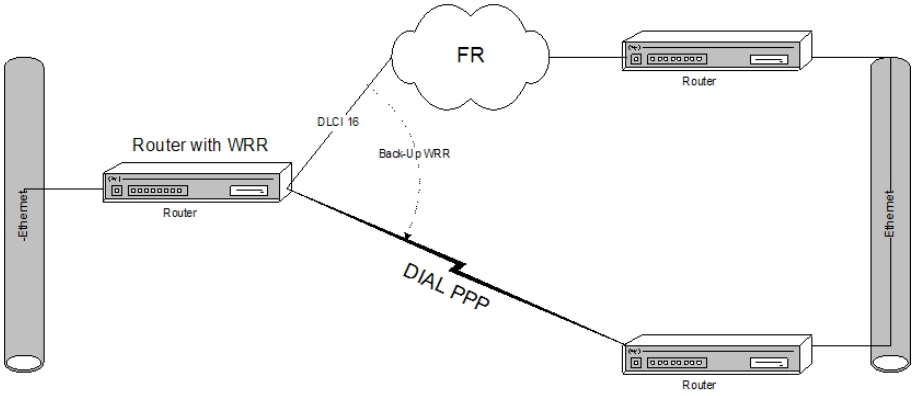

Fig. 1: **Example of backup through rerouting (WRR)**

While the primary link is active, the secondary interface is on 'standby', i.e., as if it were down. No calls are provoked when RIP is enabled on the secondary link because the link is down. Traffic is routed through the primary link.

When the primary link goes down, the secondary interface activates. If RIP is enabled, it will start learning routes through the secondary link. Any static routes configured through the secondary will activate. Dynamic routes learned through the primary and static routes with the primary as the next hop will fall causing traffic to be rerouted through the secondary interface. Routes learned through the secondary interface are assigned a greater cost. This prevents IP traffic for DLCIs that are still active from being rerouted through the secondary interface when using a single secondary to backup multiple DLCIs.

When the primary link recovers, the static routes activate again. If RIP is enabled in the primary, it will start learning routes through the primary. Dynamic routes learned through the secondary and any static routes configured, are deleted. The IP traffic is then routed through the primary.

Chapter 2 Configuration

2.1 Accessing the Backup WRR Configuration prompt

The WRR configuration commands are available from the associated configuration prompt. To access the WRR configuration prompt, perform the following steps:

(1) Access the general configuration menu, *Config*>.

(2) Enter the WRR `feature wrr-backup-wan` command.

Example:

```
*config


Config>feature wrr-backup-wan

-- WAN Reroute Backup user configuration --
Backup WRR>
```

Once you have accessed the WRR configuration prompt (*Backup WRR*>), you can configure the feature through the commands described in the following section.

2.2 Backup WRR Configuration Commands

The following table describes the Backup WRR configuration commands.

Command	Function
? (HELP)	Displays the Backup WRR configuration commands or lists the options for a specific command.
DISABLE	Allows you to disable the entire Backup WRR function.
ENABLE	Enables the Backup WRR function.
FIRST-STABILIZATION-TIME	Configures the global first stabilization time.
LIST	Displays the configuration parameters.
NO	Deletes a Backup WRR association or sets the default values for various parameters.
PAIR	Creates a Backup WRR association.
STABILIZATION-TIME	Configures the global stabilization time.
EXIT	Exits the Backup WRR prompt and returns to the general configuration prompt, *Config*>.

Any parameters not entered in the command line which are necessary for completion of a command, will be requested by the device.

2.2.1 ? (HELP)

The `?` (HELP) command lists all of the commands available for the level. It also lists the options for a specific command.

Syntax:

```
Backup WRR>?
```

Example:

```
Backup WRR>?
  disable                     Disables the Backup WRR functionality
  enable                      Enables the Backup WRR functionality
  first-stabilization-time    Default first stabilization time value
  list                        View all the Backup WRR configuration information
  no
  pair                        Association for the Backup WRR
  stabilization-time          Default stabilization time value
  exit
Backup WRR>
```

2.2.2 DISABLE

The Backup WRR functionality is completely disabled through this command. None of the associations configured will be operational. The configuration of the associations is maintained, however, allowing you to enable Backup WRR at a later stage and conserve all the configured parameters.

Syntax:

```
Backup WRR>disable
```

Example:

```
Backup WRR>disable
Backup WRR>
```

2.2.3 ENABLE

Enables the Backup WRR functionality. You will not be able to execute anything related to the Backup WRR unless you enable overall functionality through this command.

Syntax:

```
Backup WRR>enable
```

Example:

```
Backup WRR>enable
Backup WRR>
```

2.2.4 FIRST-STABILIZATION-TIME

Configures the *Default First Stabilization Time* value.

Syntax:

```
Backup WRR>first-stabilization-time
  <0s..32767s>    Time value
    <cr>
```

Example:

```
Backup WRR>first-stabilization-time 2s
Backup WRR>
```

2.2.5 LIST

The `list` command displays all of the Backup WRR configuration information.

This includes both the general parameters and the different associations present.

Syntax:

```
Backup WRR>list
```

Example:

```
Backup WRR>list
Backup-WRR is enabled.
Default First Stabilization Time: 1 (seconds)
Default Stabilization Time:       1 (seconds)

         Primary                   Secondary    Re-route T.1st T     Working
  Ifc/Route     Circuit/Mask       Interface    Enabled  Stab  Stab  Mode
------------------------------ --------------- -------- ----- ----- --------
serial0/1       16              fr1             Yes      Def   Def   default
serial0/0                       ppp1            Yes      Def   Def   default
172.24.0.0      255.255.0.0     ppp1            Yes      Def   Def   default
Outgoing Ifc:   ethernet0/0
192.6.1.0       255.255.255.0   ppp1            Yes      Def   Def   default
Backup WRR>
```

2.2.6 NO

2.2.6.1 NO FIRST-STABILIZATION-TIME

Sets the *Default First Stabilization Time* value to its default value (1 second).

Syntax:

```
Backup WRR>no first-stabilization-time
```

Example:

```
Backup WRR>no first-stabilization-time
Backup WRR>
```

2.2.6.2 NO PAIR

This eliminates one of the Backup WRR associations configured in the router. Here, you only need to indicate the identifier of the primary-secondary pair or association.

Syntax:

```
Backup WRR>no pair
  <0..65535>    Backup pair Id
    <cr>
```

Example:

```
Backup WRR>no pair 1
Backup WRR>
```

2.2.6.3 NO STABILIZATION-TIME

Sets the *Default Stabilization Time* value to its default value (1 second).

Syntax:

```
Backup WRR>no stabilization-time
```

Example:

```
Backup WRR>no stabilization-time
Backup WRR>
```

2.2.7 PAIR

Creates a new association for the Backup WRR. To do this you must indicate the primary interface (or route) that you wish to monitor, the subinterface (where appropriate), secondary interface and stabilization times.

If you wish to configure Backup WRR for a primary interface or subinterface (or route) over various secondary inter-

faces, or various primary interfaces and/or subinterfaces (or routes) over the same secondary interface, add as many associations to the same common interface (or route) as necessary.

Syntax:

```
Backup WRR>pair
  <0..65535>    Backup pair Id
    active                      Activate/deactivate this backup pair
      <cr>
    first-stabilization-time    First stabilization time
      <0s..32767s>    Time value
        <cr>
      default         Use default value
        <cr>
    inverse-wrr                 Activate/deactivate inverse wrr mode
      <cr>
    phy-shutdown                Disable physically the secondary interface
      <cr>
    primary                     Primary interface/circuit
      interface          Primary interface
        <interface>        Interface name
          secondary          Secondary interface
            interface          Secondary interface
              <interface>        Interface name
                <cr>
          <cr>
      circuit            Primary circuit
        <na>               Primary Circuit
          secondary          Secondary interface
            interface          Secondary interface
              <interface>        Interface name
                <cr>
          <cr>
        <cr>
      ip-route           Primary Ip Route
        <a.b.c.d>          Ipv4 format
          secondary          Secondary interface
            interface          Secondary interface
              <interface>        Interface name
                <cr>
          <cr>
      ip-mask            Primary Route mask
        <a.b.c.d>          Ipv4 format
          secondary          Secondary interface
            interface          Secondary interface
              <interface>        Interface name
                <cr>
          <cr>
      ip-outgoing-ifc    Outgoing interface
        <interface>        Interface name
          secondary          Secondary interface
            interface          Secondary interface
              <interface>        Interface name
                <cr>
        <cr>
      Vrf                 Primary VRF instance
       <vrf name>           Table name
            Secondary         Secondary interface
            Interface            Secondary interface
              <interface>         Interface name
```

```
              <cr>
      <cr>
   secondary                   Secondary interface
     <interface>        Interface name
       <cr>
   stabilization-time          Stabilization time
     <0s..32767s>    Time value
       <cr>
     default         Use default value
       <cr>
   no
     active         Activate/deactivate this backup pair
       <cr>
     inverse-wrr    Activate/deactivate inverse wrr mode
       <cr>
```

active	activates this backup pair.
first-stabilization-time	sets the first stabilization time for this backup pair.
inverse-wrr	when this mode is configured, and the primary is *Down*, the secondary interface changes to an *available* state. The secondary interface exits this state when the primary interface changes to *Up*, (contrary to normal behavior).
phy-shutdown	sets the secondary interface to *down* instead of *available*.
primary interface	configures the primary interface for this backup pair.
primary circuit	configures the primary port/subinterface for this backup pair.
primary ip-route	configures the IP route to be monitored as the primary link.
primary ip-mask	configures the IP mask for the route destination subnet.
primary ip-outgoing-ifc	establishes a specific output interface to determine which paths to monitor in a multipath route. If you do not specify an output interface, the primary link is considered down when the route being monitored is inactive. If you do specify an output interface, the secondary link activates when all the paths of a route going through that interface disappear (even if there is another active path with a different output interface).
primary vrf	configures the VRF instance to which the primary link belongs.
secondary interface	configures the secondary interface for this backup pair.
stabilization-time	configures the stabilization time for this backup pair.

The *primary interface* and *primary IP-route* configurations are exclusive. That is, a backup pair shall be defined as monitored by either the primary interface or by the route; the same backup pair cannot be defined both ways at the same time.

Example:

```
Backup WRR>pair 1 primary interface serial0/0 secondary interface fr1
Backup WRR>
```

2.2.8 STABILIZATION-TIME

Configures the default stabilization time.

Syntax:

```
Backup WRR>stabilization-time
  <0s..32767s>    Time value
```

```
    <cr>
```

Example:

```
Backup WRR>stabilization-time 2s
Backup WRR>
```

2.2.9 EXIT

Exits the Backup WRR configuration prompt and returns to the general configuration prompt, *Config*>.

Syntax:

```
Backup WRR>exit
```

Example:

```
Backup WRR>exit
Config>
```

2.3 Interaction with other Protocols

2.3.1 WRS Backup

Interfaces enabled with this type of backup (Backup WAN Restoral) should not be configured as a primary or secondary link.

Configuration is independent between backups. An interface cannot have both backup types.

2.3.2 Static Routing

The rerouting backup process does not disrupt static routing in any way. Normal functioning is not affected because the static routes become active according to the state of the links rather than the state of the Backup WRR.

2.3.3 Dynamic Routing

The rerouting backup process does not disrupt dynamic routing. Routes are learned through the secondary link when it is enabled during a backup situation. If you want to return traffic to the primary link once it recovers, you must increase the interface cost so that it is higher than the routes learned through the secondary link (in this way, routes dynamically learned through the main, or primary, link will always have priority).

Chapter 3 Monitoring

3.1 Accessing the WRR Monitoring prompt

The feature monitoring commands are available from the Backup WRR monitoring prompt. To access the WRR monitoring prompt, perform the following steps:

(1) Access the general monitoring menu, (+).

(2) Enter the WRR `FEATURE WRR-BACKUP-WAN` command.

Example:

```
*MONITOR
Console Operator
+FEATURE WRR-BACKUP-WAN

-- Backup WAN Reroute user console --
WRR+
```

3.2 Backup WRR Monitoring Commands

The following table describes the Backup WRR monitoring commands.

Command	Function
? (HELP)	Displays the Backup WRR monitoring commands or lists the options for a specific command.
LIST	Displays statistics relating to Backup WRR.
EXIT	Exits the Backup WRR monitoring prompt and returns to the general monitoring prompt (+).

3.2.1 ? (HELP)

The `?` (HELP) command lists all the commands available at that level. It also lists the options for a specific command.

Syntax:

```
WRR+?
```

Example:

```
WRR+?
  list    List WRR information
  exit
WRR+
```

3.2.2 LIST

The `list` command displays information on the Backup WRR; statistics etc.

```
WRR+list ?
  all                     List all WRR information
  counters                List statistics
  pairs                   List the global information and data relative to the
                          associations
  states-secondary-ifcs   List the states of the various secondary link
```

3.2.2.1 LIST ALL

Displays all available information on monitoring.

The meaning of the various parts is detailed in the associated command descriptions.

Syntax:

```
WRR+list all
```

Example:

```
WRR+list all

Global information:
-------------------
Backup-WRR is enabled.
Default First Stabilization Time: 1 (seconds)
Default Stabilization Time:       1 (seconds)
Per pair information:
---------------------
         Primary                 Secondary   R-r  T.1st T     Last   Num   Num
  Ifc/Route     Circuit/Mask     Interface   Enab Stab  Stab  Event  Act   Inact
------------------------------ ------------ ---- ----- ----- ------ ----- -----
serial0/0       16              ppp1        Yes  1     1     PriDwn 0     1
atm3/0                          fr1         Yes  1     1     PriDwn 0     1
172.24.0.0      255.255.0.0     ppp1        Yes  1     1     PriUp  1     0
Outgoing Ifc:   ethernet0/0
192.6.1.0       255.255.255.0   ppp1        Yes  1     1     Desc   0     0

Per secondary current status:
-----------------------------
Secondary       Working    Re-route   Second. C.1st C     Cir#  Current
 Network        Mode   State      State   Stab  Stab  InBUp Duration
--------------- ---------- ---------- ------- ----- ----- ----- ---------------
ppp1            default        Pri:Dwn    Act     0     0     1             0:00:34
fr1             default        Pri:Dwn    Act     0     0     1             0:00:34

Statistics summarized:
----------------------
Total number of times Pri:Dwn state is reached:     2
Total number of times Pri:Dwn->Up state is reached: 0
Total number of times Pri:Up state is reached:      0
Total number of times Pri:Up->Dwn state is reached: 2
Longest completed WRR backup process:           0:00:00
Accumulated amount of time doing WRR backup:    0:00:00

Per secondary ifc statistics:
-----------------------------
Secondary       Num   Num   Num   Num   Current      Accumulated  Longest
 Network        UP    U->D  DWN   D->U  Duration     Duration     Duration
--------------- ----- ----- ----- ----- ------------ ------------ ------------
ppp1            0     1     1     0          0:00:35      0:00:00      0:00:00
fr1             0     1     1     0          0:00:35      0:00:00      0:00:00

WRR+
```

3.2.2.2 LIST COUNTERS

Displays various statistical information on the secondary links of the associations or a general summary of all the Backup WRR.

```
WRR+list counters ?
  secondary-ifcs    List statistics of each interface configured as a secondary
                    link
  summary           List statistics relevant to the state changes in the
                    associations and the duration time of the Backup WRR
                    rerouting
```

LIST COUNTERS SECONDARY-IFCs

Displays statistics for each interface configured as a secondary link.

Syntax:

```
WRR+list counters secondary-ifcs
```

Example:

```
WRR+list counters secondary-ifcs

Per secondary ifc statistics:
-----------------------------
Secondary       Num   Num   Num   Num   Current      Accumulated  Longest
 Network        UP    U->D  DWN   D->U  Duration     Duration     Duration
--------------- ----- ----- ----- ----- ------------ ------------ ------------
ppp1            0     1     1     0          0:01:22      0:00:00      0:00:00
fr1             0     1     1     0          0:01:22      0:00:00      0:00:00
WRR+
```

The meaning of each field is as follows:

Secondary Network	Interface name of the secondary link.
Num UP	Number of times the main link has been in an “UP” state.
Num U->D	Number of times the main link has been in an “UP -> DOWN” state.
Num DWN	Number of times the main link has been in a “DOWN” state.
Num D->U	Number of times the main link has been in a “DOWN -> UP” state.
Current Duration	Current rerouting process time.
Accumulated Duration	Accumulated rerouting process time.
Longest Duration	Maximum rerouting process time.

LIST COUNTERS SUMMARY

Displays the counters for the changes of state in the associations and for the backup WRR rerouting duration.

Syntax:

```
WRR+list counters summary
```

Example:

```
WRR+list counters summary

Statistics summarized:
----------------------
Total number of times Pri:Dwn state is reached:     2
Total number of times Pri:Dwn->Up state is reached: 1
Total number of times Pri:Up state is reached:      2
Total number of times Pri:Up->Dwn state is reached: 2
Longest completed WRR backup process:           0:12:34
```

```
Accumulated amount of time doing WRR backup:    0:12:34
WRR+
```

3.2.2.3 LIST STATES-SECONDARY-IFCs

Displays the states of the various secondary links.

Syntax:

```
WRR+list states-secondary-ifcs
```

Example:

```
WRR+list states-secondary-ifcs

Per secondary current status:
-----------------------------
Secondary       Working    Re-route   Second. C.1st C     Cir#  Current
 Network        Mode   State      State   Stab  Stab  InBUp Duration
--------------- ---------- ---------- ------- ----- ----- ----- ---------------
ppp1            default        Pri:Dwn    Act     0     0     1             0:01:49
fr1             default        Pri:Dwn    Act     0     0     1             0:01:49
WRR+
```

The meaning of each field is as follows:

Secondary Network	Interface name of the secondary link.
Inverse Re-route	Indicates whether the inverse operation mode has been configured.
Working Mode	Shows the state of the secondary link: standard mode (*default*), inverse mode (*inv*) or physically disabled (*phy*).
Second State	State of the secondary interface.
C.1st Stab	Time remaining before backup.
C Stab	Time remaining before backup recovery.
Cir# InBUp	Number of primary links associated in backup.
Current Duration	Current time in backup.

3.2.2.4 LIST PAIRS

Displays the global information and data relating to the associations.

Syntax:

```
WRR+list pairs
```

Example:

```
WRR+list pairs

Global information:
-------------------
Backup-WRR is enabled.
Default First Stabilization Time: 1 (seconds)
Default Stabilization Time:       1 (seconds)

Per pair information:
---------------------
         Primary                 Secondary   R-r  T.1st T     Last   Num   Num
  Ifc/Route     Circuit/Mask     Interface   Enab Stab  Stab  Event  Act   Inact
```

```
------------------------------ ------------ ---- ----- ----- ------ ----- -----
serial0/0       16             ppp1         Yes  1     1     PriDwn 0     1
atm3/0                         fr1          Yes  1     1     PriDwn 0     1
172.24.0.0      255.255.0.0    ppp1         Yes  1     1     PriUp  1     0
Outgoing Ifc:   ethernet0/0
192.6.1.0       255.255.255.0  ppp1         Yes  1     1     Desc   0     0
WRR+
```

The fields have the following meanings:

Default Stabilization Time	Default Stabilization Time.
Default First Stabilization Time	Default First Stabilization Time.
Primary Ifc / *Circuit*	Interface name and subinterface of the primary link.
Primary Route / *Mask*	Associated IP route and mask.
Outgoing Ifc	Output interface associated with the paths of the multipath route, which are monitored to switch to backup when necessary.
Secondary Interface	Interface name of the secondary link.
R-r Enab	Specifies whether the association is enabled (YES) or disabled (NO) to carry out backup.
T.1st Stab	First Stabilization Time.
T Stab	Stabilization Time.
Last Event	The last event provoked by the primary interface. (The various events that may occur are detailed in Chapter **1**, section **2.3.b**).
Num Act	Number of times that a primary link has activated.
Num Inact	Number of times that a primary link has gone down or has deactivated.

3.2.3 EXIT

Exits the Backup WRR monitoring prompt.

Syntax:

```
WRR+exit
```

Example:

```
WRR+exit
+
```

Chapter 4 Practical example of Backup WRR Configuration

4.1 Backup WRR Configuration Example

We will now set out the steps required to configure the case given in chapter *1*.

The user environment consists of:

- A device where you configure the WRR feature with an association and where the primary link is a DLCI (16) and the secondary a PPP interface over an ISDN B channel.
- A device at the remote end of the FR link.
- A device functioning as a PPP server.

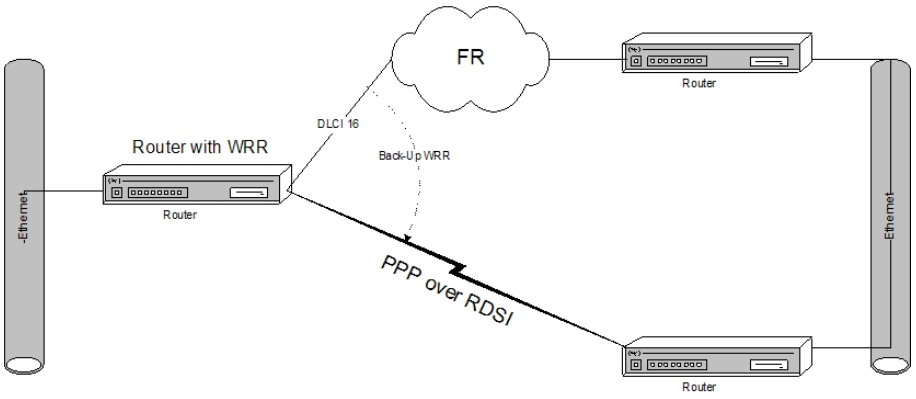

Fig. 2: **Backup WRR Configuration Example**

Let us suppose that you want to establish the backup through WRR shown in the above figure: when the Frame Relay interface DLCI 16 goes down, a PPP link over the ISDN line B channel activates and establishes the call etc., until the DLCI recovers, causing it to deactivate and release the call.

To do this, you must configure the Frame Relay interface with PVC in the router and the necessary parameters in the DLCI 16 and the PPP over ISDN interface. For further information on configuring these interfaces, please consult the following manuals: Teldat-Dm710-I “PPP Interface”, Teldat-Dm703-I “Frame Relay”.

Let us suppose that both interfaces are configured in the router. Check that they are included on the interface list:

```
*config


Interface            Connector     Type of interface
ethernet0/0          LAN1          Fast Ethernet interface
serial0/0            SERIAL0/WAN1  Frame Relay
serial0/1            SERIAL1/WAN2  X25
serial0/2            SERIAL2/WAN3  X25
bri0/0               BRI/ISDN1     ISDN Basic Rate Int
x25-node             ---           Router->Node
ppp1                 ---           Generic PPP
Config>
```

Supposing you want to establish WRR backup of the Frame Relay interface DLCI 16 configured in WAN line 1 (interface serial0/0) over the PPP interface that has already been configured over an ISDN line B channel (interface ppp1).

Enter the following to access the Backup WRR configuration menu:

```
Config>feature wrr-backup-wan

-- WAN Reroute Backup user configuration --
Backup WRR>
```

Enable Backup WRR:

```
Backup WRR>enable
Backup WRR>
```

Create the association between the required interfaces, establishing the default parameters for the timers:

```
Backup WRR>pair 1 primary interface serial0/0 secondary interface ppp1
Backup WRR>pair 1 primary circuit 16
Backup WRR>
```

View the list of associations to check that the association has been created correctly:

```
Backup WRR>list
Backup-WRR is enabled.
Default First Stabilization Time: 1 (seconds)
Default Stabilization Time:       1 (seconds)

         Primary                    Secondary    Re-route   T.1st T     Working
  Ifc/Route     Circuit/Mask        Interface    Enabled    Stab  Stab  Mode
------------------------------- --------------- ---------- ----- ----- --------
serial0/0       16               ppp1           Yes        Def   Def   default
Backup WRR>
```

Execute the `show config` command to obtain the device configuration:

```
Config>show config
; Showing System Configuration for access-level 15 ...
; ATLAS Router 2 32 Version 10.7.0

log-command-errors
no configuration
add device ppp 1
set data-link frame-relay serial0/0
set data-link x25 serial0/1
set data-link x25 serial0/2
global-profiles dial
; -- Dial Profiles Configuration --
   profile ejemplo default
   profile ejemplo dialout
   profile ejemplo remote-address 123456
;
exit
;
;
network ethernet0/0
; -- Ethernet Interface User Configuration --
   ip address 172.24.78.5 255.255.0.0
;
;
;
;
exit
;
;
network serial0/0
; -- Frame Relay user configuration --
   ip address 192.6.1.1 255.255.255.0
;
;
;
;
   pvc 16 default
```

```
;
exit
;
;
;
network x25-node
; -- X25-node interface configuration --
   no ip address
;
exit
;
;
network ppp1
; -- Generic PPP User Configuration --
   ip address 192.168.1.1 255.255.255.0
;
;
;
;
   base-interface
; -- Base Interface Configuration --
      base-interface bri0/0 255 link
      base-interface bri0/0 255 profile ejemplo
;
   exit
;
exit
;
;
;
feature wrr-backup-wan
; -- WAN Reroute Backup user configuration --
   pair 1 primary interface serial0/0 secondary interface ppp1
   pair 1 primary circuit 16
;
   enable
exit
;
dump-command-errors
end
; --- end ---
```