



ACAT Facility

bintec-Dm 798-I

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Chapter 1 Introduction

1.1 ACAT Feature: Description

The Advanced Choice-based Action Taker (ACAT) feature is a tool that allows the router to perform a series of actions based on the choice of one or more options within a group.

The diagram below illustrates how the feature operates:

A group is a set of alternatives or options that compete with each other every time a choice is made. The diagram shows that there are 4 possible options defined for Group 1. Each of these options has the following:

- An index to identify it. This index must be unique for each of the options, and can range between 1 and the maximum number of permitted options. In the diagram, each option is represented by a polygon with a different number of sides.
- A state. There are only two possible states for an option: UP or DOWN. This state can be fixed – always UP – or depend on the position of other router elements such as tracking the status of an interface. In the diagram, options in red are UP, and option 2 is DOWN.
- A priority level. This can range between 1 (highest priority) and the maximum number of permitted options. This means that you can have a different priority for each option configured. To make the choice, all options in the UP state are considered and the one with the highest priority is selected: the selected priority consequently becomes the active priority. In the diagram, option 1 has been selected because it is in an UP state and has the highest priority. If, for example, option 1 changes to DOWN, the next option selected is 4. Each option is shown with a different associated priority, but it is equally possible to have multiple options with the same priority level. If said level is selected, all options with that priority become selected. Selecting an option is equivalent to activating it; if during the next selection action, the active option isn't selected, then it will be deactivated before the new option is activated. In any case, if there aren't any options in an UP state, then no options are selected.
- A list of actions. If the option is enabled because it has been chosen, all the actions defined for the option are carried out. These can be, for example, installing a default route or allowing RIP to operate over an interface. If the option is disabled, then the inverse actions are performed; so in the examples cited, the default route would be uninstalled or RIP would be prevented from executing in the configured interface. In the diagram the actions are presented as 5-, 6-, and 7-pointed stars; the same stars are repeated in various options because the possible types of actions are limited, although the colors vary in some cases because the parameters within the same type of action can change. For example, one action might be to install a default route, but this can be done using one gateway or another.

As regards the actual selection procedure, this is done when an option changes to UP, when an active option changes to DOWN or when there are changes to the router's dynamic configuration.

In addition to setting up the group options, other general features can be configured to alter the behavior of the group:

- Recovery Timer. This mechanism is optional, and is used to reduce the frequency of changes in the selected option. Thanks to this, recurring activations and deactivations can be avoided if a high priority option frequently changes state during short periods of time. Here's how it works: when a priority is chosen as the active priority, the timer starts at the configured interval. Until the timer expires, the active priority remains the same, and any options changing to the UP state during this period are ignored. Only when the active options change to DOWN will the timer stop, and a new choice is selected. When the timer expires, a new selection process begins to determine whether the active priority remains as is or changes. If there is a change, then the Recovery Timer restarts. You can also configure this timer as infinite, blocking priority changes while the active options are UP.
- Advanced settings:

Sending RIP with a variable cost added. This mechanism is combined with the configured action allowing the RIP protocol in the interface or disabling it. This means that with any new selection in the group, the cost assigned to the routes broadcast by RIP is modified. By doing this, once a new selection is done, the routing tables of other devices within the Autonomous System are immediately updated because the new routes sent by the router cost less than the previous ones.

Multiple groups of options can coexist in the router so that within each group selections are independently carried out among the options themselves.

Chapter 2 Configuring the ACAT Feature

2.1 Configuring the ACAT General Menu

To configure the ACAT feature, go to the general configuration menu and enter **feature acat**.

Syntax:

```
Config>feature acat
-- Advanced Choice-based Action Taker feature configuration --
ACAT Config>
```

The following commands are available from the ACAT feature configuration menu:

```
ACAT Config>?
  group      One set of options and associated parameters
  no         Negate a command or set its defaults
  exit
ACAT Config>
```

2.1.1 [NO] GROUP <INDEX>

For this command, you need to enter an index **<INDEX>** to identify the desired group. This opens a new menu where you can configure said group. Using the **NO** form of the command removes the entire group configuration (if it exists).

Syntax:

```
ACAT Config>group ?
<1..10>    Index to identify group
ACAT Config>
```

The index can be between 1 and 10, with 10 being the maximum number of groups supported.

Example:

```
ACAT Config>group 1
-- Advanced Choice-based Action Taker Group configuration --
ACAT Group 1>
```

2.1.2 EXIT

Use the **EXIT** command to return to the general configuration prompt *Config>*.

Example:

```
ACAT Config>exit
Config>
```

2.2 Configuring a Group

You can use the following commands from the general configuration menu to configure a group:

```
ACAT Group 1>?
  advanced      Advanced group configuration
  enable        Enable this group
  no            Negate a command or set its defaults
  option        One of the alternatives
  recovery-time Minimum delay before activating a higher priority option
  exit
ACAT Group 1>
```

Group 1 is taken as the example throughout this section.

2.2.1 ADVANCED

This command is used to perform an advanced configuration for the whole group, modifying the global behavior.

```
ACAT Group 1>advanced ?
  rip      RIP offset modification
ACAT Group 1>advanced
```

2.2.1.1 [NO] ADVANCED RIP

This modifies the behavior of RIP in the configured interfaces for **ALLOW-RIP** actions from the options that are active at any point.

Using the **NO** command removes all the advanced RIP settings for the group.

The cost of the routes being sent is the only thing that can be varied; the following configuration options are available for this:

```
ACAT Group 1>advanced rip send ?
  initial-added-offset  Offset added at first activation
  eventual-added-offset Offset added after a period without changes
  step                  Variation of offset in every priority change (def: -1)
ACAT Group 1>advanced rip send
```

2.2.1.1.1 ADVANCED RIP SEND INITIAL-ADDED-OFFSET <COST>

The first time that an option is activated, the cost **<COST>** established through this command is added to the routes broadcast by the interface configured through the **ALLOW-RIP** action in said option.

Syntax:

```
ACAT Group 1>advanced rip send initial-added-offset ?
  <0..16>  Value in the specified range
ACAT Group 1>advanced rip send initial-added-offset
```

The initial added cost is 0 by default, i.e., it isn't configured. From ACAT, the cost of the routes broadcast by RIP isn't initially altered.

If this command is configured in more than one group and affects the same interfaces, the total added cost is the sum of the costs added in each group.

2.2.1.1.2 ADVANCED RIP SEND EVENTUAL-ADDED-OFFSET <COST> DELAY <TIM>

Using this command, the cost added to RIP routes broadcast by interfaces configured through the **ALLOW-RIP** action becomes variable. Based on the initial added offset value, with each new selection made (with a change of priority), the offset is recalculated by adding a value configured through the **STEP** command to it. By default, this value is -1, so that for each selection the cost of the routes sent in a unit is reduced. Consequently, if the new routes reach a device which has also received previous routes at a higher cost, the new ones immediately replace the old ones. The cost cannot be reduced indefinitely because once the additional cost has reached 0, it doesn't keep on decreasing. To solve this, you can use the new **<TIM>** command to establish a minimum time for routes to be considered installed in the rest of the devices in the Autonomous System; once this time has timed out, the added cost becomes **<COST>**, normally at a higher cost. The rest of the devices in the Autonomous System receive the same routes through the same interface as before, though at a higher cost, and update their routing tables. In the next selection, the cost of the sent routes can be reduced again.

If the **FAST-UPDATES** command in RIP has been configured, then as soon as the timer times out, corresponding "update" messages are sent adding the **<COST>** to the cost of the routes.

Syntax:

```
ACAT Group 1>advanced rip send eventual-added-offset ?
  <0..16>  Value in the specified range
ACAT Group 1>advanced rip send eventual-added-offset 8 delay ?
  <0s..1d> Time value
ACAT Group 1>advanced rip send eventual-added-offset 8 delay
```

By default this is disabled, with 0 added cost and a temporary threshold of 0 seconds; in this case the added cost does not vary and only depends on the initial added cost.

2.2.1.1.3 ADVANCED RIP SEND STEP <STEP>

This command is configurable provided that **EVENTUAL-ADDED-OFFSET** has a non-null DELAY value configured. This indicates the variation in the cost added to the routes sent by RIP for each new selection where the selected priority changes.

Syntax:

```
ACAT Group 1>advanced rip send step ?
<-16..16>   Value in the specified range
ACAT Group 1>advanced rip send step
```

By default, this value is -1, so that the cost of the routes sent by RIP is one unit less in each new change of priority.

2.2.2 [NO] ENABLE

This command enables or disables the functionality for an entire group. When a group is disabled there are no active options, all the options change to the DOWN state, the actions are redundant, the timers stopped, and advanced RIP remains in its initial state.

On enabling a group the option states update, the interfaces configured through **ALLOW-RIP** remain disabled for RIP, and LED dependencies with the cellular interfaces are created, etc. It's at this point that the first selection from the active options is made. **IMPORTANT**: By default, a new group is created disabled, so you must configure this command in order to activate it.

Syntax:

```
ACAT Group 1>enable
ACAT Group 1>
```

2.2.3 [NO] OPTION <INDEX>

This command is used to configure each of the possible options within a group. To determine which option is being configured, an index is specified whose range of values is between 1 and 10, with 10 being the maximum number of options supported in a group.

The **NO** command removes all the settings for the option, if any exist.

Syntax:

```
ACAT Group 1>option ?
<1..10>   Index to identify option
ACAT Group 1>option
```

After specifying the index, the following configuration options are available:

```
ACAT Group 1>option 1 ?
priority   Priority to activate option (1 is highest)
track      Follow the state of an object to bring up/down the option
action     Actions to do when this option is activated
ACAT Group 1>option 1
```

2.2.3.1 [NO] OPTION <INDEX> PRIORITY <PRI>

This configures the priority level for the option. This value is between 1 (highest priority) and 10, the maximum number of supported options (lowest priority). This field is essential when creating the option. If it is not explicitly configured, the minimum priority value is automatically taken.

If you execute the **NO** command, this value is also taken by default.

Syntax:

```
ACAT Group 1>option 1 priority ?
<1..10>   Value in the specified range
ACAT Group 1>option 1 priority
```

2.2.3.2 [NO] OPTION <INDEX> TRACK

This command is used to indicate that the status of the interface depends on the state of another router element. In order to complete this command, you need to indicate the element that's going to track this status.

Running the **NO** command ensures that the option status does not depend on other router elements but on the fact that it is always UP (if the group is enabled).

Syntax:

```
ACAT Group 1>option 1 track ?
  interface      Interface used for the tracking
ACAT Group 1>option 1 track
```

Interface state tracking is available.

2.2.3.2.1 OPTION <INDEX> TRACK INTERFACE <IFACE>

This completes the command to specify that the option status depends on the interface specified in **<IFACE>**. This value must be the name of an interface that exists in the configuration. If that interface is removed, this command is automatically removed from the option configuration.

Syntax:

```
ACAT Group 1>option 1 track interface ?
  <interface>   Interface name
ACAT Group 1>option 1 track interface
```

2.2.3.3 OPTION <INDEX> ACTION

This is the beginning of the commands used to define actions to be carried out if the option is active.

Possible actions are as follows:

```
ACAT Group 1>option 1 action ?
  default-route  Install default route when activated
  allow-rip      Disable RIP when not activated
  associate-leds Associate LEDs to a cellular interface
ACAT Group 1>option 1 action
```

2.2.3.3.1 [NO] OPTION <INDEX> ACTION DEFAULT-ROUTE <GW>

This specifies that the action to install a default route (destination 0.0.0.0 with mask 0.0.0.0) through the gateway indicated by **<GW>** be added. This value can be either an IP address or the name of an existing interface on the device.

When activating an option, this installs said route with a cost of 1 and an administrative distance of 254. Consequently another default route installed from other modules would normally take precedence. The ACAT feature can install multiple default routes through different gateways if there are several active options that have this action configured.

If you execute the **NO** command, this action is removed from the option configuration.

Syntax:

```
ACAT Group 1>option 1 action default-route ?
  <a.b.c.d>      Via gateway at IP address
  <interface>   Via gateway at interface
ACAT Group 1>option 1 action default-route
```

2.2.3.3.2 [NO] OPTION <INDEX> ACTION ALLOW-RIP <IFACE>

Specifies that the action to enable RIP on the interface specified in **<IFACE>** only be added when the option is active. Otherwise, nothing is sent or received from the RIP protocol through this interface. The **<IFACE>** value can be either a local IP address or the name of an existing unnumbered interface on the device. If the interface subsequently ceases to be an unnumbered interface or the local IP address no longer exists, this action has no effect when the option is activated.

If the same interface is configured for this action in multiple options, the RIP protocol is only permitted in said interface if ALL the implicated options are active.

An additional cost is also added to the routes broadcast by the interface complying with the group's **ADVANCED RIP** global configuration.

If the **FAST-UPDATES** command is configured in RIP, the corresponding "update" messages are sent with all the routes when the option is activated.

With the **NO** command, this action is removed from the option configuration.

Syntax:

```
ACAT Group 1>option 1 action allow-rip ?
<a.b.c.d>      Local IP configured in RIP protocol
<interface>   Local unnumbered interface configured in RIP protocol
ACAT Group 1>option 1 action allow-rip
```

2.2.3.3.3 [NO] OPTION <INDEX> ACTION ASSOCIATE-LEDS <CELL_IFACE>

Specifies that the active SIM indicator LEDs, which indicate coverage and connection status, be associated with the cellular interface specified in <CELL_IFACE>. <CELL_IFACE> must be the name of a cellular interface with a 0 instance, e.g., cellular1/0 or cellular2/0. All mobile interfaces that can act on the indicated LEDs should be configured in the ACAT options so they function properly.

If the action is configured but the option is not active, the involved LEDs do not represent the status of said interface. However, when the option is active, the LED status represents the state of the cellular interface.

It makes no sense to have several active options among whose actions are associating the LEDs with different cellular interfaces. It does make sense, however, to have several active options associate the LEDs with the same cellular interface.

By using the **NO** command, this action is removed from the option configuration.

Syntax:

```
ACAT Group 1>option 1 action associate-leds ?
<interface>   Select cellular interface
ACAT Group 1>option 1 action associate-leds
```

2.2.4 [NO] RECOVERY-TIME <TIM>

With this command you can create a timer to help reduce fluctuations in the active priority. This is particularly suitable if you want as few active option changes as possible while not always having the highest priority available selected.

When making a choice in changing the active priority, the timer starts with a time <TIM>. Until this has expired, no new elections are permitted, even if an option with higher priority arises. When the timer expires, a new selection is made which may or may not involve a change in the active priority.

An exception to the above description is when all the active options change to DOWN, at which point the timer that is running is canceled and a new choice is attempted.

The **NO** command stops and disables the timer, which is the default behavior. In this case, this always activates the highest priority available in the group.

Syntax:

```
ACAT Group 1>recovery-time ?
<0s..1d>     Value in the specified range
ACAT Group 1>recovery-time
```

2.2.5 EXIT

Use the **EXIT** command to quit the group setup menu and return to the general ACAT feature configuration menu.

Example:

```
ACAT Group 1>exit
ACAT Config>
```

Chapter 3 Monitoring the ACAT Feature

3.1 Monitoring ACAT

To monitor the ACAT feature enter **feature acat** at the monitoring root menu.

Syntax:

```
+feature acat
-- Advanced Choice-based Action Taker feature monitor --
ACAT+
```

The menu commands available from the monitoring ACAT feature are as follows:

```
ACAT+?
  list   Display state of the feature
  exit
ACAT+
```

3.1.1 LIST

This command displays the status of the ACAT groups.

Syntax:

```
ACAT+list ?
  all       Display all groups
  group     Display only one group
  <cr>
ACAT+list
```

3.1.1.1 LIST [ALL]

Displays the status of all groups configured on ACAT. The following command shows an example of a group state.

3.1.1.2 LIST GROUP <INDEX>

Displays the status of the group specified by <INDEX>.

Syntax:

```
ACAT+list group ?
  <1..10>   Value in the specified range
ACAT+list group
```

Example:

```
ACAT+list group 1
Group 1
-----
Enabled. Active priority: 1
Recovery Timer set to infinite. Now fixed to one priority
Advanced RIP enabled
  Sending
    Current added offset: 5
    Initial added offset: 8
    Eventual added offset: 8 after 150s. Timer running
    Step: -1

Options:
- Option 1
  Priority 1
  Status UP. ACTIVE!
  Tracking interface tnip1
```

```

Actions:
  - Default route via 192.168.0.1
  - Allow RIP protocol through IP 192.168.0.190
  - Do not interfere with LEDs association

- Option 2
  Priority 2
  Status UP
  Tracking interface tnip2
  Actions:
    - Default route via 192.168.1.1
    - Allow RIP protocol through IP 192.168.1.190
    - Do not interfere with LEDs association

- Option 3
  Priority 3
  Status UP
  Tracking interface tnip3
  Actions:
    - Default route via 192.168.2.1
    - Allow RIP protocol through IP 192.168.2.190
    - Do not interfere with LEDs association

- Option 4
  Priority 4
  Status UP
  Tracking interface tnip4
  Actions:
    - Default route via 192.168.3.1
    - Allow RIP protocol through IP 192.168.3.190
    - Do not interfere with LEDs association

```

ACAT+

Here you can see the meaning of the group parameters and their possible states.

First, it indicates whether the group is enabled (*Enabled*) or not (*Disabled*). If enabled, then you can see which priority is currently active; if it is 0, there is no active priority and consequently all the options are DOWN.

After the first line, you can see the status of the group's global functions:

- Recovery Timer; this can be disabled (*disabled*), have a value in seconds or set to infinite (*set to infinite*). If it is enabled, it also indicates whether the timer is running (*timer running*) or in the case of being infinite, if it is fixed to a priority (*Now fixed to one priority*).

RIP advanced, this can be enabled or disabled. If enabled, this removes all the parameters that affect the cost added to the routes sent by RIP. *Current* reflects the actual added cost, and the rest shows what is configured. Finally, this also tells you whether the timer for the *eventual-added-offset* is configured (*timer running*) or not.

All the options in the order that they have been configured are listed after the group global functionality, together with their parameters. Each option gives the following information:

Priority Level

- Option State: *UP* or *DOWN*. If it is in the UP state and is also an active option, then the text *ACTIVE!* is displayed. If the group is disabled, the state is always DOWN.

Tracking option: this tells you if it is tracking the status of an interface (*Tracking interface ...*) or if it is always active (*Not tracking -> always UP*). It only makes sense if the group is enabled.

List of configured actions. The actions are listed regardless of whether the option is active or not, consequently it will only run if the option is active:

Installs the default route through a gateway (*Default route via...*) or doesn't install a new route if the action isn't configured (*Do not install a new default route*).

Enables RIP on an interface (*Allow RIP protocol through ...*) or doesn't interfere with RIP if this action isn't configured (*Do not interfere with RIP protocol*).

Associates the LEDs to a cellular interface (*Associate LEDs to interface...*) or doesn't interfere with the LEDs association if the action hasn't been configured (*Do not interfere with LEDs association*).

3.1.2 EXIT

The **EXIT** command exits the ACAT feature monitoring menu and returns to the router's general monitoring menu.

Example:

```
ACAT+exit  
+
```