DIRECT-IP Interface

Teldat-Dm 811-I

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Chapter 1 Direct-IP Interface

1.1 Description

Up till now, to establish a connection through a cellular interface we used a PPP interface over a serial interface (cellularX/1) that contained all relevant data. This method is also known as Dial-Up networking (DUN).

It allows you to obtain the address assigned to the connection and, additionally, provides a way to encapsulate data. By using this elevated data-processing method, and depending on the negotiated values (ACCM), you give certain transparency to each datum transmitted or received.

With the evolution of technology, connection speeds in these interfaces have increased (from the initial 64 Kbps in GPRS interfaces to current values of 21 Mbps in HSPA+ interfaces, 42 Mbps in HSPA-DC and even 100 Mbps in LTE interfaces). As a result, and given the amount of processing that has to be done, this encapsulation method is no longer adequate.

Manufacturers of 3G/4G modules offer the possibility of using an alternative mechanism known as “Network Driver Interface Specification” (NDIS). Through this mechanism, connection to the interface is directly established using an Ethernet network interface. All data transmission and reception is then carried out through the direct encapsulation of IP datagrams in level 2 frames (Ethernet encapsulation). This method, known as **DIRECT-IP**, saves the user from having to execute a process for each character sent.

This mechanism offers a method of transmission that downloads to the CPU, both for the cellular module as well as the router, and increases the effective transmission and reception speeds of a PPP interface.

Routers equipped with 3G (HSPA+) and 4G (LTE) modules support this alternative mechanism and work at a greater speed.

Chapter 2 Configuring the DIRECT-IP Interface

2.1 Creating the DIRECT-IP interface

To create DIRECT-IP interfaces, enter the following command located in the general configuration menu:

add device direct-ip <direct-ip interface identifier>

```
Config>add device direct-ip 1
Config>
```

You also need to configure the data interface in the cellular interface as a network interface and not a serial interface.

```
Config>set data-link nic cellular1/1
Config>
```

You can check that the interface has been correctly generated and added by listing the existing interfaces in the device:

```
Config>list dev
Interface            Connector     Type of interface
ethernet0/0          EXP/SWITCH    Marvell Fast Ethernet Switch
x25-node             ---           Router->Node
cellular1/0          SLOT1         AT COM
cellular1/1          SLOT1         USBNIC Interface
wlan2/0              SLOT2         Wireless LAN Interface
direct-ip1           ---           Generic DirectIP encapsulation
Config>
```

2.2 Clearing the DIRECT-IP interface

To remove an existing DIRECT-IP interface, use the following command located in the general configuration menu:

no device <direct-ip interface>

Syntax:

```
Config>no device <interface_name>
```

- *<interface_name>* is the name of the interface to delete (direct-ip*X*, *X*=Interface identifier).

Example:

```
*config
Config>no device direct-ip1
Config>
```

You can return to serial mode through the cellular module data interface.

```
Config>set data-link at cellular1/1
Config>
```

You can check that the newly generated interface has been properly deleted by listing the existing interfaces in the device:

```
Config>list devices
Interface            Connector     Type of interface
ethernet0/0          EXP/SWITCH    Marvell Fast Ethernet Switch
x25-node             ---           Router->Node
cellular1/0          SLOT1         AT COM
cellular1/1          SLOT1         USBNIC Interface
wlan2/0              SLOT2         Wireless LAN Interface
direct-ip1           ---           Generic DirectIP encapsulation
Config>no device direct-ip1
Config>set data-link at cellular1/1
Config>list devices
Interface            Connector     Type of interface
ethernet0/0          EXP/SWITCH    Marvell Fast Ethernet Switch
```

```
x25-node              ---           Router->Node
cellular1/0           SLOT1         AT COM
cellular1/1           SLOT1         AT COM
wlan2/0               SLOT2         Wireless LAN Interface
Config>
```

2.3 Configuring the DIRECT-IP interface

To access the DIRECT-IP interface configuration menu, you need to enter **<DIRECT_IP interface>** on the general configuration menu. E.g. if you want to access the **direct-ip1** interface, enter:

```
Config>network direct-ip1
-- Generic Direct IP Encapsulation User Configuration --
direct-ip1 config>
```

All interfaces in the device share some common commands. These are detailed in manual *Teldat-Dm 772-I "Common Configuration Interfaces"*.

The specific commands for the DIRECT-IP interface configuration menu are as follows:

```
direct-ipX config>?
  base-interface    Enter the Base Interface configuration menu
  direct-ip         Takes you to the direct ip encapsulation configuration
                    prompt
  exit
pppX config>
```

Command	Function
? (HELP)	Displays the available commands or their options.
BASE-INTERFACE	Accesses the configuration menu for the base interfaces associated to the DIRECT-IP interface.
DIRECT-IP	Accesses the menu where you can configure the DIRECT-IP parameters.
EXIT	Exits the DIRECT-IP interface configuration.

The configuration for the DIRECT-IP interface mainly consists of the following tasks:

- Specifying the base interfaces where you will establish the DIRECT-IP.
- Configuring the DIRECT-IP's *own* parameters (address, authentication, etc.)

2.3.1 Configuring the base interfaces for the DIRECT-IP interface

To access the configuration for the base interfaces, enter the **base-interface** command from the DIRECT-IP interface configuration menu.

```
Config>network direct-ipX
-- Generic Direct IP Encapsulation User Configuration -
direct-ipX config>base-interface
-- Base Interface Configuration --
direct-ipX Base IFC config>
```

The following commands are available in this configuration menu:

```
direct-ipX Base IFC config>?
  base-interface    Specify a base interface
  list              List current configuration
  no                Negates a command or sets its defaults
  exit
pppX Base IFC config>
```

Command	Function
BASE-INTERFACE	Allows you to specify the base interfaces over which the DIRECT-IP link is established.
LIST	Displays the base interfaces that are linked to the DIRECT-IP interface.

2.3.1.1 BASE-INTERFACE

This command allows you to link a given base interface and some DIAL profile (call) parameters to the DIRECT-IP interface.

For further information on how to configure the Call Profile, please see manual *Teldat-Dm 732-I "Dial Profile"* .

The **base-interface** command syntax for the most general case is as follows:

```
direct-ipX Base IFC config>base-interface <interface> <options>
  link                 Add this interface to the dial group
  profile              Dial profile to use with this interface
```

<interface>	Name of the base interface.
link	Adds the base interface to the DIRECT-IP
profile	Call profile that the base interface uses.

Important

Currently, the only type of base interface supported is the NIC (“cellular/1 Interface configured in NIC mode).

Example:

Assuming that the cellular1/1 interface is configured as an NIC interface:

```
direct-ip1 Base IFC config>base-interface cellular1/1 link
direct-ip1 Base IFC config>base-interface cellular1/1 profile HSPA
direct-ip1 Base IFC config>list
      Base Interface        Profile Name     Base Circuit Id  Number of circuits
-------------------------  ------------     ---------------  ------------------
    cellular1/1      nic/0    HSPA                   1                  1
direct-ip1 Base IFC config>
```

To delete a base interface of this type:

```
direct-ipX Base IFC config>no base-interface <interface>
```

Important

You must enter a valid DIAL profile. Otherwise, the base interface cannot establish the link as it doesn’t have the call parameters.

Command history:

Release	Modification
11.01.00	Since version 11.01.00, associating a DIAL profile that doesn't exist is impossible. The profile must be created first.

2.3.1.2 LIST

This command displays the base interfaces that are linked to the DIRECT-IP interface.

Example:

```
direct-ip1 Base IFC config>list
      Base Interface        Profile Name     Base Circuit Id  Number of circuits
-------------------------  ------------     ---------------  ------------------
    cellular1/1      nic/0    HSPA                   1                  1
direct-ip1 Base IFC config>
```

Base Interface	Base interface associated to the DIRECT-IP interface.
Profile Name	**Name** (identifier) for the DIAL profile the base interface is going to use (this only applies to switch interfaces).
Base Circuit Id	Circuit identifier.
Number of circuits	This is the number of base interface circuits to be used.

2.3.2 Configuring the DIRECT-IP parameters for the DIRECT-IP interface

To establish the specific parameters for DIRECT-IP, you need to access the DIRECT-IP parameter menu through the **direct-ip** command found in the DIRECT-IP interface configuration menu.

```
Config>network direct-ipX
-- Generic Direct IP Encapsulation User Configuration --
direct-ipX config>dir
direct-ipX config>direct-ip
-- Direct IP encapsulator user configuration --
direct-ipX DIP config>
```

The commands, available in the PPP parameter configuration menu, are as follows:

```
direct-ipX DIP config>?
  address           Address negotiation options
  authentication    Set authentication parameters
  dns               Set DNS options
  list              Display Interface Configuration
  modem-mode        Behave like a modem assigning host
                    subnet mask and 0.0.0.0 gateway
  no                Negate a command or set its defaults
  router            Set default router options
  exit
pppX PPP config>
```

Command	Function
? (HELP)	Displays the available commands or their options.
ADDRESS	Configures the parameters to handle the DIP link address.
AUTHENTICATION	Configures the DIP link authentication parameters.
DNS	Configures options to use the DNS.
MODEM-MODE	Configures the router so that it behaves like a modem, assigning host subnet mask and 0.0.0.0 as default gateway address, by DHCP.
NO	Configures the default value for a given option, disables parameters or deletes previously added configuration elements.
ROUTER	Configures options to manage the default route.
EXIT	Exits the DIP parameter configuration.

2.3.2.1 ADDRESS

Configures the IP address to be used by the local end.

Syntax:

```
direct-ip1 DIP config>address ?
  fixed       Fixed local IP
  assigned    Assigned local IP
  dhcp        Dhcp local IP
```

- *fixed*, if the IP address to be used by the local end should be that configured by the user for the DIRECT-IP interface.
- *assigned*, if you want the remote end to assign the IP address for the local end.
- *dhcp*, if you obtain the IP address for the local end through DHCP consulting. Default is *assigned*.

Example:

```
direct-ip1 DIP config>address dhcp
```

2.3.2.2 AUTHENTICATION

This command allows you to configure the authentication options for the DIP link.

The options available in this command are as follows:

```
direct-ipX DIP config>authentication ?
  chap         CHAP authentication
```

```
  none          Disable authentication
  pap           PAP authentication
  sent-user     Set outbound user to authenticate itself to a remote peer
direct-ipX DIP config>
```

- *chap*, the protocol to use for authenticating the CHAP link (*Challenge Authentication Protocol*).
- *pap*, the protocol to use for authenticating the PAP link (*Password Authentication Protocol*).
- *none*, when a protocol is not used to authenticate the link.
- *sent-user*, to define the user/password that the router uses to identify itself when the remote end requests authentication.

Example:

```
direct-ip1 DIP config>authentication pap
direct-ip1 DIP config>authentication sent-user USER password PASSWORD
```

2.3.2.3 DNS

This command allows you to configure the options in the primary and secondary DNS servers' negotiation.

- *learn,* the addresses for the DNS servers gathered in the interface are communicated to the DNS process in order to be used. This is the default option.
- *ignore,* the addresses for the DNS servers gathered in the interface are ignored and not used.

Example:

```
direct-ip1 DIP config>dns ignore
```

2.3.2.4 LIST

Use this command to display the configured options.

Example:

```
direct-ip1 DIP config>list
AUTHENTICATION:
  Authentication pap required
  Sent user (local): USER
ADDRESSING:
  Local IP address dhcp learned
DNS:
  DNS ignore
MTU:
  Size 1500
direct-ip1 DIP config>
```

2.3.2.5 MODEM-MODE

This command helps configure the router so that it behaves like a modem. If you want to use the router as a modem, configure a bridge between the Direct-ip and Ethernet interfaces and use this command to enable *modem-mode*. The IP address assigned by DHCP will then have host type subnet mask (255.255.255.255) and IP address 0.0.0.0 as default gateway.

Example:

```
direct-ip1 DIP config>modem-mode
```

Command history:

Release	Modification
10.09.25	This command was introduced as of version 10.09.25.
11.00.04	This command was introduced as of version 11.00.04.
11.00.00.02.08	This command was introduced as of version 11.00.00.02.08.

2.3.2.6 ROUTER

This command allows you to configure the options in the default route negotiation obtained through DHCP.

- *learn,* the default address obtained through DHCP in the interface is communicated to the IP protocol for installa-

tion. Since the interface is point-to-point, the route installed is the DIRECT-IP interface itself. This is default.

- *ignore,* The default router address obtained by DHCP in the interface is ignored and not used.

Example:

```
direct-ip1 DIP config>router ignore
```

2.4 Configuring the CELLULAR (NIC) interface

The cellular data interface configured in NIC mode is different from the one configured in AT commands mode.

```
*config
Config>network cellular1/1
-- Direct IP. Configuration --
cellular1/1 NIC config>
```

The options in this menu are as follows:

```
cellular1/1 NIC config>?
  input-buffers    Number of rx buffers
  no               Negate a command or set its defaults
  exit
cellular1/1 config>)
```

Command	Function
? (HELP)	Lists the commands or their options.
INPUT-BUFFERS	Configures the number of buffers at reception.
NO	Establishes the default values.
EXIT	Returns to the configuration menu.

2.4.1 INPUT-BUFFERS

Configures the number of buffers at the interface's reception. Default is 128.

Syntax:

```
cellular1/1 NIC config>input-buffers ?
  <128..512>    Value in the specified range
```

Example:

```
cellular1/1 NIC config>input-buffers 256
```

Chapter 3 Monitoring the DIRECT-IP Interface

3.1 Monitoring the DIRECT-IP interface

This section summarizes and explains the DIRECT-IP interface monitoring commands.

To access the DIRECT_IP interface monitoring menu, enter the **NETWORK <DIRECT-IP Interface>** command found in the general monitoring menu:

```
*monitor
Console Operator
+network direct-ipX
Generic Direct IP Console
direct-ipX+
```

Command	Function
? (HELP)	Lists the commands or their options.
BASE-INTERFACE	Accesses the monitoring menu for the base interfaces associated to the DIRECT-IP interface.
DIRECT-IP	Accesses the monitoring menu for the DIRECT-IP parameters.
EXIT	Exits the DIRECT-IP interface monitoring.

3.2 Monitoring the DIRECT-IP interface base interfaces

To access the menu where you can monitor the DIRECT-IP interface base interfaces, enter the **BASE-INTERFACE** command from the DIRECT-IP interface's monitoring menu.

```
direct-ipX+base-interface
-- Base Interface Console --
direct-ipX Base IFC+
```

The options available in this menu are as follows:

```
direct-ipX Base IFC+?
  list    Display base interface parameters
  exit
```

3.2.1 LIST

Displays the parameters of the base interfaces associated to a given DIRECT-IP interface. In cases where more than one base interface has been associated to the DIRECT-IP interface, the value of these parameters is shown for each link.

Syntax:

```
direct-ipX Base IFC+list
```

Example:

```
direct-ip1 Base IFC+list
Destination address    :
Local address          :
Base interface         : cellular1/1
Circuit id request     : 1
Dial circuit status    : CLOSED
Circuit id assigned    : 1
direct-ip1 Base IFC+
```

Destination address	Remote address used.
Local address	Displays the local address used.
Base interface	Base interface.
Circuit id request	Identifier of the circuit requested in the configuration.
Dial circuit status	Current DIAL circuit status (base interface status).
Circuit id assigned	Identifier for the assigned circuit.

3.2.2 EXIT

This command allows you to exit the monitoring for the DIRECT-IP base interface and return to the DIRECT-IP general monitoring menu.

Syntax:

```
direct-ipX Base IFC+exit
```

Example:

```
direct-ipX Base IFC+exit
direct-ipX +
```

3.3 DIRECT-IP monitoring for the DIRECT-IP interface

To access the monitoring menu for the DIRECT-IP parameters, enter the **direct-ip** command from the DIRECT-IP interface monitoring menu:

```
direct-ipX+direct-ip
-- Direct IP Encapsulator Console --
direct-ipX DIP+
```

The following commands are found in the DIRECT-IP monitoring menu:

```
direct-ip1 DIP+?
  bitrate    Bit rate monitor
  list       List interface parameters
  exit
direct-ip1 DIP+
```

3.3.1 BITRATE

Displays the instant speed in the interface.

Each line change indicates a maximum in the direction detected with respect to the values already displayed .

Syntax:

```
direct-ipX DIP+bitrate
```

Example:

```
direct-ip1 DIP+bitrate
             Interface direct-ip1
 Trx rate (bps/pps)  Rcv rate (bps/pps)
 ------------------------------------
       7376/   13        8032/    6
      29272/   16       61552/   11
      48216/   17       29816/   11
      60128/   33      373968/   46
      38936/   32      404984/   43
      16544/   37      446816/   46
      79104/   36      484680/   56
     108952/   20       75672/   18
     130416/   31       78600/   24
     152472/  199     2461416/  292
     125024/  220     5552288/  576
     128656/  269     6520656/  672
     161704/  314     6049456/  629
     290944/  532     6224672/  680
     339152/  589     5429552/  591
     340952/  355     3639448/  402
     378864/   42       22192/   26
    1210216/  134      108096/   66
    1698856/  176       83744/   92
    1994824/  205       84872/  122
    2009024/  210      102264/  116
    2196245/  227       81495/  114
```

```
    2425736/  250       87384/  126
```

3.3.2 LIST

Displays monitoring information relative to the DIRECT_IP interface.

Syntax:

```
direct-ipX DIP+list
```

Example:

```
direct-ip1 DIP+list
base interface state is up
protocol state is up
out frames: 6893
        IP: 6893
       TCP: 6754
out reject: 0
in  frames: 7599
in  reject: 0
direct-ip1 DIP+
```

Base interface state	Base interface state (up/down).
Protocol state	Direct-ip interface state (up/down).
Out Frames	Number of frames sent.
IP	Frames sent from the IP protocol.
TCP	Frames sent from the TCP protocol.
Out Reject	Frames rejected in transmission.
In Frames	Number of frames received.
In Reject	Frames rejected at reception.

3.3.3 EXIT

This command allows you to exit the DIRECT-IP parameters monitoring and return to the DIRECT-IP general monitoring menu.

Syntax:

```
direct-ipX DIP+exit
```

Example:

```
direct-ip1 DIP+exit
direct-ip1+
```

3.4 Monitoring the CELLULAR (NIC) interface

The cellular data interface configured in NIC mode has a different monitoring menu to the one configured in AT commands mode.

```
*monitor
Console Operator
+network cellular1/1
-- Direct IP Monitor --
cellular1/1 NIC+
```

The options on this menu are as follows:

```
cellular1/1 NIC+?
  bdescs        List descriptors
  bitrate       Bit rate monitor
  clear         Clear interface parameters
  dump          Dump internal stats
  list          List interface parameters
  statistics    Interface statistics
  exit
```

```
cellular1/1 NIC+
```

Command	Function
? (HELP)	Lists the commands or their options.
BDESC	Information on the buffers and the descriptions used.
BITRATE	Information on the interface's instant throughput.
CLEAR	Clears the interface statistics.
LIST	Lists the interface parameters.
STATISTICS	Information on the interface statistics.
EXIT	Exits the DIRECT-IP interface monitoring.

3.4.1 BDESC

Displays information on the buffers and the descriptions used by the interface.

Syntax:

```
cellular1/1 NIC+bdesc
```

Example:

```
cellular1/1 NIC+bdesc
Mnemonic          = cellular1/1
Intf ID           = 1
Memory            = 0x0158f000
Max Tx completions per poll = 1
Max Rx processed per poll   = 2
TX QUEUE
   Head        = 0x0158f000
   Tail        = 0x0158f7f0
   To check    = 0x0158f320
   To use      = 0x0158f320
   TXBD location        iob             data            length  status
   000  0158f000        00000000        00000000        0000    0x00000000
   001  0158f010        00000000        00000000        0000    0x00000000
   002  0158f020        00000000        00000000        0000    0x00000000
   003  0158f030        00000000        00000000        0000    0x00000000
   004  0158f040        00000000        00000000        0000    0x00000000
   005  0158f050        00000000        00000000        0000    0x00000000
   006  0158f060        00000000        00000000        0000    0x00000000
   007  0158f070        00000000        00000000        0000    0x00000000

   121  0158f790        00000000        00000000        0000    0x00000000
   122  0158f7a0        00000000        00000000        0000    0x00000000
   123  0158f7b0        00000000        00000000        0000    0x00000000
   124  0158f7c0        00000000        00000000        0000    0x00000000
   125  0158f7d0        00000000        00000000        0000    0x00000000
   126  0158f7e0        00000000        00000000        0000    0x00000000
   127  0158f7f0        00000000        00000000        0000    0x00000000
RX QUEUE
   Head        = 0x0158f800
   Tail        = 0x0158fff0
   To check    = 0x0158fb50
   To use      = 0x0158fb50
   RXBD location        iob             data            length  status
   000  0158f800        013ff000        03df11da        0000    0x00000100
   001  0158f810        013ff2b0        03df07ea        0000    0x00000100
   002  0158f820        013ff560        03defdfa        0000    0x00000100
   003  0158f830        013ff810        03def40a        0000    0x00000100
   004  0158f840        013ffac0        03deea1a        0000    0x00000100
   005  0158f850        013ffd70        03dee02a        0000    0x00000100
   006  0158f860        01400020        03ded63a        0000    0x00000100
   007  0158f870        014002d0        03decc4a        0000    0x00000100
   121  0158ff90        01413530        03da5f6a        0000    0x00000100
   122  0158ffa0        014137e0        03da557a        0000    0x00000100
   123  0158ffb0        01413a90        03da4b8a        0000    0x00000100
```

```
   124  0158ffc0        01413d40        03da419a        0000    0x00000100
   125  0158ffd0        01413ff0        03da37aa        0000    0x00000100
   126  0158ffe0        014142a0        03da2dba        0000    0x00000100
   127  0158fff0        01414550        03da23ca        0000    0x00000500
cellular1/1 NIC+
```

3.4.2 BITRATE

Displays the instant speed in the interface.

Each line change indicates a maximum in the direction detected with respect to the values displayed.

Syntax:

```
cellular1/1 NIC+bitrate
```

Example:

```
cellular1/1 NIC+bitrate
             Interface cellular1/1
 Trx rate (bps/pps)  Rcv rate (bps/pps)
 ------------------------------------
        624/    1         624/    1
      23944/   19       11952/    9
      16632/   11       58368/    7
      24880/   12        7880/    8
      54976/   21       90368/   17
     113056/   81     1103944/  114
     132992/   76      583536/   75
      36016/    7       49368/   11
cellular1/1 NIC+
```

3.4.3 CLEAR

Clears the information on the interface statistics.

Syntax:

```
cellular1/1 NIC+clear ?
  interface-stats    Interface statistics
  layer3-stats       Layer 3 interface statistics
```

3.4.4 LIST

Displays information associated to the interface.

Syntax:

```
cellular1/1 NIC+list
```

Example:

```
cellular1/1 NIC+list
        Drop by ping failed         = 0
        Drop by tracert failed      = 0
        Drop by traffic failed      = 0
        Dialers registered          = H1
        Current dialer registered   = H1
        State                       = (8) CONNECT
        Call request                = 1
        Access Point Name           = ac.vodafone.es
        Total connection time       = 8 minutes 6 seconds
        Current connection time     = 8 minutes 6 seconds
        Time to establish connection = 16 sec
        Hardware Interface address  = 0215E0EC0100
        Low layer link state        = Up
        IP Interface address        = 77.209.5.136
        DNS primary server address  = 212.166.210.82
        DNS secondary server address= 212.73.32.67
```

```
cellular1/1 NIC+
```

Drop by ping failed	Disconnections detected in the interface due to loss of ping in the access control.
Drop by tracert failed	Disconnections detected in the interface due to loss of trace route in the access control.
Drop by traffic failed	Disconnections detected in the interface due to loss of data (traffic) in the access control.
Dialers registered	Dialers registered in the interface.
Current dialer registered	Dialers registered in the interface at a given time.
State	State of the states machine for the interface.
Call request	Connections that have established in the interface.
Access Point Name	Access point used in the connection.
Total connection time	Total time for all the connections executed by the interface.
Current connection time	The time the current connection has been established for.
Hardware Interface address	Address used to encapsulate the frames towards the cellular module.
Low layer link state	State of the data connection in the cellular module. Internal information.
IP interface address	IP address assigned to the connection.
DNS primary server address	DNS address assigned for the primary DNS server.
DNS secondary server address	DNS address assigned for the secondary DNS server.

3.4.5 STATISTICS

Displays diverse interface statistics.

Syntax:

```
cellular1/0 AT+statistics ?
  layer3-stats    Layer 3 interface statistics
```

3.4.5.1 STATISTICS LAYER3-STATS

Displays statistics for the interface's layer 3 regarding the packets and bytes exchanged by the radio interface. Please note that the interface statistics displayed through the **STATISTICS** command in process 3 (*monitor*) refer to all the packets and bytes exchanged with the module, and also include the statistics for layer 3 linked to the AT command for module control and to DIRECT-IP encapsulation.

The throughput values measured during the last second, the last minute and the last 5 minutes are also displayed.

Syntax:

```
cellular1/0 AT+statistics layer3-stats
```

Example:

```
cellular1/1 NIC+statistics layer3-stats
Total
Rx pkts:           443   Tx pkts:           422
Rx bytes:       312577   Tx bytes:       127216
Throughput (bps)
Last sec   Rx:            0    Tx:            0
Last 1 min Rx:        41192    Tx:        16435
Last 5 min Rx:         8260    Tx:         3314
cellular1/0 AT+
```

Total:	
Rx/Tx pkts:	Packets transmitted / received by the interface.
Rx/Tx bytes:	Bytes transmitted / received by the interface.
Throughput:	
Last sec Rx/Tx:	Performance measured during the last second.
Last 1 min Rx/Tx	Performance measured during the last minute.
Last 5 min Rx/Tx	Performance measured during the last five minutes.

Chapter 4 DIRECT-IP Interface Configuration Examples

4.1 DIRECT-IP interface over the cellular interface

4.1.1 Description

In this example, we are going to configure a DIRECT-IP interface over the cellular interface network interface. The DIRECT-IP interface is configured so that it obtains its assigned IP address through DHCP.

4.1.2 Configuration

```
*config
Config>set data-link nic cellular1/1
Config>add device direct-ip 1
Config>
```

The next step is to indicate how to obtain the address. To do this, you need to access the configuration menu and execute the **ip address** command indicating the "*dhcp-negotiated*" option.

```
Config>network direct-ip1
-- Generic Direct IP Console --
ppp1 config>ip address dhcp-negotiated
ppp1 config>exit
Config>
```

The following step is to create the connection profile.

```
Config>global dial
-- Dial Profiles Configuration --
Dial Profiles config> profile HSPA default
Dial Profiles config> profile HSPA dialout
Dial Profiles config> profile HSPA 3gpp-apn internet
Dial Profiles config> exit
-- Generic PPP User Configuration --
direct-ip1 config>base-interface
Config>
```

Next, you have to indicate that the created DIRECT-IP interface is going to be mounted over the cellular interface network interface "cellular1/1". To do this, you first need to access the configuration menu for the base interfaces associated to the direct-ip1 interface. Once there, execute the **base-interface** command indicating the base interface and the option to associate said interface to the DIRECT-IP. Likewise, you need to indicate the connection profile that must be used.

```
Config>network direct-ip1
-- Generic PPP User Configuration --
direct-ip1 config>base-interface
-- Base Interface Configuration --
direct-ip1 Base IFC config>base-interface cellular1/1 link
direct-ip1 Base IFC config>base-interface cellular1/1 profile HSPA
direct-ip1 Base IFC config>exit
direct-ip1 config>exit
Config>
```

Subsequently, carry out the configuration for the aforementioned DIRECT-IP parameters, address mode, authentication used and the user/password for this.

```
Config>net direct-ip1
-- Generic Direct IP Encapsulation User Configuration --
direct-ip1 config>direct-ip
-- Direct IP encapsulator user configuration --
direct-ip1 DIP config>address dhcp
direct-ip1 DIP config>authentication pap
direct-ip1 DIP config>authentication user-sent USER password PASSWORD
direct-ip1 DIP config>exit
direct-ip1 config>exit
Config>
```

Once you have executed all of the configuration steps, simply save the configuration and restart the device.

```
Config>save
Save configuration (Yes/No)? yes
Building configuration as text... OK
Writing configuration... OK on Flash
Config>                                                    pulsar <ctrl-p>
*restart
Are you sure to restart the system(Yes/No)? yes
  Done
Restarting. Please wait ..............................................
```

The complete configuration for this example is as follows:

```
; Showing Menu and Submenus Configuration for access-level 15 ...
; H1 Auto. IPSec SNA VoIP T+ Router 20 12 Version 10.9.3-MR
   log-command-errors
   no configuration
   set inactivity-timer disabled
   add device direct-ip 1
   set data-link at cellular1/0
   set data-link nic cellular1/1
   feature afs
      alg ftp port 21
;
      enable
   exit
;
   feature access-lists
; -- Access Lists user configuration --
      access-list 10
         entry 1 default
         entry 1 permit
         entry 1 source address 192.168.212.0 255.255.254.0
;
      exit
;
   exit
;
   global-profiles dial
; -- Dial Profiles Configuration --
      profile HSPA default
      profile HSPA dialout
      profile HSPA 3gpp-apn internet
;
   exit
;
;
   network ethernet0/0
; -- Ethernet Interface User Configuration --
      ip address 192.168.213.150 255.255.254.0
;
   exit
;
   network cellular1/0
; -- Interface AT. Configuration  --
      coverage-timer 10
;
      no register-denied-reset
;
      sim-select internal-socket-2
      record-changes cell enable
      record-changes cell samples 200
      record-changes enable
      record-changes registration enable
      record-changes plmn enable
      record-changes technology enable
      record-changes technology samples 200
```

```
      record-changes coverage enable
      record-changes coverage samples 200
      record-changes call-state enable
      record-changes sim enable
      network mode automatic
      network domain cs+ps
   exit
;
;
   network direct-ip1
; -- Generic Direct IP Encapsulation User Configuration --
      ip address dhcp-negotiated
;
      ip mtu 1300
      ip tcp adjust-mss 1200
      base-interface
; -- Base Interface Configuration --
         base-interface cellular1/1 link
         base-interface cellular1/1 profile HSPA
;
      exit
;
      direct-ip
; -- Direct IP encapsulator user configuration --
         address dhcp
         authentication sent-user USER password PASSWORD
      exit
;
   exit
;
   event
; -- ELS Config --
      enable trace subsystem AT ALL
;
      enable filter
      filter 1 default
      filter 1 text "UMTS"
      filter 1 action green
      filter 2 default
      filter 2 text "HS"
      filter 2 action magent
      filter 3 default
      filter 3 text "GPRS"
      filter 3 action red
      filter 4 default
      filter 4 text "RX level (dBm):"
      filter 4 action yellow
   exit
;
;
   protocol ip
; -- Internet protocol user configuration --
      route 0.0.0.0 0.0.0.0 direct-ip1
;
      classless
      no icmp-redirects
      nat
         rule 1 out direct-ip1 list 10 dynamic overload
         rule 1 translation source interface direct-ip1
;

      exit
;
   exit
;
;
   feature dns
```

```
; -- DNS resolver user configuration --
      server 8.8.8.8
   exit
;
   dump-command-errors
   end
; --- end ---
```