Application Note 2

Using the TCPDIAL & TCPPERM commands to connect two TransPort Serial interfaces over TCP/IP

Reverse Telnet (AKA Serial Terminal Server)

MultiTX

Contents

1 INTRODUCTION

This document contains information regarding the configuration and use of the TCPDIAL command.

1.1 Overview

The TCPDIAL command is built into all TransPorts that can perform PPP (Point-to-Point Protocol) connections. It is used to initiate a TCP/IP connection over a PPP connection.

The TCPDIAL command can be used for a wide range of applications.

One specific role is to connect to serial ports of remote TransPorts and access data from telemetry of other serial devices connected to that port.

TCPDIAL can be configured to establish "serial port to serial port" links over PPP. For example, an IM1040 unit with four serial ports can be connected over a single ISDN BRI to another unit using TCPDIAL. Each of the local serial ports is configured to have a one-to-one mapping to the remote end, and by this means the two units operate as a very effective serial multiplexer.

1.2 Assumptions

This guide has been written for use by technically competent personnel with a good understanding of the communications technologies used in the product, and of the requirements for their specific application.

Configuration: This Application Note (AN) assumes that the TransPorts will be connecting to a cellular network.

This AN applies to:

Models shown: Digi Transport WR21 & WR44 (with serial port expansion card)

Other Compatible Models: All Digi TransPort products.

Firmware versions: 4.694 and above.

NOTE: The MultiTX feature is only supported in the WR series of TransPorts.

Configuration: This AN assumes the devices are set to their factory default configurations. Most configuration commands are only shown if they differ from the factory default.

Corrections: Requests for corrections or amendments to this AN are welcome and should be addressed to: tech.support@digi.com

Requests for new AN's can be sent to the same address.

1.3 Version

Version Number	Status
1.0	Published
1.1	Rebranded & updated
1.2	New Web GUI
1.3	Added MultiTx (firmware ver 5156)
1.4	Rebrand (2015)
1.5	Updated screenshots and instructions for new web interface, rebranding (May 2016)

2   CONFIGURATION

In this example, we will consider a local TransPort WR21 which needs to access a single remote site where there are four telemetry devices, attached to the serial ports of a WR44. Both routers have cellular WAN connectivity.

Although telemetry devices have been used in this example at the remote site, it is also possible to connect to the management serial port of another router for remote management purposes.

2.1   Cabling

This is the most important part to get right! The serial cable(s) connecting the TransPort to the other device must be wired up correctly. Cabling diagrams with pinouts can be found in the Digi Transport User Guide.

2.2   Remote TransPort (WR44)

Ensure that the serial port parameters are set correctly to connect to the telemetry devices by checking the

Configuration - Network > Interfaces > Serial > Serial Port n pages (where **n** is the number of the port you are going to use to connect to the telemetry devices).

Once you have finished configuring the ASY port, click on the **Apply & Save Changes to Profile** button.

NOTE: It is advisable to use hardware flow control; however, many telemetry type devices do not support this. A simple 3-wire interface will probably suffice, provided that the data rates are not too high.

2.3   Local TransPort (WR21)

Setup the serial port that we are going to use with the local equipment (probably a PC or other host).

In the WR21 web interface, navigate to the **Configuration - Serial > ASY Ports > ASY n** page (where **n** is the number of the port you are going to use to connect to your PC).

Set the baud rate (do not use the "AUTO" selection) which your local PC will use to talk to the TransPort, and set hardware flow control if you are using it.

While on this page, check that the **DTR control** and **DTR de-bounce time** settings are set as follows:

This will ensure that you drop the line cleanly when you have finished communicating with the remote device, but that momentary glitches in the DTR line will not prematurely drop the call.

Once you have finished configuring the ASY port, click on the **Apply & Save Changes to Profile** button, and then click the **Save All** button from **Administration - Save configuration**.

3   ESTABLISHING THE LINK

Now we can establish the link. The general command for TCPDIAL is

```
TCPDIAL  <ASY  0-3|CMD>  <Destination  Host>  <Destination  Port>  <-i
timeout_value_sconds>
```

Each time you wish to connect to a remote site (assuming you are connected to ASY port o locally) you will need to do the following:

Issue the TCPDIAL command. The serial port you will connect to at the remote end can be selected by choosing the correct TCP/IP port number. These start at 4000 for the first serial port (ASY 0). 4001 is for the second serial port (ASY 1) and so forth.

For example:

TCPDIAL ASY 0 1.2.3.4 4000 –i60<CR> to connect to ASY 0 on remote unit.

TCPDIAL ASY 0 1.2.3.4 4001 –i60<CR> to connect to ASY 1 on remote unit.

TCPDIAL ASY 0 1.2.3.4 4002 –i60<CR> to connect to ASY 2 on remote unit.

TCPDIAL ASY 0 1.2.3.4 4003 –i60<CR> to connect to ASY 3 on remote unit.

Wait for `<CR><LF>CONNECT<CR><LF>`.

Transfer data.

When the data transfer is complete and after 60 seconds of inactivity, the TransPort will close the TCP socket, which will result in `<CR><LF>NO CARRIER<CR><LF>`.

If you now wish to connect a different ASY port on the same unit, this can be achieved with another TCPDIAL command performed right away.

If you require the TCPDIAL socket to be closed immediately, rather than wait for the timeout, either send the hang up string '+++' then wait 1 second and send 'ATH', otherwise lower the DTR at the local serial port, again waiting for the `<CR><LF>NO CARRIER<CR><LF>`.

4 TCPPERM

TCPPERM is an alternative to TCPDIAL. TCPPERM is used to create a permanent socket between the local and remote TransPorts. This may be useful if there is only 1 serial device connected to the remote TransPort.

4.1 Configure the ASY serial port

If you are using the TCPPERM command, you should configure the ASY serial port 0 so that the session cannot be exited with an escape sequence (+++ pause ATH).

Make the following changes in **Configuration - Network > Interfaces > Serial > Serial Port 0 > Advanced**.
DTR control: None
Escape character: 255
Escape delay (x20ms): 255

Configuration - Network > Interfaces > Serial > Serial Port 0

▼ Advanced

Answer V.120 calls after 0 rings (0 = Don't answer)

DCD: Auto

DTR Control: None

DTR de-bounce time: 5 X 20 milliseconds

Escape Character: 255

Escape Delay: 255 X 20 milliseconds

Forwarding Timeout: 2 X 10 milliseconds

Break Transmit Escape Character: 0

☐ Enable level inverting

Each serial port can have two profiles which can be configured differently. You can configure which profile is used at power-up.

Use profile 0 ▼ at power-up

Load Config from Profile 0 ▼

Apply & Save Changes to Profile 0 ▼

Apply

Once you have finished configuring the ASY port, click on the **Apply & Save Changes to Profile** button.

4.2 TCPPERM command usage

The syntax is the same as TCPDIAL, but the $-i$ inactivity timeout is negated from the command.

For example, to create a permanent TCP socket between the 2 serial ports, the command is:

TCPPERM ASY 0 1.2.3.4 4000<CR> to connect to ASY 0 on remote unit.

5   IMPORTANT NOTES

5.1   Flow control & baud rates

While we strongly recommend that you use hardware flow control, if it is not available, it is essential that the baud rate at the remote end matches the baud rate at the local end, and that flow control is turned off at both ends, otherwise data corruption will occur on all but the shortest of transactions.

5.2   Result codes

Also, you should note that you will get `CONNECT` and `NO CARRIER` messages at **both ends** of the link unless you specifically disable them. This behavior may not be desirable at the remote end where it may upset any telemetry devices attached to the serial ports. To disable this, you need to set "Quiet mode" to "On" either by using an `ATQ1` command or by setting the **CLI result Codes** parameter to "**None**" on the **Configuration - Network > Interfaces > Serial > Serial Port n** page as shown below:

6   UDP BETWEEN 2 TRANSPORTS, NOT TCP

In circumstances where the traffic will be one way only, it may be preferable to use UDP rather than TCP. If this is the case, then you can use the following command:

```
tcpperm asy 0 1.2.3.4 4000 udp -l4000 -s4000 nodeact -ao<CR>
```

If 2 way communication is required using UDP, both routers need to have a TCPPERM command running. For example:

TransPort 1: `tcpperm asy 0 1.2.3.4 4000 udp -l4000 -s4000 nodeact -ao<CR>`

TransPort 2: `tcpperm asy 0 1.2.3.5 4000 udp -l4000 -s4000 nodeact -ao<CR>`

7   REVERSE TELNET (AKA SERIAL TERMINAL SERVER)

7.1   Cabling

This is the most important part to get right! The serial cable(s) connecting the TransPort to the other device must be wired up correctly. Cabling diagrams with pinouts can be found in the Digi Transport User Guide.

7.2   Cable to connect TransPort "WR" models to Cisco 1000/1600/2500/2600/3600 series Console or AUX ports:

TransPort (DCE)			Cisco (DTE)	
RJ45 Pin	Name	Wire color	Name	RJ45 Pin
1	RTS	Orange-White	RTS	1
2	DTR	Orange	DTR	2
3	RxD	Green-White	RxD	6
4	n/a	Blue	**	
5	GND	Blue-White	GND	5
6	TxD	Green	TxD	3
7	DCD	Brown-White	DSR	7
8	CTS	Brown	CTS	8

NOTE: Do not connect pin 4; clip this wire off.

Due to the wiring of this cable, the ends must be connected properly. Connect the "TransPort (DCE)" end to the TransPort and the Cisco (DTE) end to the Cisco device.

7.3 Cable to connect TransPort "WR" models to other Cisco series Console or AUX ports:

Digi TransPort (DCE)			Cisco (DTE)	
RJ45 Pin	Name	Wire color	Name	RJ45 Pin
1	RTS	Orange-White	RTS	8
2	DTR	Orange	DTR	2
3	RxD	Green-White	RxD	6
4	n/a	Blue	**	
5	GND	Blue-White	GND	5
6	TxD	Green	TxD	3
7	DCD	Brown-White	DSR	7
8	CTS	Brown	CTS	1

NOTE: Do not connect pin 4; clip this wire off.

Due to the wiring of this cable, the ends must be connected properly. Connect the "TransPort (DCE)" end to the TransPort and the Cisco (DTE) end to the Cisco device.

NOTE: We have done our best to research Cisco Console and AUX port pinouts. According to Cisco, unless you are using a model listed in 7.2, the above pinout in 7.3 should be used. However, please double check that this pinout does match the router you intend to use.

Pages used for reference:

Table in 7.2

http://www.cisco.com/en/US/products/hw/routers/ps214/products_tech_note09186a00801f5d85.shtml

Table in 7.3

http://www.cisco.com/en/US/products/hw/routers/ps332/products_tech_note09186a00080094ce6.shtml

7.4   Router Configuration

This is a method that is often used to manage a device connected to a TransPort serial port.

As discussed earlier, the ASY ports can be accessed by opening a TCP connection to ports:

4000 for ASY 0

4001 for ASY 1

4002 for ASY 2

4003 for ASY 3

If for example a Cisco router was attached to ASY 0 on a remote TransPort, then you would need to configure the ASY port baud rate and flow control as described in 2.2 to match the Cisco serial port settings.

Then configure the DTR control, Escape sequence and Escape delay as described in 4.1.

Finally, set the result codes to "None" as in 5.2

7.5   Usage

You should now be able to telnet to the TransPort's mobile IP address and specify the required TCP port number. The received data will be forwarded out of the serial port.

For example, to access the management port of another router connected to ASY 0 on a WR44 with the public IP address of 217.12.33.29, you would use the Windows command '`telnet 217.12.33.29 4000`'.

NOTE: Modern versions of Windows no longer include the telnet client by default. The Windows telnet client may be added via Control Panel > Programs and Features > "Turn Windows features on or off".

7.6   Using SSH instead of Telnet

If this traffic needs to be secure, SSH forwarding can be used instead of Telnet.

Navigate to **Configuration - Network > SSH Server > SSH Server n** then configure **Command Session IP Address & Port.**

NOTE: In some older firmware versions, these settings are in **Configuration - Management > SSH server.**

These parameters are used to specify the host IP address and port number of the device that will handle incoming request for a command session from SSH clients, instead of using the TransPort's normal command interpreter.

For example, if the parameters used were IP 127.0.0.1, Port 4000, the SSH client will make a direct connection to ASY 0 and the device attached to ASY 0 will receive and process the commands from the SSH client.

Alternatively, you can specify a host on the LAN attached to the TransPort and configure TCP port 23. This will allow you Telnet access to the host on the LAN, but the traffic over the Internet to the TransPort will be secured with SSH.

8   REVERSE TELNET – EXTRA CONFIGURATION

8.1   ASY 0 Telnet mode - Essential

If the serial connection to the remote device is returning unexpected text results, change the Telnet mode of the ASY port in use. This is done in **Configuration – Network > Advanced Network Settings**.
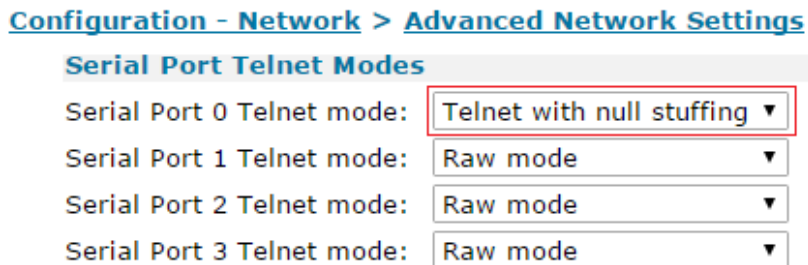
"Telnet with null stuffing" normally works best.

NOTE: In some older firmware versions, these settings are in **Configuration - System > General.**

8.2   Windows Telnet client configuration

If you are using the built-in Windows Telnet client, then you will need to disable the default mode of sending a <CR><LF> (carriage return, line feed) when 'Enter' is pressed on the keyboard. You need to change this mode so only a <CR> is sent.

As you can see here, 'Enter' was only pressed once, but 2 lines have been displayed in the Telnet output:

To resolve this issue, configure the Windows Telnet client as follows:

Open a command prompt and type 'telnet' then press 'Enter'.

Type 'u crlf' then press Enter. This switches off <CR><LF> mode.

Type 'q' to save and exit the Telnet configuration.

Now Telnet back to port 4000 and the output should be correct.

```
Cisco-Router#disable
Cisco-Router>en
Password:
Cisco-Router#_
```

Alternatively, choose a different Telnet client. We have found that TeraTerm works without modification.

9 TCPPERM & TCPDIAL COMMAND SYNTAX DETAIL

The format of the command is:

```
TCPPERM <[ASY 0-1]> <Dest Host> <Dest Port> [UDP] [nodeact] [-l<listening port>]

[-i<inact_timeout>] [-f<fwd_time>] [-e<eth_ip>][-d(deact link)]

[-k<keepalive_time>] [-s<src_port>] [-ok] [-t<telnet_mode>] [-ho(host only)]

[-ssl] [-ao(always open)] [-m<mhome idx>]"
```

The parameters are detailed in the following table:

Parameter	Description
ASY	The number of the local ASY port that the link will be made from/to
Dest Host	The IP address (or name) of the remote peer
Dest Port	The port number to use on the remote peer
UDP	Open a UDP connection (the default is TCP)
-ao	Open socket immediately, and reopen if and when the socket is closed
-e	Use the address of ethernet port 'n' for the socket connection rather than the default of the address of the interface over which the socket is opened (i.e ppp 1, ppp 2, etc.)
-d	Deactivate link - if non-zero, when the socket is closed and there are no other sockets using the interface then the interface connection is dropped (switched connections only)
-f	The forwarding time (x10ms) for packetising data from the serial port
-ho	Host - indicates that the socket should only accept connections from the specified host.
-i	The inactivity timeout (s) after which the socket will be closed
-k	Keep alive packet timer (s)
-l	Listening port - allows the user to set a new TCP port number to listen on rather than the default value of 4000+ASY port #
-m	Multihome additional consecutive addresses index
-ok	Open socket in 'quiet mode', i.e. there is no 'OK' response to the TCPPERM command.

-s	Source port number
-ssl	Use SSL mode
-t	Use Telnet mode. Opens socket in the corresponding Telnet mode (port 23 default), 0=raw, 1 Telnet Mode, 2 - Telnet Mode with null stuffing. If this is not specified then the mode specified for the associated ASY port in general setup is used. If the -t option is specified then the "ok" option is always used.

10 MULTITX

MultiTX is a feature that is used to send data received on the specified ASY serial interface to the specified host(s).

An alternative to TCPPERM, this feature can only be used to initiate a socket connection to a single host or multiple hosts; MultiTX does not have a listening mode.

Up to 5 TCP or UDP destination hosts can be added and the same serial data will be transmitted to each host that accepts the socket connection.

In TCP mode, when the 'Socket inactivity timer' expires, the socket is closed. The socket will be re-opened when more data is received on the serial interface and needs to be transmitted to the remote host(s).

In UDP mode, any data received on the serial interface is transmitted to the specified host(s). The socket inactivity timer has no use in UDP mode.

For example, to configure the router to send data received on ASY 0 to 4 IP addresses (2 private & internal, 2 public), the configuration would look like this:

Configuration - Network > Interfaces > Serial > MultiTX

▼ **MultiTX**

☑ Enable MultiTX

Serial Port: 0 ▼

Protocol: ⦿ TCP ○ UDP

Socket Inactivity Timeout: 0

Source port: 0

☐ Send Socket ID

☐ Reopen closed sockets:

☐ Send serial data only when the match string is present

You can specify up to 5 remote hosts

Remote Hosts		
Host	**Port**	
172.16.1.20	2222	Delete
172.16.2.20	2222	Delete
217.24.13.21	2221	Delete
64.213.12.89	2221	Delete
	0	Add

Apply

10.1 Socket IDs and match strings

In certain applications, a socket ID might be required to identify the source of the data to the recipient host application when the socket is connected. If this is required, check the box 'Send Socket ID' and enter the required text string.

It is also possible to only forward the serial data to an IP host if a specified test string is received from the serial device. If this is required, check the box 'Send serial data only when the match string is present' and enter the required text string.

Optionally, the specified string can be removed from the packet that is sent to the specified hosts by checking the box 'Strip match string before sending'.

☑ Send Socket ID
☐ Reopen closed sockets:

Socket ID: `-PLC1-`

☑ Send serial data only when the match string is present

Match String: `FLOOD-ALERT`

☐ Strip match string before sending