NETX Duo

Telnet Protocol (Telnet) for NetX Duo

User Guide

Express Logic, Inc.

858.613.6640
Toll Free 888.THREADX
FAX 858.521.4259

www.expresslogic.com

Part Number: 000-1055
Revision 5.12

Contents

Chapter 1

Introduction to Telnet

The Telnet Protocol (Telnet) is a protocol designed for transferring commands and responses between two nodes on the Internet. Telnet is a simple protocol that utilizes reliable Transmission Control Protocol (TCP) services to perform its transfer function. Because of this, Telnet is a highly reliable transfer protocol. Telnet is also one of the most used application protocols.

Telnet Requirements

In order to function properly, the NetX Duo Telnet package requires that a NetX IP instance has already been created. In addition, TCP must be enabled on that same IP instance. The Telnet Client portion of the NetX Duo Telnet package has no further requirements.

The Telnet Server portion of the NetX Duo Telnet package has one additional requirement. It requires complete access to TCP *well-known port 23* for handling all Client Telnet requests.

Telnet Constraints

The NetX Duo Telnet protocol implements the Telnet standard. However, the interpretation and response of Telnet commands, indicated by a byte with the value of 255, is the responsibility of the application. The various Telnet commands and command parameters are defined in the *nxd_telnet_client.h* and *nxd_telnet_server.h* files.

Telnet Communication

As mentioned previously, the Telnet Server utilizes the *well-known TCP port 23* to field Client requests. Telnet Clients may use any available TCP port.

Telnet Authentication

Telnet authentication is the responsibility of the application's Telnet Server callback function. The application's Telnet Server "new connection" callback would typically prompt the Client for name and/or password. The Client would then be responsible for providing the information. The Server would then process the information in the "receive data" callback. This is where the application Server code would have to authenticate the information and decide whether or not it is valid.

Telnet New Connection Callback

The NetX Duo Telnet Server calls the application specified callback function whenever a new Telnet Client request is received. The application specifies the callback function when the Telnet Server is created via the ***nx_telnet_server_create*** function. Typical actions of the "new connection" callback include sending a banner or prompt to the Client. This could very well include a prompt for login information.

The format of the application "new connection" callback routine is very simple and is defined below:

```
void  telnet_new_connection(NX_TELNET_SERVER *server_ptr,
                                 UINT logical_connection);
```

The input parameters are defined as follows:

Parameter	**Meaning**
server_ptr	Pointer to the calling Telnet Server.
logical_connection	The internal logical connection for the Telnet Server. This can be used by the application as an index into buffers and/or data structures specific for each Client connection. Its value ranges from 0 through NX_TELNET_MAX_CLIENTS - 1.

Telnet Receive Data Callback

The NetX Duo Telnet Server calls the application specified callback function whenever a new Telnet Client data is received. The application specifies the callback function when the Telnet Server is created via the

nx_telnet_server_create function. Typical actions of the “new connection” callback include echoing the data back and/or parsing the data and providing data as a result of interpreting a command from the client.

Note that this callback routine must also release the supplied packet.

The format of the application “receive data” callback routine is very simple and is defined below:

```
void  telnet_receive_data(NX_TELNET_SERVER *server_ptr,
                          UINT logical_connection, NX_PACKET *packet_ptr);
```

The input parameters are defined as follows:

Parameter	**Meaning**
server_ptr	Pointer to the calling Telnet Server.
logical_connection	The internal logical connection for the Telnet Server. This can be used by the application as an index into buffers and/or data structures specific for each Client connection. Its value ranges from 0 through NX_TELNET_MAX_CLIENTS - 1.
packet_ptr	Pointer to packet containing the data from the Client.

Telnet End Connection Callback

The NetX Duo Telnet Server calls the application specified callback function whenever a Telnet Client ends the connection. The application specifies the callback function when the Telnet Server is created via the ***nx_telnet_server_create*** function. Typical actions of the “end connection” callback include cleaning up any Client specific data structures associated with the logical connection.

The format of the application “end connection” callback routine is very simple and is defined below:

```
void  telnet_end_connection(NX_TELNET_SERVER *server_ptr,
                            UINT logical_connection);
```

The input parameters are defined as follows:

Parameter	Meaning
server_ptr	Pointer to the calling Telnet Server.
logical_connection	The internal logical connection for the Telnet Server. This can be used by the application as an index into buffers and/or data structures specific for each Client connection. Its value ranges from 0 through NX_TELNET_MAX_CLIENTS - 1.

Telnet Option Negotiation

The NetX Duo Telnet Server supports a limited set of Telnet options, `Echo` and `Suppress Go Ahead`.

To enable this feature the NX_TELNET_SERVER_OPTION_DISABLE must not be defined. By default it is not defined. The Telnet Server creates a packet pool in the *nx_telnet_server_create* service from which it allocates packets for sending telnet options requests to the Client. See "Configuration Options" for setting the packet payload (NX_TELNET_SERVER_PACKET_PAYLOAD) and packet pool size (NX_TELNET_SERVER_PACKET_POOL_SIZE**)** for this packet pool. It will delete this packet pool when the *nx_telnet_server_delete* service is called.

Upon making a connection with the Telnet Client, it will send out this set of telnet options to the Client if it has not received option requests from the Client:

```
will echo

dont echo

will sga
```

When it receives Telnet data from the Client, the Telnet Server checks if the first byte is the "IAC" code. If so, it will process all the options in the Client packet. Options not in the list above are ignored.

By default, the Telnet Server creates its own internal packet pool if NX_TELNET_SERVER_OPTION_DISABLE is not defined and it needs to transmit Telnet option commands. The Telnet Server packet pool is defined by NX_TELNET_SERVER_PACKET_PAYLOAD and NX_TELNET_SERVER_PACKET_POOLSIZE. If, however, NX_TELNET_SERVER_USER_CREATE_PACKET_POOL is defined, the application must create the Telnet Server packet pool and set it as the Telnet Server packet pool by calling *_nx_telnet_server_packet_pool_set*. See Chapter 3 “Description of Telnet Services” for more details about this function.

Unlike the NetX Duo Telnet Server, the NetX Duo Telnet Client task thread does not automatically send and respond to received options from the Telnet Server. This must be done by the Telnet Client application.

Telnet Multi-Thread Support

The NetX Duo Telnet Client services can be called from multiple threads simultaneously. However, read or write requests for a particular Telnet Client instance should be done in sequence from the same thread.

Telnet RFCs

NetX Duo Telnet is compliant with RFC854 and related RFCs.

Chapter 2

Installation and Use of Telnet

This chapter contains a description of various issues related to installation, setup, and usage of the NetX Duo Telnet component.

Product Distribution

Telnet for NetX Duo is shipped on a single CD-ROM compatible disk. The package includes three source files, two include files, and a PDF file that contains this document, as follows:

nxd_telnet_client.h	Header file for Telnet Client for NetX Duo
nxd_telnet_client.c	C Source file for Telnet Client for NetX Duo
nxd_telnet_server.h	Header file for Telnet Server for NetX Duo
nxd_telnet_server.c	C Source file for Telnet Server for NetX Duo
nxd_telnet.pdf	PDF description of Telnet for NetX Duo
demo_netxduo_telnet.c	NetX Duo Telnet demonstration

Telnet Installation

In order to use Telnet for NetX Duo, the entire distribution mentioned previously should be copied to the same directory where NetX Duo is installed. For example, if NetX Duo is installed in the directory "*\threadx\arm7\green*" then the *nxd_telnet_client.h*, *nxd_telnet_client.c*, *nxd_telnet_server.c and nxd_telnet_server.h* files should be copied into this directory.

Using Telnet

Using Telnet for NetX Duo is easy. Basically, the application code must include *nxd_telnet_server.h* for Telnet Server applications and *nxd_telnet_client.h* for Telnet Client applications after it includes *tx_api.h* and *nx_api.h*, in order to use ThreadX and NetX Duo. Once the header is included, the application code is then able to make the Telnet function calls specified later in this guide. The application must also include *nxd_telnet_client.c* and *nxd_telnet_server.c* in the build process. These files must be compiled in the same manner as other application files and its object form must be linked along with the files of the application. This is all that is required to use NetX Duo Telnet.

If no Telnet Client capabilities are required, the *nxd_telnet_client.c* file may be omitted.

Note also that because Telnet utilizes NetX Duo TCP services, TCP must be enabled with the *nx_tcp_enable* call prior to using Telnet.

Small Example System

An example of how to use NetX Duo Telnet is shown in Figure 1.1 below. In this example, the Telnet include files *are* brought in at line 7 and 8. Next, the Telnet Server is created in "*tx_application_define*" at line 146. Note that the Telnet Server and Client control blocks are defined as global variables at line 23-24 previously.

Before the Telnet Server or Client can be started they must validate their IP address with NetX Duo. For IPv4 connections this is accomplished by simply waiting briefly to let the NetX driver initialize the system on line 166. For IPv6 connections, this requires enabling IPv6 and ICMPv6 which it does in lines 171-172. The Client sets its global and link local IPv6 addresses on the primary interface on lines 181-186 and waits for NetX Duo validation to complete in the background. The Server also sets its global and link local addresses on its primary interface in lines 192 – 198. Note that the two services, *nxd_ipv6_global_address_set* and *nxd_ipv6_linklocal_address_set* are replaced with *nxd_ipv6_address_set service*. The former two services are still available for legacy NetX Duo applications but are eventually deprecated. Developers are encouraged to use *nxd_ipv6_address_set* instead.

After successful IP address validation with NetX Duo, the Telnet Server is started at line 215 using the *nxd_telnet_server_start* service. At line 226 the Telnet Client is created using the *nx_telnet_client_create* service. It then connects with the Telnet Server on line 242 for IPv4 applications and line 238 for IPv6 applications using the *nxd_telnet_client_connect* and *nx_telnet_client_connect* services respectively. After successful validation and connection with the server, it makes a few exchanges before disconnecting.

```
1    /* This is a small demo of TELNET on the high-performance NetX Duo TCP/IP stack.
2       This demo relies on ThreadX and NetX Duo to show a simple TELNET connection,
3       send, server echo, and then disconnection from the TELNET server.  */
4
5    #include  "tx_api.h"
6    #include  "nx_api.h"
7    #include  "nxd_telnet_client.h"
8    #include  "nxd_telnet_server.h"
9    #define     DEMO_STACK_SIZE         4096
10
11
12   /* Define the ThreadX and NetX object control blocks...  */
13
14   TX_THREAD               test_thread;
15   NX_PACKET_POOL          pool_server;
```

```
NX_PACKET_POOL          pool_client;
NX_IP                   ip_server;
NX_IP                   ip_client;


/* Define TELNET objects.  */

NX_TELNET_SERVER        my_server;
NX_TELNET_CLIENT        my_client;


#ifdef FEATURE_NX_IPV6

/* Define NetX Duo IP address for the NetX Duo Telnet Server and Client. */

NXD_ADDRESS     server_ip_address;
NXD_ADDRESS     client_ip_address;

#endif

#define         SERVER_ADDRESS          IP_ADDRESS(1,2,3,4)
#define         CLIENT_ADDRESS          IP_ADDRESS(1,2,3,5)



/* Define the counters used in the demo application...  */

ULONG                   error_counter;


/* Define timeout in ticks for connecting and sending/receiving data. */

#define                 TELNET_TIMEOUT  200

/* Define function prototypes.  */

void    thread_test_entry(ULONG thread_input);
void    _nx_ram_network_driver(struct NX_IP_DRIVER_STRUCT *driver_req);


/* Define the application's TELNET Server callback routines.  */

void    telnet_new_connection(NX_TELNET_SERVER *server_ptr, UINT
                                        logical_connection);
void    telnet_receive_data(NX_TELNET_SERVER *server_ptr, UINT logical_connection,
                                        NX_PACKET *packet_ptr);
void    telnet_connection_end(NX_TELNET_SERVER *server_ptr, UINT
                                        logical_connection);


/* Define main entry point.  */

int main()
{

    /* Enter the ThreadX kernel.  */
    tx_kernel_enter();
}


/* Define what the initial system looks like.  */
void    tx_application_define(void *first_unused_memory)
{

UINT    status;
CHAR    *pointer;
UINT    iface_index, address_index;

    /* Setup the working pointer.  */
    pointer =  (CHAR *) first_unused_memory;

    /* Create the main thread.  */
    tx_thread_create(&test_thread, "test thread", thread_test_entry, 0,
            pointer, DEMO_STACK_SIZE,
            2, 2, TX_NO_TIME_SLICE, TX_AUTO_START);
    pointer =  pointer + DEMO_STACK_SIZE;

    /* Initialize the NetX system.  */
    nx_system_initialize();

    /* Create packet pool.  */
    nx_packet_pool_create(&pool_server, "Server NetX Packet Pool",
                 600, pointer, 8192);
    pointer = pointer + 8192;

    /* Create an IP instance.  */
    nx_ip_create(&ip_server, "Server NetX IP Instance", SERVER_ADDRESS,
                        0xFFFFFF00UL, &pool_server, _nx_ram_network_driver,
                        pointer, 4096, 1);

    pointer =  pointer + 4096;

    /* Create another packet pool. */
    nx_packet_pool_create(&pool_client, "Client NetX Packet Pool", 600,
                            pointer, 8192);
    pointer = pointer + 8192;

    /* Create another IP instance.  */
    nx_ip_create(&ip_client, "Client NetX IP Instance", CLIENT_ADDRESS,
                        0xFFFFFF00UL, &pool_client, _nx_ram_network_driver,
                        pointer, 4096, 1);

    pointer = pointer + 4096;

    /* Enable ARP and supply ARP cache memory for IP Instance 0.  */
    nx_arp_enable(&ip_server, (void *) pointer, 1024);
    pointer = pointer + 1024;

    /* Enable ARP and supply ARP cache memory for IP Instance 1.  */
    nx_arp_enable(&ip_client, (void *) pointer, 1024);
    pointer = pointer + 1024;

    /* Enable TCP processing for both IP instances.  */
    nx_tcp_enable(&ip_server);
    nx_tcp_enable(&ip_client);


#ifdef FEATURE_NX_IPV6

    /* Next set the NetX Duo Telnet Server and Client addresses. */
    server_ip_address.nxd_ip_address.v6[3] = 0x105;
    server_ip_address.nxd_ip_address.v6[2] = 0x0;
    server_ip_address.nxd_ip_address.v6[1] = 0x0000f101;
    server_ip_address.nxd_ip_address.v6[0] = 0x20010db1;
    server_ip_address.nxd_ip_version = NX_IP_VERSION_V6;

    client_ip_address.nxd_ip_address.v6[3] = 0x101;
    client_ip_address.nxd_ip_address.v6[2] = 0x0;
    client_ip_address.nxd_ip_address.v6[1] = 0x0000f101;
    client_ip_address.nxd_ip_address.v6[0] = 0x20010db1;
    client_ip_address.nxd_ip_version = NX_IP_VERSION_V6;

#endif

    /* Create the NetX Duo TELNET Server.  */
    status =  nx_telnet_server_create(&my_server, "Telnet Server", &ip_server,
                    pointer, 2048, telnet_new_connection, telnet_receive_data,
                    telnet_connection_end);

    /* Check for errors.  */
    if (status)
        error_counter++;

    return;
}


/* Define the test thread.  */
void    thread_test_entry(ULONG thread_input)
{

NX_PACKET   *my_packet;
UINT        status;

    /* Allow other threads (e.g. IP thread task) to run first. */
    tx_thread_sleep(100);

#ifdef FEATURE_NX_IPV6

    /* Here's where we make the Telnet Client IPv6 enabled. */
    nxd_ipv6_enable(&ip_client);
    nxd_icmp_enable(&ip_client);

    /* Wait till the IP task thread initializes the system. */
    tx_thread_sleep(100);


    /* Set up the Client addresses on the Client IP for the primary interface. */
    if_index = 0;

    status = nxd_ipv6_address_set(&ip_ client, iface_index, NX_NULL, 10,
                                   &address_index);
     status = nxd_ipv6_address_set(&ip_ client, iface_index, & client _ip_address,
                                        64, &address_index);

    /* Allow NetX Duo time to validate addresses. */
     tx_thread_sleep(400);


    /* Set up the Server addresses on the Client IP. */

   iface_index = 0;
    status = nxd_ipv6_address_set (&ip_server, iface_index, NX_NULL, 10,
                                   &address_index);

    status = nxd_ ipv6_address _set(&ip_server, iface_index, & server _ip_address,
                                        64, &address_index);



    /* Allow NetX Duo time to validate addresses. */
    tx_thread_sleep(400);

 #endif


    /* Start the TELNET Server.  */
    status =  nx_telnet_server_start(&my_server);

    /* Check for errors.  */
    if (status != NX_SUCCESS)
    {

        return;
    }


    /* Create a TELENT client instance.  */
    status =  nx_telnet_client_create(&my_client, "My TELNET Client",
                                               &ip_client, 600);

    /* Check status.  */
    if (status != NX_SUCCESS)
    {
        return;
    }


#ifdef FEATURE_NX_IPV6

    /* Connect the TELNET client to the TELNET Server at port 23.  */
    status =  nxd_telnet_client_connect(&my_client, &server_ip_address, 23,
                                               TELNET_TIMEOUT);

#else
    /* Connect the TELNET client to the TELNET Server at port 23.  */
    status =  nx_telnet_client_connect(&my_client, SERVER_ADDRESS, 23,
                                         TELNET_TIMEOUT);
#endif

    /* Check status.  */
    if (status != NX_SUCCESS)
    {
        return;
    }


    /* Allocate a packet.  */
    status =  nx_packet_allocate(&pool_client, &my_packet, NX_TCP_PACKET,
                                        NX_WAIT_FOREVER);

    /* Check status.  */
    if (status != NX_SUCCESS)
    {
        return;
    }

    /* Build a simple 1-byte message.  */
    nx_packet_data_append(my_packet, "a", 1, &pool_client, NX_WAIT_FOREVER);

    /* Send the packet to the TELNET Server.  */
    status =  nx_telnet_client_packet_send(&my_client, my_packet, TELNET_TIMEOUT);

    /* Check status.  */
    if (status != NX_SUCCESS)
    {
        return;
    }



    /* Pickup the Server header.  */
    status =  nx_telnet_client_packet_receive(&my_client, &my_packet,
                                                              TELNET_TIMEOUT);

    /* Check status.  */
    if (status != NX_SUCCESS)
    {
        return;
    }


    /* At this point the packet should contain the Server's banner
       message sent by the Server callback function below.  Just
       release it for this demo.  */
    nx_packet_release(my_packet);

    /* Pickup the Server echo of the character.  */
    status =  nx_telnet_client_packet_receive(&my_client, &my_packet,
                                                      TELNET_TIMEOUT);

    /* Check status.  */
    if (status != NX_SUCCESS)
    {
        return;
    }


    /* At this point the packet should contain the character 'a' that
       we sent earlier.  Just release the packet for now.  */
    nx_packet_release(my_packet);

    /* Now disconnect form the TELNET Server.  */
    status =  nx_telnet_client_disconnect(&my_client, TELNET_TIMEOUT);


    /* Check status.  */
    if (status != NX_SUCCESS)
    {
        return;
    }


    /* Delete the TELNET Client.  */
    status =  nx_telnet_client_delete(&my_client);

    /* Check status.  */
    if (status != NX_SUCCESS)
    {
        return;
    }
}


/* This routine is called by the NetX Telnet Server whenever a new Telnet client
   connection is established.  */
void  telnet_new_connection(NX_TELNET_SERVER *server_ptr, UINT logical_connection)
{

UINT        status;
NX_PACKET   *packet_ptr;


```

```
    /* Allocate a packet for client greeting. */
    status =  nx_packet_allocate(&pool_server, &packet_ptr, NX_TCP_PACKET,
                                        NX_NO_WAIT);

    if (status != NX_SUCCESS)
    {
        error_counter++;
        return;
    }


    /* Build a banner message and a prompt.  */
    nx_packet_data_append(packet_ptr,
          "**** Welcome to NetX TELNET Server ****\r\n\r\n\r\n", 45,
          &pool_server, NX_NO_WAIT);


    nx_packet_data_append(packet_ptr, "NETX> ", 6, &pool_server, NX_NO_WAIT);

    /* Send the packet to the client.  */
    status =  nx_telnet_server_packet_send(server_ptr, logical_connection,
                 packet_ptr, TELNET_TIMEOUT);

    if (status != NX_SUCCESS)
    {
        error_counter++;
        nx_packet_release(packet_ptr);
    }


    return;
}


/* This routine is called by the NetX Telnet Server whenever data is present on a
   Telnet client connection.  */
void  telnet_receive_data(NX_TELNET_SERVER *server_ptr, UINT logical_connection,
                          NX_PACKET *packet_ptr)
{

UINT    status;
UCHAR   alpha;


    /* This demo echoes the character back; on <cr,lf> sends a new prompt back to
       the client.  A real system would likely buffer the character(s) received in a
       buffer associated with the supplied logical connection and process it.  */


    /* Just throw away carriage returns.  */
    if ((packet_ptr -> nx_packet_prepend_ptr[0] == '\r') &&
        (packet_ptr ->  nx_packet_length == 1))
    {

        printf("telnet server received just a CRLF\n");

        nx_packet_release(packet_ptr);
        return;
    }


    /* Setup new line on line feed.  */
    if ((packet_ptr -> nx_packet_prepend_ptr[0] == '\n') || (packet_ptr ->
         nx_packet_prepend_ptr[1] == '\n'))
    {

        /* Clean up the packet.  */
        packet_ptr -> nx_packet_length =  0;
        packet_ptr -> nx_packet_prepend_ptr =  packet_ptr -> nx_packet_data_start +
                                               NX_TCP_PACKET;
        packet_ptr -> nx_packet_append_ptr =   packet_ptr -> nx_packet_data_start +
                                               NX_TCP_PACKET;

        /* Build the next prompt.  */
        nx_packet_data_append(packet_ptr, "\r\nNETX> ", 8, &pool_server,
                              NX_NO_WAIT);

        /* Send the packet to the client.  */
        status =  nx_telnet_server_packet_send(server_ptr, logical_connection,
                                               packet_ptr, TELNET_TIMEOUT);

        if (status != NX_SUCCESS)
        {
            error_counter++;
            nx_packet_release(packet_ptr);
        }

        return;
    }


    /* Pickup first character (usually only one from client).  */
    alpha =  packet_ptr -> nx_packet_prepend_ptr[0];

    /* Echo character.  */
    status =  nx_telnet_server_packet_send(server_ptr, logical_connection,
                                            packet_ptr, TELNET_TIMEOUT);

    if (status != NX_SUCCESS)
    {
        error_counter++;
        nx_packet_release(packet_ptr);
    }

    /* Check for a disconnection.  */
    if (alpha == 'q')
    {

        /* Initiate server disconnection.  */
        nx_telnet_server_disconnect(server_ptr, logical_connection);
    }
}


/* This routine is called by the NetX Telnet Server when the client disconnects.  */
void  telnet_connection_end(NX_TELNET_SERVER *server_ptr, UINT logical_connection)
{
    /* Cleanup any application specific connection or buffer information.  */
    return;
}
```

Figure 1.1 Example of Telnet use with NetX Duo

Configuration Options

There are several configuration options for building Telnet for NetX Duo. These #defines can be set by the application prior to inclusion of *nxd_telnet_server.h*.and *nxd_telnet_client.h.*

Following is a list of all options, where each is described in detail:

Define	Meaning
NX_DISABLE_ERROR_CHECKING	Defined, this option removes the basic Telnet error checking. It is typically used after the application has been debugged.
NX_TELNET_MAX_CLIENTS	The maximum number of Telnet Clients supported by the Server thread. By default, this value is defined as 4 to specify a maximum of 4 clients at a time.
NX_TELNET_SERVER_PRIORITY	The priority of the Telnet Server thread. By default, this value is defined as 16 to specify priority 16.
NX_TELNET_TOS	Type of service required for the Telnet TCP requests. By default, this value is defined as NX_IP_NORMAL to indicate normal IP packet service.
NX_TELNET_FRAGMENT_OPTION	Fragment enable for Telnet TCP requests. By default, this value is NX_DONT_FRAGMENT to disable Telnet TCP fragmenting.
NX_TELNET_SERVER_WINDOW_SIZE	Server socket window size. By default, this value is 2048 bytes.
NX_TELNET_TIME_TO_LIVE	Specifies the number of routers this packet can pass before it

	is discarded. The default value is set to 0x80.
NX_TELNET_SERVER_TIMEOUT	Specifies the number of ThreadX ticks that internal services will suspend for. The default value is set to 10 seconds.
NX_TELNET_ACTIVITY_TIMEOUT	Specifies the number of seconds that can elapse without any activity before the Server disconnects the Client connection. The default value is set to 600 seconds.
NX_TELNET_TIMEOUT_PERIOD	Specifies the number of seconds between checking for Client activity timeouts. The default value is set to 60 seconds.
NX_TELNET_SERVER_OPTION_DISABLE	Defined, Telnet option negotiation is disabled. By default this option is not defined.
NX_TELNET_SERVER_USER_CREATE_PACKET_POOL	If defined, the Telnet Server packet pool must be created externally. This is only meaningful if NX_TELNET_SERVER_OPTION_DISABLE is not defined. By default this option is not defined and the Telnet Server thread creates its own packet pool.
NX_TELNET_SERVER_PACKET_PAYLOAD	Defines the size of the packet payload created by the Telnet Server for option negotiation. Note that the Telnet Server only creates this packet pool if NX_TELNET_SERVER _OPTION_DISABLE is not defined (Telnet options are enabled).

The default value of this option is 300.

NX_TELNET_SERVER_PACKET_POOL_SIZE

Defines the size of the Telnet Server packet pool used for Telnet negotiations. Note that the Telnet Server only creates this packet pool if NX_TELNET_SERVER_OPTION_DISABLE is not defined (Telnet options are enabled). The default value of this option is 2048 (~5-6 packets).

Chapter 3

Description of Telnet Services

This chapter contains a description of all NetX Telnet services (listed below) in alphabetic order.

In the “Return Values” section in the following API descriptions, values in **BOLD** are not affected by the **NX_DISABLE_ERROR_CHECKING** define that is used to disable API error checking, while non-bold values are completely disabled.

nx_telnet_client_connect	*Connect a Telnet Client with IPv4 address*
nxd_telnet_client_connect	*Connect an IPv6 Telnet Client with IPv6 address*
nx_telnet_client_create	*Create a Telnet Client*
nx_telnet_client_delete	*Delete a Telnet Client*
nx_telnet_client_disconnect	*Disconnect a Telnet Client*
nx_telnet_client_packet_receive	*Receive packet via Telnet Client*
nx_telnet_client_packet_send	*Send packet via Telnet Client*
nx_telnet_server_create	*Create a Telnet Server*
nx_telnet_server_delete	*Delete a Telnet Server*
nx_telnet_server_disconnect	*Disconnect a Telnet Client*

nx_telnet_server_get_open_connection_count
Retrieve the number of open connections

nx_telnet_server_packet_send
Send packet through Client connection

nx_telnet_server_packet_pool_set
Set packet pool as Telnet Server packet pool

nx_telnet_server_start
Start a Telnet Server

nx_telnet_server_stop
Stop a Telnet Server

nx_telnet_client_connect

Connect a Telnet Client with IPv4 address

Prototype

```
UINT nx_telnet_client_connect(NX_TELNET_CLIENT *client_ptr,
                              ULONG server_ip, UINT server_port,
                              ULONG wait_option);
```

Description

This service attempts to connect the previously created Telnet Client instance to the Server at the specified IP and port using an IPv4 address for the Telnet Server. This service actually inserts the ULONG server IP address in an NXD_ADDRESS control block and sets the IP version to 4 before calling the *nxd_telnet_client_connect* service described below.

Input Parameters

client_ptr	Pointer to Telnet Client control block.
server_ip	IPv4 Address of the Telnet Server.
server_port	TCP Port of Server (Telnet Server is port 23).
wait_option	Defines how long the service will wait for the Telnet Client connect. The wait options are defined as follows: **timeout value** (0x00000001 through 0xFFFFFFFE) **TX_WAIT_FOREVER** (0xFFFFFFFF) Selecting TX_WAIT_FOREVER causes the calling thread to suspend indefinitely until the Telnet Server responds to the request. Selecting a numeric value (1-0xFFFFFFFE) specifies the maximum number of timer-ticks to stay suspended while waiting for the Telnet Server response.

Return Values

NX_SUCCESS	(0x00)	Successful Client connect.

NX_TELNET_NOT_DISCONNECTED		
	(0xF4)	Client already connected.
NX_PTR_ERROR	(0x07)	Invalid Client pointer.
NX_IP_ADDRESS_ERROR	(0x21)	Invalid IP address.
NX_CALLER_ERROR	(0x11)	Invalid caller of service.

Allowed From

Threads

Example

```
/* Connect the Telnet Client instance “my_client” to the Server at
   IP address 1.2.3.4 and port 23.  */
status =  nx_telnet_client_connect(&my_client, IP_ADDRESS(1,2,3,4), 23, 100);


/* If status is NX_SUCCESS the Telnet Client instance was successfully
   connected to the Telnet Server.  */
```

nxd_telnet_client_connect

Connect a Telnet Client with IPv6 or IPv4 address

Prototype

```
UINT nxd_telnet_client_connect(NX_TELNET_CLIENT *client_ptr,
                               NXD_ADDRESS *server_ip_address,
                               UINT server_port,
                               ULONG wait_option);
```

Description

This service attempts to connect the previously created Telnet Client instance to the Server at the specified IP and port using the Telnet Server's IPv6 address. This service can take an IPv4 or an IPv6 address but must be contained in the NXD_ADDRESS variable *server_ip_address.*

Input Parameters

client_ptr	Pointer to Telnet Client control block.
server_ip_address	IP Address of Server.
server_port	TCP Port of Server (Telnet Server is port 23).
wait_option	Defines how long the service will wait for the Telnet Client connect. The wait options are defined as follows: **timeout value** (0x00000001 through 0xFFFFFFFE) **TX_WAIT_FOREVER** (0xFFFFFFFF) Selecting TX_WAIT_FOREVER causes the calling thread to suspend indefinitely until the Telnet Server responds to the request. Selecting a numeric value (1-0xFFFFFFFE) specifies the maximum number of timer-ticks to stay suspended while waiting for the Telnet Server response.

Return Values

NX_SUCCESS	(0x00)	Successful Client connect.

NX_TELNET_ERROR	(0xF0)	Client connect error.
NX_TELNET_NOT_DISCONNECTED	(0xF4)	Client already connected.
NX_PTR_ERROR	(0x07)	Invalid Client pointer.
NX_CALLER_ERROR	(0x11)	Invalid caller of service.
NX_TELNET_INVALID_PARAMETER	(0xF5)	Invalid non pointer input

Allowed From

Threads

Example

```
/* Connect the Telnet Client instance “my_client” to the Server at
   IPv6 address 20010db1:0:f101::101 and port 23.  */
status =  nxd_telnet_client_connect(&my_client, &server_ip_address, 23, 100);


/* If status is NX_SUCCESS the Telnet Client instance was successfully
   connected to the Telnet Server.  */
```

nx_telnet_client_create

Create a Telnet Client

Prototype

```
UINT nx_telnet_client_create(NX_TELNET_CLIENT *client_ptr,
               CHAR *client_name, NX_IP *ip_ptr, ULONG window_size);
```

Description

This service creates a Telnet Client instance.

Input Parameters

client_ptr	Pointer to Telnet Client control block.
client_name	Name of Client instance.
ip_ptr	Pointer to IP instance.
window_size	Size of TCP receive window for this Client.

Return Values

NX_SUCCESS	(0x00)	Successful Client create.
NX_TELNET_ERROR	(0xF0)	Socket create error.
NX_PTR_ERROR	(0x07)	Invalid Client or IP pointer.

Allowed From

Initialization, Threads

Example

```
/* Create the Telnet Client instance “my_client” on the IP instance “ip_0”.  */
status =  nx_telnet_client_create(&my_client, “My Telnet Client”, &ip_0, 2048);


/* If status is NX_SUCCESS the Telnet Client instance was successfully
   created.  */
```

nx_telnet_client_delete

Delete a Telnet Client

Prototype

```
UINT nx_telnet_client_delete(NX_TELNET_CLIENT *client_ptr);
```

Description

This service deletes a previously created Telnet Client instance.

Input Parameters

client_ptr	Pointer to Telnet Client control block.

Return Values

NX_SUCCESS	(0x00)	Successful Client delete.
NX_TELNET_NOT_DISCONNECTED	(0xF4)	Client still connected.
NX_PTR_ERROR	(0x07)	Invalid Client pointer.
NX_CALLER_ERROR	(0x11)	Invalid caller of this service.

Allowed From

Threads

Example

```
/* Delete the Telnet Client instance "my_client".  */
status =  nx_telnet_client_delete(&my_client);


/* If status is NX_SUCCESS the Telnet Client instance was successfully
   deleted.  */
```

nx_telnet_client_disconnect

Disconnect a Telnet Client

Prototype

```
UINT nx_telnet_client_disconnect(NX_TELNET_CLIENT *client_ptr,
                                                 ULONG wait_option);
```

Description

This service disconnects a previously connected Telnet Client instance.

Input Parameters

client_ptr	Pointer to Telnet Client control block.
wait_option	Defines how long the service will wait for the Telnet Client disconnect. The wait options are defined as follows: **timeout value** (0x00000001 through 0xFFFFFFFE) **TX_WAIT_FOREVER** (0xFFFFFFFF) Selecting TX_WAIT_FOREVER causes the calling thread to suspend indefinitely until the Telnet Server responds to the request. Selecting a numeric value (1-0xFFFFFFFE) specifies the maximum number of timer-ticks to stay suspended while waiting for the Telnet Server response.

Return Values

NX_SUCCESS	(0x00)	Successful Client disconnect.
NX_TELNET_NOT_CONNECTED	(0xF3)	Client not connected.
NX_PTR_ERROR	(0x07)	Invalid Client pointer.
NX_CALLER_ERROR	(0x11)	Invalid caller of this service.

Allowed From

Threads

Example

```
/* Disconnect the Telnet Client instance “my_client”.  */
status =  nx_telnet_client_disconnect(&my_client, 100);


/* If status is NX_SUCCESS the Telnet Client instance was successfully
   disconnected.  */
```

nx_telnet_client_packet_receive

Receive packet via Telnet Client

Prototype

```
UINT nx_telnet_client_packet_receive(NX_TELNET_CLIENT *client_ptr,
                                      NX_PACKET **packet_ptr,
                                      ULONG wait_option);
```

Description

This service receives a packet from the previously connected Telnet Client instance.

Input Parameters

client_ptr	Pointer to Telnet Client control block.
packet_ptr	Pointer to the destination for the received packet.
wait_option	Defines how long the service will wait for the Telnet Client packet receive. The wait options are defined as follows:

timeout value (0x00000001 through 0xFFFFFFFE)
TX_WAIT_FOREVER (0xFFFFFFFF)

Selecting TX_WAIT_FOREVER causes the calling thread to suspend indefinitely until the Telnet Server responds to the request.

Selecting a numeric value (1-0xFFFFFFFE) specifies the maximum number of timer-ticks to stay suspended while waiting for the Telnet Server response.

Return Values

NX_SUCCESS	(0x00)	Successful Client packet receive.
NX_PTR_ERROR	(0x07)	Invalid pointer input

NX_CALLER_ERROR	(0x11)	Invalid caller of service.

Allowed From

Threads

Example

```
/* Receive a packet from the Telnet Client instance “my_client”.  */
status =  nx_telnet_client_packet_receive(&my_client, &my_packet, 100);


/* If status is NX_SUCCESS the “my_packet” pointer contains data received from
   the Telnet Client connection.  */
```

nx_telnet_client_packet_send

Send packet via Telnet Client

Prototype

```
UINT nx_telnet_client_packet_send(NX_TELNET_CLIENT *client_ptr,
                                  NX_PACKET *packet_ptr,
                                  ULONG wait_option);
```

Description

This service sends a packet through the previously connected Telnet Client instance.

Input Parameters

client_ptr	Pointer to Telnet Client control block.
packet_ptr	Pointer to the packet to send.
wait_option	Defines how long the service will wait for the Telnet Client packet send. The wait options are defined as follows: **timeout value** (0x00000001 through 0xFFFFFFFE) **TX_WAIT_FOREVER** (0xFFFFFFFF) Selecting TX_WAIT_FOREVER causes the calling thread to suspend indefinitely until the Telnet Server responds to the request. Selecting a numeric value (1-0xFFFFFFFE) specifies the maximum number of timer-ticks to stay suspended while waiting for the Telnet Server response.

Return Values

NX_SUCCESS	(0x00)	Successful Client packet send.
NX_TELNET_ERROR	(0xF0)	Send packet failed – caller is responsible for releasing the packet.

NX_PTR_ERROR	(0x07)	Invalid pointer input
NX_CALLER_ERROR	(0x11)	Invalid caller of service.

Allowed From

Threads

Example

```
/* Send a packet via the Telnet Client instance “my_client”.  */
status =  nx_telnet_client_packet_send(&my_client, my_packet, 100);

/* If status is NX_SUCCESS the packet was successfully sent.  */
```

nx_telnet_server_create

Create a Telnet Server

Prototype

```
UINT nx_telnet_server_create(NX_TELNET_SERVER *server_ptr,
                  CHAR *server_name, NX_IP *ip_ptr,
                  VOID *stack_ptr, ULONG stack_size,
                  void (*new_connection)(struct NX_TELNET_SERVER_STRUCT
                         *telnet_server_ptr, UINT logical_connection),
                  void (*receive_data)(struct NX_TELNET_SERVER_STRUCT
                        *telnet_server_ptr, UINT logical_connection,
                        NX_PACKET *packet_ptr),
                  void (*connection_end)(struct NX_TELNET_SERVER_STRUCT
                        *telnet_server_ptr, UINT logical_connection));
```

Description

This service creates a Telnet Server instance on the specified IP instance.

Input Parameters

server_ptr	Pointer to Telnet Server control block.
server_name	Name of Telnet Server instance.
ip_ptr	Pointer to associated IP instance.
stack_ptr	Pointer to stack for the internal Server thread.
sack_size	Size of the stack, in bytes.
new_connection	Application callback routine function pointer. This routine is called whenever a new Telnet Client connection request is detected by the Server.
receive_data	Application callback routine function pointer. This routine is called whenever a new Telnet Client data is present on the connection. This routine is responsible for releasing the packet.
end_connection	Application callback routine function pointer. This routine is called whenever a Telnet Client connection is disconnected by the Client or the Client connection times out ("activity timeout" expires). The Server can also disconnect via the *nx_telnet_server_disconnect* service described below.

Return Values

NX_SUCCESS	(0x00)	Successful Server create.
NX_PTR_ERROR	(0x07)	Invalid Server, IP, stack, or application callback pointers.

Allowed From

Initialization, Threads

Example

```
/* Create a Telnet Server instance “my_server”.  */
status =  nx_telnet_server_create(&my_server, "Telnet Server", &ip_0,
                    pointer, 2048, telnet_new_connection, telnet_receive_data,
                    telnet_connection_end);


/* If status is NX_SUCCESS the Telnet Server was successfully created.  */
```

nx_telnet_server_delete

Delete a Telnet Server

Prototype

```
UINT nx_telnet_server_delete(NX_TELNET_SERVER *server_ptr);
```

Description

This service deletes a previously created Telnet Server instance.

Input Parameters

server_ptr	Pointer to Telnet Server control block.

Return Values

NX_SUCCESS	(0x00)	Successful Server delete.
NX_PTR_ERROR	(0x07)	Invalid Server pointer.
NX_CALLER_ERROR	(0x11)	Invalid caller of this service.

Allowed From

Threads

Example

```
/* Delete the Telnet Server instance "my_server".  */
status =  nx_telnet_server_delete(&my_server);

/* If status is NX_SUCCESS the Telnet Server was successfully deleted.  */
```

nx_telnet_server_disconnect

Disconnect a Telnet Client

Prototype

```
UINT nx_telnet_server_disconnect(NX_TELNET_SERVER *server_ptr,
                                           UINT logical_connection);
```

Description

This service disconnects a previously connected Client on this Telnet Server instance. This routine is typically called from the application's receive data callback function in response to a condition detected in the data received.

Input Parameters

server_ptr	Pointer to Telnet Server control block.
logical_connection	Logical connection corresponding the Client connection on this Server. Valid value range from 0 through NX_TELENET_MAX_CLIENTS.

Return Values

NX_SUCCESS	(0x00)	Successful Server disconnect.
NX_TELNET_ERROR	(0xF0)	Server disconnect failed.
NX_OPTION_ERROR	(0x0A)	Invalid logical connection.
NX_PTR_ERROR	(0x07)	Invalid Server pointer.
NX_CALLER_ERROR	(0x11)	Invalid caller of this service.

Allowed From

Threads

Example

```
/* Disconnect the Telnet Client associated with logical connection 2 on
   the Telnet Server instance “my_server”.  */
status =  nx_telnet_server_disconnect(&my_server, 2);

/* If status is NX_SUCCESS the Client on logical connection 2 was
   disconnected.  */
```

nx_telnet_server_get_open_connection_count

Return number of currently open connections

Prototype

```
UINT nx_telnet_server_get_open_connection_count(NX_TELNET_SERVER
                    *server_ptr, UINT *connection_count);
```

Description

This service returns the number of currently connected Telnet Clients.

Input Parameters

server_ptr	Pointer to Telnet Server control block.
Connection_count	Pointer to memory to store connection count

Return Values

NX_SUCCESS	(0x00)	Successful completion.
NX_PTR_ERROR	(0x07)	Invalid Server pointer.
NX_CALLER_ERROR	(0x11)	Invalid caller of this service.

Allowed From

Threads

Example

```
/* Get the number of Telnet Clients connected to the Server. */

status =  nx_telnet_server_get_open_connection_count(&my_server, &conn_count);

/* If status is NX_SUCCESS the conn_count holds the number of open connections.
*/
```

nx_telnet_server_packet_send

Send packet through Client connection

Prototype

```
UINT nx_telnet_server_packet_send(NX_TELNET_SERVER *server_ptr,
                                  UINT logical_connection,
                                  NX_PACKET *packet_ptr,
                                  ULONG wait_option);
```

Description

This service sends a packet to the Client connection on this Telnet Server instance. This routine is typically called from the application's receive data callback function in response to a condition detected in the data received.

Input Parameters

server_ptr	Pointer to Telnet Server control block.
logical_connection	Logical connection corresponding the Client connection on this Server. Valid value range from 0 through NX_TELENET_MAX_CLIENTS.
packet_ptr	Pointer to the received packet.
wait_option	Defines how long the service will wait for the Telnet Server packet send. The wait options are defined as follows:

timeout value	(0x00000001 through 0xFFFFFFFE)
TX_WAIT_FOREVER	(0xFFFFFFFF)

Selecting TX_WAIT_FOREVER causes the calling thread to suspend indefinitely until the Telnet Server responds to the request.

Selecting a numeric value (1-0xFFFFFFFE) specifies the maximum number of timer-ticks to stay suspended while waiting for the Telnet Server response.

Return Values

NX_SUCCESS	(0x00)	Successful packet send.
NX_TELNET_FAILED	(0xF2)	TCP socket send failed.
NX_OPTION_ERROR	(0x0A)	Invalid logical connection.
NX_PTR_ERROR	(0x07)	Invalid Server pointer.
NX_CALLER_ERROR	(0x11)	Invalid caller of service.

Allowed From

Threads

Example

```
/* Send a packet to the Telnet Client associated with logical connection 2 on
   the Telnet Server instance “my_server”.  */
status =  nx_telnet_server_packet_send(&my_server, 2, my_packet, 100);

/* If status is NX_SUCCESS the packet was sent to the Client on logical
   connection 2.  */
```

nx_telnet_server_packet_pool_set

Set previously created packet pool as Telnet Server pool

Prototype

```
UINT nx_telnet_server_packet_pool_set(NX_TELNET_SERVER *server_ptr,
                                      NX_PACKET_POOL *packet_pool_ptr);
```

Description

This service sets a previously created packet pool as the Telnet Server packet pool if NX_TELNET_SERVER_USER_CREATE_PACKET_POOL is defined. It also requires that NX_TELNET_SERVER_OPTION_DISABLE not be defined such that the Telnet Server needs a packet pool to transmit Telnet options to Telnet clients.

This permits applications to create the packet pool in different memory e.g. no cache memory, than the Telnet Server stack. Note that if this function does not check if the Telnet Server packet pool is already set. If it is called on a non null Telnet Server packet pool pointer, it will overwrite it and replace the existing packet pool with packet pool pointed to by the input pointer.

Input Parameters

server_ptr	Pointer to Telnet Server control block
packet_pool_ptr	Pointer to previously created packet pool

Return Values

NX_SUCCESS	(0x00)	Successfully set pool.
NX_PTR_ERROR	(0x07)	Invalid Server pointer.

Allowed From

Init, Threads

Example

```
status =  nx_packet_pool_create(&telnet_server_packet_pool, "Telnet Server Packet
                                Pool", telnet_server_pool_area, 600*10);

/* Set the packet pool as the Telnet Server packet pool.   */
status =  nx_telnet_server_packet_pool_set(&my_server,
                                           &telnet_server_packet_pool);

/* If status is NX_SUCCESS the packet pool is set as Telnet Server pool.  */
```

nx_telnet_server_start

Start a Telnet Server

Prototype

```
UINT nx_telnet_server_start(NX_TELNET_SERVER *server_ptr);
```

Description

This service starts a previously created Telnet Server instance.

Input Parameters

server_ptr	Pointer to Telnet Server control block.

Return Values

NX_SUCCESS	(0x00)	Successfully started.
NX_TELNET_NO_PACKET_POOL	(0xF6)	No packet pool set
NX_PTR_ERROR	(0x07)	Invalid Server pointer.

Allowed From

Initialization, Threads

Example

```
/* Start the Telnet Server instance “my_server”.  */
status =  nx_telnet_server_start(&my_server);

/* If status is NX_SUCCESS the Server was started.  */
```

nx_telnet_server_stop

Stop a Telnet Server

Prototype

```
UINT nx_telnet_server_stop(NX_TELNET_SERVER *server_ptr);
```

Description

This service stops a previously created and started Telnet Server instance.

Input Parameters

server_ptr	Pointer to Telnet Server control block.

Return Values

NX_SUCCESS	(0x00)	Successfully stopped
NX_PTR_ERROR	(0x07)	Invalid Server pointer.
NX_CALLER_ERROR	(0x11)	Invalid caller of service

Allowed From

Threads

Example

```
/* Stop the Telnet Server instance “my_server”.  */
status =  nx_telnet_server_stop(&my_server);

/* If status is NX_SUCCESS the Server was stopped.  */
```