

NetX™

BSD 4.3 Sockets API Compliancy Wrapper for NetX

User Guide

Renesas Synergy™ Platform

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Renesas Synergy Specific Information

If you are using NetX BSD for the Renesas Synergy platform, please use the following information.

Installation

Page 5: If you are using Renesas Synergy SSP and the e² studio ISDE, BSD will already be installed. You can ignore the BSD Installation section.



BSD 4.3 Sockets API Compliancy Wrapper for NetX

User Guide

Express Logic, Inc.

858.613.6640
Toll Free 888.THREADX
FAX 858.521.4259

www.expresslogic.com

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Contents

Chapter 1 Introduction to NetX BSD.....	4
BSD Sockets API Compliancy Wrapper Source	4
Chapter 2 Installation and Use of NetX BSD	5
Product Distribution.....	5
NetX BSD Installation	5
Building the ThreadX and NetX components of a BSD Application	5
Using NetX BSD.....	6
NetX BSD Limitations.....	6
NetX BSD with DNS Support	7
Configuration Options	8
BSD Socket Options	11
Small Example System	13
Chapter 3 NetX BSD Services.....	20

Chapter 1

Introduction to NetX BSD

The BSD Sockets API Compliancy Wrapper supports some of the basic BSD Sockets API calls with some limitations and utilizes NetX primitives underneath. This BSD Sockets API compatibility layer should perform as fast or slightly faster than typical BSD implementations, since this Wrapper utilizes internal NetX primitives and bypasses basic NetX error checking.

BSD Sockets API Compliancy Wrapper Source

The BSD Wrapper source code is designed for simplicity and is comprised of only two files, *[nx_bsd.h](#)* and *[nx_bsd.c](#)*. The *[nx_bsd.h](#)* file defines all the necessary BSD Sockets API Wrapper constants and subroutine prototypes, while *[nx_bsd.c](#)* contains the actual BSD Sockets API compatibility source code. These BSD Wrapper source files are common to all NetX support packages.

The package consists of:

<code>nx_bsd.c:</code>	Wrapper source code
<code>nx_bsd.h:</code>	Main header file

Sample demo programs:

<code>bsd_demo_tcp.c</code>	<i>Demo with a single TCP server and client</i>
<code>bsd_demo_udp.c</code>	<i>Demo with two UDP clients and a UDP server</i>

Chapter 2

Installation and Use of NetX BSD

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

Product Distribution

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

<code>nx_bsd.h</code>	Header file for NetX BSD
<code>nx_bsd.c</code>	C Source file for NetX BSD
<code>nx_bsd.pdf</code>	User Guide for NetX BSD

Demo files:

`bsd_demo_tcp.c`
`bsd_demo_udp.c`

NetX BSD Installation

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

Building the ThreadX and NetX components of a BSD Application

ThreadX

The ThreadX library must define `bsd_errno` in the thread local storage. We recommend the following procedure:

1. In *tx_port.h*, set one of the `TX_THREAD_EXTENSION` macros as follows:

```
#define TX_THREAD_EXTENSION_3      int bsd_errno
```

2. Rebuild the ThreadX library.

Note that if `TX_THREAD_EXTENSION_3` is already used, the user is free to use one of the other `TX_THREAD_EXTENSION` macros.

NetX

Before using NetX BSD Services, the NetX library must be built with `NX_ENABLE_EXTENDED_NOTIFY_SUPPORT` defined (e.g. in *`nx_user.h`*). By default it is not defined.

Using NetX BSD

Using BSD for NetX is easy. Basically, the application code must include *`nx_bsd.h`* after it includes *`tx_api.h`* and *`nx_api.h`*, in order to use ThreadX and NetX, respectively. Once *`nx_bsd.h`* is included, the application code is then able to use the BSD services specified later in this guide. The application must also include *`nx_bsd.c`* in the build process. This file 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 BSD.

To utilize NetX BSD services, the application must create an IP instance, a packet pool, and initialize BSD services by calling *`bsd_initialize`*. This is demonstrated in the “Small Example” section later in this guide. The prototype is shown below:

```
INT    bsd_initialize(NX_IP *default_ip, NX_PACKET_POOL *default_pool,
                    CHAR *free_memory_ptr, ULONG bsd_thread_stack_size,
                    UINT bsd_thread_priority);
```

The last three parameters are used for creating a thread for performing periodic tasks such as checking for TCP events and define the thread stack space.

Note: in contrast to BSD sockets, which work in network byte order, NetX works in the host byte order of the host processor. For source compatibility reasons, the macros `htons()`, `ntohs()`, `htonl()`, `ntohl()` have been defined, but do not modify the argument passed.

NetX BSD Limitations

Due to performance and architecture issues, NetX BSD does not support all the BSD 4.3 socket features:

INT flags are not supported for *send*, *recv*, *sendto* and *recvfrom* calls.

NetX BSD with DNS Support

If `NX_BSD_ENABLE_DNS` is defined, NetX BSD can send DNS queries to obtain hostname or host IP information. This feature requires a NetX DNS Client to be previously created using the *nx_dns_create* service. One or more known DNS server IP addresses must be registered with the DNS instance using the *nx_dns_server_add* for adding server addresses.

DNS services and memory allocation are used by *getaddrinfo* and *getnameinfo* services:

```
INT getaddrinfo(const CHAR *node, const CHAR *service,
               const struct addrinfo *hints, struct addrinfo **res)

INT getnameinfo(const struct sockaddr *sa, socklen_t salen,
               char *host, size_t hostlen, char *serv, size_t servlen, int flags)
```

When the BSD application calls *getaddrinfo* with a hostname, NetX BSD will call any of the below services to obtain the IP address:

- `nx_dns_ipv4_address_by_name_get`
- `nx_dns_cname_get`

For *nx_dns_ipv4_address_by_name_get*, NetX BSD uses the `ipv4_addr_buffer` memory areas. The size of these buffers are defined by `(NX_BSD_IPV4_ADDR_PER_HOST * 4)`.

For returning address information from *getaddrinfo*, NetX BSD uses the ThreadX block memory table `nx_bsd_addrinfo_pool_memory`, whose memory area is defined by another set of configurable options, `NX_BSD_IPV4_ADDR_MAX_NUM`.

See **Configuration Options** for more details on the above configuration options.

Additionally, if `NX_DNS_ENABLE_EXTENDED_RR_TYPES` is defined, and the host input is a canonical name, NetX BSD will allocate memory dynamically from a previously created block pool `_nx_bsd_cname_block_pool`

Note that after calling *getaddrinfo* the BSD application is responsible for releasing the memory pointed to by the *res* argument back to the block table using the *freeaddrinfo* service.

Configuration Options

User configurable options in *nx_bsd.h* allow the application to fine tune NetX BSD sockets for its particular requirements. The following is a list of these parameters:

Define	Meaning
NX_BSD_TCP_WINDOW	Used in TCP socket create calls. 65535 is a typical window size for 100Mb Ethernet. The default value is 65535.
NX_BSD_SOCKFD_START	This is the logical index for the BSD socket file descriptor start value. By default this option is 32.
NX_BSD_MAX_SOCKETS	Specifies the maximum number of total sockets available in the BSD layer and must be a multiple of 32. The value is defaulted to 32.
NX_BSD_SOCKET_QUEUE_MAX	Specifies the maximum number of UDP packets stored on the receive socket queue. The value is defaulted to 5.
NX_BSD_MAX_LISTEN_BACKLOG	This specifies the size of the listen queue ('backlog') for BSD TCP sockets. The default value is 5.
NX_MICROSECOND_PER_CPU_TICK	Specifies the number of microseconds per timer interrupt

NX_BSD_TIMEOUT	Specifies the timeout in timer ticks on NetX internal calls required by BSD. The default value is $20 * \text{NX_IP_PERIODIC_RATE}$.
NX_BSD_TCP_SOCKET_DISCONNECT_TIMEOUT	Specifies the timeout in timer ticks on NetX disconnect call. The default value is 1.
NX_BSD_PRINT_ERRORS	If set, the error status return of a BSD function returns a line number and type of error e.g. <code>NX_SOC_ERROR</code> where the error occurs. This requires the application developer to define the debug output. The default setting is disabled and no debug output is specified in <i>nx_bsd.h</i>
NX_BSD_TIMER_RATE	Interval after which BSD periodic timer task runs. The default value is 1 second ($1 * \text{NX_IP_PERIODIC_RATE}$).
NX_BSD_TIMEOUT_PROCESS_IN_TIMER	If set, this option allows the BSD timeout process to execute in the system timer context. The default behavior is disabled. This feature is described in more detail in Chapter 2 “Installation and Use of NetX BSD”.
NX_BSD_ENABLE_DNS	If enabled, NetX BSD will send a DNS query for a hostname or host IP address. Requires a DNS Client instance to be previously created and started. By default it is not enabled.

NX_BSD_IPV4_ADDR_MAX_NUM

Maximum number of IPv4 addresses returned by *getaddrinfo*. This along with `NX_BSD_IPV4_ADDR_MAX_NUM` defines the size of the NetX BSD block pool `nx_bsd_addrinfo_block_pool` for dynamically allocating memory to address information storage in *getaddrinfo*. The default value is 5.

NX_BSD_IPV4_ADDR_PER_HOST

Defines maximum IPv4 addresses stored per DNS query. The default value is 5.

BSD Socket Options

The following list of NetX BSD socket options can be enabled (or disabled) at run time on a per socket basis using the *setsockopt* service:

```
INT  setsockopt(INT sockID, INT option_level, INT option_name, const
               void *option_value, INT option_length);
```

There are two different settings for *option_level*.

The first type of run time socket options is *SOL_SOCKET* for socket level options. To enable a socket level option, call *setsockopt* with *option_level* set to *SOL_SOCKET* and *option_name* set to the specific option e.g. *SO_BROADCAST*. To retrieve an option setting, call *getsockopt* for the *option_name* with *option_level* again set to *SOL_SOCKET*.

The list of run time socket level options is shown below.

<i>SO_BROADCAST</i>	If set, this enables sending and receiving broadcast packets from Netx sockets. This is the default behavior for NetX. All sockets have this capability.
<i>SO_ERROR</i>	Used to obtain socket status on the previous socket operation of the specified socket, using the <i>getsockopt</i> service. All sockets have this capability.
<i>SO_KEEPALIVE</i>	If set, this enables the TCP Keep Alive feature. This requires the NetX library to be built with <i>NX_TCP_ENABLE_KEEPALIVE</i> defined in <i>nx_user.h</i> . By default this feature is disabled.
<i>SO_RCVTIMEO</i>	This sets the wait option in seconds for receiving packets on NetX BSD sockets. The default value is the <i>NX_WAIT_FOREVER</i> (0xFFFFFFFF) or, if non-blocking is enabled, <i>NX_NO_WAIT</i> (0x0).
<i>SO_RCVBUF</i>	This sets the window size of the TCP socket. The default value,

NX_BSD_TCP_WINDOW, is set to 64k for BSD TCP sockets. To set the size over 65535 requires the NetX library to be built with the NX_TCP_ENABLE_WINDOW_SCALING be defined.

SO_REUSEADDR

If set, this enables multiple sockets to be mapped to one port. The typical usage is for the TCP Server socket. This is the default behavior of NetX sockets.

The second type of run time socket options is the IP option level. To enable an IP level option, call *setsockopt* with *option_level* set to IP_PROTO and *option_name* set to the option e.g. IP_MULTICAST_TTL. To retrieve an option setting, call *getsockopt* for the *option_name* with *option_level* again set to IP_PROTO.

The list of run time IP level options is shown below.

IP_MULTICAST_TTL

This sets the time to live for UDP sockets. The default value is NX_IP_TIME_TO_LIVE (0x80) when the socket is created. This value can be overridden by calling *setsockopt* with this socket option.

IP_ADD_MEMBERSHIP

If set, this options enables the BSD socket (applies only to UDP sockets) to join the specified IGMP group.

IP_DROP_MEMBERSHIP

If set, this options enables the BSD socket (applies only to UDP sockets) to leave the specified IGMP group.

Small Example System

An example of how to use NetX BSD is shown in Figure 1.0 below. In this example, the include file *nx_bsd.h* is brought in at line 7. Next, the IP instance *bsd_ip* and packet pool *bsd_pool* are created as global variables at line 20 and 21. Note that this demo uses a ram (virtual) network driver (line 41). The client and server will share the same IP address on single IP instance in this example.

The client and server threads are created on line 303 and 309 in *tx_application_define* which sets up the application and is defined on lines 293-361. After IP instance successful creation on line 327, the IP instance is enabled for TCP services on line 350. The last requirement before BSD services can be used is to call *bsd_initialize* on line 360 to set up all data structures and NetX, and ThreadX resources needed by BSD.

In the server thread entry function, *thread_1_entry*, which is defined on lines 381-397, the application waits for the driver to initialize NetX with network parameters. Once this is done, it calls *tcpServer*, defined on lines 146-253, to handle the details of setting up the TCP server socket.

tcpServer creates the master socket by calling the *socket* service on line 159 and binds it to the listening socket using the *bind* call on line 176. It is then configured for listening for connection requests on line 191. Note that the master socket does not accept a connection request. It runs in a continuous loop which calls *select* each time to detect connection requests. A secondary BSD socket chosen from an array of BSD sockets is assigned the connection request after calling the *accept* service on line 218.

On the Client side, the client thread entry function, *thread_0_entry*, defined on lines 366-377, should also wait for NetX to be initialized by the driver. Here we just wait for the server side to do so. It then calls *tcpClient* defined on line 54-142, to handle the details of setting up the TCP client socket and requesting a TCP connection.

The TCP client socket is created on line 68. The socket is bound to the specified IP address and attempts to connect to the TCP server by calling *connect* on line 84. It is now ready to begin sending and receiving packets.

```

1  /* This is a small demo of BSD wrapper for the high-performance NetX TCP/IP stack.
2     This demo demonstrate TCP connection, disconnection, sending, and receiving using
3     ARP and a simulated Ethernet driver. */
4
5  #include      "tx_api.h"
6  #include      "nx_api.h"
7  #include      "nx_bsd.h"
8  #include      <string.h>
9  #include      <stdlib.h>
10

```



```

11 #define          DEMO_STACK_SIZE      (16*1024)
12
13
14 /* Define the ThreadX and NetX object control blocks... */
15
16 TX_THREAD        thread_0;
17 TX_THREAD        thread_1;
18
19
20 NX_PACKET_POOL    bsd_pool;
21 NX_IP             bsd_ip;
22
23
24 /* Define the counters used in the demo application... */
25
26 ULONG            error_counter;
27
28 /* Define fd_set for select call */
29 fd_set            master_list, read_ready, read_ready1;
30
31
32 /* Define thread prototypes. */
33
34 VOID              thread_0_entry(ULONG thread_input);
35 VOID              thread_1_entry(ULONG thread_input);
36
37 VOID              tcpClient(CHAR *msg0);
38 VOID              tcpServer(VOID);
39 INT               HandleClient(INT sock);
40
41 VOID              _nx_ram_network_driver(struct NX_IP_DRIVER_STRUCT *driver_req);
42
43
44 /* Define main entry point. */
45
46 int main()
47 {
48
49     /* Enter the ThreadX kernel. */
50     tx_kernel_enter();
51 }
52
53
54 VOID tcpClient(CHAR *msg0)
55 {
56
57     INT            status, status1, send_counter;
58     INT            sock_tcp_1, length, length1;
59     struct         sockaddr_in echoServAddr;           /* Echo server address */
60     struct         sockaddr_in localAddr;              /* Local address */
61     struct         sockaddr_in remoteAddr;            /* Remote address */
62
63     UINT           echoServPort;                      /* Echo Server Port */
64     CHAR           rcvBuffer1[32];
65
66
67     /* Create BSD TCP Socket */
68     sock_tcp_1 = socket( PF_INET, SOCK_STREAM, IPPROTO_TCP);
69     if (sock_tcp_1 == -1)
70     {
71         printf("\nError: BSD TCP Client socket create \n");
72         return;
73     }
74
75     printf("\nBSD TCP Client socket created %lu \n", sock_tcp_1);
76     /* Fill destination port and IP address */
77     echoServPort = 12;
78     memset(&echoServAddr, 0, sizeof(echoServAddr));
79     echoServAddr.sin_family = PF_INET;
80     echoServAddr.sin_addr.s_addr = htonl(0x01020304);
81     echoServAddr.sin_port = echoServPort;
82
83     /* Now connect this client the server */
84     status1 = connect(sock_tcp_1, (struct sockaddr *)&echoServAddr,
85                      sizeof(echoServAddr));
86
87     /* Check for error. */
88     if (status1 != OK)
89     {
90         printf("\nError: BSD TCP Client socket Connect, %d \n", sock_tcp_1);
91         status = soc_close(sock_tcp_1);
92         if (status != ERROR)

```

```

91         printf("\nConnect ERROR so BSD Client Socket Closed: %d\n",sock_tcp_1);
92     else
93         printf("\nError: BSD Client Socket close %d\n",sock_tcp_1);
94     return;
95 }

96 /* Get and print source and destination information */
97 printf("\nBSD TCP Client socket: %d connected \n", sock_tcp_1);
98
99 status = getsockname(sock_tcp_1, (struct sockaddr *)&localAddr, &length);
100 printf("Client port = %lu , Client = %lu,", localAddr.sin_port,
        localAddr.sin_addr.s_addr);

101 status = getpeername( sock_tcp_1, (struct sockaddr *) &remoteAddr, &length1);
102 printf("Remote port = %lu, Remote IP = %lu \n", remoteAddr.sin_port,
        remoteAddr.sin_addr.s_addr);

103
104 send_counter = 1;
105
106 /* Now receive the echoed packet from the server */
107 while(1)
108 {
109     tx_thread_sleep(2);
110
111     printf("\nClient sock: %d Sending packet No: %d to
        server\n",sock_tcp_1,send_counter);

112     status = send(sock_tcp_1,msg0, ( strlen(msg0)+1), 0);
113     if (status == ERROR)
114         printf("Error: BSD Client Socket send %d\n",sock_tcp_1);
115     else
116     {
117         printf("\nMessage sent: %s\n",msg0);
118         send_counter++;
119     }
120
121     status = recv(sock_tcp_1, (VOID *)rcvBuffer1, 31,0);
122     if (status == 0)
123         break;
124
125     rcvBuffer1[status] = 0;
126
127     if (status != ERROR)
128         printf("\nBSD Client Socket: %d received %lu bytes: %s ",
            sock_tcp_1,strlen(rcvBuffer1),rcvBuffer1);
129     else
130         printf("\nError: BSD Client Socket receive %d \n",sock_tcp_1);
131
132 }
133
134 /* close this client socket */
135 status = soc_close(sock_tcp_1);
136 if (status != ERROR)
137     printf("\nBSD Client Socket Closed %d\n",sock_tcp_1);
138 else
139     printf("\nError: BSD Client Socket close %d \n",sock_tcp_1);
140
141 /* End */
142 }
143
144
145
146 void tcpServer(void)
147 {
148
149     INT          status,status1,sock,sock_tcp_2,i;
150     struct        sockaddr_in echoServAddr;          /* Echo server address */
151     struct        sockaddr_in ClientAddr;
152
153     INT          Clientlen;
154     UINT          echoServPort;                    /* Echo Server Port */
155
156     INT          maxfd;
157
158     /* Create BSD TCP Server Socket */
159     sock_tcp_2 = socket( PF_INET, SOCK_STREAM, IPPROTO_TCP);
160     if (sock_tcp_2 == -1)
161     {
162         printf("Error: BSD TCP Server socket create\n");
163         return;
164     }

```

```

165     else
166         printf("BSD TCP Server socket created \n");
167
168     /* Now fill server side information */
169     echoServPort = 12;
170     memset(&echoServAddr, 0, sizeof(echoServAddr));
171     echoServAddr.sin_family = PF_INET;
172     echoServAddr.sin_addr.s_addr = htonl(0x01020304);
173     echoServAddr.sin_port = echoServPort;
174
175     /* Bind this server socket */
176     status = bind(sock_tcp_2, (struct sockaddr *) &echoServAddr,
177                  sizeof(echoServAddr));
178     if (status < 0)
179     {
180         printf("Error: BSD TCP Server Socket Bind \n");
181         return;
182     }
183     else
184         printf("BSD TCP Server Socket bound \n");
185
186     FD_ZERO(&master_list);
187     FD_ZERO(&read_ready);
188     FD_SET(sock_tcp_2, &master_list);
189     maxfd = sock_tcp_2;
190
191     /* Now listen for any client connections for this server socket */
192     status = listen(sock_tcp_2, 5);
193     if (status < 0)
194     {
195         printf("Error: BSD TCP Server Socket Listen\n");
196         return;
197     }
198     else
199         printf("BSD TCP Server Socket Listen complete, ");
200
201     /* All set to accept client connections */
202     printf("Now accepting client connections\n");
203
204     /* Loop to create and establish server connections. */
205     while(1)
206     {
207         read_ready = master_list;
208         tx_thread_sleep(2); /* Allow some time to other threads too */
209         status = select(maxfd+1, &read_ready, 0, 0, 0);
210         if (status == ERROR)
211         {
212             continue;
213         }
214
215         status = FD_ISSET(sock_tcp_2, &read_ready);
216         if(status)
217         {
218             sock = accept(sock_tcp_2, (struct sockaddr*)&ClientAddr, &Clientlen);
219
220             /* Add this new connection to our master list */
221             FD_SET(sock, &master_list);
222             if ( sock > maxfd)
223             {
224                 maxfd = sock;
225             }
226
227             continue;
228         }
229         for (i = 0; i < (maxfd+1); i++)
230         {
231             if ((i != sock_tcp_2) && (FD_ISSET(i, &master_list)) &&
232                 (FD_ISSET(i, &read_ready)))
233             {
234                 status1 = HandleClient(i);
235                 if (status1 == 0)
236                 {
237                     status1 = soc_close(i);
238                     if (status1 == OK)
239                     {
240                         FD_CLR(i, &master_list);
241                         printf("\nBSD Server Socket:%d closed\n", i);
242                     }
243                     else
244                         printf("\nError:BSD Server Socket:%d close\n", i);

```

```

244         }
245     }
246 }
247 }
248
249     /* Loop back to check any next client connection */
250 } /* while(1) ends */
251 }
252
253 CHAR
254     rcvBuffer[128];
255
256 INT
257     HandleClient(INT sock)
258 {
259     INT
260         status;
261
262     status = recv(sock, (VOID *)rcvBuffer, 128,0);
263     if (status == ERROR )
264     {
265         printf("\n BSD Server Socket:%d receive \n",sock);
266         return(ERROR);
267     }
268
269     /* a zero return from a recv() call indicates client is terminated! */
270     if (status == 0)
271     {
272         /* Done with this client , close this secondary server socket */
273         return(status);
274     }
275
276     /* print data received from the client */
277     printf("\nBSD Server Socket:%d received %lu bytes: %s \n", sock,
278         strlen(rcvBuffer),rcvBuffer);
279
280     /* And echo the same data to the client */
281     status = send(sock,rcvBuffer, ( strlen(rcvBuffer)+1), 0);
282     if (status == ERROR )
283     {
284         printf("\nError: BSD Server Socket:%d send \n",sock);
285         return(ERROR);
286     }
287     return(status);
288 }
289
290 /* Define what the initial system looks like. */
291
292 void
293     tx_application_define(void *first_unused_memory)
294 {
295     CHAR
296         *pointer;
297     UINT
298         status;
299
300     /* Setup the working pointer. */
301     pointer = (CHAR *) first_unused_memory;
302
303     /* Create a client thread. */
304     tx_thread_create(&thread_0, "Client1", thread_0_entry, 0,
305         pointer, DEMO_STACK_SIZE, 2, 2, TX_NO_TIME_SLICE, TX_AUTO_START);
306
307     pointer = pointer + DEMO_STACK_SIZE;
308
309     /* Create a server thread. */
310     tx_thread_create(&thread_1, "Server", thread_1_entry, 0,
311         pointer, DEMO_STACK_SIZE,1,1, TX_NO_TIME_SLICE, TX_AUTO_START);
312
313     pointer = pointer + DEMO_STACK_SIZE;
314
315     /* Initialize the NetX system. */
316     nx_system_initialize();
317
318     /* Create a BSD packet pool. */
319     status = nx_packet_pool_create(&bsd_pool,"NetX BSD Packet Pool", 128,
320         pointer, 16384);
321
322     pointer = pointer + 16384;
323     if (status)
324     {
325         error_counter++;
326     }

```

```

323     printf("Error in creating BSD packet pool\n!");
324 }
325
326 /* Create an IP instance for BSD. */
327 status = nx_ip_create(&bsd_ip, "NetX IP Instance 2", IP_ADDRESS(1, 2, 3, 4),
                      0xFFFFFFFFUL, &bsd_pool, _nx_ram_network_driver,
                      pointer, 2048, 1);
328
329 pointer = pointer + 2048;
330
331 if (status)
332 {
333     error_counter++;
334     printf("Error creating BSD IP instance\n!");
335 }
336
337 /* Enable ARP and supply ARP cache memory for BSD IP Instance */
338 status = nx_arp_enable(&bsd_ip, (void *) pointer, 1024);
339 pointer = pointer + 1024;
340
341 /* Check ARP enable status. */
342 if (status)
343 {
344     error_counter++;
345     printf("Error in Enable ARP and supply ARP cache memory to BSD IP
346           instance\n");
347 }
348
349 /* Enable TCP processing for BSD IP instances. */
350 status = nx_tcp_enable(&bsd_ip);
351
352 /* Check TCP enable status. */
353 if (status)
354 {
355     error_counter++;
356     printf("Error in Enable TCP \n");
357 }
358
359 /* Now initialize BSD Socket wrapper */
360 status = bsd_initialize(&bsd_ip, &bsd_pool, pointer, 2048, 1);
361 }
362
363
364 /* Define the test threads. */
365
366 void thread_0_entry(ULONG thread_input)
367 {
368
369     CHAR *msg0 = "Client 1:
370                 "ABCDEFGHIIJKLMNOPQRSTUVWXYZ<>ABCDEFGHIJKLMNOPQRSTUVWXYZ<> \
371                 "ABCDEFGHIJKLMNOPQRSTUVWXYZ<>END";
372
373     /* Wait till Server side is all set */
374     tx_thread_sleep(2);
375     while (1)
376     {
377         tcpClient(msg0);
378         tx_thread_sleep(1);
379     }
380 }
381
382 /* Define the server thread entry function. */
383 void thread_1_entry(ULONG thread_input)
384 {
385     UINT status;
386     ULONG actual_status;
387
388     /* Ensure the IP instance has been initialized. */
389     status = nx_ip_status_check(&bsd_ip, NX_IP_INITIALIZE_DONE, &actual_status,
390                                100);
389
390     /* Check status... */
391     if (status != NX_SUCCESS)
392     {
393         error_counter++;
394         return;
395     }
396     /* Start a TCP Server */
397     tcpServer();

```

398 }
399

Chapter 3

NetX BSD Services

This chapter contains a description of all NetX BSD basic services listed below in alphabetic order.

```

INT  accept(INT sockID, struct sockaddr *ClientAddress, INT *addressLength);

INT  bind (INT sockID, struct sockaddr *localAddress, INT addressLength);

INT  bsd_initialize(NX_IP *default_ip, NX_PACKET_POOL *default_pool, CHAR
                  *bsd_thread_stack_area, ULONG bsd_thread_stack_size,
                  UINT bsd_thread_priority);

INT  connect(INT sockID, struct sockaddr *remoteAddress, INT addressLength);

INT  getpeername( INT sockID, struct sockaddr *remoteAddress, INT *addressLength);

INT  getsockname( INT sockID, struct sockaddr *localAddress, INT *addressLength);

INT  ioctl(INT sockID, INT command, INT *result);

in_addr_t inet_addr(const_CHAR *buffer);

INT  inet_aton(const CHAR *cp_arg, struct in_addr *addr);

CHAR inet_ntoa(struct in_addr address_to_convert);

const CHAR *inet_ntop(INT af, const VOID *src, CHAR *dst, socklen_t size);

INT  inet_pton(INT af, const CHAR *src, VOID *dst);

INT  listen(INT sockID, INT backlog);

INT  recvfrom(INT sockID, CHAR *buffer, INT buffersize, INT flags,
              struct sockaddr *fromAddr, INT *fromAddrLen);

INT  recv(INT sockID, VOID *rcvBuffer, INT bufferLength, INT flags);

INT  sendto(INT sockID, CHAR *msg, INT msgLength, INT flags,
            struct sockaddr *destAddr, INT destAddrLen);

INT  send(INT sockID, const CHAR *msg, INT msgLength, INT flags);

INT  select(INT nfds, fd_set *readfds, fd_set *writefds, fd_set *exceptfds,
            struct timeval *timeout);

INT  soc_close ( INT sockID);

```

```

INT  socket( INT protocolFamily, INT type, INT protocol);

INT  fcntl( INT sock_ID, UINT flag_type, UINT f_options);

INT  getsockopt( INT sockID, INT option_level, INT option_name, VOID *option_value,
                 INT *option_length);

INT  setsockopt( INT sockID, INT option_level, INT option_name,
                 const VOID *option_value, INT option_length);

INT  getaddrinfo( const CHAR *node, const CHAR *service, const struct addrinfo *hints,
                  struct addrinfo **res);

VOID freeaddrinfo( struct addrinfo *res);

INT  getnameinfo( const struct sockaddr *sa, socklen_t salen, char *host,
                  size_t hostlen, char *serv, size_t servlen, int flags);

VOID nx_bsd_set_service_list( struct NX_BSD_SERVICE_LIST *serv_list_ptr,
                              ULONG serv_list_len);

VOID FD_SET( INT fd, fd_set *fdset);

VOID FD_CLR( INT fd, fd_set *fdset);

INT  FD_ISSET( INT fd, fd_set *fdset);

VOID FD_ZERO ( fd_set *fdset);

```

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Renesas Electronics Corporation

TOYOSU FORESIA, 3-2-24 Toyosu, Koto-ku, Tokyo 135-0061, Japan

Renesas Electronics America Inc.

1001 Murphy Ranch Road, Milpitas, CA 95035, U.S.A.

Tel: +1-408-432-8888, Fax: +1-408-434-5351

Renesas Electronics Canada Limited

9251 Yonge Street, Suite 8309 Richmond Hill, Ontario Canada L4C 9T3

Tel: +1-905-237-2004

Renesas Electronics Europe Limited

Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K

Tel: +44-1628-651-700

Renesas Electronics Europe GmbH

Arcadiastrasse 10, 40472 Düsseldorf, Germany

Tel: +49-211-6503-0, Fax: +49-211-6503-1327

Renesas Electronics (China) Co., Ltd.

Room 1709 Quantum Plaza, No.27 ZhichunLu, Haidian District, Beijing, 100191 P. R. China

Tel: +86-10-8235-1155, Fax: +86-10-8235-7679

Renesas Electronics (Shanghai) Co., Ltd.

Unit 301, Tower A, Central Towers, 555 Langao Road, Putuo District, Shanghai, 200333 P. R. China

Tel: +86-21-2226-0888, Fax: +86-21-2226-0999

Renesas Electronics Hong Kong Limited

Unit 1601-1611, 16/F., Tower 2, Grand Century Place, 193 Prince Edward Road West, Mongkok, Kowloon, Hong Kong

Tel: +852-2265-6688, Fax: +852 2886-9022

Renesas Electronics Taiwan Co., Ltd.

13F, No. 363, Fu Shing North Road, Taipei 10543, Taiwan

Tel: +886-2-8175-9600, Fax: +886 2-8175-9670

Renesas Electronics Singapore Pte. Ltd.

80 Bendemeer Road, Unit #06-02 Hyflux Innovation Centre, Singapore 339949

Tel: +65-6213-0200, Fax: +65-6213-0300

Renesas Electronics Malaysia Sdn.Bhd.

Unit 1207, Block B, Menara Amcorp, Amcorp Trade Centre, No. 18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia

Tel: +60-3-7955-9390, Fax: +60-3-7955-9510

Renesas Electronics India Pvt. Ltd.

No.777C, 100 Feet Road, HAL 2nd Stage, Indiranagar, Bangalore 560 038, India

Tel: +91-80-67208700, Fax: +91-80-67208777

Renesas Electronics Korea Co., Ltd.

17F, KAMCO Yangjae Tower, 262, Gangnam-daero, Gangnam-gu, Seoul, 06265 Korea

Tel: +82-2-558-3737, Fax: +82-2-558-5338

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