OS-9® Network Programming Reference

Version 4.2

www.radisys.com

Revision A • April 2003

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April 2003

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1 OS-9® Networking Structure

This chapter describes the OS-9® networking structures.

Internet Data Module Structures

`netdb.h` and `resolve.h` are header files that store information about Internet data module activities. The structures included in each of these header files are listed and described in the following table.

Table 1-1. netdb.h and resolve.h Structures and Descriptions

Structure	Description
`hostent`	`Retrieve/Add/Remove Host Entry`.
`n_ifaliasreq`	`Add/Remove Interface Address Structure`.
`n_ifaliasreq6`	`Add/Remove IPV6 Interface Address Structure`.
`n_ifnet`	`Add Interface Structure`.
`netent`	`Retrieve/Add/Remove Network Entry`.
`protoent`	`Retrieve/Add/Remove Protocol Entry`.
`resolvent`	`Retrieve/Add/Remove DNS Client Entry`.
`rtreq`	`Add/Remove Route Structure`.
`rtreq6`	`Add/Remove Route Structure`.
`servent`	`Retrieve/Add/Remove Services Entry`.

hostent
Retrieve/Add/Remove Host Entry

Declaration

The `hostent` structure is declared in the file `netdb.h` as follows:

```
struct   hostent
{
    char              *h_name;
    char              **h_aliases;
    int               h_addrtype;
    int               h_length;
    char              **h_addr_list;
#define h_addr        h_addr_list[0]
}
```

Description

Returns and sets host entries in the Internet data module. This structure is used by the following functions:

`gethostbyaddr()`

`gethostbyname()`

`puthostent()`

`gethostent()`

Fields

`h_name`
: is a pointer to the official name of the host.

`h_aliases`
: points to a null-terminated array of pointers, which point to alternate names for the host.

`h_addrtype`
: is the type of address (`AF_INET` only) returned.

`h_length`
: is the address length in bytes.

`h_addr`
: is a pointer to the network address for the host. Host addresses are returned in network-byte order.

`h_addr_list`
: is a list of addresses from name server.

hostconfent
Return and Set Host Entries

Declaration

The `hostconfent` structure is declared in the file `netdb.h` as follows:

```
struct hostconfent {
 char *key;
 char *value;
};
```

Description

The `hostconfent` structure returns and sets host entries in the Internet data module. This structure is used by the following functions:

`delhostconfent()`

`endhostconfent()`

`gethostconfent()`

`puthostconfent()`

Fields

`h_key`
: is a pointer to the key string.

`h_value`
: is a pointer to value of the host.

n_ifaliasreq
Add/Remove Interface Address Structure

Declaration

The `n_ifaliasreq` is defined in `netdb.h` as follows:

```
struct n_ifaliasreq
{
   char                          ifra_name[16];
   struct sockaddr               ifra_addr;
   struct sockaddr               ifra_broadaddr;
   #define ifra_broadaddr       ifra_dstaddr
   struct sockaddr               ifra_mask;
} n_ifaliasreq;
```

Description

`n_ifaliasreq` is the interface structure for adding an interface. This structure is used in the function `putintent()`.

Fields

`ifra_name`
: is the interface name.

`ifra_addr`
: is the IP address.

`ifra_broadaddr`
: is the broadcast address or destination address.

`ifra_mask`
: is the subnet mask.

n_ifaliasreq6
Add/Remove IPV6 Interface Address Structure

Declaration

The `n_ifaliasreq6` is defined in `netdb.h` as follows:

```
struct n_ifaliasreq6
{
   char                          ifra_name[16];
   struct sockaddr_int6          ifra_addr;
   struct sockaddr_int6          ifra_dstaddr;
   struct sockaddr_int6          ifra_mask;
} n_ifaliasreq6;
```

Description

`n_ifaliasreq6` is the interface structure for adding an Internet Protocol version 6 (IPv6) interface. This structure is used in the function `putintent6()`.

Fields

`ifra_name`
: is the IPv6 Interface name.

`ifra_addr`
: is the IPv6 address.

`ifra_broadaddr`
: is the IPv6 Broadcast address or destination address.

`ifra_mask`
: is the IPv6 subnet mask.

n_ifnet
Add Interface Structure

Declaration

The n_ifnet structure is defined in netdb.h as follows:

```
struct n_ifnet {
   char             if_name[16];
   char             if_stack_name[30];
   short            if_flags;
   struct n_if_data {
                    u_long ifi_type;
                    u_long ifi_addrlen;
                    u_long ifi_mtu;
                    u_long ifi_metric;
   } if_data;
   u_long           mw_flags;
} n_ifnet;
```

Description

The n_ifnet structure adds interface structures to the Internet data module.

Fields

if_name
: is the interface name.

if_stack_name
: is the binding device path.

if_flags
: is the interface state:

  Refer to MWOS/SRC/DEFS/SPF/BSD/net/if.h for possible values.

ifi_type
: is the type of interface (not used, set to zero).

ifi_addrlen
: is the hardware address length (not used; set to zero).

ifi_mtu
: is the maximum transfer unit.

  This is the largest piece of data handled by interface.

`ifi_metric`
: is the weighted routing metric.

  This is typically zero.

`mw_flags`
: is a Microware-defined interface flag.

  This is typically set to zero.

See Also

`putintent()`

netent
Retrieve/Add/Remove Network Entry

Declaration

The netent structure is declared in the file netdb.h as follows:

```
struct netent {
    char      *n_name;
    char      **n_aliases;
    int       n_addrtype;
    long      n_net;
};
```

Description

The netent structure obtains network entries in the Internet date module.

Fields

n_name
: is a pointer to the official name of the network.

n_aliases
: points to a null-terminated list of pointers, which points to alternate names for the network.

n_addrtype
: is the type of the network number (AF_INET only) returned.

n_net
: is the network number.

  Network numbers are returned in host-byte order.

See Also

getnetbyaddr()

getnetbyname()

getnetent()

protoent
Retrieve/Add/Remove Protocol Entry

Declaration

The `protoent` structure is declared in the file `netdb.h` as follows:

```
struct protoent {
   char      *p_name;
   char      **p_aliases;
   int       p_proto;
};
```

Description

The `protoent` structure obtains protocol information in the Internet data module.

Fields

`p_name`
: is a pointer to the official name of the protocol.

`p_aliases`
: points to a null-terminated list of pointers, which points to alternate names for the protocol.

`p_proto`
: is the protocol number in host-byte order.

See Also

`getprotobyname()`

`getprotobynumber()`

`getprotoent()`

resolvent
Retrieve/Add/Remove DNS Client Entry

Declaration

The `resolvent` structure is declared in the file `resolv.h` as follows:

```
struct resolvent {
    char      *domain;
    char      *nameservers [MAXNS+1];
    char      *search [MAXDNSRCH+1]
}
```

Description

The `resolvent` structure is used for updating and obtaining DNS client resolving information in the Internet data module.

Fields

`domain`
: is a pointer to the local domain name.

`nameservers`
: is an ordered list of `nameservers` (in dot notation).

`search`
: is a search list for host-name lookup.

See Also

`getresolvent()`

`putresolvent()`

rtreq
Add/Remove Route Structure

Declaration

The `rtreq` structure is declared in `netdb.h` as follows:

```
struct rtreq {
   int                  req;
   int                  flags;
   struct sockaddr      dst;
   struct sockaddr      gateway;
   struct sockaddr      netmask;
};
```

Description

The `rtreq` structure updates and obtains routing information in the Internet data module.

Fields

`req`
: is a request type (`RTM_ADD`).

`flags`
: is the type of route.

  `RTF_HOST` for a host route.

`dst`
: is the destination address.

`gateway`
: is the gateway address.

`netmask`
: is the network mask address.

See the file `MWOS/SRC/DEFS/SPF/BSD/net/route.h` for additional `req` and `flags` settings.

See Also

`putroutent()`

`delroutent()`

rtreq6
Add/Remove Route Structure

Declaration

The `rtreq` structure is declared in `netdb.h` as follows:

```
struct rtreq {
  int                       req;
  int                       flags;
  struct sockaddr_in6       dst;
  struct sockaddr_in6       gateway;
  struct sockaddr_in6       netmask;
};
```

Description

The `rtreq6` structure updates and obtains IPv6 routing information in the Internet data module.

Fields

`req`
: is the request type (`RTM_ADD`).

`flags`
: is the type of route.

  `RTF_HOST` for a host route.

`dst`
: is the IPv6 destination address.

`gateway`
: is the IPv6 gateway address.

`netmask`
: is the IPv6 network mask address.

Refer to the file `MWOS/SRC/DEFS/SPF/BSD/net/route.h` for additional `req` and `flags` settings.

See Also

`putroutent6()`

`delroutent()`

servent
Retrieve/Add/Remove Services Entry

Declaration

The `servent` structure is declared in the file `netdb.h` as follows:

```
struct servent {
char      *s_name;
char      **s_aliases;
int       s_port;
char      *s_proto;
};
```

Description

The `servent` structure obtains service information from the Internet data module.

Fields

`s_name`
: is a pointer to the official name of the service.

`s_aliases`
: points to a null-terminated list of pointers, which points to alternate names for the service.

`s_port`
: is the port number at which the service resides.

  Port numbers are returned in network-byte order.

`s_proto`
: is a pointer to the name of the protocol to use when contacting the service.

See Also

`getservbyport()`

`getservbyname()`

`getservent()`

Point-to-Point Protocol Structures

There are five important structures that allow interaction between the calling application and the PPP stack. These structures are defined in the `ppplib.h` header file and are also listed below.

In all structures (except `auth_handle`), there are fields reserved for future use. It is important for the application to "zero" out all of these fields to ensure compatibility with future versions of drivers and this API. There are two methods to accomplish this: set the structure equal to zero or use the `memset()` function. The methods are described as follows:

```
ppp_option_block     pppopts = {0};
```

or

```
ppp_option_block     pppopts;
memset(&pppopts, 0, sizeof(pppopts));
```

Table 1-2 lists and describes the `ppplib.h` structures.

Table 1-2. ppplib.h Structures and Descriptions

Structure	Description
`auth_handle`	`Allocated by Authentication Database Functions.`
`ppp_conninfo`	`Record PPP Connection Error Information`
`ppp_error`	`Store Error Information`
`ppp_hdlc_stats`	`Allow HDLC Driver to Return Current Receive and Transmit Statics.`
`ppp_modem_p`	`Get and Set Asynchronous Parameter or PPP Link`
`ppp_option_block`	`Obtain or Change Desired PPP Negotiation Options`
`ppp_param_block`	`Obtain Stack Parameters.`

auth_handle
Allocated by Authentication Database Functions

Declaration

```
typedef struct _auth_handle
{
     mh_data     *mod_hdr;
     Auth_data   data;
}
auth_handle,*Auth_handle;
```

Description

The `auth_handle` structure is used by the authentication database functions. Applications do not have to interpret the internal portions of this structure (`mod_hdr`, `data`). However, they need to allocate `auth_handle` and pass a pointer to the authentication functions that fill out and manage the structure.

ppp_conninfo
Record PPP Connection Error Information

Declaration

```
struct _ppp_conninfo{
     signal_code     sig_lcp_up;
     signal_code     sig_lcp_down;
     signal_code     sig_ipcp_up;
     signal_code     sig_ipcp_down;

     u_int32         flags;
     error_code      last_err;
     u_int32         max_errors;
     ppp_error       error_array;

     signal_code     sig_lcp_finish;
     signal_code     sig_ipcp_finish;
     u_int32         rsvd[4];
}
Ppp_conninfo, *Ppp_conninfo;
```

Description

The `ppp_conninfo` structure is allocated by the calling application and must be retained for the life of a PPP link. The `ppp_conninfo` area is where the PPP stack records error information regarding the PPP connection. Detailed error information is recorded in the `error_array`, which is a separately allocated array of `ppp_error` structures.

The following source code illustrates how to allocate a `ppp_conninfo` structure and details an error array that can hold `MAX_ERRORS` entries (error detection not shown):

```
ppp_conninfo ci = {0};
u_int32 size;
ci.max_errors = MAX_ERRORS;
size = sizeof(ppp_error) * MAX_ERRORS;
ci.error_array = malloc(size);
memset(ci.error_array, 0, size);
```

ppp_error
Store Error Information

Declaration

```
typedef struct _ppp_error {
   u_int32                layer;
     union {
            struct {
                 error_code  err;
                 u_int32     line;
                 u_int32     abort_line;
            } chat;

            struct {
                 u_int32     option;
                 u_int32     my_request;
                 u_int32     his_request;
   } lncp;
     } err_info;
} ppp_error, *Ppp_error;
```

Layer values may be PPP_LAYER_IPCP, PPP_LAYER_LCP, PPP_LAYER_HDLC, or PPP_LAYER_CHAT.

Description

When a significant error occurs within the PPP stack and an application has provided an error reporting array, information about the error will be stored in the first empty ppp_error slot. An empty slot is defined by the “layer” field having a value of 0.

The manner in which the information within the ppp_error structure is decoded depends on which layer recorded the error. For CHAT errors, the OS-9 error value is saved along with the offending CHAT line number. If an abort string has caused the CHAT script to terminate, the line number within the script, in which the abort string was defined, is also recorded. For LCP and IPCP layers, the desired option number, local request, and remote request are all recorded.

ppp_hdlc_stats

Allow HDLC Driver to Return Current Receive and Transmit Statics

Declaration

```
typedef struct _ppp_hdlc_stats{
       /*Receive Statistics */
       u_int32  rx_bytes;
       u_int32  rx_frames;
       u_int32  rx_frames_compressed;
       u_int32  rx_frames_dropped;
       u_int32  rx_frames_overrun;
       u_int32  rx_errors;
       u_int32  rx_fcs_errors;

      /*Transmit statistics */
      u_int32     tx_bytes;
      u_int32     tx_frames;
      u_int32     tx_frames_compressed;
      u_int32     tx_frames_dropped;
      u_int32     tx_frames_overrun;
      u_int32     tx_errors;

      u_int32     rsvd[3];
} ppp_hdlc_stats, *Ppp_hdlc_stats;
```

Description

The `ppp_hdlc_stats` structure is allocated by the calling application and referred to in the `ppp_get_statistics()` function. This structure allows the HDLC driver to return the current receive and transmit statics to the calling application.

For both the receive and transmit, the total number of bytes (bytes on the wire, including all HDLC framing bytes), errors (includes internal OS-9/SPF errors), and frames, including the Van-Jacobson compressed frames, dropped frames, and overrun frames (frames exceeding MTU/MRU) are part of this structure. For receive, there is also a field that tabulates the total number of frames having an invalid FCS (Frame Check Sequence); this is similar to a CRC check.

ppp_modem_p
Get and Set Asynchronous Parameter or PPP Link

Declaration

```
typedef struct ppp_modem_p{
     char      rx_dev_name[MAX_NAME_LEN];
     char      tx_dev_name[MAX_NAME_LEN];
     u_int8    baud_rate;
     u_int8    parity;
     u_int8    word_size;
     u_int8    stop_bits;
     u_int8    rts_enable;
     u_int32   rx_bufsize;
     u_int32   tx_bufsize;
} ppp_modem_p, *Ppp_modem_p;
```

Description

This structure is defined in ppp.h. It is used by the PPP function to get and set the asynchronous parameter or a PPP link, such as baud rate.

ppp_option_block

Obtain or Change Desired PPP Negotiation Options

Declaration

```
typedef struct _ppp_option_block{
     /*Generic Stack Settings */
       u_int32     ppp_mode;

       /*IPCP-Specific Stack Options */
     u_int32     ipcp_timeout;
     u_int32     ipcp_max_configure;
     u_int32     ipcp_max_terminate;
     u_int32     ipcp_max_failure;
     struct      pppopt_ui32     ipcp_accept_local;
     struct      pppopt_ui32     ipcp_accept_remote;
     struct      pppopt_ui32     tx_ip_cproto;
     struct      pppopt_ui32     tx_ip_cproto;
     struct      pppopt_ui32     rx_ipcp_cslot;
     struct      pppopt_ui32     rx_ipcp_mslot;

       /*LCP-Specific Stack Options */
     u_int32     lcp_timeout;
     u_int32     lcp_max_configure;
     u_int32     lcp_max_terminate;
     u_int32     lcp_max_failure;
     struct      pppopt_ui32     rx_accm;
     struct      pppopt_ui32_8 tx_accm;
     struct      pppopt_ui32     rx_acfc;
     struct      pppopt_ui32     rx_pfc;
     struct      pppopt_ui32     rx_mru;
     struct      pppopt_ui32     tx_mru;
     struct      pppopt_ui32     auth_challenge;
     u_int32      ipcp_default_route;

     u_int32     rsvd[5];
} ppp_option_block, *Ppp_option_block;
```

Description

This structure is used to obtain or change the desired PPP negotiation options via the `ppp_get_options()` and `ppp_set_options()` functions, respectively. Many of these options are specified using a `pppopt_ui32` structure, which looks similar to the following code:

```
struct pppopt_ui32
{
     u_int32   priority;/* DEFAULT, DESIRED, or REQUIRED */
     u_int32   value;
};
```

The `tx_accm` must have a size of 256-bits; therefore, it uses the following structure:

```
struct pppopt_ui32_8
{
u_int32     priority;
u_int32     value[8];
};
```

These structures do not allow individual PPP options to be negotiated (DEFAULT), requested (DESIRED), or forced (REQUIRED), which causes a failure if the option cannot be negotiated. Priority levels are currently not supported and all stack options are treated as DESIRED. The “value” field depends on the option specified.

Most of these options are specified within the LCP and IPCP descriptors. The descriptor values will be used by default unless altered by a `ppp_set_options()` call.

ppp_param_block
Obtain Stack Parameters

Declaration

```
typedef struct _ppp_param_block
{
     /*Generic stack parameters*/
     u_int32     ppp_mode;

     /*IPCP-specific stack parameters*/
     u_int32     rx_ip_cproto;
     u_int32     tx_ip_cproto;
     u_int32     rx_ipcp_cslot;
     u_int32     tx_ipcp_cslot;
     u_int32     rx_ipcp_mslot;
     u_int32     tx_ipcp_mslot;

     /*LCP-specific stack parameters*/
     u_int32     rx_accm;
     u_int32     tx_accm[8];
     u_int32     rx_acfc;
     u_int32     tx_acfc;
     u_int32     rx_pfc;
     u_int32     tx_pfc;
     u_int32     rx_mru;
     u_int32     tx_mru;
     u_int32     local_magic;
     u_int32     remote_magic;

     /*I/O enabled flags*/
     u_char     hdlc_io_enabled;
     u_char     lcp_io_enabled;
     u_char     ipcp_io_enabled;

     u_char     rsvd1;
     u_int32     rsvd2[3];
} ppp_param_block, *Ppp_param_block;
```

Description

The `ppp_param_block` structure is allocated by the calling application and used to obtain the stack parameters after LCP and IPCP negotiation has completed (both LCP and IPCP are I/O-enabled). Both transmit and receive parameters are returned at the same time.

Refer to the parameter descriptions for the `ppp_option_block` for more information on what each parameter represents.

The `local_magic` and `remote_magic` parameters are the negotiated "magic numbers" for the PPP link.

For more information on these parameters, refer to the *Request for Comment (RFC) 1661*.

RPC/XDR Programming Structures

The main "include" file for all RPC files is `rpc.h`. It can be found in the following directory:

`MWOS/SRC/DEFS/SPF/RPC`

This header file includes the following RPC include files:

`RPC/xdr.h`

`RPC/auth.h`

`RPC/clnt.h`

`RPC/svc.h`

`RPC/pmap_clnt.h`

`RPC/rpc_msg.h`

`RPC/auth_unix.h`

`RPC/svc_auth.h`

auth.h

The main structure in `RPC/auth.h` is shown below:

```
/*
* Auth handle, interface to client side authenticators.
*/
typedef struct {
        struct  opaque_auth     ah_cred;
        struct  opaque_auth     ah_verf;
        struct auth_ops {
                void   (*ah_nextverf)();
            int    (*ah_marshal)();        /* nextverf & serialize */
            int    (*ah_validate)();       /* validate varifier */
            int    (*ah_refresh)();        /* refresh credentials */
            void   (*ah_destroy)();        /* destroy this structure */
      } *ah_ops;
      caddr_t ah_private;
} AUTH;
```

clnt.h

The main structure in RPC/clnt.h is shown below:

```
/* Client rpc handle. Created by individual implementations, see e.g.
rpc_udp.c. Client is responsible for initializing auth, see e.g.
auth_none.c. */

typedef struct {
     AUTH    *cl_auth;                  /* authenticator */
     struct clnt_ops {
        enum clnt_stat   (*cl_call)();      /* call remote procedure */
        void             (*cl_abort)();     /* abort a call */
        void             (*cl_geterr)();    /* get specific error code */
        bool_t           (*cl_freeres)();   /* frees results */
        void             (*cl_destroy)();   /* destroy this structure */
        bool_t           (*cl_control)();   /* the ioctl() of rpc */
     } *cl_ops;
     caddr_t            cl_private;      /* private stuff */
} CLIENT;
```

svc.h

The main structure RPC/svc.h is shown below:

```
* Server side transport handle */

typedef struct {
   int                 xp_sock;
   u_short             xp_port;         /* associated port number */
   struct xp_ops {
     bool_t            (*xp_recv)();    /* receive incoming requests */
     enum xprt_stat    (*xp_stat)();    /* get transport status */
     bool_t            (*xp_getargs)(); /* get arguments */
     bool_t            (*xp_reply)();   /* send reply */
     bool_t            (*xp_freeargs)();/* free mem allocated for args */
     void              (*xp_destroy)(); /* destroy this struct */
   } *xp_ops;
   int                 xp_addrlen;      /* length of remote address */
   struct sockaddr_in  xp_raddr;        /* remote address */
   struct opaque_auth  xp_verf;         /* raw response verifier */
   caddr_t             xp_p1;           /* private */
   caddr_t             xp_p2;           /* private */
} SVCXPRT;
```

xdr.h

The main structure in RPC/xdr.h is shown below:

```
/*
* The XDR handle.
* Contains operation which is being applied to the stream,
* an operations vector for the particular implementation
  (e.g. see xdr_mem.c),
* and two private fields for the use of the particular implementation.
*/
typedef struct {
   enum xdr_op     x_op;        /* operation; fast additional param */
   struct xdr_ops {
      bool_t  (*x_getlong)();   /* get a long from underlying stream */
      bool_t  (*x_putlong)();   /* put a long to " */
      bool_t  (*x_getbytes)();  /* get some bytes from " */
      bool_t  (*x_putbytes)();  /* put some bytes to " */
      u_int   (*x_getpostn)();  /* returns bytes off from beginning */
      bool_t  (*x_setpostn)();  /* lets you reposition the stream */
      long *  (*x_inline)();    /* buf quick ptr to buffered data */
      void    (*x_destroy)();   /* free privates of this xdr_stream */
   } *x_ops;
   caddr_t         x_public;    /* users' data */
   caddr_t         x_private;   /* pointer to private data */
   caddr_t         x_base;      /* private used for position info */
   int             x_handy;     /* extra private word */
} XDR;
```

mbuf Data Structure

The mbuf data structure is a common data structure used to store variable-length data blocks. The structure is defined below.

Declaration

The mbuf structure is declared in the `mbuf.h` header file as follows:

```
typedef struct mbuf {
                struct mbuf *m_pnext;
                struct mbuf *m_qnext;
                u_int16      m_alloc;
                u_int16      m_size;
                u_int8       m_flags;
                u_int8       m_type;
                u_int16      m_offset;
} *mbuf;
```

Fields

`m_pnext`
: chains multiple mbufs into a packet chain called a message unit.

`m_qnext`
: chains multiple packet chains into a message queue.

`m_alloc`
: indicates the total size of the memory allocated for this mbuf.

  This is set by sysmbuf and must not be altered. If you do alter this field, system crashes result.

`m_size`
: indicates the number of valid data bytes in this mbuf.

`m_flags`
: contains bit flags which may be set to give special meaning to various mbufs.

  There are currently two uses for the `m_flags` field in an mbuf:

  1. Enable protocols to implement reliable data transfer through acknowledgment timeout and retransmission by using the `SPF_NOFREE` and `SPF_DONE` bits.
  2. Enable drivers to use protocols that contain receive packets with errors without tossing the entire packet.

`m_type`
: indicates the type of mbuf.

  The main use of the `m_type` field is to allow the network I/O system to distinguish certain types of mbufs that may be on a data queue. The main types used are `MB_DATA` and `MB_ADDR`. Others are defined but not widely used.

  The `MB_DATA` type indicates the real payload that the end application wants to read. The `MB_ADDR` indicates this mbuf is not the payload, but contains address information the application may return when performing, for example, a `recvfrom()` socket call.

  Currently defined values are:

```
#define MB_NONE 0
#define MB_DATA 1
#define MB_ADDR 2
#define MB_HEADER 3
```

`m_offset`
: indicates the offset in bytes, from the beginning of the mbuf to the first valid bytes.

SPF_NOFREE/SPF_DONE

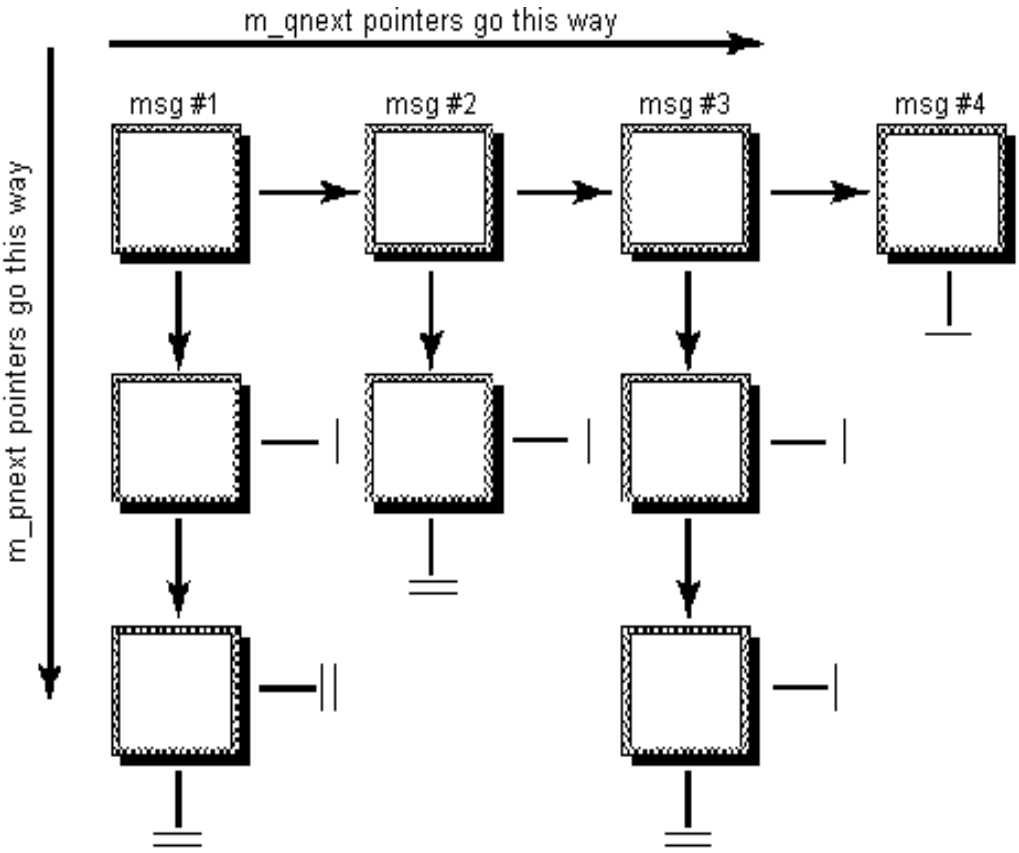
If you are writing a protocol driver that enables reliable data transfer, you typically create a module array to store the pointers to data sent down for transmission, but not yet acknowledged by the far end. However, when the driver is through transmitting the packet, it typically performs an `m_free_p()` on the transmitted mbuf. If this were allowed to happen, the mbuf in the unacknowledged array would be lost.

The mbuf library implements the `SPF_NOFREE` to indicate that the mbuf must not be returned to the free pool. When any `m_free_x()` call is done, the library checks for the `SPF_NOFREE` bit. If it is set, the library does not return the mbuf to the free pool. Instead, the library only sets the `SPF_DONE` bit to indicate that the packet has been transmitted. With this approach, hardware drivers can still call the regular `m_free()` functions and the library can take care of the `SPF_NOFREE` details.

There are special calls provided in `misc.c` that enable you to get and free what are called “nofree” mbufs. These calls internally set and clear the `SPF_NOFREE` bit for proper operation.

Example mbuf Queue Structure

Figure 1-1. Example mbuf Queue Structure



Each square in Figure 1-1 represents one mbuf structure.

The mbuf packet chain consists of the series of mbufs pointed to by the `mbuf->m_pnext` fields. In this figure, the mbuf packet chain for message #1 consists of three mbufs.

The mbuf queue consists of the series of mbuf packet chains pointed to by the `mbuf->m_qnext` fields. In this figure, the mbuf queue consists of messages one through four.

2 Function Reference

This chapter documents the OS-9 networking APIs.

Internet Network Database Functions

The following sections detail the network database functions.

netdb.l Library Functions

The Internet library (`netdb.l`) provides functions for retrieving information from the Internet data files or embedded in the `inetdb` data module and for Internet address manipulation. Each data access function links to `inetdb` and returns a structure pointing to the appropriate entry from the data files or modules.

There are two methods of linking to `inetdb`:

- Call `sethostent()`, `setnetent()`, `setservent()`, or `setprotoent()` explicitly links to `inetdb`.
- Call any of the Internet `get` functions implicitly links to `inetdb`.

To unlink a process from `inetdb`, use one of the `end` functions.

The Internet Library

LAN Communications provides two variations of the Internet library:

`netdb.l`	This library provides bindings that call the shared `netdb` trap handler for OS-9 systems and subroutines for the OS-9 module.
`netdb_dns.l`	This library contains functions for DNS client support and local hostname resolution. These functions do not call the `netdb` trap handler.

References to `netdb.l` also refer to `netdb_dns.l` in the function definitions.

`netdb.l` links to the `netdb` trap/subroutine module and executes the code in that module.

For application development, you can link with `netdb_dns.l` and create applications that do not call the `netdb` trap handler. The application size will be larger but the inlined code will execute faster. This may also remove the need for loading the `netdb` module.

To link with the `netdb.l` library, a `netdb` trap/subroutine module must be loaded prior to running the application.

`netdb_dns`	The `netdb_dns` module provides Internet database functionality. To do this, it searches the local `inetdb` data module or uses the DNS client functionality to contact a name-server if a host name cannot be resolved or found locally within the `inetdb` data module.

The different combinations of library and trap/subroutine modules are identified in the following table.

Table 2-1. Subroutine Modules

Components	Shared Code via Trap Module	DNS Client Support
`netdb.l + netdb_dns`	Yes	Yes
`netdb_dns.l`	No	Yes

The following table lists and describes the functions that compose the `netdb.l` libraries.

Table 2-2. netdb.l Library Functions and Descriptions

Function	Description
`delhostbyname()`	Delete Host Entry by Name
`delhostconfent()`	Removes Host Entry by Key
`delintbyname()`	Delete Interface Entry by Name
`delresolvent()`	Delete DNS Resolver Entry
`delroutent()`	Delete Route Entry
`delroutent6()`	Delete IPV6 Route Entry
`delservbyname()`	Delete Service Entry by Name
`endhostconfent()`	Unlink from Structure
`endhostent()`	Unlink from Network Database
`endintent()`	Unlink from Network Database
`endnetent()`	Unlink from Network Database
`endprotoent()`	Unlink from Network Database
`endresolvent()`	Unlink from Network Database
`endroutent()`	Unlink from Network Database
`endservent()`	Unlink from Network Database
`getaddrinfo()`	Map Names to Address Information
`gethostbyaddr()`	Get Network Host Entry by Address
`gethostbyname()`	Get Network Host Entry by Name
`gethostbyname2()`	Get IPV4 or IPV6 Network Host Entry by Name
`gethostconfent()`	Get Network Entry by Name
`gethostent()`	Get Network Host Entry
`getifaddrs()`	Store List of Network Interfaces
`getinetdent()`	Get Inetd Entry
`getintent()`	Get Interface Entry
`getnameinfo()`	Look up IP Address and service name
`getnetbyaddr()`	Get Network Entry by Address
`getnetbyname()`	Get Network Entry by Name
`getnetent()`	Get Network Entry
`getprotobyname()`	Get Protocol Entry
`getprotobynumber()`	Get Protocol Entry by Number

Table 2-2. netdb.l Library Functions and Descriptions (Continued)

Function	Description
getprotoent()	Get Protocol Entry
getresolvent()	Returns Pointer to DNS Structure
getservbyname()	Get Service Entry by Name
getservbyport()	Get Service Entry by Port
getservent()	Get Service Entry
htonl()	Convert 32-Bit Values from Host to Network Byte Order
htons()	Convert 16-Bit Values from Host to Network Byte Order
if_indextoname()	Map Interface Index to Interface Name
if_nameindex()	Return an Array of if_nameindex Structures
if_nametoindex()	Map Interface Name to Interface Index
inet_addr()	Convert Dot Notation into Network Address
inet_aton()	Convert Internet Address to Binary Address
inet_lnaof()	Get Local Address
inet_makeaddr()	Get Address from Network and Host Address
inet_netof()	Get Network Number
inet_network()	Interpret Network Number
inet_ntoa()	Return Address in Dot Notation
inet_ntop()	Convert network order to presentation order
inet_pton()	Convert presentation format address to network format
ntohl()	Convert 32-Bit Values from Network to Host Byte Order
ntohs()	Convert 32-Bit Values from Network to Host Byte Order
puthostconfent()	Add Host Entry
puthostent()	Add Network Host Entry
putintent()	Add Interface Entry
putintent6()	Add IPV6 Interface Entry
putnetent()	Add a network entry to inetdb
putprotoent()	Add protocol entry to inetdb
putresolvent()	Set the DNS Entry
putroutent()	Add Route Entry
putroutent6()	Add IPV6 Route Entry
putservent()	Add interface entry to inetdb
res_cancel()	Cancel DNS Client Request
sethostent()	Set Host Entry
setnetent()	Set Network Entry
setprotoent()	Set Protocol Entry
setservent()	Set Services Entry

delhostbyname()

Delete Host Entry by Name

Syntax

```
#include <netdb.h>

error_code

delhostbyname(char *name)
```

Libraries

```
netdb.l
```

Description

`delhostbyname()` removes the host pointed to by `name` from the host section of the applicable `inetdb` data module. If successful, `delhostbyname()` returns 0; otherwise it returns an error.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`ENOMEM`	Insufficient RAM (POSIX).
`EOS_PARAM`	Bad parameter.
`EOS_PERMIT`	No permission.
`EOS_PNNF`	Attempted to delete an entry that does not exist.
`EOS_TRAP`	`netdb` module not found.

delhostconfent()

Removes Host Entry by Key

Syntax

```
#include <netdb.h>

error_code

delhostconfent (char *key)
```

Libraries

```
netdb.l
```

Description

`delhostconfent()` removes the host pointed to by `key` from the `hostconfent` structure. If successful, `delhostconfent()` returns 0; otherwise it returns an error.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`EOS_PARAM`	Bad parameter.
`EOS_PNNF`	Attempted to delete an entry that does not exist.
`EOS_PERMIT`	No permission.

See Also

`hostconfent`

`endhostconfent()`

`gethostconfent()`

`puthostconfent()`

delintbyname()

Delete Interface Entry by Name

Syntax

```
#include <netdb.h>

error_code

delintbyname(char *name)
```

Libraries

```
netdb.l
```

Description

`delintbyname()` removes the interface pointed to by `name` from the interface section of the `inetdb` data module. If successful, `delintbyname()` returns 0; otherwise it returns an error.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`EOS_PARAM`	Bad parameter.
`EOS_PERMIT`	No permission.
`EOS_PNNF`	Attempted to delete an entry that does not exist.
`EOS_TRAP`	`netdb` module not found.

delresolvent()
Delete DNS Resolver Entry

Syntax

```
#include <netdb.h>

error_code

delresolvent(void)
```

Libraries

```
netdb.l
```

Description

`delresolvent()` removes the current DNS resolver entry from the appropriate `inetdb` module. If successful, `delresolvent()` returns `0`; otherwise it returns an error.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`EOS_MNF`	`netdb_dns` module not found. This error is also returned when the `netdb_local` module is loaded.
`EOS_PARAM`	Bad parameter; not linked to an `inetdb`.
`EOS_PNNF`	Attempted to delete entry that does not exist.
`EOS_TRAP`	`netdb` module not found.

See Also

`endresolvent()`

`getresolvent()`

`putresolvent()`

delroutent()
Delete Route Entry

Syntax

```
#include <netdb.h>

error_code

delroutent(const struct rtreq      *route_ptr)
```

Libraries

`netdb.l`

Description

`delroutent()` removes the route entry matching `route_ptr` from the route section of the `inetdb` data module. Both the destination and gateway must match. If successful, `delroutent()` returns 0; otherwise it returns an error.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`EOS_PARAM`	Bad parameter.
`EOS_PERMIT`	No write access.
`EOS_PNNF`	Attempted to delete an entry that does not exist.
`EOS_TRAP`	`netdb` module not found.

See Also

`putroutent()`

delroutent6()
Delete IPV6 Route Entry

Syntax

```
#include <netdb.h>

error_code

delroutent6(

     const struct rtreq6      *route_ptr)
```

Libraries

```
netdb.l
```

Description

`delroutent6()` removes the Internet Protocol version 6 (IPv6) route entry that matches `route_ptr` from the route section of the `inetdb` data module. Both the IPv6 destination and gateway must match. If successful, `delroutent()` returns 0; otherwise it returns an error.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`EOS_PARAM`	Bad parameter.
`EOS_PERMIT`	No write access.
`EOS_PNNF`	Attempted to delete an entry that does not exist.
`EOS_TRAP`	`netdb` module not found.

See Also

`putroutent6()`

delservbyname()

Delete Service Entry by Name

Syntax

```
error code delservbyname (
                    char     *name)
```

Libraries

`netdb.l`

Description

`delservbyname()` removes the service entries pointed to by name from the `inetdb` data module. If succesful, it returns 0; otherwise, it returns an error.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`EOS_PARAM`	Bad parameter.
`EOS_PNNF`	Attempted to delete an entry that does not exist.
`EOS_TRAP`	`netdb` module not found.
`EOS_PERMIT`	No write access.

See Also

`getservbyname()`

endhostconfent()
Unlink from Structure

Syntax

```
#include <netdb.h>

error_code

endhostconfent (void)
```

Libraries

`netdb.l`

Description

`endhostconfent()` indicates the process is finished using the `hostconfent` structure. The link count of `inetdb` is decremented.

`endhostconfent()` returns 0 if successful; otherwise it returns an error.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`ENOMEM`	Insufficient RAM (POSIX).
`EOS_PARAM`	Bad parameter.

See Also

`hostconfent`

`delhostconfent()`

`gethostconfent()`

`puthostconfent()`

endhostent()

Unlink from Network Database

Syntax

```
#include <netdb.h>
int endhostent(void)
```

Libraries

`netdb.l`

Description

`endhostent()` indicates the process is finished using the host section of the `inetdb` data module. The link count of `inetdb` is decremented.

`endhostent()` returns `0` if successful; otherwise it returns an error.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`ENOMEM`	Insufficient RAM (POSIX).
`EOS_PARAM`	Bad parameter.

See Also

`gethostbyaddr()`

`gethostbyname()`

`gethostent()`

`sethostname()`

endintent()
Unlink from Network Database

Syntax

```
#include <netdb.h>

error_code

endintent(void)
```

Libraries

```
netdb.l
```

Description

`endintent()` indicates the process is finished using the interface section of the `inetdb` data module. The link count of `inetdb` is decremented. If successful, `endintent()` returns 0; otherwise it returns an error.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`ENOMEM`	Insufficient RAM (POSIX).
`EOS_PARAM`	Bad parameter.

endnetent()

Unlink from Network Database

Syntax

```
#include <netdb.h>
int endnetent(void)
```

Libraries

`netdb.l`

Description

`endnetent()` indicates the process is finished using the network section of the `inetdb` data module. The link count of `inetdb` is decremented. `endnetent()` returns `0` if successful; otherwise it returns an error.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`ENOMEM`	Insufficient RAM (POSIX).
`EOS_PARAM`	Bad parameter.

See Also

`getnetbyaddr()`

`getnetbyname()`

`getnetent()`

endprotoent()
Unlink from Network Database

Syntax

```
#include <netdb.h>
int endprotoent(void)
```

Libraries

`netdb.l`

Description

`endprotoent()` indicates the process is finished using the protocol section of the `inetdb` data module. The link count of `inetdb` is decremented. `endprotoent()` returns `0` if successful; otherwise it returns an error.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`ENOMEM`	Insufficient RAM (POSIX).
`EOS_PARAM`	Bad parameter.

See Also

`getprotobyname()`

`getprotoent()`

endresolvent()
Unlink from Network Database

Syntax

```
#include <netdb.h>
endresolvent(void)
```

Libraries

`netdb.l`

Description

`endresolvent()` indicates the process is finished using the resolve section of the `inetdb` data module. The link count of `inetdb` is decremented. `endresolvent()` returns `0` if successful; otherwise it returns an error.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`ENOMEM`	Insufficient RAM (POSIX).
`EOS_PARAM`	Bad parameter.

See Also

`getresolvent()`

endroutent()

Unlink from Network Database

Syntax

```
#include <netdb.h>

error_code endroutent(void)
```

Libraries

```
netdb.l
```

Description

`endroutent()` indicates the process is finished using the route section of the `inetdb` data module. The link count of `inetdb` is decremented. If successful, `endroutent()` returns 0.; otherwise it returns an error.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`ENOMEM`	Insufficient RAM (POSIX).
`EOS_PARAM`	Bad parameter.

endservent()
Unlink from Network Database

Syntax

```
#include <netdb.h>
int endservent(void)
```

Libraries

`netdb.l`

Description

`endservent()` indicates the process is finished using the services section of the `inetdb` data module. The link count of `inetdb` is decremented. `endservent()` returns `0` if successful; otherwise it returns an error.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`ENOMEM`	Insufficient RAM (POSIX).
`EOS_PARAM`	Bad parameter.

See Also

`getnetbyaddr()`

`getservbyname()`

`getservent()`

`setservent()`

getaddrinfo()
Map Names to Address Information

Syntax

```
#include <sys/types.h>
#include <sys/socket.h>
#include <netdb.h>
int getaddrinfo(
      const char *nodename,
      const char *servname,
      const struct addrinfo *hints,
      struct addrinfo **res);
void freeaddrinfo(struct addrinfo *ai);
char *gai_strerror(int ecode);
```

Libraries

netdb.l

Description

`getaddrinfo()` provides a protocol independent way of mapping names to addresses information. Given a hostname and service name, the function searches from the beginning of the hosts and services entries of `inetdb` until a matching IP address and matching port number is found, or until EOF is encountered. If the entry is not in `inetdb`, it seaches in DNS and returns either filled in `addrinfo` structure or error.

The `addrinfo` structure can be optionally passed as hints structure. The last four members must be set to zero or a NULL pointer.

All of the information returned by `getaddrinfo()` is dynamically allocated, `freeaddrinfo()` must be called to free the dynamically allocated memory.

Attributes

Operating System:	OS-9
State:	User
Threads:	Not Safe

Parameters

`nodename and servname`
: pointers to null-terminated strings or NULL

  One or both of these must be a non-NULL pointer.

`hints`
: optional hints structure

`res`
: pointer to a linked list of one or more addrinfo structures

`ai`
: `_addr` member points to a filled-in socket address structure and `ai_addrlen` specifies its length.

Errors

The return value is 0 upon success or a nonzero error code. `gai_strerror()` can be used to print error messages based on the code returned by `getaddrinfo()` and defined in `netdb.h`.

See Also

`getnameinfo()`

`gethostbyname()`

`gethostbyname2()`

`getservbyname()`

gethostbyaddr()
Get Network Host Entry by Address

Syntax

```
#include <netdb.h>
struct hostent *gethostbyaddr(
     const char     *addr,
     int            len,
     int            type)
```

Libraries

`netdb.l`

Description

`gethostbyaddr()` sequentially searches from the beginning of the `hosts` entries of `inetdb` until a matching host address is found or until `EOF` is encountered. Host addresses are supplied in network order. If an entry is not found in `inetdb`, the search is done in DNS. The search order can be reversed by setting the `ENV_SERVORDER` to "dns" or "bind". (For example, search in DNS first; if nothing is found, search in inetdb.)

`gethostbyaddr()` returns a pointer to a `hostent` structure in the `inetdb` data module. A null pointer (0) returns on `EOF`, or an error is returned and `errno` is set to the error value.

`gethostbyaddr()` implicitly links to `inetdb` if the calling process has not previously linked to the data module.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`addr`
: points to the Internet address of the host to get in network order.

`len`
: specifies the length of the address in bytes.

`type`
: specifies the AF_INET address type.

Errors

`EOS_MNF`	`inetdb` module could not be found.

See Also

`gethostbyname()`

`gethostent()`

`sethostname()`

gethostbyname()
Get Network Host Entry by Name

Syntax

```
#include <netdb.h>
struct hostent *gethostbyname(const char *name)
```

Libraries

`netdb.l`

Description

`gethostbyname()` sequentially searches from the beginning of the `hosts` entries of `inetdb` until a matching host name or alias is found, or until `EOF` is encountered. If an entry is not found in `inetdb`, the search is done in DNS. The search order can be reversed by setting the `ENV_SERVORDER` to “dns” or “bind”. (For example, serach in DNS first; if nothing is found, search in `inetdb`.)

`gethostbyname()` returns a pointer to a hostent structure in the `inetdb` data module. A null pointer (0) returns on `EOF` or error and `errno` is set to the error value.

`gethostbyname()` implicitly links to `inetdb` if the calling process has not previously linked to the data module.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`name`
: is a pointer to the name of the host.

Errors

`EOS_MNF`	`netdb` module could not be found.

See Also

`endhostent()`

`gethostbyaddr()`

`gethostent()`

gethostbyname2()

Get IPV4 or IPV6 Network Host Entry by Name

Syntax

```
#include <netdb.h>


struct hostent *gethostbyname2(const char *name, int af);
```

Libraries

`netdb.l`

Description

`gethostbyname2()` is an extension of `gethostbyname()` and it can also search for IPv6 network host entries. The second argument af must be set to `AF_INET` or `AF_INET6`.

It sequentially searches from the beginning of the hosts entries of `inetdb` until a matching host name or alias is found, or until EOF is encountered. If an entry is not found in `inetdb`, the search is done in DNS. The search order can be reversed by setting the `ENV_SERVORDER` to “dns” or “bind”.(For example, serach in DNS first; if not found, search in inetdb.)

`gethostbyname2()` returns a pointer to a hostent structure. A null pointer (0) returns on EOF or error and `errno` is set to the error value.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`name`
: points to the name of the host.

`af`
: family type: `AF_INET` or `AF_INET6`

Errors

EOS_MNF	`netdb` module could not be found.

See Also

`endhostent()`

`gethostbyname()`

`gethostbyaddr()`

`gethostent()`

gethostconfent()
Reads Next Host Entry

Syntax

```
#include <netdb.h>
struct hostconfent *gethostconfent (void)
```

Libraries

```
netdb.l
```

Description

`gethostconfent()` reads the next host entry from `inetdb`. It returns a pointser to a `hostent` structure in the `inetdb` data module.

A null pointer returns an `EOF` or error.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`EOS_MNF`	`inetdb` module could not be found.
`EOS_PARAM`	Bad parameter.

See Also

`hostconfent`

`delhostconfent()`

`endhostconfent()`

`puthostconfent()`

gethostent()
Get Network Host Entry

Syntax

```
#include <netdb.h>
struct hostent *gethostent(void)
```

Libraries

```
netdb.l
```

Description

`gethostent()` reads the next host entry from `inetdb`. It returns a pointer to a `hostent` structure in the `inetdb` data module. A null pointer returns on `EOF` or error.

`gethostent()` implicitly links to `inetdb` if the calling process has not previously linked to the data module.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

See Also

`endhostent()`

`gethostbyaddr()`

`gethostbyname()`

`sethostent()`

getifaddrs()

Store List of Network Interfaces

Syntax

```
#include <sys/types.h>
#include <sys/socket.h>
#include <ifaddrs.h>

int getifaddrs(struct ifaddrs **ifap);
void freeifaddrs(struct ifaddrs *ifp);
```

Libraries

netdb.l

Description

The `getifaddrs()` function stores a reference to a linked list of the network interfaces on the local machine in the memory referenced by `ifap`. The list consists of `ifaddrs` structures, as defined in the `ifaddrs.h`.

Upon successful completion, a value of 0 is returned. Otherwise, a value of -1 is returned and `errno` is set to indicate the error.

`getifaddrs()` allocates memory dynamically, and it should be freed using `freeifaddrs()`.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`ifap`	points to linked list of network interfaces.

See Also

`if_indextoname()`

`if_nameindex()`

`if_nametoindex()`

getinetdent()
Get Inetd Entry

Syntax

```
#include <netdb.h>

struct inetdent *getinetdent(void)
```

Libraries

```
netdb.l
```

Description

`getinetdent()` gets the next `inetd` entry. On success, `getinetdent()` returns a pointer to a `inetdent` structure in the `inetdb` module. A null pointer (0) returns on error and `errno` is set to the error value.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`EOS_MNF`	`netdb` module could not be found.
`EOS_PARAM`	Bad parameter.

getintent()
Get Interface Entry

Syntax

```
#include <netdb.h>
char *getintent(void)
```

Libraries

`netdb.l`

Description

`getintent()` gets the next interface entry. On success, `getintent()` returns a pointer that is cast to a `n_ifnet` structure. Immediately following the `n_ifnet` structure is a `u_int32`, which indicates how many `n_ifaliasreq` structures follow it. Otherwise, it returns a null pointer (0) with the appropriate error code placed in the global variable `errno`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`EOS_MNF`	`netdb` module could not be found.
`EOS_PARAM`	Bad parameter.

getnameinfo()

Look up IP Address and service name

Syntax

```
#include <sys/types.h>
#include <sys/socket.h>
#include <netdb.h>

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

Libraries

netdb.l

Description

`getnameinfo()` is a protocol-independent way of mapping address information to name. Given a IP address and port number, the function searches from the beginning of the hosts and services entries of `inetdb` until a matching host name or alias and matching port number
(in network order) is found, or until EOF is encountered. If it does not find any entry in `inetdb`, it searches in DNS. Upon successful completion, it returns the hostname and service name in the buffer pointed to by the host and serv argument. The `hostlen` or `servlen` arguments must be set to zero value to specify not to return either string.

The flags can be set as shown below:

`NI_NOFQDN`	By default, FQDN is searched and returned in DNS. Setting this bit will return only the nodename portion of the FQDN of `host`.
`NI_NUMERICHOST`	Return numeric form of host's address instead of name.
`NI_NUMERICSERV`	Return port number instead of port name.
`NI_DGRAM`	This is a datagram service; `getservport()` is called with protocol set to `udp` instead of the default, `tcp`.
`NI_WITHSCOPEID`	Return numeric IPv6 address notation with scope identifier.

Attributes

Operating System:	OS-9
State:	User
Threads:	Not Safe

Parameters

`sa`
: is a pointer to either a `sockaddr_in` (IPv4) or `sockaddr_in6` (IPv6) structure that holds the IP address and port number.

`salen`
: is the length of either `sockaddr_in` or `sockaddr_in6` structure.

`host`
: is a pointer to buffer for returned `hostname`.

`hostlen`
: is the length of host buffer, defined as such in `netdb.h`:

```
#define NI_MAXHOST  1025
```

`serv`
: is a pointer to buffer for returned service name.

`serv`
: len is the length of `serv` buffer, defined as such in `netdb.h`:

```
#define NI_MAXSERV    32
```

Errors

The function returns zero upon successful completion, A non-zero value is returned upon failure.

See Also

`getaddrinfo()`

`gethostbyaddr()`

`getservbyport()`

getnetbyaddr()
Get Network Entry by Address

Syntax

```
#include <netdb.h>
struct netent *getnetbyaddr(
     long     net,
     int      type)
```

Libraries

`netdb.l`

Description

`getnetbyaddr()` sequentially searches from the beginning of the `networks` entries of `inetdb` until a matching `net` address and `type` is found, or until `EOF` is encountered.

`getnetbyaddr()` returns a pointer to a `netent` structure in the `inetdb` data module. A null pointer (0) returns on `EOF` or error and `errno` is set to the error value.

`getnetbyaddr()` implicitly links to `inetdb` if the calling process has not previously linked to the data module.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`net`	is the network number (network byte order).
`type`	is the network number type (network byte order).

Errors

`EOS_MNF`	`netdb` module could not be found.
`EOS_PARAM`	Bad parameter.

See Also

`endnetent()`

`getnetbyname()`

`getnetent()`

`setnetent()`

getnetbyname()
Get Network Entry by Name

Syntax

```
#include <netdb.h>
struct netent *getnetbyname(const char *name)
```

Libraries

`netdb.l`

Description

`getnetbyname()` sequentially searches from the beginning of the `networks` entries of `inetdb` until a matching name or alias is found, or until `EOF` is encountered.

`getnetbyname()` returns a pointer to a `netent` structure in the `inetdb` data module. A null pointer (0) returns on `EOF` or error and `errno` is set to the error value.

`getnetbyname()` implicitly links to `inetdb` if the calling process has not previously linked to the data module.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`name`	is a pointer to the network name.

Errors

`EOS_MNF`	`netdb` module could not be found.
`EOS_PARAM`	Bad parameter.

See Also

`endnetent()`

`getnetbyaddr()`

`getnetent()`

`setnetent()`

getnetent()
Get Network Entry

Syntax

```
#include <netdb.h>
struct netent *getnetent(void)
```

Libraries

`netdb.l`

Description

`getnetent()` reads the next `inetdb` network entry.

`getnetent()` returns a pointer to a `netent` structure in the `inetdb` data module. A null pointer (0) on `EOF` or error and `errno` is set to the error value.

`getnetent()` implicitly links to `inetdb` if the calling process has not previously linked to the data module.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`EOS_MNF`	`netdb` module could not be found.
`EOS_PARAM`	Bad parameter.

See Also

`endnetent()`

`getnetbyaddr()`

`getnetbyname()`

`setnetent()`

getprotobyname()
Get Protocol Entry

Syntax

```
#include <netdb.h>
struct protoent *getprotobyname(const char *name)
```

Libraries

`netdb.l`

Description

`getprotobyname()` sequentially searches from the beginning of the `protocols` entries of `inetdb` until it finds a matching protocol name or alias, or until it encounters `EOF`.

`getprotobyname()` returns a pointer to a `protoent` structure in the `inetdb` data module. `getprotobyname()` returns a null pointer (0) on `EOF` or error and places the error value in `errno`.

`getprotobyname()` implicitly links to `inetdb` if the calling process has not previously linked to the data module.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`name`
: is a pointer to the name of the protocol.

Errors

`EOS_MNF`	`netdb` module could not be found.
`EOS_PARAM`	Bad parameter.

See Also

`endprotoent()`

`getprotobynumber()`

`getprotoent()`

`setprotoent()`

getprotobynumber()
Get Protocol Entry by Number

Syntax

```
#include <netdb.h>
struct protoent *getprotobynumber(long proto)
```

Libraries

`netdb.l`

Description

`getprotobynumber()` sequentially searches from the beginning of the `protocols` entries of `inetdb` until it finds a matching protocol number, or until it encounters `EOF`.

`getprotobynumber()` returns a pointer to a protoent structure in the `inetdb` data module. `getprotobynumber()` returns a null pointer (0) on `EOF` or error and sets `errno` to the error value.

`getprotobynumber()` implicitly links to `inetdb` if the calling process has not previously linked to the data module.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`proto`
: specifies the protocol number in host byte order.

Errors

`EOS_MNF`	`inetdb` module could not be found.
`EOS_PARAM`	Bad parameter.

See Also

`endprotoent()`

`getprotobyname()`

`getprotoent()`

`setprotoent()`

getprotoent()
Get Protocol Entry

Syntax

```
#include <netdb.h>
struct protoent *getprotoent(void)
```

Libraries

`netdb.l`

Description

`getprotoent()` reads the next protocols entry of `inetdb`.

If successful, `getprotoent()` returns a pointer to a `protoent` structure in the `inetdb` data module. On `EOF` or error It returns a null pointer (0) and sets `errno` to the error value.

`getprotoent()` implicitly links to `inetdb` if the calling process has not previously linked to the data module.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`EOS_MNF`	`inetdb` module could not be found.
`EOS_PARAM`	Bad parameter.

See Also

`endprotoent()`

`getprotobyname()`

`getprotobynumber()`

`setprotoent()`

getresolvent()
Returns Pointer to DNS Structure

Syntax

```
#include <netdb.h>
struct resolvent *getresolvent(void)
```

Libraries

`netdb.l`

Description

`getresolvent()` returns a pointer to the resolver structure used by the DNS in the `netdb` data module. It returns the last one it finds. For example, the following modules are searched in this order (when x<4):

```
inetdbx
inetdbx-1
inetdb2
inetdb
```

The last valid pointer in the nameservers and search arrays is followed by a null pointer to indicate the end of valid data. On success, `getresolvent()` returns a pointer to a `resolvent` structure in the `inetdb` data module. On failure, it returns a null pointer and sets `errno` to the error value.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`EOS_MNF`	`inetdb` module could not be found.
`EOS_PARAM`	Bad parameter.

See Also

`delresolvent()`

`endresolvent()`

getservbyname()
Get Service Entry by Name

Syntax

```
#include <netdb.h>
struct servent *getservbyname(
     const char     *name,
     const char     *proto)
```

Libraries

`netdb.l`

Description

`getservbyname()` sequentially searches from the beginning of the `services` entries of `inetdb` until it finds a matching protocol name or alias, or until it encounters `EOF`. If a non-null protocol name is supplied, searches must also match the protocol.

`getservbyname()` returns a pointer to a `servent` structure in the inetdb data module. `getservbyname()` returns a null pointer (0) on `EOF` or error and sets `errno` to the error value.

`getservbyname()` implicitly links to `inetdb` if the calling process has not previously linked to the data module.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`name`	is a pointer to the name of the service.
`proto`	is a pointer to the name of the protocol.

Errors

`EOS_MNF`	`inetdb` module could not be found.
`EOS_PARAM`	Bad parameter.

See Also

`endservent()`

`getservbyport()`

`getservent()`

`setservent()`

getservbyport()
Get Service Entry by Port

Syntax

```
#include <netdb.h>
struct servent *getservbyport(
     long           port,
     const char     *proto)
```

Libraries

`netdb.l`

Description

`getservbyport()` sequentially searches from the beginning of the `services` entries of `inetdb` until a matching protocol port number (in network order) is found, or until `EOF` is encountered. If a non-null protocol name is supplied, searches must also match the protocol.

`getservbyport()` returns a pointer to a `servent` structure in the `inetdb` data module. `getservbyport()` returns a null pointer (0) on `EOF` or error.

`getservbyport()` implicitly links to `inetdb` if the calling process has not previously linked to the data module.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`port`	specifies the service port number in network byte order.
`proto`	is a pointer to the protocol name.

Errors

`EOS_MNF`	`inetdb` module could not be found.
`EOS_PARAM`	Bad parameter.

See Also

`endservent()`

`getservbyname()`

`getservent()`

`setservent()`

getservent()
Get Service Entry

Syntax

```
#include <netdb.h>
struct servent *getservent(void)
```

Libraries

`netdb.l`

Description

`getservent()` reads the next `services` entry of `inetdb`.

`getservent()` returns a pointer to a servent structure in the `inetdb` data module. It returns a null pointer (0) on `EOF` or error and sets `errno` to the error value.

`getservent()` implicitly links to `inetdb` if the calling process has not previously linked to the data module.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`EOS_MNF`	`inetdb` module could not be found.
`EOS_PARAM`	Bad parameter.

See Also

`endservent()`

`getservbyname()`

`getservbyport()`

`setservent()`

htonl()

Convert 32-Bit Values from Host to Network Byte Order

Syntax

```
#include <sys/endian.h>
u_long  htonl(u_long hostlong)
```

Libraries

`netdb.l`

Description

`htonl()` converts 32-bit quantities from host to network byte order and returns the long in a network byte order representation. `htonl()` is most often used with Internet addresses and ports as returned by `gethostent()` and `getservent()`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`hostlong`	specifies the host byte order representation to convert.

See Also

`htons()`

`ntohl()`

`ntohs()`

htons()

Convert 16-Bit Values from Host to Network Byte Order

Syntax

```
#include <sys/endian.h>
u_short htons(u_short hostshort)
```

Libraries

`netdb.l`

Description

`htons()` converts 16-bit quantities from host to network byte order and returns the short in a network byte order representation. `htons()` is most often used with Internet addresses and ports as returned by `gethostent()` and `getservent()`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`hostshort`
: specifies the host byte order representation to convert.

See Also

`htonl()`

`ntohl()`

`ntohs()`

if_indextoname()

Map Interface Index to Interface Name

Syntax

```
#include <net/if.h>


char *if_indextoname(
       unsigned int ifindex,
       char *ifname);
```

Libraries

netdb.l

Description

`if_indextoname()` maps the interface index `ifindex` to its corresponding interface name, and returns it in buffer `ifname`, which must be of at least IFNAMSIZ bytes. If the specified interface does not exist, it returns 0.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`ifindex`
: is the interface index.

`ifname`
: is a pointer to interface name, return value from function.

Errors

The function returns NULL pointer upon failure or if no interface is found.

See Also

`getifaddrs()`

`if_nameindex()`

`if_nametoindex()`

if_nameindex()

Return an Array of if_nameindex Structures

Syntax

```
#include <net/if.h>


struct if_nameindex *if_nameindex(void);

void if_freenameindex(struct if_nameindex *ptr);
```

Libraries

netdb.l

Description

The `if_nameindex()` function returns an array of if_nameindex structures, one structure for each interface. The end of the array of structures is indicated by a structure with an `if_index` of 0 and an if_name of NULL. Upon successful completion, `if_nametoindex()` returns the index number of the interface.

The function allocates memory dynamically, `freenameindex()` must be called to free the memory allocated by `if_nameindex()`. `freenameindex()` takes argument returned by `if_nameindex()`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Not Safe

Parameters

`ptr`
: is a pointer to structure `if_nameindex` returned by `if_nameindex`.

Errors

The function returns NULL pointer upon failure or if no interface is found.

See Also

`getifaddrs()`

`if_indextoname()`

`if_nametoindex()`

if_nametoindex()

Map Interface Name to Interface Index

Syntax

```
#include <net/if.h>
unsigned int if_nametoindex(const char *ifname);
```

Libraries

netdb.l

Description

The `if_nametoindex()` function maps the interface name specified in `ifname` to its corresponding index. If the specified interface does not exist, it returns 0.

Upon successful completion, `if_nametoindex()` returns the index number of the interface. A value of 0 is returned if the interface is not found or an error occurs while retrieving the list of interfaces via `getifaddrs()`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Not Safe

Parameters

`ifname`	is a pointer to interface name.

Errors

The function returns NULL pointer upon failure or if no interface is found.

See Also

`getifaddrs()`

`if_indextoname()`

`if_nametoindex()`

inet_addr()

Convert Dot Notation into Network Address

Syntax

```
#include <netdb.h>
unsigned long inet_addr(char *cp)
```

Libraries

```
netdb.l
```

Description

`inet_addr()` interprets character strings representing numbers expressed in the Internet standard "." notation. It returns numbers suitable for use as Internet addresses, which are then returned in network order. On error, `inet_addr()` returns `0xFFFFFF` (or `-1` when cast to unsigned).

Refer to the *Using LAN Communications* manual for more information about Internet addresses.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`cp`	pointer to Internet address character string.

See Also

`inet_aton()`

`inet_lnaof()`

`inet_makeaddr()`

`inet_netof()`

`inet_network()`

`inet_ntoa()`

inet_aton()
Convert Internet Address to Binary Address

Syntax

```
#include <netdb.h>
inet_aton(const char *cp, struct in_addr *addr)
```

Libraries

```
netdb.l
```

Description

`inet_aton()` determines whether the parameter `cp` is a valid ASCII representation of an Internet address and converts it to a binary address.

`inet_aton()` returns 1 if the address is valid and 0 if the address is not valid. This return value is more sophisticated than that of `inet_addr()`, which can not distinguish whether the return is a failure or a broadcast address.

Refer to the *Using LAN Communications* manual for more information about Internet addresses.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`cp`
: is a pointer to the Internet address character string.

`addr`
: is a pointer to the resulting Internet address.

See Also

`inet_addr()`

`inet_lnaof()`

`inet_makeaddr()`

`inet_netof()`

`inet_network()`

`inet_ntoa()`

inet_lnaof()
Get Local Address

Syntax

```
#include <netdb.h>
int inet_lnaof(struct in_addr in)
```

Libraries

```
netdb.l
```

Description

`inet_lnaof()` returns the host address portion of an Internet address (in host byte order). All host address parts are returned as integer values.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`in`
: specifies the Internet address to break apart.

See Also

`inet_addr()`

`inet_aton()`

`inet_makeaddr()`

`inet_netof()`

`inet_network()`

`inet_ntoa()`

inet_makeaddr()

Get Address from Network and Host Address

Syntax

```
#include <sys/socket.h>
#include <netdb.h>
struct in_addr inet_makeaddr(
     int     net,
     int     lna)
```

Libraries

`netdb.l`

Description

`inet_makeaddr()` takes an Internet network number and a local network address and constructs an Internet address from it.

Refer to the *Using LAN Communications* manual for more information about Internet addresses.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`net`
: specifies the network number in host byte order.

`lna`
: specifies the host number.

See Also

`inet_addr()`

`inet_aton()`

`inet_lnaof()`

`inet_netof()`

`inet_network()`

`inet_ntoa()`

inet_netof()
Get Network Number

Syntax

```
#include <netdb.h>
int inet_netof(struct in_addr in)
```

Libraries

```
netdb.l
```

Description

`inet_netof()` takes as input an Internet host address and returns the network number (in host byte order).

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`in`
: specifies the Internet address.

See Also

`inet_addr()`

`inet_aton()`

`inet_lnaof()`

`inet_makeaddr()`

`inet_network()`

`inet_ntoa()`

inet_network()
Interpret Network Number

Syntax

```
#include <netdb.h>
unsigned long inet_network(char *cp)
```

Libraries

`netdb.l`

Description

`inet_network()` interprets character strings representing numbers expressed in the Internet standard "." notation. `inet_network()` returns numbers suitable for use as Internet network numbers. Network numbers are returned as unsigned long values (in host byte order).

On error, `inet_network()` returns `0xFFFFFFFF` (or `-1` when cast to unsigned).

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`cp`
: is a pointer to a character string.

See Also

`inet_addr()`

`inet_aton()`

`inet_lnaof()`

`inet_makeaddr()`

`inet_netof()`

`inet_ntoa()`

inet_ntoa()
Return Address in Dot Notation

Syntax

```
#include <netinet/in.h>
#include <sys/socket.h>
#include <netdb.h>
char *inet_ntoa(struct in_addr in)
```

Libraries

```
netdb.l
```

Description

`inet_ntoa()` takes an Internet address and returns a pointer to a string in the Internet standard dot notation.

Refer to the *Using LAN Communications* manual for more information about Internet addresses.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`in`
: specifies the Internet address to be converted to a string in network byte order.

See Also

`inet_addr()`

`inet_aton()`

`inet_lnaof()`

`inet_makeaddr()`

`inet_netof()`

`inet_network()`

inet_ntop()

Convert network order to presentation order

Syntax

```
#include <sys/socket.h>
inet_ntop(int af,
            const void *src,
            char *dst,
            size_t size);
```

Libraries

netdb.l

Description

`inet_ntop()` converts a numeric address (network order) to presentation format. The returned IP address string is stored in buffer `dst`, which must be large enough to fit addresses. `size` is the size of the `dst` buffer. Following constants from `netinet/in.h` can be used to declare buffer of proper size for either IPV4 or IPV6 address.

```
#define INET_ADDRSTRLEN 16
#define INET6_ADDRSTRLEN 46
```

The function returns pointer to IP address `dst` upon success or NULL on error.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`af`

family type: `AF_INET` or `AF_INET6`

`srcis a pointer to buffer holding IPv4 or IPv6 address in network order.`

`dst`
is a buffer for returned IP address.

`size`
is the size of `dst`.

Errors

NULL if error.

See Also

`inet_aton()`

`inet_ntop()`

`inet_pton()`

`inet_addr()`

inet_pton()

Convert presentation format address to network format

Syntax

```
#include <sys/socket.h>
int
inet_pton(
      int af,
      const char *src,
      void *dst);
```

Libraries

netdb.l

Description

`inet_pton()` converts an address from standard text presentation form to its numeric binary form. The `af` argument specifies the family of the address. The address is returned in network byte order. It returns 1 upon success, and 0 if input is not a valid IPv4 dotted- decimal string or a valid IPv6 address string, and -1 if `af` argument is unknown.

Attributes

Operating System:	OS-9
State:	User
Threads:	Not Safe

Parameters

`af`
: family type: `AF_INET` or `AF_INET6`

`src`
: is a pointer to address string.

`dst`
: is a pointer to buffer for numeric IP address.

  The buffer must be large enough to hold numeric address: four bytes for `AF_INET` or 16 bytes for `AF_INET6`.

Errors

0 if input is not a valid IPv4 dotted- decimal string or a valid IPv6 address string, and -1 if `af` argument is unknown.

See Also

`inet_aton()`

`inet_ntop()`

`inet_addr()`

ntohl()

Convert 32-Bit Values from Network to Host Byte Order

Syntax

```
#include <sys/endian.h>
u_long ntohl(u_long netlong)
```

Libraries

`netdb.l`

Description

`ntohl()` converts 32-bit quantities from network to host byte order and is used with Internet addresses and ports as returned by `gethostent()` and `getservent()`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`netlong`
: specifies the 32-bit network byte order value to convert to host long.

See Also

`htonl()`

`htons()`

`ntohs()`

ntohs()

Convert 32-Bit Values from Network to Host Byte Order

Syntax

```
#include <sys/endian.h>
u_short ntohs(u_short netshort)
```

Libraries

`netdb.l`

Description

`ntohs()` converts 16-bit quantities from network to host byte order. On machines such as the 68000, `ntohs()` is defined as a null macro in the include file `in.h`.

`ntohs()` is used with Internet addresses and ports as returned by `gethostent()` and `getservent()`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`netshort`
: specifies the 16-bit network byte order value to convert to host short.

See Also

`htonl()`

`htons()`

`ntohl()`

puthostconfent()
Add Host Entry

Syntax

```
#include <netdb.h>
error_code
puthostconfent (
          char *key
          char    *value)
```

Libraries

`netdb.l`

Description

`puthostconfent` adds the host entry that is pointed to by the `hostconfent` structure to the `inetdb` data module (or an expansion `inetdb` data module). There must be space available in the data module to hold the host entry.

`key` and `value` are pointers to the `hostconfent` structure allocated and set by the user.

If successful, `puthostconfent()` returns 0; otherwise it returns an error.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`EOS_MNF`	`inetdb` module could not be found.
`EOS_PARAM`	Bad parameter.
`EOS_FULL`	No `inetdb` module found with enough space for the new entry.

See Also

`hostconfent`

`delhostconfent()`

`endhostconfent()`

`gethostconfent()`

puthostent()
Add Network Host Entry

Syntax

```
#include <netdb.h>
error_code
puthostent(cons struct hostent *hp)
```

Libraries

```
netdb.l
```

Description

`puthostent()` adds the host entry pointed to by `hp` to the `inetdb` data module or an expansion `inetdb` data module. There must be space available in the data module to hold the host entry.

`hp`
: is a pointer to a `hostent` structure allocated and set by the user.

  The `h_aliases` and `h_addr_list` elements are arrays of pointers to name and address information, and must be terminated by a null pointer.

If successful, `puthostent()` returns `0`; otherwise it returns an error.

`puthostent()` supports a single IP address.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`hp`	specifies the host entry to be added.

Errors

`EOS_FULL`	No `inetdb` module found with enough space for the new entry.
`EOS_MNF`	Not linked to a `netdb` module.
`EOS_PARAM`	Bad parameter.
`EOS_TRAP`	`netdb` module not found.

See Also

`gethostent()`

putintent()
Add Interface Entry

Syntax

```
#include <netdb.h>
error_code putintent(
     n_ifnet          *ifp,
     n_ifaliasreq     *ia,
     u_int32          ia_cnt)
```

Libraries

`netdb.l`

Description

`putintent()` adds an interface entry to `inetdb` data module or an expansion `inetdb` data module. There must be space available in the data module to hold the entry. If successful, `putintent()` returns `0`.

The `n_ifaliasreq` and `n_ifnet` structures (defined in `/netdb.h`) are described in Chapter 1.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`ifp`
: specifies a pointer to the user allocated and set interface structure.

`ia`
: specifies an array of null-terminated addresses to be associated with the interface.

`ia_cnt`
: specifies the number of addresses contained in the ia array, and may be 0.

Errors

`EOS_MNF`	`inetdb` module not found.
`EOS_FULL`	No `inetdb` module found with enough space for the new entry.

See Also

`getnetent()`

putintent6()
Add IPV6 Interface Entry

Syntax

```
#include <netdb.h>
error_code putintent6(
    n_ifnet *ifp,
    n_ifaliasreq6 *ia,
    u_int32 ia_cnt)
```

Libraries

`netdb.l`

Description

`putintent6()` adds an IPv6 interface entry to the `inetdb` data module or an expansion `inetdb` data module. There must be space available in the data module to hold the entry. If successful, `putintent6` returns `0`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`ifp`
: specifies a pointer to the user allocated and set interface structure.

`ia`
: specifies an array of null-terminated IPv6 addresses to be associated with the interface.

`ia_cnt`
: specifies the number of addresses contained in the ia array, and may be 0.

Errors

`EOS_MNF`	`inetdb` module not found.
`EOS_FULL`	No `inetdb` module found with enough space for the new entry.

See Also

`getnetent()`

putnetent()

Add a network entry to inetdb

Syntax

```
#include <netdb.h>
putnetent(const struct netent *np);
```

Libraries

```
netdb.l
```

Description

`putnetent()` adds a network entry to the `inetdb` data module or an expansion `inetdb` data module. There must be space available in the data module to hold the entry. If successful, `putnetent` returns 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`np`
: specifies a pointer to the user allocated and initialized network entry structure.

Errors

`EOS_MNF`	`inetdb` module not found.
`EOS_PARAM`	Bad parameter.
`EOS_FULL`	No `inetdb` module found with enough space for the new entry.

putprotoent()

Add protocol entry to inetdb

Syntax

```
#include <netdb.h>
putprotoent(const struct protoent *pep);
```

Libraries

```
netdb.l
```

Description

`putprotoent()` adds a protocol entry to the `inetdb` data module or an expansion `inetdb` data module. There must be space available in the data module to hold the entry. If successful, it returns 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`pep`
: specifies a pointer to the user allocated and initialized protocol entry structure.

Errors

`EOS_MNF`	`inetdb` module not found.
`EOS_PARAM`	Bad parameter.
`EOS_FULL`	No `inetdb` module found with enough space for the new entry.

putresolvent()
Set the DNS Entry

Syntax

```
#include <resolv.h>
error_code putresolvent(resolvent *res)
```

Libraries

`netdb.l`

Description

`putresolvent()` adds the DNS resolver entry pointed to by `res` to the `inetdb` data module or an expansion `inetdb` data module. There must be space available in the data module to hold the resolver entry.

If successful, `putresolvent()` returns zero.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`res`
: is a pointer to a resolvent structure allocated and set by the user.

  The name server and search pointer arrays must be terminated by a null pointer. There can be only one active resolver entry.

  Only the first entry of the highest numbered inetdbx module is used. If you have enough space, you can add more than one, but it is ignored. To be safe, use delresolvent.

Errors

`EOS_FULL`	No `inetdb` module found with enough space for the new entry.
`EOS_MNF`	`inetdb` module not found.
`EOS_PARAM`	Bad parameter.
`EOS_TRAP`	`netdb` module not found.

See Also

`delresolvent()`

`endresolvent()`

`getresolvent()`

putroutent()
Add Route Entry

Syntax

```
#include <netdb.h>

error_code *putroutent(struct rtreq *route_ptr)
```

Libraries

`netdb.l`

Description

`putroutent()` adds the route entry to the `inetdb` data module. If successful, `putroutent()` returns 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`EOS_MNF`	`inetdb` module not found.
`EOS_PARAM`	Bad parameter.
`EOS_FULL`	No `inetdb` module found with enough space for the new entry.

putroutent6()
Add IPV6 Route Entry

Syntax

```
#include <netdb.h>

error_code *putroutent6(struct rtreq6 *route_ptr)
```

Libraries

`netdb.l`

Description

`putroutent6()` adds the IPv6 route entry to the `inetdb` data module. If successful, `putroutent()` returns 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`EOS_MNF`	`inetdb` module not found.
`EOS_PARAM`	Bad parameter.
`EOS_FULL`	No `inetdb` module found with enough space for the new entry.

putservent()

Add interface entry to inetdb

Syntax

```
#include <netdb.h>
putservent(const struct servent *sp)
```

Libraries

```
netdb.l
```

Description

`putservent()` adds an interface entry to the `inetdb` data module or an expansion `inetdb` data module. There must be space available in the data module to hold the entry. If successful, it returns 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`sp`
: specifies a pointer to the user allocated and initialized interface entry structure.

Errors

`EOS_MNF`	`inetdb` module not found.
`EOS_PARAM`	Bad parameter.
`EOS_FULL`	No `inetdb` module found with enough space for the new entry.

res_cancel()
Cancel DNS Client Request

Syntax

```
#include <netdb.h>
void res_cancel(void)
```

Libraries

`netdb.l`

Description

`res_cancel()` sets a flag to cancel a DNS client query (`gethostbyname()`). This stops an application from blocking on a `gethostbyname()` call. `res_cancel()` can only be used from the `netdb_dns.l` library since the trap library is not reentrant.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

sethostent()
Set Host Entry

Syntax

```
#include <netdb.h>
int sethostent(int stayopen)
```

Libraries

`netdb.l`

Description

`sethostent()` links the calling process to `inetdb`, if necessary, and resets the pointer to the beginning of the `hosts` entries.

If successful, `sethostent()` returns a value of `0`.

LAN Communications ignores the `stayopen` flag. It is included for compatibility only.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`ENOMEM`	Insufficient RAM (POSIX).
`EOS_MNF`	`inetdb` module could not be found.

See Also

`endhostent()`

`gethostbyaddr()`

`gethostbyname()`

`gethostent()`

`sethostname()`

setnetent()
Set Network Entry

Syntax

```
#include <netdb.h>
int setnetent(int stayopen)
```

Libraries

`netdb.l`

Description

`setnetent()` links the calling process to `inetdb`, if necessary, and resets the pointer to the beginning of the network entries.

If successful, `setnetent()` returns a value of `0`. Otherwise, it returns `-1` and sets `errno` to the error value.

LAN Communications ignores the `stayopen` flag. It is included for compatibility only.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`EOS_MNF`	`inetdb` module could not be found.

See Also

`endnetent()`

`getnetent()`

setprotoent()
Set Protocol Entry

Syntax

```
#include <netdb.h>
int setprotoent(int stayopen)
```

Libraries

`netdb.l`

Description

`setprotoent()` links the calling process to `inetdb`, if necessary, and resets the pointer to the beginning of the `protocol` entries.

If successful, `setprotoent()` returns a value of `0`. Otherwise, it returns `-1` and sets `errno` to the error value.

LAN Communications ignores the `stayopen` flag. It is included for compatibility only.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`EOS_MNF`	`inetdb` module could not be found.

See Also

`getprotobyname()`

`getprotobynumber()`

`getprotoent()`

setservent()
Set Services Entry

Syntax

```
#include <netdb.h>
int setservent(int stayopen)
```

Libraries

`netdb.l`

Description

`setservent()` links the calling process to `inetdb`, if necessary, and resets the pointer to the beginning of the `services` entries.

If successful, `setservent()` returns a value of `0`. Otherwise, it returns `-1` and sets `errno` to the error value.

LAN Communications ignores the `stayopen` flag. It is included for compatibility only.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`EOS_MNF`	`inetdb` module could not be found.

See Also

`endservent()`

`getservbyname()`

`getservbyport()`

`getservent()`

ndblib.l Library Functions

The ndblib.l library can be used to dynamically create an inetdb data module. This enables an application to configure a system before the IP stack is initialized.

The netdb.l library may call functions defined in ndblib.l. Therefore, when linking with netdb.l, ndblib.l must also be linked. The following table lists and describes the functions that compose the ndblib.l library.

Table 2-3. ndblib.l Functions and Descriptions

Function	Description
ndb_create_ndbmod()	Create Network Database Module

Refer to the *Using LAN Communications* manual for more information about dynamic configuration.

Prototypes for these calls are declared in the following header files:

MWOS/SRC/DEFS/SPF/BSD/sys/socket.h.

MWOS/SRC/DEFS/SPF/BSD/netdb.h.

MWOS/SRC/DEFS/SPF/BSD/netinet/in.h

MWOS/SRC/DEFS/SPF/BSD/netinet6/in6.h

The sockaddr structure is defined in sys/socket.h as:

```
struct sockaddr
{
   u_char sa_len; /* total length */
   u_char sa_family;/* address family */
   char sa_data [14];/* up to 14 bytes of direct address */
};
```

This is a generic socket address meant to accompany various types of layer-three protocols. When using the IP protocol, only addresses belonging to the AF_INET or AF_INET6 protocol family are allowed.

The AF_INET type address is declared in the following file:

MWOS/SRC/DEFS/SPF/BSD/netinet/in.h

as follows:

```
struct sockaddr_in
{
    u_char       sin_len;
    u_char       sin_family;
    u_short      sin_port;
    struct in_addrsin_addr;
    char         sin_zero[8];
};
```

The in_addr structure is defined in the same file as shown below:

```
struct in_addr
{
    u_long       s_addr;
};
```

The AF_INET6 type address is declared in the following header file:

```
MWOS/SRC/DEFS/SPF/BSD/netinet6/in6.h
```

It is defined as follows:

```
struct sockaddr_in6 {
   u_int8_tsin6_len;
   u_int8_tsin6_family;
   u_int16_tsin6_port;
   u_int32_tsin6_flowinfo;
   structin6_addrsin6_addr;
   u_int32_tsin6_scope_id;
};
```

The in6_addr structure is defined in the same file as shown below:

```
struct in6_addr{
   unicn {
             u_int8_t__u6_addr8[16];
             u_int16_t__u6_addr16[8];
             u)int32_t__u6_addr32[4];
   } __u6_addr;
};
```

ndb_create_ndbmod()
Create Network Database Module

Syntax

```
#include <netdblib.h>

error_code
ndb_create_ndbmod(
                  char        *modname,
                  int         num_files,
                  int         *file_sizes,
                  u_int32     perm,
                  u_int16     rev);
```

Libraries

`ndblib.l`

Description

`create_ndbmod` creates the Internet data module `modname` and reserves space as specified by the parameters passed.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`modname`
is the name of the module to create.

While it can be any string, the `ndb_link_ndbmod` function (and hence the `netdb` calls) only check for `inetdb`, `inetdb2`, `inetdb3`, `inedb4`.

`num_files`
is the number of different files (record types) that this module stores.

File numbers 1-32 are assigned as shown in Table 2-4:

Table 2-4. File Designations

1	hosts (approx. 25 bytes per host)
2	hosts equiv (not used)
3	networks (approx. 40 bytes per network)
4	protocols (approx. 25 bytes per protocol)
5	services (approx. 25 bytes per service)

Table 2-4. File Designations (Continued)

6	`inetd` entries (approx. 50 bytes per entry)
7	DNS client configuration (approx. 100 bytes)
8	local host configuration (not used)
9	host interfaces (approx 200 bytes per interface)
10	hostname (>= length of hostname + 1, recommended 65)
11	static routes (approx. 64 bytes per entry)
12-32	Reserved

`file_sizes`
is an array of size `num_files`, where the value of element N indicates how many bytes to reserve for file N+1.

If `file_sizes[6] = 400`, then 400 bytes are reserved for storing resolver information.

`perm`
is the permission given to the newly created module.

If future updates are allowed, the user must have permission to link, read, and write to the module.

`rev`
The revision number given to the newly created module. An existing module may be overlaid if a higher revision number is specified.

Errors

`EOS_PARAM`	Bad parameter.

Berkeley Socket Functions

SPF includes an implementation of the Berkeley socket API in the `socket.l` library. The Internet socket library provides a BSD 4.4 socket API. The following table lists and describes the functions that compose the `socket.l` library:

Table 2-5. socket.l Functions and Descriptions

Function	Description
accept()	Accept Connection on Socket
bind()	Binds Name to Socket
connect()	Initiates Connection on Socket
gethostname()	Gets Name of Current Host
getpeername()	Get Network Entry
getsockname()	Gets Socket Name
getsockopt()	Get Socket Options
ip_start()	Initialize IP stack
listen()	Listen for Connections on Socket
recv()	Receives Message From Connected Socket
recvfrom()	Receives Message from Socket
recvmsg()	Receives Message from Socket
send()	Sends Message to Connected Socket
sendto()	Sends Message to Socket
sendmsg()	Sends Message to Socket
sethostname()	Set Name of Current Host
setsockopt()	Set Options on Sockets
shutdown()	Shut Down Part of Full-Duplex Connection
socket()	Creates Endpoint for Communication

When creating socket applications, the `ndblib.l` and `item.l` libraries must also be linked.

accept()
Accept Connection on Socket

Syntax

```
#include <sys/socket.h>
int accept(
          int                 s,
          struct sockaddr     *addr,
          socklen_t           *addrlen)
```

Libraries

`socket.l`

`item.l` (for 68K)

Description

`accept()` takes the first connection on the queue of pending connections and creates a new socket with the same properties as socket `s`. It allocates and returns a new socket descriptor. This new socket reads and writes data to and from the socket to which it is connected. It does not accept more connections. The original socket, `s`, remains open for accepting further connections.

If pending connections are nonexistent on the queue and the socket is configured for blocking, `accept()` blocks the caller until a connection is present.

If the socket is configured as non-blocking and pending connections are nonexistent on the queue, `accept()` returns `EWOULDBLOCK`.

`accept()` is used with connection-based socket types (`SOCK_STREAM` type only).

`accept()` returns `-1` on error and `errno` is set to the error value. If successful, it returns a non-negative integer path number.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`s`
is the original socket path.

It is created by `socket()`, bound to an address with `bind()`, and is listening for connections after a `listen()`.

`addr`
is a pointer returning the address of the peer as known to the communications layer.

`addr`
is determined by the domain.

`addrlen`
is a pointer to a value-result parameter used to pass the amount of space pointed to by `addr`.

This parameter returns the actual length in bytes of the address returned.

Errors

`EINVAL`	The socket must be listening to call `accept()`.
`EOPNOTSUPP`	The referenced socket type or option is not supported.
`EWOULDBLOCK`	The socket is non-blocking and no connections are waiting to be accepted.

See Also

`bind()`

`connect()`

`listen()`

`socket()`

bind()
Binds Name to Socket

Syntax

```
#include <sys/socket.h>
int bind(
        int               s,
        struct sockaddr   *name,
        socklen_t         namelen)
```

Libraries

```
socket.l
```

Description

`bind()` assigns a name to an unnamed socket. When `socket()` creates a socket, it exists in a name space (address family) but has no assigned name. `bind()` requests the name pointed to by the parameter `name` be assigned to the socket. Only names belonging to the `AF_INET` family are supported.

`bind()` returns `0` if successful. Otherwise, it returns `-1` with the appropriate error code placed in the global variable `errno`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`s`
: specifies the path number of the socket.

`name`
: points to the socket address.

`namelen`
: specifies the length of the assigned name.

Errors

`EADDRINUSE`	The specified address `name` is already in use.
`EADDRNOTAVAIL`	The specified address `name` is not available on the local machine.
`EINVAL`	The socket is already bound to an address `name`.
`EOS_PERMIT`	The user is asking for a reserved port and the user is not super user.

connect()

Initiates Connection on Socket

Syntax

```
#include <sys/socket.h>

int connect(
            int                 s,
            struct sockaddr     *name,
            socklen_t           namelen)
```

Libraries

```
socket.l
```

Description

If `s` is socket of type `SOCK_STREAM` (TCP), `connect()` attempts to connect to a listening socket. If the socket is a datagram socket such as `SOCK_DGRAM` (UDP) or `SOCK_RAW` (RAW), `connect()` stores the destination address locally. A successful connection returns 0. Otherwise, it returns -1 with the appropriate error code in `errno`.

If `s` is a non-blocking socket the initial `connect()` call returns `EINPROGRESS`. Subsequent calls return `EALREADY` until the connection is established, at which point an `EISCONN` error is returned.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`s`
: specifies the path number of the socket to connect. If `s` is of type `SOCK_STREAM`, `connect()` attempts to connect to another socket.

`name`
: points to the other socket.

`namelen`
: specifies the length of the assigned name.

Errors

EADDRINUSE	The address is already in use.
EADDRNOTAVAIL	The specified address is not available from this machine.
EAFNOSUPPORT	Address in the specified address family cannot be used with this socket.
EALREADY	The socket is non-blocking and a previous connection attempt has not been completed.
ECONNREFUSED	The attempt to connect was forcefully rejected.
EINPROGROSS	A non-blocking socket connection cannot be completed immediately.
EISCONN	The socket is already connected.
EHOSTONREACH	No route to the host exists
ETIMEDOUT	An attempt to establish a connection timed out without establishing the connection.

See Also

accept()

gethostname()

Gets Name of Current Host

Syntax

```
#include <sys/socket.h>
int gethostname(
    char *name,
    size_t namelen)
```

Libraries

```
socket.l
```

Description

`gethostname()` returns the host name for the current device. The returned name is null-terminated string.

If successful, `gethostname()` returns a value of `0`. Otherwise, it returns `-1` and places the appropriate error code in the global variable `errno`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`name`	points to the standard host name.
`namelen`	specifies the size of the name array.

Errors

`EOS_MNF`	`netdb` module could not be found.

getpeername()
Get Network Entry

Syntax

```
#include <sys/socket.h>
int getpeername(
                int                 s,
                struct sockaddr     *name,
                socklen_t           *namelen)
```

Libraries

`socket.l`

Description

`getpeername()` returns the name of the remote node (peer) connected to socket `s`. If successful, `getpeername()` returns `0`. Otherwise, it returns `-1` with `errno` set to the error value.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`s`
: specifies the path number of the socket.

`name`
: is a pointer to the socket address.

`namelen`
: initializes namelen--before calling--to indicate the amount of space pointed to by name.

  On return, it contains the actual size of the name returned in bytes.

Errors

`ENOTCONN`	The socket is not connected.

See Also

`bind()`

`getsockname()`

`socket()`

getsockname()
Gets Socket Name

Syntax

```
#include <sys/socket.h>
int getsockname(
               int                 s,
               struct sockaddr     *name,
               socklen_t           *namelen)
```

Libraries

```
socket.l
```

Description

`getsockname()`returns the current local node name for the specified socket. It returns `0` if the call succeeds. Otherwise, it returns `-1` and sets `errno` to the error value.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`s`
: specifies the path number of the socket.

`name`
: points to the socket address.

`namelen`
: initializes namelen--before calling--to indicate the number of bytes pointed to by name. On return, it contains the actual size in bytes of the name returned.

Errors

`ENOBUFS`	Insufficient resources are available in the system to perform the operation.
`EBUFTOOSMALL`	Return buffer (`name`) is too small.

See Also

`bind()`

`getpeername()`

`socket()`

getsockopt()
Get Socket Options

Syntax

```
#include <sys/socket.h>
int getsockopt(
                ints,
                intlevel,
                intoptname,
                void*optval,
                socklen_t*optlen)
```

Libraries

`socket.l`

Description

`getsockopt()` returns options associated with a socket. Options may exist at multiple protocol levels, but they are always present at the uppermost socket level.

If successful, the call returns `0`. Otherwise, it returns `-1` and sets `errno` to the error value.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Options

`socket.h` contains definitions for the socket level options. Options at other protocol levels vary in format and name and are defined in the protocol's header file.

Supported socket options are described in Table 2-6.

Table 2-6. Socket Level Options

Level	optname	Description	Data Type
`IPPROTO_IP`	`IP_MULTICAST_TTL`	Get TTL for multicast packets	`u_char`
`IPPROTO_IP`	`IP_MULTICAST_LOOP`	Send multicast packets to the loopback interface	`u_char`
`IPPROTO_IP`	`IP_MULTICAST_IF`	Retrieve interface used for sending multicast packets	`in_addr{}`

Table 2-6. Socket Level Options (Continued)

Level	optname	Description	Data Type
IPPROTO_TCP	TCP_MAXSEG	Get maximum segment size.	int
IPPROTO_TCP	TCP_NODELAY	Do not delay send to coalesce packets.	int
SOL_SOCKET	SO_KEEPALIVE	Keep connection alive by forcing peer to respond periodically.	int
SOL_SOCKET	SO_LINGER	Linger on close if data present.	linger{}
SOL_SOCKET	SO_REUSEADDR	Allow local address reuse.	int
SOL_SOCKET	SO_BROADCAST	Permit sending broadcast datagrams.	int
SOL_SOCKET	SO_OOBINLINE	Leave out-of-band data in normal input queue.	int
SOL_SOCKET	SO_SNDBUF	Get size of send buffer.	int
SOL_SOCKET	SO_RCVBUF	Get size of receive buffer.	int
SOL_SOCKET	SO_SNDLOWAT	Minimum space required in send buffer before to accept more data.	int
SOL_SOCKET	SO_USELOOPBACK	Routing socket receives copy of any data sent (AF_ROUTE only).	int
SOL_SOCKET	SO_TYPE	Get socket type (SOCK_STREAM, SOCK_DGRAM, SOCK_RAW).	int
SOL_SOCKET	SO_ERROR	Retrieve pending socket error	int

Parameters

`s`
specifies the path number of the socket.

`level`
specifies the options level.

When getting socket options, you must specify the level at which the option resides and the option name.

To get options at the socket level, specify level as `SOL_SOCKET`.

To get options at any other level, supply the protocol number of the appropriate protocol controlling the option. For example, `IPPROTO_TCP` specifies TCP options.

`optname`
specifies the name of the option. optname and any specified options are passed uninterpreted to the appropriate protocol module.

`optval`
is a pointer to the buffer for the requested option.

`optval` and `optlen` together identify the buffer in which to return the value for the requested option(s). If an option value is not to be supplied or returned, set optval to 0.

`optlen`
is a pointer to a value-result parameter.

`optlen`
initially contains the size of the buffer pointed to by optval. optlen is modified on return to indicate the actual size of the returned value.

Errors

`ENOPROTOOPT`	The option is unknown.

See Also

`setsockopt()`

`socket()`

ip_start()
Initialize IP stack

Syntax

```
#include <sys/socket.h>
error_code ip_start(void)
```

Libraries

```
socket.l
```

Description

`ip_start()` initializes the IP stack and all the configured drivers. If successful, `ip_start()` returns 0. Otherwise, it returns the appropriate error code.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Errors

`EOS_MNF`	Module not found.

listen()

Listen for Connections on Socket

Syntax

```
#include <sys/socket.h>
int listen(
          int     s,
          int     backlog)
```

Libraries

`socket.l`

Description

`listen()` marks an existing socket as willing to accept incoming connections. The incoming connections are queued until `accept()` is called to retrieve them. The listen call applies only to sockets of type `SOCK_STREAM`.

`listen()` returns `0` if successful. Otherwise, it returns a `-1` with the appropriate code in `errno`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`s`
: specifies the path number of the socket.

`backlog`
: define maximum length to which the queue of pending connections may grow.

  The backlog is limited from 0 to the maximum queue of 128. If the backlog is greater than 128, it defaults to 128. If a connection request arrives with the queue full, the client receives an ECONNREFUSED error.

Errors

`EINVAL`	The socket must be bound in order to listen.
`EOPNOTSUPP`	The socket is not of a type supporting the operation `listen()`.

See Also

`accept()`
`connect()`
`socket()`

recv()
Receives Message From Connected Socket

Syntax

```
#include <sys/socket.h>
size_t recv(
          int     s,
          void    *buf,
          size_t  len,
          int     flags);
```

Libraries

```
socket.l
```

Description

`recv()` receives messages from a socket. Use `recv()` only on connected sockets.

If no data are available at the socket, the call waits for data to arrive, unless the socket is non-blocking. In this case, `-1` is returned with the external variable `errno` set to `EWOULDBLOCK`.

On success, the number of bytes read is returned. This value may be less than the number of bytes requested in `len`. If the socket is of type `SOCK_STREAM`, a return value of 0 indicates the peer has closed its half of the connection and no more data is available to read. On error, `-1` is returned and `errno` is set to the error value.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`s`
: specifies the path number of the socket.

`buf`
: points to the buffer into which the message is received.

`len`
: specifies the length of the buffer.

`flags`
: MSG_PEEK; MSG_WAITALL

Errors

ENOTCONN	The socket is not connected.
EWOULDBLOCK	The socket is marked non-blocking and the receive operation would block.

recvfrom()
Receives Message from Socket

Syntax

```
#include <sys/socket.h>
ssize_t recvfrom(
                int                s,
                void               *buf,
                size_t             len,
                int                flags,
                struct sockaddr    *from,
                socklen_t          *fromlen);
```

Libraries

`socket.l`

Description

`recvfrom()` receives messages from a socket. You may use `recvfrom()` to receive data on a socket in an unconnected state.

`recvfrom()` returns the length of the incoming message. If a message is too long to fit in the supplied buffer, excess bytes may be discarded depending on the type of socket from which the message is received.

If no data are available at the socket, the call waits for data to arrive, unless the socket is non-blocking. In this case, `-1` is returned with the external variable `errno` set to `EWOULDBLOCK`.

On success the number of bytes read is returned. This value may be less than the number of bytes requested in `len`. If the socket is of type `SOCK_STREAM`, a return value of 0 indicates the peer has closed its half of the connection and no more data is available to read. On error, `-1` is returned and `errno` is set to the error value.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`s`
: specifies the path number of the socket.

`buf`
: points to the buffer into which the message is received.

`len`
specifies the length of the buffer.

`flags`
MSG_PEEK; MSG_WAITALL.

`from`
points to a buffer specifying the sender of the message. If `from` is non-zero, the source address of the message is filled in.

`fromlen`
is initialized to the size of the buffer associated with `from`. `fromlen` is modified on return to indicate the actual size of the address stored.

Errors

`EWOULDBLOCK`	The socket is marked non-blocking and the receive operation is blocked.

recvmsg()
Receive Messages from Socket

Syntax

```
#include <sys/socket.h>
ssize_t recvmsg (ints,
                 struct msghdr *msg,
                 int flags);
```

Libraries

`socket.l`

Description

`recvmsg()` uses an `msghdr` structure to minimize the number of directly supplied parameters.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`s`
specifies the path number of the socket.

`msg`
points to a message header structure defined in `<sys/socket.h>`

`flags`
MSG_PEEK; MSG_WAITALL

Errors

`EWOULDBLOCK`	The socket is marked non-blocking and the receive operation is blocked.

send()
Sends Message to Connected Socket

Syntax

```
#include <sys/socket.h>
ssize_t send(
   int                 s,
   const void*msg,
   size_t              len,
   int                 flags);
```

Libraries

```
socket.l
```

Description

`send()` transmits a message to another socket. Use `send()` only when the socket is in a connected state.

If the socket is a datagram socket and the message is too long to pass atomically through the underlying protocol, an error is returned and the message is not transmitted.

For reliable protocols, such as TCP, if no message space is available at the socket to hold the transmitted message, `send()` normally blocks, unless the socket has been placed in non-blocking I/O mode.

No indication of failure to deliver is implicit in a send. Return values of `-1` indicate some locally detected errors. On success, `send()` returns the number of characters sent. On error, `-1` is returned and `errno` is set to the error value.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`s`
: specifies the path number of a socket created with `socket()`.

`msg`
: points to the message to send.

`len`
: specifies the length of the message.

`flags`
: is not supported. Set `flags` to `0`.

Errors

EMSGSIZE	The message is too long.
EHOSTUNREACH	No route to host.
ENOBUFS	Driver cannot allocate buffer.
ENOTCONN	Packets are sent through a non-established socket. The socket must be connected.
EWOULDBLOCK	The socket is marked non-blocking and the requested operation would block.

sendto()
Sends Message to Socket

Syntax

```
#include <sys/socket.h>
ssize_t sendto(
          int                 s,
          const void          *msg,
          size_t              len,
          int                 flags,
          struct sockaddr     *to,
          sockle_t            tolen);
```

Libraries

`socket.l`

Description

`sendto()` transmits a message to another socket. You may use the function with unconnected sockets.

For reliable protocols, such as TCP, if no message space is available at the socket to hold the message to transmit, `send()` normally blocks, unless the socket has been placed in non-blocking I/O mode.

No indication of failure to deliver is implicit in a send. Return values of `-1` indicate some locally detected errors. On success, `sendto()` returns the number of characters sent. On error, `-1` is returned and `errno` is set to the error value.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`s`
: specifies the path number of a socket created with `socket()`.

`buf`
: points to the message to send.

`len`
: specifies the length of the message.

`flags`
: is not supported. Set `flags` to `0`.

`to`
: points to the address of the target.

`tolen`
: specifies the size of the buffer associated with `to`.

Errors

`EDSTADDRREQ`	The `to` address pointer must be non-null and `tolen` variable must be non-zero.
`EMSGSIZE`	The message is too long.
`EHOSTUNREACH`	No route to host.
`ENOBUFS`	Driver cannot allocate buffer.
`ENOTCONN`	Packets are sent through a non-established socket.
`EWOULDBLOCK`	The socket is marked non-blocking and the requested operation would block.

sendmsg()
Send Message to Socket

Syntax

```
#include <sys/socket.h>
ssize_t sendmsg(int s,
                const struct msghdr *msg,
                int flags);
```

Library

`socket.l`

Description

`sendmsg()` transmits a message to another socket. This function may be used with unconnected sockets.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`s`
specifies the path number of a socket created with `socket()`.

`msg`
points to the message structure to send.

`flags`
MSG_OOB

Errors

`EMSGSIZE`	The message is too long.
`EHOSTUNREACH`	No route to host.
`ENOBUFS`	Driver cannot allocate buffer.
`ENOTCONN`	Packets are sent through non-established socket.
`EWOULDBLOCK`	The socket is marked non-blocking and the requested operation would block.

sethostname()
Set Name of Current Host

Syntax

```
#include <sys/socket.h>
int sethostname(
                char    *name,
                size_t  namelen)
```

Libraries

`socket.l`

Description

`sethostname()` sets the host name for the current host.

If successful, `sethostname()` returns a value of `0`. Otherwise, it returns `-1` and places the appropriate error code in the global variable `errno`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`name`
: is a pointer to a null-terminated string containing the new standard host name for the current processor.

`namelen`
: specifies the size of the name array.

Errors

`EOS_MNF`	`inetdb` module could not be found.

See Also

`endnetent()`

`getnetbyaddr()`

`getnetbyname()`

`getnetent()`

setsockopt()
Set Options on Sockets

Syntax

```
#include <sys/socket.h>
int setsockopt(
                int     s,
                int     level,
                int     optname,
                void   *optval,
                socklen_t     optlen)
```

Libraries

`socket.l`

Description

`setsockopt()` sets options associated with a socket. Options may exist at multiple protocol levels; they are always present at the uppermost socket level.

`setsockopt()` returns `0` if the call succeeds. Otherwise, it returns `-1` and sets `errno` to the error value.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Options

The include file `sys/socket.h` contains definitions for socket level options. Options at other protocol levels vary in format and name and are defined in the protocol's header file.

Table 2-7. Options

Level	optname	Description	Data Type
`IPPROTO_IP`	`IP_ADD_MEMBERSHIP`	Join multicast group	`ip_mreq{}`
`IPPROTO_IP`	`IP_DROP_MEMBERSHIP`	Leave multicast group	`ip_mreq{}`
`IPPROTO_IP`	`IP_MULTICAST_TTL`	Set TTL for multicast packets	`u_char`
`IPPROTO_IP`	`IP_MULTICAST_LOOP`	Send multicast packets to the loopback interface	`u_char`

Table 2-7. Options (Continued)

Level	optname	Description	Data Type
IPPROTO_IP	IP_MULTICAST_IF	Select interface for sending multicast packets	in_addr{}
IPPROTO_TCP	TCP_MAXSEG	Set maximum segment size	int
IPPROTO_TCP	TCP_NODELAY	Do not delay send to coalesce packets	int
SOL_SOCKET	SO_KEEPALIVE	Keep connection alive by forcing peer to respond periodically	int
SOL_SOCKET	SO_LINGER	Linger on close if data present	linger{}
SOL_SOCKET	SO_REUSEADDR	Allow local address reuse	int
SOL_SOCKET	SO_BROADCAST	Permit sending broadcast datagrams	int
SOL_SOCKET	SO_OOBINLINE	Leave out-of-bandbt queue	int
SOL_SOCKET	SO_SNDBUF	Set size of send buffer	int
SOL_SOCKET	SO_RCVBUF	Set size of receive buffer	int
SOL_SOCKET	SO_SNDLOWAT	Minimum space required in send buffer to accept more data	int
SOL_SOCKET	SO_USELOOPBACK	Routing socket receives copy of any data sent (AF_ROUTE only)	int

Parameters

`s`
: specifies the path number of the socket.

`level`
: specifies where the option resides.

- To set options at the socket level, specify `level` as `SOL_SOCKET`.
- To set options at any other level, supply the protocol number of the appropriate protocol controlling the option. For example, `IPPROTO_TCP` specifies TCP options.

`optname`
: is the name of the option to be set.

`optval`
: is the new value of the option.

`optlen`
: is the size of `optval` in bytes.

Errors

`ENOPROTOOPT`	The option is unknown.
`EFAULT`	The address pointed to by `optval` is not in a valid part of the process address space.

See Also

`getsockopt()`

`socket()`

shutdown()

Shut Down Part of Full-Duplex Connection

Syntax

```
#include <sys/socket.h>
int shutdown(
            int     s,
            int     how)
```

Libraries

`socket.l`

Description

`shutdown()` shuts down all or part of a full-duplex connection of the socket specified by `s`.

If successful, `shutdown()` returns a value of `0`. Otherwise, it returns `-1` and places the appropriate error code in the global variable `errno`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`s`
: specifies the path number of the socket.

`how`
: specifies the method for receiving and sending permissions.

- If `how` is `0`, further receives are disallowed.
- If `how` is `1`, further sends are disallowed.
- If `how` is `2`, further sends and receives are disallowed.

Errors

`ENOTCONN`	The specified socket is not connected.

See Also

`connect()`

`socket()`

socket()

Creates Endpoint for Communication

Syntax

```
#include <sys/types.h>
#include <sys/socket.h>
int socket(
           int     af,
           int     type,
           int     protocol)
```

Libraries

```
socket.l
```

Description

`socket()` creates an endpoint for communication and returns a path number.

If successful, `socket()` returns the descriptor referencing the socket. Otherwise, it returns `-1` and places the appropriate error code in the global variable `errno`.

SOCK_STREAM Sockets

Sockets of type `SOCK_STREAM` are sequenced, reliable, and full-duplex byte streams, similar to pipes. A stream socket must be in a connected state before any data may be sent or received on it. A `connect()` call creates a connection to another socket.

Once connected, data may be transferred using `_os_read()` and `_os_write()` calls or some variant of the `send()` and `recv()` calls.

SOCK_DGRAM Sockets

`SOCK_DGRAM` sockets provide an unreliable datagram service. The socket may be either connected or unconnected. If it is connected, data may be sent and received using `read()`, `write()`, `_os_read()`, `_os_write()`, `send()` or `recv()`. If the socket is unconnected, `sendto()`, `sendmsg()`, `recvfrom()`, and `recvmsg()` must be used.

SOCK_RAW Sockets

`SOCK_RAW` allows you to build datagrams, including headers. It is used to send and receive ICMP messages, internal routing requests, and user-defined protocols. Sockets of this type require super-user privileges to create.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`af`
specifies an address format with which addresses specified in later operations using the socket should be interpreted.

These formats are defined in the include file `socket.h`. Accepted formats are listed below:

- `AF_INET`: ARPA Internet address family.
- `AF_INET6`: IP version 6
- `AF_ROUTE`: Internal Routing Protocol

`type`
specifies the semantics of communication.

Type values are listed below:

- `SOCK_STREAM` provides sequenced, reliable, two-way connection based byte streams with an out-of-band data transmission mechanism.
- `SOCK_DGRAM` supports datagrams (connectionless, unreliable messages of a fixed and small maximum length).
- `SOCK_RAW` supports datagrams (connectionless, unreliable messages of a fixed and typically small maximum length).

`protocol`
specifies a particular protocol to use with the socket.

Normally only a single protocol exists to support a particular socket type, using a given address format. However, many protocols may exist, in which case a particular protocol must be specified in this manner. The protocol number is particular to the communication domain in which communication is to take place.

Errors

`EAFNOSUPPORT`	The specified address family is not supported in this version of the system.
`EPROTONOSUPPORT`	Specified protocol is not supported.
`ENOBUFS`	There is no end-buffer space available. The socket cannot be created.

See Also

`accept()` `bind()`
`getsockname()` `getsockopt()`
`listen()` `recv()`
`send()` `shutdown()`

Other OS-9 Functions

The following generic OS-9 system calls are also supported by sockets.

```
_os_close()
_os_gs_popt()
_os_gs_ready()
_os_read()
_os_ss_popt()
_os_ss_relea()
_os_ss_sendsig()
_os_write()
ioctl()
select()
```

Point-to-Point Protocol Functions

The Point-to-Point Protocol (PPP) Application Programming Interface (API) provides four types of function calls: stack configuration, CHAT scripting, authentication database, and connection/disconnect. In addition, this API defines structures that provide error reporting and other functionalities between the PPP stack and the software using the API.

The PPP API functions are listed in the `ppplib.l` library. The following table lists and describes the API functions that compose the `ppplib.l` file:

Table 2-8. ppplib.l Library Functions and Descriptions

Function	Description
ppp_auth_add_chap()	Add CHAP Entry to Authentication Module
ppp_auth_add_pap()	Add PAP Entry to Authentication Module
ppp_auth_create_mod()	Create a New Authentication Module (Database)
ppp_auth_del_chap()	Delete CHAP Entry from Authentication Module
ppp_auth_del_pap()	Delete PAP Entry from Authentication Module
ppp_auth_get_cur_chap()	Get CHAP Name/Secret for Currently Set Peer
ppp_auth_get_cur_pap()	Get PAP Name/Secret for Currently Set Peer
ppp_auth_get_peer_name()	Get Name of Currently Set Peer
ppp_auth_link_mod()	Link to Existing Authentication Module
ppp_auth_set_peer_name()	Set Current Peer
ppp_auth_unlink_mod()	Unlink from an Authentication Module
ppp_chat_close()	Close CHAT Path
ppp_chat_open()	Open a Raw CHAT Path
ppp_chat_read()	Read Data from CHAT Path
ppp_chat_script()	Run a CHAT Script
ppp_chat_write()	Write Data to CHAT Path
ppp_close()	Close the PPP Stack
ppp_connect()	Run Optional CHAT Script and Establish PPP Link
ppp_disconnect()	Terminate Current PPP Link
ppp_get_asynch_params()	Get Asynchronous Link Parameters
ppp_get_options()	Get Negotiable Stack Options
ppp_get_params()	Obtain Negotiated Stack Parameters
ppp_get_statistics()	Obtain Current Stack Statistics
ppp_init()	Initialize the PPP API
ppp_open()	Open the PPP Stack

Table 2-8. ppplib.l Library Functions and Descriptions (Continued)

Function	Description
ppp_reset_statistics()	Reset Stack Statistics
ppp_set_asynch_params()	Set Asynchronous Link Parameters
ppp_set_options()	Set Negotiable Stack Options
ppp_start()	Establish a PPP Link
ppp_term()	Terminate the PPP API

ppp_auth_add_chap()
Add CHAP Entry to Authentication Module

Syntax

```
#include <SPF/ppplib.h>

error_code

ppp_auth_add_chap(

                  char        *peer_name,

                  char        *id,

                  char        *secret,

                  auth_handle *hndl);
```

Libraries

`ppplib.l`

Description

This function adds new CHAP peer/ID/secret group to the authentication module. The peer name must be unique; each peer may only have only one CHAP entry and one PAP entry. If a peer already has a CHAP entry within the database, the existing entry is overwritten.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`peer_name`
is a pointer to new peer name.

This string should not exceed `PPP_MAX_PEER_NAME` in length.

`id`
is a pointer to new name.

This string should not exceed `PPP_MAX_NAME` bytes in length.

`secret`
is a pointer to new CHAP secret.

This string should not exceed `PPP_MAX_SECRET` bytes in length.

`hndl`
is a handle to the authentication module.

This parameter is obtained from `ppp_auth_create_mod()` or `ppp_auth_link_mod()`.

Errors

EOS_NOTRDY	Returned when the API has not been initialized.
EOS_FULL	No more free entries within the authentication module.
EOS_ILLPRM	Illegal parameter.

ppp_auth_add_pap()
Add PAP Entry to Authentication Module

Syntax

```
#include <SPF/ppplib.h>

error_code

ppp_auth_add_pap(

                char        *peer_name,

                char        *id,

                char        *secret,

                auth_handle *hndl);
```

Libraries

`ppplib.l`

Description

This function adds new PAP peer/ID/secret group to the authentication module. The peer name must be unique in that each peer may only have one CHAP entry and one PAP entry. If a peer already has a PAP entry within the database, the existing entry is overwritten.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`peer_name`
is a pointer to new peer name.

This string should not exceed `PPP_MAX_PEER_NAME` in length.

`id`
is a pointer to new name.

This string should not exceed `PPP_MAX_NAME` bytes in length.

`secret`
is a pointer to new PAP secret.

This string should not exceed `PPP_MAX_SECRET` bytes in length.

`hndl`
is a handle to the authentication module.

This parameter is obtained from `ppp_auth_create_mod()` or `ppp_auth_link_mod()`.

Errors

EOS_NOTRDY	Returned when the API has not been initialized.
EOS_FULL	Allows no more free entries within the authentication module.
EOS_ILLPRM	Illegal parameter.

ppp_auth_create_mod()

Create a New Authentication Module (Database)

Syntax

```
#include <SPF/ppplib.h>

error_code

ppp_auth_create_mod(

                    u_int16       max_entries,

                    auth_handle   *hndl);
```

Libraries

```
ppplib.l
```

Description

This function creates a new authentication module. This module is used to store authentication information when PAP or CHAP authentication is being used to connect to a remote peer.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`max_entries`
: is the maximum of host/ID/secret groups to be stored in the module.

`hndl`
: is the location where `ppp_auth_create_mod()` will store a handle to the new authentication module.

  This handle will be used in all subsequent calls to the authentication functions in this library.

Errors

`EOS_KWNMOD`	signifies that the authentication module already exists. If this error appears, a call to `ppp_auth_link_mod()` should be made.

See Also

`auth_handle`

`ppp_auth_link_mod()`

ppp_auth_del_chap()
Delete CHAP Entry from Authentication Module

Syntax

```
#include <SPF/ppplib.h>

error_code

ppp_auth_del_chap(

                  char          *peer_name,

                  auth_handle   *hndl);
```

Libraries

```
ppplib.l
```

Description

This function deletes existing CHAP entry for specified peer from the authentication module.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`peer_name`
: is a pointer to peer name.

  This string should not exceed `PPP_MAX_PEER_NAME` in length.

`hndl`
: is a handle to the authentication module.

  This parameter is obtained from `ppp_auth_create_mod()` or `ppp_auth_link_mod()`.

Errors

`EOS_NOTRDY`	Returned when the API has not been initialized.
`EOS_PNNF`	No CHAP entry for specified peer.

ppp_auth_del_pap()
Delete PAP Entry from Authentication Module

Syntax

```
#include <SPF/ppplib.h>

error_code

ppp_auth_del_pap(

                char          *peer_name,

                auth_handle   *hndl);
```

Libraries

```
ppplib.l
```

Description

This function deletes existing PAP entry for specified peer from the authentication module.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`peer_name`
is a pointer to peer name.

This string should not exceed `PPP_MAX_PEER_NAME` in length.

`hndl` is a handle to the authentication module.
This parameter is obtained from `ppp_auth_create_mod()` or `ppp_auth_link_mod()`.

Errors

`EOS_NOTRDY`	Returned when the API has not been initialized.
`EOS_PNNF`	No PAP entry for specified peer.

ppp_auth_get_cur_chap()
Get CHAP Name/Secret for Currently Set Peer

Syntax

```
#include <SPF/ppplib.h>
error_code
ppp_auth_get_cur_chap(
                      char          *name,
                      char          *secret,
                      auth_handle   *hndl);
```

Libraries

```
ppplib.l
```

Description

This call gets the CHAP secret needed to connect to the current host.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`name`
is the location of a character array containing the CHAP name.

This NULL-terminated character array should no more than `PPP_MAX_NAME` bytes in length.

`secret`
is the location of a character array where the CHAP secret will be placed.

This character array should be at most `PPP_MAX_SECRET` bytes in length.

`hndl`
is the handle to the authentication module.

This parameter is obtained from `ppp_auth_create_mod()` or `ppp_auth_link_mod()`.

Errors

`EOS_NOTRDY`	Returned when the API has not been initialized.
`EOS_BNAM`	Signifies that the secret could not be found for the current host and name.

See Also

`ppp_auth_get_peer_name()ppp_auth_set_peer_name()`

ppp_auth_get_cur_pap()
Get PAP Name/Secret for Currently Set Peer

Syntax

```
#include <SPF/ppplib.h>
error_code
ppp_auth_get_cur_pap(
                    char          *name,
                    char          *secret,
                    auth_handle   *hndl);
```

Libraries

```
ppplib.l
```

Description

This call gets the PAP secret needed to connect to the current host.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`name`
is the location of a character array containing the PAP name.

This character array must be no more than `PPP_MAX_NAME` bytes in length.

`secret`
is the location of a character array where the PAP secret will be placed.

This character array should be at least `PPP_MAX_SECRET` bytes in length.

`hndl`
is the handle to the authentication module.

This parameter is obtained from `ppp_auth_create_mod()` or `ppp_auth_link_mod()`.

Errors

`EOS_NOTRDY`	Returned when the API has not been initialized.
`EOS_BNAM`	Secret could not be found for the current host and name.

See Also

`ppp_auth_get_peer_name()ppp_auth_set_peer_name()`

ppp_auth_get_peer_name()
Get Name of Currently Set Peer

Syntax

```
#include <SPF/ppplib.h>

error_code

ppp_auth_get_peer_name(

                        char            *name,

                        auth_handle     *hndl);
```

Libraries

```
ppplib.l
```

Description

This call gets the current remote peer name from the authentication module, as was set with a previous `ppp_auth_set_peer_name()` call.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`name`
is the location to store the current peer name.

This buffer should be at least `PPP_MAX_PEER_NAME` bytes in length.

`hndl`
is the handle to the authentication module.

This parameter is obtained from `ppp_auth_create_mod()` or `ppp_auth_link_mod()`.

Errors

`EOS_NOTRDY`	Returned when the API has not been initialized.

See Also

`ppp_auth_set_peer_name()`

ppp_auth_link_mod()
Link to Existing Authentication Module

Syntax

```
#include <SPF/ppplib.h>

error_code

ppp_auth_link_mod(auth_handle    *hndl);
```

Libraries

```
ppplib.l
```

Description

This function links to an existing authentication module. It is used to store authentication information when PAP or CHAP authentication is being used to connect to a remote peer.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`hndl`
: is the location where `ppp_auth_create_mod()` will store a handle to the new authentication module.

  This handle will be used in all subsequent calls to the authentication functions in this library.

Errors

`EOS_NOTRDY`	Returned when the API has not been initialized.
`EOS_MNF`	Signifies that the authentication module was not found in memory. If this error appears, a call to `ppp_auth_create_mod()` should be made.

See Also

`auth_handle`

`ppp_auth_create_mod()`

ppp_auth_set_peer_name()
Set Current Peer

Syntax

```
#include <SPF/ppplib.h>

error_code

ppp_auth_set_peer_name(

                        char          *name,

                        auth_handle   *hndl);
```

Libraries

```
ppplib.l
```

Description

This function sets the current remote peer name in the authentication module. This determines which values (such as PAP/CHAP names and secrets) will be get/set in subsequent authentication calls.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`name`
: is the location of the new remote peer name.

  This character array should be no more than `PPP_MAX_PEER_NAME` bytes in length.

`hndl`
: is the handle to the authentication module.

  This parameter is obtained from `ppp_auth_create_mod()` or `ppp_auth_link_mod()`.

Errors

`EOS_NOTRDY`	Returned when the API has not been initialized.

See Also

`ppp_auth_get_peer_name()`

ppp_auth_unlink_mod()
Unlink from an Authentication Module

Syntax

```
#include <SPF/ppplib.h>

error_code

ppp_auth_unlink_mod(auth_handle     *hndl);
```

Libraries

```
ppplib.l
```

Description

This call unlinks from an authentication module previously linked to with `ppp_auth_link_mod()`, or created with `ppp_auth_create_mod()`.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`hndl`
handle of the authentication module to unlink.

Errors

`EOS_NOTRDY`	Returned when API has not been initialized.
`EOS_MNF`	Signifies that the authentication module was not found in memory.

See Also

`auth_handle`

`ppp_auth_create_mod()`

`ppp_auth_link_mod()`

ppp_chat_close()
Close CHAT Path

Syntax

```
#include <SPF/ppplib.h>

error_code

ppp_chat_close(path_id      chat_path);
```

Libraries

```
ppplib.l
```

Description

This function closes the path opened by `ppp_chat_open()`.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`chat_path`
: Path identifier that was returned from a successful call to `ppp_chat_open()`.

Errors

`EOS_NOTRDY`	Returned when the API has not been initialized.
`EOS_BPNUM`	Returned when this not a valid path identifier.

See Also

`ppp_chat_read()`

`ppp_chat_write()`

`ppp_open()`

`ppp_start()`

ppp_chat_open()
Open a Raw CHAT Path

Syntax

```
#include <SPF/ppplib.h>

error_code

ppp_chat_open(

              char       *hdlc_name,

              path_id    *chat_path);
```

Libraries

```
ppplib.l
```

Description

This function opens a path to the HDLC driver and places the driver into CHAT mode. When in this mode, the caller can use the `chat_path` to read/write directly from or to the communications device below the HDLC layer.

The name of the HDLC descriptor should be the same as the one used within the PPP stack name. For example, the PPP stack name of `</dev>/hdlc0/lcp0/ipcp0` would use `/hdlc0` for the `hdlc_name` field.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`stack_name`
: is the name of the HDLC descriptor contained within the PPP stack name.

`chat_path`
: returns the path of the HDLC layer at this location.

Errors

`EOS_NOTRDY`	Returned when the API has not been initialized.
`EOS_BPNUM`	Returned when this not a valid PPP stack path identifier.

See Also

`ppp_chat_close()` `ppp_chat_read()`
`ppp_chat_write()` `ppp_open()`
`ppp_start()`

ppp_chat_read()
Read Data from CHAT Path

Syntax

```
#include <SPF/ppplib.h>
error_code
ppp_chat_read(
              path_id m   chat_path,
              void         *buffer,
              u_int32      *count);
```

Libraries

```
ppplib.l
```

Description

This function reads user data from the path. Use this call after `ppp_chat_open()` to read data from the data port without HDLC decoding.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`chat_path`	is the path identifier that was returned from a successful call to `ppp_chat_open()`.
`buffer`	is the pointer to the caller's character buffer.
`count`	is the pointer to the number of bytes in the caller's character buffer. After the call completes, the number of bytes actually read is returned here.

Errors

`EOS_NOTRDY`	Returned when the API has not been initialized.
`EOS_BPNUM`	Returned when this not a valid PPP stack path identifier.

See Also

`ite_data_read()`

`_os_read()`

`ppp_chat_write()`

ppp_chat_script()
Run a CHAT Script

Syntax

```
#include <SPF/ppplib.h>

error_code

ppp_chat_script(

                path_id         chat_path,

                path_id         log_path,

                u_int8          chat_type,

                char            *chat_name,

                ppp_conninfo    *ci);
```

Libraries

```
ppplib.l
```

Description

This function runs a CHAT script from either a text file or a data module. An optional logging path may be specified where CHAT commands and responses will be echoed. A log path of `PPP_NOLOG` denotes no logging is desired.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`chat_path`
: is the CHAT path identifier that was returned from a successful call to `ppp_chat_open()`.

`log_path`
: is the path where CHAT commands and responses will be echoed for logging purposes.

  The `log_path` of `PPP_NOLOG` may be used to prevent logging.

`chat_type`
: specifies the container of the CHAT script commands: `PPP_CHAT_TYPE_MODULE` or `PPP_CHAT_TYPE_FILE`.

`chat_name`
is the name of the CHAT module or file.

`ci`
is a pointer to structure allocated by the application that contains connection information for the life of the connection.

Applications must keep this memory structure to prevent errors from resulting.

Errors

`EOS_NOTRDY`	Returned when the API has not been initialized.
`EOS_BPNUM`	CHAT or log path is invalid.
`EOS_ILLFNC`	Unknown command in CHAT script.
`EOS_ILLPRM`	Bad argument in CHAT script.
`EOS_NORAM`	Unable to allocate CHAT engine memory.
`EOS_PPP_CHAT_BADSTR`	Malformed string in CHAT script.
`EOS_PPP_CHAT_ABORT`	Script aborted due to reception of an `ABORT` string.
`EOS_PPP_CHAT_APPABORT`	Script aborted due to application setting the `PPP_CIFLAG_CHATABORT` flag within the ppp_conninfo data structure.
`ETIMEDOUT`	Communication with the remote peer timed out.

See Also

`ppp_chat_close()`

`ppp_chat_open()`

`ppp_start()`

ppp_chat_write()
Write Data to CHAT Path

Syntax

```
#include <SPF/ppplib.h>
error_code
ppp_chat_write(
               path_id    chat_path,
               void       *buffer,
               u_int32    *count);
```

Libraries

```
ppplib.l
```

Description

This function writes user data down the CHAT path. Use this function after `ppp_chat_open()` to send data out the data port without HDLC framing.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`chat_path`
is a path identifier returned from a successful call to `ppp_chat_open()`.

`buffer`
is a pointer to the caller's character buffer.

`count`
is a pointer to the number of bytes in the caller's character buffer.

After the call is completed, the number of bytes actually written is returned here.

Errors

`EOS_NOTRDY`	Returned when the API has not been initialized.
`EOS_BPNUM`	Returned when this not a valid PPP stack path identifier.

See Also

`_os_write()`

`ppp_chat_read()`

ppp_close()
Close the PPP Stack

Syntax

```
#include <SPF/ppplib.h>

error_code

ppp_close(path_id    stack_path);
```

Libraries

```
ppplib.l
```

Description

This function closes the PPP stack associated with the `stack_path` handle.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`stack_path`
is a path identifier returned from a successful call to `ppp_open()`.

Errors

`EOS_NOTRDY`	Returned when API has not been initialized.
`EOS_DEVBSY`	Returned if PPP link is still established.
`EOS_BPNUM`	Returned when not a valid PPP stack path identifier.

See Also

`ppp_open()`

ppp_connect()
Run Optional CHAT Script and Establish PPP Link

Syntax

```
#include <SPF/ppplib.h>
error_code
ppp_connect(
            path_id       stack_path,
            path_id       log_path,
            char          *hdlc_name,
            u_int8        chat_type,
            char          *chat_name,
            ppp_conninfo  *connection_info);
```

Libraries

`ppplib.l`

Description

This function connects an open PPP stack to a remote peer. It can be direct connect or dial-up. If the connection is dial-up, the function can parse a data module or disk file (a CHAT script) into send/expect command pairs, which are sent/received to/from a modem to establish the connection with the remote peer.

This function will return when the modems have connected and HDLC is enabled, when the protocol has timed out, or when the function encounters an error in the CHAT commands. If `stack_up_sig` and `stack_down_sig` in the `connection_info` structure are non-zero, the application will receive one or the other when the connection attempt resolves. If the signals are zero, the calling process will be sent to no signals.

If it is necessary to run a customized chat script, use the `chat_open()`, `chat_write()`, `chat_read()`, `chat_close()` and `ppp_start()` calls instead of the `ppp_connect()` call.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`stack_path`
is a path identifier returned from a successful call to `ppp_open()`.

`log_path`
is a path where CHAT commands and responses will be echoed for logging purposes. `log_path` of `PPP_NOLOG` may be used for this parameter to prevent logging.

`hdlc_name`
is the name of the HDLC descriptor contained within the PPP stack name.

For example, the PPP stack name of `</dev>/hdlc0/lcp0/ipcp0` would use `/hdlc0` for this parameter.

`chat_type`
specifies the container of the send/expect commands: `PPP_CHAT_TYPE_MODULE`, `PPP_CHAT_TYPE_FILE`, or `PPP_CHAT_TYPE_NONE` (if no CHAT script is required).

`chat_name`
is the name of the chat module/file (or NULL pointer if chat_type is `PPP_CHAT_TYPE_NONE`).

`connection_info`
is a pointer to structure allocated by the application containing connection information for the life of the connection.

Applications must keep this memory structure to prevent errors from resulting.

Errors

`EOS_NOTRDY`	Returned when the API has not been initialized.
`EOS_DEVBSY`	Returned when a PPP link is established.
`EOS_BPNUM`	Returned when this not a valid PPP stack path identifier.
`EOS_PARAM`	There was an error in the chat commands.
`EOS_MNF`	Module not found.
`EOS_PNNF`	Disk file not found.
`ETIMEDOUT`	Communication with the remote peer timed out.

See Also

`_os_intercept()`

`ppp_chat_open()`

`ppp_chat_write()`

`ppp_get_params()`

`ppp_open()`

`ppp_start()`

ppp_disconnect()
Terminate Current PPP Link

Syntax

```
#include <SPF/ppplib.h>

error_code

ppp_disconnect(path_id      stack_path);
```

Libraries

```
ppplib.l
```

Description

This call specifies a disconnect from the remote peer. This is done by sending a terminate request message to the remote peer. Also, a request is made to drop the modem carrier to the driver below the HDLC layer. After this call, it is safe for the application to return the memory for the `ppp_conninfo` structure passed in from the `ppp_connect()` or `ppp_start()`.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`stack_path`
: is a path identifier returned from a successful call to `ppp_open()`.

Errors

`EOS_NOTRDY`	Returned when the API has not been initialized or if a PPP link is not established.
`EOS_BPNUM`	Returned when this not a valid PPP path identifier.

See Also

`ppp_connect()`

`ppp_open()`

ppp_get_asynch_params()
Get Asynchronous Link Parameters

Syntax

```
#include <SPF/ppplib.h>

error_code

ppp_get_asynch_params(

                    path_id       stack_path,

                    ppp_modem_p   *params);
```

Libraries

```
ppplib.l
```

Description

This call gets the parameter values for the asynchronous PPP link. The desired options are returned in the `ppp_modem_p` structure.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`stack_path`
is a path identifier that was returned from a successful call to `ppp_open()`.

`paramsi`
s a pointer to the location where `ppp_get_asynch_params()` will store the current asynchronous parameter values for the PPP link.

Errors

`EOS_NOTRDY`	Returned when the API has not been initialized.
`EOS_BPNUM`	Returned when this not a valid PPP stack path identifier.
`EOS_PERMIT`	Invalid pointer.
`EOS_ILLPRM`	Illegal parameter.

See Also

`ppp_connect()ppp_modem_p`
`ppp_open()ppp_set_asynch_params()`

`(ppp_set_asynch_params() is valid only for asynchronous PPP links.)`

ppp_get_options()
Get Negotiable Stack Options

Syntax

```
#include <SPF/ppplib.h>

error_code

ppp_get_options(

                path_id             stack_path,

                ppp_option_block    *options);
```

Libraries

```
ppplib.l
```

Description

This call gets the negotiable options of the drivers in an open PPP stack. The options will be stored in the specified `ppp_option_block`.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`stack_path`
: is a path identifier that was returned from a successful call to `ppp_open()`.

`options`
: is a pointer to the location at which `ppp_get_options()` will store the current options for the PPP stack.

Errors

`EOS_NOTRDY`	Returned when the API has not been initialized.
`EOS_BPNUM`	Returned when this not a valid PPP stack path identifier.
`EOS_PERMIT`	Invalid pointer.
`EOS_ILLPRM`	Illegal parameter.

See Also

`ppp_connect()`

`ppp_open()`

`ppp_option_block`

`ppp_set_options()`

ppp_get_params()
Obtain Negotiated Stack Parameters

Syntax

```
#include <SPF/ppplib.h>

error_code

ppp_get_params(

               path_id          stack_path,

               ppp_param_block  *params);
```

Libraries

```
ppplib.l
```

Description

This call obtains the current negotiated link parameters of the drivers in an open PPP stack. This information will be placed at the location of the indicated `ppp_param_block` structure.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`stack_path`
: is a path identifier that was returned from a successful call to `ppp_open()`.

`params`
: is a pointer to the location where `ppp_get_params()` will store the current negotiated parameters of the PPP stack.

Errors

`EOS_NOTRDY`	Returned when API has not been initialized.
`EOS_BPNUM`	Returned when this not a valid PPP stack path identifier.

See Also

`ppp_get_options()`

`ppp_open()`

`ppp_param_block`

`ppp_set_options()`

ppp_get_statistics()
Obtain Current Stack Statistics

Syntax

```
#include <SPF/ppplib.h>
error_code
ppp_get_statistics(
path_id          stack_path,
ppp_ipcp_stats   *ipcp_stats,
ppp_lcp_stats    *lcp_stats,
ppp_hdlc_stats   *hdlc_stats);
```

Libraries

`ppplib.l`

Description

This function queries the drivers in the specified PPP stack and returns current statistics for each layer. A NULL pointer may be passed in for any layer in which the caller is not interested.

The LCP and IPCP layers do not currently support statistics and therefore must be NULL.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`stack_path`
: is a path identifier that was returned from a successful call to `ppp_open()`.

`ipcp_stats`
: is a pointer to a user-allocated statistics structure where `ppp_get_statistics()` will return the IPCP-layer statistics.

`lcp_stats`
: is a pointer to a user-allocated statistics structure where `ppp_get_statistics()` will return the LCP-layer statistics.

`hdlc_stats`
: is a pointer to a user-allocated statistics structure where `ppp_get_statistics()` will return the HDLC-layer statistics.

Errors

EOS_NOTRDY	Returned when the API has not been initialized.
EOS_PERMIT	Invalid pointer was passed in.
EOS_BPNUM	Returned when this not a valid PPP stack path identifier.

See Also

ppp_open()

ppp_init()
Initialize the PPP API

Syntax

```
#include <SPF/ppplib.h>

error_code

ppp_init(void     *rsvd);
```

Libraries

```
ppplib.l
```

Description

This call initializes the PPP API. This call must be made before any other calls are allowed. Currently, the single `rsvd` parameter is reserved for future use and must be NULL.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`rsvd`
: Reserved for possible future use; must be set to NULL.

Errors

`EOS_DEVBSY`	Returned when the API has been initialized.

See Also

`ppp_close()`

`ppp_disconnect()`

ppp_open()
Open the PPP Stack

Syntax

```
#include <SPF/ppplib.h>

error_code

ppp_open(

         char     *stack_name,

         path_id  *stack_path);
```

Libraries

```
ppplib.l
```

Description

This is the PPP function that opens the PPP stack.

This function merely opens a path to the stack. To actually connect to a remote peer use `ppp_connect()` or `ppp_start()` after the `ppp_open()`. The path identifier that is returned from a successful `ppp_open()` should eventually be used in a call to `ppp_close()`.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`stack_name`
: is a NULL-terminated string containing the name of the PPP stack (`/hdlc0/lcp0/ipcp0`).

`stack_path`
: is a pointer to the location where `ppp_open()` will store the path identifier of the opened path.

Errors

`EOS_NOTRDY`	Returned when the API has not been initialized.
`EOS_MNF`	Returned when the specified descriptors are not found in memory.

See Also

`ppp_close()`

`ppp_disconnect()`

ppp_reset_statistics()
Reset Stack Statistics

Syntax

```
#include <SPF/ppplib.h>
error_code
ppp_reset_statistics(
                    path_id   stack_path,
                    u_int16   layers);
```

Libraries

```
ppplib.l
```

Description

This function resets the statistics in the specified PPP stack. `layers` is a bitmask that determines which layers should reset their statistics. Currently, only the HDLC layer supports statistics; therefore, the only valid value for layers is `PPP_LAYER_HDLC`.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`stack_path`
is a path identifier that was returned from a successful call to `ppp_open()`.

`layers`
is a bitmask that determines which layers should reset their statistics.

Layer bit values are defined in `SPF/ppplib.h` (`PPP_LAYER_IPCP`, `PPP_LAYER_LCP`, and `PPP_LAYER_HDLC`).

Errors

`EOS_NOTRDY`	Returned when the API has not been initialized.
`EOS_BPNUM`	Returned when this not a valid PPP stack path identifier.

See Also

`ppp_open()`

ppp_set_asynch_params()
Set Asynchronous Link Parameters

Syntax

```
#include <SPF/ppplib.h>

error_code

ppp_set_asynch_params(

                    path_id        stack_path,

                    ppp_modem_p    *params);
```

Libraries

```
ppplib.l
```

Description

This call sets the configurable parameter values for the asynchronous PPP link. The desired options are specified in the `ppp_modem_p` structure. This structure may be filled out completely by the user or selected items may be updated in a `ppp_modem_p` returned from a successful call to `ppp_get_asynch_params()`. The configuration must be set before the call to `ppp_connect()` or `ppp_start()` for the given path.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`stack_path`
: is a path identifier returned from a successful call to `ppp_open()`.

`params`
: is a pointer to the location that `ppp_set_asynch_params()`uses to update the asynchronous parameter values for the PPP link.

Errors

`EOS_NOTRDY`	Returned when the API has not been initialized.
`EOS_BPNUM`	Returned when this not a valid PPP stack path identifier.
`EOS_ILLPRM`	Illegal value was specified for one of the options.

See Also

`ppp_connect()`

`ppp_get_asynch_params()`

`ppp_modem_p`

`ppp_open()`

(`ppp_open()` is valid only for asynchronous PPP links.The rx_dev_name and `tx_dev_name` fields of the PPP parameter structure should refer to the same device.The `rx_dev_name` field is used to specify the device that the PPP stack will use for communication.The `tx_dev_name` field is ignored.)

ppp_set_options()
Set Negotiable Stack Options

Syntax

```
#include <SPF/ppplib.h>

error_code

ppp_set_options(

                path_id           stack_path,

                ppp_option_block  *options);
```

Libraries

`ppplib.l`

Description

This call sets the negotiable options of the drivers in an open PPP stack. The options will be taken from the specified `ppp_option_block`. This structure can be filled out completely by the user or selected items can be modified in a `ppp_option_block` returned from a successful call to `ppp_get_options()`. The configuration must be set before the call to `ppp_connect()` or `ppp_start()` for the given path.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`stack_path`	is a path identifier returned from a successful call to `ppp_open()`.
`options`	is a pointer to the location where `ppp_set_options()` will take the new options for the PPP stack.

Errors

`EOS_NOTRDY`	Returned when the API has not been initialized.
`EOS_BPNUM`	Returned when this not a valid PPP stack path identifier.
`EOS_ILLPRM`	Illegal value was specified for one of the options.

See Also

`ppp_connect()`

`ppp_get_options()`

`ppp_open()`

`ppp_option_block`

ppp_start()
Establish a PPP Link

Syntax

```
#include <SPF/ppplib.h>

error_code

ppp_start(

          path_id        stack_path,

          ppp_conninfo   *connection_info);
```

Libraries

```
ppplib.l
```

Description

This function completes the PPP connection after the CHAT operation has been performed. This call does not use the chat_path, rather the stack_path, which contains the complete PPP signaling stack.

The chat_path must have been closed prior to making this call in order to allow the HDLC layer to begin HDLC framing.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`stack_path`
: is a path identifier that was returned from a successful call to `ppp_open()`.

`connection_info`
: is a pointer to structure allocated by the application that contains connection information for the life of the connection.

  Applications must keep this memory structure to prevent errors from resulting.

Errors

`EOS_NOTRDY`	Returned when the API has not been initialized.
`EOS_BPNUM`	Returned when this not a valid PPP stack path identifier.
`EOS_PARAM`	Error in the chat commands.
`ETIMEDOUT`	Communication with the remote peer timed out.

See Also

`ppp_open()`

ppp_term()
Terminate the PPP API

Syntax

```
#include <SPF/ppplib.h>

error_code

ppp_term(void    *rsvd);
```

Libraries

```
ppplib.l
```

Description

This call terminates (deinitializes) the use of this API. Currently, the single `rsvd` parameter is reserved for future use and must be NULL.

Attributes

Operating System:	OS-9
State:	User
Threads:	Safe

Parameters

`rsvd`	is reserved for possible future use; must be set to NULL.

Errors

`EOS_NOTRDY`	Returned when the API has not been initialized.

See Also

`ppp_close()`

`ppp_connect()`

Per-Path Static Storage Functions

A library (ppstat.l) is supplied with the SoftStax package that facilitates usage of per-path storage (PPS). PPS allows a protocol driver to store unique information for each path that it is currently open on a particular logical unit. The PPS structures are simply stored in a linked list pointed to by the lu_pps_list field of the SPF logical unit static storage.

There are two sections of the PPS structure: the ppstat.l section and the driver's section. ppstat.l's section is defined in ppstat.h. The driver's section is specified by defining the pre-processor macro SPF_PPSTAT prior to including spf.h (which includes ppstat.h). Fields enumerated in the macro are added after the ppstat.l section. There is no automatic way to initialize the driver's PPS; the driver must initialize it at run-time after allocating it via `pps_add_entry()`. See the `spproto` example driver for more details.

The ppstat.l section of the PPS includes these fields:

```
Spf_ppstat    pp_next;     /* Next pointer in the list */
```

The next PPS associated with a given logical unit static storage.

```
void          *pp_pd;      /* Path descriptor pointer  */
```

The pointer to the path descriptor with which the PPS corresponds.

```
Dev_list      pp_updrvr,   /* Dev_list of driver above */
```

The device list pointer for the "up" driver for this PPS.

```
Dev_list      pp_dndrvr,   /* Dev_list of driver below */
```

The device list pointer for the "down" driver for this PPS.

```
Dev_list      pp_deventry; /* driver's Dev_list        */
```

The device list pointer for this driver.

The `ppstat.l` library includes functions to create, search for, and delete PPS. The following table lists and describes the functions that compose the `ppstat.l` library.

Table 2-9. ppstat.l Library Functions and Descriptions

Function	Description
`pps_add_entry()`	Delete Host Entry by Name
`pps_chg_updrvr()`	Change the "up" Driver
`pps_del_entry()`	Delete a PPS
`pps_find_entry()`	Find a PPS
`pps_find_entry_by_offset()`	Find a PPS by a Key

pps_add_entry()
Create a PPS

Syntax

```
#include <SPF/spf.h>

error_code

pps_add_entry(Dev_list deventry, Spf_ppstat *ret_pps);
```

Libraries

```
ppstat.l
```

Description

`pps_add_entry()` allocates a PPS structure, clears the driver's section to zero, and adds the PPS to the list of PPS structures for the specified logical unit static storage.

Prior to calling `pps_add_entry()`, the driver must initialize the `lu_pps_size` field of the logical unit static storage. In most cases, `sizeof(spf_ppstat)` should be used as the value.

The driver's section of the PPS will be cleared to zero by `pps_add_entry()`. Thus, it must be initialized at run-time after calling `pps_add_entry`.

Parameters

`deventry`
: Pointer to the device list entry currently in use.

`ret_pps`
: Pointer to a pointer to a PPS structure. If this parameter is non-NULL `pps_add_entry` will fill it in with a pointer to the new PPS.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	System

Errors

`EOS_NORAM`	Insufficient RAM.
`EOS_PARAM`	Bad parameter (e.g. `lu_pps_size` is zero).

pps_chg_updrvr()
Change the "up" Driver

Syntax

```
#include <SPF/spf.h>

error_code

pps_chg_updrvr(Spf_lustat lustat,
               Spf_pdstat pd,
               Dev_list new_updrvr);
```

Libraries

```
ppstat.l
```

Description

`pps_chg_updrvr()` changes the "up" driver (`pp_updrvr` field) for the PPS associated with the specified path descriptor. It searches the specified logical unit static storage for the PPS associated with the specified path descriptor and changes the "up" driver field of that PPS.

Parameters

`lustat`
: Current logical unit static storage.

`pd`
: The path descriptor associated with the PPS for which to change the "up" driver.

`new_updrvr`
: The new "up" driver device list pointer.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	System

Errors

`EOS_PPS_NOTFND`	No PPS found for specified path descriptor.

pps_del_entry()
Delete a PPS

Syntax

```
#include <SPF/spf.h>

error_code

pps_find_entry(Spf_lustat lustat, Spf_pdstat pd);
```

Libraries

```
ppstat.l
```

Description

`pps_del_entry()` removes the PPS structure currently associated with the specified path descriptor from the PPS list for the specified logical unit static storage. The memory is returned to the operating system.

Parameters

`lustat`
: Pointer to the logical unit static storage from which to delete the PPS entry.

`pd`
: Pointer to the path descriptor with which the PPS to delete is associated.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	System

Errors

`EOS_PPS_NOTFND`	No PPS could be found for the specified path descriptor.
`EOS_DAMAGE`	`_os_srtmem()` error.

pps_find_entry()
Find a PPS

Syntax

```
#include <SPF/spf.h>

error_code
pps_del_entry(   Spf_lustat lustat,
                 Spf_pdstat pd,
                 Spf_ppstat *ret_pps);
```

Libraries

```
ppstat.l
```

Description

`pps_find_entry()` searches the PPS list on the specified logical unit static storage for a PPS structure associated with the specified path descriptor. A pointer to the matching PPS is returned at `ret_pps`. If none is found, the pointer at `ret_pps` will be set to NULL.

Parameters

`lustat`
: Pointer to the logical unit static storage to search.

`pd`
: Pointer to path descriptor with which the located PPS is associated.

`ret_pps`
: Pointer to a pointer to a PPS structure to fill in with the located PPS structure pointer.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	System

Errors

`EOS_PPS_NOTFND`	No PPS found for specified path descriptor.

pps_find_entry_by_offset()
Find a PPS by a Key

Syntax

```
#include <SPF/spf.h>
error_code
pps_find_entry_by_offset(Spf_lustat lustat,
                  u_int16    offset,
                  u_int16    size,
                  void       *cmp_val,
                  Spf_ppstat *ret_pps);
```

Libraries

```
ppstat.l
```

Description

This function searches the PPS list on the specified logical unit static storage for a PPS structure containing a specified byte pattern at a specified offset. This function might be used to search via a key in the driver's section of the PPS. A pointer to the matching PPS is returned at ret_pps. If none is found, the pointer at `ret_pps` will be set to NULL. For example, these two calls perform the same function:

```
err = pps_find_entry(lustat, pd, &found);
err = pps_find_entry_by_offset(lustat,
offsetof(spf_ppstat, pp_pd), sizeof(pd), &pd,&found);
```

Parameters

`lustat`
: Pointer to the logical unit static storage to search.

`offset`
: The offset into the PPS to the key.

`size`
: The number of bytes in the key.

`cmp_val`
: A pointer to the key to search for.

`ret_pps`
: address of a pointer where the located PPS structure pointer is stored.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	System

Errors

`EOS_PPS_NOTFND`	No PPS could be found for the specified path descriptor.

ITEM Library Functions

This section contains descriptions, in alphabetical order, of the telecommunications Application Programming Interface (API) functions in the Integrated Telephony Environment for Multimedia (ITEM) library.

The following table lists and describes the functions that compose the ITEM library.

Table 2-10. ITEM Library Functions and Descriptions

Function	Description
ite_ctl_addrset()	Sets ITEM Address Information
ite_ctl_answer()	Answers Incoming Call
ite_ctl_connect()	Establishes an End-to-end Connection
ite_ctl_connstat()	Returns Device Type Status Information
ite_ctl_disconnect()	Disconnects End-to-end Connection
ite_ctl_rcvrasgn()	Sets Up Path for Incoming Calls
ite_ctl_rcvrrmv()	Removes Notification Request
ite_data_avail_asgn()	Notifies Path of Incoming Data
ite_data_avail_rmv()	Removes Notification Request
ite_data_read()	Reads From a Path
ite_data_readmbuf()	Gets mbuf Data
ite_data_ready()	Returns Number of Bytes Available
ite_data_recvfrom()	Receive Data from a Specified Location
ite_data_sendto()	Send Data to a Specified Location
ite_data_write()	Writes Data to Packet
ite_data_writembuf()	Writes mbuf-packet
ite_dev_attach()	Attaches a Device
ite_dev_detach()	Detaches Device
ite_dev_getmode()	Gets Device Mode
ite_dev_getname()	Gets Device Name
ite_dev_gettype()	Gets Device Type
ite_dev_setmode()	Sets Device Mode
ite_fehangup_asgn()	Registers Caller for Notification of Far End Disconnect
ite_fehangup_rmv()	Removes Request for Far-end Hang-up
ite_linkdown_asgn()	Notifies Caller of Link Failure
ite_linkdown_rmv()	Removes Linkdown Notification Assignment
ite_linkup_asgn()	Notifies Caller of Link Failure
ite_linkup_rmv()	Removes Linkup Notification Assignment
ite_path_clone()	Duplicates a Path - Independent Connection
ite_path_close()	Closes a Path
ite_path_dup()	Duplicates Path and Shares Connection
ite_path_open()	Opens a Path

Table 2-10. ITEM Library Functions and Descriptions

Function	Description
ite_path_pop()	Removes Driver from Top of Stack
ite_path_profileget()	Get Path Profile
ite_path_profileset()	Set Path Profile
ite_path_push()	Pushes Protocol or Hardware-Driver Onto Path

ite_ctl_addrset()

Sets ITEM Address Information

Syntax

```
#include <SPF/item.h>
error_code ite_ctl_addrset(
     ath_id        path,
     addr_type     *our_num,
     addr_type     *their_num);
```

Libraries

`item.l`

Description

`ite_ctl_addrset()` allows you to set the address information for the ITEM path. Specifically, it sets the `dev_ournum` and `dev_theirnum` structures in the item path descriptor. If `our_num` or `their_num` is set to `NULL`, the corresponding value of `dev_ournum` and `dev_theirnum` respectively is left unchanged.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`	contains a handle identifying the input/output (I/O) path. This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`. For in-band protocols, the path is also used to read and write data. For out-of-band protocols, the path is used only as the signalling path; it is not used to read and write data.
`our_num`	points to the caller-allocated `addr_type` structure set up to represent the new address information for your device.
`their_num`	points to the caller-allocated `addr_type` structure. It is set up to represent the new address of the far-end device with which to communicate.

Indirect Errors

`EOS_ILLPRM`	`addr_size` field in `addr_type` structure is greater than 32 bytes.
`EOS_BPNUM`	Returned when the path number is invalid.

`EOS_PTHLOST`	Returned when the path was lost and is no longer valid.
`EOS_PPS_NOTFND`	Returned when the driver cannot find its local path storage for the `path_id` passed in.

Other errors may be returned by SoftStax® drivers.

Refer to the description of `item.h` in the *Using SoftStax* manual for information about the `addr_type` structure.

ite_ctl_answer()
Answers Incoming Call

Syntax

```
#include <SPF/item.h>
error_code ite_ctl_answer(
     path_id         path,
     ite_cctl_pb     *ccpb,
     notify_type     *npb);
```

Libraries

`item.l`

Description

`ite_ctl_answer()` allows a process to answer an incoming call on the specified path. The path must have previously performed an `ite_ctl_rcvrasgn()` call to enable notification of incoming calls.

Alternatively, the application can continuously poll using the `ite_ctl_connstat()` call until the `dev_callstate` field equals `ITE_CS_INCALL`.

If the `npb` parameter is `NULL`, control is returned to the caller after the call control procedure puts this connection into the active state, indicating an end-to-end connection is being established.

If a notification parameter block is passed in, the driver sends notification when the end-to-end connection has been confirmed by the network. In either case, before answering, the `ite_ctl_connstat()` call can be used to screen the call or get the display information, if there is any, for the incoming call (that is, caller ID).

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`	contains a handle identifying the I/O path. This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`. For in-band protocols, the path is also used to read and write data. For out-of-band protocols, the path is used only as the signalling path; it is not used to read and write data.

ccpb	points to the call control parameter block. This parameter block provides additional information from the application to the driver responsible for performing the answer. If no additional information is needed, the application may pass NULL for this pointer.
npb	points to the notification parameter block, telling ITEM the type of notification the caller requests when the connection is established.

Refer to information on notify_type in the *Using SoftStax* manual for information about setting up the notification parameter block.

Indirect Errors

EOS_BPNUM	Returned when the path number is invalid.
EOS_PPS_NOTFND	Returned when the driver cannot find its local path storage for the path_id passed in.
EOS_PTHLOST	Returned when the path was lost and is no longer valid.
EOS_TSTATE	Path is in the wrong state to answer incoming call.
EOS_UNKSVC	Returned when drivers for connection-oriented ITEM calls (connect, disconnect, or answer) are not connected.

See Also

ite_ctl_addrset()

ite_ctl_connect()

ite_ctl_connstat()

ite_ctl_disconnect()

ite_ctl_connect()
Establishes an End-to-end Connection

Syntax

```
#include <SPF/item.h>
error_code ite_ctl_connect(
     path_id          path,
      addr_type        *ournum,
      addr_type        *theirnum,
     notify_type      *npb);
```

Libraries

`item.l`

Description

`ite_ctl_connect()` sets the `dev_ournum` and `dev_theirnum` structures in the `item` path descriptor, to the `addr_type` structures that you passed in. This is only done if the `ournum` or `theirnum` pointer is not `NULL`. Then, this function establishes an end-to-end connection from the ITEM device referenced by path to the far-end device with the address found in the `dev_theirnum` structure of your device. If the `ournum` and/or `theirnum` pointers passed in are `NULL`, ITEM uses the default addresses found in the path descriptor.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`	contains a handle identifying the I/O path. This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`. For in-band protocols, the path is also used to read and write data. For out-of-band protocols, the path is used only as the signalling path; it is not used to read and write data.
`ournum`	points to the caller-allocated `addr_type` structure set up to represent the new local address information for your device.

`theirnum`	points to the caller-allocated `addr_type` structure. It is set up to represent the new remote address of the far-end device with which to communicate.
`npb`	points to the notification parameter block. This tells ITEM the type of notification the caller requests upon establishing a connection.

Refer to information on `notify_type` in the *Using SoftStax* manual for information about setting up the notification parameter block.

Direct Errors

`EOS_ILLPRM`	The notify parameter block (`npb`) passed in is `NULL`.

Indirect Errors

`EOS_DEVBSY`	Returned when trying to connect to a path that already has, or is establishing, a connection. (The `device_type` cellstate is `ITE_CS_CONNECT`, `ITE_CS_ACTIVE`, or `ITE_CS_CONNTERM`). In order for a connection to be successful, the path must be in the `ITE_CS_IDLE` state.
`EOPNOTSUPP`	Returned when trying to connect on a connectionless protocol.
`EOS_UNKSVC`	Returned if no protocol on the stack performs cell control functions.
`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_PTHLOST`	Returned when the path was lost and is no longer valid.

See Also

`ite_ctl_addrset()`

`ite_ctl_answer()`

`ite_ctl_connstat()`

`ite_ctl_disconnect()`

ite_ctl_connstat()
Returns Device Type Status Information

Syntax

```
#include <SPF/item.h>
error_code ite_ctl_connstat(
     path_id         path,
     device_type     *dev_info);
```

Libraries

`item.l`

Description

`ite_ctl_connstat()` returns a copy of the `dev_type` structure for the specified path. This structure contains information about the our-end and far-end connection addresses, call state, display information, and the network type of the device.

Refer to `device_type` in *Using SoftStax* for information about its fields.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`	contains a handle identifying the I/O path. This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`. For in-band protocols, the path is also used to read and write data. For out-of-band protocols, the path is used only as the signalling path; it is not used to read and write data.

Indirect Errors

`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_BPADD`	Returned if `dev_info` is `NULL` or points to memory not owned by the process. This error is only returned on systems with SSM (system security module) running.
`EOS_PTHLOST`	Returned when the path was lost and is no longer valid.

Refer to `item.h` in *Using SoftStax* for information about the `dev_type`.

See Also

`ite_ctl_addrset()`

ite_ctl_disconnect()

Disconnects End-to-end Connection

Syntax

```
#include <SPF/item.h>
error_code ite_ctl_disconnect(
     path_id         path,
     ite_cctl_pb     *ccpb);
```

Libraries

`item.l`

Description

`ite_ctl_disconnect()` disconnects the end-to-end connection established by `ite_ctl_connect()`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`	contains a handle identifying the I/O path. This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`. For in-band protocols, the path is also used to read and write data. For out-of-band protocols, the path is used only as the signalling path; it is not used to read and write data.
`ccpb`	points to the call control parameter block. This parameter block provides additional information from the application to the driver for performing the disconnection. If no additional information is needed, the application can pass `NULL` for this pointer.

Indirect Errors

`EOS_UNKSVC`	Returned if no protocol on the stack performs cell control functions.
`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_PTHLOST`	Returned when the path is lost and no longer valid.
`EOS_PPS_NOTFND`	Returned when the driver cannot find its local path storage for the `path_id` passed in.

See Also

`ite_ctl_connect()`

ite_ctl_rcvrasgn()

Sets Up Path for Incoming Calls

Syntax

```
#include <SPF/item.h>

error_code ite_ctl_rcvrasgn(
     path_id         path,
     addr_type       *their_num,
     notify_type     *npb);
```

Libraries

```
item.l
```

Description

`ite_ctl_rcvrasgn()` sets up the calling process to receive notification of an incoming call. If a notification has already been registered on this path, this call returns `EOS_DEVBSY`. You can set up only one process per path to receive incoming calls.

If `their_num` is `NULL`, the path receives a notification for any incoming call.

If `their_num` is not `NULL`, the path only receives notification for an incoming call with a calling address matching the `their_num` address.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`	contains a handle identifying the I/O path. This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`. For in-band protocols, the path is also used to read and write data. For out-of-band protocols, the path is used only as the signalling path; it is not used to read and write data.
`their_num`	contains either a `NULL` value, or points to the `addr_type` structure. The caller allocates and sets up this structure to receive incoming calls from a specified address. If `NULL` is used, the application receives notification on any incoming call.
`npb`	points to the notification parameter block structure ITEM uses to send notification to the caller.

Direct Errors

EOS_ILLPRM	Returned when npb is NULL.

Indirect Errors

EOS_ILLPRM	Returned if the addr_size parameter in the their_num structure is greater than 32.
EOS_DEVBSY	Returned if any process has already registered for receiving notification of an incoming call.
EOS_BPNUM	Returned when the path number is invalid.
EOS_PTHLOST	Returned when the path is lost and no longer valid.
EOS_PPS_NOTFND	Returned when the driver cannot find its local path storage for the path_id passed in.

See Also

ite_ctl_rcvrrmv()

ite_ctl_rcvrrmv()
Removes Notification Request

Syntax

```
#include <SPF/item.h>

error_code ite_ctl_rcvrrmv(path_id path);
```

Libraries

```
item.l
```

Description

`ite_ctl_rcvrrmv()` removes the notification request created with `ite_ctl_rcvrasgn()`. This call resolves successfully even if the application executes the call without a prior notification assignment.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`	contains a handle identifying the I/O path. This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`. For in-band protocols, the path is also used to read and write data. For out-of-band protocols, the path is used only as the signalling path; it is not used to read and write data..

Indirect Errors

`EOS_BPNUM`	Returned on a bad path number.
`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_PTHLOST`	Returned when the path is lost and no longer valid.
`EOS_PPS_NOTFND`	Returned when the driver cannot find its local path storage for the `path_id` passed in.

See Also

`ite_ctl_rcvrasgn()`

ite_data_avail_asgn()
Notifies Path of Incoming Data

Syntax

```
#include <SPF/item.h>

error_code ite_data_avail_asgn(
     path_id         path,
     notify_type     *npb);
```

Libraries

`item.l`

Description

`ite_data_avail_asgn()` sets up the calling process to receive a notification when incoming data is available for the specified path.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`	contains a handle identifying the I/O path. This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`. For in-band protocols, the path is also used to read and write data. For out-of-band protocols, the path is used only as the signalling path; it is not used to read and write data.
`npb`	points to the notification parameter block structure ITEM uses to send notification to the caller.

Direct Errors

`EOS_ILLPRM`	Returned when `npb` is `NULL` or, if requesting an event, the `ntfy_evid` is `0`.

Indirect Errors

`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_PTHLOST`	Returned when the path is lost and no longer valid.
`EOS_PPS_NOTFND`	Returned when the driver cannot find its local path storage for the `path_id` passed in.

See Also

`ite_data_avail_rmv()`

`ite_data_ready()`

`_os_ss_sendsig()` in the *OS-9 Technical Manual*

ite_data_avail_rmv()
Removes Notification Request

Syntax

```
#include <SPF/item.h>

error_code ite_data_avail_rmv(path_id path);
```

Libraries

`item.l`

Description

`ite_data_avail_rmv()` removes the notification request created with `ite_data_avail_asgn()`. This call resolves successfully even if the application executes it without a prior notification assignment.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`	contains a handle identifying the I/O path. This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`.

Indirect Errors

`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_PTHLOST`	Returned when the path was lost and is no longer valid.
`EOS_PPS_NOTFND`	Returned when the driver cannot find its local path storage for the `path_id` passed in.

See Also

`ite_data_avail_asgn()`

`_os_ss_relea()` in the *OS-9 Technical Manual*

ite_data_read()
Reads From a Path

Syntax

```
#include <SPF/item.h>
error_code ite_data_read(
     path_id     path,
     void        *buffer,
     u_int32     *count);
```

Libraries

`item.l`

Description

`ite_data_read()` performs a read on a path. Data is removed from the path's receive queue and passed back to the caller in `buffer`. The read operation depends on the I/O options of the path, (`pd_ispacket`, `pd_ioasync`, and `pd_iotime`) which may be changed via the `_os_ss_popt()` call.

Refer to the *Using SoftStax* manual for more information about `pd_iopacket`, `pd_ioasync`, and `pd_iotime`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`	contains a handle identifying the I/O path. This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`.
`buffer`	points to the caller-allocated buffer in which to place the data. SoftStax copies the data from the receive queue into this buffer.
`count`	points to the number of bytes to read. When the call is completed, the address that is pointed to is updated with the number of bytes SoftStax copies into the buffer.

Indirect Errors

EOS_DEVBSY	Returned when another process is already waiting for incoming data on this path.
EOS_NOTRDY	Returned when the SoftStax driver's lu_ioenabled flag is 0. This error indicates either that the protocol stack contains a driver that is not initialized or the end-to-end protocol has an error causing a break in the end-to-end protocol link.
EOS_SIGNAL	Returned when a fatal signal is received.
ETIMEOUT	Returned when the read request timed out before completion.
EWOULDBLOCK	Returned when a read request is made, but there is currently not enough data available to actually read. This error occurs only if the IO_READ_ASYNC bit is set in the pd_ioasync byte in the path options, indicating the read side of the path is in asynchronous mode.
E_BPADDR	Returned if buffer is NULL or does not point to memory owned by the calling process.
EOS_RXMB_ERR	Returned when data being read into the application buffer is flagged as incorrect by the received data hardware. This could happen as a result of bad CRC, overflow, abort sequence, or bad hardware. At this point, the application should request hardware statistics to discover the source of the error. The data is returned through the read call. The hardware error occurred somewhere in the current received buffer.
EOS_BPNUM	Returned when the path number is invalid.
EOS_PTHLOST	Returned when the path is lost and no longer valid.
EOS_PPS_NOTFND	Returned when the driver cannot find its local path storage for the path_id passed in.

See Also

_os_gs_popt() and _os_ss_popt() in the *OS-9 Technical Manual*

ite_data_readmbuf()
Gets mbuf Data

Syntax

```
#include <SPF/item.h>

error_code ite_data_readmbuf(
     path_id     path,

     mbuf        *mb_ptr);
```

Libraries

`item.l`

Description

`ite_data_readmbuf()` allows the caller to get the buffer SoftStax uses to store the mbuf (incoming packets) instead of passing in a user buffer with data copied into it. This call returns one mbuf packet chain in `mb_ptr`. This call facilitates true zero copy reads for faster throughput. SoftStax gives the caller permissions to access the returned mbuf packet chain.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`	contains a handle identifying the I/O path. This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`.
`mb_ptr`	contains the pointer to the mbuf packet chain.

Indirect Errors

`EOS_DEVBSY`	Returned when another process is already waiting for incoming data on this path.
`EOS_NOTRDY`	Returned when the SoftStax driver's `lu_ioenabled` flag is `0`. This error indicates that the protocol stack contains a driver that is not initialized or the end-to-end protocol has an error causing a break in the end-to-end protocol link.
`EOS_SIGNAL`	Returned when a fatal signal is received.
`ETIMEOUT`	Returned when the read request timed out before completion.

EWOULDBLOCK	Returned when a read request is made but there is currently not enough data available to read. This error only occurs if the IO_READ_ASYNC bit is set in the pd_ioasync byte in the path options, indicating the read side of the path is in asynchronous mode.
EOS_BPNUM	Returned when the path number is invalid.
EOS_PTHLOST	Returned when the path is lost and no longer valid.
EOS_PPS_NOTFND	Returned when the driver cannot find its local path storage for the path_id passed in.

See Also

ite_data_read()

ite_data_writembuf()

the mbuf facility in the *Using SoftStax* manual

ite_data_ready()
Returns Number of Bytes Available

Syntax

```
#include <SPF/item.h>

error_code ite_data_ready(
     path_id      path,

     u_int32      *avail_count);
```

Libraries

`item.l`

Description

`ite_data_ready()` counts the number of bytes on the specified path that are available for reading. An `EOS_NOTRDY` error is returned if there is no data available.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`	contains a handle identifying the I/O path. This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`.
`avail_count`	Points to a `u_int32` field where the number of bytes available for reading is returned.

Indirect Errors

`EOS_NOTRDY`	Returned if no data is ready to read.
`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_PTHLOST`	Returned when the path is lost and no longer valid.
`EOS_PPS_NOTFND`	Returned when the driver cannot find its local path storage for the `path_id` passed in.

See Also

`_os_gs_ready()` in the *OS-9 Technical Manual*

ite_data_recvfrom()

Receive Data from a Specified Location

Syntax

```
#include <SPF/item.h>
error_code ite_data_recvfrom(
     path_id     path,
     void        *buffer,
     u_int32     size,
     u_int32     flags,
     addr_type   *recvfrom_addr);
```

Libraries

`item.l`

Description

`ite_data_recvfrom()` allows the caller to send data to a particular remote location.

The call might block if the `IO_WRITE_ASYNCH` bit in the `pd_ioasync` byte in the path options structure is set and there are no mbufs available in the mbuf pool.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`	contains a handle identifying the I/O path. This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`.
`buffer`	points to the data to be transmitted.
`size`	is the number of valid bytes of data in the buffer.
`flags`	is not used.
`sendto_addr`	points to the caller-allocated `addr_type` structure. It is set up to represent the remote address of the far-end device to which the caller is sending data.

Indirect Errors

ENOBUFS	Returned when both the IO_WRITE_ASYNC bit in the pd_ioasync byte is set and the transmit mbuf cannot be allocated for the data being written. This indicated that either the mbuf pool is empty or the system cannot allocate an mbuf large enough for this transport packet.
EOS_NOTRDY	Returned when the SoftStax driver's lu_ioenabled flag is 0, indicating the protocol stack contains a driver that is not initialized or the end-to-end protocol has an error causing a break in the end-to-end protocol link.
EOS_PPS_NOTFND	Returned when the driver cannot find its local path storage for the path_id passed in.

Other errors may be returned by the SoftStax drivers.

ite_data_sendto()
Send Data to a Specified Location

Syntax

```
#include <SPF/item.h>
error_code ite_data_sendto(
     path_id      path,
     void         *buffer,
     u_int32      size,
     u_int32      flags,
     addr_type    *sendto_addr);
```

Libraries

`item.l`

Description

`ite_data_sendto()` allows the caller to send data to a particular remote location.

The call may block if the `IO_WRITE_ASYNCH` bit in the `pd_ioasync` byte in the path options structure is set and there are no mbufs available in the mbuf pool.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`	contains a handle identifying the I/O path. This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`.
`buffer`	points to the data to be transmitted.
`size`	is the number of valid bytes of data in the buffer.
`flags`	is not used.
`sendto_addr`	points to the caller-allocated `addr_type` structure. It is set up to represent the remote address of the far-end device to which the caller is sending data.

Indirect Errors

`ENOBUFS`	Returned when both the `IO_WRITE_ASYNC` bit in the `pd_ioasync` byte is set and the transmit mbuf cannot be allocated for the data being written. This indicated that either the mbuf pool is empty or the system cannot allocate an mbuf large enough for this transport packet.
`EOS_NOTRDY`	Returned when the SoftStax driver's `lu_ioenabled` flag is `0`, indicating the protocol stack contains a driver that is not initialized or the end-to-end protocol has an error causing a break in the end-to-end protocol link.
`EOS_PPS_NOTFND`	Returned when the driver cannot find its local path storage for the `path_id` passed in.

Other errors may be returned by the SoftStax drivers.

ite_data_write()
Writes Data to Packet

Syntax

```
#include <SPF/item.h>
error_code ite_data_write(
     path_id     path,
     void        *buffer,
     u_int32     *count);
```

Libraries

`item.l`

Description

`ite_data_write()` causes SoftStax to create a packet out of the buffer that is to be written. In addition, it sends the packet down the protocol chain for the path until the hardware driver queues it up for transmission.

The call might block if the `IO_WRITE_ASYNCH` bit in the `pd_ioasync` byte in the path options structure is set and there are no mbufs available in the mbuf pool.

A return from this call does not ensure the data has been transmitted. It only indicates that the data has been queued for transmission by the device.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`	contains a handle identifying the I/O path. This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`.
`buffer`	points to the data to be transmitted.
`count`	points to the number of valid bytes of data in the buffer.

Indirect Errors

`ENOBUFS`	Returned when both the `IO_WRITE_ASYNC` bit in the `pd_ioasync` byte is set and the transmit mbuf cannot be allocated for the data being written. This indicated that either the mbuf pool is empty or the system cannot allocate an mbuf large enough for this transport packet.

EOS_NOTRDY	Returned when the SoftStax driver's lu_ioenabled flag is 0, indicating the protocol stack contains a driver that is not initialized or the end-to-end protocol has an error causing a break in the end-to-end protocol link.
E_BPADDR	Returned if buffer is NULL.
EOS_BPNUM	Returned when the path number is invalid.
EOS_PTHLOST	Returned when the path is lost and no longer valid.
EOS_PPS_NOTFND	Returned when the driver cannot find its local path storage for the path_id passed in.

ite_data_writembuf()

Writes mbuf-packet

Syntax

```
#include <SPF/item.h>
error_code ite_data_writembuf(
     path_id     path,
     mbuf        mb_ptr);
```

Libraries

```
item.l
```

Description

`ite_data_writembuf()` accepts an mbuf for transmission through the protocol stack and out to the hardware device. For best efficiency, the caller should save enough space at the beginning of the mbuf to allow the protocol stack to add headers to the same mbuf passed in. The caller can obtain the number of bytes the stack needs by getting the path options and looking at the `pd_txoffset` field. Otherwise, the protocol must find another mbuf in which to place the header information and chain those packets together.

Drivers that cannot operate correctly on mbuf chains are unable to process this call if there is not enough space for all headers at the beginning of the mbuf.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`	contains a handle identifying the I/O path. This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`.
`mb_ptr`	points to the mbuf packet chain that is to be transmitted.

Indirect Errors

`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_PTHLOST`	Returned when the path is lost and no longer valid.
`EOS_PPS_NOTFND`	Returned when the driver cannot find its local path storage for the `path_id` passed in.

See Also

`ite_data_readmbuf()` `ite_data_write()`
the `mbuf` facility in the *Using SoftStax* manual

ite_dev_attach()
Attaches a Device

Syntax

```
#include <SPF/item.h>
error_code ite_dev_attach(
     char        *name,
     u_int32     mode,
     u_int32     *handle);
```

Libraries

`item.l`

Description

`ite_dev_attach()` performs a simple attach of a device into ITEM.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`name`	points to the name of the device descriptor with which to attach.
`mode`	contains the mode in which to open the device. Recommended default value for mode is `FAM_READ` or `FAM_WRITE`.
`handle`	points to the unique ID returned by ITEM. It identifies this device.

Indirect Errors

`EOS_UNKSVC`	Returned when the `sysmbuf` utility is not installed.
`EOS_MNF`	Returned when the driver, descriptor, or file manager is not loaded into memory.

Drivers may return their own error codes. Refer to the specific driver's description for more information.

See Also

`ite_dev_detach()`

`_os_attach()` in the *Ultra C Library Reference* manual

ite_dev_detach()
Detaches Device

Syntax

```
#include <SPF/item.h>

error_code ite_dev_detach(u_int32 handle);
```

Libraries

```
item.l
```

Description

`ite_dev_detach()` allows you to detach a device from ITEM. If the attach count is greater than `1` (was attached multiple times by multiple applications), only the attach count of the device is decremented; thus, the device remains in the set of active devices used by ITEM. When the attach count is `1` (the last application detaches from the ITEM device), the device is removed from the set of initialized devices used by ITEM.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`handle`
: contains the unique ID returned by ITEM. It identifies this device.

  Drivers may return their own error codes. Refer to the specific driver's description for more information.

See Also

`ite_dev_attach()`

`_os_detach()` in the *Ultra C Library Reference* manual

ite_dev_getmode()
Gets Device Mode

Syntax

```
#include <SPF/item.h>

error_code ite_dev_getmode(
     path_id      path,
     u_int16      *mode);
```

Libraries

`item.l`

Description

`ite_dev_getmode()` allows you to determine the mode of the device using the specified path.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`
contains a handle identifying the I/O path.

This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`.

`mode`
points to where SoftStax returns the mode of the device the path is using.

The possible bit field values for mode are: `FAM_READ`, `FAM_WRITE`, or `FAM_NONSHARE`.

Indirect Errors

`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_PTHLOST`	Returned when the path is lost and no longer valid.

See Also

`modes.h` contains macros for the mode bit fields.

ite_dev_getname()
Gets Device Name

Syntax

```
#include <SPF/item.h>

error_code ite_dev_getname(
     path_id      path,
     char         *name);
```

Libraries

`item.l`

Description

`ite_dev_getname()` allows you to determine the name of the device using the specified path.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`
contains a handle identifying the I/O path.

This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`.

`name`
points to the user allocated buffer where SoftStax puts the device name string.

In OS-9, the buffer pointed to by `name` must be at least 64 bytes to accommodate the device name. In OS-9 for 68K processors, the buffer should be at least 32 bytes.

Indirect Errors

`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_PTHLOST`	Returned when the path is lost and no longer valid.

ite_dev_gettype()
Gets Device Type

Syntax

```
#include <SPF/item.h>
error_code ite_dev_gettype(
     path_id      path,
     u_char       *type_in,
     u_char       *type_out);
```

Libraries

`item.l`

Description

`ite_dev_gettype()` allows you to determine the type of the device using the specified path.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`
: contains a handle identifying the I/O path.

  This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`.

`type_in`
: points to where SoftStax puts the type of the receive-side of the ITEM device.

`type_out`
: points to where SoftStax places the type of the transmit-side of the ITEM device.

Table 2-11 lists the different device types.

Table 2-11. Device Types

Value	Description
`ITE_NET_NONE`	If only one side has this value, the device is uni-directional.
`ITE_NET_CTL`	Set-top box control channel device.
`ITE_NET_DATA`	Set-top box data channel device.

Table 2-11. Device Types (Continued)

Value	Description
ITE_NET_MPEG2	MPEG-2 device.
ITE_NET_CHMGR	Set-top box channel management device.
ITE_NET_OOB	Out-of-band code signalling device.
ITE_NET_ANY	Generic network device. No specific payload is required.
ITE_NET_VIPDIR	Video Information Provider Directory
ITE_NET_SESCTL	Session control device.
ITE_NET_X25	X.25 network device.

Indirect Errors

EOS_BPNUM	Returned when the path number is invalid.
EOS_PTHLOST	Returned when the path is lost and is no longer valid.

Refer to the information on `item.h` and the *Using SoftStax* manual for the `device_type` structure.

ite_dev_setmode()
Sets Device Mode

Syntax

```
#include <SPF/item.h>
error_code ite_dev_setmode(
     path_id      path,
     u_int16      mode);
```

Libraries

`item.l`

Description

`ite_dev_setmode()` allows you to set the device mode.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`
contains a handle identifying the I/O path.

This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`.

`mode`
contains the mode to set. Bit field values for mode include the following:

`FAM_READ`, `FAM_WRITE`, or `FAM_NONSHARE`.

Indirect Errors

`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_PTHLOST`	Returned when the path is lost and no longer valid.
`EOS_PPS_NOTFND`	Returned when the driver cannot find its local path storage for the `path_id` passed in.

See Also

`ite_dev_getmode()`

`item.h` and *Using SoftStax* manual for the `device_type` structure

`modes.h` for the macros that define the mode bits

ite_fehangup_asgn()

Registers Caller for Notification of Far End Disconnect

Syntax

```
#include <SPF/item.h>

error_code ite_fehangup_asgn(
     path_id       path,
     notify_type   *npb);
```

Libraries

`item.l`

Description

`ite_fehangup_asgn()` registers the caller for notification of disconnection by the far-end.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`
: contains a handle identifying the I/O path.

  This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`.

`npb`
: Points to the notification parameter block structure ITEM uses to send notification to the caller.

Indirect Errors

`EOS_ILLPRM`	Returned when `npb` is `NULL`.
`EOS_DEVBSY`	Returned if another process has already registered for this notification on the path.
`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_PTHLOST`	Returned when the path is lost and no longer valid.
`EOS_PPS_NOTFND`	Returned when the driver cannot find its local path storage for the `path_id` passed in.

See Also

`ite_fehangup_rmv()`

ite_fehangup_rmv()

Removes Request for Far-end Hang-up

Syntax

```
#include <SPF/item.h>

error_code ite_fehangup_rmv(path_id path);
```

Libraries

```
item.l
```

Description

`ite_fehangup_rmv()` removes the notification request for far-end disconnection. This call resolves successfully even if the application executes it without a prior notification assignment.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`
: contains a handle identifying the I/O path.

  This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`.

Indirect Errors

`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_PTHLOST`	Returned when the path is lost and no longer valid.
`EOS_PPS_NOTFND`	Returned when the driver cannot find its local path storage for the `path_id` passed in.

See Also

`ite_fehangup_asgn()`

ite_linkdown_asgn()
Notifies Caller of Link Failure

Syntax

```
#include <SPF/item.h>

error_code ite_linkdown_asgn(
     path_id          path,
     notify_type      *npb);
```

Libraries

`item.l`

Description

`ite_linkdown_asgn()` tells SoftStax drivers to notify the caller if the link fails at any layer of the protocol stack.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`
: contains a handle identifying the I/O path.

  This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`..

`npb`
: points to the notification parameter block structure ITEM uses to send notification to the caller.

Indirect Errors

`EOS_ILLPRM`	Returned when `npb` is `NULL`.
`EOS_DEVBSY`	Returned if another process has already registered for this notification on the path.
`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_PTHLOST`	Returned when the path is lost and no longer valid.
`EOS_PPS_NOTFND`	Returned when the driver cannot find its local path storage for the `path_id` passed in.

See Also

`ite_linkdown_rmv()`

ite_linkdown_rmv()

Removes Linkdown Notification Assignment

Syntax

```
#include <SPF/item.h>

error_code ite_linkdown_rmv(path_id path);
```

Libraries

```
item.l
```

Description

`ite_linkdown_rmv()` removes the previous link failure notification assignment created with the `ite_linkdown_asgn()` call. This call returns successfully even if the application executes it without a prior notification assignment.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`
: contains a handle identifying the I/O path.

  This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`.

Indirect Errors

`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_PTHLOST`	Returned when the path is lost and no longer valid.
`EOS_PPS_NOTFND`	Returned when the driver cannot find its local path storage for the `path_id` passed in.

See Also

`ite_linkdown_asgn()`

ite_linkup_asgn()
Notifies Caller of Link Failure

Syntax

```
#include <SPF/item.h>

error_code ite_linkup_asgn(
     path_id       path,
     notify_type   *npb);
```

Libraries

```
item.l
```

Description

`ite_linkup_asgn()` tells SoftStax drivers to notify the caller if the link fails at any layer of the protocol stack.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`
: contains a handle identifying the I/O path.

  This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`.

`npb`
: points to the notification parameter block structure ITEM uses to send notification to the caller.

Indirect Errors

`EOS_ILLPRM`	Returned when `npb` is `NULL`.
`EOS_DEVBSY`	Returned if another process has already registered for this notification on the path.
`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_PTHLOST`	Returned when the path is lost and no longer valid.
`EOS_PPS_NOTFND`	Returned when the driver cannot find its local path storage for the `path_id` passed in.

See Also

`ite_linkup_rmv()`

ite_linkup_rmv()

Removes Linkup Notification Assignment

Syntax

```
#include <SPF/item.h>

error_code ite_linkup_rmv(path_id path);
```

Libraries

```
item.l
```

Description

`ite_linkup_rmv()` removes the previous link failure notification assignment created with `ite_linkup_asgn()`. This call returns successfully even if the application executes it without prior notification.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`
: contains a handle identifying I/O path. This handle is obtained from `ite_path_open()`, `_os_open()`, and `socket()`.

Indirect Errors

`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_PTHLOST`	Returned when path is no longer valid.
`EOS_PPS_NOTFND`	Returned when the driver cannot find its local path storage for the `path_id` passed in.

See Also

`ite_linkup_asgn()`

ite_path_clone()

Duplicates a Path - Independent Connection

Syntax

```
#include <SPF/item.h>
error_code ite_path_clone(
     path_id       dup_path,
     path_id       *new_path,
     notify_type   *npb);
```

Libraries

```
item.l
```

Description

`ite_path_clone()` creates a new path with the same device type information, properties, and connection state as the original path. It assigns a new path identifier to the newly cloned path.

`ite_path_clone()` is similar to `ite_path_dup()`, except that if the original path has an active connection, the `ite_clone_path()` call creates a new connection to the same two endpoints as the original path. If the paths are duplicated (with `ite_path_dup()`), both paths share a connection. Also, unlike duplicated paths, cloned paths point to different SoftStax path descriptors.

If you are duplicating a connection-oriented device, this call uses the asynchronous `ite_ctl_connect()` call. In this case, the `ite_path_clone()` call becomes asynchronous and the caller is notified using the `npb` notification. Otherwise, `ite_path_clone()` is synchronous for connectionless devices.

Refer to `ite_ctl_connect()` for more information about `npb`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`dup_path`	specifies the path to clone.
`new_path`	points to the location where the ID of the new path is returned. A new connection is established between the ITEM device and the far-end address, as specified in the `device_type` structure for the original path. This ensures that the `dup_path` and `new_path` do not share a connection.
`npb`	points to the notification parameter block structure ITEM uses to send notification to the caller.

Refer to the *Using SoftStax* manual for information about the `notify_type` structure.

Indirect Errors

`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_PTHLOST`	Returned when the path is lost and no longer valid.
`EOS_DEVBSY`	Returned when you are trying to clone a non-sharable device on the second open to the device. You can avoid this error by calling `ite_dev_getmode()` to make sure the path you are cloning is a sharable device.

See Also

`ite_ctl_connect()`

`ite_path_dup()`

ite_path_close()
Closes a Path

Syntax

```
#include <SPF/item.h>

error_code ite_path_close(path_id path);
```

Libraries

```
item.l
```

Description

`ite_path_close()` closes the specified path. If there is a connection to that path, it is terminated.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`	contains a handle identifying the I/O path. This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`.

Indirect Errors

`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_PTHLOST`	Returned when the path is lost and no longer valid.

See Also

`ite_path_open()`

ite_path_dup()
Duplicates Path and Shares Connection

Syntax

```
#include <SPF/item.h>
error_code ite_path_dup(
     path_id      dup_path,
     path_id      *new_path);
```

Libraries

`item.l`

Description

`ite_path_dup()` creates a new path ID referencing the same path as the original.

`ite_path_dup()` is similar to `ite_path_clone()`, except that if the original path has an active connection, the `ite_clone_path()` creates a new connection to the same two endpoints used by the original path. Also, unlike cloned paths, duplicated paths point to the same SoftStax path description.

With `ite_path_dup()`, both paths share the same connection. If one path terminates the connection, both paths lose that connection to the endpoint. However, if the new path created by this call is closed, the original path's connection remains open.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`dup_path`	specifies the path to duplicate.
`new_path`	points to where the new paths's ID is returned.

Indirect Errors

`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_PTHLOST`	Returned when the path is lost and no longer valid.
`EOS_PPS_NOTFND`	Returned when the driver cannot find its local path storage for the `path_id` passed in.

See Also

`ite_path_clone()`

ite_path_open()
Opens a Path

Syntax

```
#include <SPF/item.h>

error_code ite_path_open(
     char          *dev_name,
     u_int32       mode,
     path_id       *new_path,
     addr_type     *our_num);
```

Libraries

`item.l`

Description

`ite_path_open()` performs two operations:

- opens and initializes the device type structure for the path
- initializes the `our_num` field in the ITEM device's `device_type` structure

The result of the `ite_path_open()` call is that a path to the device pointed to by `dev_name` is returned. If `our_num` is not `NULL`, the call also initializes the `dev_ournum` structure in the ITEM device. If `our_num` equals `NULL`, ITEM uses the default local addressing out of the device descriptor being opened.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`dev_name`
: points to the string name specifying the device to which you are opening a path.

  This string can contain the name of an OS-9 device descriptor that refers to a single protocol driver, a string defining all the protocols to stack on the path, the far end address to convert to, or an OS-9 device descriptor containing the stack to be built.

`mode`
: contains the mode in which to open a device.

  Possible bit field values for mode include the following: `FAM_READ`, `FAM_WRITE`, or `FAM_NONSHARE`.

`new_path`
: points to the location where SoftStax returns the new path ID.

`our_num`
: points to the `addr_type` structure allocated by the application to initialize the `dev_ournum` field in the ITEM device you are opening. For valid parameters for the `addr_type` structure, refer to the `item.h` file.

  You can pass `our_num` as `NULL`. In this case, the `ite_path_open()` call uses the default address information for the ITEM device.

Indirect Errors

`EOS_EVBSY`	Returned when the receive-thread event cannot be created because it already exists.
`EOS_MNF`	Returned when the device descriptor, driver, or the SoftStax manager is not loaded.
`EOS_STKFULL`	Returned if more than six protocols are being stacked on the path.

See Also

`ite_path_close()`

`item.h` for `addr_type` parameters

ite_path_pop()
Removes Driver from Top of Stack

Syntax

```
#include <SPF/item.h>
error_code ite_path_pop(path_id);
```

Libraries

`item.l`

Description

`ite_path_pop()` removes the driver from the top of the protocol stack on the path. It does not alter any other protocols on the stack.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`
: contains a handle identifying the I/O path.

  This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`.

Indirect Errors

`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_BTMSTK`	Returned if the last driver on the stack has already been reached and no more pops can take place.
`EOS_NOSTACK`	Returned if there are no protocol drivers on the stack.
`EOS_PTHLOST`	Returned when the path is lost and no longer valid.

See Also

`ite_path_pop()`

ite_path_profileget()
Get Path Profile

Syntax

```
#include <SPF/item.h>
#include <SPF/spf_oob.h>
error_code ite_path_profileget(
     path_id      path,
     conn_type    *conn,
     u_int32      *pr_size,
     void         *pr_buffer);
```

Libraries

`item.l`

Description

The `conn_type` pointer may be passed in by the application as `NULL` or a pointer to a valid `conn_type` structure. If the `conn_type` pointer is `NULL`, the driver should return the per path storage profile structure (`pp_profile`) in the user buffer. If the `conn_type` pointer is not `NULL`, the `conn_svc_type` field in the `conn_type` pointer is set to the `ITE_SVC_xxx` for the profile the user wants to get.

If the service profile is not supported, the driver should return `EOS_UNKSVC`. If the profile number is invalid, the driver should return `EOS_ILLPRM`. Once the profile structure element in the profile array of the logical unit has been determined, the driver should check to make sure the user buffer size is big enough to fit the entire profile. If not, the driver should copy as much of the profile as can be put in the buffer and return `EOS_BADSIZ` error. If the buffer is big enough, the driver should copy the profile into the buffer and return `SUCCESS`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`
: contains a handle identifying the I/O path.

  This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`.

`conn`
points to the caller-allocated `conn_type` structure set up to represent the connection type information for your device.

`pr_size`
points to the number of bytes in the `pr_buffer` to read.

`pr_buffer`
points to the caller-allocated buffer in which the path profile is placed.

Indirect Errors

`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_PTHLOST`	Returned when the path is lost and no longer valid.
`EOS_PPS_NOTFND`	Returned when the driver cannot find its local path storage for the `path_id` passed in.
`EOS_ILLPATH`	Returned when `conn_type` structure is `NULL`, or `conn_svc_type` in `conn_type` structure is invalid.
	Other errors may be returned by SoftStax drivers.

See Also

`ite_path_profileset()`

ite_path_profileset()
Set Path Profile

Syntax

```
#include <SPF/item.h>
#include <SPF/spf_oob.h>
error_code ite_path_profileset(
     path_id      path,
     conn_type    *conn,
     u_int32      *pr_size,
     void         *pr_buffer);
```

Description

For the set profile setstat, the user passes in the new parameters for the profile of the path. The driver should attempt to validate the new parameters of the profile as needed to ensure the application has not made any illegal parameter settings for the protocol. If so, `EOS_ILLPRM` can be returned. This profile should be copied into the `pp_profile` structure in the per path storage by the driver.

If the buffer field is `NULL` and the parameter field is non-NULL, the user has passed in a valid `conn_type` pointer. The `conn_svc_type` field in the `conn_type` structure should be used by the driver to set the new profile for the path. For instance, when a path opens and the default profile is a voice call, this profile is copied into the per path storage. If a set profile call is made with a `conn_type` structure and the `conn_svc_type` field is `ITE_SVC_DATA_ANY`, the driver should copy the `ITE_SVC_DATA_ANY` profile from the logical unit array into the per path storage profile structure.

If the buffer field is non-NULL, then it points to an `xxx_profile` structure that has probably been modified by the application. The driver should do some integrity checking on the modifications, then change the profile structure in the per path storage to the contents of the passed in buffer.

Once copied, this profile becomes valid for the path. Notice the only way to set profiles in the logical unit array is to make a change to the descriptor.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`
contains a handle identifying the I/O path.

This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`.

`conn`
points to the caller-allocated `conn_type` structure set up to represent the connection type information for your device.

`pr_size`
points to the number of bytes to read in the `pr_buffer`.

`pr_buffer`
points to the caller-allocated buffer in which the path profile is placed.

Indirect Errors

`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_PTHLOST`	Returned when the path is lost and no longer valid.
`EOS_PPS_NOTFND`	Returned when the driver cannot find its local path storage for the `path_id` passed in.
`EOS_ILLPATH`	Returned when `conn_type` structure is `NULL`, or `conn_svc_type` in `conn_type` structure is invalid.
	Other errors may be returned by SoftStax drivers.

See Also

`ite_path_profileget()`

ite_path_push()

Pushes Protocol or Hardware-Driver Onto Path

Syntax

```
#include <SPF/item.h>
error_code ite_path_push(
     path_id      path,
     char         *dev_name);
```

Libraries

`item.l`

Description

`ite_path_push()` pushes a protocol or hardware driver onto the path.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`
contains a handle identifying the I/O path.

This handle is usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`.

`dev_name`
Contains the ITEM device name string referencing the ITEM device to be stacked on this path.

Indirect Errors

`EOS_MNF`	Returns when the module referenced by `dev_name` is not currently in memory.
`EOS_STKFULL`	Returned if there are already six protocols stacked on the path being pushed.
`EOS_BUSERR`	Returned if `dev_name` is `NULL`.
`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_PTHLOST`	Returned when the path is lost and no longer valid.
`EOS_PPS_NOTFND`	Returned when the driver cannot find its local path storage for the `path_id` passed in.

See Also

`ite_path_pop()`

Conv and OS Functions

This section contains descriptions of the telecommunications Application Programming Interface (API) functions.

The following table lists and describes the functions that compose the conv and OS libraries.

Table 2-12. Conv and OS Library Functions and Descriptions

Function	Description
_os_getstat()	Getstat
_os_setstat()	Setstat

_os_getstat()
Getstat

Syntax

```
#include <sg_codes.h>
#include <types.h>
#include <SPF/spf.h>
error_code _os_getstat(
     path_id      path,
     u_int32      code,
     void         *pb);
```

Libraries

`conv_lib.l` (OS-9 for 68K)
`os_lib.l` (OS-9)

Description

`_os_getstat()` is a wildcard call used to get individual device parameters that are not uniform on all devices or that are highly hardware dependent.

This call is only available for OS-9 for 68K with `conv_lib.l` is used.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`
contains a handle identifying the I/O path, usually obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`.

`code`
contains the getstat code.

`pb`
points to the getstat `spf_ss_pb` parameter block.

Indirect Errors

`EOS_BPNUM`	Returned when the path number is invalid.
`EOS_PTHLOST`	Returned when the path is lost and no longer valid.
`EOS_PPS_NOTFND`	Returned when the driver cannot find its local path storage for the `path_id` passed in.

See Also

`_os_setstat()`

_os_setstat()
Setstat

Syntax

```
#include <sg_codes.h>
#include <types.h>
#include <SPF/spf.h>
error_code _os_setstat(
     path_id      path,
     u_int32      code,
     void         *pb);
```

Libraries

```
conv_lib.l (OS-9 for 68K)
os_lib.l (OS-9)
```

Description

`_os_setstat()` is a wildcard call used to set individual device parameters that are not uniform on all devices or are highly hardware dependent.

This call is only available for OS-9 for 68K with `conv_lib.l` is used.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`path`
: contains a handle identifying the I/O path. This handle is obtained from calls such as `ite_path_open()`, `_os_open()`, and `socket()`.

`code`
: contains the setstat code.

`pb`
: points to the setstat parameter block.

See Also

`_os_getstat()`

Debugging Functions

The dbg_mod.l library enables you to incorporate debugging information into drivers you are developing. The library creates a data module in memory into which the driver can write information. The data module can be reviewed for debugging information. This library allows you to debug in real time

The following table lists and describes the debugging functions.

Table 2-13. Debugging Functions and Descriptions

Function	Description
debug_4data()	Write Four Longs of Debug Data
debug_data()	Write a Character String and One Integer
debug_init()	Entry Point
debug_string()	Write a Character String in the Data Module
debug_timestamp()	Write a Time Stamp into the Data Module

debug_4data()

Write Four Longs of Debug Data

Syntax

```
void debug_4data (
     debug_stat,
     u_int32      a,
     u_int32      b,
     u_int32      c,
     u_int32      d);
```

Description

This function writes four longs of debug data.

Parameters

`debug_stat`
: points to modules debug_stat structure.

`a`
: is the first 32-bit data value.

`b`
: is the second 32-bit data value.

`c`
: is the third 32-bit data value.

`d`
: is the fourth 32-bit data value.

debug_data()
Write a Character String and One Integer

Syntax

```
void debug_data (
     Dbg_stat      debug_stat,
     u_int32       *sptr,
     u_int32       data);
```

Description

This call writes a character string (no larger than 10 characters, not including the `NULL` byte at the end of the string) and one `u_int32` into the debug module. It is created to use one full line if you dump the debug module in `rombug` or if you are using the `dump` utility.

Parameters

`debug_stat`
: points to modules `debug_stat` structure.

`*sptr`
: points to an ASCII string with a maximum length of 10 bytes. To ensure readability of the debug module, always make the string exactly 10 bytes.

`data`
: is a 32-bit data value.

Refer to the *SoftStax Porting Guide* for more information about debug data string conventions.

debug_init()
Entry Point

Syntax

```
error_code debug_init (
     u_int32      size,
     Dbg_stat     *dbg_ptr,
     char         *mod_name);
```

Description

This is the entry point where the caller tells the debug library which data module name to use and the data module size requirements.

It is recommended the module name and data module size parameters be kept in a device descriptor so the calling code can get them out and they do not have to be hard-coded anywhere within the module.

Parameters

`size`
: contains the size of the data module.

  It must be greater than 64 bytes.

`*dbg_ptr`
: points to the pointer defined in static storage.

`*mod_name`
: contains the name of the data module.

  It must not be `NULL`.

debug_string()

Write a Character String in the Data Module

Syntax

```
void debug_string (
     Dbg_stat     debug_stat,
     u_char       *dptr,
     u_int32      size);
```

Description

This call writes a character string of `size` bytes into the data module. The function rounds up to the nearest dump line, padding with zeros, so the debug module remains readable when dumped in `rombug` or when using the `dump` utility.

Parameters

`debug_stat`
: points to modules debug_stat structure.

`*dptr`
: points to an ASCII string.

`size`
: contains the size of the string to place into the debug module.

debug_timestamp()

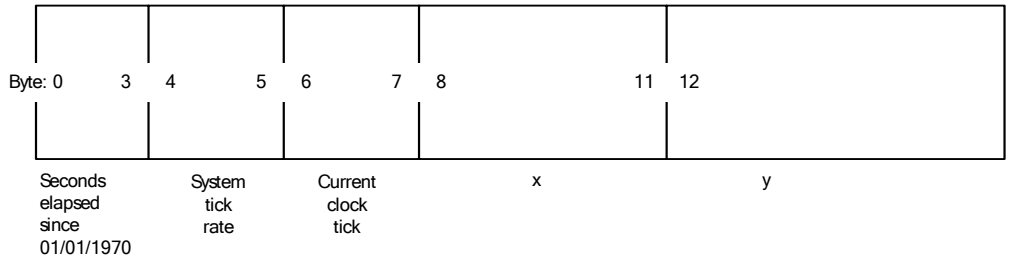
Write a Time Stamp into the Data Module

Syntax

```
void debug_timestamp (
     Dbg_stat      debug_stat,
     u_int32       x,
     u_int32       y);
```

Description

This function writes a time stamp into the debug data module. The time-stamp has the following layout:



Parameters

`debug_stat`
: points to modules `debug_stat` structure.

x
: is the first 32-bit data value.

  Unsigned long you can pass in for debugging.

y
: is the second 32-bit data value.

  Unsigned long you can pass in for debugging.

mbuf Functions

An mbuf is a common data structure used to store variable-length data blocks. mbufs can be queued, allocated, and deallocated, and are used for compatibility between local area networking packets and wide area networking packets.

The following table lists the mbuf functions provided in `mbuflib.l`.

Table 2-14. mbuf functions

Function	Description
`m_adj()`	Adjust Pointers and Sizes
`m_cat()`	Append mbuf
`m_copy()`	Allocate New mbuf and Copy Data to New mbuf
`m_deq()`	Remove First mbuf Packet
`m_enq()`	Append mbuf to mbuf Queue
`m_flush()`	Free Empty mbufs in Packet Chain
`m_free()`	Free mbuf
`m_free_m()`	Return mbuf to Free Pool
`m_free_p()`	Free Packet Chain
`m_free_q()`	Free mbuf Queue
`m_get()`	Allocate mbuf (Blocking)
`m_getn()`	Allocate mbuf (Non-Blocking)
`m_len_p()`	Return Number of Data Bytes
`m_move()`	Copy Specified Number of Bytes
`m_msize()`	Return Number of Bytes in Packet
`m_pad(), M_PAD()`	Advance Data Pointer
`M_PREPEND()`	Prepend Space to mbuf
`m_ptod()`	Return Pointer to First Valid Byte
`m_pullup()`	Ensure First mbuf Has Data
`mtod()`	Get Pointer to mbuf Data
`m_unpad(), M_UNPAD()`	Move Data Pointer

The `m_get()`, `m_getn()`, and `m_free()` mbuf library functions request and free mbuf structures through a user-installed system call. The remaining functions operate only on the mbuf header fields and are contained within the `mbuflib.l` library.

m_adj()
Adjust Pointers and Sizes

Syntax

```
#include <mbuf.h>
u_int32 m_adj(
     mbuf         mb,
     u_int32      count);
```

Description

`m_adj()` adjusts pointers and sizes to remove data from the packet. `m_adj()` does not free the mbufs; only the pointers and sizes are adjusted as indicated. `m_adj()` returns the actual count of data removed.

Parameters

`mb`
: is a pointer to the packet chain.

`count`
: specifies the amount and location of data to remove.

  If `count` is positive, the data is removed from the beginning of the packet chain. If `count` is negative, the data is removed from the end of the packet chain.

See Also

`m_pad(), M_PAD()`

`m_unpad(), M_UNPAD()`

m_cat()
Append mbuf

Syntax

```
#include <mbuf.h>

mbuf m_cat(
     mbuf      mb,
     mbuf      nb);
```

Description

`m_cat()` appends mbuf packet `nb` to the end of packet `mb`. The result combines the two mbufs into a single packet. `m_cat()` returns `mb`, if `mb` is non-NULL. Otherwise, `m_cat()` returns `nb`.

Parameters

`mb`
: is a pointer to the packet chain on to which to append `nb`.

`nb`
: is a pointer to the packet chain to append to `mb`.

m_copy()
Allocate New mbuf and Copy Data to New mbuf

Syntax

```
#include <mbuf.h>
mbuf m_copy(
     mbuf           mb,
     u_int32        offset,
     u_int16        count,
     int32          *status);
```

Description

`m_copy()` allocates a new mbuf and copies data beginning from the original mbuf to the new mbuf `m_copy()` returns `NULL` if `offset` points past the end of the packet. If less than `count` bytes are in the packet following the `offset`, the returned mbuf is at least of size `count`, but it is not full. `m_copy()` calls `m_getn()` to allocate the new mbuf. If `m_getn()` fails, `m_copy()` returns `NULL` and places the error code status from `m_getn()` in `status`.

Parameters

`mb`
: is a pointer to the original mbuf.

`offset`
: specifies the location to begin the copy.

`count`
: specifies the number of bytes to copy.

`status`
: is a pointer to the returned error status code.

Fatal Errors

`EOS_ILLARG`	Returned when the request is for a size greater than 32767 bytes.
`EOS_MEMFUL`	Returned when system memory is full.
`ENOBUFS`	Returned when a desired mbuf is unavailable.

See Also

`m_getn()`

m_deq()
Remove First mbuf Packet

Syntax

```
#include <mbuf.h>
mbuf m_deq(mbuf *q);
```

Description

`m_deq()` removes the first mbuf packet chain from an mbuf queue. `m_deq()` returns a pointer to the removed mbuf packet chain.

Parameters

`q`
: is a pointer to a pointer to the queue.

See Also

`m_enq()`

m_enq()
Append mbuf to mbuf Queue

Syntax

```
#include <mbuf.h>
void m_enq(
     mbuf      *q,
     mbuf      mb);
```

Description

`m_enq()` appends an mbuf packet chain to the end of an mbuf queue.

Parameters

`q`
: is a pointer to a pointer to the original mbuf queue.

`mb`
: is a pointer to the mbuf packet.

See Also

`m_deq()`

m_flush()
Free Empty mbufs in Packet Chain

Syntax

```
#include <mbuf.h>
mbuf m_flush(mbuf mb);
```

Description

`m_flush()` frees all empty mbufs in the mbuf packet chain `mb`. `m_flush()` returns a pointer to the new head of the mbuf packet chain.

Parameters

`mb`
: is a pointer to the mbuf packet chain.

See Also

`m_free()`

m_free()
Free mbuf

Syntax

```
#include <mbuf.h>
mbuf m_free(mbuf mb);
```

Description

`m_free()` returns the specified mbuf to the free pool. `m_free()` returns a pointer to the next mbuf in the mbuf packet chain or `NULL` if this was the last mbuf in the packet chain.

If the `SPF_NOFREE` bit is set in the `M_FLAGS` field of the mbuf header then the mbuf is not freed, instead the `SPF_DONE` bit is set in the `m_flag` field.

Parameters

`mb`
: is a pointer to the mbuf to free.

See Also

`m_free_m()`

`m_free_p()`

`m_free_q()`

m_free_m()
Return mbuf to Free Pool

Syntax

```
#include <mbuf.h>

int32 m_free_m(mbuf mb);
```

Description

`m_free_m()` returns the specified mbuf to the free pool. `m_free_m()` returns 0 if successful. Non-zero return values indicate the system memory data structure is corrupted.

If the `SPF_NOFREE` bit is set in the `M_FLAGS` field of the mbuf header then the mbuf is not freed, instead the `SPF_DONE` bit is set in the `m_flag` field.

Parameters

`mb`
: is a pointer to the mbuf to free.

  You must ensure `mb` is a pointer to an address returned by `m_get()` or `m_getn()`.

See Also

`m_free()`

`m_free_p()`

`m_free_q()`

m_free_p()
Free Packet Chain

Syntax

```
#include <mbuf.h>

mbuf m_free_p(mbuf mb);
```

Description

`m_free_p()` returns an entire mbuf packet chain to the free pool. All mbufs in the packet are freed. `m_free_p()` returns a pointer to the next mbuf packet chain in the mbuf queue or `NULL` if this was the last packet chain in the queue.

If the `SPF_NOFREE` bit is set in the `M_FLAGS` field of the mbuf header then the mbuf is not freed, instead the `SPF_DONE` bit is set in the `m_flag` field.

Parameters

`mb`
: is a pointer to the mbuf packet chain to free.

See Also

`m_free()`

`m_free_m()`

`m_free_q()`

m_free_q()
Free mbuf Queue

Syntax

```
#include <mbuf.h>

void m_free_q(mbuf *queue);
```

Description

`m_free_q()` returns the entire mbuf queue to the free pool. All mbufs for all packet chains in the queue are freed.

If the `SPF_NOFREE` bit is set in the `M_FLAGS` field of the mbuf header then the mbuf is not freed, instead the `SPF_DONE` bit is set in the `m_flag` field.

Parameters

`queue`
: is a pointer to a pointer to the mbuf queue to free.

See Also

`m_free()`

`m_free_m()`

`m_free_p()`

m_get()
Allocate mbuf (Blocking)

Syntax

```
#include <mbuf.h>
mbuf m_get(
     u_int16      size,
     int32        *status);
```

Description

Given a size, `m_get()` allocates an mbuf with a data area of `size` bytes. `m_get()` blocks until an mbuf of the requested size is available. If an error occurs, `m_get()` returns `NULL` and sets `status` to the error code. Otherwise, `m_get()` returns a pointer to the allocated mbuf.

Parameters

`size`
: specifies the number of bytes to allocate for the data area. `m_get()` can allocate a maximum of 0XFFFF minus the size of the mbuf header, which is 0X010.

`status`
: is a pointer to the returned error status code.

Non-fatal Errors

`EOS_ILLARG`	Returned when the request is for a size greater than 32767 bytes.
`EOS_MEMFUL`	Returned when no more system memory is available.
`ENOBUFS`	Returned when an mbuf of the requested size is unavailable.

See Also

`m_getn()`

m_getn()
Allocate mbuf (Non-Blocking)

Syntax

```
#include <mbuf.h>
mbuf m_getn(
     u_int16      size,
     int32        *status);
```

Description

`m_getn()` allocates an mbuf with a data area of `size` bytes and returns a pointer to it. If the memory request cannot be granted immediately, `m_getn()` returns `NULL` and `ENOBUFS` is returned in `status`. If an error occurs, `m_getn()` returns `NULL` and sets `status` to the error code. Otherwise, `m_getn()` returns a pointer to the allocated mbuf.

Parameters

`size`
: specifies the number of bytes to allocate for the data area. `m_getn()` can allocate a maximum of 0XFFFF minus the size of the mbuf header, which is 0X010.

`status`
: is a pointer to the returned error status code.

Non-fatal Errors

`EOS_ILLARG`	Returned when the request is for a size greater than 32767 bytes.
`EOS_MEMFUL`	Returned when no more system memory is available.
`ENOBUFS`	Returned when an mbuf of the requested size is unavailable.

See Also

`m_get()`

m_len_p()
Return Number of Data Bytes

Syntax

```
#include <mbuf.h>
u_int32 m_len_p(mbuf mb);
```

Description

`m_len_p()` adds up the total number of bytes used by each mbuf data allocation in the packet list. `m_len_p()` returns the total number of data bytes in the mbuf packet chain.

Parameters

`mb`
: is a pointer to the packet.

m_move()
Copy Specified Number of Bytes

Syntax

```
#include <mbuf.h>
u_int32 m_move(
     mbuf        mb,
     u_int32     offset,
     u_int32     count,
     char        *buffer);
```

Description

`m_move()` copies `count` bytes in the mbuf packet chain starting at `offset` into `buffer`. The mbuf remains unchanged. `m_move()` returns the count of bytes actually copied.

Parameters

`mb`
: is a pointer to the mbuf packet chain.

`offset`
: specifies the number of bytes from the front of the buffer into which to begin copying.

`count`
: specifies the number of bytes to copy.

`buffer`
: is a pointer to the buffer in which to copy the data.

m_msize()
Return Number of Bytes in Packet

Syntax

```
#include <mbuf.h>
u_int32 m_msize(mbuf mb);
```

Description

`m_msize()` adds up the total number of bytes used by the entire mbuf packet chain including headers, data, and non-used memory. `m_msize()` returns the number of bytes in the specified mbuf packet chain.

Parameters

`mb`
: is a pointer to the mbuf packet chain.

See Also

`m_len_p()`

m_pad(), M_PAD()
Advance Data Pointer

Syntax

```
#include <mbuf.h>
u_int32 m_pad(
     mbuf         mb,
     u_int16      count);
void M_PAD(
     mbuf         mb,
     u_int16      count);
```

Description

`m_pad()` advances the data pointer in the mbuf. `m_pad()` returns `0` if successful and adjusts the data pointer. If the request exceeds the available space, the amount of space available is returned and the data pointer remains unchanged.

A macro, `M_PAD()`, is also available and has the same functionality as `m_pad()`. However, `M_PAD()` does not check to see if the request exceeds the available space.

Parameters

`mb`
: is a pointer to the mbuf.

`count`
: specifies the number of bytes to advance the data pointer.

See Also

`m_adj()`

`m_unpad(), M_UNPAD()`

m_ptod()
Return Pointer to First Valid Byte

Syntax

```
#include <mbuf.h>
char *m_ptod(mbuf mb);
```

Description

`m_ptod()` returns a pointer to the first valid data byte in an mbuf packet chain.

Parameters

`mb`
: is a pointer to the mbuf packet chain.

See Also

`mtod()`

M_PREPEND()
Prepend Space to mbuf

Syntax

```
#include <mbuf.h>
u_int32 M_PREPEND (
                mbuf mbp,
                u_int16 count,
                u_int16 how;
```

Description

`M_PREPEND()` prepends the number of bytes specified in the front of the data. If there is not enough space, return the NULL mbuf pointer.

Parameters

`mbp`
: is a pointer to the mbuf.

`count`
: specifies the number of bytes to prepend.

`how`
: is not currently used.

m_pullup()
Ensure First mbuf Has Data

Syntax

```
#include <mbuf.h>

int32 m_pullup(
     mbuf          *mb,
     u_int16       count);
```

Description

`m_pullup()` ensures the first mbuf on the packet chain contains at least `count` bytes of data. An implicit `m_getn()` is performed if necessary. `m_pullup()` returns `0` if successful. The replaced mbufs are automatically freed. It returns a non-zero error code if the `m_getn()` failed or the mbuf chain did not contain the requested amount of data. In this case, the original mbuf packet chain remains untouched.

Parameters

`mb`
: is a pointer to a pointer to the first mbuf.

`count`
: specifies the minimum amount of data for the first mbuf to contain.

Non-fatal Errors

`EOS_ILLARG`	Returned when the request is for a size greater than 32767 bytes.
`EBUFTOOSMALL`	Returned when `count` is greater than the memory within the mbuf.
`ENOBUFS`	An mbuf of the requested size is unavailable.

See Also

`m_getn()`

mtod()
Get Pointer to mbuf Data

Syntax

```
#include <mbuf.h>
(t) *mtod(
     mbuf          m,
     typedef       t);
```

Description

`mtod()` is a macro returning a pointer to the data area in an mbuf packet. `mtod()` returns a pointer with type `t` which points to the first byte of data in the mbuf packet. This pointer is obtained by adding the `m_offset` field of the mbuf packet to the beginning address of the mbuf.

Parameters

`m`
: is a pointer to the mbuf.

`t`
: is the type with which to cast the returned pointer.

See Also

`m_ptod()`

m_unpad(), M_UNPAD()
Move Data Pointer

Syntax

```
#include <mbuf.h>
u_int32 m_unpad(
     mbuf         mb,
     u_int16      count);

void M_UNPAD(
     mbuf         mb,
     u_int16      count);
```

Description

`m_unpad()` tries to move the data pointer so there are `count` bytes at the front of the mbuf. If successful, `m_unpad()` returns `0` and adjusts the data pointer. If the request exceeds the available space, the amount of space available is returned and the data pointer remains unchanged.

A macro, `M_UNPAD()`, is also available and has the same functionality as `m_unpad()`. However, `M_UNPAD()` does not check to see if the request exceeds the available space.

Parameters

`mb`
: is a pointer to the mbuf.

`count`
: specifies the number of bytes to leave before the data pointer.

See Also

`m_adj()`

`m_pad(), M_PAD()`

RPC Functions

The RPC library routines enable C programs to make procedure calls on machines across a network.

The following table lists and describes the RPC C library functions.

Table 2-15. RPC C Library Functions

Function	Description
auth_destroy()	Destroy Authentication Information
authnone_create()	Create Authentication Handle
authunix_create()	Create Authentication Handle
authunix_create_default()	Create Authentication Handle
callrpc()	Call a Remote Procedure
clnt_broadcast()	Broadcast an RPC Call
clnt_call()	Call Remote Procedure
clnt_control()	Change Client Object
clnt_create()	Create Client Handle
clnt_destroy()	Destroy Client Handle
clnt_freeres()	Free Data Area Associated with Result
clnt_geterr()	Copy Client Error Structure
clnt_pcreateerror()	Print Message to Standard Error
clnt_perrno()	Print Message to Standard Error
clnt_perror()	Print Message to Standard Error
clnt_spcreateerror()	Encode Message to a Buffer
clnt_sperrno()	Encode Message to a Buffer
clnt_sperror()	Encode Message to a Buffer
clntraw_create()	Create Loopback Client Handle
clnttcp_create()	Create Client Handle Using TCP
clntudp_create()	Create Client Handle Using UDP
get_myaddress()	Return Local Machine's Internet Address
pmap_getmaps()	Return List of Program to Port Mappings
pmap_getport()	Return Service Port Number
pmap_rmtcall()	Request Portmap to Make an RPC Call
pmap_set()	Establish Mapping for RPC Service
pmap_unset()	Destroy Mapping for RPC Service
registerrpc()	Register RPC Service with Portmap
svc_destroy()	Destroy Service Transport Handle
svc_freeargs()	Free Data Area for Parameters
svc_getargs()	Decode Parameters of a Service Request
svc_getcaller()	Get Network Address of Caller
svc_getreq()	Custom Asynchronous Event Processor
svc_getreqset()	Custom Asynchronous Event Processor
svc_register()	Establish Service with Dispatch Routine

Table 2-15. RPC C Library Functions (Continued)

Function	Description
svc_run()	Process RPC Request
svc_sendreply()	Send RPC Results
svc_unregister()	Remove Mapping for RPC Service
svcerr_auth()	Report Authentication Error
svcerr_decode()	Report Decoding Error
svcerr_noproc()	Report Unknown Procedure Number
svcerr_noprog()	Report Unknown Program Number
svcerr_progvers()	Report Unknown Version Number
svcerr_systemerr()	Report System Error
svcerr_weakauth()	Report Weak Authentication
svcfd_create()	Create Service Transport on Open Descriptor
svcraw_create()	Create Loopback Service Transport
svctcp_create()	Create TCP Service Transport
svcudp_create()	Create UDP Service Transport

auth_destroy()
Destroy Authentication Information

Syntax

```
#include <RPC/rpc.h>
void auth_destroy(AUTH *auth)
```

Description

The `auth_destroy()` macro destroys the authentication information associated with `auth`. Destruction usually involves deallocation of private data structures.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`auth`
is a pointer to the authentication handle.

The use of `auth` is undefined after calling `auth_destroy()`.

authnone_create()
Create Authentication Handle

Syntax

```
#include <RPC/rpc.h>
AUTH * authnone_create(void)
```

Description

`authnone_create()` creates and returns an authentication handle that passes nonusable authentication information with each remote procedure call. This is the default authentication used by RPC.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

authunix_create()
Create Authentication Handle

Syntax

```
#include <RPC/rpc.h>
AUTH * authunix_create(
     char      *machname,
     int       uid,
     int       gid,
     int       len,
     int       aup_gids)
```

Description

`authunix_create()` creates and returns an authentication handle that contains authentication information. The `len` and `aup_gids` parameters are ignored.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`machname`
: is the name of the machine the information was created on.

`uid`
: is the user's OS-9 user ID.

`gid`
: is the user's OS-9 group ID.

`len`
: is the number of elements in `aup_gids`.

`aup_gids`
: is a reference to a counted array of user's groups.

authunix_create_default()
Create Authentication Handle

Syntax

```
#include <RPC/rpc.h>
AUTH * authunix_create_default(void)
```

Description

`authunix_create_default()` calls `authunix_create()` using the appropriate parameters.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

callrpc()
Call a Remote Procedure

Syntax

```
#include <RPC/rpc.h>
int callrpc(
     char           *host,
     int            prognum,
     int            versnum,
     int            procnum,
     xdrproc_t      inproc,
     char           *in,
     xdrproc_t      outproc,
     char           *out)
```

Description

`callrpc()` calls the remote procedure associated with `prognum`, `versnum`, and `procnum` on the machine host. `callrpc()` returns a value of 0 if it succeeds or the value of the error cast to an integer if it fails. This routine is useful for translating failure statuses into messages.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`host`
: is the name of the machine the info was created on.

`prognum`
: is the program number.

`versnum`
: is the version number.

`procnum`
: is the procedure number.

`inprocen`
: codes the parameters.

`in`
: is the address of the parameter(s).

`outproc`
: decodes the results.

`out`
: is the address of where to place the result(s).

Calling remote procedures with this routine uses TCP as a transport. You do not have control over time-outs or authentication when using this routine.

clnt_broadcast()
Broadcast an RPC Call

Syntax

```
#include <RPC/rpc.h>
enum clnt_stat clnt_broadcast(
     u_long          prog,
     u_long          vers,
     u_long          proc,
     xdrproc_t       xargs,
     caddr_t         argsp,
     xdrproc_t       xresults,
     caddr_t         resultsp,
     resultproc_t    eachresult)
```

Description

`clnt_broadcast()` calls a remote procedure by broadcasting the call message to all locally connected systems.

If `eachresult()` returns 0, `clnt_broadcast()` waits for more replies. Otherwise, it returns with the appropriate status.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`prog`
: is the program number.

`vers`
: is the version number.

`proc`
: is the procedure number.

`xargs`
: is the address of the parameter(s).

`argsp`
: is the address of where to place the result(s).

`xresultsen`
: codes the parameters.

`resultsp`
: decodes the results.

`eachresult`
: is called each time `clnt_broadcast()` receives a response.

  Broadcast packets are limited in size to the maximum transfer unit of the data link. For ethernet, this value is 1500 bytes.

clnt_call()
Call Remote Procedure

Syntax

```
#include <RPC/rpc.h>
enum clnt_stat clnt_call(
     CLIENT             *rh
     u_long             proc,
     xdrproc_t          xargs,
     caddr_t            argsp,
     xdrproc_t          xres,
     caddr_t            resp,
     struct timeval     timeout)
```

Description

The `clnt_call()` macro calls the remote procedure associated with the client handle. The client handle is obtained from a client creation routine such as `clnt_create()`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`rh`
: is the client handle.

`proc`
: is the procedure number.

`xargs`
: encodes the parameters.

`argsp`
: decodes the results.

`xres`
: is the address of the parameter(s).

`resp`
: is the address of where to place the result(s).

`timeout`
: is the time allowed for the results to return.

clnt_control()
Change Client Object

Syntax

```
#include <RPC/rpc.h>
bool_t clnt_control(
     CLIENT     *cl,
     int        request,
     char       *info)
```

Description

The `clnt_control()` macro changes or retrieves information concerning a client object. These include the parameters timeout, retry count, and server address.

The requests are shown in Table 2-16.

Table 2-16. Requests

Request	Description
`CLSET_TIMEOUT`	Set timeout value.
`CLGET_TIMEOUT`	Get timeout value.
`CLSET_RETRY_TIMEOUT`	Set retry timeout value.
`CLGET_RETRY_TIMEOUT`	Get retry timeout value.
`CLGET_SERVER_ADDR`	Get server `inet` address.

Attributes

Operating System: OS-9 and OS-9 for 68K

State: User

Threads: Safe

Parameters

`cl`
is the client handle.

`request`
indicates the type of operation.

`info`
is a pointer to the information.

clnt_create()
Create Client Handle

Syntax

```
#include <RPC/rpc.h>
CLIENT * clnt_create (
     char         *hostname,
     unsigned     prog,
     unsigned     vers,
     char         *proto)
```

Description

`clnt_create()` is a generic client creation routine. Default time outs are set, but you can modify them using `clnt_call()` or `clnt_control()`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`hostname`
identifies the remote host.

`prog`
is the program number.

`vers`
is the version number.

`proto`
is the transport protocol to be used.

The currently supported values for `proto` are `tcp` and `udp`.

Using `clnt_create()` with UDP has its shortcomings. Because messages can only hold up to 8K of encoded data, you cannot use this transport for procedures that take large parameters or return large results.

clnt_destroy()
Destroy Client Handle

Syntax

```
#include <RPC/rpc.h>
void clnt_destroy(CLIENT *rh)
```

Description

The `clnt_destroy()` macro destroys the client's handle. Destruction usually involves deallocation of private data structures, including its own structure. If the library opened the associated socket, it will close the socket. Otherwise, the socket remains open.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`rh`
: is a pointer to the client handle.

  Use of `rh` is undefined after calling `clnt_destroy()`.

clnt_freeres()
Free Data Area Associated with Result

Syntax

```
#include <RPC/rpc.h>
bool_t clnt_freeres(
     CLIENT        *rh,
     xdrproc_t     xres,
     char          *resp);
```

Description

The `clnt_freeres()` macro frees any data allocated by the system when the results of a call were decoded. If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`rh`
: is the client handle.

`xres`
: is the routine describing results in simple primitive.

`resp`
: is the address of the results.

clnt_geterr()
Copy Client Error Structure

Syntax

```
#include <RPC/rpc.h>
void clnt_geterr(
     CLIENT             *rh,
     struct rpc_err     *errp);
```

Description

The `clnt_geterr()` macro copies the error structure out of the client handle to the structure at address `errp`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`rh`
: is a pointer to the client handle.

`errp`
: is a pointer to `rpc_err` structure.

clnt_pcreateerror()

Print Message to Standard Error

Syntax

```
#include <RPC/rpc.h>
void clnt_pcreateerror(char *msg)
```

Description

`clnt_pcreateerror()` prints a message to standard error indicating why a client handle could not be created. The message is prepended with string `msg` and a colon (:). `clnt_pcreateerror()` is used when a `clnt_create()` call fails.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`msg`
: is a string to print.

clnt_perrno()
Print Message to Standard Error

Syntax

```
#include <RPC/rpc.h>
void clnt_perrno(enum clnt_stat num)
```

Description

`clnt_perrno()` prints a message to standard error corresponding to the condition indicated by `num`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`num`
: specifies client error status.

clnt_perror()
Print Message to Standard Error

Syntax

```
#include <RPC/rpc.h>
void clnt_perror(
     CLIENT     *clnt,
     char       *msg)
```

Description

`clnt_perror()` prints a message to standard error indicating why a call failed. `clnt` is the handle used to perform the call. The message is prepended with string `msg` and a colon (:).

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`clnt`
: is a client handle.

`msg`
: is a message to print.

clnt_spcreateerror()
Encode Message to a Buffer

Syntax

```
#include <RPC/rpc.h>
char * clnt_spcreateerror(char *msg)
```

Description

`clnt_spcreateerror()` operates like `clnt_pcreateerror()` except that it returns a pointer to a string instead of printing to standard error.

`clnt_spcreateerror()` returns a pointer to static data. This static data area is overwritten on each call.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`msg`
: is a message to encode.

clnt_sperrno()
Encode Message to a Buffer

Syntax

```
#include <RPC/rpc.h>
char * clnt_sperrno(enum clnt_stat num)
```

Description

`clnt_sperrno()` accepts the same parameters as `clnt_perrno()`. However, instead of sending a message to standard error indicating why a call failed, it returns a pointer to a string containing the message. The string ends with a newline character.

`clnt_sperrno()` returns a pointer to static data. This static data area is overwritten on each call.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`num`
: is the client error status.

clnt_sperror()
Encode Message to a Buffer

Syntax

```
#include <RPC/rpc.h>
char * clnt_sperror(
     CLIENT      *clnt,
     char        *msg)
```

Description

`clnt_sperror()` is similar to `clnt_perror()`. However, `clnt_sperror()` returns a pointer to a string instead of printing to standard error.

`clnt_sperror()` returns a pointer to static data. This static data area is overwritten on each call.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`clnt`
: is the client handle.

`msg`
: is the message to encode.

clntraw_create()
Create Loopback Client Handle

Syntax

```
#include <RPC/rpc.h>
CLIENT * clntraw_create(
     u_long     prog,
     u_long     vers)
```

Description

`clntraw_create()` creates a local client for the remote program `prog` and version `vers`. The transport used to pass messages to the service is actually a buffer within the process's address space. Therefore, the corresponding server should be located in the same address space. This allows simulation and acquisition of overheads, such as round trip times.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`prog`
: is the program number.

`vers`
: is the version number.

clnttcp_create()
Create Client Handle Using TCP

Syntax

```
#include <RPC/rpc.h>
CLIENT * clnttcp_create(
     struct sockaddr_in     *addr,
     u_long                 prog,
     u_long                 vers,
     int                    *sockp,
     u_int                  sendsz,
     u_int                  recvsz)
```

Description

`clnttcp_create()` creates a client for the remote program `prog` and version `vers`. The client uses TCP as a transport.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`addr`
is the internet address of the remote program.

If `addr->sin_port` is zero, it is set to the actual port on which the remote program is listening. The remote service is consulted for this information.

`prog`
is the program number.

`vers`
is the version number.

`sockp`
is a pointer to a socket.

If `sockp` is null, this routine opens a new socket.

`sendsz`
is the size of the send buffer.

If 0, the default is chosen.

`recvsz`
is the size of the receive buffer.

If 0, the default is chosen.

clntudp_create()
Create Client Handle Using UDP

Syntax

```
#include <RPC/rpc.h>
CLIENT * clntudp_create(
     struct sockaddr_in     *addr,
     u_long                 prog,
     u_long                 vers,
     struct timeval         wait,
     int                    *sockp)
```

Description

This function creates a client handle for the remote program `prog` and version `vers`. The client uses UDP as a transport. `clntudp_create()` sends the call message until it receives a ressponse or the call times out.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`addr`
is the internet address of the remote program.

If `addr->sin_port` is zero, it is set to the actual port on which the remote program is listening. The remote service is consulted for this information.

`prog`
is the program number.

`vers`
is the version number.

`wait`
is a time-out value used for this call.

`sockp`is a pointer to a socket. If `sockp` is null, this routine opens a new socket.

get_myaddress()
Return Local Machine's Internet Address

Syntax

```
#include <RPC/rpc.h>
void get_myaddress(struct sockaddr_in *addr)
```

Description

`get_myaddress()` returns the machine's address in `addr`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`addr`
is the location at which to store the machine's socket address.

pmap_getmaps()

Return List of Program to Port Mappings

Syntax

```
#include <RPC/rpc.h>

struct pmaplist *pmap_getmaps(
  struct sockaddr_in *addr)
```

Description

`pmap_getmaps()` returns a list of the current program-to-port mappings on the host located at address `addr`. This routine can return null. The `rpcinfo` command uses this routine.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`addr`
: specifies the socket address of the host.

pmap_getport()
Return Service Port Number

Syntax

```
#include <RPC/rpc.h>
u_short pmap_getport(
     struct sockaddr_in     *addr,
     u_long                 prog,
     u_long                 vers,
     u_int                  protocol)
```

Description

`pmap_getport()` returns the port number on which waits a service that supports program `prog` and version `vers` and speaks the transport protocol `protocol`. A return value of 0 indicates that the mapping does not exist or that the system failed to contact the remote portmap service.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`addr`
: is the socket address.

`prog`
: is the program number requested.

`vers`
: is the version number requested.

`protocol`
: is the protocol to be used.

  Supported values are `IPPROTO_UDP` and `IPPROTO_TCP`.

pmap_rmtcall()
Request Portmap to Make an RPC Call

Syntax

```
#include <RPC/rpc.h>
enum clnt_stat pmap_rmtcall(
     struct sockaddr_in     *addr,
     u_long                 prog,
     u_long                 vers,
     u_long                 proc,
     xdrproc_t              xdrargs,
     caddr_t                argsp,
     xdrproc_t              xdrves,
     caddr_t                resp,
     struct timeval         tout,
     u_long                 *port_ptr)
```

Description

`pmap_rmtcall()` instructs the port mapper on the host at address `addr` to make an RPC call for the user to a procedure on that host.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`addr`
: is the socket address.

`prog`
: is the program number.

`vers`
: is the version number.

`proc`
: is the procedure number.

`xdrargs`
: is the address of the parameter(s).

`argsp`
is the address of where to place the result(s).

`xdrres`
encodes the parameters.

`resp`
decodes the results.

`tout`
is the time allowed for the results to return.

`port_ptr`
is the port number.

`port_ptr` is modified to the program's port number if the procedure succeeds.

pmap_set()
Establish Mapping for RPC Service

Syntax

```
#include <RPC/rpc.h>
bool_t pmap_set(
     u_long      prog,
     u_long      vers,
     int         protocol,
     u_short     port)
```

Description

`pmap_set()` establishes a mapping between `port`, `prog`, `vers`, and `protocol` on the machine's `portmap` service. If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`prog`
: is the program number.

`vers`
: is the version number.

`protocol`
: is the protocol to be used.

  Supported values are `IPPROTO_UDP` and `IPPROTO_TCP`.

`port`
: is the port number to associate with the program, version, and protocol triple.

pmap_unset()
Destroy Mapping for RPC Service

Syntax

```
#include <RPC/rpc.h>
bool_t pmap_unset(
     u_long     prog,
     u_long     vers)
```

Description

`pmap_unset()` destroys all mappings involving program `prog` and version `vers` on the machine's `portmap` service. If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`prog`
: is the program number.

`vers`
: is the version number.

registerrpc()

Register RPC Service with Portmap

Syntax

```
#include <RPC/rpc.h>
int registerrpc(
     u_long        prog,
     u_long        vers,
     u_long        proc,
     char          *(*procname)(),
     xdrproc_t     inproc,
     xdrproc_t     outproc)
```

Description

`registerrpc()` registers a procedure with the service package. If a request arrives for program `prog`, version `vers`, and procedure `proc`, `procname` is called with a pointer to its parameter(s). `procname` should return a pointer to its static result(s). This routine returns a value of 0 if the registration succeeded. Otherwise, it returns a value of -1.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`prog`
: is the program number.

`vers`
: is the version number.

`proc`
: is the procedure number.

`procname`
: is the name of a procedure.

`inproc`
: decodes the parameters.

`outproc`
: encodes the results.

svc_destroy()
Destroy Service Transport Handle

Syntax

```
#include <RPC/rpc.h>
void svc_destroy(SVCXPRT *xprt)
```

Description

`svc_destroy()` destroys the service transport handle `xprt`. Destruction usually involves deallocation of private data structures. This includes its own data structure.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xprt`
: is the service transport handle.

  Use of `xprt` is undefined after calling this routine.

svc_freeargs()
Free Data Area for Parameters

Syntax

```
#include <RPC/rpc.h>
bool_t svc_freeargs(
     SVCXPRT       *xprt,
     xdrproc_t     xargs,
     char          *argsp)
```

Description

`svc_freeargs()` frees any data allocated by the system when the parameters to a service procedure using `xargs` were decoded. This routine returns a value of 1 if the results were successfully freed. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xprt`
: is the service transport handle.

`xargs`
: decodes the parameters.

`argsp`
: is the address at which parameters are placed.

svc_getargs()
Decode Parameters of a Service Request

Syntax

```
#include <RPC/rpc.h>
bool_t svc_getargs(
     SVCXPRT       *xprt,
     xdrproc_t     xargs,
     char          *argsp)
```

Description

`svc_getargs()` decodes the parameters of a request associated with `xprt`. This routine returns a value of 1 if decoding succeeds. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xprt`
: is the service transport handle.

`xargs`
: decodes the parameters.

`argsp`
: is the address at which parameters are placed.

svc_getcaller()
Get Network Address of Caller

Syntax

```
#include <RPC/rpc.h>

struct sockaddr_in *svc_getcaller(SVCXPRT *xprt)
```

Description

`svc_getcaller()` gets the network address of the caller of a procedure associated with `xprt`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xprt`
: is the service transport handle.

svc_getreq()
Custom Asynchronous Event Processor

Syntax

```
#include <RPC/rpc.h>
void svc_getreq(int *rdfds)
```

Description

`svc_getreq()` is similar to `svc_getreqset()` but limited to 32 descriptors. `svc_run()` makes this interface obsolete.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`rdfds`
: is the resultant `read` file descriptor bit mask.

svc_getreqset()
Custom Asynchronous Event Processor

Syntax

```
#include <RPC/rpc.h>
void svc_getreqset(int *readfds)
```

Description

`svc_getreqset()` is only of interest if a service implementor does not call `svc_run()`, but instead implements custom asynchronous event processing. `svc_getreqset()` is called when the system has determined that a request has arrived on some socket(s). The routine returns when all sockets associated with the value of `readfds` have been serviced.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`readfds`
: is the resultant `read` file descriptor bit mask.

svc_register()
Establish Service with Dispatch Routine

Syntax

```
#include <RPC/rpc.h>
bool_t svc_register(
     SVCXPRT     xprt,
     u_long      prog,
     u_long      vers,
     void        (*dispatch)(,)
     int         protocol)
```

Description

`svc_register()` associates `prog` and `vers` with the service dispatch procedure. If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xprt`
: is the service transport handle.

  If `xprt` is 0, the service is not registered with dispatch. If `xprt` is non-zero, a mapping of `prog`, `vers`, and `protocol` is established with the local service.

`prog`
: is the program number.

`vers`
: is the version number.

`dispatch`
: is the service dispatch procedure.

  The dispatch procedure has the following form (`xprt` is the service transport handle):

```
dispatch(request, xprt)
struct svc_req*request;
```

`protocol`
: is the protocol to be used.

  Supported values are `IPPROTO_UDP` and `IPPROTO_TCP`.

svc_run()
Process RPC Request

Syntax

```
#include <RPC/rpc.h>
void svc_run(void)
```

Description

`svc_run()` never returns. It waits for requests to arrive. When a request arrives, `svc_run()` calls the appropriate service procedure. This procedure is usually waiting for I/O.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

svc_sendreply()
Send RPC Results

Syntax

```
#include <RPC/rpc.h>
bool_t svc_sendreply(
     SVCXPRT       *xprt,
     xdrproc_t     xdr_results,
     caddr_t       xdr_location)
```

Description

`svc_sendreply()` is called by a service dispatch routine to send the results of a remote procedure call. If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xprt`
: is the service transport handle.

`xdr_results`
: is the routine used to encode the results.

`xdr_location`
: is the address of the results.

svc_unregister()
Remove Mapping for RPC Service

Syntax

```
#include <RPC/rpc.h>
void svc_unregister(
     u_long     prog,
     u_long     vers)
```

Description

`svc_unregister()` removes all mapping of the service to dispatch routines and `portmap`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`prog`
specifies a remote program.

`vers`
specifies the version of a remote program.

svcerr_auth()
Report Authentication Error

Syntax

```
#include <RPC/rpc.h>
void svcerr_auth(
     SVCXPRT            *xprt,
     enum auth_stat     *why)
```

Description

`svcerr_auth()` reports an authentication error. It is called by a service dispatch routine that refuses to perform a remote procedure call due to an authentication error.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xprt`
: is the service transport handle.

`why`
: is the authentication error status.

svcerr_decode()
Report Decoding Error

Syntax

```
#include <RPC/rpc.h>
void svcerr_decode(SVCXPRT *xprt)
```

Description

`svcerr_decode()` reports a decoding error. It is called by a service dispatch routine that cannot successfully decode its parameters.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xprt`
: is the service transport handle.

svcerr_noproc()
Report Unknown Procedure Number

Syntax

```
#include <RPC/rpc.h>
void svcerr_noproc(SVCXPRT *xprt)
```

Description

`svcerr_noproc()` reports an unknown procedure number. It is called by a service dispatch routine that does not implement the procedure number that the caller requests.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xprt`
: is the service transport handle.

svcerr_noprog()
Report Unknown Program Number

Syntax

```
#include <RPC/rpc.h>
void svcerr_noprog(SVCXPRT *xprt)
```

Description

`svcerr_noprog()` reports an unknown program number. It is called when the desired program is not registered with the package. Service implementors usually do not need to use this routine.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xprt`
: is the service transport handle.

svcerr_progvers()
Report Unknown Version Number

Syntax

```
#include <RPC/rpc.h>
void svcerr_progvers(SVCXPRT *xprt)
```

Description

`svcerr_progvers()` reports an unknown version number. It is called when the desired version of a program is not registered with the package. Service implementors usually do not need to use this routine.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xprt`
: is the service transport handle.

svcerr_systemerr()
Report System Error

Syntax

```
#include <RPC/rpc.h>
void svcerr_systemerr(SVCXPRT *xprt)
```

Description

`svcerr_systemerr()` reports a system error. It is called by a service dispatch routine when the routine detects a system error not covered by any particular protocol. For example, if a service can no longer allocate storage, it may call this routine.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xprt`
: is the service transport handle.

svcerr_weakauth()
Report Weak Authentication

Syntax

```
#include <RPC/rpc.h>
void svcerr_weakauth(SVCXPRT *xprt)
```

Description

`svcerr_weakauth()` reports weak authentication. It is called by a service dispatch routine that refuses to perform a remote procedure call due to insufficient (but correct) authentication parameters.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xprt`
: is the service transport handle.

svcfd_create()

Create Service Transport on Open Descriptor

Syntax

```
#include <RPC/rpc.h>
SVCXPRT *svcfd_create(
     int       fd,
     u_int     sendsize,
     u_int     recvsize)
```

Description

`svcfd_create()` creates a service on top of an open path. Typically, this path is a connected socket for a stream protocol such as TCP.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`fd`
: is the path number.

`sendsize`
: is the size of the send buffer.

  If 0, defaults are chosen.

`recvsize`
: is the size of the receive buffer.

  If 0, defaults are chosen.

svcraw_create()

Create Loopback Service Transport

Syntax

```
#include <RPC/rpc.h>
SVCXPRT * svcraw_create(void)
```

Description

`svcraw_create()` creates a local service transport. This routine returns a pointer to the transport. The transport is a buffer within the process's address space. The corresponding client should live in the same address space. This routine allows for the simulation and acquisition of overheads, such as round trip times.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

svctcp_create()
Create TCP Service Transport

Syntax

```
#include <RPC/rpc.h>
SVCXPRT * svctcp_create(
     int       sock,
     u_int     sendsize,
     u_int     recvsize)
```

Description

`svctcp_create()` creates a service transport and returns a pointer to it. The transport is associated with the socket `sock`. If the socket is not bound to a local port, this routine binds it to an arbitrary port. This routine chooses suitable defaults if a value of 0 is specified for `sendsize` and `recvsize`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`sock`
: is the transport's socket number.

  `sock` may be null. In this case, a new socket is created.

`sendsize`
: is the size of the send buffer.

`recvsize`
: is the size of the receive buffer.

svcudp_create()

Create UDP Service Transport

Syntax

```
#include <RPC/rpc.h>

SVCXPRT * svcudp_create(int sock)
```

Description

`svcudp_create()` creates a service transport and returns a pointer to it. The transport is associated with the socket `sock`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`sock`

is the transport's socket number.

`sock` may be null. In this case, a new socket is created. If the socket is not bound to a local port, this routine binds it to an arbitrary port.

XDR Functions

The XDR C library routines enable C programmers to describe arbitrary data structures in a machine-independent fashion. Data for remote procedure calls are transmitted using these routines.

XDR functions can be found in the `rpc.l` library.

The main include file for XDR is `RPC/rpc.h`, which includes `RPC/xdr.h`. It can be found in `MWOS/SRC/DEFS/SPF/RPC`. `RPC/xdr.h` defines the preliminary XDR structure:

```
/*
* The XDR handle.
* Contains operation which is being applied to the stream, an
* operations vector for the paticular implementation (e.g. see
* xdr_mem.c), and two private fields for the use of the particular
* implementation.
*/
typedef struct {
   enum xdr_opx_op;/* operation; fast additional param */
struct xdr_ops {
   bool_t(*x_getlong)();/* get long from underlying stream */
   bool_t(*x_putlong)();/* put a long to " */
   bool_t(*x_getbytes)();/* get some bytes from " */
   bool_t(*x_putbytes)();/* put some bytes to " */
   u_int(*x_getpostn)();/* returns bytes off from beginning */
   bool_t(*x_setpostn)();/* lets you reposition the stream */
   long *(*x_inline)();  /* buf quick ptr to buffered data */
   void(*x_destroy)(); /* free privates of this xdr_stream */
} *x_ops;
   caddr_tx_public;/* users' data */
   caddr_tx_private;/* pointer to private data */
   caddr_tx_base;/* private used for position info */
   int x_handy;/* extra private word */
} XDR;
```

RPCGEN is the compiler that generates client and server sides of an RPC program.

The following table lists and describes the XDR C library functions.

Table 2-17. XDR C Library Functions

Function	Description
xdr_accepted_reply()	Encode RPC Reply Messages
xdr_array()	Translate Arrays to/from XDR
xdr_authunix_parms()	Generate UNIX Credentials
xdr_bool()	Translate Booleans to/from XDR
xdr_bytes()	Translate Counted Bytes to/from XDR
xdr_callhdr()	Encode RPC Call Header
xdr_callmsg()	Encode RPC Call Message
xdr_char()	Translate Characters to/from XDR
xdr_destroy()	Destroy XDR Stream
xdr_double()	Translate Double Precision Numbers to/from XDR
xdr_enum()	Translate Enumerated Types to/from XDR
xdr_float()	Translate Floating Point Numbers to/from XDR
xdr_free()	Free XDR Structure
xdr_getpos()	Return Position in an XDR Stream
xdr_inline()	Invoke Inline XDR Function
xdr_int()	Translate Integers to/from XDR
xdr_long()	Translate Long Integers to/from XDR
xdr_opaque()	Translate Opaque Data to/from XDR
xdr_opaque_auth()	Describe RPC Authentication Information
xdr_pmap()	Describe Procedure Parameters and Port Maps
xdr_pmaplist()	Describe Procedure Parameters and Port Maps
xdr_pointer()	Translate Pointer to/from XDR
xdr_reference()	Translate Pointers to/from XDR
xdr_rejected_reply()	Encode Rejected RPC Message
xdr_replymsg()	Encode RPC Reply Message
xdr_setpos()	Set Position within XDR Stream
xdr_short()	Translate Short Integers to/from XDR
xdr_string()	Translate Strings to/from XDR
xdr_u_char()	Translate Unsigned Characters to/from XDR
xdr_u_int()	Translate Unsigned Integers to/from XDR
xdr_u_long()	Translate Unsigned Long Integers to/from XDR
xdr_u_short()	Translate Unsigned Short Integers to/from XDR
xdr_union()	Translate Discriminated Union to/from XDR
xdr_vector()	Translate Fixed-Length Arrays to/from XDR
xdr_void()	Translate Nothing to/from XDR
xdr_wrapstring()	Package RPC Message
xdrmem_create()	Initialize XDR Stream Object

Table 2-17. XDR C Library Functions (Continued)

Function	Description
xdrrec_create()	Initialize XDR Stream
xdrrec_endofrecord()	Mark End of Record in XDR Stream
xdrrec_eof()	Check EOF on XDR Stream
xdrrec_skiprecord()	Skip Current Record in XDR Stream
xprt_register()	Register Transport Handle
xprt_unregister()	Unregister Service Transport Handle
xdrtdio_create()	Initialize XDR Stream Object

xdr_accepted_reply()
Encode RPC Reply Messages

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_accepted_reply(
     XDR                       *xdrs,
     struct accepted_reply     *ar)
```

Description

`xdr_accepted_reply()` encodes the status of the RPC call. It is used to generate RPC-style messages without using the RPC package.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the service transport handle.

`ar`
: is the message accepted reply.

xdr_array()
Translate Arrays to/from XDR

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_array(
     XDR           *xdrs,
     caddr_t       *addrp,
     u_int         *sizep,
     u_int         maxsize,
     u_int         elsize,
     xdrproc_t     elproc)
```

Description

The `xdr_array()` filter primitive translates between variable-length arrays and their corresponding external representations. `elproc` translates between the array elements' C form and their external representation.

If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

`addrp`
: is the address of the pointer to the array.

`sizep`
: is the address of the element count of the array.

`maxsize`
: specifies the maximum size of `sizep`.

`elsize`
: is the size of each of the array's elements.

`elproc`
: is the filter.

xdr_authunix_parms()
Generate UNIX Credentials

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_authunix_parms(
     XDR                        *xdrs,
     struct authunix_parms      *p)
```

Description

`xdr_authunix_parms()` externally describes credentials. This routine generates these credentials without using the authentication package.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the service transport handle.

`p`
: is the authentication parameter.

xdr_bool()

Translate Booleans to/from XDR

Syntax

```
#include <RPC/rpc.h>
boot_l xdr_bool(
     XDR        *xdrs,
     bool_t     *bp)
```

Description

The `xdr_bool()` filter primitive translates between booleans (C integers) and their external representations. When encoding data, this filter produces values of either 1 or 0.

If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

`bp`
: is the target boolean variable or constant.

xdr_bytes()
Translate Counted Bytes to/from XDR

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_bytes(
     XDR        *xdrs,
     char       *cpp,
     u_int      *sizep,
     u_int      maxsize)
```

Description

The `xdr_bytes()` filter primitive translates between counted byte strings and their external representations.

If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

`cpp`
: is the address of the string pointer.

`sizep`
: is the length of the string.

`maxsize`
: specifies the maximum size of `sizep`.

xdr_callhdr()
Encode RPC Call Header

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_callhdr(
     XDR               *xdrs,
     struct rpc_msg    *cmsg)
```

Description

`xdr_callhdr()` encodes the static part of the call message header. It is used to generate RPC-style messages without using the RPC package.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the service transport handle.

`cmsg`
: is the header portion of RPC message.

xdr_callmsg()
Encode RPC Call Message

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_callmsg(
     XDR               *xdrs,
     struct rpc_msg    *cmsg)
```

Description

`xdr_callmsg()` encodes an RPC call message. It is used to generate RPC-style messages without using the RPC package.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the service transport handle.

`cmsg`
: is the RPC call message.

xdr_char()
Translate Characters to/from XDR

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_char(
     XDR      *xdrs,
     char     *cp)
```

Description

The `xdr_char()` filter primitive translates between C characters and their external representations.

If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

`cp`
: is the target character.

  Encoded characters are not packed. They occupy four bytes each.

xdr_destroy()
Destroy XDR Stream

Syntax

```
#include <RPC/rpc.h>
void xdr_destroy(XDR *xdrs)
```

Description

The `xdr_destroy()` macro invokes the destroy routine associated with `xdrs`. Destruction usually involves freeing private data structures associated with the stream. Using `xdrs` after invoking `xdr_destroy()` is undefined.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

xdr_double()

Translate Double Precision Numbers to/from XDR

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_double(
     XDR        *xdrs,
     double     *dp)
```

Description

The `xdr_double()` filter primitive translates between C double precision numbers and their external representations.

If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

`dp`
: is the target double precision variable.

xdr_enum()

Translate Enumerated Types to/from XDR

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_enum(
     XDR        *xdrs,
     enum_t     *ep)
```

Description

The `xdr_enum()` filter primitive translates between C enumerations (actually integers) and their external representations.

If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

`ep`
: is the target enumeration variable.

xdr_float()

Translate Floating Point Numbers to/from XDR

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_float(
     XDR       *xdrs,
     float     *fp)
```

Description

The `xdr_float()` filter primitive translates between C floating point numbers and their external representations.

If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

`fp`
: is the target float variable.

xdr_free()
Free XDR Structure

Syntax

```
#include <RPC/rpc.h>
void xdr_free(
     xdrproc_t     proc,
     char          *objp)
```

Description

`xdr_free()` is a generic freeing routine.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`proc`
: is the routine for the object being freed.

`objp`
: is the pointer to the object itself.

  The pointer passed to this routine is not freed, but what it points to is recursively freed.

xdr_getpos()
Return Position in an XDR Stream

Syntax

```
#include <RPC/rpc.h>
u_int xdr_getpos(XDR *xdrs)
```

Description

The `xdr_getpos()` macro invokes the get-position routine associated with `xdrs`. The routine returns an unsigned integer indicating the position of the byte stream. A desirable feature of streams is that simple arithmetic works with this number, although the stream instances need not guarantee this.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

xdr_inline()
Invoke Inline XDR Function

Syntax

```
#include <RPC/rpc.h>
long * xdr_inline(
     XDR     *xdrs,
     int     len)
```

Description

The `xdr_inline` macro invokes the inline routine associated with `xdrs`. The routine returns a pointer to a contiguous piece of the stream's buffer.

`xdr_inline()` may return 0 if it cannot allocate a contiguous piece of a buffer. Therefore, the behavior may vary among stream instances. It exists for efficiency.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

`len`
: is the byte length of the desired buffer.

xdr_int()
Translate Integers to/from XDR

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_int(
     XDR     *xdrs,
     int     *ip)
```

Description

The `xdr_int()` filter primitive translates between C integers and their external representations.

If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

`ip`
: is the target integer variable.

xdr_long()

Translate Long Integers to/from XDR

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_long(
     XDR      *xdrs,
     long     *lp)
```

Description

The `xdr_long()` filter primitive translates between C long integers and their external representations.

If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

`lp`
: is the target long variable.

xdr_opaque()
Translate Opaque Data to/from XDR

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_opaque(
     XDR         *xdrs,
     caddr_t     cp,
     u_int       cnt)
```

Description

The `xdr_opaque()` filter primitive translates between fixed size opaque data and its external representation.

If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

`cp`
: is the address of opaque object.

`cnt`
: is the size of the opaque object in bytes.

xdr_opaque_auth()
Describe RPC Authentication Information

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_opaque_auth(
     XDR                    *xdrs,
     struct opaque_auth     *ap)
```

Description

`xdr_opaque_auth()` describes RPC authentication information messages. It is used to generate RPC-style messages without using the RPC package.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the service transport handle.

`ap`
: is the opaque authentication structure.

xdr_pmap()

Describe Procedure Parameters and Port Maps

Syntax

```
#include <RPC/pmap_prot.h)
bool_t xdr_pmap(
     XDRS            *xdrs,
     struct pmap     *regs)
```

Description

`xdr_pmap()` externally describes parameters to various procedures. This routine generates these parameters without using the `pmap` interface.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the service transport handle.

`regs`
: is the portmap parameter.

xdr_pmaplist()

Describe Procedure Parameters and Port Maps

Syntax

```
#include <RPC/pmap_prot.h)
bool_t xdr_pmaplist(
     XDR                *xdrs,
     struct pmaplist    **rp)
```

Description

`xdr_pmaplist()` externally describes a list of port mappings. This routine generates these parameters without using the
`pmap` interface.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the service transport handle.

`rp`
: is the portmap list.

xdr_pointer()
Translate Pointer to/from XDR

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_pointer(
     XDR           *xdrs,
     char          *objpp,
     u_int         obj_size,
     xdrproc_t     xdr_obj)
```

Description

`xdr_pointer()` serializes pointers. This routine can handle recursive data structures, such as binary trees or linked lists.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
is the stream.

`objpp`
is a pointer to an object.

`obj_size`
is the size of object.

`xdr_obj`
is the XDR procedure to process target object.

xdr_reference()
Translate Pointers to/from XDR

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_reference(
     XDR           *xdrs,
     caddr_t       *pp,
     u_int         size,
     xdrproc_t     proc)
```

Description

The `xdr_reference()` primitive provides pointer chasing within structures. `proc` filters the structure between its C form and its external representation.

If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

`pp`
: is the address of the pointer.

`size`
: is the size of structure pointed to by `pp`.

`proc`
: is the filter.

xdr_rejected_reply()
Encode Rejected RPC Message

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_rejected_reply(
     XDR                       *xdrs,
     struct rejected_reply     *rr)
```

Description

`xdr_rejected_reply()` encodes the rejecting RPC message. It is used to generate RPC-style messages without using the RPC package.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the service transport handle.

`rr`
: is the message rejected reply.

xdr_replymsg()
Encode RPC Reply Message

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_replymsg(
     XDR               *xdrs,
     struct rpc_msg    *rmsg)
```

Description

`xdr_replymsg` encodes an RPC reply message. It is used to generate RPC-style messages without using the RPC package.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
is the service transport handle.

`rmsg`
is the RPC message.

xdr_setpos()
Set Position within XDR Stream

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_setpos(
     XDR       *xdrs,
     u_int     pos)
```

Description

The `xdr_setpos()` macro invokes the set position routine associated with `xdrs`. This routine returns a value of 1 if the stream could be repositioned. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

`pos`
: is the position value.

  It is difficult to reposition some stream types. This routine may fail with one type of stream and succeed with another.

xdr_short()
Translate Short Integers to/from XDR

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_short(
     XDR       *xdrs,
     short     *sp)
```

Description

The `xdr_short()` filter primitive translates between C short integers and their external representations.

If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

`sp`
: is the target short variable.

xdr_string()
Translate Strings to/from XDR

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_string(
     XDR       *xdrs,
     char      **cpp,
     u_int     maxsize)
```

Description

The `xdr_string()` filter primitive translates between C strings and their corresponding external representations.

If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

`cpp`
: is the address of the pointer to the string.

`maxsize`
: is the maximum size of the string.

xdr_u_char()

Translate Unsigned Characters to/from XDR

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_u_char(
     XDR        *xdrs,
     u_char     *cp)
```

Description

The `xdr_u_char()` filter primitive translates between C unsigned characters and their external representations.

If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

`cp`
: is the target unsigned `char` variable.

xdr_u_int()
Translate Unsigned Integers to/from XDR

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_u_int(
     XDR       *xdrs,
     u_int     *up)
```

Description

The `xdr_u_int()` filter primitive translates between C integers and their external representations.

If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

`up`
: is the target unsigned integer variable.

xdr_u_long()

Translate Unsigned Long Integers to/from XDR

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_u_long(
     XDR        *xdrs,
     u_long     *ulp)
```

Description

The `xdr_u_long()` filter primitive translates between C unsigned long integers and their external representations.

If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

`ulp`
: is the target unsigned long variable.

xdr_u_short()

Translate Unsigned Short Integers to/from XDR

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_u_short(
     XDR         *xdrs,
     u_short     *usp)
```

Description

The `xdr_u_short()` filter primitive translates between C unsigned short integers and their external representations.

If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

`usp`
: is the target unsigned short variable.

xdr_union()

Translate Discriminated Union to/from XDR

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_union(
     XDR                    *xdrs,
     enum_t                 *dscmp,
     char                   *unp,
     struct xdr_discrim     *choices,
     xdrproc_t              dfault)
```

Description

The `xdr_union()` filter primitive translates between a discriminated C union and its corresponding external representation. It translates the discriminant of the union located at `dscmp`. This discriminant is always an integer. Then, the union located at `unp` is translated. Each structure contains an ordered pair of values. If the union's discriminant is equal to the associated value, the routine translates the union. The end of the structure array is denoted by a routine of value 0. If the discriminant is not found in the array, the `dfault` procedure is called.

If successful, this routine returns a value of 1. Otherwise, it returns zero.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

`dscmp`
: is the location of a union.

`unp`
: is the location of a union.

`choices`
: is the pointer to an array of structures.

`dfault`
: is the function to call if discriminant is not found (may be `NULL`).

xdr_vector()
Translate Fixed-Length Arrays to/from XDR

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_vector(
     XDR           *xdrs,
     char          *basep,
     u_int         nelem,
     u_int         elemsize,
     xdrproc_t     xdr_elem)
```

Description

The `xdr_vector()` filter primitive translates between fixed-length arrays and their corresponding external representations. `xdr_elem` translates between the array elements' C form and their external representation.

If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
is the stream.

`basep`
is the address of the pointer to the array.

`nelem`
is the element count of array.

`elemsize`
is the size of each of the array's elements.

`xdr_elem`
is a filter.

xdr_void()
Translate Nothing to/from XDR

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_void(void)
```

Description

`xdr_void()` always returns 1. It may be passed to routines that require a function parameter, where nothing is to be done.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

xdr_wrapstring()
Package RPC Message

Syntax

```
#include <RPC/rpc.h>
bool_t xdr_wrapstring(
     XDR      *xdrs,
     char     **cpp)
```

Description

The `xdr_wrapstring()` primitive calls `xdr_string()`. It is useful because the package passes a maximum of two routines as parameters, and one of the most frequently used primitives, `xdr_string()` requires three.

If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

`cpp`
: is the address of pointer to the string to convert.

xdrmem_create()
Initialize XDR Stream Object

Syntax

```
#include <RPC/rpc.h>
void xdrmem_create(
     XDR             *xdrs,
     caddr_t         addr,
     u_int           size,
     enum xdr_op     op)
```

Description

`xdrmem_create()` initializes the stream object pointed to by `xdrs`. The stream's data is written to memory or read from memory at location `addr`. `size` specifies the stream size.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

`addr`
: is the address of a memory location.

`size`
: is the maximum length of memory location.

`op`
: determines the direction of the stream.

xdrrec_create()
Initialize XDR Stream

Syntax

```
#include <RPC/rpc.h>
void xdrrec_create(
     XDR         *xdrs,
     u_int       sendsize,
     u_int       recvsize,
     caddr_t     handle,
     int         (*readit)(),
     int         (*writeit)())
```

Description

`xdrrec_create()` initializes the stream object pointed to by `xdrs`. Specifying values of 0 for `sendsize` or `recvsize` causes the system to choose suitable defaults. When a stream's output buffer is full, `writeit` is called. Similarly, when a stream's input buffer is empty, `readit` is called.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

`sendsize`
: is the size of stream's outgoing data buffer.

`recvsize`
: is the size of stream's incoming data buffer.

`handle`
: is the client handle.

`readit`
: is the procedure for input empty condition.

`writeit`
: is the procedure for output full condition.

  This stream implements an intermediate record stream. Therefore, additional bytes in the stream provide record boundary information.

xdrrec_endofrecord()
Mark End of Record in XDR Stream

Syntax

```
#include <RPC/rpc.h>
bool_t xdrrec_endofrecord(
     XDR        *xdrs,
     bool_t     sendnow)
```

Description

`xdrrec_endofrecord()` marks the end of record in an XDR stream. This routine can be invoked only on record streams. The data in the output buffer is marked as a completed record. The output buffer is optionally written out if `sendnow` equals TRUE.

If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is the stream.

`sendnow`
: sends flag.

xdrrec_eof()
Check EOF on XDR Stream

Syntax

```
#include <RPC/rpc.h>
bool_t xdrrec_eof(XDR *xdrs)
```

Description

`xdrrec_eof()` checks for an end-of-file condition on an XDR stream. After using the rest of the current record in the stream, this routine returns 1 if the stream has no more input. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is a pointer to a stream.

xdrrec_skiprecord()
Skip Current Record in XDR Stream

Syntax

```
#include <RPC/rpc.h>
bool_t xdrrec_skiprecord(XDR *xdrs)
```

Description

`xdrrec_skiprecord()` skips the rest of the current record in the stream's input buffer. If successful, this routine returns a value of 1. Otherwise, it returns a value of 0.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is a pointer to a stream.

xprt_register()
Register Transport Handle

Syntax

```
#include <RPC/rpc.h>
void xprt_register(SVCXPRT *xprt)
```

Description

`xprt_register()` registers the transport handle `xprt`. After service transport handles are created, they should register themselves with the service package. Service implementors usually do not need to use this routine.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xprt`
: is a service transport handle.

xprt_unregister()
Unregister Service Transport Handle

Syntax

```
#include <RPC/rpc.h>
void xprt_unregister(SVCXPRT *xprt)
```

Description

`xprt_unregister()` unregisters a service transport handle. Before a service transport handle is destroyed, it should unregister itself with the service package. Service implementors usually do not need to use this routine.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xprt`
: is a service transport handle.

xdrtdio_create()
Initialize XDR Stream Object

Syntax

```
#include <RPC/rpc.h>
void xdrstdio_create(
     XDR             *xdrs,
     FILE            *file,
     enum xdr_op     op)
```

Description

`xdrstdio_create()` initializes the stream object pointed to by `xdrs`. The stream data is written to, or read from, `file`.

Attributes

Operating System:	OS-9 and OS-9 for 68K
State:	User
Threads:	Safe

Parameters

`xdrs`
: is a stream.

`file`
: is the name of file containing stream data.

`op`
: determines the direction of the stream.

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