

C

Summary of Kernel Support Functions

This appendix summarizes the kernel support functions (and some macros that behave like functions) that loadable kernel servers can call. Within the general categories of "General Functions" and "Network Functions," function declarations are further subgrouped to help you identify their interrelationships.

Chapter 10, "Kernel Support Functions," contains full descriptions of all the functions listed here. In addition, loadable kernel servers can use many Mach kernel functions, which are described in a section of Chapter 4, "Mach Functions." The Mach kernel functions are summarized in the manual, *NeXTSTEP Programmer Interface Summary*.

General Functions

This section contains a summary of the general purpose kernel support functions. Most of the functions and macros in this section are declared through either the **kernserv/kern_server_types.h** or **kernserv/prototypes.h** header file.

Time Functions

Busy-wait for a certain amount of time:

```
void          DELAY(unsigned int usecs)
```

Get or set the current time:

```
ns_time_t     clock_value(clock_types_t which_clock)
void          set_clock(clock_types_t which_clock, ns_time_t ns)
```

Get information about a clock:

```
chrono_attributes_t
               clock_attributes(clock_types_t which_clock)
```

Convert between **ns_time_t** and **timeval** data formats:

```
void          ns_time_to_timeval(ns_time_t ns, struct timeval *tv)
ns_time_t     timeval_to_ns_time(struct timeval *tv)
```

Schedule or unschedule a function to be called later:

void	ns_abstimeout (func <i>function</i> , vm_address_t <i>arg</i> , ns_time_t <i>deadline</i> , int <i>priority</i>)
void	ns_timeout (func <i>function</i> , vm_address_t <i>arg</i> , ns_time_t <i>time</i> , int <i>priority</i>)
boolean_t	ns_untimeout (func <i>function</i> , vm_address_t <i>arg</i>)

Memory Functions

Make addresses pageable or memory-resident:

kern_return_t	kern_serv_unwire_range (kern_server_t * <i>ksp</i> , vm_address_t <i>address</i> , vm_size_t <i>size</i>)
kern_return_t	kern_serv_wire_range (kern_server_t * <i>ksp</i> , vm_address_t <i>address</i> , vm_size_t <i>size</i>)

Copy or initialize data:

void	bcopy (void * <i>from</i> , void * <i>to</i> , int <i>length</i>)
void	bytecopy (void * <i>from</i> , void * <i>to</i> , int <i>length</i>)
void	bzero (void * <i>address</i> , int <i>length</i>)

Allocate or free memory:

void *	kalloc (int <i>size</i>)
void	kfree (void * <i>address</i> , int <i>size</i>)
void *	kget (int <i>size</i>)

Critical Section and Synchronization Functions

Use read and write locks:

lock_t	lock_alloc (void)
void	lock_free (lock_t <i>lock</i>)
void	lock_done (lock_t <i>lock</i>)
void	lock_init (lock_t <i>lock</i> , boolean_t <i>can_sleep</i>)
void	lock_read (lock_t <i>lock</i>)
void	lock_write (lock_t <i>lock</i>)

Use simple, nonsleeping locks:

void	simple_lock (simple_lock_t <i>lock</i>)
simple_lock_t	simple_lock_alloc (void)
void	simple_lock_free (simple_lock_t <i>lock</i>)
void	simple_lock_init (simple_lock_t <i>lock</i>)
void	simple_unlock (simple_lock_t <i>lock</i>)

Cause a thread to sleep or wake up:

void	assert_wait (int <i>event</i> , boolean_t <i>interruptible</i>)
void	clear_wait (thread_t <i>thread</i> , int <i>result</i> , boolean_t <i>interrupt_only</i>)
void	thread_block (void)
void	thread_set_timeout (int <i>ticks</i>)
void	thread_sleep (int <i>event</i> , simple_lock_t <i>lock</i> , boolean_t <i>interruptible</i>)
void	thread_wakeup (int <i>event</i>)

General Task and Thread Functions

Get information about this thread or task:

task_t	current_task (void)
int	thread_wait_result (void)

Create or kill a thread:

thread_t	kernel_thread (task_t <i>task</i> , void (* <i>start</i>))(void))
void	thread_halt_self (void)

Port and Message Functions

Request notification messages, such as port death notification:

kern_return_t	kern_serv_notify (kern_server_t * <i>ksp</i> , port_t <i>reply_port</i> , port_t <i>request_port</i>)
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Get the kernel's task port:

port_t	kern_serv_kernel_task_port (void)
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Get or set information about this server's ports:

port_t	kern_serv_bootstrap_port (kern_server_t * <i>ksp</i>)
port_t	kern_serv_local_port (kern_server_t * <i>ksp</i>)
port_t	kern_serv_notify_port (kern_server_t * <i>ksp</i>)
void	kern_serv_port_gone (kern_server_t * <i>ksp</i> , port_name_t <i>port</i>)
kern_return_t	kern_serv_port_proc (kern_server_t * <i>ksp</i> , port_all_t <i>port</i> , port_map_proc_t <i>function</i> , int <i>arg</i>)
kern_return_t	kern_serv_port_serv (kern_server_t * <i>ksp</i> , port_all_t <i>port</i> , port_map_proc_t <i>function</i> , int <i>arg</i>)
port_set_name_t	kern_serv_port_set (kern_server_t * <i>ksp</i>)

Hardware Interface Functions

Set up or remove an interrupt handler:

int	install_polled_intr (int <i>which</i> , int (* <i>my_intr</i>)(void))
int	uninstall_polled_intr (int <i>which</i> , int (* <i>my_intr</i>)(void))

Get or test a virtual address that corresponds to a hardware address:

caddr_t	map_addr (caddr_t <i>address</i> , int <i>size</i>)
int	probe_rb (void * <i>address</i>)

Change or determine the processor level:

int	curipl (void)
int	spl0 (void), spl1 (void), spl2 (void), spl3 (void), spl4 (void), spl5 (void), spl6 (void), spl7 (void)
void	splx (int <i>priority</i>)

Logging and Debugging Functions

Kill the loadable kernel server:

void	ASSERT (int <i>expression</i>)
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kern_return_t	kern_serv_panic (port_t <i>bootstrap_port</i> , panic_msg_t <i>message</i>)
void	panic (char * <i>string</i>)

Log a message:

void	kern_serv_log (kern_server_t * <i>ksp</i> , int <i>log_level</i> , char * <i>format</i> , <i>arg1</i> , ..., <i>arg5</i>)
int	log (int <i>level</i> , char * <i>format</i> , <i>arg</i> , ...)
int	printf (char * <i>format</i> , <i>arg</i> , ...)

UNIX Support Functions

In a UNIX-style server, determine whether the user has root privileges:

int	suser (void)
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In a UNIX-style server, wait for I/O completion on a buffer:

void	biodone (struct buf * <i>bp</i>)
void	biowait (struct buf * <i>bp</i>)

In a UNIX-style server, copy data between user and kernel address space:

int	copyin (void * <i>from</i> , void * <i>to</i> , int <i>length</i>)
int	copyout (void * <i>from</i> , void * <i>to</i> , int <i>length</i>)

In a UNIX-style server, implement the **select()** system call:

int	selthreadcache (void ** <i>waiterPtr</i>)
void	selthreadclear (void ** <i>waiterPtr</i>)
int	selwakeup (void * <i>waiter</i> , int <i>collided</i>)

Miscellaneous Functions

Modify or inspect a string:

int	sprintf (char * <i>string</i> , char * <i>format</i> , <i>arg</i> , ...)
char *	strcat (char * <i>string1</i> , char * <i>string2</i>)
int	strcmp (char * <i>string1</i> , char * <i>string2</i>)
int	strncmp (char * <i>string1</i> , char * <i>string2</i> , unsigned long <i>length</i>)
char *	strcpy (char * <i>to</i> , char * <i>from</i>)
char *	strncpy (char * <i>to</i> , char * <i>from</i> , unsigned long <i>length</i>)
int	strlen (char * <i>string</i>)

Call a function from the main thread:

kern_return_t	kern_serv_callout (kern_server_t * <i>ksp</i> , void (* <i>func</i>)(void *), void * <i>arg</i>)
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Network Functions

This section contains a summary of the network-specific kernel support functions, which are described in detail in Chapter 10. A general discussion of networking drivers and protocols is in Chapter 8, “Network Modules.”

Netif Functions

To use these functions, you need to include the header file **net/netif.h**.

Initialize and install a new netif:

```
netif_t      if_attach(if_init_func_t init_func, if_input_func_t input_func, if_output_func_t
               output_func, if_getbuf_func_t getbuf_func, if_control_func_t
               control_func, const char *name, unsigned int unit, const char
               *type, unsigned int mtu, unsigned int flags, netif_class_t class,
               void *private)
void         if_registervirtual(if_attach_func_t attach_func, void *private)
```

Remove a netif:

```
void         if_detach(netif_t netif)
```

Get or set data for a netif:

```
unsigned int  if_collisions(netif_t netif)
void         if_collisions_set(netif_t netif, unsigned int collisions)
unsigned int  if_flags(netif_t netif)
void         if_flags_set(netif_t netif, unsigned int flags)
unsigned int  if_ierrors(netif_t netif)
void         if_ierrors_set(netif_t netif, unsigned int ierrors)
unsigned int  if_oerrors(netif_t netif)
void         if_oerrors_set(netif_t netif, unsigned int oerrors)
unsigned int  if_ipackets(netif_t netif)
void         if_ipackets_set(netif_t netif, unsigned int ipackets)
unsigned int  if_opackets(netif_t netif)
void         if_opackets_set(netif_t netif, unsigned int opackets)
unsigned int  if_mtu(netif_t netif)
const char *  if_name(netif_t netif)
void *        if_private(netif_t netif)
const char *  if_type(netif_t netif)
unsigned int  if_unit(netif_t netif)
```

Call a function implemented by a network module:

```
int          if_control(netif_t netif, const char *command, void *data)
netbuf_t     if_getbuf(netif_t netif)
int          if_init(netif_t netif)
int          if_ioctl(netif_t netif, unsigned int command, void *data)
int          if_output(netif_t netif, netbuf_t packet, void *address)
```

Get information about netifs:

```
netif_class_t if_class(netif_t netif)
netif_t       iflist_first(void)
netif_t       iflist_next(netif_t netif)
```

Dispatch a packet to a protocol handler:

```
int          if_handle_input(netif_t netif, netbuf_t packet, void *extra)
```

Netbuf Functions

You should include the header file **net/netbuf.h** when you use these functions.

Allocate or free a netbuf or its wrapper:

netbuf_t	nb_alloc (unsigned int <i>size</i>)
netbuf_t	nb_alloc_wrapper (void * <i>data</i> , unsigned int <i>size</i> , void <i>freefunc</i> (void *), void * <i>freefunc_arg</i>)
void	nb_free (netbuf_t <i>nb</i>)
void	nb_free_wrapper (netbuf_t <i>nb</i>)

Change the size of a netbuf:

int	nb_grow_bot (netbuf_t <i>nb</i> , unsigned int <i>size</i>)
int	nb_shrink_bot (netbuf_t <i>nb</i> , unsigned int <i>size</i>)
int	nb_grow_top (netbuf_t <i>nb</i> , unsigned int <i>size</i>)
int	nb_shrink_top (netbuf_t <i>nb</i> , unsigned int <i>size</i>)

Access the data in a netbuf:

char *	nb_map (netbuf_t <i>nb</i>)
int	nb_read (netbuf_t <i>nb</i> , unsigned int <i>offset</i> , unsigned int <i>size</i> , void * <i>target</i>)
int	nb_write (netbuf_t <i>nb</i> , unsigned int <i>offset</i> , unsigned int <i>size</i> , void * <i>source</i>)
unsigned int	nb_size (netbuf_t <i>nb</i>)

Miscellaneous Functions

For the host-network conversion functions, you need to include the header file **netinet/in.h**. For **inet_queue()**, you should include both **net/netif.h** and **net/netbuf.h**.

Convert values between host and network byte order:

u_long	htonl (u_long <i>hostlong</i>)
u_short	htons (u_short <i>hostshort</i>)
u_long	ntohl (u_long <i>netlong</i>)
u_short	ntohs (u_short <i>netshort</i>)

Give an IP input packet to the kernel for processing:

void	inet_queue (netif_t <i>netif</i> , netbuf_t <i>netbuf</i>)
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