



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 function, vm_address_t arg, ns_time_t deadline, int priority)
void          ns_timeout(func function, vm_address_t arg, ns_time_t time, int priority)
boolean_t     ns_untimeout(func function, vm_address_t arg)
```

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>)
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)
```

In a UNIX-style server, wait for I/O completion on a buffer:

```
void          biodone(struct buf *bp)  
void          biowait(struct buf *bp)
```

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

```
int           copyin(void *from, void *to, int length)  
int           copyout(void *from, void *to, int length)
```

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

```
int           selthreadcache(void **waiterPtr)  
void          selthreadclear(void **waiterPtr)  
int           selwakeup(void *waiter, int collided)
```

Miscellaneous Functions

Modify or inspect a string:

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

Call a function from the main thread:

```
kern_return_t kern_serv_callout(kern_server_t *ksp, void (*func)(void *), void *arg)
```

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_register_virtual**(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 *size*)
netbuf_t **nb_alloc_wrapper**(void **data*, unsigned int *size*, void (**freefunc*)(void *), void **freefunc_arg*)
void **nb_free**(netbuf_t *nb*)
void **nb_free_wrapper**(netbuf_t *nb*)

Change the size of a netbuf:

int **nb_grow_bot**(netbuf_t *nb*, unsigned int *size*)
int **nb_shrink_bot**(netbuf_t *nb*, unsigned int *size*)

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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