

**NAME**

**vmem** - general purpose resource allocator

**SYNOPSIS**

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

*vmem\_t* \*

```
vmem_create(const char *name, vmem_addr_t base, vmem_size_t size, vmem_size_t quantum,
            vmem_size_t qcache_max, int flags);
```

*int*

```
vmem_add(vmem_t *vm, vmem_addr_t addr, vmem_size_t size, int flags);
```

*int*

```
vmem_xalloc(vmem_t *vm, const vmem_size_t size, vmem_size_t align, const vmem_size_t phase,
            const vmem_size_t nocross, const vmem_addr_t minaddr, const vmem_addr_t maxaddr, int flags,
            vmem_addr_t *addrp);
```

*void*

```
vmem_xfree(vmem_t *vm, vmem_addr_t addr, vmem_size_t size);
```

*int*

```
vmem_alloc(vmem_t *vm, vmem_size_t size, int flags, vmem_addr_t *addrp);
```

*void*

```
vmem_free(vmem_t *vm, vmem_addr_t addr, vmem_size_t size);
```

*void*

```
vmem_destroy(vmem_t *vm);
```

**DESCRIPTION**

The **vmem** is a general purpose resource allocator. Despite its name, it can be used for arbitrary resources other than virtual memory.

**vmem\_create()** creates a new vmem arena.

*name*        The string to describe the vmem.

*base*        The start address of the initial span. Pass 0 if no initial span is required.

*size*        The size of the initial span. Pass 0 if no initial span is required.

*quantum*    The smallest unit of allocation.

*qcache\_max* The largest size of allocations which can be served by quantum cache. It is merely a hint and can be ignored.

*flags*        malloc(9) wait flag.

**vmem\_add()** adds a span of size *size* starting at *addr* to the arena. Returns 0 on success, ENOMEM on failure. *flags* is malloc(9) wait flag.

**vmem\_xalloc()** allocates a resource from the arena.

*vm*        The arena which we allocate from.

*size*        Specify the size of the allocation.

*align*      If zero, don't care about the alignment of the allocation. Otherwise, request a resource segment starting at offset *phase* from an *align* aligned boundary.

*phase*      See the above description of *align*. If *align* is zero, *phase* should be zero. Otherwise, *phase* should be smaller than *align*.

*nocross*    Request a resource which doesn't cross *nocross* aligned boundary.

*minaddr*

Specify the minimum address which can be allocated, or VMEM\_ADDR\_MIN if the caller does not care.

*maxaddr*

Specify the maximum address which can be allocated, or VMEM\_ADDR\_MAX if the caller does not care.

*flags*      A bitwise OR of an allocation strategy and a malloc(9) wait flag. The allocation strategy is one of:

**M\_FIRSTFIT**

Prefer allocation performance.

**M\_BESTFIT**

Prefer space efficiency.

**M\_NEXTFIT**

Perform an address-ordered search for free addresses, beginning where the previous search ended.

*addrp* On success, if *addrp* is not NULL, **vmem\_xalloc()** overwrites it with the start address of the allocated span.

**vmem\_xfree()** frees resource allocated by **vmem\_xalloc()** to the arena.

*vm* The arena which we free to.

*addr* The resource being freed. It must be the one returned by **vmem\_xalloc()**. Notably, it must not be the one from **vmem\_alloc()**. Otherwise, the behaviour is undefined.

*size* The size of the resource being freed. It must be the same as the *size* argument used for **vmem\_xalloc()**.

**vmem\_alloc()** allocates a resource from the arena.

*vm* The arena which we allocate from.

*size* Specify the size of the allocation.

*flags* A bitwise OR of an **vmem** allocation strategy flag (see above) and a malloc(9) sleep flag.

*addrp*

On success, if *addrp* is not NULL, **vmem\_alloc()** overwrites it with the start address of the allocated span.

**vmem\_free()** frees resource allocated by **vmem\_alloc()** to the arena.

*vm* The arena which we free to.

*addr* The resource being freed. It must be the one returned by **vmem\_alloc()**. Notably, it must not be the one from **vmem\_xalloc()**. Otherwise, the behaviour is undefined.

*size* The size of the resource being freed. It must be the same as the *size* argument used for

**vmem\_alloc()**.

**vmem\_destroy()** destroys a vmem arena.

*vm* The vmem arena being destroyed. The caller should ensure that no one will use it anymore.

## RETURN VALUES

**vmem\_create()** returns a pointer to the newly allocated `vmem_t`. Otherwise, it returns `NULL`.

On success, **vmem\_xalloc()** and **vmem\_alloc()** return 0. Otherwise, `ENOMEM` is returned.

## CODE REFERENCES

The **vmem** subsystem is implemented within the file `sys/kern/subr_vmem.c`.

## SEE ALSO

`malloc(9)`

Jeff Bonwick and Jonathan Adams, "Magazines and Vmem: Extending the Slab Allocator to Many CPUs and Arbitrary Resources", *2001 USENIX Annual Technical Conference*, 2001.

## HISTORY

The **vmem** allocator was originally implemented in NetBSD. It was introduced in FreeBSD 10.0.

## AUTHORS

Original implementation of **vmem** was written by YAMAMOTO Takashi. The FreeBSD port was made by Jeff Roberson.

## BUGS

**vmem** relies on `malloc(9)`, so it cannot be used as early during system bootstrap.