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Chapter 1. Locking Interface

1.1. Why use it ?

The main reason in creating it was to have a single transparent interface to various locking methods. For example right now SIP Express Router uses the following locking methods, depending on their availability on the target system.

- *FAST_LOCK*

Fast inline assembly locks, defined in `fast_lock.h`. They are currently available for x86, sparc64, strongarm (amv4l) and ppc (external untested contributed code). In general if the assembly code exists for a given architecture and the compiler knows inline assembly (for example sun cc does not) *FAST_LOCK* is preferred. The main advantage of using *FAST_LOCK* is very low memory overhead and extremely fast lock/unlock operations (like 20 times faster than SYSV semaphores on linux & 40 times on solaris). The only thing that comes close to them are pthread mutexes (which are about 3-4 times slower).

- *PTHREAD_MUTEX*

Uses `pthread_mutex_lock/unlock`. They are quite fast but they work between processes only on some systems (they do not work on linux).

- *POSIX_SEM*

Uses posix semaphores (`sem_wait/sem_post`). They are slower than the previous methods but still way faster than SYSV semaphores. Unfortunately they also do not work on all the systems (e.g. linux).

- *SYSV_SEM*

This is the most portable but also the slowest locking method. Another problem is that the number of semaphores that can be allocated by a process is limited. One also has to free them before exiting.

1.2. How to use it ?

First of all you have to include `locking.h`. Then when compiling the code one or all of *FAST_LOCK*, *USE_PTHREAD_MUTEX*, *USE_PTHREAD_SEM* or *USE_SYSV_SEM* must be defined (the `ser Makefile.defs` takes care of this, you should need to change it only for new architectures or compilers). `locking.h` defines 2 new types: `gen_lock_t` and `lock_set_t`.

1.3. Simple Locks

The simple locks are simple mutexes. The type is `gen_lock_t`.

Warning

Do not make any assumptions on `gen_lock_t` base type, it does not have to be always an int.

1.3.1. Allocation & Initialization

The locks are allocated with: `gen_lock_t* lock_alloc()` and initialized with `gen_lock_t* lock_init(gen_lock_t* lock)`. Both functions return 0 on failure. The locks must be initialized before use. A proper alloc/init sequence looks like:

```
gen_lock_t* lock;

lock=lock_alloc();
if (lock==0) goto error;
if (lock_init(lock)==0){
    lock_dealloc(lock);
    goto error; /* could not init lock*/
}
...
```

Lock allocation can be skipped in some cases: if the lock is already in shared memory you don't need to allocate it again, you can initialize it directly, but keep in mind that the lock *MUST* be in shared memory.

Example:

```
struct s {
    int foo;
    gen_lock_t lock;
} bar;

bar=shm_malloc(sizeof struct s); /* we allocate it in the shared memory */
if (lock_init(&bar->lock)==0){
    /* error initializing the lock */
    ...
}
```

1.3.2. Destroying & Deallocating the Locks

```
void lock_destroy(gen_lock_t* lock);
void lock_dealloc(gen_lock_t* lock);
```

The `lock_destroy` function must be called first. It removes the resources associated with the lock, but it does not also free the lock shared memory part. Think of `sysv rmid`. Please don't forget to call this function, or you can leave allocated resources in some cases (e.g `sysv` semaphores). Be carefull to call it in your module destroy function if you use any global module locks.

Example:

```
lock_destroy(lock);
lock_dealloc(lock);
```

Of course you don't need to call `lock_dealloc` if your lock was not allocated with `lock_alloc`.

1.3.3. Locking & Unlocking

```
void lock_get(gen_lock_t* lock);
void lock_release(gen_lock_t* lock);
```

1.4. Lock Sets

The lock sets are kind of `sysv` semaphore sets equivalent. The type is `lock_set_t`. Use them when you need a lot of mutexes. In some cases they waste less system resources than arrays of `gen_lock_t` (e.g. `sys v` semaphores).

1.4.1. Allocating & Initializing

```
lock_set_t* lock_set_alloc(int no);
lock_set_t* lock_set_init(lock_set_t* set);
```

Both functions return 0 on failure.

Warning

Expect the allocation function to fail for large numbers. It depends on the locking method used & the system available resources (again the `sysv` semaphores example).

Example:

```
lock_set_t *lock_set;

lock_set=lock_set_alloc(100);
if (lock_set==0) goto error;
if (lock_set_init(lock_set)==0){
```

```
    lock_set_dealloc(lock_set);  
    goto error;  
}
```

1.4.2. Destroying & Deallocating

```
void lock_set_destroy(lock_set_t* s);  
void lock_set_dealloc(lock_set_t* s);
```

Again don't forget to "destroy" the locks.

1.4.3. Locking & Unlocking

```
void lock_set_get( lock_set_t* s int i );  
void lock_set_release( lock_set_t* s int i );
```

Example:

```
lock_set_get(lock_set, 2);  
/* do something */  
lock_set_release(lock_set, 2);
```