TWL-SDK

About Threads

Version 0.1.5

The content of this document is highly confidential and should be handled accordingly.

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Revision History

Version	Revision Date	Description
0.1.5	2008/10/16	Changed wording for inclusion in the TWL SDK
	2005/09/27	Added `alarmForSleep` to `OSThread` structure descriptions.

1 Where Thread Information Is Stored

Thread information (`OSThreadInfo`) is allocated in the main memory. The region storing the address region that stores the thread information is located in the System Work Area, which is part of the main memory. It can be accessed by both ARM9 and ARM7. The System Work Area start address is:

```
HW_MAIN_MEM_SYSTEM = HW_MAIN_MEM + 0xFFFC00 = 0x2FFFC00
```

To get this address from within user programs, use `OS_GetSystemWork()`.

For ARM9, the pointer is stored at:

```
HW_THREADINFO_MAIN = HW_MAIN_MEM + 0x00FFFFA0 = 0x2FFFFA0
```

To get the store address of this pointer, call `OS_GetSystemWork()->threadinfo_mainp`.

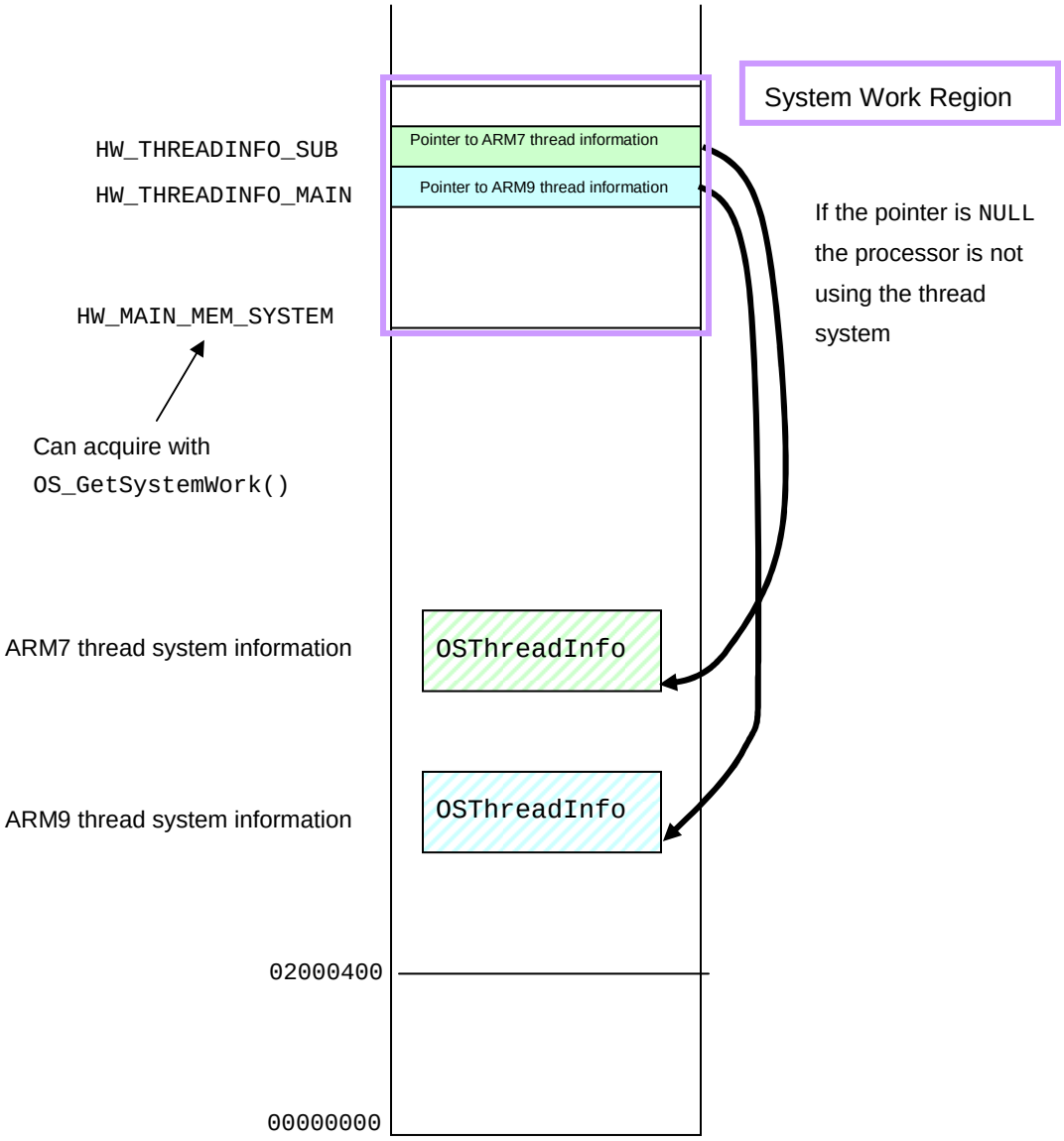
For ARM7, the pointer is stored at:

```
HW_THREADINFO_SUB = HW_MAIN_MEM + 0x00FFFFA4 = 0x2FFFFA4.
```

You can acquire the store address of this pointer as `OS_GetSystemWork()->threadinfo_subp`.

If the pointer is `NULL`, the processor is not using the thread system.

Figure 1-1 Thread Information



2 OSThreadInfo Thread System Information

```
// ---------------- Thread & context packed structure
typedef struct  OSThreadInfo
{
   u16               isNeedRescheduling;
   u16               irqDepth;
   OSThread*         current;
   OSThread*         list;
   void*             switchCallback;
} OSThreadInfo;
```

The following is a description of each member of the `OSThreadInfo` structure.

- `isNeedRescheduling` is a flag for remembering whether it is necessary to reschedule when a thread switch request is generated at the time of an IRQ interrupt., and the IRQ interrupt is terminated. This flag has two values: TRUE and FALSE. Since this value is used by the OS, do not touch it.
- `irqDepth` stores the IRQ interrupt level. Since this variable is accessed by multiple interrupts and is used internally by the OS, making manual changes is strongly discouraged.
- `current` is a pointer to the thread information of the current thread.
- `list` is a pointer to the thread list. Threads are connected in order from the one having the highest priority, using the next member in `OSThread`. At the end, `next = NULL`. If no threads are registered, the list will be `NULL`.
- `switchCallback` stores the callback value during thread switching; NULL if no callback has been set.

3 The OSThread Thread Structure

```
// ----------------- Thread structure
typedef struct _OSThread OSThread;
struct _OSThread
{
   OSContext         context;
   OSThreadState     state;
   OSThread*         next;
   u32               id;
   u32               priority;
   void*             profiler;
   OSThreadQueue*    queue;
   OSThreadLink      link
  OSMutex*             mutex;
  OSMutexQueue     mutexQueue;

   u32               stackTop;      // for stack overflow
   u32               stackBottom;   // for stack underflow
   u32               stackWarningOffset;
   OSThreadQueue     joinQueue;
   void*             specific[OS_THREAD_SPECIFIC_MAX];
   OSAlarm*              alarmForSleep;
   OSThreadDestructor  destructor;
   void*             userParameter;
   int               systemError;
};
```

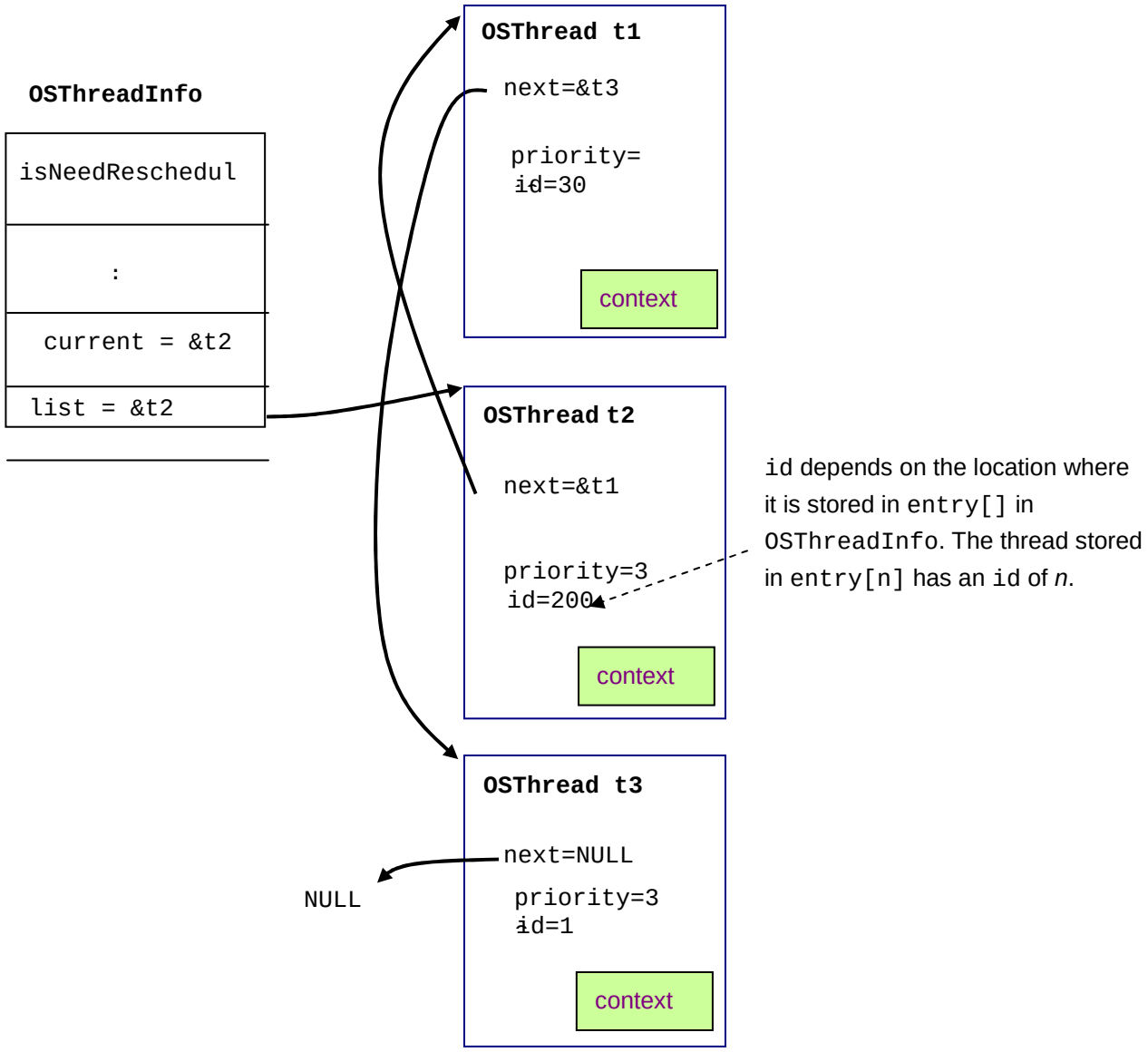
The following is a description of each member of the `OSThread` structure.

- `context` is the location at which context is stored during the time that threads are being switched.
- `state` indicates thread status:
  - `OS_THREAD_STATE_WAITING (=0)` indicates that a thread is stopped.
  - `OS_THREAD_STATE_READY (=1)` indicates that the thread is ready to run.
    For a thread that has ended, `state` is `OS_THREAD_STATE_TERMINATED`.
- `next` is a pointer to the next thread when constructing a thread list. It will be NULL at the end.
- `id` indicates thread id. Its values are `0` – `0x7fffffff`. The value is increased each time a thread is created.

- `priority` indicates the priority level of a thread. Values are `0`–`31`. `0` indicates the thread that has the highest priority. The thread list is ordered by this thread priority. The idle thread created by `OS_InitThread()` is assigned a priority value of `32`. The priority of the idle thread cannot be altered.
- **profile** is a pointer used by the profile function routines (e.g. function call tracing and function cost measurement) to store thread information. When the profile function is not used, it does nothing.
- **queue** and **link** are areas for the thread queue. queue stores a pointer to the thread queue specified when a thread is sleeping; link is link information for linking sleeping threads to the same thread queue.
- `mutex` and `mutexQueue` are parameters used for the automatic execution of the `mutex` de-allocation when the thread ends. Since the OS uses these values internally, please do not touch them.
- `stackTop, stackBottom, stackWarningOffset` are parameters used in the stack leak check. Since the OS uses these values internally, please do not touch them. They may be referenced.
- `JoinQueue`, a queue that is used to resume threads that have been sleeping when the current thread stops.
- `specific` is used internally by the system.
- `alarmForSleep` is a pointer to the alarm used when a thread sleeps.
- `destructor` is a thread destructor. It specifies the function called when the thread ends.
- `userParameter` is the user parameter. The user can use this area freely. It is neither changed nor referenced by the system.
- `systemError` is the system error value. It is used internally by the system.

Threads `t1`, `t2`, and `t3` are present in the following example, `t2` being the current thread.

Figure 3-1 Thread Information Example



For ARM9, the thread that is idle (priority of 32) should be the last in the list. (Although t3 is used here, the `OSThread` structure is `OSi_IdleThread` in `os_thread.c`.) ARM7 does not have idle threads.

Figure 3-2 Thread Example

In the following example, threads `t1`, `t2`, and `t4` are linked to thread queue `tq`.