Freescale MQX RTOS Example Guide

Demo_lite example

This document explains the Demo_lite example, what to expect from the example and a brief introduction to the API used.

The example

The example demonstrates the usage of common components of the MQX RTOS for synchronizing tasks including the semaphore, mutex, message, event and the Round Robin scheduling component.

The example defines 11 different tasks and context switch between tasks is examined in order for the user to understand how MQX task scheduler functions. With regards to the priority tasks are assigned into three groups with priority levels 9, 10 and 11 respectively. Also semaphore, mutex, message and event are used to block or run different tasks at specific moment in time.
For demonstration purpose of scheduling components only one task outputs simple dot character '.' to the terminal output. The user needs to use the task aware debugging (TAD) component of the IDE to examine the state of different tasks in time and the dependence of tasks on the scheduling components.

Running the example

The user only needs to do compilation of MQX libraries, ksdk library and the example without any further step.

Then we compile the project demo_lite.

In <MQX_folder>\rtos\mqx\config\mcu\<board>\mqx_sdk_config.h please set

```
#define MQX_USE_SEMAPHORES  1

#define MQX_USE_LOGS   1

#define MQX_USE_LWLOGS 1

#define MQX_KERNEL_LOGGING  1

#define MQX_HAS_TIME_SLICE  1

#define MQX_USE_NAME 1

#define MQX_USE_MESSAGES 1

#define MQX_USE_MUTEXES 1

#define MQX_USE_EVENTS 1

#define MQXCFG_STATIC_KLOG 0

#define MQXCFG_STATIC_LWLOG 0
```

```
#define MQXCFG_ALLOCATOR MQX_ALLOCATOR_LWMEM
```

If the platform supports floating point, you have to disable floating point:

```
#define MQXCFG_ENABLE_FP              0
```

To run the example the corresponding IDE, compiler, debugger and a terminal program are needed.

Explaining the example

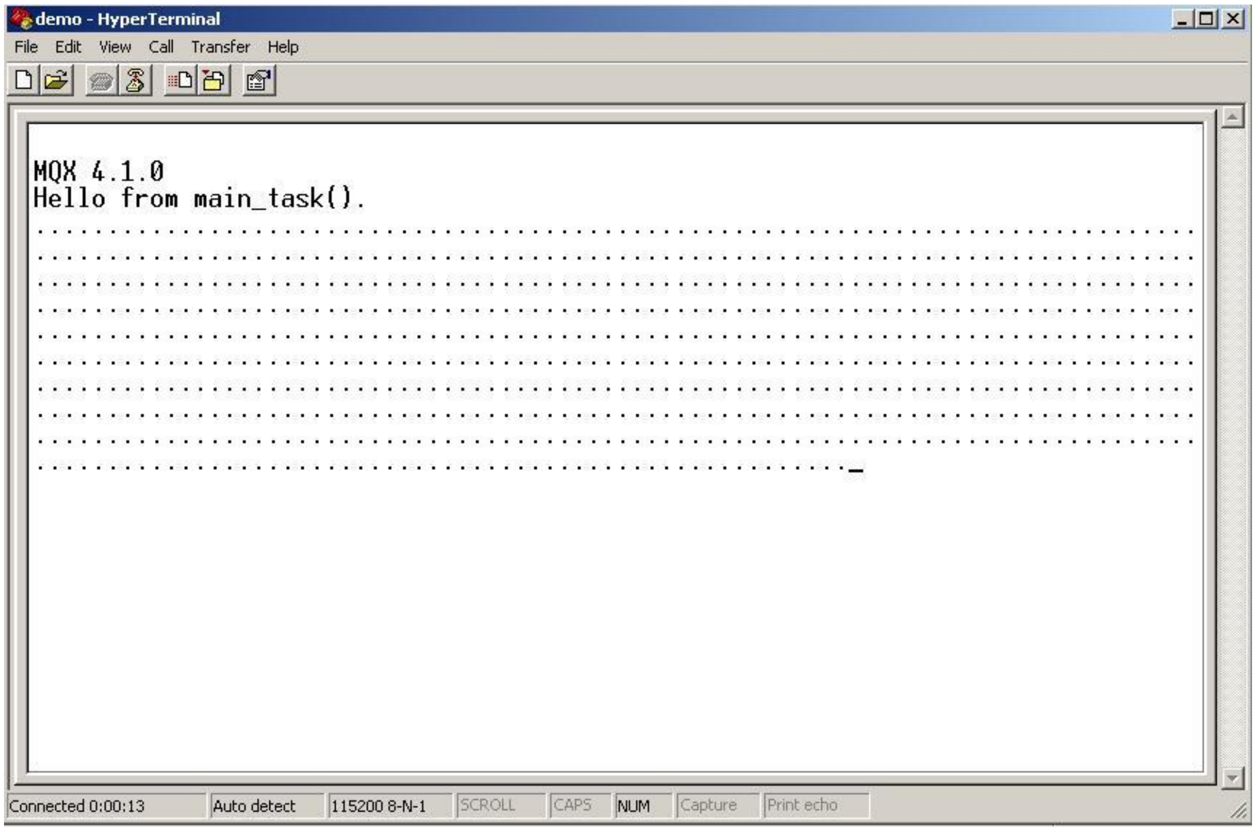
The application example creates 11 tasks with the flow control and explanation as shown in page 3 and 4.

The MQX allocates tasks into three queues with corresponding priority levels 9, 10, 11. In each queue the ready tasks wait to be scheduled in the first in first out (FIFO) manner.

- Task MutexA and task MutexB have the same priority level – level 9 - and wait for the mutex. Hence the task is ready next is the task that has the mutex and has been waiting the longest in the task ready queue.
- Task SemA and task SemB have priority levels of 9 and 10 respectively and they wait for the semaphore. Therefore task SemA is scheduled to run before task SemB in case the semaphore is available.
- Task EventA and task EventB have similar priority level – level 9. Task EventA sets the event bit which allows task EventB to run.
- Task Sender has priority level 10 whereas task Responder's priority level is 9. The two tasks exchange messages and the task Responder has the priority to run over task Sender in case both of them have message in their message queues.
- Task ATimeSliceTask and task BTimeSliceTask have the same priority level – level 9. Task ATimeSliceTask is scheduled to run only one time slot of 50 ms because the Round Robin component is applied to it.
- Task main_task is blocked after it sends the message to task Sender as there is no other task exchanging message with it.

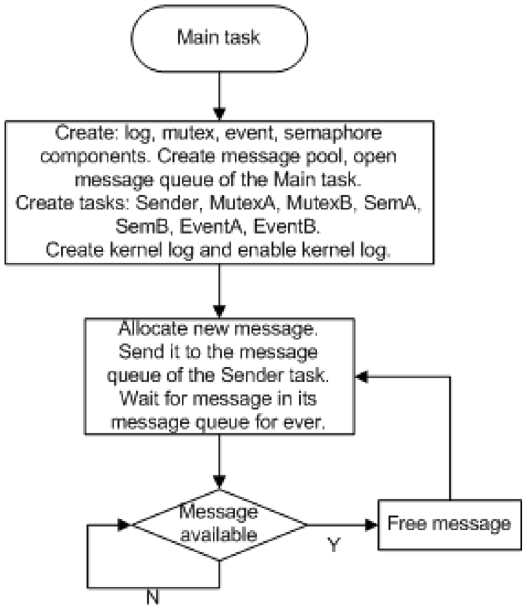
To see how MQX manages the task scheduling user should look up the items under the MQX in the menu bar of the IDE.

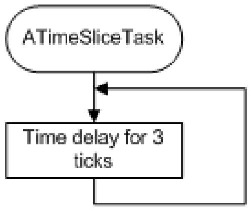
The following output is expected on terminal.

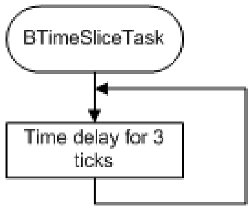


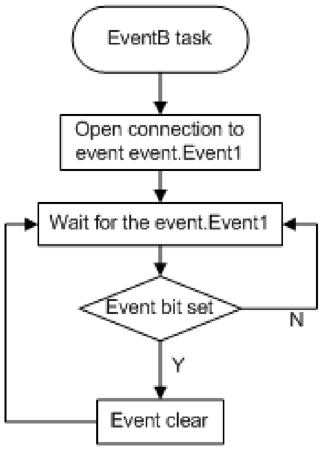
```
MQX 4.1.0
Hello from main_task().
................................................................................
................................................................................
................................................................................
................................................................................
................................................................................
................................................................................
................................................................................
................................................................................
................................................................................
........................................................_
```

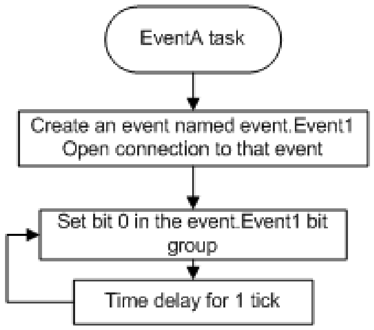
Connected 0:00:13 | Auto detect | 115200 8-N-1 | SCROLL | CAPS | NUM | Capture | Print echo

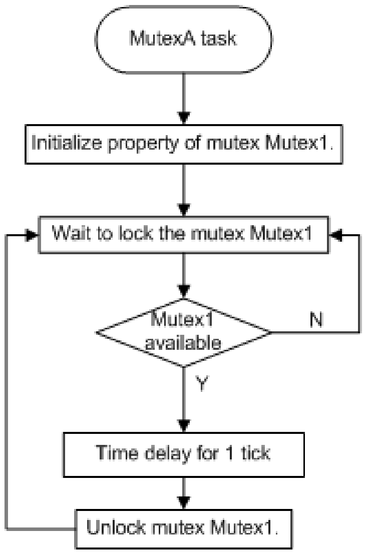

Main task
Create: log, mutex, event, semaphore components. Create message pool, open message queue of the Main task.
Create tasks: Sender, MutexA, MutexB, SemA, SemB, EventA, EventB.
Create kernel log and enable kernel log.
Allocate new message. Send it to the message queue of the Sender task. Wait for message in its message queue for ever.
Message available
Y
Free message
N

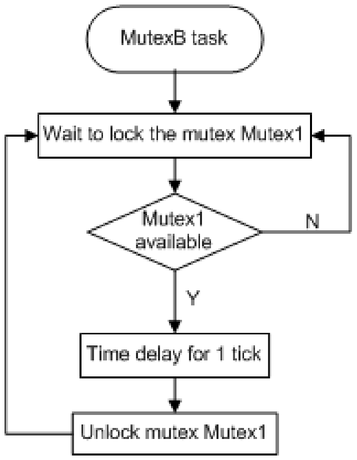

ATimeSliceTask
Time delay for 3 ticks

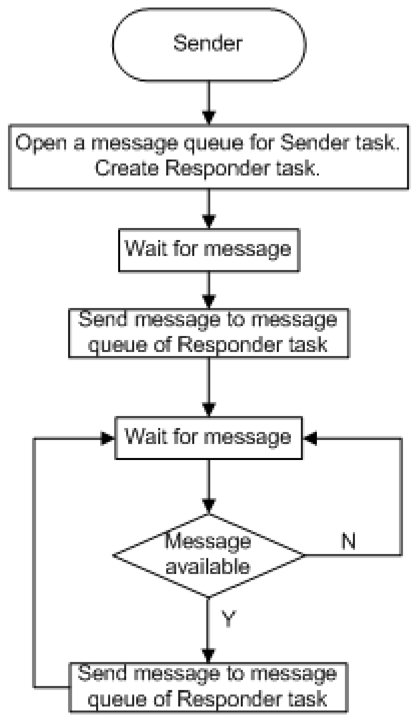

BTimeSliceTask
Time delay for 3 ticks

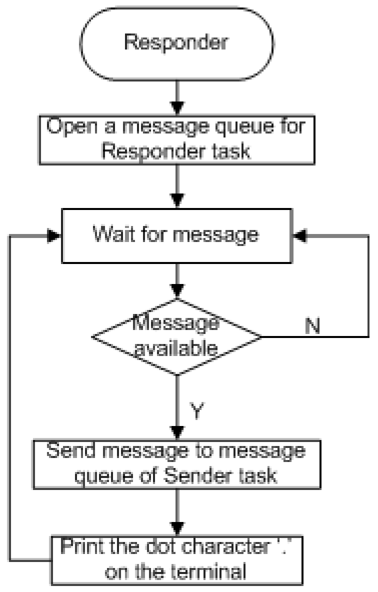

EventB task
Open connection to event event.Event1
Wait for the event.Event1
Event bit set
N
Y
Event clear

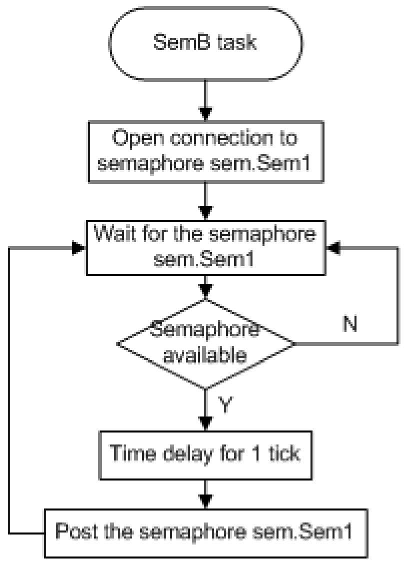

EventA task
Create an event named event.Event1
Open connection to that event
Set bit 0 in the event.Event1 bit group
Time delay for 1 tick

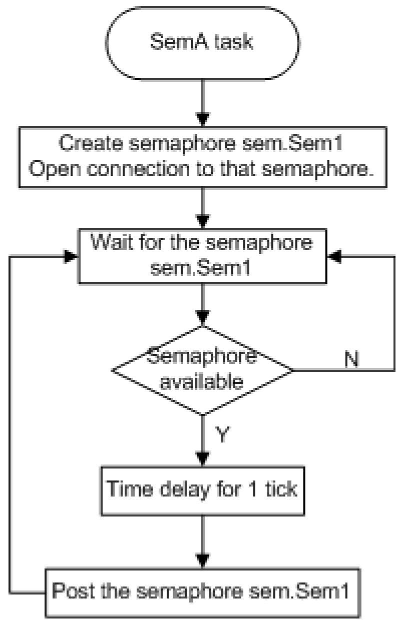

MutexA task
Initialize property of mutex Mutex1.
Wait to lock the mutex Mutex1
Mutex1 available
N
Y
Time delay for 1 tick
Unlock mutex Mutex1.


MutexB task
Wait to lock the mutex Mutex1
Mutex1 available
N
Y
Time delay for 1 tick
Unlock mutex Mutex1


Sender
Open a message queue for Sender task. Create Responder task.
Wait for message
Send message to message queue of Responder task
Wait for message
Message available
N
Y
Send message to message queue of Responder task


Responder
Open a message queue for Responder task
Wait for message
Message available
N
Y
Send message to message queue of Sender task
Print the dot character '.' on the terminal


SemB task
Open connection to semaphore sem.Sem1
Wait for the semaphore sem.Sem1
Semaphore available
N
Y
Time delay for 1 tick
Post the semaphore sem.Sem1


SemA task
Create semaphore sem.Sem1 Open connection to that semaphore.
Wait for the semaphore sem.Sem1
Semaphore available
N
Y
Time delay for 1 tick
Post the semaphore sem.Sem1