

Lab 2:

The purpose of this lab is to just implement the introduction code to blink an LED using RTOS.

Lab 4:

TI-RTOS Products SYSBIOS BIOS - Basic Runtime Options

Welcome System Overview Runtime Error Handling Device Support Advanced

Library Selection Options

SYS/BIOS library type

- ☒ Instrumented (Asserts and Logs enabled)
- ☐ Non-instrumented (Asserts and Logs disabled)
- ☐ Custom (Fully configurable)
- ☐ Debug (Fully configurable)

The library options above allow you to select between several variations of SYS/BIOS libraries depending on your application's requirements. All options except Debug are aggressively optimized with minimal debug content.

☒ Enable Asserts

☒ Enable Logs

Custom Compiler Options: `seed=2 --program_level_compile -o3 -g --optimize_with_debug`

Threading Options

- ☒ Enable Tasks (When disabled, the Task module is not configurable)
- ☒ Enable Software Interrupts (When disabled, the Swi module is not configurable)
- ☒ Enable Clock Manager (When disabled, the Clock module is not configurable)

C Standard Library Lock: `GateMutex`

Dynamic Instance Creation Support

☒ Enable Dynamic Instance Creation

A savings in code and data size can be achieved by disabling dynamic instance creation.

Runtime Memory Options

System (Hwi and Swi) stack size: `1024`

Heap size: `0`

Heap section: `null`

☐ Use HeapTrack

The heap configured above is used for the standard C malloc() and free() functions or when the 'heap' argument to Memory_alloc() is NULL.

Platform Settings

These settings should reflect the hardware platform that runs your application.

CPU clock frequency (Hz): `80000000`

Problems *Live Session *Execution Graph *CPU Load: Graph

Type	Time	Error	Master	Message	Event	EventClass	Da
1.. i	3789719637		CORT...	[./rtos_lab4.c:107] LED TO...	Log_L_info	Info	
1.. i	4042366412		CORT...	[./rtos_lab4.c:107] LED TO...	Log_L_info	Info	
1.. i	4295012862		CORT...	[./rtos_lab4.c:107] LED TO...	Log_L_info	Info	
1.. i	4547659637		CORT...	[./rtos_lab4.c:107] LED TO...	Log_L_info	Info	
1.. i	4800311600		CORT...	[./rtos_lab4.c:107] LED TO...	Log_L_info	Info	
2.. i	5052952887		CORT...	[./rtos_lab4.c:107] LED TO...	Log_L_info	Info	
2.. i	5305604837		CORT...	[./rtos_lab4.c:107] LED TO...	Log_L_info	Info	
2.. i	5558251625		CORT...	[./rtos_lab4.c:107] LED TO...	Log_L_info	Info	
2.. i	5810898087		CORT...	[./rtos_lab4.c:107] LED TO...	Log_L_info	Info	
2.. i	6063544862		CORT...	[./rtos_lab4.c:107] LED TO...	Log_L_info	Info	
2.. i	6316196800		CORT...	[./rtos_lab4.c:107] LED TO...	Log_L_info	Info	
2.. i	6568838087		CORT...	[./rtos_lab4.c:107] LED TO...	Log_L_info	Info	
2.. i	6821490050		CORT...	[./rtos_lab4.c:107] LED TO...	Log_L_info	Info	

Lab 5:

Outline Resource Explorer CCS App Center Getting Started main.c empty.cfg

TI-RTOS Products SYSBIOS Scheduling Hwi - Instance Settings

Module Instance Advanced

Portable Hwis

HWI_TIMER2 Add ... Remove

Required Settings

Handle HWI_TIMER2

ISR function ledToggle

Interrupt number 39

Additional Settings

Argument passed to ISR function 0

Interrupt priority -1

Event Id -1

☒ Enable at startup

Masking options MaskingOption_SELF

TI-RTOS Properties cfg Script

TI-RTOS Products SYSBIOS BIOS - Basic Runtime Options

Library Selection Options

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☒ Enable Logs

Custom Compiler Options =2 --program_level_compile -o3 -g --optimize_with_debug

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☒ Enable Software Interrupts (When disabled, the Swi module is not configurable)

☒ Enable Clock Manager (When disabled, the Clock module is not configurable)

C Standard Library Lock GateMutex

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System (Hwi and Swi) stack size 1024

Heap size 0

Heap section null

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These settings should reflect the hardware platform that runs your application.

CPU clock frequency (Hz) 80000000

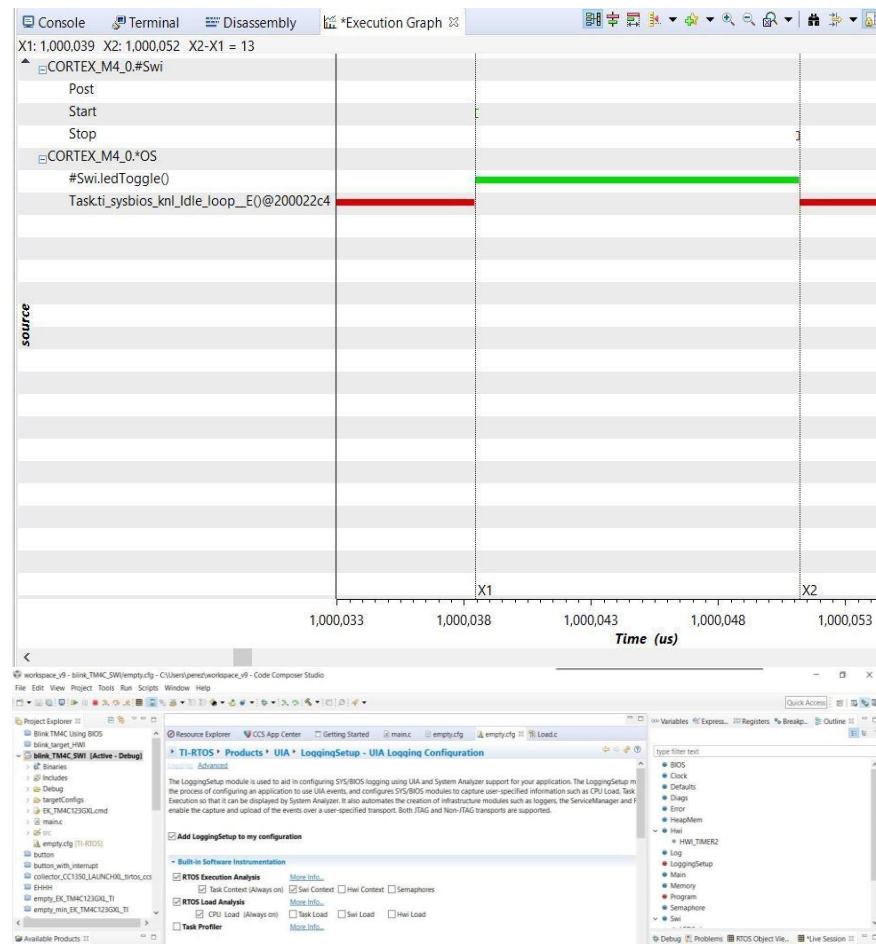
The image displays two screenshots of the Code Composer Studio (CCS) interface, specifically the TI-RTOS configuration and execution graph.

Top Screenshot: RTOS Configuration

The top screenshot shows the "Instance Settings" window for the "empty_cty" project. The "Required Settings" tab is active, showing the "LEDToggle" module. The "Thread Context" section is expanded, showing the "Argument 0" and "Argument 1" fields. The "Thread Context" section is also expanded, showing the "Argument 0" and "Argument 1" fields.

Bottom Screenshot: Execution Graph

The bottom screenshot shows the "Execution Graph" window. The graph displays the execution of the "CORTEX_M4_0.Swi" task. The graph shows the task's execution flow, including the "Post", "Start", and "Stop" events. The task is shown as a red bar, indicating its execution time. The graph also shows the "CORTEX_M4_0.OS" task, which is shown as a green bar, indicating its execution time. The task is shown as a red bar, indicating its execution time.



The screenshot displays the TI-RTOS IDE interface during a live session. The top pane shows a log of messages from the Master to the slave (Cortex_M4_0). The bottom pane shows the 'Instance Settings' for the 'ledToggleCik' module.

Log Messages:

Source	Message	Event
tr	Master	
CORTEX_M4_0	LS_cpuLoad: 0%	Load
CORTEX_M4_0	LS_cpuLoad: 0%	Load
CORTEX_M4_0	LS_cpuLoad: 0%	Load
CORTEX_M4_0	[./main.c:146] LED TOGGLED [3] TIMES	Log_L_info
CORTEX_M4_0	LS_cpuLoad: 0%	Load
CORTEX_M4_0	[./main.c:146] LED TOGGLED [4] TIMES	Log_L_info
CORTEX_M4_0	LS_cpuLoad: 0%	Load
CORTEX_M4_0	[./main.c:137] LED BENCHMARK = [11] TM4C...	Log_L_info
CORTEX_M4_0	[./main.c:146] LED TOGGLED [5] TIMES	Log_L_info
CORTEX_M4_0	LS_cpuLoad: 0%	Load
CORTEX_M4_0	[./main.c:146] LED TOGGLED [6] TIMES	Log_L_info
CORTEX_M4_0	LS_cpuLoad: 0%	Load
CORTEX_M4_0	[./main.c:137] LED BENCHMARK = [11] TM4C...	Log_L_info
CORTEX_M4_0	[./main.c:146] LED TOGGLED [7] TIMES	Log_L_info
CORTEX_M4_0	LS_cpuLoad: 0%	Load
CORTEX_M4_0	[./main.c:146] LED TOGGLED [8] TIMES	Log_L_info
CORTEX_M4_0	LS_cpuLoad: 0%	Load
CORTEX_M4_0	[./main.c:137] LED BENCHMARK = [11] TM4C...	Log_L_info
CORTEX_M4_0	[./main.c:146] LED TOGGLED [9] TIMES	Log_L_info
CORTEX_M4_0	LS_cpuLoad: 0%	Load

Instance Settings for ledToggleCik:

- Portable Clocks:** ledToggleCik (Add, Remove buttons)
- Required Settings:**
 - Handle: ledToggleCik
 - Function: ledToggle
 - Initial timeout: 1
 - Period: 1
 - ☒ Start at boot time when instance is created
- Thread Context:**
 - Argument: null

TI-RTOS › Products › SYSBIOS › Scheduling › Clock - Module Settings

☒ Add the Clock support module to my configuration

Time Base

☒ Internally configure a Timer to periodically call Clock_tick()
☐ Application code calls Clock_tick()
☐ The Clock module is disabled

Scheduling

Swi priority: 15
The priority above sets the priority for all Clock functions independent of their period. Higher numbers have higher priority.

When the Clock Manager is enabled, the Time Base setting will follow the user's configuration.
When the Clock Manager is disabled, the Time Base setting will be internally forced to "The Clock module is disabled".
See the SYS/BIOS 'Enable Clock Manager' setting under 'Threading Options'.

Timer Control

Tick period (us): 500000
Timer Id: ANY
Tick mode: Unnecessary timer ticks will be suppressed

TI-RTOS Properties | **cfg Script**

X1: 11,000 X2: 11,501 X2-X1 = 500

source

CORTEX_M4_0_#Swi

Post

Start

Stop

CORTEX_M4_0_#OS

X1 X2

Resource Explorer CCS App Center Getting Started main.c empty.cfg empty.cfg Hwi.c

TI-RTOS Products SYSBIOS Scheduling Task - Module Settings

The Task module allows you to create one or more prioritized threads, each with a separate stack, that can block on one or more events.

☒ Add the Task threads module to my configuration

Global Task Options

Number of priorities: 16

All blocked function: null

☒ Initialize stack

☒ Check for task stack overflow

☐ Delete terminated tasks

Default Task Options

Default stack size: 2048

Default stack section: .bssTaskStackSection

Default stack heap: null

Idle Task Options

☒ Enable Idle Task

☒ Idle Task is vital

Idle Task stack size: 2048

Idle Task stack section: .bssTaskStackSection

Resource Explorer CCS App Center Getting Started main.c empty.cfg empty.cfg Hwi.c

TI-RTOS Products SYSBIOS Synchronization Semaphore - Instance Settings

Module Instance Advanced

Semaphores

LEDsem Add ... Remove

Required Settings

Handle: LEDsem

Initial count: 0

Semaphore type: ☒ Counting (FIFO) ☐ Binary (FIFO) ☐ Counting (priority-based) ☐ Binary (priority-based)

Event Support

These options are only available when [Event](#) support is enabled by the [Semaphore module](#).

Event instance: null Event Id: Event_Id_00

The screenshot displays a real-time operating system (RTOS) debugger interface. The top section shows a console log with various system events and task messages. Below this, the RTOS Object View (ROV) is visible, showing a list of objects and their properties. The bottom section displays the details of a specific task, including its address, label, priority, mode, and function.

Console Log:

Time	Message	Event	EventClass	Data1	Data2	SeqNo	Logger	Module	Domain	Process	PID	Local Time	Arg1	Arg2	Av
4,0	LM_post: sem: 0x20002d38, count: 0	Semaphore_LM_post	Unknown			96	SYSBL...	ti.sysb...	ti.sysbi...			291112325	0x2...	0x0	
4,0	LD_ready: tsk: 0x200027b0, func: 0x2c39, pri...	Task_LD_ready	Unknown	ledT...		97	SYSBL...	ti.sysb...	ti.sysbi...			291112640	0x2...	0x2...	C
4,0	LM_switch: oldtsk: 0x20002800, oldfunc: 0x5...	CtxChg	TSK	ledT...		98	SYSBL...	ti.uia...	ti.sysbi...			291113319	0x2...	0x5...	0x
4,0	[./main.c:134] LED TOGGLED [16] TIMES	Log_L_info	Info			15	Main...	xdcru...	xdcru...			291113750	0x2...	0x86	0x
4,0	LM_pend: sem: 0x20002d38, count: 0, timeo...	Semaphore_LM_pend	Unknown			99	SYSBL...	ti.sysb...	ti.sysbi...			291114003	0x2...	0x0	0x
4,0	LD_block: tsk: 0x200027b0, func: 0x2c39	Task_LD_block	Unknown	ledT...		100	SYSBL...	ti.sysb...	ti.sysbi...			291114349	0x2...	0x2...	
4,0	LM_switch: oldtsk: 0x200027b0, oldfunc: 0x...	CtxChg	TSK	ti.sy...		101	SYSBL...	ti.uia...	ti.sysbi...			291114894	0x2...	0x2...	0x
4,0	LS_taskLoad: 0x200027b0, 1575, 20000389, 0x...	Load	TSK	ledT...	0.01	42	Load...	ti.sysb...	ti.sysbi...			300009751	0x2...	0x6...	0x
4,0	LS_taskLoad: 0x20002800, 19998814, 200003...	Load	TSK	ti.sy...	99.99	43	Load...	ti.sysb...	ti.sysbi...			300009994	0x2...	0x1...	0x
4,0	LS_cpuLoad: 0%	Load	CPU	CPU	0.00	44	Load...	ti.sysb...	ti.sysbi...			300010293	0x0		
4,0	LM_post: sem: 0x20002d38, count: 0	Semaphore_LM_post	Unknown			102	SYSBL...	ti.sysb...	ti.sysbi...			311112326	0x2...	0x0	
4,0	LD_ready: tsk: 0x200027b0, func: 0x2c39, pri...	Task_LD_ready	Unknown	ledT...		103	SYSBL...	ti.sysb...	ti.sysbi...			311112641	0x2...	0x2...	C
4,0	LM_switch: oldtsk: 0x20002800, oldfunc: 0x5...	CtxChg	TSK	ledT...		104	SYSBL...	ti.uia...	ti.sysbi...			311113320	0x2...	0x5...	0x
4,0	[./main.c:134] LED TOGGLED [17] TIMES	Log_L_info	Info			16	Main...	xdcru...	xdcru...			311113719	0x2...	0x86	0x
4,0	LM_pend: sem: 0x20002d38, count: 0, timeo...	Semaphore_LM_pend	Unknown			105	SYSBL...	ti.sysb...	ti.sysbi...			311113972	0x2...	0x0	0x
4,0	LD_block: tsk: 0x200027b0, func: 0x2c39	Task_LD_block	Unknown	ledT...		106	SYSBL...	ti.sysb...	ti.sysbi...			311114318	0x2...	0x2...	
4,0	LM_switch: oldtsk: 0x200027b0, oldfunc: 0x...	CtxChg	TSK	ti.sy...		107	SYSBL...	ti.uia...	ti.sysbi...			311114863	0x2...	0x2...	0x
4,0	LS_taskLoad: 0x200027b0, 1543, 20000611, 0x...	Load	TSK	ledT...	0.01	45	Load...	ti.sysb...	ti.sysbi...			320010362	0x2...	0x6...	0x
4,0	LS_taskLoad: 0x20002800, 19999068, 200006...	Load	TSK	ti.sy...	99.99	46	Load...	ti.sysb...	ti.sysbi...			320010605	0x2...	0x1...	0x
4,0	LS_cpuLoad: 0%	Load	CPU	CPU	0.00	47	Load...	ti.sysb...	ti.sysbi...			320010904	0x0		
4,0	LM_post: sem: 0x20002d38, count: 0	Semaphore_LM_post	Unknown			108	SYSBL...	ti.sysb...	ti.sysbi...			331112327	0x2...	0x0	
4,0	LD_ready: tsk: 0x200027b0, func: 0x2c39, pri...	Task_LD_ready	Unknown	ledT...		109	SYSBL...	ti.sysb...	ti.sysbi...			331112642	0x2...	0x2...	C
4,0	LM_switch: oldtsk: 0x20002800, oldfunc: 0x5...	CtxChg	TSK	ledT...		110	SYSBL...	ti.uia...	ti.sysbi...			331113321	0x2...	0x5...	0x
4,0	[./main.c:134] LED TOGGLED [18] TIMES	Log_L_info	Info			17	Main...	xdcru...	xdcru...			331113720	0x2...	0x86	0x
4,0	LM_pend: sem: 0x20002d38, count: 0, timeo...	Semaphore_LM_pend	Unknown			111	SYSBL...	ti.sysb...	ti.sysbi...			331113973	0x2...	0x0	0x
4,0	LD_block: tsk: 0x200027b0, func: 0x2c39	Task_LD_block	Unknown	ledT...		112	SYSBL...	ti.sysb...	ti.sysbi...			331114319	0x2...	0x2...	
4,0	LM_switch: oldtsk: 0x200027b0, oldfunc: 0x...	CtxChg	TSK	ti.sy...		113	SYSBL...	ti.uia...	ti.sysbi...			331114864	0x2...	0x2...	0x

RTOS Object View (ROV):

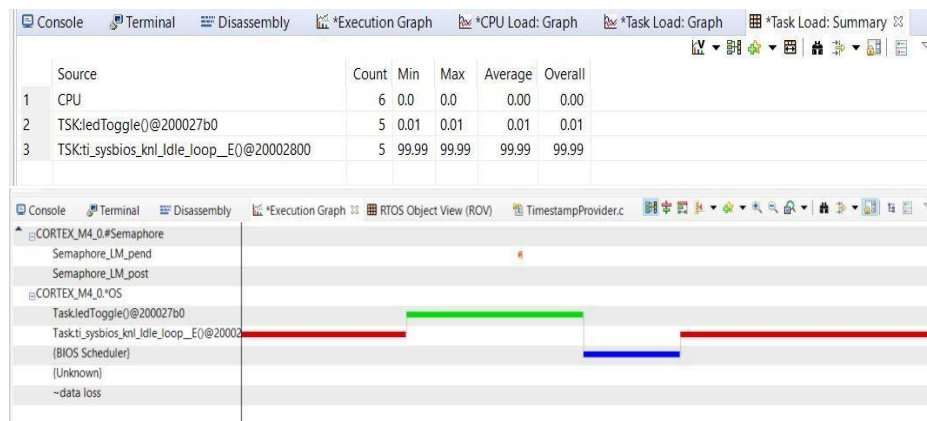
Basic Raw

address	label	event	eventId	mode	count	pendTasks
0x20002d38	LEDsem	none	n/a		count: 0	Label: ledToggleTask, priority: 1, pendState: Waiting forever

Task Details:

Basic Detailed CallStacks ReadyQs Module Raw

address	label	priority	mode	fn	arg0	arg1	stackSize	stackBase	curCoreId	affinity
0x200027b0	ledToggleTask	1	Blocked	ledToggle	0x0	0x0	2048	0x20000...	n/a	n/a
0x20002800	ti.sysbios.knl.TaskIdleTask	0	Running	ti.sysbios_knl_idle_loop_E	0x0	0x0	2048	0x20000...	n/a	n/a



Lab 9:

Part A & B

TI-RTOS ▸ Products ▸ SYSBIOS ▸ Scheduling ▸ Hwi - Instance Settings

Module Instance Advanced

▼ Portable Hwis

Timer_2A_INT Add ... Remove

▼ Required Settings

Handle Timer_2A_INT

ISR function Timer_ISR

Interrupt number 39

▼ Additional Settings

Argument passed to ISR function 0

Interrupt priority -1

Event Id -1

☒ Enable at startup

Masking options MaskingOption_SELF ▼

TI-RTOS ▸ Products ▸ SYSBIOS ▸ Synchronization ▸ Mailbox - Instance Settings

Module Instance Advanced

▼ Mailboxes

LED_Mbx Add ... Remove

▼ Required Settings

Handle LED_Mbx

Size of messages (chars) 4

Max number of messages 2

▼ Event Synchronization

The events below can be used to synchronize with threads that need to wait for messages to arrive in the mailbox (reader event) or for space to become available in the mailbox for a new message to be posted (writer event). These options are only available when [Event](#) support is enabled by the [Semaphore module](#).

Reader event null ▼ Event id Event_Id_00 ▼

Writer event null ▼ Event id Event_Id_00 ▼

▼ Message Memory Management

Heap null

Buffer section null

Buffer pointer null

Buffer size (chars) 0

TI-RTOS ▸ Products ▸ SYSBIOS ▸ Synchronization ▸ Queue - Instance Settings

Module Instance

Queues

LED_Queue

Add ...
Remove

Required Settings

Handle LED_Queue

TI-RTOS ▸ Products ▸ SYSBIOS ▸ Synchronization ▸ Semaphore - Instance Settings

Module Instance Advanced

Semaphores

mailbox_queue_Sem
QueSem

Add ...
Remove

Required Settings

Handle mailbox_queue_Sem

Initial count 0

Semaphore type

☒ Counting (FIFO)
☐ Binary (FIFO)
☐ Counting (priority-based)
☐ Binary (priority-based)

Event Support

These options are only available when [Event](#) support is enabled by the [Semaphore module](#).

Event instance null Event Id Event_Id_00

TI-RTOSProductsSYSBIOSynchronizationSemaphore - Instance Settings

ModuleInstanceAdvanced

Semaphores

mailbox_queue_Sem
QueSem

Add ...
Remove

Required Settings

HandleQueSem

Initial count0

Semaphore type

Counting (FIFO)

Binary (FIFO)

Counting (priority-based)

Binary (priority-based)

Event Support

These options are only available when [Event](#) support is enabled by the [Semaphore module](#).

Event instance nullEvent Id Event_Id_00

ModuleInstanceAdvanced

Tasks

ledToggleTask
mailbox_queue_Task

Add ...
Remove

Required Settings

HandleledToggleTask

FunctionledToggle

Priority1

Use the vital flag to prevent system exit until this thread exits

☒ Task is vital

Stack Control

Stack size2048

Stack memory section.bss:taskStackSection

Stack pointernull

Stack heapnull

Thread Context

Argument 00

Argument 10

Environment pointernull

TI-RTOScfa Script

TI-RTOS ▸ Products ▸ SYSBIOS ▸ Scheduling ▸ Task - Instance Settings

Module Instance Advanced

Tasks

ledToggleTask mailbox_queue_Task

Add ... Remove

Required Settings

Handle mailbox_queue_Task

Function mailbox_queue

Priority 2

Use the vital flag to prevent system exit until this thread exits

☒ Task is vital

Stack Control

Stack size 2048

Stack memory section .bss:taskStackSection

Stack pointer null

Stack heap null

Thread Context

Argument 0 0

Argument 1 0

Environment pointer null

TI-RTOS cfq Script

Lab 10:

[illegible]