

# **Star Shine**

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**None**

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## 1. 星星世界

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## 2. Mode Manger

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### 2.1 EcuM

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#### 2.1.1 EcuM

##### 概述

1. 初始化和取消初始化操作系统、SchM和BswM以及一些基本软件驱动程序模块
2. ECU配置休眠和关机
3. 管理ECU上的所有唤醒事件
4. EcuM提供唤醒验证协议，以区分“真实”唤醒事件和“不稳定”唤醒事件
5. 分步骤启动
6. 多核ECU: 在ECU的所有核心上协调启动、关机、休眠和唤醒

##### 特殊名称

术语	描述
被动唤醒	由连接的总线引起的唤醒，而不是计时器或传感器活动等内部事件
关机目标	ECU必须在进入休眠状态、断电或重置之前关闭。因此，SLEEP、OFF和RESET是有效的停机目标。通过选择关闭目标，应用程序可以将其对下一次关闭后ECU行为的期望传达给ECU管理器模块。
唤醒事件	引起唤醒的物理事件。CAN消息或切换IO线可以是唤醒事件。类似地，内部SW表示（例如中断）也可以称为唤醒事件
唤醒原因	唤醒原因是唤醒事件，它是上次唤醒的实际原因。
唤醒源	处理唤醒事件的外围设备或ECU部件称为唤醒源。

##### 限制

关断目标OFF只能使用ECU特殊硬件（例如电源保持电路）来实现。如果此硬件不可用，则此规范建议改为发出重置。但是，允许其他默认行为。

##### 依赖其他模块

###### MCU

初始化MCU

###### 具有唤醒功能的外网设备

唤醒源必须由驱动程序处理和封装。

驱动程序必须调用EcuM\_SetWakeupEvent以通知EcuM模块检测到挂起的唤醒事件。驱动程序不仅必须在ECU在睡眠阶段等待唤醒事件时调用EcuM\_SetWakeupEvent,还必须在驱动程序初始化阶段以及正常运行期间EcuM\_MainFunction运行时调用。

驱动程序必须提供显示函数才能将唤醒源置于睡眠状态。此功能应将唤醒源置于节能惰性运行模式，并重新启动唤醒通知机制。

如果唤醒源能够生成虚假事件1，则

- 驱动程序
- 使用驱动程序的软件堆栈
- 其他的合适BSW模块

必须为唤醒事件提供验证标注或调用ECU管理器模块的验证函数。如果不需要验证，则此要求不适用于相应的唤醒源。

## 操作系统

ECU 管理器模块启动 AUTOSAR 操作系统并关闭它。ECU 管理器模块定义了协议在操作系统启动之前如何处理控制，以及在操作系统关闭后如何处理控制。

## BSW调度器

ECU 管理器模块初始化 BSW 调度程序，ECU 管理器模块还包含EcuM\_MainFunction，该模块计划定期评估唤醒请求并更新闹钟。

## BSWM

BSW 模式管理器只能在模式管理运行后管理 ECU 状态机 – 即在初始化 SchM 之后，直到 SchM 被取消初始化或停止。当 BSW 模式管理器不运行时，ECU 管理器模块将控制 ECU。

- ECU 管理器模块在 ECU 启动后立即获得控制权，并在初始化 SchM 和 BswM 后将控制权移交给 BSW 模式管理器。
- BswM 将 ECU 的控制权传回 ECU 管理器模块，以锁定操作系统并处理唤醒事件。
- BswM 还会在操作系统在关机时停止之前立即将控制权传回 ECU 管理器。
- 验证唤醒源时，ECU Manager 模块通过模式切换请求指示唤醒源状态对 BswM 的更改。

## 软件组件

ECU 管理器模块处理以下 ECU 范围的属性：

- Shutdown targets.

## 2.1.2 Function

### 功能描述

- 启动阶段一直持续到模式管理设施运行为止。基本上，启动阶段包括启动模式管理所需的最少活动： 初始化低级驱动程序，启动操作系统以及初始化BSW调度程序和BSW模式管理器模块。类似地，关断阶段与启动阶段相反，启动阶段是模式管理被取消初始化的。
- UP阶段包含默认模式，以防使用ECU模式处理。这些模式之间的转换是通过 ECU状态管理器模块和BSW模式管理器模块 之间的合作完成的。

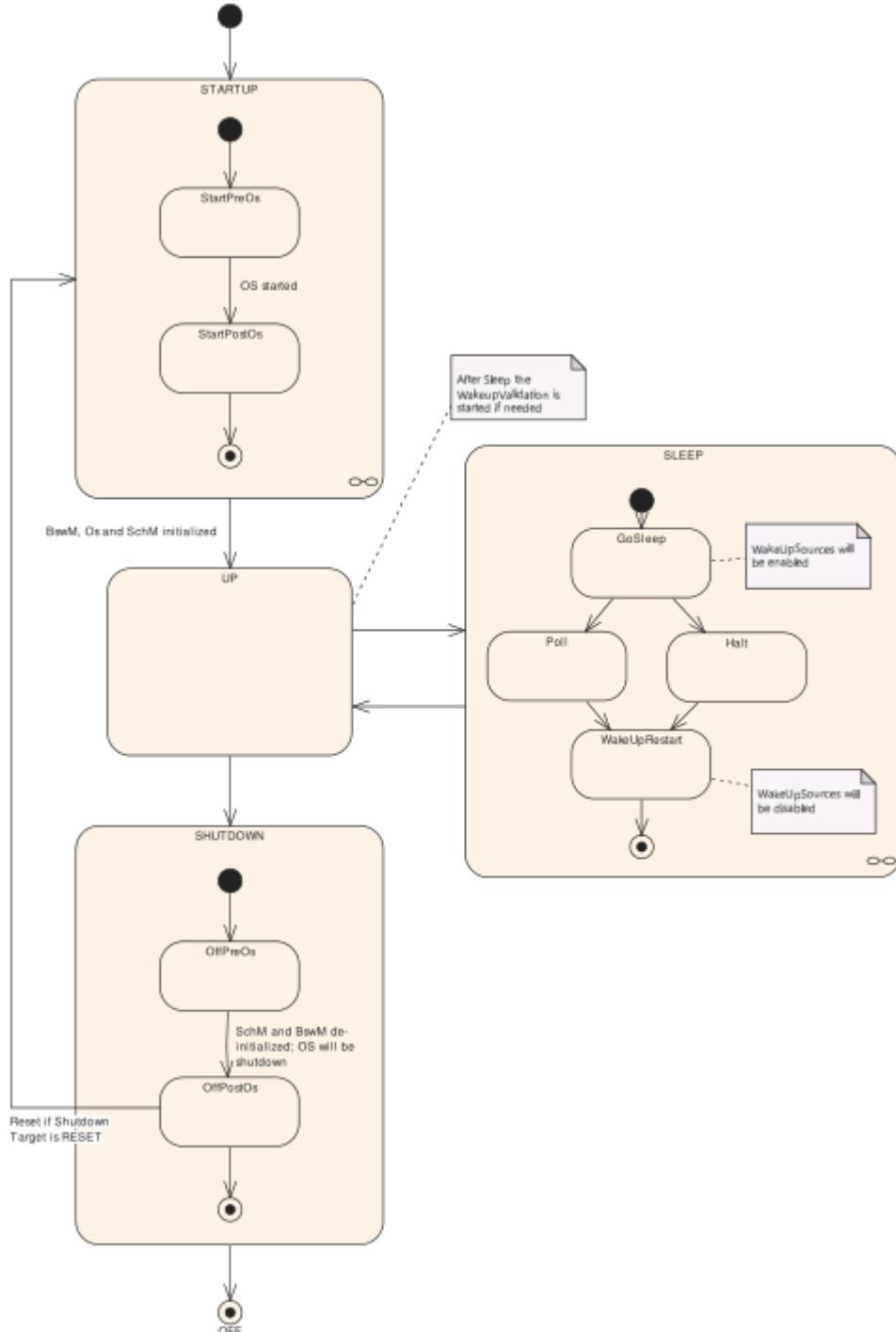


Figure 7.1: Phases of the ECU Manager

不同阶段的功能：

1. 启动阶段：目的是将基本软件模块初始化到通用模式管理设施正常运行的程度。:smile:
2. UP阶段：当 BSW 调度程序启动并调用BswM\_Init时，UP 阶段开始。BSW和SWC运行直到它们准备好关闭或者休眠ECU.
3. SHUTDOWN阶段： The SHUTDOWN phase handles the controlled shutdown of basic software modules and finally results in the selected shutdown target OFF or RESET .
4. SLEEP阶段： 在该阶段节能，一般，不执行代码，但仍提供电源。（EcuM根据预期或意外的唤醒事件唤醒ECU，但是应该忽略意外的唤醒事件，所以 EcuM提供了一个协议（指定了处理唤醒源的驱动程序和ECUM之间的协助过程）来验证唤醒事件）
5. OFF阶段：ECU在断电时进入关闭状态。ECU在这种状态下可以唤醒，但仅适用于具有集成电源控制的唤醒源。

#### STARTUP 阶段

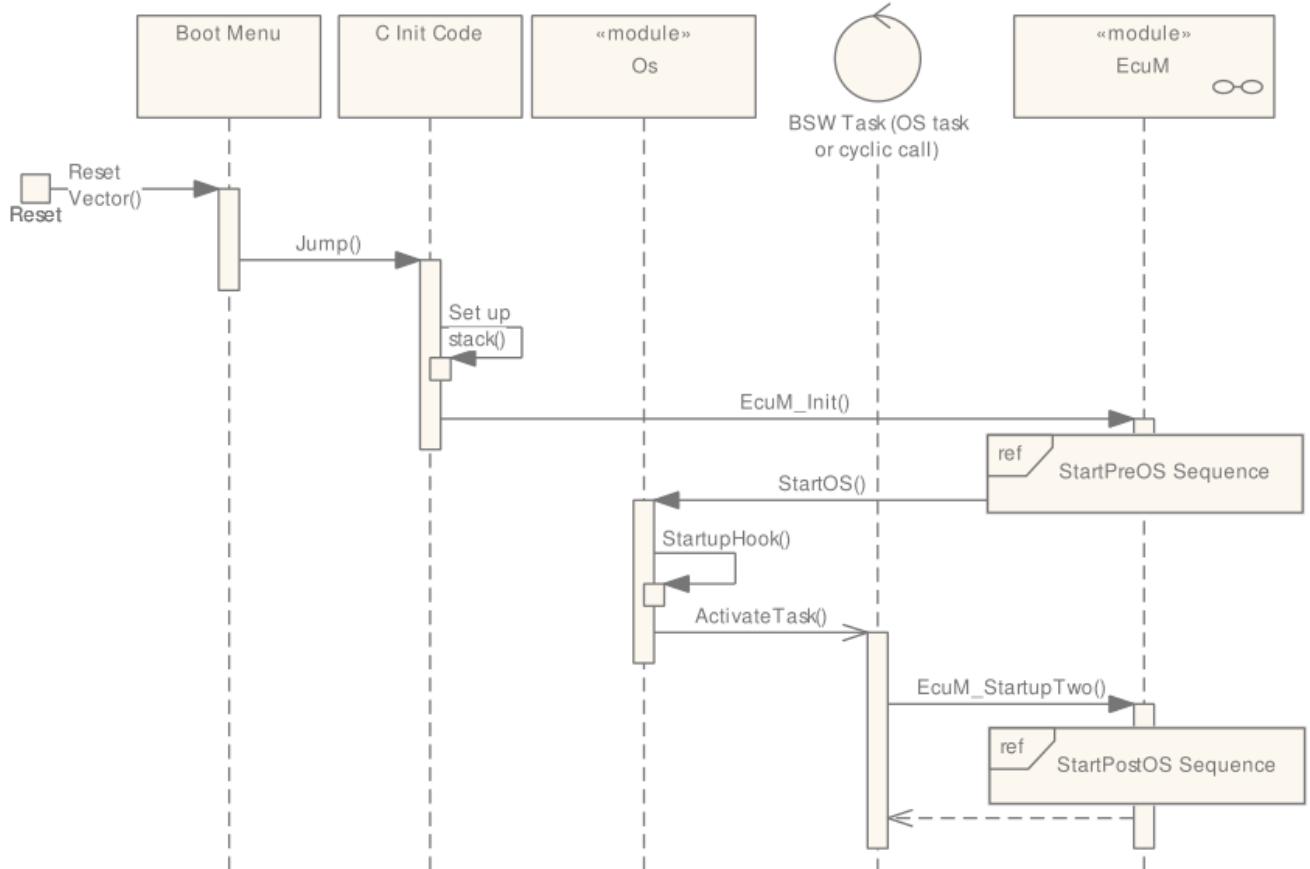
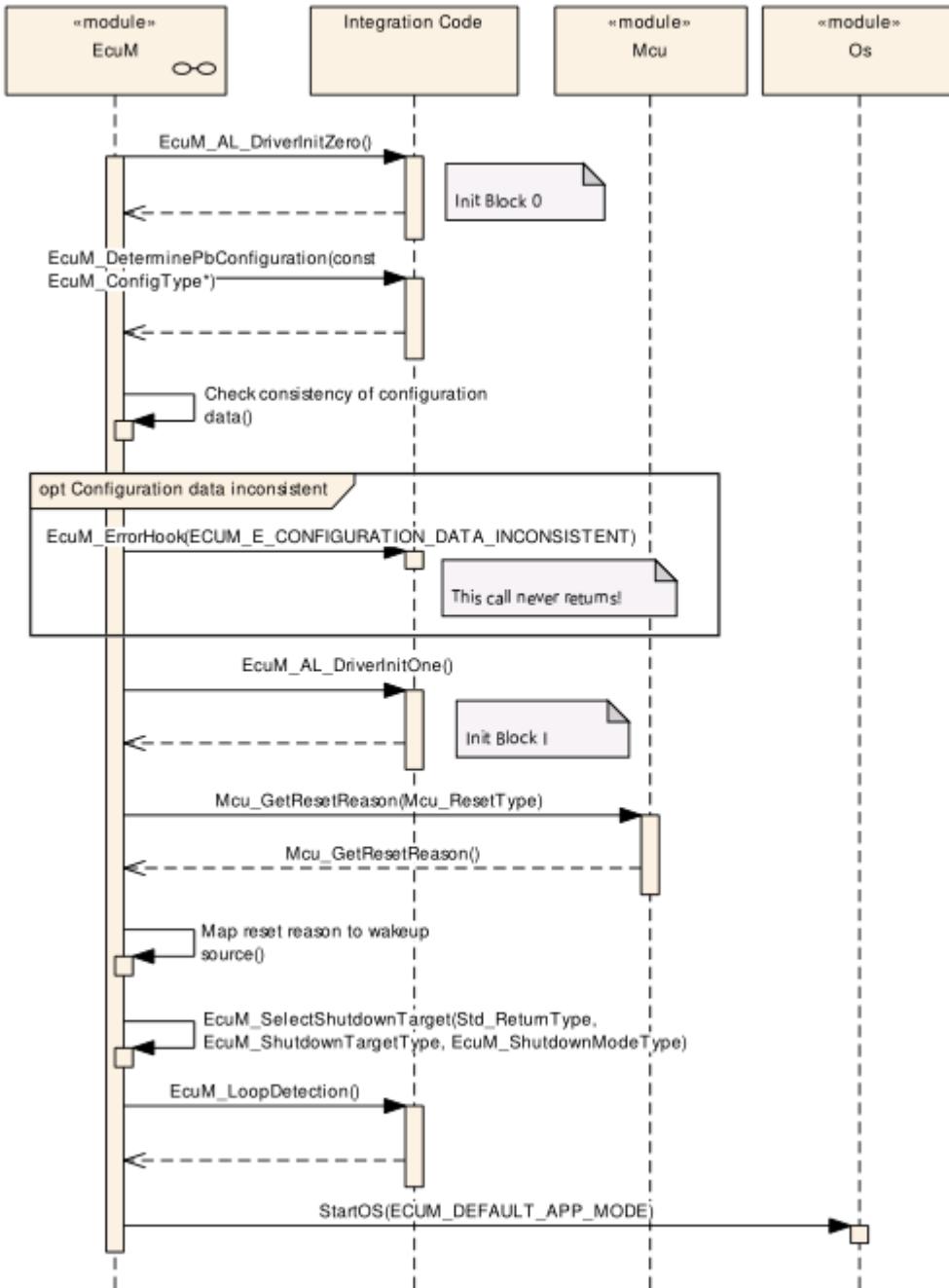


Figure 7.3: STARTUP Phase

## StartPreOS序列中的活动

表StartPreOS Sequence显示StartPreOS序列中的活动及其在EcuM\_Init中执行的顺序：

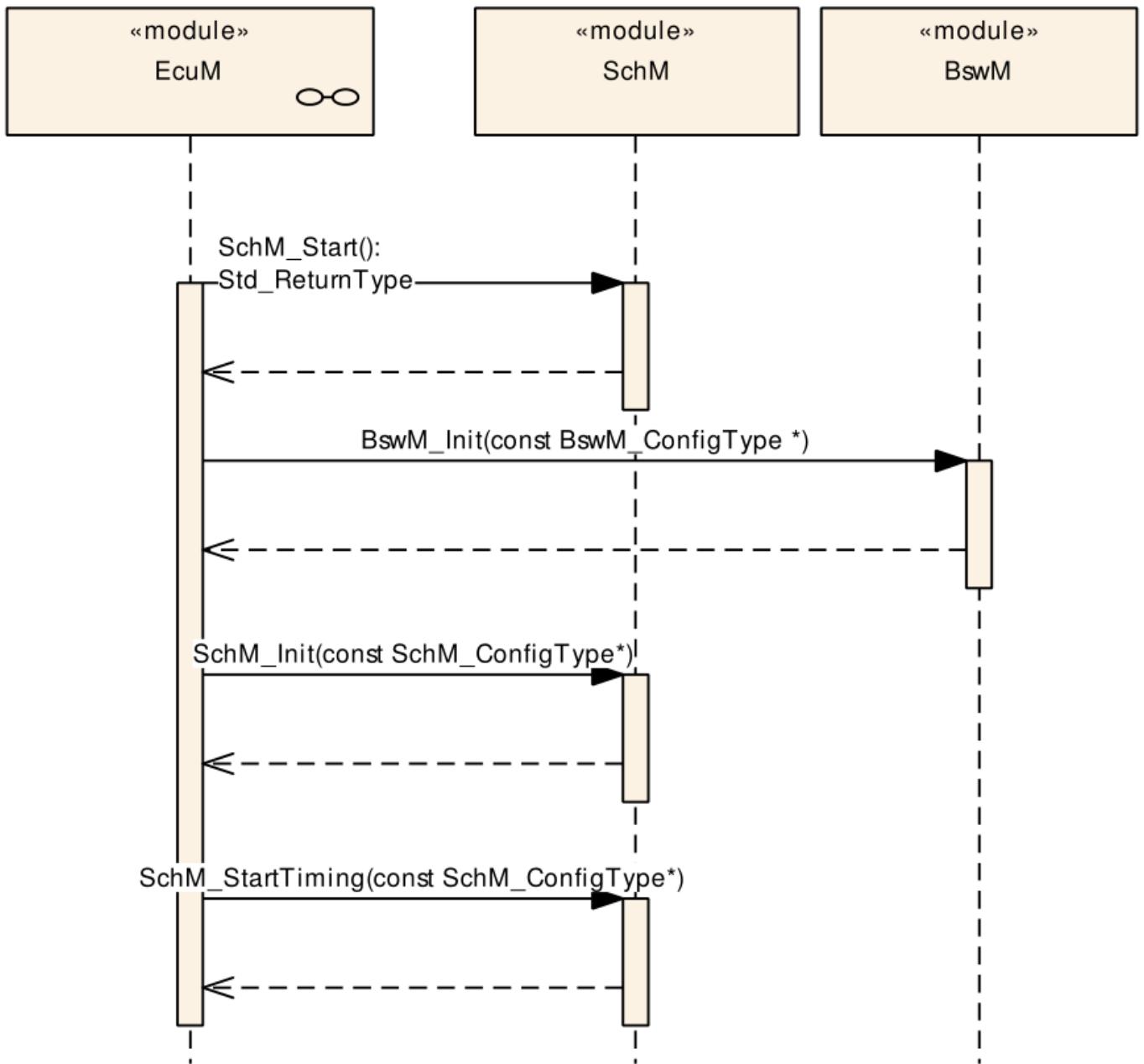
StartPreOS Sequence		
Initialization Activity	Comment	Opt.
Callout EcuM_AL_SetProgrammableInterrupts	在具有可编程中断优先级的ECU上，必须在启动操作系统之前设置这些优先级。	yes
Callout EcuM_AL_DriverInitZero	初始化块0此调用只能初始化不使用生成后配置参数的BSW模块。调用不仅可以包含驱动程序初始化，还可以包含任何类型的preOS、低级初始化代码	yes
Callout EcuM_DeterminePbConfiguration	此调用预期将返回一个指向完全初始化的EcuM_ConfigType结构的指针，该结构包含ECU管理器模块和所有其他BSW模块的构建后配置数据。	no
Check consistency of configuration data	如果检查失败，则调用EcuM_ErrorHook。	no
Call EcuMA DriverInitOne	调用不仅可以包含驱动程序初始化，还可以包含任何类型的预操作系统、低级初始化代码	yes
Get reset reason	重置原因源自对Mcu_GetResetReason的调用以及通过EcuM_WakeupSource配置容器定义的映射	no
Select default shutdown target	ECU Manager 模块应使用配置的默认关机目标（EcuMDefaultShutdownTarget）调用EcuM_GetValidatedWakeupEvents。	no
Call EcuM LoopDetection	如果启用了循环检测，则每次启动时都会调用此调用	yes
Start OS	启动AUTOSAR OS	no

**Figure 7.4: StartPreOS Sequence**

StartPostOS序列中的活动

StartPostOS Sequence		
Initialization Activity	Comment	Opt.
Start BSW Scheduler		no
Init BSW Mode Manager		no
Init BSW Scheduler	Initialize the semaphores for critical sections used by BSW modules	no
Start Scheduler Timing	Start periodical events for BSW/SWCs	no

当通过EcuM\_StartupTwo 功能激活时，ECU管理器模块应执行StartPostOS序列中的操作：



**Figure 7.5: StartPostOS Sequence**

## SHUTDOWN 阶段

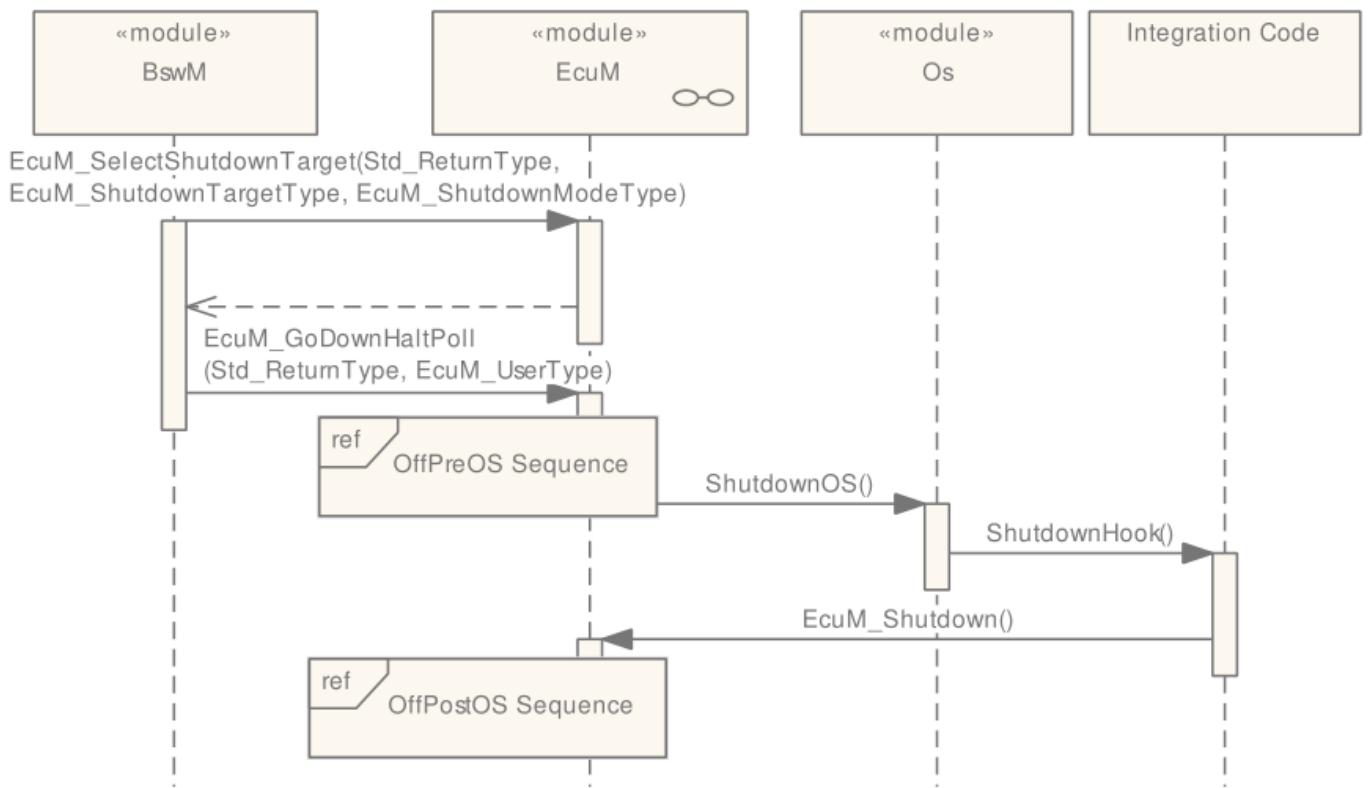
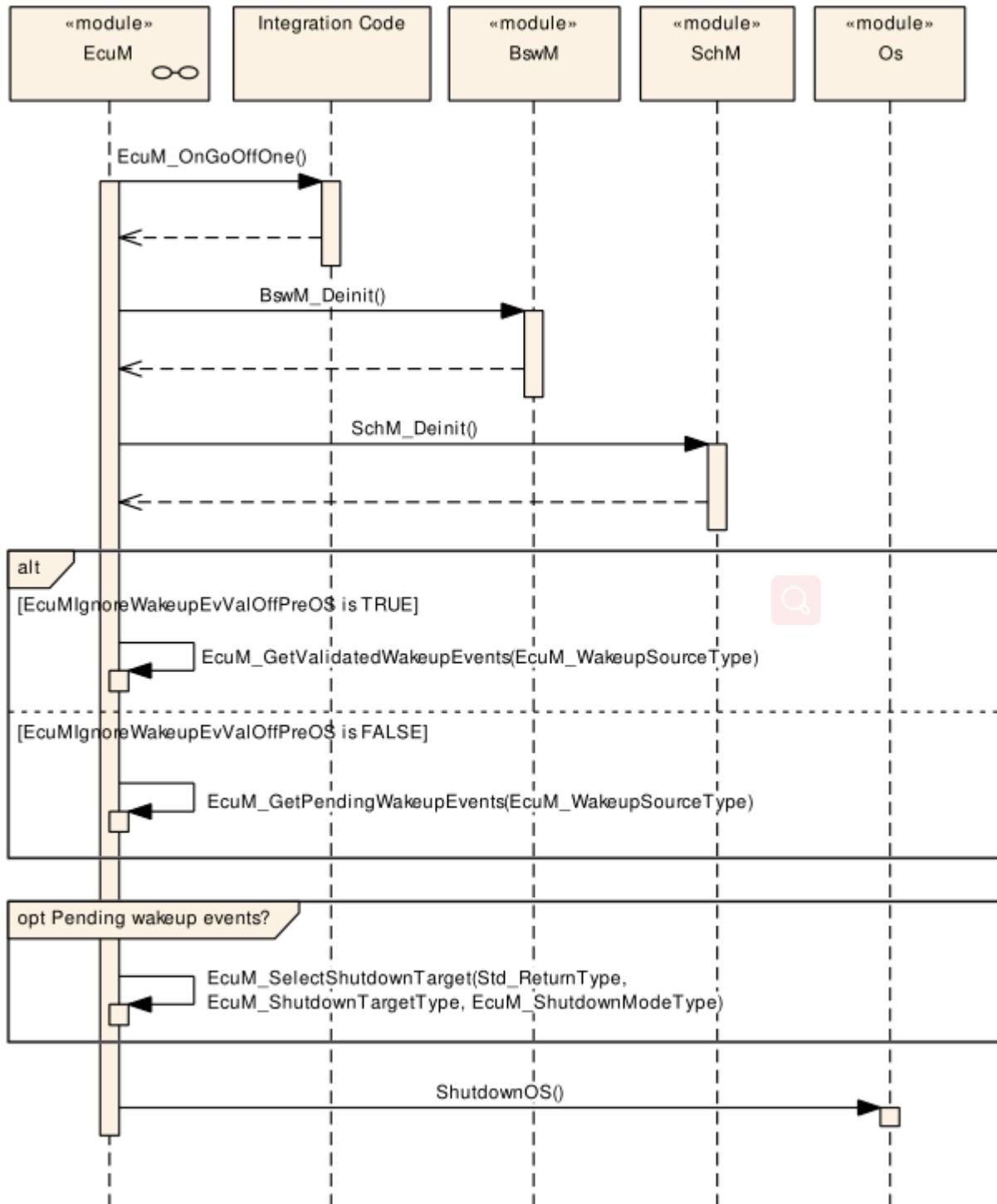


Figure 7.7: SHUTDOWN Phase

## OffPreOS序列中的活动

OffPreOS Sequence			
Shutdown Activity	Comment	Opt.	
De-init BSW Mode Manager		no	
De-init BSW Scheduler		no	
检查唤醒事件。所有挂起的唤醒事件或仅在关机期间验证的唤醒事件都将被考虑在关机期间，具体取决于 EcuMIgnoreWakeupEvValOffPreOS 的配置。	Purpose is to detect wakeup events that occurred during shutdown	no	
如果唤醒事件处于挂起状态，请将 RESET 设置为关机目标（将使用 EcuMDefaultResetModeRef 的默认复位模式）	仅当检测到挂起的唤醒事件以允许立即启动时，才应执行此操作	no	
ShutdownOS	Last operation in this OS task	no	

**Figure 7.8: OffPreOS Sequence**

OffPostOS序列中的活动

OffPostOS Sequence			
Shutdown Activity	Comment	Opt.	
Callout EcuM_OnGoOffTwo			
Callout EcuM_AL_Reset or Callout EcuM_AL_SwitchOff	Depends on the selected shutdown target (RESET or OFF)	no	

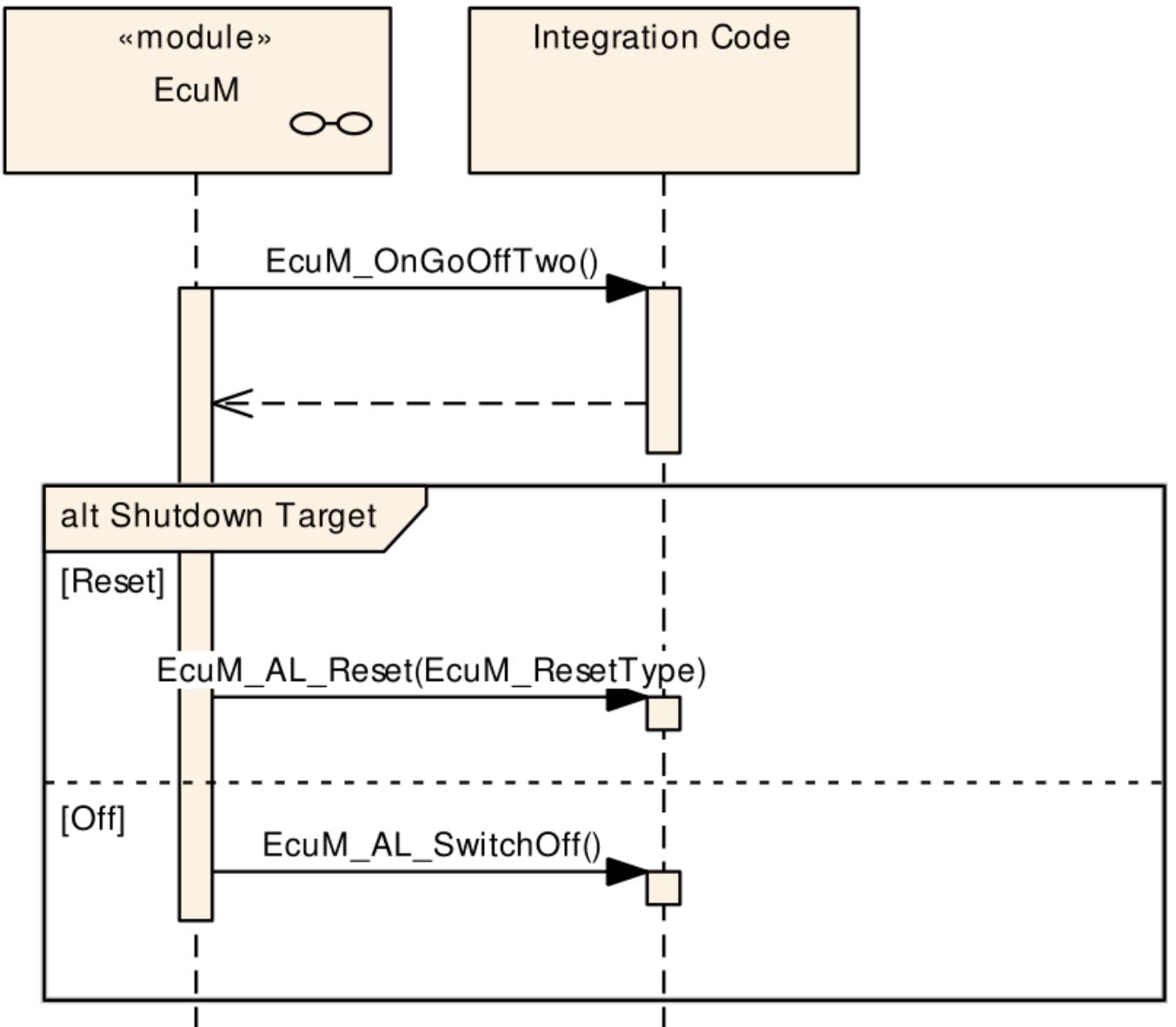


Figure 7.9: OffPostOS Sequence

## SLEEP 阶段

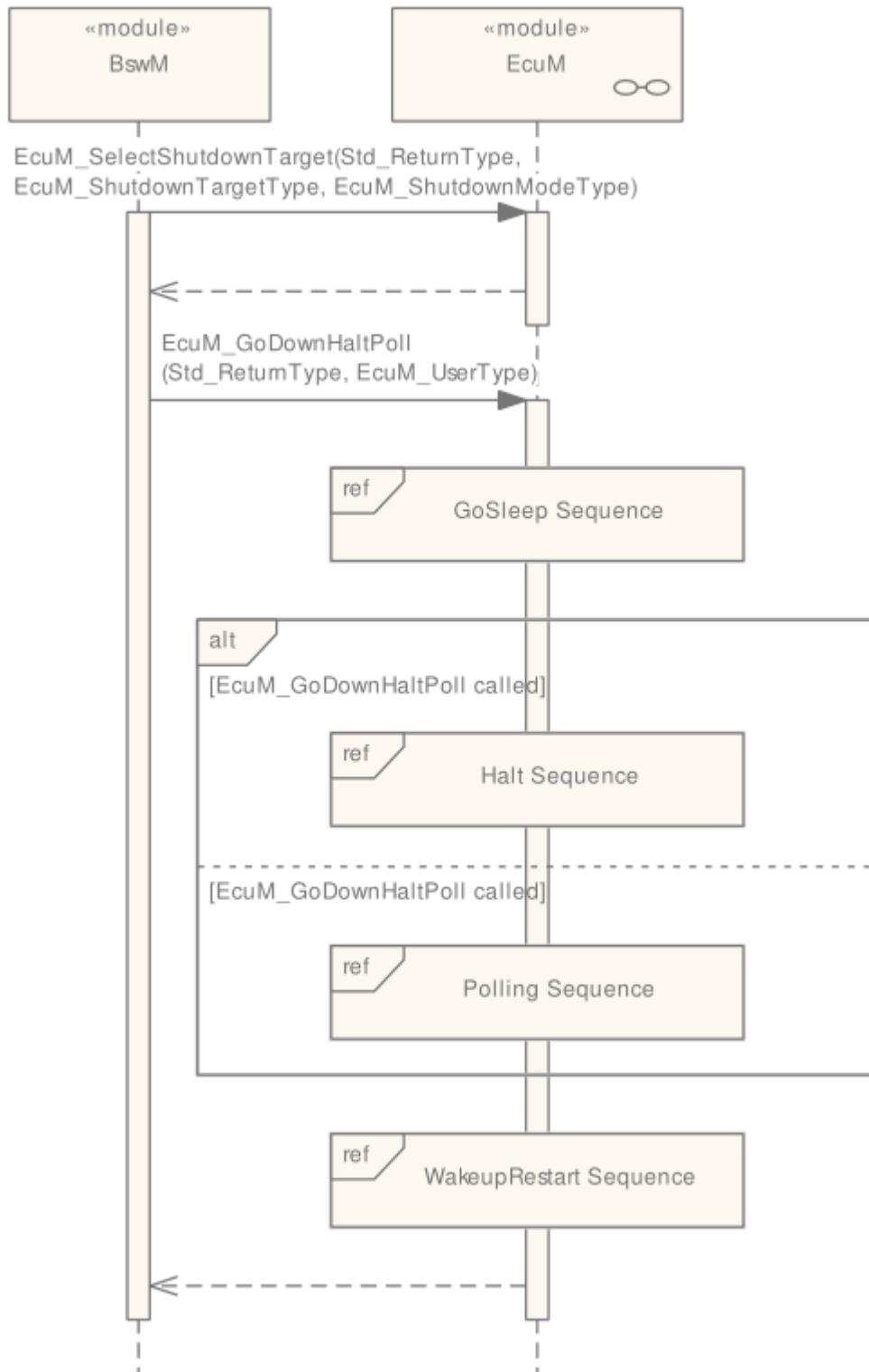


Figure 7.10: SLEEP Phase

GoSleep序列中的活动

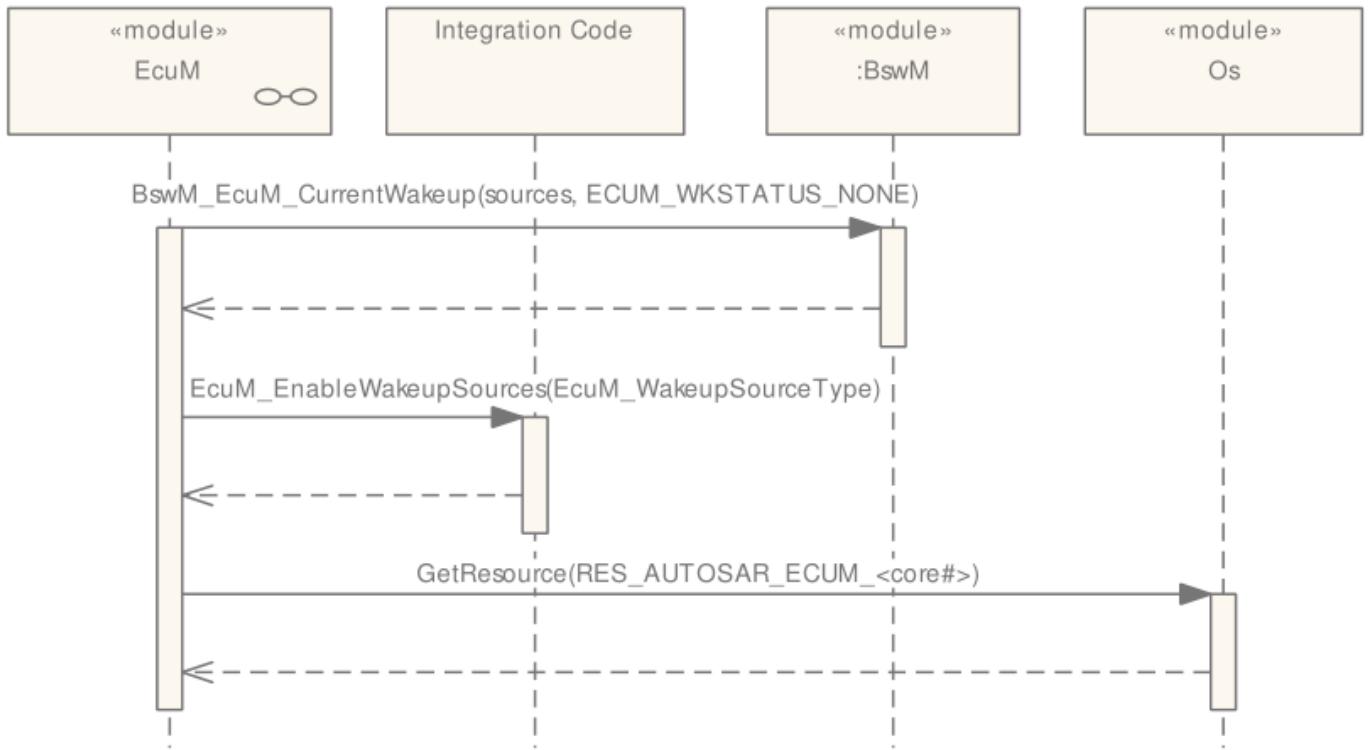


Figure 7.11: GoSleep Sequence

暂停序列中的活动

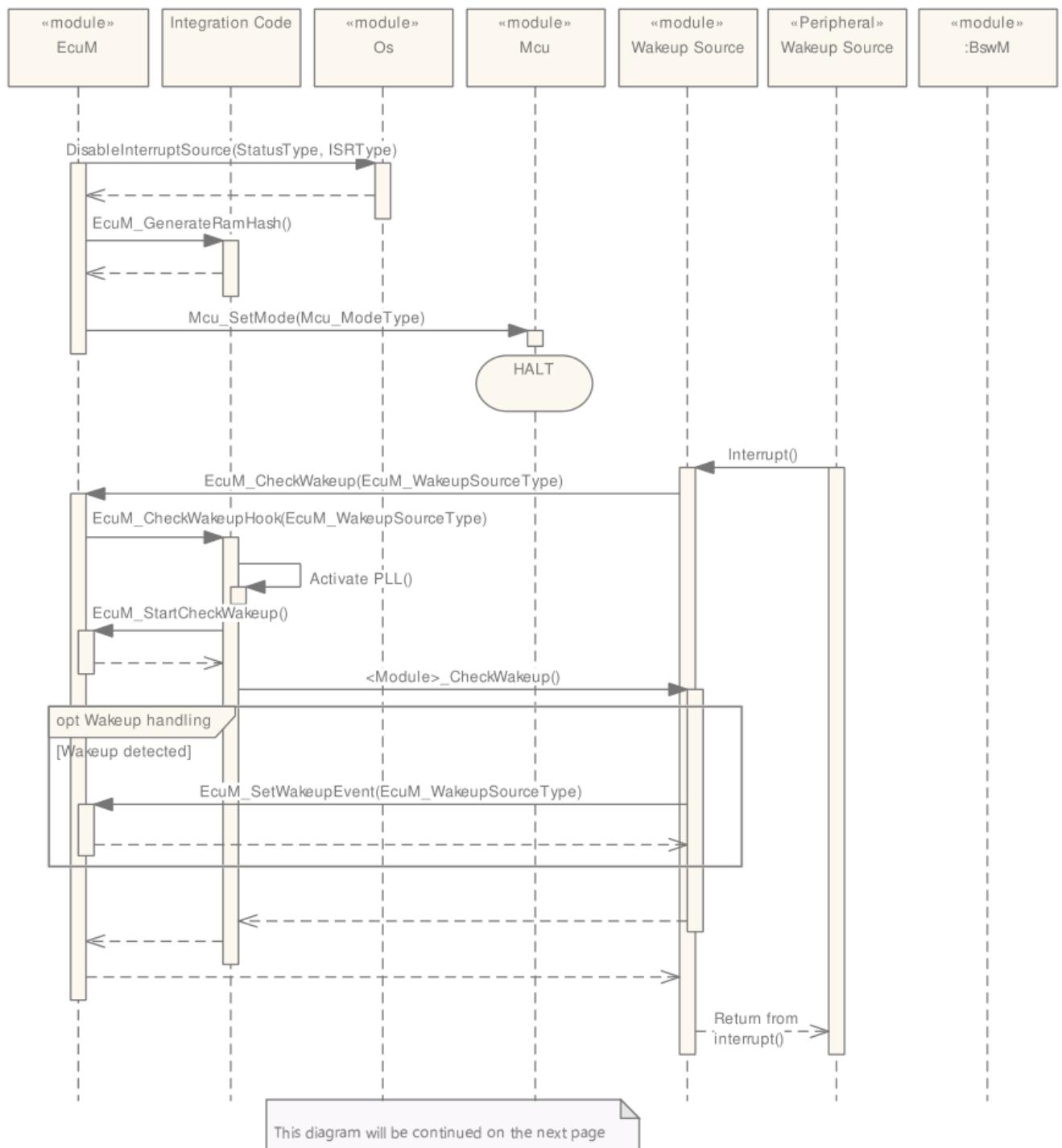


Figure 7.12: Halt Sequence

## 轮询序列中的活动

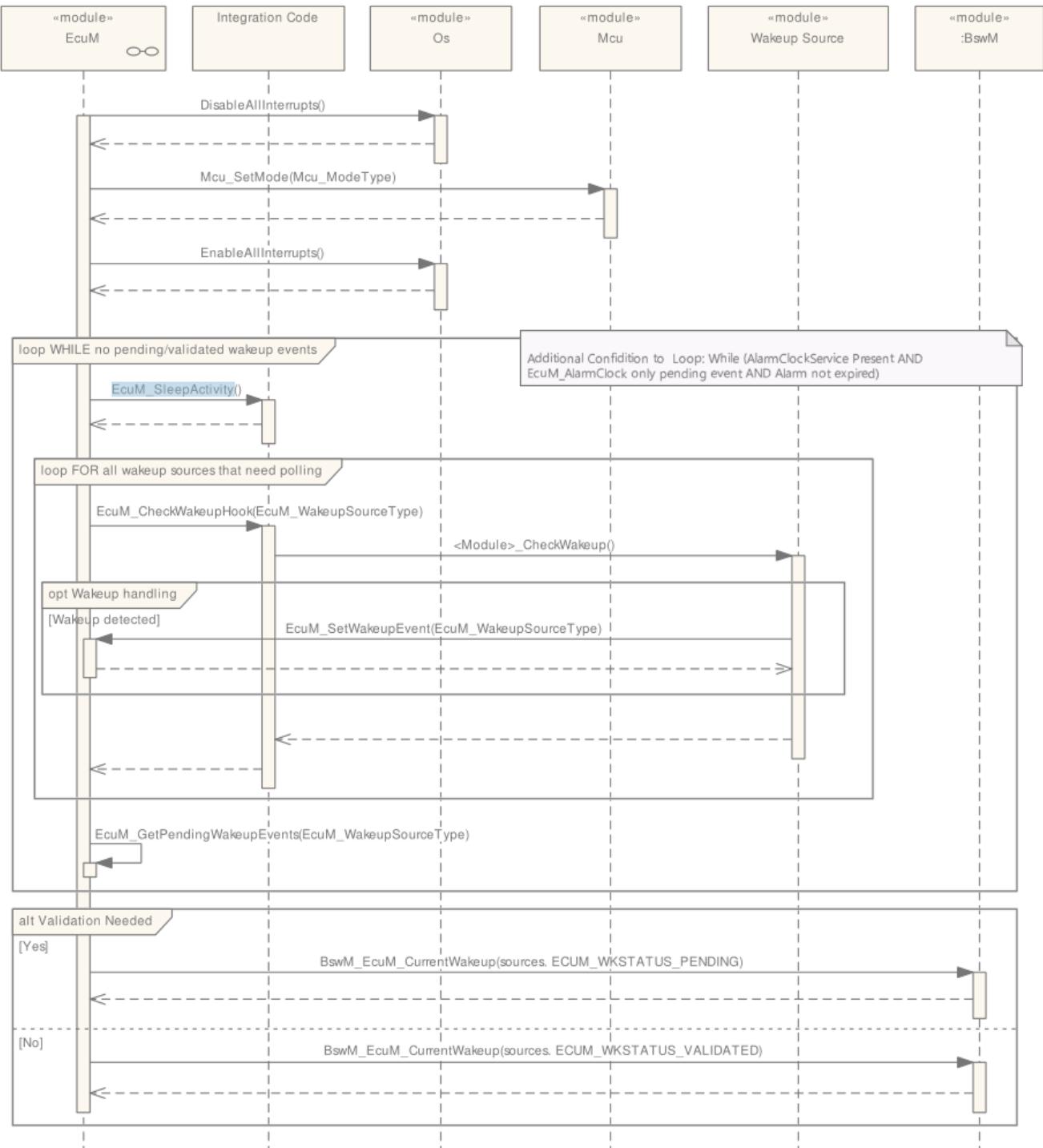


Figure 7.13: Poll Sequence

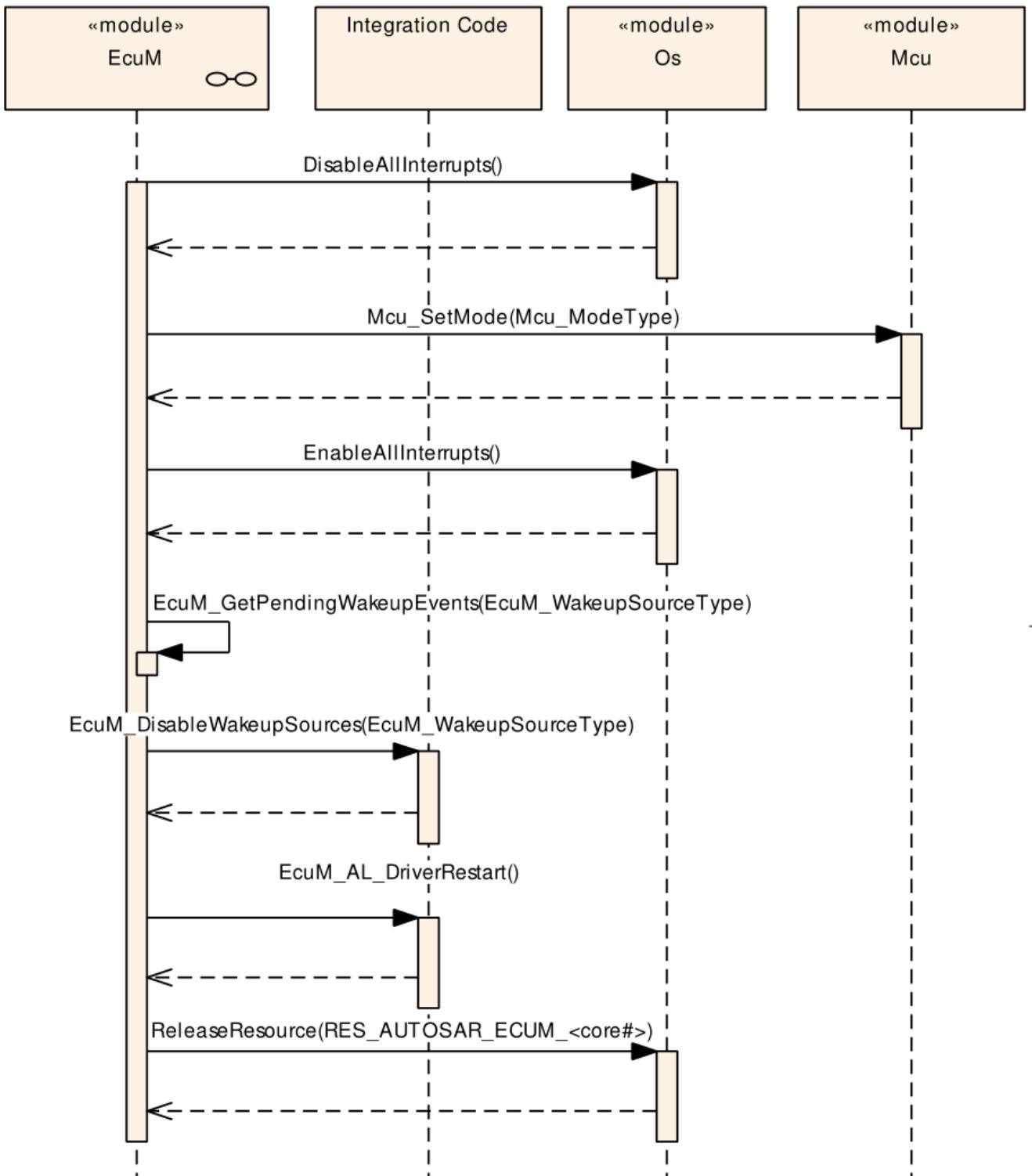
## Leaving Halt or Poll

- 如果在ECU处于停止或轮询状态时发生唤醒事件（例如切换唤醒线路，CAN总线上的通信等），则ECU管理器模块应通过执行唤醒重启序列重新获得控制权并退出睡眠阶段。
- 可以调用ISR来处理唤醒事件，但这取决于硬件和驱动程序实现。

如果在ECU处于停止或轮询状态时发生异常事件（硬件复位或电源循环），ECU管理器模块应在STARTUP阶段重新启动ECU。

## 唤醒重启序列中的活动

WakeupRestart*		
Wakeup Activity	Comment	Opt.
Restore MCU normal mode	选定的MCU模式在配置参数EcuMNormalMcuModeRef中配置	
Get the pending wakeup sources		
Callout EcuM_DisableWakeupSources	禁用当前挂起的唤醒源，但保留其他唤醒源，以便以后可以唤醒。	
Callout EcuM_AL_DriverRestart	初始化需要重新启动的驱动程序	
Unlock Scheduler	从此时开始，所有其他任务可能会再次运行。	

**Figure 7.14: WakeupRestart Sequence**

UP 阶段

在UP阶段，EcuM\_MainFunction定期执行，它有三个主要功能：

- 检查唤醒源是否已唤醒，并在必要时启动唤醒验证
- 更新闹钟计时器
- 仲裁RUN和POST\_RUN请求和释放。

## 唤醒源状态处理

唤醒源不仅在唤醒期间处理，而且与所有其他 EcuM 活动并行连续处理。此功能在EcuM\_MainFunction中运行，通过模式请求与ECU管理的其余部分完全分离。

State	Description
NONE	No wakeup event was detected or has been cleared.
PENDING	A wakeup event was detected but not yet validated.
VALIDATED	A wakeup event was detected and successfully validated.
EXPIRED	A wakeup event was detected but validation failed.

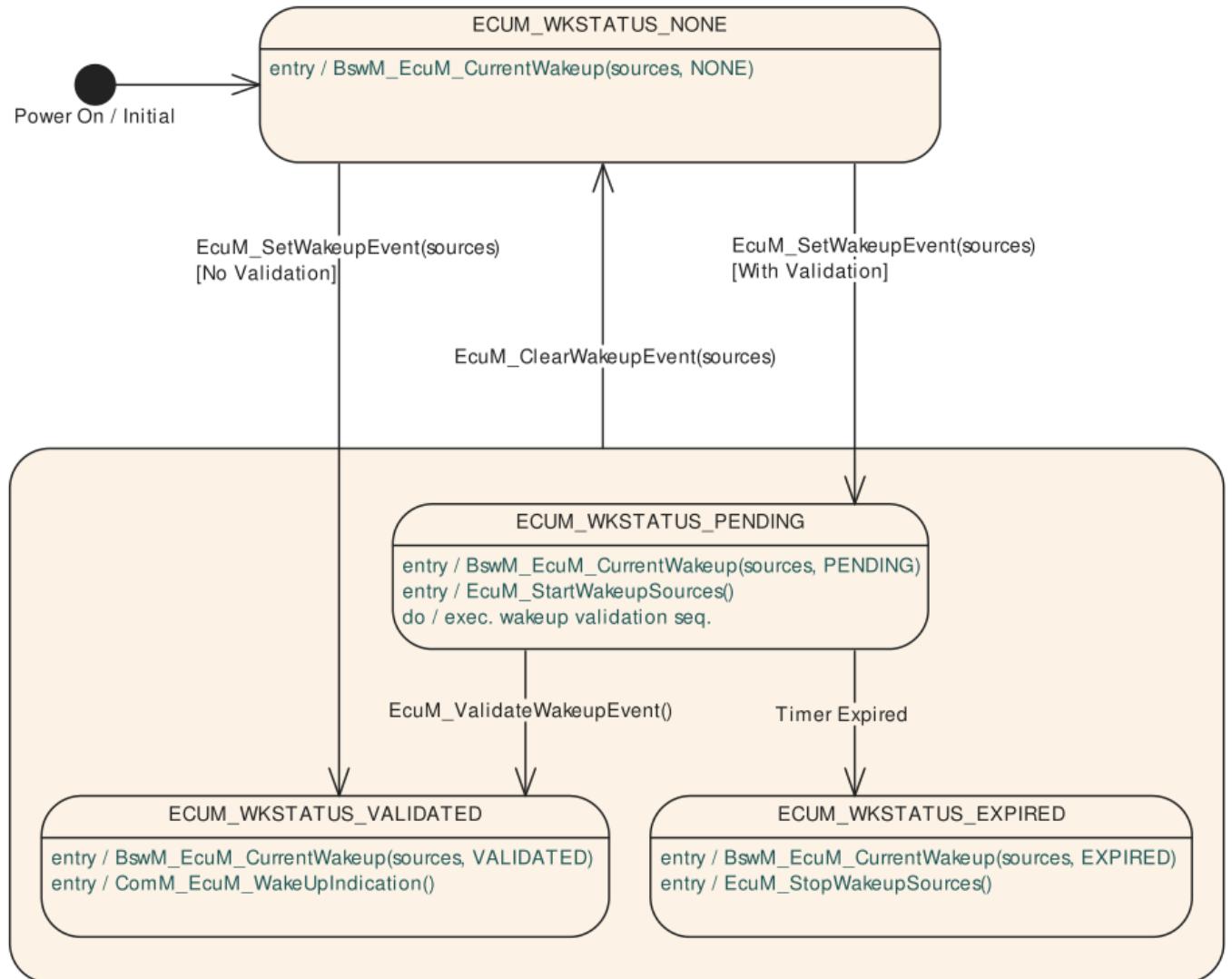


Figure 7.15: Wakeup Source States

当ECU管理器操作导致唤醒源的状态发生变化时，ECU管理器模块应向BswM发出模式请求，将唤醒源的模式更改为新的唤醒源状态。

当ECU管理器模块处于UP阶段时，唤醒事件通常不会触发状态更改。但是，它们会触发停止和轮询子阶段的结束。然后，ECU管理器模块自动执行唤醒重启序列，然后返回到 UP 阶段。

总结：每个挂起的事件都是独立验证的（如果已配置），EcuM 将结果作为模式请求发布到 BswM，这反过来可以触发 EcuM 中的状态更改。

唤醒验证序列中的活动

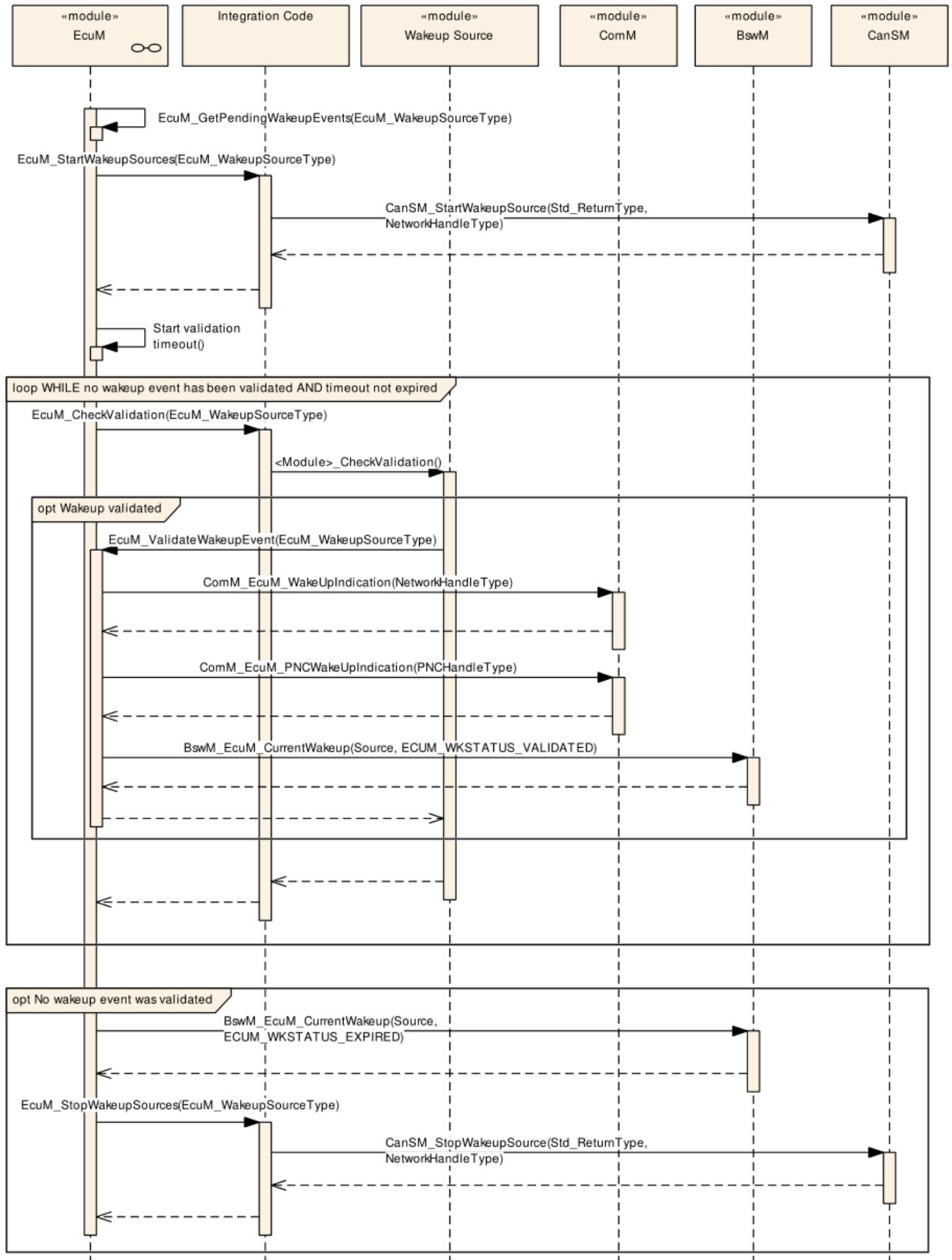


Figure 7.16: The WakeupValidation Sequence

## 通信信道唤醒

如果通信信道上发生唤醒，则相应的总线收发器驱动程序必须通过调用 `EcuM_SetWakeupEvent` 功能来通知ECU管理器模块。

## 唤醒源与ECU管理器的交互

当发生唤醒事件时，相应的驱动程序应通知ECU管理器模块唤醒。此通知最可能的方式是：

- 退出“停止”或“轮询”序列后。在这种情况下，ECU Manager 模块调用 `EcuM_AL_DriverRestart` 来重新初始化相关驱动程序，从而有机会扫描其硬件，例如挂起的唤醒中断。
- 如果唤醒源实际上处于睡眠模式，则驱动程序必须自主扫描唤醒事件；通过轮询或等待中断。

## 唤醒验证超时

ECU 管理器模块应提供单个唤醒验证超时计时器或每个唤醒源一个计时器。

## 具有唤醒源的驱动程序的要求

检测到唤醒事件时，驱动程序必须调用 `EcuM_SetWakeupEvent` 一次，并提供一个 `EcuM_WakeupSourceType` 参数，用于标识配置中指定的唤醒源。

ECU 管理器模块应检测在驱动程序初始化之前发生的唤醒，无论是从停止/轮询还是从关闭。

## SHUTDOWN TARGETS

“关闭标志”是一个描述性术语，用于描述未执行代码的所有状态 ECU。它们被称为关闭标志，因为它们是状态机在离开 UP 阶段时将驱动到的目标状态。以下状态是关闭标志：

- Off
- Sleep
- Reset

### Sleep

1. 在睡眠阶段不会错过任何唤醒事件。如果在进入睡眠序列中发生了唤醒事件，则不应输入停止或轮询序列。
2. ECU管理器模块可以定义一组可配置的睡眠模式（参见 `EcuMSleepMode`），其中每个模式本身都是一个关断目标。
3. ECU 管理器模块应允许将 MCU 休眠模式映射到 ECU 休眠模式，从而允许将它们作为关断目标寻址。
4. 关机目标睡眠应将所有内核置于睡眠状态。

### Reset

1. ECU 管理器模块应定义一组可配置的复位模式（参见 `EcuMResetMode` 和 `EcuM_ResetType`），其中每种模式本身都是一个关断目标。该集将最低限度地包含以下目标：
  - `Mcu_PerformReset`
  - `WdgM_PerformReset`
  - Toggle I/O Pin via DIO / SPI
2. ECU管理器模块应允许为复位目标定义别名
3. ECU 管理器模块应定义一组可配置的复位原因（请参阅 `EcuMSshutdownCause` 和 `EcuM_ShutdownCauseType`）。该集应至少包含以下目标：
  - ECU状态机进入停机状态
  - WdgM检测到故障
  - DCM请求关闭I
  - 重置时间。
4. ECU管理器模块应为BSW模块和SW-C提供设施
  - 记录停机原因
  - 获取一组最近的关机原因

**ALARM CLOCK**

ECU 管理器模块维护一个主闹钟，其值决定了 ECU 被唤醒的时间。此外，ECU管理器管理一个内部时钟，即EcuM时钟，用于与主报警进行比较。

请注意，警报唤醒机制仅与 SLEEP 阶段相关。SWC 和 BSW 模块可以在 UP 阶段（并且仅在 UP 阶段）设置和检索报警值，但是，这将在 SLEEP 阶段得到遵守。

与可以使用通用ECU管理器模块工具实现的其他定时/唤醒机制相比，闹钟服务在计时器到期之前不会启动唤醒重启序列。当ECU模块检测到其定时器引起唤醒事件时，它会增加其定时器并立即返回睡眠状态，除非时钟时间超过闹钟时间。

1. 当闹钟服务存在时（参见 `EcuMAlarmClockPresent`），EcuM 管理器模块应维护一个 EcuM 时钟，其时间应为自电池连接以来的时间（以秒为单位）。
2. EcuM时钟应跟踪UP和SLEEP阶段的时间。
3. 硬件允许时，ECU重置不应重置EcuM时钟时间。
4. 应有一个且仅一个唤醒源分配给 EcuM 时钟（请参阅 `EcuMAlarmWakeupSource`）。

**Alarm Clocks and Users**

SW-C和BSW模块可以各自维护一个闹钟（用户闹钟）。每个用户闹钟（参见`EcuMAlarmClock`）都与一个`EcuMAlarmClockUser`相关联，该用户标识相应的SW-C或BSW模块。

1. 每个EcuM用户最多应有一个用户闹钟。
2. EcuM用户不得设置其他用户闹钟的值。
3. ECU 管理器模块应始终将主闹钟值设置为最早的用户闹钟值的值。
4. 只有授权的 EcuM 用户才能设置 EcuM 时钟时间（请参阅 `EcuMSetClockAllowedUsers`）。

**EcuM Clock Time**

如果底层硬件机制是基于滴答的，ECUM应相应地“纠正”时间。

**EcuM Clock Time in the UP Phase**

`EcuM_MainFunction`在UP阶段递增EcuM时钟。它使用标准操作系统机制（警报/计数器）来推导其时间。请注意计数器与 EcuM 时间之间的粒度差异，以秒为单位

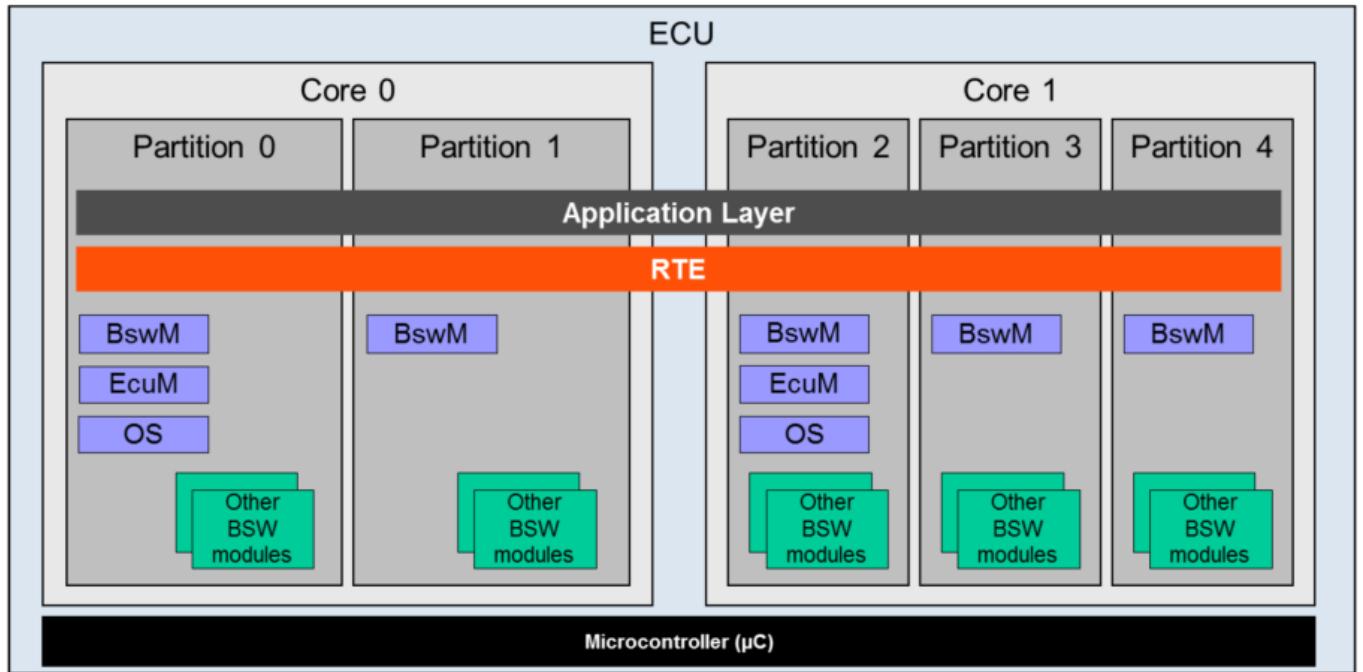
**EcuM Clock Time in the Sleep Phase**

有两种替代方法可以在睡眠期间增加 EcuM 时钟，具体取决于所选的睡眠模式（`EcuMSleepModeSuspend` 参数）在停止序列中（请参阅 7.5.2 停止序列中的活动），必须将 GPT 驱动程序放入`GPT_MODE_SLEEP`，以仅配置时基所需的计时器通道。它还要求 GPT 使用 `Gpt_EnableWakeup` API 启用基于计时器的唤醒通道。最好将`Gpt_StartTimer` API 设置为 1 秒，但如果无法达到此值，则需要更频繁地唤醒 EcuM 以累积多个计时器唤醒，直到累积 1 秒以增加时钟值。

1. 当离开睡眠状态时，ECU管理器模块将中止任何活动用户闹钟和主闹钟。这意味着时钟感应和其他事件引起的唤醒都将导致清除所有警报。
2. 用户警报和主警报应在启动前操作系统序列、唤醒重启序列和关闭前操作系统序列中取消

**MULTICORE**

BSW 模块可以分布在不同的分区上，因此可以分布在不同的内核上。一些BSW模块作为BswM必须包含在每个分区中。操作系统或 EcuM 等其他模块已包含在每个内核的一个分区中。



**Figure 7.17: Partitions inside an ECU**

在多核架构中，EcuM必须以每核一个实例的方式分布。

有一个指定的主核心，引导加载程序通过EcuM\_Init启动主 Ecu M。主 EcuM 启动一些驱动程序，确定构建后配置，并使用所有附属 EcuM 启动所有剩余内核。

现在，每个 EcuM 启动核心本地操作系统和所有核心本地 BswM（每个分区中正好驻留一个 BswM）。

#### Master Core

有一个明确的主核心。主内核是哪个内核，由引导加载器确定。主核心的EcuM作为第一个BSW模块启动并执行初始化操作。

然后是使用所有其他 EcuM 启动所有其他内核。

当这些启动时，它与每个卫星EcuM一起初始化核心本地操作系统和BswM。

#### Slave Core

在每个从属核心上，必须运行一颗卫星EcuM。如果一个核心包含多个分区，则每个核心只能存在于 EcuM 上。

## 2.1.3 API

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### API specification

### Type definitions

EcuM\_ConfigType

<b>Name</b>	EcuM_ConfigType				
<b>Kind</b>	Structure				
<b>Elements</b>	-				
	<b>Type</b>	—			
	<b>Comment</b>	The content of this structure depends on the post-build configuration of EcuM.			
<b>Description</b>	A pointer to such a structure shall be provided to the ECU State Manager initialization routine for configuration.				
<b>Available via</b>	EcuM.h				

EcuM\_RunStatusType

<b>Name</b>	EcuM_RunStatusType		
<b>Kind</b>	Type		
<b>Derived from</b>	uint8		
<b>Range</b>	ECUM_RUNSTATUS_UNKNOWN	0	Unknown status. Init Value.
	ECUM_RUNSTATUS_REQUESTED	1	Status requested from EcuM
	ECUM_RUNSTATUS_RELEASED	2	Status released from EcuM.
<b>Description</b>	Result of the Run Request Protocol sent to BswM		
<b>Available via</b>	EcuM.h		

## Ecum\_WakeupSourceType

<b>Name</b>	Ecum_WakeupSourceType		
<b>Kind</b>	Type		
<b>Derived from</b>	uint32		
<b>Range</b>	ECUM_WKSOURCE_POWER	0x01	Power cycle (bit 0)
	ECUM_WKSOURCE_RESET(default)	0x02	Hardware reset (bit 1)  If the Mcu driver cannot distinguish between a power cycle and a reset reason, then this shall be the default wakeup source
	ECUM_WKSOURCE_INTERNAL_RESET	0x04	internal reset of uC (bit 2) The internal reset typically only resets the uC core but not peripherals or memory controllers The exact behavior is hardware specific. This source may also indicate an unhandled exception
	ECUM_WKSOURCE_INTERNAL_WDG	0x08	Reset by internal watchdog (bit 3)
	ECUM_WKSOURCE_EXTERNAL_WDG	0x10	Reset by external watchdog (bit 4), if detection supported by hardware
<b>Description</b>	Ecum_WakeupSourceType 定义了一个具有 5 个预定义位置的位域（请参阅范围）。位域为每个唤醒源提供一个位。  在 WAKEUP 中，清除的所有位都表示没有已知的唤醒源。  在 STARTUP 中，所有清除的位都表示不知道重新启动或重置的原因。在这种情况下，应假定 ECUM_WKSOURCE_RESET。		
<b>Available via</b>	Ecum.h		

## EcuM\_WakeupStatusType

<b>Name</b>	EcuM_WakeupStatusType		
<b>Kind</b>	Type		
<b>Derived from</b>	uint8		
<b>Range</b>	ECUM_WKSTATUS_NONE	0	No pending wakeup event was detected
	ECUM_WKSTATUS_PENDING	1	The wakeup event was detected but not yet validated
	ECUM_WKSTATUS_VALIDATED	2	The wakeup event is valid
	ECUM_WKSTATUS_EXPIRED	3	The wakeup event has not been validated and has expired therefore
<b>Description</b>	The type describes the possible states of a wakeup source.		
<b>Available via</b>	EcuM.h		

## EcuM\_ResetType

<b>Name</b>	EcuM_ResetType		
<b>Kind</b>	Type		
<b>Derived from</b>	uint8		
<b>Range</b>	ECUM_RESET MCU	0	Microcontroller reset via Mcu_PerformReset
	ECUM_RESET_WDG	1	Watchdog reset via WdgM_PerformReset
	ECUM_RESET_IO	2	Reset by toggeling an I/O line.
<b>Description</b>	This type describes the reset mechanisms supported by the ECU State Manager. It can be extended by configuration.		
<b>Available via</b>	EcuM.h		

## EcuM\_StateType

<b>Name</b>	EcuM_StateType		
<b>Kind</b>	Type		
<b>Derived from</b>	uint8		
<b>Range</b>	ECUM_SUBSTATE_MASK	0x0f	—
	ECUM_STATE_STARTUP	0x10	—
	ECUM_STATE_RUN	0x32	—
	ECUM_STATE_POST_RUN	0x33	—
	ECUM_STATE_SHUTDOWN	0x40	—
	ECUM_STATE_SLEEP	0x50	—
<b>Description</b>	ECU State Manager states.		
<b>Available via</b>	EcuM.h		

## FUNCTION DEFINITIONS

EcuM\_GetVersionInfo

<b>Service Name</b>	EcuM_GetVersionInfo	
<b>Syntax</b>	<pre>void EcuM_GetVersionInfo (     Std_VersionInfoType* versioninfo )</pre>	
<b>Service ID [hex]</b>	0x00	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	None	
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	versioninfo	Pointer to where to store the version information of this module.
<b>Return value</b>	None	
<b>Description</b>	Returns the version information of this module.	
<b>Available via</b>	EcuM.h	

EcuM\_GoDownHaltPoll

<b>Service Name</b>	EcuM_GoDownHaltPoll	
<b>Syntax</b>	<pre>Std_ReturnType EcuM_GoDownHaltPoll (     EcuM_UserType UserID )</pre>	
<b>Service ID [hex]</b>	0x2c	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	UserID	Id of the user calling this API. Only configured users are allowed to call this function.
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	Std_ReturnType	E_NOT_OK: The request was not accepted. E_OK: If the ShutdownTargetType is SLEEP the call successfully returns, the ECU has left the sleep again. If the ShutdownTargetType is RESET or OFF this call will not return.
<b>Description</b>	Instructs the ECU State Manager module to go into a sleep mode, Reset or OFF depending on the previously selected shutdown target.	
<b>Available via</b>	EcuM.h	

## EcuM\_Init

<b>Service Name</b>	EcuM_Init
<b>Syntax</b>	<pre>void EcuM_Init (     void )</pre>
<b>Service ID [hex]</b>	0x01
<b>Sync/Async</b>	Synchronous
<b>Reentrancy</b>	Reentrant
<b>Parameters (in)</b>	None
<b>Parameters (inout)</b>	None
<b>Parameters (out)</b>	None
<b>Return value</b>	None
<b>Description</b>	Initializes the ECU state manager and carries out the startup procedure. The function will never return (it calls StartOS)
<b>Available via</b>	EcuM.h

## EcuM\_StartupTwo

<b>Service Name</b>	EcuM_StartupTwo
<b>Syntax</b>	<pre>void EcuM_StartupTwo (     void )</pre>
<b>Service ID [hex]</b>	0x1a
<b>Sync/Async</b>	Synchronous
<b>Reentrancy</b>	Non Reentrant
<b>Parameters (in)</b>	None
<b>Parameters (inout)</b>	None
<b>Parameters (out)</b>	None
<b>Return value</b>	None
<b>Description</b>	This function implements the STARTUP II state.
<b>Available via</b>	EcuM.h

## EcuM\_Shutdown

<b>Service Name</b>	EcuM_Shutdown
<b>Syntax</b>	<pre>void EcuM_Shutdown (     void )</pre>
<b>Service ID [hex]</b>	0x02
<b>Sync/Async</b>	Synchronous
<b>Reentrancy</b>	Reentrant
<b>Parameters (in)</b>	None
<b>Parameters (inout)</b>	None
<b>Parameters (out)</b>	None
<b>Return value</b>	None
<b>Description</b>	Typically called from the shutdown hook, this function takes over execution control and will carry out GO OFF II activities.
<b>Available via</b>	EcuM.h

**EcuM\_SetState**

Service Name	EcuM_SetState	
Syntax	void EcuM_SetState( EcuM_StateType state )	
Service ID [hex]	0x2b	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	state	State indicated by BswM.
Parameters (inout)	None	
Parameters (out)	None	
Return value	None	
Description	BswM调用的通知状态切换的函数。	
Available via	EcuM.h	

**EcuM\_RequestRUN**

Service Name	EcuM_RequestRUN	
<b>Syntax</b>	Std_ReturnType EcuM_RequestRUN ( EcuM_UserType user )	
<b>Service ID [hex]</b>	0x03	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant for different users	
<b>Parameters (in)</b>	user	ID of the entity requesting the RUN state.
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	Std_ReturnType	E_OK: The request was accepted by EcuM. E_NOT_OK: The request was not accepted by EcuM
<b>Description</b>	Places a request for the RUN state. Requests can be placed by every user made known to the state manager at configuration time.	
<b>Available via</b>	EcuM.h	

## EcuM\_ReleaseRUN

<b>Service Name</b>	EcuM_ReleaseRUN	
<b>Syntax</b>	Std_ReturnType EcuM_ReleaseRUN ( EcuM_UserType user )	
<b>Service ID [hex]</b>	0x04	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	user	ID of the entity releasing the RUN state.
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	Std_ReturnType	E_OK: The release request was accepted by EcuM E_NOT_OK: The release request was not accepted by EcuM
<b>Description</b>	Releases a RUN request previously done with a call to EcuM_RequestRUN. The service is intended for implementing AUTOSAR ports.	
<b>Available via</b>	EcuM.h	

## EcuM\_RequestPOST\_RUN

<b>Service Name</b>	EcuM_RequestPOST_RUN	
<b>Syntax</b>	Std_ReturnType EcuM_RequestPOST_RUN ( EcuM_UserType user )	
<b>Service ID [hex]</b>	0x0a	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	user	ID of the entity requesting the POST RUN state.
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	Std_ReturnType	E_OK: The request was accepted by EcuM E_NOT_OK: The request was not accepted by EcuM
<b>Description</b>	Places a request for the POST RUN state. Requests can be placed by every user made known to the state manager at configuration time. Requests for RUN and POST RUN must be tracked independently (in other words: two independent variables). The service is intended for implementing AUTOSAR ports.	
<b>Available via</b>	EcuM.h	

## EcuM\_ReleasePOST\_RUN

<b>Service Name</b>	EcuM_ReleasePOST_RUN	
<b>Syntax</b>	Std_ReturnType EcuM_ReleasePOST_RUN ( EcuM_UserType user )	
<b>Service ID [hex]</b>	0x0b	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	user	ID of the entity releasing the POST RUN state.
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	Std_ReturnType	E_OK: The release request was accepted by EcuM E_NOT_OK: The release request was not accepted by EcuM
<b>Description</b>	Releases a POST RUN request previously done with a call to EcuM_RequestPOST_RUN. The service is intended for implementing AUTOSAR ports.	
<b>Available via</b>	EcuM.h	

## EcuM\_SelectShutdownTarget

<b>Service Name</b>	EcuM_SelectShutdownTarget	
<b>Syntax</b>	Std_ReturnType EcuM_SelectShutdownTarget ( EcuM_ShutdownTargetType shutdownTarget, EcuM_ShutdownModeType shutdownMode )	
<b>Service ID [hex]</b>	0x06	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	shutdownTarget	The selected shutdown target.
	shutdownMode	The identifier of a sleep mode (if target is ECUM_SHUTDOWN_TARGET_SLEEP) or a reset mechanism (if target is ECUM_SHUTDOWN_TARGET_RESET) as defined by configuration.
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	Std_ReturnType	E_OK: The new shutdown target was set E_NOT_OK: The new shutdown target was not set
<b>Description</b>	EcuM_SelectShutdownTarget selects the shutdown target. EcuM_SelectShutdownTarget is part of the ECU Manager Module port interface.	
<b>Available via</b>	EcuM.h	

## EcuM\_GetShutdownTarget

<b>Service Name</b>	EcuM_GetShutdownTarget	
<b>Syntax</b>	<pre>Std_ReturnType EcuM_GetShutdownTarget (     EcuM_ShutdownTargetType* shutdownTarget,     EcuM_ShutdownModeType* shutdownMode )</pre>	
<b>Service ID [hex]</b>	0x09	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	None	
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	shutdownTarget	One of these values is returned: ECUM_SHUTDOWN_TARGET_SLEEP ECUM_SHUTDOWN_TARGET_RESET ECUM_SHUTDOWN_TARGET_OFF
	shutdownMode	If the out parameter "shutdownTarget" is ECUM_SHUTDOWN_TARGET_SLEEP, sleepMode tells which of the configured sleep modes was actually chosen. If "shutdownTarget" is ECUM_SHUTDOWN_TARGET_RESET, sleepMode tells which of the configured reset modes was actually chosen.
<b>Return value</b>	Std_ReturnType	E_OK: The service has succeeded E_NOT_OK: The service has failed, e.g. due to NULL pointer being passed
<b>Description</b>	EcuM_GetShutdownTarget returns the currently selected shutdown target as set by EcuM_SelectShutdownTarget. EcuM_GetShutdownTarget is part of the ECU Manager Module port interface.	
<b>Available via</b>	EcuM.h	

## EcuM\_GetLastShutdownTarget

<b>Service Name</b>	<b>EcuM_GetLastShutdownTarget</b>	
<b>Syntax</b>	<pre>Std_ReturnType EcuM_GetLastShutdownTarget (     Ecu_shutdownTargetType     shutdownTarget     Ecu_shutdownModeType      shutdownMode )</pre>	
<b>Service ID</b>	0x08	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	None	
<b>Parameters</b>	None	
<b>Parameters (out)</b>	shutdownTarget	返回以下值之一：ECUM_SHUTDOWN_TARGET_SLEEP ECUM_SHUTDOWN_TARGET_RESET ECUM_SHUTDOWN_TARGET_OFF
	shutdownMode	如果输出参数“shutdownTarget”为 ECUM_SHUTDOWN_TARGET_SLEEP，则sleepMode告诉实际 选择了哪些配置的休眠模式。如果“shutdownTarget” 是ECUM_SHUTDOWN_TARGET_RESET，则sleepMode告诉实 际选择了哪些配置的重置模式
<b>Return value</b>	Std_ReturnType	E_OK: 服务已成功 E_NOT_OK: 服务已失败，例如，由于 传递了NULL指针
<b>Description</b>	EcuM_GetLastShutdownTarget返回上一个关闭进程的关闭目标。  EcuM_GetLastShutdownTarget是ECU管理器模块端口接口的一部分	
<b>Available via</b>	EcuM.h	

## EcuM\_SelectShutdownCause

<b>Service Name</b>	EcuM_SelectShutdownCause	
<b>Syntax</b>	<pre>Std_ReturnType EcuM_SelectShutdownCause (     EcuM_ShutdownCauseType target )</pre>	
<b>Service ID [hex]</b>	0x1b	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	target	The selected shutdown cause.
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	Std_ReturnType	E_OK: The new shutdown cause was set E_NOT_OK: The new shutdown cause was not set
<b>Description</b>	EcuM_SelectShutdownCause elects the cause for a shutdown. EcuM_SelectShutdownCause is part of the ECU Manager Module port interface.	
<b>Available via</b>	EcuM.h	

## EcuM\_GetShutdownCause

<b>Service Name</b>	EcuM_GetShutdownCause	
<b>Syntax</b>	<pre>Std_ReturnType EcuM_GetShutdownCause (     EcuM_ShutdownCauseType* shutdownCause )</pre>	
<b>Service ID [hex]</b>	0x1c	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	None	
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	shutdownCause	The selected cause of the next shutdown.
<b>Return value</b>	Std_ReturnType	E_OK: The service has succeeded E_NOT_OK: The service has failed, e.g. due to NULL pointer being passed
<b>Description</b>	EcuM_GetShutdownCause returns the selected shutdown cause as set by EcuM_Select ShutdownCause. EcuM_GetShutdownCause is part of the ECU Manager Module port interface.	
<b>Available via</b>	EcuM.h	

## EcuM\_CheckWakeup

<b>Service Name</b>	EcuM_CheckWakeup	
<b>Syntax</b>	<pre>void EcuM_CheckWakeup (     EcuM_WakeupSourceType wakeupSource )</pre>	
<b>Service ID [hex]</b>	0x49	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Parameters (in)</b>	wakeupSource	-
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	This function can be called to check the given wakeup sources. It will pass the argument to the integrator function EcuM_CheckWakeupHook. It can also be called by the ISR of a wakeup source to set up the PLL and check other wakeup sources that may be connected to the same interrupt.	
<b>Available via</b>	EcuM.h	

## EcuM\_GetPendingWakeupEvents

<b>Service Name</b>	EcuM_GetPendingWakeupEvents	
<b>Syntax</b>	<pre>EcuM_WakeupSourceType EcuM_GetPendingWakeupEvents (     void )</pre>	
<b>Service ID [hex]</b>	0x0d	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non-Reentrant, Non-Interruptible	
<b>Parameters (in)</b>	None	
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	EcuM_WakeupSource Type	All wakeup events
<b>Description</b>	Gets pending wakeup events.	
<b>Available via</b>	EcuM.h	

## EcuM\_ClearWakeupEvent

<b>Service Name</b>	EcuM_ClearWakeupEvent	
<b>Syntax</b>	<pre>void EcuM_ClearWakeupEvent (     EcuM_WakeupSourceType sources )</pre>	
<b>Service ID [hex]</b>	0x16	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non-Reentrant, Non-Interruptible	
<b>Parameters (in)</b>	sources	Events to be cleared
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	Clears wakeup events.	
<b>Available via</b>	EcuM.h	

## EcuM\_GetValidatedWakeupEvents

<b>Service Name</b>	EcuM_GetValidatedWakeupEvents	
<b>Syntax</b>	<pre>EcuM_WakeupSourceType EcuM_GetValidatedWakeupEvents (     void )</pre>	
<b>Service ID [hex]</b>	0x15	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non-Reentrant, Non-Interruptible	
<b>Parameters (in)</b>	None	
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	EcuM_WakeupSource Type	All wakeup events
<b>Description</b>	Gets validated wakeup events.	
<b>Available via</b>	EcuM.h	

## EcuM\_GetExpiredWakeupEvents

<b>Service Name</b>	EcuM_GetExpiredWakeupEvents	
<b>Syntax</b>	<pre>EcuM_WakeupSourceType EcuM_GetExpiredWakeupEvents (     void )</pre>	
<b>Service ID [hex]</b>	0x19	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non-Reentrant, Non-Interruptible	
<b>Parameters (in)</b>	None	
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	EcuM_WakeupSource Type	All wakeup events: Returns all events that have been set and for which validation has failed. Events which do not need validation must never be reported by this function.
<b>Description</b>	Gets expired wakeup events.	
<b>Available via</b>	EcuM.h	

## EcuM\_SetRelWakeupAlarm

<b>Service Name</b>	EcuM_SetRelWakeupAlarm	
<b>Syntax</b>	<pre>Std_ReturnType EcuM_SetRelWakeupAlarm (     EcuM_UserType user,     EcuM_TimeType time )</pre>	
<b>Service ID [hex]</b>	0x22	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	user	The user that wants to set the wakeup alarm.
	time	Relative time from now in seconds.
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	Std_ReturnType	E_OK: The service has succeeded E_NOT_OK: The service failed ECUM_E_EARLIER_ACTIVE: An earlier alarm is already set
<b>Description</b>	EcuM_SetRelWakeupAlarm sets a user's wakeup alarm relative to the current point in time. EcuM_SetRelWakeupAlarm is part of the ECU Manager Module port interface.	
<b>Available via</b>	EcuM.h	

## EcuM\_SetAbsWakeupAlarm

<b>Service Name</b>	EcuM_SetAbsWakeupAlarm	
<b>Syntax</b>	<pre>Std_ReturnType EcuM_SetAbsWakeupAlarm (     EcuM_UserType user,     EcuM_TimeType time )</pre>	
<b>Service ID [hex]</b>	0x23	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	user	The user that wants to set the wakeup alarm.
	time	Absolute time in seconds. Note that, absolute alarms use knowledge of the current time.
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	Std_ReturnType	<p>E_OK: The service has succeeded          E_NOT_OK: The service failed          ECUM_E_EARLIER_ACTIVE: An earlier alarm is already set          ECUM_E_PAST: The given point in time has already passed</p>
<b>Description</b>	EcuM_SetAbsWakeupAlarm sets the user's wakeup alarm to an absolute point in time. EcuM_SetAbsWakeupAlarm is part of the ECU Manager Module port interface.	
<b>Available via</b>	EcuM.h	

## EcuM\_AbortWakeupAlarm

<b>Service Name</b>	EcuM_AbortWakeupAlarm	
<b>Syntax</b>	<pre>Std_ReturnType EcuM_AbortWakeupAlarm (     EcuM_UserType user )</pre>	
<b>Service ID [hex]</b>	0x24	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	user	The user that wants to cancel the wakeup alarm.
<b>Parameters</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	Std_ReturnType	<p>E_OK: 服务已成功          E_NOT_OK: 服务失败          ECUM_E_NOT_ACTIVE: 未找到所属报警</p>
<b>Description</b>	Ecum_AbortWakeupAlarm中止此用户先前设置的唤醒警报。 EcuM_AbortWakeupAlarm是ECU管理器模块端口接口的一部分。	
<b>Available via</b>	EcuM.h	

## EcuM\_GetCurrentTime

<b>Service Name</b>	EcuM_GetCurrentTime	
<b>Syntax</b>	Std_ReturnType EcuM_GetCurrentTime ( EcuM_TimeType* time )	
<b>Service ID [hex]</b>	0x25	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	None	
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	time	Absolute time in seconds since battery connect.
<b>Return value</b>	Std_ReturnType	E_OK: The service has succeeded E_NOT_OK: time points to NULL or the module is not initialized
<b>Description</b>	EcuM_GetCurrentTime returns the current value of the EcuM clock (i.e. the time since battery connect). EcuM_GetCurrentTime is part of the ECU Manager Module port interface.	
<b>Available via</b>	EcuM.h	

## EcuM\_GetWakeupTime

<b>Service Name</b>	EcuM_GetWakeupTime	
<b>Syntax</b>	Std_ReturnType EcuM_GetWakeupTime ( EcuM_TimeType* time )	
<b>Service ID [hex]</b>	0x26	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	None	
<b>Parameters</b>	None	
<b>Parameters (out)</b>	time	Absolute time in seconds for next wakeup. 0xFFFFFFFF means
<b>Return value</b>	Std_ReturnType	E_OK: 服务已成功 E_NOT_OK: 时间指向NULL或模块未初始化
<b>Description</b>	EcuM_GetWakeupTime返回主闹钟的当前值（所有用户闹钟的最小绝对时间）。EcuM_GetWakeupTime是ECU管理器模块端口接口的一部分。	
<b>Available via</b>	EcuM.h	

## EcuM\_SetClock

<b>Service Name</b>	EcuM_SetClock	
<b>Syntax</b>	<pre>Std_ReturnType EcuM_SetClock (     EcuM_UserType user,     EcuM_TimeType time )</pre>	
<b>Service ID [hex]</b>	0x27	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	user	User that wants to set the clock
	time	Absolute time in seconds since battery connect.
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	Std_ReturnType	E_OK: The service has succeeded E_NOT_OK: The service failed
<b>Description</b>	EcuM_SetClock sets the EcuM clock time to the provided value. This API is useful for testing the alarm services; Alarms that take days to expire can be tested. EcuM_SetClock is part of the ECU Manager Module port interface.	
<b>Available via</b>	EcuM.h	

## EcuM\_SelectBootTarget

<b>Service Name</b>	EcuM_SelectBootTarget	
<b>Syntax</b>	<pre>Std_ReturnType EcuM_SelectBootTarget (     EcuM_BootTargetType target )</pre>	
<b>Service ID [hex]</b>	0x12	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	target	The selected boot target.
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	Std_ReturnType	E_OK: The new boot target was accepted by EcuM E_NOT_OK: The new boot target was not accepted by EcuM
<b>Description</b>	EcuM_SelectBootTarget selects a boot target. EcuM_SelectBootTarget is part of the ECU Manager Module port interface.	
<b>Available via</b>	EcuM.h	

## Ecum\_GetBootTarget

<b>Service Name</b>	<b>EcuM_GetBootTarget</b>	
<b>Syntax</b>	<pre>Std_ReturnType EcuM_GetBootTarget(     EcuM_BootTargetType * target )</pre>	
<b>Service ID</b>	0x13	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	None	
<b>Parameters</b>	None	
<b>Parameters</b>	target	The currently selected boot target.
<b>Return value</b>	Std_ReturnType	E_OK: The service always succeeds.
<b>Description</b>	EcuM_GetBootTarget返回当前引导目标-请参阅EcuM_SelectBootTarget。EcuM_GetBootTarget是ECU管理器模块端口接口的一部分。	
<b>Available via</b>	<b>EcuM.h</b>	

## Ecum\_SetWakeupEvent

<b>Service Name</b>	Ecum_SetWakeupEvent	
<b>Syntax</b>	<pre>void Ecum_SetWakeupEvent (     Ecum_WakeupSourceType sources )</pre>	
<b>Service ID [hex]</b>	0x0c	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non-Reentrant, Non-Interruptible	
<b>Parameters (in)</b>	sources	Value to be set
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	Sets the wakeup event.	
<b>Available via</b>	<b>EcuM.h</b>	

## EcuM\_ValidateWakeupEvent

<b>Service Name</b>	EcuM_ValidateWakeupEvent	
<b>Syntax</b>	<pre>void EcuM_ValidateWakeupEvent (     EcuM_WakeupSourceType sources )</pre>	
<b>Service ID [hex]</b>	0x14	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	sources	Events that have been validated
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	After wakeup, the ECU State Manager will stop the process during the WAKEUP VALIDATION state/sequence to wait for validation of the wakeup event. This API service is used to indicate to the ECU Manager module that the wakeup events indicated in the sources parameter have been validated.	
<b>Available via</b>	EcuM.h	

## EcuM\_ErrorHook

<b>Service Name</b>	EcuM_ErrorHook	
<b>Syntax</b>	<pre>void EcuM_ErrorHook (     uint16 reason )</pre>	
<b>Service ID [hex]</b>	0x30	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Parameters (in)</b>	reason	Reason for calling the error hook
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	The ECU State Manager will call the error hook if fatal errors occur. In this situation it is not possible to continue processing and the ECU must be stopped. The integrator may choose the modality how the ECU is stopped, i.e. reset, halt, restart, safe state etc.	
<b>Available via</b>	EcuM_Externals.h	

## EcuM\_AL\_SetProgrammableInterrupts

<b>Service Name</b>	EcuM_AL_SetProgrammableInterrupts
<b>Syntax</b>	<pre>void EcuM_AL_SetProgrammableInterrupts (     void )</pre>
<b>Service ID [hex]</b>	0x4A
<b>Sync/Async</b>	Asynchronous
<b>Reentrancy</b>	Non Reentrant
<b>Parameters (in)</b>	None
<b>Parameters (inout)</b>	None
<b>Parameters (out)</b>	None
<b>Return value</b>	None
<b>Description</b>	If the configuration parameter EcuMSetProgrammableInterrupts is set to true, this callout EcuM_AL_SetProgrammableInterrupts is executed and shall set the interrupts on ECUs with programmable interrupts.
<b>Available via</b>	EcuM_externals.h

## EcuM\_AL\_DriverInitZero

<b>Service Name</b>	EcuM_AL_DriverInitZero
<b>Syntax</b>	<pre>void EcuM_AL_DriverInitZero (     void )</pre>
<b>Service ID [hex]</b>	0x31
<b>Sync/Async</b>	Synchronous
<b>Reentrancy</b>	Non Reentrant
<b>Parameters (in)</b>	None
<b>Parameters (inout)</b>	None
<b>Parameters (out)</b>	None
<b>Return value</b>	None
<b>Description</b>	This callout shall provide driver initialization and other hardware-related startup activities for loading the post-build configuration data. Beware: Here only pre-compile and link-time configurable modules may be used.
<b>Available via</b>	EcuM_externals.h

## EcuM\_DeterminePbConfiguration

<b>Service Name</b>	EcuM_DeterminePbConfiguration	
<b>Syntax</b>	<pre>const EcuM_ConfigType* EcuM_DeterminePbConfiguration (     void )</pre>	
<b>Service ID [hex]</b>	0x32	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Parameters (in)</b>	None	
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	<code>const EcuM_ConfigType*</code>	Pointer to the EcuM post-build configuration which contains pointers to all other BSW module post-build configurations.
<b>Description</b>	This callout should evaluate some condition, like port pin or NVRAM value, to determine which post-build configuration shall be used in the remainder of the startup process. It shall load this configuration data into a piece of memory that is accessible by all BSW modules and shall return a pointer to the EcuM post-build configuration as a base for all BSW module post-build configurations.	
<b>Available via</b>	EcuM_Externals.h	

## EcuM\_AL\_DriverInitOne

<b>Service Name</b>	EcuM_AL_DriverInitOne
<b>Syntax</b>	<pre>void EcuM_AL_DriverInitOne (     void )</pre>
<b>Service ID</b>	0x33
<b>Sync/Async</b>	Synchronous
<b>Reentrancy</b>	Non Reentrant
<b>Parameters (in)</b>	None
<b>Parameters</b>	None
<b>Parameters</b>	None
<b>Return value</b>	None
<b>Description</b>	该调用应提供驱动器初始化和其他硬件相关的启动活动，以防电源复位。
<b>Available via</b>	EcuM_Externals.h

## EcuM\_LoopDetection

<b>Service Name</b>	EcuM_LoopDetection
<b>Syntax</b>	<pre>void EcuM_LoopDetection (     void )</pre>
<b>Service ID [hex]</b>	0x4B
<b>Sync/Async</b>	Synchronous
<b>Reentrancy</b>	Non Reentrant
<b>Parameters (in)</b>	None
<b>Parameters (inout)</b>	None
<b>Parameters (out)</b>	None
<b>Return value</b>	None
<b>Description</b>	If the configuration parameter EcuMResetLoopDetection is set to true, this callout EcuM_Loop Detection is called on every startup.
<b>Available via</b>	EcuM_Externals.h

## EcuM\_OnGoOffOne

<b>Service Name</b>	EcuM_OnGoOffOne
<b>Syntax</b>	<pre>void EcuM_OnGoOffOne (     void )</pre>
<b>Service ID [hex]</b>	0x3C
<b>Sync/Async</b>	Synchronous
<b>Reentrancy</b>	Non Reentrant
<b>Parameters (in)</b>	None
<b>Parameters (inout)</b>	None
<b>Parameters (out)</b>	None
<b>Return value</b>	None
<b>Description</b>	This call allows the system designer to notify that the GO OFF I state is about to be entered.
<b>Available via</b>	EcuM_Externals.h

## EcuM\_OnGoOffTwo

<b>Service Name</b>	EcuM_OnGoOffTwo
<b>Syntax</b>	<pre>void EcuM_OnGoOffTwo (     void )</pre>
<b>Service ID [hex]</b>	0x3D
<b>Sync/Async</b>	Synchronous
<b>Reentrancy</b>	Non Reentrant
<b>Parameters (in)</b>	None
<b>Parameters (inout)</b>	None
<b>Parameters (out)</b>	None
<b>Return value</b>	None
<b>Description</b>	This call allows the system designer to notify that the GO OFF II state is about to be entered.
<b>Available via</b>	EcuM_Externals.h

## EcuM\_AL\_SwitchOff

<b>Service Name</b>	EcuM_AL_SwitchOff
<b>Syntax</b>	<pre>void EcuM_AL_SwitchOff (     void )</pre>
<b>Service ID [hex]</b>	0x3E
<b>Sync/Async</b>	Synchronous
<b>Reentrancy</b>	Non Reentrant
<b>Parameters (in)</b>	None
<b>Parameters (inout)</b>	None
<b>Parameters (out)</b>	None
<b>Return value</b>	None
<b>Description</b>	This callout shall take the code for shutting off the power supply of the ECU. If the ECU cannot unpower itself, a reset may be an adequate reaction.
<b>Available via</b>	EcuM_Externals.h

## EcuM\_AL\_Reset

<b>Service Name</b>	EcuM_AL_Reset	
<b>Syntax</b>	<pre>void EcuM_AL_Reset (     EcuM_ResetType reset )</pre>	
<b>Service ID [hex]</b>	0x4C	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Parameters (in)</b>	reset	Type of reset to be performed.
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	This callout shall take the code for resetting the ECU.	
<b>Available via</b>	EcuM_Externals.h	

## EcuM\_EnableWakeupSources

<b>Service Name</b>	EcuM_EnableWakeupSources	
<b>Syntax</b>	<pre>void EcuM_EnableWakeupSources (     EcuM_WakeupSourceType wakeupSource )</pre>	
<b>Service ID [hex]</b>	0x3F	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Parameters (in)</b>	wakeupSource	-
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	The ECU Manager Module calls EcuM_EnableWakeupSource to allow the system designer to notify wakeup sources defined in the wakeupSource bitfield that SLEEP will be entered and to adjust their source accordingly.	
<b>Available via</b>	EcuM_Externals.h	

## EcuM\_GenerateRamHash

<b>Service Name</b>	<b>EcuM_GenerateRamHash</b>
<b>Syntax</b>	<code>void EcuM_GenerateRamHash (</code> <code>void</code> <code>)</code>
<b>Service ID [hex]</b>	0x40
<b>Sync/Async</b>	Synchronous
<b>Reentrancy</b>	Non Reentrant
<b>Parameters (in)</b>	None
<b>Parameters</b>	None
<b>Parameters (out)</b>	None
<b>Return value</b>	None
<b>Description</b>	see <a href="#">EcuM_CheckRamHash</a>
<b>Available via</b>	<a href="#">EcuM_Externals.h</a>

## EcuM\_SleepActivity

<b>Service Name</b>	EcuM_SleepActivity
<b>Syntax</b>	<code>void EcuM_SleepActivity (</code> <code>void</code> <code>)</code>
<b>Service ID [hex]</b>	0x41
<b>Sync/Async</b>	Synchronous
<b>Reentrancy</b>	Non Reentrant
<b>Parameters (in)</b>	None
<b>Parameters (inout)</b>	None
<b>Parameters (out)</b>	None
<b>Return value</b>	None
<b>Description</b>	This callout is invoked periodically in all reduced clock sleep modes. It is explicitly allowed to poll wakeup sources from this callout and to call wakeup notification functions to indicate the end of the sleep state to the ECU State Manager.
<b>Available via</b>	<a href="#">EcuM_Externals.h</a>

## EcuM\_StartCheckWakeups

<b>Service Name</b>	EcuM_StartCheckWakeups	
<b>Syntax</b>	<pre>void EcuM_StartCheckWakeups (     EcuM_WakeupSourceType WakeupSource )</pre>	
<b>Service ID [hex]</b>	0x00	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Parameters (in)</b>	WakeupSource	For this wakeup source the corresponding CheckWakeupsTimer shall be started.
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	This API is called by the ECU Firmware to start the CheckWakeupsTimer for the corresponding WakeupSource. If EcuMCheckWakeupsTimeout > 0 the CheckWakeupsTimer for the Wakeup Source is started. If EcuMCheckWakeupsTimeout <= 0 the API call is ignored by the EcuM.	
<b>Available via</b>	EcuM_externals.h	

## EcuM\_CheckWakeupsHook

<b>Service Name</b>	EcuM_CheckWakeupsHook	
<b>Syntax</b>	<pre>void EcuM_CheckWakeupsHook (     EcuM_WakeupSourceType wakeupSource )</pre>	
<b>Service ID [hex]</b>	0x42	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Parameters (in)</b>	wakeupSource	-
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	This callout is called by the EcuM to poll a wakeup source.	
<b>Available via</b>	EcuM_externals.h	

## EcuM\_CheckRamHash

<b>Service Name</b>	EcuM_CheckRamHash	
<b>Syntax</b>	<pre>uint8 EcuM_CheckRamHash (     void )</pre>	
<b>Service ID [hex]</b>	0x43	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Parameters (in)</b>	None	
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	uint8	0: RAM integrity test failed else: RAM integrity test passed
<b>Description</b>	<p>This callout is intended to provide a RAM integrity test. The goal of this test is to ensure that after a long SLEEP duration, RAM contents is still consistent. The check does not need to be exhaustive since this would consume quite some processing time during wakeups. A well designed check will execute quickly and detect RAM integrity defects with a sufficient probability. This specification does not make any assumption about the algorithm chosen for a particular ECU. The areas of RAM which will be checked have to be chosen carefully. It depends on the check algorithm itself and the task structure. Stack contents of the task executing the RAM check e.g. very likely cannot be checked. It is good practice to have the hash generation and checking in the same task and that this task is not preemptible and that there is only little activity between hash generation and hash check. The RAM check itself is provided by the system designer. In case of applied multi core and existence of Satellite-EcuM(s): this API will be called by the Master-EcuM only.</p>	
<b>Available via</b>	EcuM_Externals.h	

## EcuM\_DisableWakeupSources

<b>Service Name</b>	EcuM_DisableWakeupSources	
<b>Syntax</b>	<pre>void EcuM_DisableWakeupSources (     EcuM_WakeupSourceType wakeupSource )</pre>	
<b>Service ID [hex]</b>	0x44	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Parameters (in)</b>	wakeupSource	-
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	<p>The ECU Manager Module calls EcuM_DisableWakeupSources to set the wakeup source(s) defined in the wakeupSource bitfield so that they are not able to wake the ECU up.</p>	
<b>Available via</b>	EcuM_Externals.h	

## EcuM\_AL\_DriverRestart

<b>Service Name</b>	EcuM_AL_DriverRestart
<b>Syntax</b>	<pre>void EcuM_AL_DriverRestart (     void )</pre>
<b>Service ID [hex]</b>	0x45
<b>Sync/Async</b>	Synchronous
<b>Reentrancy</b>	Non Reentrant
<b>Parameters (in)</b>	None
<b>Parameters (inout)</b>	None
<b>Parameters (out)</b>	None
<b>Return value</b>	None
<b>Description</b>	This callout shall provide driver initialization and other hardware-related startup activities in the wakeup case.
<b>Available via</b>	EcuM_Externals.h

## EcuM\_StartWakeupSources

<b>Service Name</b>	EcuM_StartWakeupSources	
<b>Syntax</b>	<pre>void EcuM_StartWakeupSources (     EcuM_WakeupSourceType wakeupSource )</pre>	
<b>Service ID [hex]</b>	0x46	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Parameters (in)</b>	wakeupSource	-
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	The callout shall start the given wakeup source(s) so that they are ready to perform wakeup validation.	
<b>Available via</b>	EcuM_Externals.h	

## EcuM\_CheckValidation

<b>Service Name</b>	<b>EcuM_CheckValidation</b>	
<b>Syntax</b>	<pre>void EcuM_CheckValidation (     EcuM_WakeupSourceType wakeupSource )</pre>	
<b>Service ID</b>	0x47	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Parameters (in)</b>	wakeupSource	
<b>Parameters</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	EcuM调用此调用以验证唤醒源。如果检测到有效唤醒，则应通过EcuM_ValidateWakeupEvent () 向EcuM报告。	
<b>Available via</b>	EcuM_Externals.h	

## EcuM\_StopWakeupSources

<b>Service Name</b>	EcuM_StopWakeupSources	
<b>Syntax</b>	<pre>void EcuM_StopWakeupSources (     EcuM_WakeupSourceType wakeupSource )</pre>	
<b>Service ID [hex]</b>	0x48	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Non Reentrant	
<b>Parameters (in)</b>	wakeupSource	-
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	The callout shall stop the given wakeup source(s) after unsuccessful wakeup validation.	
<b>Available via</b>	EcuM_Externals.h	

## EcuM\_MainFunction

<b>Service Name</b>	EcuM_MainFunction	
<b>Syntax</b>	<pre>void EcuM_MainFunction (     void )</pre>	
<b>Service ID [hex]</b>	0x18	
<b>Description</b>	The purpose of this service is to implement all activities of the ECU State Manager while the OS is up and running.	
<b>Available via</b>	SchM_EcuM.h	

Callbacks from the STARTUP phase

<b>Service Name</b>	EcuM_AL_DriverInitBswM_<x>
<b>Syntax</b>	void EcuM_AL_DriverInitBswM_<x> ( void )
<b>Service ID [hex]</b>	0x28
<b>Sync/Async</b>	Synchronous
<b>Reentrancy</b>	Non Reentrant
<b>Parameters (in)</b>	None
<b>Parameters (inout)</b>	None
<b>Parameters (out)</b>	None
<b>Return value</b>	None
<b>Description</b>	This callback shall provide BSW module initializations to be called by the BSW Mode Manager.
<b>Available via</b>	EcuM.h

Ports and Port Interface for EcuM\_ShutdownTarget Interface

EcuM\_ShutdownTarget客户端-服务器接口允许 SW-C 选择一个关闭目标，该目标将在下一个关闭阶段得到遵守。但是，请注意，ECU 管理器模块不提供端口接口来允许 SW-C 启动关断。

Service Interfaces

<b>Name</b>	EcuM_ShutdownTarget		
<b>Comment</b>	A SW-C can select a shutdown target using this interface		
<b>IsService</b>	true		
<b>Variation</b>	-		
<b>Possible Errors</b>	0	E_OK	Operation successful
	1	E_NOT_OK	Operation failed

<b>Operation</b>	GetLastShutdownTarget																
<b>Comment</b>	Returns the shutdown target of the previous shutdown																
<b>Mapped to AP</b>	<a href="#">EcuM_GetLastShutdownTarget</a>																
<b>Variation</b>																	
	<b>shutdownTarget</b> <table border="1"> <tr> <td>Type</td> <td><a href="#">EcuM_ShutdownTargetType</a></td> </tr> <tr> <td>Direction</td> <td>OUT</td> </tr> <tr> <td>Comment</td> <td>The shutdown target of the previous shutdown</td> </tr> <tr> <td>Variation</td> <td>—</td> </tr> </table> <b>shutdownMode</b> <table border="1"> <tr> <td>Type</td> <td><a href="#">EcuM_ShutdownMode_Type</a></td> </tr> <tr> <td>Direction</td> <td>OUT</td> </tr> <tr> <td>Comment</td> <td>The sleep mode (if target is ECUM_SHUTDOWN_TARGET_SLEEP) or the reset mechanism (if target is ECUM_SHUTDOWN_TARGET_RESET) of the</td> </tr> <tr> <td>Variation</td> <td>—</td> </tr> </table>	Type	<a href="#">EcuM_ShutdownTargetType</a>	Direction	OUT	Comment	The shutdown target of the previous shutdown	Variation	—	Type	<a href="#">EcuM_ShutdownMode_Type</a>	Direction	OUT	Comment	The sleep mode (if target is ECUM_SHUTDOWN_TARGET_SLEEP) or the reset mechanism (if target is ECUM_SHUTDOWN_TARGET_RESET) of the	Variation	—
Type	<a href="#">EcuM_ShutdownTargetType</a>																
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Comment	The sleep mode (if target is ECUM_SHUTDOWN_TARGET_SLEEP) or the reset mechanism (if target is ECUM_SHUTDOWN_TARGET_RESET) of the																
Variation	—																
<b>Possible Errors</b>	<a href="#">E_OK</a> <a href="#">E_NOT_OK</a>																

<b>Operation</b>	GetShutdownCause								
<b>Comment</b>	Returns the selected shutdown cause as set by the operation SelectShutdownCause.								
<b>Mapped to API</b>	<a href="#">EcuM_GetShutdownCause</a>								
<b>Variation</b>	—								
<b>Parameters</b>	<b>shutdownCause</b> <table border="1"> <tr> <td>Type</td> <td><a href="#">EcuM_ShutdownCauseType</a></td> </tr> <tr> <td>Direction</td> <td>OUT</td> </tr> <tr> <td>Comment</td> <td>The selected cause of the next shutdown</td> </tr> <tr> <td>Variation</td> <td>—</td> </tr> </table>	Type	<a href="#">EcuM_ShutdownCauseType</a>	Direction	OUT	Comment	The selected cause of the next shutdown	Variation	—
Type	<a href="#">EcuM_ShutdownCauseType</a>								
Direction	OUT								
Comment	The selected cause of the next shutdown								
Variation	—								
<b>Possible Errors</b>	<a href="#">E_OK</a> <a href="#">E_NOT_OK</a>								

<b>Operation</b>	GetShutdownTarget																
<b>Comment</b>	Returns the currently selected shutdown target for the next shutdown as set by the operation SelectShutdownTarget.																
<b>Mapped to API</b>	<a href="#">EcuM_GetShutdownTarget</a>																
<b>Variation</b>	–																
<b>Parameters</b>	<p>shutdownTarget</p> <table> <tr> <td><b>Type</b></td><td><a href="#">EcuM_ShutdownTargetType</a></td></tr> <tr> <td><b>Direction</b></td><td>OUT</td></tr> <tr> <td><b>Comment</b></td><td>The shutdown target of the next shutdown</td></tr> <tr> <td><b>Variation</b></td><td>–</td></tr> </table> <p>shutdownMode</p> <table> <tr> <td><b>Type</b></td><td><a href="#">EcuM_ShutdownModeType</a></td></tr> <tr> <td><b>Direction</b></td><td>OUT</td></tr> <tr> <td><b>Comment</b></td><td>The sleep mode (if target is ECUM_SHUTDOWN_TARGET_SLEEP) or the reset mechanism (if target is ECUM_SHUTDOWN_TARGET_RESET) of the shutdown</td></tr> <tr> <td><b>Variation</b></td><td>–</td></tr> </table>	<b>Type</b>	<a href="#">EcuM_ShutdownTargetType</a>	<b>Direction</b>	OUT	<b>Comment</b>	The shutdown target of the next shutdown	<b>Variation</b>	–	<b>Type</b>	<a href="#">EcuM_ShutdownModeType</a>	<b>Direction</b>	OUT	<b>Comment</b>	The sleep mode (if target is ECUM_SHUTDOWN_TARGET_SLEEP) or the reset mechanism (if target is ECUM_SHUTDOWN_TARGET_RESET) of the shutdown	<b>Variation</b>	–
<b>Type</b>	<a href="#">EcuM_ShutdownTargetType</a>																
<b>Direction</b>	OUT																
<b>Comment</b>	The shutdown target of the next shutdown																
<b>Variation</b>	–																
<b>Type</b>	<a href="#">EcuM_ShutdownModeType</a>																
<b>Direction</b>	OUT																
<b>Comment</b>	The sleep mode (if target is ECUM_SHUTDOWN_TARGET_SLEEP) or the reset mechanism (if target is ECUM_SHUTDOWN_TARGET_RESET) of the shutdown																
<b>Variation</b>	–																
<b>Possible Errors</b>	<a href="#">E_OK</a> <a href="#">E_NOT_OK</a>																

<b>Operation</b>	SelectShutdownCause								
<b>Comment</b>	–								
<b>Mapped to API</b>	<a href="#">EcuM_SelectShutdownCause</a>								
<b>Variation</b>	–								
<b>Parameters</b>	<p>shutdownCause</p> <table> <tr> <td><b>Type</b></td><td><a href="#">EcuM_ShutdownCauseType</a></td></tr> <tr> <td><b>Direction</b></td><td>IN</td></tr> <tr> <td><b>Comment</b></td><td>The selected shutdown cause</td></tr> <tr> <td><b>Variation</b></td><td>–</td></tr> </table>	<b>Type</b>	<a href="#">EcuM_ShutdownCauseType</a>	<b>Direction</b>	IN	<b>Comment</b>	The selected shutdown cause	<b>Variation</b>	–
<b>Type</b>	<a href="#">EcuM_ShutdownCauseType</a>								
<b>Direction</b>	IN								
<b>Comment</b>	The selected shutdown cause								
<b>Variation</b>	–								
<b>Possible Errors</b>	<a href="#">E_OK</a> <a href="#">E_NOT_OK</a>								

<b>Operation</b>	SelectShutdownTarget																
<b>Comment</b>	The SW-C selects the cause corresponding to the next shutdown target																
<b>Mapped to API</b>	<a href="#">EcuM_SelectShutdownTarget</a>																
<b>Variation</b>	–																
<b>Parameters</b>	<p>shutdownTarget</p> <table> <tr> <td><b>Type</b></td><td><a href="#">EcuM_Shutdown targetType</a></td></tr> <tr> <td><b>Direction</b></td><td>IN</td></tr> <tr> <td><b>Comment</b></td><td>The selected shutdown cause</td></tr> <tr> <td><b>Variation</b></td><td>–</td></tr> </table> <p>shutdownMode</p> <table> <tr> <td><b>Type</b></td><td><a href="#">EcuM_Shutdown modeType</a></td></tr> <tr> <td><b>Direction</b></td><td>IN</td></tr> <tr> <td><b>Comment</b></td><td>The identifier of a sleep mode (if shutdownTarget is ECUM_SHUTDOWN_TARGET_SLEEP) or a reset mechanism (if shutdownTarget is ECUM_SHUTDOWN_TARGET_RESET) as defined by configuration.</td></tr> <tr> <td><b>Variation</b></td><td>–</td></tr> </table>	<b>Type</b>	<a href="#">EcuM_Shutdown targetType</a>	<b>Direction</b>	IN	<b>Comment</b>	The selected shutdown cause	<b>Variation</b>	–	<b>Type</b>	<a href="#">EcuM_Shutdown modeType</a>	<b>Direction</b>	IN	<b>Comment</b>	The identifier of a sleep mode (if shutdownTarget is ECUM_SHUTDOWN_TARGET_SLEEP) or a reset mechanism (if shutdownTarget is ECUM_SHUTDOWN_TARGET_RESET) as defined by configuration.	<b>Variation</b>	–
<b>Type</b>	<a href="#">EcuM_Shutdown targetType</a>																
<b>Direction</b>	IN																
<b>Comment</b>	The selected shutdown cause																
<b>Variation</b>	–																
<b>Type</b>	<a href="#">EcuM_Shutdown modeType</a>																
<b>Direction</b>	IN																
<b>Comment</b>	The identifier of a sleep mode (if shutdownTarget is ECUM_SHUTDOWN_TARGET_SLEEP) or a reset mechanism (if shutdownTarget is ECUM_SHUTDOWN_TARGET_RESET) as defined by configuration.																
<b>Variation</b>	–																
<b>Possible Errors</b>	<a href="#">E_OK</a> <a href="#">E_NOT_OK</a>																

Port Interface for EcuM\_BootTarget Interface

想要选择引导目标的SW-C必须需要客户端-服务器接口EcuM\_BootT target。

Service Interfaces

Name	<a href="#">EcuM_BootTarget</a>		
<b>Comment</b>	A SW-C that wants to select a boot target must use the client-server interface <a href="#">EcuM_Boot</a>		
<b>IsService</b>	true		
<b>Variation</b>			
<b>Possible Errors</b>	0	<a href="#">E_OK</a>	Operation successful
	1	<a href="#">E_NOT_OK</a>	Operation failed

<b>Operation</b>	GetBootTarget										
<b>Comment</b>	Returns the current boot target										
<b>Mapped to API</b>	<a href="#">EcuM_GetBootTarget</a>										
<b>Variation</b>	–										
<b>Parameters</b>	<p>target</p> <table> <tr> <td><b>Type</b></td><td><a href="#">EcuM_Boot targetType</a></td></tr> <tr> <td><b>Direction</b></td><td>OUT</td></tr> <tr> <td><b>Comment</b></td><td>The currently selected boot target</td></tr> <tr> <td><b>Variation</b></td><td>–</td></tr> </table>			<b>Type</b>	<a href="#">EcuM_Boot targetType</a>	<b>Direction</b>	OUT	<b>Comment</b>	The currently selected boot target	<b>Variation</b>	–
<b>Type</b>	<a href="#">EcuM_Boot targetType</a>										
<b>Direction</b>	OUT										
<b>Comment</b>	The currently selected boot target										
<b>Variation</b>	–										
<b>Possible Errors</b>	<a href="#">E_OK</a>										

<b>Operation</b>	SelectBootTarget
<b>Comment</b>	Selects a boot target
<b>Mapped to API</b>	<a href="#">EcuM_SelectBootTarget</a>
<b>Variation</b>	-
<b>Parameters</b>	target
	<b>Type</b> <a href="#">EcuM_BootTargetType</a>
	<b>Direction</b> IN
	<b>Comment</b> The selected boot target
	<b>Variation</b> -
<b>Possible Errors</b>	<a href="#">E_OK</a> <a href="#">E_NOT_OK</a>

## Port Interface for EcuM\_AlarmClock Interface

想要使用闹钟的 SW-C 必须要求客户端-服务器接口EcuM\_AlarmClock。EcuM\_AlarmClock 接口使用端口定义的参数值来标识管理其闹钟的用户。

## Service Interfaces

<b>Name</b>	EcuM_AlarmClock		
<b>Comment</b>	A SW-C that wants to use an alarm clock must use the client-server interface EcuM_Alarm Clock.		
<b>IsService</b>	true		
<b>Variation</b>	{ecuc(EcuM/EcuMFlexGeneral/EcuMAlarmClockPresent)} == True		
<b>Possible Errors</b>	0	<a href="#">E_OK</a>	Operation successful
	1	<a href="#">E_NOT_OK</a>	Operation failed
	3	<a href="#">ECUM_E_EARLIER_ACTIVE</a>	An earlier alarm is already set
	4	<a href="#">ECUM_E_PAST</a>	The desired point in time has already passed
	5	<a href="#">ECUM_E_NOT_ACTIVE</a>	No active alarm found

<b>Operation</b>	AbortWakeupAlarm		
<b>Comment</b>	Aborts the wakeup alarm previously set by this user		
<b>Mapped to API</b>	<a href="#">EcuM_AbortWakeupAlarm</a>		
<b>Variation</b>	-		
<b>Possible Errors</b>	<a href="#">E_OK</a> <a href="#">E_NOT_OK</a> <a href="#">ECUM_E_NOT_ACTIVE</a>		

<b>Operation</b>	SetAbsWakeupAlarm		
<b>Comment</b>	Sets the user's wakeup alarm to an absolute point in time		
<b>Mapped to API</b>	<a href="#">EcuM_SetAbsWakeupAlarm</a>		
<b>Variation</b>	–		
<b>Parameters</b>	time <b>Type</b> <a href="#">EcuM_TimeType</a> <b>Direction</b> IN <b>Comment</b> Absolute time in seconds. Note that, absolute alarms use knowledge of the current time <b>Variation</b> –		
<b>Possible Errors</b>	<a href="#">E_OK</a> <a href="#">E_NOT_OK</a> <a href="#">ECUM_E_EARLIER_ACTIVE</a> <a href="#">ECUM_E_PAST</a>		

<b>Operation</b>	SetClock		
<b>Comment</b>	Sets the EcuM clock time to the provided value		
<b>Mapped to API</b>	<a href="#">EcuM_SetClock</a>		
<b>Variation</b>	–		
<b>Parameters</b>	time <b>Type</b> <a href="#">EcuM_TimeType</a> <b>Direction</b> IN <b>Comment</b> Absolute time in seconds since battery connect <b>Variation</b> –		
<b>Possible Errors</b>	<a href="#">E_OK</a> <a href="#">E_NOT_OK</a>		

<b>Operation</b>	SetRelWakeupAlarm		
<b>Comment</b>	Sets a user's wakeup alarm relative to the current point in time		
<b>Mapped to API</b>	<a href="#">EcuM_SetRelWakeupAlarm</a>		
<b>Variation</b>	–		
<b>Parameters</b>	time <b>Type</b> <a href="#">EcuM_TimeType</a> <b>Direction</b> IN <b>Comment</b> Relative time from now in seconds <b>Variation</b> –		
<b>Possible Errors</b>	<a href="#">E_OK</a> <a href="#">E_NOT_OK</a> <a href="#">ECUM_E_EARLIER_ACTIVE</a>		

Port Interface for EcuM\_Time Interface

想要使用EucM的时间功能的SW-C必须需要客户端-服务器接口EcuM\_time

Service Interfaces

<b>Name</b>	EcuM_Time		
<b>Comment</b>	—		
<b>IsService</b>	true		
<b>Variation</b>	—		
<b>Possible Errors</b>	0	E_OK	Operation successful
	1	E_NOT_OK	Operation failed

<b>Operation</b>	GetCurrentTime		
<b>Comment</b>	返回EcuM时钟的当前值（即电池连接后的秒数）		
<b>Mapped to API</b>	<a href="#">EcuM_GetCurrentTime</a>		
<b>Variation</b>	—		
<b>Parameters</b>	time		
	Type	<a href="#">EcuM_TimeType</a>	
	Direction	OUT	
	Comment	Absolute time in seconds since battery connect	
	Variatio		
<b>Possible Errors</b>	E_OK E_NOT_OK		

<b>Operation</b>	GetWakeupTime		
<b>Comment</b>	Returns the current value of the master alarm clock (the minimum absolute time of all user alarm clocks)		
<b>Mapped to API</b>	<a href="#">EcuM_GetWakeupTime</a>		
<b>Variation</b>	—		
<b>Parameters</b>	time		
	Type	<a href="#">EcuM_TimeType</a>	
	Direction	OUT	
	Comment	Absolute time in seconds for next wakeup. 0xFFFFFFFF means no active alarm.	
	Variatio	—	
<b>Possible Errors</b>	E_OK E_NOT_OK		

Port Interface for EcuM\_StateRequest Interface

当容器 EcuMMModeHandling 可用时，ECU 状态管理器模块应为以下功能提供系统服务：

- requesting RUN
- releasing RUN
- requesting POST\_RUN
- releasing POST\_RUN

需要保持 ECU 活动状态或需要在 ECU 关闭之前执行任何操作的 SW-C 需要客户端-服务器接口 EcuM\_StateRequest。此接口使用端口定义的参数值来标识请求模式的用户。

Service Interfaces

<b>Name</b>	EcuM_StateRequest		
<b>Comment</b>	Interface to request a specific ECU state		
<b>IsService</b>	true		
<b>Variation</b>	–		
<b>Possible Errors</b>	0	E_OK	Operation successful
	1	E_NOT_OK	Operation failed

<b>Operation</b>	ReleasePOSTRUN		
<b>Comment</b>	–		
<b>Mapped to API</b>	<a href="#">EcuM_ReleasePOST_RUN</a>		
<b>Variation</b>	–		
<b>Possible Errors</b>	<a href="#">E_OK</a> <a href="#">E_NOT_OK</a>		

<b>Operation</b>	ReleaseRUN		
<b>Comment</b>	–		
<b>Mapped to API</b>	<a href="#">EcuM_ReleaseRUN</a>		
<b>Variation</b>	–		
<b>Possible Errors</b>	<a href="#">E_OK</a> <a href="#">E_NOT_OK</a>		

<b>Operation</b>	RequestPOSTRUN		
<b>Comment</b>	–		
<b>Mapped to API</b>	<a href="#">EcuM_RequestPOST_RUN</a>		
<b>Variation</b>	–		
<b>Possible Errors</b>	<a href="#">E_OK</a> <a href="#">E_NOT_OK</a>		

<b>Operation</b>	RequestRUN		
<b>Comment</b>	–		
<b>Mapped to API</b>	<a href="#">EcuM_RequestRUN</a>		
<b>Variation</b>	–		
<b>Possible Errors</b>	<a href="#">E_OK</a> <a href="#">E_NOT_OK</a>		

Port Interface for EcuM\_CurrentMode Interface

ECU 状态管理器模块的模式端口应声明以下模式:

- STARTUP
- RUN
- POST\_RUN
- SLEEP
- SHUTDOWN

此定义是应用程序确实需要知道的ECU模式的简化视图。它不会以任何方式限制或限制如何定义应用程序模式。应用程序模式完全由应用程序本身处理。

发生模式更改时，应通过 RTE 模式端口将模式更改通知 SW-C。

该规范假定端口名为 currentMode，并且将使用 RTE 的直接 API。在这些条件下，通过调用 `ype Rte_Switch_currentMode currentMode (Rte_ModeT ype_EcuM_Mode mode) Rte_StatusT` 模式发出信号，其中模式是要通知的新模式。值范围由前面的要求指定。应忽略返回值。

想要收到模式更改通知的 SW-C 应要求模式开关接口 `EcuM_CurrentMode`。

#### Service Interfaces

<b>Name</b>	<code>EcuM_CurrentMode</code>		
<b>Comment</b>	Interface to read the current ECU mode		
<b>IsService</b>	true		
<b>Variation</b>	-		
<b>ModeGroup</b>	currentMode	<code>EcuM_Mode</code>	

#### Definition of the ECU Manager Service

请注意，这些定义只能在ECU配置期间完成（因为某些ECU管理器模块配置参数决定了ECU管理器模块服务提供的端口数）。另请注意，SW-C 的实现不依赖于这些定义。

在 AUTOSAR 系统中，RTE 上方和下方都有端口。ECU 管理器模块服务描述定义了提供给 RTE 的端口，使用此服务的每个软件的描述都必须包含“服务端口”，这些端口需要来自 RTE 的这些 ECU 管理器模块端口。

EcuM 提供以下端口：

<b>Name</b>	<code>ShutdownTarget_{UserName}</code>		
<b>Kind</b>	ProvidedPort	<b>Interface</b>	<code>EcuM_ShutdownTarget</code>
<b>Description</b>	Provides an interface to SW-Cs to select a new shutdown target and query the current shutdown target.		
<b>Variation</b>	<code>UserName = {ecuc(EcuM/EcuMConfiguration/EcuMFlexConfiguration/EcuMFlexUserConfig/EcuMFlexUser.SHORT-NAME)}</code>		

<b>Name</b>	<code>BootTarget_{UserName}</code>		
<b>Kind</b>	ProvidedPort	<b>Interface</b>	<code>EcuM_BootTarget</code>
<b>Description</b>	Provides an interface to SW-Cs to select a new boot target and query the current boot target.		
<b>Variation</b>	<code>UserName = {ecuc(EcuM/EcuMConfiguration/EcuMFlexConfiguration/EcuMFlexUserConfig/EcuMFlexUser.SHORT-NAME)}</code>		

<b>Name</b>	<code>AlarmClock_{UserName}</code>		
<b>Kind</b>	ProvidedPort	<b>Interface</b>	<code>EcuM_AlarmClock</code>
<b>Description</b>	Provides to SW-Cs an alarm clock. The <code>EcuM_AlarmClock</code> port uses port-defined argument values to identify the user that manages its alarm clock.		
<b>Port Defined Argument Value(s)</b>	<b>Type</b>	<code>EcuM_UserType</code>	
	<b>Value</b>	<code>{ecuc(EcuM/EcuMConfiguration/EcuMFlexConfiguration/EcuMFlexUserConfig/EcuMFlexUser.value)}</code>	
<b>Variation</b>	<code>{ecuc(EcuM/EcuMFlexGeneral/EcuMAutoClockPresent)} == true</code> <code>UserName = {ecuc(EcuM/EcuMConfiguration/EcuMFlexConfiguration/EcuMAutoClock.Clock.SHORT-NAME)}</code>		

<b>Name</b>	time		
<b>Kind</b>	ProvidedPort	<b>Interface</b>	EcuM_Time
<b>Description</b>	Provides the EcuM's time service to SWCs		
<b>Variation</b>	-		

<b>Name</b>	StateRequest_{UserName}		
<b>Kind</b>	ProvidedPort	<b>Interface</b>	EcuM_StateRequest
<b>Description</b>	Provides an interface to SWCs to request state changes of the ECU state. The port uses port-defined argument values to identify the user.		
<b>Port Defined Argument Value(s)</b>	Type	EcuM_UserType	
	Value	{ecuc(EcuM/EcuMConfiguration/EcuMFlexConfiguration/EcuMFlexUserConfig/EcuMFlexUser.value)}	
<b>Variation</b>	UserName -{ecuc(EcuM/EcuMConfiguration/EcuMFlexConfiguration/EcuMFlexUserConfig/EcuMFlexUser.SHORT-NAME)}		

<b>Name</b>	currentMode		
<b>Kind</b>	ProvidedPort	<b>Interface</b>	EcuM_CurrentMode
<b>Description</b>	-		
<b>Variation</b>	-		

EcuM提供以下类型:

<b>Name</b>	EcuM_UserType		
<b>Kind</b>	Type		
<b>Derived from</b>	uint8		
<b>Description</b>	Unique value for each user.		
<b>Variation</b>	-		
<b>Available via</b>	Rte_EcuM_Type.h		

<b>Name</b>	EcuM_TimeType		
<b>Kind</b>	Type		
<b>Derived from</b>	uint32		
<b>Description</b>	This data type represents the time of the ECU Manager module.		
<b>Variation</b>	-		
<b>Available via</b>	Rte_EcuM_Type.h		

<b>Name</b>	EcuM_BootTargetType		
<b>Kind</b>	Type		
<b>Derived from</b>	uint8		
<b>Range</b>	ECUM_BOOT_TARGET_APP	0	The ECU will boot into the application
	ECUM_BOOT_TARGET_OEM_BOOTLOADER	1	The ECU will boot into the OEM bootloader
	ECUM_BOOT_TARGET_SYS_BOOTLOADER	2	The ECU will boot into the system supplier bootloader
<b>Description</b>	This type represents the boot targets the ECU Manager module can be configured with. The default boot target is ECUM_BOOT_TARGET_OEM_BOOTLOADER.		
<b>Variation</b>	-		
<b>Available via</b>	Rte_EcuM_Type.h		

<b>Name</b>	EcuM_ShutdownCauseType		
<b>Kind</b>	Type		
<b>Derived from</b>	uint8		
<b>Range</b>	ECUM_CAUSE_UNKNOWN	0	No cause was set.
	ECUM_CAUSE_ECU_STATE	1	ECU state machine entered a state for shutdown
	ECUM_CAUSE_WDGM	2	Watchdog Manager detected a failure
	ECUM_CAUSE_DCM	3	Diagnostic Communication Manager requests a shutdown due to a service request
<b>Description</b>	This type describes the cause for a shutdown by the ECU State Manager. It can be extended by configuration.		
<b>Variation</b>	-		
<b>Available via</b>	Rte_EcuM_Type.h		

<b>Name</b>	EcuM_ShutdownModeType		
<b>Kind</b>	Type		
<b>Derived from</b>	uint16		
<b>Range</b>	{ecuc(EcuM/EcuMConfiguration/EcuMFlexConfiguration/EcuMResetMode.SHORT-NAME)}	{256 + ecuc(EcuM/EcuMConfiguration/EcuMFlexConfiguration/EcuMResetMode.EcuMResetModelId)}	Configured Reset Modes
	{ecuc(EcuM/EcuMConfiguration/EcuMCommonConfiguration/EcuMSleepMode.SHORT-NAME)}	{ecuc(EcuM/EcuMConfiguration/EcuMCommonConfiguration/EcuMSleepMode.EcuMSleepModelId)}	Configured Sleep Modes
<b>Description</b>	This data type represents the modes of the ECU Manager module.		
<b>Variation</b>	-		
<b>Available via</b>	Rte_EcuM_Type.h		

<b>Name</b>	EcuM_ShutdownTargetType		
<b>Kind</b>	Type		
<b>Derived from</b>	uint8		
<b>Range</b>	ECUM_SHUTDOWN_TARGET_SLEEP	0x0	-
	ECUM_SHUTDOWN_TARGET_RESET	0x1	-
	ECUM_SHUTDOWN_TARGET_OFF	0x2	-
<b>Description</b>	-		
<b>Variation</b>	-		
<b>Available via</b>	Rte_EcuM_Type.h		

对于多核ECU，可以在一个或多个内核上提供EcuM AUTOSAR服务（标准化AUTOSAR接口）。

对于多核ECU，其他BSW模块使用的EcuM C-API接口（标准化接口）应在运行EcuM的每个分区中提供。

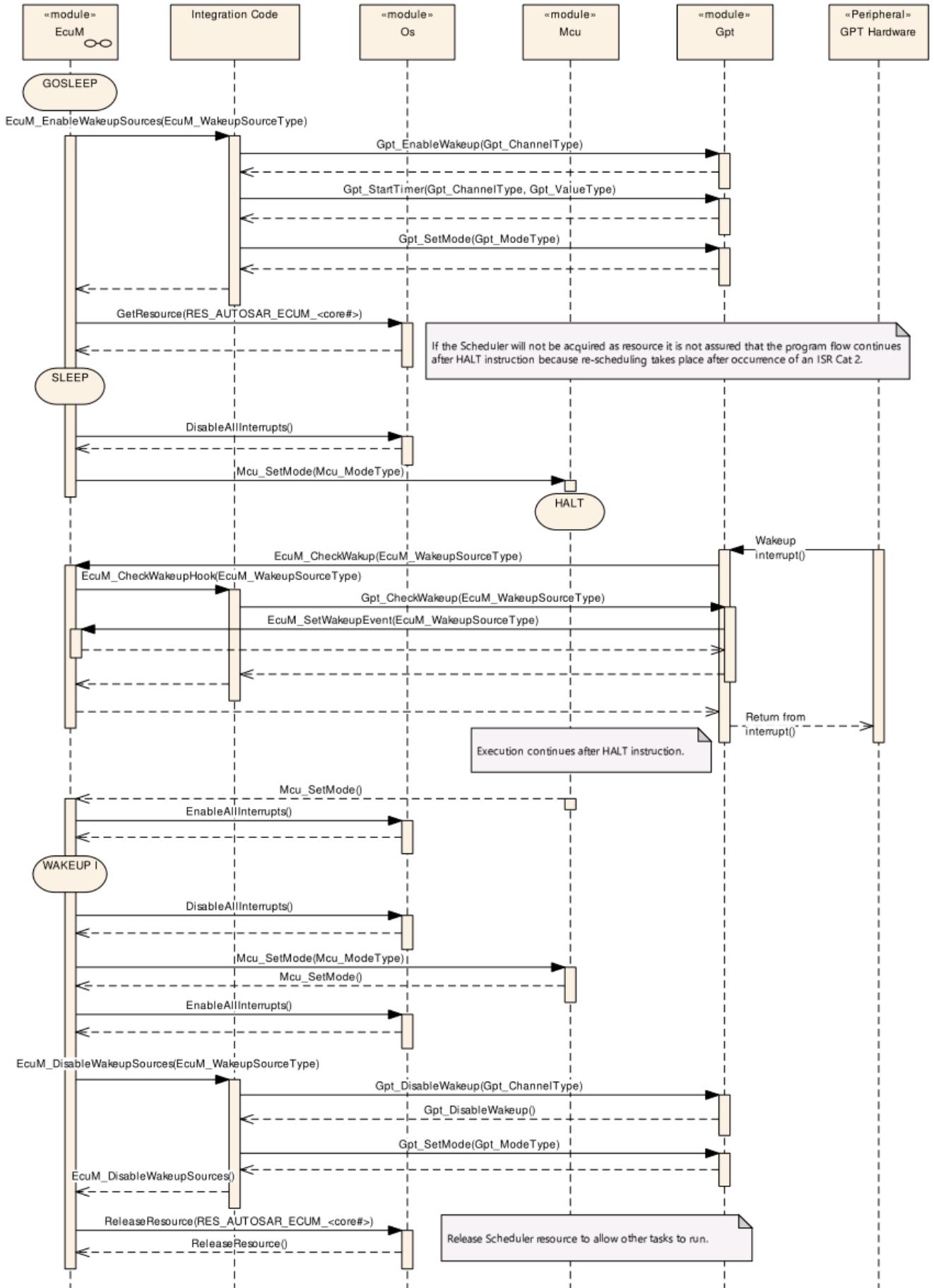
其他 BSW 模块用于与 EcuM 通信的 C-API 接口由每个 EcuM 实例提供，因为每个 EcuM 实例都可以执行一些独立的操作。如果 BSW 模块想要使用 EcuM，但位于不包含自己的 EcuM 实例的分区。这些模块可以使用 SchM 函数来跨越分区边界。

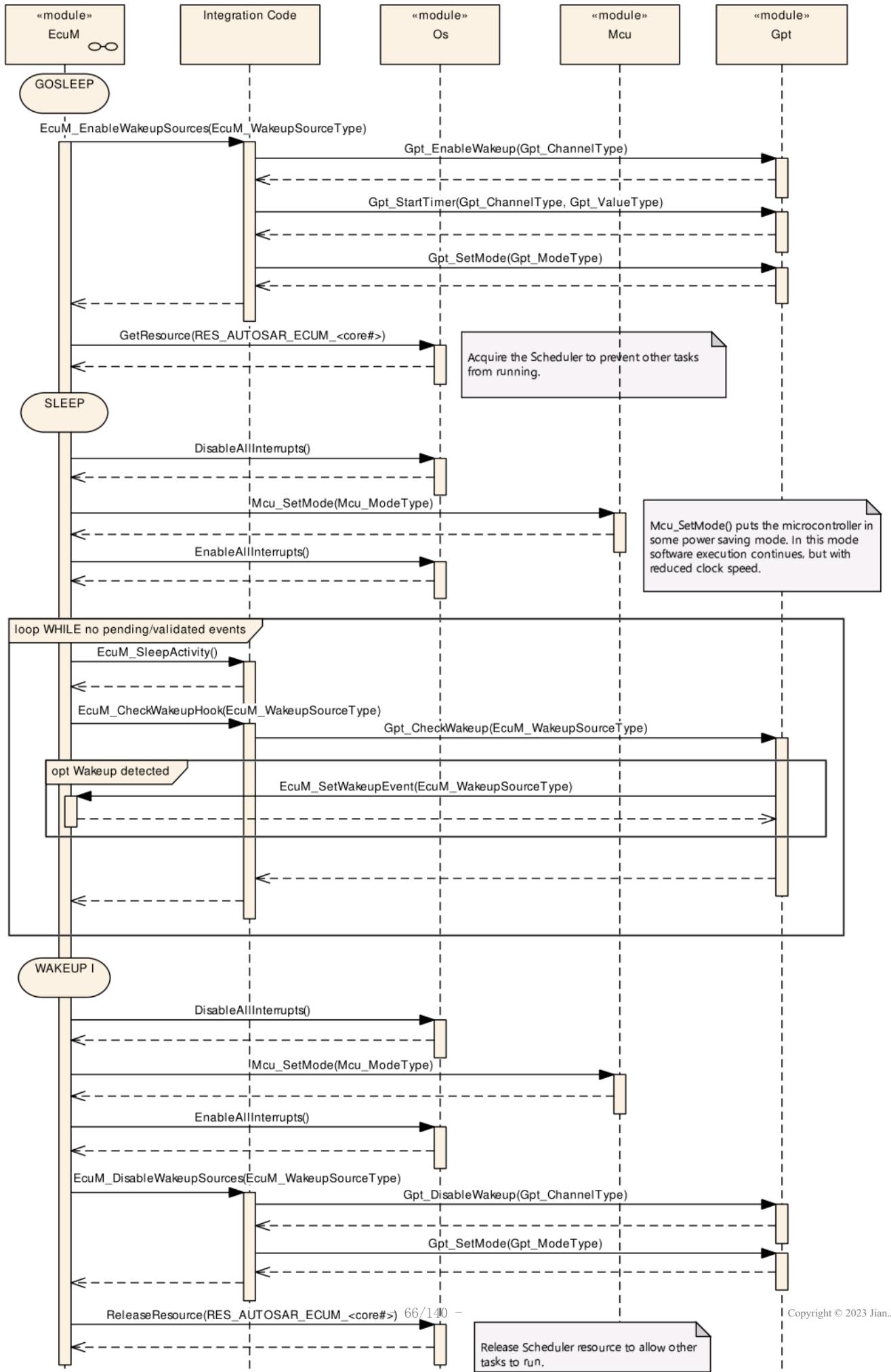
## 2.1.4 Sequence Charts

### Sequence Charts

#### GPT WAKEUP SEQUENCES

通用计时器（GPT）是可能的唤醒源之一。通常，GPT 在 ECU 进入睡眠状态之前启动，硬件计时器在到期时会导致中断。中断唤醒微控制器，并在 GPT 模块中执行中断处理程序。它通知 ECU 状态管理器模块发生了 GPT 唤醒。为了区分导致唤醒的不同 GPT 通道，集成商可以为每个 GPT 通道分配不同的唤醒源标识符。图 9.1 显示了相应的调用顺序。

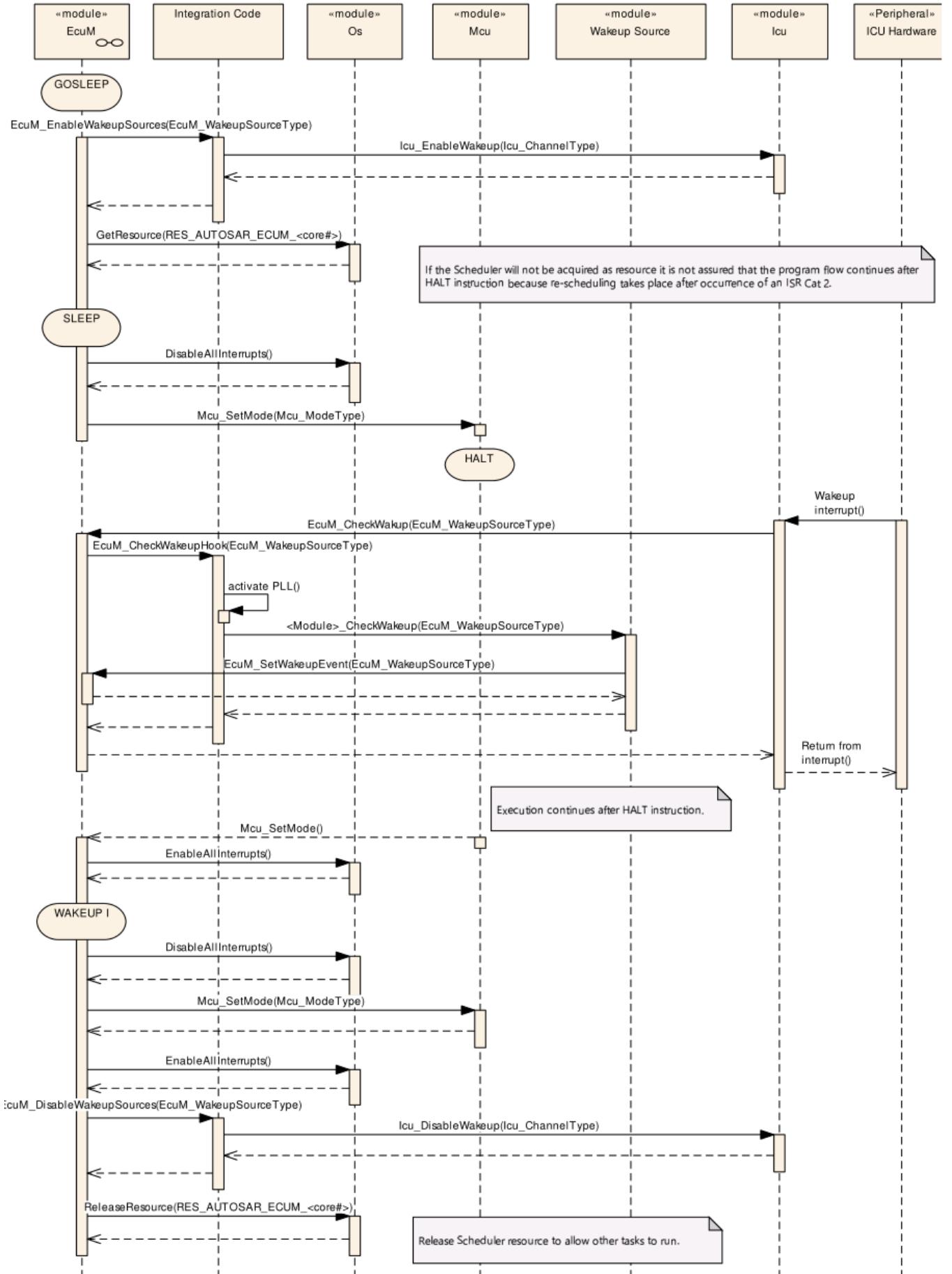
**Figure 9.1: GPT wake up by interrupt**



#### ICU WAKEUP SEQUENCES

输入捕获单元（ICU）是另一个唤醒源。与GPT相反，ICU驱动程序本身并不是唤醒源。它只是处理唤醒中断的模块。因此，只有唤醒源的驱动程序才能判断它是否负责该唤醒。这使得EcuM\_CheckWakeupHook必须询问作为实际唤醒源的模块。为了知道要询问哪个模块，ICU必须将唤醒源的标识符传递给EcuM\_CheckWakeup。对于共享中断，集成代码可能必须检查EcuM\_CheckWakeupHook内的多个唤醒源。为此，ICU必须传递可能导致此中断EcuM\_CheckWakeup的所有唤醒源的标识符。请注意，EcuM\_WakeupSourceType（请参阅 8.2.3 EcuM\_WakeupSourceType）包含每个唤醒源的一个位，因此可以在一次调用中传递多个唤醒源。

图 9.3 显示了生成的调用序列。由于 ICU 只负责处理唤醒中断，因此轮询 ICU 是不明智的。为了轮询，必须直接检查唤醒源，如图 38 所示。

**Figure 9.3: ICU wake up by interrupt**

#### CAN WAKEUP SEQUENCES

在CAN上，收发器或通信控制器可以使用中断或轮询来检测唤醒。唤醒源标识符应在收发器和控制器之间共享，因为ECU状态管理器模块只需要知道已唤醒的网络并将其传递给通信管理器模块。

在中断或共享中断情况下，不清楚哪个特定的唤醒源（CAN控制器、CAN收发器、LIN控制器等）检测到唤醒。因此，集成器必须将派生的 EcuM\_CheckWakeups 唤醒源（wakeupSource），它可以代表共享中断或仅代表中断通道，分配给传递给 CanIf\_CheckWakeups（WakeupSource）的特定唤醒源。因此，这里的参数 wakeupSource 来自 EcuM\_CheckWakeups（）可能与 CanIf\_CheckWakeups 的 WakeupSource 不同，或者它们可以相等。这取决于硬件拓扑和EcuM\_CheckWakeupsHook集成器代码中的实现。

在中断或共享中断情况下，不清楚哪个特定的唤醒源（CAN控制器、CAN收发器、LIN控制器等）检测到唤醒。因此，集成器必须将 EcuM\_CheckWakeups(wakeupSource) 的派生的唤醒源分配给传递给特定唤醒源，它可以代表共享中断或仅代表中断通道，并传递给 CanIf\_CheckWakeups(WakeupSource)。因此，这里的参数 wakeupSource 来自 EcuM\_CheckWakeups（）可能与 CanIf\_CheckWakeups 的 WakeupSource 不同，或者它们可以相等。这取决于硬件拓扑和EcuM\_CheckWakeupsHook集成器代码中的实现。

在CanIf\_CheckWakeups(WakeupSource)期间，CAN接口模块(CanIf)将检查是否有任何设备(CAN通信控制器或收发器)配置了“WakeupSource”的值。如果是这种情况，则通过相应的设备驱动程序模块检查设备是否唤醒。如果设备检测到唤醒，设备驱动程序将通过EcuM\_SetWakeupsEvent(sources)通知 EcuM。参数“sources”在设备上设置为已配置的值。因此它被设置为调用CanIf\_CheckWakeups()时使用的值。

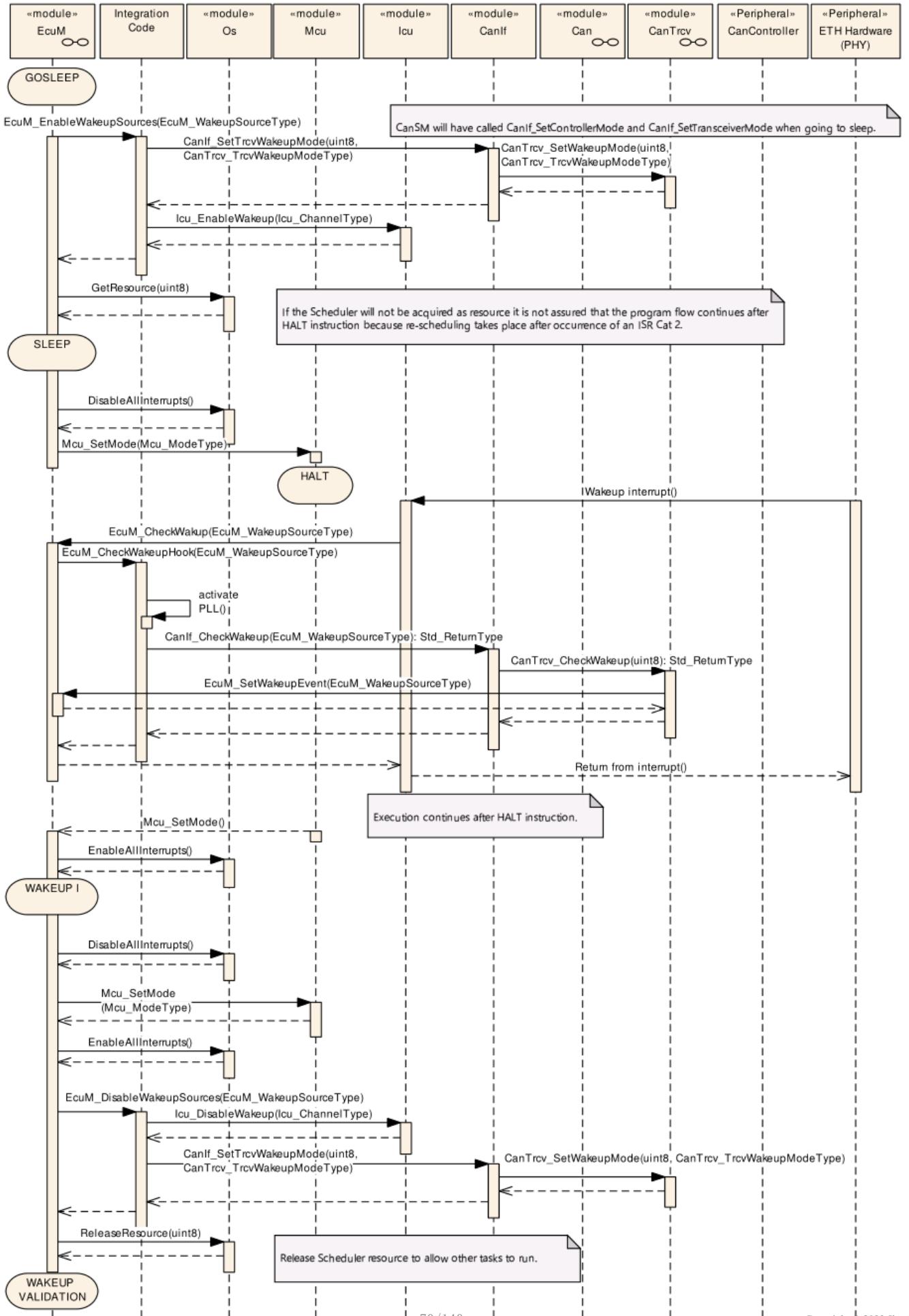


Figure 9.4: CAN transceiver wake up by interrupt

CAN控制器中断唤醒的工作方式类似于GPT唤醒。此处，中断处理程序和 CheckWakeup 功能都封装在 CAN 驱动程序模块中，如图 9.5 所示。

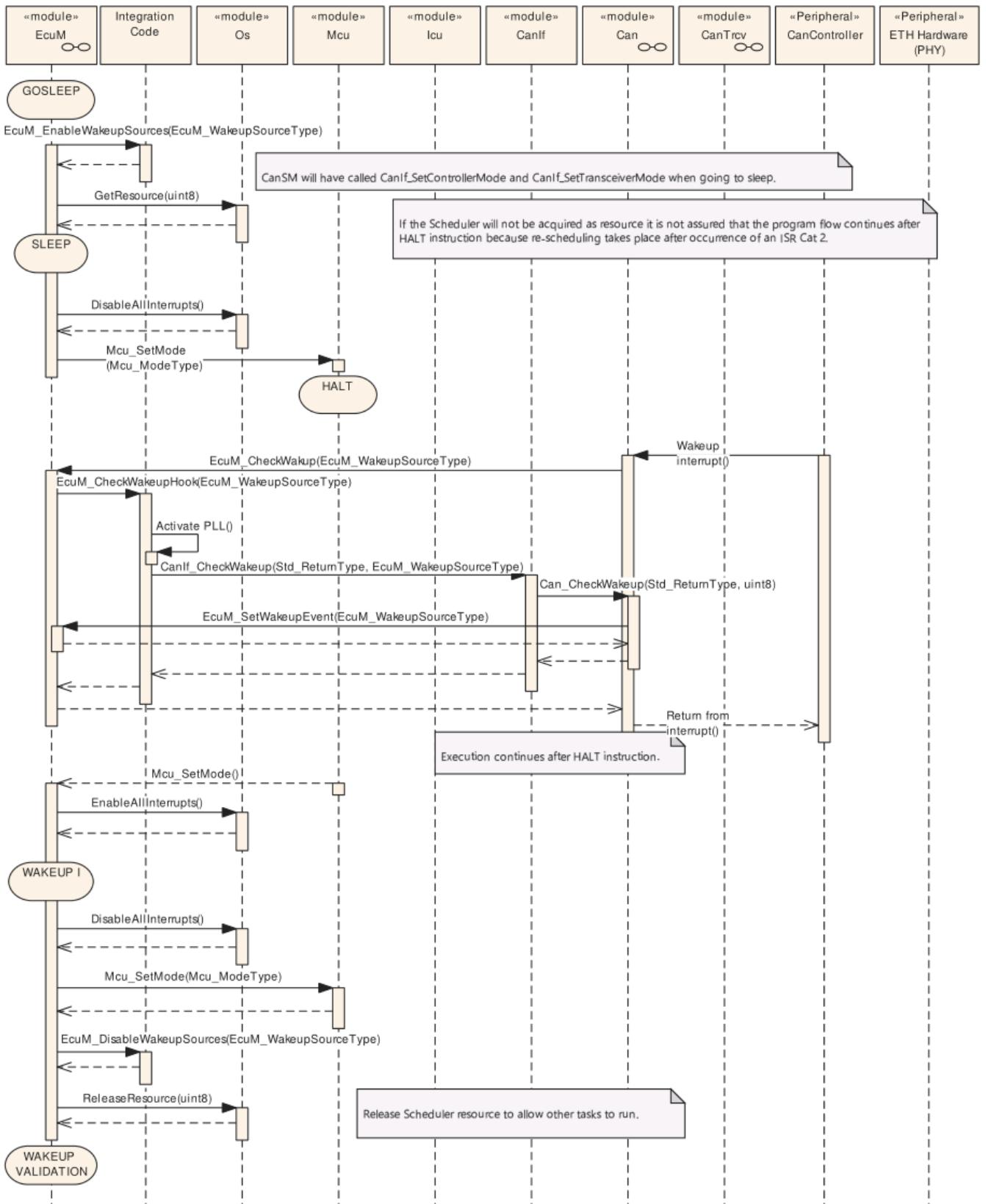


Figure 9.5: CAN controller wake up by interrupt

CAN收发器和控制器都可以通过轮询唤醒。ECU状态管理器模块将定期检查CAN接口模块，该模块根据传递给CAN接口模块的唤醒源参数询问CAN驱动程序模块或CAN收发器驱动程序模块，如图9.6所示。

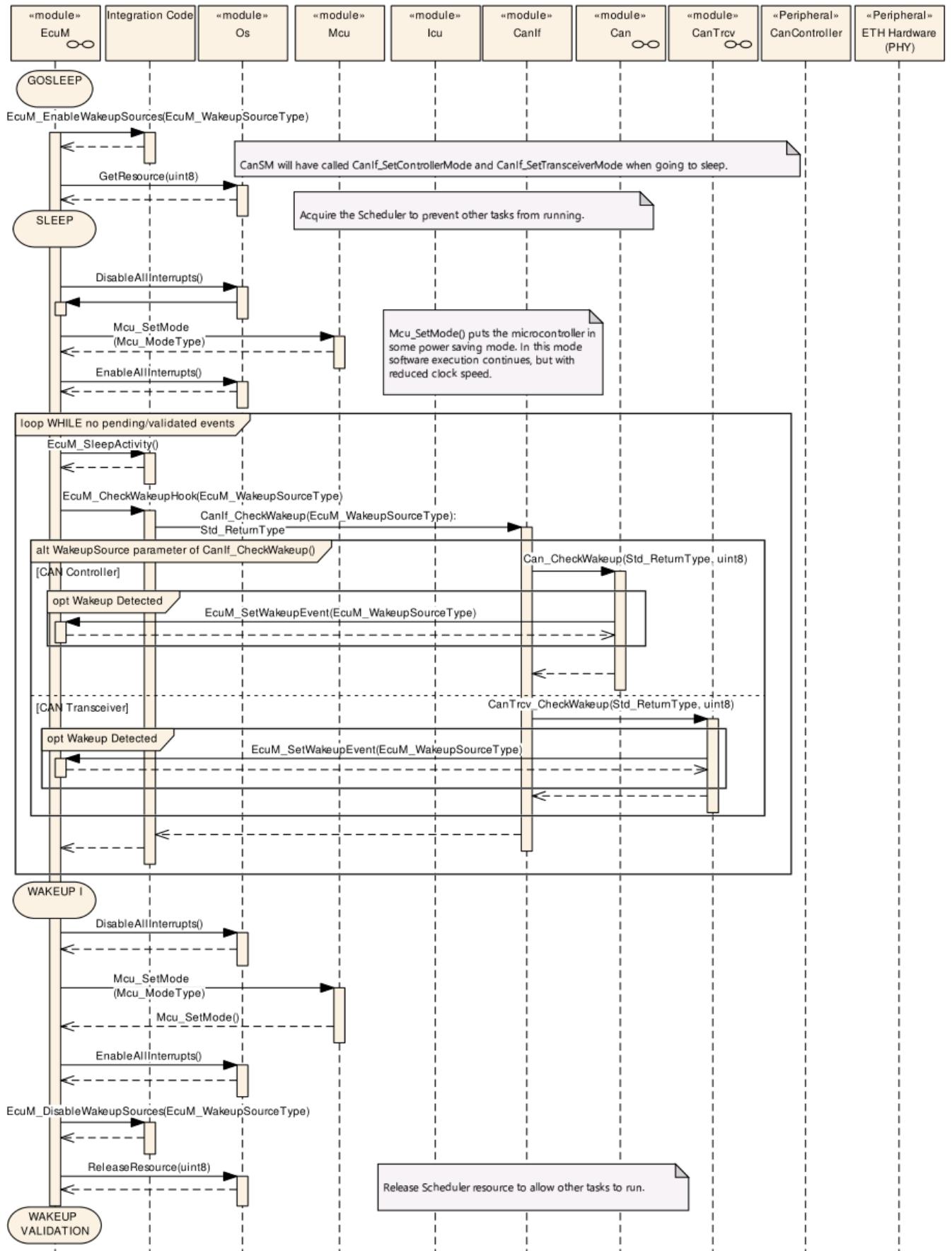
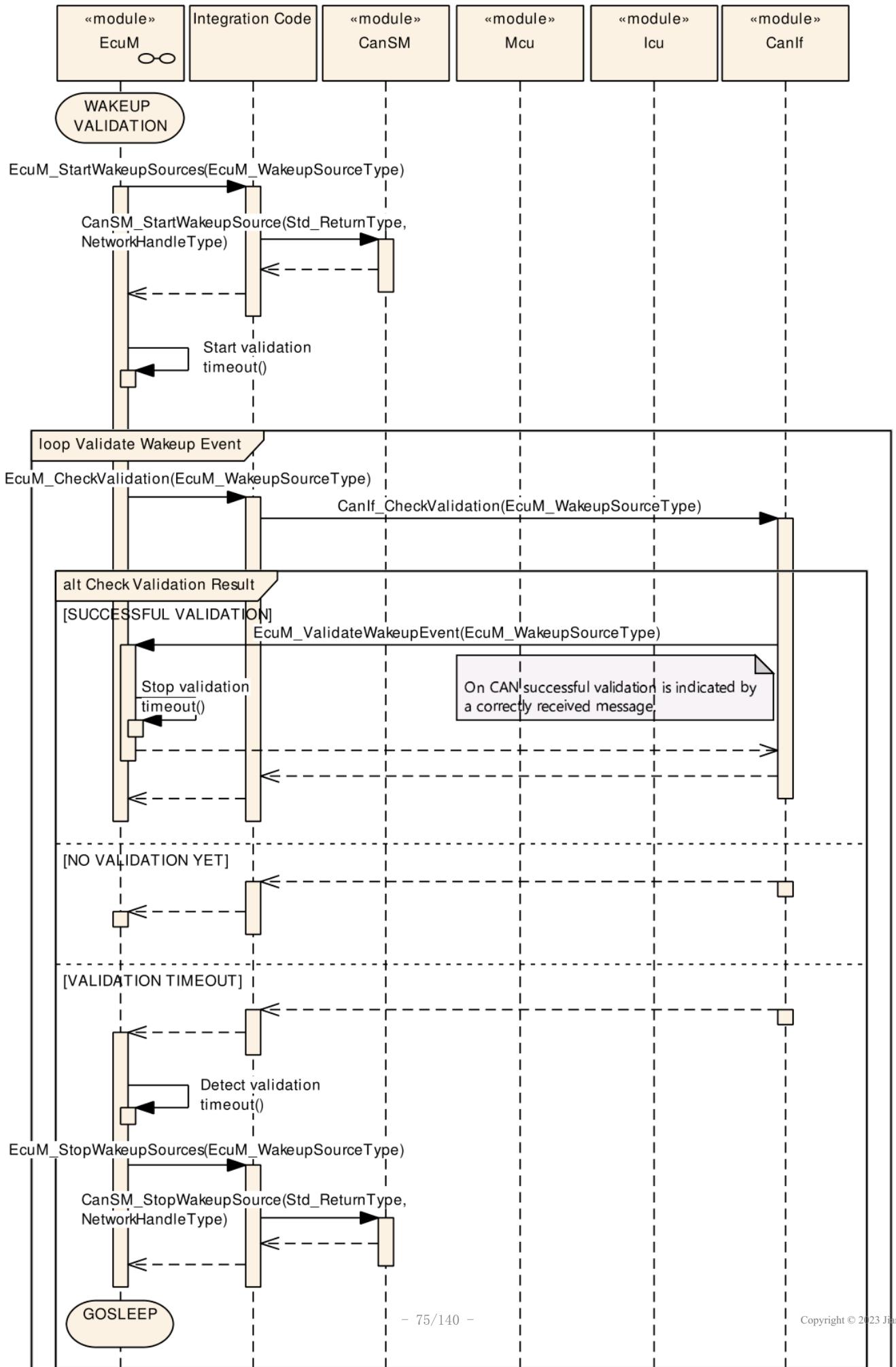


Figure 9.6: CAN controller or transceiver wake up by polling

通过中断或轮询检测到来自CAN收发器或控制器的唤醒事件后，可以验证唤醒事件。这是通过打开EcuM\_StartWakeupSources中相应的CAN收发器和控制器来完成的（参见[SWS\_EcuM\_02924]）。这取决于所使用的CAN收发器和控制器，集成器代码EcuM\_StartWakeupSource中的哪些函数调用是必要的。例如，在图 9.7 中，提到了启动和停止来自 CAN 状态管理器模块的唤醒源所需的函数调用。

CanIf 识别成功接收至少一条消息，并将其记录为成功验证。在验证期间，ECU状态管理器模块定期检查集成器代码EcuM\_CheckValidation中的CanIf ECU状态管理器模块在验证成功后，将通过通信管理器模块继续正常启动CAN网络。



**LIN WAKEUP SEQUENCES**

图9.8显示了LIN收发器通过中断唤醒。中断通常由ICU驱动程序处理，如9.2.2章所述。

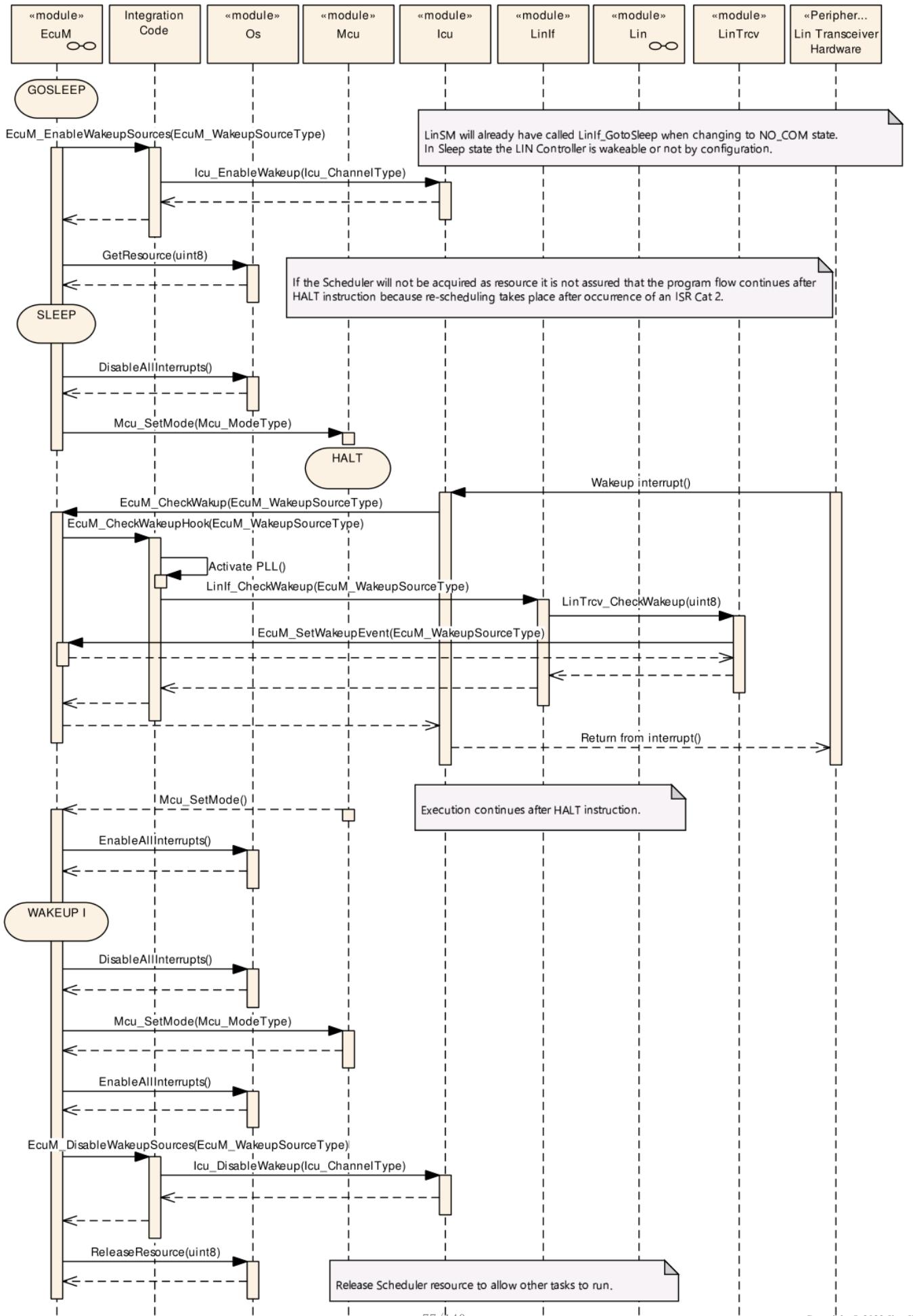


Figure 9.8: LIN transceiver wake up by interrupt

如图9.9所示，LIN控制器中断唤醒原理与CAN控制器中断唤醒原理类似。在这两种情况下，Driver模块封装了中断处理程序。

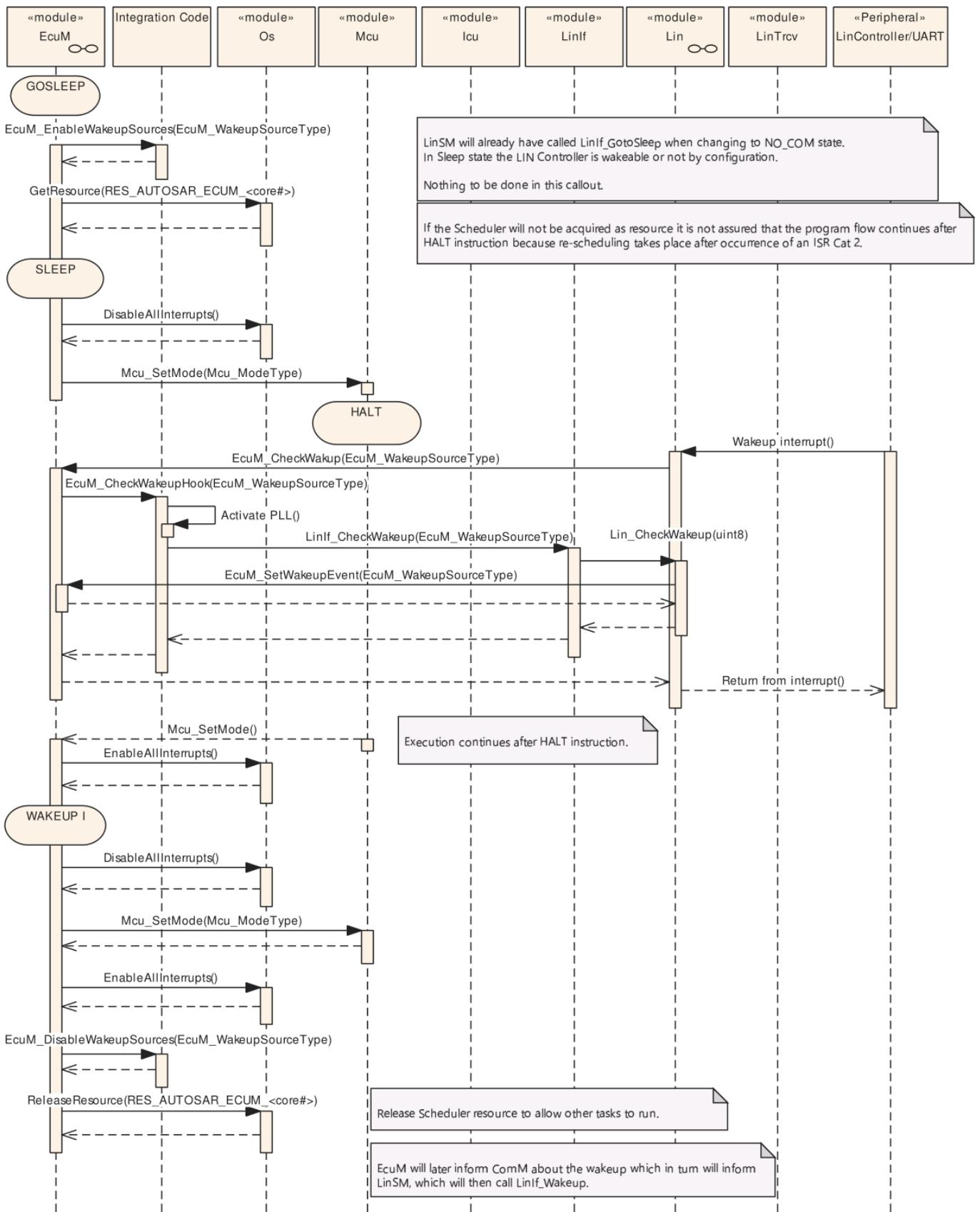
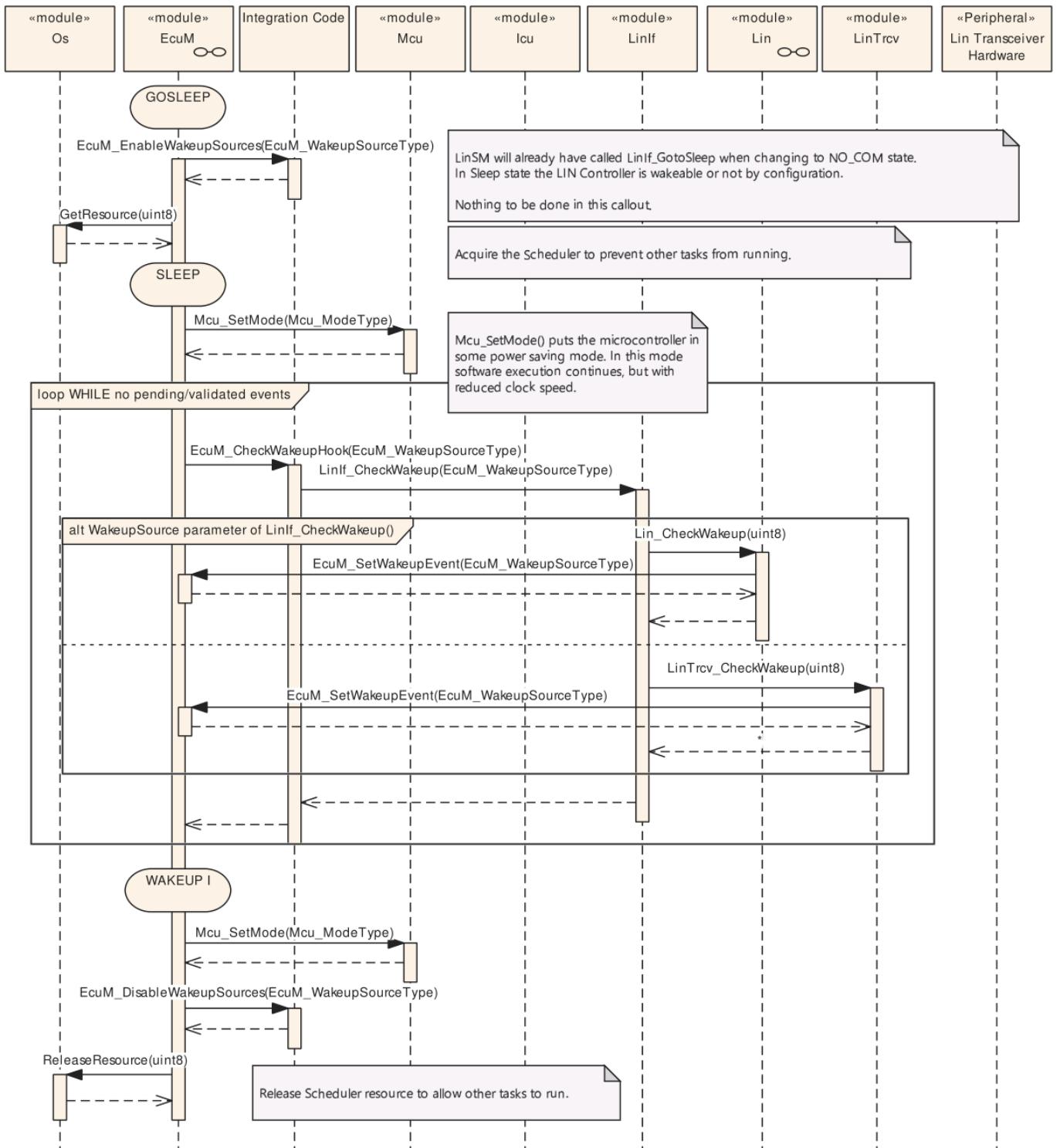


Figure 9.9: LIN controller wake up by interrupt

LIN收发器和控制器可以轮询唤醒。ECU状态管理器模块会定期检查LIN接口模块，而LIN接口模块会询问LIN驱动模块或LIN收发器驱动模块，如图9.10所示。



**Figure 9.10: LIN controller or transceiver wake up by polling**

#### FLEXRAY WAKEUP SEQUENCES

对于FlexRay，只有通过FlexRay收发器才能实现唤醒。FlexRay集群中有两个不同通道的收发器。它们被视为属于一个网络，因此，两个通道应该只配置一个唤醒源标识符。图9.11显示了FlexRay收发器通过中断唤醒。

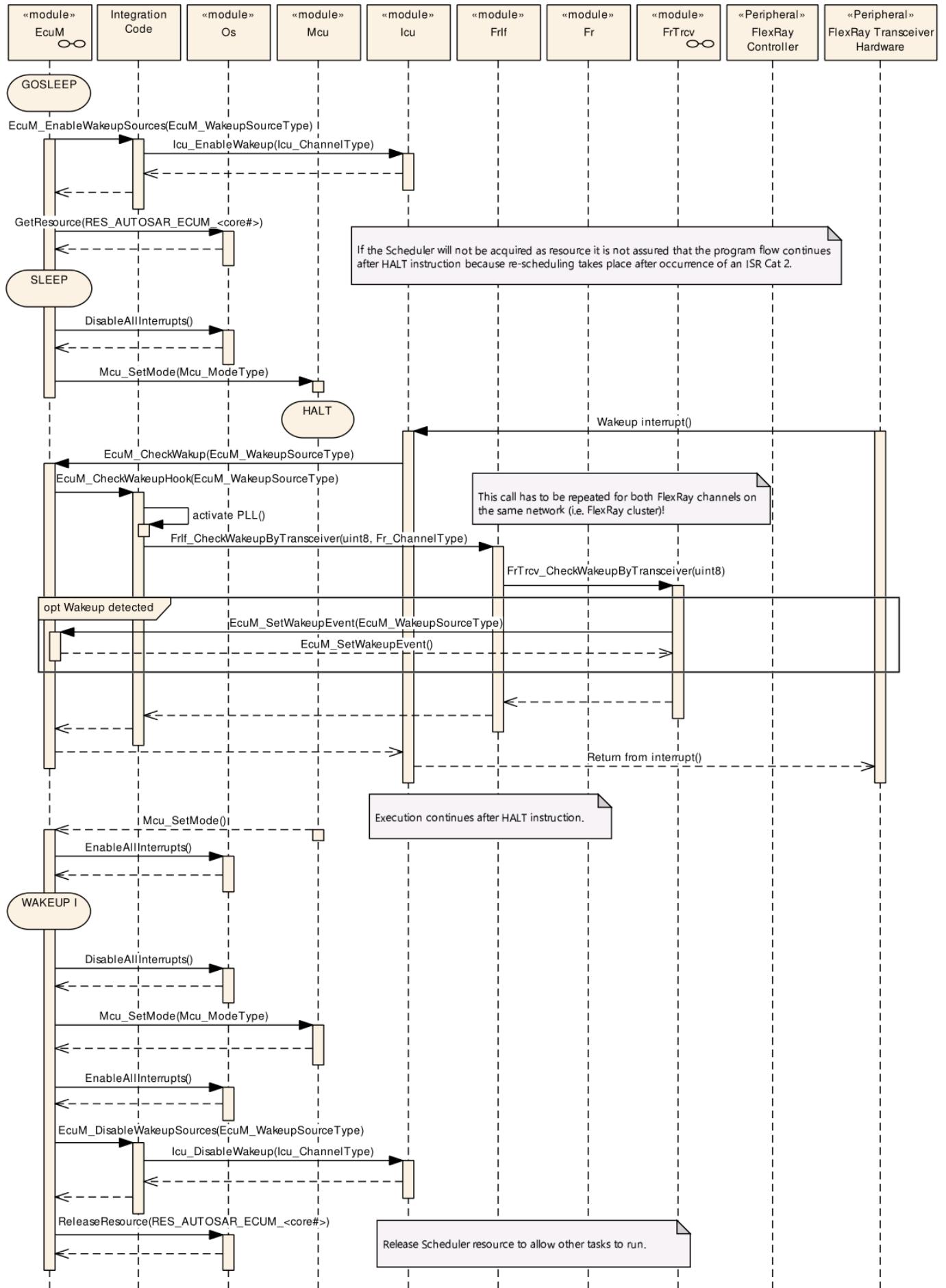


Figure 9.11: FlexRay transceiver wake up by interrupt

注意，在EcuMM\_CheckWakeupHook中需要对FrIf\_WakeupByTransceiver进行两个单独的调用，每个FlexRay通道一个。

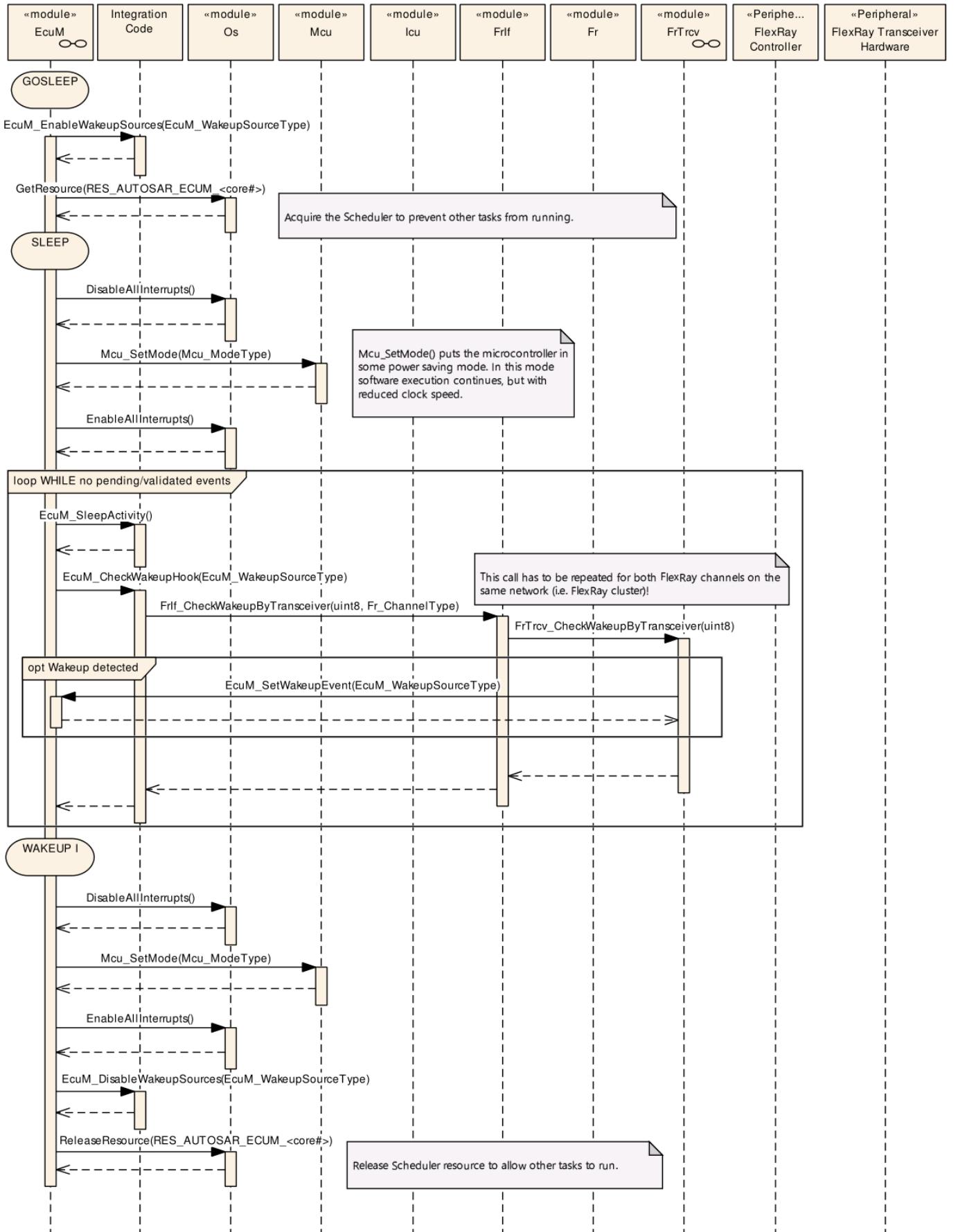


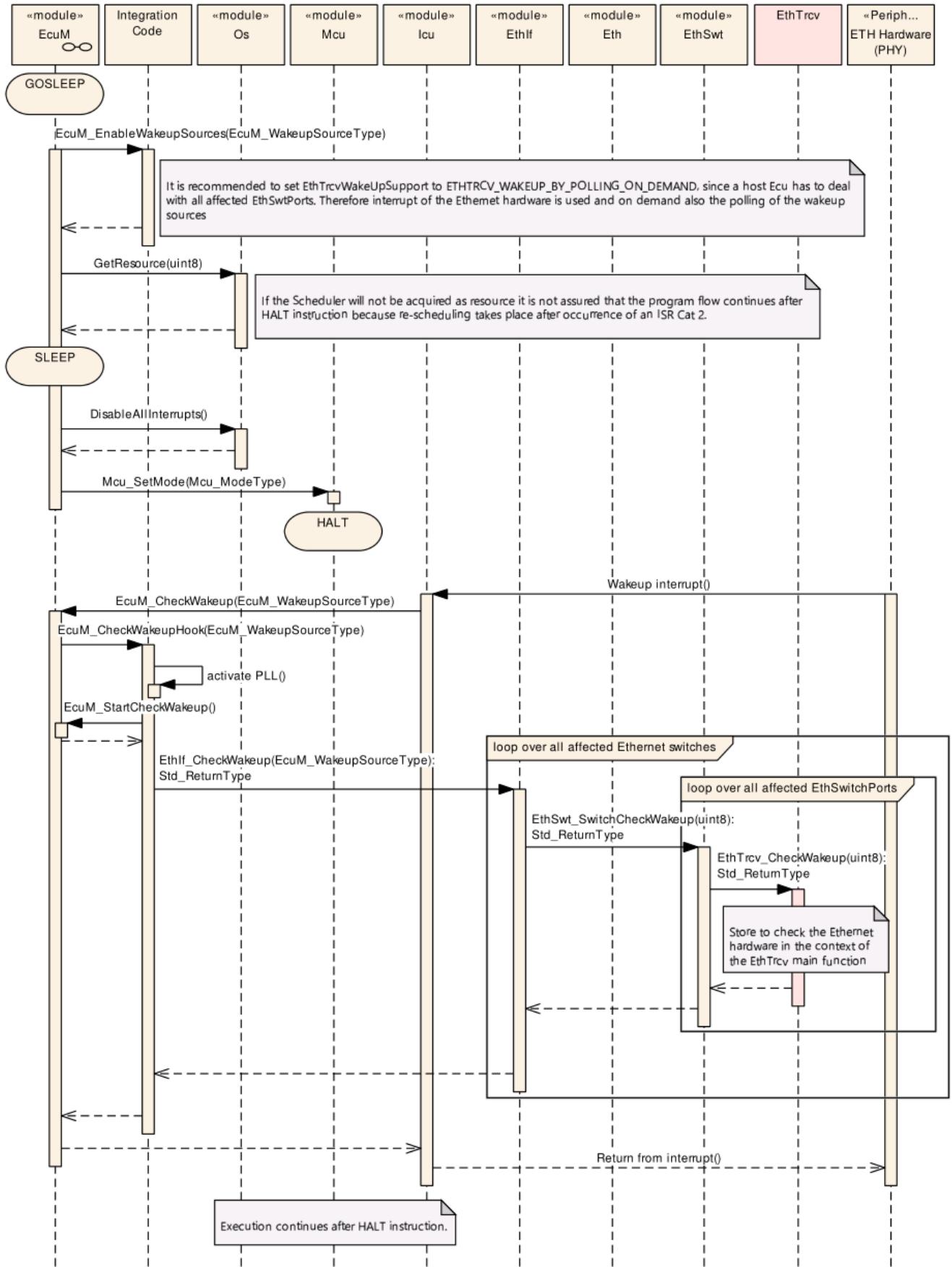
Figure 9.12: FlexRay transceiver wake up by polling

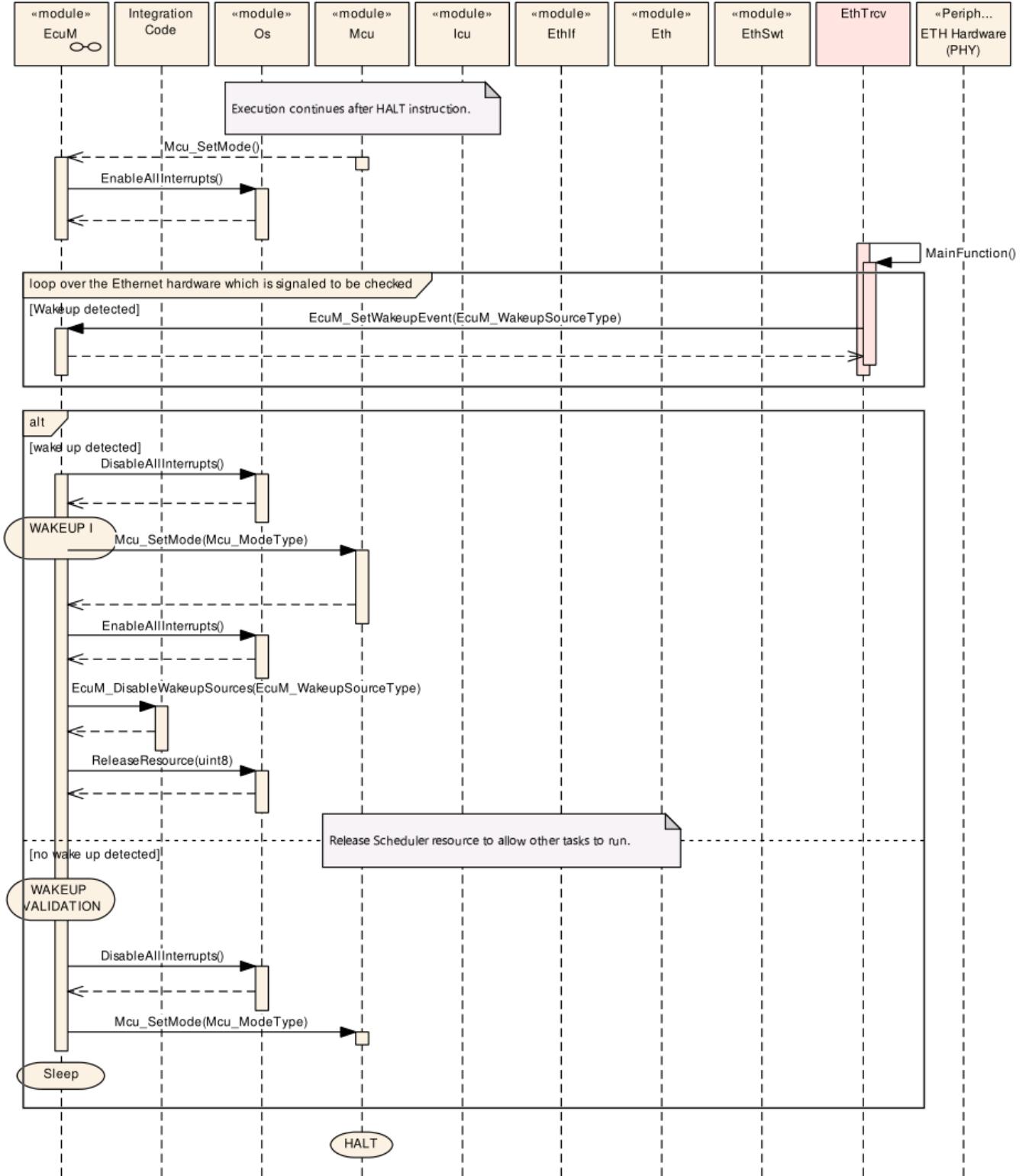
#### ETHERNET WAKEUP SEQUENCE

在具有OATC10兼容以太网硬件的以太网交换网络上，使用的以太网硬件(PHY)可以检测到唤醒。对于维护以太网交换机(主机ECU)的以太网ECU，建议使用按需轮询来检查以太网硬件通知的唤醒。因为检查所有受影响的EthSwtPort可能会花费时间，并且在中断中检查是不可接受的。因此，中断信号表明至少有一个以太网交换机端口检测到唤醒。在中断的上下文中，受影响的EthTrcv在EthTrcv\_MainFunction中被发出异步检查的信号。

每个EthTrcv应该有自己的唤醒源，以区分唤醒到达哪个EthSwtPort。如果EthSwtPort分配给相同的pnc，则可以共享唤醒源。

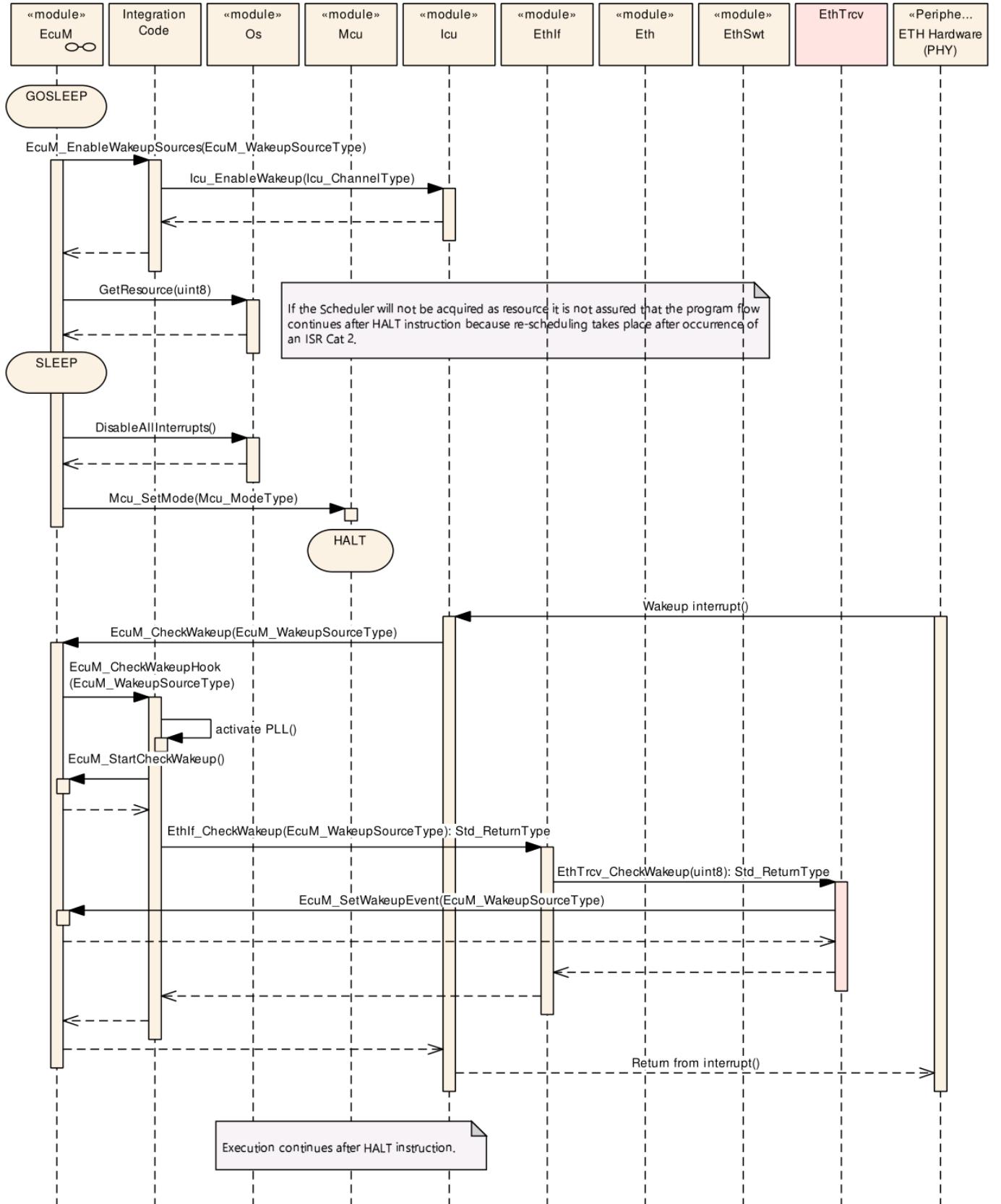
下面的以太网唤醒序列部分是可选的，因为没有“集成代码”的规范。因此，它是特定于实现的，例如在EcuM\_CheckWakeupHook期间调用EthIf来检查唤醒源。

**Figure 9.13: Passive wakeup of a host ecu (ECU that maintain a Ethernet switch) (part 1)**

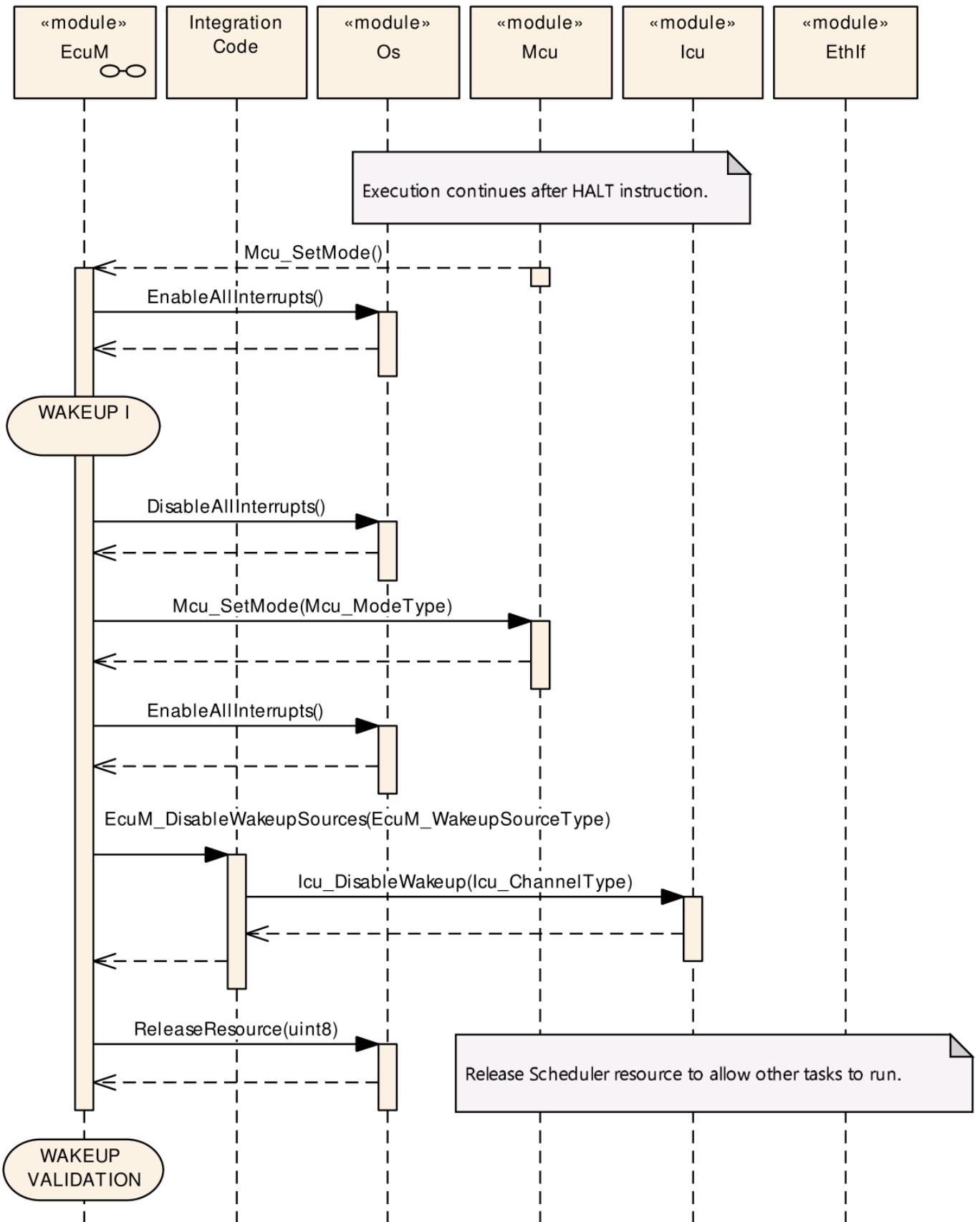


**Figure 9.14: Passive wakeup of a host ecu (ECU that maintain a Ethernet switch) (part 2)**

单个以太网ECU(不维护以太网交换机的ECU)可以选择如何通过中断或轮询来检测唤醒。与主机ECU的不同之处在于，它不需要检查大量的以太网交换机端口。



**Figure 9.15: Passive wakeup of a single ECU (ECU which do not maintain a Ethernet switch) (part 1)**

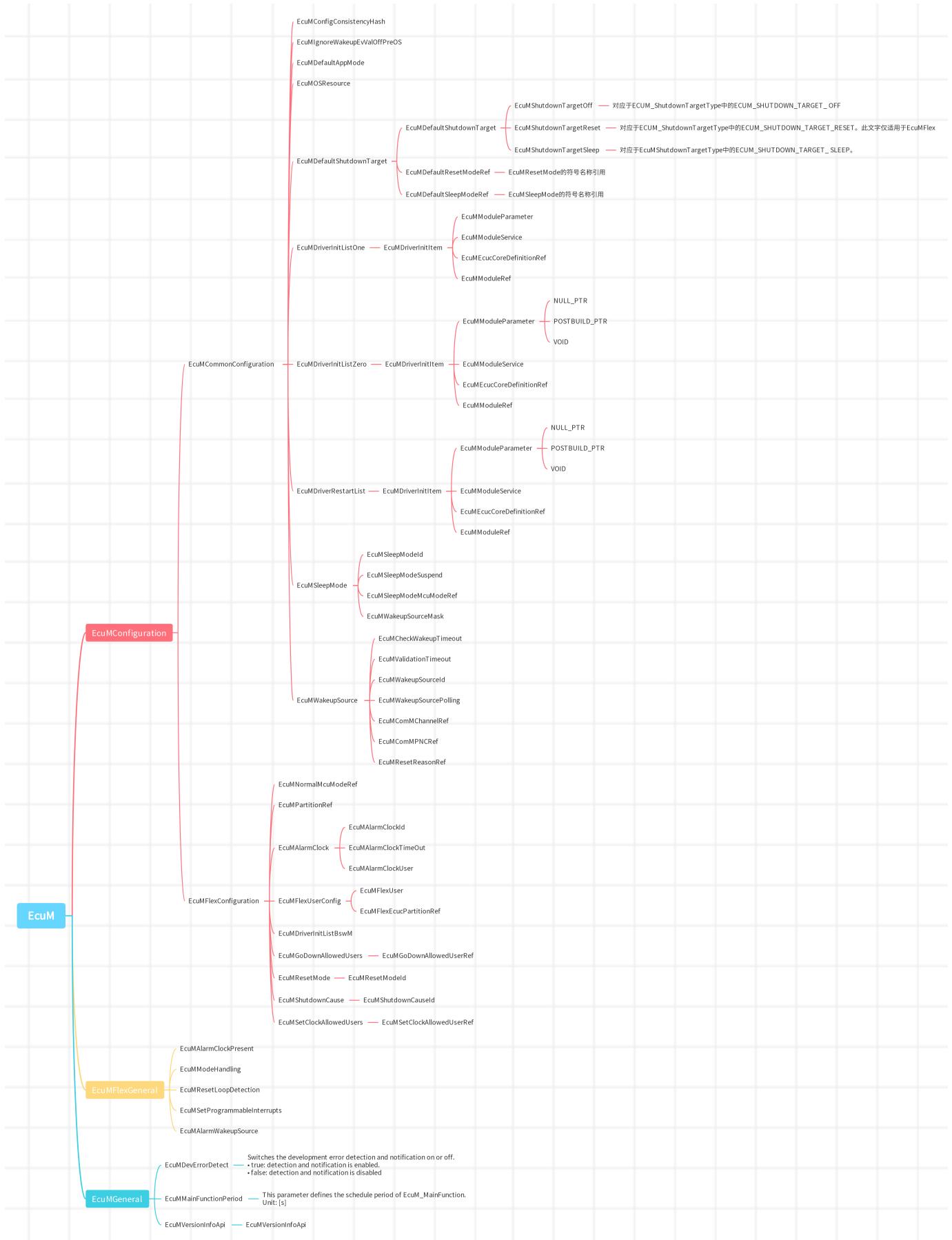


**Figure 9.16: Passive wakeup of a single ECU (ECU which do not maintain a Ethernet switch) (part 2)**

## 2.1.5 Configuration

---

### **Configuration specification**



## 2.2 BswM

### 2.2.1 BswM

#### 概述

BSW 模式管理器是实现驻留在 BSW 中的车辆模式管理和应用模式管理概念部分的模块。其职责是基于简单的规则对来自应用层 SW-C 或其他 BSW 模块的模式请求进行仲裁，并根据仲裁结果执行操作。

#### 特殊名称

术语	描述
BSW	Basic Software
BswM	BSW Mode Manager
BSWMD	Basic Software Module Description
CDD	Complex Drive
Dem	Diagnostic Event Manager

#### 限制

一个分区内最多可以使用一个 BSW 模式管理器实例。

#### 依赖其他模块

BSW 模式管理器具有与 AUTOSAR 架构中的许多 BSW 模块的接口。然而，这些接口中的大多数都是可选的，并根据每个 ECU 的需求使用。

##### RTE

BswM 通过 RTE 接收来自 SW-C 的模式请求。模式切换通知也通过 RTE 传播到 SW-C。

##### ECUM-FLEX

EcuM Flex 可以向 BswM 指示其唤醒源的状态。当使用 ECU 模式处理时，BswM 可以设置 EcuM - Flex 的状态，并根据 RUN 请求协议接收某些模式的状态。

##### COMM

源自通信的模式开关指示通过 BswM 进一步传播到 SW-C。

BswM 可以通过 ComMUsers 在 ComM 上请求通信模式。

##### COM

COM 中 I-PDU 组的处理由 BswM 执行。作为 IPDU 组启动/停止的一部分，可以将包含的信号值重置为其相应的初始化值。

BswM 处理 COM 中信号的截止时间监控的启用和禁用

BswM 还可以触发 I-PDU 的传输。

##### PDUR

BswM 可以在 PDU 路由器中启用和禁用 I-PDU 的路由组。

##### CANSM

源自 CanSM 的模式开关指示通过 BswM 进一步传播到 SW-C。

**LINSM**

BswM 协调 LinSM 中 LIN 计划表的切换，以及 COM 中相应 I-PDU 组的启动和停止。

源自 LinSM 的模式开关指示通过 BswM 进一步传播到 SW-C。

**FRSM**

源自 FrSM 的模式开关指示通过 BswM 进一步传播到 SW-C。

FlexRay 上“单插槽模式”的使用由FrSM根据BswM的请求控制。FlexRay 堆栈的发送功能可以通过调用 API FrSM\_SetEcuPassive由 BswM 通过 FrSM 进行控制。

**ETHSM**

源自 EthSM 的模式开关指示通过 BswM 进一步传播到 SW-C。

**DCM**

DCM 根据收到的诊断请求对 BswM 执行模式请求。

示例：DCM 可以请求“禁用正常通信”。在此模式下，BswM 将关闭相应的 I-PDU 组和 NM PDU。

**J1939DCM**

J1939Dcm将通信状态变化报告给BswM，以便进一步传播到sw - c。BswM通过 J1939Dcm\_SetState 改变J1939Dcm的状态。

**J1939RM**

BswM通过J1939Rm\_SetState改变J1939Rm的状态。

**NM INTERFACE**

BswM将使用Nm\_EnableCommunication和Nm\_DisableCommunication基于当前模式控制Nm通信。

示例：在“禁用正常通信”模式下，BswM需要禁用相应NM信道上的NM通信。

Nm使用BswM\_Nm\_CarWakeUpIndication指示车辆唤醒。

**NvM**

NvM模块通过注册为NvM回调的“集成代码”向BswM报告其块的状态。BswM的操作导致NvM在启动和关闭期间读取和写入所有块。

**OS**

BswM所需的操作系统特性是特定于实现的。

**SD**

BswM通过几个导出的API从Sd接收状态指示（示例见第8.3章）。来自Sd的这些状态指示可以配置为BswMModeRequestSources。

## 2.2.2 Function

### 功能描述

BSW模式管理器基本功能的操作可以描述为两个不同的任务：模式仲裁和模式控制。

模式仲裁部分启动模式切换，由从 SW-C 或其他 BSW 模块收到的模式请求和模式指示的基于规则的仲裁产生

模式控制部分通过执行包含其他BSW模块的模式切换操作的动作列表来执行模式切换。

BswM应该被视为一个模式管理框架模块，其中行为完全由其配置定义。

#### MODE ARBITRATION (仲裁)

BswM 执行的模式仲裁简单且基于规则。用于模式仲裁的规则在 BSW 模式管理器模块的配置中指定。

这些规则由平凡的布尔表达式组成，因此模式仲裁对运行时的影响很小

#### Arbitration Rules

规则是由一组模式请求条件组成的==逻辑表达式==。当输入 模式请求 和 模式指示发生更改时，或在执行 BswM 主函数期间，将评估规则。评估结果（True 或 False）用于决定相应模式控制操作列表的执行。

#### Mode Conditions(条件) and Logical Expressions (表达式) .

组成模式仲裁规则的逻辑表达式可以使用不同的运算符，例如AND、OR、XOR、NOT和NAND。 表达式中的每一项对应于一个模式请求条件。 如果模式条件引用 BswMModeRequestPort，则该条件将验证请求或指示的模式是否等于或不等于特定模式。 如果条件引用 BswMEventRequestPort，则条件将验证请求端口是 SET 还是 CLEAR。 BswMEventRequestPort 事件请求不同于模式请求，因为请求者不向 BswM 发送请求的模式/值，因此，没有模式条件供 BswM 评估。 相反，只有 BswM 评估事件的接收。 当请求者发送/调用事件时，BswMEventRequestPort 将处于 SET 状态。 BswM 随后可以通过执行 BswMClearEventRequest 操作将 BswMEventRequestPort 置于 CLEAR 状态。 图 7.1 显示了具有两个条件的示例规则。 规则和可用逻辑操作集被定义为第 10.2 章中描述的 ECU 配置的一部分。



**Figure 7.1: Pseudocode representation of an example rule with two conditions.**

当 BswMModeCondition 具有 BswMConditionType = BSWM\_EVENT\_IS\_SET 并引用 BswMEventRequestPort 时：

- 如果 BswMEventRequestPort 处于 SET 状态，则 BswMModeCondition 应评估为 TRUE
- 如果 BswMEventRequestPort 处于 CLEAR 状态，则 BswMModeCondition 应评估为 FALSE

当 BswMModeCondition 具有 BswMConditionType = BSWM\_EVENT\_IS\_CLEARED 并引用 BswMEventRequestPort 时：

- 如果 BswMEventRequestPort 处于 SET 状态，则 BswMModeCondition 应评估为 FALSE
- 如果 BswMEventRequestPort 处于 CLEAR 状态，则 BswMModeCondition 应评估为 TRUE

当 BswM 在配置的 BswMEventRequestPort 上接收到事件时（例如，ComM 调用 BswM\_ComM\_InitiateReset），BswMEventRequestPort 应置于 SET 状态。

当在 BswMEventRequestPort 上执行 BswMClearEventRequest 动作时，BswMEventRequestPort 应置于 CLEAR 状态。

**Requirements of Mode Arbitration**

如上所述，BswM 接受模式请求和模式指示作为模式仲裁的输入。模式请求通常源自应用程序 SW-C，但也可能源自其他 BSW 模块，例如 DCM。模式指示总是由其他 BSW 模块发出，例如不同的总线特定状态管理器和 EcuM。在本文档中，通用术语模式仲裁请求对应于模式指示或模式请求。

BswM 应根据传入的模式请求执行模式仲裁。

BswM 应根据传入模式指示执行模式仲裁。

BswM 应根据事件请求以及事件请求的清除执行模式仲裁。



BswM 以相同的方式处理所有模式仲裁请求（请求和指示）。它们通过在 BswMModeRequestSource 配置容器中选择相应的模式条件类型来配置。

BswM 应使用配置的规则执行模式仲裁

模式仲裁规则应使用模块配置参数进行配置。

不允许 BswM 使用先前仲裁规则评估的结果作为逻辑表达式的输入。



禁止使用规则评估的结果作为其他规则评估的输入。它在很大程度上满足于 BswM 配置容器的现有结构，因为逻辑表达式的可配置输入不包括先前规则评估的结果。

作为评估 BswM 仲裁规则的结果而调用的动作只能在动作列表的上下文中调用。

BswM 应根据传入的模式切换通知执行模式仲裁。

**Immediate and Deferred Operation**

有两种不同的方式来安排模式仲裁的处理。它要么在模式请求/指示的上下文中==立即完成==，要么==延迟（循环）==到 BswM 的主要功能。

“立即” 请求在调用者的上下文中执行。系统集成商有责任确保操作列表的执行不会危及系统性能或一致性。

“立即” 请求在调用者的上下文中执行。系统集成商有责任确保操作列表的执行不会危及系统性能或一致性。

应该可以将 BswM 配置为在收到模式仲裁请求后立即执行模式仲裁。这是通过将 BswMRequestProcessing 配置参数（在 BswMModeRequestPort 容器内）设置为 BSWM\_IMMEDIATE 来配置的。

只有使用特定立即模式条件的模式仲裁规则才应由 BswM 在该特定模式请求/指示的上下文中进行评估。

应该（也）可以将模式仲裁推迟到执行 BswM 的主要功能之前。这是通过将 BswMRequestProcessing 配置参数（在 BswMModeRequestPort 容器内）设置为 BSWM\_DEFERRED 来配置的。

应该可以将 BswM 配置为在设置事件时立即执行模式仲裁。这是通过将 BswMEventRequestProcessing 配置参数（在 BswMEventRequestPort 容器内）设置为 BSWM\_IMMEDIATE 来配置的。

应该（也）可以将模式仲裁推迟到执行 BswM 的主要功能之前。这是通过将 BswMEventRequestProcessing 配置参数（在 BswMEventRequestPort 容器内）设置为 BSWM\_DEFERRED 来配置的。

在每次执行 BswM 的主要功能期间，应评估使用至少一个延迟模式条件的所有规则。

BswM 应推迟在其主要功能处理期间收到的模式仲裁请求，直到它完成。任何此类延迟的 IMMEDIATE 请求应在 BswM 主函数退出之前直接处理。任何此类延迟的 DEFERRED 请求应在下一个后续 BswM 主函数中处理。

BswM 应推迟在处理 IMMEDIATE 请求期间收到的模式仲裁请求，直到它完成。任何此类推迟的 IMMEDIATE 请求应在处理原始 IMMEDIATE 请求后直接处理。任何此类推迟的 DEFERRED 请求都应在下一个后续 BswM 主函数中处理。

BswM 实现可以选择使用保护机制（例如独占区域），以保证操作或 BswM 主要功能的执行不会被任何其他任务（例如更高优先级的任务）打断。

端口“更新”的术语说明：任何模式请求端口都有关联的值\状态。更新一个端口意味着改变它的值\状态。

BswM 应在仲裁实际发生之前直接更新立即模式请求端口的值，而不是在模式请求端口被触发时更新。

当模式请求端口被触发时，BswM 将更新 DEFERRED 模式请求端口的值。

#### Arbitration(仲裁) Behavior(行为) after Initialization

初始化后 BswM 模式仲裁的行为由配置容器 BswMModeInitValue 控制。该参数可以为配置中的每个 BswMModeRequestPort 配置一次。

如果容器 BswMModeInitValue 不存在或 ModeRequest 还没有初始值，则 BswM 应将相应的模式条件视为未定义并且不会将其用于模式仲裁，直到相应的模式仲裁请求已被第一次更新。

BswM 应仅仲裁在其逻辑表达式中不包含任何未定义模式条件的规则。

每个BswMModeRequestPort初始化后的初始值可以由配置容器BswMModeInitValue控制。

在定义 BswMModeInitValue 的情况下，BswM 应在 BswM 初始化时使用 BswMBswModeInitValue 或 BswMCompuScaleModeValue 初始化相应的 BswMModeRequestSource。BswM 应拒绝包含单个 BswMModeInitValue 的 BswMBswModeInitValue 和 BswMCompuScaleModeValue 的配置。该初始化值应用于仲裁规则，直到相应的模式仲裁请求已更新，例如 BswM\_RequestMode 的每次调用都应更新 GenericRequest 模式。

#### Note

the Rte and SchM modes always have an intial value

在 BswM 初始化时，所有 BswMEventRequestPort 都应初始化为 CLEAR 状态。

#### MODE CONTROL(控制)

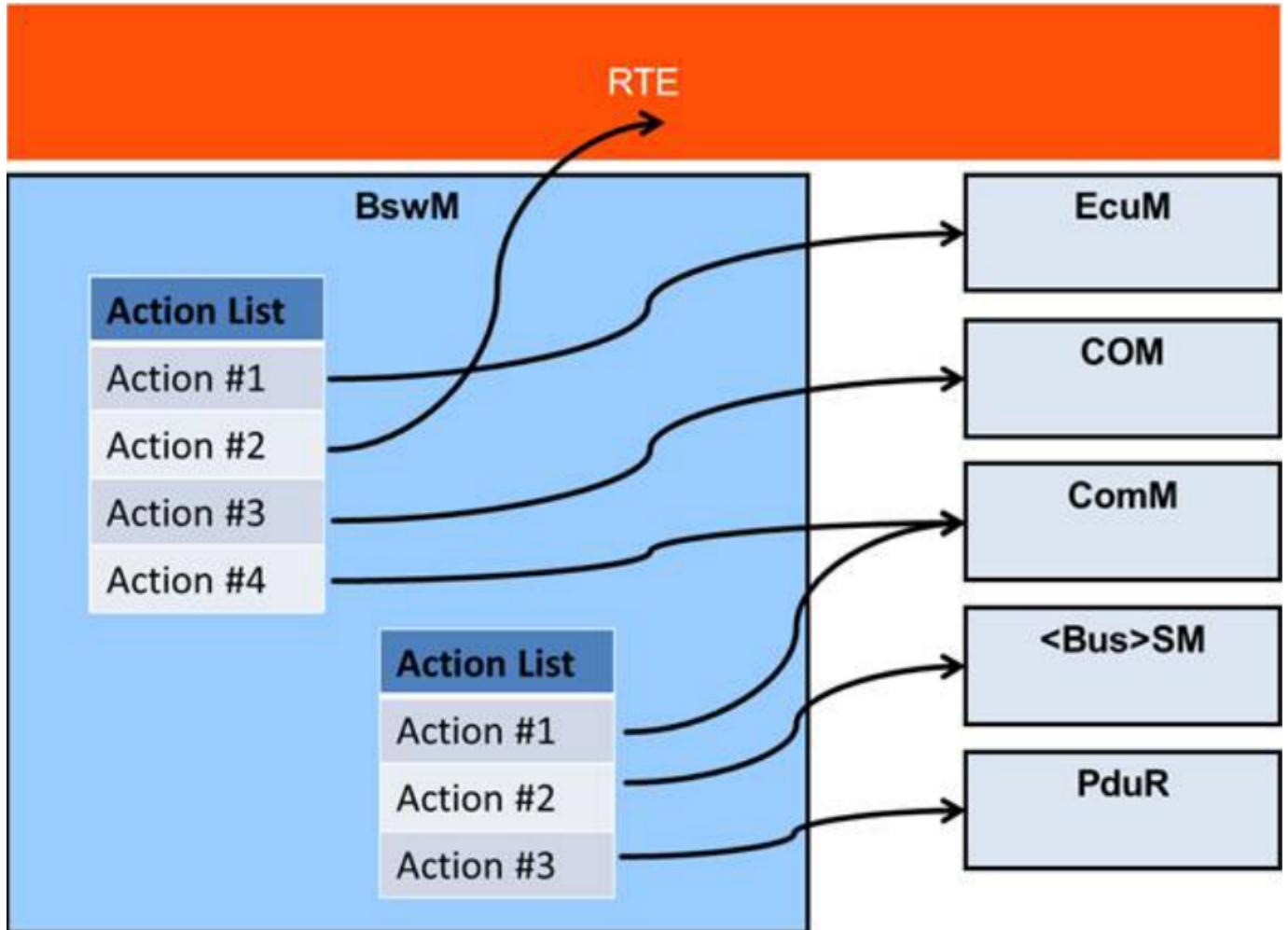
BswM 的模式控制部分根据模式仲裁的结果执行所有必需的操作。这是使用动作列表完成的。动作列表是 BswM 在模式仲裁触发时执行的有序动作列表。

动作列表中的动作可以分为三种类型：

1. 调用其他 BSW 模块或 RTE。
2. 链接到要包含在执行中的==其他操作列表==。
3. 模式仲裁规则。当相应的动作列表被执行时，这些规则将被评估。这样，就得到了规则的层次结构。

BswM 不需要存储或响应任何 BSW 模块特定返回值对其执行的操作。因此，BSW 中的不同状态管理器将它们的当前状态指示给 BswM，以用作模式仲裁的输入。

但是，如果返回错误 (E\_NOT\_OK)，则 BswM 可以发出 Det Runtime Error 和/或取消当前正在执行的操作列表。



**Figure 7.2: Example showing two action lists**

如图7.2所示，BswM可以包含多个Action List，一个Action List可以容纳多个action。为了减少动作列表的总数，应该可以将它们级联起来。动作列表的元素可以是具体动作或对另一个动作列表的引用，或者如上所述，模式仲裁要执行的规则。应该有一个标志连接到每个动作列表条目，说明它的类型（动作/参考/规则）。激活具有具体操作的列表的方式与激活具有引用的列表甚至混合列表的方式之间应该没有区别。

## Mode Processing Cycle

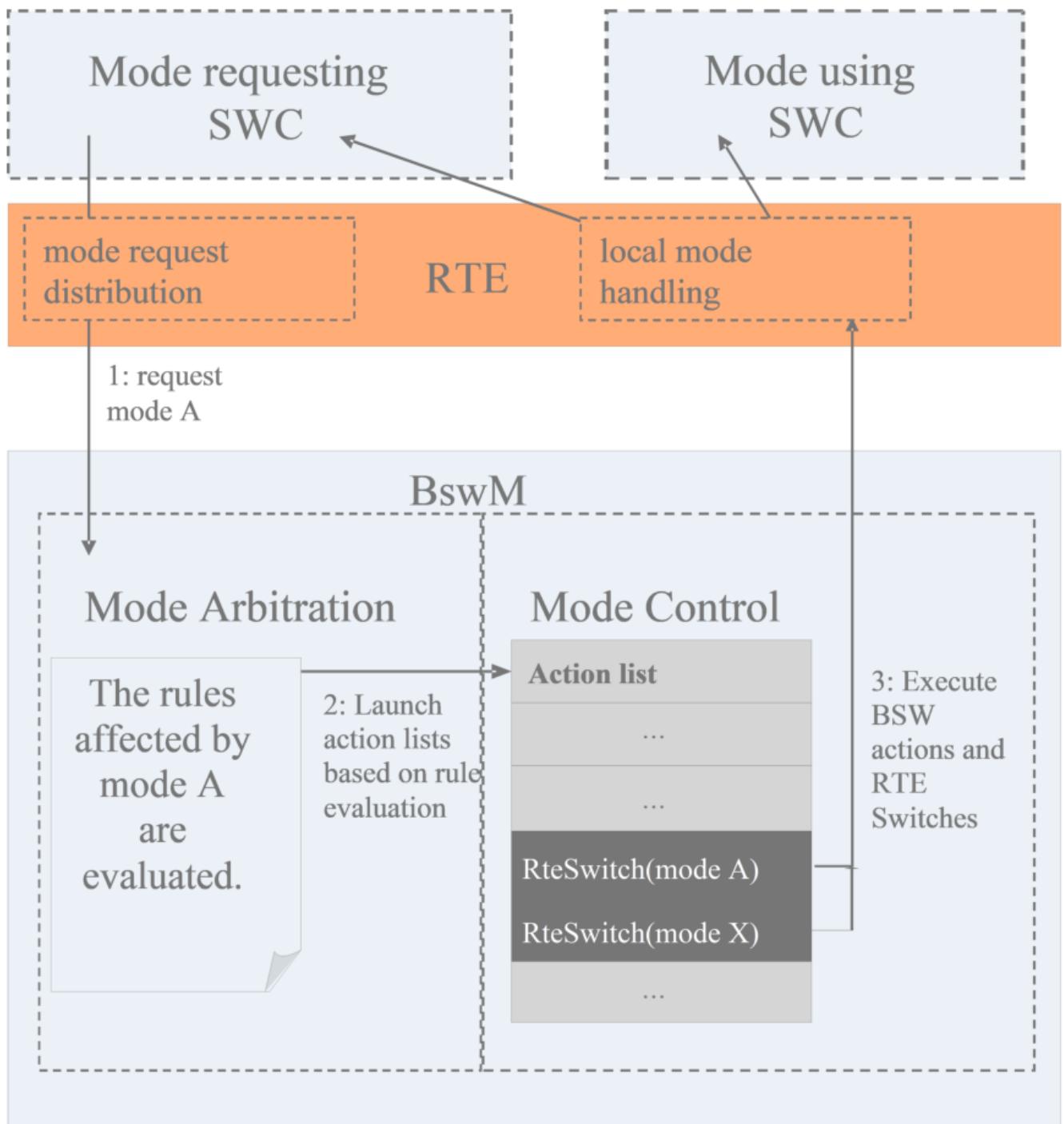


Figure 7.3: Mode Processing Cycle

1. 模式请求器 SW-C 通过其发送端口请求模式 A。RTE 分发请求，BswM 通过其接收端口接收请求。
2. BswM 评估其规则作为接收到的模式仲裁请求的结果，或者在 BswM 主要功能的执行期间循环评估。
3. 根据选择的执行方法执行相应的动作列表（参见“触发和条件动作列表”部分）。
4. 在执行动作列表时，BswM 可能会发出一个或多个对 RTE 开关 API [6] 的调用，作为通知受影响的 SW-C 仲裁结果的动作。任何 SW-C，尤其是模式请求者都可以注册以接收模式切换指示。

**Note**

注意，模式请求者只能从本地 BswM 接收模式切换指示；对于本地代理 SW-C 发出的来自不同 ECU 的请求也是如此。

**Requirements(要求) on Mode Control**

BswM 应通过作为模式仲裁中规则评估结果执行的动作列表来执行模式控制。

对于模式仲裁的每条规则，BswM 应能够根据规则评估为 True 或 False 执行不同的操作列表。

动作列表包含 BswM 应以有序方式执行的一组动作。

动作列表可能包含指向 BswM 应包含在执行中的其他动作列表的链接。

动作列表还可以包括模式仲裁规则的链接，BswM 应在当前动作列表的执行范围内评估这些规则。

如果使用级联动作列表（即使用对其他规则或动作列表的引用），动作列表结构最多可包含七（7）个分层级别。

注意：此限制的目的是使 BswM 实现和生成器工具的测试成为可能。该限制必须由生成器工具检查。

与在模式仲裁请求的上下文中评估的规则关联的动作列表应在模式仲裁触发时立即由 BswM 执行，而不是延迟到主函数执行。

基本原理(Rationale)：这允许在必要时对模式请求进行非常短的延迟。

如果顶层动作列表在模式仲裁期间被多个规则触发，这将导致在模式控制期间执行动作列表的单个触发器。

顶级动作列表是由顶级规则（即不嵌套在动作列表中的规则）直接执行的动作列表，并且不嵌套在另一个动作列表中。[SWS\_BswM\_00223] 仅适用于顶级操作列表。[SWS\_BswM\_00223] 不适用于嵌套规则和嵌套操作列表，因为它们在父操作列表中的顺序是用户定义的，应予以遵守。

如果在模式控制期间要执行多个顶级动作列表，则执行顺序应从==最高==的 BswMActionListPriority 开始，并继续到最低的。在 BswMActionListPriority 相同的情况下，执行顺序是==任意的

对于不是顶级动作列表的动作列表，BswMActionListPriority 将被忽略。

没有 BswMActionListPriority 的动作列表应被解释为具有等于 0 的 BswMActionListPriority

BswM 应拒绝 BswMActionList 包含具有相同值 BswMActionListItemIndexes 的 BswMActionListItems 的配置

当执行 BswMActionList 时：BswM 应从具有最低值 BswMActionListItemIndex 的 BswMActionListItem 开始。随后的 BswMActionListItems 应按其 BswMActionListItemIndex 的递增顺序执行。

在动作列表中，配置的 BswMActionListItemIndexes 不一定需要连续或从零开始。BswM 将开始执行具有最低索引的操作列表项，并继续执行具有最高索引的操作列表项。如果索引有“间隙”（即不连续），这些间隙将被忽略。

**Triggered and Conditional action lists**

有两种方法可以基于规则的评估来执行动作列表。要么在每次使用相应的结果评估规则时执行，要么仅在评估结果与之前的评估发生变化时执行。使用 BswMActionListExecution 参数（在 BswMActionList 容器内）配置动作列表的执行方法。

但是，对于不被规则直接引用的嵌套动作列表，BswMActionListExecution 参数（例如 BSWM\_CONDITION 或 BSWM\_TRIGGER）没有意义，并且不会影响嵌套动作列表的执行方式。每当执行其父动作列表时，相应地执行这样的嵌套动作列表（即不被规则直接引用）。

如果为触发执行配置了 True 动作列表，则 BswM 应仅在相应规则的评估从 False 变为 True 时执行它。

如果为触发执行配置了 False 动作列表，则 BswM 应仅在相应规则的评估从 True 变为 False 时执行它。

如果为条件执行配置了 True 动作列表，则 BswM 应在每次相应规则被评估为 True 时执行它。

如果 False 动作列表被配置为条件执行，BswM 将在每次相应规则被评估为 False 时执行它。

如果动作返回 E\_NOT\_OK 并且相应的 BswMAbortOnFail 配置参数设置为“true”，则 BswM 将中止动作列表的执行。

### Available Actions

可在动作列表中使用的一组动作是预定义的。这样做的原因是简化 ECU 配置和 BswM 配置代码的生成。

BswM 应能够执行由配置容器 BswMAvailableActions 定义的预定义操作。

BswM 应能够调用 AUTOSAR BSW 中的任何函数，即使它不在 BswMAvailableActions 中定义的标准化操作中。

BswM 应能够调用用户定义的函数

用户定义函数的参数及其值应在 ECU 配置时使用 BswMUserCallout 配置容器定义。

### Behavior of Mode Control after Initialization

BswM 初始化后模式控制的行为由 BswMRuleInitState 参数（在 BswMRule 容器内）配置。它定义了“先前的评估结果”，用于在初始化后第一次评估规则后决定执行什么动作列表时使用。配置参数 BswMActionListExecution（在 BswMActionList 容器内）也会影响初始化后的动作列表执行。

BswMRuleInitState	BswMActionListExecution	Rule evaluated to true	Rule evaluated to false
BSWM_UNDEFINED	BSWM_TRIGGER	Execute "true" action list	Execute "false" action list
BSWM_TRUE	BSWM_TRIGGER	Do nothing	Execute "false" action list
BSWM_FALSE	BSWM_TRIGGER	Execute "true" action list	Do nothing
BSWM_UNDEFINED	BSWM_CONDITION	Execute "true" action list	Execute "false" action list
BSWM_TRUE	BSWM_CONDITION	Execute "true" action list	Execute "false" action list
BSWM_FALSE	BSWM_CONDITION	Execute "true" action list	Execute "false" action list

### Waiting Functionality

有时需要延迟特定操作或等待进一步的模式控制。为此，将定时器处理添加到 BswM。

计时器始终由作为 BswMModeRequestSource 的 BswMTimer 和控制此 BswMTimer 的相应操作（请参阅 BswMTimerControl）组成，即计时器只能在操作 BswMTimerControl-> BswMModeRequestSource/BsMTimer 的上下文中控制。BswMTimer 的值（例如 BSWM\_TIMER\_STOPPED、BSWM\_TIMER\_STARTED、BSWM\_TIMER\_EXPIRED）可以通过 BswM 中配置的其他规则进行评估，以触发操作列表。没有外部接口来控制或操纵定时器。

每个 BswMTimer 都应在初始化期间停止（BSWM\_TIMER\_STOPPED）。

动作 BswMTimerAction BSWM\_TIMER\_START 应使用相应的定时器值（参考 BswMTimerValue）重新加载参考的 BswMTimer（通过 BswMTimerRef）并将定时器的模式更改为 BSWM\_TIMER\_STARTED。

#### Note

计时器只能通过 BswMTimerAction 操作重新加载（不可能自动重新加载）

BSWM\_TIMER\_STARTED 模式下的每个 BswMTimer 应在 BSWM\_MainFunction 期间递减计时器（按 BSWM\_MainFunction 的循环时间）。

#### Note

BswMTimer 分辨率是 BswM\_MainFunction 周期的倍数。此外，BswMTimer 的准确性取决于 BswM\_MainFunction 的准确性。

如果处于模式 BSWM\_TIMER\_STARTED 的 BswMTimer 到期，其模式应更改为 BSWM\_TIMER\_EXPIRED，然后 BswMTimer 模式应在同一 BswM\_MainFunction 周期中仲裁。

动作 BswMTimerAction BSWM\_TIMER\_STOP 应立即停止引用的 BswMTimer（通过 BswMTimerRef）并将其模式更改为 BSWM\_TIMER\_STOPPED。

BswM 应忽略与 BswMTimer 关联的 BswMRequestProcessing（例如，IMMEDIATE、DEFERRED）配置。BswM 应始终将 BswMTimer 的处理视为已延迟；BswMTimer 在 BswM 主函数期间被仲裁。

### Note

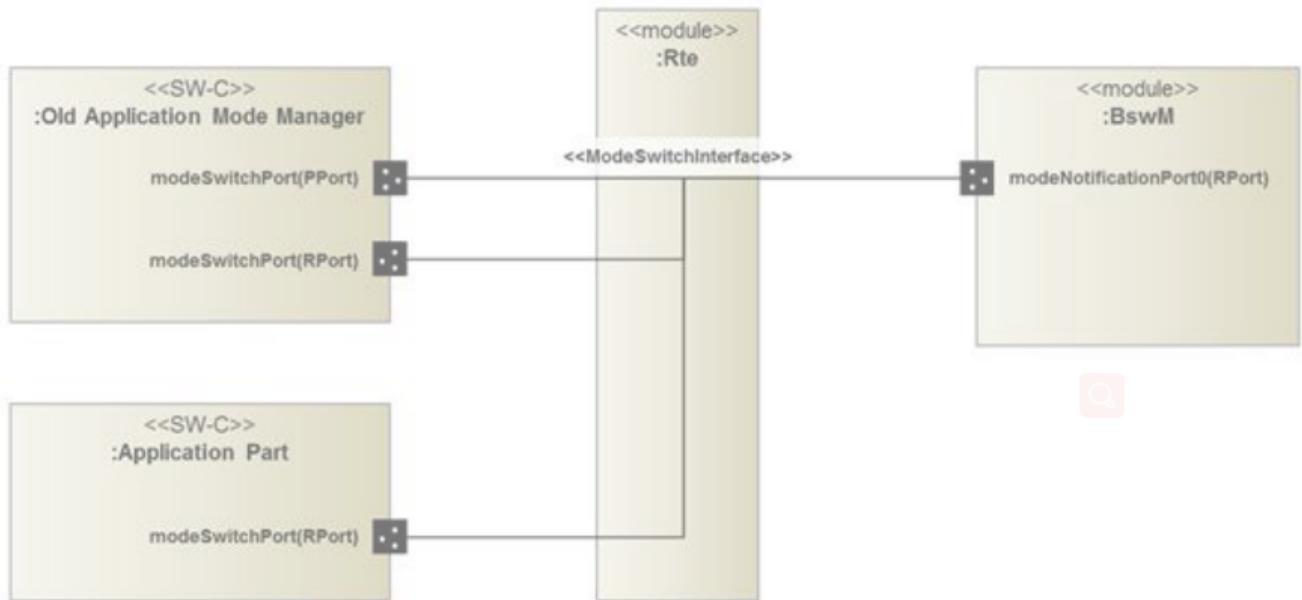
BswM\_TIMER\_EXPIRED 模式下的 BswMTimer 不会被 BswM 自动设置为 BSWM\_TIMER\_STOPPED。 用户需要配置一个动作，以便将 BswMTimer 从 BSWM\_TIMER\_EXPIRED 转换到另一种模式。 如果没有配置将 BswMTimer 转换出 BSWM\_TIMER\_EXPIRED 模式的操作，则 BswMTimer 将在接下来的 BswM 主函数周期中继续被仲裁为 BSWM\_TIMER\_EXPIRED。

### Multi Partition Support

对于多个 BswM 实例，每个 BswM 实例将根据自己的配置集生成自己单独的服务组件描述。 集成商需要将这些单独的服务组件分配给相应的分区。

BswM 存在于==每个分区==中，具有特定于分区的配置（每个分区的 BswMConfig 的==单独实例==）。 包含的动作列表在本地分区执行。

### BswM Interfaces and Ports



**Figure 7.5: Connections between SW-C based Application Mode Manager, Application Parts and the BSW Mode Manager**

### Mode Request Ports

BSW 模式管理器必须使用在 SW-C 的上下文中定义的接口声明一个接收器端口：

```
RequirePort AppModeRequestInterface modeRequestPort_{ArbName}_{ReqName};
```

要读取当前请求的模式，BSW 模式管理器实现必须调用：

```
Rte_Read_modeRequestPort_{ArbName}_{ReqName}_requestedMode( &<variable> );
```

### Mode Switch Ports

与模式请求一样，BSW 模式管理器仅引用在其为模式开关提供端口的相应 SW-C 描述的上下文中定义的模式开关接口。 对于上面的例子，模式开关的声明是：

```
ProvidePort AppModeInterface modeSwitchPort_{ModConName}_{SwitchName};
```

配置参数BswMModeSwitchInterfaceRef引用此模式切换接口。

要切换当前活动模式，BSW 模式管理器实现必须将以下调用之一插入其操作列表：

```
Rte_Switch_modeSwitchPort_{ModConName}_{SwitchName}_currentMode( <new_mode> );
```

```
SchM_Switch_modeSwitchPort_{ModConName}_{SwitchName}_currentMode( <new_mode> );
```

### Notifications of Mode Switches

除了模式请求之外，当前活动的模式也可以用作模式仲裁的输入。对于应用程序和车辆模式，BSW 模式管理员需要注册为模式用户。然后它通过模式切换端口接收有关模式更改的通知。对于上面的例子，模式通知的声明是：

```
RequirePort AppModeInterface modeNotificationPort_{ArbName}_{ModeName};
```

要读取当前活动模式，BSW 模式管理器实现必须调用以下函数之一：

```
Rte_Mode_modeNotificationPort_{ArbName}_{ModeName}_currentMode(&<variable> );
```

```
SchM_Mode_modeNotificationPort_{ArbName}_{ModeName}_currentMode( &<variable> );
```

如果配置了增强型 Rte\_Mode 或 SchM\_Mode，BSW 模式管理器实现必须调用以下函数之一：

```
Rte_Mode_modeNotificationPort_{ArbName}_{ModeName}_currentMode(&<variable>, &<previousmode>, &<nextmode> );
```

```
SchM_Mode_modeNotificationPort_{ArbName}_{ModeName}_currentMode( &<variable>, &<previousmode>, &<nextmode> );
```

## 2.2.3 API

---

### API specification

#### TYPE DEFINITIONS

BswM\_ConfigType

<b>Name</b>	BswM_ConfigType				
<b>Kind</b>	Structure				
<b>Elements</b>	-				
	<b>Type</b>	-			
	<b>Comment</b>	The contents of this structure depends on the configuration variant.			
<b>Description</b>	This structure contains all post-build configurable parameters of the BSW Mode Manager. A pointer to this structure is passed to the BSW Mode Manager initialization function for configuration.				
<b>Available via</b>	BswM.h				

BswM\_ModeType

<b>Name</b>	BswM_ModeType		
<b>Kind</b>	Type		
<b>Derived from</b>	uint16		
<b>Range</b>	0-65535	-	-
<b>Description</b>	This type identifies the modes that can be requested by BswM Users.		
<b>Available via</b>	BswM.h		

BswM\_UserType

<b>Name</b>	BswM_UserType		
<b>Kind</b>	Type		
<b>Derived from</b>	uint16		
<b>Range</b>	0-65535	-	-
<b>Description</b>	This type identifies a BswM User that makes mode requests to the BswM.		
<b>Available via</b>	BswM.h		

## FUNCTION DEFINITIONS

BswM\_BswMPartitionRestarted

<b>Service Name</b>	BswM_BswMPartitionRestarted
<b>Syntax</b>	<pre>void BswM_BswMPartitionRestarted (     void )</pre>
<b>Service ID [hex]</b>	0x1e
<b>Sync/Async</b>	Synchronous
<b>Reentrancy</b>	Reentrant
<b>Parameters (in)</b>	None
<b>Parameters (inout)</b>	None
<b>Parameters (out)</b>	None
<b>Return value</b>	None
<b>Description</b>	Function called by Restart Task if the partition containing the BswM has been restarted.
<b>Available via</b>	BswM.h

BswM\_CanSM\_CurrentState

<b>Service Name</b>	BswM_CanSM_CurrentState	
<b>Syntax</b>	<pre>void BswM_CanSM_CurrentState (     NetworkHandleType Network,     CanSM_BswMCurrentStateType CurrentState )</pre>	
<b>Service ID [hex]</b>	0x05	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	Network	The CAN channel that the indicated state corresponds to.
	CurrentState	The current state of the CAN channel.
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	Function called by CanSM to indicate its current state.	
<b>Available via</b>	BswM_CanSM.h	

## BswM\_ComM\_CurrentMode

<b>Service Name</b>	<b>BswM_ComM_CurrentMode</b>	
<b>Syntax</b>	<pre>void BswM_ComM_CurrentMode (     NetworkHandleType Network,     ComM_ModeType RequestedMode )</pre>	
<b>Service ID [hex]</b>	0x0e	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	Network	The ComM communication channel that the indicated state corresponds to.
	RequestedMode	The current state of the ComM communication channel
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	Function called by ComM to indicate the current communication mode of a ComM channel.	
<b>Available via</b>	BswM_ComM.h	

## BswM\_ComM\_CurrentPNCMode

<b>Service Name</b>	<b>BswM_ComM_CurrentPNCMode</b>	
<b>Syntax</b>	<pre>void BswM_ComM_CurrentPNCMode (     PNCHandleType PNC,     ComM_PncModeType CurrentPncMode )</pre>	
<b>Service ID [hex]</b>	0x15	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	PNC	The handle of the PNC for which the current state is reported.
	CurrentPncMode	The current mode of the PNC.
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	Function is called by ComM to indicate the current mode of the PNC.	
<b>Available via</b>	BswM_ComM.h	

## BswM\_ComM\_InitiateReset

<b>Service Name</b>	BswM_ComM_InitiateReset
<b>Syntax</b>	<pre>void BswM_ComM_InitiateReset (     void )</pre>
<b>Service ID [hex]</b>	0x22
<b>Sync/Async</b>	Synchronous
<b>Reentrancy</b>	Non Reentrant
<b>Parameters (in)</b>	None
<b>Parameters (inout)</b>	None
<b>Parameters (out)</b>	None
<b>Return value</b>	None
<b>Description</b>	Function is called by ComM to signal a shutdown.
<b>Available via</b>	BswM_ComM.h

## BswM\_Dcm\_ApplicationUpdated

<b>Service Name</b>	BswM_Dcm_ApplicationUpdated
<b>Syntax</b>	<pre>void BswM_Dcm_ApplicationUpdated (     void )</pre>
<b>Service ID [hex]</b>	0x14
<b>Sync/Async</b>	Synchronous
<b>Reentrancy</b>	Reentrant
<b>Parameters (in)</b>	None
<b>Parameters (inout)</b>	None
<b>Parameters (out)</b>	None
<b>Return value</b>	None
<b>Description</b>	This function is called by the DCM in order to report an updated application.
<b>Available via</b>	BswM_Dcm.h

## BswM\_Dcm\_CommunicationMode\_CurrentState

<b>Service Name</b>	BswM_Dcm_CommunicationMode_CurrentState	
<b>Syntax</b>	<pre>void BswM_Dcm_CommunicationMode_CurrentState (     NetworkHandleType Network,     Dcm_CommunicationModeType RequestedMode )</pre>	
<b>Service ID [hex]</b>	0x06	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	Network	The communication channel that the diagnostic mode corresponds to.
	RequestedMode	The requested diagnostic communication mode.
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	Function called by DCM to inform the BswM about the current state of the communication mode.	
<b>Available via</b>	BswM_Dcm.h	

## BswM\_Deinit

<b>Service Name</b>	BswM_Deinit
<b>Syntax</b>	<pre>void BswM_Deinit (     void )</pre>
<b>Service ID [hex]</b>	0x04
<b>Sync/Async</b>	Synchronous
<b>Reentrancy</b>	Non Reentrant
<b>Parameters (in)</b>	None
<b>Parameters (inout)</b>	None
<b>Parameters (out)</b>	None
<b>Return value</b>	None
<b>Description</b>	Deinitializes the BSW Mode Manager.
<b>Available via</b>	BswM.h

## BswM\_EcuM\_CurrentState

<b>Service Name</b>	BswM_EcuM_CurrentState	
<b>Syntax</b>	<pre>void BswM_EcuM_CurrentState (     EcuM_StateType CurrentState )</pre>	
<b>Service ID [hex]</b>	0x28	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	CurrentState	The requested ECU Operation Mode
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	Function called EcuM to indicate the current ECU Operation Mode.	
<b>Available via</b>	BswM_EcuM.h	

## BswM\_EcuM\_CurrentWakeup

<b>Service Name</b>	BswM_EcuM_CurrentWakeup	
<b>Syntax</b>	<pre>void BswM_EcuM_CurrentWakeup (     EcuM_WakeupSourceType source,     EcuM_WakeupStatusType state )</pre>	
<b>Service ID [hex]</b>	0x10	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	source	Wakeup source(s) that changed state.
	state	The new state of the wakeup source(s)
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	Function called by EcuM to indicate the current state of a wakeup source.	
<b>Available via</b>	BswM_EcuM.h	

## BswM\_EcuM\_RequestState

<b>Service Name</b>	<b>BswM_EcuM_RequestState</b>	
<b>Syntax</b>	<pre>void BswM_EcuM_RequestState (     EcuM_StateType State,     EcuM_RunStatusType CurrentState )</pre>	
<b>Service ID [hex]</b>	0x29	
<b>Sync/Async</b>	<b>Synchronous</b>	
<b>Reentrancy</b>	<b>Reentrant</b>	
<b>Parameters (in)</b>	State	The requested state by EcuM
	CurrentState	Result of the Run Request Protocol
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	Function called by EcuM notify about current Status of the Run Request Protocol.	
<b>Available via</b>	BswM_EcuM.h	

## BswM\_EthIf\_PortGroupLinkStateChg

<b>Service Name</b>	<b>BswM_EthIf_PortGroupLinkStateChg</b>	
<b>Syntax</b>	<pre>void BswM_EthIf_PortGroupLinkStateChg (     EthIf_SwitchPortGroupIdxType PortGroupIdx,     EthTrcv_LinkstateType PortGroupState )</pre>	
<b>Service ID [hex]</b>	0x26	
<b>Sync/Async</b>	<b>Synchronous</b>	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	PortGroupIdx	The port group index in the context of the Ethernet Interface
	PortGroupState	The state of the port group. State is derived from the physical link of the Ethernet Transceiver:ETHTRCV_LINK_STATE_DOWN==Port group has link down. ETHTRCV_LINK_STATE_ACTIVE==Port group has link up.
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	Function called by EthIf to indicate the link state change of a certain Ethernet switch port group.	
<b>Available via</b>	BswM_EthIf.h	

## BswM\_EthSM\_CurrentState

<b>Service Name</b>	BswM_EthSM_CurrentState	
<b>Syntax</b>	<pre>void BswM_EthSM_CurrentState (     NetworkHandleType Network,     EthSM_NetworkModeStateType CurrentState )</pre>	
<b>Service ID [hex]</b>	0x0d	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	Network	The Ethernet channel that the indicated state corresponds to.
	CurrentState	The current state of the Ethernet channel.
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	Function called by EthSM to indicate its current state.	
<b>Available via</b>	BswM_EthSM.h	

## BswM\_FrSM\_CurrentState

<b>Service Name</b>	BswM_FrSM_CurrentState	
<b>Syntax</b>	<pre>void BswM_FrSM_CurrentState (     NetworkHandleType Network,     FrSM_BswM_StateType CurrentState )</pre>	
<b>Service ID [hex]</b>	0x0c	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	Network	The FlexRay cluster that the indicated state corresponds to.
	CurrentState	The current state of the FlexRay cluster.
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	Function called by FrSM to indicate its current state.	
<b>Available via</b>	BswM_FrSM.h	

## BswM\_GetVersionInfo

<b>Service Name</b>	<b>BswM_GetVersionInfo</b>	
<b>Syntax</b>	<pre>void BswM_GetversionInfo(     Std_VersionInfoType* VersionInfo )</pre>	
<b>Service ID [hex]</b>	0x01	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	None	
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	VersionInfo	Pointer to where to store the version information of the module.
<b>Return value</b>	None	
<b>Description</b>	Returns the version information of this module.	
<b>Available via</b>	BswM.h	

## BswM\_Init

<b>Service Name</b>	<b>BswM_Init</b>	
<b>Syntax</b>	<pre>void BswM_Init (     const BswM_ConfigType * ConfigPtr )</pre>	
<b>Service ID [hex]</b>	0x00	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Conditionally Reentrant	
<b>Parameters (in)</b>	ConfigPtr	Pointer to post-build configuration data
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	Initializes the BSW Mode Manager.	
<b>Available via</b>	BswM.h	

## BswM\_J1939DcmBroadcastStatus

<b>Service Name</b>	BswM_J1939DcmBroadcastStatus	
<b>Syntax</b>	<pre>void BswM_J1939DcmBroadcastStatus (     uint16 NetworkMask )</pre>	
<b>Service ID [hex]</b>	0x1b	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	NetworkMask	Mask containing one bit for each available network. The bit position within this mask corresponds to the ComMChannel.ComMChannelId for the communication channel (so ComMChannelID 0 is represented by bit 0). The meaning for each bit is: 1: Network enabled, 0: Network disabled. Note: only the first 16 communication channel IDs can be supported by this API.
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	This API tells the BswM the desired communication status of the available networks. The status will typically be activated via COM I-PDU group switches.	
<b>Available via</b>	BswM_J1939Dcm.h	

## BswM\_J1939Nm\_StateChangeNotification

<b>Service Name</b>	BswM_J1939Nm_StateChangeNotification	
<b>Syntax</b>	<pre>void BswM_J1939Nm_StateChangeNotification (     NetworkHandleType Network,     uint8 Node,     Nm_StateType NmState )</pre>	
<b>Service ID [hex]</b>	0x18	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	Network	Identification of the J1939 channel
	Node	Identification of the J1939 node
	NmState	Current (new)state of the J1939 node
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	Notification of current J1939Nm state after state changes	
<b>Available via</b>	BswM_J1939Nm.h	

## BswM\_LinSM\_CurrentSchedule

<b>Service Name</b>	BswM_LinSM_CurrentSchedule	
<b>Syntax</b>	<pre>void BswM_LinSM_CurrentSchedule (     NetworkHandleType Network,     LinIf_SchHandleType CurrentSchedule )</pre>	
<b>Service ID [hex]</b>	0x0a	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	Network	The LIN channel that the schedule table switch have occurred on.
	CurrentSchedule	The currently active schedule table of the LIN channel.
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	Function called by LinSM to indicate the currently active schedule table for a specific LIN channel.	
<b>Available via</b>	BswM_LinSM.h	

## BswM\_LinSM\_CurrentState

<b>Service Name</b>	BswM_LinSM_CurrentState	
<b>Syntax</b>	<pre>void BswM_LinSM_CurrentState (     NetworkHandleType Network,     LinSM_ModeType CurrentState )</pre>	
<b>Service ID [hex]</b>	0x09	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	Network	The LIN channel that the indicated state corresponds to.
	CurrentState	The current state of the LIN channel.
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	Function called by LinSM to indicate its current state.	
<b>Available via</b>	BswM_LinSM.h	

## BswM\_LinTp\_RequestMode

<b>Service Name</b>	BswM_LinTp_RequestMode	
<b>Syntax</b>	<pre>void BswM_LinTp_RequestMode (     NetworkHandleType Network,     LinTp_Mode LinTpRequestedMode )</pre>	
<b>Service ID [hex]</b>	0x0b	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	Network	The LIN channel that the LinTp mode request relates to.
	LinTpRequestedMode	The requested LIN TP mode.
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	Function called by LinTP to request a mode for the corresponding LIN channel. The LinTp_Mode correlates to the LIN schedule table that should be used.	
<b>Available via</b>	BswM_LinTp.h	

## BswM\_Nm\_CarWakeUpIndication

<b>Service Name</b>	BswM_Nm_CarWakeUpIndication	
<b>Syntax</b>	<pre>void BswM_Nm_CarWakeUpIndication (     NetworkHandleType Network )</pre>	
<b>Service ID [hex]</b>	0x24	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	Network	Identification of the Nm-Channel
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	Function called by Nm to indicate a CarWakeUp.	
<b>Available via</b>	BswM_Nm.h	

## BswM\_Nm\_StateChangeNotification

<b>Service Name</b>	BswM_Nm_StateChangeNotification	
<b>Syntax</b>	<pre>void BswM_Nm_StateChangeNotification (     NetworkHandleType Network,     Nm_StateType currentState )</pre>	
<b>Service ID [hex]</b>	0x27	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	Network	Identification of the Nm-channel
	currentState	Current (new) state of the Nm-channel
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	Notification of current Nm state after state changes.	
<b>Available via</b>	BswM_Nm.h	

## BswM\_NvM\_CurrentBlockMode

<b>Service Name</b>	BswM_NvM_CurrentBlockMode	
<b>Syntax</b>	<pre>void BswM_NvM_CurrentBlockMode (     NvM_BlockIdType Block,     NvM_RequestResultType CurrentBlockMode )</pre>	
<b>Service ID [hex]</b>	0x16	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	Block	The Block that the new NvM Mode corresponds to.
	CurrentBlockMode	The current block mode of the NvM block.
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	Function called by NvM to indicate the current block mode of an NvM block.	
<b>Available via</b>	BswM_NvM.h	

## BswM\_NvM\_CurrentJobMode

Service Name	BswM_NvM_CurrentJobMode	
Syntax	<pre>void BswM NvM CurrentJobMode (     NvM MultiBlockRequestType     MultiBlockRequest,     NvM RequestResultType  CurrentJobMode )</pre>	
Service ID [hex]	0x17	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	MultiBlockRequest	Indicates which multi block service this callback refers to
	CurrentJobMode	Current state of the multi block job indicated by parameter MultiBlockRequest
Parameters (inout)	None	
	None	
Return value	None	
	Function called by NvM to inform the BswM about the current state of a multi block job.	
Available via	BswM_NvM.h	

## BswM\_RequestMode

Service Name	BswM_RequestMode	
Syntax	<pre>void BswM_RequestMode (     BswM_UserType requesting_user,     BswM_ModeType requested_mode )</pre>	
Service ID [hex]	0x02	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	requesting_user	The user that requests the mode
	requested_mode	The requested mode.
Parameters (inout)	None	
Parameters (out)	None	
Return value	None	
Description	Generic function call to request modes. This function shall only be used by other BSW modules that does not have a specific mode request interface.	
Available via	BswM.h	

## BswM\_Sd\_ClientServiceCurrentState

<b>Service Name</b>	BswM_Sd_ClientServiceCurrentState	
<b>Syntax</b>	<pre>void BswM_Sd_ClientServiceCurrentState (     uint16 SdClientServiceHandleId,     Sd_ClientServiceCurrentStateType CurrentClientState )</pre>	
<b>Service ID [hex]</b>	0x1f	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	SdClientServiceHandleId	HandleId to identify the ClientService
	CurrentClientState	Current state of the ClientService
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	Function called by Service Discovery to indicate current state of the Client Service (available/down).	
<b>Available via</b>	BswM_Sd.h	

## BswM\_Sd\_ConsumedEventGroupCurrentState

<b>Service Name</b>	BswM_Sd_ConsumedEventGroupCurrentState	
<b>Syntax</b>	<pre>void BswM_Sd_ConsumedEventGroupCurrentState (     uint16 SdConsumedEventGroupHandleId,     Sd_ConsumedEventGroupCurrentStateType ConsumedEventGroupState )</pre>	
<b>Service ID [hex]</b>	0x21	
<b>Sync/Async</b>	Synchronous	
<b>Reentrancy</b>	Reentrant	
<b>Parameters (in)</b>	SdConsumedEventGroup HandleId	HandleId to identify the Consumed Eventgroup
	ConsumedEventGroup State	Status of the Consumed Eventgroup
<b>Parameters (inout)</b>	None	
<b>Parameters (out)</b>	None	
<b>Return value</b>	None	
<b>Description</b>	Function called by Service Discovery to indicate current status of the Consumed Eventgroup (available/down).	
<b>Available via</b>	BswM_Sd.h	

## BswM\_Sd\_EventHandlerCurrentState

Service Name	BswM_Sd_EventHandlerCurrentState	
Syntax	<pre>void BswM_Sd_EventHandlerCurrentstate (     uint16 SdEventHandlerHandleId,     Sd_EventHandlerCurrentStateType EventHandlerStatus )</pre>	
Service ID [hex]	0x20	
Sync/Async	Synchronous	
Reentrancy	Reentrant	
Parameters (in)	SdEventHandlerHandleId	HandleId to identify the EventHandler
	EventHandlerStatus	Status of the EventHandler
Parameters (inout)	None	
Parameters (out)	None	
Return value	None	
Description	Function called by Service Discovery to indicate current status of the EventHandler (requested/released).	
Available via	BswM_Sd.h	

## BswM\_SoAd\_SoConModeChg

Service Name	BswM_SoAd_SoConModeChg	
Syntax	<pre>void BswM_SoAd_SoConModeChg (     SoAd_SoConIdType SoConId,     SoAd_SoConModeType State )</pre>	
Service ID [hex]	0x2a	
Sync/Async	Synchronous	
Reentrancy	Reentrant for different SoConIds. Non reentrant for the same SoConId.	
Parameters (in)	SoConId	The socket connection index.
	State	The state of the SoAd socket connection.
Parameters (inout)	None	
Parameters (out)	None	
Return value	None	
Description	Function called by SoAd to notify state changes of a socket connection.	
Available via	BswM_SoAd.h	

## SCHEDULED FUNCTIONS

## BswM\_MainFunction

<b>Service Name</b>	BswM_MainFunction
<b>Syntax</b>	void BswM_MainFunction ( void )
<b>Service ID [hex]</b>	0x03
<b>Description</b>	Main function of the BswM
<b>Available via</b>	SchM_BswM.h

## SERVICE INTERFACES

## Ports

## BswM\_modeNotificationPort

<b>Name</b>	modeNotificationPort_{ArbName}_{ModeName}
<b>Kind</b>	RequiredPort
<b>Interface-Ref</b>	{ecuc(BswM/BswMConfig/BswMArbitration/BswMMModeRequestPort/BswMMModeRequestSource/BswMSwcModeNotification.BswMSwcModeNotificationModeDeclarationGroupPrototypeRef)}.parent
<b>Description</b>	
<b>Variation</b>	ArbName = {ecuc(BswM/BswMConfig/BswMArbitration.SHORT-NAME)} ModeName = {ecuc(BswM/BswMConfig/BswMArbitration/BswMMModeRequestPort/BswMMModeRequestSource/BswMSwcModeNotification.SHORT-NAME)}

## BswM\_modeRequestPort

<b>Name</b>	modeRequestPort_{ArbName}_{ReqName}
<b>Kind</b>	RequiredPort
<b>Interface-Ref</b>	{ecuc(BswM/BswMConfig/BswMArbitration/BswMMModeRequestPort.BswMMModeRequestSource.BswMSwcModeRequest.BswMSwcModeRequestVariableDataPrototypeRef)}.parent
<b>Description</b>	–
<b>Variation</b>	ArbName = {ecuc(BswM/BswMConfig/BswMArbitration.SHORT-NAME)} ReqName = {ecuc(BswM/BswMConfig/BswMArbitration/BswMMModeRequestPort.SHORT-NAME)}

## BswM\_modeSwitchPort

<b>Name</b>	modeSwitchPort_{ModConName}_{SwitchName}
<b>Kind</b>	ProvidedPort
<b>Interface-Ref</b>	{ecuc(BswM/BswMConfig/BswMMModeControl/BswMSwitchPort.BswMMModeSwitchInterfaceRef)}
<b>Description</b>	–
<b>Variation</b>	{ecuc(BswM/BswMConfig/BswMMModeControl/BswMSwitchPort.BswMMModeSwitchInterfaceRef} != NULL ModConName = {ecuc(BswM/BswMConfig/BswMMModeControl.SHORT-NAME)} SwitchName = {ecuc(BswM/BswMConfig/BswMMModeControl/BswMSwitchPort.SHORT-NAME)}

## API TO REQUEST PORT MAPPINGS

API	Request Port	API/ Config-parameter pairs
BswM_BswMPartitionRestarted	BswMPartitionRestarted	
BswM_CanSM_CurrentState	BswMCanSMIndication	Network / BswMCanSMChan- nelRef
BswM_ComM_CurrentMode	BswMComMIndication	Network / BswMComMChannel- Ref
BswM_ComM_CurrentPNCMode	BswMComMPncRequest	PNC /BswMComMPncRef
BswM_ComM_InitiateReset	BswMComMInitiateReset	
BswM_Dcm_ApplicationUpdated	BswMDcmApplicationUpdated Indication	
BswM_Dcm_CommunicationMode_CurrentState	BswMDcmComModeRequest	Network / BswMDcmComM ChannelRef
BswM_EcuM_CurrentState	BswMEcuMIndication	
BswM_EcuM_CurrentWakeups	BswMEcuMWakeupSource	source / BswMEcuMWakeupSr- cRef
BswM_EcuM_RequestedState	BswMEcuMRUNRequestIndica- tion	State / BswMEcuMRUNRequest ProtocolPort
BswM_Ethlf_PortGroupLinkStateChg	BswMEthlfPortGroupLinkState- Chg	PortGroupIdx/ BswMEthlf SwitchPortGroupRef
BswM_EthSM_CurrentState	BswMEthSMIndication	Network /BswMEthSMChannel- Ref
BswM_FrSM_CurrentState	BswMFrSMIndication	Network / BswMFrSMChannel- Ref
BswM_J1939DcmBroadcastStatus	BswMJ1939DcmBroadcast Status	NetworkMask / BswMJ1939 DcmChannelRef
BswM_J1939Nm_StateChangeNotification	BswMJ1939NmIndication	Network / BswMJ1939NmChan- nelRef,Node / BswMJ1939Nm NodeRef
BswM_LinSM_CurrentSchedule	BswMLinScheduleIndication	Network / BswMLinSMChannel Ref
BswM_LinSM_CurrentState	BswMLinSMIndication	Network / BswMLinSMChannel Ref
BswM_LinTp_RequestMode	BswMLinTpModeRequest	Network / BswMLinTpChannel Ref
BswM_Nm_CarWakeUpIndication	BswMNmCarWakeUpIndication	
BswM_Nm_StateChangeNotification	BswMNmStateChangeNotifica- tion	Network / BswMNmChannelRef
BswM_NvM_CurrentBlockMode	BswMNVMBRequest	Block/ BswMNVMBBlockRef
BswM_NvM_CurrentJobMode	BswMNVMJobModeIndication	MultiBlockRequest / BswMNvm Service
BswM_RequestMode	BswMGenericRequest	requesting user / BswMMode RequesterId
BswM_Sd_ClientServiceCurrentState	BswMSdClientServiceCurrent State	SdClientServiceHandleId BswMSdClientMethodsRef
BswM_Sd_ConsumedEventGroupCurrentState	BswMSdConsumedEventGroup CurrentState	SdConsumedEventGroupHan- dleId / BswMSdConsumedEvent GroupRef
BswM_Sd_EventHandlerCurrentState	BswMSdEventHandlerCurrent State	SdEventHandlerHandleId BswMSdEventHandlerRef

## 2.2.4 Sequence Charts

### Sequence diagrams

#### DEFERRED OPERATION OF BSWM

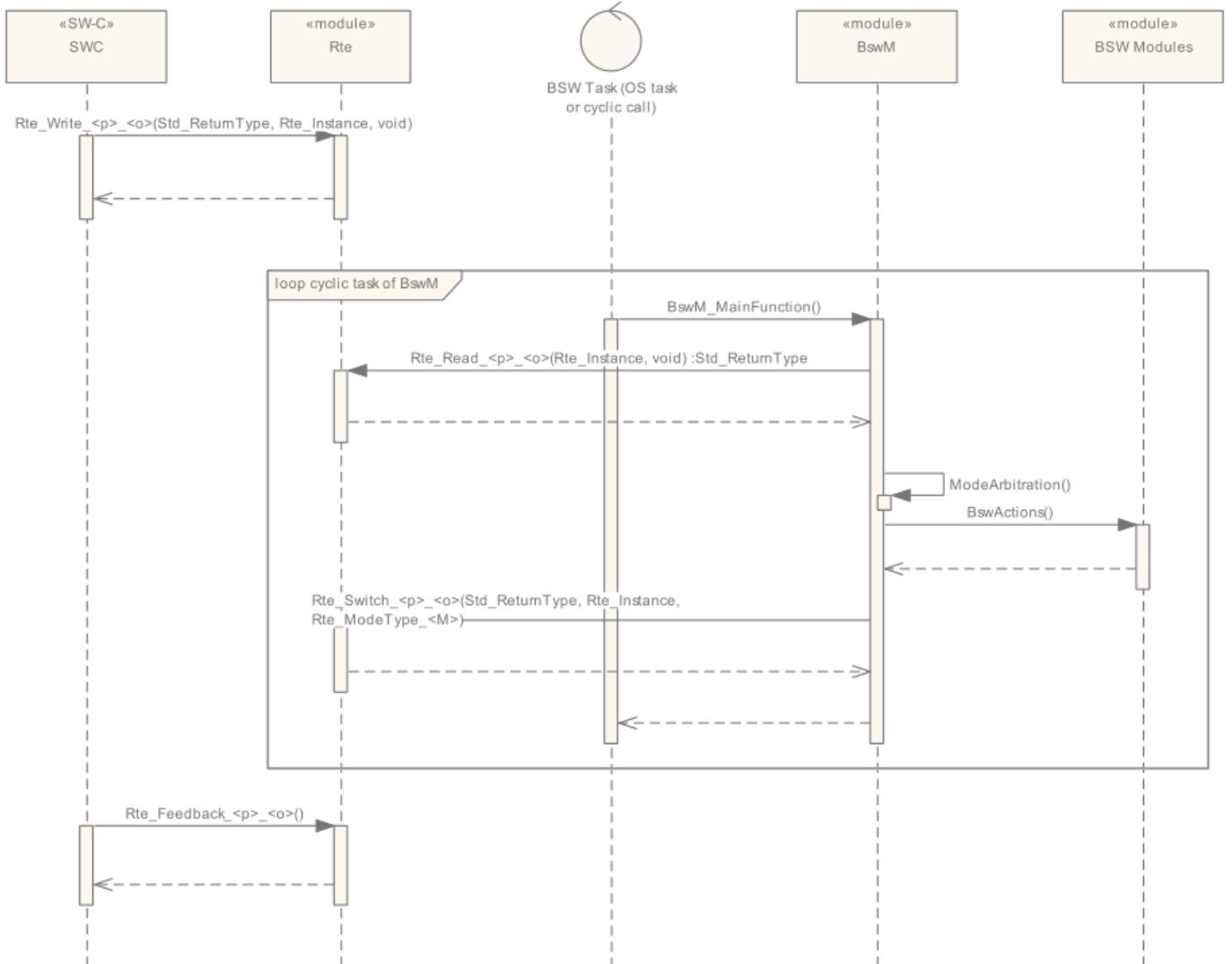


Figure 9.1: Deferred operation of BswM

## IMMEDIATE OPERATION OF BSWM

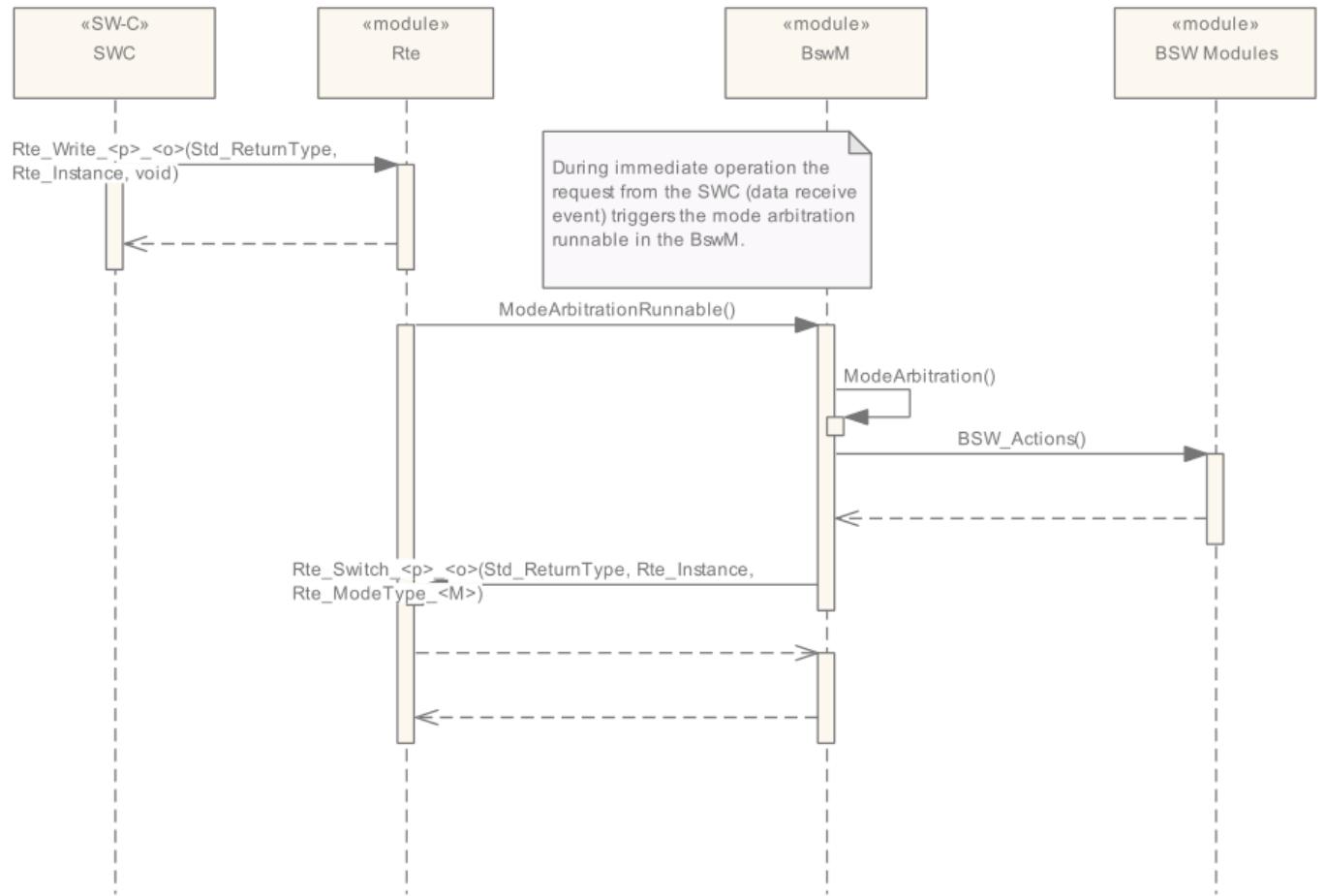
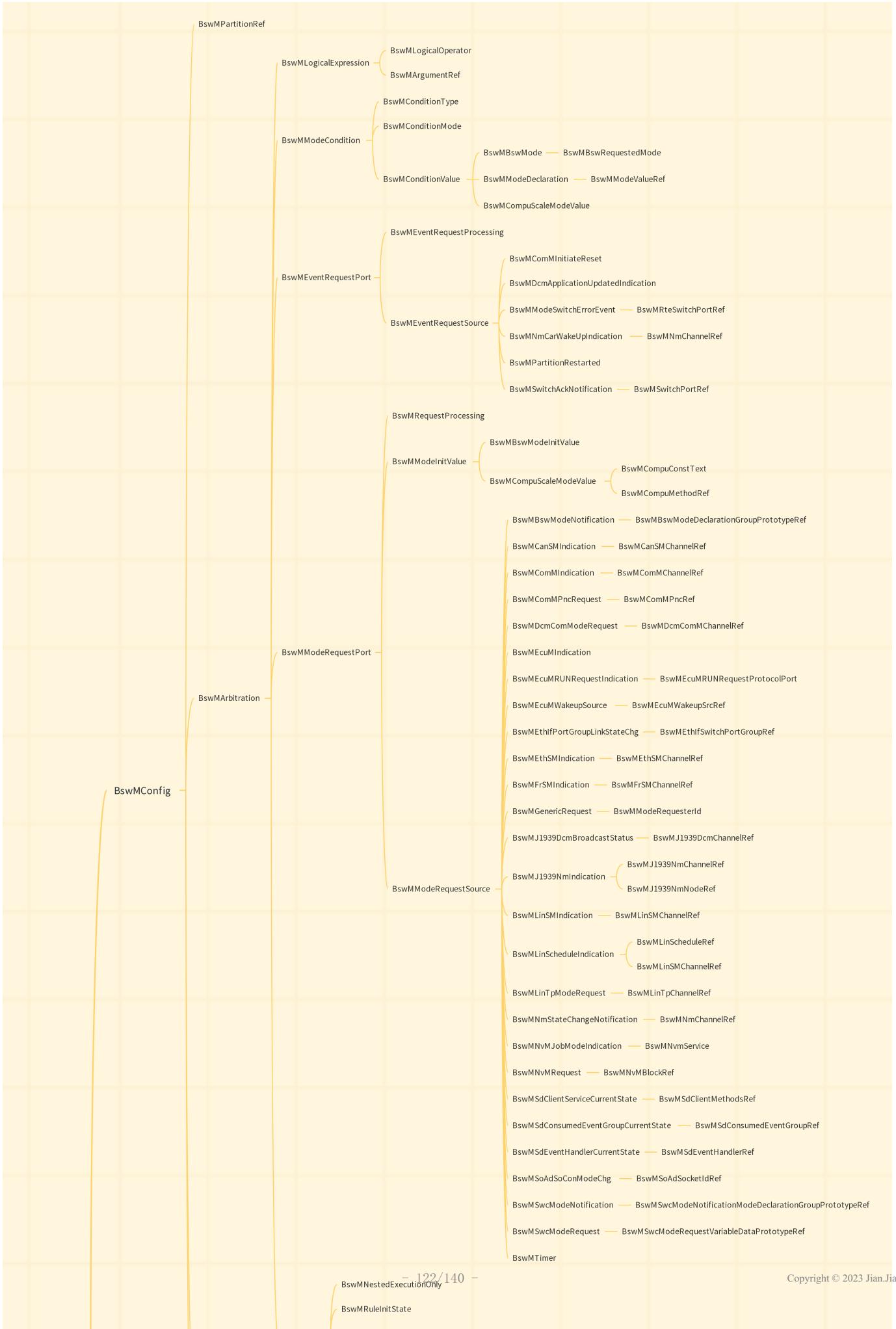


Figure 9.2: Immediate operation of BswM

## 2.2.5 Configuration

---

### **Configuration specification**



## 3. 关于

### 3.1 发行说明

#### 3.1.1 升级

要将MkDocs升级到最新版本，请使用pip:

```
1 pip install -U mkdocs
```

您可以使用 `mkdocs --version` 确定当前安装的版本:

```
1 $ mkdocs --version
2 mkdocs, version 1.0 from /path/to/mkdocs (Python 3.6)
```

#### 3.1.2 维护团队

MkDocs团队的现任成员和过去成员。

- [@tomchristie](#)
- [@d0ugal](#)
- [@waylan](#)

#### 3.1.3 Version 1.1 (开发中)

##### Major Additions to Version 1.1

###### SUPPORT FOR LUNR.PY AS `PREBUILD_INDEX` ENGINE

Mkdocs now supports prebuilding indices using [Lunr.py](#), a pure Python implementation of Lunr.js, allowing the user to avoid installing a NodeJS environment if so desired. For more information please read the [prebuild\\_index documentation](#).

###### READTHEDOCS THEME UPDATED WITH UPSTREAM (#588 AND #1374)

The `readthedocs` theme now more closely matches the [upstream](#) Sphinx theme (version 0.4.1). A number of new theme configuration settings were added which mirror the upstream configuration options. See the [theme documentation](#) for details.

###### Update `mkdocs` theme to bootswatch 4.1.3 (#1563)

The `mkdocs` theme now supports all the features of [Bootswatch 4.1](#). Note that the `dropdowns` used in the navigation only support one level of nesting. If your global navigation uses more than one level, things will likely be broken.

##### Other Changes and Additions to Version 1.1

- Bugfix: Exclude Markdown files and READMEs from theme. (#1766).
- Bugfix: Account for encoded URLs (#1670).
- Bugfix: Ensure theme files do not override `docs_dir` files (#1671).
- Bugfix: Do not normalize URL fragments (#1655).
- Bugfix: Skip external URLs in sitemap.xml (#1742).
- Add canonical tag to `readthedocs` theme (#1669).

### 3.1.4 Version 1.0.4 (2018-09-07)

- Bugfix: Ignore absolute links in Markdown (#1621).

### 3.1.5 Version 1.0.3 (2018-08-29)

- Bugfix: Warn on relative paths in navigation (#1604).
- Bugfix: Handle empty `theme_config.yml` files correctly (#1602).

### 3.1.6 Version 1.0.2 (2018-08-22)

- Bugfix: Provide absolute `base_url` to error templates (#1598).

### 3.1.7 Version 1.0.1 (2018-08-13)

- Bugfix: Prevent page reload when [Enter] is pressed in search box (#1589).
- Bugfix: Avoid calling `search` until all assets are ready (#1584).
- Bugfix: Exclude `README.md` if `index.md` is present (#1580).
- Bugfix: Fix `readthedocs` theme navigation bug with homepage (#1576).

### 3.1.8 Version 1.0 (2018-08-03)

#### Major Additions to Version 1.0

##### INTERNAL REFACTOR OF PAGES, FILES, AND NAVIGATION

Internal handling of pages, files and navigation has been completely refactored. The changes included in the refactor are summarized below.

- Support for hidden pages. All Markdown pages are now included in the build regardless of whether they are included in the navigation configuration (#699).
- The navigation can now include links to external sites (#989 #1373 & #1406).
- Page data (including titles) is properly determined for all pages before any page is rendered (#1347).
- Automatically populated navigation now sorts index pages to the top. In other words, The index page will be listed as the first child of a directory, while all other documents are sorted alphanumerically by file name (#73 & #1042).
- A `README.md` file is now treated as an index file within a directory and will be rendered to `index.html` (#608).
- The URLs for all files are computed once and stored in a files collection. This ensures all internal links are always computed correctly regardless of the configuration. This also allows all internal links to be validated, not just links to other Markdown pages. (#842 & #872).
- A new `url` template filter smartly ensures all URLs are relative to the current page (#1526).
- An `on_files` plugin event has been added, which could be used to include files not in the `docs_dir`, exclude files, redefine page URLs (i.e. implement extensionless URLs), or to manipulate files in various other ways.

##### Backward Incompatible Changes

As part of the internal refactor, a number of backward incompatible changes have been introduced, which are summarized below.

##### URLS have changed when `use_directory_urls` is `False`

Previously, all Markdown pages would be have their filenames altered to be index pages regardless of how the `use_directory_urls` setting was configured. However, the path munging is only needed when `use_directory_urls` is set to `True` (the default). The path munging no longer happens when `use_directory_urls` is set to `False`, which will result in different URLs for all pages that were not already index files. As this behavior only effects a non-default configuration, and the most common user-case for setting the option to `False` is for local file system (`file://`) browsing, its not likely to effect most users. However, if you have

`use_directory_urls` set to `False` for a MkDocs site hosted on a web server, most of your URLs will now be broken. As you can see below, the new URLs are much more sensible.

Markdown file	Old URL	New URL
index.md	index.html	index.html
foo.md	foo/index.html	foo.html
foo/bar.md	foo/bar/index.html	foo/bar.html

Note that there has been no change to URLs or file paths when `use_directory_urls` is set to `True` (the default), except that MkDocs more consistently includes an ending slash on all internally generated URLs.

The `pages` configuration setting has been renamed to `nav`.

The `pages` configuration setting is deprecated and will issue a warning if set in the configuration file. The setting has been renamed `nav`. To update your configuration, simply rename the setting to `nav`. In other words, if your configuration looked like this:

```
pages:
  - Home: index.md
  - User Guide: user-guide.md
```

Simply edit the configuration as follows:

```
nav:
  - Home: index.md
  - User Guide: user-guide.md
```

In the current release, any configuration which includes a `pages` setting, but no `nav` setting, the `pages` configuration will be copied to `nav` and a warning will be issued. However, in a future release, that may no longer happen. If both `pages` and `nav` are defined, the `pages` setting will be ignored.

Template variables and `base_url`

In previous versions of MkDocs some URLs expected the `base_url` template variable to be prepended to the URL and others did not. That inconsistency has been removed in that no URLs are modified before being added to the template context.

For example, a theme template might have previously included a link to the `site_name` as:

```
<a href="{{ nav.homepage.url }}>{{ config.site_name }}</a>
```

And MkDocs would magically return a URL for the homepage which was relative to the current page. That "magic" has been removed and the `url` template filter should be used:

```
<a href="{{ nav.homepage.url|url }}>{{ config.site_name }}</a>
```

This change applies to any navigation items and pages, as well as the `page.next_page` and `page.previous_page` attributes. For the time being, the `extra_javascript` and `extra_css` variables continue to work as previously (without the `url` template filter), but they have been deprecated and the corresponding configuration values (`config.extra_javascript` and `config.extra_css` respectively) should be used with the filter instead.

```
{% for path in config['extra_css'] %}
  <link href="{{ path|url }}" rel="stylesheet">
{% endfor %}
```

Note that navigation can now include links to external sites. Obviously, the `base_url` should not be prepended to these items. However, the `url` template filter is smart enough to recognize the URL is absolute and does not alter it. Therefore, all navigation items can be passed to the filter and only those that need to will be altered.

```
{% for nav_item in nav %}
  <a href="{{ nav_item.url|url }}>{{ nav_item.title }}</a>
{% endfor %}
```

#### PATH BASED SETTINGS ARE RELATIVE TO CONFIGURATION FILE (#543)

Previously any relative paths in the various configuration options were resolved relative to the current working directory. They are now resolved relative to the configuration file. As the documentation has always encouraged running the various MkDocs commands from the directory that contains the configuration file

(project root), this change will not affect most users. However, it will make it much easier to implement automated builds or otherwise run commands from a location other than the project root.

Simply use the `-f/--config-file` option and point it at the configuration file:

```
mkdocs build --config-file /path/to/my/config/file.yml
```

As previously, if no file is specified, MkDocs looks for a file named `mkdocs.yml` in the current working directory.

#### ADDED SUPPORT FOR YAML META-DATA (#1542)

Previously, MkDocs only supported MultiMarkdown style meta-data, which does not recognize different data types and is rather limited. MkDocs now also supports YAML style meta-data in Markdown documents. MkDocs relies on the presence or absence of the delimiters (`---` or `...`) to determine whether YAML style meta-data or MultiMarkdown style meta-data is being used.

Previously MkDocs would recognize MultiMarkdown style meta-data between the delimiters. Now, if the delimiters are detected, but the content between the delimiters is not valid YAML meta-data, MkDocs does not attempt to parse the content as MultiMarkdown style meta-data. Therefore, MultiMarkdown style meta-data must not include the delimiters. See the [MultiMarkdown style meta-data documentation](#) for details.

Prior to version 0.17, MkDocs returned all meta-data values as a list of strings (even a single line would return a list of one string). In version 0.17, that behavior was changed to return each value as a single string (multiple lines were joined), which some users found limiting (see #1471). That behavior continues for MultiMarkdown style meta-data in the current version. However, YAML style meta-data supports the full range of "safe" YAML data types. Therefore, it is recommended that any complex meta-data make use of the YAML style (see the [YAML style meta-data documentation](#) for details). In fact, a future version of MkDocs may deprecate support for MultiMarkdown style meta-data.

#### REFACTOR SEARCH PLUGIN

The search plugin has been completely refactored to include support for the following features:

- Use a web worker in the browser with a fallback (#1396).
- Optionally pre-build search index locally (#859 & #1061).
- Upgrade to lunr.js 2.x (#1319).
- Support search in languages other than English (#826).
- Allow the user to define the word separators (#867).
- Only run searches for queries of length  $> 2$  (#1127).
- Remove dependency on require.js (#1218).
- Compress the search index (#1128).

Users can review the [configuration options](#) available and theme authors should review how [search and themes](#) interact.

#### THEME\_DIR CONFIGURATION OPTION FULLY DEPRECATED

As of version 0.17, the `custom_dir` option replaced the deprecated `theme_dir` option. If users had set the `theme_dir` option, MkDocs version 0.17 copied the value to the `theme.custom_dir` option and a warning was issued. As of version 1.0, the value is no longer copied and an error is raised.

### Other Changes and Additions to Version 1.0

- Keyboard shortcuts changed to not conflict with commonly used accessibility shortcuts (#1502.)
- User friendly YAML parse errors (#1543).
- Officially support Python 3.7.
- A missing theme configuration file now raises an error.
- Empty `extra_css` and `extra_javascript` settings no longer raise a warning.
- Add highlight.js configuration settings to built-in themes (#1284).
- Close search modal when result is selected (#1527).
- Add a level attribute to AnchorLinks (#1272).
- Add MkDocs version check to gh-deploy script (#640).

- Improve Markdown extension error messages. (#782).
- Drop official support for Python 3.3 and set `tornado>=5.0` (#1427).
- Add support for GitLab edit links (#1435).
- Link to GitHub issues from release notes (#644).
- Expand `{sha}` and `{version}` in gh-deploy commit message (#1410).
- Compress `sitemap.xml` (#1130).
- Defer loading JS scripts (#1380).
- Add a title attribute to the search input (#1379).
- Update RespondJS to latest version (#1398).
- Always load Google Analytics over HTTPS (#1397).
- Improve scrolling frame rate (#1394).
- Provide more version info. (#1393).
- Refactor `writing-your-docs.md` (#1392).
- Workaround Safari bug when zooming to < 100% (#1389).
- Remove addition of `clicky` class to body and animations. (#1387).
- Prevent search plugin from reinjecting `extra_javascript` files (#1388).
- Refactor `copy_media_files` util function for more flexibility (#1370).
- Remove PyPI Deployment Docs (#1360).
- Update links to Python-Markdown library (#1360).
- Document how to generate manpages for MkDocs commands (#686).

### 3.1.9 Version 0.17.5 (2018-07-06)

---

- Bugfix: Fix Python 3.7 and PEP 479 incompatibility (#1518).

### 3.1.10 Version 0.17.4 (2018-06-08)

---

- Bugfix: Add multi-level nesting support to `sitemap.xml` (#1482).

### 3.1.11 Version 0.17.3 (2018-03-07)

---

- Bugfix: Set dependency `tornado>=4.1,<5.0` due to changes in 5.0 (#1428).

### 3.1.12 Version 0.17.2 (2017-11-15)

---

- Bugfix: Correct `extra_*` config setting regressions (#1335 & #1336).

### 3.1.13 Version 0.17.1 (2017-10-30)

---

- Bugfix: Support `repo_url` with missing ending slash. (#1321).
- Bugfix: Add length support to `mkdocs.toc.TableOfContext` (#1325).
- Bugfix: Add some theme specific settings to the search plugin for third party themes (#1316).
- Bugfix: Override `site_url` with `dev_addr` on local server (#1317).

## 3.1.14 Version 0.17.0 (2017-10-19)

### Major Additions to Version 0.17.0

#### PLUGIN API. (#206)

A new [Plugin API](#) has been added to MkDocs which allows users to define their own custom behaviors. See the included documentation for a full explanation of the API.

The previously built-in search functionality has been removed and wrapped in a plugin (named "search") with no changes in behavior. When MkDocs builds, the search index is now written to `search/search_index.json` instead of `mkdocs/search_index.json`. If no plugins setting is defined in the config, then the `search` plugin will be included by default. See the [configuration](#) documentation for information on overriding the default.

#### THEME CUSTOMIZATION. (#1164)

Support had been added to provide theme specific customizations. Theme authors can define default options as documented in [Theme Configuration](#). A theme can now inherit from another theme, define various static templates to be rendered, and define arbitrary default variables to control behavior in the templates. The theme configuration is defined in a configuration file named `mkdocs_theme.yml` which should be placed at the root of your template files. A warning will be raised if no configuration file is found and an error will be raised in a future release.

Users can override those defaults under the `theme` configuration option of their `mkdocs.yml` configuration file, which now accepts nested options. One such nested option is the `custom_dir` option, which replaces the now deprecated `theme_dir` option. If users had previously set the `theme_dir` option, a warning will be issued, with an error expected in a future release.

If a configuration previously defined a `theme_dir` like this:

```
theme: mkdocs
theme_dir: custom
```

Then the configuration should be adjusted as follows:

```
theme:
  name: mkdocs
  custom_dir: custom
```

See the `theme` configuration option documentation for details.

#### PREVIOUSLY DEPRECATED TEMPLATE VARIABLES REMOVED. (#1168)

##### Page Template

The primary entry point for page templates has been changed from `base.html` to `main.html`. This allows `base.html` to continue to exist while allowing users to override `main.html` and extend `base.html`. For version 0.16, `base.html` continued to work if no `main.html` template existed, but it raised a deprecation warning. In version 1.0, a build will fail if no `main.html` template exists.

##### Context Variables

Page specific variable names in the template context have been refactored as defined in [Custom Themes](#). The old variable names issued a warning in version 0.16, but have been removed in version 1.0.

Any of the following old page variables should be updated to the new ones in user created and third-party templates:

Old Variable Name	New Variable Name
current_page	page
page_title	page.title
content	page.content
toc	page.toc
meta	page.meta
canonical_url	page.canonical_url
previous_page	page.previous_page
next_page	page.next_page

Additionally, a number of global variables have been altered and/or removed and user created and third-party templates should be updated as outlined below:

Old Variable Name	New Variable Name or Expression
current_page	page
include_nav	nav length>1
include_next_prev	(page.next_page or page.previous_page)
site_name	config.site_name
site_author	config.site_author
page_description	config.site_description
repo_url	config.repo_url
repo_name	config.repo_name
site_url	config.site_url
copyright	config.copyright
google_analytics	config.google_analytics
homepage_url	nav.homepage.url
favicon	{{ base_url }}/img/favicon.ico

#### AUTO-POPULATED EXTRA\_CSS AND EXTRA\_JAVASCRIPT FULLY DEPRECATED. (#986)

In previous versions of MkDocs, if the `extra_css` or `extra_javascript` config settings were empty, MkDocs would scan the `docs_dir` and auto-populate each setting with all of the CSS and JavaScript files found. On version 0.16 this behavior was deprecated and a warning was issued. In 0.17 any unlisted CSS and JavaScript files will not be included in the HTML templates, however, a warning will be issued. In other words, they will still be copied to the `site-dir`, but they will not have any effect on the theme if they are not explicitly listed.

All CSS and JavaScript files in the `docs_dir` should be explicitly listed in the `extra_css` or `extra_javascript` config settings going forward.

#### Other Changes and Additions to Version 0.17.0

- Add "edit Link" support to MkDocs theme (#1129)
- Open files with `utf-8-sig` to account for BOM (#1186)
- Symbolic links are now followed consistently (#1134)
- Support for keyboard navigation shortcuts added to included themes (#1095)

- Some refactoring and improvements to config\_options (#1296)
- Officially added support for Python 3.6 (#1296)
- 404 Error page added to readthedocs theme (#1296))
- Internal refactor of Markdown processing (#713)
- Removed special error message for mkdocs-bootstrap and mkdocs-bootswatch themes (#1168)
- The legacy pages config is no longer supported (#1168)
- The deprecated `json` command has been removed (#481)
- Support for Python 2.6 has been dropped (#165)
- File permissions are no longer copied during build (#1292)
- Support query and fragment strings in `edit_uri` (#1224 & #1273)

### 3.1.15 Version 0.16.3 (2017-04-04)

---

- Fix error raised by autoscrolling in the readthedocs theme (#1177)
- Fix a few documentation typos (#1181 & #1185)
- Fix a regression to livereload server introduced in 0.16.2 (#1174)

### 3.1.16 Version 0.16.2 (2017-03-13)

---

- System root (`/`) is not a valid path for site\_dir or docs\_dir (#1161)
- Refactor readthedocs theme navigation (#1155 & #1156)
- Add support to dev server to serve custom error pages (#1040)
- Ensure nav.homepage.url is not blank on error pages (#1131)
- Increase livereload dependency to 2.5.1 (#1106)

### 3.1.17 Version 0.16.1 (2016-12-22)

---

- Ensure scrollspy behavior does not affect nav bar (#1094)
- Only "load" a theme when it is explicitly requested by the user (#1105)

### 3.1.18 Version 0.16 (2016-11-04)

---

#### **Major Additions to Version 0.16.0**

TEMPLATE VARIABLES REFACTORED. (#874)

Page Context

Page specific variable names in the template context have been refactored as defined in [Custom Themes](#). The old variable names will issue a warning but continue to work for version 0.16, but may be removed in a future version.

Any of the following old page variables should be updated to the new ones in user created and third-party templates:

Old Variable Name	New Variable Name
current_page	page
page_title	page.title
content	page.content
toc	page.toc
meta	page.meta
canonical_url	page.canonical_url
previous_page	page.previous_page
next_page	page.next_page

#### Global Context

Additionally, a number of global variables have been altered and/or deprecated and user created and third-party templates should be updated as outlined below:

Previously, the global variable `include_nav` was altered programmatically based on the number of pages in the nav. The variable will issue a warning but continue to work for version 0.16, but may be removed in a future version. Use `{% if nav|length>1 %}` instead.

Previously, the global variable `include_next_prev` was altered programmatically based on the number of pages in the nav. The variable will issue a warning but continue to work for version 0.16, but may be removed in a future version. Use `{% if page.next_page or page.previous_page %}` instead.

Previously the global variable `page_description` was altered programmatically based on whether the current page was the homepage. Now it simply maps to `config['site_description']`. Use `{% if page.is_homepage %}` in the template to conditionally change the description.

The global variable `homepage_url` maps directly to `nav.homepage.url` and is being deprecated. The variable will issue a warning but continue to work for version 0.16, but may be removed in a future version. Use `nav.homepage.url` instead.

The global variable `favicon` maps to the configuration setting `site_favicon`. Both the template variable and the configuration setting are being deprecated and will issue a warning but continue to work for version 0.16, and may be removed in a future version. Use `{{ base_url }}/img/favicon.ico` in your template instead. Users can simply save a copy of their custom favicon icon to `img/favicon.ico` in either their `docs_dir` or `theme_dir`.

A number of variables map directly to similarly named variables in the `config`. Those variables are being deprecated and will issue a warning but continue to work for version 0.16, but may be removed in a future version. Use `config.var_name` instead, where `var_name` is the name of one of the `configuration` variables.

Below is a summary of all of the changes made to the global context:

Old Variable Name	New Variable Name or Expression
current_page	page
include_nav	nav length>1
include_next_prev	(page.next_page or page.previous_page)
site_name	config.site_name
site_author	config.site_author
page_description	config.site_description
repo_url	config.repo_url
repo_name	config.repo_name
site_url	config.site_url
copyright	config.copyright
google_analytics	config.google_analytics
homepage_url	nav.homepage.url
favicon	{{ base_url }}/img/favicon.ico

#### INCREASED TEMPLATE CUSTOMIZATION. (#607)

The built-in themes have been updated by having each of their many parts wrapped in template blocks which allow each individual block to be easily overridden using the `theme_dir` config setting. Without any new settings, you can use a different analytics service, replace the default search function, or alter the behavior of the navigation, among other things. See the relevant [documentation](#) for more details.

To enable this feature, the primary entry point for page templates has been changed from `base.html` to `main.html`. This allows `base.html` to continue to exist while allowing users to override `main.html` and extend `base.html`. For version 0.16, `base.html` will continue to work if no `main.html` template exists, but it is deprecated and will raise a warning. In version 1.0, a build will fail if no `main.html` template exists. Any custom and third party templates should be updated accordingly.

The easiest way for a third party theme to be updated would be to simply add a `main.html` file which only contains the following line:

```
{% extends "base.html" %}
```

That way, the theme contains the `main.html` entry point, and also supports overriding blocks in the same manner as the built-in themes. Third party themes are encouraged to wrap the various pieces of their templates in blocks in order to support such customization.

#### AUTO-POPULATED EXTRA\_CSS AND EXTRA\_JAVASCRIPT DEPRECATED. (#986)

In previous versions of MkDocs, if the `extra_css` or `extra_javascript` config settings were empty, MkDocs would scan the `docs_dir` and auto-populate each setting with all of the CSS and JavaScript files found. This behavior is deprecated and a warning will be issued. In the next release, the auto-populate feature will stop working and any unlisted CSS and JavaScript files will not be included in the HTML templates. In other words, they will still be copied to the `site-dir`, but they will not have any effect on the theme if they are not explicitly listed.

All CSS and JavaScript files in the `docs_dir` should be explicitly listed in the `extra_css` or `extra_javascript` config settings going forward.

#### SUPPORT FOR DIRTY BUILDS. (#990)

For large sites the build time required to create the pages can become problematic, thus a "dirty" build mode was created. This mode simply compares the modified time of the generated HTML and source markdown. If the markdown has changed since the HTML then the page is re-constructed. Otherwise, the page remains as is. This mode may be invoked in both the `mkdocs serve` and `mkdocs build` commands:

```
mkdocs serve --dirtyreload
```

```
mkdocs build --dirty
```

It is important to note that this method for building the pages is for development of content only, since the navigation and other links do not get updated on other pages.

#### STRICTER DIRECTORY VALIDATION

Previously, a warning was issued if the `site_dir` was a child directory of the `docs_dir`. This now raises an error. Additionally, an error is now raised if the `docs_dir` is set to the directory which contains your config file rather than a child directory. You will need to rearrange your directory structure to better conform with the documented [layout](#).

#### Other Changes and Additions to Version 0.16.0

- Bugfix: Support `gh-deploy` command on Windows with Python 3 (#722)
- Bugfix: Include .woff2 font files in Python package build (#894)
- Various updates and improvements to Documentation Home Page/Tutorial (#870)
- Bugfix: Support livereload for config file changes (#735)
- Bugfix: Non-media template files are no longer copied with media files (#807)
- Add a flag (-e/--theme-dir) to specify theme directory with the commands `mkdocs build` and `mkdocs serve` (#832)
- Fixed issues with Unicode file names under Windows and Python 2. (#833)
- Improved the styling of in-line code in the MkDocs theme. (#718)
- Bugfix: convert variables to JSON when being passed to JavaScript (#850)
- Updated the ReadTheDocs theme to match the upstream font sizes and colors more closely. (#857)
- Fixes an issue with permalink markers showing when the mouse was far above them (#843)
- Bugfix: Handle periods in directory name when automatically creating the pages config. (#728)
- Update searching to Lunr 0.7, which comes with some performance enhancements for larger documents (#859)
- Bugfix: Support SOURCE\_DATE\_EPOCH environment variable for "reproducible" builds (#938)
- Follow links when copying media files (#869).
- Change "Edit on..." links to point directly to the file in the source repository, rather than to the root of the repository (#975), configurable via the new `edit_uri` setting.
- Bugfix: Don't override config value for strict mode if not specified on CLI (#738).
- Add a `--force` flag to the `gh-deploy` command to force the push to the repository (#973).
- Improve alignment for current selected menu item in readthedocs theme (#888).
- `http://user.github.io/repo => https://user.github.io/repo/` (#1029).
- Improve installation instructions (#1028).
- Account for wide tables and consistently wrap inline code spans (#834).
- Bugfix: Use absolute URLs in nav & media links from error templates (#77).

#### 3.1.19 Version 0.15.3 (2016-02-18)

- Improve the error message the given theme can't be found.
- Fix an issue with relative symlinks (#639)

#### 3.1.20 Version 0.15.2 (2016-02-08)

- Fix an incorrect warning that states external themes [will be removed from MkDocs](#).

#### 3.1.21 Version 0.15.1 (2016-01-30)

- Lower the minimum supported Click version to 3.3 for package maintainers. (#763)

## 3.1.22 Version 0.15.0 (2016-01-21)

---

### Major Additions to Version 0.15.0

#### ADD SUPPORT FOR INSTALLABLE THEMES

MkDocs now supports themes that are distributed via Python packages. With this addition, the Bootstrap and Bootswatch themes have been moved to external git repositories and python packages. See their individual documentation for more details about these specific themes.

- [MkDocs Bootstrap](#)
- [MkDocs Bootswatch](#)

They will be included with MkDocs by default until a future release. After that they will be installable with pip: `pip install mkdocs-bootstrap` and `pip install mkdocs-bootswatch`

See the documentation for [Styling your docs](#) for more information about using and customizing themes and [Custom themes](#) for creating and distributing new themes

### Other Changes and Additions to Version 0.15.0

- Fix issues when using absolute links to Markdown files. (#628)
- Deprecate support of Python 2.6, pending removal in 1.0.0. (#165)
- Add official support for Python version 3.5.
- Add support for `site_description` and `site_author` to the [ReadTheDocs](#) theme. (#631)
- Update FontAwesome to 4.5.0. (#789)
- Increase IE support with X-UA-Compatible. (#785)
- Added support for Python's `-m` flag. (#706)
- Bugfix: Ensure consistent ordering of auto-populated pages. (#638)
- Bugfix: Scroll the tables of contents on the MkDocs theme if it is too long for the page. (#204)
- Bugfix: Add all ancestors to the page attribute `ancestors` rather than just the initial one. (#693)
- Bugfix: Include HTML in the build output again. (#691)
- Bugfix: Provide filename to Read the Docs. (#721 and RTD#1480)
- Bugfix: Silence Click's `unicode_literals` warning. (#708)

## 3.1.23 Version 0.14.0 (2015-06-09)

---

- Improve Unicode handling by ensuring that all config strings are loaded as Unicode. (#592)
- Remove dependency on the six library. (#583)
- Remove dependency on the ghp-import library. (#547)
- Add `--quiet` and `--verbose` options to all sub-commands. (#579)
- Add short options (`-a`) to most command line options. (#579)
- Add copyright footer for [readthedocs](#) theme. (#568)
- If the requested port in `mkdocs serve` is already in use, don't show the user a full stack trace. (#596)
- Bugfix: Fix a JavaScript encoding problem when searching with spaces. (#586)
- Bugfix: gh-deploy now works if the `mkdocs.yml` is not in the git repo root. (#578)
- Bugfix: Handle (pass-through instead of dropping) HTML entities while parsing TOC. (#612)
- Bugfix: Default `extra_templates` to an empty list, don't automatically discover them. (#616)

### 3.1.24 Version 0.13.3 (2015-06-02)

- Bugfix: Reduce validation error to a warning if the `site_dir` is within the `docs_dir` as this shouldn't cause any problems with building but will inconvenience users building multiple times. (#580)

### 3.1.25 Version 0.13.2 (2015-05-30)

- Bugfix: Ensure all errors and warnings are logged before exiting. (#536)
- Bugfix: Fix compatibility issues with ReadTheDocs. (#554)

### 3.1.26 Version 0.13.1 (2015-05-27)

- Bugfix: Fix a problem with minimal configurations which only contain a list of paths in the pages config. (#562)

### 3.1.27 Version 0.13.0 (2015-05-26)

#### Deprecations to Version 0.13.0

##### DEPRECATE THE JSON COMMAND

In this release the `mkdocs json` command has been marked as deprecated and when used a deprecation warning will be shown. It will be removed in a [future release](#) of MkDocs, version 1.0 at the latest. The `mkdocs json` command provided a convenient way for users to output the documentation contents as JSON files but with the additions of search to MkDocs this functionality is duplicated.

A new index with all the contents from a MkDocs build is created in the `site_dir`, so with the default value for the `site_dir` it can be found in `site/mkdocs/search_index.json`.

This new file is created on every MkDocs build (with `mkdocs build`) and no configuration is needed to enable it.

##### CHANGE THE PAGES CONFIGURATION

Provide a [new way](#) to define pages, and specifically [nested pages](#), in the `mkdocs.yml` file and deprecate the existing approach, support will be removed with MkDocs 1.0.

##### WARN USERS ABOUT THE REMOVAL OF BUILTIN THEMES

All themes other than `mkdocs` and `readthedocs` will be moved into external packages in a future release of MkDocs. This will enable them to be more easily supported and updated outside MkDocs releases.

#### Major Additions to Version 0.13.0

##### SEARCH

Support for search has now been added to MkDocs. This is based on the JavaScript library [lunr.js](#). It has been added to both the `mkdocs` and `readthedocs` themes. See the custom theme documentation on [supporting search](#) for adding it to your own themes.

##### NEW COMMAND LINE INTERFACE

The command line interface for MkDocs has been re-written with the Python library [Click](#). This means that MkDocs now has an easier to use interface with better help output.

This change is partially backwards incompatible as while undocumented it was possible to pass any configuration option to the different commands. Now only a small subset of the configuration options can be passed to the commands. To see in full commands and available arguments use `mkdocs --help` and `mkdocs build --help` to have them displayed.

##### SUPPORT EXTRA HTML AND XML FILES

Like the `extra_javascript` and `extra_css` configuration options, a new option named `extra_templates` has been added. This will automatically be populated with any `.html` or `.xml` files in the project docs directory.

Users can place static HTML and XML files and they will be copied over, or they can also use Jinja2 syntax and take advantage of the [global variables](#).

By default MkDocs will use this approach to create a sitemap for the documentation.

### Other Changes and Additions to Version 0.13.0

- Add support for [Markdown extension configuration options](#). (#435)
- MkDocs now ships Python [wheels](#). (#486)
- Only include the build date and MkDocs version on the homepage. (#490)
- Generate sitemaps for documentation builds. (#436)
- Add a clearer way to define nested pages in the configuration. (#482)
- Add an [extra config](#) option for passing arbitrary variables to the template. (#510)
- Add `--no-livereload` to `mkdocs serve` for a simpler development server. (#511)
- Add copyright display support to all themes (#549)
- Add support for custom commit messages in a `mkdocs gh-deploy` (#516)
- Bugfix: Fix linking to media within the same directory as a markdown file called index.md (#535)
- Bugfix: Fix errors with Unicode filenames (#542).

### 3.1.28 Version 0.12.2 (2015-04-22)

- Bugfix: Fix a regression where there would be an error if some child titles were missing but others were provided in the pages config. (#464)

### 3.1.29 Version 0.12.1 (2015-04-14)

- Bugfix: Fixed a CSS bug in the table of contents on some browsers where the bottom item was not clickable.

### 3.1.30 Version 0.12.0 (2015-04-14)

- Display the current MkDocs version in the CLI output. (#258)
- Check for CNAME file when using gh-deploy. (#285)
- Add the homepage back to the navigation on all themes. (#271)
- Add a strict mode for local link checking. (#279)
- Add Google analytics support to all themes. (#333)
- Add build date and MkDocs version to the ReadTheDocs and MkDocs theme outputs. (#382)
- Standardize highlighting across all themes and add missing languages. (#387)
- Add a verbose flag. (-v) to show more details about what the build. (#147)
- Add the option to specify a remote branch when deploying to GitHub. This enables deploying to GitHub pages on personal and repo sites. (#354)
- Add favicon support to the ReadTheDocs theme HTML. (#422)
- Automatically refresh the browser when files are edited. (#163)
- Bugfix: Never re-write URLs in code blocks. (#240)
- Bugfix: Don't copy ditfiles when copying media from the `docs_dir`. (#254)
- Bugfix: Fix the rendering of tables in the ReadTheDocs theme. (#106)
- Bugfix: Add padding to the bottom of all bootstrap themes. (#255)
- Bugfix: Fix issues with nested Markdown pages and the automatic pages configuration. (#276)
- Bugfix: Fix a URL parsing error with GitHub enterprise. (#284)
- Bugfix: Don't error if the `mkdocs.yml` is completely empty. (#288)
- Bugfix: Fix a number of problems with relative URLs and Markdown files. (#292)
- Bugfix: Don't stop the build if a page can't be found, continue with other pages. (#150)

- Bugfix: Remove the site\_name from the page title, this needs to be added manually. (#299)
- Bugfix: Fix an issue with table of contents cutting off Markdown. (#294)
- Bugfix: Fix hostname for BitBucket. (#339)
- Bugfix: Ensure all links end with a slash. (#344)
- Bugfix: Fix repo links in the readthedocs theme. (#365)
- Bugfix: Include jQuery locally to avoid problems using MkDocs offline. (#143)
- Bugfix: Don't allow the docs\_dir to be in the site\_dir or vice versa. (#384)
- Bugfix: Remove inline CSS in the ReadTheDocs theme. (#393)
- Bugfix: Fix problems with the child titles due to the order the pages config was processed. (#395)
- Bugfix: Don't error during live reload when the theme doesn't exist. (#373)
- Bugfix: Fix problems with the Meta extension when it may not exist. (#398)
- Bugfix: Wrap long inline code otherwise they will run off the screen. (#313)
- Bugfix: Remove HTML parsing regular expressions and parse with HTMLParser to fix problems with titles containing code. (#367)
- Bugfix: Fix an issue with the scroll to anchor causing the title to be hidden under the navigation. (#7)
- Bugfix: Add nicer CSS classes to the HTML tables in bootswatch themes. (#295)
- Bugfix: Fix an error when passing in a specific config file with `mkdocs serve`. (#341)
- Bugfix: Don't overwrite index.md files with the `mkdocs new` command. (#412)
- Bugfix: Remove bold and italic from code in the ReadTheDocs theme. (#411)
- Bugfix: Display images inline in the MkDocs theme. (#415)
- Bugfix: Fix problems with no-highlight in the ReadTheDocs theme. (#319)
- Bugfix: Don't delete hidden files when using `mkdocs build --clean`. (#346)
- Bugfix: Don't block newer versions of Python-markdown on Python >= 2.7. (#376)
- Bugfix: Fix encoding issues when opening files across platforms. (#428)

### 3.1.31 Version 0.11.1 (2014-11-20)

- Bugfix: Fix a CSS wrapping issue with code highlighting in the ReadTheDocs theme. (#233)

### 3.1.32 Version 0.11.0 (2014-11-18)

- Render 404.html files if they exist for the current theme. (#194)
- Bugfix: Fix long nav bars, table rendering and code highlighting in MkDocs and ReadTheDocs themes. (#225)
- Bugfix: Fix an issue with the google\_analytics code. (#219)
- Bugfix: Remove `__pycache__` from the package tar. (#196)
- Bugfix: Fix markdown links that go to an anchor on the current page. (#197)
- Bugfix: Don't add `prettyprint_well` CSS classes to all HTML, only add it in the MkDocs theme. (#183)
- Bugfix: Display section titles in the ReadTheDocs theme. (#175)
- Bugfix: Use the polling observer in watchdog so rebuilding works on filesystems without inotify. (#184)
- Bugfix: Improve error output for common configuration related errors. (#176)

### 3.1.33 Version 0.10.0 (2014-10-29)

- Added support for Python 3.3 and 3.4. (#103)
- Configurable Python-Markdown extensions with the config setting `markdown_extensions`. (#74)
- Added `mkdocs json` command to output your rendered documentation as json files. (#128)

- Added `--clean` switch to `build`, `json` and `gh-deploy` commands to remove stale files from the output directory. (#157)
- Support multiple theme directories to allow replacement of individual templates rather than copying the full theme. (#129)
- Bugfix: Fix `<ul>` rendering in readthedocs theme. (#171)
- Bugfix: Improve the readthedocs theme on smaller displays. (#168)
- Bugfix: Relaxed required python package versions to avoid clashes. (#104)
- Bugfix: Fix issue rendering the table of contents with some configs. (#146)
- Bugfix: Fix path for embedded images in sub pages. (#138)
- Bugfix: Fix `use_directory_urls` config behavior. (#63)
- Bugfix: Support `extra_javascript` and `extra_css` in all themes. (#90)
- Bugfix: Fix path-handling under Windows. (#121)
- Bugfix: Fix the menu generation in the readthedocs theme. (#110)
- Bugfix: Fix the mkdocs command creation under Windows. (#122)
- Bugfix: Correctly handle external `extra_javascript` and `extra_css`. (#92)
- Bugfix: Fixed favicon support. (#87)

## 3.2 为MkDocs做贡献

为MkDocs项目做出贡献的介绍。

MkDocs项目欢迎并依赖于开源社区中开发人员和用户的贡献。 贡献可以通过多种方式进行，例如：

- 提交代码补丁
- 改进文档
- 错误报告和补丁评论

### 3.2.1 行为准则

在MkDocs项目的代码库，问题跟踪器，聊天室和邮件列表中进行交互的每个人都应遵循[PyPA行为准则]。

### 3.2.2 报告问题

请尽可能详细地提供详细信息。 让我们知道您的平台和MkDocs版本。 如果问题是可视的（例如主题或设计问题），请添加屏幕截图，如果出现错误，请包含完整错误和追溯。

### 3.2.3 测试开发版本

如果您只想安装并试用MkDocs的最新开发版本，可以使用以下命令执行此操作。如果您想为新功能提供反馈或想要确认您遇到的错误是否已在git主服务器中修复，则此功能非常有用。 强烈建议您在virtualenv中执行此操作。

```
pip install https://github.com/mkdocs/mkdocs/archive/master.tar.gz
```

### 3.2.4 安装开发

首先，您需要fork并克隆存储库。 获得本地副本后，请运行以下命令。 强烈建议您在virtualenv中执行此操作。

```
pip install --editable .
```

这将在开发模式下安装MkDocs，它将 `mkdocs` 命令绑定到git存储库。

### 3.2.5 运行测试

要运行测试，建议您使用tox。

通过运行命令 `pip install tox` 使用pip安装Tox。 然后，可以通过在MkDocs存储库的根目录中运行命令 `tox` 来为MkDocs运行测试套件。

它将尝试针对我们支持的所有Python版本运行测试。 所以不要担心，如果你错过了一些，他们会失败。 当您提交pull request时，Travis将验证其余部分。

### 3.2.6 提交Pull Requests

一旦您对更改感到满意，或者您已准备好提供反馈，请将其推送到您的分支并发送拉取请求。要接受更改，如果它是新功能，则很可能需要测试和文档。

## 3.3 许可

法律相关的东西。

### 3.3.1 包含的项目

主题使用了ReadTheDocs项目。

- ReadTheDocs主题 – [View license.](#)

非常感谢这些伟大项目的作者和贡献者。

### 3.3.2 MkDocs许可证 (BSD)

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