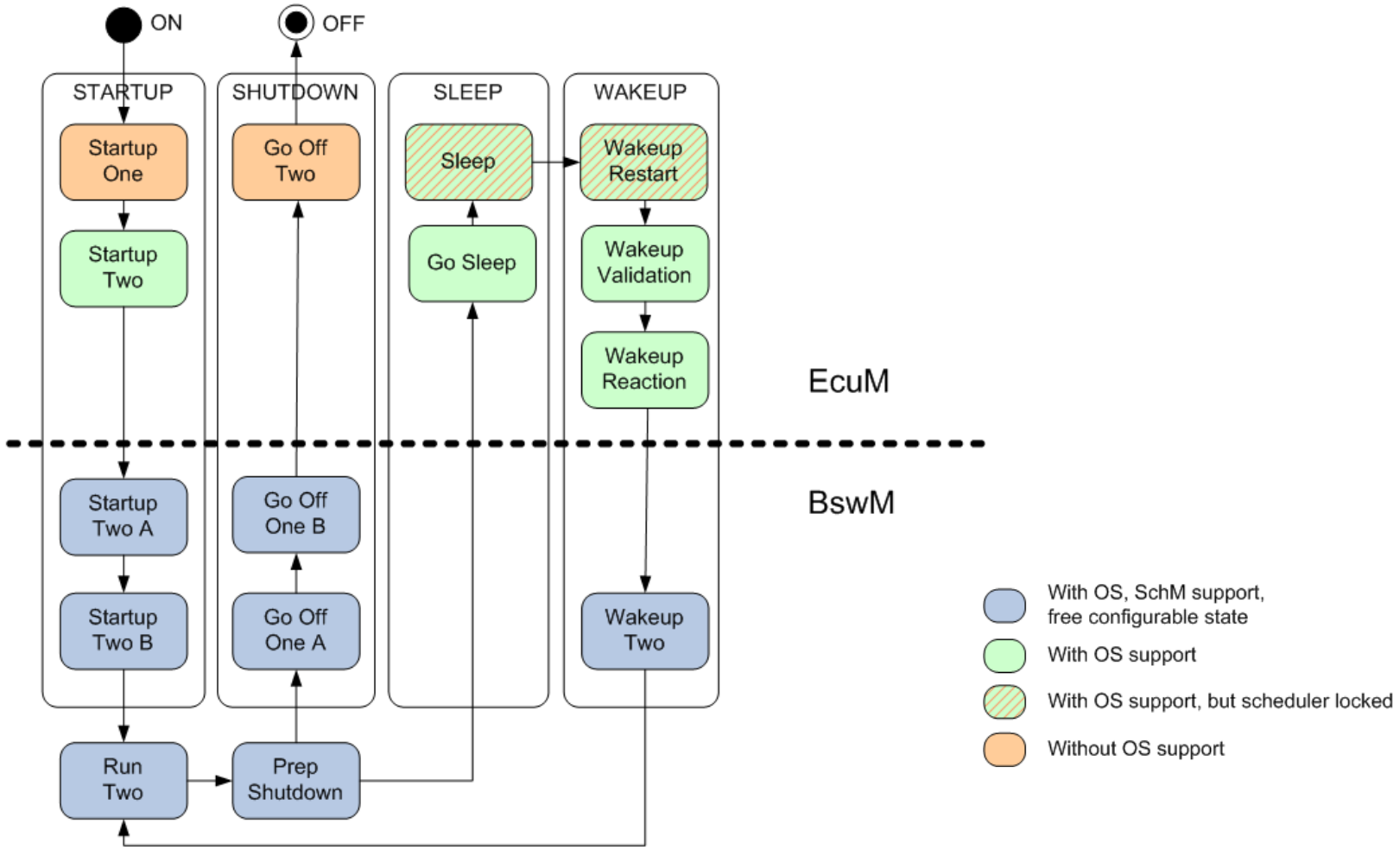
EB tresos classic AUTOSAR training - Mode management

Chapter overview

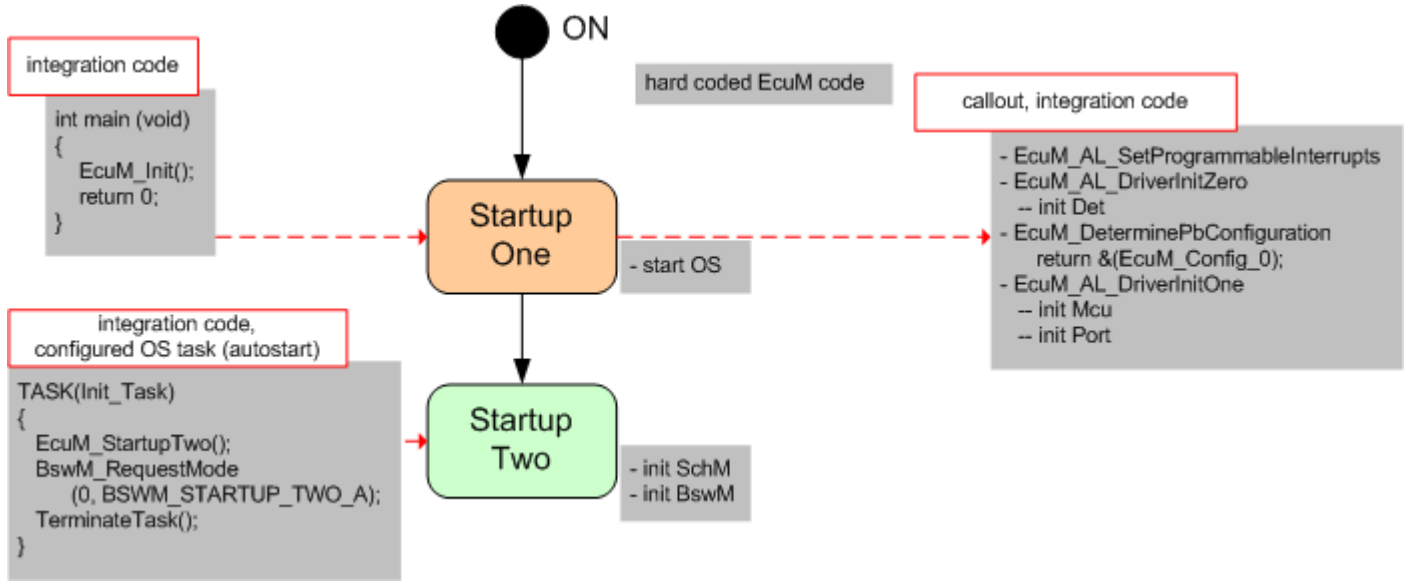
- ECU State- BSW Mode- Manager
- Watchdog Management
- Communication Management
  - Communication Manager ComM
  - State Management
  - Network Management

ECU state manager
BSW mode manager

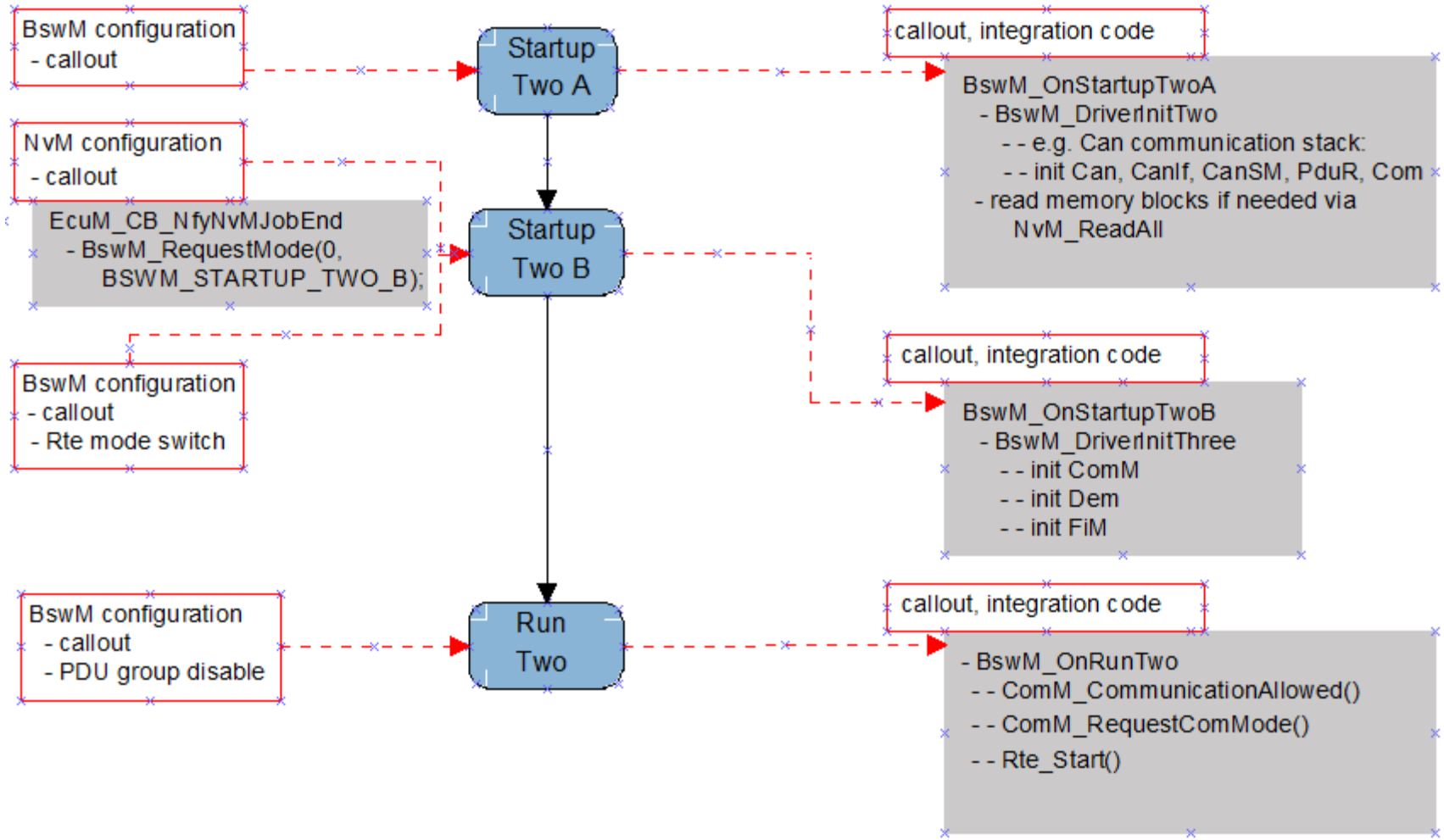
Overview of all states



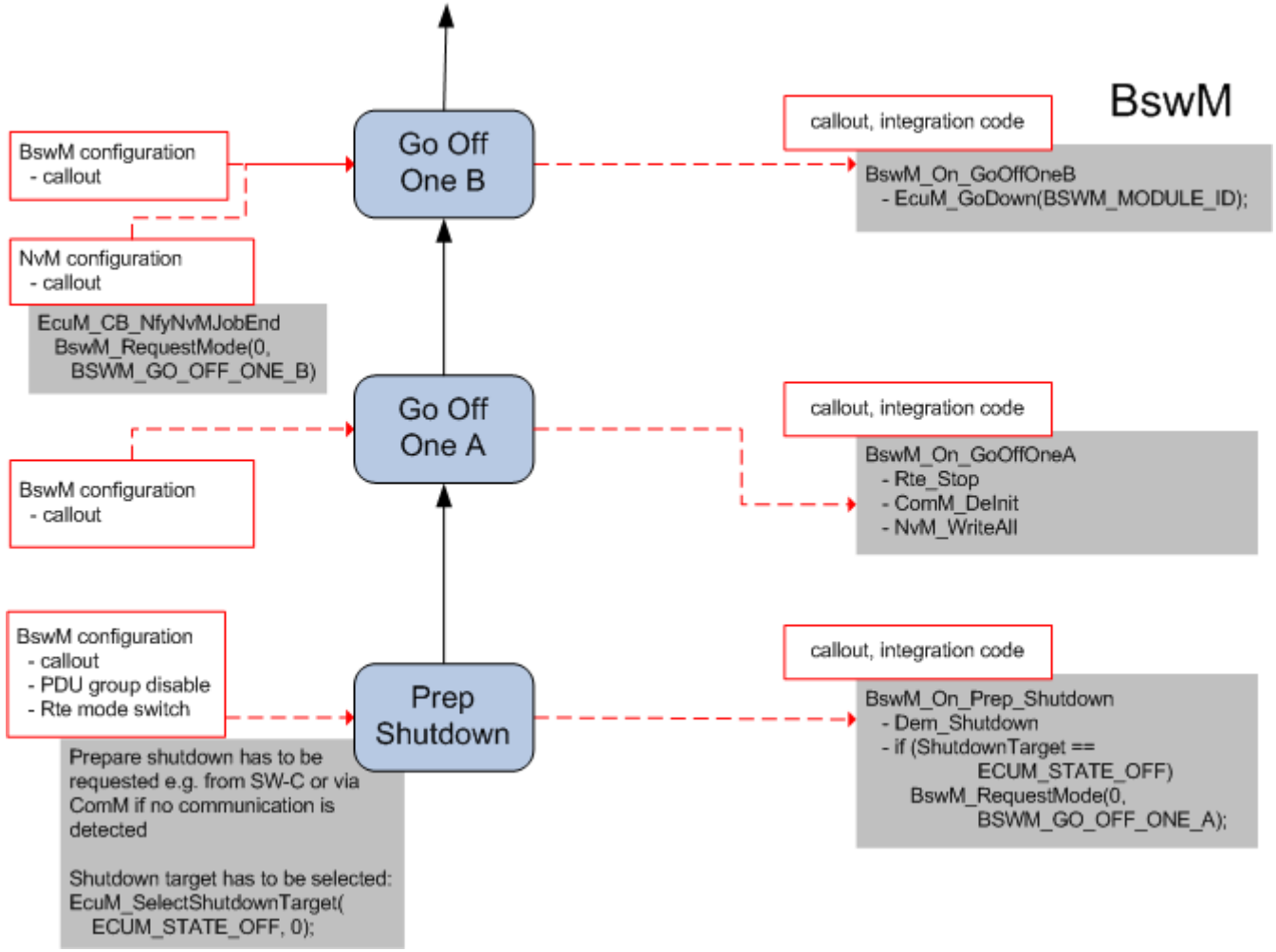
STARTUP - EcuM



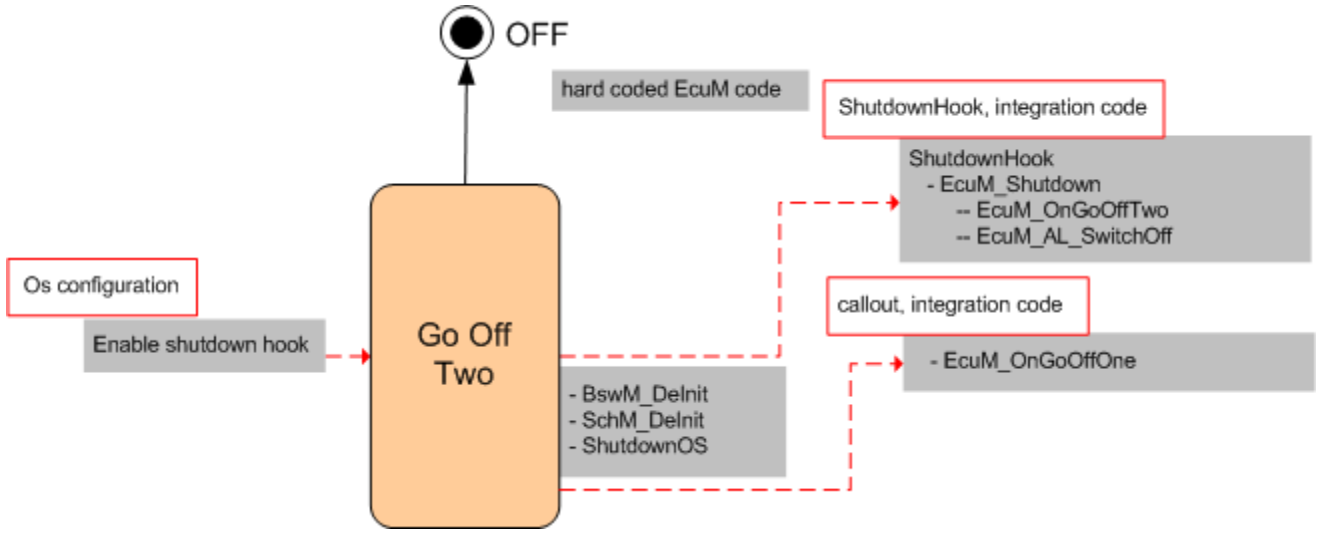
STARTUP - BswM



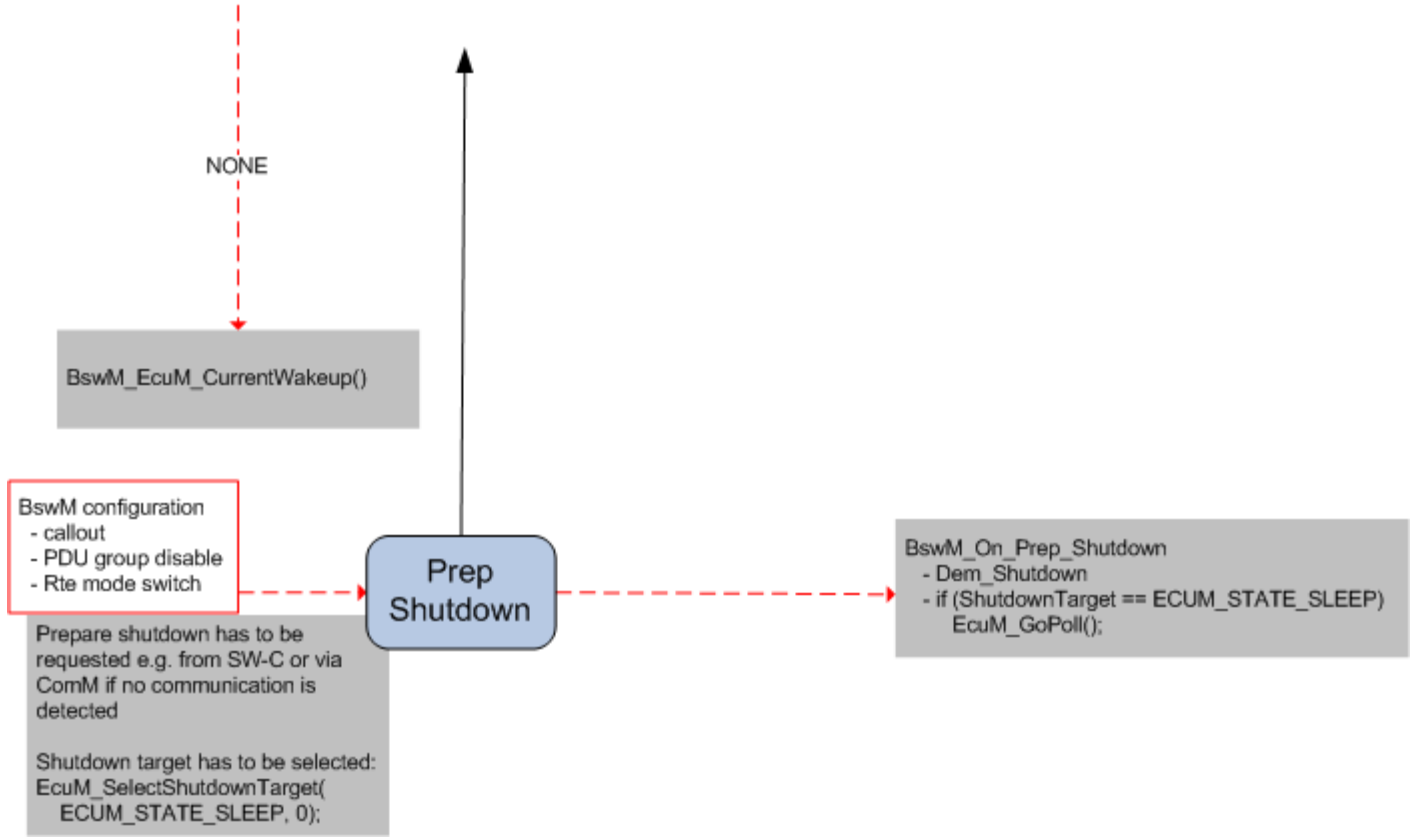
SHUTDOWN - BswM



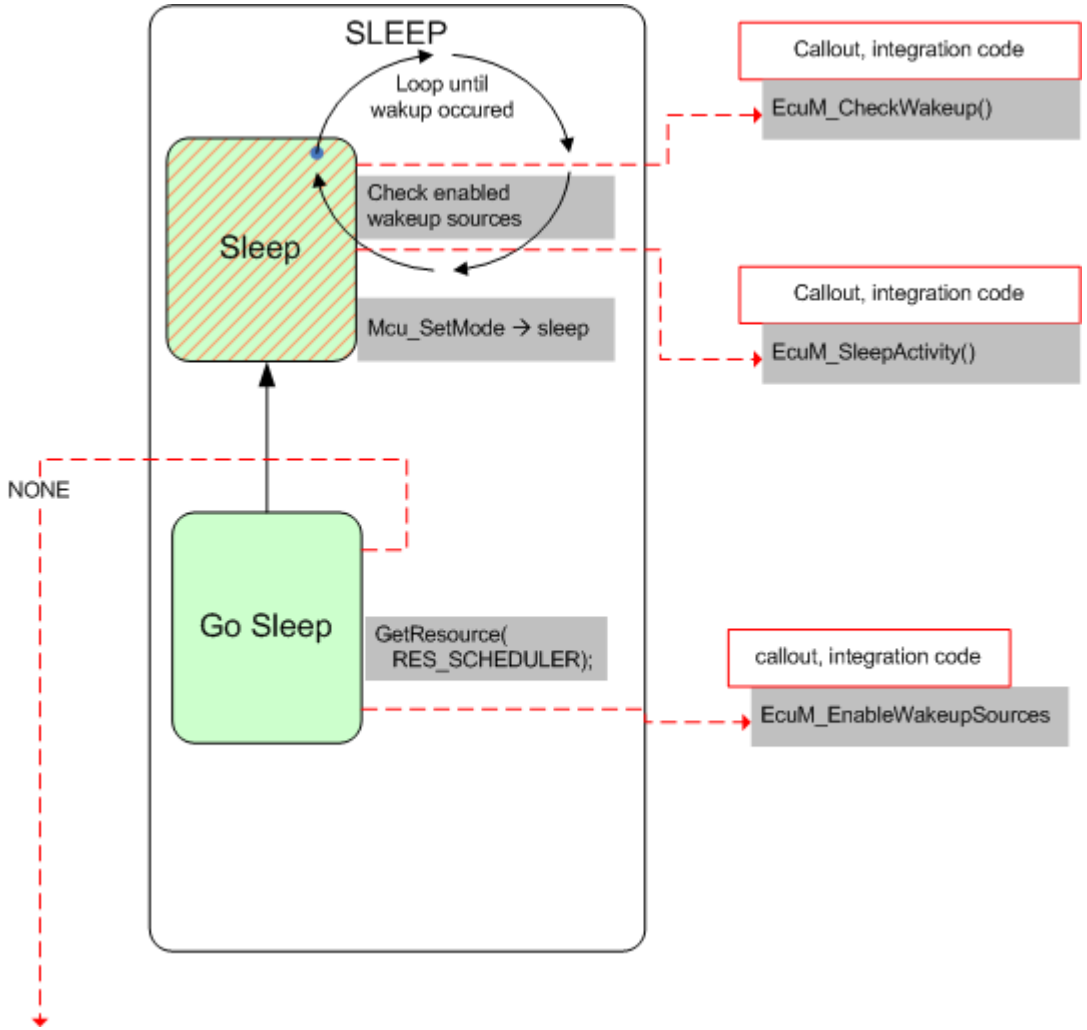
SHUTDOWN - EcuM



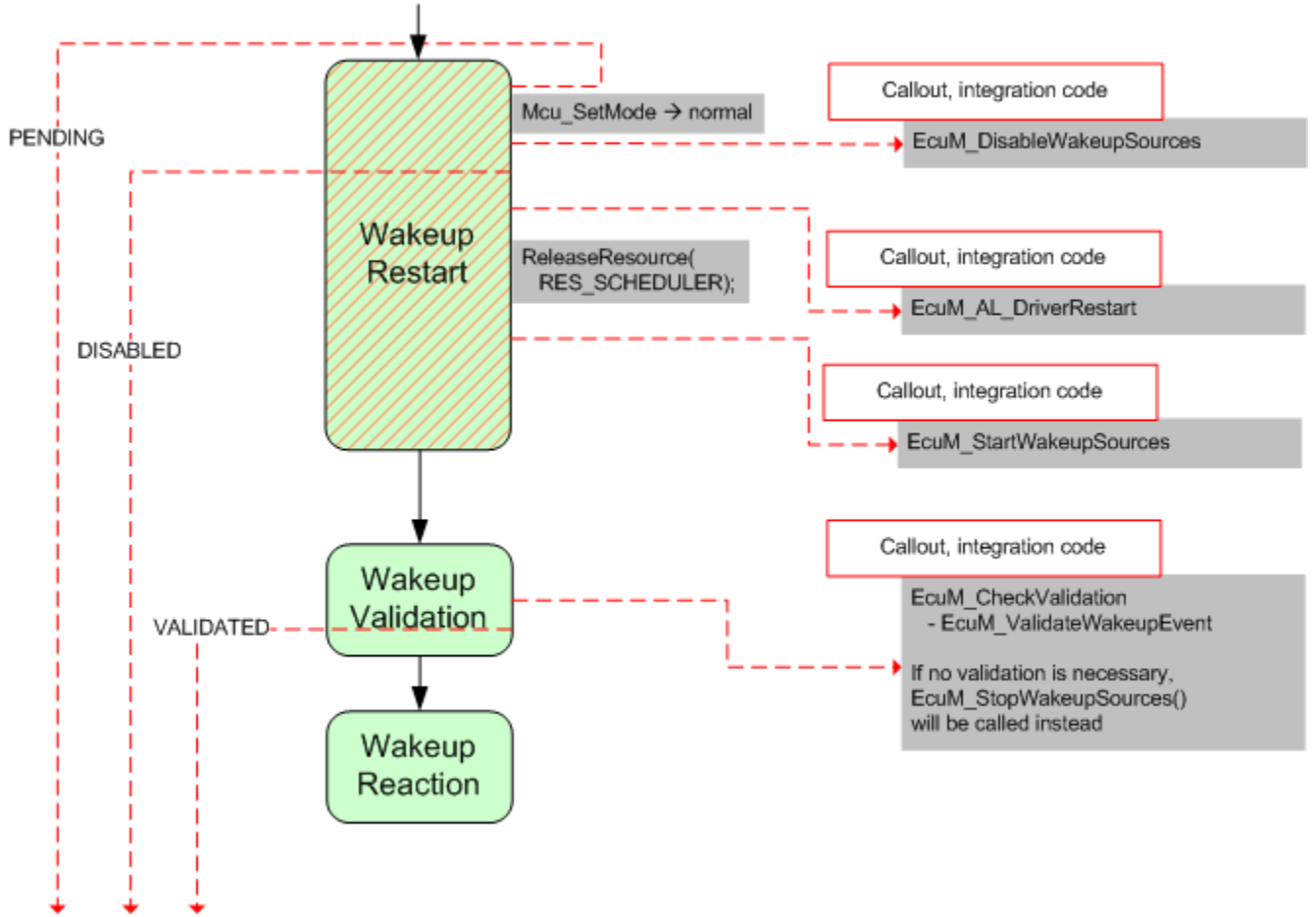
SLEEP - BswM



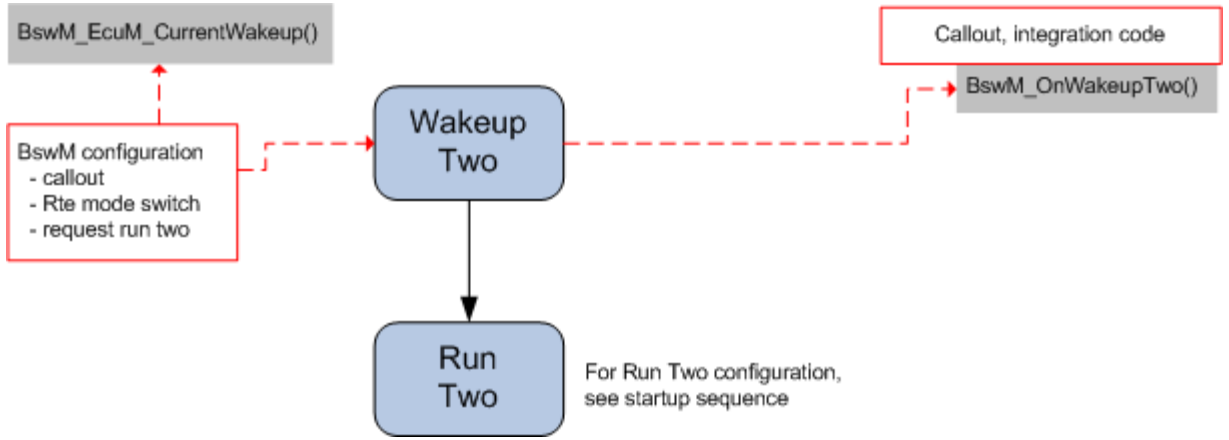
SLEEP - EcuM



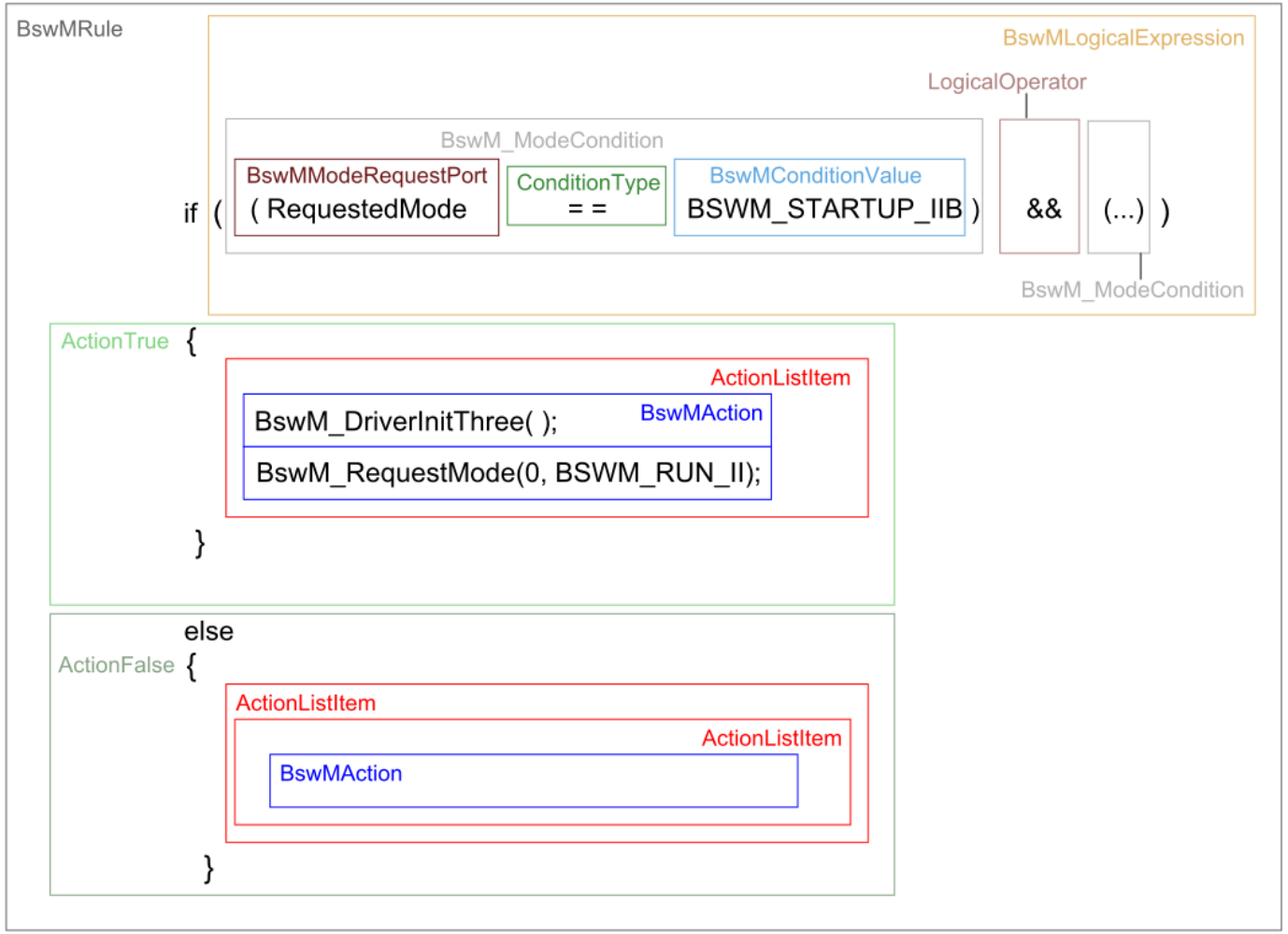
WAKEUP - EcuM



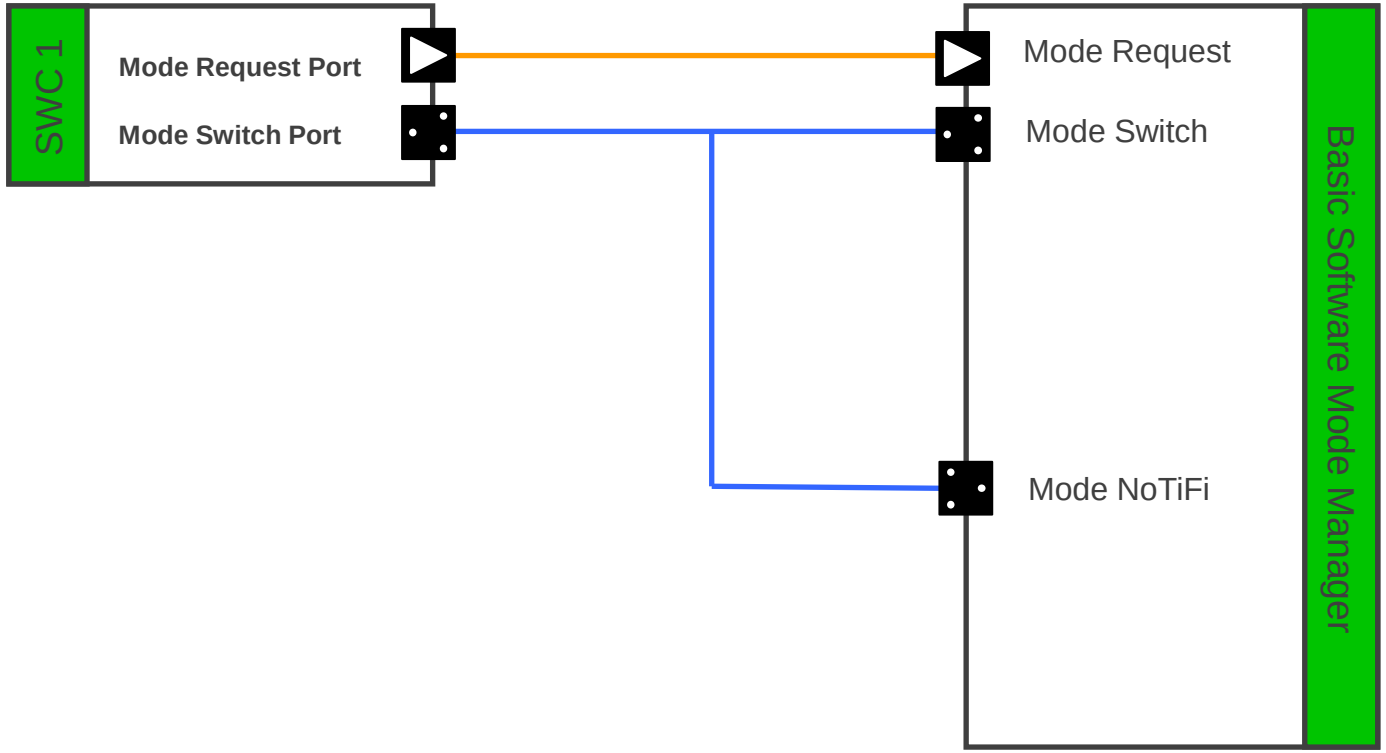
WAKEUP - BswM



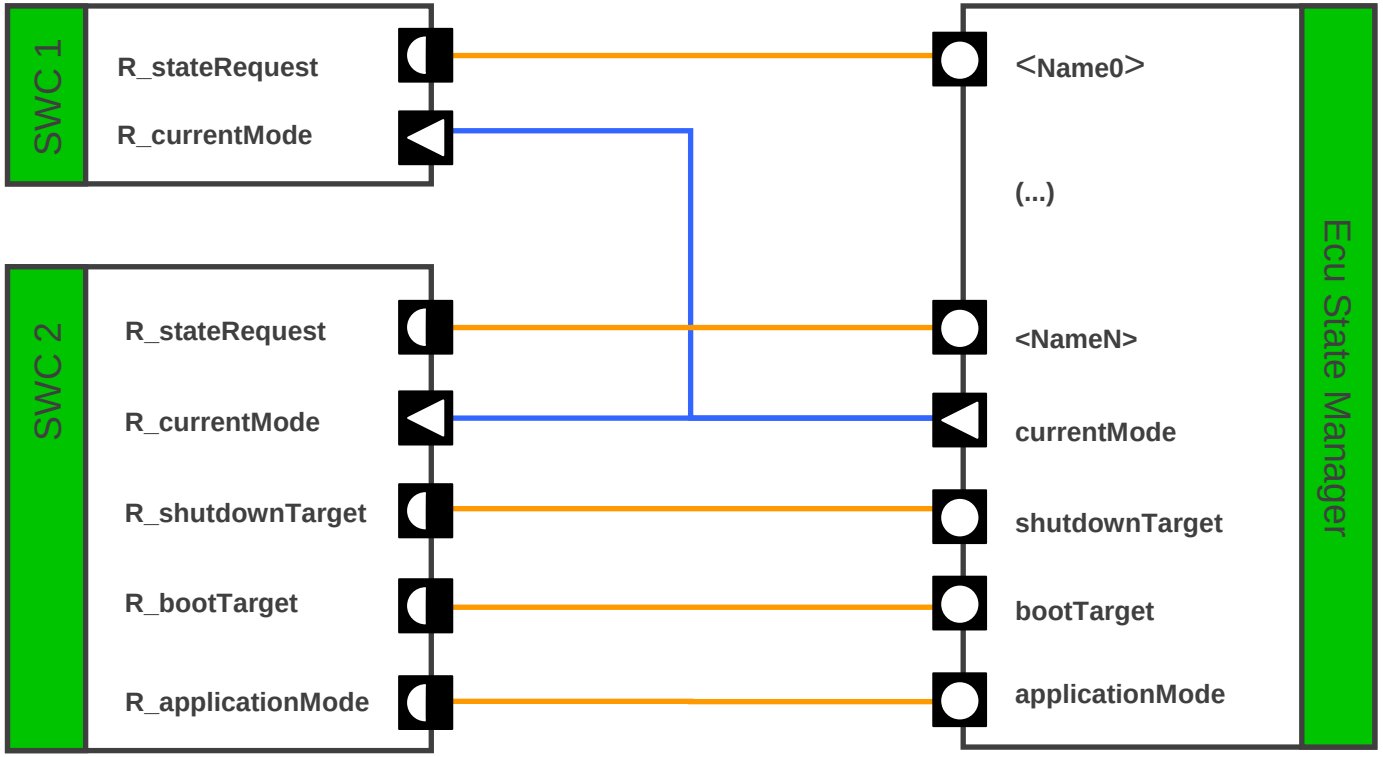
BswM - Rule



BswM - ports



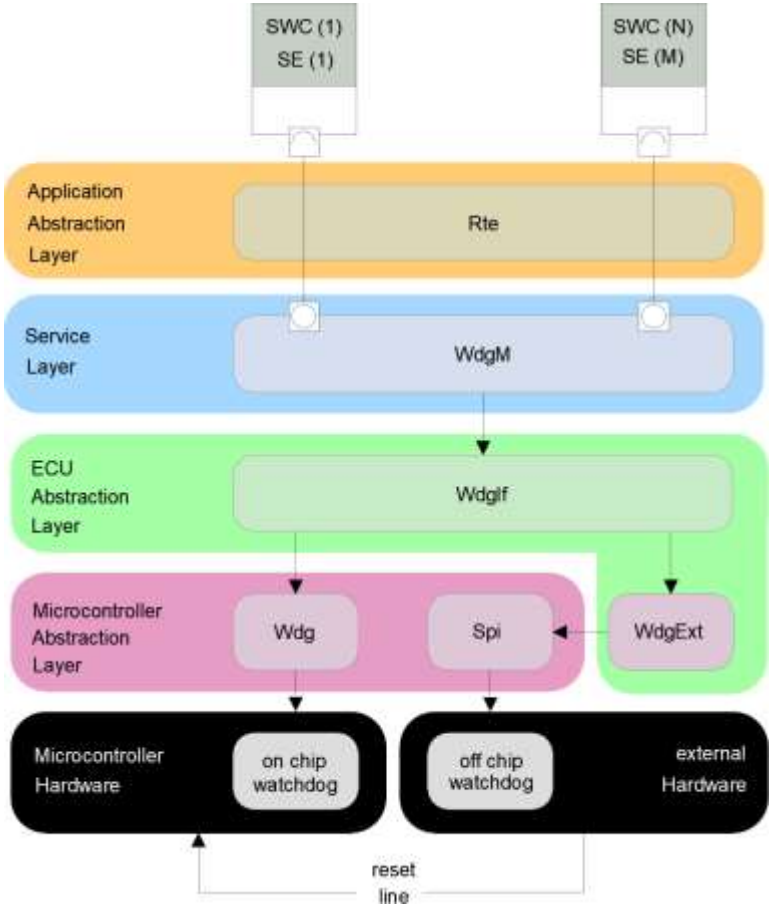
EcuM - ports



Watchdog stack

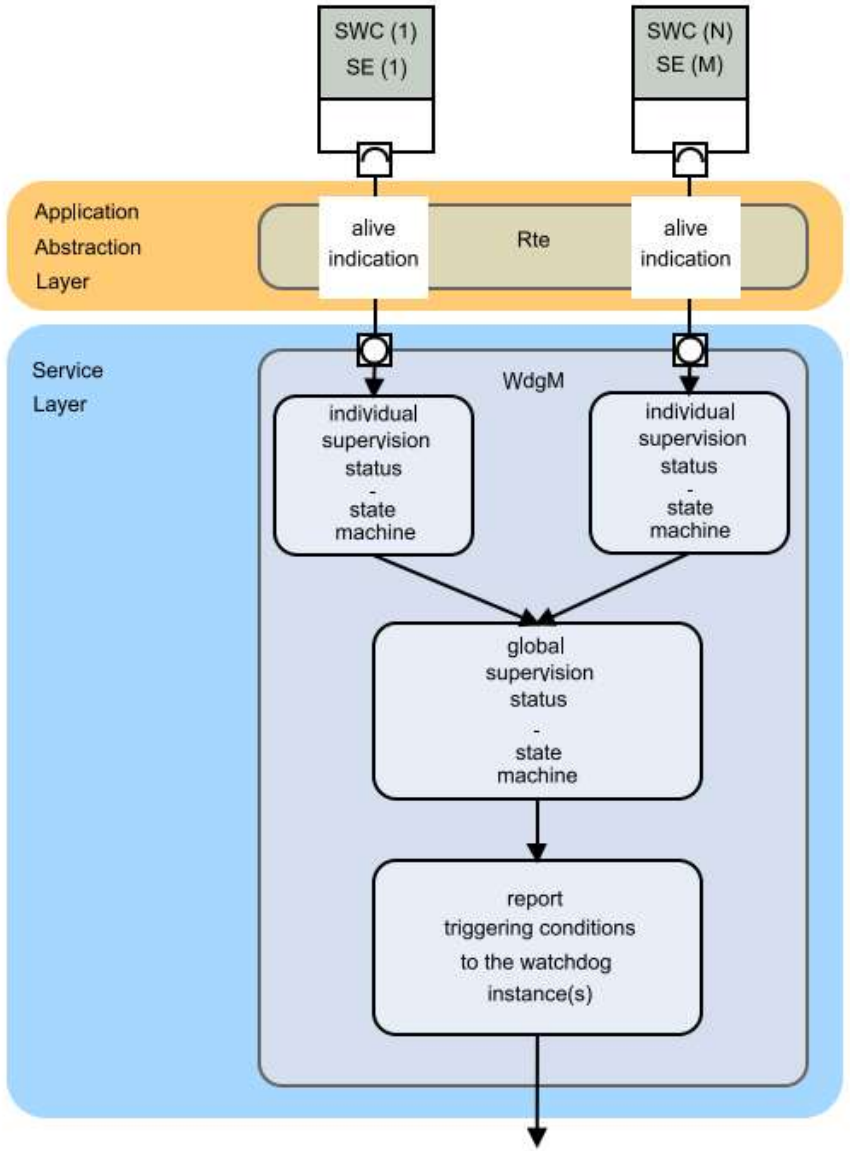
- Within SWCs, a **Supervised Entiy (SE) i**ndicates to the Watchdog Manager that a Checkpoint within a Supervised Entity has been reached
- **The Watchdog Manger (WdgM)** and the **Watchdog Interface (WdgIf)** determine the Trigger condition of the underlying Watchdog(s) based on different Supervision Mechanisms:
  - Alive Supervision
  - Deadline Supervision*
  - Logical Supervision (Program Flow Monitoring)*
- The **WdgM** also determines the Global Supervision status

**These features require additional licensing*



Checkpoint Supervision

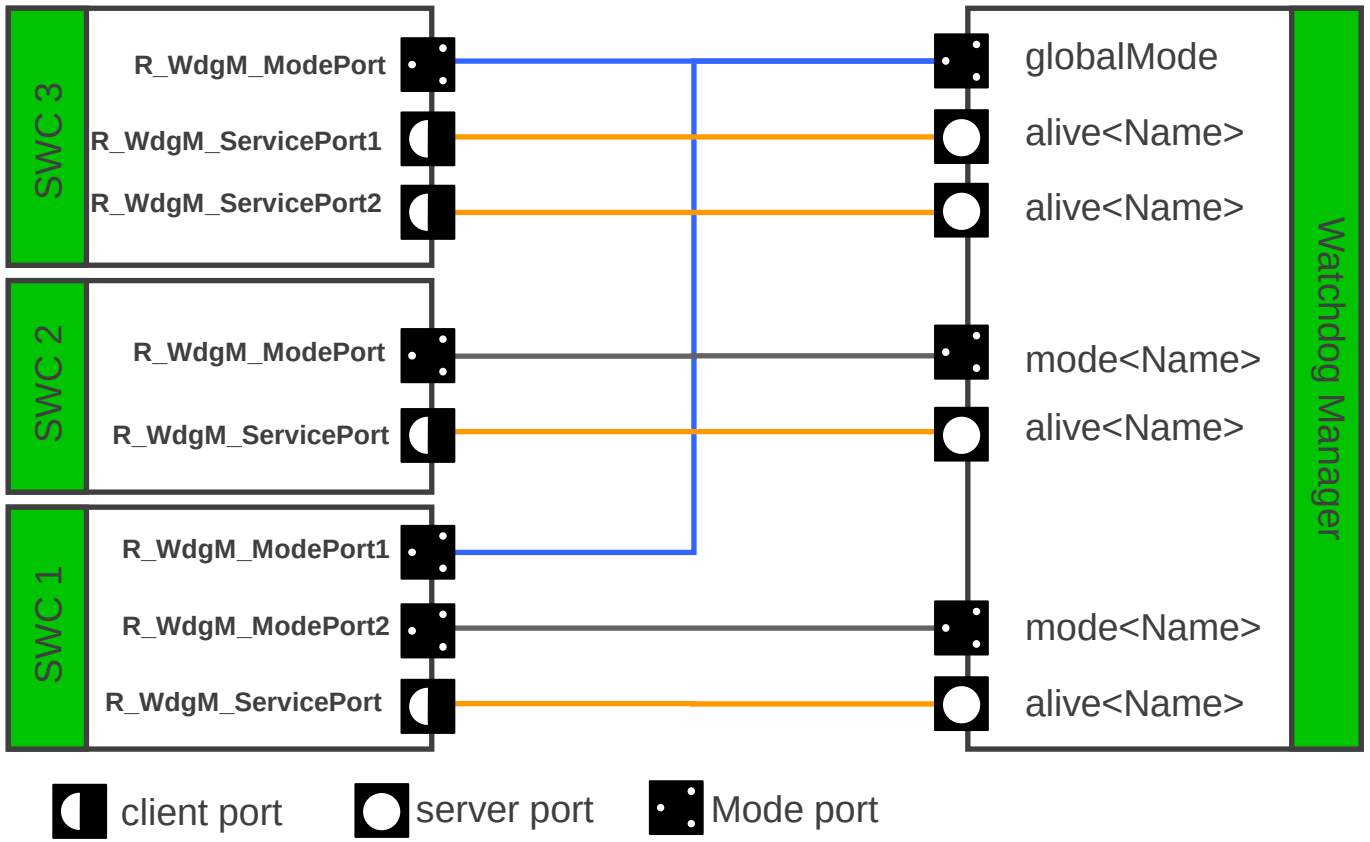
- Every **supervised entity (SE)** must provide live indications to the WdgM
- Checkpoint Supervision is done by calling `WdgM_CheckpointReached()`
  - Indications are proofed
  - Local Supervision Status is calculated (Local → for individual SE)
  - Global supervision status is calculated (Global → for all SEs)
  - Supervision statuses are provided via RTE ports
    - GetLocalStatus, GetGlobalStatus
- Escalation steps for the Global Supervision Status:
  - WDGM_GLOBAL_STATUS_OK
  - WDGM_GLOBAL_STATUS_FAILED
  - WDGM_GLOBAL_STATUS_EXPIRED
  - WDGM_GLOBAL_STATUS_STOPPED



Interaction of Watchdog Stack modules

- Initialisation
  - by calling `WdgM_Init()` and `Wdg_Init()`
  - Usually performed by EcuM
  - Done on the first `WdgM_MainFunction()` (not AUTOSAR specific)
- Periodic scheduling of the `WdgM_MainFunction()`
  - Examination of configured Supervised Entitys in respect to the configured values
- The WdgM reports via the WdgIf the triggering condition to the Watchdog Driver
- The Wdg driver will trigger the Watchdog (e.g. via timer interrupt) as long as the trigger condition is fulfilled

WdgM ports

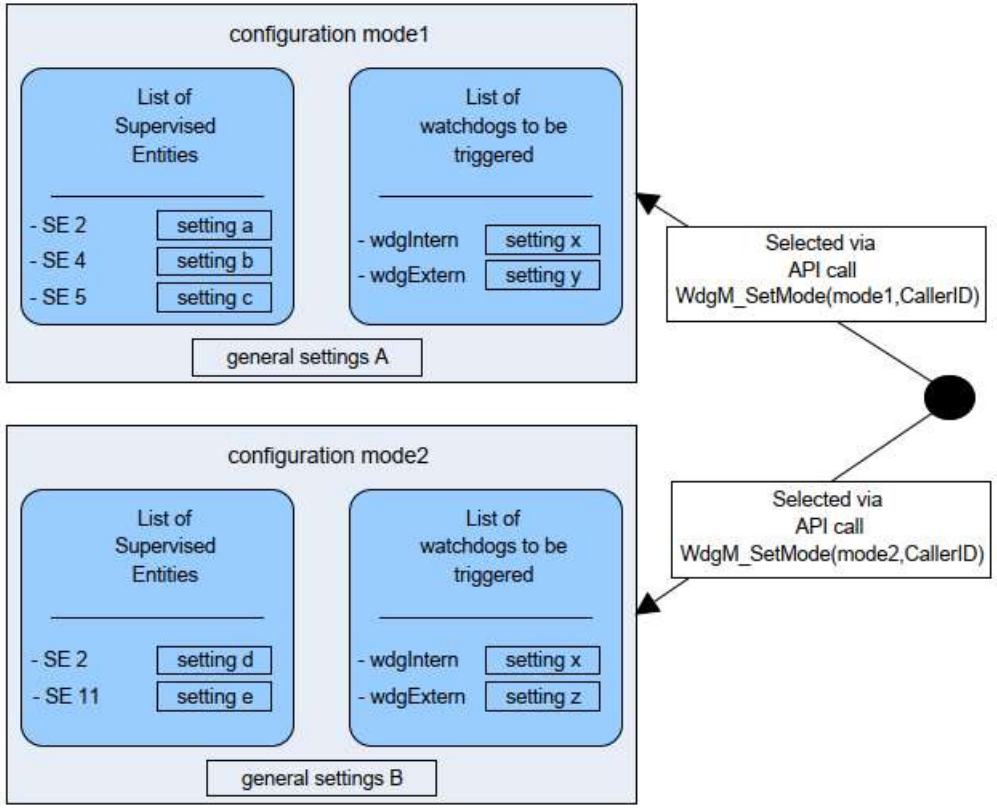


- WdgMModePort
  - reports global alive supervision status
    - WDGM_GLOBAL_STATUS_OK
    - WDGM_GLOBAL_STATUS_FAILED
    - WDGM_GLOBAL_STATUS_EXPIRED
    - WDGM_GLOBAL_STATUS_STOPPED
    - WDGM_GLOBAL_STATUS_DEACTIVATED

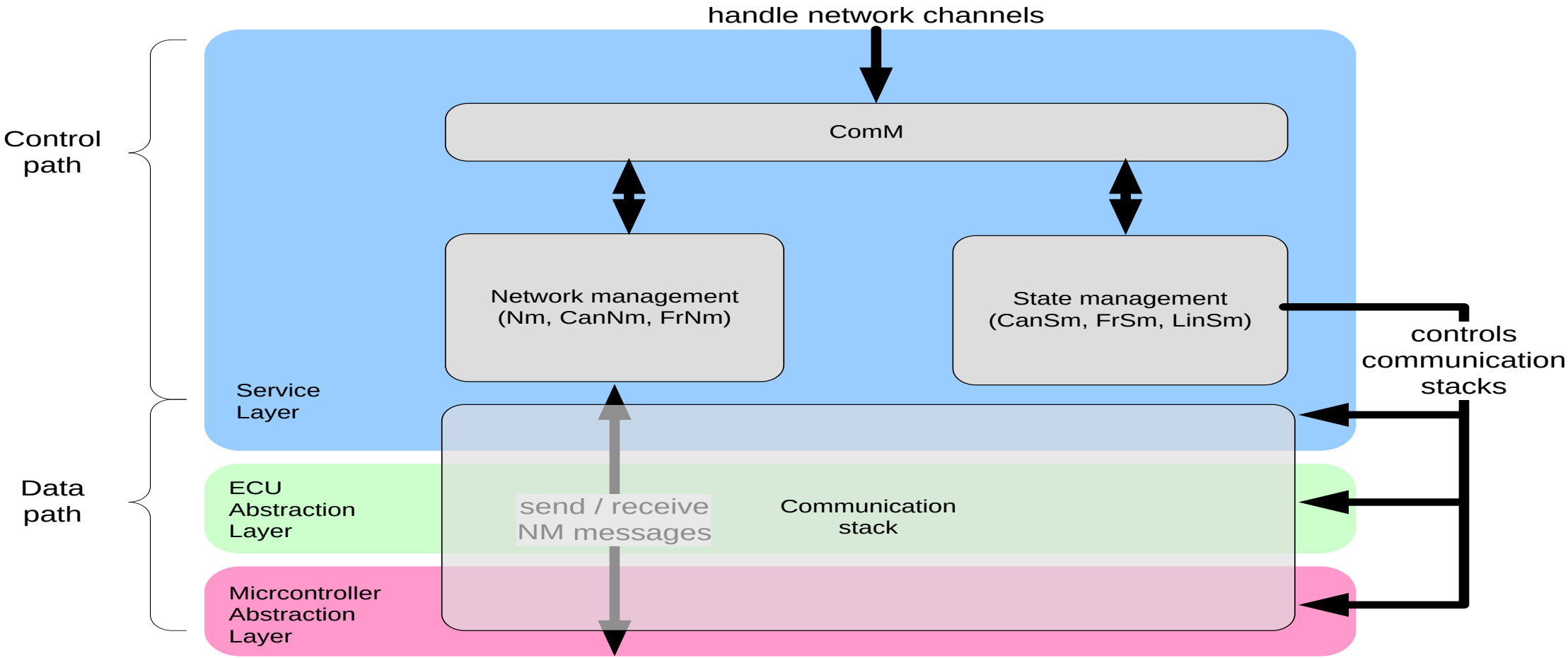
- WdgMServicePortSE<nnn>
  - Reporting of CheckpointReached of SE to WdgM

WdgM - Modes

- The WdgM allows to configure different modes, e.g.
  - 1 mode for ECU startup
  - 1 mode for Normal Operation
- You may configure a list of supervised entities for each mode. This list of entities is to be supervised for the mode specified
- You may switch between the settings configured during runtime with the API call WdgM_SetMode



Communication Management



ComM overview

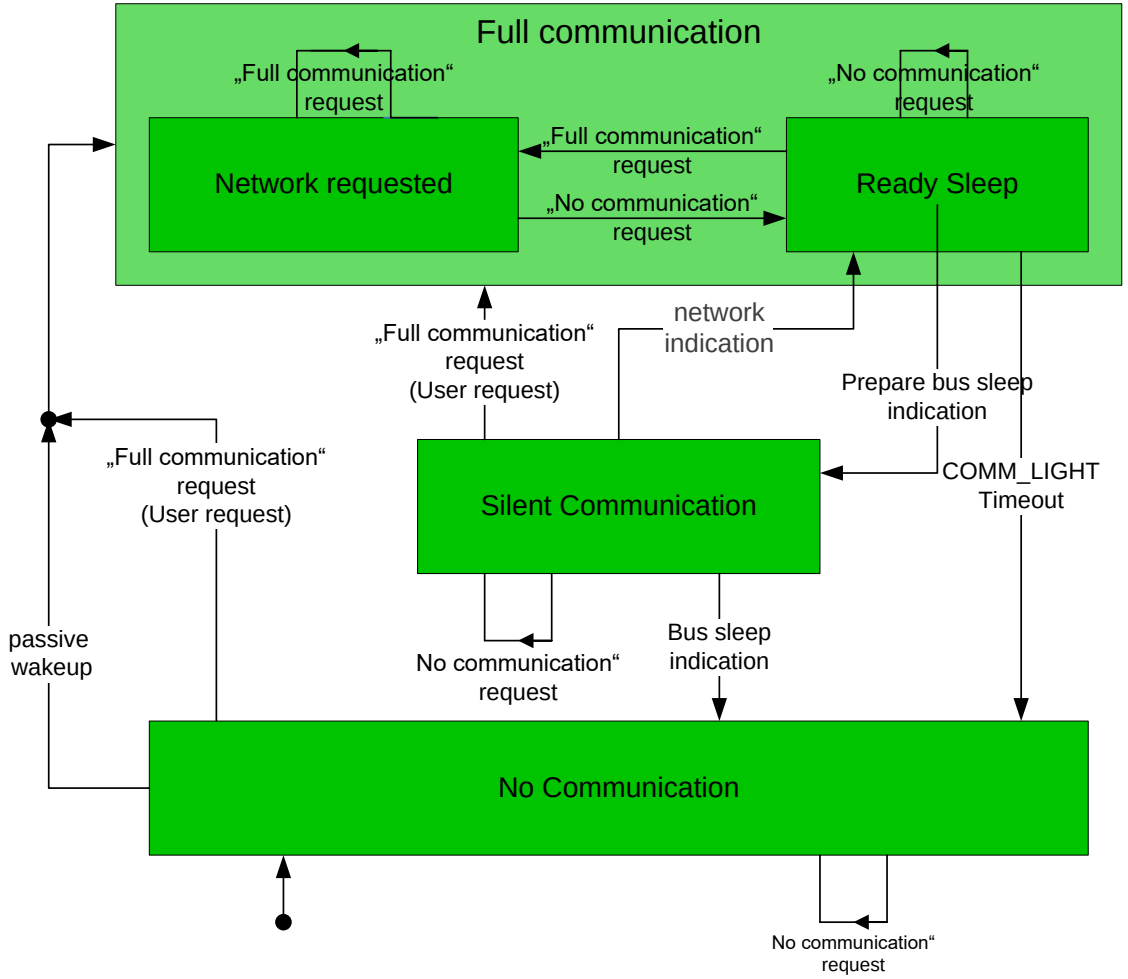
- Handles communication modes for each channel
- Collects and coordinates the bus communication access requests from communication requestors
- Offers an API to disable sending of signals to prevent the ECU from (actively) waking up the communication bus
- Handles Bus error management
- Supports Partial Networking

ComM States

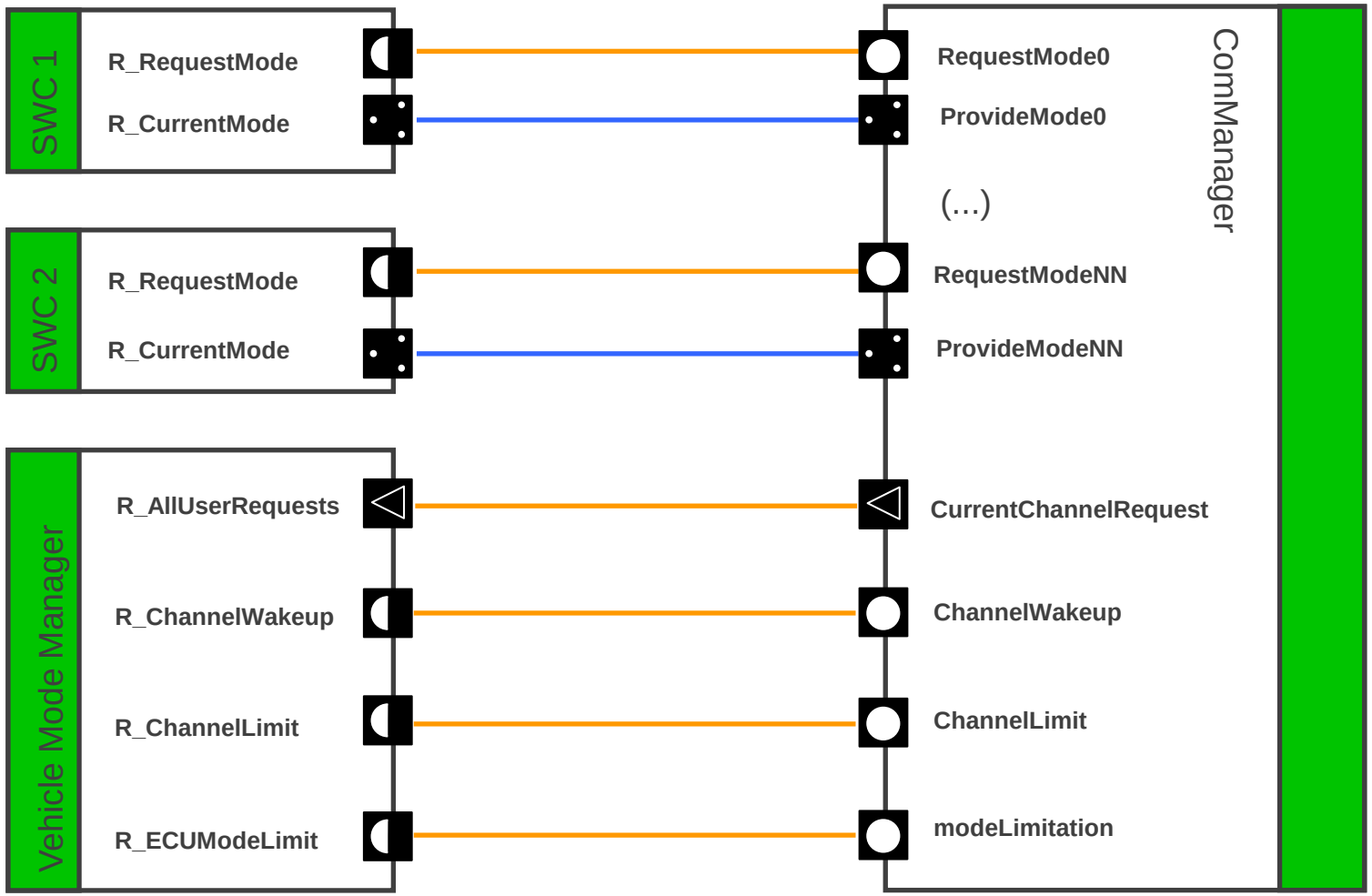
- A channel is an abstraction of physical Controller (in case of Ethernet also applies to a Virutal LAN)
- Each Channel has its own communication Mode
- A user can request “Full communication” or “no communication” only

State	Message Transmission	Message Reception	Nm / bus communication	Wake-up capability
Full communication / network requested	On	On	Requested	Not applicable
Full communication / ready sleep	On	On	Released	Not applicable
Silent communication	Off	On	Released	• User/diagnostic request • Network indication
No communication	Off	Off	Released	• User/diagnostic request • Passive wakeup

ComM state machine (simplified)



ComM ports



Partial Network handling

- The status of all partial networks is exchanged on the bus in PN bit vector (Partial Network Information)
- Each bit in the PN bit vector represents the status of one partial network cluster (PNC)
- ComM realizes on state machine for each PNC
- PN bit vector is exchanged between <Bus>NM modules and ComM by using PduR and Com signals
- EIRA (external and internal request array)
  - Aggregated state of external and internal requests
- ERA (external request array)
  - Used by gateways to collect external requests
  - PNC gateway

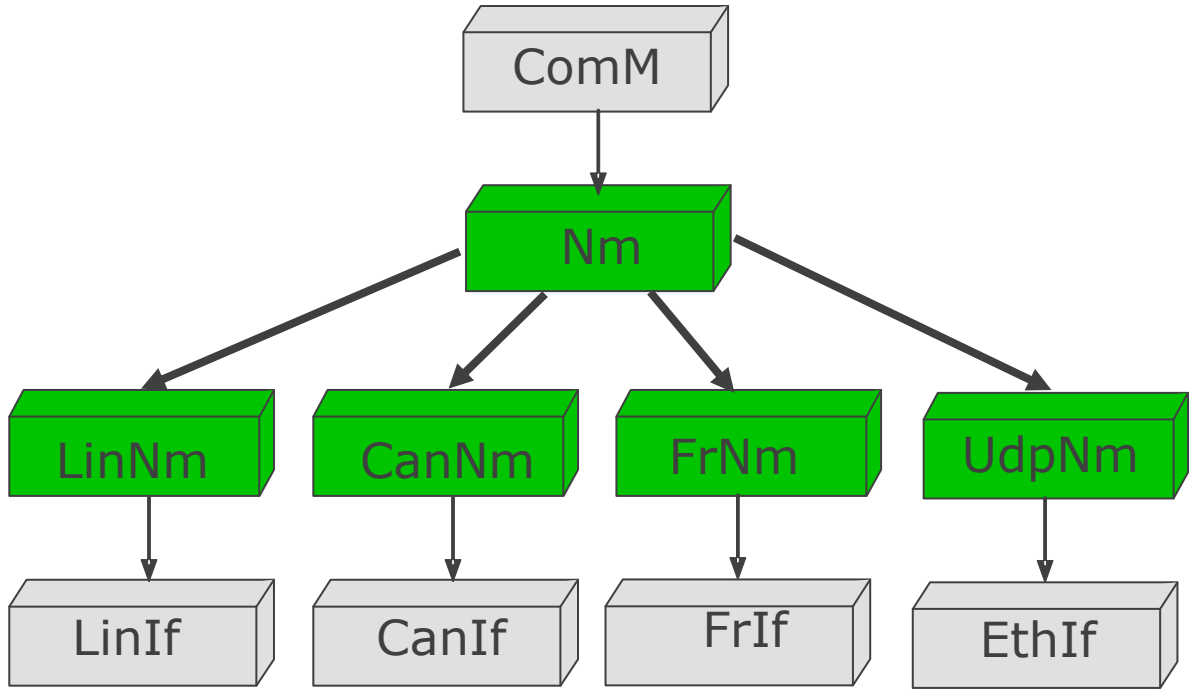
State manager overview

- The state management is handled by the bus specific modules **CanSm**, **FrSm, LinSm and EthSm** and controlled by the Com Manger
- The *Sm modules perform the following tasks:
  - Provide bus-independent interface towards the ComM module
  - Handle bus-specific wakeup
  - CAN and Flexray only:
    - Set transceiver mode
    - Set controller mode
  - Ethernet only:
    - Set Ethernet switch mode
  - Handle bus-specific “go to sleep” sequence
  - LIN only: Switch schedule table

Network management

Network Management modules

- The Nm is controlled by the ComM which sees only Nm channels
- The generic Nm module coordinates the bus-specific *Nm modules
- The Nm messages are sent/received via the bus specific Interface module (*If)



Tasks of the Network Management

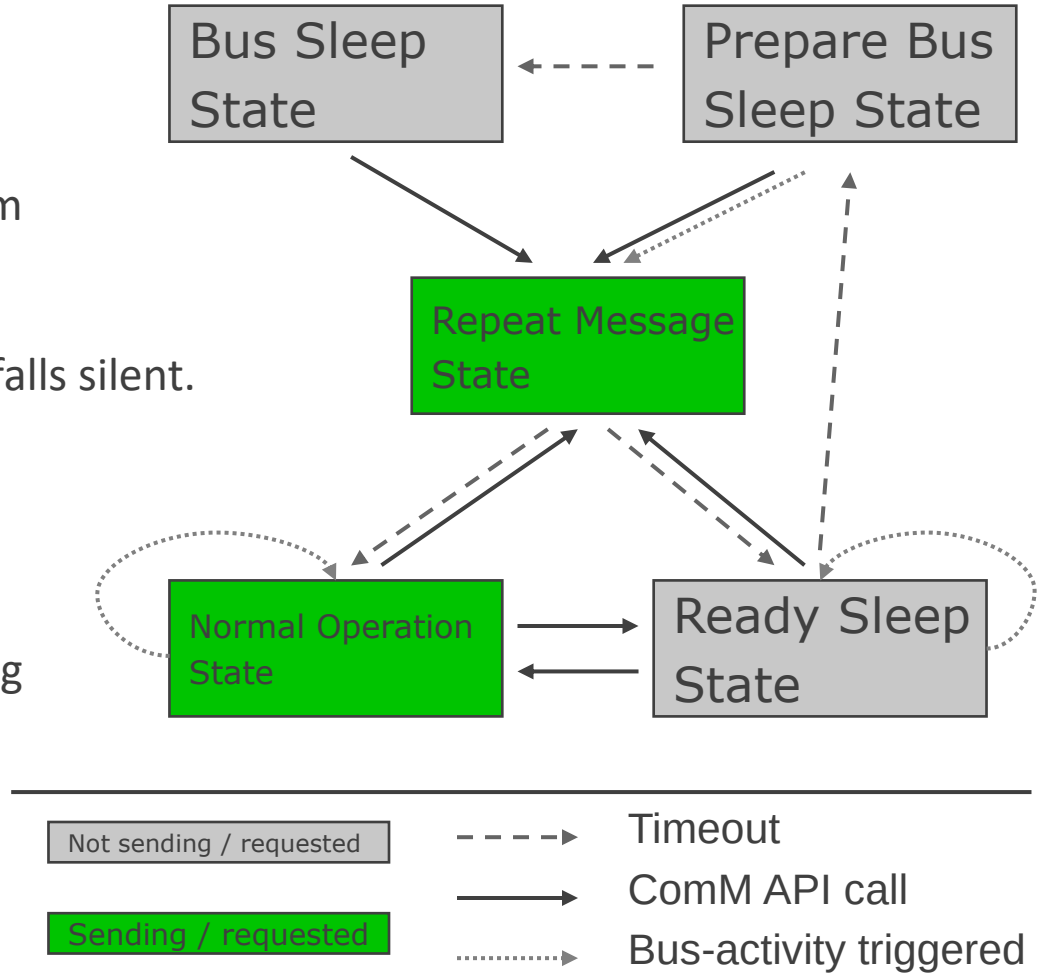
- Detecting bus activity
  - are other nodes active?
  - Allows vendor-specific extension to identify active nodes
- Synchronizing bus sleep
  - coordination algorithm to ensure that all nodes go to sleep in the same moment*)
- Preventing bus sleep
  - keep the bus (and other nodes) active, while needed
- Coordination of busses
  - synchronize AUTOSAR / OSEK-NM busses
- Least important: Sending (arbitrary) „User Data“

Network Management Basic Facts

- A network management „cluster“ consists of a set of nodes, which form a logical network.
- Special NM-messages are broadcast from/to any node to indicate activity
- NM messages may contain an ID identifying the node (unique inside the logical network)
  - If so, it is possible to detect if all required network nodes are active
- NM messages may contain a „User Data“ field
- NM messages may contain partial network information

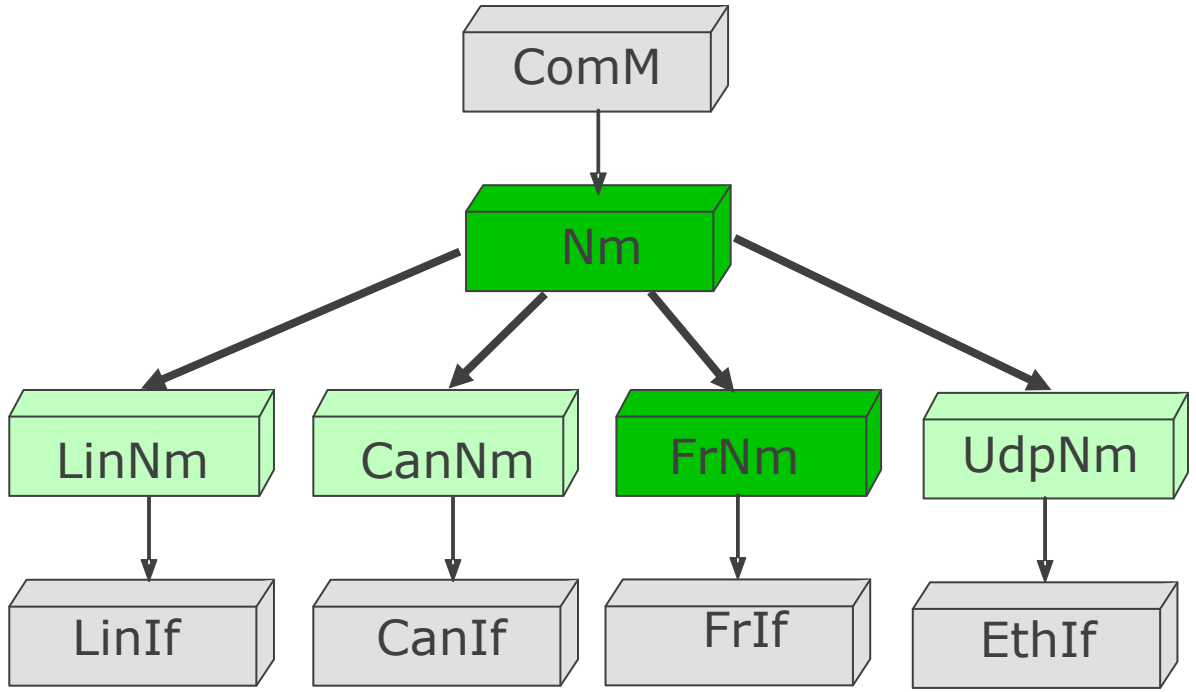
CanNm State Machine, Simplified

- Repeat Message State is mainly used to enable node detection upon NM startup.
- In Normal Operation State, a bus load reduction mechanism can be enabled.
- Ready Sleep State: The NM stays in this state until the bus falls silent.
- In Bus Sleep State, the NM is disabled until the ComM (re-)starts it
- In Prepare Bus Sleep State, the (unexpected) recommencing of network activity triggers a special indication to the ComM
- It is possible to detect if all nodes but the own are asleep (Remote Sleep Indication)



Bus-specific Features

- For FlexRay, the Nm state machine looks a bit different, with states for handling Bus startup & recovery
- As sending Nm messages cannot be suspended in the static segment under FlexRay, a „voting“ flag can be used to void a Nm message



Summary

- ECU State- BSW Mode- Manager
- Watchdog Management
- Communication Management
  - Communication Manager ComM
  - State Management
  - Network Management

Get in touch!

Elektrobit

sales@elektrobit.com
www.elektrobit.com