

Usage of AUTOSAR Diagnostic Modules in a MOST Electronic Control Unit.

Concepts and Results from a first Prototype.

BMW Group



Content.

Introduction.

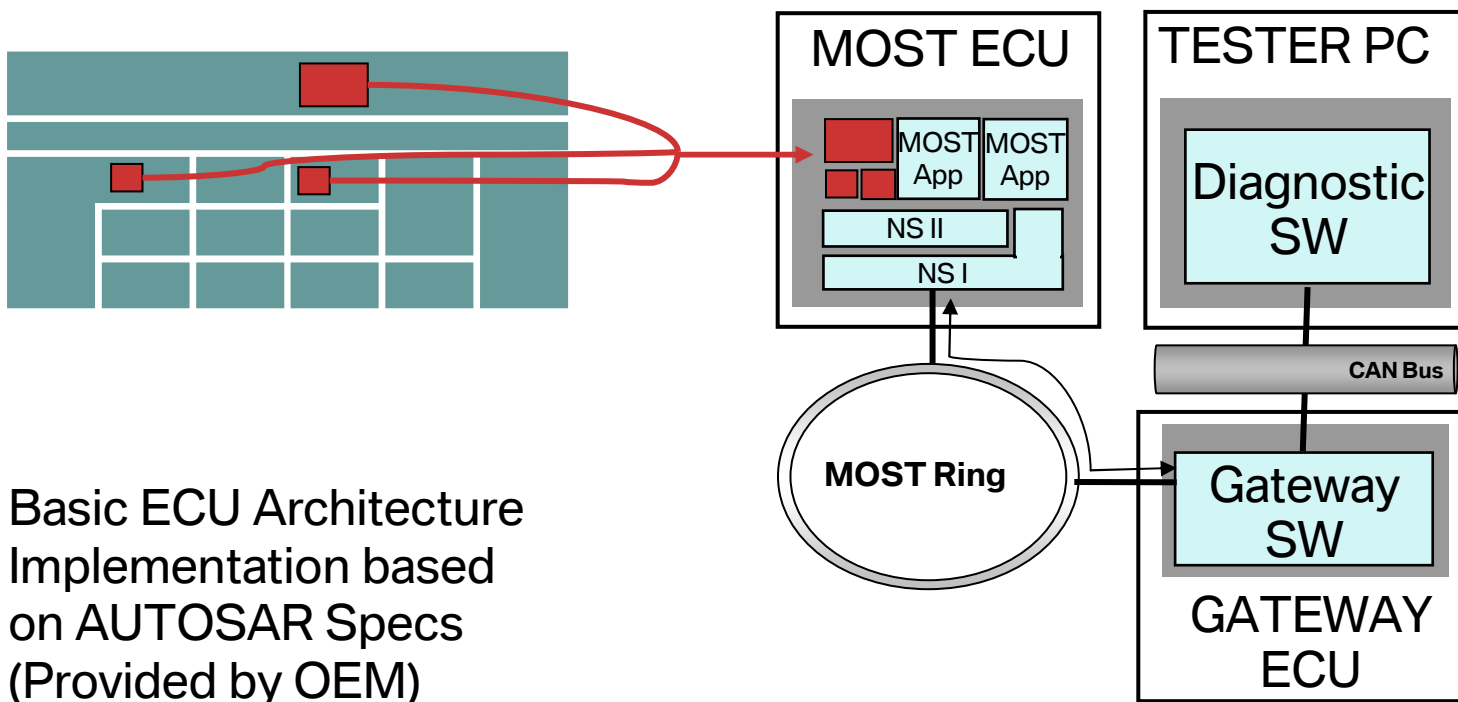
Porting the AUTOSAR Diagnostic Modules.

- Porting the DCM.
- Porting the DEM.
- Porting the CDC.

Porting Arbitrary Software Components.

Conclusion.

Introduction. Project Goal.



Introduction.

Motivation.

DON'T REPEAT YOURSELF!

- Frequent usage of software in different ECUs increases its quality.
- Especially for common system functionalities one implementation for all ECUs is desirable.
- As it reduces the effort of development.
- As it reduces the effort of testing.
- As it reduces the effort of integration.
- As it reduces the effort of updating.

Introduction.

AUTOSAR Architecture Overview.

Basic Software Modules (BSWMs).

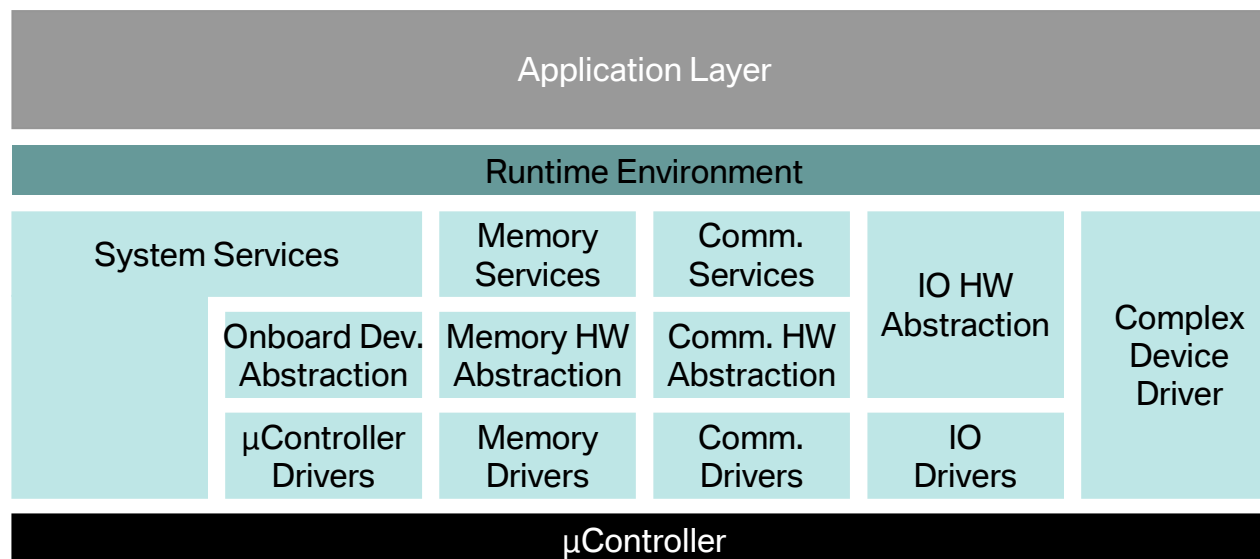
- Provide common services required in most ECUs.

Runtime Environment (RTE).

- The RTE is a middleware which abstracts from the location of comm. partners.

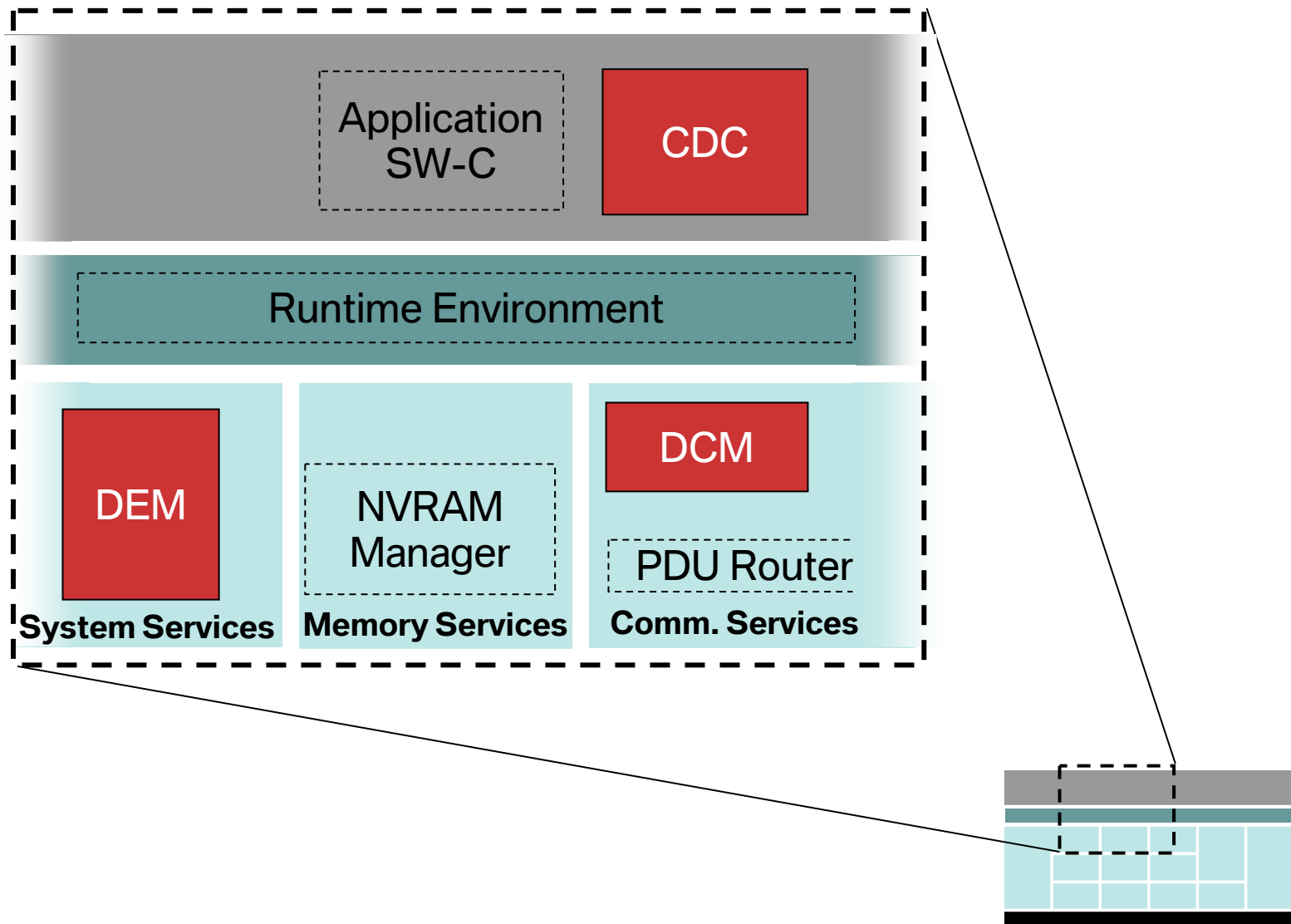
Software Components (SW-Cs) .

- SW-Cs only communicate via the RTE with each other and BSWMs.



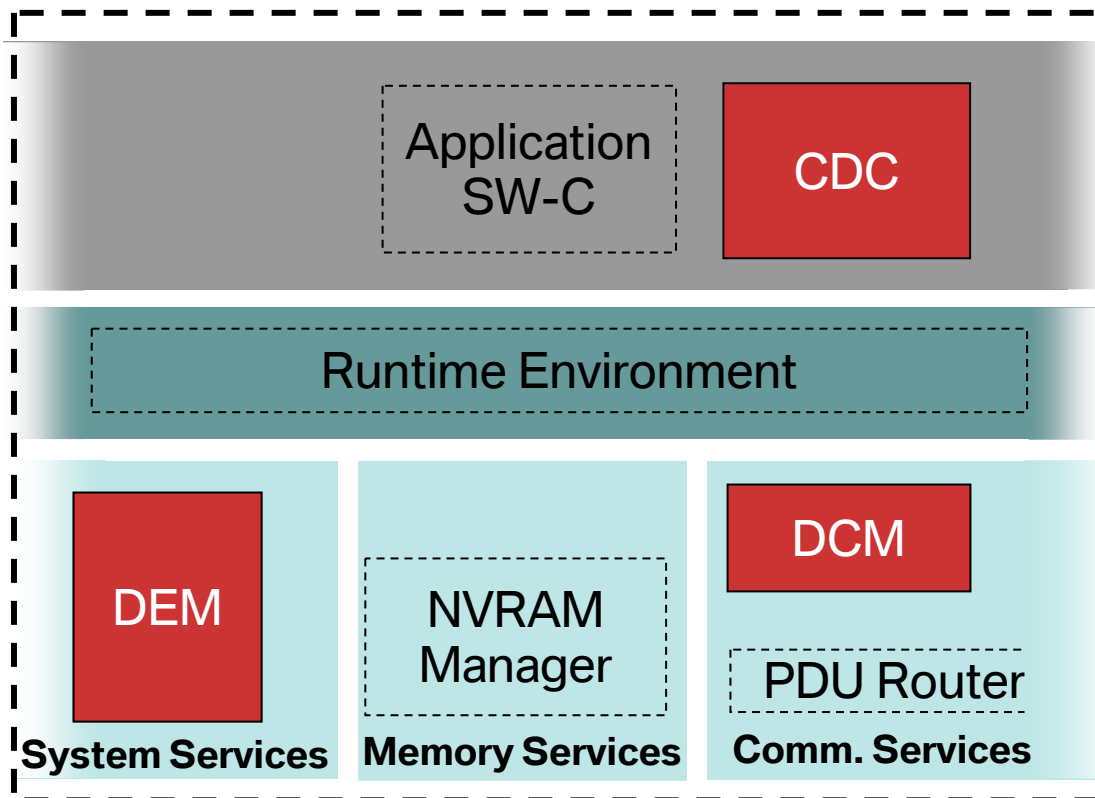
Introduction.

AUTOSAR Diagnostic Request Handling.



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AUTOSAR Diagnostic Request Handling.



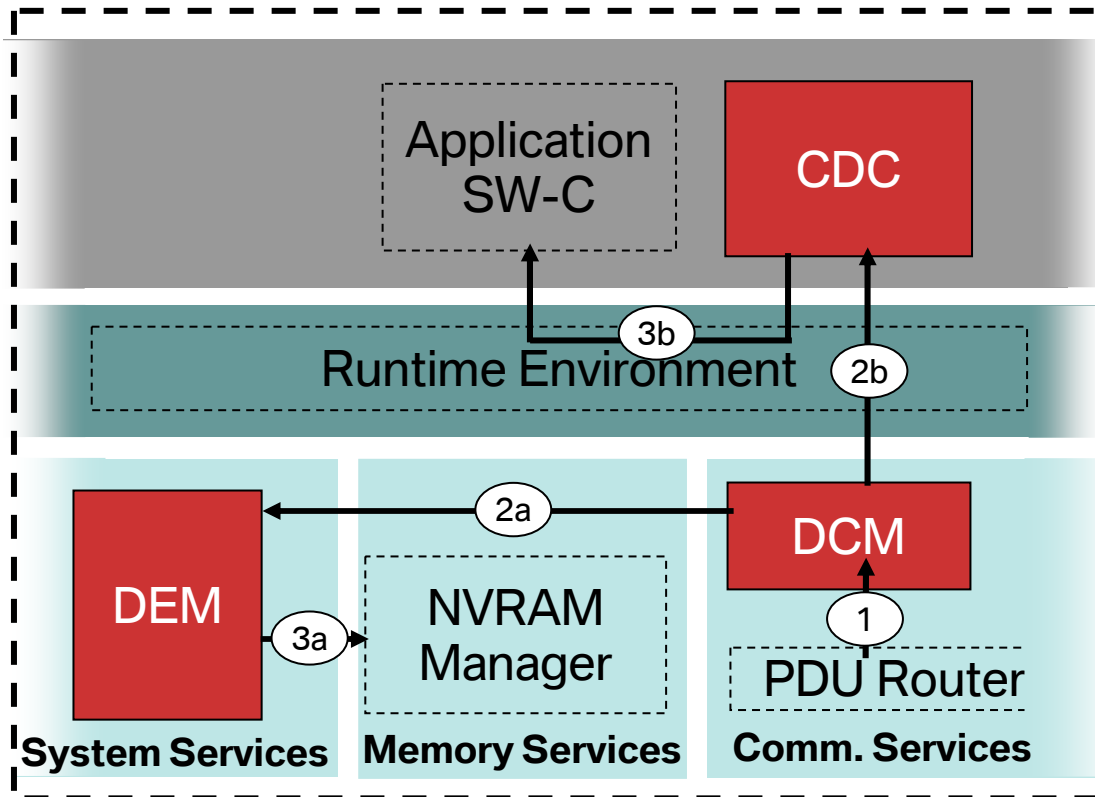
Central Diagnostic Software Component
Handles OEM specific diagnostic requests.

Diagnostic Event Manager
Handles error entries in a persistent manner.

Diagnostic Comm. Manager
Implements the KWP2000 & UDS protocols.

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AUTOSAR Diagnostic Request Handling.



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Porting the AUTOSAR Diagnostic Modules.

Porting AUTOSAR BSWMs & SW-Cs.

BSWMs & SWCs are deployed into and run in a non-AUTOSAR Environment (Linux/QNX & MOST).

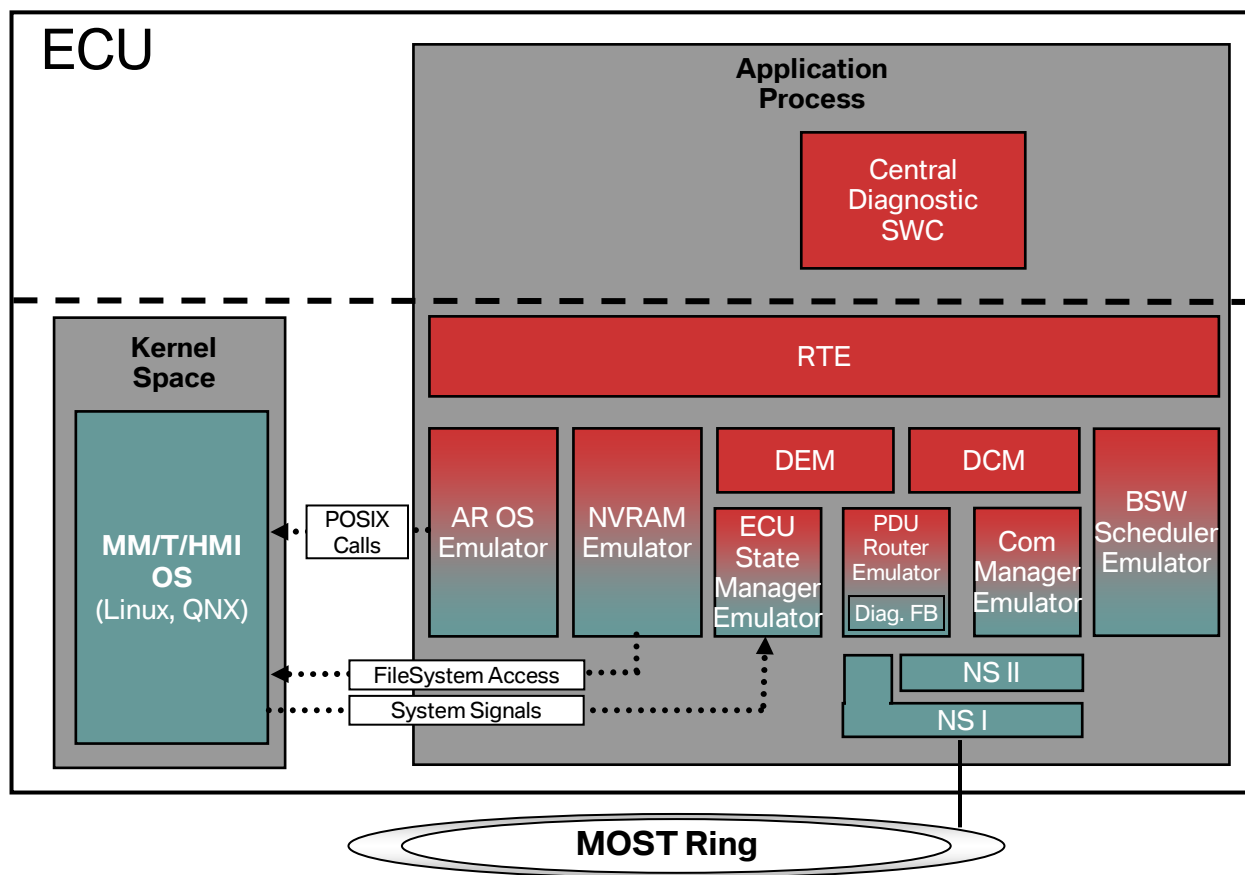
BSWMs & SW-Cs Expectations

- BSWMs depend on the presence of other BSWMs.
- SWCs depend on the presence of the RTE.
- Not only interfaces are expected but also the specified behavior (triggering of functions).

Approach

- Emulation of the required BSWMs.
- Integration of the RTE.

Porting the AUTOSAR Diagnostic Modules. Overview.



- AUTOSAR BSWM / SWC
- Non-AUTOSAR Software
- BSWM Emulator

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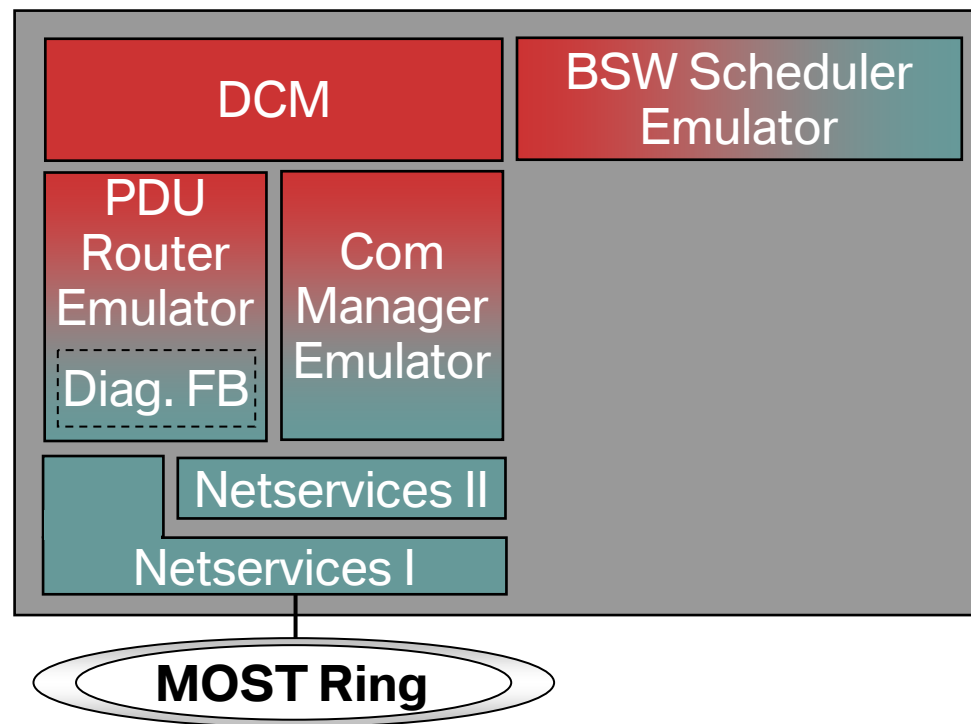
Conclusion.

Porting the DCM. Overview.

ComManager – Initializes the DCM and changes its mode (silent/listen/full).

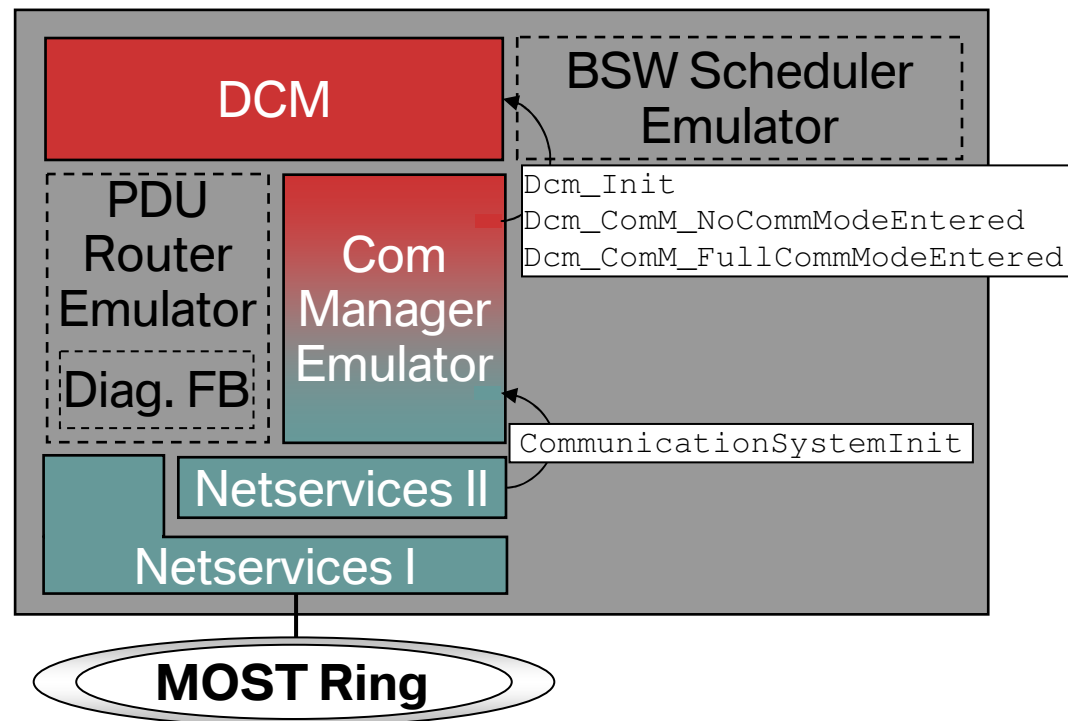
PDU Router – DCM's access to comm. channels (send/receive messages).

BSW Scheduler – Triggers the DCM's main processing function.



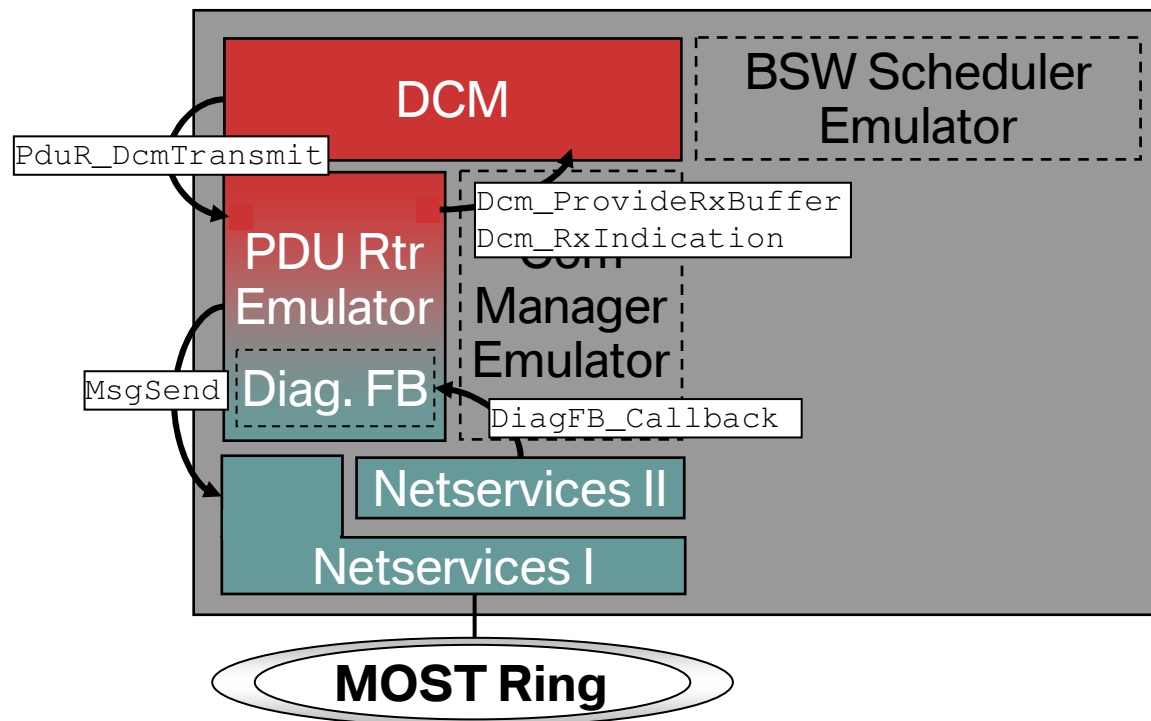
Porting the DCM. Initialization.

- The ComManager Emulator is attached to the `CommunicationSystemInit(byte ConfigStatusOk)` callback of the MOST Supervisor Layer II.
- The ComManager Emulator initializes and changes the DCM's communication mode based on the `ConfigStatusOk` parameter.



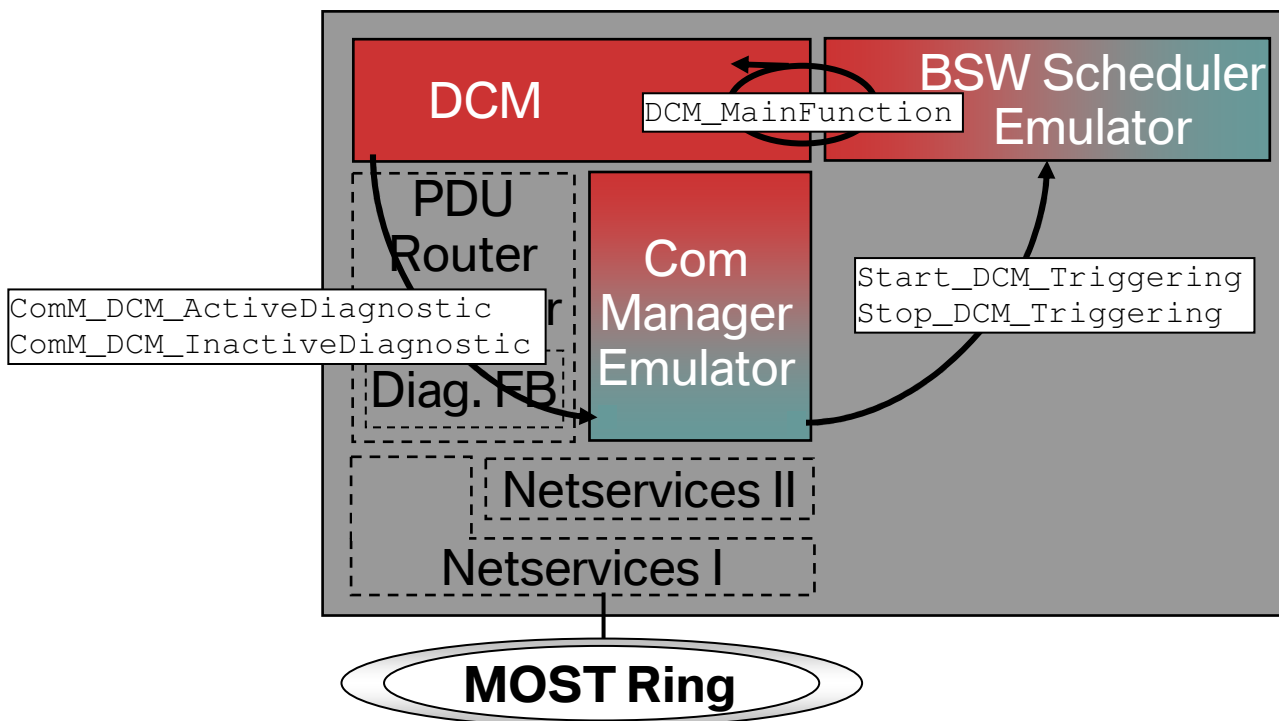
Porting the DCM. Communication Channel Access.

- The PDU Router Emulator provides a Function Block which is called by MOST's Command Interpreter on the reception of a diagnostic request.
- The PDU Router Emulator sends diagnostic responses by calling `MsgSend()` on MOST's Asynchronous Message Service.



Porting the DCM. Scheduling.

- The DCM expects to be triggered periodically which is not desirable.
- The functions `ComM_DCM_ActiveDiagnostic()` and `ComM_DCM_InactiveDiagnostic()` can be used to only run the DCM on demand.



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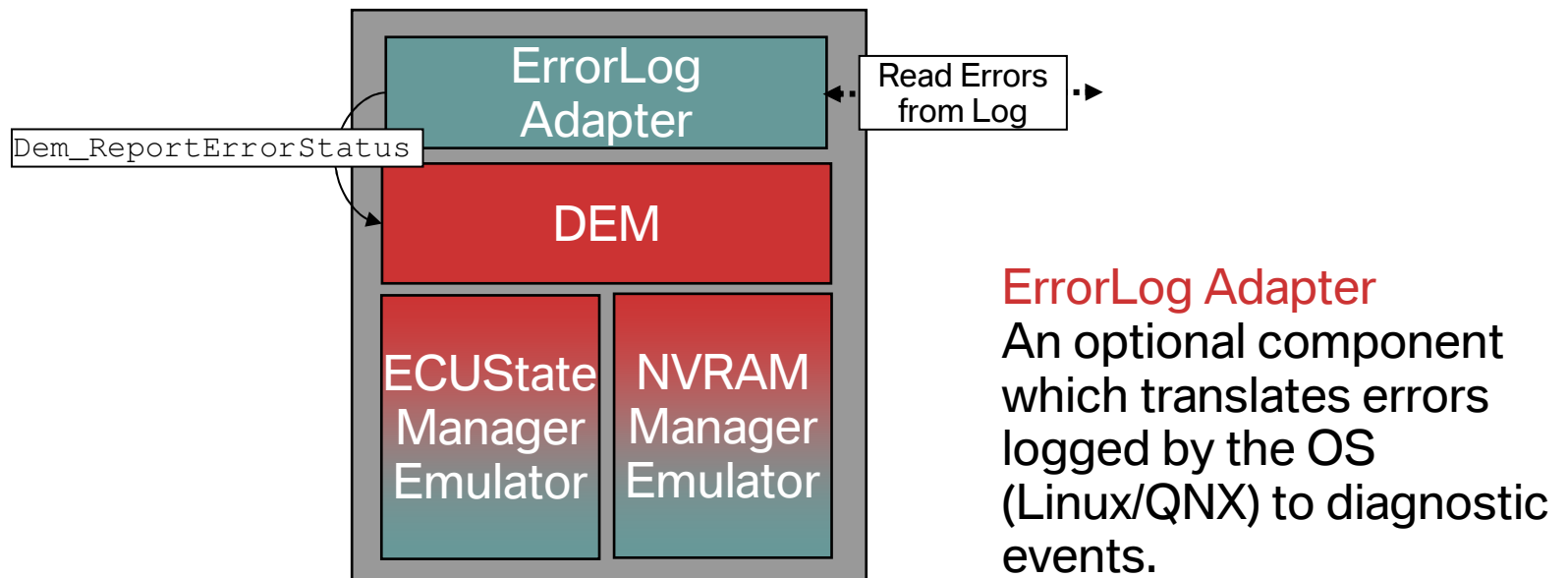
Porting Arbitrary Software Components.

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Porting the DEM. Overview.

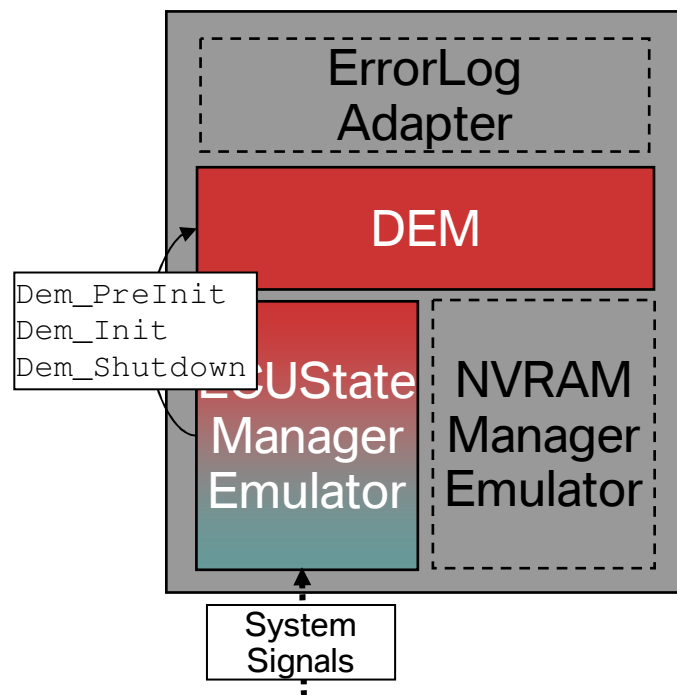
ECU State Manager – Initializes the DEM.

NVRAM Manager – DCM's access to persistent storage.



Porting the DEM. Initialization.

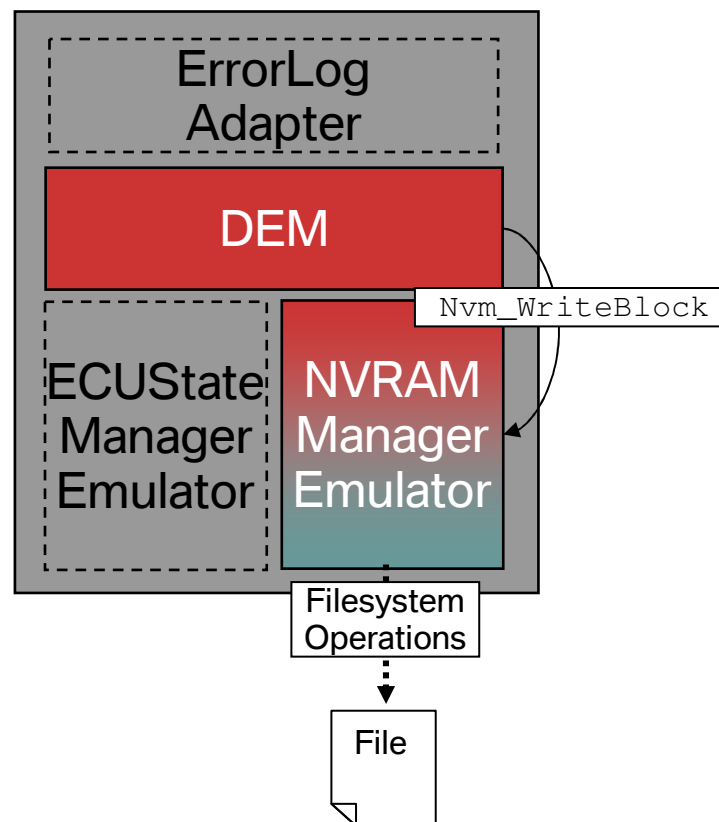
- The ECU State Manager Emulator is triggered in the `main()` function and hooked up with termination signals.
- The two phased initialization can be omitted.



Porting the DEM.

Accessing Persistent Storage.

- The NVRAM Manager Emulator maps block ids to file names.
- A possible mapping would be to have one file per block id.



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Porting the AUTOSAR Diagnostic Modules.

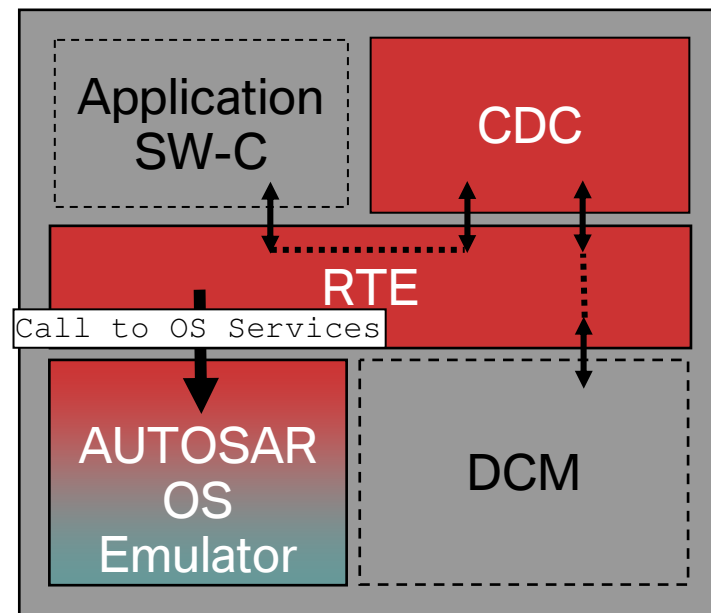
- Porting the DCM.
- Porting the DEM.
- **Porting the CDC.**

Porting Arbitrary Software Components.

Conclusion.

Porting the CDC. Overview.

- Software Components only communicate via the RTE.
- AUTOSAR has no MOST support, hence remote communication via the RTE is not possible – BUT not needed.
- Porting the CDC boils down to porting the RTE which implies the emulation of AUTOSAR OS services.



Porting the CDC.

Emulating AUTOSAR OS with POSIX.

`ActivateTask()` & `TerminateTask()`
Emulated by creating a POSIX Thread.

`SetRelAlarm()` & `CancelAlarm()`
Emulated by creating a POSIX Timer and setting the offset and period.

`SetEvent()`, `GetEvent()` & `ClearEvent()`
Emulated by setting bits in an `int` variable representing the occurred events.

`WaitEvent()`
Emulated by letting the Thread wait on a Condition which is signaled by the `SetEvent()` service.

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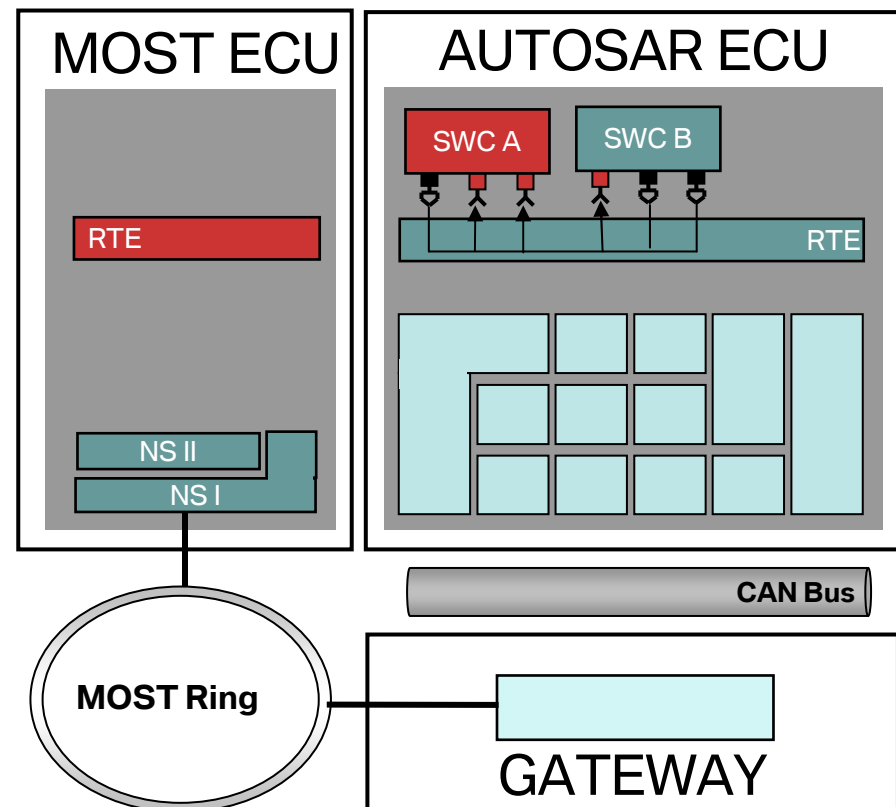
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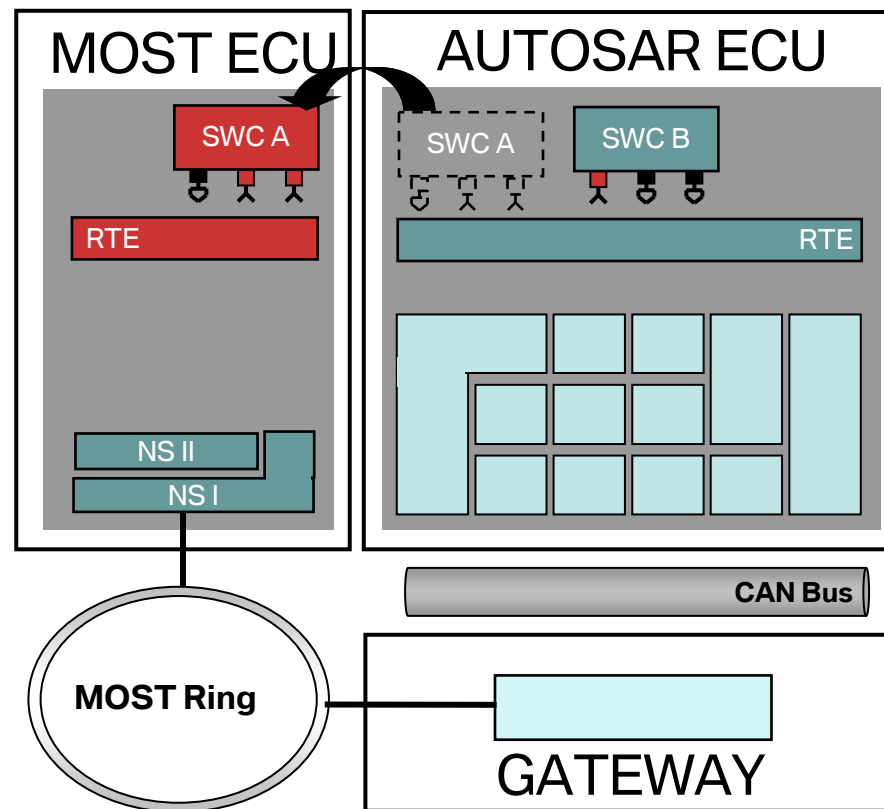
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Porting Arbitrary Software Components. The MOST Proxy Concept.



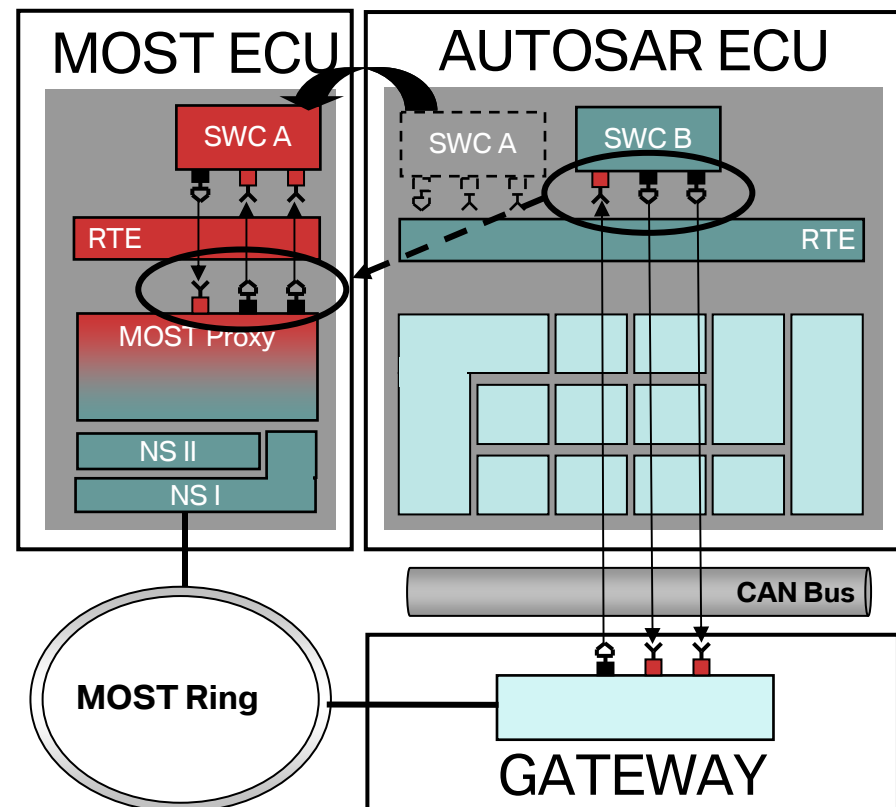
Porting Arbitrary Software Components. The MOST Proxy Concept.

- The RTE does not support access to the MOST Netservices.



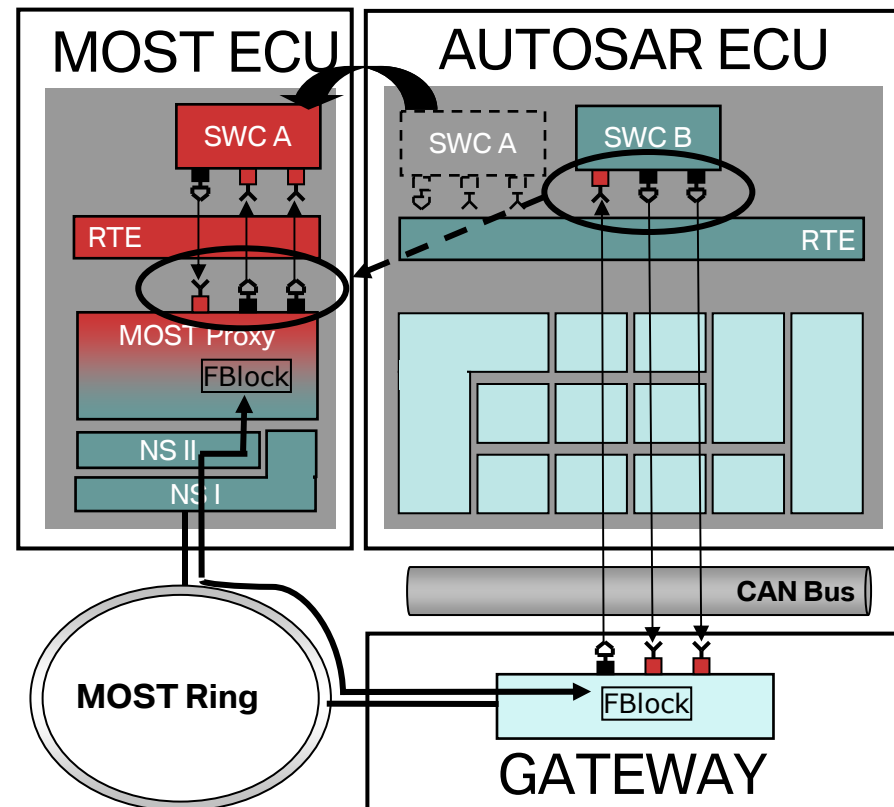
Porting Arbitrary Software Components. The MOST Proxy Concept.

- The RTE does not support access to the MOST Netservices.
- The MOST Proxy proxies the remote AUTOSAR SWC.
- The RTE only has to realize local communication.



Porting Arbitrary Software Components. The MOST Proxy Concept.

- The RTE does not support access to the MOST Netservices.
- The MOST Proxy proxies the remote AUTOSAR SW-C.
- RTE only has to realize local communication.
- The MOST Proxy translates RTE-Calls to MOST FBlock-Calls.



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MOST ECUs can benefit from AUTOSAR by reusing selected BSWMs & SWCs.

By providing a MOST Proxy MOST ECUs can host AUTOSAR SWCs.

A tighter coupling between AUTOSAR and MOST could increase the benefits of porting BSWMs (e.g. Netservices log errors via DEM).

Thank you for your attention.