



OSEK/VDX - OSEKtime

OSEKtime – Zeitgesteuerte Erweiterung des OSEK Standards

**Time-triggered Real-Time Operating System and
Fault-tolerant Communication Layer for
Drive-by-wire Applications**

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OSEK/VDX - OSEKtime

- 1. Motivation**
- 2. The OSEKtime Consortium**
- 3. System Architecture**
- 4. OSEKtime - Operating System (OS)**
- 5. OSEKtime - FT Communication Layer (FTCom)**
- 6. Conclusion**



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1. Motivation - the OSEK/VDX Project

Goals of the OSEK/VDX Project:

- Support of the portability and reusability of the application software
- Savings in costs and development time
- Enhanced quality of the software of control units of various companies
- Standardised interfaces for control units with different architectures
- Provides independence with regards to individual implementations

The OSEK/VDX Specifications:

OS 2.1 Operating System

COM 2.2 Communication

NM 2.5.1 Network Management

OIL 2.2 OSEK Implementation Language

Goal of the OSEKtime Working group (founded in '98):

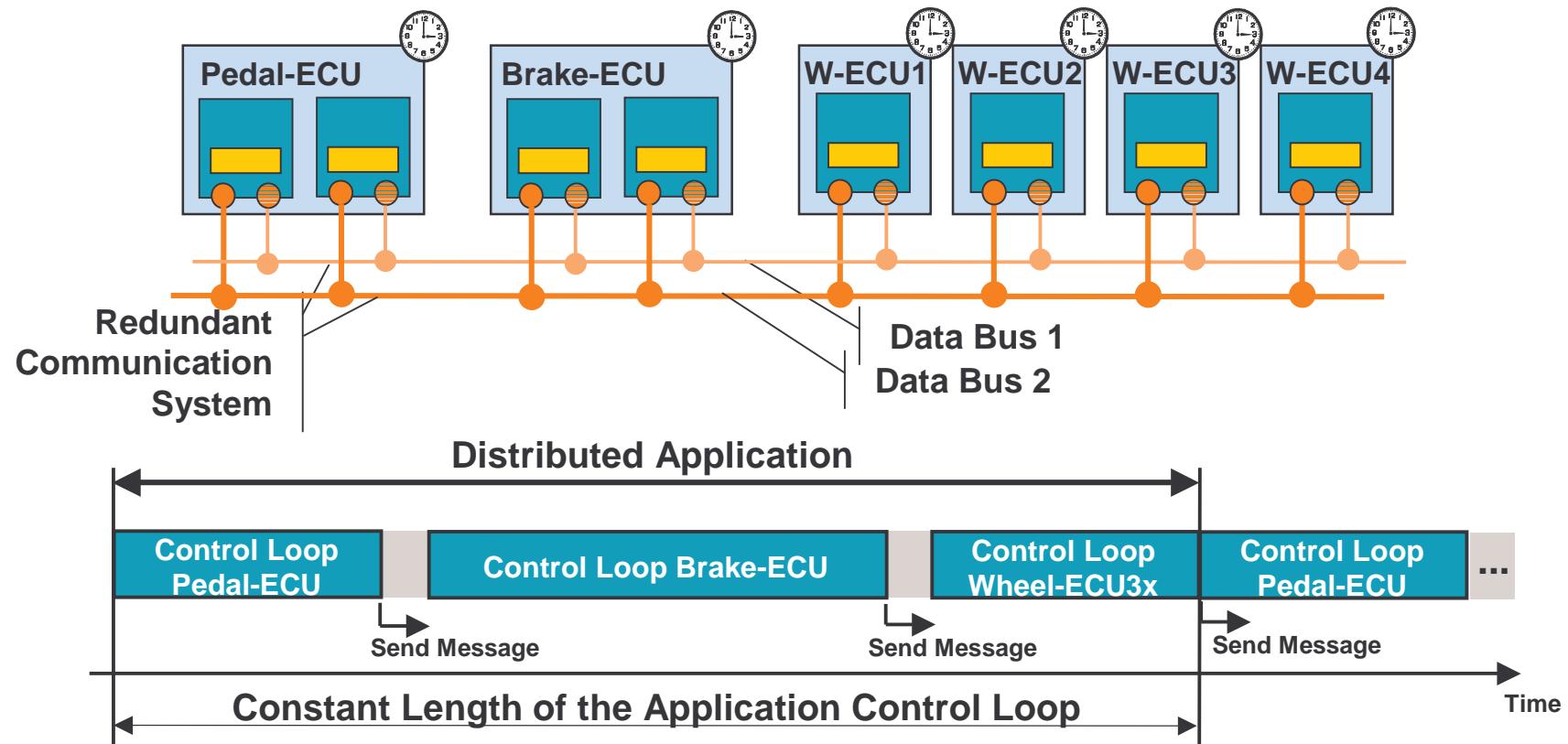
- ➡ Extension of the OSEK/VDX standard for time-triggered fault-tolerant real-time systems



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1. Motivation - Example for an OSEKtime System

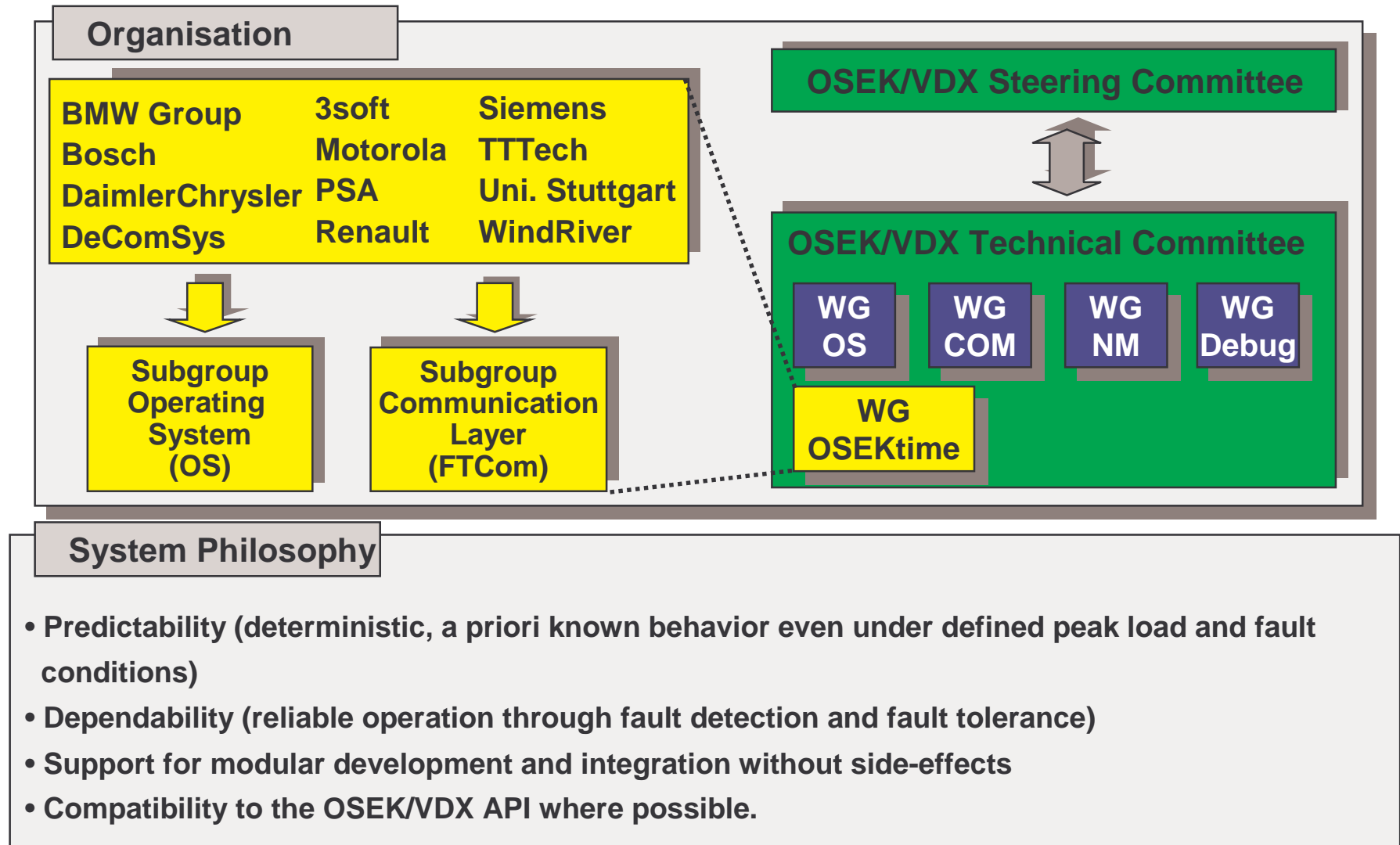
- Distributed control loops
- Fault-tolerant nodes
- Synchronization of tasks to a global time base





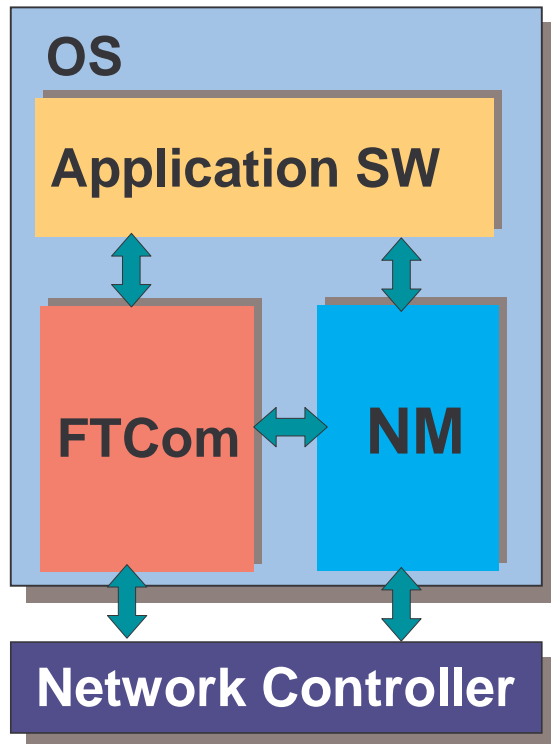
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2. The OSEKtime Consortium





3. System Architecture



OS

- Stack based scheduling (planned offline)
- Optimized with respect to runtime, resources and deterministic behavior
- Support of fault detection (deadline monitoring,...)

FTCom

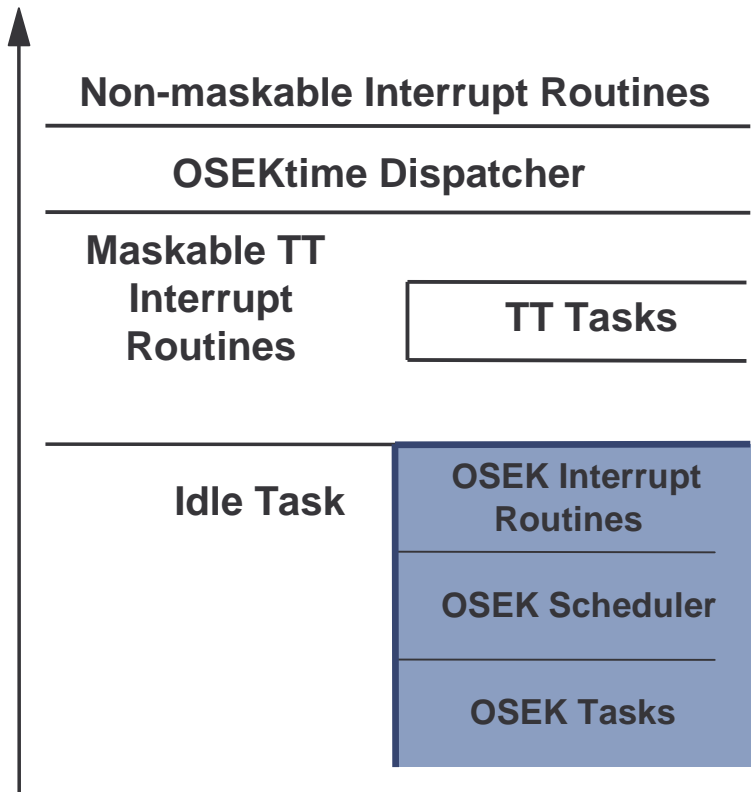
- Global message handling
 - Message packing/unpacking
 - Replication and agreement
 - Message filtering
- Startup and Synchronization
- Bus membership service (optional)

NM

- Same functionality as OSEK/VDX NM
- Adaptation to new communications systems



4. OSEKtime - OS: Processing Levels



- OSEKtime Dispatcher has the highest processing level (exception: non-maskable interrupts)
- Optional OSEK/VDX subsystem for code reuse, gateways and compatibility reasons
- For low performance ECUs pure OSEKtime system with idle task as background process



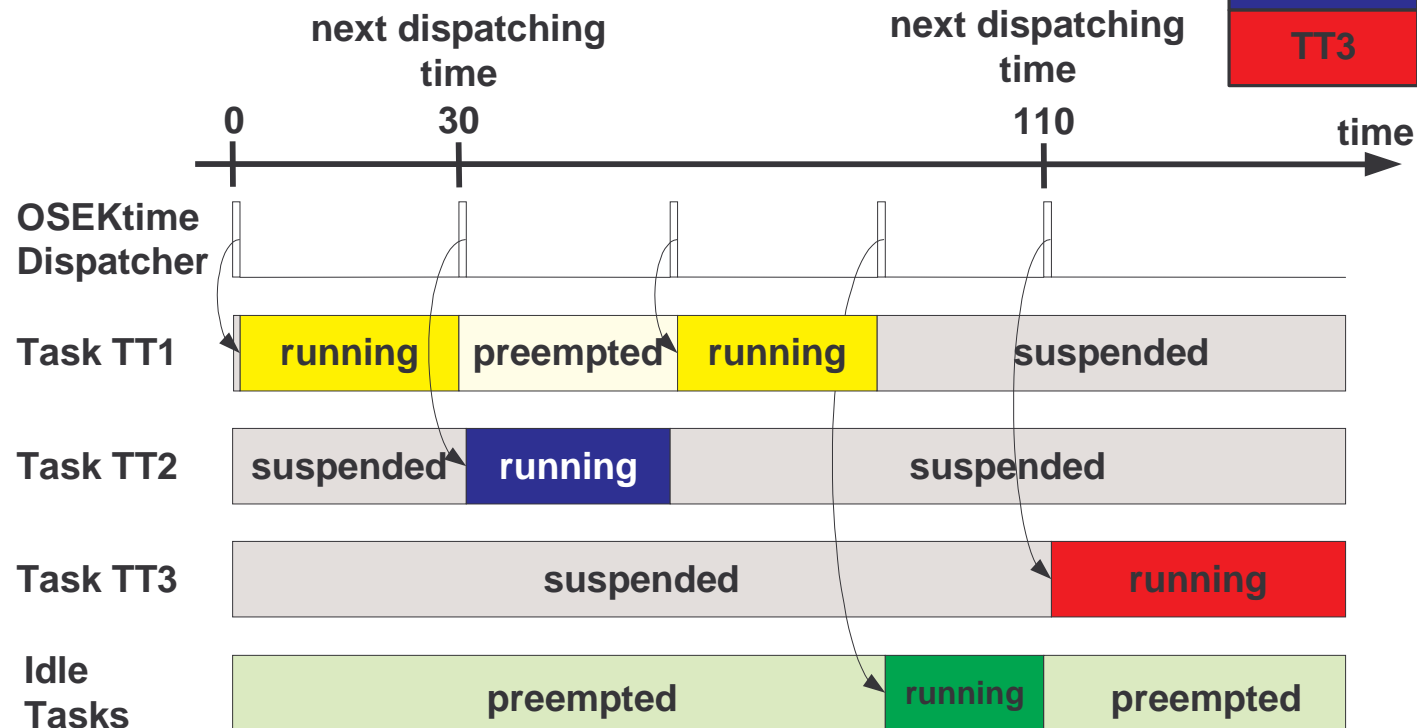
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4. OSEKtime - OS: Task Activation

- Stack-based scheduling, full preemptive
- Activation time table based
- Schedule is defined offline, no re-scheduling during runtime

Dispatcher Table

Task Name	Activation Time
TT1	0
TT2	30
TT3	110

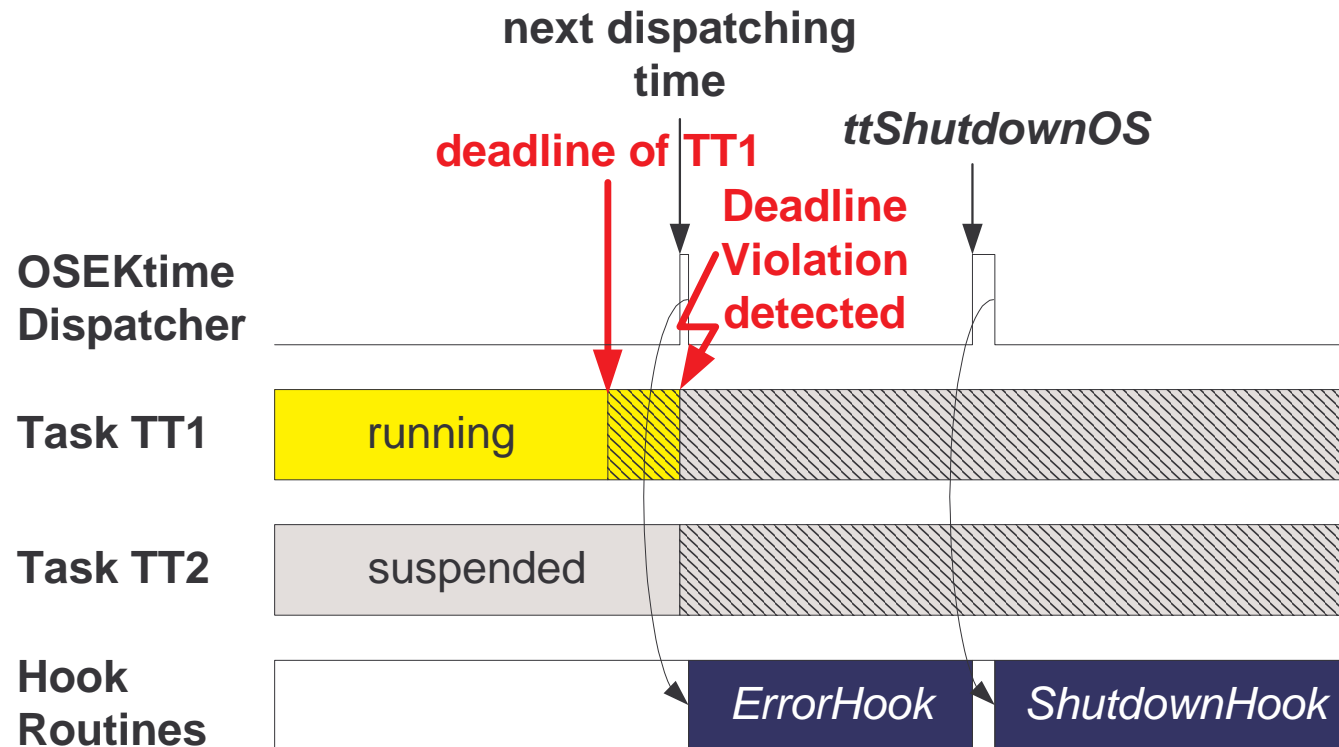




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4. OSEKtime - OS: Deadline Monitoring

- Every OSEKtime task is deadline checked (exception: Idle Task)
- Checking the task status at deadline expiration or at next dispatching time (configurable)
- Error handling after deadline violation: Shutdown of the OSEKtime system



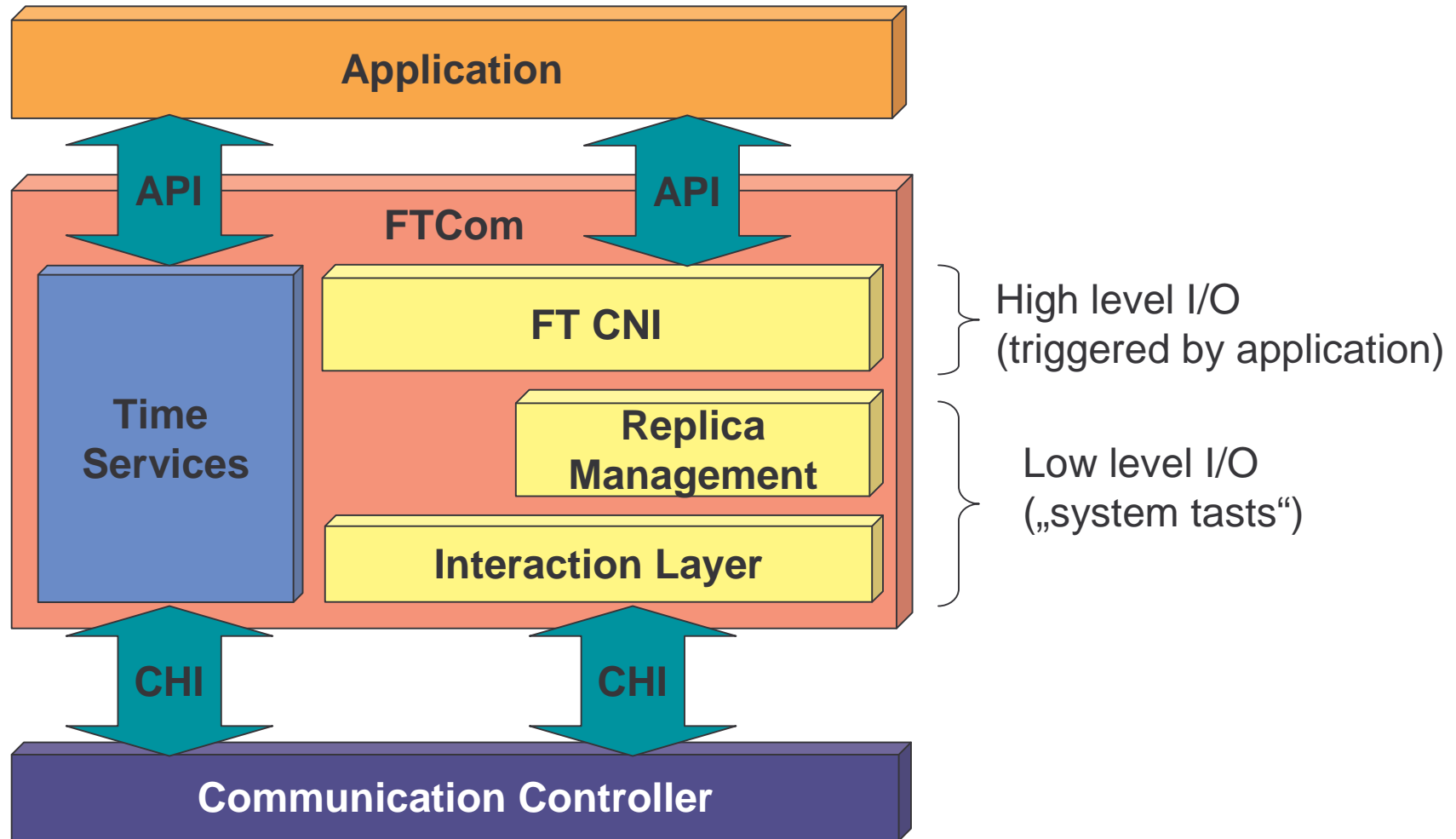


5. OSEKtime – FTCom Features

- **Standardized communication layer**
- **Abstraction from communication hardware**
- **Configurable prior to compilation**
- **Static operation during run-time**
- **Key Services:**
 - **Message management**
 - **Replica management**
 - **Synchronization**



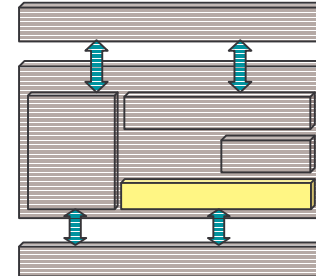
5. OSEKtime - FTCom: Architecture



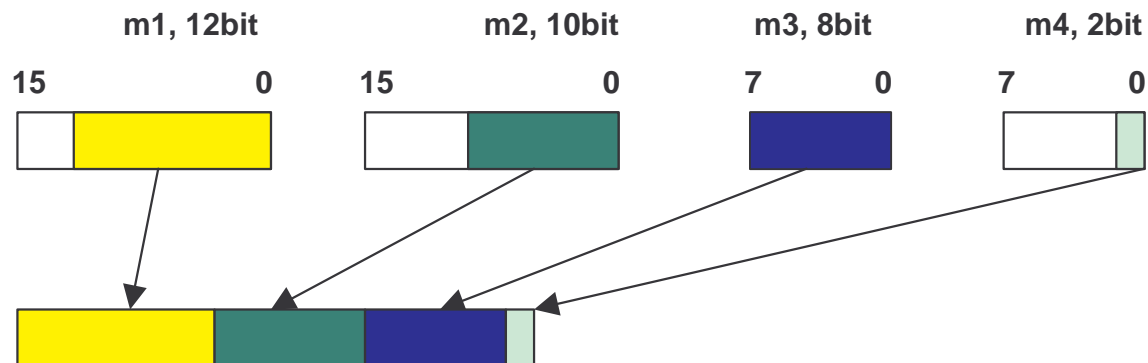


5. OSEKtime – FTCom: Packing/Unpacking

- Packing/Unpacking of messages in/out frames
- Messages of maximal frame length are supported
- Resolves representation issues (byte order, ...)



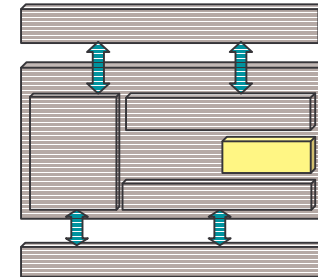
UNPACKED MESSAGE REPRESENTATION



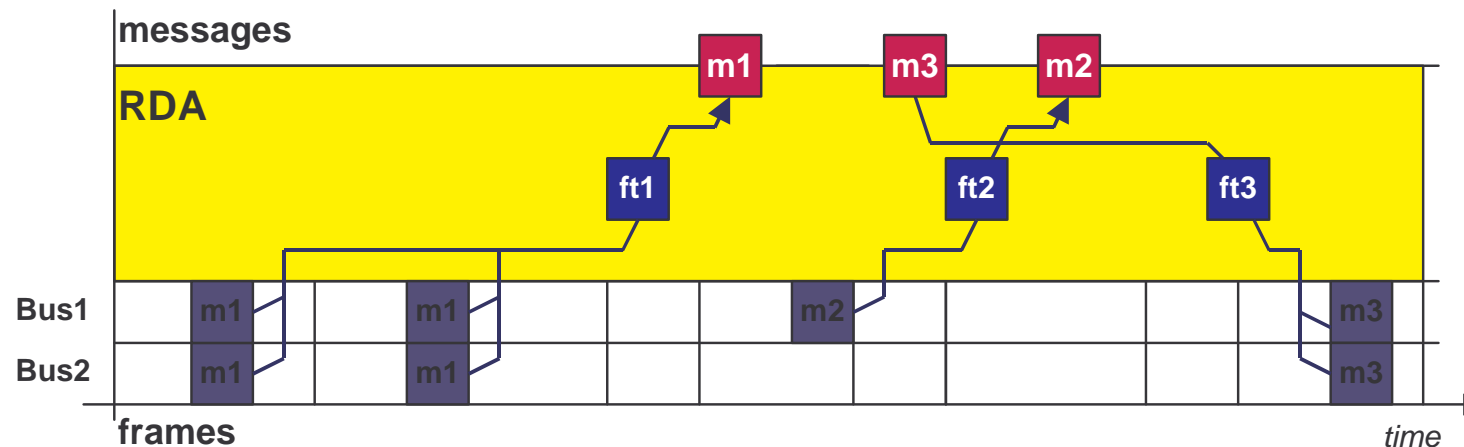
PACKED REPRESENTATION



5. OSEKtime - FTCom: RDA - Replica Determinate Agreement



- E.g. message m1 is 4 times represented in the communication system (redundant channels, redundant nodes)
- RDA layer generates one consistent message
- RDA supports different voting mechanisms and a generic framework for user defined algorithms (pick-first-valid, majority-voting, ...)





5. OSEKtime - FTCom: Message API

a) Transmission of messages:

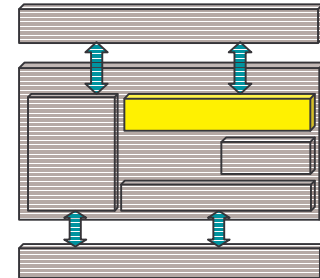
- ttSendMessage()

b) Reception of messages:

- ttReceiveMessage()

c) Invalidation of messages:

- ttInvalidateMessages

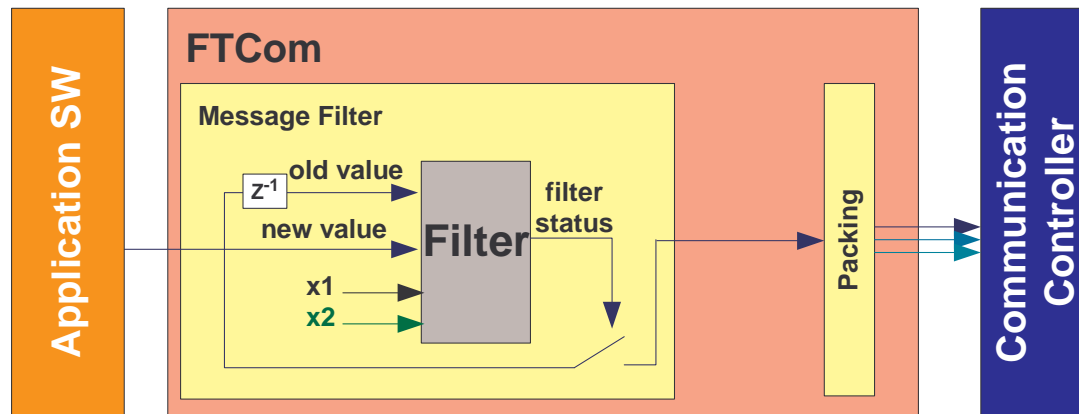




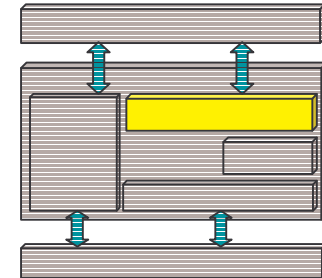
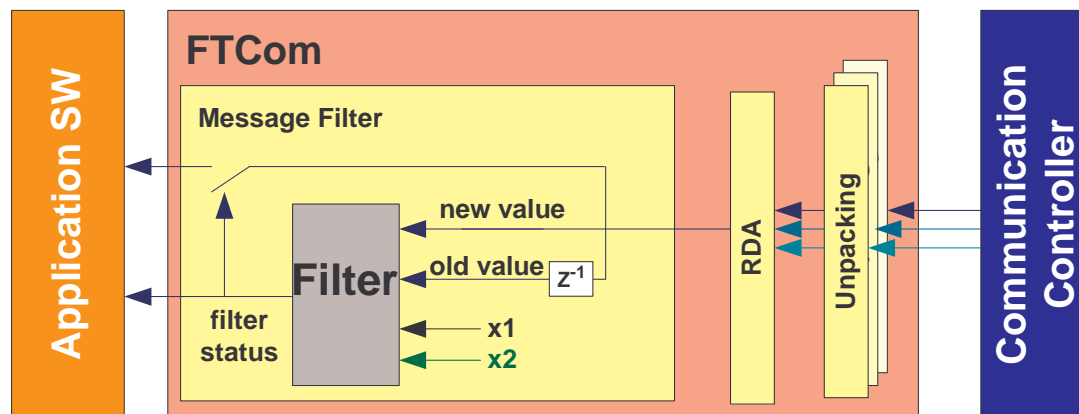
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5. OSEKtime - FTCom: Message Filtering

a) Sending a Message



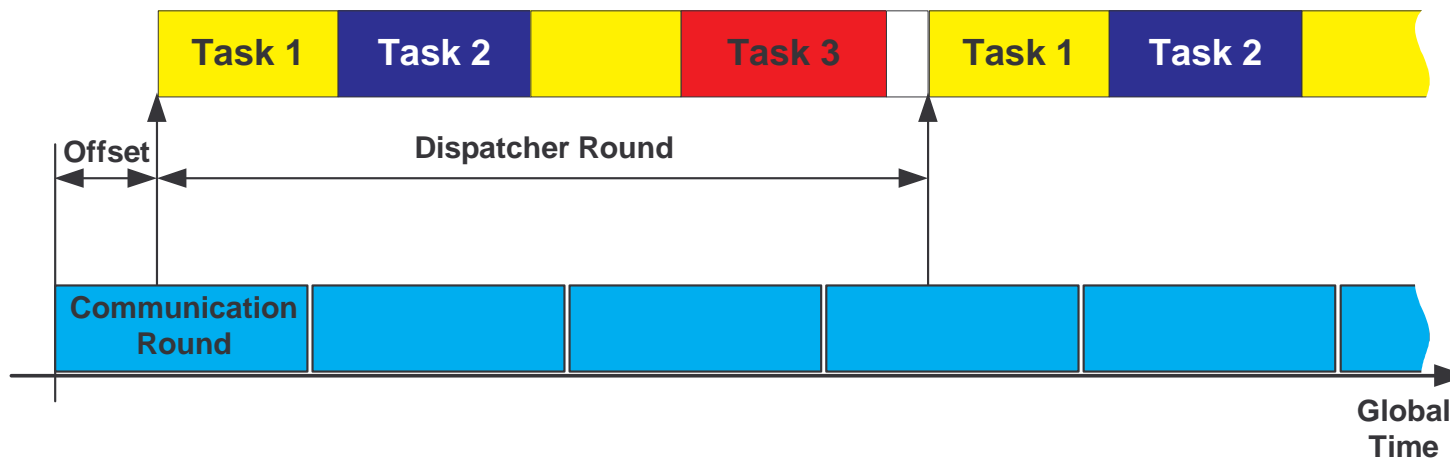
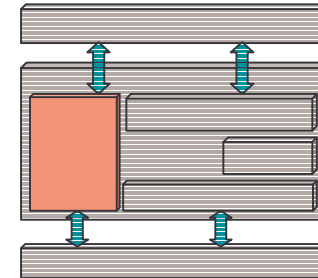
b) Receiving a Message





5. OSEKtime - FTCom: Time Service

- Synchronisation layer for application tasks
- API to synchronize OSEKtime dispatcher with global time
- Support of system startup and resynchronisation during runtime





6. Conclusion

- **OSEKtime extension of the OSEK/VDX standard for time-triggered, fault-tolerant real-time systems**
- **Scaleable architecture support and code reuse**
- **Release 1.0 of the OSEKtime OS and FTCom specification available at www.osek-vdx.com**
- **Further jobs to do: extension of OIL description**