# Marte by Time4Sys

| REVISION HISTORY | | | |
|---|---|---|---|
| NUMBER | DATE | DESCRIPTION | NAME |
| | | | |

# Contents

# Chapter 1

# Introduction

This document presents the main result of the Waruna project, ie an Ecore implementation of the OMG's Marte specification. This implementation follow quite closely its original specification excepts in a few areas as explained in following chapter.

# Chapter 2

# Deviation from OMG Marte specication

## 2.1 Pattern of Activation

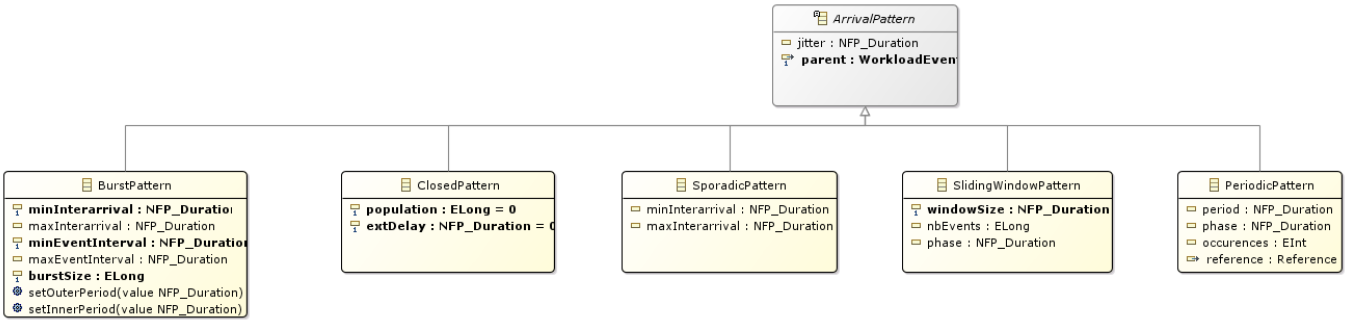



Figure 2.1: activation-pattern

Contraryly to the Marte specification, we have flatten the hierarchy and also haven't (yet?) implemented all pattern.

Table 2.1: Comparions of arrival pattern table

| Pattern | Marte | Time4Sys | Description |
|---|---|---|---|
| PeriodicPattern | X | X | It describes periodic interarrival patterns, with an optional maximal deviation (jitter) |
| AperiodicPattern | X | | It describes an unbounded pattern that is defined by a distribution function. |
| SporadicPattern | X | X | It describes a bounded pattern that is defined by a corner case interarrival times and a maximum deviation (jitter). |
| BurstPattern | X | X | It describes a bursty interarrival pattern with a number of events that can occur in a bounded period. |
| IrregularPattern | X | | It describes an aperiodic pattern that is described by a table of successive interarrivals durations measured from a starting phase. |
| ClosedPattern | X | | It describes a workload characterized by a fixed number of active or potential users or jobs that cycle between executing the scenario. |

Table 2.1: (continued)

| Pattern | Marte | Time4Sys | Description |
|---|---|---|---|
| OpenPattern | X | | It describes a workload that is modeled as a stream of requests that arrive at a given rate in some predetermined pattern (such as Poisson arrivals). |
| SlidingWindowPattern | | X | It describes a bounded pattern that is defined by the maximum number of events that can occur on a sliding window. |

## 2.2 Links of Precedence between tasks

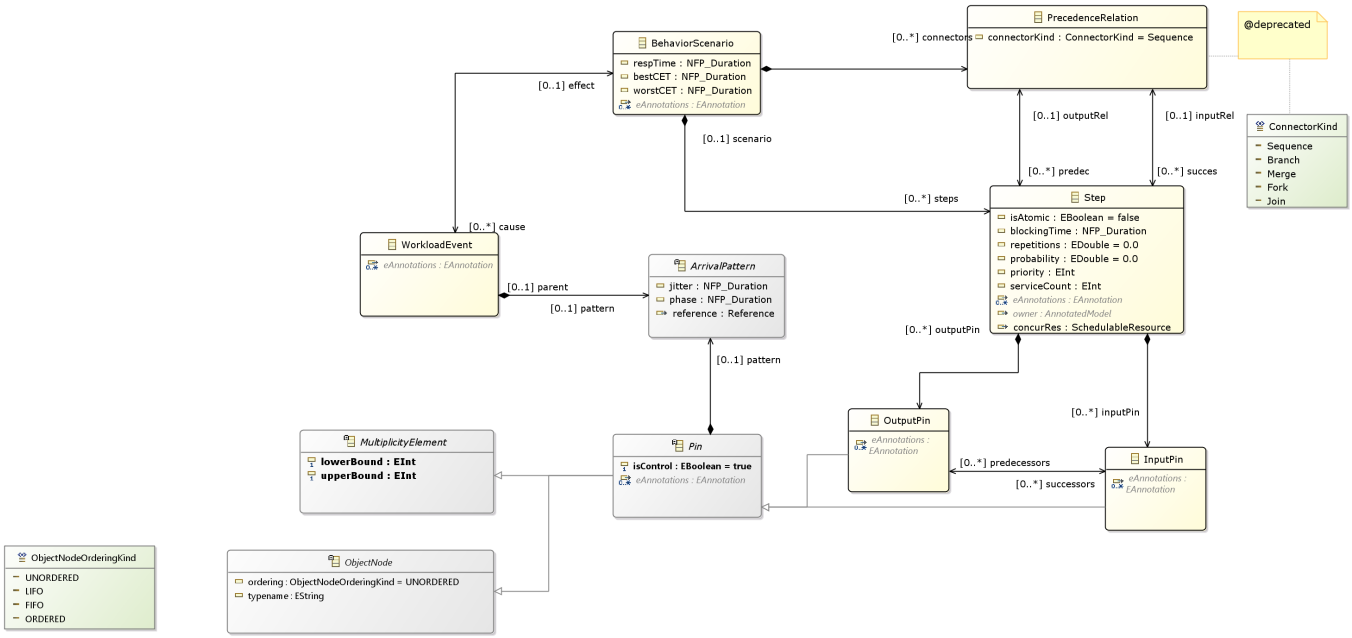



Figure 2.2: precedence-diagram

The model from Marte is not precise enough to express other than simple relationship. Thus we reuse the concepts of Pin from the UML 2.5 Activity Diagram.

NB: Shall we also reuse ActivityEdge instead of the successor-predecessor link?

## 2.3 EndToEnd Flow

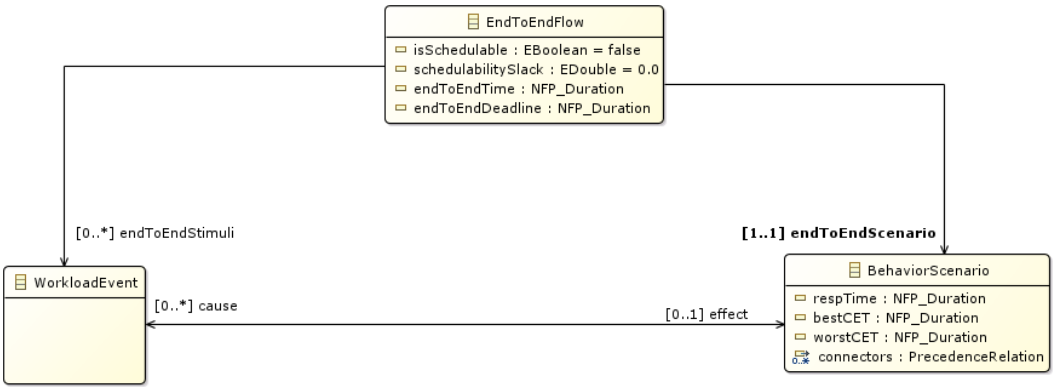



Figure 2.3: endtoendflow-diagram

This class is modeled in the Gqam Package while originally it is from the Sam MARTE subpackage. This is subject to futur modification, especially when the constraint (aka timing requirements) will be further developped.

# Chapter 3

# Marte package

## 3.1 Overview

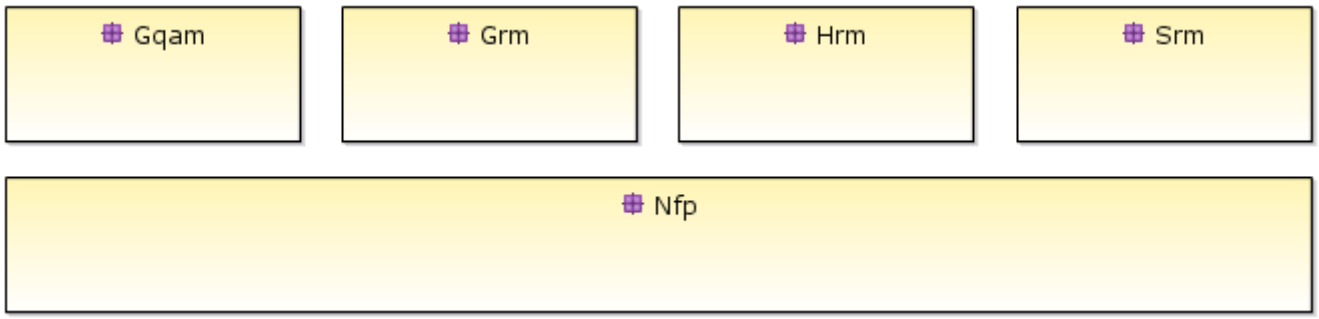



Figure 3.1: Marte-class-diagram-overview

# Chapter 4

# Coreelements package

## 4.1 Overview

coreelements-class-diagram-overview.png

Figure 4.1: coreelements-class-diagram-overview

## 4.2 Abstraction classifier

TODO: write an overview

### 4.2.1 Generalizations

- Dependency from coreelements

### 4.2.2 Specializations

- Allocate from alloc

### 4.2.3 Semantics

TODO: write a semantic

## 4.3 Constraint classifier

TODO: write an overview

### 4.3.1 Generalizations

- PackageableElement from coreelements

### 4.3.2 Specializations

- Constraint from annotation
- LatencyObserver from gqam
- TimedObserver from gqam
- SchedulingObserver from sam

### 4.3.3 Semantics

TODO: write a semantic

## 4.4 Dependency classifier

from UML 2.5

TODO: write an overview

### 4.4.1 Generalizations

- DirectedRelationship from coreelements
- PackageableElement from coreelements

### 4.4.2 Specializations

- Abstraction from coreelements
- Allocate from alloc

### 4.4.3 Semantics

TODO: write a semantic

## 4.5 DirectedRelationship classifier

TODO: write an overview

### 4.5.1 Specializations

- Abstraction from coreelements
- Dependency from coreelements
- Allocate from alloc

### 4.5.2 Semantics

TODO: write a semantic

## 4.6 ModelElement classifier

TODO: write an overview

### 4.6.1 Generalizations

- EModelElement from ecore

### 4.6.2 Semantics

TODO: write a semantic

## 4.7 NamedElement classifier

TODO: write an overview

### 4.7.1 Generalizations

- ENamedElement from Ecore
- ModelElement from coreelements

### 4.7.2 Semantics

TODO: write a semantic

## 4.8 Package classifier

TODO: write an overview

### 4.8.1 Generalizations

- PackageableElement from coreelements

### 4.8.2 Specializations

- ResourcePackage from grm
- HardwareInterfacePackage from hrm
- HardwareResourcePackage from hrm
- SoftwareInterfacePackage from srm
- SoftwareResourcePackage from srm

### 4.8.3 Semantics

TODO: write a semantic

## 4.9 PackageableElement classifier

TODO: write an overview

### 4.9.1 Generalizations

- NamedElement from coreelements

### 4.9.2 Specializations

- Abstraction from coreelements
- Constraint from coreelements
- Dependency from coreelements
- Package from coreelements
- ModelingConcern from annotation
- Constraint from annotation
- Allocate from alloc
- CommunicationChannel from gqam
- LatencyObserver from gqam
- TimedObserver from gqam
- ClockResource from grm
- CommunicationEndPoint from grm
- CommunicationMedia from grm
- ComputingResource from grm
- ConcurrencyResource from grm
- CommunicationResource from grm
- DeviceResource from grm
- MutualExclusionResource from grm
- ProcessingResource from grm
- Resource from grm
- ResourceBroker from grm

- ResourceInstance from grm
- ResourceInterface from grm
- ResourceManager from grm
- ResourcePackage from grm
- ResourcePackageableElement from grm
- ResourcePort from grm
- Scheduler from grm
- SchedulableResource from grm
- SecondaryScheduler from grm
- StorageResource from grm
- SynchResource from grm
- TimingResource from grm
- TimerResource from grm
- UsageTypedAmount from grm
- FirmwareArchitecture from hrm
- HardwareActuator from hrm
- HardwareArbiter from hrm
- HardwareAsic from hrm
- HardwareBranchPredictor from hrm
- HardwareBridge from hrm
- HardwareBus from hrm
- HardwareCache from hrm
- HardwareClock from hrm
- HardwareCommunicationResource from hrm
- HardwareComputingResource from hrm
- HardwareDevice from hrm
- HardwareDma from hrm
- HardwareDrive from hrm
- HardwareInterface from hrm
- HardwareInterfacePackage from hrm
- HardwareIo from hrm

- HardwareIpBlock from hrm
- HardwareIsa from hrm
- HardwareMedia from hrm
- HardwareMemory from hrm
- HardwareMmu from hrm
- HardwarePlatform from hrm
- HardwarePld from hrm
- HardwarePort from hrm
- HardwareProcessingMemory from hrm
- HardwareProcessor from hrm
- HardwareRam from hrm
- HardwareResourcePackage from hrm
- HardwareResource from hrm
- HardwareRom from hrm
- HardwareSensor from hrm
- HardwareStorageManager from hrm
- HardwareStorageMemory from hrm
- HardwareSupport from hrm
- HardwareTimingResource from hrm
- HardwareTimer from hrm
- HardwareWatchdog from hrm
- SchedulingObserver from sam
- Alarm from srm
- DeviceBroker from srm
- InterruptResource from srm
- MemoryBroker from srm
- MemoryPartition from srm
- MessageComResource from srm
- NotificationResource from srm
- SharedDataComResource from srm
- SoftwareArchitecture from srm

- SoftwareCommunicationResource from srm
- SoftwareConcurrentResource from srm
- SoftwareInteractionResource from srm
- SoftwareInterface from srm
- SoftwareInterfacePackage from srm
- SoftwareMutualExclusionResource from srm
- SoftwarePort from srm
- SoftwareResource from srm
- SoftwareResourcePackage from srm
- SoftwareSchedulableResource from srm
- SoftwareScheduler from srm
- SoftwareSynchronizationResource from srm
- SoftwareTimerResource from srm

### 4.9.3 Semantics

TODO: write a semantic

# Chapter 5

# Annotation package

## 5.1 Overview

annotation-class-diagram-overview.png

Figure 5.1: annotation-class-diagram-overview

## 5.2 AnnotatedElement classifier

TODO: write an overview

### 5.2.1 Generalizations

- ModelElement from coreelements

### 5.2.2 Specializations

- AcquireStep from gqam
- CommunicationStep from gqam
- Delay from gqam
- ExecutionStep from gqam
- ReleaseStep from gqam
- RequestedService from gqam
- ResourceServiceExcecution from gqam
- Step from gqam
- EndToEndFlow from sam

### 5.2.3 Semantics

TODO: write a semantic

## 5.3 AnnotatedModel classifier

TODO: write an overview

### 5.3.1 Semantics

TODO: write a semantic

## 5.4 ModelingConcern classifier

TODO: write an overview

### 5.4.1 Generalizations

- PackageableElement from coreelements

### 5.4.2 Attributes

- description: EString [0:1]

### 5.4.3 Semantics

TODO: write a semantic

## 5.5 Constraint classifier

TODO: write an overview

### 5.5.1 Generalizations

- Constraint from coreelements

### 5.5.2 Specializations

- LatencyObserver from gqam
- TimedObserver from gqam
- SchedulingObserver from sam

### 5.5.3 Attributes

- kind: ConstraintKind [0:1]

### 5.5.4 Semantics

TODO: write a semantic

## 5.6 ConstraintKind classifier

TODO: write an overview

### 5.6.1 Values

- required
- offered
- contract

### 5.6.2 Semantics

TODO: write a semantic

# Chapter 6

# Alloc package

## 6.1 Overview

alloc-class-diagram-overview.png

Figure 6.1: alloc-class-diagram-overview

## 6.2 Allocate classifier

Allocate is a dependency based on UML::Abstraction. It is a mechanism for associating elements of different types, or in different hierarchies, at an abstract level. Allocate is used for assessing user model consistency and directing future design activity. It is expected that an «allocate» relationship between model elements is a precursor to a more concrete relationship between the elements, their properties, operations, attributes, or sub-classes.

TODO: write an overview

### 6.2.1 Generalizations

- Abstraction from coreelements

### 6.2.2 Attributes

- kind: AllocationKind [0:1]This differentiates the kind of allocations, whether both allocated elements on each side are structural, behavioral, or whether this is a hybrid allocation.
- nature: AllocationNature [0:1]This identifies the purpose of the allocation, whether the allocation is equivalent to a spatial distribution, where several application model elements are distributed to different resources or whether timed elements are scheduled according to a given scheduler.

### 6.2.3 Semantics

TODO: write a semantic

## 6.3 AllocationNature classifier

TODO: write an overview

### 6.3.1 Values

- spatialDistribution It indicates that the suppliers are distributed on the clients. Spatial distribution is the allocation of computations to processing elements, of data to memories, and of data/control dependencies to communication resources.
- timeScheduling It indicates that the allocation consists in a temporal/behavioral ordering of the suppliers, the order being given by the clients. Scheduling is the temporal/behavioral ordering of the activities (computations, data storage movements or communication) allocated to each resource.

### 6.3.2 Semantics

TODO: write a semantic

## 6.4 AllocationKind classifier

TODO: write an overview

### 6.4.1 Values

- structural Indicates that the suppliers and the clients are all structural named elements.
- behavioral Indicates that the suppliers and the clients are all behavioral named elements.
- hybrid Indicates that the suppliers and the clients are not of the same kind.

### 6.4.2 Semantics

TODO: write a semantic

# Chapter 7

# Gqam package

## 7.1 Overview

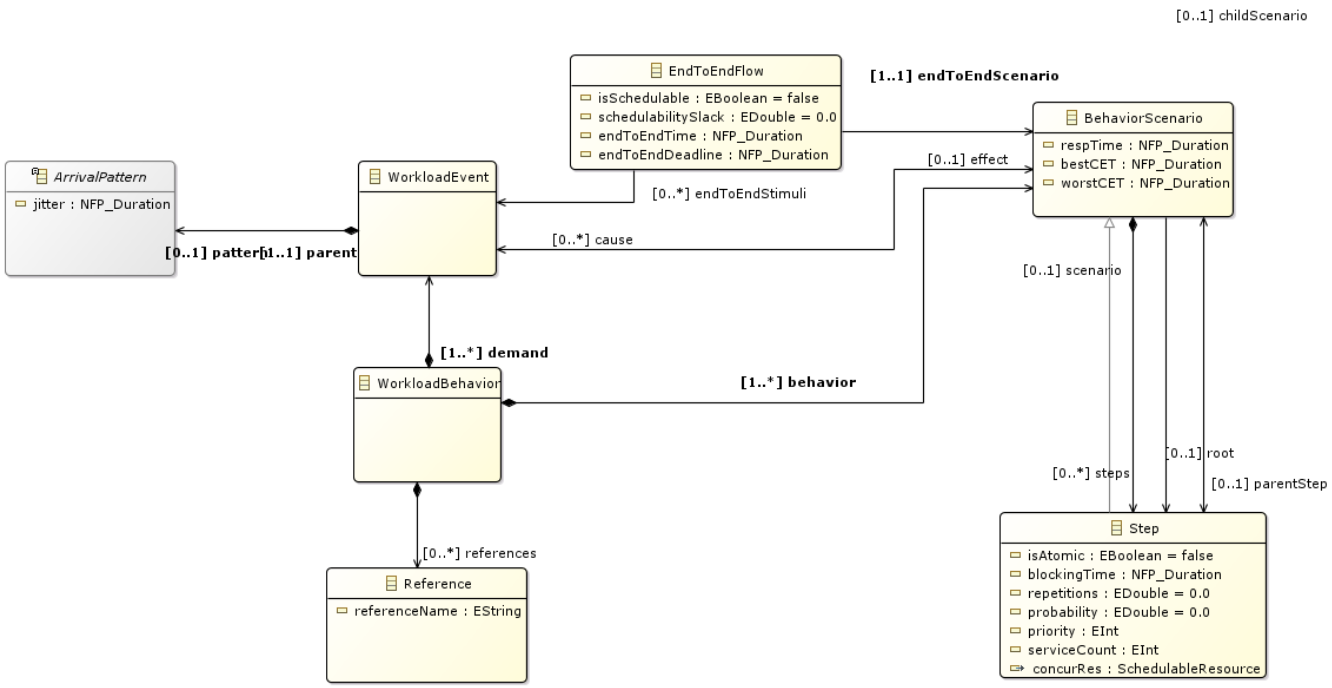



Figure 7.1: gqam-class-diagram-overview

Generic Quantitative Analysis Modeling

## 7.2 AcquireStep classifier

TODO: write an overview

### 7.2.1 Generalizations

- Step from gqam

### 7.2.2 Attributes

- resUnits: EInt [0:1]

### 7.2.3 Semantics

TODO: write a semantic

## 7.3 ArrivalPattern classifier

TODO: write an overview

### 7.3.1 Generalizations

- ModelElement from coreelements

### 7.3.2 Specializations

- BurstPattern from gqam
- ClosedPattern from gqam
- Once from gqam
- PeriodicPattern from gqam
- SlidingWindowPattern from gqam
- SporadicPattern from gqam

### 7.3.3 Attributes

- jitter: NFP_Duration [0:1]
- phase: NFP_Duration [0:1]

### 7.3.4 Semantics

TODO: write a semantic

## 7.4 BehaviorScenario classifier

TODO: write an overview

### 7.4.1 Generalizations

- NamedElement from coreelements
- FlowInvolvedElement from gqam

### 7.4.2 Specializations

- AcquireStep from gqam
- CommunicationStep from gqam
- Delay from gqam
- ExecutionStep from gqam
- ReleaseStep from gqam
- RequestedService from gqam
- ResourceServiceExcecution from gqam
- Step from gqam

### 7.4.3 Attributes

- respTime: NFP_Duration [0:1]
- bestCET: NFP_Duration [0:1]
- worstCET: NFP_Duration [0:1]

### 7.4.4 Semantics

TODO: write a semantic

## 7.5 BurstPattern classifier

It describes a bursty interarrival pattern with a number of events that can occur in a bounded period.

TODO: write an overview

### 7.5.1 Generalizations

- ArrivalPattern from gqam

### 7.5.2 Attributes

- minInterarrival: NFP_Duration [1:1]The minimum interarrival duration between two successive occurrences of a burst.
- maxInterarrival: NFP_Duration [0:1]The maximum interarrival duration between two successive occurrences of a burst.
- minEventInterval: NFP_Duration [1:1]The minimum interval between two event occurrences within a burst.
- maxEventInterval: NFP_Duration [0:1]The maximum interval between two event occurrences within a burst.
- burstSize: ELong [1:1]The number of event occurrences within a burst.

### 7.5.3 Semantics

TODO: write a semantic

## 7.6 ClosedPattern classifier

This is a TupleType that contains the parameters that are necessary to specify a closed pattern. It is characterized by a fixed number of active or potential users or jobs that cycle between executing the scenario, and spending an external delay period (sometimes called “think time”) outside the system, between the end of one response and the next request.

TODO: write an overview

### 7.6.1 Generalizations

- ArrivalPattern from gqam

### 7.6.2 Attributes

- population: ELong [1:1]The size of the workload (number of system users).
- extDelay: NFP_Duration [1:1]The delay between the end of one response and the start of the next for each member of the population of system users.

### 7.6.3 Semantics

TODO: write a semantic

## 7.7 CommunicationChannel classifier

TODO: write an overview

### 7.7.1 Generalizations

- SchedulableResource from grm

### 7.7.2 Semantics

TODO: write a semantic

## 7.8 CommunicationStep classifier

TODO: write an overview

### 7.8.1 Generalizations

- Step from gqam

### 7.8.2 Attributes

- msgSize: NFP_DataSize [0:1]

### 7.8.3 Semantics

TODO: write a semantic

## 7.9 ConnectorKind classifier

TODO: write an overview

### 7.9.1 Values

- Sequence
- Branch
- Merge
- Fork
- Join

### 7.9.2 Semantics

TODO: write a semantic

## 7.10 Delay classifier

A special kind of Step that just introduce a delay without any resource consumption.

TODO: write an overview

#### 7.10.1 Generalizations

- Step from gqam

#### 7.10.2 Attributes

- duration: NFP_Duration [1:1]

#### 7.10.3 Semantics

TODO: write a semantic

### 7.11 ExecutionStep classifier

TODO: write an overview

#### 7.11.1 Generalizations

- Step from gqam

#### 7.11.2 Semantics

TODO: write a semantic

### 7.12 FlowInvolvedElement classifier

An Flow Involved Element is a model element that is part of a functional chain, data-flow, or control-flow of interest.
TODO: write an overview

#### 7.12.1 Specializations

- AcquireStep from gqam
- BehaviorScenario from gqam
- CommunicationStep from gqam
- Delay from gqam
- ExecutionStep from gqam
- InputPin from gqam
- OutputPin from gqam
- Pin from gqam
- ReleaseStep from gqam

- RequestedService from gqam
- ResourceServiceExcecution from gqam
- Step from gqam

#### 7.12.2 Semantics

TODO: write a semantic

### 7.13 InputPin classifier

from UML 2.5
TODO: write an overview

#### 7.13.1 Generalizations

- Pin from gqam

#### 7.13.2 Semantics

TODO: write a semantic

### 7.14 LatencyObserver classifier

TODO: write an overview

#### 7.14.1 Generalizations

- TimedObserver from gqam

#### 7.14.2 Attributes

- latency: NFP_Duration [0:1]
- missRatio: EDouble [0:1]
- maxJitter: NFP_Duration [0:1]

#### 7.14.3 Semantics

TODO: write a semantic

### 7.15 LaxityKind classifier

TODO: write an overview

### 7.15.1 Values

- undef
- hard
- soft
- other

### 7.15.2 Semantics

TODO: write a semantic

## 7.16 MultiplicityElement classifier

from UML 2.5

TODO: write an overview

### 7.16.1 Specializations

- InputPin from gqam
- OutputPin from gqam
- Pin from gqam

### 7.16.2 Attributes

- lowerBound: EInt [1:1]
- upperBound: EInt [1:1]

### 7.16.3 Semantics

TODO: write a semantic

## 7.17 NFP_DataSize classifier

TODO: write an overview

See org.polarsys.time4sys.marte.nfp.DataSize.

TODO: write a semantic

## 7.18 NFP_Duration classifier

TODO: write an overview

See org.polarsys.time4sys.marte.nfp.Duration.

TODO: write a semantic

## 7.19 ObjectNode classifier

from UML 2.5

TODO: write an overview

### 7.19.1 Generalizations

- ModelElement from coreelements

### 7.19.2 Specializations

- InputPin from gqam
- OutputPin from gqam
- Pin from gqam

### 7.19.3 Attributes

- ordering: ObjectNodeOrderingKind [0:1]Indicates how the tokens held by the ObjectNode are ordered for selection to traverse ActivityEdges outgoing from the ObjectNode. from UML 2.5
- typename: [0:1]The name of the type of the tokens that the ObjectNode hold. Same as UML 2.5 OCL expression: self.type.name

### 7.19.4 Semantics

TODO: write a semantic

## 7.20 ObjectNodeOrderingKind classifier

ObjectNodeOrderingKind is an enumeration indicating queuing order for offering the tokens held by an ObjectNode. from UML 2.5

TODO: write an overview

### 7.20.1 Values

- UNORDERED Indicates that tokens are unordered.
- LIFO Indicates that tokens are queued in a last in, first out manner.
- FIFO Indicates that tokens are queued in a first in, first out manner.
- ORDERED Indicates that tokens are ordered. ORDERED means that an algorithm exists on how to choose the order but is not LIFO nor FIFO. For example, it could FIFO within a priority level. The ObjectNode.selection attribute shall point out a procedure for that.

### 7.20.2 Semantics

TODO: write a semantic

## 7.21 Once classifier

TODO: write an overview

### 7.21.1 Generalizations

- ArrivalPattern from gqam

### 7.21.2 Semantics

TODO: write a semantic

## 7.22 OutputPin classifier

from UML 2.5

TODO: write an overview

### 7.22.1 Generalizations

- Pin from gqam

### 7.22.2 Semantics

TODO: write a semantic

## 7.23 PeriodicPattern classifier

It describes periodic interarrival patterns, with an optional maximal deviation (jitter).

TODO: write an overview

### 7.23.1 Generalizations

- ArrivalPattern from gqam

### 7.23.2 Attributes

- period: NFP_Duration [0:1]
- occurences: EInt [0:1]

### 7.23.3 Semantics

TODO: write a semantic

## 7.24 Pin classifier

The concept is from UML 2.5 Pin

TODO: write an overview

### 7.24.1 Generalizations

- MultiplicityElement from gqam
- NamedElement from coreelements
- ObjectNode from gqam
- FlowInvolvedElement from gqam

### 7.24.2 Specializations

- InputPin from gqam
- OutputPin from gqam

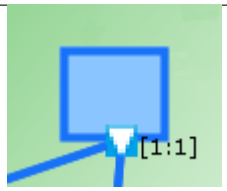
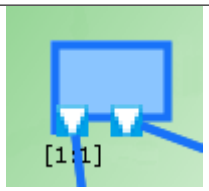
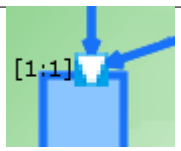
### 7.24.3 Attributes

- isControl: [1:1]Contrary to UML specification, default is true.

### 7.24.4 Semantics

The semantic is the same as per UML 2.5. It can be seen as tokens passing. The cardinality of the pin indicates how much tokens it needs for the task to be activable, and how much at maximum it will consume.

All in all, it enables to express advance activation patterns. For instance, all pattern that can be expressed with logical expressions can easily be encoded.

| | AND | OR |
|---|---|---|
| **Output** |   |   |
| **Input** |   |   |

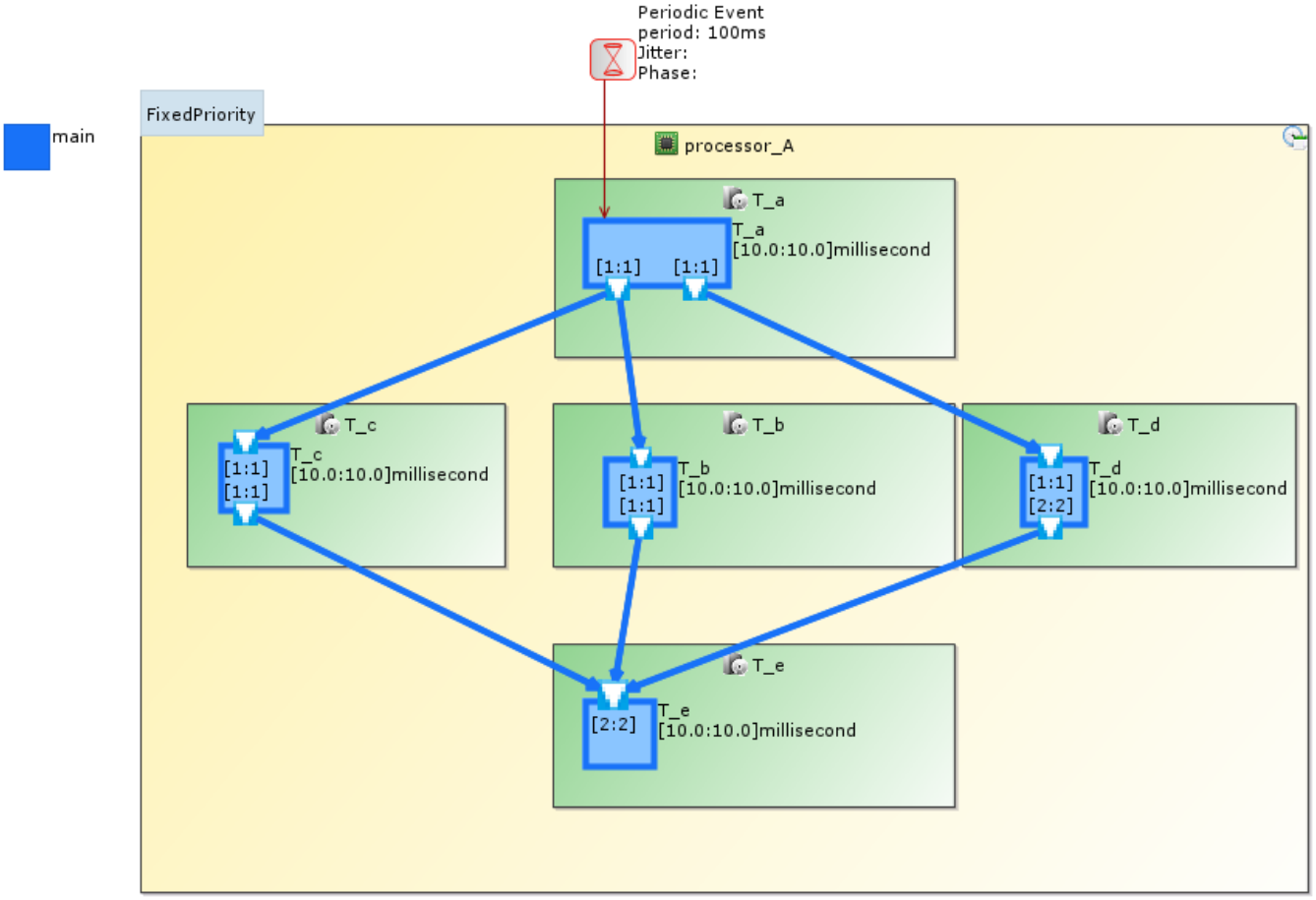



Figure 7.2: e = (b and c) or d

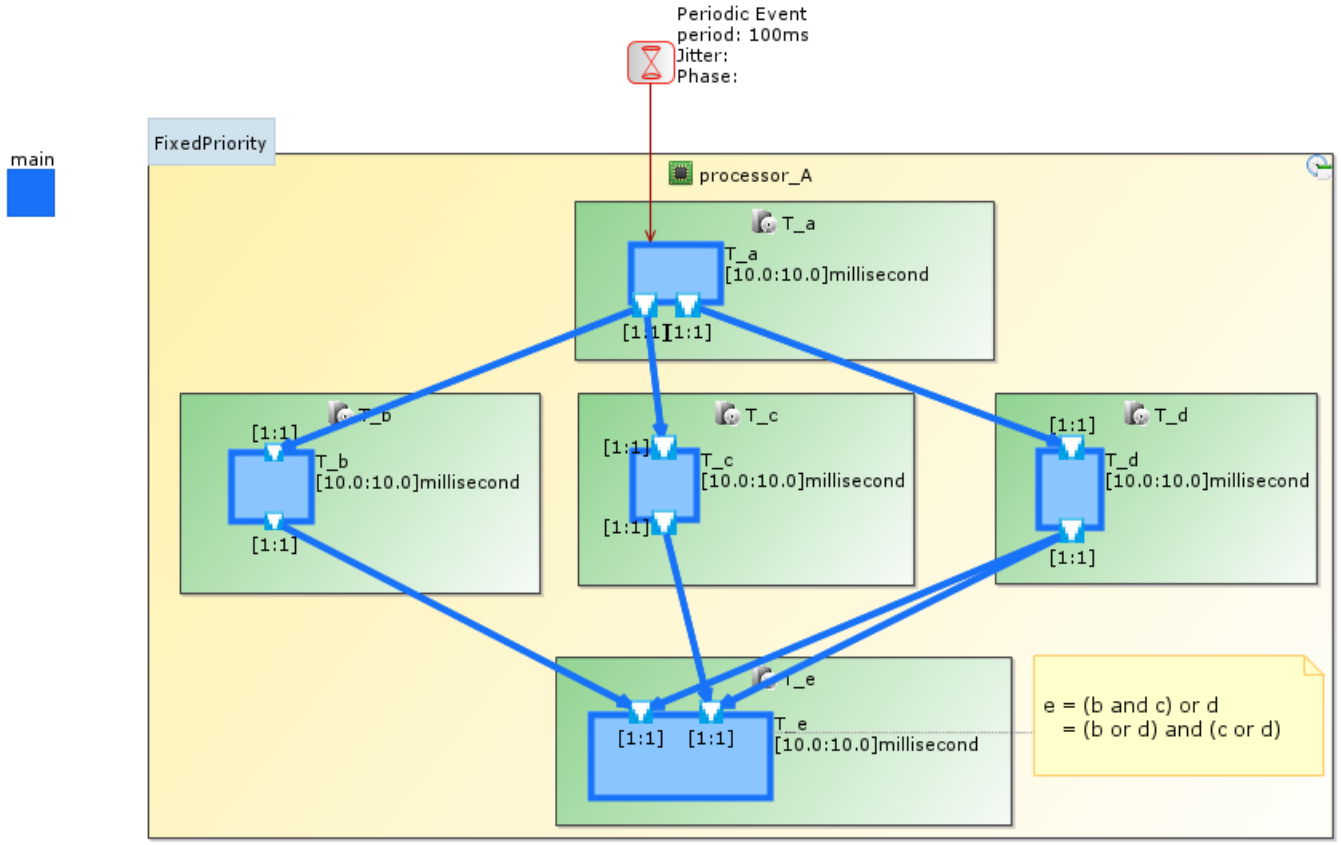



Figure 7.3: Another way of describing activation pattern based on CNF

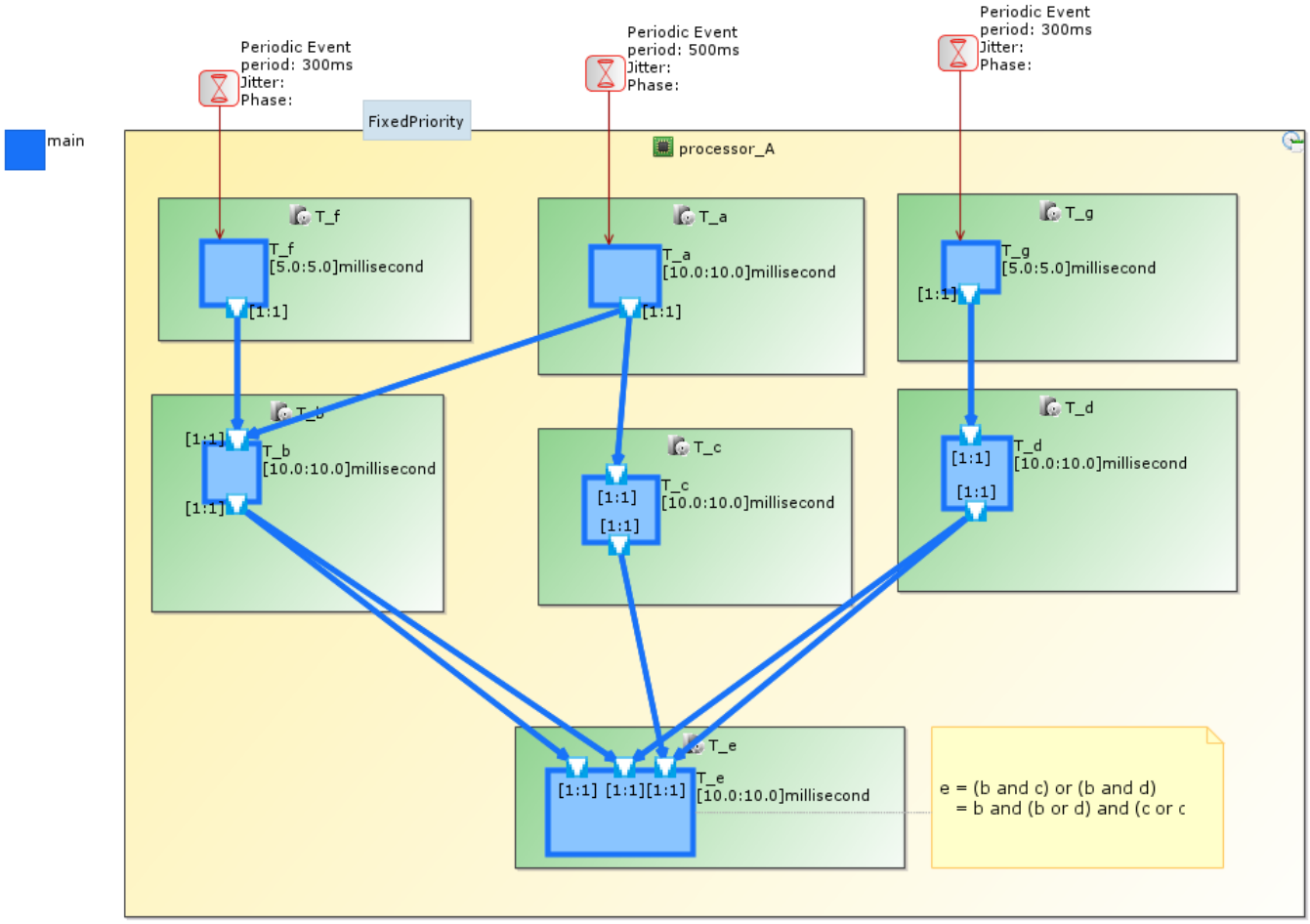



Figure 7.4: Complex pattern of activations of the task T_E

Figure 7.4 illustrates a pattern activation that could be expressed with a logical expression. For ease of encoding, it needs to be rewritten in conjunctive normal fo rm (CNF).

## 7.25 PrecedenceRelation classifier

This is to be deprecated by ports usage.

TODO: write an overview

### 7.25.1 Attributes

- connectorKind: ConnectorKind [0:1]

### 7.25.2 Semantics

TODO: write a semantic

## 7.26 Reference classifier

TODO: write an overview

### 7.26.1 Generalizations

- NamedElement from coreelements

### 7.26.2 Attributes

- referenceName: EString [0:1]

### 7.26.3 Semantics

TODO: write a semantic

## 7.27 ReleaseStep classifier

TODO: write an overview

### 7.27.1 Generalizations

- Step from gqam

### 7.27.2 Attributes

- resUnits: EInt [0:1]

### 7.27.3 Semantics

TODO: write a semantic

## 7.28 RequestedService classifier

TODO: write an overview

### 7.28.1 Generalizations

- Step from gqam

### 7.28.2 Semantics

TODO: write a semantic

## 7.29 ResourceServiceExcecution classifier

TODO: write an overview

### 7.29.1 Generalizations

- Step from gqam

### 7.29.2 Semantics

TODO: write a semantic

## 7.30 SlidingWindowPattern classifier

TODO: write an overview

### 7.30.1 Generalizations

- ArrivalPattern from gqam

### 7.30.2 Attributes

- windowSize: NFP_Duration [1:1]
- nbEvents: ELong [0:1]

### 7.30.3 Semantics

TODO: write a semantic

## 7.31 SporadicPattern classifier

It describes a bounded pattern that is defined by a corner case interarrival times and a maximum deviation (jitter).

TODO: write an overview

### 7.31.1 Generalizations

- ArrivalPattern from gqam

### 7.31.2 Attributes

- minInterarrival: NFP_Duration [0:1]
- maxInterarrival: NFP_Duration [0:1]

### 7.31.3 Semantics

TODO: write a semantic

## 7.32 Step classifier

TODO: write an overview

### 7.32.1 Generalizations

- BehaviorScenario from gqam
- AnnotatedElement from annotation

### 7.32.2 Specializations

- AcquireStep from gqam
- CommunicationStep from gqam
- Delay from gqam
- ExecutionStep from gqam
- ReleaseStep from gqam
- RequestedService from gqam
- ResourceServiceExcecution from gqam

### 7.32.3 Attributes

- isAtomic: EBoolean [0:1]
- blockingTime: NFP_Duration [0:1]
- repetitions: EDouble [0:1]
- probability: EDouble [0:1]
- priority: EInt [0:1]The higher the value of the priority, the higher the urgency of the step.
- serviceCount: EInt [0:1]

### 7.32.4 Semantics

TODO: write a semantic

## 7.33 TimedObserver classifier

TODO: write an overview

### 7.33.1 Generalizations

- Constraint from annotation

### 7.33.2 Specializations

- LatencyObserver from gqam
- SchedulingObserver from sam

### 7.33.3 Attributes

- laxity: LaxityKind [0:-1]

### 7.33.4 Semantics

TODO: write a semantic

## 7.34 WorkloadBehavior classifier

TODO: write an overview

### 7.34.1 Generalizations

- NamedElement from coreelements

### 7.34.2 Semantics

TODO: write a semantic

## 7.35 WorkloadEvent classifier

TODO: write an overview

### 7.35.1 Generalizations

- NamedElement from coreelements

### 7.35.2 Semantics

TODO: write a semantic

# Chapter 8

# Grm package

## 8.1 Overview

grm-class-diagram-overview.png

Figure 8.1: grm-class-diagram-overview

Generic Resource Modeling

## 8.2 AccessControlPolicy classifier

TODO: write an overview

### 8.2.1 Generalizations

- NamedElement from coreelements

### 8.2.2 Specializations

- MutualExclusionProtocol from grm
- SchedulingPolicy from grm

### 8.2.3 Semantics

TODO: write a semantic

## 8.3 ClockResource classifier

TODO: write an overview

### 8.3.1 Generalizations

- TimingResource from grm

### 8.3.2 Semantics

TODO: write a semantic

## 8.4 CommunicationEndPoint classifier

TODO: write an overview

### 8.4.1 Generalizations

- CommunicationResource from grm

### 8.4.2 Specializations

- ResourcePort from grm
- HardwarePort from hrm
- MessageComResource from srm
- NotificationResource from srm
- SharedDataComResource from srm
- SoftwareCommunicationResource from srm
- SoftwareInteractionResource from srm
- SoftwareMutualExclusionResource from srm
- SoftwarePort from srm
- SoftwareSynchronizationResource from srm

### 8.4.3 Attributes

- packetSize: EInt [0:1]

### 8.4.4 Semantics

TODO: write a semantic

## 8.5 CommunicationMedia classifier

TODO: write an overview

### 8.5.1 Generalizations

- CommunicationResource from grm
- ProcessingResource from grm

### 8.5.2 Specializations

- MessageComResource from srm
- SharedDataComResource from srm
- SoftwareCommunicationResource from srm

### 8.5.3 Attributes

- elementSize: NFP_DataSize [0:1]
- capacity: NFP_DataTxRate [0:1]
- packetTime: NFP_Duration [0:1]
- blockingTime: NFP_Duration [0:1]
- transmMode: TransmModeKind [0:1]

### 8.5.4 Semantics

TODO: write a semantic

## 8.6 ComputingResource classifier

TODO: write an overview

### 8.6.1 Generalizations

- ProcessingResource from grm

### 8.6.2 Specializations

- HardwareAsic from hrm
- HardwareComputingResource from hrm
- HardwarePld from hrm
- HardwareProcessor from hrm

### 8.6.3 Semantics

TODO: write a semantic

## 8.7 ConcurrencyResource classifier

TODO: write an overview

### 8.7.1 Generalizations

- Resource from grm

### 8.7.2 Specializations

- CommunicationChannel from gqam
- SchedulableResource from grm
- Alarm from srm
- InterruptResource from srm
- SoftwareConcurrentResource from srm
- SoftwareSchedulableResource from srm

### 8.7.3 Semantics

TODO: write a semantic

## 8.8 CommunicationResource classifier

TODO: write an overview

### 8.8.1 Generalizations

- Resource from grm

### 8.8.2 Specializations

- CommunicationEndPoint from grm
- CommunicationMedia from grm
- ResourcePort from grm
- HardwareArbiter from hrm

- HardwareBridge from hrm
- HardwareBus from hrm
- HardwareCommunicationResource from hrm
- HardwareDma from hrm
- HardwareMedia from hrm
- HardwarePort from hrm
- MessageComResource from srm
- NotificationResource from srm
- SharedDataComResource from srm
- SoftwareCommunicationResource from srm
- SoftwareInteractionResource from srm
- SoftwareMutualExclusionResource from srm
- SoftwarePort from srm
- SoftwareSynchronizationResource from srm

### 8.8.3 Semantics

TODO: write a semantic

## 8.9 DeviceResource classifier

TODO: write an overview

### 8.9.1 Generalizations

- ProcessingResource from grm

### 8.9.2 Specializations

- HardwareActuator from hrm
- HardwareDevice from hrm
- HardwareIo from hrm
- HardwareSensor from hrm
- HardwareSupport from hrm

### 8.9.3 Semantics

TODO: write a semantic

## 8.10 DynamicUsage classifier

TODO: write an overview

### 8.10.1 Generalizations

- ResourceUsage from grm

### 8.10.2 Semantics

TODO: write a semantic

## 8.11 EDFParameters classifier

TODO: write an overview

### 8.11.1 Generalizations

- SchedulingParameter from grm

### 8.11.2 Attributes

- deadline: NFP_Duration [1:1]

### 8.11.3 Semantics

TODO: write a semantic

## 8.12 FixedPriorityParameters classifier

TODO: write an overview

### 8.12.1 Generalizations

- SchedulingParameter from grm

### 8.12.2 Specializations

- PeriodicServerParameters from grm
- PoolingParameters from grm

### 8.12.3 Attributes

- priority: [1:1]priority is the urgency of the SchedulableResource, ie the higher the priority, the higher the urgency (higher numerical value). NB: This is the opposite of the posix priority where highest priority have lowest numerical value. In Time4Sys, the highest priority have the highest numerical value.

### 8.12.4 Semantics

TODO: write a semantic

## 8.13 MutualExclusionProtocol classifier

TODO: write an overview

### 8.13.1 Generalizations

- AccessControlPolicy from grm

### 8.13.2 Attributes

- protocol: ProtectProtocolKind [0:1]
- otherProtocol: EString [0:1]

### 8.13.3 Semantics

TODO: write a semantic

## 8.14 MutualExclusionResource classifier

TODO: write an overview

### 8.14.1 Generalizations

- SynchResource from grm

### 8.14.2 Specializations

- SoftwareMutualExclusionResource from srm

### 8.14.3 Semantics

TODO: write a semantic

## 8.15 PeriodicServerKind classifier

TODO: write an overview

### 8.15.1 Values

- Undef
- Sporadic
- Deferrable
- Other

### 8.15.2 Semantics

TODO: write a semantic

## 8.16 PeriodicServerParameters classifier

TODO: write an overview

### 8.16.1 Generalizations

- FixedPriorityParameters from grm

### 8.16.2 Attributes

- kind: PeriodicServerKind [0:1]indicates the type of periodic server.
- backgroundPriority: [0:1]is the priority used to run the server when it is in the background.
- initialBudget: NFP_Duration [0:1]is the full ammount of execution time available for a cycle of the server.
- replenishPeriod: NFP_Duration [0:1]is the replenishment period defined for the server.
- maxPendingReplenish: [0:1]is the maximum number of replenishments that can be stored in the queue of pending replenishments, it limits the number of times a schedulable resource may block itself in the time frame of a cycle period.

### 8.16.3 Semantics

TODO: write a semantic

## 8.17 PoolingParameters classifier

TODO: write an overview

### 8.17.1 Generalizations

- FixedPriorityParameters from grm

### 8.17.2 Attributes

- period: NFP_Duration [0:1]
- overhead: NFP_Duration [0:1]

### 8.17.3 Semantics

TODO: write a semantic

## 8.18 ProcessingResource classifier

TODO: write an overview

### 8.18.1 Generalizations

- Resource from grm

### 8.18.2 Specializations

- CommunicationMedia from grm
- ComputingResource from grm
- DeviceResource from grm
- HardwareActuator from hrm
- HardwareAsic from hrm
- HardwareComputingResource from hrm
- HardwareDevice from hrm
- HardwareIo from hrm
- HardwarePld from hrm
- HardwareProcessor from hrm
- HardwareSensor from hrm
- HardwareSupport from hrm
- MessageComResource from srm
- SharedDataComResource from srm
- SoftwareCommunicationResource from srm

#### 8.18.3 Attributes

- speedFactor: EFloat [0:1]

#### 8.18.4 Semantics

TODO: write a semantic

### 8.19 ProtectionParameter classifier

TODO: write an overview

#### 8.19.1 Generalizations

- NamedElement from coreelements

#### 8.19.2 Attributes

- priorityCeiling: EInt [0:1]
- preemptionLevel: EInt [0:1]

#### 8.19.3 Semantics

TODO: write a semantic

### 8.20 ProtectProtocolKind classifier

TODO: write an overview

#### 8.20.1 Values

- FIFO
- NoPreemption
- PriorityCeiling
- PriorityInheritance
- StackBased
- Undef
- Other

### 8.20.2 Semantics

TODO: write a semantic

## 8.21 Resource classifier

TODO: write an overview

### 8.21.1 Generalizations

- ResourcePackageableElement from grm

### 8.21.2 Specializations

- CommunicationChannel from gqam
- ClockResource from grm
- CommunicationEndPoint from grm
- CommunicationMedia from grm
- ComputingResource from grm
- ConcurrencyResource from grm
- CommunicationResource from grm
- DeviceResource from grm
- MutualExclusionResource from grm
- ProcessingResource from grm
- ResourceBroker from grm
- ResourceManager from grm
- ResourcePort from grm
- Scheduler from grm
- SchedulableResource from grm
- SecondaryScheduler from grm
- StorageResource from grm
- SynchResource from grm
- TimingResource from grm
- TimerResource from grm
- UsageTypedAmount from grm

- FirmwareArchitecture from hrm
- HardwareActuator from hrm
- HardwareArbiter from hrm
- HardwareAsic from hrm
- HardwareBranchPredictor from hrm
- HardwareBridge from hrm
- HardwareBus from hrm
- HardwareCache from hrm
- HardwareClock from hrm
- HardwareCommunicationResource from hrm
- HardwareComputingResource from hrm
- HardwareDevice from hrm
- HardwareDma from hrm
- HardwareDrive from hrm
- HardwareIo from hrm
- HardwareIpBlock from hrm
- HardwareIsa from hrm
- HardwareMedia from hrm
- HardwareMemory from hrm
- HardwareMmu from hrm
- HardwarePlatform from hrm
- HardwarePld from hrm
- HardwarePort from hrm
- HardwareProcessingMemory from hrm
- HardwareProcessor from hrm
- HardwareRam from hrm
- HardwareResource from hrm
- HardwareRom from hrm
- HardwareSensor from hrm
- HardwareStorageManager from hrm
- HardwareStorageMemory from hrm

- HardwareSupport from hrm
- HardwareTimingResource from hrm
- HardwareTimer from hrm
- HardwareWatchdog from hrm
- Alarm from srm
- DeviceBroker from srm
- InterruptResource from srm
- MemoryBroker from srm
- MemoryPartition from srm
- MessageComResource from srm
- NotificationResource from srm
- SharedDataComResource from srm
- SoftwareArchitecture from srm
- SoftwareCommunicationResource from srm
- SoftwareConcurrentResource from srm
- SoftwareInteractionResource from srm
- SoftwareMutualExclusionResource from srm
- SoftwarePort from srm
- SoftwareResource from srm
- SoftwareSchedulableResource from srm
- SoftwareScheduler from srm
- SoftwareSynchronizationResource from srm
- SoftwareTimerResource from srm

### 8.21.3 Attributes

- resMult: EInt [0:1]
- isProtected: EBoolean [0:1]
- isActive: EBoolean [0:1]

### 8.21.4 Semantics

TODO: write a semantic

## 8.22 ResourceBroker classifier

TODO: write an overview

### 8.22.1 Generalizations

- Resource from grm

### 8.22.2 Specializations

- Scheduler from grm
- SecondaryScheduler from grm
- HardwareArbiter from hrm
- HardwareDma from hrm
- HardwareMmu from hrm
- HardwareStorageManager from hrm
- DeviceBroker from srm
- MemoryBroker from srm
- SoftwareScheduler from srm

### 8.22.3 Semantics

TODO: write a semantic

## 8.23 ResourceConnector classifier

TODO: write an overview

### 8.23.1 Generalizations

- ModelElement from coreelements

### 8.23.2 Specializations

- HardwareConnector from hrm
- SoftwareConnector from srm

### 8.23.3 Semantics

TODO: write a semantic

## 8.24 ResourceControlPolicy classifier

TODO: write an overview

### 8.24.1 Generalizations

- NamedElement from coreelements

### 8.24.2 Semantics

TODO: write a semantic

## 8.25 ResourceInstance classifier

TODO: write an overview

### 8.25.1 Generalizations

- ResourcePackageableElement from grm

### 8.25.2 Semantics

TODO: write a semantic

## 8.26 ResourceInterface classifier

TODO: write an overview

### 8.26.1 Generalizations

- ResourcePackageableElement from grm

### 8.26.2 Specializations

- HardwareInterface from hrm
- SoftwareInterface from srm

### 8.26.3 Semantics

TODO: write a semantic

## 8.27 ResourceManager classifier

TODO: write an overview

### 8.27.1 Generalizations

- Resource from grm

### 8.27.2 Specializations

- Alarm from srm
- DeviceBroker from srm
- InterruptResource from srm
- MemoryBroker from srm
- MemoryPartition from srm
- MessageComResource from srm
- NotificationResource from srm
- SharedDataComResource from srm
- SoftwareArchitecture from srm
- SoftwareCommunicationResource from srm
- SoftwareConcurrentResource from srm
- SoftwareInteractionResource from srm
- SoftwareMutualExclusionResource from srm
- SoftwareResource from srm
- SoftwareSchedulableResource from srm
- SoftwareSynchronizationResource from srm

### 8.27.3 Semantics

TODO: write a semantic

## 8.28 ResourcePackage classifier

Deprecated. Use CoreElements::Package

TODO: write an overview

### 8.28.1 Generalizations

- Package from coreelements

### 8.28.2 Specializations

- HardwareInterfacePackage from hrm
- HardwareResourcePackage from hrm
- SoftwareInterfacePackage from srm
- SoftwareResourcePackage from srm

### 8.28.3 Semantics

TODO: write a semantic

## 8.29 ResourcePackageableElement classifier

Deprecated. Use CoreElements::PackageElement

TODO: write an overview

### 8.29.1 Generalizations

- PackageableElement from coreelements

### 8.29.2 Specializations

- CommunicationChannel from gqam
- ClockResource from grm
- CommunicationEndPoint from grm
- CommunicationMedia from grm
- ComputingResource from grm
- ConcurrencyResource from grm
- CommunicationResource from grm
- DeviceResource from grm
- MutualExclusionResource from grm
- ProcessingResource from grm
- Resource from grm
- ResourceBroker from grm

- ResourceInstance from grm
- ResourceInterface from grm
- ResourceManager from grm
- ResourcePort from grm
- Scheduler from grm
- SchedulableResource from grm
- SecondaryScheduler from grm
- StorageResource from grm
- SynchResource from grm
- TimingResource from grm
- TimerResource from grm
- UsageTypedAmount from grm
- FirmwareArchitecture from hrm
- HardwareActuator from hrm
- HardwareArbiter from hrm
- HardwareAsic from hrm
- HardwareBranchPredictor from hrm
- HardwareBridge from hrm
- HardwareBus from hrm
- HardwareCache from hrm
- HardwareClock from hrm
- HardwareCommunicationResource from hrm
- HardwareComputingResource from hrm
- HardwareDevice from hrm
- HardwareDma from hrm
- HardwareDrive from hrm
- HardwareInterface from hrm
- HardwareIo from hrm
- HardwareIpBlock from hrm
- HardwareIsa from hrm
- HardwareMedia from hrm

- HardwareMemory from hrm
- HardwareMmu from hrm
- HardwarePlatform from hrm
- HardwarePld from hrm
- HardwarePort from hrm
- HardwareProcessingMemory from hrm
- HardwareProcessor from hrm
- HardwareRam from hrm
- HardwareResource from hrm
- HardwareRom from hrm
- HardwareSensor from hrm
- HardwareStorageManager from hrm
- HardwareStorageMemory from hrm
- HardwareSupport from hrm
- HardwareTimingResource from hrm
- HardwareTimer from hrm
- HardwareWatchdog from hrm
- Alarm from srm
- DeviceBroker from srm
- InterruptResource from srm
- MemoryBroker from srm
- MemoryPartition from srm
- MessageComResource from srm
- NotificationResource from srm
- SharedDataComResource from srm
- SoftwareArchitecture from srm
- SoftwareCommunicationResource from srm
- SoftwareConcurrentResource from srm
- SoftwareInteractionResource from srm
- SoftwareInterface from srm
- SoftwareMutualExclusionResource from srm

- SoftwarePort from srm
- SoftwareResource from srm
- SoftwareSchedulableResource from srm
- SoftwareScheduler from srm
- SoftwareSynchronizationResource from srm
- SoftwareTimerResource from srm

#### 8.29.3 Semantics

TODO: write a semantic

### 8.30 ResourcePort classifier

TODO: write an overview

#### 8.30.1 Generalizations

- CommunicationEndPoint from grm
- NamedElement from coreelements

#### 8.30.2 Specializations

- HardwarePort from hrm
- SoftwarePort from srm

#### 8.30.3 Semantics

TODO: write a semantic

### 8.31 ResourceService classifier

TODO: write an overview

#### 8.31.1 Generalizations

- NamedElement from coreelements

### 8.31.2 Specializations

- HardwareService from hrm
- SoftwareAccessService from srm
- SoftwareService from srm

### 8.31.3 Semantics

TODO: write a semantic

## 8.32 ResourceUsage classifier

TODO: write an overview

### 8.32.1 Generalizations

- ModelElement from coreelements

### 8.32.2 Specializations

- DynamicUsage from grm
- StaticUsage from grm

### 8.32.3 Semantics

TODO: write a semantic

## 8.33 SchedPolicyKind classifier

TODO: write an overview

### 8.33.1 Values

- Undef
- EarliestDeadlineFirst
- FIFO
- FixedPriority
- LeastLaxityFirst
- RoundRobin
- TimeTableDriven
- Other

### 8.33.2 Semantics

TODO: write a semantic

## 8.34 Scheduler classifier

TODO: write an overview

### 8.34.1 Generalizations

- ResourceBroker from grm

### 8.34.2 Specializations

- SecondaryScheduler from grm
- SoftwareScheduler from srm

### 8.34.3 Semantics

TODO: write a semantic

## 8.35 SchedulableResource classifier

TODO: write an overview

### 8.35.1 Generalizations

- ConcurrencyResource from grm

### 8.35.2 Specializations

- CommunicationChannel from gqam
- SoftwareSchedulableResource from srm

### 8.35.3 Semantics

TODO: write a semantic

## 8.36 ScheduleSpecification classifier

TODO: write an overview

### 8.36.1 Generalizations

- ModelElement from coreelements

### 8.36.2 Specializations

- TableDrivenSchedule from grm

### 8.36.3 Semantics

TODO: write a semantic

## 8.37 SchedulingParameter classifier

TODO: write an overview

### 8.37.1 Generalizations

- NamedElement from coreelements

### 8.37.2 Specializations

- EDFParameters from grm
- FixedPriorityParameters from grm
- PeriodicServerParameters from grm
- PoolingParameters from grm
- TableEntryType from grm

### 8.37.3 Attributes

- value: EString [0:1]

### 8.37.4 Semantics

TODO: write a semantic

## 8.38 SchedulingPolicy classifier

TODO: write an overview

### 8.38.1 Generalizations

- AccessControlPolicy from grm

### 8.38.2 Attributes

- policy: SchedPolicyKind [0:1]
- otherSchedPolicy: EString [0:1]

### 8.38.3 Semantics

TODO: write a semantic

## 8.39 SecondaryScheduler classifier

TODO: write an overview

### 8.39.1 Generalizations

- Scheduler from grm

### 8.39.2 Semantics

TODO: write a semantic

## 8.40 StaticUsage classifier

TODO: write an overview

### 8.40.1 Generalizations

- ResourceUsage from grm

### 8.40.2 Semantics

TODO: write a semantic

## 8.41 StorageResource classifier

TODO: write an overview

### 8.41.1 Generalizations

- Resource from grm

### 8.41.2 Specializations

- HardwareCache from hrm
- HardwareDrive from hrm
- HardwareMemory from hrm
- HardwareProcessingMemory from hrm
- HardwareRam from hrm
- HardwareRom from hrm
- HardwareStorageMemory from hrm

### 8.41.3 Semantics

TODO: write a semantic

## 8.42 SynchResource classifier

TODO: write an overview

### 8.42.1 Generalizations

- Resource from grm

### 8.42.2 Specializations

- MutualExclusionResource from grm
- NotificationResource from srm
- SoftwareMutualExclusionResource from srm
- SoftwareSynchronizationResource from srm

### 8.42.3 Semantics

TODO: write a semantic

## 8.43 TableDrivenSchedule classifier

TODO: write an overview

### 8.43.1 Generalizations

- ScheduleSpecification from grm

### 8.43.2 Attributes

- frameCycleTime: NFP_Duration [0:1]

### 8.43.3 Semantics

TODO: write a semantic

## 8.44 TableEntryType classifier

TODO: write an overview

### 8.44.1 Generalizations

- SchedulingParameter from grm

### 8.44.2 Attributes

- timeSlot: NFP_Duration [1:-1]
- offset: NFP_Duration [0:-1]
- initialBudget: NFP_Duration [0:1]

### 8.44.3 Semantics

TODO: write a semantic

## 8.45 TimingResource classifier

TODO: write an overview

### 8.45.1 Generalizations

- Resource from grm

### 8.45.2 Specializations

- ClockResource from grm
- TimerResource from grm
- HardwareClock from hrm
- HardwareTimingResource from hrm
- HardwareTimer from hrm
- HardwareWatchdog from hrm
- SoftwareTimerResource from srm

### 8.45.3 Semantics

TODO: write a semantic

## 8.46 TimerResource classifier

TODO: write an overview

### 8.46.1 Generalizations

- TimingResource from grm

### 8.46.2 Specializations

- SoftwareTimerResource from srm

### 8.46.3 Attributes

- duration: NFP_Duration [0:1]
- isPeriodic: EBoolean [0:1]

### 8.46.4 Semantics

TODO: write a semantic

## 8.47 TransmModeKind classifier

TODO: write an overview

### 8.47.1 Values

- simplex
- half_duplex
- full_duplex

### 8.47.2 Semantics

TODO: write a semantic

## 8.48 UsageDemand classifier

TODO: write an overview

### 8.48.1 Generalizations

- ModelElement from coreelements

### 8.48.2 Attributes

- event: EString [0:1]

### 8.48.3 Semantics

TODO: write a semantic

## 8.49 UsageTypedAmount classifier

TODO: write an overview

### 8.49.1 Generalizations

- Resource from grm

### 8.49.2 Attributes

- execTime: EInt [0:1]
- msgSize: EInt [0:1]
- allocatedmemory: EInt [0:1]
- usedMemory: EInt [0:1]
- powerPeak: EInt [0:1]
- energy: EInt [0:1]

### 8.49.3 Semantics

TODO: write a semantic

## 8.50 NFP_Duration classifier

TODO: write an overview

See org.polarsys.time4sys.marte.nfp.Duration.

TODO: write a semantic

## 8.51 NFP_DataSize classifier

TODO: write an overview

See org.polarsys.time4sys.marte.nfp.DataSize.

TODO: write a semantic

## 8.52 NFP_DataTxRate classifier

TODO: write an overview

See org.polarsys.time4sys.marte.nfp.DataTxRate.

TODO: write a semantic

# Chapter 9

# Hrm package

## 9.1 Overview

hrm-class-diagram-overview.png

Figure 9.1: hrm-class-diagram-overview

## 9.2 CacheType classifier

TODO: write an overview

### 9.2.1 Values

- data
- instruction
- unified
- other
- undef

### 9.2.2 Semantics

TODO: write a semantic

## 9.3 ComponentState classifier

TODO: write an overview

### 9.3.1 Values

- operating
- storage
- other
- undef

### 9.3.2 Semantics

TODO: write a semantic

## 9.4 ConditionType classifier

TODO: write an overview

### 9.4.1 Values

- temperature
- humidity
- altitude
- vibration
- shock
- other
- undef

### 9.4.2 Semantics

TODO: write a semantic

## 9.5 Direction classifier

TODO: write an overview

### 9.5.1 Values

- in
- out
- inout

### 9.5.2 Semantics

TODO: write a semantic

## 9.6 EnvCondition classifier

TODO: write an overview

### 9.6.1 Generalizations

- ModelElement from coreelements

### 9.6.2 Attributes

- type: ConditionType [0:1]
- status: ComponentState [0:1]
- description: EString [0:1]
- range: EInt [0:1]

### 9.6.3 Semantics

TODO: write a semantic

## 9.7 FirmwareArchitecture classifier

TODO: write an overview

### 9.7.1 Generalizations

- HardwareResource from hrm

### 9.7.2 Semantics

TODO: write a semantic

## 9.8 IsaType classifier

TODO: write an overview

### 9.8.1 Values

- risc
- cisc
- vliw
- simd
- mimd
- other
- undef

### 9.8.2 Semantics

TODO: write a semantic

## 9.9 HardwareActuator classifier

TODO: write an overview

### 9.9.1 Generalizations

- HardwareIo from hrm

### 9.9.2 Semantics

TODO: write a semantic

## 9.10 HardwareArbiter classifier

TODO: write an overview

### 9.10.1 Generalizations

- HardwareCommunicationResource from hrm
- ResourceBroker from grm

### 9.10.2 Specializations

- HardwareDma from hrm

### 9.10.3 Semantics

TODO: write a semantic

## 9.11 HardwareAsic classifier

TODO: write an overview

### 9.11.1 Generalizations

- HardwareComputingResource from hrm

### 9.11.2 Semantics

TODO: write a semantic

## 9.12 HardwareBranchPredictor classifier

TODO: write an overview

### 9.12.1 Generalizations

- HardwareResource from hrm

### 9.12.2 Semantics

TODO: write a semantic

## 9.13 HardwareBridge classifier

TODO: write an overview

### 9.13.1 Generalizations

- HardwareMedia from hrm

### 9.13.2 Semantics

TODO: write a semantic

## 9.14 HardwareBus classifier

TODO: write an overview

### 9.14.1 Generalizations

- HardwareMedia from hrm

### 9.14.2 Attributes

- addressWidth: EInt [0:1]
- wordWidth: EInt [0:1]
- isSynchronous: EBoolean [0:1]
- isSerial: EBoolean [0:1]

### 9.14.3 Semantics

TODO: write a semantic

## 9.15 HardwareCache classifier

TODO: write an overview

### 9.15.1 Generalizations

- HardwareProcessingMemory from hrm

### 9.15.2 Attributes

- level: EInt [0:1]
- type: CacheType [0:1]
- nbSets: EInt [0:1]
- blockSize: EInt [0:1]
- associativity: EInt [0:1]

### 9.15.3 Semantics

TODO: write a semantic

## 9.16 HardwareCard classifier

TODO: write an overview

### 9.16.1 Generalizations

- HardwareComponent from hrm

### 9.16.2 Specializations

- HardwarePlatform from hrm

### 9.16.3 Semantics

TODO: write a semantic

## 9.17 HardwareChannel classifier

TODO: write an overview

### 9.17.1 Generalizations

- HardwareComponent from hrm

### 9.17.2 Specializations

- HardwareArbiter from hrm
- HardwareBridge from hrm
- HardwareBus from hrm
- HardwareCommunicationResource from hrm
- HardwareDma from hrm
- HardwareMedia from hrm

### 9.17.3 Attributes

- nbWires: EInt [0:1]

### 9.17.4 Semantics

TODO: write a semantic

## 9.18 HardwareChip classifier

TODO: write an overview

### 9.18.1 Generalizations

- HardwareComponent from hrm

### 9.18.2 Specializations

- HardwareActuator from hrm
- HardwareAsic from hrm
- HardwareCache from hrm
- HardwareClock from hrm
- HardwareComputingResource from hrm
- HardwareDevice from hrm
- HardwareDma from hrm
- HardwareDrive from hrm
- HardwareIo from hrm
- HardwareMemory from hrm
- HardwareMmu from hrm
- HardwarePld from hrm
- HardwareProcessingMemory from hrm
- HardwareProcessor from hrm
- HardwareRam from hrm
- HardwareRom from hrm
- HardwareSensor from hrm
- HardwareStorageManager from hrm
- HardwareStorageMemory from hrm
- HardwareSupport from hrm
- HardwareTimingResource from hrm
- HardwareTimer from hrm
- HardwareWatchdog from hrm

### 9.18.3 Attributes

- technology: EInt [0:1]

#### 9.18.4 Semantics

TODO: write a semantic

## 9.19 HardwareClock classifier

TODO: write an overview

#### 9.19.1 Generalizations

- HardwareTimingResource from hrm

#### 9.19.2 Attributes

- frequency: EInt [0:1]

#### 9.19.3 Semantics

TODO: write a semantic

## 9.20 HardwareCommunicationResource classifier

TODO: write an overview

#### 9.20.1 Generalizations

- CommunicationResource from grm
- HardwareResource from hrm
- HardwareChannel from hrm

#### 9.20.2 Specializations

- HardwareArbiter from hrm
- HardwareBridge from hrm
- HardwareBus from hrm
- HardwareDma from hrm
- HardwareMedia from hrm

#### 9.20.3 Semantics

TODO: write a semantic

## 9.21 HardwareComponent classifier

TODO: write an overview

### 9.21.1 Generalizations

- ModelElement from coreelements

### 9.21.2 Specializations

- HardwareActuator from hrm
- HardwareArbiter from hrm
- HardwareAsic from hrm
- HardwareBridge from hrm
- HardwareBus from hrm
- HardwareCache from hrm
- HardwareCard from hrm
- HardwareChannel from hrm
- HardwareChip from hrm
- HardwareClock from hrm
- HardwareCommunicationResource from hrm
- HardwareComputingResource from hrm
- HardwareDevice from hrm
- HardwareDma from hrm
- HardwareDrive from hrm
- HardwareIo from hrm
- HardwareMedia from hrm
- HardwareMemory from hrm
- HardwareMmu from hrm
- HardwarePlatform from hrm
- HardwarePld from hrm
- HardwarePort from hrm
- HardwareProcessingMemory from hrm
- HardwareProcessor from hrm

- HardwareRam from hrm
- HardwareRom from hrm
- HardwareSensor from hrm
- HardwareStorageManager from hrm
- HardwareStorageMemory from hrm
- HardwareSupport from hrm
- HardwareTimingResource from hrm
- HardwareTimer from hrm
- HardwareWatchdog from hrm

#### 9.21.3 Attributes

- dimension: EInt [0:1]
- area: EInt [0:1]
- posX: EInt [0:1]
- posY: EInt [0:1]
- grid: EInt [0:1]
- nbPins: EInt [0:1]
- weight: EInt [0:1]
- price: EInt [0:1]

#### 9.21.4 Semantics

TODO: write a semantic

### 9.22 HardwareComputingResource classifier

TODO: write an overview

#### 9.22.1 Generalizations

- ComputingResource from grm
- HardwareResource from hrm
- HardwareChip from hrm

### 9.22.2 Specializations

- HardwareAsic from hrm
- HardwarePld from hrm
- HardwareProcessor from hrm

### 9.22.3 Attributes

- opFrequencies: EInt [0:1]

### 9.22.4 Semantics

TODO: write a semantic

## 9.23 HardwareConnector classifier

TODO: write an overview

### 9.23.1 Generalizations

- ResourceConnector from grm

### 9.23.2 Semantics

TODO: write a semantic

## 9.24 HardwareDevice classifier

TODO: write an overview

### 9.24.1 Generalizations

- DeviceResource from grm
- HardwareResource from hrm
- HardwareChip from hrm

### 9.24.2 Specializations

- HardwareActuator from hrm
- HardwareIo from hrm
- HardwareSensor from hrm
- HardwareSupport from hrm

### 9.24.3 Semantics

TODO: write a semantic

## 9.25 HardwareDma classifier

TODO: write an overview

### 9.25.1 Generalizations

- HardwareStorageManager from hrm
- HardwareArbiter from hrm

### 9.25.2 Attributes

- nbChannels: EInt [0:1]
- transferWidth: EInt [0:1]

### 9.25.3 Semantics

TODO: write a semantic

## 9.26 HardwareDrive classifier

TODO: write an overview

### 9.26.1 Generalizations

- HardwareStorageMemory from hrm

### 9.26.2 Attributes

- sectorSize: EInt [0:1]

### 9.26.3 Semantics

TODO: write a semantic

## 9.27 HardwareInterface classifier

TODO: write an overview

### 9.27.1 Generalizations

- ResourceInterface from grm

### 9.27.2 Semantics

TODO: write a semantic

## 9.28 HardwareInterfacePackage classifier

TODO: write an overview

### 9.28.1 Generalizations

- ResourcePackage from grm

### 9.28.2 Semantics

TODO: write a semantic

## 9.29 HardwareIo classifier

TODO: write an overview

### 9.29.1 Generalizations

- HardwareDevice from hrm

### 9.29.2 Specializations

- HardwareActuator from hrm
- HardwareSensor from hrm

### 9.29.3 Semantics

TODO: write a semantic

## 9.30 HardwareIpBlock classifier

TODO: write an overview

#### 9.30.1 Generalizations

- HardwareResource from hrm

#### 9.30.2 Semantics

TODO: write a semantic

### 9.31 HardwareIsa classifier

TODO: write an overview

#### 9.31.1 Generalizations

- HardwareResource from hrm

#### 9.31.2 Attributes

- family: EString [0:1]
- instWidth: EInt [0:1]
- type: IsaType [0:1]

#### 9.31.3 Semantics

TODO: write a semantic

### 9.32 HardwareMedia classifier

TODO: write an overview

#### 9.32.1 Generalizations

- HardwareCommunicationResource from hrm

#### 9.32.2 Specializations

- HardwareBridge from hrm
- HardwareBus from hrm

#### 9.32.3 Semantics

TODO: write a semantic

## 9.33 HardwareMemory classifier

TODO: write an overview

### 9.33.1 Generalizations

- StorageResource from grm
- HardwareResource from hrm
- HardwareChip from hrm

### 9.33.2 Specializations

- HardwareCache from hrm
- HardwareDrive from hrm
- HardwareProcessingMemory from hrm
- HardwareRam from hrm
- HardwareRom from hrm
- HardwareStorageMemory from hrm

### 9.33.3 Attributes

- memorySize: EInt [0:1]
- addressSize: EInt [0:1]
- timings: EInt [0:-1]
- throughput: EInt [0:1]

### 9.33.4 Semantics

TODO: write a semantic

## 9.34 HardwareMmu classifier

TODO: write an overview

### 9.34.1 Generalizations

- HardwareStorageManager from hrm

### 9.34.2 Attributes

- virtualAddrSpace: EInt [0:1]
- physicalAddrSpace: EInt [0:1]
- memoryProtection: EBoolean [0:1]
- nbEntriesTlb: EInt [0:1]

### 9.34.3 Semantics

TODO: write a semantic

## 9.35 HardwarePin classifier

TODO: write an overview

### 9.35.1 Generalizations

- NamedElement from coreelements

### 9.35.2 Attributes

- width: EInt [0:1]
- direction: Direction [0:1]

### 9.35.3 Semantics

TODO: write a semantic

## 9.36 HardwarePlatform classifier

TODO: write an overview

### 9.36.1 Generalizations

- HardwareResource from hrm
- HardwareCard from hrm

### 9.36.2 Semantics

TODO: write a semantic

## 9.37 HardwarePld classifier

TODO: write an overview

### 9.37.1 Generalizations

- HardwareComputingResource from hrm

### 9.37.2 Attributes

- pldTechnology: PldTechnology [0:1]
- nbRows: EInt [0:1]
- nbColumns: EInt [0:1]
- kind: PldClass [0:1]
- nbLuts: EInt [0:1]
- nbLutInputs: EInt [0:1]
- nbFlipFlops: EInt [0:1]

### 9.37.3 Semantics

TODO: write a semantic

## 9.38 HardwarePort classifier

TODO: write an overview

### 9.38.1 Generalizations

- ResourcePort from grm
- HardwareComponent from hrm

### 9.38.2 Attributes

- type: PortType [0:1]

### 9.38.3 Semantics

TODO: write a semantic

## 9.39 HardwareProcessingMemory classifier

TODO: write an overview

### 9.39.1 Generalizations

- HardwareMemory from hrm

### 9.39.2 Specializations

- HardwareCache from hrm
- HardwareRam from hrm

### 9.39.3 Attributes

- replPolicy: ReplPolicy [0:1]
- writePolicy: WritePolicy [0:1]

### 9.39.4 Semantics

TODO: write a semantic

## 9.40 HardwareProcessor classifier

TODO: write an overview

### 9.40.1 Generalizations

- HardwareComputingResource from hrm

### 9.40.2 Attributes

- architecture: EInt [0:1]
- mips: EInt [0:1]
- ipc: EFloat [0:1]
- nbCores: EInt [0:1]
- nbPipelines: EInt [0:1]
- nbStages: EInt [0:1]
- nbAlus: EInt [0:1]
- nbFpus: EInt [0:1]

### 9.40.3 Semantics

TODO: write a semantic

## 9.41 HardwareRam classifier

TODO: write an overview

### 9.41.1 Generalizations

- HardwareProcessingMemory from hrm

### 9.41.2 Attributes

- nbRows: EInt [0:1]
- nbColumns: EInt [0:1]
- nbBanks: EInt [0:1]
- wordSize: EInt [0:1]
- isSynchronous: EBoolean [0:1]
- isStatic: EBoolean [0:1]
- isNonVolatile: EBoolean [0:1]

### 9.41.3 Semantics

TODO: write a semantic

## 9.42 HardwareResourcePackage classifier

TODO: write an overview

### 9.42.1 Generalizations

- ResourcePackage from grm

### 9.42.2 Semantics

TODO: write a semantic

## 9.43 HardwareResource classifier

TODO: write an overview

### 9.43.1 Generalizations

- Resource from grm

### 9.43.2 Specializations

- FirmwareArchitecture from hrm
- HardwareActuator from hrm
- HardwareArbiter from hrm
- HardwareAsic from hrm
- HardwareBranchPredictor from hrm
- HardwareBridge from hrm
- HardwareBus from hrm
- HardwareCache from hrm
- HardwareClock from hrm
- HardwareCommunicationResource from hrm
- HardwareComputingResource from hrm
- HardwareDevice from hrm
- HardwareDma from hrm
- HardwareDrive from hrm
- HardwareIo from hrm
- HardwareIpBlock from hrm
- HardwareIsa from hrm
- HardwareMedia from hrm
- HardwareMemory from hrm
- HardwarePlatform from hrm
- HardwarePld from hrm
- HardwareProcessingMemory from hrm
- HardwareProcessor from hrm
- HardwareRam from hrm
- HardwareRom from hrm
- HardwareSensor from hrm
- HardwareStorageMemory from hrm

- HardwareSupport from hrm
- HardwareTimingResource from hrm
- HardwareTimer from hrm
- HardwareWatchdog from hrm

#### 9.43.3 Semantics

TODO: write a semantic

### 9.44 HardwareRom classifier

TODO: write an overview

#### 9.44.1 Generalizations

- HardwareStorageMemory from hrm

#### 9.44.2 Attributes

- type: RomType [0:1]
- nbRows: EInt [0:1]
- nbColumns: EInt [0:1]
- nbBanks: EInt [0:1]
- wordSize: EInt [0:1]

#### 9.44.3 Semantics

TODO: write a semantic

### 9.45 HardwareSensor classifier

TODO: write an overview

#### 9.45.1 Generalizations

- HardwareIo from hrm

#### 9.45.2 Semantics

TODO: write a semantic

## 9.46 HardwareService classifier

TODO: write an overview

### 9.46.1 Generalizations

- ResourceService from grm

### 9.46.2 Semantics

TODO: write a semantic

## 9.47 HardwareStorageManager classifier

TODO: write an overview

### 9.47.1 Generalizations

- ResourceBroker from grm
- HardwareChip from hrm

### 9.47.2 Specializations

- HardwareDma from hrm
- HardwareMmu from hrm

### 9.47.3 Semantics

TODO: write a semantic

## 9.48 HardwareStorageMemory classifier

TODO: write an overview

### 9.48.1 Generalizations

- HardwareMemory from hrm

### 9.48.2 Specializations

- HardwareDrive from hrm
- HardwareRom from hrm

### 9.48.3 Semantics

TODO: write a semantic

## 9.49 HardwareSupport classifier

TODO: write an overview

### 9.49.1 Generalizations

- HardwareDevice from hrm

### 9.49.2 Semantics

TODO: write a semantic

## 9.50 HardwareTimingResource classifier

TODO: write an overview

### 9.50.1 Generalizations

- HardwareResource from hrm
- TimingResource from grm
- HardwareChip from hrm

### 9.50.2 Specializations

- HardwareClock from hrm
- HardwareTimer from hrm
- HardwareWatchdog from hrm

### 9.50.3 Semantics

TODO: write a semantic

## 9.51 HardwareTimer classifier

TODO: write an overview

#### 9.51.1 Generalizations

- HardwareTimingResource from hrm

#### 9.51.2 Specializations

- HardwareWatchdog from hrm

#### 9.51.3 Semantics

TODO: write a semantic

### 9.52 HardwareWatchdog classifier

TODO: write an overview

#### 9.52.1 Generalizations

- HardwareTimer from hrm

#### 9.52.2 Semantics

TODO: write a semantic

### 9.53 HardwareWire classifier

TODO: write an overview

#### 9.53.1 Generalizations

- ModelElement from coreelements

#### 9.53.2 Semantics

TODO: write a semantic

### 9.54 PldTechnology classifier

TODO: write an overview

### 9.54.1 Values

- sram
- antifuse
- flash
- other
- undef

### 9.54.2 Semantics

TODO: write a semantic

## 9.55 PldClass classifier

TODO: write an overview

### 9.55.1 Values

- symetricalArray
- rowBased
- seaOfGates
- hierarchicalPld
- other
- undef

### 9.55.2 Semantics

TODO: write a semantic

## 9.56 PortType classifier

TODO: write an overview

### 9.56.1 Values

- male
- female
- other
- undef

### 9.56.2 Semantics

TODO: write a semantic

## 9.57 ReplPolicy classifier

TODO: write an overview

### 9.57.1 Values

- lru
- nfu
- fifo
- random
- other
- undef

### 9.57.2 Semantics

TODO: write a semantic

## 9.58 RomType classifier

TODO: write an overview

### 9.58.1 Values

- maskedRom
- eprom
- otpEprom
- eeprom
- flash
- other
- undef

### 9.58.2 Semantics

TODO: write a semantic

## 9.59 WritePolicy classifier

TODO: write an overview

### 9.59.1 Values

- writeBack
- writeThrough
- other
- undef

### 9.59.2 Semantics

TODO: write a semantic

# Chapter 10

# Nfp package

## 10.1 Overview

nfp-class-diagram-overview.png

Figure 10.1: nfp-class-diagram-overview

## 10.2 Bucket classifier

TODO: write an overview

### 10.2.1 Attributes

- probability: EDouble [1:1]
- value: NFP_Duration [1:1]

### 10.2.2 Semantics

TODO: write a semantic

## 10.3 CompositeDistribution classifier

TODO: write an overview

### 10.3.1 Generalizations

- ProbabilisticDuration from nfp

### 10.3.2 Semantics

TODO: write a semantic

## 10.4 DataSize classifier

TODO: write an overview

### 10.4.1 Attributes

- value: EDouble [0:1]
- unit: DataSizeUnitKind [1:1]

### 10.4.2 Semantics

TODO: write a semantic

## 10.5 DataSizeUnitKind classifier

TODO: write an overview

### 10.5.1 Values

- BIT
- BYTE
- KB
- MB
- GB

### 10.5.2 Semantics

TODO: write a semantic

## 10.6 DataTxRate classifier

TODO: write an overview

### 10.6.1 Attributes

- value: EDouble [0:1]
- unit: DataTxRateUnitKind [1:1]

### 10.6.2 Semantics

TODO: write a semantic

## 10.7 DataTxRateUnitKind classifier

TODO: write an overview

### 10.7.1 Values

- B_PER_S
- KB_PER_S
- MB_PER_S

### 10.7.2 Semantics

TODO: write a semantic

## 10.8 DiscreteDistribution classifier

TODO: write an overview

### 10.8.1 Generalizations

- ProbabilisticDuration from nfp

### 10.8.2 Attributes

- kind: DiscreteDistributionKind [1:1]

### 10.8.3 Semantics

TODO: write a semantic

## 10.9 DiscreteDistributionKind classifier

TODO: write an overview

### 10.9.1 Values

- Undef
- Random
- Cyclic

### 10.9.2 Semantics

TODO: write a semantic

## 10.10 Duration classifier

TODO: write an overview

### 10.10.1 Specializations

- CompositeDistribution from nfp
- DiscreteDistribution from nfp
- GeneralizedExtremeValueDistribution from nfp
- NormalDistribution from nfp
- ProbabilisticDuration from nfp
- UniformDistribution from nfp

### 10.10.2 Attributes

- value: EDouble [0:1]
- unit: TimeUnitKind [1:1]
- best: EDouble [0:1]
- worst: EDouble [0:1]
- clock: EString [0:1]
- precision: EDouble [0:1]

### 10.10.3 Semantics

TODO: write a semantic

## 10.11 GeneralizedExtremeValueDistribution classifier

TODO: write an overview

### 10.11.1 Generalizations

- ProbabilisticDuration from nfp

### 10.11.2 Attributes

- mu: NFP_Duration [1:1]
- sigma: NFP_Duration [1:1]
- xi: NFP_Duration [1:1]

### 10.11.3 Semantics

TODO: write a semantic

## 10.12 MathContext classifier

TODO: write an overview

See java.math.MathContext.

TODO: write a semantic

## 10.13 NormalDistribution classifier

TODO: write an overview

### 10.13.1 Generalizations

- ProbabilisticDuration from nfp

### 10.13.2 Attributes

- mu: NFP_Duration [1:1]
- sigma: NFP_Duration [1:1]

### 10.13.3 Semantics

TODO: write a semantic

## 10.14 NFP_Duration classifier

TODO: write an overview

See org.polarsys.time4sys.marte.nfp.Duration.

TODO: write a semantic

## 10.15 ProbabilisticDuration classifier

TODO: write an overview

### 10.15.1 Generalizations

- TimeInterval from nfp
- Duration from nfp

### 10.15.2 Specializations

- CompositeDistribution from nfp
- DiscreteDistribution from nfp
- GeneralizedExtremeValueDistribution from nfp
- NormalDistribution from nfp
- UniformDistribution from nfp

### 10.15.3 Semantics

TODO: write a semantic

## 10.16 TimeInterval classifier

TODO: write an overview

### 10.16.1 Specializations

- CompositeDistribution from nfp
- DiscreteDistribution from nfp
- GeneralizedExtremeValueDistribution from nfp
- NormalDistribution from nfp
- ProbabilisticDuration from nfp
- UniformDistribution from nfp

### 10.16.2 Attributes

- minOpen: EBoolean [1:1]
- maxOpen: EBoolean [1:1]

### 10.16.3 Semantics

TODO: write a semantic

## 10.17 TimeUnitKind classifier

TODO: write an overview

### 10.17.1 Values

- ps
- ns
- us
- ms
- s
- mn
- h
- d

### 10.17.2 Semantics

TODO: write a semantic

## 10.18 UniformDistribution classifier

TODO: write an overview

### 10.18.1 Generalizations

- ProbabilisticDuration from nfp

### 10.18.2 Semantics

TODO: write a semantic

# Chapter 11

# Sam package

## 11.1 Overview

sam-class-diagram-overview.png

Figure 11.1: sam-class-diagram-overview

## 11.2 EndToEndFlow classifier

End-to-end flows describe a unit of processing work in the analyzed system, which contend for use of the processing resources. This is a conceptual entity only, which is represented by its concrete elements: end-to-end stimuli and end-to- end response.

TODO: write an overview

### 11.2.1 Generalizations

- NamedElement from coreelements
- AnnotatedElement from annotation

### 11.2.2 Attributes

- isSchedulable: EBoolean [0:1]
- schedulabilitySlack: EDouble [0:1]
- endToEndTime: NFP_Duration [0:1]
- endToEndDeadline: NFP_Duration [0:1]

### 11.2.3 Semantics

TODO: write a semantic

## 11.3 NFP_Duration classifier

TODO: write an overview

See org.polarsys.time4sys.marte.nfp.Duration.

TODO: write a semantic

## 11.4 SchedulingObserver classifier

TODO: write an overview

### 11.4.1 Generalizations

- TimedObserver from gqam

### 11.4.2 Attributes

- suspensions: NFP_Duration [0:1]
- blockingTime: NFP_Duration [0:1]
- overlaps: NFP_Duration [0:1]

### 11.4.3 Semantics

TODO: write a semantic

# Chapter 12

# Srm package

## 12.1 Overview

srm-class-diagram-overview.png

Figure 12.1: srm-class-diagram-overview

## 12.2 AccessPolicyKind classifier

TODO: write an overview

### 12.2.1 Values

- Read
- Write
- ReadWrite
- Undef
- Other

### 12.2.2 Semantics

TODO: write a semantic

## 12.3 Alarm classifier

TODO: write an overview

### 12.3.1 Generalizations

- InterruptResource from srm

### 12.3.2 Attributes

- isWatchdog: EBoolean [0:1]

### 12.3.3 Semantics

TODO: write a semantic

## 12.4 ConcurrentAccesProtocolKind classifier

TODO: write an overview

### 12.4.1 Values

- PCP
- PIP
- NoPreemption
- Undef
- Other

### 12.4.2 Semantics

TODO: write a semantic

## 12.5 DeviceBroker classifier

TODO: write an overview

### 12.5.1 Generalizations

- ResourceBroker from grm
- SoftwareResource from srm

### 12.5.2 Attributes

- accessPolicy: AccessPolicyKind [0:1]
- isBuffered: EBoolean [0:1]

### 12.5.3 Semantics

TODO: write a semantic

## 12.6 InterruptKind classifier

TODO: write an overview

### 12.6.1 Values

- HardwareInterruption
- ProcessorDetectedException
- ProgrammedException
- Undef
- Other

### 12.6.2 Semantics

TODO: write a semantic

## 12.7 QueuePolicyKind classifier

TODO: write an overview

### 12.7.1 Values

- FIFO
- LIFO
- Priority
- Undef
- Other

### 12.7.2 Semantics

TODO: write a semantic

## 12.8 InterruptResource classifier

TODO: write an overview

### 12.8.1 Generalizations

- SoftwareConcurrentResource from srm

### 12.8.2 Specializations

- Alarm from srm

### 12.8.3 Attributes

- kind: InterruptKind [1:1]
- isMaskable: EBoolean [1:1]
- maskElements: EString [0:-1]
- vectorElements: EString [0:-1]
- isrEntryPoints: EString [0:-1]

### 12.8.4 Semantics

TODO: write a semantic

## 12.9 MemoryBroker classifier

TODO: write an overview

### 12.9.1 Generalizations

- ResourceBroker from grm
- SoftwareResource from srm

### 12.9.2 Attributes

- accessPolicy: AccessPolicyKind [0:1]
- memoryBlockAddressElements: EString [0:-1]
- memoryBlockSizeElements: EString [0:-1]

### 12.9.3 Semantics

TODO: write a semantic

## 12.10 MemoryPartition classifier

TODO: write an overview

### 12.10.1 Generalizations

- SoftwareResource from srm

### 12.10.2 Semantics

TODO: write a semantic

## 12.11 MessageComResource classifier

TODO: write an overview

### 12.11.1 Generalizations

- SoftwareCommunicationResource from srm

### 12.11.2 Attributes

- isFixedMessageSize: EBoolean [1:1]
- messageSizeElements: EString [0:-1]
- mechanism: MessageResourceKind [0:1]
- messageQueuePolicy: QueuePolicyKind [0:1]
- messageQueueCapacityElements: EString [0:-1]

### 12.11.3 Semantics

TODO: write a semantic

## 12.12 MessageResourceKind classifier

TODO: write an overview

### 12.12.1 Values

- MessageQueue
- Pipe
- Blackboard
- Undef
- Other

### 12.12.2 Semantics

TODO: write a semantic

## 12.13 MutualExclusionResourceKind classifier

TODO: write an overview

### 12.13.1 Values

- BooleanSemaphore
- CountSemaphore
- Mutex
- Undef
- Other

### 12.13.2 Semantics

TODO: write a semantic

## 12.14 NotificationResource classifier

TODO: write an overview

### 12.14.1 Generalizations

- SoftwareSynchronizationResource from srm

### 12.14.2 Attributes

- policy: OccurencePolicyKind [1:1]
- mechanism: NotificationResourceKind [1:1]
- occurenceCountElements: EString [0:-1]
- maskElements: EString [0:-1]

### 12.14.3 Semantics

TODO: write a semantic

## 12.15 NotificationResourceKind classifier

TODO: write an overview

### 12.15.1 Values

- Barrier
- Event
- Undef
- Other

### 12.15.2 Semantics

TODO: write a semantic

## 12.16 OccurencePolicyKind classifier

TODO: write an overview

### 12.16.1 Values

- Memorized
- Bounded
- Memoryless
- Undef
- Other

### 12.16.2 Semantics

TODO: write a semantic

## 12.17 SharedDataComResource classifier

TODO: write an overview

### 12.17.1 Generalizations

- SoftwareCommunicationResource from srm

### 12.17.2 Semantics

TODO: write a semantic

## 12.18 SoftwareAccessService classifier

TODO: write an overview

### 12.18.1 Generalizations

- ResourceService from grm

### 12.18.2 Attributes

- isModifier: EBoolean [0:1]
- accessedElement: EString [0:1]

### 12.18.3 Semantics

TODO: write a semantic

## 12.19 SoftwareArchitecture classifier

TODO: write an overview

### 12.19.1 Generalizations

- SoftwareResource from srm

### 12.19.2 Semantics

TODO: write a semantic

## 12.20 SoftwareCommunicationResource classifier

TODO: write an overview

### 12.20.1 Generalizations

- SoftwareInteractionResource from srm
- CommunicationMedia from grm

### 12.20.2 Specializations

- MessageComResource from srm
- SharedDataComResource from srm

### 12.20.3 Semantics

TODO: write a semantic

## 12.21 SoftwareConcurrentResource classifier

TODO: write an overview

### 12.21.1 Generalizations

- SoftwareResource from srm
- ConcurrencyResource from grm

### 12.21.2 Specializations

- Alarm from srm
- InterruptResource from srm
- SoftwareSchedulableResource from srm

### 12.21.3 Attributes

- periodElements: EString [0:-1]
- activationCapacity: EInt [0:1]
- priorityElements: EString [0:-1]
- stackSizeElements: EString [0:-1]
- heapSizeElements: EString [0:-1]
- entryPoints: EString [0:-1]
- arrivalPattern: EString [0:1]

### 12.21.4 Semantics

TODO: write a semantic

## 12.22 SoftwareConnector classifier

TODO: write an overview

### 12.22.1 Generalizations

- ResourceConnector from grm

### 12.22.2 Semantics

TODO: write a semantic

## 12.23 SoftwareInteractionResource classifier

TODO: write an overview

### 12.23.1 Generalizations

- CommunicationEndPoint from grm
- SoftwareResource from srm

### 12.23.2 Specializations

- MessageComResource from srm
- NotificationResource from srm
- SharedDataComResource from srm
- SoftwareCommunicationResource from srm
- SoftwareMutualExclusionResource from srm
- SoftwareSynchronizationResource from srm

### 12.23.3 Attributes

- isIntraMemoryPartitionInteraction: EBoolean [1:1]
- waitingQueuePolicy: QueuePolicyKind [0:1]
- waitingQueueCapacity: EInt [0:1]
- waitingPolicyElements: EString [0:-1]

### 12.23.4 Semantics

TODO: write a semantic

## 12.24 SoftwareInterface classifier

TODO: write an overview

### 12.24.1 Generalizations

- ResourceInterface from grm

### 12.24.2 Semantics

TODO: write a semantic

## 12.25 SoftwareInterfacePackage classifier

TODO: write an overview

### 12.25.1 Generalizations

- ResourcePackage from grm

### 12.25.2 Semantics

TODO: write a semantic

## 12.26 SoftwareMutualExclusionResource classifier

TODO: write an overview

### 12.26.1 Generalizations

- SoftwareSynchronizationResource from srm
- MutualExclusionResource from grm

### 12.26.2 Attributes

- concurrentAccessProtocol: ConcurrentAccesProtocolKind [0:1]
- mechanism: MutualExclusionResourceKind [0:1]

### 12.26.3 Semantics

TODO: write a semantic

## 12.27 SoftwarePort classifier

TODO: write an overview

### 12.27.1 Generalizations

- ResourcePort from grm

### 12.27.2 Semantics

TODO: write a semantic

## 12.28 SoftwareResource classifier

TODO: write an overview

### 12.28.1 Generalizations

- ResourceManager from grm

### 12.28.2 Specializations

- Alarm from srm
- DeviceBroker from srm
- InterruptResource from srm
- MemoryBroker from srm
- MemoryPartition from srm
- MessageComResource from srm
- NotificationResource from srm
- SharedDataComResource from srm
- SoftwareArchitecture from srm
- SoftwareCommunicationResource from srm
- SoftwareConcurrentResource from srm
- SoftwareInteractionResource from srm
- SoftwareMutualExclusionResource from srm
- SoftwareSchedulableResource from srm
- SoftwareSynchronizationResource from srm

### 12.28.3 Attributes

- memorySizeFootprint: EInt [0:1]
- stateElements: EString [0:-1]
- identifierElements: EString [0:-1]

### 12.28.4 Semantics

TODO: write a semantic

## 12.29 SoftwareResourcePackage classifier

TODO: write an overview

### 12.29.1 Generalizations

- ResourcePackage from grm

### 12.29.2 Semantics

TODO: write a semantic

## 12.30 SoftwareSchedulableResource classifier

TODO: write an overview

### 12.30.1 Generalizations

- SchedulableResource from grm
- SoftwareConcurrentResource from srm

### 12.30.2 Attributes

- isStaticSchedulingFeature: EBoolean [1:1]
- isPreemptable: EBoolean [1:1]
- deadlineElements: EString [0:-1]
- deadlineTypeElements: EString [0:-1]
- timeSliceElements: EString [0:-1]

### 12.30.3 Semantics

TODO: write a semantic

## 12.31 SoftwareScheduler classifier

TODO: write an overview

### 12.31.1 Generalizations

- Scheduler from grm

### 12.31.2 Semantics

TODO: write a semantic

## 12.32 SoftwareService classifier

TODO: write an overview

### 12.32.1 Generalizations

- ResourceService from grm

### 12.32.2 Semantics

TODO: write a semantic

## 12.33 SoftwareSynchronizationResource classifier

TODO: write an overview

### 12.33.1 Generalizations

- SoftwareInteractionResource from srm
- SynchResource from grm

### 12.33.2 Specializations

- NotificationResource from srm
- SoftwareMutualExclusionResource from srm

### 12.33.3 Semantics

TODO: write a semantic

## 12.34 SoftwareTimerResource classifier

TODO: write an overview

### 12.34.1 Generalizations

- TimerResource from grm

### 12.34.2 Attributes

- durationElements: EString [0:-1]

### 12.34.3 Semantics

TODO: write a semantic

## 12.35 NFP_Duration classifier

TODO: write an overview

See org.polarsys.time4sys.marte.nfp.Duration.

TODO: write a semantic