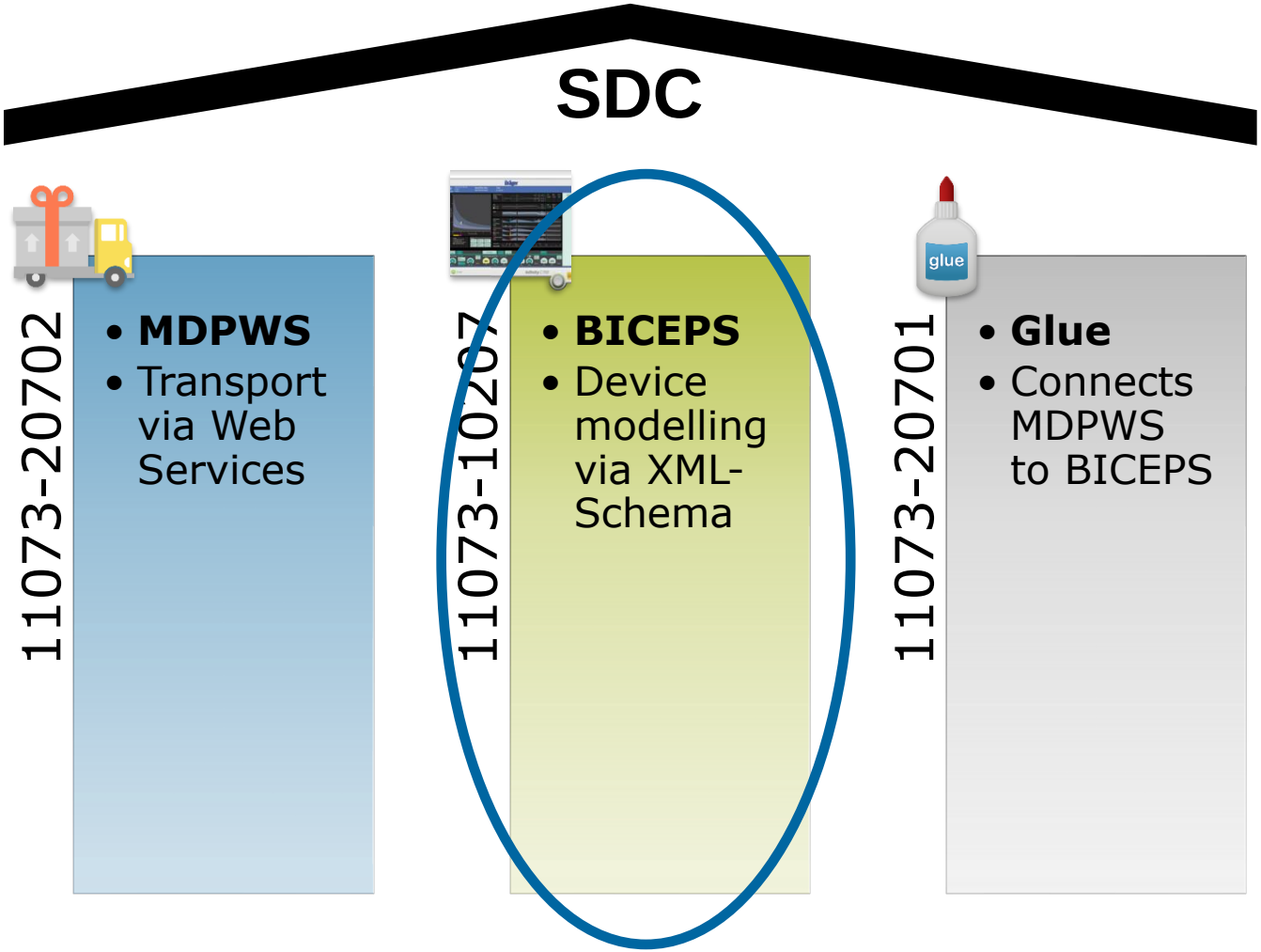
BICEPS Modelling of Alert Systems

Revision 1,
2018-03-10

IEEE
Advancing Technology for Humanity

Orientation



DEFINITION

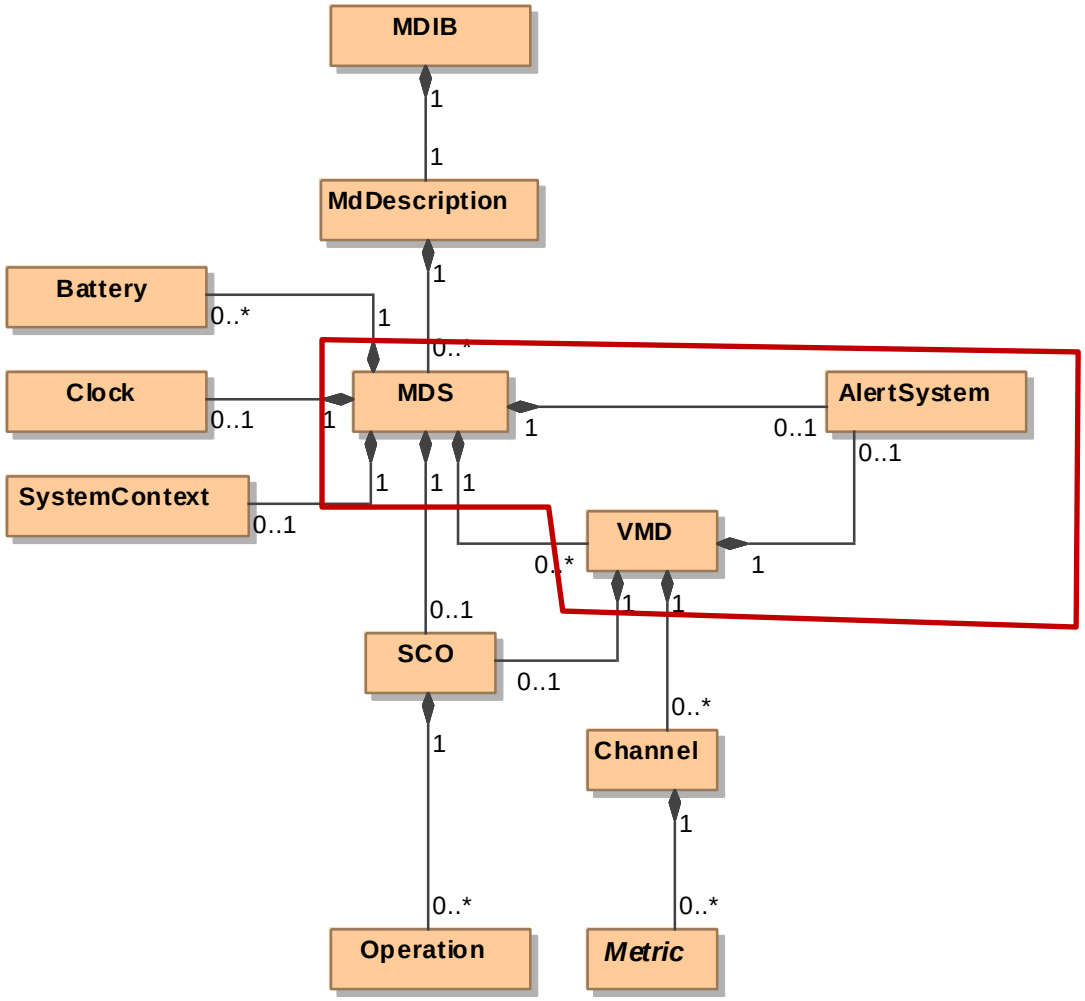
Definition

Alert vs. alarm

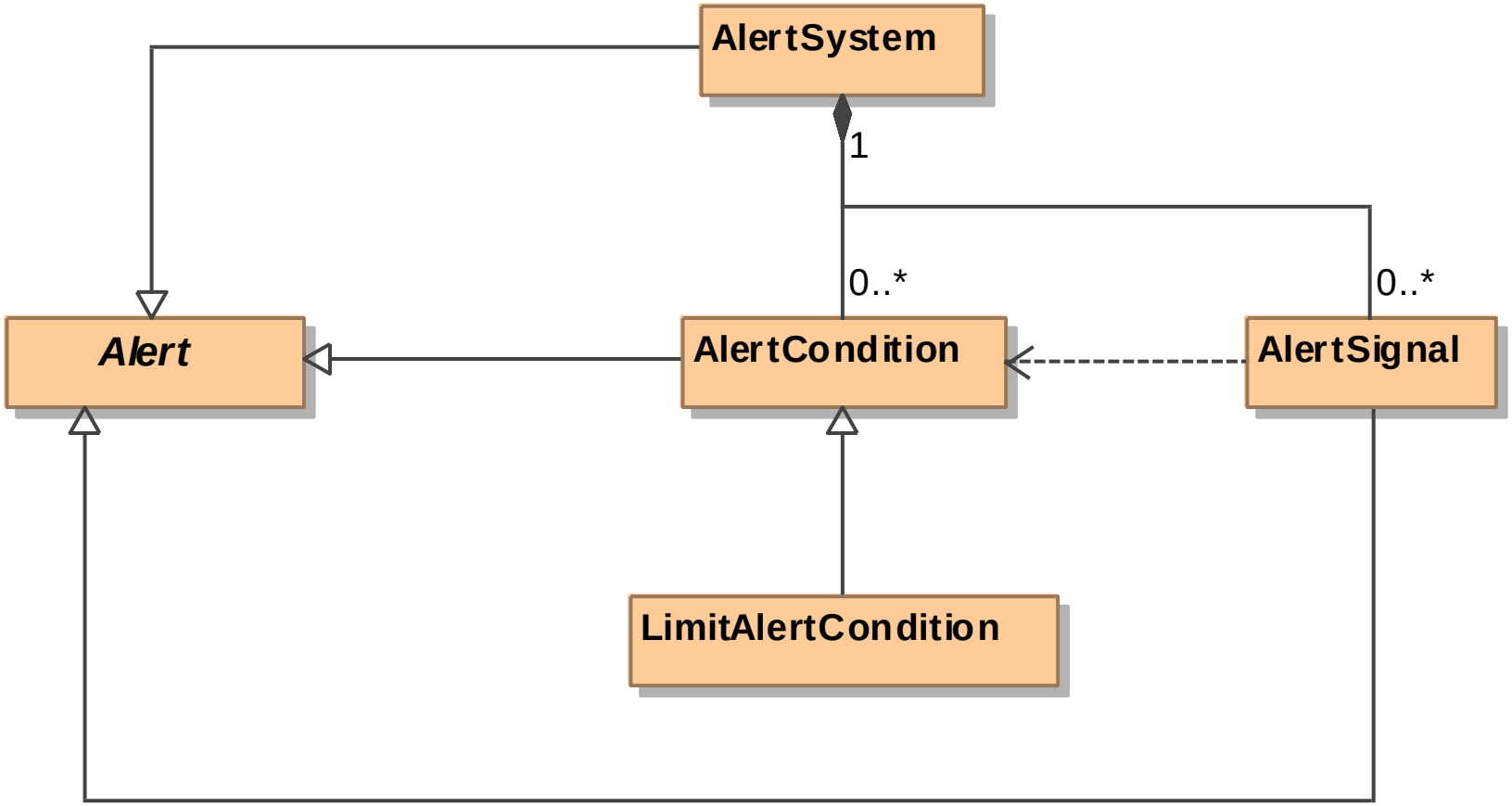
BICEPS defines all alarm-related items by the term alert. The term alert is used as a synonym for the combination of patient-related physiological alarms, technical alarms, and equipment user-advisory signals.

CLASS DIAGRAM

Class diagram
Placement in MDIB



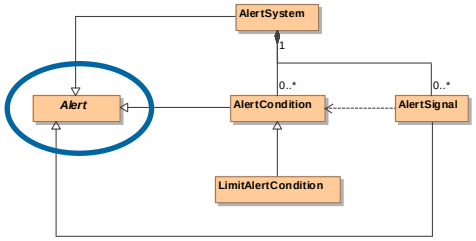
Class diagram
Relationship and derived types



PROPERTIES

Properties

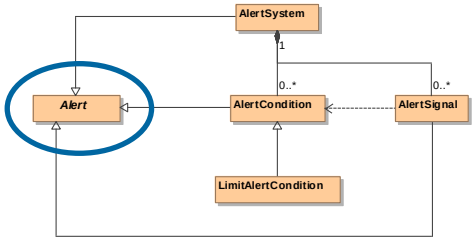
pm:AbstractAlertDescriptor



- No attributes defined

Properties

pm:AbstractAlertState

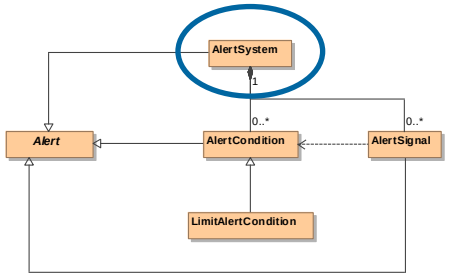


ActivationState

- On (operating), off (not operating), or paused (temporarily not operating)

Properties

pm:AlertSystemDescriptor



AlertCondition [list]

- Conditions that are enclosed by the alert system

AlertSignal [list]

- Signals that are enclodes by the alert system
- Every signal point to the condition it is configured to signalize

MaxPhysiologicalParallelAlarms [optional]

- Maximum number of physiological alarm conditions that can be present at the same time

MaxTechnicalParallelAlarms [optional]

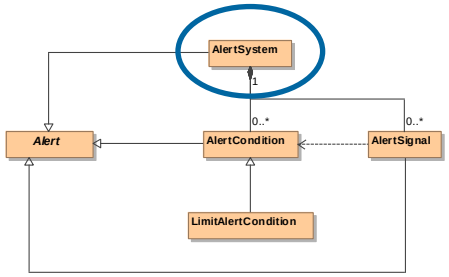
- Maximum number of technical alarm conditions that can be present at the same time

SelfCheckPeriod [optional]

- Period after a self check is performed
- Can be used to determine if an alert system is “alive”
  - See also pm:AlertSystemState/@LastSelfCheck

Properties

pm:AlertSystemState I



LastSelfCheck [optional]

- Timepoint of last self-check – required to be updated if SelfCheckPeriod in descriptor is present

SelfCheckCount [optional]

- Number of self checks performed without knowledge of the value's origin

SystemSignalActivation

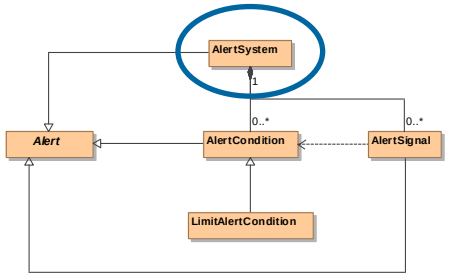
- Definition of compound signal activation
  - Example: pause audio signal for all audio signals in alert system

PresentPhysiologicalAlarmConditions & PresentTechnicalAlarmCondition

- Next slide

Metric properties

pm:AlertSystemState II

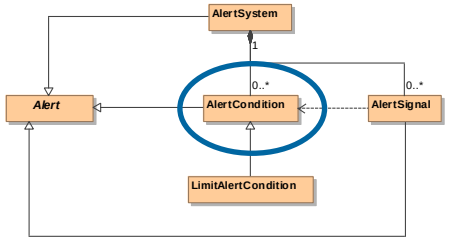


- pm:AlertSystemState possesses lists of present physiological and technical alert conditions:
  - pm:AlertSystemState/@PresentPhysiologicalAlarmConditions
  - pm:AlertSystemState/@PresentTechnicalAlarmConditions
- Those lists shall be be in sync with all pm:AlertConditionState/@Presence flags
- Example: PhysiologicalAlertCondition(X).Presence="true" ➔ AlertSystem(Y).PresentPhysiologicalAlarmConditions=„X“

PresentPhysiologicalAlarmConditions and PresentTechnicalAlarmConditions can be used to verify condition presence with every alert system self check.

Properties

pm:AlertConditionDescriptor



Kind

- Physiological, technical, other

Priority

- Low, medium, high, none

DefaultConditionGenerationDelay [optional]

- Delay from physical fulfillment to generation of an alert condition on the device

Source [list]

- Sources that cause the condition

CauseInfo [list]

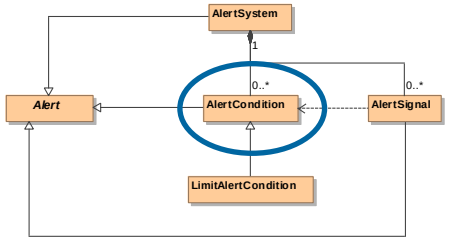
- Human-readable cause-remedy information

CanEscalate/CanDeescalate [optional]

- Indicates if an alert condition can escalate/deescalate from one priority to another

Properties

pm:AlertConditionState



ActualPriority [optional]

- Overrides the priority from descriptor if present

Rank [optional]

- Finer distinction of priorities
- Definition is defined per device, hence cannot be used to sort conditions over more than one device
- There is no mapping between Priority and Rank predefined

Presence

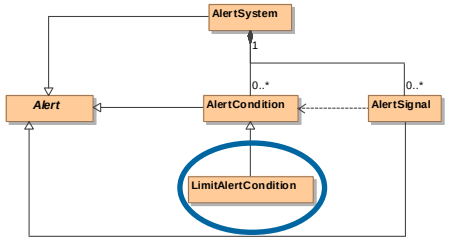
- Boolean flag to determine if the condition is fulfilled or not

DeterminationTime [optional]

- Last time when Presence has changed

Properties

pm:LimitAlertConditionDescriptor



AutoLimitSupported

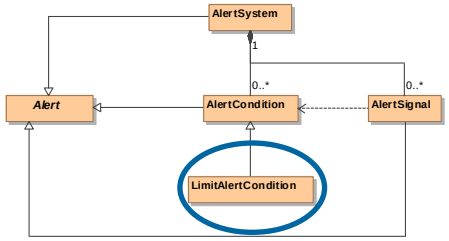
- Indicates support for automatic limit adaption

MaxLimits

- Possible value range
- Unit is equal to the unit of the source metric

Properties

pm:LimitAlertConditionState



Limits

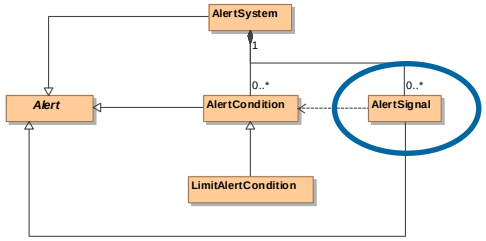
- Definition of lower and/or upper limit that triggers the condition
- As lower and upper are optional values, LimitAlertCondition allows modelling of both limits in one condition or separation into two conditions

MonitoredAlertLimits

- Defines the monitored limits (i.e., the limits that lead to condition presence = on)
- None, Lower Off, Upper Off, All

Properties

pm:AlertSignalDescriptor



ConditionSignaled [optional]

- Handle reference to the condition that causes the signal presence

Manifestation

- Audible, visible, tangible

Latching

- Defines if signal keeps present even if the alert condition is not present any longer
- Signal generation has to be stopped by deliberate action

DefaultSignalGenerationDelay

- Period between onset of a condition to generation of the signal

SignalDelegationSupported

- Indicate if the signal can be generated on a remote device

AcknowledgementSupported

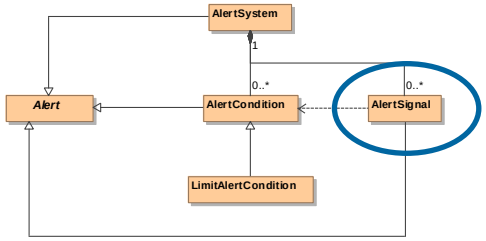
- Defines if the signal is allowed to be suppressed even if the condition is still present

AcknowledgeTimeout [optional]

- Period that defines an acknowledgement timeout – default is “indefinite”.

Properties

pm:AlertSignalState



Presence

- Defines if the signal is currently on, off, latched, acknowledged

Location

- Defines if the signal is generated remotely (on another device) or locally (on the same device)

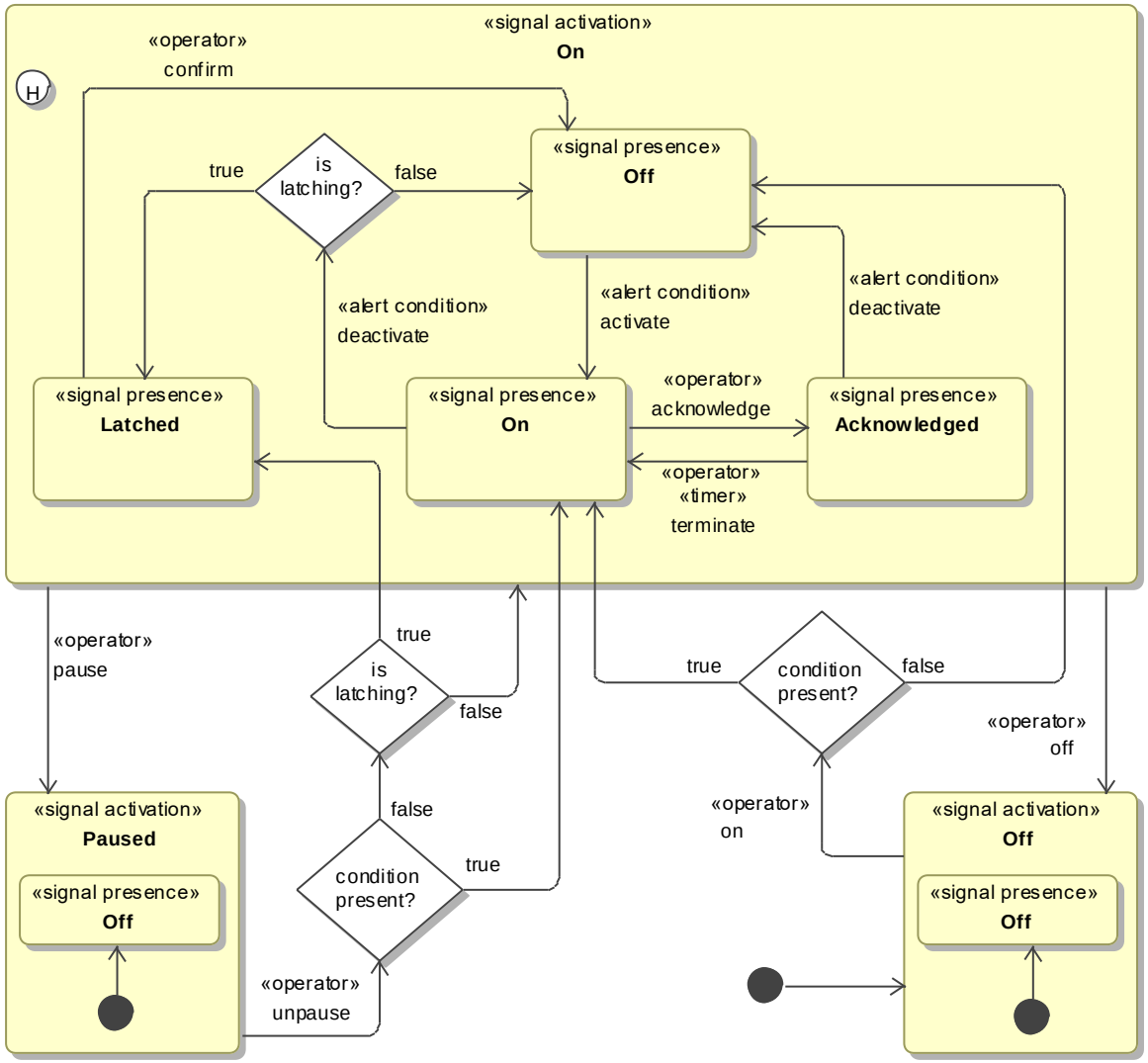
Slot [optional]

- Prioritization of alert signals
- Definition is defined per device, hence cannot be used to prioritize over more than one device

Instance of an alert signal transition diagram

- Since every medical device and medical device vendor handles their alert systems differently, there is no trivial state diagram to visualize the relationship between activation states, condition presence and signal presence
- Common alert handling between specific device combinations have to be established through profiles (IEEE 11073 device profiles or IHE TF)
- The following slide shows an instance of an alert signal transition diagram

Instance of an alert signal transition diagram



ALERT SIGNAL DELEGATION

TBD

TBD

Thank you for your attention!

Contact information

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