



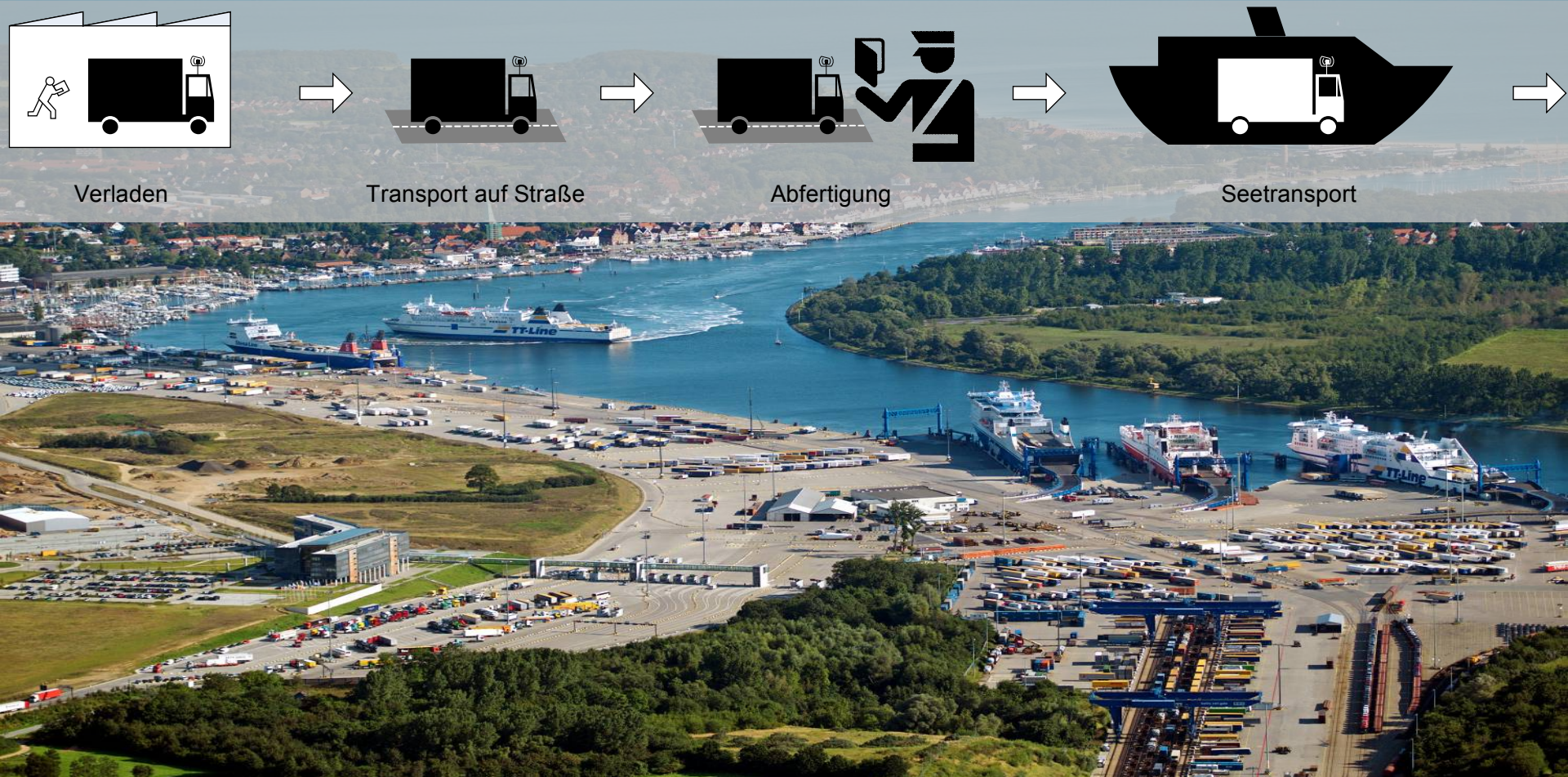
SM4RCD: Eine domänenspezifische Sprache zur Geschäftsprozessmodellierung und -ausführung im Sensornetz

Nils Glombitza

Agenda

- Anwendungsszenario & Anforderungen
- Konzept und technologische Umsetzung
- Evaluation

Anwendungsszenario

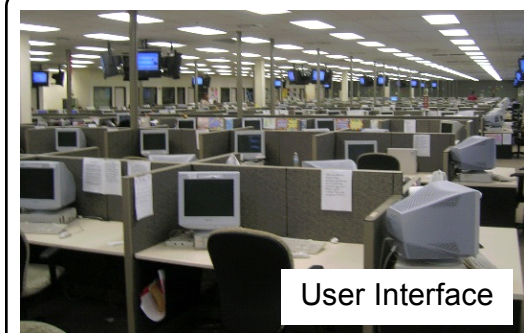
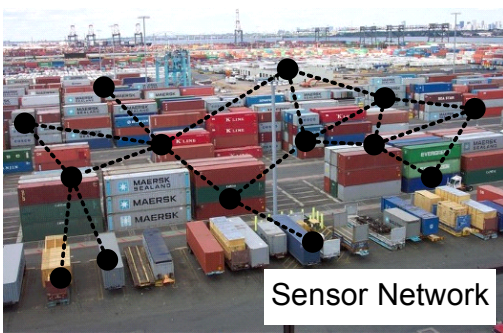


Konzept

State Machine-Based Process Modeling

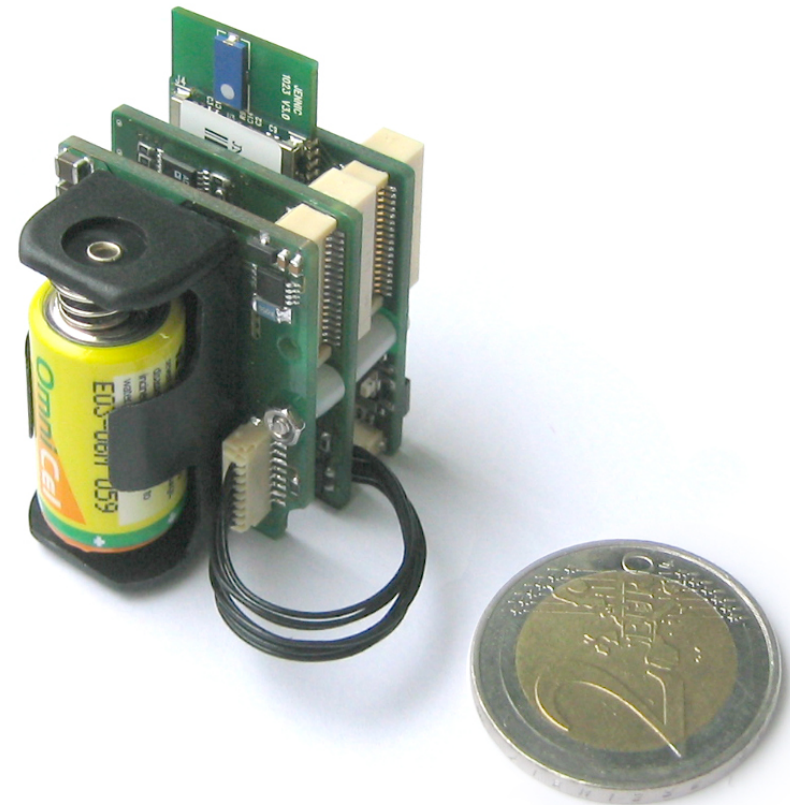
Service Oriented Architecture

Web Services

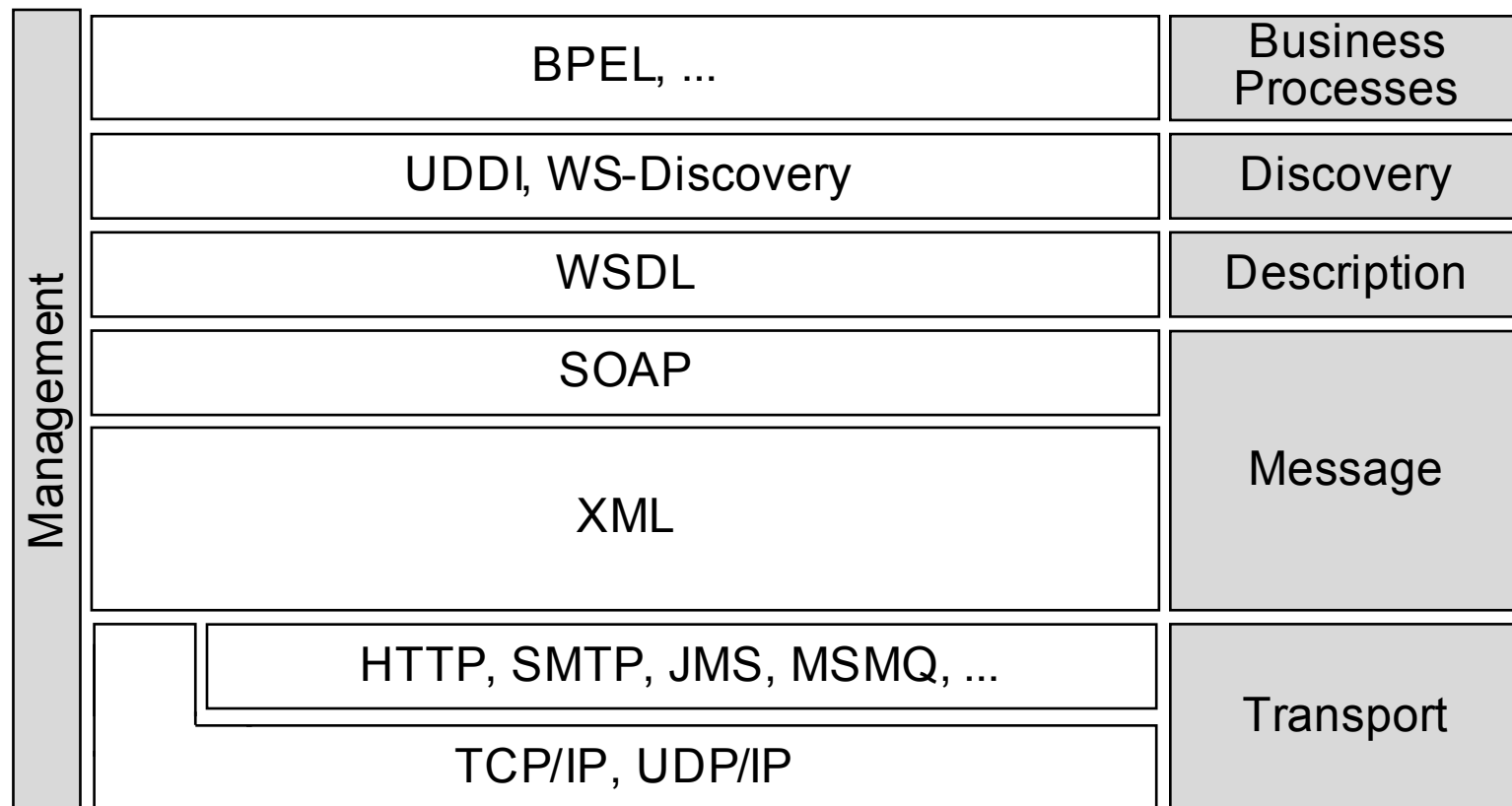


Sensornetz-Plattform

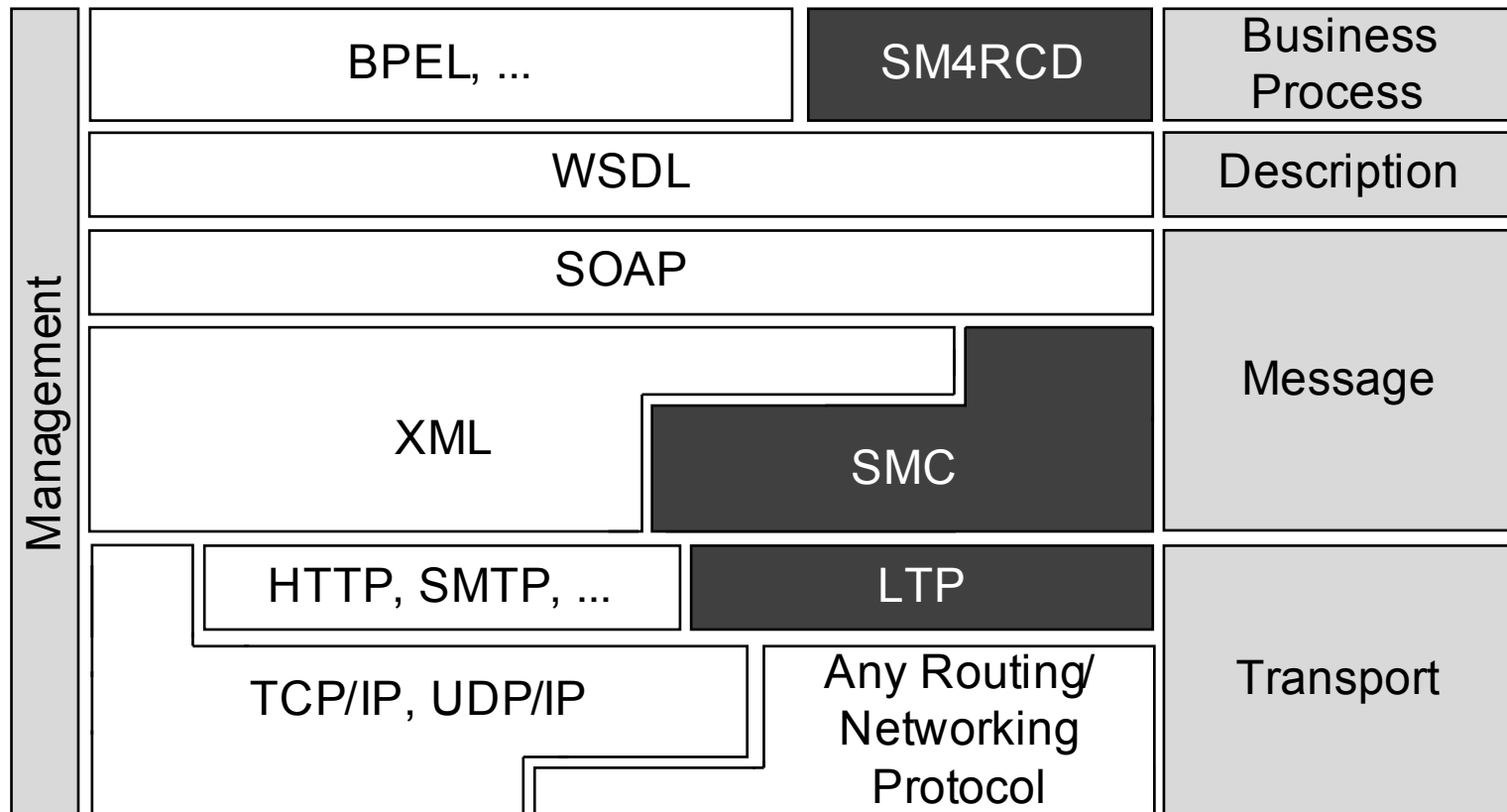
- Hauptmodul:
 - 32-bit, 16 MHz RISC Prozessor
 - 96 kBytes RAM (Daten & Code)
 - IEEE 802.15.4 Funkschnittstelle (250kBit/s)
- GPRS-Modul
- GPS-Empfänger & Temperatursensor



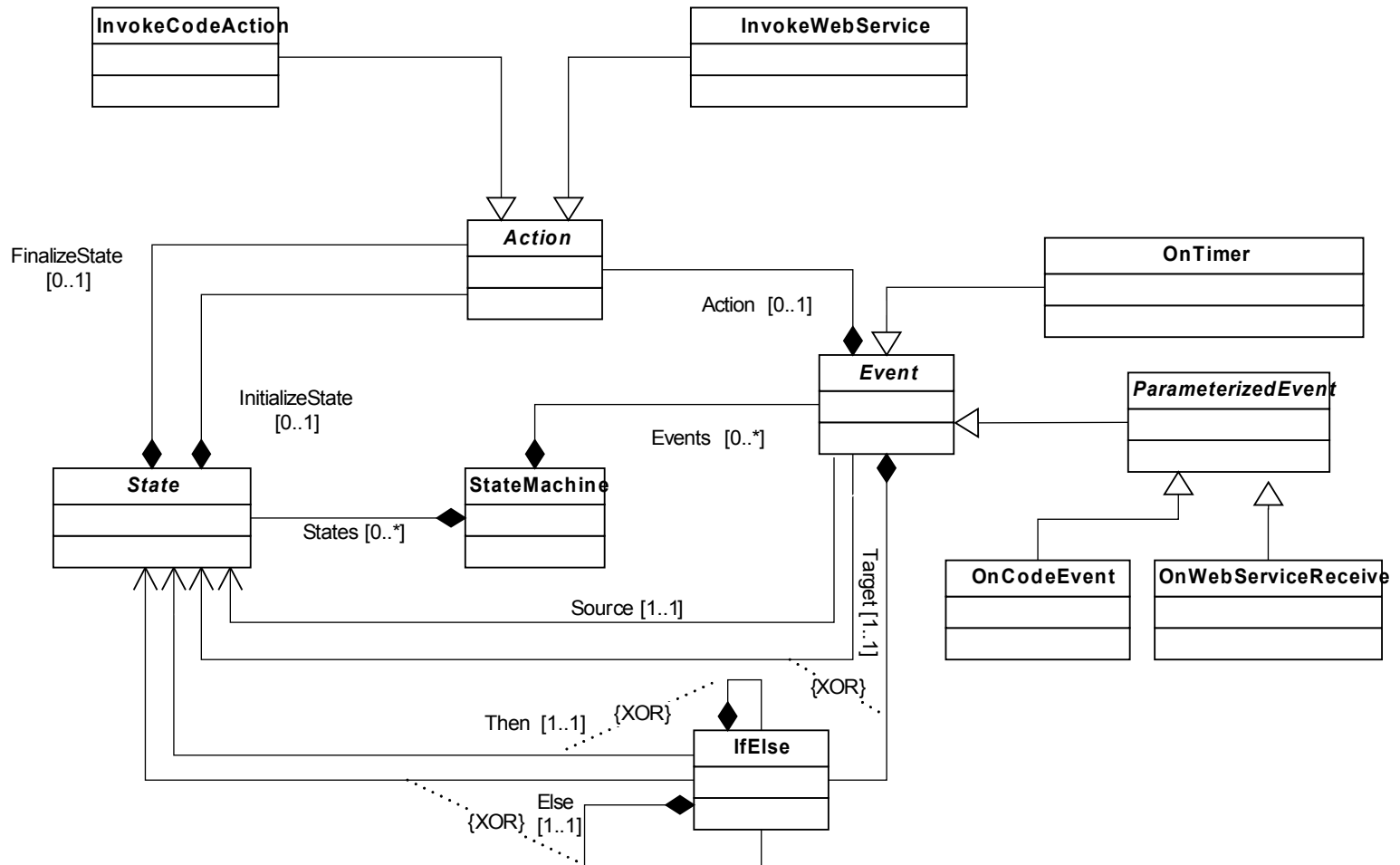
Webservice-Technologie-Stapel



Erweiterter Webservice-Technologie-Stapel



SM4RCD



Codegenerierung für Sensornetze

- Arbeitsspeicherverbrauch
- Ausführungsgeschwindigkeit
- Code-Größe
- Fehlerfrüherkennung

Entwicklungswerkzeuge

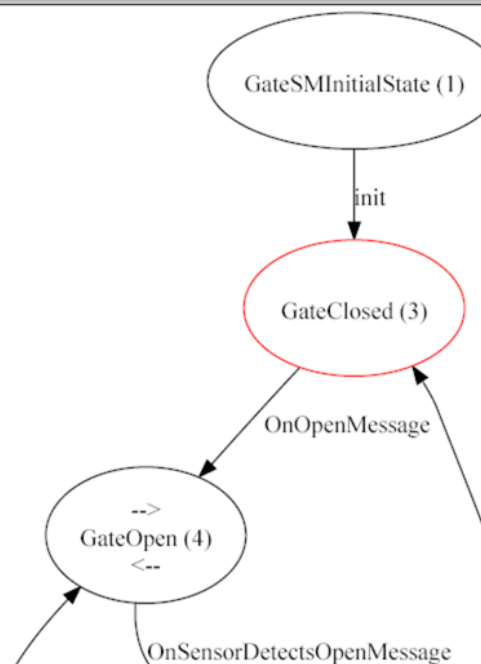
Sm4RcdStatusComputerVisualDebug

Simulation Real Sensor Node

Debug File

SM4RCD File

Sensor Node 0



```

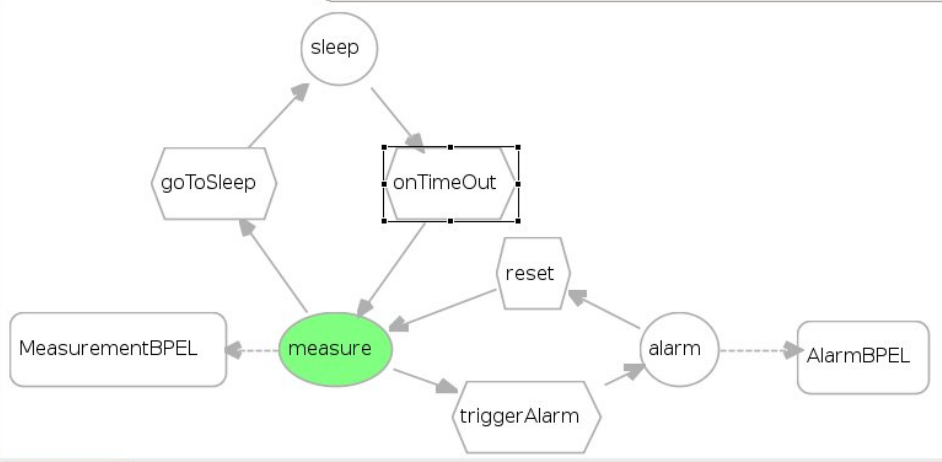
stateDiagram-v2
    [*] --> GateSMInitialState : init
    state GateSMInitialState as GateSMInitialState (1)
    state GateClosed as GateClosed (3)
    state GateOpen as GateOpen (4)
    GateSMInitialState --> GateClosed : init
    GateClosed --> GateOpen : OnOpenMessage
    GateOpen --> GateClosed : OnSensorDetectsOpenMessage
    
```

Debug, id 0 @ 5.0 (5.0): 0
 Sm4RcdStatusComputerVisualDebug::setState 3
 Debug, id 0 @ 5.0 (5.0): Gate angle = 0
 Debug, id 0 @ 5.0 (5.0): Time = 01.12.2009 18:03

Resource - Measure-Process/measurement.sm4rcd_diagram - Eclipse Platform

File Edit Diagram Navigate Search Project Run Window Help

Sans 9 B I A



```

stateDiagram-v2
    [*] --> sleep
    state sleep as sleep
    state goToSleep as goToSleep
    state onTimeout as onTimeout
    state reset as reset
    state alarm as alarm
    state triggerAlarm as triggerAlarm
    state measure as measure
    state MeasurementBPEL as MeasurementBPEL
    state AlarmBPEL as AlarmBPEL

    sleep --> goToSleep
    goToSleep --> measure
    measure --> onTimeout
    onTimeout --> reset
    reset --> alarm
    alarm --> triggerAlarm
    triggerAlarm --> measure
    measure --> MeasurementBPEL
    alarm --> AlarmBPEL
    
```

Properties

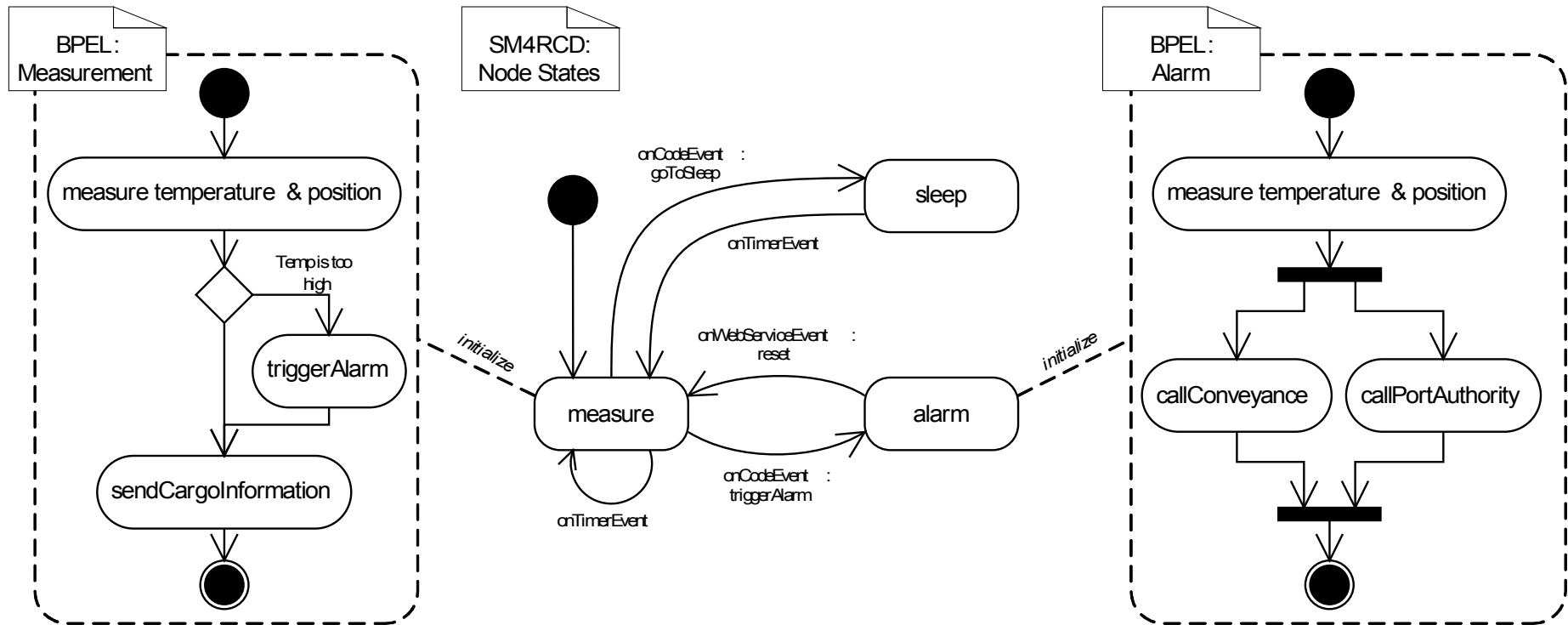
OnTimerDelay

Core	Property	Value
Appearance	Delay	60000
	Guard	
	Name	onTimeout
	Source	Regular State sleep
	Target State	Initial State measure

Palette

- InitialState
- RegularState
- FinalState
- InitializeState
- FinalizeState
- OnTimerDelay
- OnCodeEvent
- OnWebServiceReceive
- OnTimerPointOfTime
- Source
- TargetState
- TargetIfElse
- Action
- InvokeCodeAction

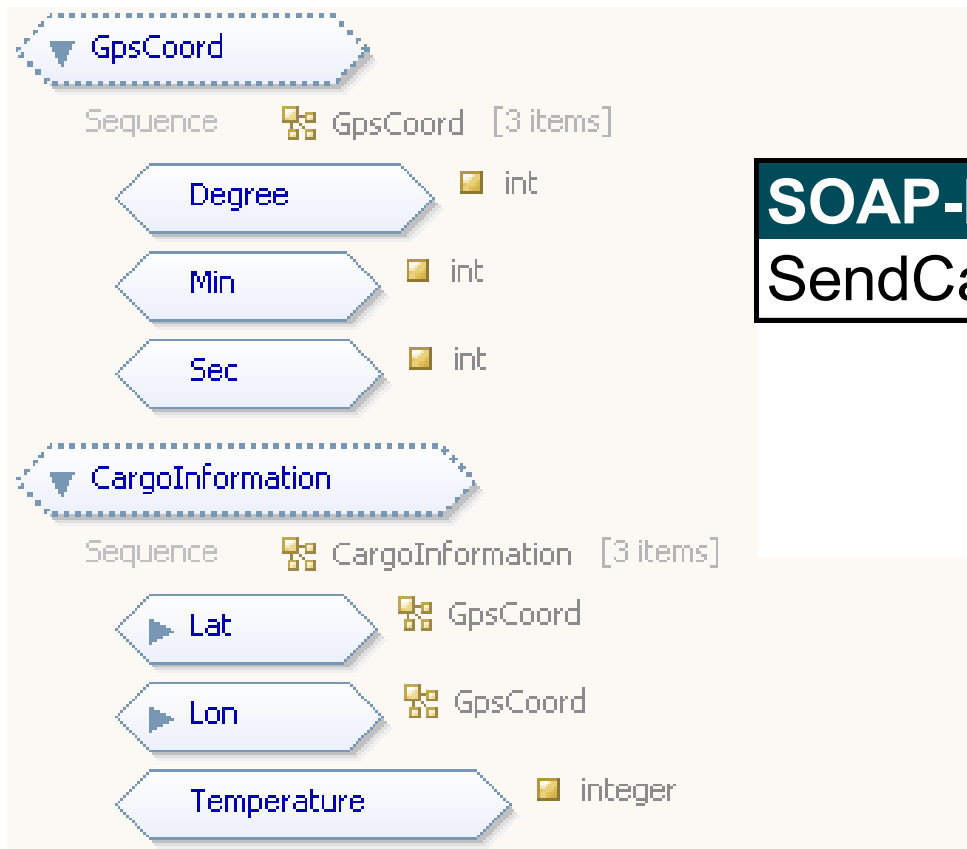
Evaluation



Evaluation - Codegröße

Kommunikation		Prozesslogik		Σ
SOAP-Nachrichten-serialisierung	LTP	SM4RCD	BPEL	
2.036 byte	5.160 byte	1.816 byte	5.372 byte	14.384 byte

Evaluation - Nachrichtengröße

**SOAP-Nachricht****Größe**

SendCargoInfoRequest

8 byte

Zusammenfassung

- Webservice-Kommunikation für Sensornetze mit **LTP+SMC**
- **SM4RCD** als domänenspezifische Sprache zur Prozessmodellierung für Sensornetze

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