The four (five) Sensors

SWE based sensor integration in the German Indonesian Tsunami Early Warning and Mitigation System project (GITEWS)

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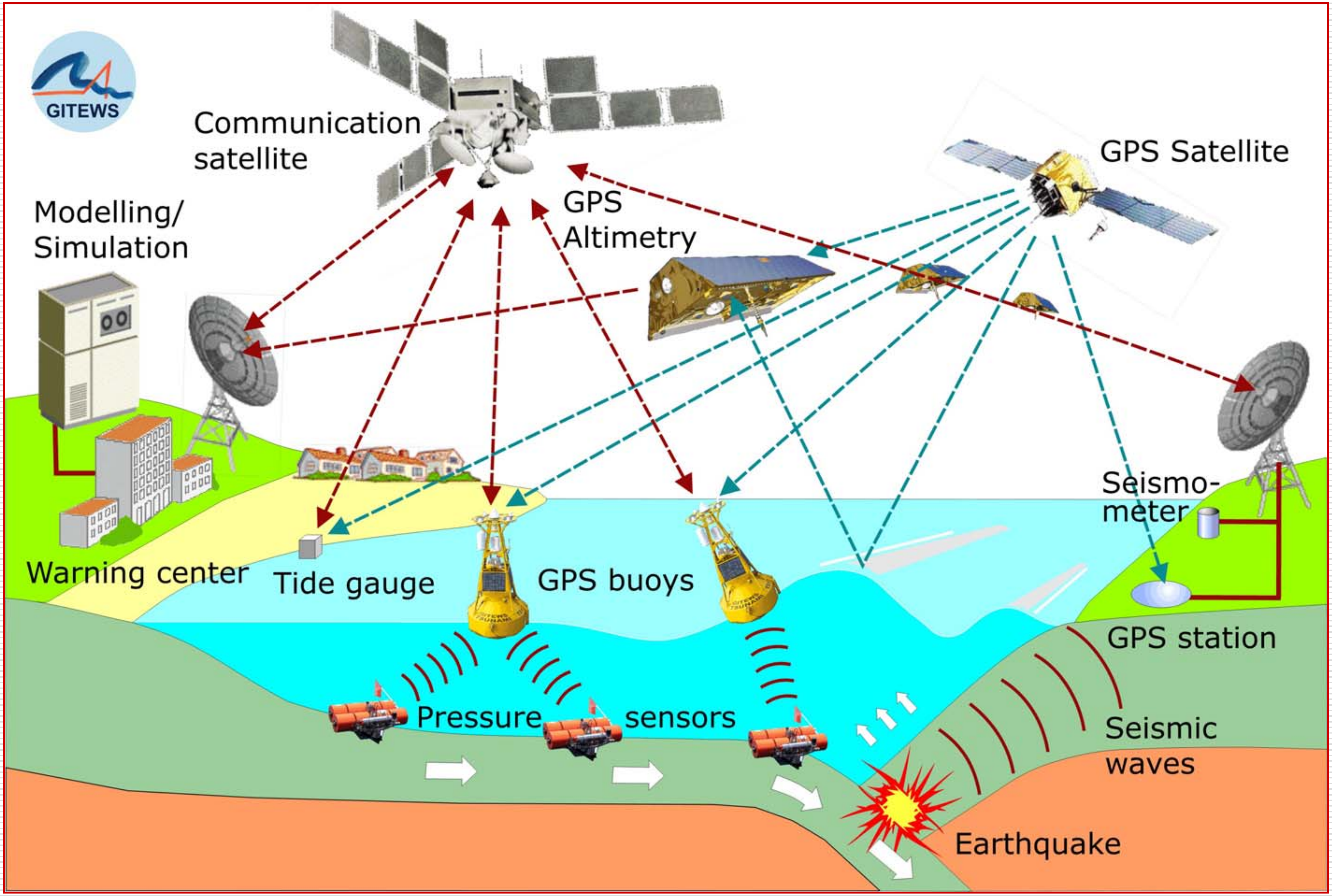
Content

- GITEWS: A short introduction
- SWE: A short introduction
- SWE: Characterization of the GITEWS sensors
- SWE, sensor integration: Realization, technology
- GITEWS: Adoption of the GITEWS sensors
- GITEWS: Architecture
- SWE: Process flow

GITEWS: Overview



GITEWS: The Sensors

A colorful presentation of the GITEWS Sensors

SWE: Sensor Integration, Categories

- Sensor, Sensor System *(individuals)*

  e.g.: Buoy (wave height)

- Sensor Systems Network *(network of sensors and sensor systems)*

  e.g.: Seismic System (earthquake location, -strength)

- Models, Databases *(virtual sensors)*

  e.g.: Tsunami Simulation (scalar field of wave height)

- Warning Systems *(system of systems)*

  e.g.: GITEWS (tsunami phenomenon and parameters)

- Actuators *(active controlling units)*

  e.g.: Sensor activation (increase sampling rate)

SWE: Sensor Integration, Sensors

- Seismic System

  QuakeML, proprietary data format, Messaging System (JMS) : complex event model

- Buoys

  Proprietary data format and protocol: time series

- Tide Gauges

  Proprietary data format and protocol: time series

- GPS Ground Tracking System

  Proprietary data format and protocol: time series

- Simulation

  SWE adoption planned

Sensor Web Enablement (SWE)

SWE comprises all endeavours to make all **types** of sensors and instruments **available** on the Web, but also archives of sensor data via the WWW, **traceable**, **accessible** and if possible, **controllable** as well. (OGC)

SWE Encodings

- Sensor Model Language (SensorML)

  standardized description of sensors and sensor data

- Observations and Measurements (O&M)

  model and encoding of sensor measurements

SWE Services

- Sensor Observation Service (SOS):

  standardized access to sensor data

- Sensor Planning Service (SPS):

  monitoring and control of sensors and sensor networks

- Sensor Alert Service (SAS):

  active sending of data if defined events occur

- *Web Notification Service (WNS):*

  a service by which a service (client) may conduct asynchronous dialogues (message exchange) to one or more other services (clients). Messaging via various communication encodings (e.g. SMS, e-mail)

Sensor Integration (Technology)

Approach:

“Tsunami Service Bus”

Establishment of a Service Oriented Architecture based on the concept Enterprise Service Bus

Tsunami Service Bus (Wikipedia)

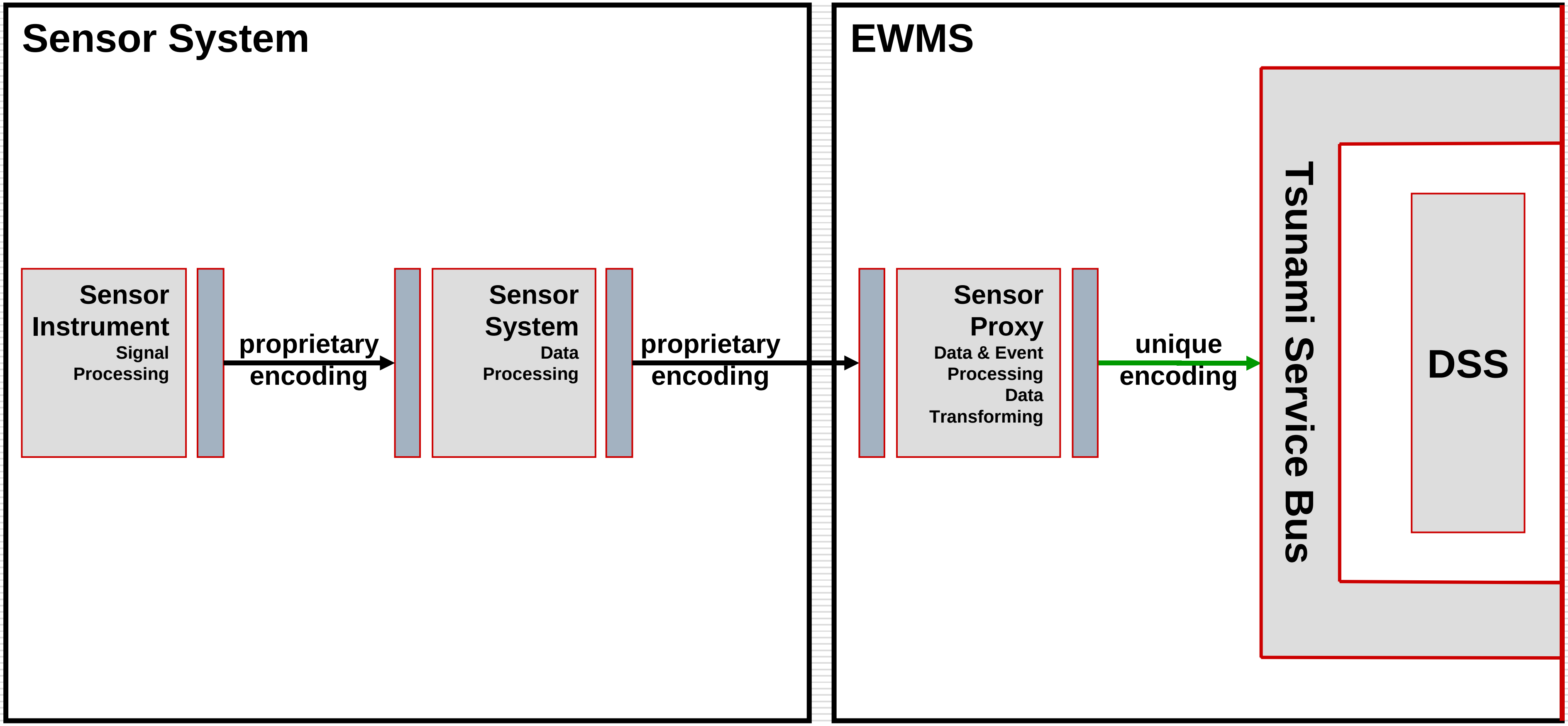
In computing, an **enterprise service bus** (ESB) refers to a software architecture construct, implemented by technologies found in a category of **middleware infrastructure products** usually based on **standards**, that provides foundational services for more complex architectures via an **event-driven and standards-based messaging engine (the bus)**.

An ESB generally provides an **abstraction layer on top of an implementation** of an enterprise messaging system which allows integration architects to exploit the value of messaging without writing code. Contrary to the more classical enterprise application integration (EAI) approach of a monolithic stack in a hub and spoke architecture, the foundation of an enterprise service bus is built of **base functions** broken up into their constituent parts, with **distributed deployment** where needed, working in harmony as necessary.

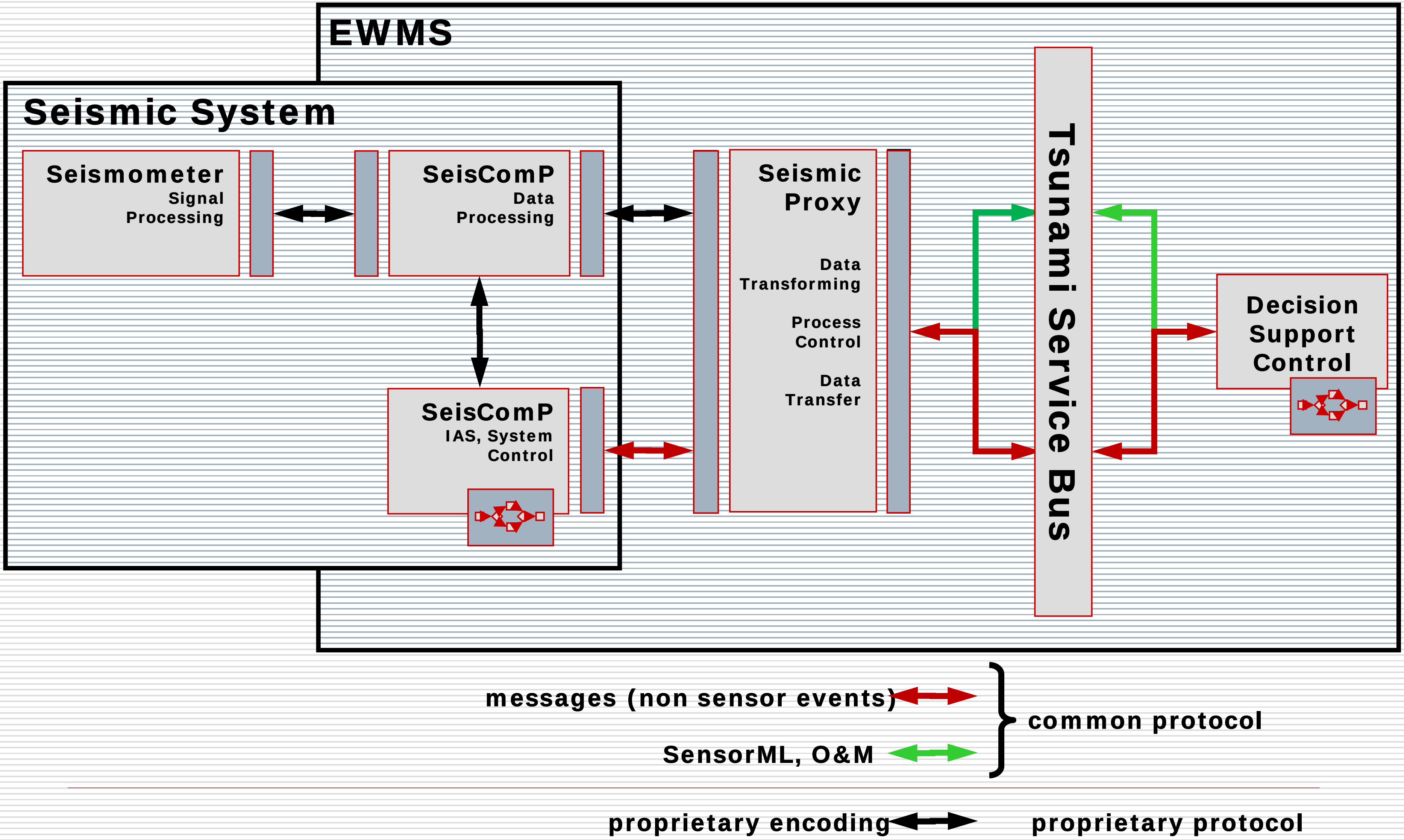
ESB does not implement a service-oriented architecture (SOA) but provides the features with which one may be implemented. Although a common belief, ESB is not necessarily web-services based. ESB should be **standards-based and flexible, supporting many transport mediums**. Based on EAI rather than SOA patterns, it tries to **remove the coupling between the service called and the transport medium**.

Most ESB providers now build ESBs to incorporate SOA principles and increase their sales, e.g. **Business Process Execution Language** (BPEL).

Adoption of Sensor Systems



Adoption of the Seismic System



EWMS

Seismic System

Seismometer
Signal
Processing

SeisComP
Data
Processing

SeisComP
IAS, System
Control

Seismic
Proxy

Data
Transforming

Process
Control

Data
Transfer

Tsunami Service Bus

Decision
Support
Control

messages (non sensor events)

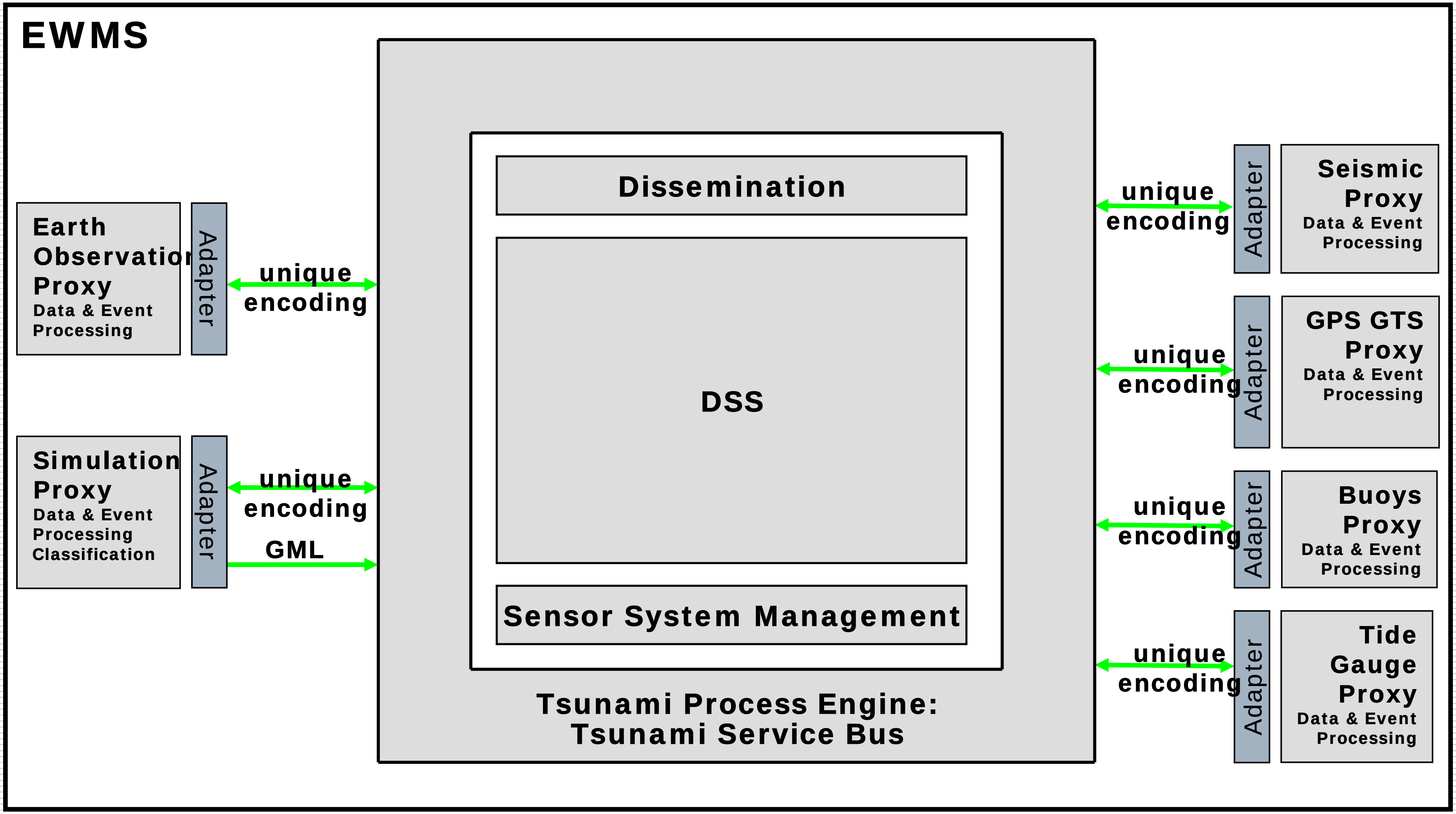
SensorML, O&M

common protocol

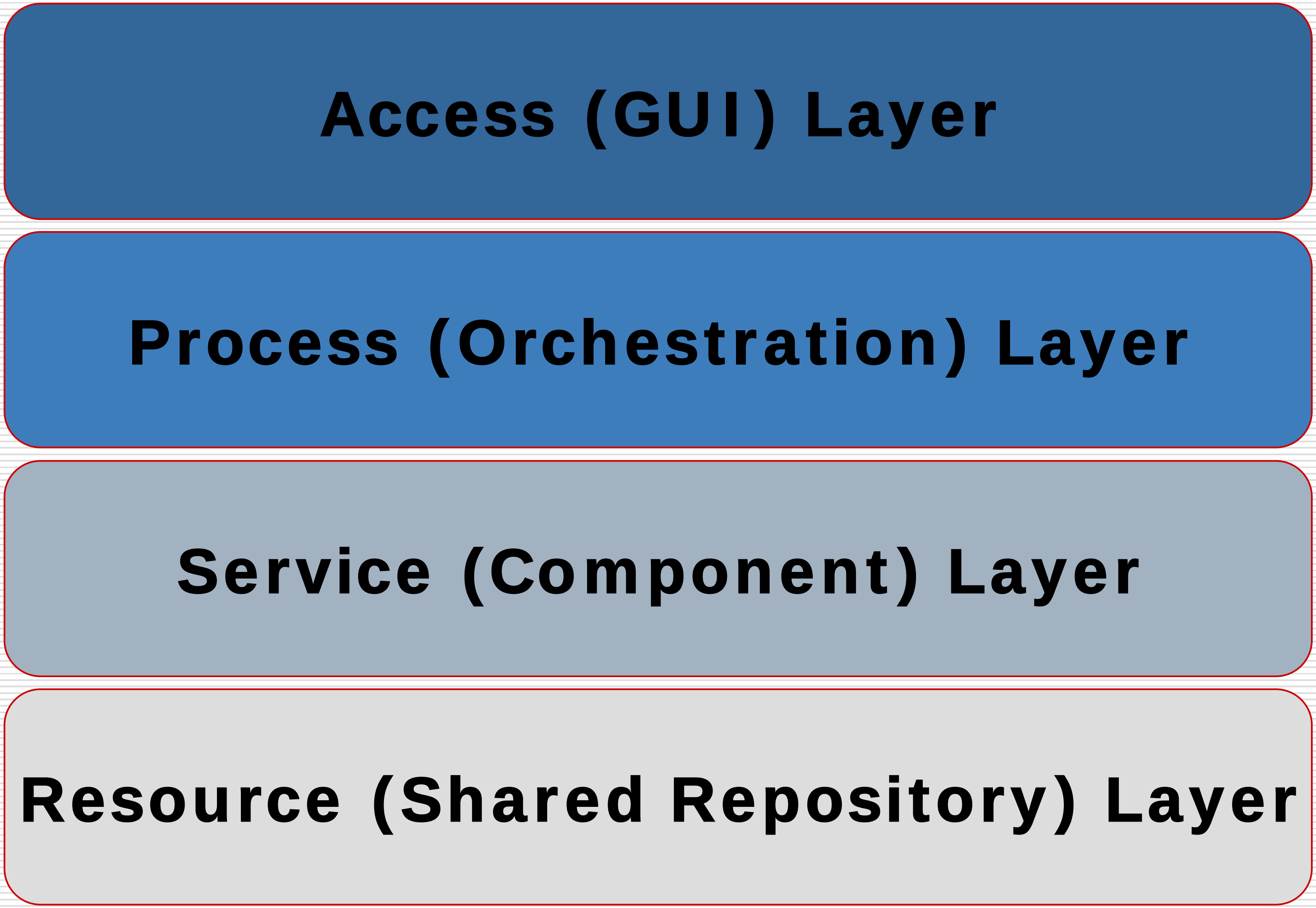
proprietary encoding

proprietary protocol

Sensor Integration: EWMS



Tsunami Service Bus: SOA Layers



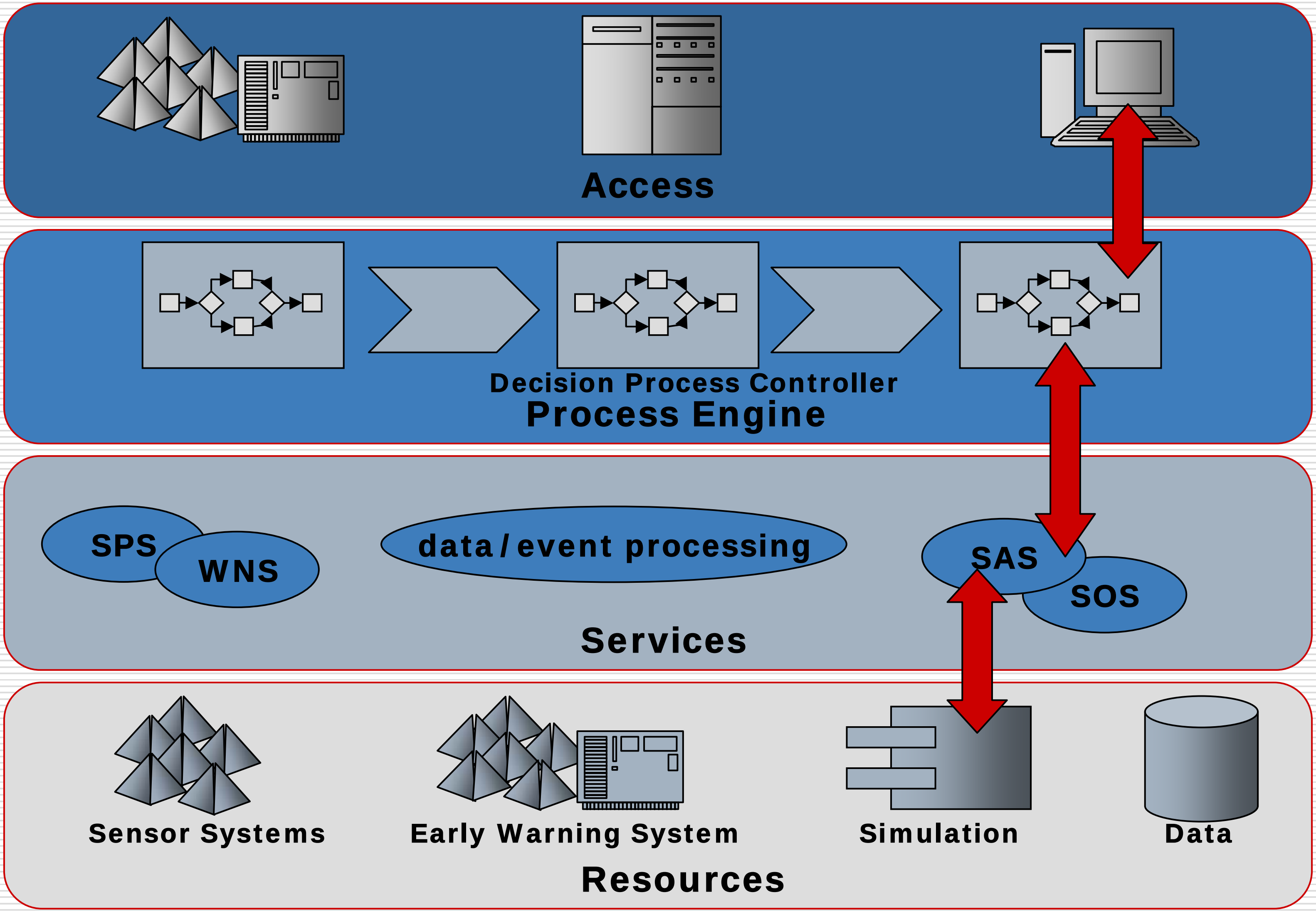
Access (GUI) Layer

Process (Orchestration) Layer

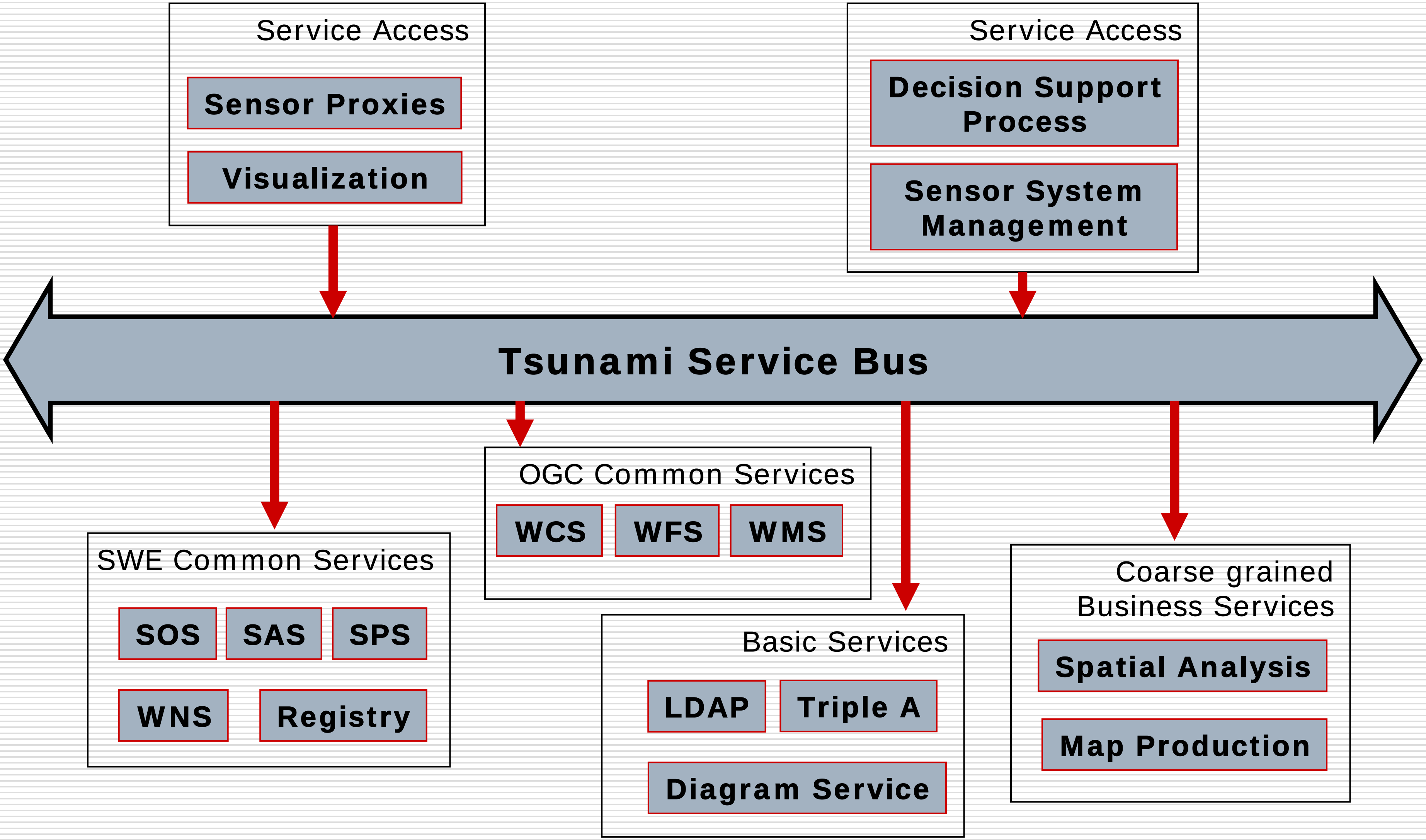
Service (Component) Layer

Resource (Shared Repository) Layer

Tsunami Service Bus: Scenario



Tsunami Service Bus



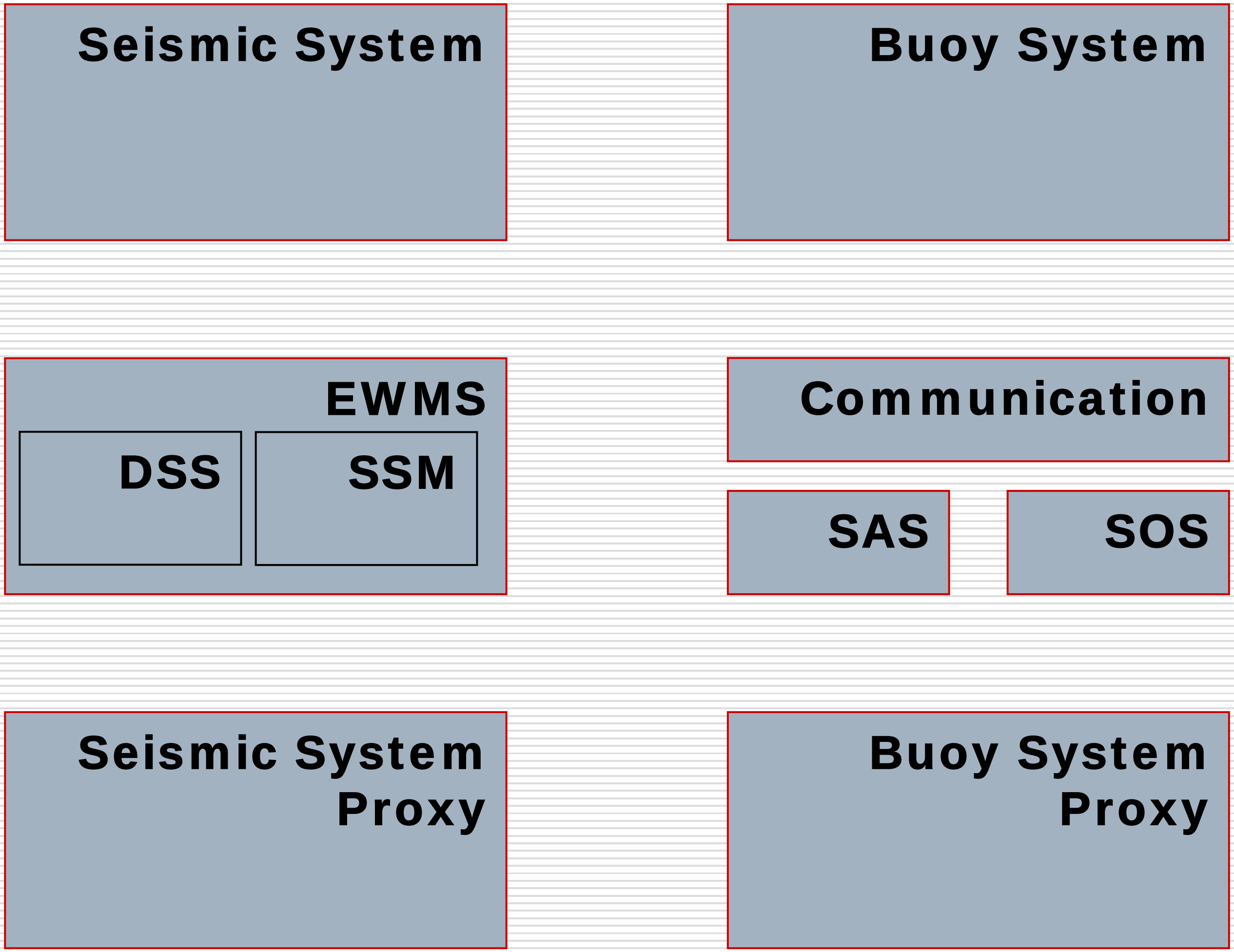
Tsunami Service Bus, what is

- Standards
  XML, SWE. OGC, ISO
- Protocols
  O&M, SOAP, WSDL, JMS
- Services
  SOS, SAS, WCS, Registry
- Processing Engines
  BPEL
- Loosely Coupling of Components
  Standardized Interfaces
- Middleware
  J2EE, JMS, SOAP

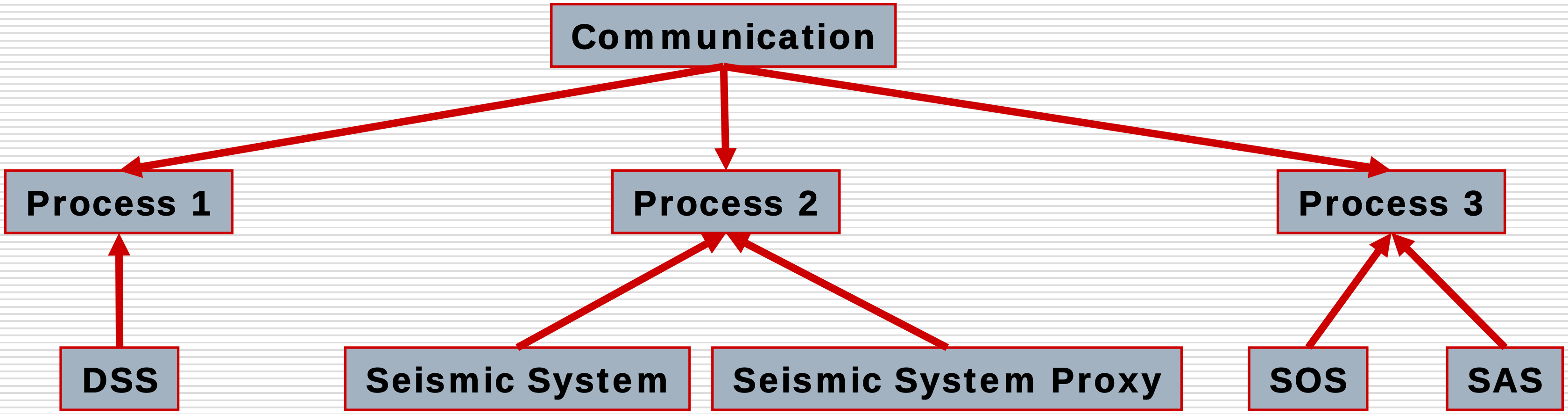
Software Architecture

- Logical View
- Physical View
  - Component View
  - Deployment View

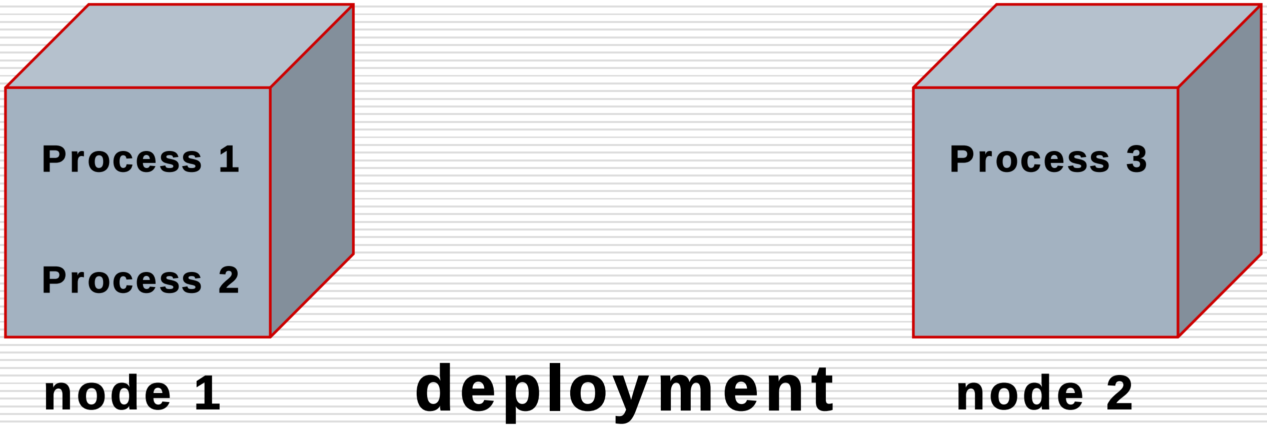
Logical View: Decomposition



Physical View: Composition

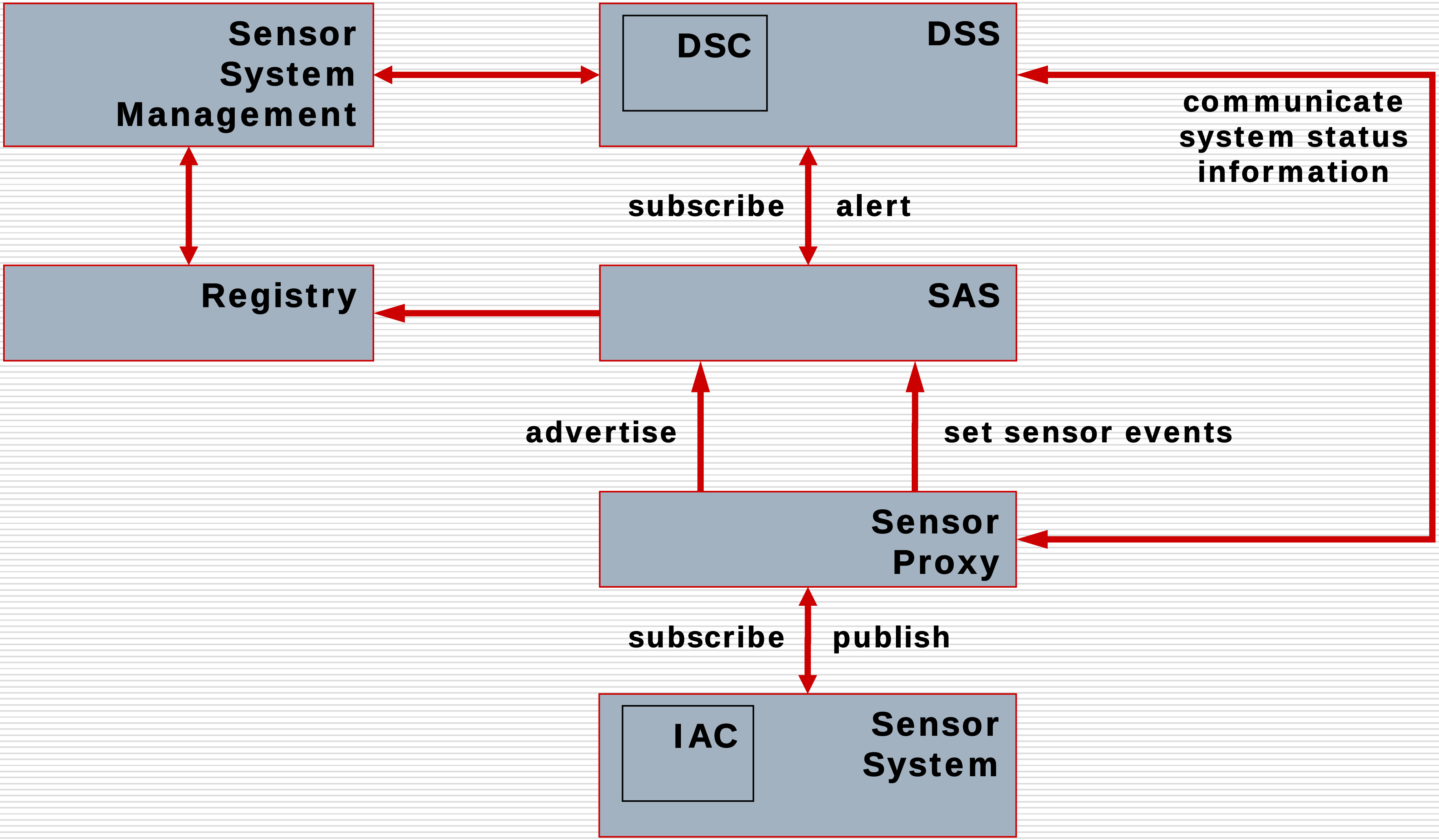


components

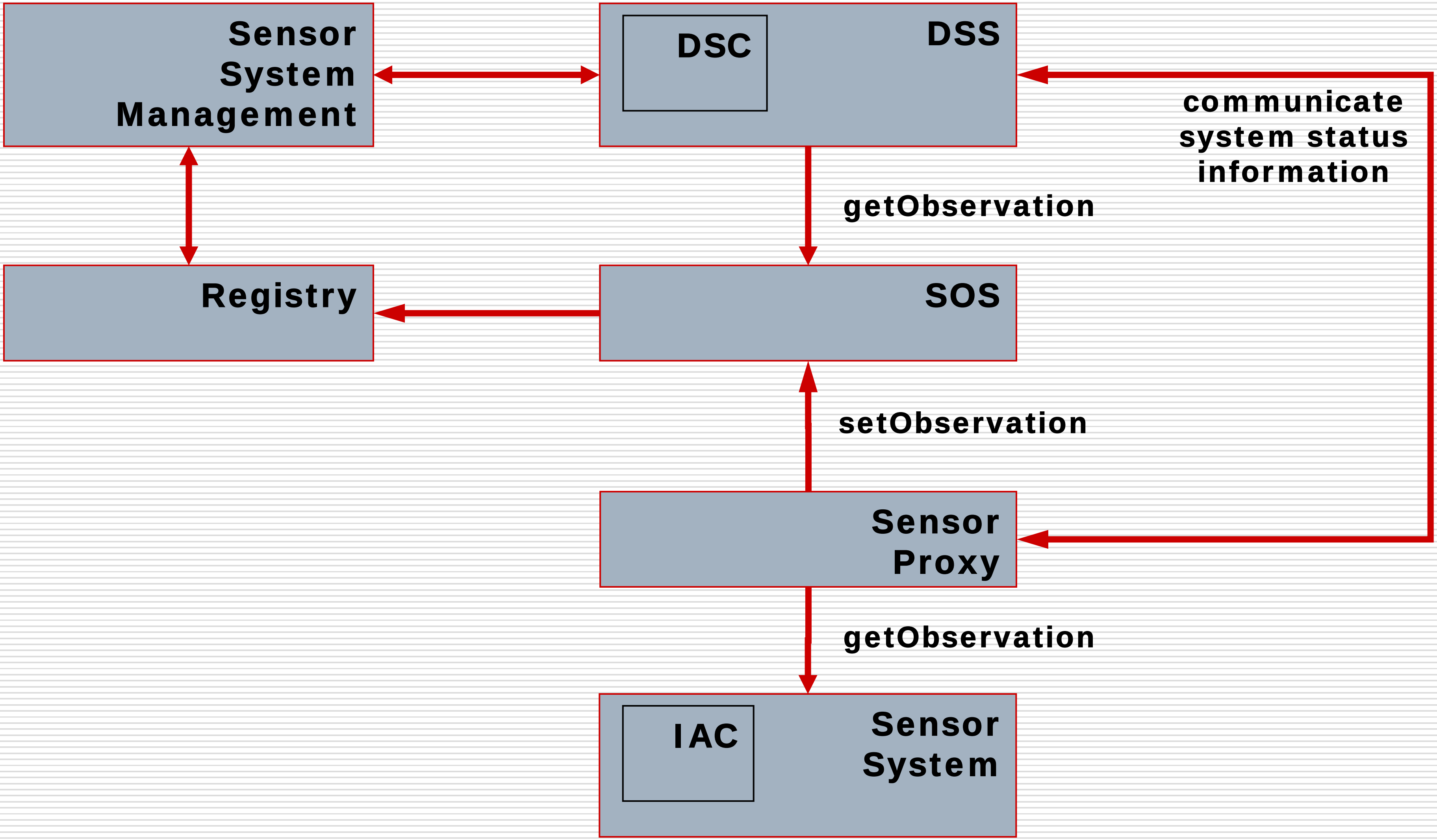


deployment

SWE, Sensor Proxy: SAS



SWE, Sensor Proxy: SOS



Sensor System Management

DSC

DSS

communicate system status information

getObservation

Registry

SOS

setObservation

Sensor Proxy

getObservation

IAC

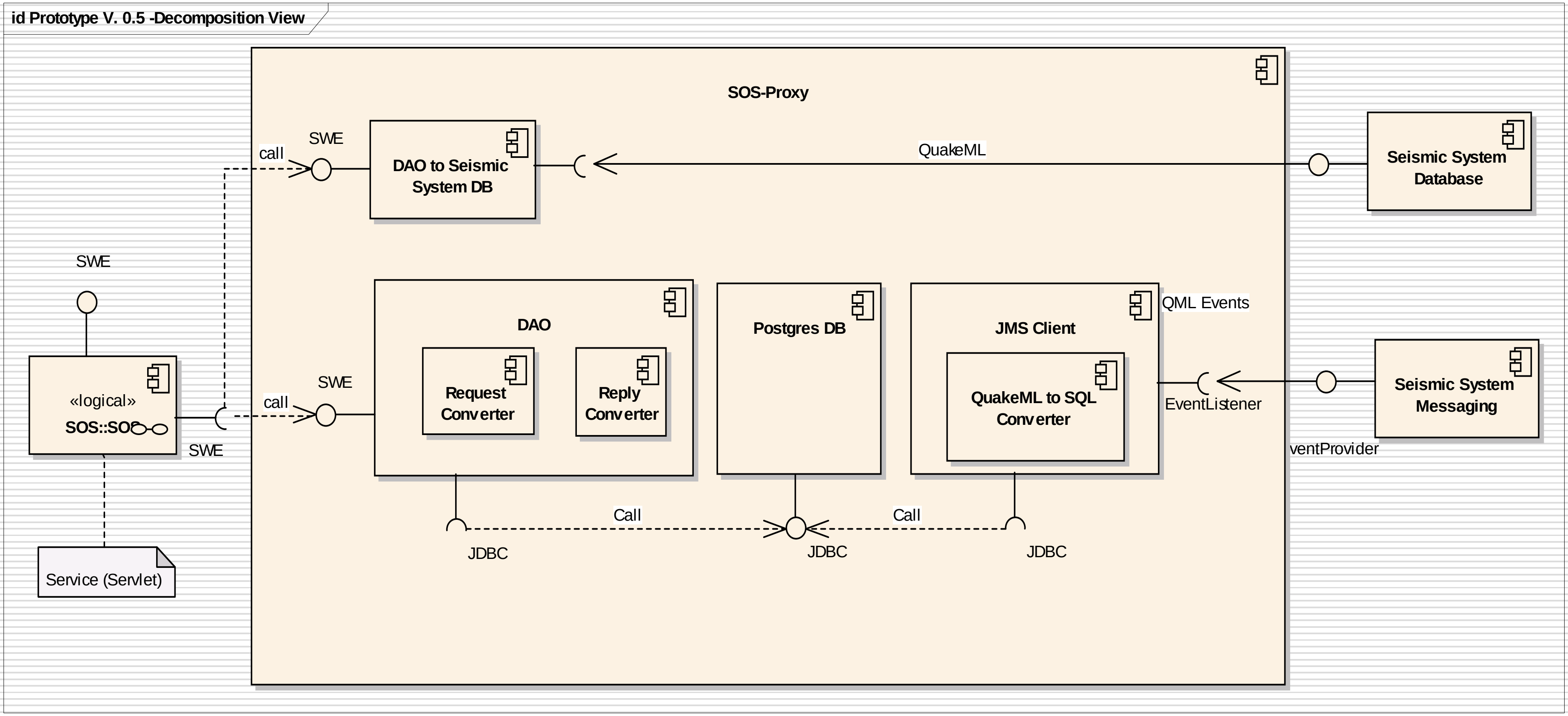
Sensor System

SWE, Sensor Proxy: SOS

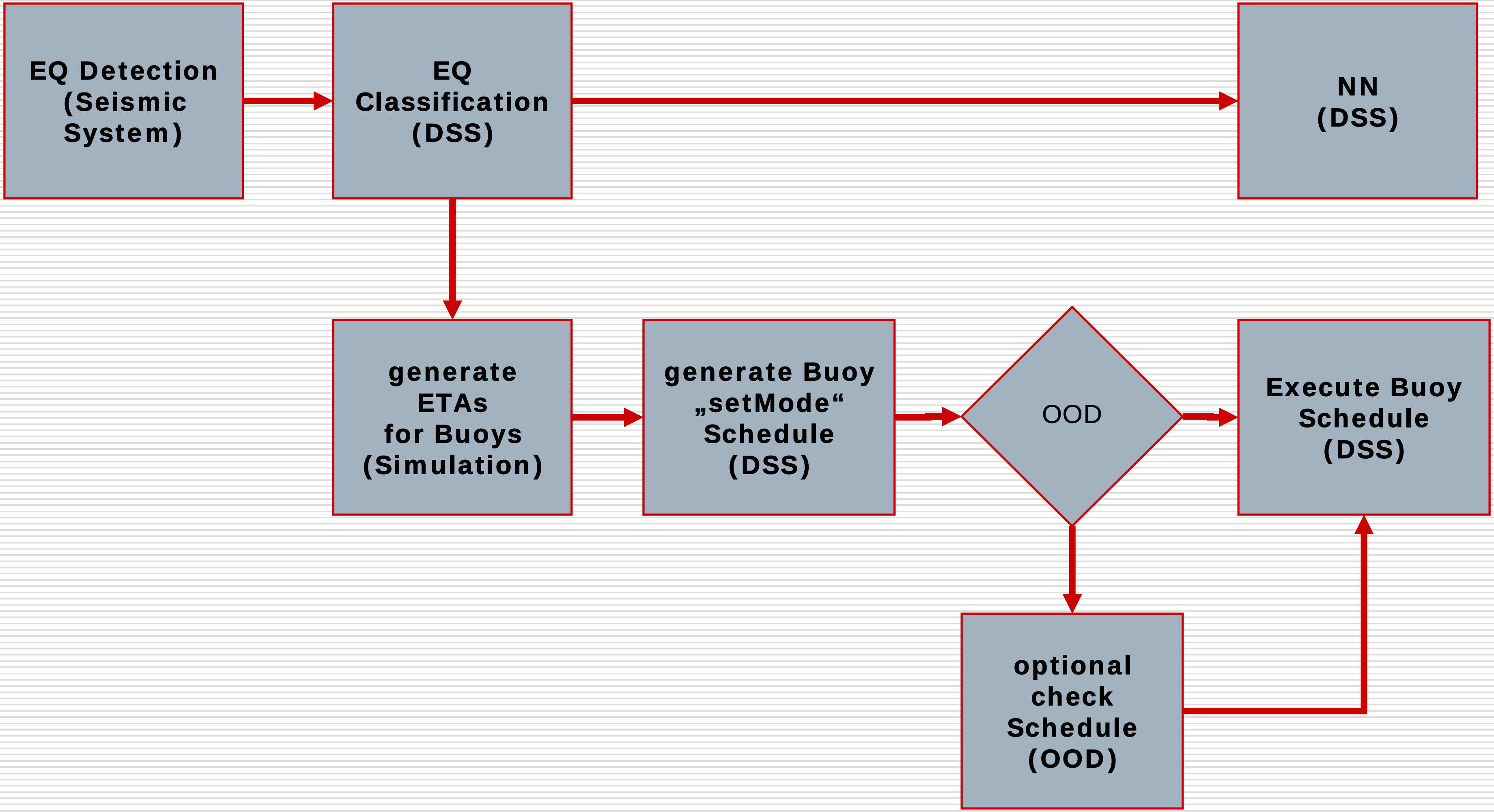
Some XML Code with XML Spy:
Seismic System Event Collection

Some buoy data with a visualization tool:
Sadly just simulated

Seismic System Proxy



Tsunami Service Bus: Process Flow (extract)



EQ Detection (Seismic System)

EQ Classification (DSS)

NN (DSS)

generate ETAs for Buoys (Simulation)

generate Buoy „setMode“ Schedule (DSS)

OOD

Execute Buoy Schedule (DSS)

optional check Schedule (OOD)