# Software Architecture and data processing

Architecture

The **general COCOP architecture** is based on loose coupling of systems using a message bus architecture. The approach emphasizes a separation of concern of message semantics and communication protocols. Agreed message structures form the basis of information produced and consumed between system components.
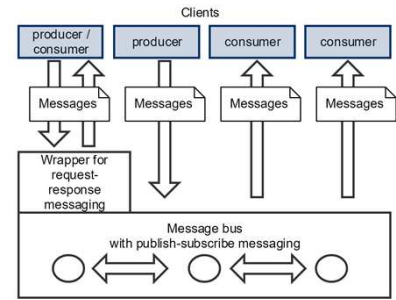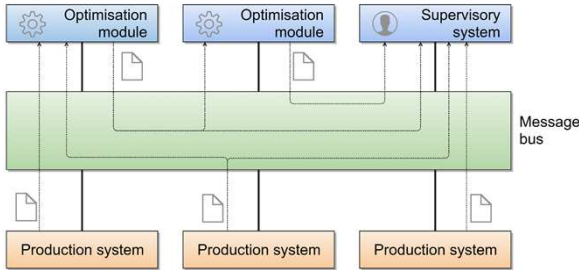

The communication architecture relies on the message bus as a broker. In addition to publish-subscribe communication, the architecture also considers request-response based communication to support integration to a variety of existing systems.

Data repository and data pre-processing

To support the model development (conventional and data based) and the optimization,

- the collection of data in repositories and the extension of existing databases must be done continuously,
- the collected data must be representative,
- the applied infrastructure and implemented interfaces for accessing these repositories must ensure the interoperability between the various systems and applications
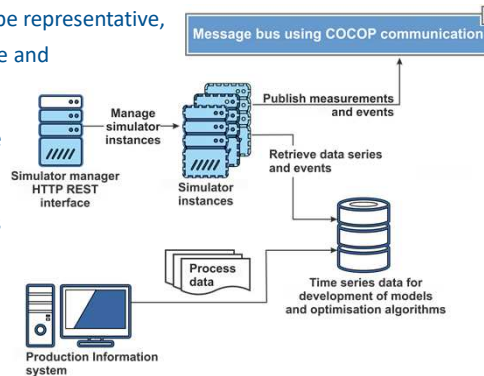
- the pre-processing of collected data is essential for proper model development,
- methods of re-sampling, filtering, identification and removal of noisy data, and replacement by interpolated/extrapolated or modelled data are used to clean and repair data,
- time dynamics and delays are compensated from time-series and dynamic data,
- data transformations, e.g. by FFT, extract necessary information from the signals.

Detection of 2-dimensional outliers
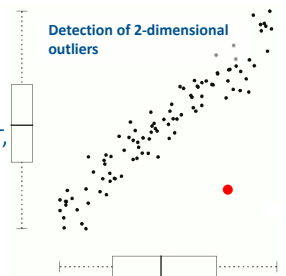
SDK

- The two-layer approach has advantages:
  1. Design is straightforward, when messages are separated from delivery
  2. If one layer is later replaced, the other can stay intact
- The communication protocol is AMQP, which is a standard
- The message structures are based on standards as well
  - XML schemata by Open Geospatial Consortium (http://opengeospatial.org)
- SDKs have been developed for .NET (C#) and Java
  - Still, any runtime is possible for the each software module
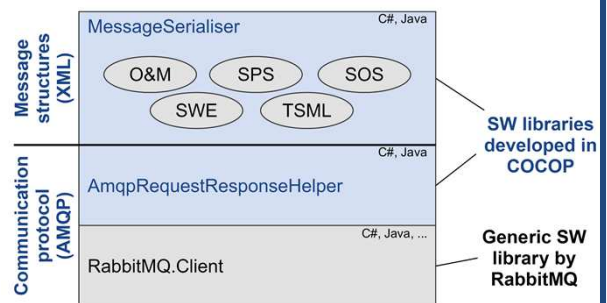
O&M	Observations and Measurements (2013)	Measurements and metadata
SOS	Sensor Observation Service (2012)	Request-response delivery of measurements
SPS	Sensor Planning Service (2011)	Management of tasks
SWE	SWE Common Data Model Encoding Standard (2011)	Generic data structurres
TSML	TimeseriesML (2016)	Data structures for time series