Use of OGC Sensor Web Enablement Standards in the Meteorology Domain

in partnership with

METEO FRANCE
Toujours un temps d'avance

Alexandre Robin   -   March 2013

Outline

Introduction to OGC Sensor Web Enablement Standards

- Web services
- Metadata encodings

SWE as front-end of METEO FRANCE Ground Obs. Network

- Use of modified 52° North software
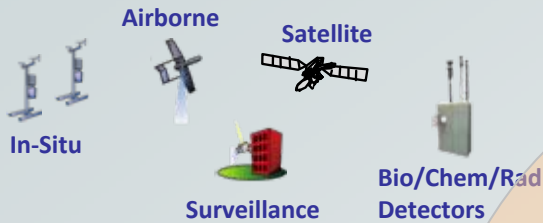- Lessons learned

Other Possible Uses of SWE in Meteorology

- Other observation types (buoys, radars, profilers and sounders...)
- Directly on sensor hardware
- Models and simulation

Sensia
Software

Introduction to SWE Standards

Sensor Web Enablement Framework

Heterogeneous Sensor Networks

Airborne

Satellite

In-Situ

Surveillance

Bio/Chem/Rad Detectors

Any type of sensors

Decision Support Tools
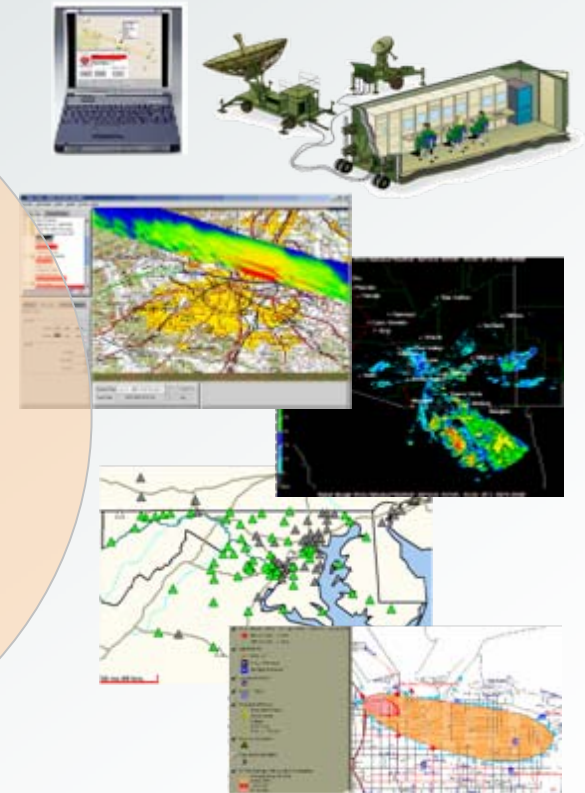
Sensor Web Enablement

- Discovery
- Data Access
- Asset Tasking
- Alerts and Notifications

Web services and encodings
based on Open Standards
(OGC, ISO, OASIS, IEEE)

Models and Simulations
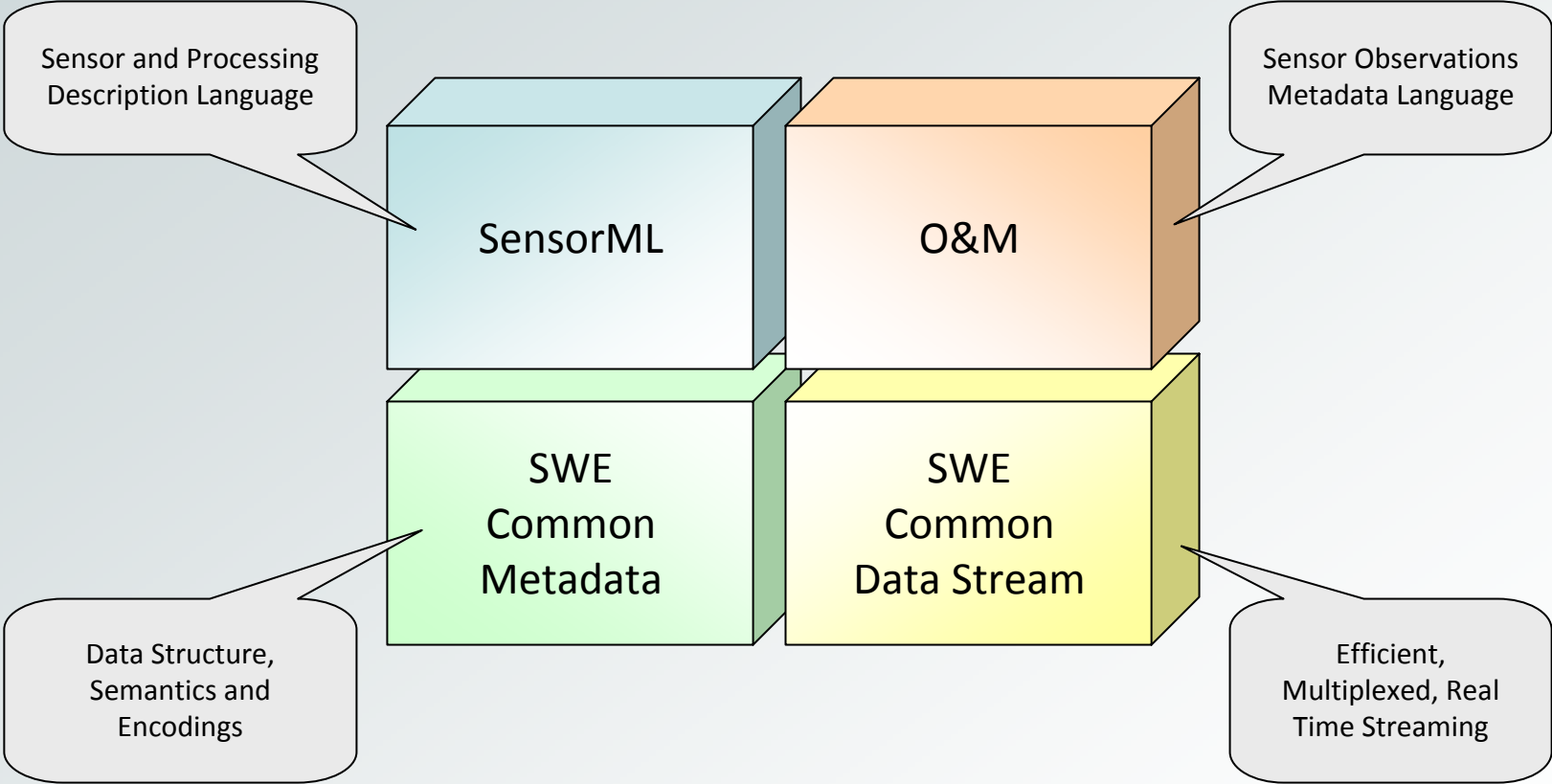
Models of any scale and complexity

Vendor neutral, application specific
tools based on generic software

Sensia Software

SWE Components – Web Services

Access sensor description and observations

SOS

Command and task sensor systems

SPS

Discover services, sensors, providers, datasets

Catalog Service

SAS

Dispatch sensor alerts to registered users

Accessible from various types of clients from PDAs and cell phones to high end workstations

Clients

Sensia Software
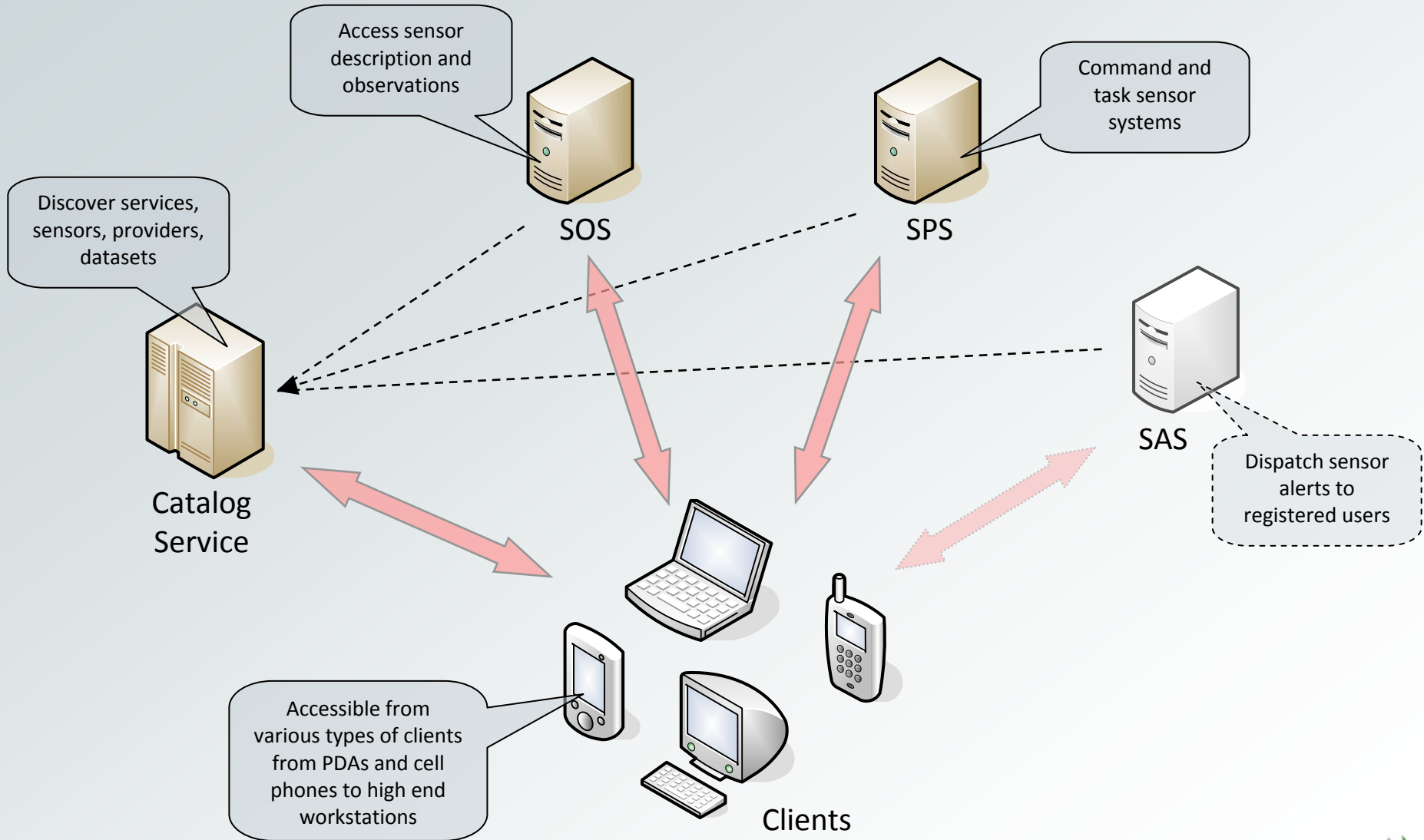
SWE Components – Metadata Encodings

Sensor and Processing
Description Language

Sensor Observations
Metadata Language

SensorML

O&M

SWE
Common
Metadata

SWE
Common
Data Stream

Data Structure,
Semantics and
Encodings

Efficient,
Multiplexed, Real
Time Streaming

Sensia
Software

O&M – Observation Centric Viewpoint

Feature of Interest

GML

Procedure

SensorML

O&M Observation

Time

Geometry

Result Data

SWE Common
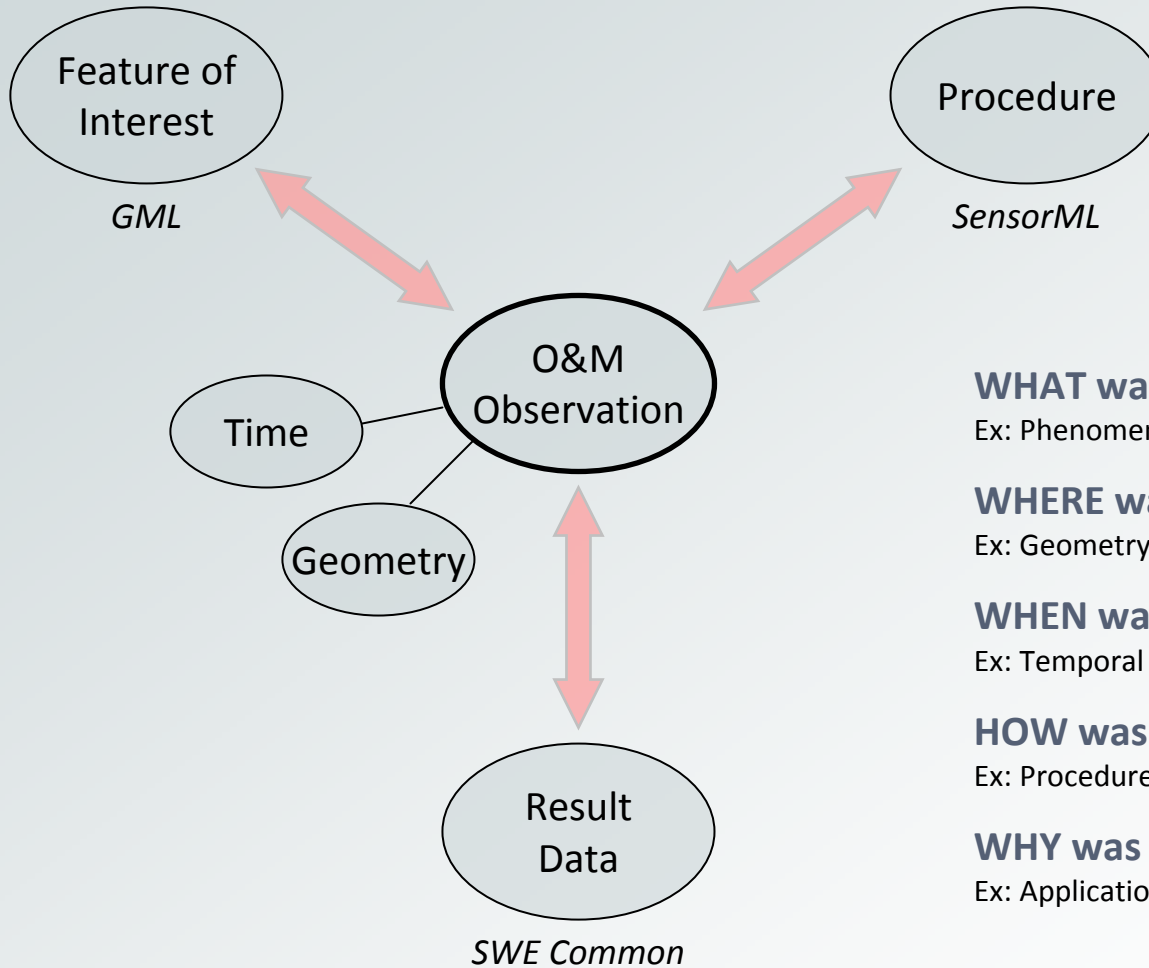
WHAT was measured?
Ex: Phenomenology, Spectral Response

WHERE was it measured?
Ex: Geometry, Sampling, Spatial Response

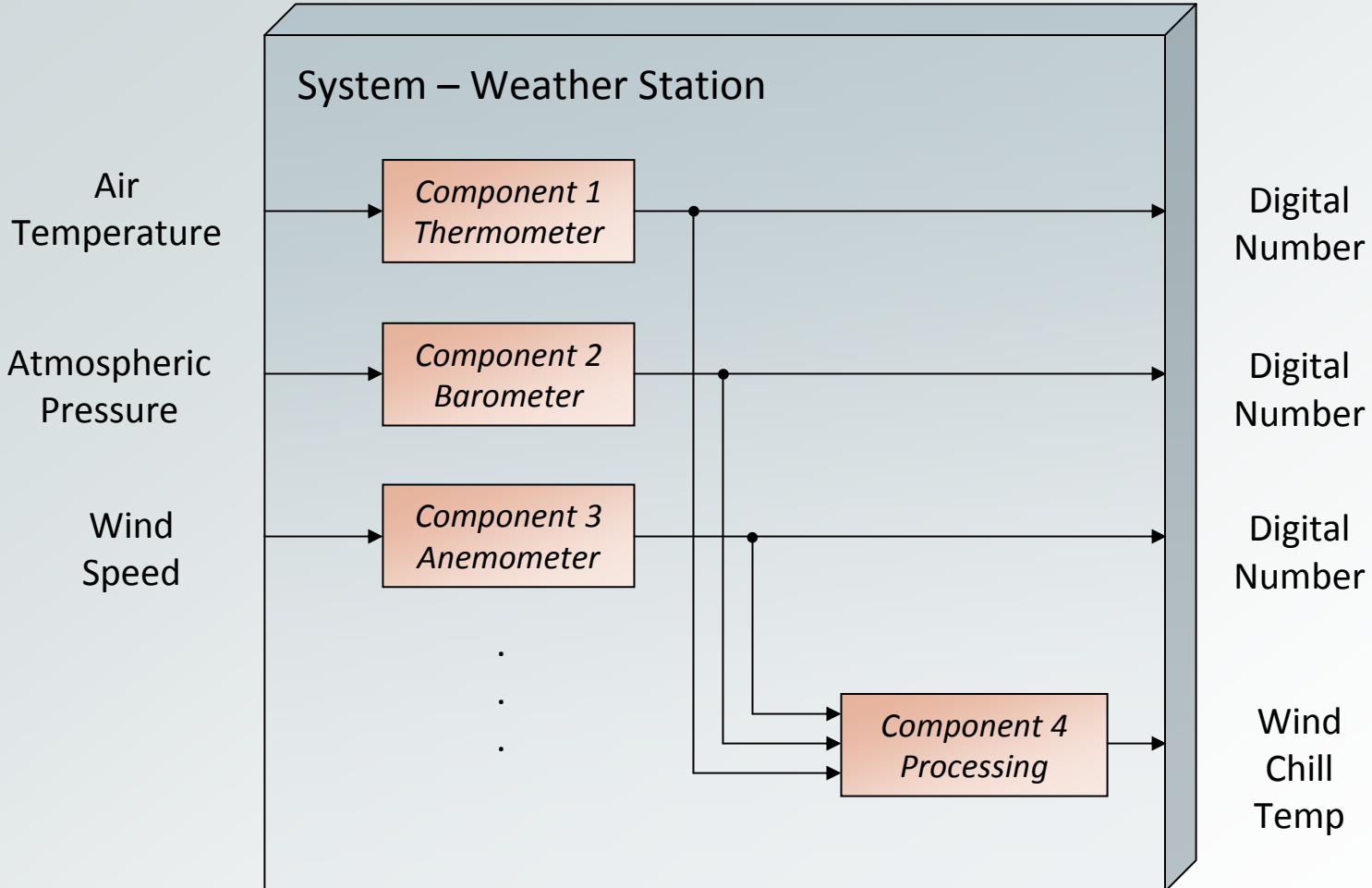**WHEN was it measured?**
Ex: Temporal Sampling, Impulse Response

HOW was it measured?
Ex: Procedure, Quality, Calibration

WHY was it measured?
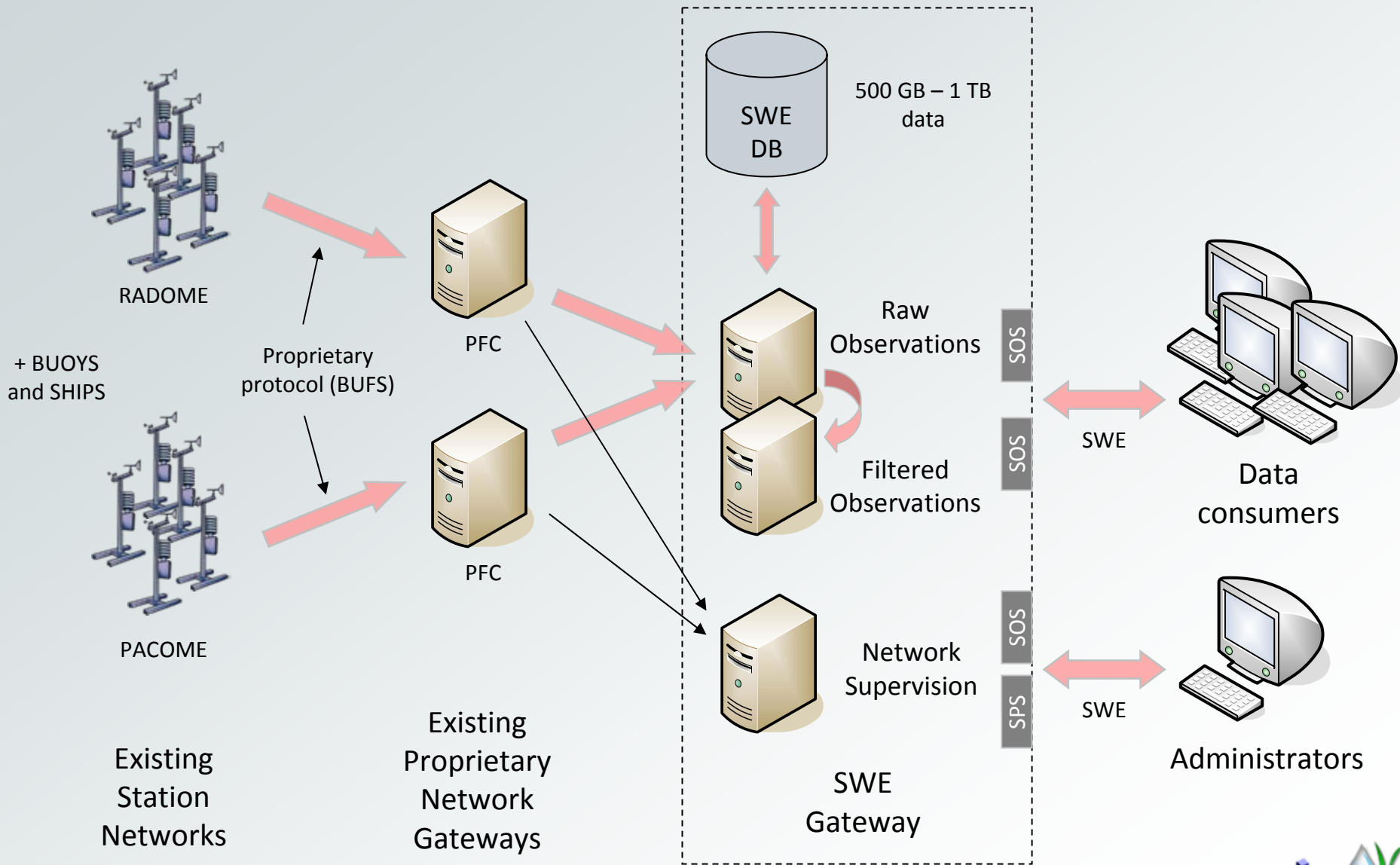Ex: Application, Further processing

Sensia Software

SensorML – Sensor System

System – Weather Station

Air Temperature → Component 1 Thermometer → Digital Number

Atmospheric Pressure → Component 2 Barometer → Digital Number

Wind Speed → Component 3 Anemometer → Digital Number

Component 4 Processing → Wind Chill Temp

Sensia
Software

SWE as front-end of METEO FRANCE

Ground Observations Network

Sensia
Software

Overall Architecture

RADOME

+ BUOYS and SHIPS

Proprietary protocol (BUFS)

PFC

PFC

PACOME

SWE DB

500 GB – 1 TB data

Raw Observations

SOS

Filtered Observations

SOS

SWE

Data consumers

Network Supervision

SOS

SPS

SWE

Administrators

Existing Station Networks

Existing Proprietary Network Gateways

SWE Gateway

Sensia Software

Software Implementation

Built on SWE standards version 1.0

Based on 52° North SOS and SPS implementations

- Modified to reduce database size (several millions rows per day, total size of 500GB - 1 TB)
- Modified to reduce capabilities document size
  (Features of Interest and Procedures not listed)
- Added support for deletion/update of sensor stations
- Added support for new SWE Common data types (i.e. time)

Developed a SensorML profile + Dictionary

- Description of stations and all installed sensors
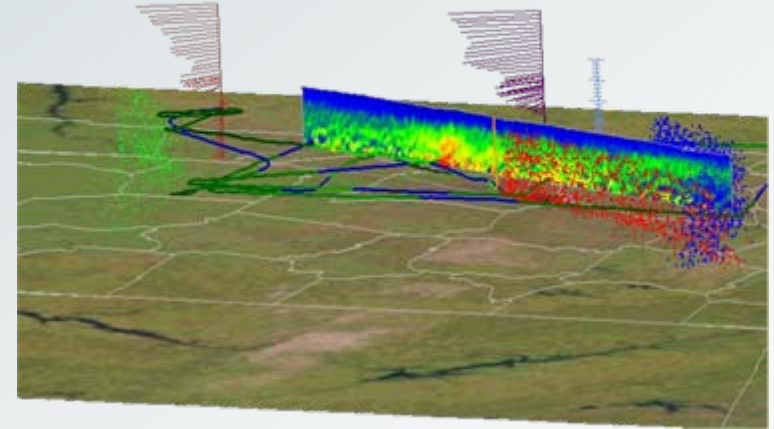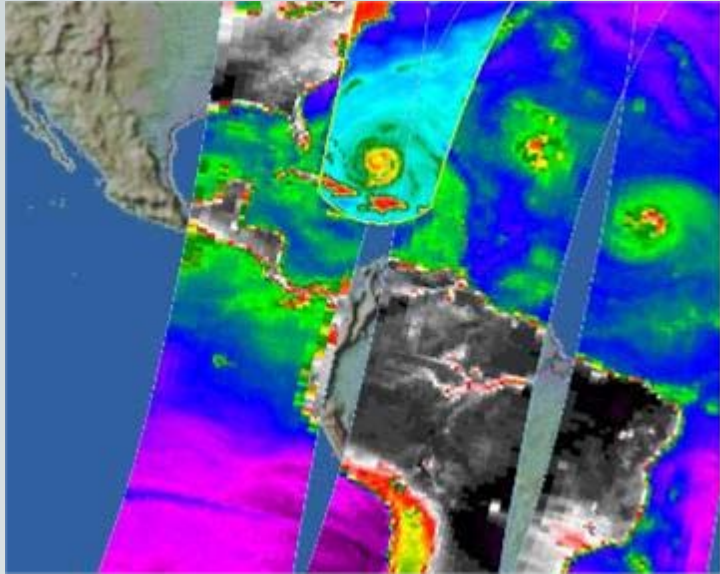- Model with separate sampling points (airport runways)

Sensia
Software

Lessons Learned

☑ **Successfully adapted to cover our use-cases**

☑ **SWE models well adapted to describe ground stations, sensors and observations**

☑ **Could not use existing server implementation "out-of-the-box"** (customization and improvements necessary)

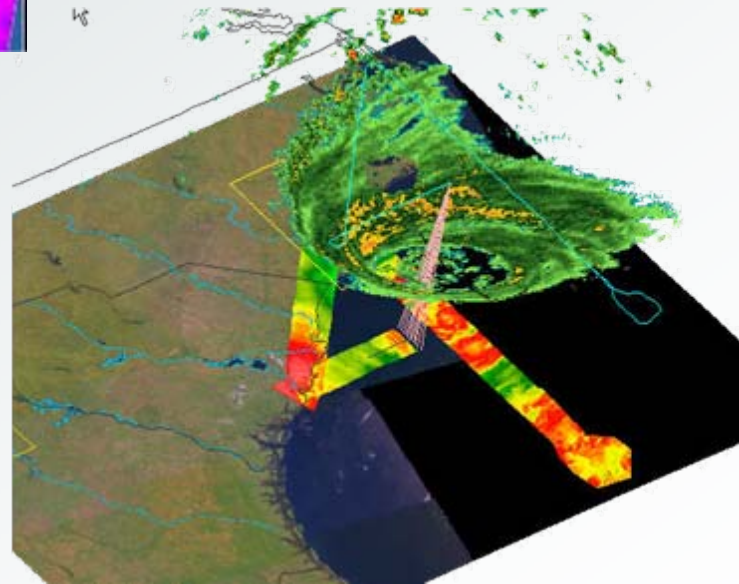☒ **Concept of capabilities document not adapted for large networks**
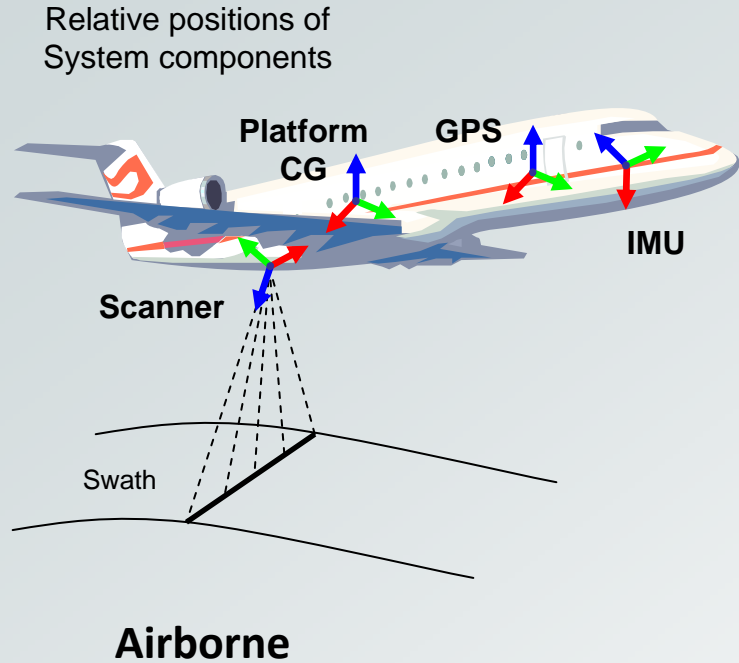
Sensia Software

Other Possible Uses
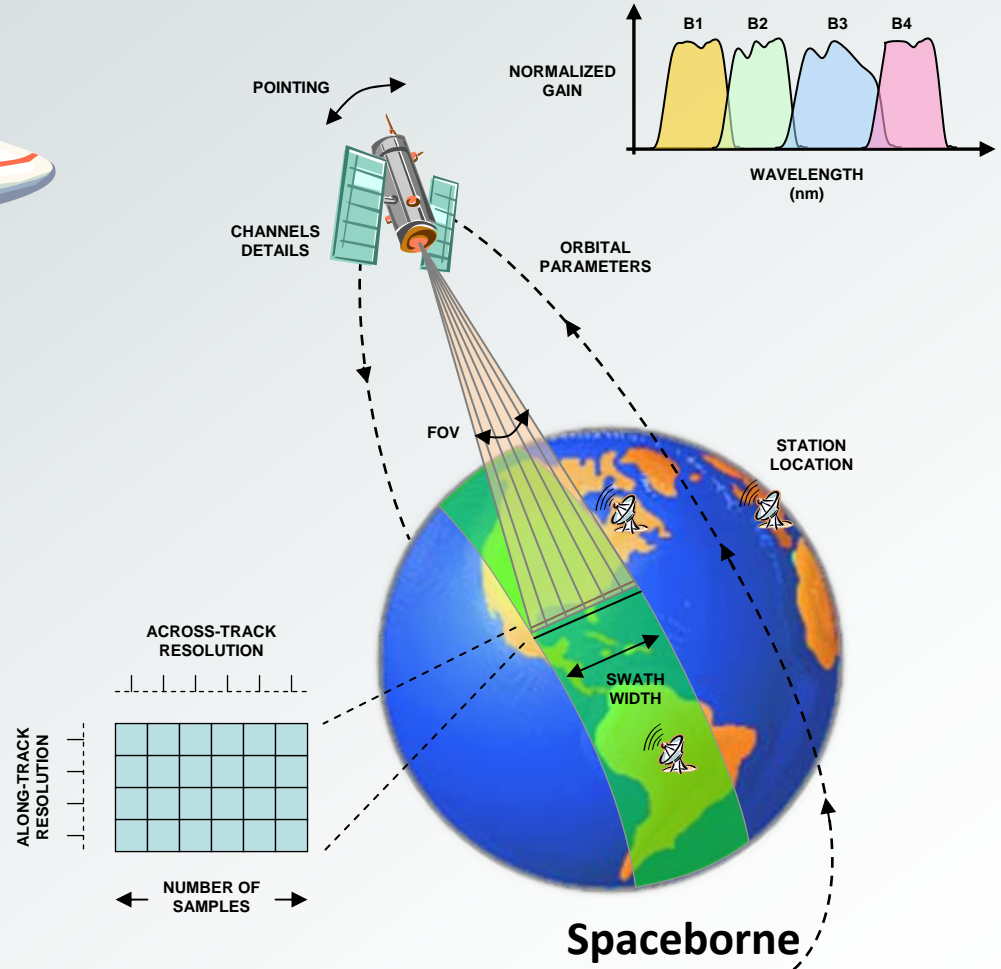# of SWE in Meteorology

SWE in Atmospheric Sciences

**SWE Common
encoded data
visualized in
Space Time Toolkit**

Sensia
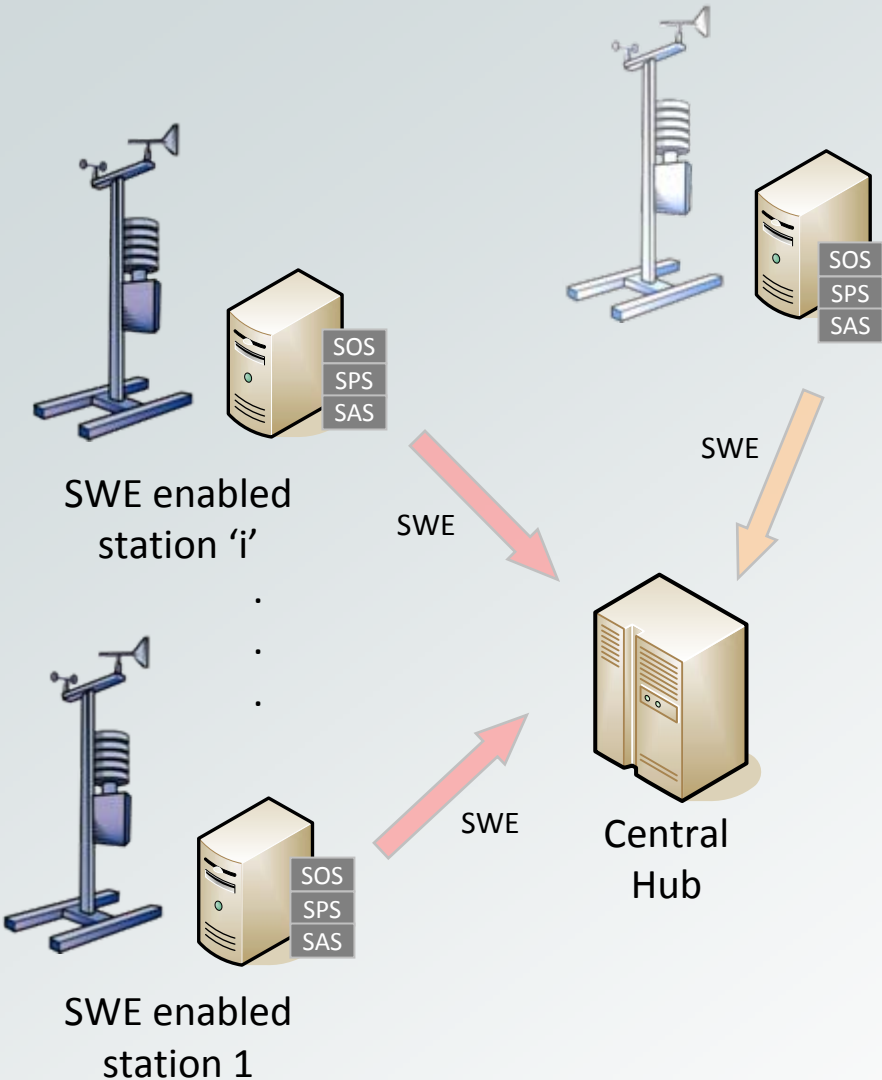Software

SWE in Earth Observation

Relative positions of
System components

Platform CG

GPS

IMU

Scanner

Swath

Airborne

Description of complex systems with SensorML

POINTING

CHANNELS DETAILS

NORMALIZED GAIN

B1 B2 B3 B4

WAVELENGTH (nm)

ORBITAL PARAMETERS

FOV

STATION LOCATION

ACROSS-TRACK RESOLUTION

ALONG-TRACK RESOLUTION

SWATH WIDTH

NUMBER OF SAMPLES

Spaceborne

Sensia
Software

SWE on Sensor Hardware

New station model easily inserted in the network

SWE enabled station 'i'

.
.
.

SWE enabled station 1
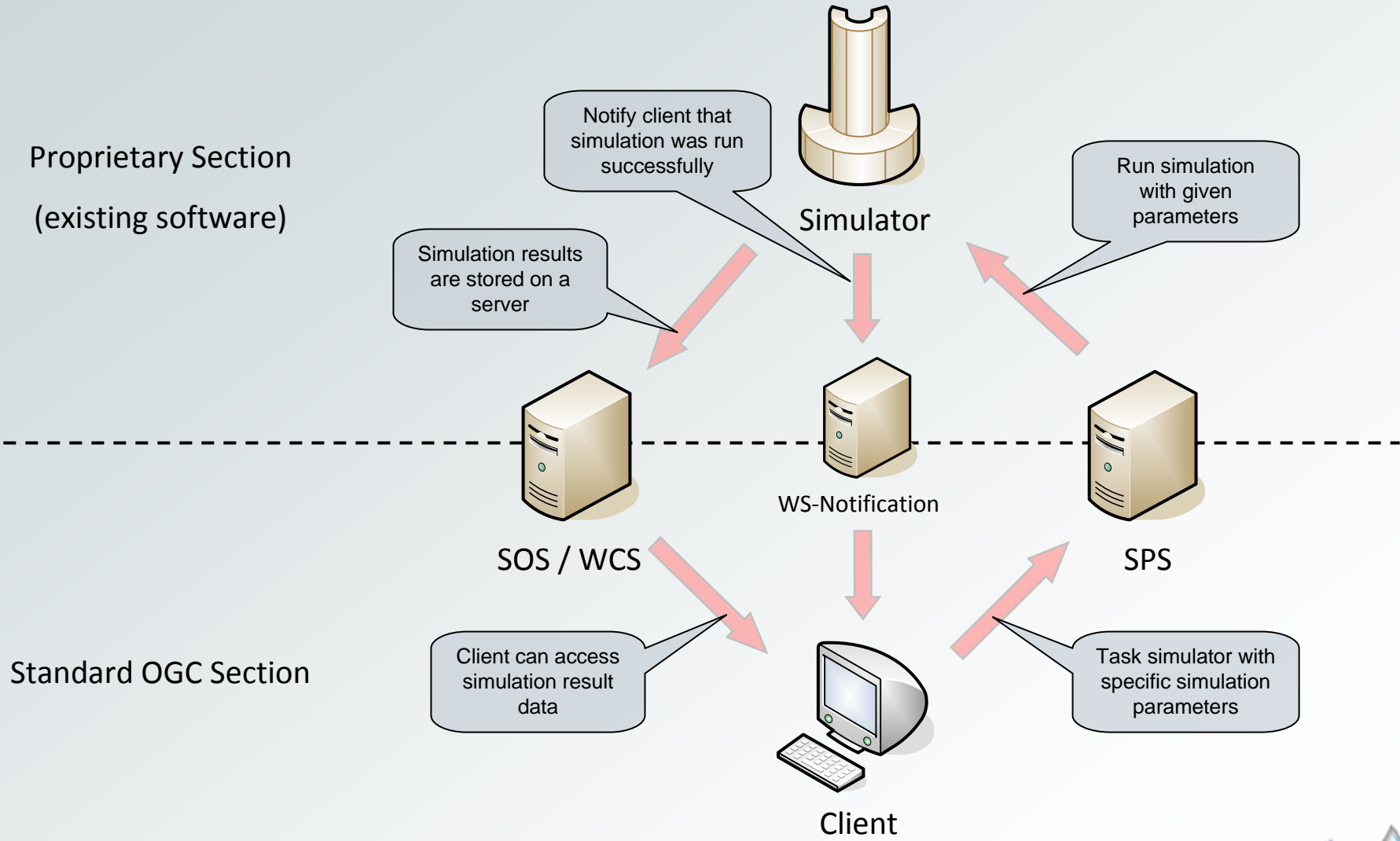
SOS
SPS
SAS

SWE

SWE

SWE

SWE

Central Hub

SWE on chip

More and more powerful single board computers
(such as ARM powered Raspberry Pi)

Sensia Software

SWE for Simulation and Models

Proprietary Section
(existing software)

Notify client that simulation was run successfully

Simulator

Run simulation with given parameters

Simulation results are stored on a server

WS-Notification

SOS / WCS

SPS

Standard OGC Section

Client can access simulation result data

Task simulator with specific simulation parameters

Client

Sensia Software

Thank you for your attention.

Any questions ?

alex.robin@sensiasoftware.com