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# From ORCHESTRA to SANY – An Open Sensor Service Architecture for Early Warning Systems

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DEWS Midterm Conference 2009  
Potsdam, Germany

8th July 2009

Dr. Désirée Hilbring, Fraunhofer IITB

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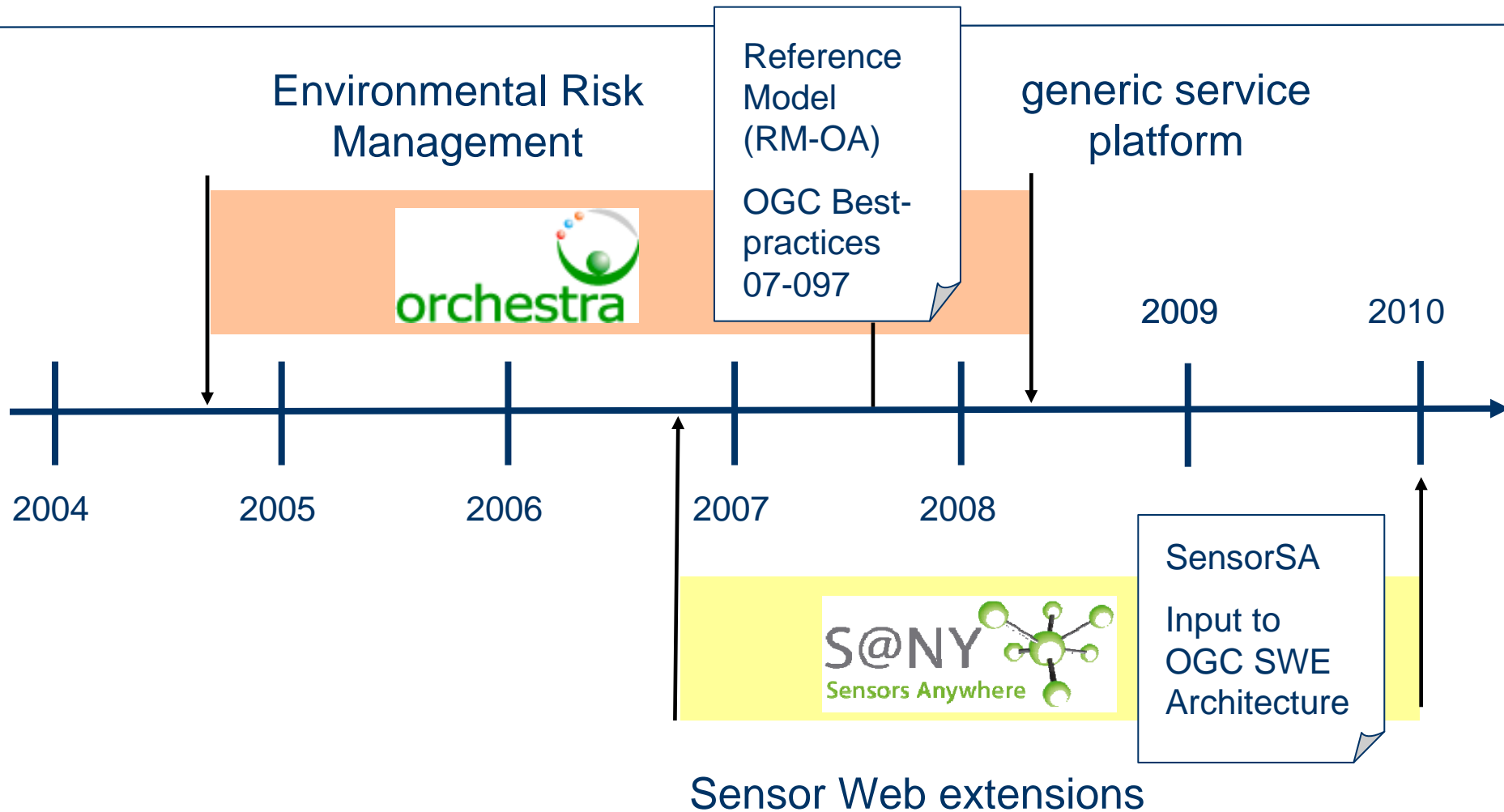
# Contents

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## From ORCHESTRA to SANY

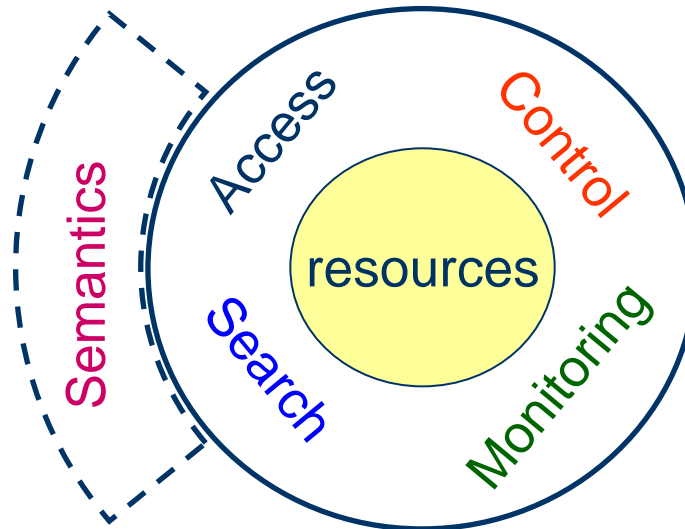
- Architecture
- Discovery
- Fusion: SANY Testbed
- Early Warning: EWS Transport

# Architecture – Timeline



# Architecture – Services/Interfaces

- Service Capabilities I/F
- Feature Access Service
- Map and Diagram Service
- Schema Mapping Interface
- Coordinate Operation Service
- Processing Service
- Ontology Access Interface
- Annotation Service
- Catalogue Service
- Sensor Access Service



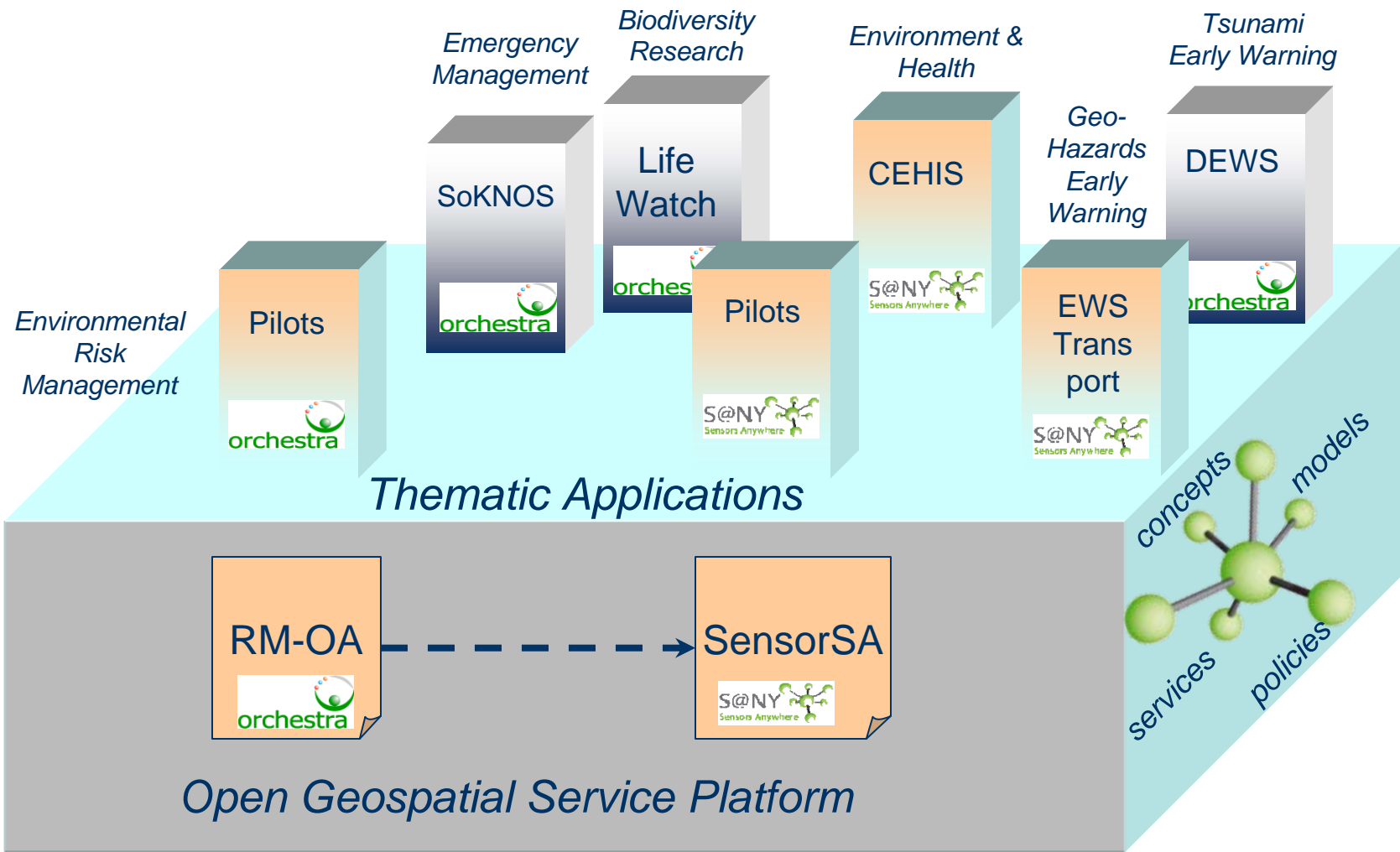
- Profile Management Service
- Identity Management and Authentication Service
- Policy Management and Authorisation Service
- Policy Enforcement Service

Service Monitoring  
Service (OGC SOS)



- OGC Sensor Observation Service
- OGC Sensor Alert Service
- OGC Sensor Planning Service
- OGC Web Notification Service
- OASIS Web Service Notification

# Architecture – Reuse and Uptake



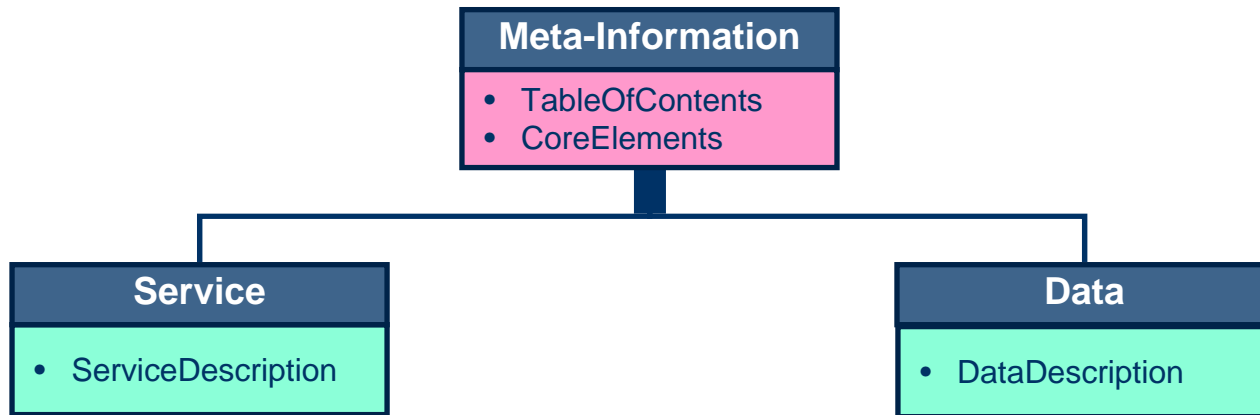
# Discovery – ORCHESTRA Catalogue Service (CS)

CS is independent from meta-information schema

Default ORCHESTRA meta-information schema

- supports the resource types “Service” and “Data”
- is flexible
- has mandatory sections: **table of contents, core elements**
- supports the definition of **optional sections**

Typical user query: “Give me all services supporting standard interface x”



# Discovery – SANY Requirements

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- Meta-information schema shall address the discovery of resources related to Sensor Web environments
- Sensor related meta-information shall be queryable

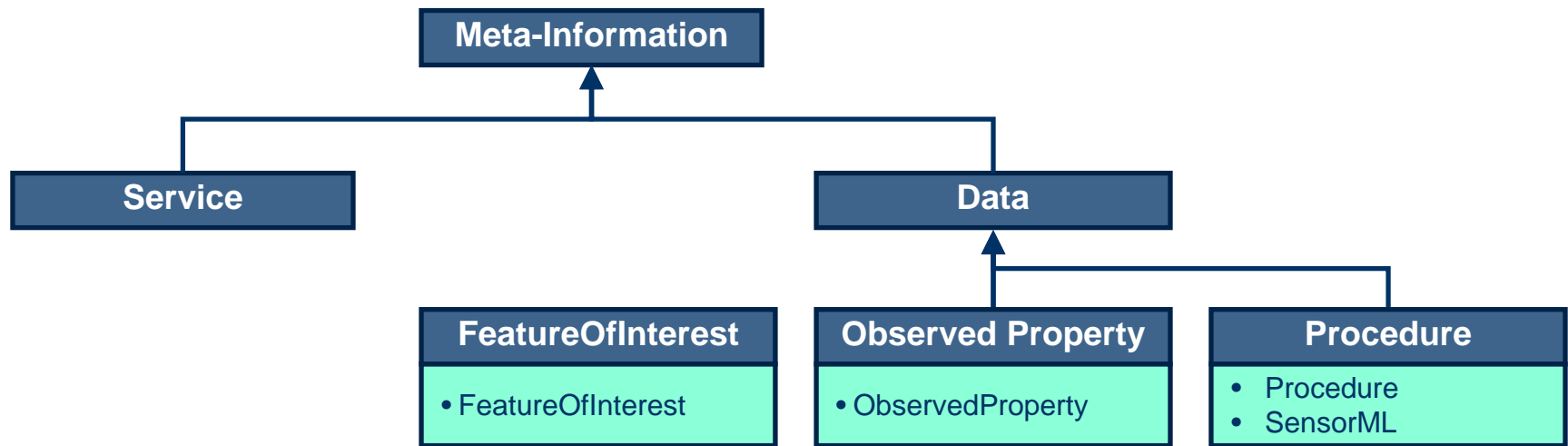
Typical questions to a catalogue containing sensor resources:

- “Give me all temperature observations in Germany in May 2009”
- “Give me all entries observed by a specific sensor”

# Discovery – SANY Meta-Information Schema (1)

SANY meta-information schema

- is an extension of the ORCHESTRA meta-information Schema
- Defines new resource types according to OGC Observation and Measurement Model
- Defines new optional sections





# Discovery – SANY Meta-Information Schema (2)

## SANY meta-information schema

- Definition of new queryables for sensor related searches:  
**ObservedProperty, FeatureOfInterest, Procedure, ServiceID**
- Find a service providing temperature observations:

Search for „**ObservedProperty** = temperature“

returns

### Observed Property

Title: Temperature  
ServiceLink: <http://ex.de/sos>

Search for „**ServiceID** = <http://ex.de/sos>“

returns

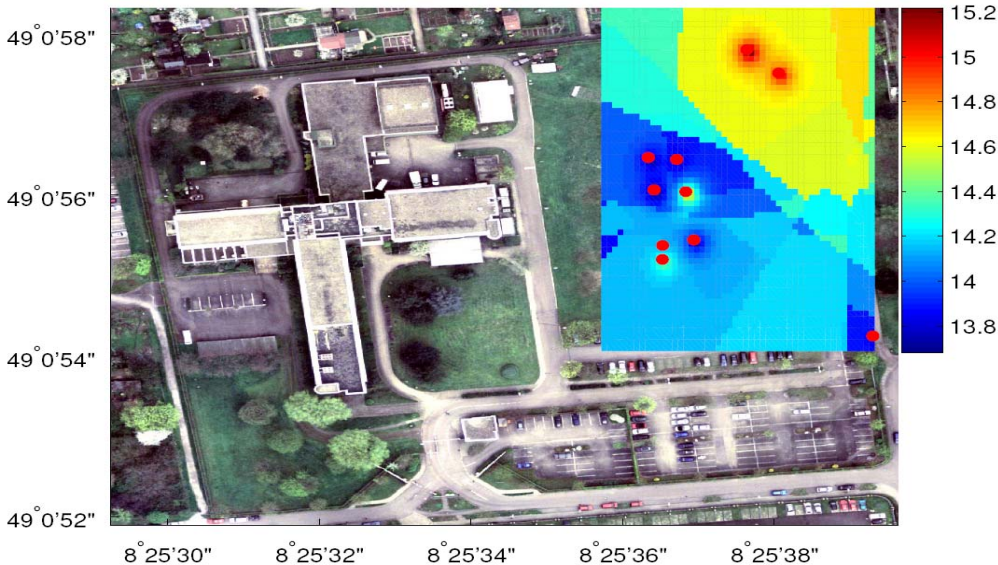
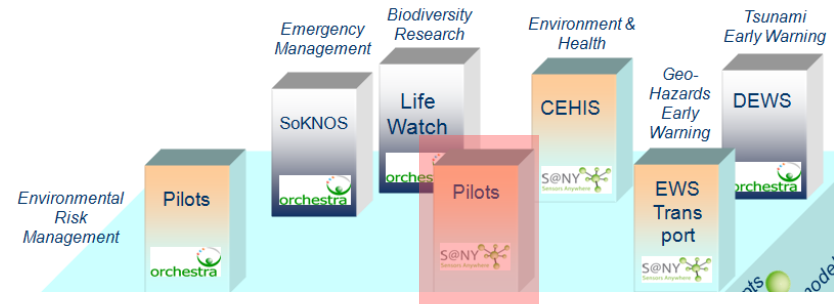
### Service

Title: Testbed SOS

# Fusion: SANY Testbed (1)

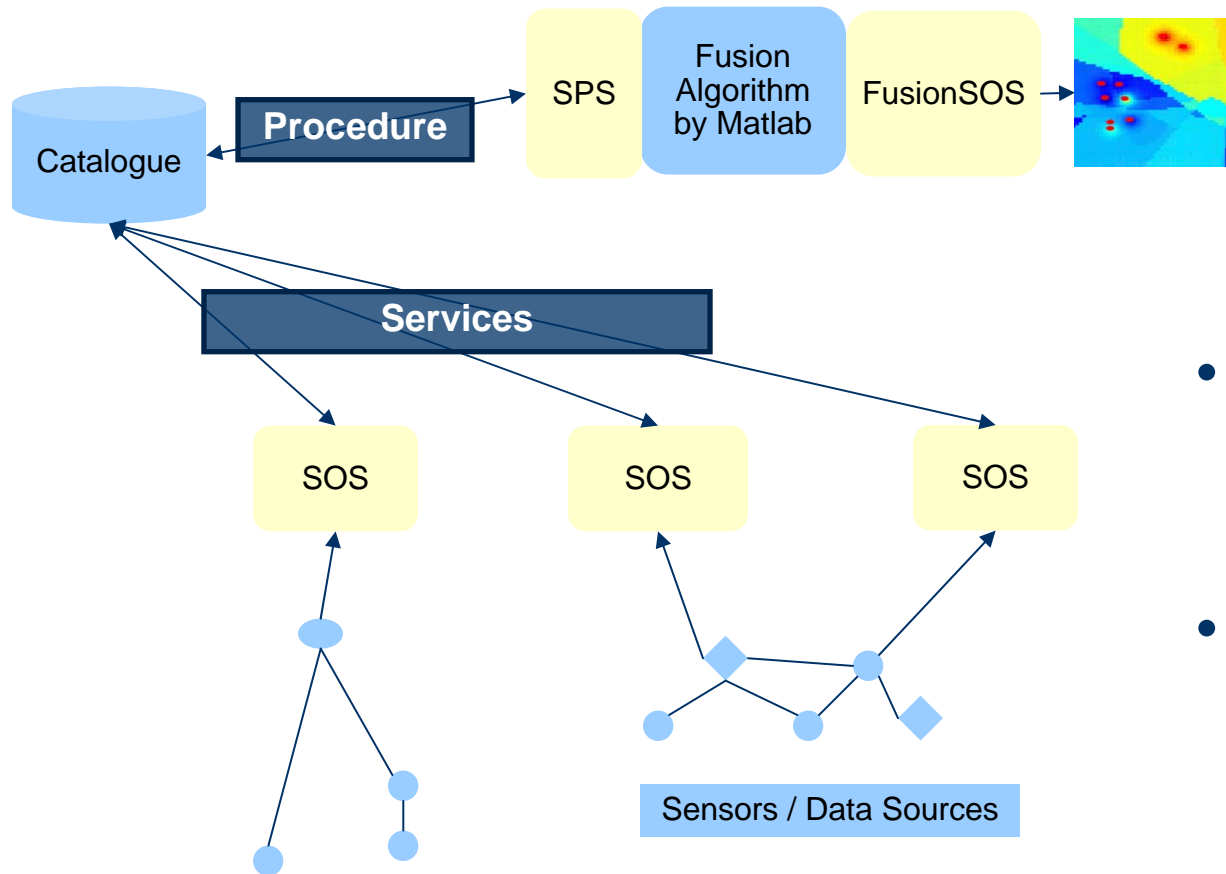
## Topic:

Fusion techniques enable the prediction of environmental parameters where sensing measurements are not available



**SANY Testbed:**  
Creation of temperature map

# Fusion: SANY Testbed (2)



- Query catalogue for SOS servers with *data* having desired characteristics (area, time, observed property (temperature))
- Query catalogue for SPS servers with *algorithms* for problem
- FusionSOS combines SOS data and delivers result coverage (temperature map)

## Project: EWS Transport

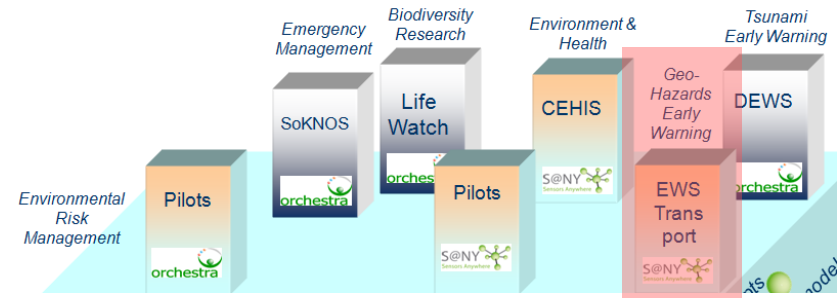
### Topic:

Earthquake Early Warning for Transport Lines

- Rapid production of an alert map during an ongoing earthquake useful as basis for train traffic alerts
- Immediate provision of a shake map after the strong motion phase used as basis for damage assessment

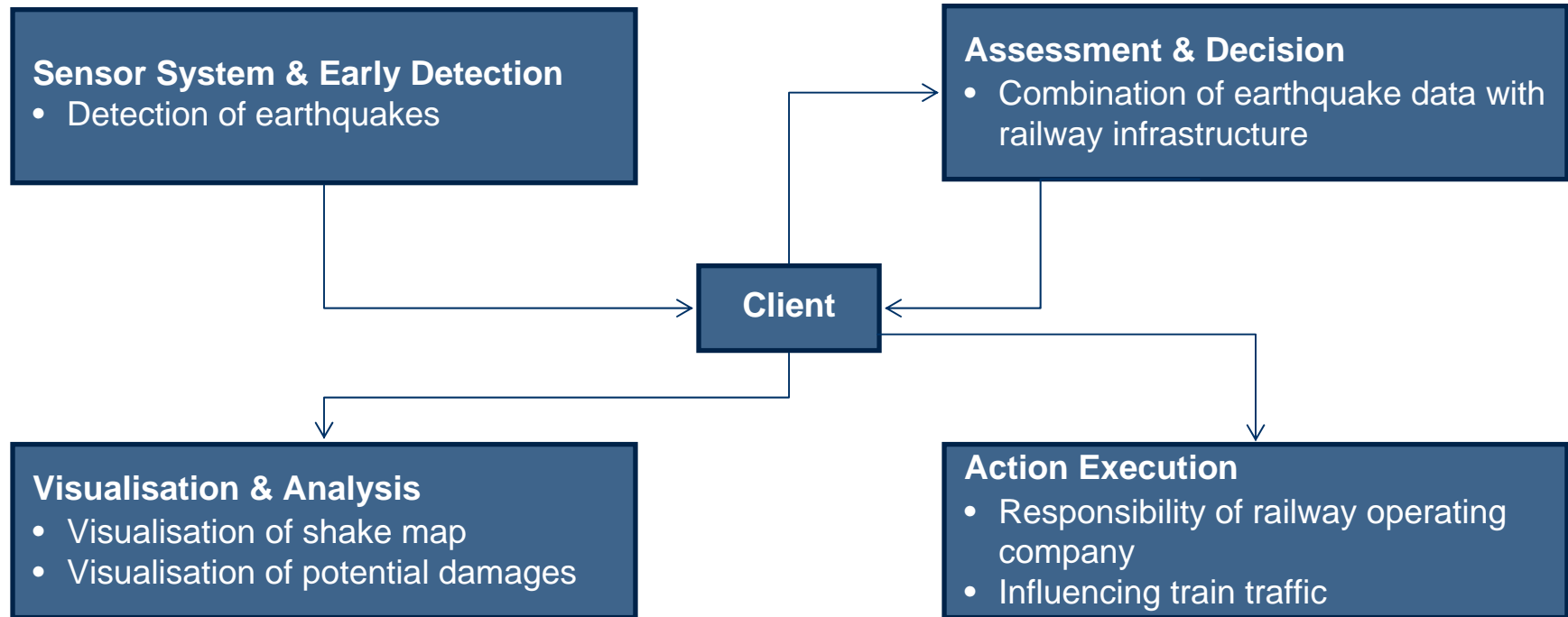
### Goal:

Design of the information system (upstream) as open service architecture



## Architecture of Information System:

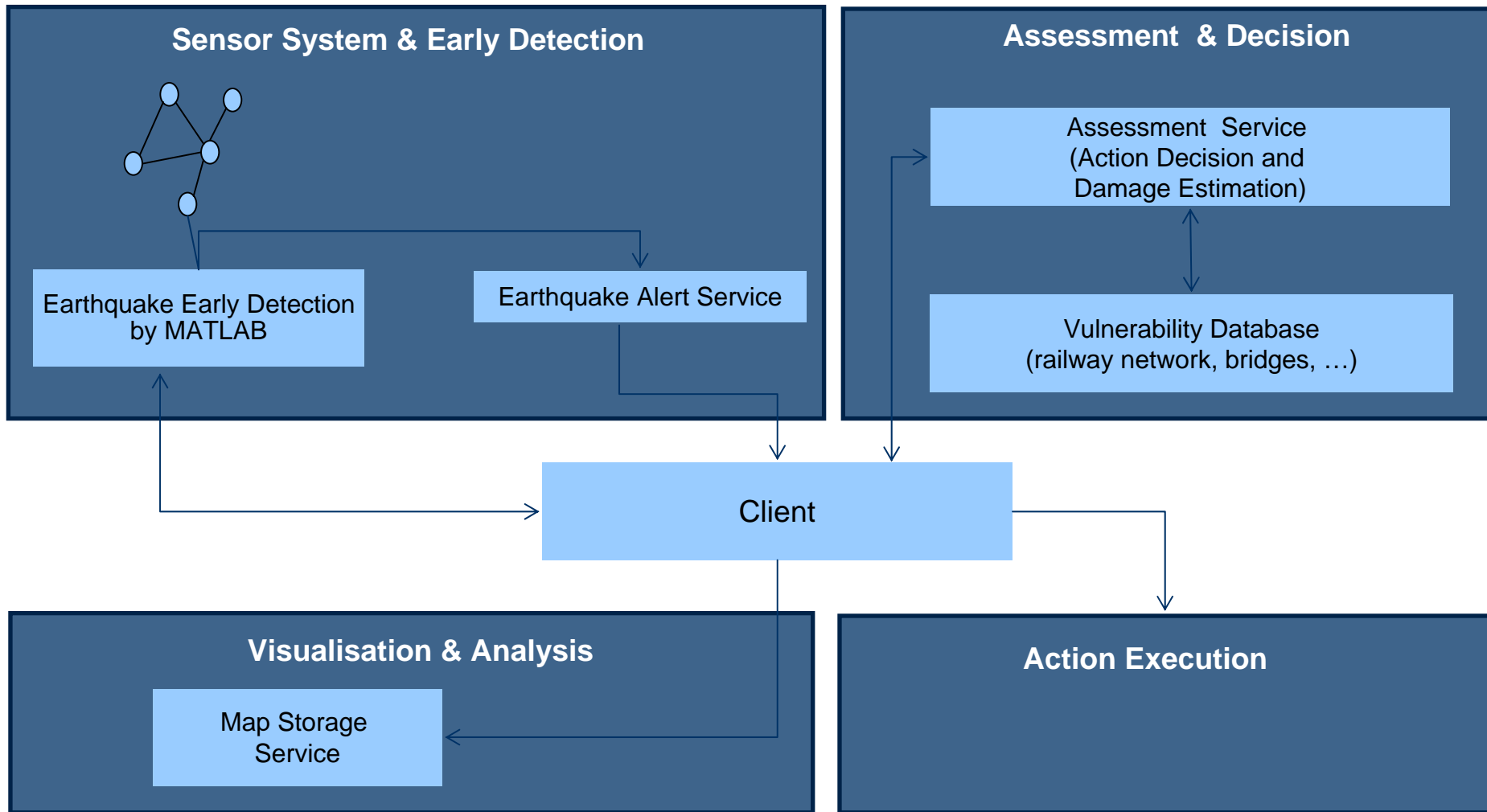
- Based on ORCHESTRA RM-OA
- Definition of scenario workflow



# Early Warning – Necessary Components



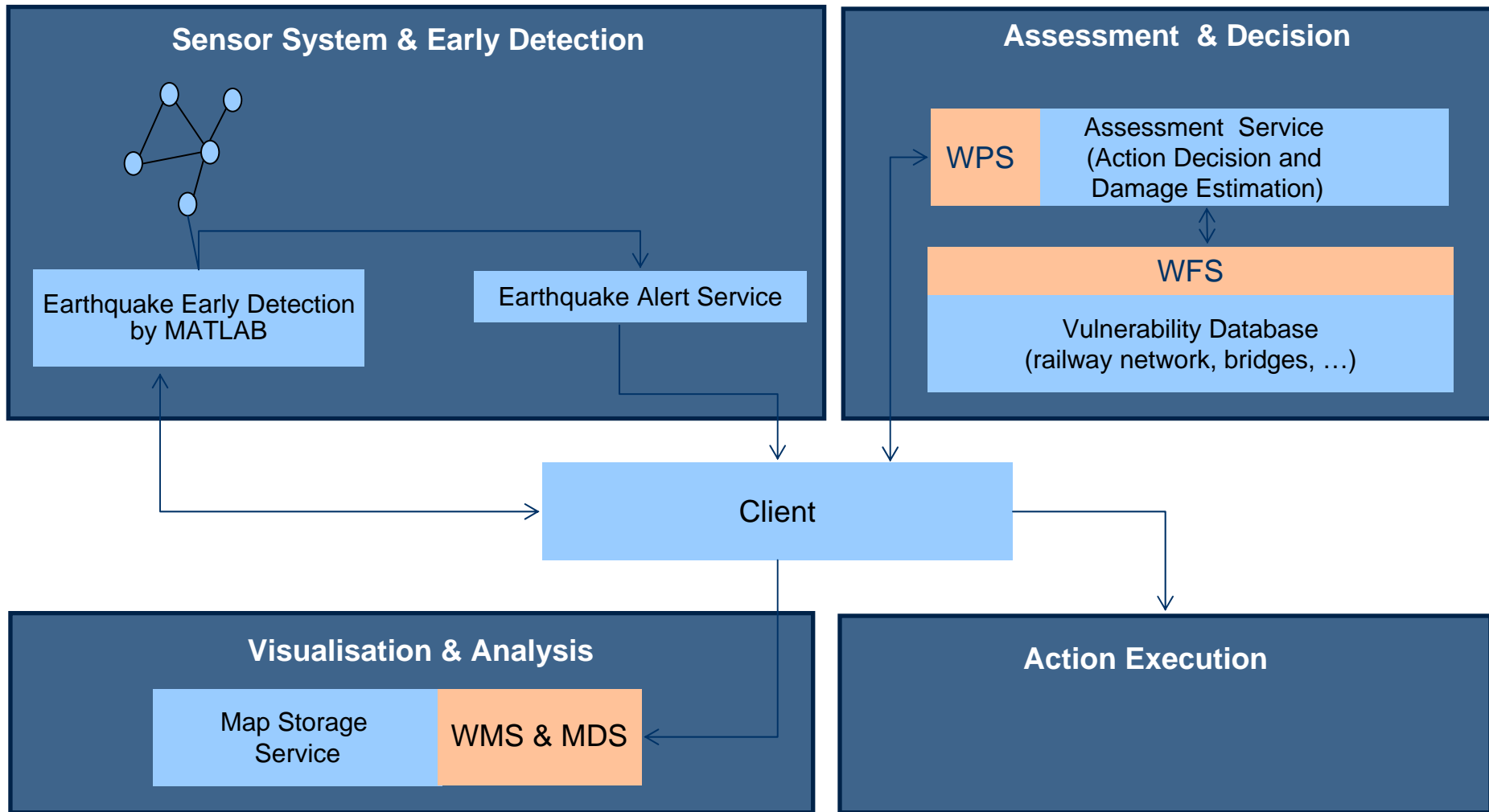
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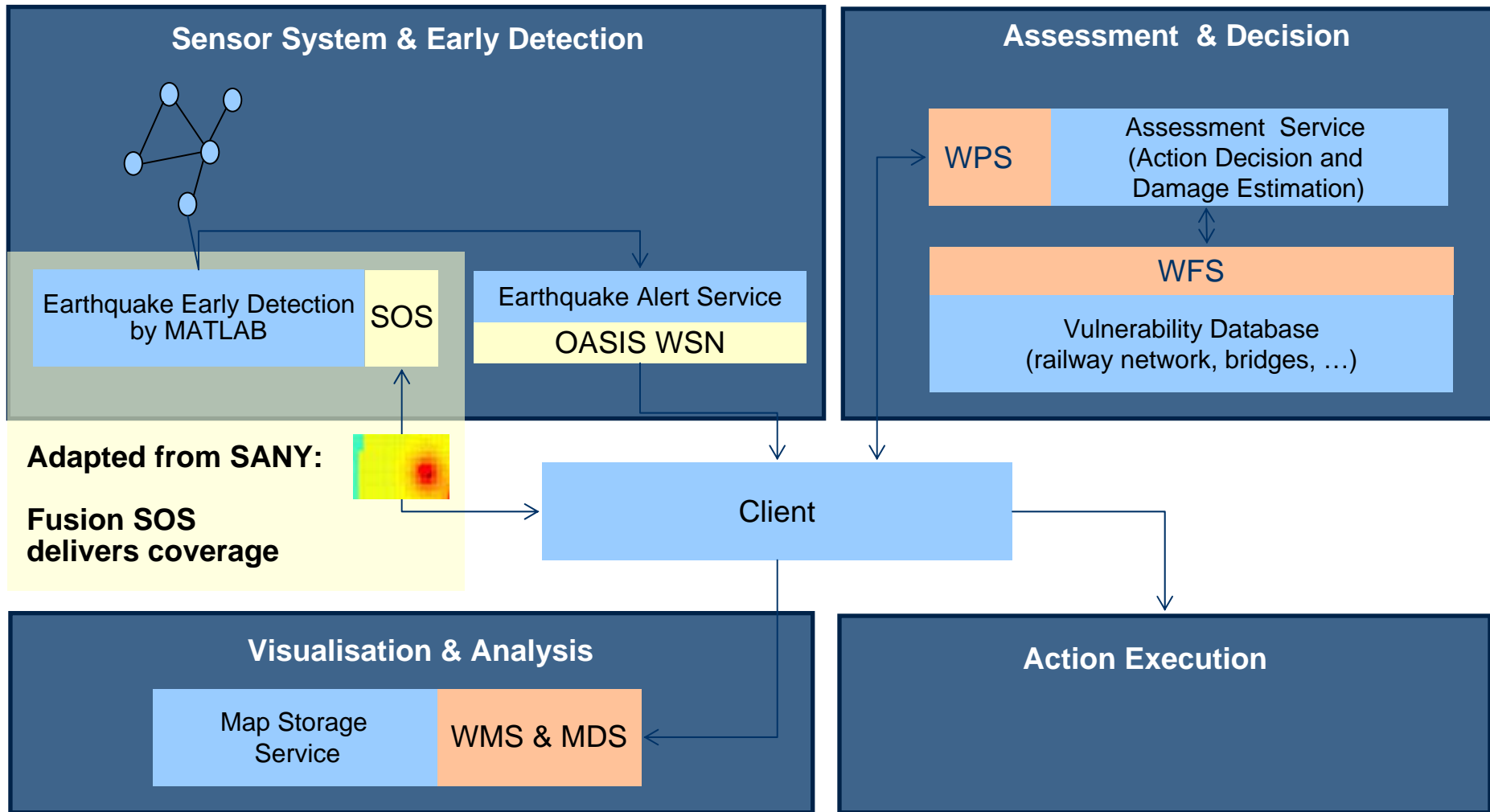
# Early Warning – Base Services – ORCHESTRA



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# Early Warning – Sensor Services – SANY





# Early Warning – <http://ews-transport.iitb.fraunhofer.de>



**EEWS Architecture**

**MDS**

**Fusion SOS**

**Simulator**

- Archive
  - 2009-02-04T15:45:19Z
  - 2009-02-04T15:46:39Z
  - 2009-02-04T15:48:12Z
  - 2009-02-04T15:49:27Z
  - 2009-02-04T15:50:42Z
  - 2009-02-04T15:51:32Z
  - 2009-02-04T15:52:29Z
  - 2009-02-04T15:53:09Z
  - 2009-02-04T15:54:38Z
  - 2009-02-04T15:56:04Z
  - 2009-02-04T15:57:35Z
  - 2009-02-04T15:59:01Z
  - 2009-02-04T15:59:56Z
  - 2009-02-04T16:00:38Z
  - 2009-02-04T16:02:09Z
  - 2009-02-04T16:03:34Z
  - 2009-02-04T16:05:02Z
  - 2009-02-04T16:05:49Z**
  - 2009-02-04T16:06:30Z
  - 2009-02-04T16:07:42Z

Live Client

**WFS**


**WPS**

Search:

Detailed Search

Sitemap

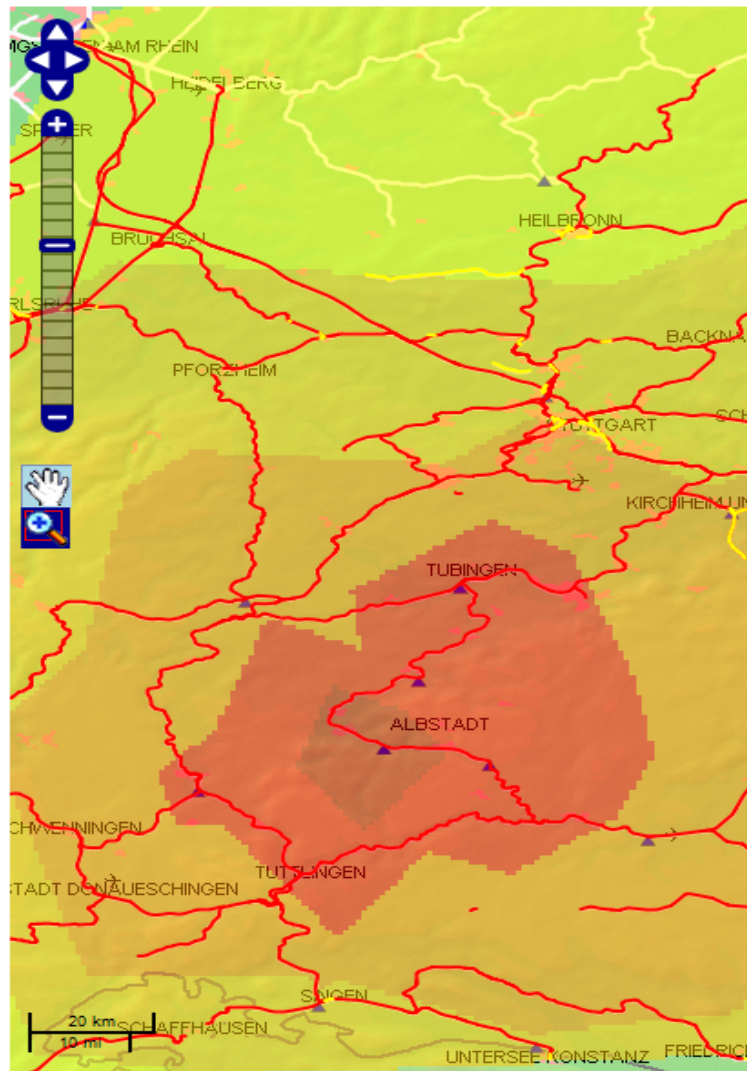
Login



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[ EWS Transport > Simulator > Archive > 2009-02-04T16:05:49Z ]

2009-02-04T16:05:49Z



Scale = 1 : 865K

**Base Layer**

- Base Map

**Overlays**

- Land features
- Man-made features
- Soil classes
- Show/hide layer legend
- Subsoil classes
- Show/hide layer legend
- Railway lines
- Railway bridges < 150m
- Railway bridges > 150m
- Sensor stations
- Alertmap
- Show/hide layer legend
- Shakemap
- Show/hide layer legend

04.02.2009

**Contents**

- Actions.html (20,47 KB)
- Alertmap.asc (559,6 KB)
- BlockedElements.xml (487,45 KB)
- DamagemapShort.xml (12,74 KB)
- DamageReport.html (4,43 KB)
- Hypocenter.xml (698 Bytes)
- Shakemap.asc (552,06 KB)
- SpeedLimitedElements.xml (77,32 KB)

Download All

## Ongoing Eartquake (2009-01-29T14:31:57.00Z)

### Recommend Actions for Railway Operating Comapny

**Estimated earthquake parameters:**  
 Hypocentre: 48.2618,8.97343  
 Magnitude: 6.33893

Search:

Railwaytrack number	From kilometer	To kilometer	Action
4000	19.102	76.404	block track
4000	367.522	414.9	block track
4080	0.0	99.266	block track
4130	-1.143	16.029	block track
4200	-5.103	39.793	block track
4211	0.821	2.353	block track

# Early Warning – <http://ews-transport.iitb.fraunhofer.de>



EEWS Architecture  
MDS  
Fusion SOS

## Simulator

- ▶ Archive
- 2009-02-04T15:45:19Z
- 2009-02-04T15:46:39Z
- 2009-02-04T15:48:12Z
- 2009-02-04T15:49:27Z
- 2009-02-04T15:50:42Z
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- 2009-02-04T16:05:02Z
- 2009-02-04T16:05:49Z
- ▶ 2009-02-04T16:06:30Z
- 2009-02-04T16:07:42Z

Live Client

WFS

WPS

▶ Detailed Search

Sitemap

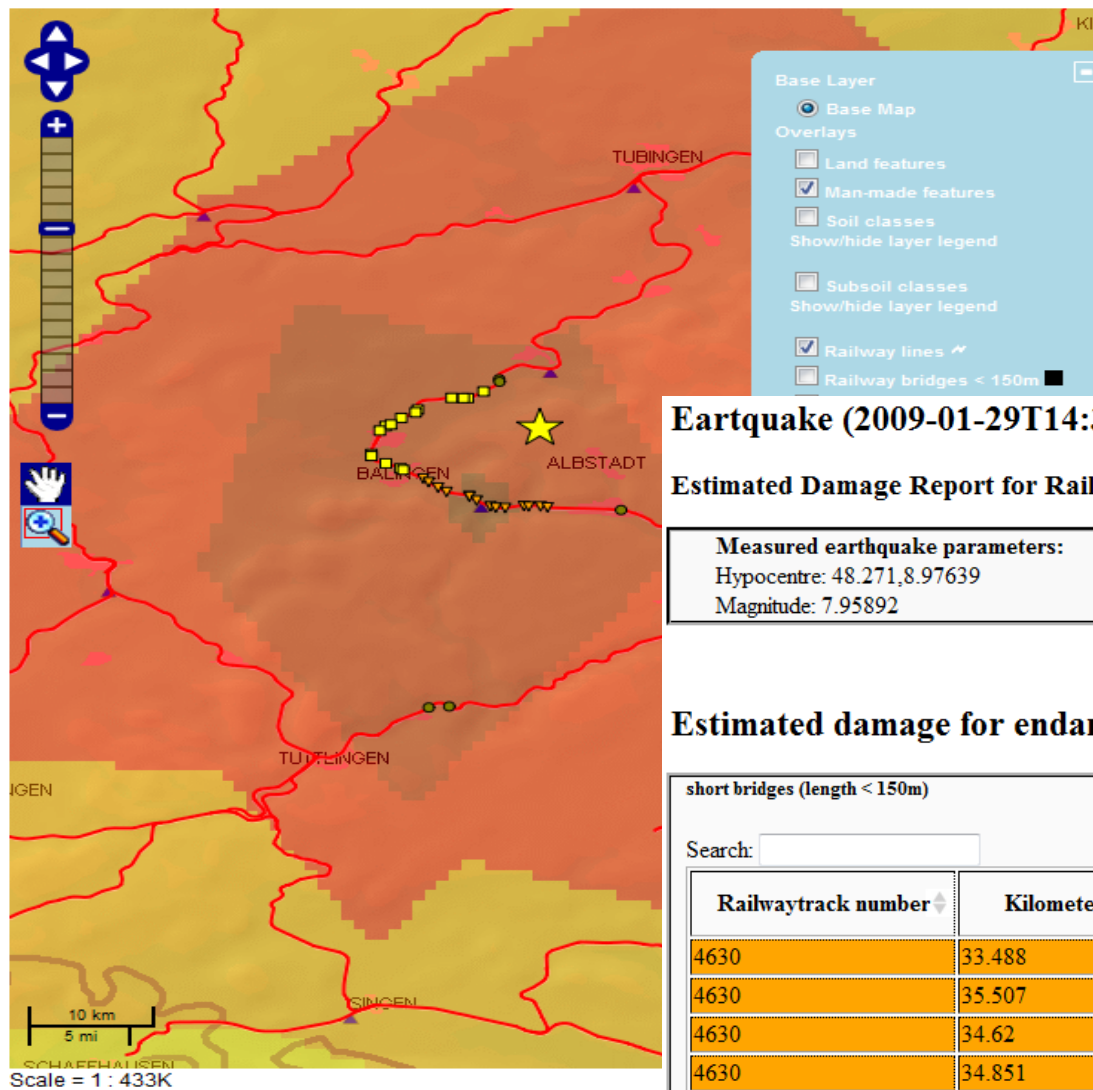
Login



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[ EWS Transport > Simulator > Archive > 2009-02-04T16:06:30Z ]

2009-02-04T16:06:30Z



## Contents

- Actions.html (26,81 KB)
- BlockedElements.xml (630,3 KB)
- DamagemapShort.xml (23,83 KB)
- DamageReport.html (5,69 KB)
- Hypocenter.xml (697 Bytes)
- Shakemap.asc (551,1 KB)

## Earthquake (2009-01-29T14:32:35.00Z)

### Estimated Damage Report for Railway Operating Company

#### Measured earthquake parameters:

Hypocentre: 48.271,8.97639  
Magnitude: 7.95892

### Estimated damage for endangered railway infrastructure:

short bridges (length < 150m)

Search:

Railwaytrack number	Kilometer	Estimated damage class	Damage class description
4630	33.488	4	heavy damage
4630	35.507	4	heavy damage
4630	34.62	4	heavy damage
4630	34.851	4	heavy damage
4630	38.175	4	heavy damage
4630	39.465	4	heavy damage

# Summary & Conclusion

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SANY reused and extended ORCHESTRA principles:

- Integration of sensor related services
- Extension of meta-information schema towards sensors
- Integration of fusion processes

**These components can be used to realize  
Early Warning Systems**

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# THANK YOU FOR YOUR ATTENTION

*Désirée Hilbring*

*Fraunhofer IITB, Fraunhoferstr. 1  
76131 Karlsruhe, Germany  
hilbring@iitb.fraunhofer.de*



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*From ORCHESTRA to SANY – An Open Sensor  
Service Architecture for Early Warning Systems*

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