



# AIP-2GEOSS Unified Modeling Team Engineering Report

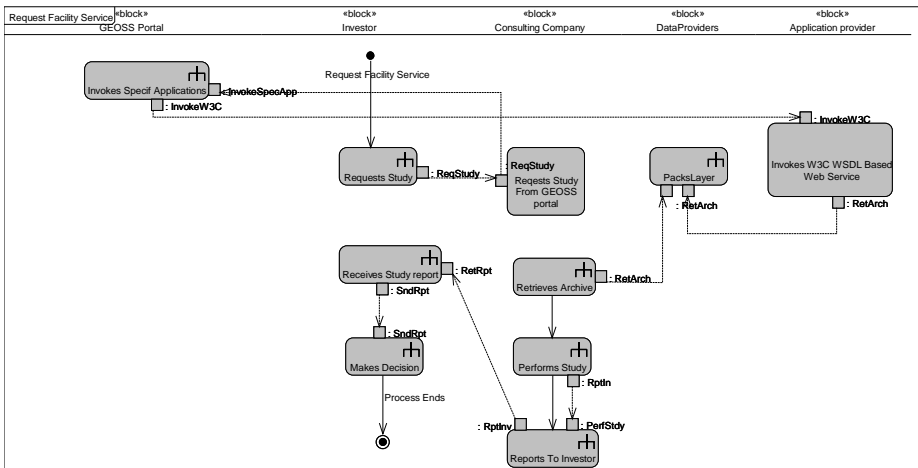
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Lawrence McGovern, ScD, Chair  
Members: Elizabeth Davies and **Arnold J. Galloway, PhD**  
International Council of System Engineers (INCOSE) and Northrop Grumman  
9/1/2009

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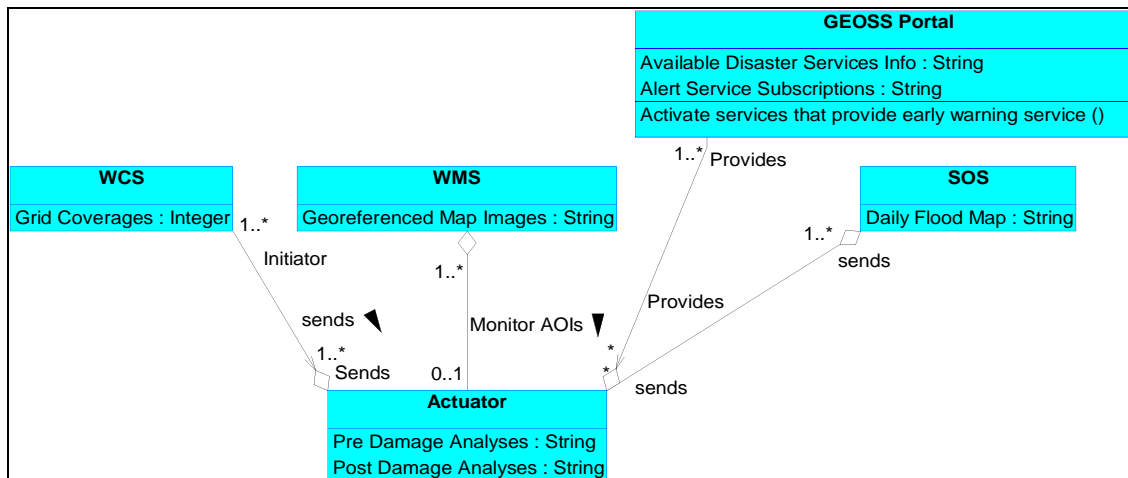
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## GEOSS Unified Modeling Team Engineering Report

### 1.0 Introduction

This report contains the results of the International Council of Systems Engineers (INCOSE) UML Team efforts to produce a UML architecture in accordance with IO/IEC 19793 2007.

#### 1.1 Scope of this document

The GEOSS Unified Modeling team engineering report provides the depiction expresses the Reference Model of the Open Distributed Processing (RM-ODP) viewpoint using the Unified Modeling Language as the syntax. This is done by expressing each scenario of each GEOSS Societal Benefit Area in five viewpoints as described in ISO/IEC 10746:1996 Part 3 Reference Model ODP Architecture and description of the UML concepts and extensions provided in ISO/IEC 19793:2007

#### 1.2 GEOSS AIP

Each of the Societal Benefit Area Teams have developed the individual scenarios and associated UML Use Cases. The UML team has developed the UML RM-ODP Architecture for each of the scenarios using three views of the ISO/IEC 19793 modeling concepts and structuring rules. These views are Enterprise, Information and Computational. The remaining two views will be completed in AIP 3.

The GEOSS Architecture Implementation Pilot (AIP) leads the incorporation of contributed components consistent with the GEOSS Architecture using a GEO Web Portal, WAF/CSW, AQ Community Portal, and a Clearinghouse search facility to access services through GEOSS Interoperability Arrangements in support of the GEOSS Societal Benefit Areas. AIP is a GEO task for elaborating the GEOSS Architecture under the purview of the GEO Architecture and Data Committee.

This Engineering Report (ER) is a key result of the second phase of AIP. AIP-2 was conducted from July 2008 to June 2009. A separate AIP-2 ER describes the overall process and results of AIP-2 and thereby provides a context for this Community SBA ER. [

## Reference Documents

- a. ISO/IEC 10746-3:1996, Information technology – Open Distributed processing – Reference Model Architecture
- b. ISO/IEC 193793:2007 Modeling concepts and structuring rules

## 2.0 UML Engineering Team Objectives

The objective of the report is to provide three of the five views expressed in Reference a. and as expressed in Reference b. for each of the Societal benefit areas and each of their scenarios. The remaining two views will be completed in AIP3. The three views provided are the Enterprise, Information and Computational views. The Enterprise View includes SysML Activity Diagrams for each scenario use case these activity diagrams represent processes. Use Cases are provided in Societal Based Area Report. Use Case Diagrams also provide Role fulfillment and assignment. SysML is an Extension of UML. Policies will be added in AIP 3. The information view includes an Entity Relationship Diagram which includes the information actions and objects. The Computational View includes Object Templates, Interface Templates, Interface Signatures, Data Types and Internet Structures.

## 3.0 Scenario Reports

This section presents all Societal Benefit Area individual UML Reports. These reports present all diagrams and views specified in references a and b.

### 3.1. Societal Benefit Area – Air Quality & Health

#### 3.1.1 Scenario – Wildfire

##### 3.1.1.1 Enterprise View

The enterprise viewpoint describes the business requirements for the Air Quality management and decision support using GEOSS-2 without specifying the technology or other system considerations.

The Enterprise View defines use cases for Air Quality, using Object Management Group's Unified Modeling Language (UML). The sections that follow the Overview Use Case Diagram are organized by use case and describe the series of processes for each use cases. The processes are defined by activity diagrams, and are currently limited in scope to only the Wildfire scenario.

### 3.1.1.1.1 Overview Use Case Diagram

A use case diagram describes the behaviors and dynamics of the system being modeled, and is composed of a component boundary, use case name, external actors and their relationships. Within the use case diagram, actors are represented as person stick figures, and use cases are shown as bubbles.

The following diagram presents the overview use case diagram for Air Quality. It identifies the use cases that comprise air quality management and decision support using GEOSS-2 and the high level relationships between them.

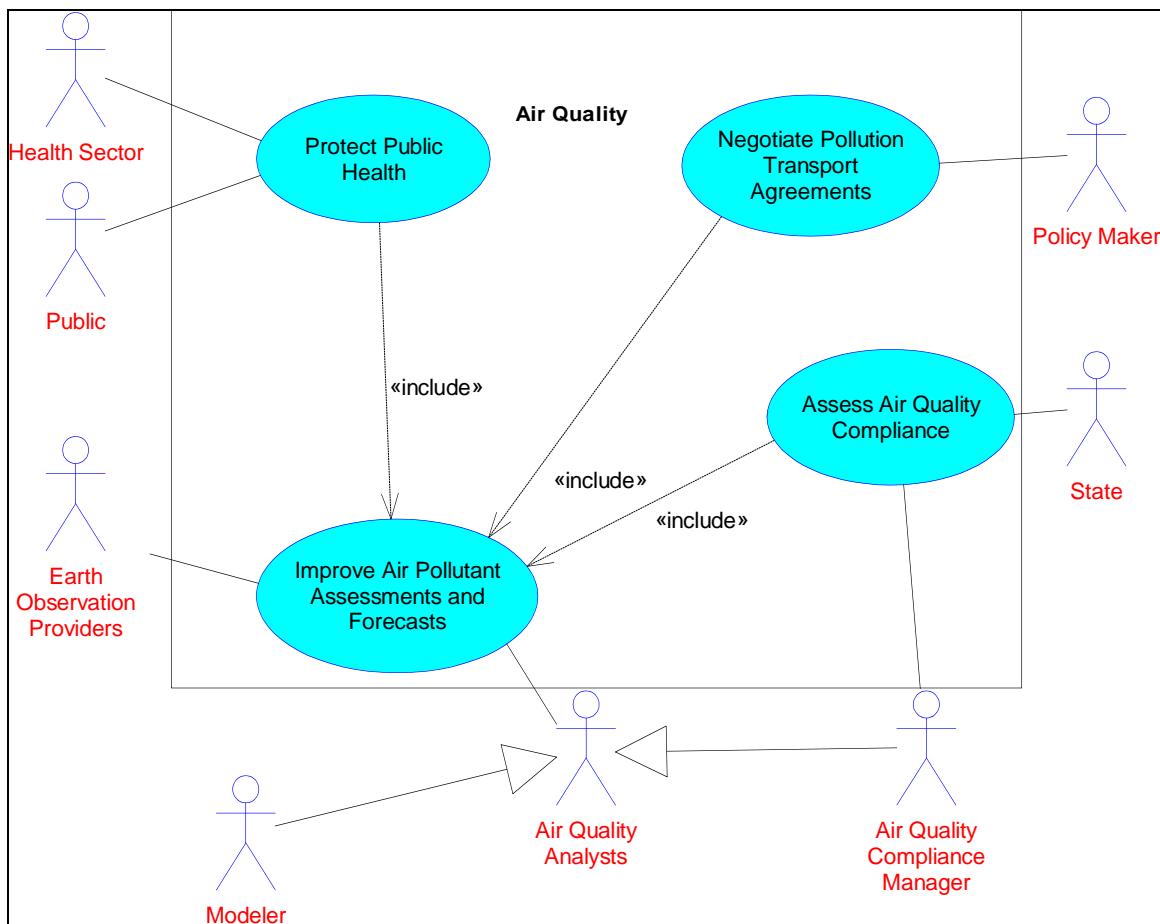


Figure 3-1 Use Case Diagram for Air Quality

Actors formalize the roles of systems, individuals, or external components which interact with this system. The following table describes the actors in the use case diagram.

Table 3-1 Actors in the System

Actor Name	Description
Air Quality Analysts	Air Quality Analysts use synthesized earth observations to improve the characterization of smoke events. Their analyses support decision making for air quality management, such as the analyses of exceptional events and long-range pollution transport.
Air Quality Compliance Manager	An Air Quality Compliance Manager ensures that States are complying with Air Quality regulations, and is responsible for assessing whether a regional pollution event was due to an "exceptional event".
Earth Observation Providers	Earth Observation Providers expected for Air Quality include: National, State/Provincial, Local Environmental Management Agencies National Meteorological Agencies National Space Agencies National Land Management Agencies Industry Consultants Academic and Other Research Institutes International Cooperative for (e.g. WMO, CEOS, EEA, ...) Health Sector Health authorities need to assess public health impacts of air pollution episodes and respond to extreme events. Health authorities must issue warnings when air pollution could harm the public.
Modeler	The Modeler runs offline forecast models. This forecast data is made available through CALPUFF.
Policy Maker	States in the USA have requirements to comply with Air Quality regulations. However, in certain events such as fires they can apply to have a location waived from being considered for Air Quality compliance to regulations.
Public	The public is interested in air quality and pollution events that are currently happening, and that are forecasted in the near future, so that activity decisions can be made.
State	States in the USA have requirements to comply with Air Quality regulations. However, in certain events such as fires they can apply to have a location waived from being considered for Air Quality compliance to regulations.

#### 3.1.1.1.1 Use Case: "Assess Air Quality Compliance"

##### Purpose:

States are required to be in compliance with Air Quality regulations; therefore Air Quality Managers are responsible for assessing whether a regional pollution event was due to an "exceptional event" (such as fire, dust storm, etc). GEOSS AIP2 can facilitate linking between actors and by promoting the development and distribution of service-oriented, interoperable tools for inter-comparison and fusion of models, observations, and emissions data for use in Exceptional Event Analysis.

##### Pre-Conditions:

Not defined

##### Post-Conditions:

Not defined

##### Processes

The following activity diagram "Request Exceptional Waiver Event" illustrates the process that is initiated by the state to request an Exceptional Waiver for an event, which could be a Wildfire.

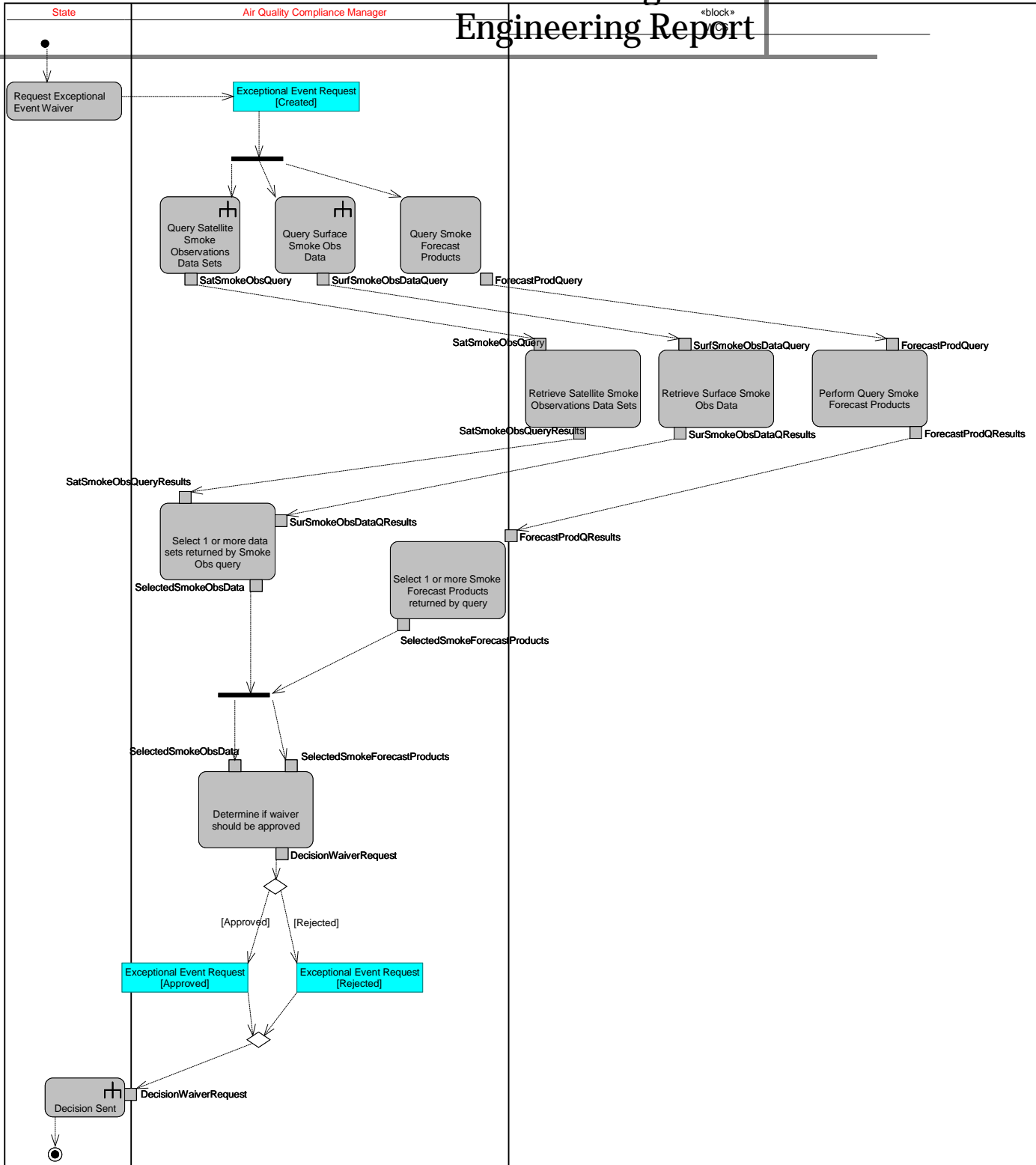


Figure 3-2 Use Case: "Request Exceptional Waiver Event"

#### 3.1.1.1.2 Use Case: “Improve Air Pollutant Forecasts and Assessments”

**Purpose:**

To improve Air Quality and Pollutant Assessments and forecasts, Air Quality Analysts need to have access to and integrate data from a combination of resources: chemical transport models, satellite observations, ambient observations, emissions inventories and models, and meteorological data.

**Pre-Conditions:**

Air Quality Analysts have access to and integrate data from a combination of resources: chemical transport models, satellite observations, ambient observations, emissions inventories and models, and meteorological data.

**Post-Conditions:**

Data Integrated and forecast report made

**Purpose:**

The public needs information about air quality now and in the near future to make activity decisions. They may need to alert when an event has occurred that causes harmful amounts of air pollution and they may be interested in a local area's Air Quality Index or other similar health-based index.

**Pre-Conditions:**

Not defined

**Post-Conditions:**

Not defined

**Processes**

The following activity diagram “Identify Public Smoke Impact” illustrates the process of how Air Quality Analysts will use smoke forecasts and population density data to assess whether a wildfire’s smoke will have a public impact. The health sector will get informed when a wildfire’s smoke could have an impact on public health.

#### 3.1.1.1.3 Use Case: “Negotiate Pollution Transport Agreements”

**Purpose:**

Policy makers need to negotiate international agreement on long-range pollutant transport. To make informed decisions on how to negotiate intercontinental pollution transport agreements, policy makers need synthetic assessment reports which quantify the impact of intercontinental pollutant transport on various nations. National or internal scientific advisory groups need technical assessments of model experiments and synthesized historical observational

datasets designed to assess long-range transport. Scientific task forces assessing long-range transport need synthetic descriptions of the atmosphere, using multiple observations and models (satellites, ambient, etc.)

Pre-Conditions:  
Not defined

Post-Conditions:  
Not defined

Processes

No processes are currently defined for this use case. It was not addressed as part of the Wildfire scenario.

#### 3.1.1.1.4 Processes

The following activity diagram “Forecast Smoke” illustrates the process of a modeler using fire occurrence data to run offline smoke forecast models. The modeler can then make a forecast report from running the offline models available to the community.

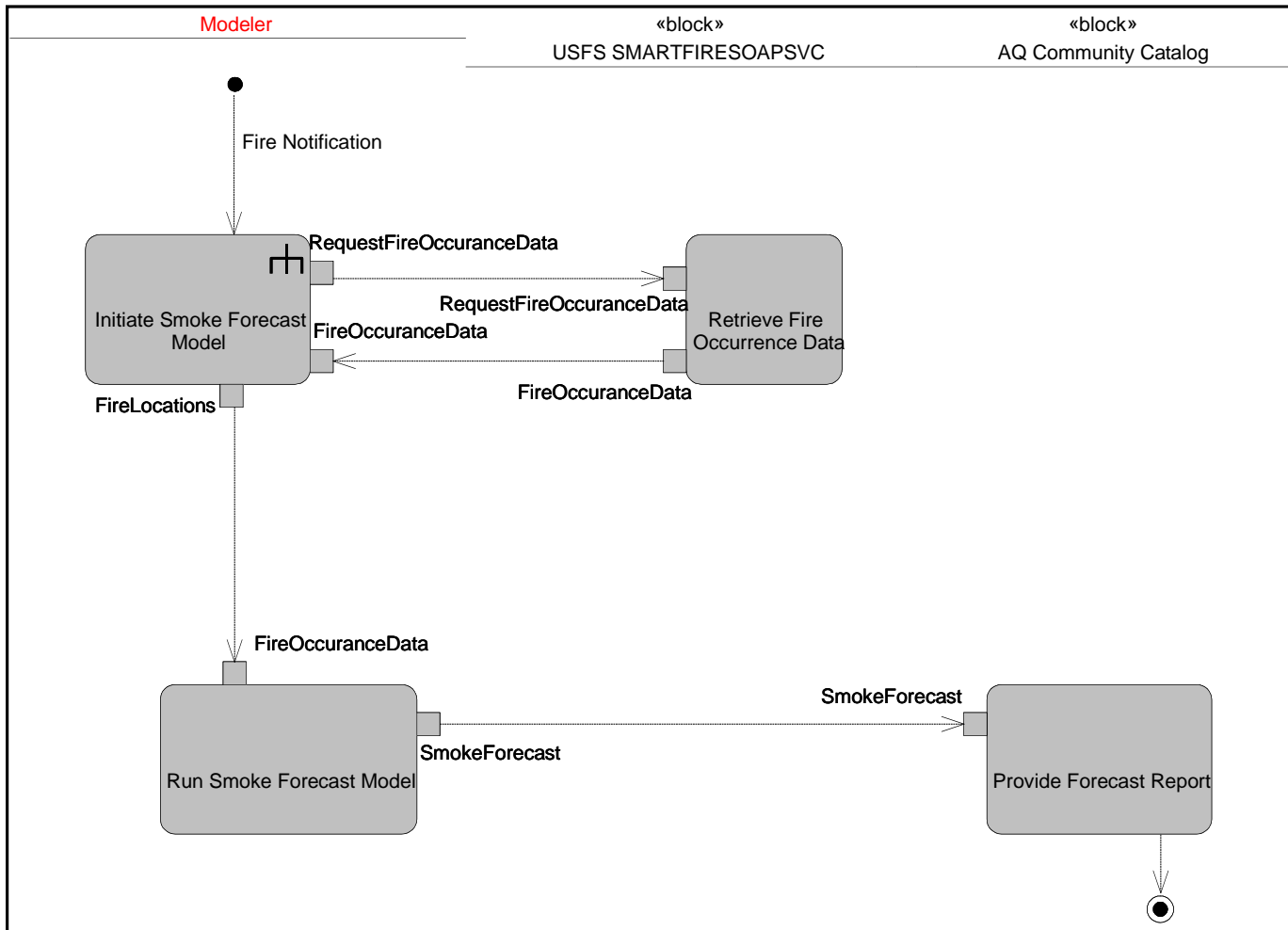


Figure 3-3 Activity Diagram for the "Forecast Smoke" process

The following activity diagram "Validate Forecast Model" illustrates the process of an Air Quality Analyst validating smoke forecasts with smoke observation data by doing a spatial-temporal comparison analysis.

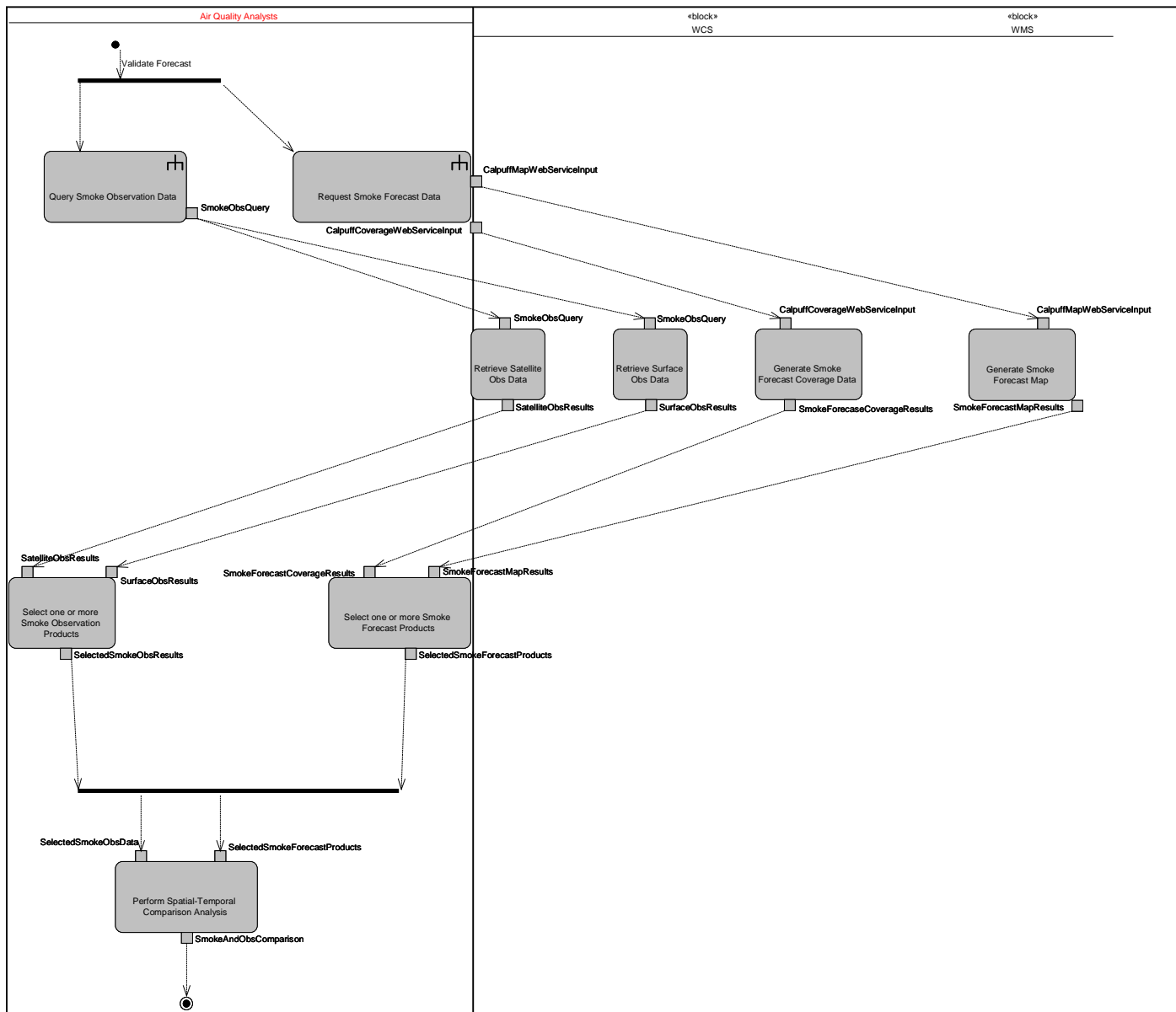


Figure 3-4 Activity Diagram for the "Validate Forecast Model" process

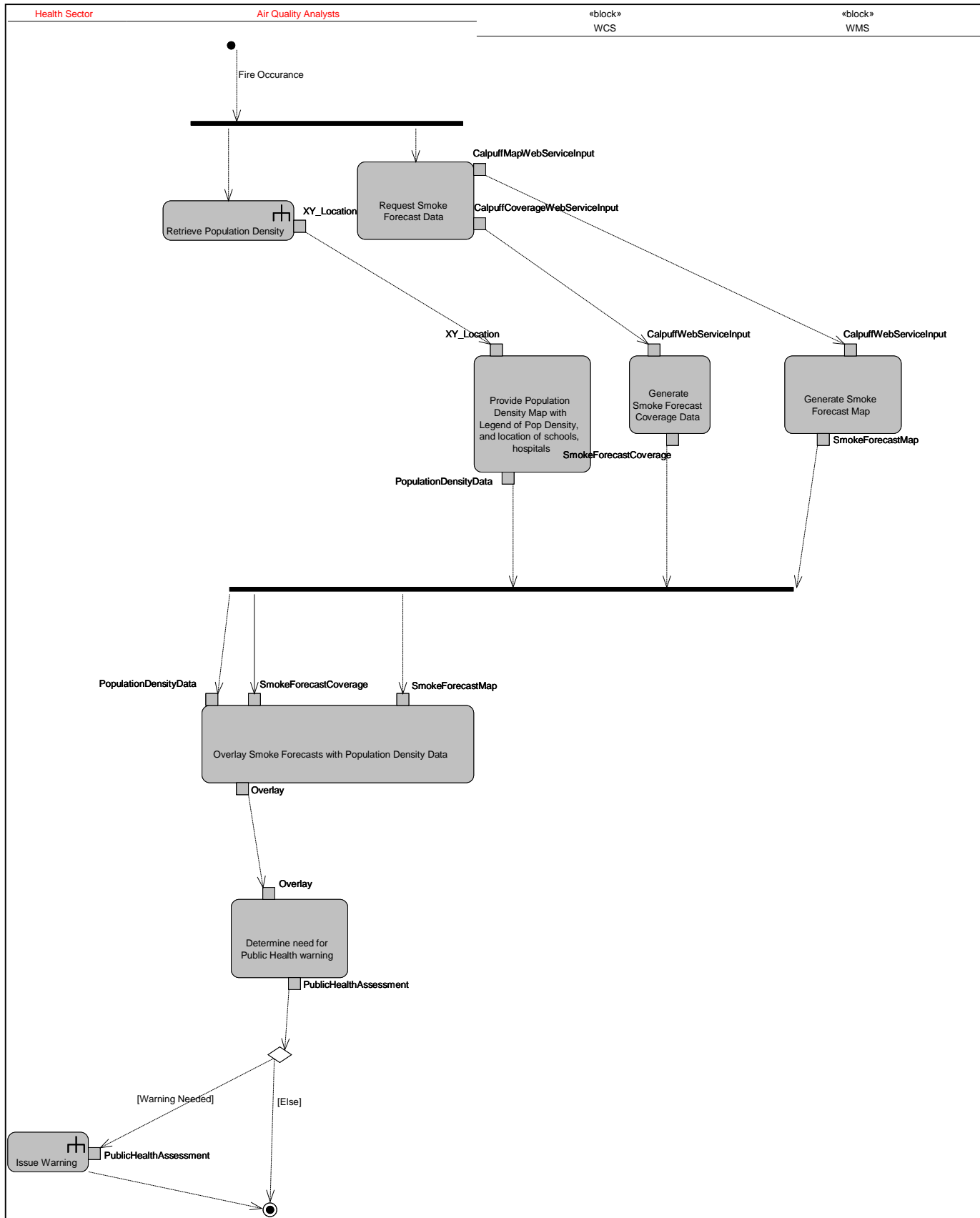


Figure 3-5 Activity Diagram for the "Identify Public Smoke Impact" process

### 3.1.1.2 Information View

The information viewpoint is concerned with information modeling. An information specification defines the semantics of information and the semantics of information processing in an ODP system, without having to worry about other system considerations, such as particular details of its implementation, the computational process, or the nature of the distributed architecture to be used. The information specification in this clause defines both the basic concepts for information used in this specification, and the invariant, static and dynamic schemata. Figure 3-5 below represents the static schema for present time. Invariant and dynamic concepts were viewed as inapplicable to GEOSS at this time.

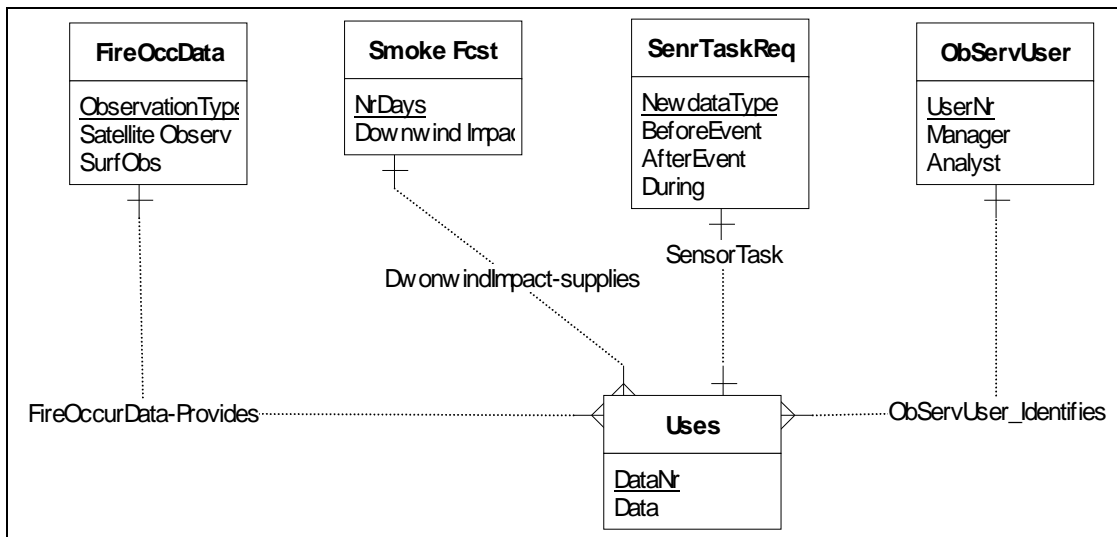


Figure 3-6 AQ Wildfire Information View Entity Relationship Diagram – Static Schema current time

### 3.1.1.3 Computational View

The computational view is described in accordance with ISO/IEC 19793 for the use of UML for Open Distributed Processing system specification.

The computational specification functionally decomposes air quality management and decision support using the GEOSS-2, with “units of function as computational objects, and interactions among those computational objects, without considering their distribution over networks and nodes.”

#### 3.1.1.3.1 Basic structure of the computational viewpoint for Air Quality

The following diagram describes the elements or packages of the computational viewpoint for Air Quality. Interface templates are described as ports, where interface signatures define operations that can handle data and return values. Data types are defined for this data handled and return values. Computational objects are components and are also described by their templates.

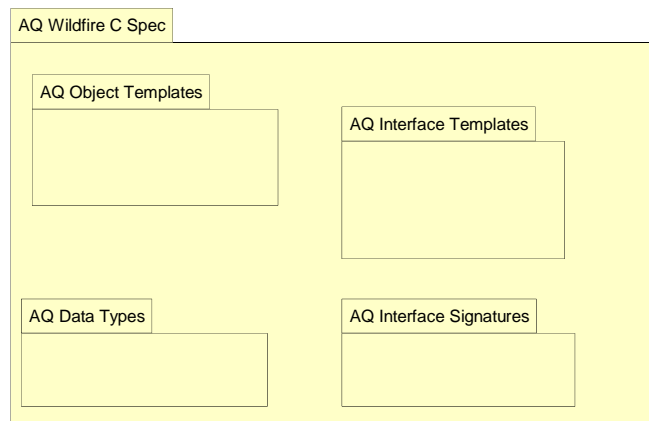


Figure 3-7 Basic structure of the computational viewpoint for Air Quality

### 3.1.1.3.2 Object and Interface Templates

In the following component diagram, system functionality is decomposed into computational objects (or components) that interact at the interfaces (or port instances). The system consists of four main components – the Air Quality Main Functionality for Wildfire, and the user interfaces that interact with it which includes the Modeler, the Air Quality Analyst/Manager, and the GEOSS Registry. This defines the high-level architecture.

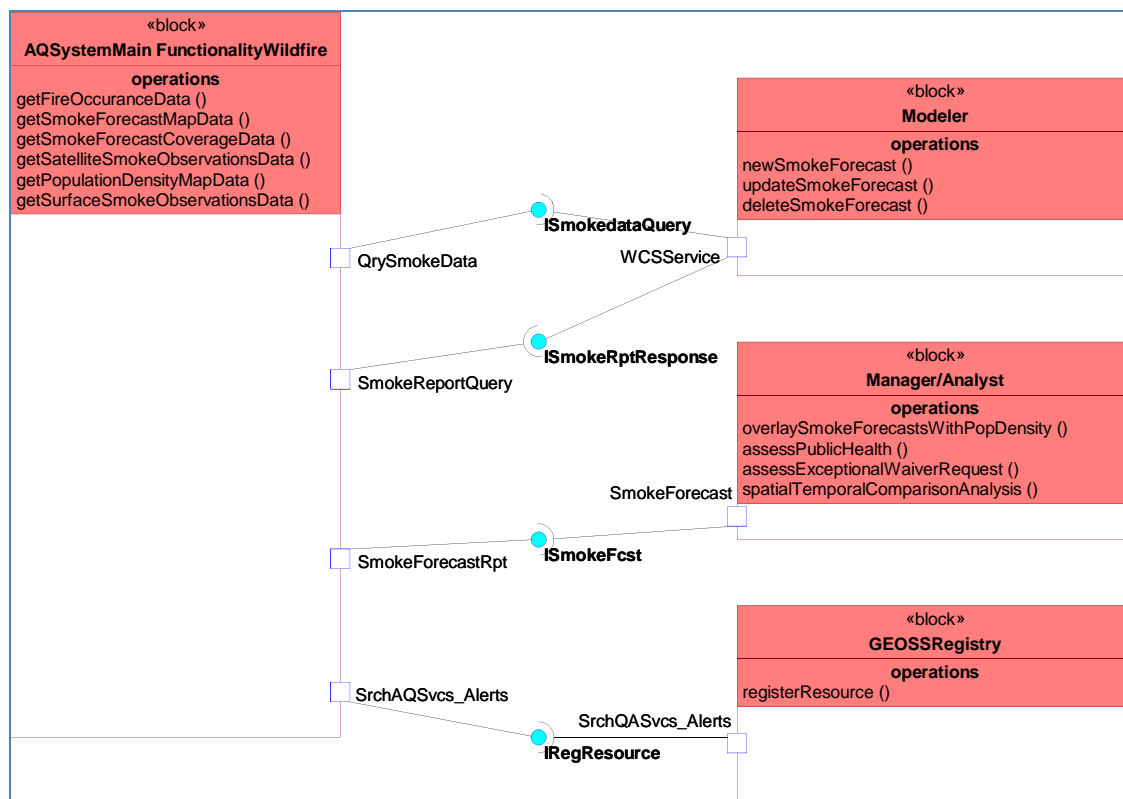


Figure 3-8 Computational Object templates and interface signatures

#### 3.1.1.3.3 Detailed Architecture

The following component diagram decomposes the high-level architecture further to define the internal components, and interactions between those components.

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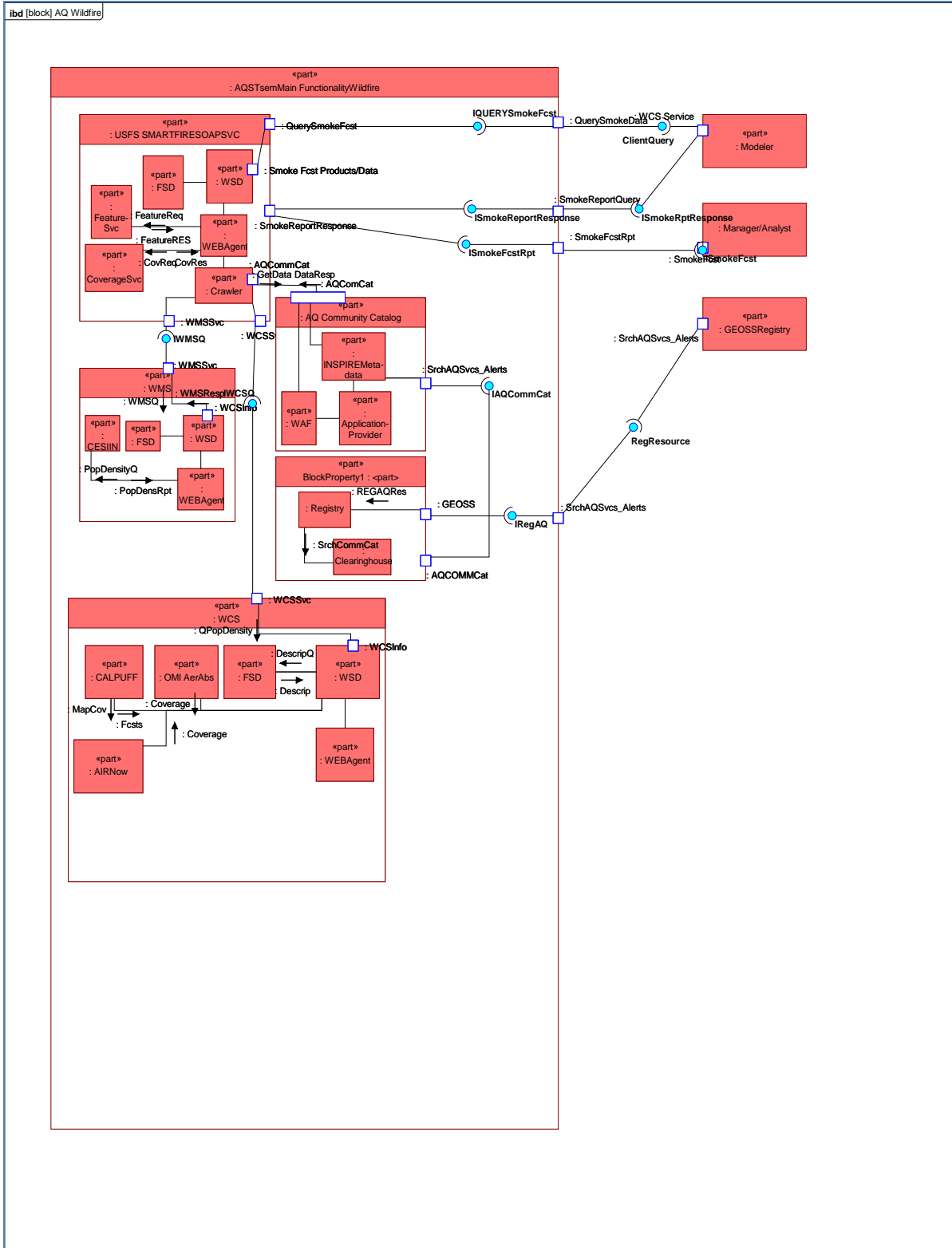


Figure 3-9 Internal structure of the Air Quality System Functionality Computational Object

### 3.1.1.3.4 Interaction Signatures

The following diagram defines the interface signatures that are instantiated by the ports defined in the prior two component diagrams.

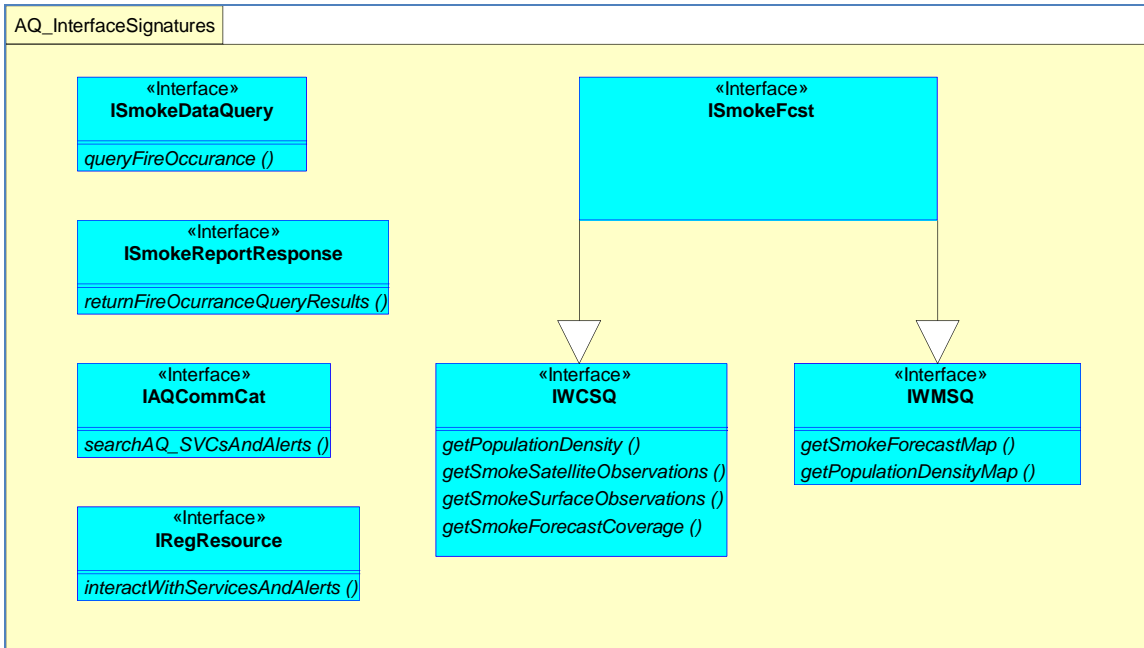


Figure 3-10 Interaction Signatures

### 3.1.1.3.5 Data Types

Interface templates are described as ports, where interface signatures define operations that can handle data and return values. The following diagram describes the data types that are defined for the data handled and return values for interfaces.

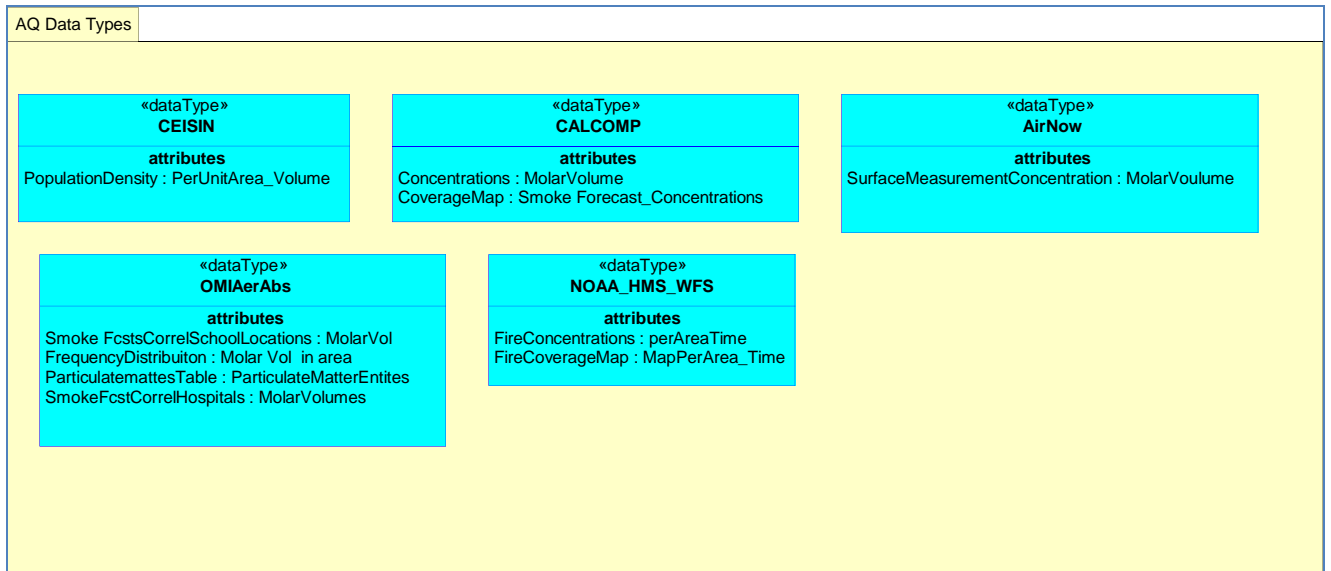


Figure 3-11 Data Types handled by computations

## 3.2 Societal Benefits Area – Climate Change and Biodiversity

### 3.2.1 Scenario – Pika Distribution

#### 3.2.1.1 Enterprise View

The enterprise viewpoint describes the business requirements for the Climate Change and Biodiversity (Pika Distribution) management and decision support using GEOSS-2 without specifying the technology or other system considerations.

The Enterprise View defines use cases for Pika Distribution, using Object Management Group's Unified Modeling Language (UML). The sections that follow the Overview Use Case Diagram are organized by use case and describe the series of processes for each use cases. The processes are defined by activity diagrams for the Pika Distribution scenario.

##### 3.2.1.1.1 Overview Use Case Diagram

A use case diagram describes the behaviors and dynamics of the system being modeled, and is composed of a component boundary, use case name, external actors and their relationships. Within the use case diagram, actors are represented as person stick figures, and use cases are shown as bubbles.

The following diagrams present the use cases diagram for Pika Distribution. The diagrams identify the use cases that comprise Pika Distribution management and decision support using GEOSS-2.

Actors formalize the roles of systems, individuals, or external components which interact with this system. The following table describes the actors in the use case diagrams.

Actor Name	Description
Scientist Member of Biodiversity Community	
Interoperability Process Pilot (IP3) Mediation Service	
Global Biodiversity Information Facility (GBIF) Web System	
GBIF IP3 Mediation Service Distributed Catalog	
TOPS/Climate Data Server	
Ip3 Ecological Niche Model (ENM) Server	
GBIF IP3 Central Services	Admin capabilities including robust search engine.

**Table 3-2 Biodiversity Actors in the system**

### 3.2.1.1.2 Use Case: CB-PD-01 Scientist Selects Species of Interest

Table 3 -3 Scientist Selects Species



Figure 3-12 Use CaseDiagram: CB-PD01 Species of Interest

<b>Title</b>	CB-PD-01 Scientist Selects Species of Interest
<b>Overview</b>	Biodiversity Scientist wants to use Interoperability Process Pilot (IP3) client application to obtain data for a given specie.
<b>Actors and Interfaces</b>	Actors: - Scientist Member of Biodiversity Community. - IP3 Mediation Service -GBIF Web System
<b>Initial Status and Preconditions</b>	Biodiversity Scientist wants to use IP3 to discover the presence datasets for a given specie. IP3 Mediation Service is available. GBIF Web System is available.
<b>Evolution</b>	STEP 1: Scientist submits query for presence datasets to IP3. STEP 2: IP3 Mediation Services mediates the query request

	<p>distributing it to the GBIF Web System. STEP 3: GBIF Web System receives query and provides presence datasets STEP 4: IP3 Mediation Service obtains and provides presence datasets. STEP 5: Scientist selects one or more datasets returned by the query. STEP 6: Scientist requests IP3 provide selected datasets. STEP 7: IP3 Mediation Service mediates request for datasets. STEP 8: GBIF receives request and provides datasets. STEP 9: IP3 Mediation Service provides requested datasets to Scientist. STEP 10: Scientist receives selected datasets.</p>
<b>Post Condition</b>	<p>Biodiversity Scientist has selected datasets from IP3 Mediation Service, which mediated the data request distributing it to the GBIF Web System.</p>

Table 3-4 Use Case Narrative CB-PD 01 Scientist Selects Species of Interest

3.2.1.1.3 Use Case: “CB-PD-02 Scientist Develops

Niche Model”

<b>Title</b>	CB-PD-02 Scientist Develops Niche Model
<b>Overview</b>	Biodiversity Scientist wants to use GBIF Interoperability Process Pilot (IP3) client applications to obtain data for species and climate. Data will be used to develop a correlation model between species and environment (climate).
<b>Actors and Interfaces</b>	Actors: <ul style="list-style-type: none"> <li>- Scientist Member of Biodiversity Community.</li> <li>- Global Biodiversity Information facility (GBIF) IP3 Mediation Service Distributed Catalog (GBIF IP3 DC)</li> <li>- TOPS/Climate Data Server (T/CDS)</li> <li>- IP3 Ecological Niche Model (ENM) Server</li> </ul>
<b>Initial Status and Preconditions</b>	Biodiversity Scientist wants to use GBIF IP3 DC to discover historical climate data for given specie ranges. GBIF IP3 Mediation Service DC is available. ENM Server is available.
<b>Evolution</b>	<p>STEP 1: Scientist submits query for presence datasets to GBIF IP3 DC.</p> <p>STEP 2: GBIF IP3 DC mediates the query request distributing it to the T/CDS.</p> <p>STEP 3: T/CDS provides query response to GBIF IP3 DC.</p> <p>STEP 4: IP3 Mediation Service receives query response from CDS</p> <p>STEP 5: IP3 Mediation Service provides query response list of datasets.</p> <p>STEP 4: Scientist selects one or more datasets returned by the query.</p> <p>STEP 5: Scientist requests T/CDS provide selected datasets.</p> <p>STEP 6: GBIF IP3 DC Mediation Service mediates request for datasets distributing it to T/CDS</p> <p>STEP 7: T/CDS provides requested datasets to IP3 Mediation Service.</p> <p>STEP 8: IP3 Mediation Service provides requested datasets to Scientist.</p> <p>STEP 9: Scientist receives selected datasets.</p> <p>STEP 10: Scientist generates Ecological Niche Model (ENM) using species datasets from CB-PD-01 and climate data from T/CDS.</p> <p>Step 11: Scientist sends ENM to IP3 Mediation service for</p>

	inclusion in IP3 ENM Server Step 12: IP3 Mediation Service receives and includes ENM in ENM Server
<b>Post Condition</b>	Biodiversity Scientist has developed correlation model (ENM) and ENM is include in ENM Server. Process was mediated by GBIF IP3 Mediation Service.

Table 3-5 Scientist Develops Niche Model

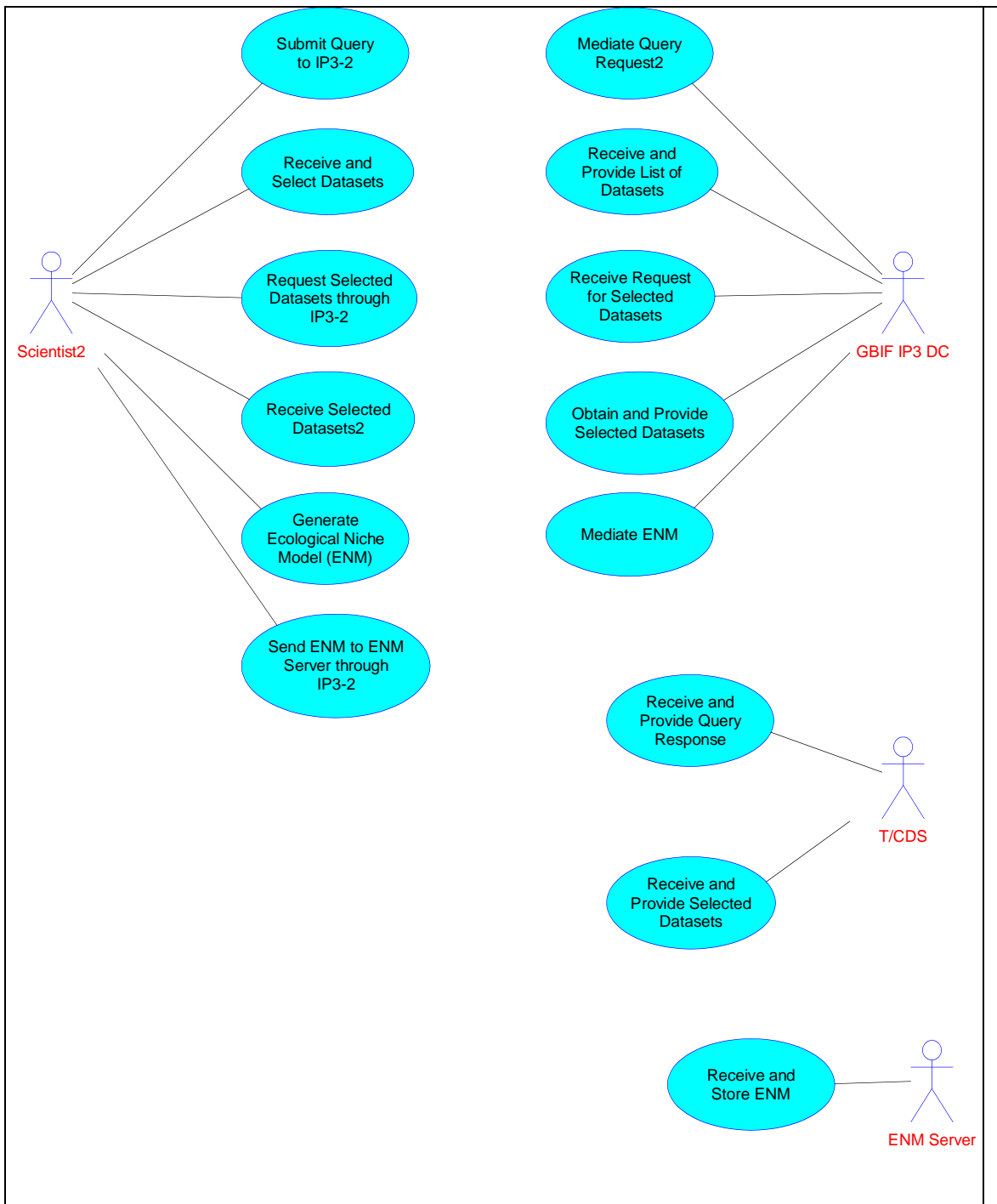


Figure 3-13 CB-PD 02 Scientist Develops Niche Model

Table 3-6 Scientist Validates Niche Model

<b>Title</b>	CB-PD-03 Scientist Validates Niche Model
<b>Overview</b>	Biodiversity Scientist wants to use GBIF Interoperability Process Pilot (IP3) client applications to obtain data for species and climate. Data will be used to validate a correlation model between species and environment (climate).
<b>Actors and Interfaces</b>	Actors: <ul style="list-style-type: none"> <li>- Scientist Member of Biodiversity Community.</li> <li>- GBIF IP3 Mediation Service Distributed Catalog</li> <li>- TOPS/Climate Data Server (T/CDS)</li> <li>-IP3 Ecological Niche Model (ENM) Server</li> </ul>
<b>Initial Status and Preconditions</b>	Biodiversity Scientist wants to use IP3 to discover presence datasets and historical climate data for given specie ranges. GBIF IP3 Mediation Service is available. TOPS/CDS is available. Ecological Niche Model (ENM) is available
<b>Evolution</b>	STEP 1: Scientist obtains specie presence datasets using CB-PD-01 through IP3 Mediation Service. STEP 2: Scientist obtains historical climate data from TOPS/Climate Data Server using CB-PD-02 through GBIF IP3 Mediation Services. STEP 3: Scientist performs ENM model validation.
<b>Post Condition</b>	Biodiversity Scientist has developed and validated a correlation model (ENM). Process was mediated by GBIF IP3 Mediation Service.

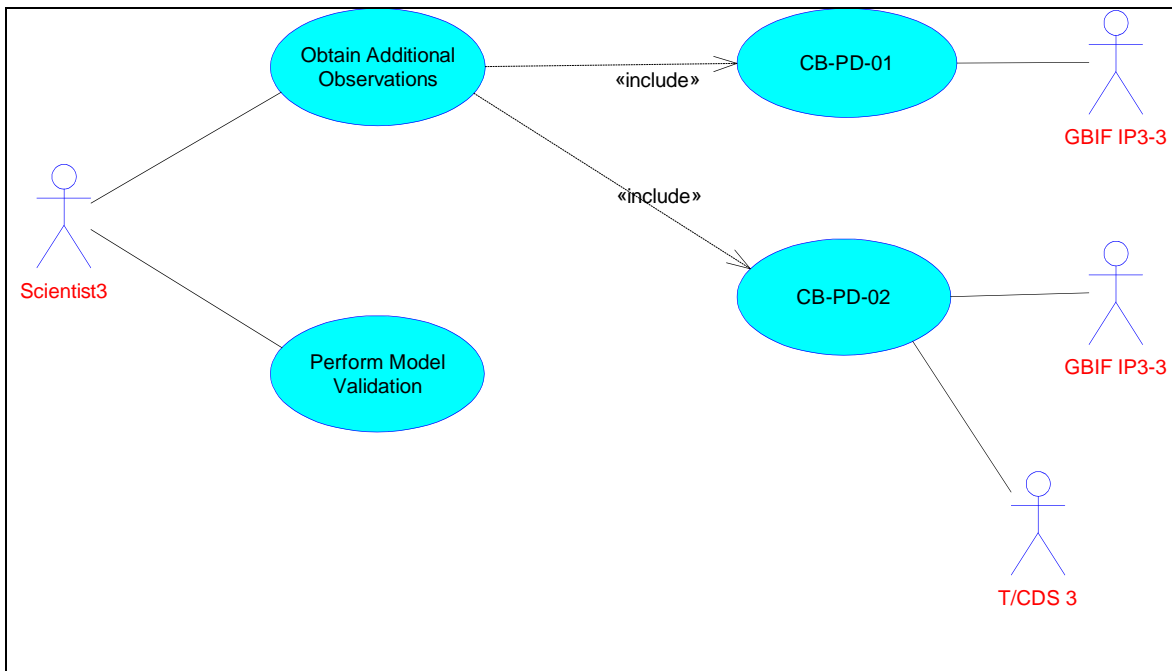


Figure 3-14 Use Case: Validate Ecological Niche Model

### 3.2.1.1.4 Use Case: “CB-PD-04 Scientist Predicts Climate Change Impact on Species Distribution”

Table 3-7 Scientist Predicts Climate Change Impacts

<b>Title</b>	CB-PD-04 Scientist Predicts Climate Change Impact on Species Distribution
<b>Overview</b>	Biodiversity Scientist wants to use Interoperability Process Pilot (IP3) client applications to obtain data for species and climate. Data will be used with species physiological limits to predict climate change impact on species distributions.
<b>Actors and Interfaces</b>	Actors: - Scientist Member of Biodiversity Community. - GBIF IP3 Mediation Service (GBIF IP3) - TOPS/Climate Data Server (T/CDS)
<b>Initial Status and Preconditions</b>	Biodiversity Scientist wants to use GBIF IP3 to discover presence datasets and historical climate data for given specie ranges. GBIF IP3 Mediation Service is available. TOPS/ Climate Data Server is available
<b>Evolution</b>	STEP 1: Scientist obtains species presence datasets using CB-PD-01 through GBIF IP3 Mediation Service.

	<p>STEP 2: Scientist obtains historical climate data from TOPS/Climate Data Server using CB-PD-02 through IP3 Mediation Services.</p> <p>STEP 3: Scientist analyses specie physiological limits.</p> <p>STEP 4: Scientist predicts climate change.</p> <p>STEP 5: Scientist predicts changes in species distributions.</p> <p>STEP 6: Scientist relates predicted climate changes to predicted change in species distributions.</p>
<b>Post Condition</b>	Biodiversity Scientist has related predicted climate change to predicted change in species distribution using GBIF IP3 Mediation Service.

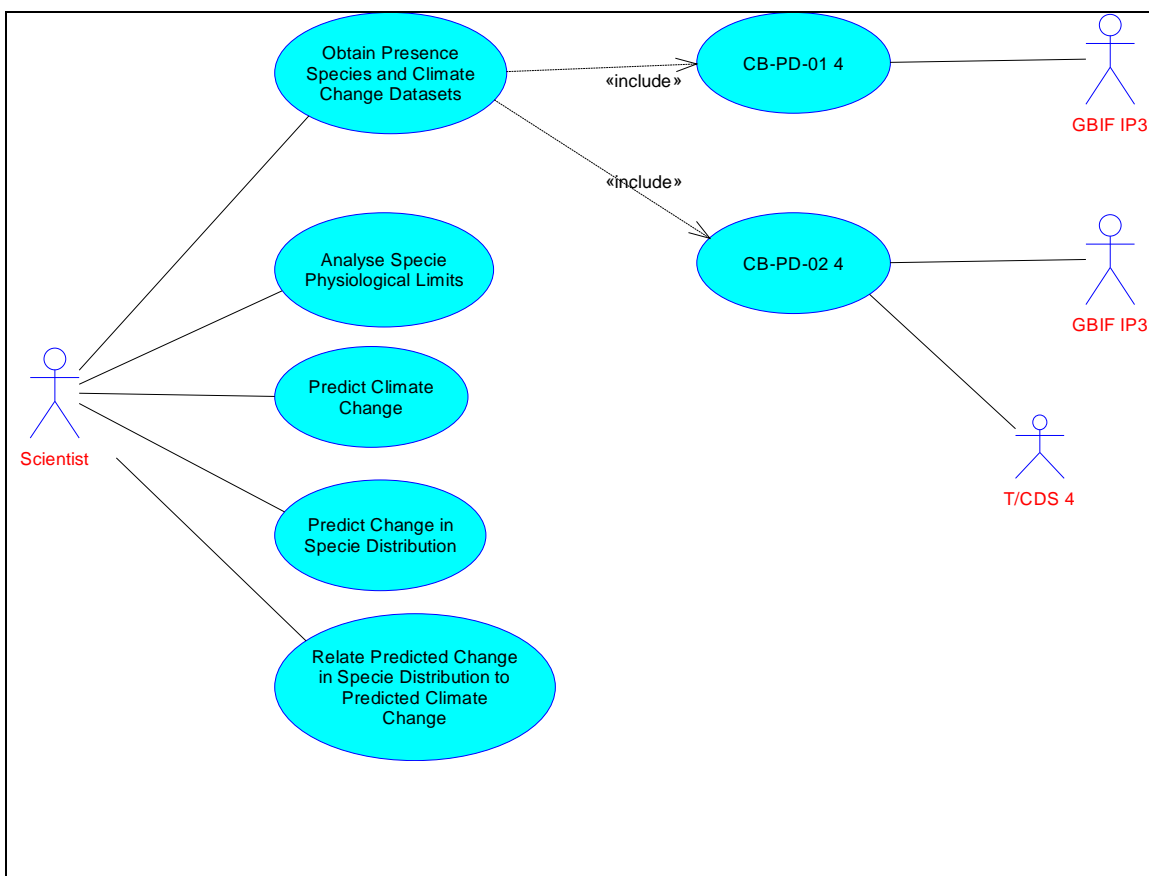


Figure 3-15 Use Case: Scientist Predicts Climate Change Impacts

### 3.2.1.1.5 Use Case: “CB-PD-05 Scientist Predicts Contraction in Range Distribution”

Table 3-8 Scientist Predicts Future Range Distribution

<b>Title</b>	CB-PD-05 Scientist Predicts Contraction in Range
--------------	--

	Distribution
<b>Overview</b>	Biodiversity Scientist wants to use Global Biodiversity Information Facility (GBIF) IP3 to predict how Pika range distributions will contract in the future.
<b>Actors and Interfaces</b>	Actors: - Scientist Member of Biodiversity Community. - GBIF Interoperability Process Pilot (IP3) Central Services
<b>Initial Status and Preconditions</b>	Biodiversity Scientist wants to use GBIF IP3 to discover Biodiversity Data and Metadata. GBIF IP3 Central Services are available.
<b>Evolution</b>	STEP 1: Scientist requests species distribution data. STEP 2: GBIF IP3 Central Services receives species distribution data request. STEP 3: GBIF IP3 Central Services provides Biodiversity Data and Metadata from GBIF Network. STEP 4: Scientist receives species distribution data. STEP 5: Scientist predicts future range distributions.
<b>Post Condition</b>	Biodiversity Scientist has used GBIF IP3 to predict how Pika range distributions will contract in the future.

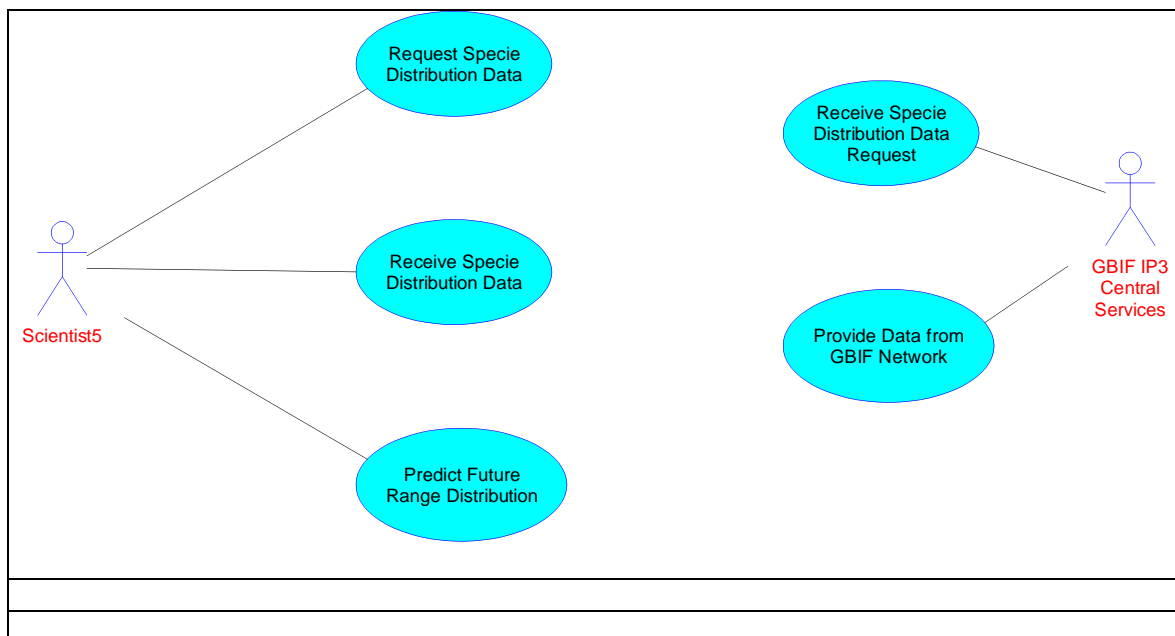


Figure 3-16 Future Range Distribution

### 3.2.1.1.5 Processes

The following activity diagram “Species of Interest” illustrates the process that is initiated by the scientist to obtain specie information.

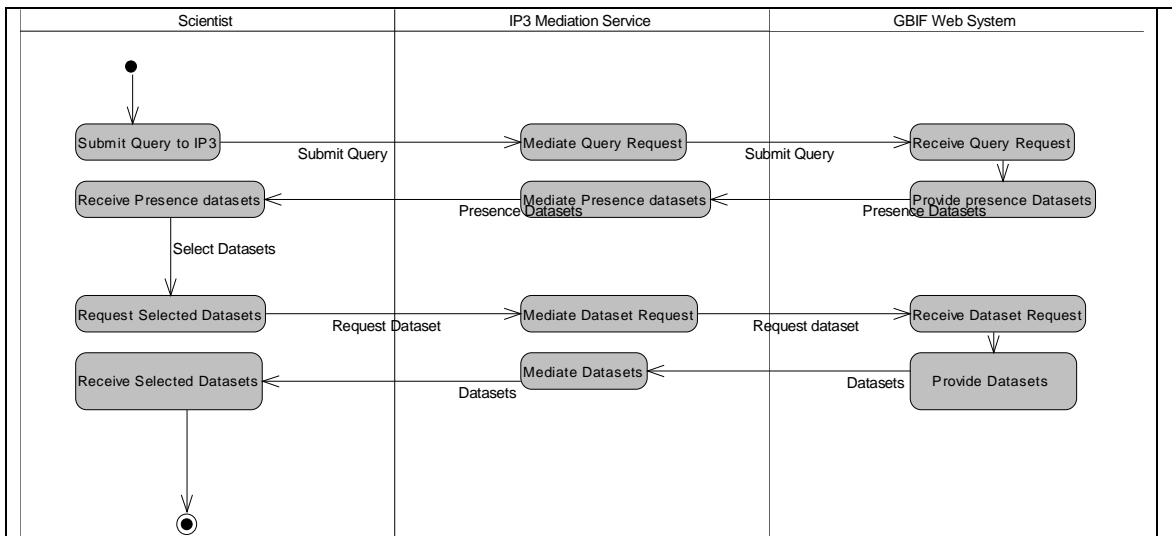


Figure 3-17 Activity Diagram for the “Species of Interest” Process

Processes:

The following activity diagram “Niche Model” illustrates the process of a scientist developing an Ecological Niche Model.

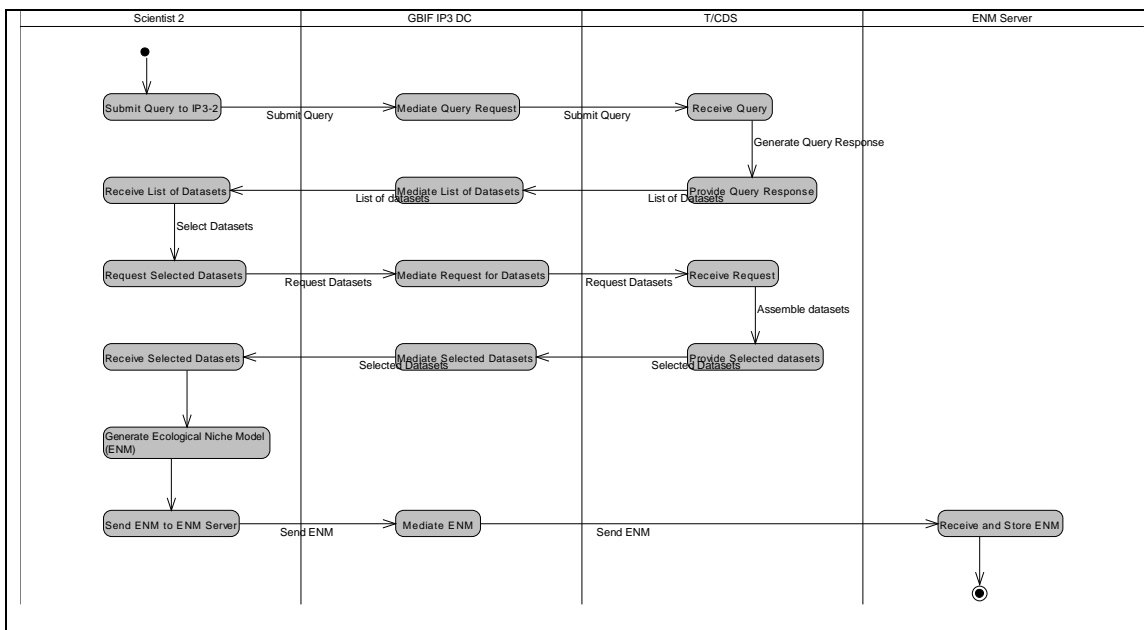


Figure 3-18 Activity Diagram for the “Niche Model” Process

Processes

The following activity diagram “Validate ENM” illustrates the process of how a scientist validates an ENM.

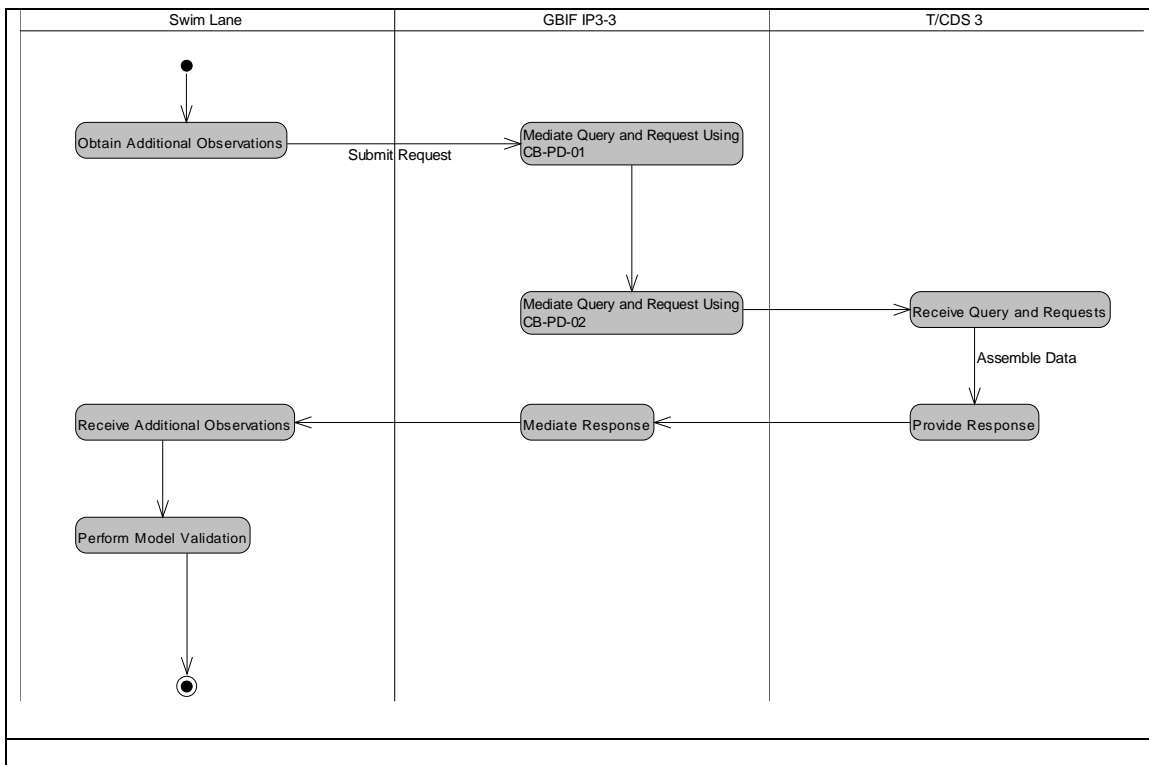
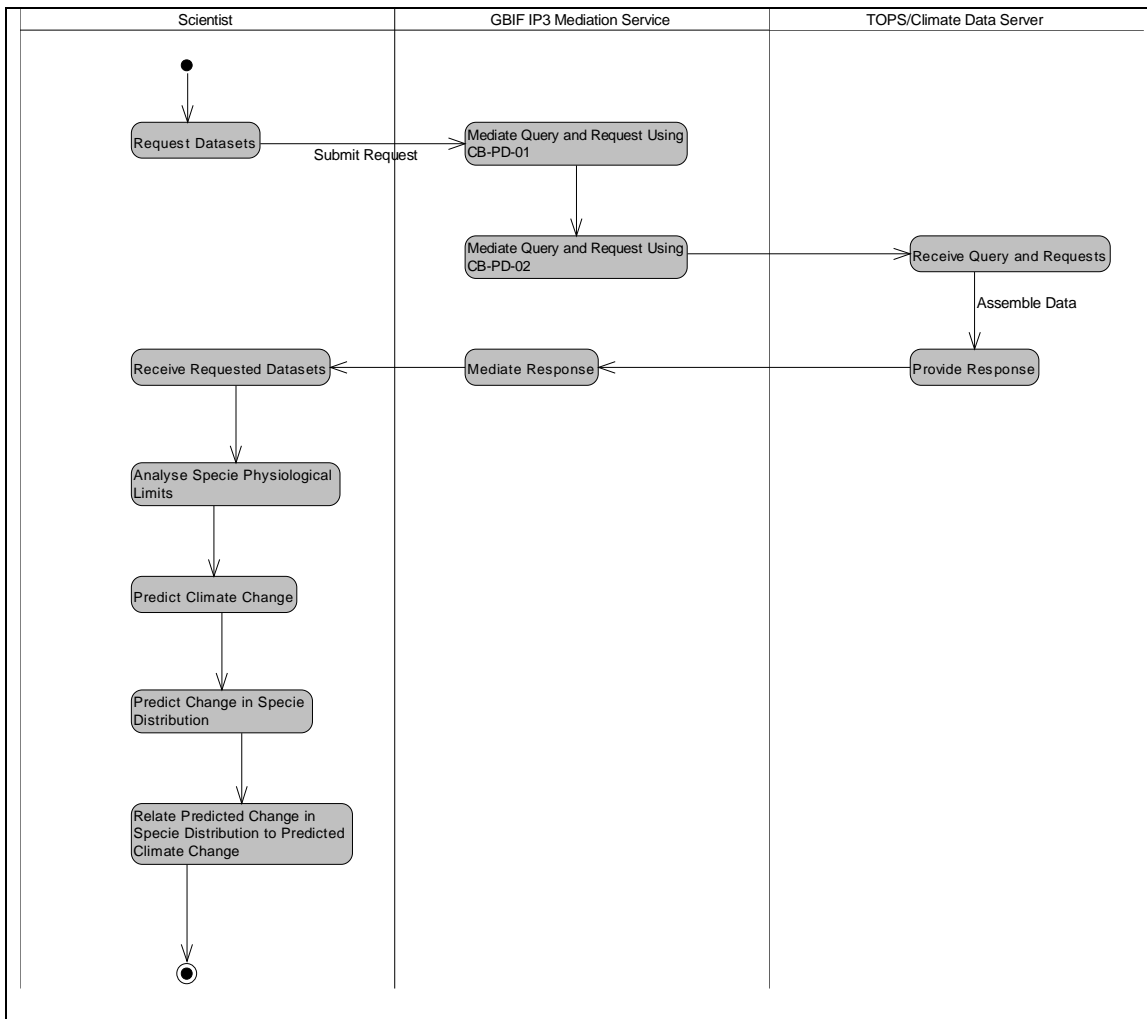


Figure 3-19 Activity Diagram for “Validate ENM”

The following Activity Diagram “Scientist Predicts Climate Change Impacts” illustrates the process used to predict impacts on specie distribution.



**Figure 3-20. Activity Diagram for “Scientist Predicts Climate Change Impacts”**

### 3.2.1. Processes

The following Activity Diagram “Future Range Distribution” illustrates the process used to predict specie distribution in the future.

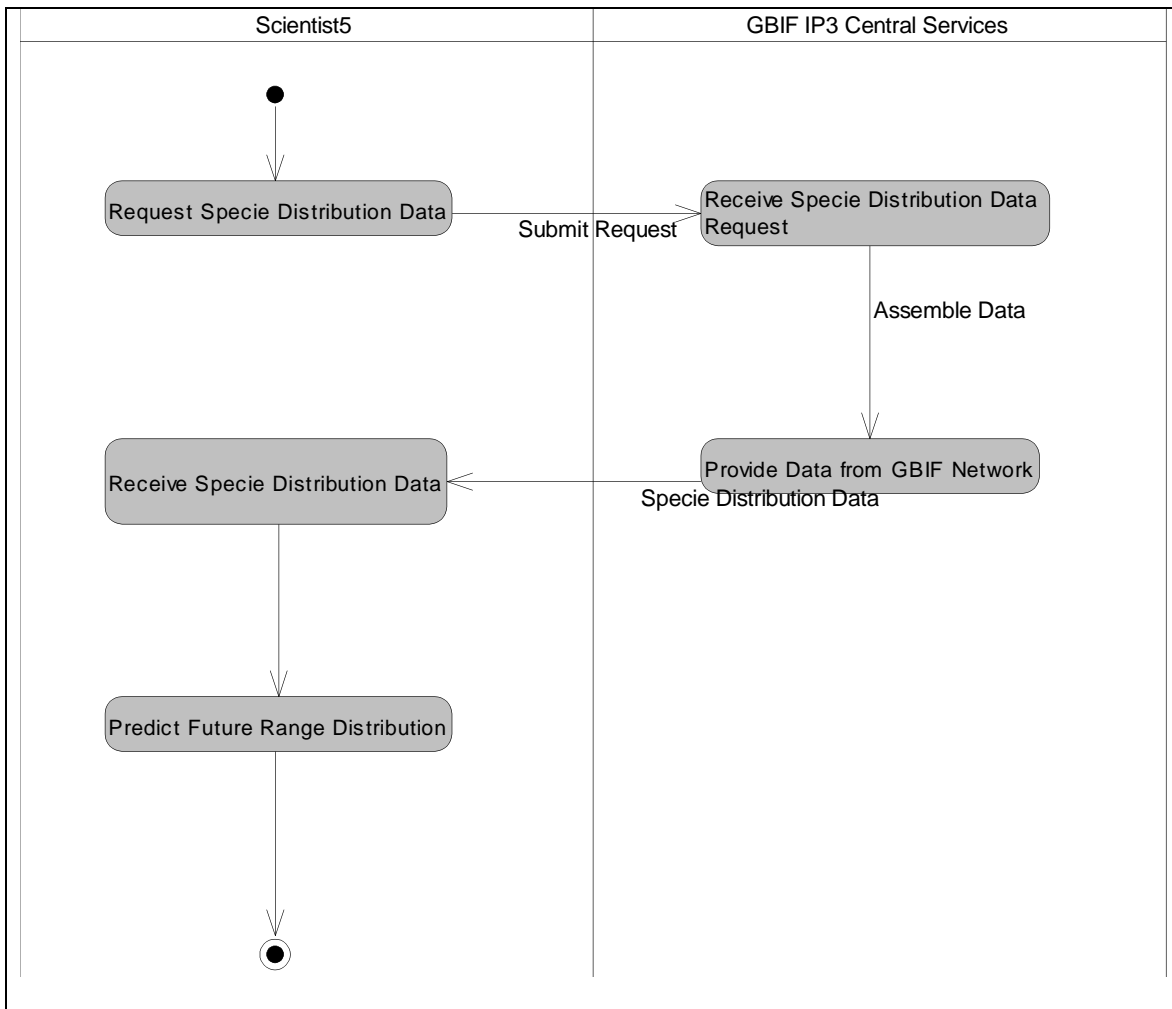


Figure 3-21 Future Range Distribution

### 3.2.1.2 Information View

The information specification viewpoint is concerned with information modeling. We have simplified the number of diagrams by offering all parts of view in an Entity Relation Diagram. It contains each information object its attributes and relationships with other information objects,

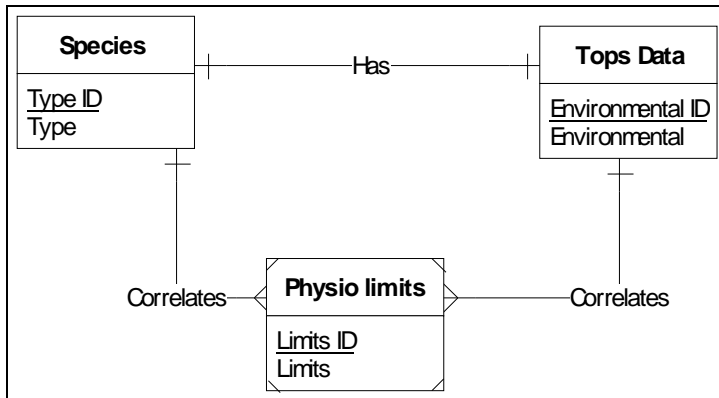


Figure 3-22 Pika Information View

### 3.2.1.3 Computational View

The computational view is described in accordance with ISO/IEC 19793 for the use of UML for Open Distributed Processing system specification.

The computational specification functionally decomposes Climate Change and Biodiversity management and decision support using the GEOSS-2, with “units of function as computational objects, and interactions among those computational objects, without considering their distribution over networks and nodes.”

#### 3.2.1.3.1 Basic structure of the computational viewpoint for Climate Change and Biodiversity

The following diagram describes the elements or packages of the computational viewpoint for Air Quality, as an example. Interface templates are described as ports, where interface signatures define operations that can handle data and return values. Data types are defined for this data handled and return values. Computational objects are components and are also described by their templates.

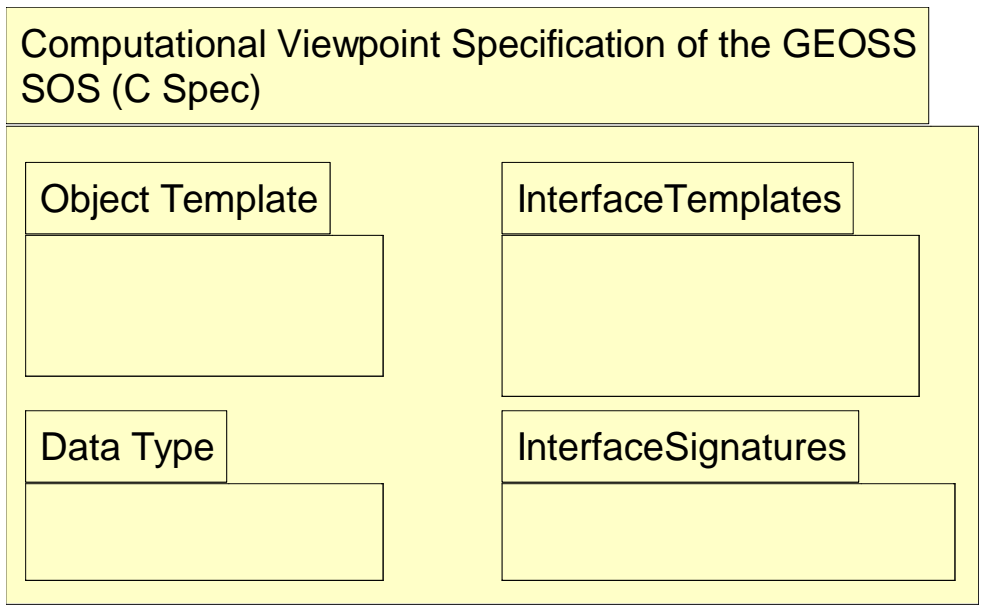


Figure 3-23 Basic structure of the computational viewpoint for Air Quality (Example)

### 3.2.1.3.2 Object and Interface Templates

In the following component diagram, system functionality is decomposed into computational objects (or components) that interact at the interfaces (or port instances). The system consists of four main components – the Pika Distribution Main Functionality, and the user interfaces that interact with it which includes the interface to the Scientist, and the interface to the Scientist/Analyst. This defines the high-level architecture.

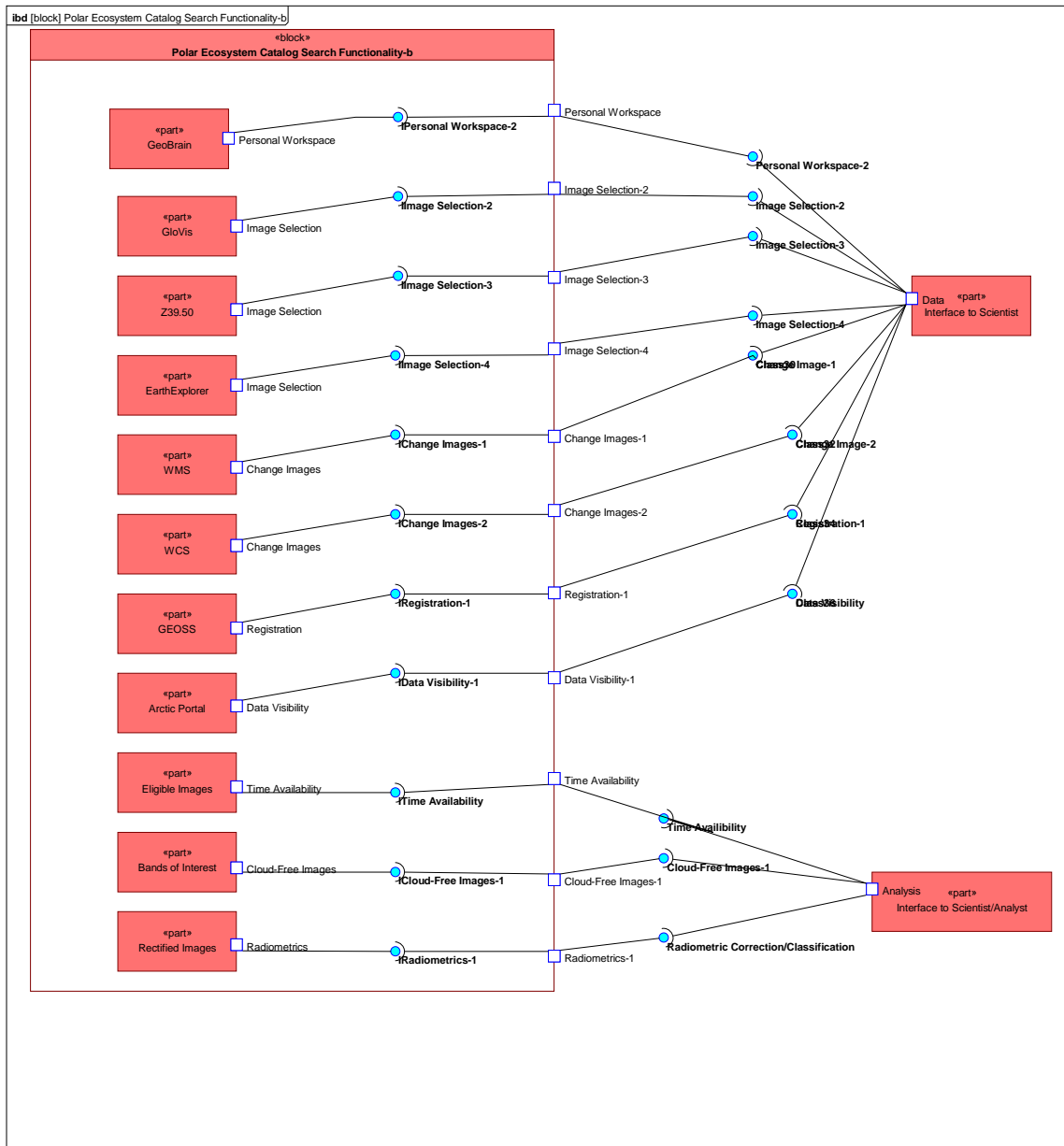


Figure 3-24 Computational object templates and interface signatures



## 3.2.1.3.3 Detailed Architecture

The following component diagram decomposes the high-level architecture further to define the internal components, and interactions between those components.

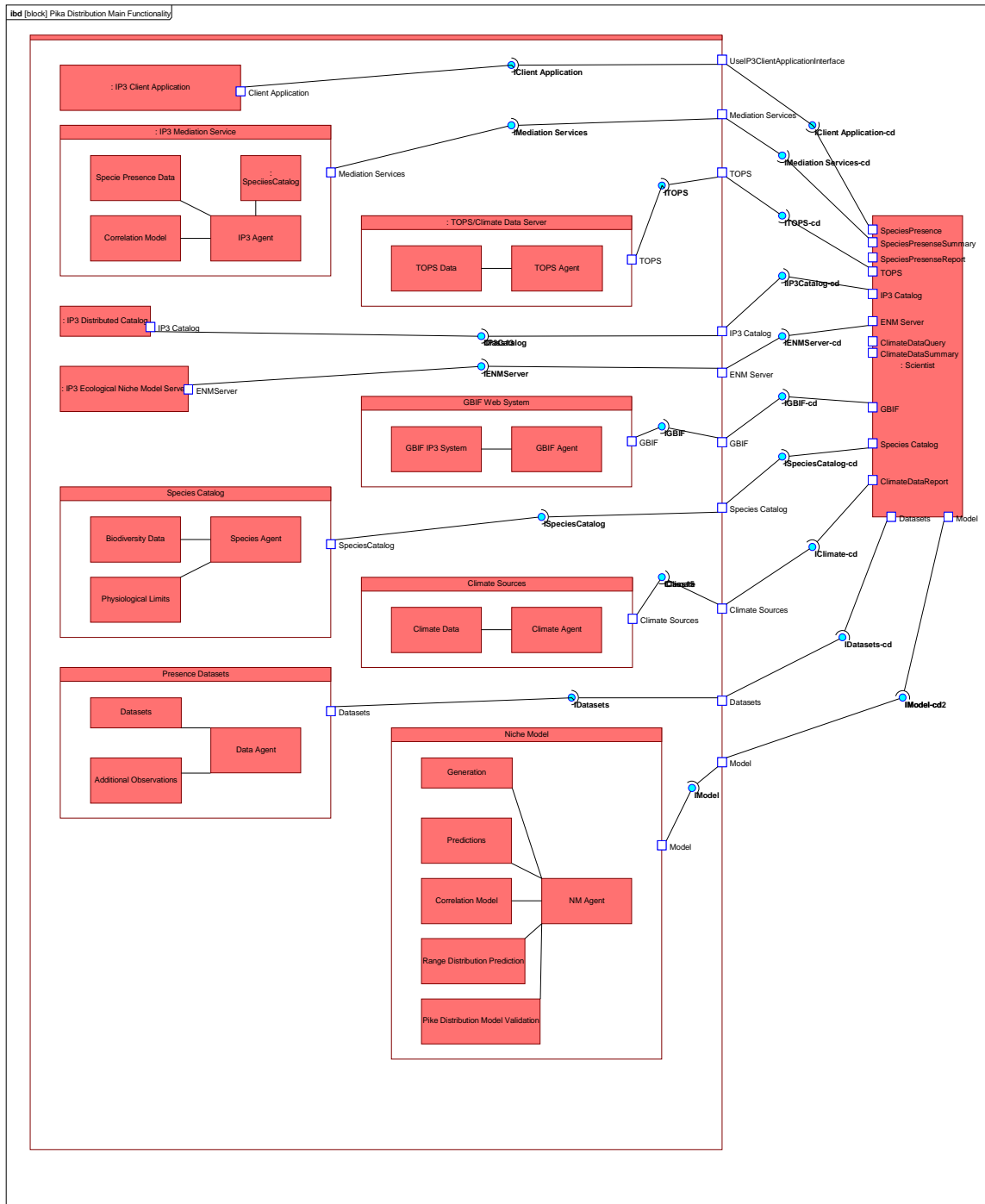


Figure 3-25 Internal structure of the Pika Distribution Functionality Computational Object

### 3.2.1.3.4 Interaction Signatures

The following diagram defines the interface signatures that are instantiated by the ports defined in the prior two component diagrams.

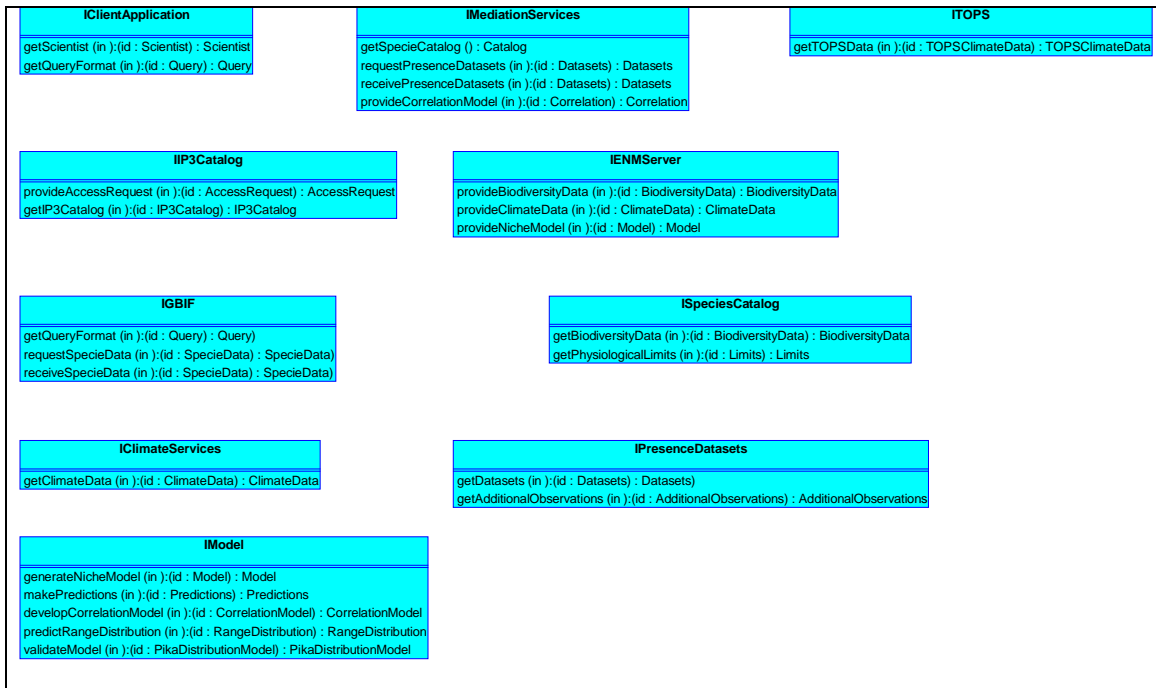


Figure 3-26 Interaction signatures

### 3.2.1.3.5 Data Types

Interface templates are described as ports, where interface signatures define operations that can handle data and return values. The following (incomplete) diagram describes the data types that are defined for the data handled and return values for interfaces.

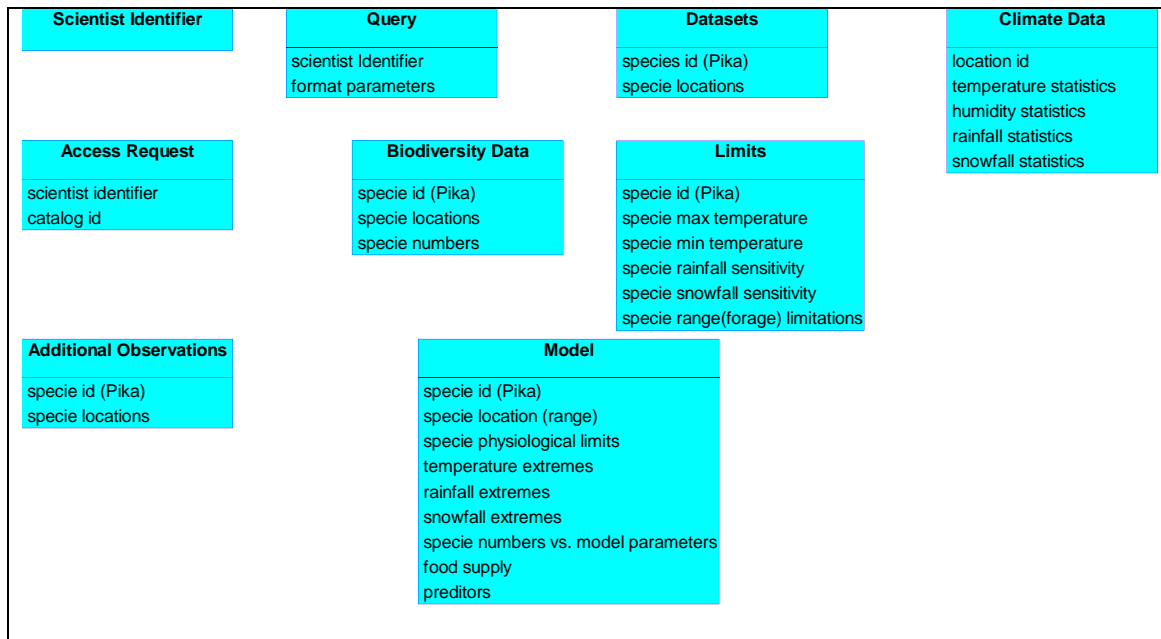


Figure 3-27 Data types handled by the com

### 3.3 Societal Benefits Area – Climate Change and Biodiversity

#### 3.3.1 Scenario – Arctic Food Chain

##### 3.3.1.1 Enterprise View

The enterprise viewpoint describes the business requirements for the Arctic Food Chain and decision support using GEOSS-2 without specifying the technology or other system considerations.

The Enterprise View defines use cases for Arctic Food Chain, using Object Management Group's Unified Modeling Language (UML). The sections that follow the Overview Use Case Diagram are organized by use case and describe the series of processes for each use cases. The processes are defined by activity diagrams, and are currently limited in scope to only the Wildfire scenario.

##### 3.3.1.1.1 Overview Use Case Diagram

A use case diagram describes the behaviors and dynamics of the system being modeled, and is composed of a component boundary, use case name, external actors and their relationships. Within the use case diagram, actors are represented as person stick figures, and use cases are shown as bubbles.

The following diagram presents the overview use case diagram for Air Quality. It identifies the use cases that comprise Arctic Food Chain and decision support using GEOSS-2 and the high level relationships between them.

### 3.3.1.1.2 Use Case Narratives

Note: Use cases selected by SBA team were really Description of the scenario and not really at level of use cases. So we developed own Use Cases that seemed to capture the scenario intent more succinctly.

### 3.3.1.1.3 Use Case: “Arctic Food Chain”

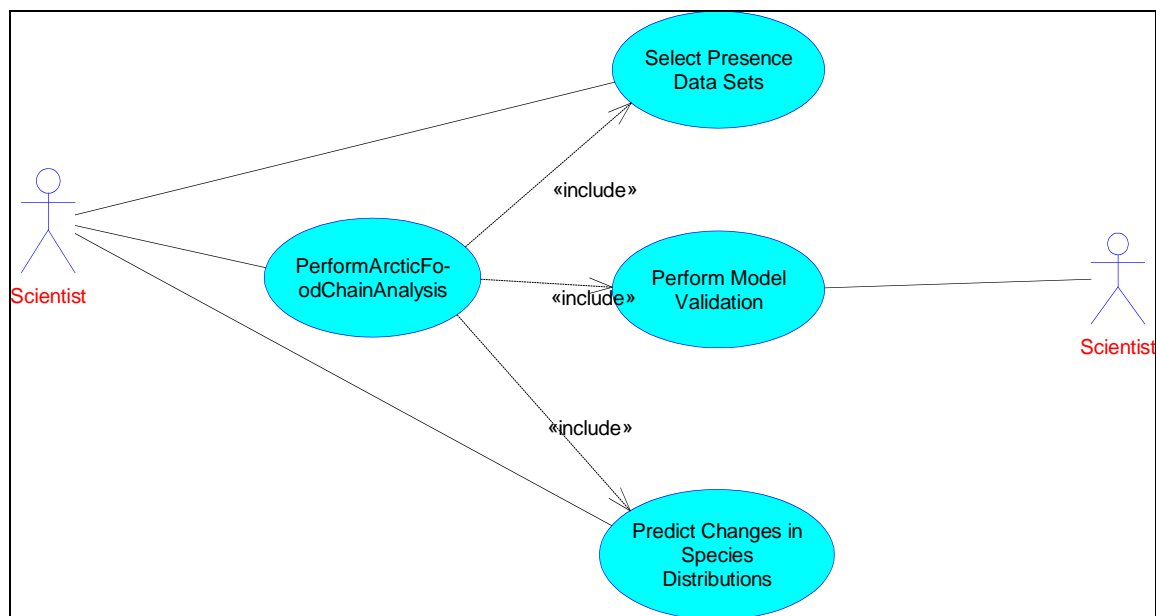


Figure 3-28 Use Case Diagram for Arctic Food Chain

Actors formalize the roles of systems, individuals, or external components which interact with this system. The following table describes the actors in the use case diagram.

Table 3-9 Actors in the System

Actor Name	Description
------------	-------------

Actor Name	Description
Arctic Food Chain Scientist	Arctic Food Scientist selects species of interest, uses IP3 Mediation Service to develop correlation model between species and environment. Climate data (published and accessed through a Web Coverage Service), validates model using additional observations. Uses known physiological limits of the species to direct the development of models relating predicted climate change to predicted change in species distribution. uses GBIF IP3 system to predict how range distributions will contract in the future

### 3.3.1.1.3 Use Case: “Select Presence Data Sets”

Purpose: CB-AF-01. Scientist selects species of interest

Pre-Conditions: Connectivity with IP3 Mediation Service

Post-Conditions: Scientist uses known physiological limits of the species to direct the development of models relating predicted climate change to predicted change in species distribution.

### 3.3.1.1.4 Use case: “Scientist validates model using additional observations.”

Purpose: CB-AF-03. Scientist validates model using additional observations

Pre Conditions: Scientist has received correlation models between species and environment.

Post Conditions; Scientist uses known physiological limits of the species to direct the development of models relating predicted climate change to predicted change in species distribution.

### 3.3.1.1.5 Use Case: “Predict changes in species distribution”

Purpose: Scientist uses GBIF IP3 system to predict how range distributions will contract in the future

Pre Conditions: Scientist has required known physiological limits of the species to direct the development of models relating predicted climate change to predicted change in species distribution.

Post Conditions: Scientist has used GBIF IP3 system provided data to predict range distributions.

#### 3.3.1.1.6 Processes

This section has the processes of the scenario presented in form of SysML Activity Diagrams.

This process encompasses all four use cases depicted on activity diagram.

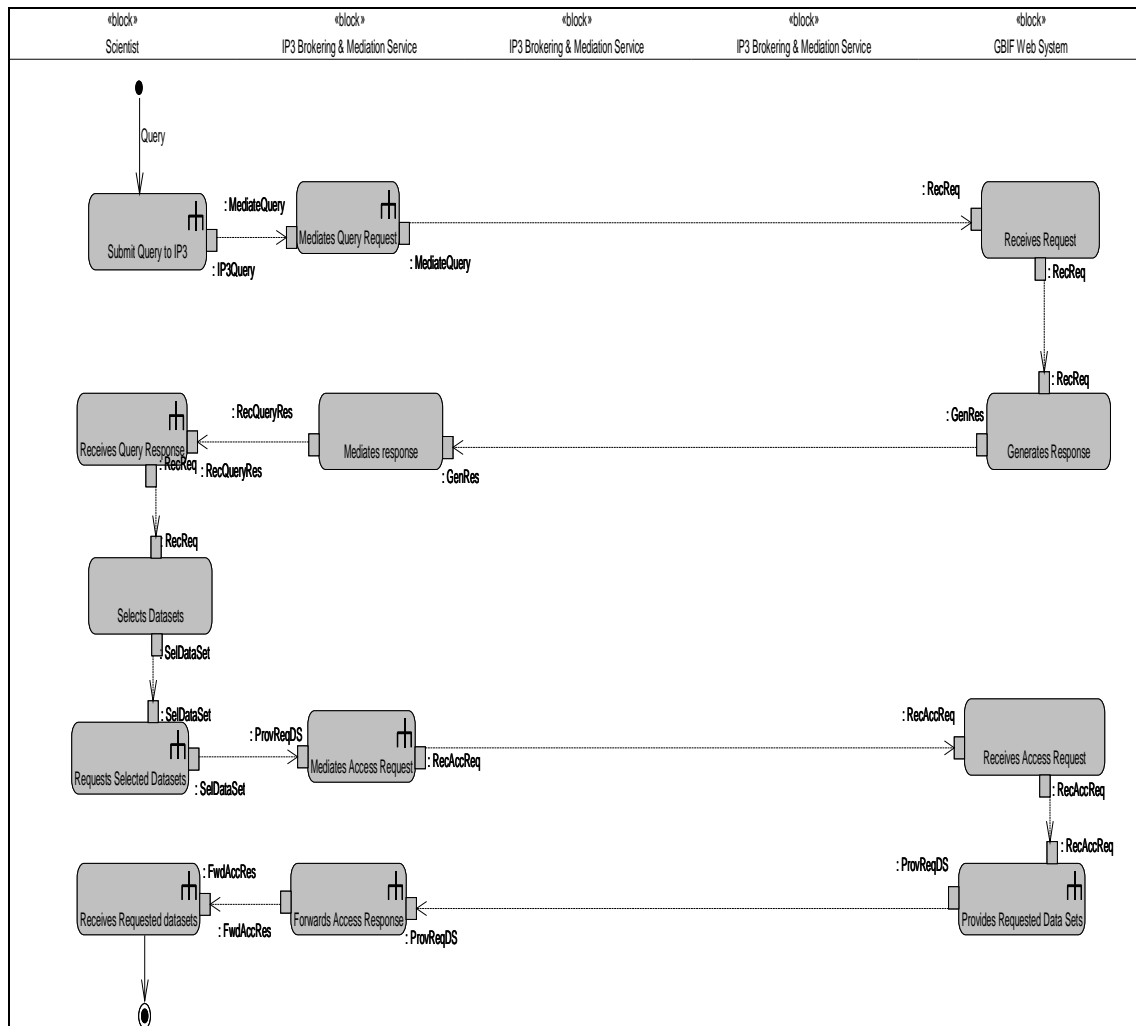


Figure 3-29 Activity Diagram for the “Arctic Food Chain Request for data” Process.

### 3.3.1.1 Information view

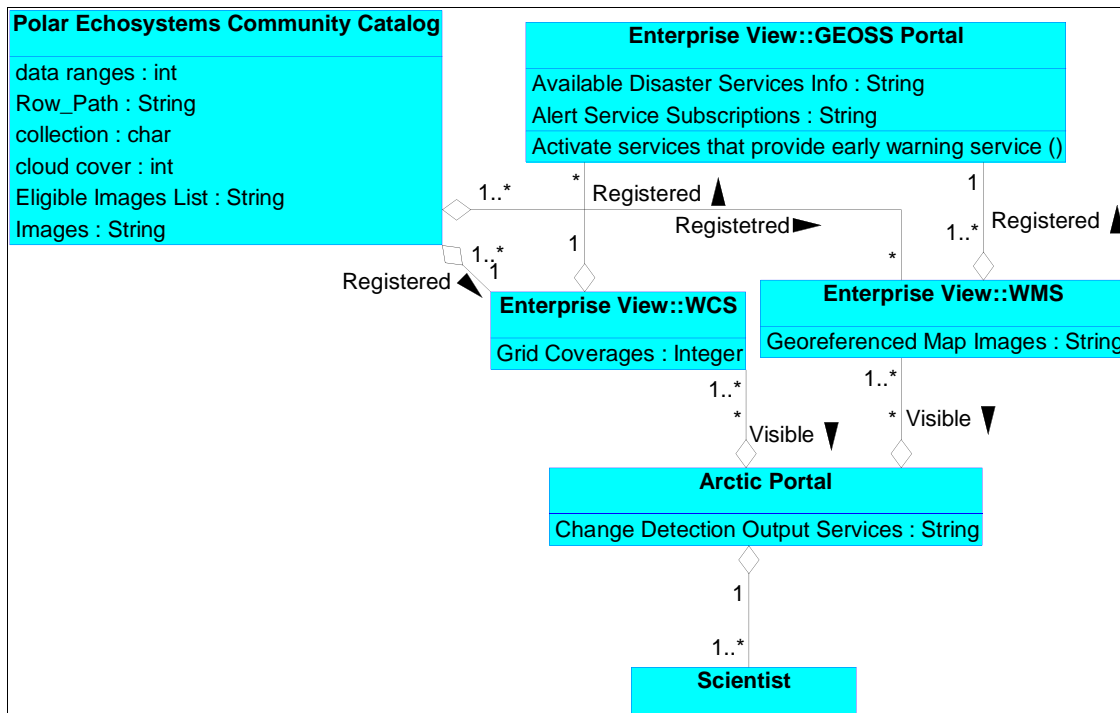


Figure 3-30 Polar Ecosystems Entity Relationship Diagram

### 3.3.1.3 Computational View

The computational view is described in accordance with ISO/IEC 19793 for the use of UML for Open Distributed Processing system specification.

The computational specification functionally decomposes Arctic Food Chain and decision support using the GEOSS-2, with “units of function as computational objects, and interactions among those computational objects, without considering their distribution over networks and nodes.”

#### 3.3.1.3.1 Basic structure of the computational viewpoint for Arctic Food Chain

The following diagram describes the elements or packages of the computational viewpoint for Arctic Food Chain as an example. Interface templates are described as ports, where interface signatures define operations that can handle data and return values. Data types are defined for this data handled and return values. Computational objects are components and are also described by their templates

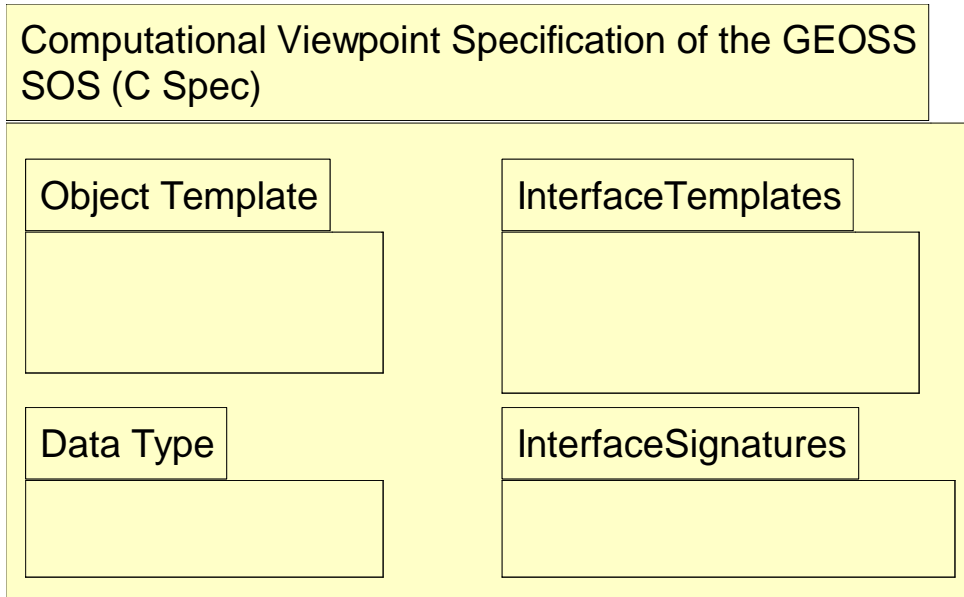


Figure 3-31 Computational Viewpoint

### 3.3.1.3.2 Object and Interface Templates

In the following component diagram, system functionality is decomposed into computational objects (or components) that interact at the interfaces (or port instances). The system consists of four main components – the Arctic Food Chain Main Functionality for Wildfire, and the user interfaces that interact with it which includes the Modeler, the Arctic Food Chain Analyst/Manager, and the GEOSS Registry. This defines the high-level architecture.

### 3.3.1.3.3 Detailed Architecture

The following component diagram decomposes the high-level architecture further to define the internal components, and interactions between those components.

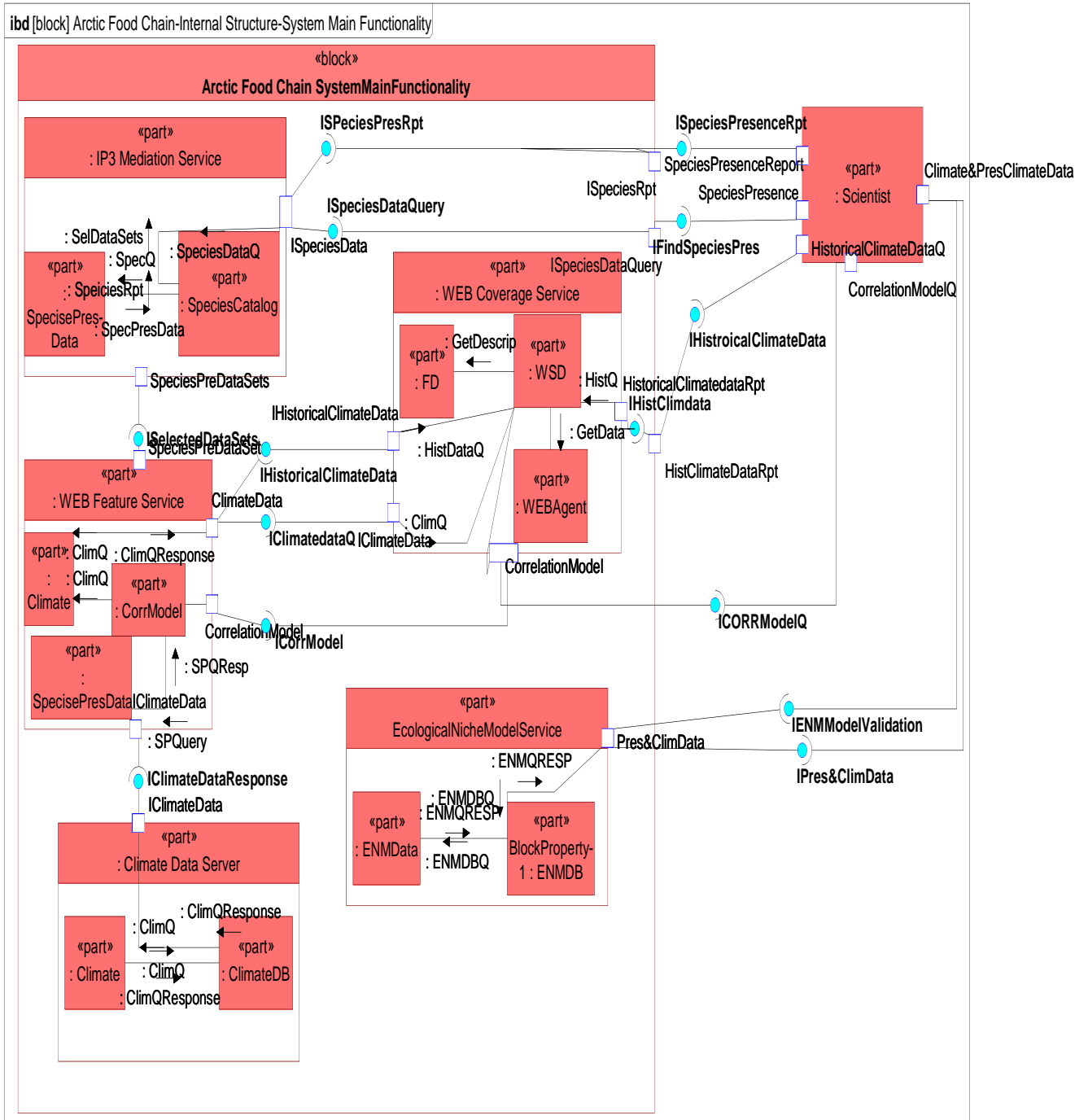


Figure 3-32 internal structure of the Arctic Food Chain System Functionality



### 3.3.1.2.4 Interaction Signatures

The following diagram defines the interaction signatures that are instantiated by the ports defined in the prior two component diagrams.

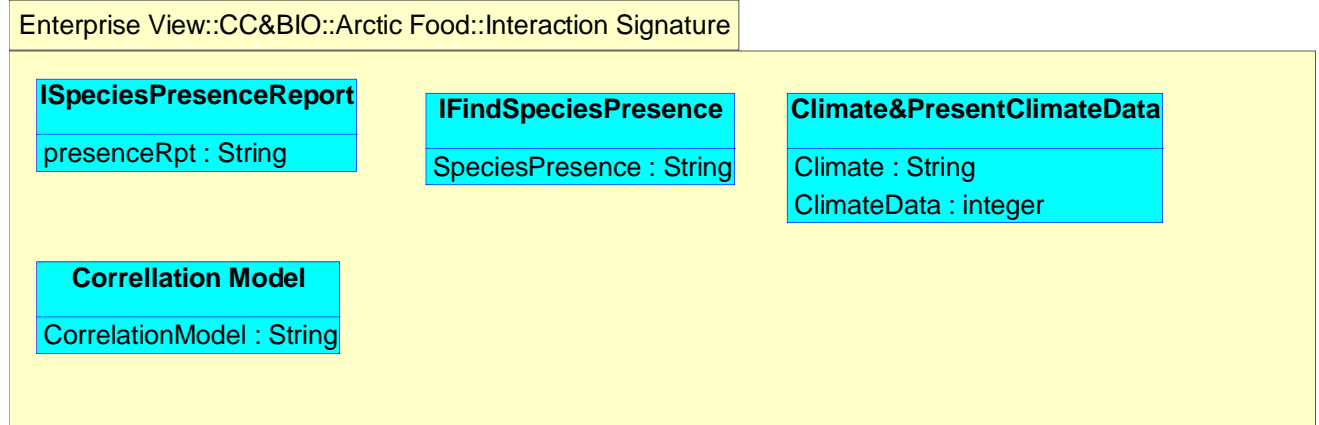


Figure 3-33. Interaction signatures

### 3.3.1.2.4 Data Types

Interface templates are described as ports, where interface signatures define operations that can handle data and return values. The following diagram describes the data types that are defined for the data handled and return values for interfaces.

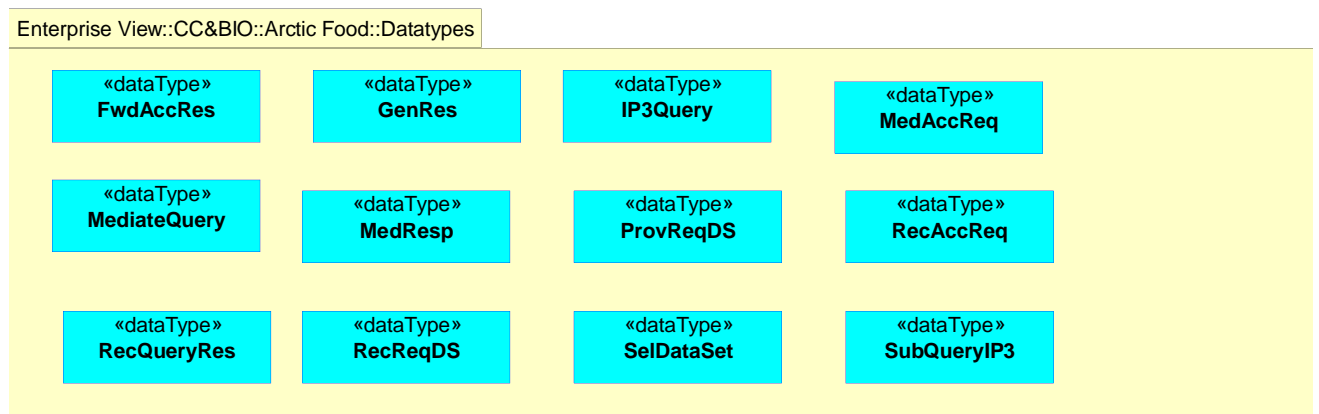


Figure 3-34 Data types handled by the Arctic Food Chain interfaces

### 3.4 Societal Benefits Area – Climate Change and Biodiversity

#### 3.4.1 Scenario – Polar Ecosystems

##### 3.4.1.1 Enterprise View

Actors formalize the roles of systems, individuals, or external components which interact with this system. The following table describes the actors in the use case diagram.

Table 3-10 Actors in the Polar Ecosystems System

Actor Name	Description
Scientist	Launches GEOBrain, establishes personal workspace and obtains LANDSAT scenes from polar regions, makes radiometric corrections that yield rectified images and registers change detection output images (WMS&WCS) services with GEOSS that are visible through Arctic portal.
GEOSS	Provides Portal, Registry and Clearinghouse
LandSAT	Has scenes of eligible images as metadata with embedded link (URL) to a thumbnail image .in various polar locations
Earth Explorer Client	Stages access/download of images by Scientist

##### 3.4.1.1.1 Use Case: “Get Change Detection Output Services”

##### 3.4.1.1.2 Overview Use Case Diagram

A use case diagram describes the behaviors and dynamics of the system being modeled, and is composed of a component boundary, use case name, external actors and their relationships. Within the use case diagram, actors are represented as person stick figures, and use cases are shown as bubbles.

The following diagram presents the overview use case diagram for Polar Ecosystems. It identifies the use cases that comprise Polar Ecosystems and decision support using GEOSS-2 and the high level relationships between them.

##### 3.4.1.1.3 Use Case Narratives

Purpose:

The purpose of this Scenario is to get and make visible via Arctic Portal detection output (WMS/WCS) of Change Images. The scenario really has one use case with seven steps and two pre conditions.

Pre-Conditions: Scientific Workbench is enabled with catalog functionality and GEO Brain has been launched and personal workspace established  
Not defined

Post-Conditions: Change detection output services (WMS/WCS) are registered with GEOSS and visible through Arctic portal.

Alternatives: Perform Radiometric Correction and produce rectified images.

Processes

The following activity diagram “Get Change Detection Output Services” illustrates the process that is initiated by the state to request an Exceptional Waiver for an event, which could be a Wildfire.

3.4.1.1.4 Use case:

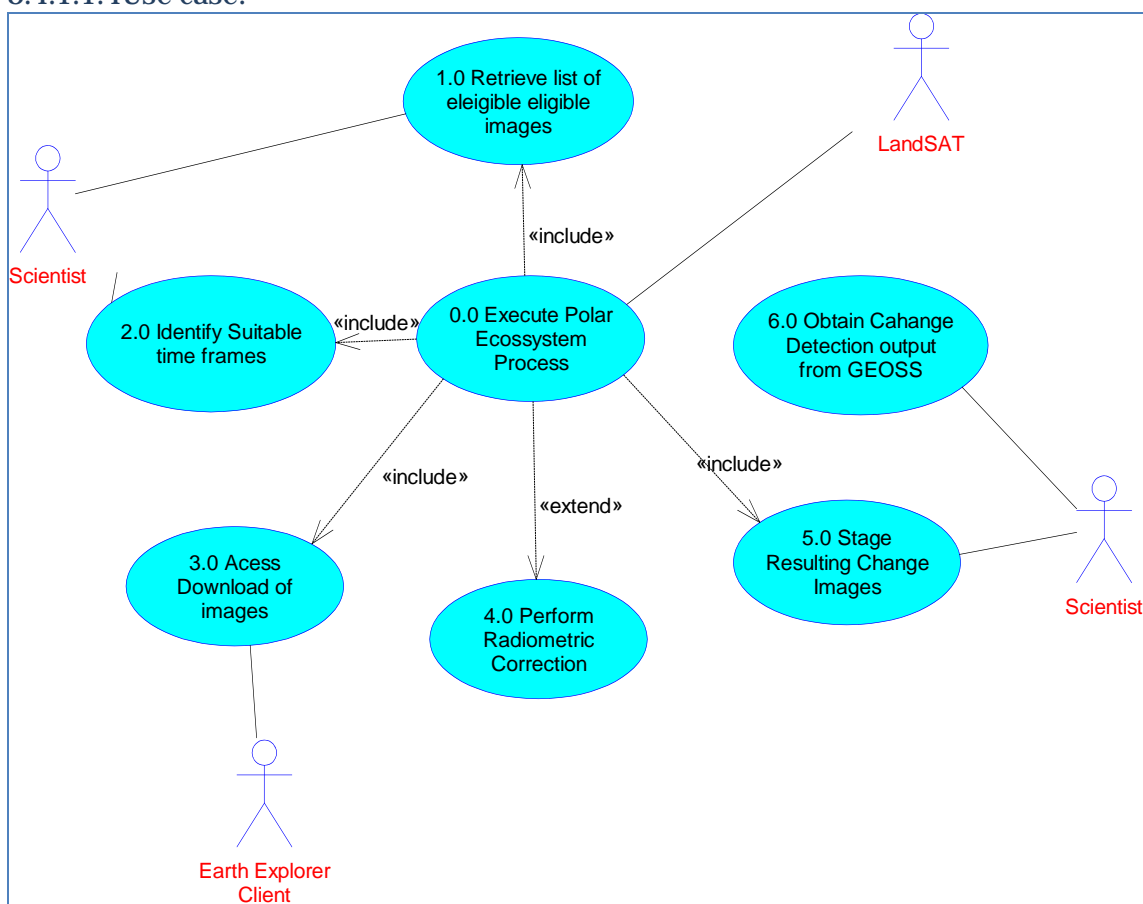


Figure 3-35 Get Change Detection Output

3.4.1.1.5 Processes

This section has the processes of the scenario presented in form of a SysML Activity Diagram. This process encompasses all use cases depicted on activity diagram. One activity diagram was selected because use cases are really better classified as steps of a process than individual use cases.



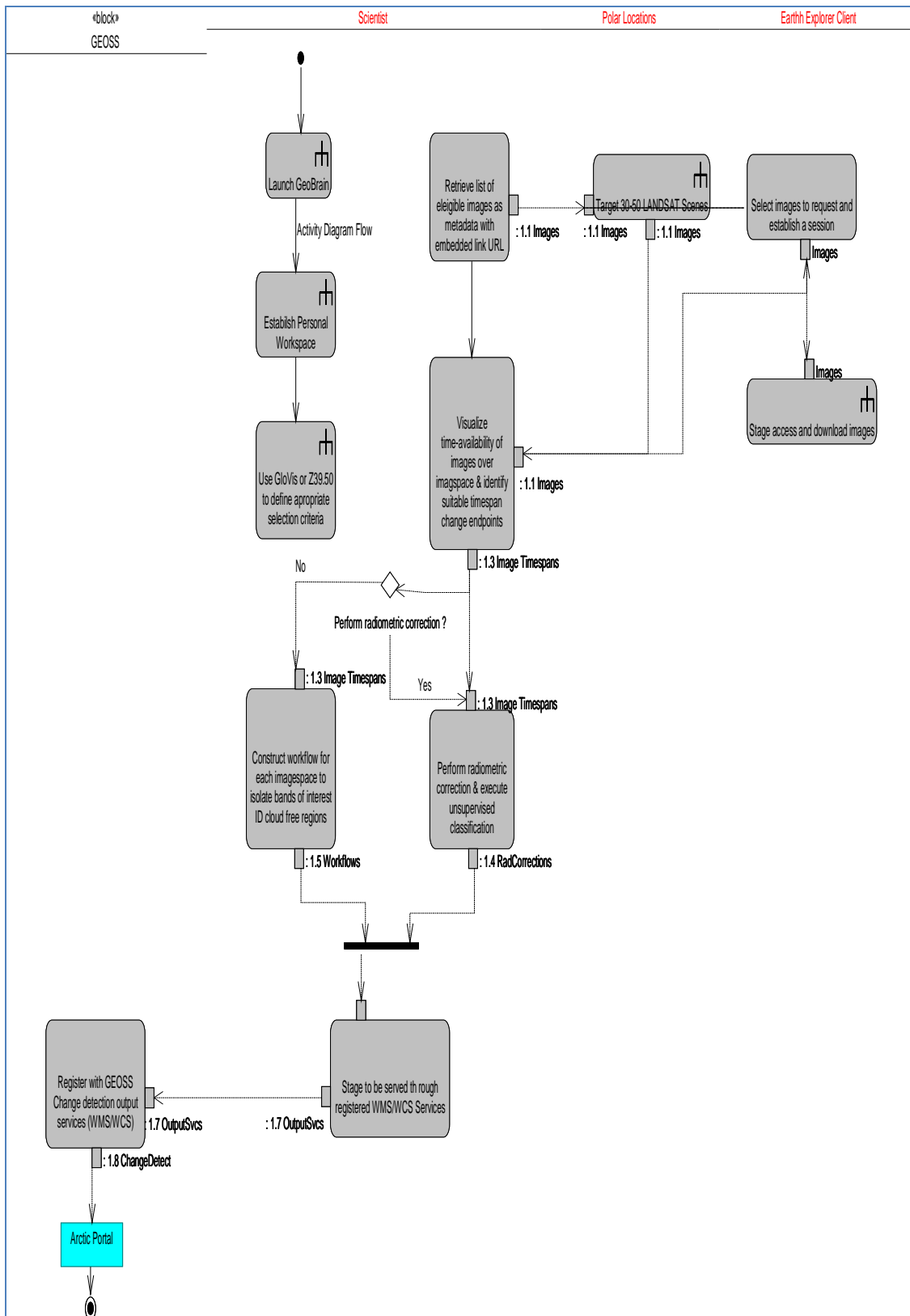


Figure 3-36 Activity Diagram "Get Change Detection Output"

### 3.4.1.2 Information View

The information specification viewpoint is concerned with information modeling. We have simplified the number of diagrams by offering all parts of view in an Entity Relation Diagram. It contains each information object its attributes and relationships with other information objects,

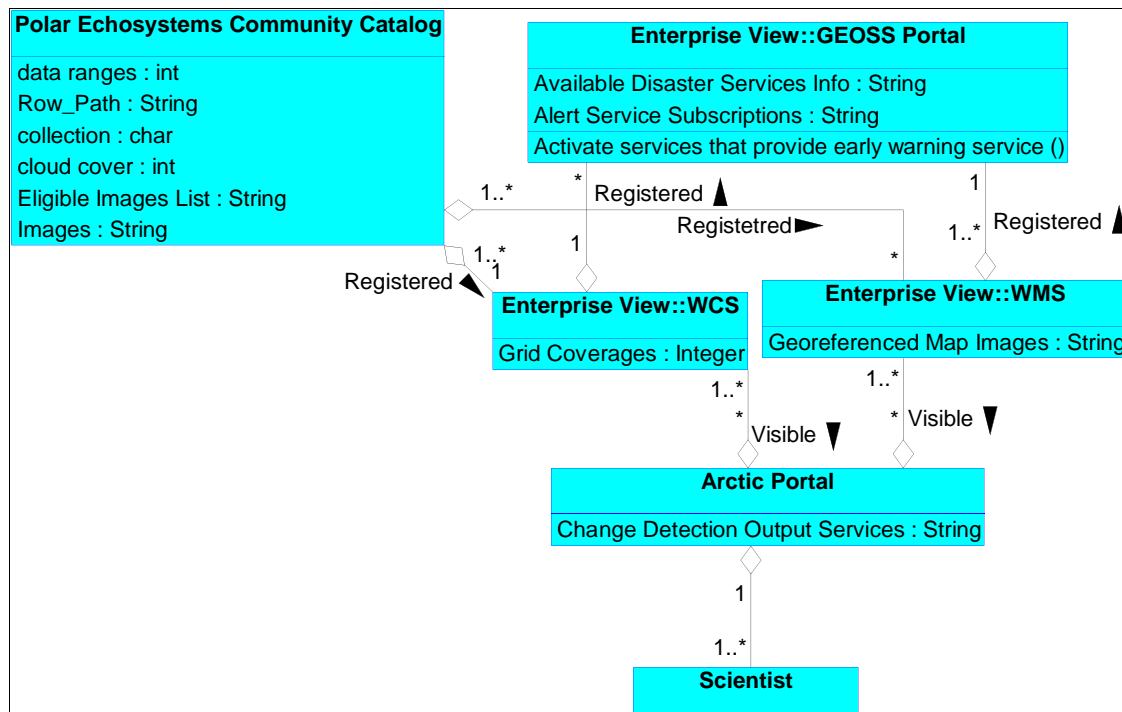


Figure 3-37 Polar ecosystem Entity Relationship Diagram

### 3.4.1.3 Computational View

The computational view is described in accordance with ISO/IEC 19793 for the use of UML for Open Distributed Processing system specification.

The computational specification functionally decomposes Polar Ecosystems and decision support using the GEOSS-2, with “units of function as computational objects, and interactions among those computational objects, without considering their distribution over networks and nodes.”

#### 3.4.1.3.1 Basic Structure of the computational viewpoint

The following diagram describes the elements or packages of the computational viewpoint for Polar Ecosystems as an example. Interface templates are described as ports, where interface signatures define operations that can handle data and return values. Data types are defined for this data handled and return values. Computational objects are components and are also described by their templates

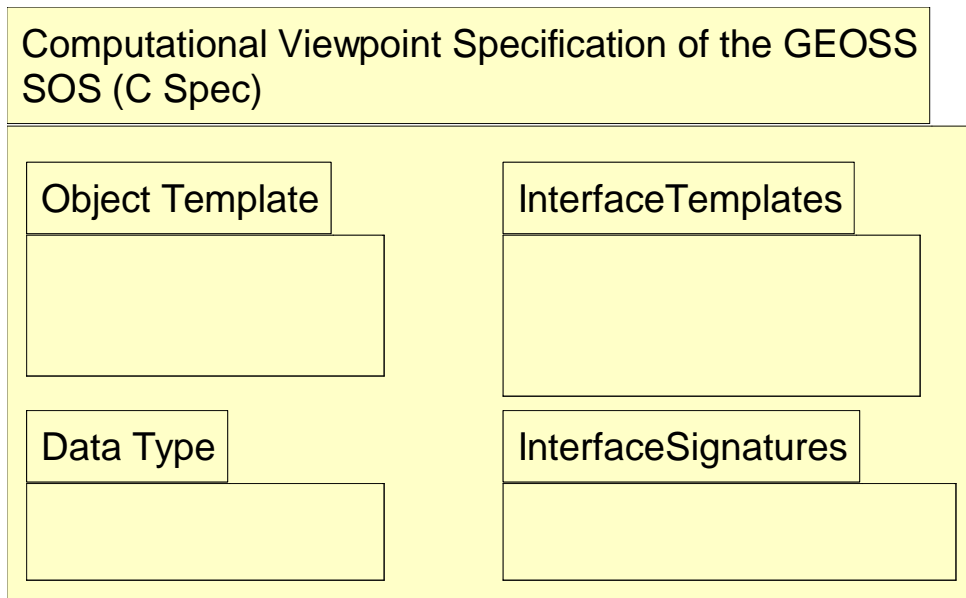


Figure 3-38 Basic Structure of the computational viewpoint

#### 3.4.1.3.2 Object and Interface templates

In the following component diagram, system functionality is decomposed into computational objects (or components) that interact at the interfaces (or port instances). The system consists of four main components – the Polar Ecosystem Main Functionality for Flooding, and the user interfaces that interact with it which

includes Scientist, and the GEOSs Portal. This defines the high-level architecture.

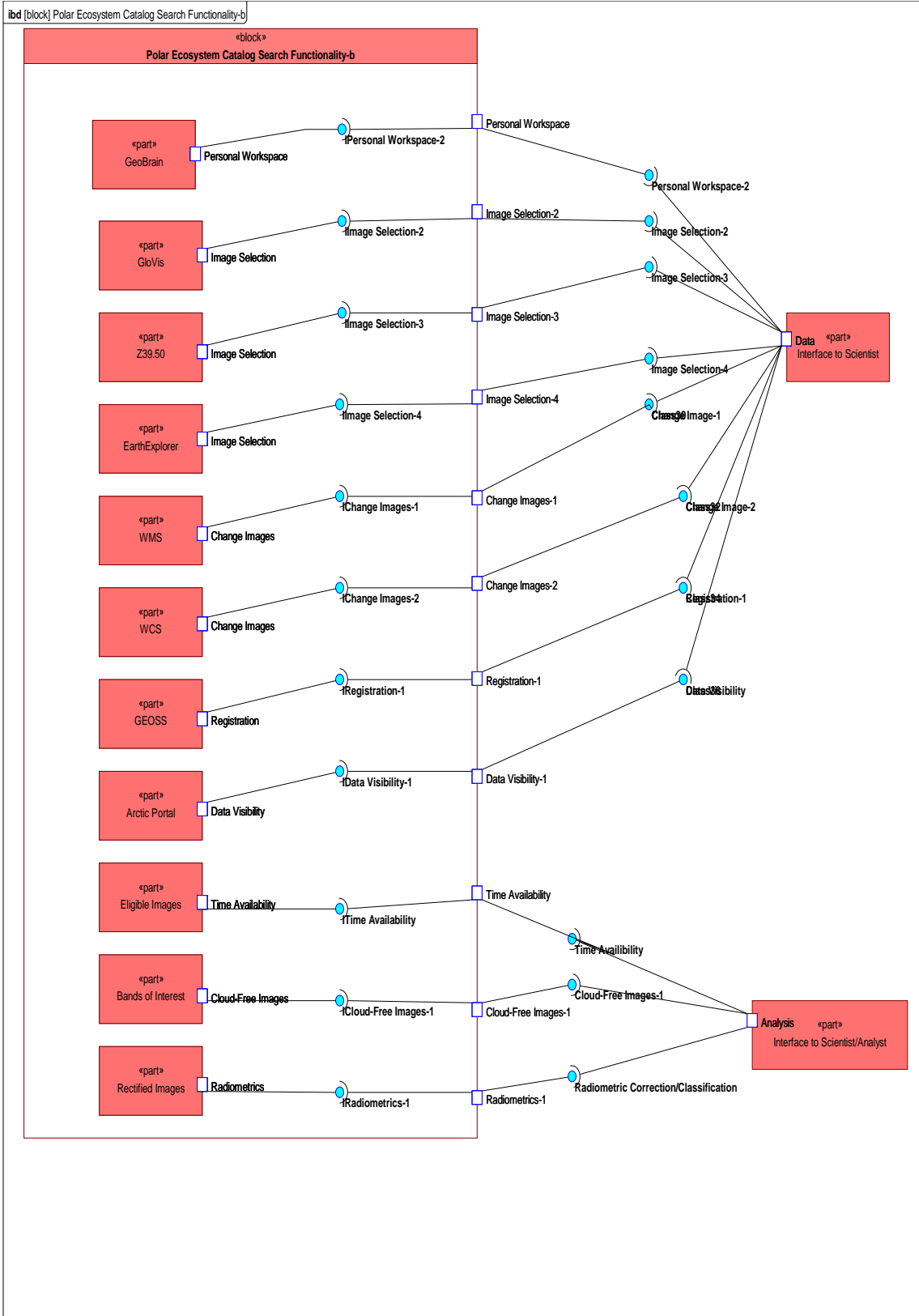


Figure 3-39 Object and interface templates

#### 3.4.1.3.3 Detailed Architecture

The following component diagram decomposes the high-level architecture further to define the internal components, and interactions between those components

# AIP-2 GEOSS Unified Modeling Team 2009 Engineering Report

ibd Internal Structure of Polar Ecosystem

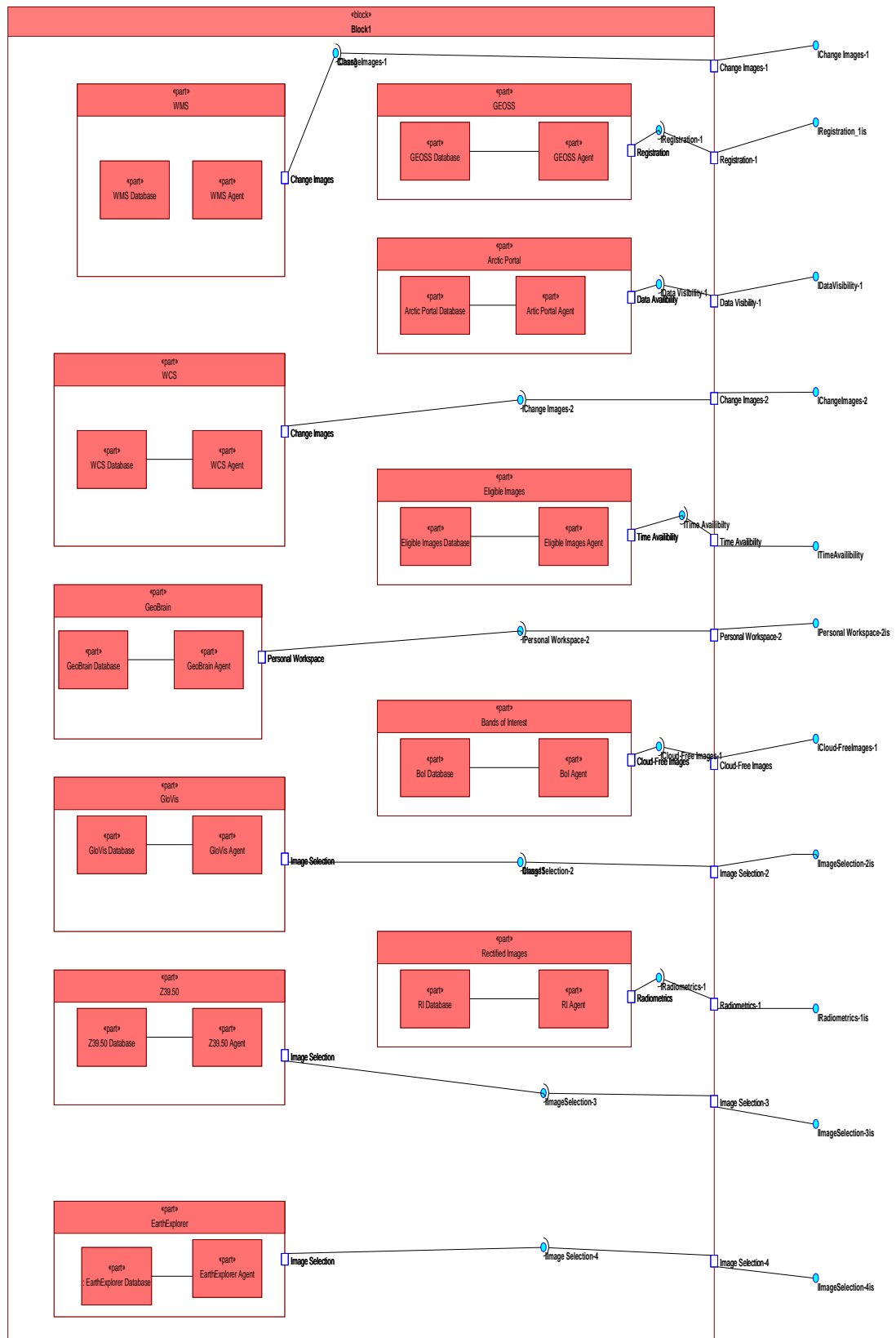


Figure 3-40 Polar ecosystem Detailed Architecture

### 3.4.1.3.4 Interaction Signatures

The following diagram defines the interaction signatures that are instantiated by the ports defined in the prior two component diagrams



Figure 3-41 Interaction Signatures



#### 3.4.1.3.5 Data Types

Interface templates are described as ports, where interface signatures define operations that can handle data and return values. The following (incomplete) diagram describes the data types that are defined for the data handled and return values for interfaces.

Interface templates are described as ports, where interface signatures define operations that can handle data and return values. The following (incomplete) diagram describes the data types that are defined for the data handled and return values for interfaces.

BDPolarEchSystemDataTypes

<b>GEOSS:Biodiversity:BD Computational View:Images</b>
collectionDate : Date locationId : Integer sensorId : Integer bandId : Integer spectralResolutionId : Integer spatialResolutionId : Integer temporalResolution : Time

<b>GEOSS:Biodiversity:BD Computational View:SelectionCriteria</b>
imageType : String imageTypeParameters : String

<b>GEOSS:Biodiversity:BD Computational View:Change Image</b>
imageComparison : String comparisonSummary : String

<b>GEOSS:Biodiversity:BD Computational View:Radiometrics-dt</b>
images : varChar imageSpatialResolution : String imageLocation : String 3.75-minuteDOCs : Date 7.5-minuteDOCs : Date imageSpectralResolution : Integer sensorCalibrationData : String

<b>GEOSS:Biodiversity:BD Computational View:Cloud-Free Images</b>
imageData : String timespans : Time

<b>GEOSS:Biodiversity:BD Computational View:Timespans</b>
images : String imageTimeA : Time

<b>GEOSS:Biodiversity:BD Computational View:ScientistIdentifier</b>
firstName : Char lastName : Char ID Number : Integer

<b>GEOSS:Biodiversity:BD Computational View:Registry Data</b>
ScientistIdentifier : varChar comparisonSummary : String GEOSSRegistryParameters : String AntiPortalRegistryParameters : String DataVisibiltySummary : String

Figure 3-42 Data Types Polar Ecosystems

## 3.5 Societal Benefits Area – Disaster Management

### 3.5.1 Scenario – Flood Disaster Management

#### 3.5.1.1 Enterprise View

The enterprise viewpoint describes the business requirements for the Disaster Management and decision support using GEOSS-2 without specifying the technology or other system considerations.

The Enterprise View defines use cases for Disaster Management, using Object Management Group's Unified Modeling Language (UML). The sections that follow the Overview Use Case Diagram are organized by use case and describe the series of processes for each use cases. The processes are defined by activity diagrams, and are currently limited in scope to only the Wildfire scenario.

##### 3.5.1.1.1 Overview Use Case Diagram

A use case diagram describes the behaviors and dynamics of the system being modeled, and is composed of a component boundary, use case name, external actors and their relationships. Within the use case diagram, actors are represented as person stick figures, and use cases are shown as bubbles.

The following diagram presents the overview use case diagram for Air Quality. It identifies the use cases that comprise Disaster Management and decision support using GEOSS-2 and the high level relationships between them.

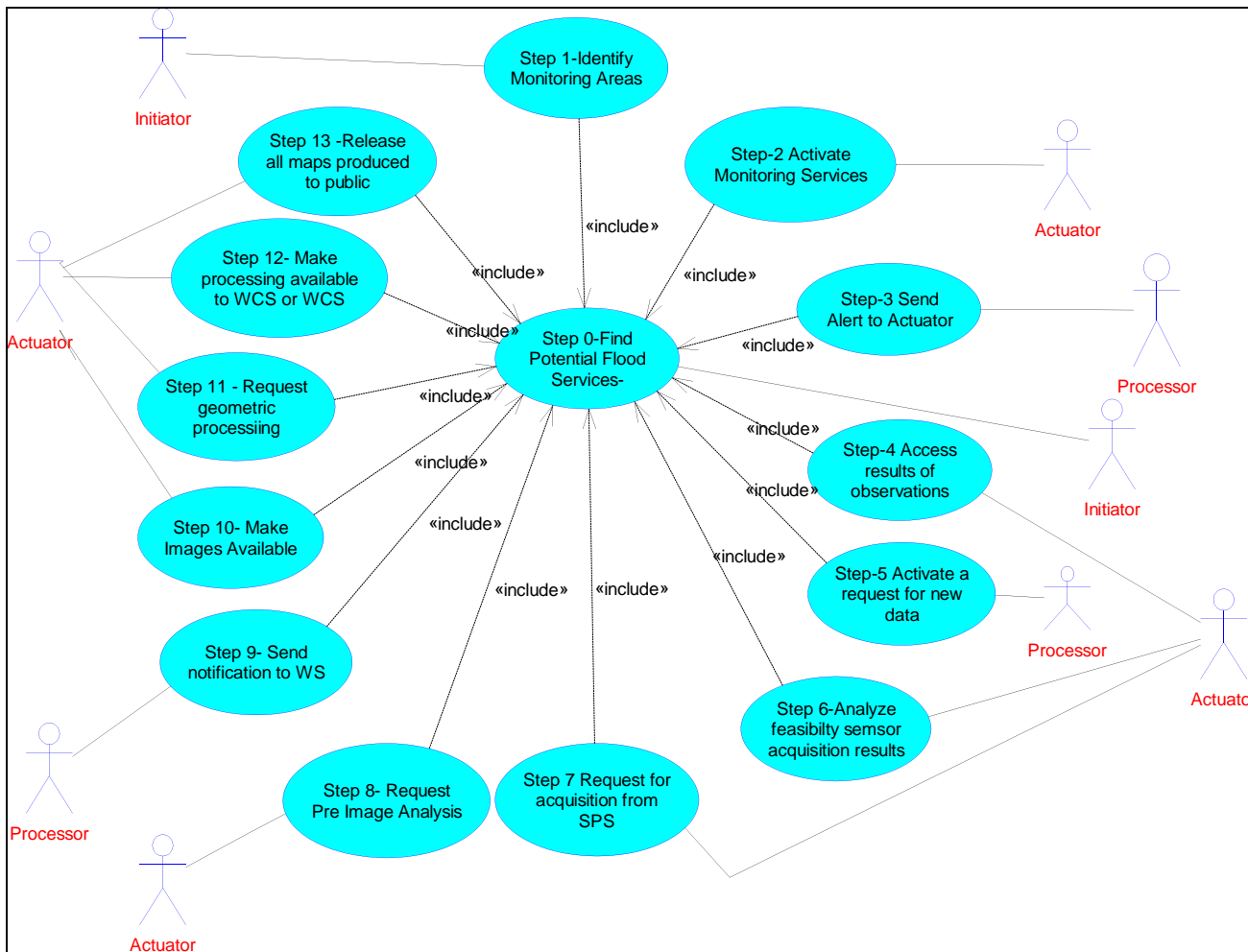


Figure 3-43 Use Case Diagram for Disaster Management

Actors formalize the roles of systems, individuals, or external components which interact with this system. The following table describes the actors in the use case diagram.

Table 3-11 Actors in the Disaster Management System

Actor Name	Description
Initiator	The Initiator is in charge of searches for warning services that provide events or predictions about potential flood on a given area.
Actuator	Actuator (Regional civil protection) to activate services that offer Early Warning (e.g. based on modeling such a Global

Actor Name	Description
	<p>Flood Potential Model) to monitor AOIs. When an alert is raised, Actuator (Regional civil protection) requests multiple Processors (Data Providers) to activate monitoring services. The Actuator (Regional civil protection) accesses the result of observations using WCS or SOS (e.g. Daily Flood Map Prediction). Based on the map analysis, the Actuator (Regional civil protection) sends back to Initiator a demand for activation of new data acquisition. Based on Initiator acknowledgment, the Actuator (Regional civil protection) activates a feasibility request for a new data acquisition to multiple Processors (Data Providers) through SPS. The Actuator analyses feasibility study, both from SPS output to a dedicated SPS client application and from SPS KML output. Based on existing feasibility studies, the Actuator (Regional civil protection) sends a request for acquisition (tasking) through SPS. If possible the acquisition should be for data before, during and after event. In parallel with acquisition request, the Actuator (Regional civil protection) request data from catalog before event for a pre-damage analysis. Actuator (Regional civil protection) accesses the data via WCS or WMS and should start the analysis process.</p> <p>The Actuator can submit such results to an Hydrology/Meteorology Disaster Management domain experts (e.g. the Caribbean Disaster Response Agency) and ask for 'near real time' feedback on the produced maps. In parallel, Actuator (Regional civil protection) should request thematic processing from Processors (Map producer). This would involve the WPS running a classification or detection algorithm, and production of PNG and KML overlays on the raster result (GeoTIFF) from the WPS. The Actuator should provide damage map after event.</p> <p>This information should be available through WMS and used for assessing damage by insurance company or by NGO organization to help Public.</p>
Processors	Processors activate such services. The output of such services should be WMS, WCS or SOS. The output should be on daily time monitoring. Processors activate such

Actor Name	Description		
	<p>services. The output of such services should be WMS, WCS or SOS. The output should be on daily time monitoring. A Processor configures/sends an event notification to Actuator (Regional civil protection) when monitoring detects upcoming disaster conditions.</p> <p>The notification can be sent by using Sensor Alert Service (SAS).</p> <p>Based on Alert issuing by a Processor, Processors (Data Providers) provide feasibility sensor acquisition results. Once data is acquired, a Processor sends notification to Actuator (Regional civil protection) via WS Addressing or WS Notification. One or more Processors (Data Providers) make ortho-image available (pre and after).</p> <p>Geometric processing / Ortho-processing can be activated via WPS.</p>		
WMS	<p>Outputs daily time monitoring services. The WMS is used on-the-field by Actuator (Regional civil protection), e.g. for building an evacuation plan.</p> <p>Whether data is acquired but delivered too late during or after event. Provide damage maps.</p> <table border="1" data-bbox="548 1188 1382 1339"> <tr> <td data-bbox="548 1188 1024 1339">All maps produced are released for public communication and accessible via mass-market products such as KML.</td> <td data-bbox="1024 1188 1382 1339"></td> </tr> </table>	All maps produced are released for public communication and accessible via mass-market products such as KML.	
All maps produced are released for public communication and accessible via mass-market products such as KML.			
WCS	Outputs daily time monitoring services		
SOS	Outputs daily time monitoring services		
SAS	Sends notifications by using Sensor Alert Service (SAS). Based on Alert issuing by a Processor,		
WPS	Geometric processing / Ortho-processing can be activated via WPS. WPS runs a classification or detection algorithm and production of PNG and KML overlays on the raster result (GeoTIFF) from the WPS.		
Domain Experts	domain experts (e.g. the Caribbean Disaster Response Agency) and ask for 'near real time' feedback on the produced maps		

#### 3.5.1.1.2 Use Case: "Assess Flooding"

**Purpose:**

Initiators provide Flooding Management and are responsible for setting up areas where monitoring services are required and obtaining these services, reporting before, during and after maps and provide alerts of current flood conditions.

**Pre-Conditions:**

Not defined

**Post-Conditions:**

Not defined

#### 3.5.1.1.3 Processes:

This section has the processes of the scenario presented in form of SysML Activity Diagrams.

This process encompasses all four use cases depicted on activity diagram.

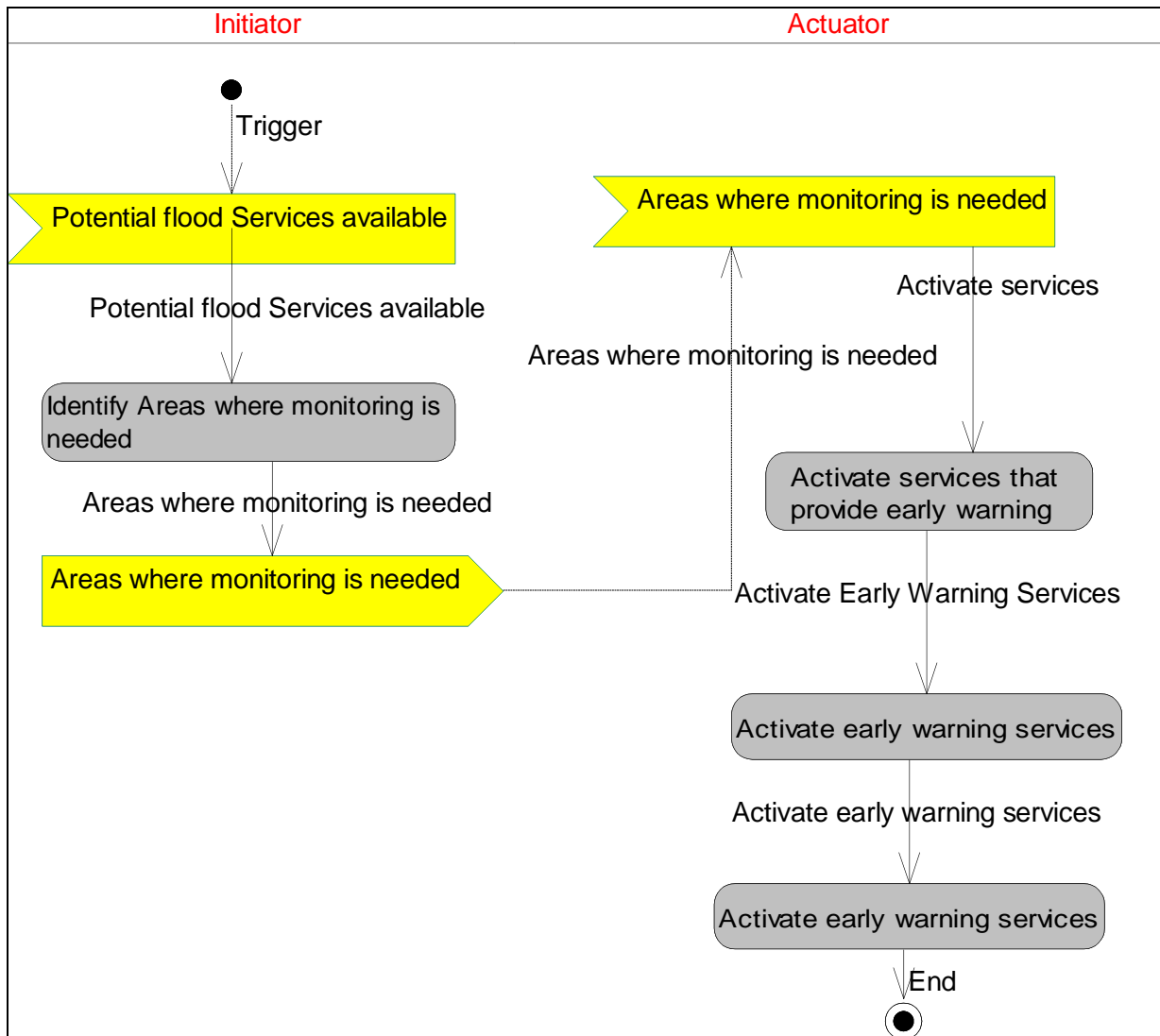


Figure 3-44 Activity Diagram for Flood assessment, mapping, and alerts

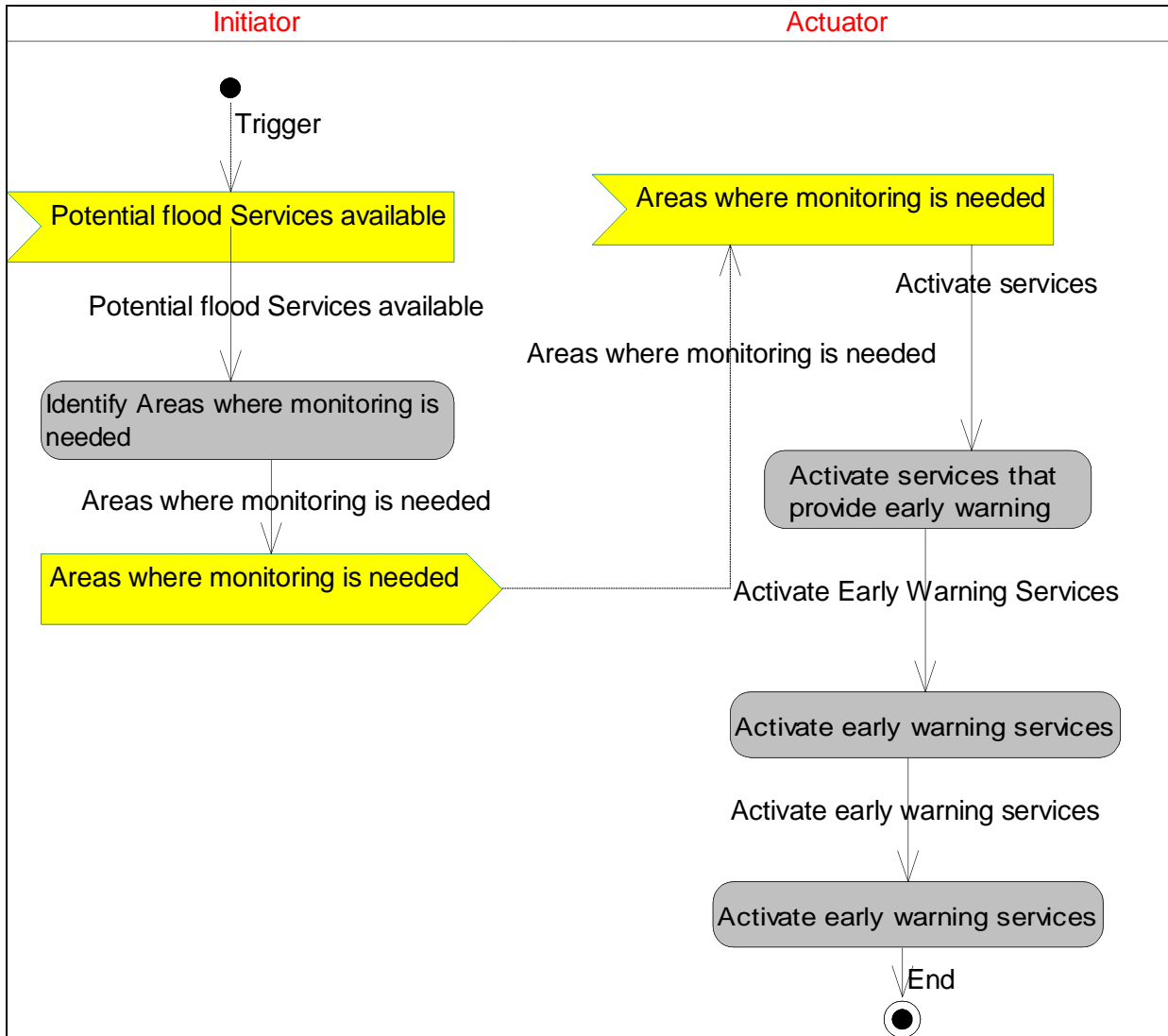


Figure 3-45 Identify Areas where Monitoring is needed

### 3.5.1.2 Information View

The information specification viewpoint is concerned with information modeling. We have simplified the number of diagrams by offering all parts of view in an Entity Relation Diagram. It contains each information object its attributes and relationships with other information objects,

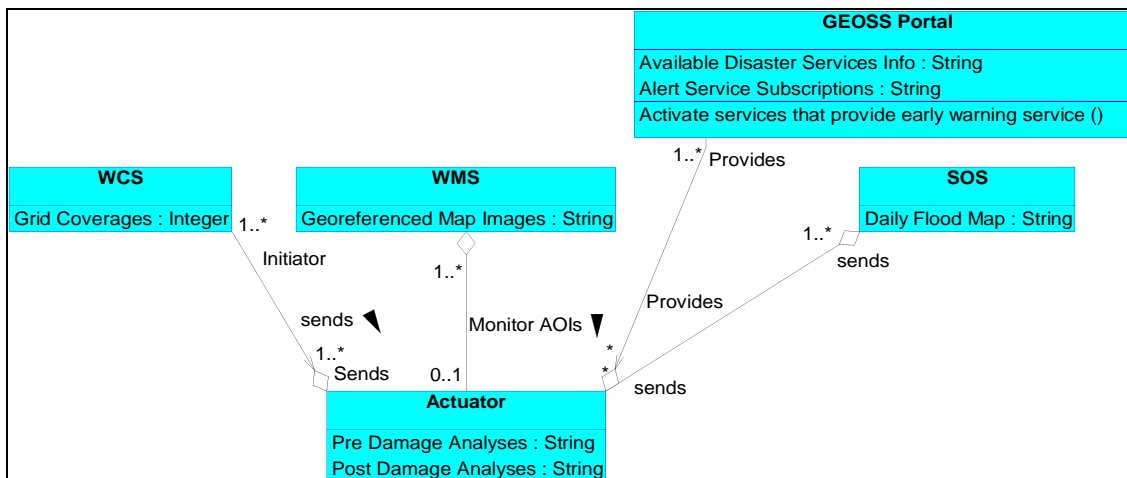


Figure 3-46 Flooding Entity Relationship Diagram

### 3.5.1.3 Computational View

The computational view is described in accordance with ISO/IEC 19793 for the use of UML for Open Distributed Processing system specification.

The computational specification functionally decomposes Disaster Management and decision support using the GEOSS-2, with “units of function as computational objects, and interactions among those computational objects, without considering their distribution over networks and nodes.”

#### 3.5.1.3.1 Basic structure of the computational viewpoint for Disaster Management

The following diagram describes the elements or packages of the computational viewpoint for Air Quality. Interface templates are described as ports, where interface signatures define operations that can handle data and return values. Data types are defined for this data handled and return values. Computational objects are components and are also described by their templates.

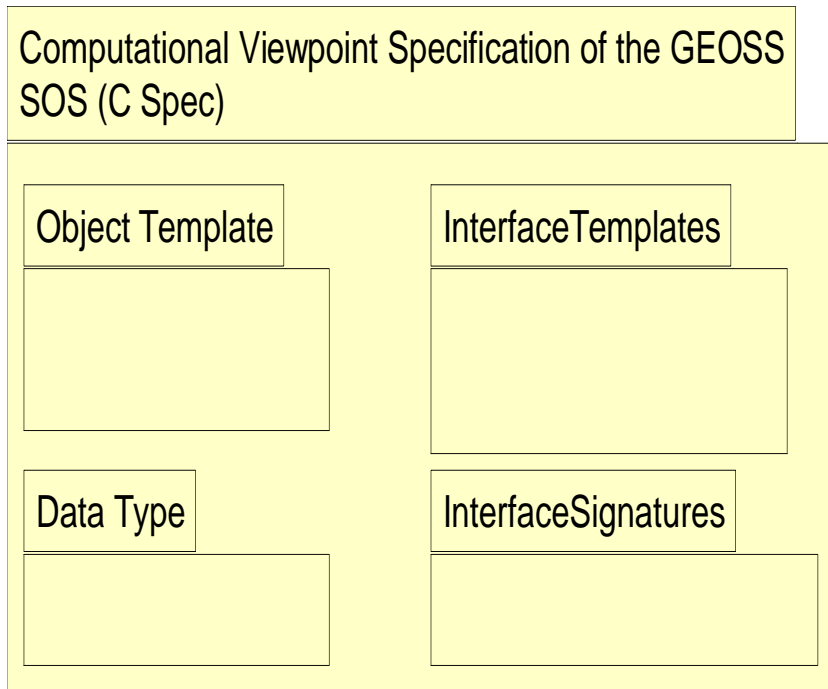


Figure 3-47. Basic structure of the computational viewpoint for Disaster Management

#### 3.5.1.3.2 Object and Interface Templates

In the following component diagram, system functionality is decomposed into computational objects (or components) that interact at the interfaces (or port instances). The system consists of four main components – the Disaster Main Functionality for Flooding, and the user interfaces that interact with it which includes the Initiator, Actuator and Processor, and the GEOSS Portal. This defines the high-level architecture.

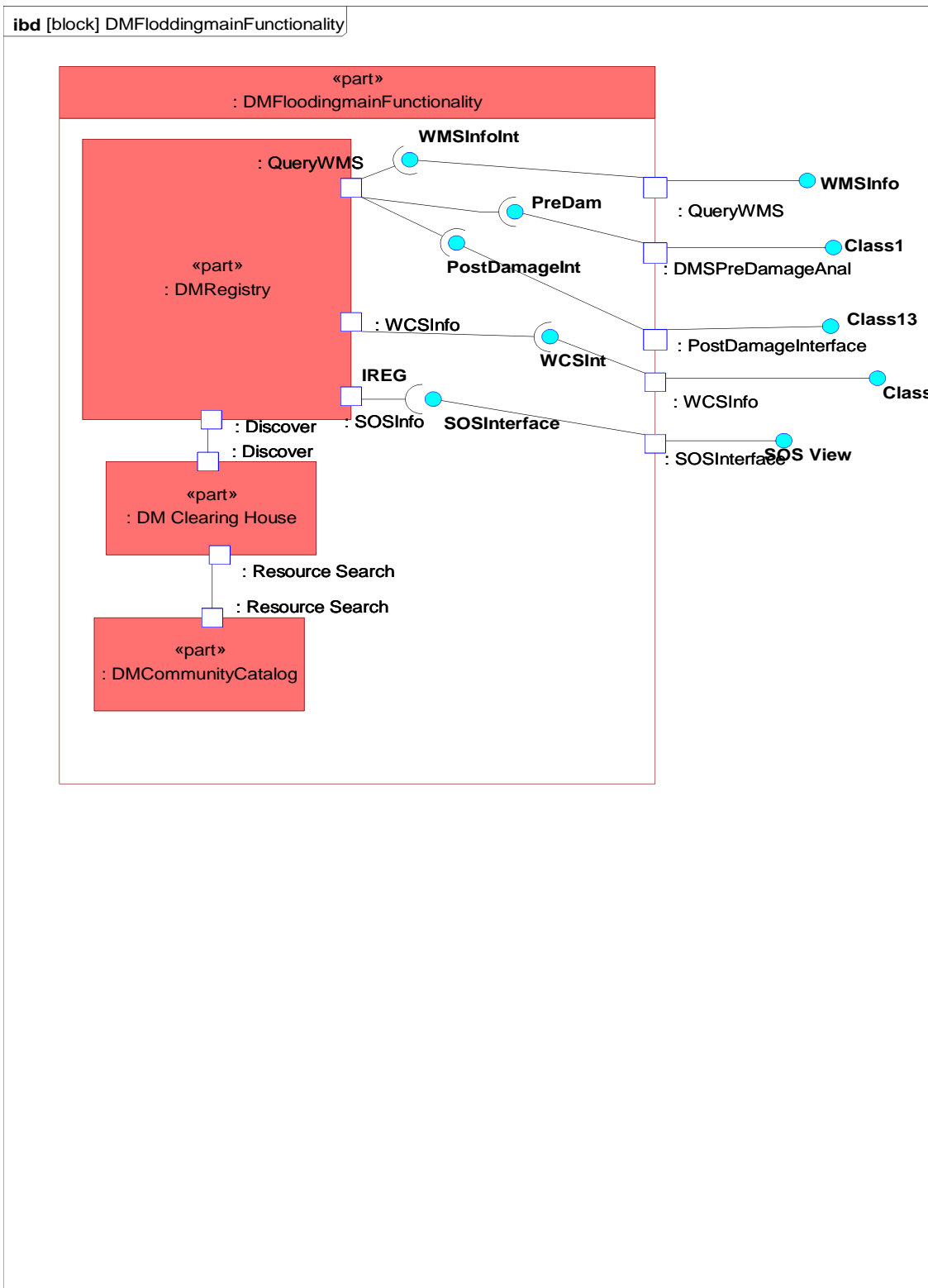


Figure 1-48 Computational Objects Flooding Disaster



### 3.5.1.1.4 Interaction Signatures

The following diagram defines the interface signatures that are instantiated by the ports defined in the prior two component diagrams.

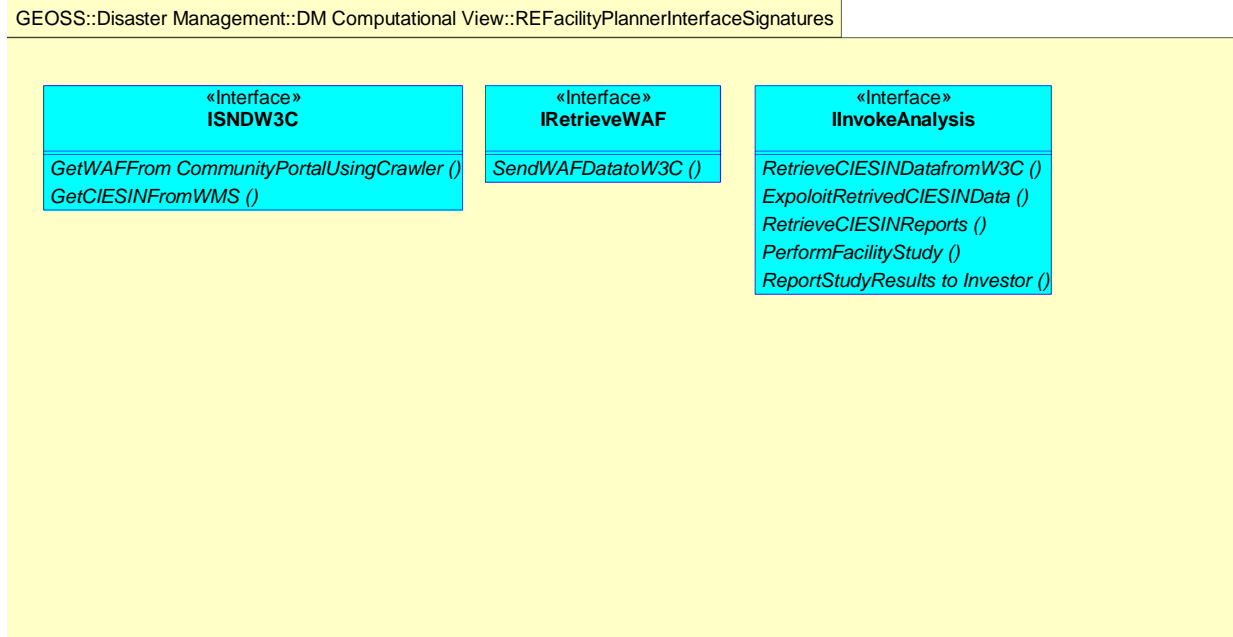


Figure 3-50 Interaction signatures

### 3.5.1.1.5 Data Types

Interface templates are described as ports, where interface signatures define operations that can handle data and return values. The following (incomplete) diagram describes the data types that are defined for the data handled and return values for interfaces.

BDPolarEchSystemDataTypes

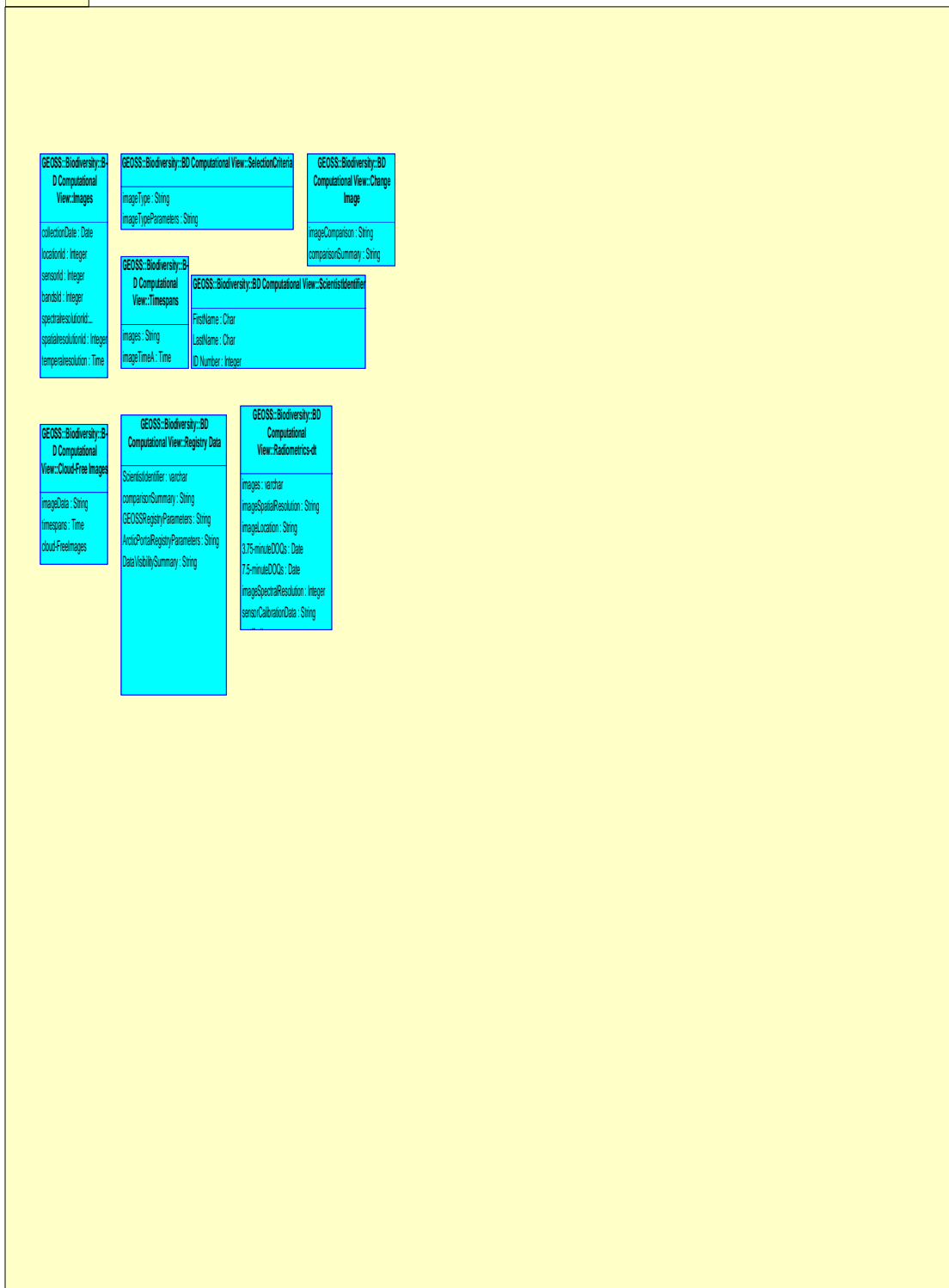


Figure 3-51 Data types handled by the computational objects

## 3.6 Societal benefits Area –Renewable Energy

### 3.6.1 Scenario – Facility Management

#### 3.6.1.1 Enterprise View

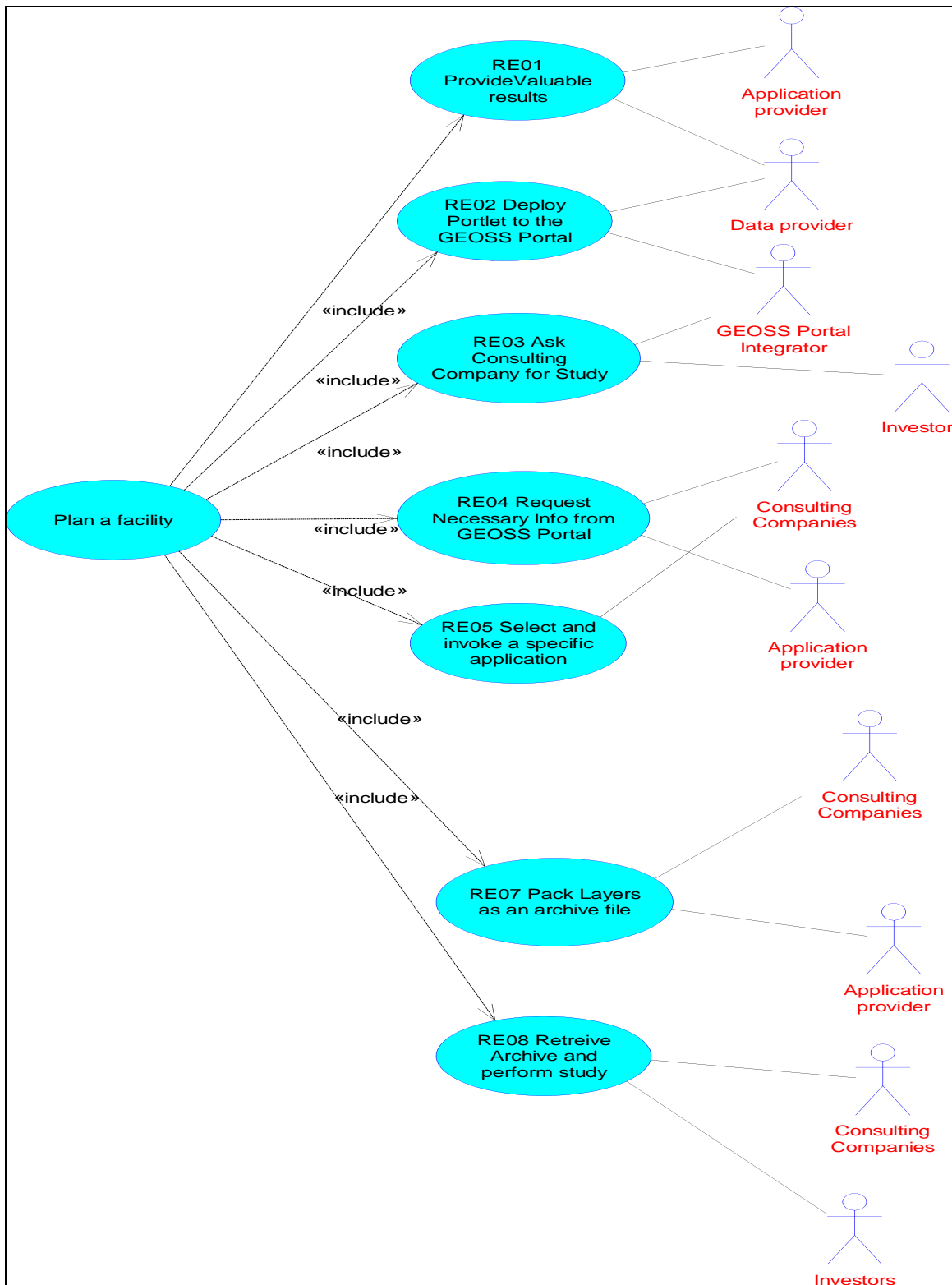
The enterprise viewpoint describes the business requirements for the Facility Management and decision support using GEOSS-2 without specifying the technology or other system considerations.

The Enterprise View defines use cases for Facility Management, using Object Management Group's Unified Modeling Language (UML). The sections that follow the Overview Use Case Diagram are organized by use case and describe the series of processes for each use cases. The processes are defined by activity diagrams, and are currently limited in scope to only the Wildfire scenario.

##### 3.6.1.1.1 Overview Use Case Diagram

A use case diagram describes the behaviors and dynamics of the system being modeled, and is composed of a component boundary, use case name, external actors and their relationships. Within the use case diagram, actors are represented as person stick figures, and use cases are shown as bubbles.

The following diagram presents the overview use case diagram for Facility Management. It identifies the use cases that comprise Facility Management and decision support using GEOSS-2 and the high level relationships between them.



TBD

Figure 3-52 Use CaseDiagram for Facility Management

Actors formalize the roles of systems, individuals, or external components which interact with this system. The following table describes the actors in the use case diagram.

Table 3-12 Actors in the Facility Management System

Actor Name	Description
Application Provider	Application Provider (operates the RE Web Services)
Data Provider	<p>Data Provider (operates a contributing Web Service). Other "optional" layers provided by Data Provider partners, implementing GEOSS interoperability arrangement (WMS), can be nested to fulfill a scenario. This includes:</p> <ul style="list-style-type: none"> <li>• Hydro Network</li> <li>• Electric Network</li> <li>• Gazetteer</li> <li>• Land Use</li> <li>• Protected Area</li> <li>• Risks &amp; Hazard</li> </ul> <p>to implement the "search and discovery" process of such data in the GEOSS Portal, Metadata and catalog must have been defined by the Data Provider to describe candidate resources. An approach using ISO 19119 Metadata describing W3C WSDL Web Service has been chosen for the core layers. For each Web Service a corresponding Metadata file is build using the INSPIRE on-line tool for building Metadata and Catalog</p>
GEOSS Portal integrator	<p>In our example we wish to provide an AOI selection through a Google Map Mashup. The GEOSS Portal Integrator will either need to change the Google API Key to match the GEOSS portal domain name or he will need to provide it to the Specific Application Provider. In any case manual deployment of the Portlet will (at least for now) will be necessary.</p>
Investor	<p>The investor asks a consulting company for a study for a given geographical area. he investor make a decision on</p>

Actor Name	Description
	geographical area to locate facility based on study from consultant
Consulting Company	The consulting company wants to obtain the necessary information and puts requests to the GEOSS portal. Among the result for his specific request, the consulting company selects and invokes the specific application. The consulting company retrieves the archive, performs the study by exploiting the retrieved information and its own models and reports to the investor.

### 3.6.1.1.2 Use Case: “Locate a suitable location for a Renewable Energy Facility”

**Purpose:** Purpose: In order to locate a suitable location to build a renewable energy facility Components are deployed as W3C Web Services by the Application Provider at the Renewable Energy Community Portal ([www.webservice-energy.org](http://www.webservice-energy.org)).

They allow access to various "core" layers such as maps for:

- DNI (Direct Normal Irradiance) from HelioClim 3 database
- Shadows, Slopes, and Altitude from STRM database

Other "optional" layers provided by Data Provider partners, implementing GEOSS interoperability arrangement (WMS), can be nested to fulfill a scenario type. These include:

- Hydro Network
- Electric Network
- Gazetteer
- Land Use
- Protected Area
- Risks & Hazard

Providing an easy access to the above mentioned data is a key component of the RE Scenario.

Accordingly it is considered to develop a graphical client as a form of a Portlet (JSR-168). This Portlet is already deployed at the RE Community Portal ([project.mesor.net](http://project.mesor.net)), and can be deployed at other GEOSS Portal Candidate platforms, supporting such Portlet mechanism.

The Portlet will provide the user with a graphical Geolocalisation map mechanism (Google Map API) for AOI (Area Of Interest) selection and extra form for

selecting the period (Date min/max), the scale, and the list of desired optional layers.

As a result the Portlet will provide an archive (.zip/.tar....) of the core layers and the selected optional layers as a form of geo-referenced raster files (GeoTIFF).

The JSR-168 Portlet is not yet in the list of GEOSS Standard component though this topic is still active in the AIP Team. This does not yet prevent to register it as a GEOSS "Special Arrangement" to make it visible within the GEOSS Portal search.

Taking into account such new component in the framework of GEOSS standard must be discuss and further validated in the SIF (Standards & Interoperability Forum).

Pre-Conditions:

Not defined

Post-Conditions:

Not defined

#### 3.6.1.1.3 Processes

The following activity diagram illustrates the process that is initiated by the Investor to request a study from a Consulting Company to provide a facility feasibility study. Since Societal Based scenario was made of several small use cases they were combined in one activity diagram rather than several very small activity diagrams.

[Figure 3-53 Activity Diagram for the "Request Facility Service"](#)



### 3.6.1.2 Information View

The information specification viewpoint is concerned with information modeling. We have simplified the number of diagrams by offering all parts of view in an Entity Relation Diagram. It contains each information object its attributes and relationships with other information objects,

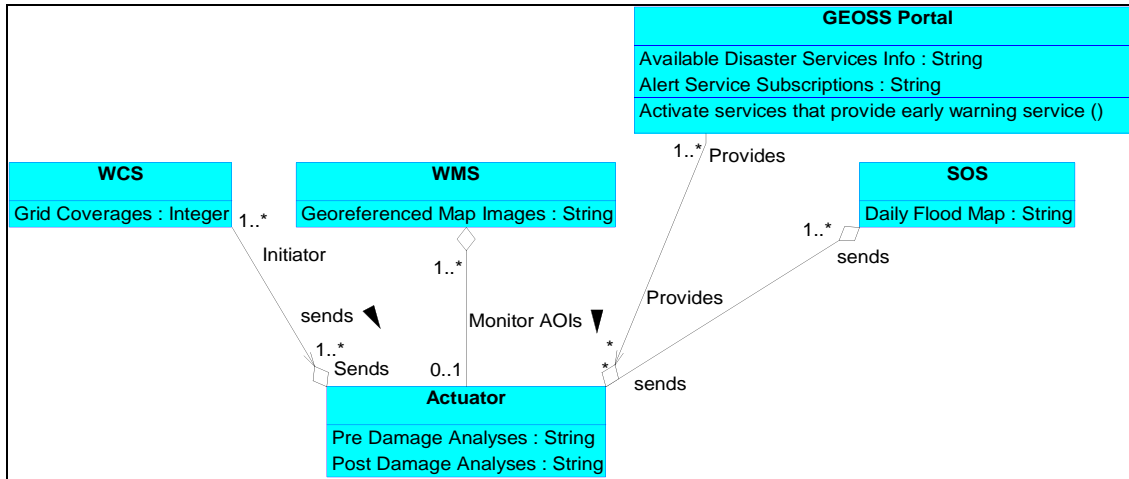


Figure 3-54 Information View Facility Management

### 3.6.1.3 Computational View

The computational view is described in accordance with ISO/IEC 19793 for the use of UML for Open Distributed Processing system specification.

The computational specification functionally decomposes Facility Management and decision support using the GEOSS-2, with “units of function as computational objects, and interactions among those computational objects, without considering their distribution over networks and nodes.”

#### 3.6.1.3.1 Basic structure of the computational viewpoint for Facility Management

The following diagram describes the elements or packages of the computational viewpoint for Facility Management. Interface templates are described as ports, where interface signatures define operations that can handle data and return values. Data types are defined for this data handled and return values. Computational objects are components and are also described by their templates.

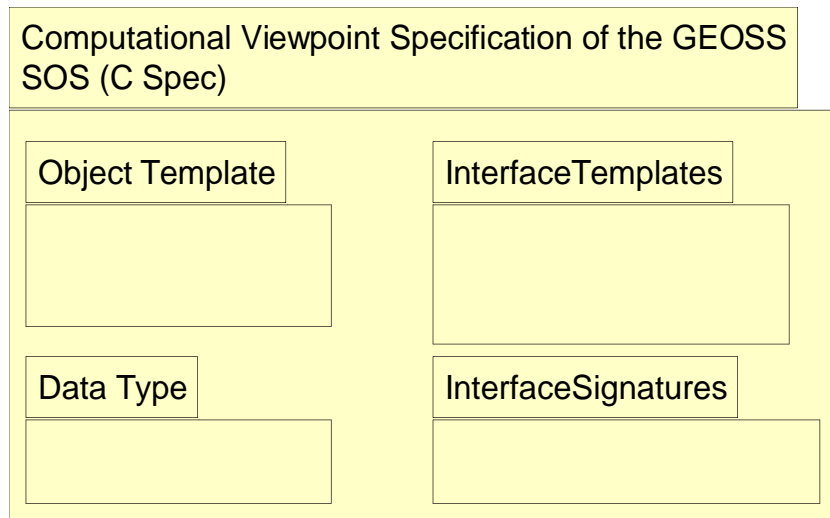


Figure 3-55 Basic structure of the computational viewpoint for Facility Management

### 3.6.1.3.2 Object and Interface Templates

In the following component diagram, system functionality is decomposed into computational objects (or components) that interact at the interfaces (or port instances). The system consists of four main components – the Facility Management Main Functionality for Investor and Consulting Company. This defines the high-level architecture.

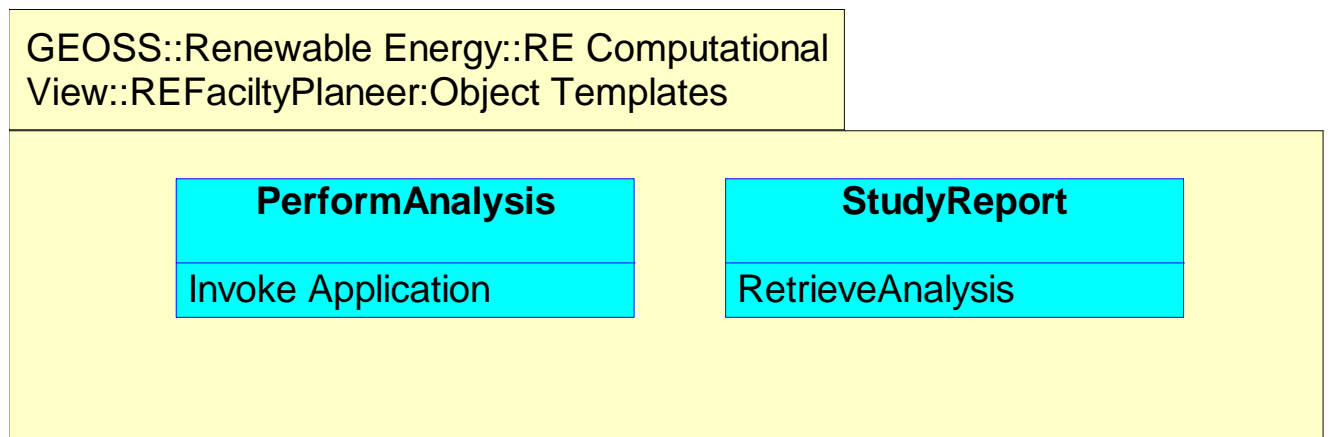


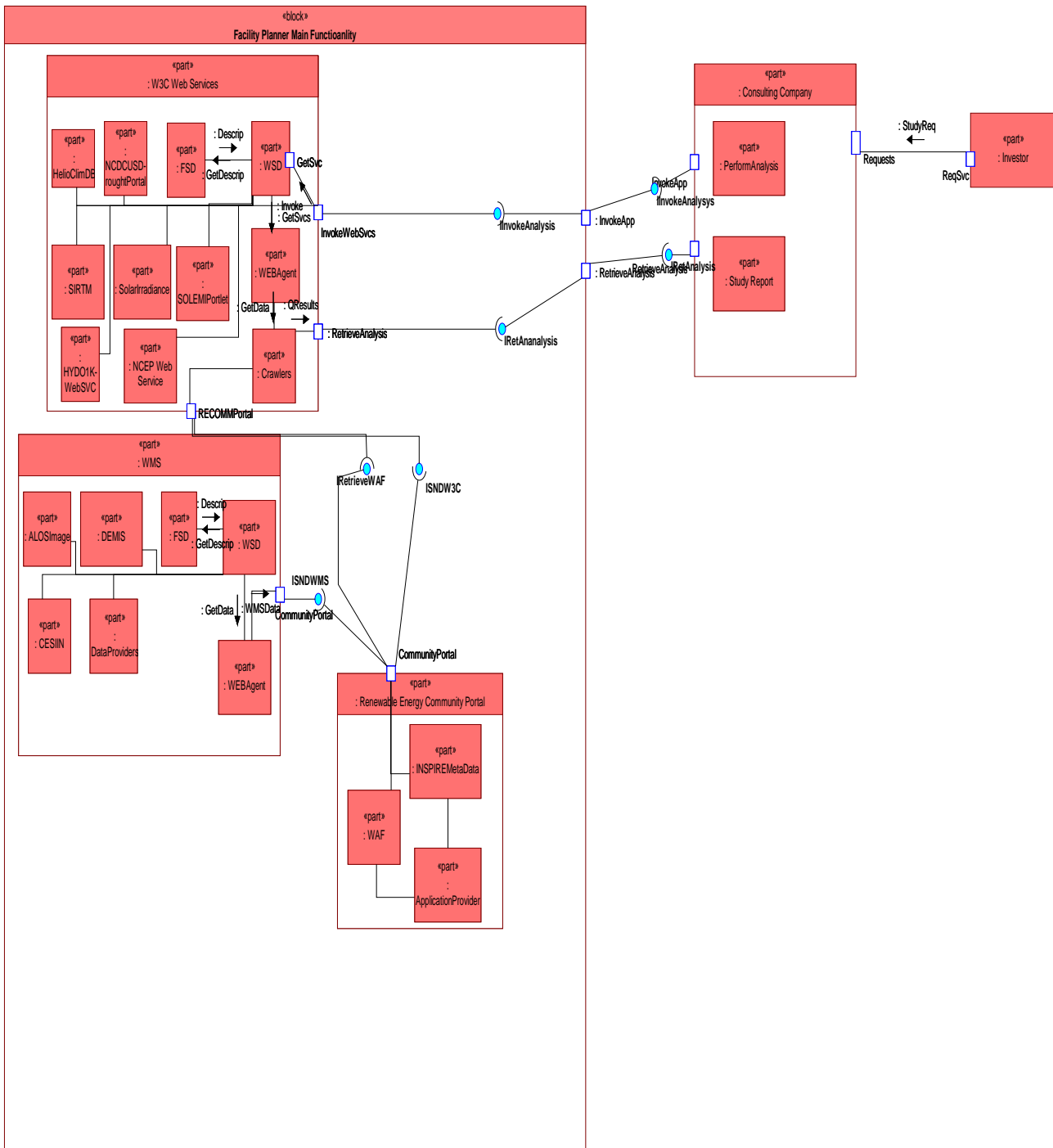
Figure 3-56 Computational object templates

### 3.6.1.3.3 Detailed Architecture

The following component diagram decomposes the high-level architecture further to define the internal components, and interactions between those components.

**Figure 3-57 Internal structure of the Facility Management System Functionality Computational Object**

libd [block] Facility Planner



### 3.6.1.1.4 Interaction Signatures

The following diagram defines the interface signatures that are instantiated by the ports defined in the prior two component diagrams.

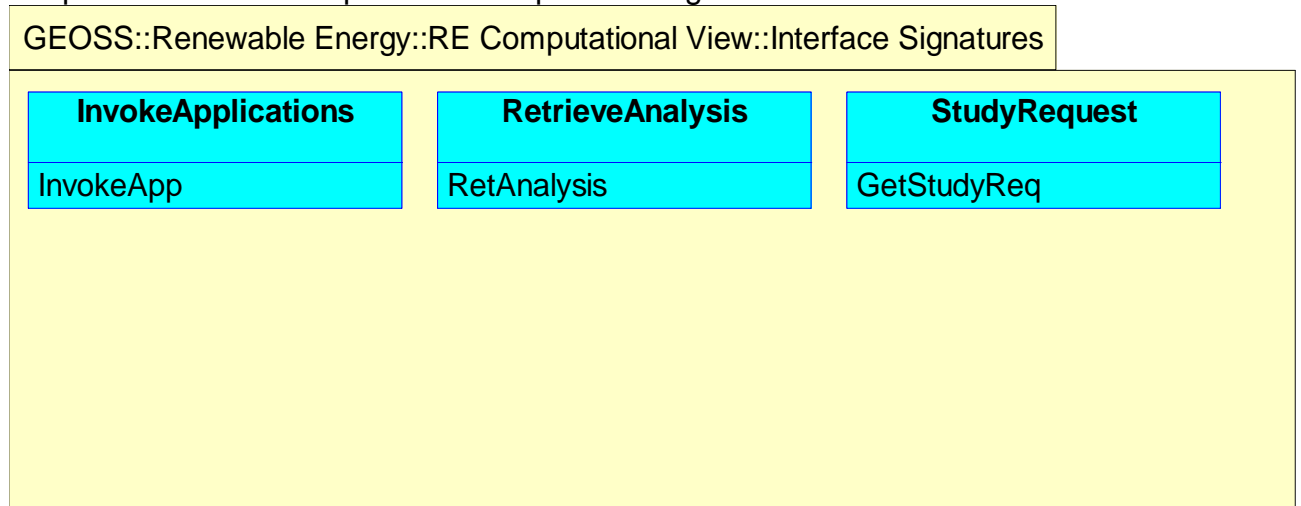


Figure 3-58 Interaction signatures

### 3.6.1.1.5 Data Types

Interface templates are described as ports, where interface signatures define operations that can handle data and return values. The following (incomplete) diagram describes the data types that are defined for the data handled and return values for interfaces.

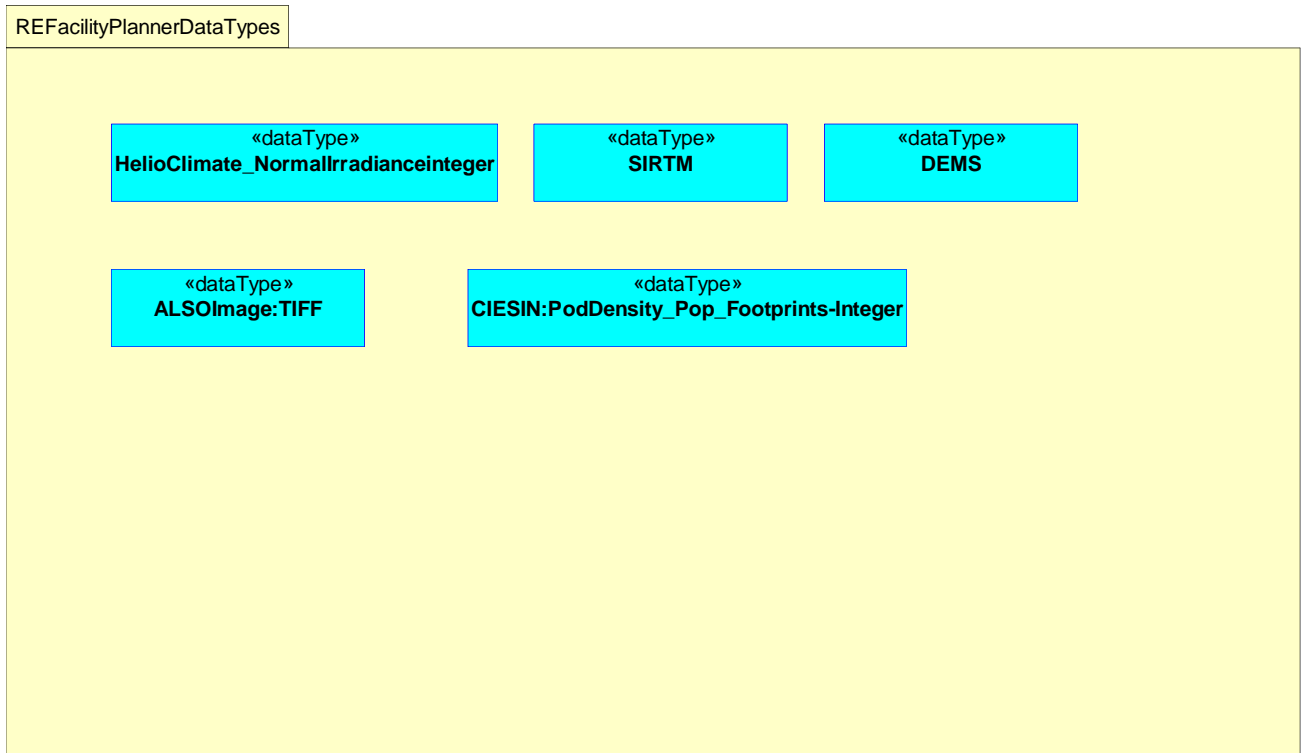


Figure 3-59 Data types Facility Management

## 4.0 Lessons Learned

This section addresses lessons learned on the application of the ISO/IEC 193793:2007 Modeling concepts and structuring rules and ISO/IEC 10746-3:1996, Information technology – Open Distributed processing – Reference Model Architecture.

### 4.1 Use Case Development

Use cases are not part of the current ISO/IEC 193793:2007 standard Enterprise View. It is recommended they be added to the Enterprise view and that they replace processes Package and is used in conjunction with Use Case Diagrams, Activity and Sequence Diagrams and these be part of new package called Use Cases in the ISO/IEC 193793:2007 standard Enterprise View<sup>1</sup>. Each Societal Based Area (SBA) team should be given formal UML training on development of Use Cases and that a standardized procedure is developed and published.

Transverse use cases and Scenario use Cases need to be combined into one set of use cases. In this way total flow can be portrayed in one set of use cases that include interface with GEOSS portal registry and clearinghouse. Scenario Based Use Cases did not always cover flow into and out of GEOSS portal.

The use cases of each SBA team scenarios' use cases should each be converted to an activity and placed in an activity diagram and horizontal data flow are captured. In this

<sup>1</sup> References a. and b.

way the horizontal data flow can be captured at the highest level. Then if necessary GEOSS System Functions and Services can be allocated by mapping one or more of these activities to a system function and/ or service. This is called use case realization. Individual use cases can then be further allocated to activity and sequence diagrams to capture data flow at next level. This provides firm evidence on how system functions and services were arrived at using analysis of the architecture.

### 5.0 Next Steps

This section covers our recommendations for next steps in AIP3.

- Step-1 Work with SBAs to clean up Use Cases, and allocate system functions and services.
- Step-2 Perform Use Case horizontal activity diagrams for SBA scenario. Allocate one or more activities to services and/or system functions
- Step-3 Update Enterprise, Information and Computational views
- Step-4 Develop Engineering Views
- Step-5 Develop Technology Views