



*iCrash* :  
A Crisis Management Case Study  
*Messir* Analysis Document  
- v 1.4 -  
(Report type: Specification)

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# Chapter 1

## Introduction

### 1.1 Overview

*iCrash* is a simple system dedicated to any person who wants to inform of a car crash crisis situation in order to allow for crisis handling. At anytime and anywhere, anyone can be the witness or victim of a car crash and might be in a situation allowing for alerting this crisis. The *iCrash* system has for objectives to support crisis declaration and secure administration and crisis handling by the *iCrash* professional users.

### 1.2 Purpose and recipients of the document

This document is an analysis document complying with the **Messip** methodology [1]. Its intent is to provide an example of a precise specification of the functional properties of the *iCrash* system.

The recipients of this document are:

- the *iCrash* system's buyer company (ABC): this document is used as a contractual document jointly with any other document considered as useful (as requirement elicitation document, ...) in order to have a higher degree of precision in requirement description. It is also used as a basis document for the *iCrash* system validation using specification based testing.
- the *iCrash* system development company (ADC) is expected to use this document as the basis for development (mainly design, implementation, maintenance). It is also used for verification and validation using test plans defined using the analysis models described in this document and according to the **Messip** methodology.

### 1.3 Application Domain

The *iCrash* system belongs to the Crisis Management Systems Domain. It is a system dedicated to crisis professional and non professional end users. It has to be considered as an autonomous and external service for the society. It is not an institutional system certified and guaranteed by any governmental entity and thus, must be used with caution.

### 1.4 Definitions, acronyms and abbreviations

N.A.

## 1.5 Document structure

The document structure is designed to be coherent with the **Messip** methodology [1]. Section 2 provides a general description of the system purpose, its users, its environment and some general non functional requirements. A more detailed description of the non functional requirements, if any, are provided in section ???. The **system operation** triggered by events sent by the external **actors** belonging to the environment are described in Section 3. The **iCrash** concepts used to represent the any persistent or transient information is given in Section 4. The precise specification of the system operations in term of system's state changes, events sent together with the constraints on the allowed sequences of system operations are described in Section 5.

# Chapter 2

## General Description

In the context of the **Messip** method, the information provided in this section is intended to present the system for which the **Messip** analysis is provided. The content of this section is made accordingly to the requirements elicitation document that might have been done during the project but also adapted coherently in order to be an abstract introduction to the **Messip** analysis.

### 2.1 Domain Stakeholders

All stakeholders of the system are detailed in this section. After a brief description of a stakeholder, its objectives are first stated. Thereafter, the responsibilities of the stakeholder are detailed which help to achieve the stakeholder objectives to a certain degree. While the objectives characterize the general problems addressed by the *iCrash* system, the responsibilities describe concrete actions that are expected from a stakeholder. Some of these responsibilities can be traced looking at the use case described in Section B.1, and hence must be supported by the *iCrash* system. All stakeholders listed in this section have an interest in the system or are affected by the system in some way, but only a subset of the stakeholders are directly involved in the use cases described. Let us remind that use case diagrams or descriptions are not **Messip** analysis phase mandatory outputs. They are proposed as informal means to help understanding the semantics of the system specification made of the mandatory analysis models, which provide a complete executable specification.

#### 2.1.1 Communication Company

A Communication Company is a company that has the capacity to ensure communication of information between its customers and the *iCrash* system. The objectives of a Communication Company are:

- to be able to deliver any SMS sent by any human to the *iCrash* 's phone number.
- to be able to transmit SMS messages from the ABC company that owns the *iCrash* system to any human having an SMS compatible device accessible using a phone number.

In order to achieve these objectives, the responsibilities of a Communication Company are:

- ensure confidentiality and integrity of the information sent by a human to the *iCrash* system or from the system to a human.
- to be always available and reliable.



### 2.1.2 Humans

A human is any person who considers himself related to a car crash either as a witness, a victim or an anonymous person. The objectives of a human are:

- inform the *iCrash* system about the crisis situation he detected.
- be sure that the ABC company has been informed about the situation.
- to be informed about the situation of the crisis he is related to as a victim or witness.

In order to achieve these objectives, the responsibilities of a human are:

- to provide as much details as possible concerning the crisis to the ABC company.
- to declare a crisis only if the crisis is real.
- to have access to the SMS compatible communication device he used to communicate with the *iCrash* system.

### 2.1.3 Coordinators

A coordinator is an employee of the ABC company being responsible of handling one or several crisis. The objectives of a coordinator are:

- to securely monitor the existing alerts and crisis.
- to securely manage alerts and crisis until their termination.

In order to achieve these objectives, the responsibilities of a coordinator are:

- to be capable to determine how an alert received should be considered.
- to be available to react to requests to handle alerts and crisis.
- to be autonomous in handling crisis and to report on its handling.
- to be able to decide when a crisis or an alert can be closed.
- to know its system identification information for secure usage of the system.

### 2.1.4 Administrator

An administrator is an employee of the ABC company being responsible of administrating the *iCrash* system. The objectives of an administrator are:

- to add or delete coordinator actors from the system and its environment.

In order to achieve these objectives, the responsibilities of a coordinator are:

- know the company employees that can be coordinators and that have access to the system.
- to know its system identification information for secure usage of the system.
- to know the security policy of the ABC company.
- to communicate the coordinators their identification information for secure system usage.

### 2.1.5 Creator

Any system has a `Creator` stakeholder which is a technician who is installing the *iCrash* system on the targeted deployment infrastructure.

The objectives of a `Creator` are:

- to install the *iCrash* system
- to define the values for the initial system's state
- to define the values for the initial system's environment
- to ensure the integration of the *iCrash* system with its initial environment

In order to achieve these objectives, the responsibilities of a `Creator` are:

- provide the necessary data to the *iCrash* system for its initialization.

### 2.1.6 Activator

An `activator` is a logical representation of the active part the *iCrash* system. It represents an implicit stakeholder belonging to the system's environment that interacts with the *iCrash* system autonomously without the need of a external entity. It is usually used for representing time triggered functionalities.

The objectives of a `activator` are:

- to communicate the current time to the system
- to notify the administrator that some crisis are still pending for a too long time.

In order to achieve these objectives, the responsibilities of a `activator` are:

- to know the current universal time
- to send the messages to the system according to the time constraints specifically defined for it.

## 2.2 System's Actors

The objective of this section is not to provide the full requirement elicitation document in this section but to reuse a part of this document to provide a informal introduction to the **Messip** specification of the system under development. The use case model is made of a use case diagrams modelling abstractly and informally the actors and their use cases together with a set of use cases descriptions. In addition, those diagrams and description tables are adapted to the **Messip** specification since actor and messages names together with parameters are partly adapted to be consistent with the specification identifiers (see [1] for more details).

Among all the stakeholders presented in the previous section, we can determine five types of *direct actors*<sup>1</sup>:

- `actComCompany`: for the Communication Company stakeholder.
- `actAdministrator`: for the Administrator stakeholder.
- `actCoordinator`: for the Coordinators stakeholders.
- `actActivator`: for the Activator stakeholder.
- `actMsrCreator`: for the Creator stakeholder.

In addition to those system actors, we can add five other types of actors related to the system's ones. Those five actors are grouped into two categories:

- *Indirect actors*
  - *Witness*: for any human that is a witness of a car crash
  - *Victim*: for any human that is a victim of a car crash
  - *Anonymous*: for any human that want to inform about a car crash while staying anonymous.
- *Abstract actors*
  - `actHuman`: represent abstractly any kind of human being actor wanting to communicate with the ABC system in the context of a car crash.
  - `actAuthenticated`: for the logical Activator stakeholder.

## 2.3 Use Cases Model

This section contains the use cases elicited during the requirements elicitation phase. The use cases are textually described as suggested by the **Messip** method and inspired by the standard Cokburn template [2].

### 2.3.1 Use Cases

#### 2.3.1.1 summary-suDeployAndRun

The goal is to install the iCrash system on its infrastructure and to exploit its capacities related to the secure administration and efficient handling of car crash situations depending on alerts received.

---

<sup>1</sup>The naming conventions in **Messip** propose to start each type name by lowercase letters indicating the meta model type used (i.e. `act` for actors, `ct` for class type, ...). In addition to ease the reading it makes the translational semantics into Prolog code more straightforward.

USE-CASE DESCRIPTION	
<i>Name</i>	suDeployAndRun
<i>Scope</i>	system
<i>Level</i>	summary
<b>Primary actor(s)</b>	
1	actAdministrator[active]
<b>Secondary actor(s)</b>	
1	actMsrCreator[active]
2	actCoordinator[active, multiple]
3	actActivator[proactive]
4	actComCompany[active]
<b>Goal(s) description</b>	
The goal is to install the iCrash system on its infrastructure and to exploit its capacities related to the secure administration and efficient handling of car crash situations depending on alerts received.	
<b>Reuse</b>	
1	<u>oeCreateSystemAndEnvironment [1..1]</u>
2	<u>ugAdministrateTheSystem [1..*]</u>
3	<u>suGlobalCrisisHandling [1..*]</u>
4	<u>oeSetClock [1..*]</u>
5	<u>oeSollicitateCrisisHandling [0..*]</u>
6	<u>oeAlert [1..*]</u>
<b>Protocol condition(s)</b>	
1	the iCrash system has never been deployed and used
<b>Pre-condition(s)</b>	
1	none
<b>Main post-condition(s)</b>	
1	the iCrash system has been created and has handled the crisis situations for which it received alerts through the communication company.
<b>Main Steps</b>	
a	the actor actMsrCreator executes the <u>oeCreateSystemAndEnvironment</u> use case
b	the actor actAdministrator executes the <u>ugAdministrateTheSystem</u> use case
c	the actor actComCompany executes the <u>oeAlert</u> use case
d	the actor actActivator executes the <u>oeSetClock</u> use case
e	the actor actActivator executes the <u>oeSollicitateCrisisHandling</u> use case
f	the actor actCoordinator executes the <u>suGlobalCrisisHandling</u> use case
<b>Steps Ordering Constraints</b>	
1	step (a) must be always the first step.
2	step (f) can be executed by different actCoordinator actors.
3	if (e) then previously (d).

Figure 2.1 shows the use case diagram for the suDeployAndRun summary use case

### 2.3.1.2 summary-suGlobalCrisisHandling

the actCoordinator's goal is to monitor the alerts received and the corresponding crisis in order to act as necessary to handle the crisis.

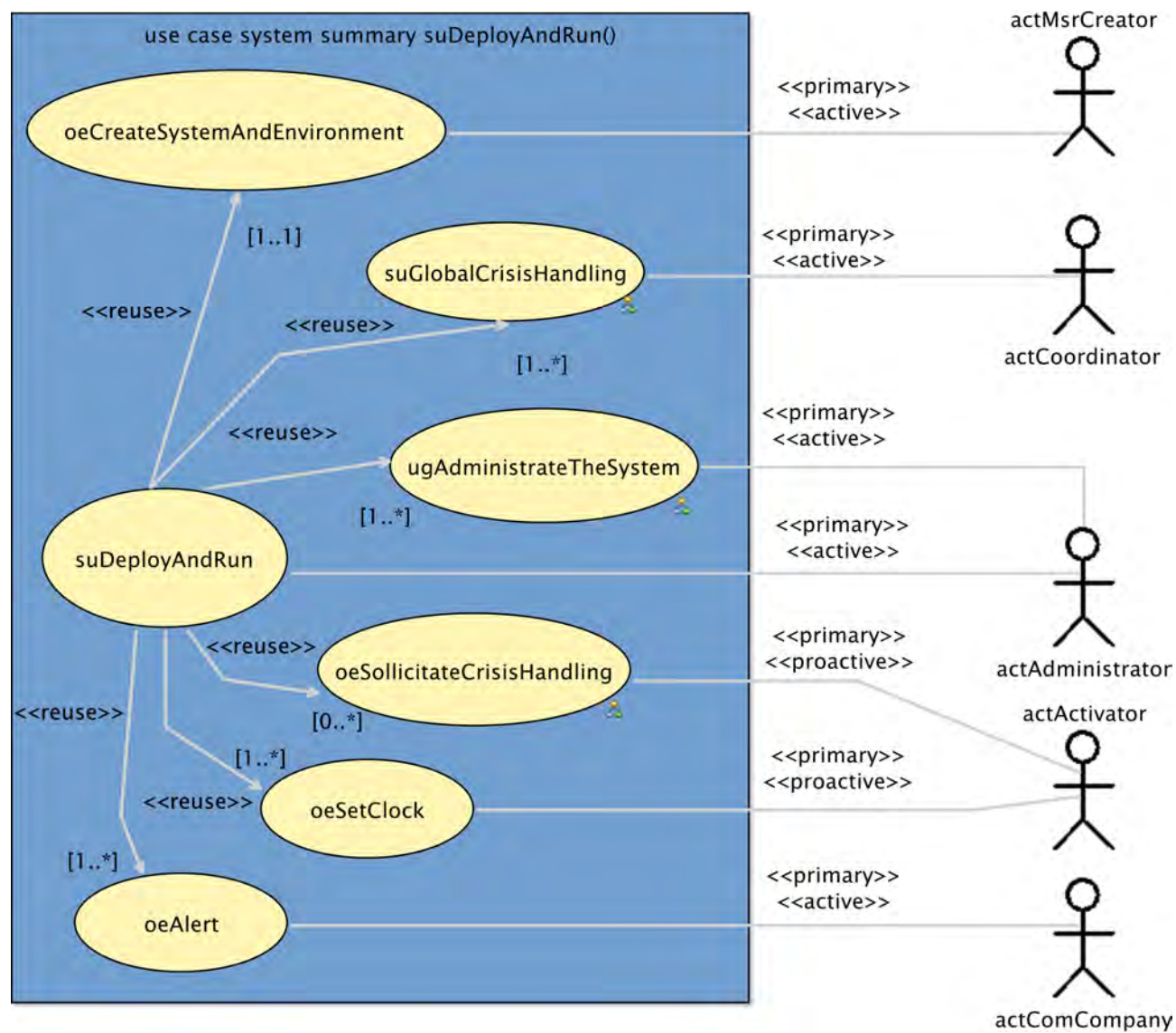


Figure 2.1: suDeployAndRun summary use case

USE-CASE DESCRIPTION	
<i>Name</i>	suGlobalCrisisHandling
<i>Scope</i>	system
<i>Level</i>	summary
<b>Primary actor(s)</b>	
1	actCoordinator[active]
<b>Goal(s) description</b>	
the actCoordinator's goal is to monitor the alerts received and the corresponding crisis in order to act as necessary to handle the crisis.	
<b>Reuse</b>	
1	<u>ugSecurelyUseSystem</u> [1..*]
2	<u>ugMonitor</u> [1..*]
3	<u>ugManageCrisis</u> [1..*]
<b>Protocol condition(s)</b>	
1	the iCrash system has been deployed
2	the coordinator actor involded in the use case has been declared by the actor actAdministrator
<b>Pre-condition(s)</b>	
1	none
<b>Main post-condition(s)</b>	
1	modifications have been made by the coordinator on existing alerts or crisis OR the coordinator requested an updated status on existing alerts or crisis.
<b>Main Steps</b>	
a	the actor actCoordinator executes the <u>ugSecurelyUseSystem</u> use case
b	the actor actCoordinator executes the <u>ugMonitor</u> use case
c	the actor actCoordinator executes the <u>ugManageCrisis</u> use case
<b>Steps Ordering Constraints</b>	
1	steps (a) (b) and (c) executions are interleaved (steps (b) and (c) have their protocol constrained by steps of (a)).
2	steps (a) (b) and (c) can be executed multiple times.

Figure 2.2 shows the use case diagram for the suGlobalCrisisHandling user goal use case

### 2.3.1.3 usergoal-ugAdministrateTheSystem

the actAdministrator's goal is to follow an identification procedure to be allowed to add or delete the necessary crisis coordinators that will be granted the responsibility to handle alerts and crisis.

USE-CASE DESCRIPTION	
<i>Name</i>	ugAdministrateTheSystem
<i>Scope</i>	system
<i>Level</i>	usergoal
<b>Primary actor(s)</b>	
1	actAdministrator[active]
<b>Goal(s) description</b>	
the actAdministrator's goal is to follow an identification procedure to be allowed to add or delete the necessary crisis coordinators that will be granted the responsibility to handle alerts and crisis.	

*continues in next page ...*

**... Use-Case Description table continuation**

<b>Reuse</b>	
1	<u>ugSecurelyUseSystem</u> [1..*]
2	<u>oeAddCoordinator</u> [1..*]
3	<u>oeDeleteCoordinator</u> [0..*]
<b>Protocol condition(s)</b>	
1	the iCrash system has been deployed
<b>Pre-condition(s)</b>	
1	none
<b>Main post-condition(s)</b>	
1	modifications have been made to the system and its environment concerning existing or new coordinators.
<b>Main Steps</b>	
a	the actor <u>actAdministrator</u> executes the <u>ugSecurelyUseSystem</u> use case
b	the actor <u>actAdministrator</u> executes the <u>oeAddCoordinator</u> use case
c	the actor <u>actAdministrator</u> executes the <u>oeDeleteCoordinator</u> use case
<b>Steps Ordering Constraints</b>	
1	steps (a) (b) and (c) executions are interleaved (steps (b) and (c) have their protocol constrained by steps of (a)).
2	steps (a) (b) and (c) can be executed multiple times.

Figure 2.3 shows the use case diagram for the ugAdministrateTheSystem user goal use case

**2.3.1.4 usergoal-ugManageCrisis**

The goal is to do an action that makes the handling of a crisis or an alert progress.

USE-CASE DESCRIPTION	
<i>Name</i>	<u>ugManageCrisis</u>
<i>Scope</i>	system
<i>Level</i>	usergoal
<b>Primary actor(s)</b>	
1	<u>actCoordinator</u> [active]
<b>Goal(s) description</b>	
The goal is to do an action that makes the handling of a crisis or an alert progress.	
<b>Reuse</b>	
1	<u>oeValidateAlert</u> [0..*]
2	<u>oeSetCrisisStatus</u> [0..*]
3	<u>oeSetCrisisHandler</u> [0..*]
4	<u>oeReportOnCrisis</u> [0..*]
5	<u>oeCloseCrisis</u> [0..*]
6	<u>oeInvalidateAlert</u> [0..*]
<b>Protocol condition(s)</b>	
1	the iCrash system has been deployed
<b>Pre-condition(s)</b>	
1	none
<b>Main post-condition(s)</b>	

**continues in next page ...**



**... Use-Case Description table continuation**

1	there exist one alert or one crisis whose related information has been changed.
<b>Main Steps</b>	
a	the actor <code>actCoordinator</code> executes the <u><code>oeValidateAlert</code></u> use case
b	the actor <code>actCoordinator</code> executes the <u><code>oeSetCrisisStatus</code></u> use case
c	the actor <code>actCoordinator</code> executes the <u><code>oeSetCrisisHandler</code></u> use case
d	the actor <code>actCoordinator</code> executes the <u><code>oeReportOnCrisis</code></u> use case
e	the actor <code>actCoordinator</code> executes the <u><code>oeCloseCrisis</code></u> use case
f	the actor <code>actCoordinator</code> executes the <u><code>oeInvalidateAlert</code></u> use case
<b>Steps Ordering Constraints</b>	
1	managing a crisis is doing one of the indicated use cases.

Figure 2.4 shows the use case diagram for the `ugManageCrisis` user goal use case

**2.3.1.5 usergoal-ugMonitor**

the `actCoordinator`'s goal is to get the detailed list of existing crisis or alerts to decide on next actions to undertake.

USE-CASE DESCRIPTION	
<i>Name</i>	<code>ugMonitor</code>
<i>Scope</i>	system
<i>Level</i>	usergoal
<b>Primary actor(s)</b>	
1	<code>actCoordinator[active]</code>
<b>Goal(s) description</b>	
the <code>actCoordinator</code> 's goal is to get the detailed list of existing crisis or alerts to decide on next actions to undertake.	
<b>Reuse</b>	
1	<u><code>oeGetCrisisSet</code> [0..*]</u>
2	<u><code>oeGetAlertsSet</code> [0..*]</u>
<b>Protocol condition(s)</b>	
1	the iCrash system has been deployed
<b>Pre-condition(s)</b>	
1	none
<b>Main post-condition(s)</b>	
1	none
<b>Main Steps</b>	
a	the actor <code>actCoordinator</code> executes the <u><code>oeGetAlertsSet</code></u> use case
b	the actor <code>actCoordinator</code> executes the <u><code>oeGetCrisisSet</code></u> use case

Figure 2.5 shows the use case diagram for the `ugMonitor` user goal use case

**2.3.1.6 usergoal-ugSecurelyUseSystem**

the `actAdministrator`'s goal is to follow an identification procedure to be allowed to add or delete the necessary crisis coordinators that will be granted the responsibility to handle alerts and crisis.

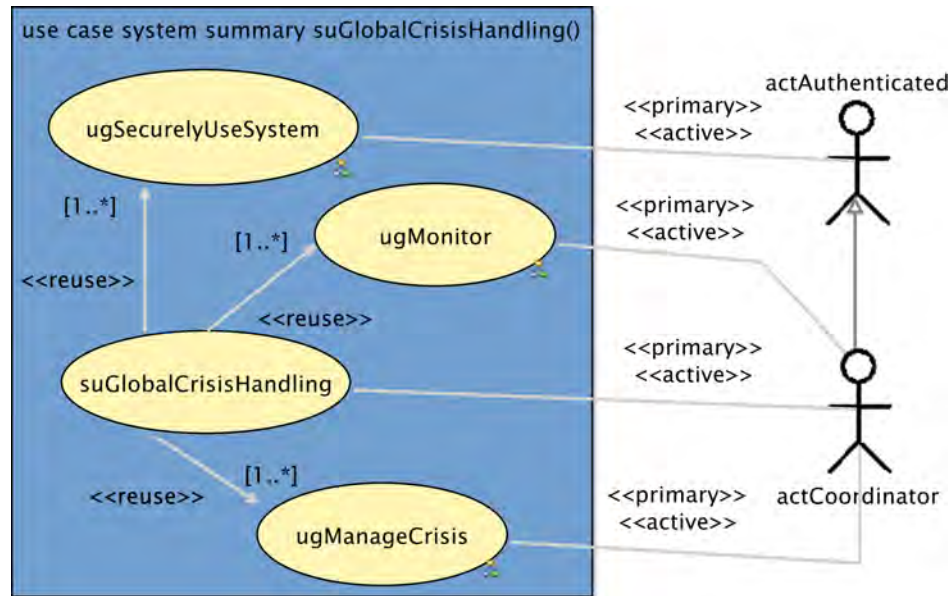


Figure 2.2: suGlobalCrisisHandling user goal use case

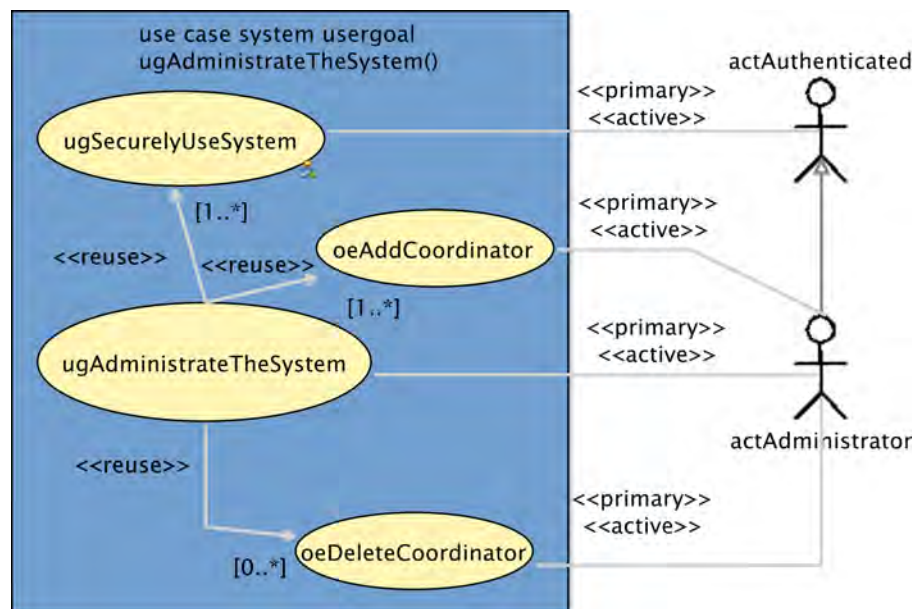
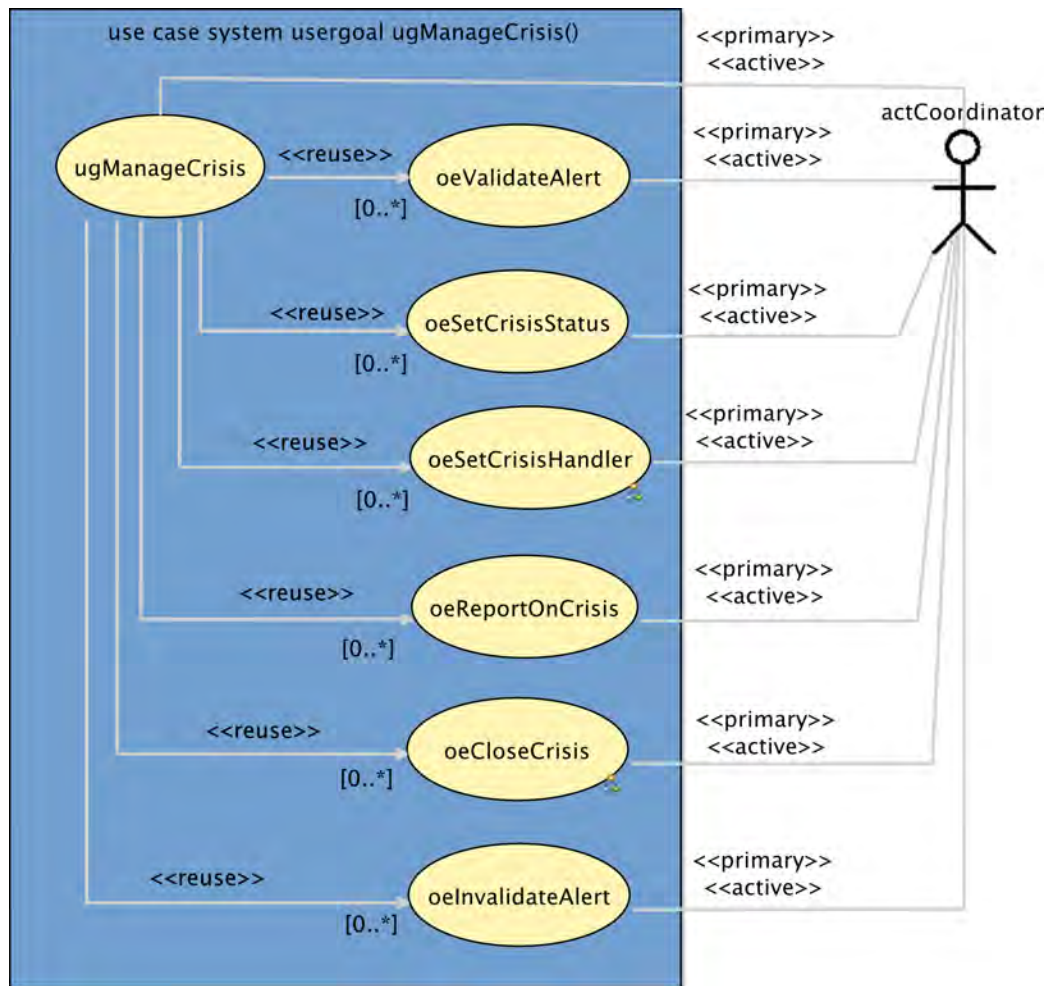
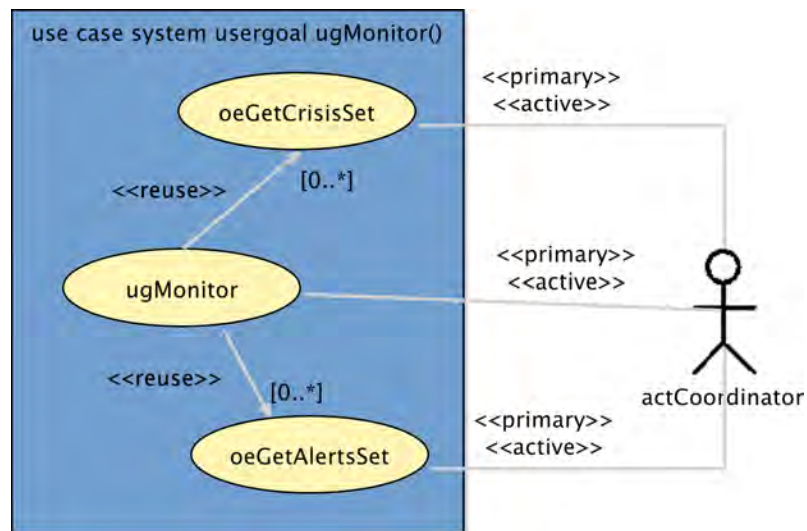


Figure 2.3: ugAdministrateTheSystem user goal use case

Figure 2.4: `ugManageCrisis` user goal use caseFigure 2.5: `ugMonitor` user goal use case

USE-CASE DESCRIPTION	
<i>Name</i>	ugSecurelyUseSystem
<i>Scope</i>	system
<i>Level</i>	usergoal
<b>Primary actor(s)</b>	
1	actAuthenticated[active]
<b>Goal(s) description</b>	
the actAdministrator's goal is to follow an identification procedure to be allowed to add or delete the necessary crisis coordinators that will be granted the responsibility to handle alerts and crisis.	
<b>Reuse</b>	
1	<u>oeLogin</u> [1..1]
2	<u>oeLogout</u> [1..1]
<b>Protocol condition(s)</b>	
1	the iCrash system has been deployed
<b>Pre-condition(s)</b>	
1	none
<b>Main post-condition(s)</b>	
1	the actAuthenticated is known by the system not to be logged.
<b>Main Steps</b>	
a	the actor actAuthenticated executes the <u>oeLogin</u> use case
b	the actor actAuthenticated executes the <u>oeLogout</u> use case
<b>Steps Ordering Constraints</b>	
1	step (a) must always precede step (b).

Figure 2.6 shows the use case diagram for the ugSecurelyUseSystem user goal use case

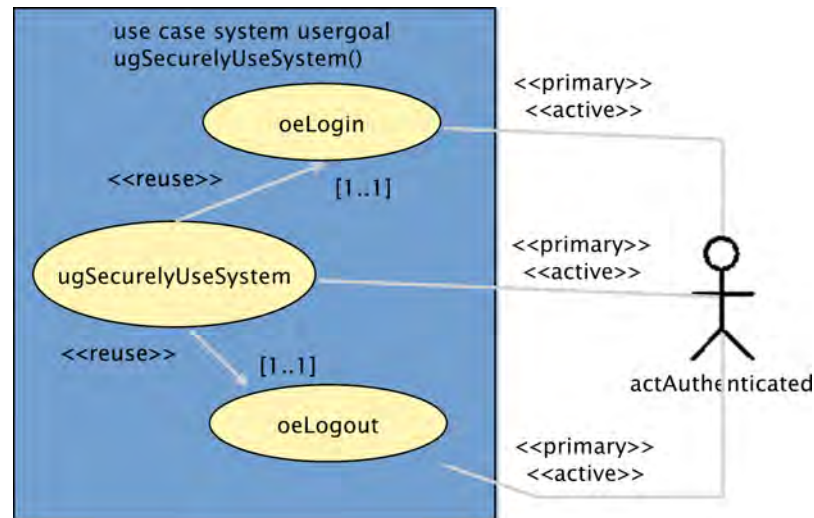


Figure 2.6: ugSecurelyUseSystem user goal use case

### 2.3.1.7 subfunction-oeSetCrisisHandler

goal is to declare himself as been the handler of a crisis having the specified id.

USE-CASE DESCRIPTION	
<i>Name</i>	oeSetCrisisHandler
<i>Scope</i>	system
<i>Level</i>	subfunction
<b>Parameters</b>	
AdtCrisisID: dtCrisisID 1	
<b>Primary actor(s)</b>	
1	actCoordinator[active]
<b>Secondary actor(s)</b>	
1	actCoordinator[passive]
2	actComCompany[passive, multiple]
<b>Goal(s) description</b>	
goal is to declare himself as been the handler of a crisis having the specified id.	
<b>Protocol condition(s)</b>	
1	
<b>Pre-condition(s)</b>	
1	
<b>Main post-condition(s)</b>	
1	
<b>Additional Information</b>	
none	

Figure 2.7 shows the use case diagram for the oeSetCrisisHandler subfunction use case

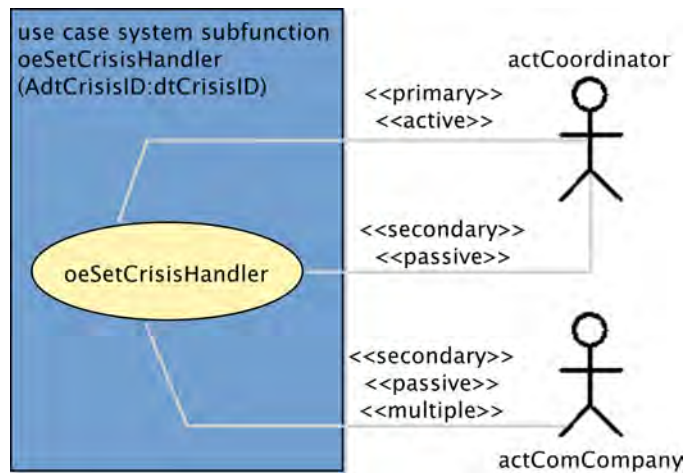


Figure 2.7: oeSetCrisisHandler subfunction use case

#### 2.3.1.8 subfunction-oeSollicitateCrisisHandling

the actActivator's goal is to decrease the number of unhandled crisis.

USE-CASE DESCRIPTION	
<i>Name</i>	oeSollicitateCrisisHandling
<i>Scope</i>	system
<i>Level</i>	subfunction
<b>Primary actor(s)</b>	
1	actActivator[proactive]
<b>Secondary actor(s)</b>	
1	actCoordinator[passive, multiple]
2	actAdministrator[passive]
<b>Goal(s) description</b>	
the actActivator's goal is to decrease the number of unhandled crisis.	
<b>Protocol condition(s)</b>	
1	the iCrash system has been deployed.
2	there exist some crisis still pending and for which no solicitation has been sent to the administrator and the coordinators for more than a predefined maximum delay.
<b>Pre-condition(s)</b>	
1	none
<b>Main post-condition(s)</b>	
1	a simple text message ieMessage('There are alerts not treated since more than the defined delay. Please REACT !') is sent to the system administrator and to all the coordinators of the environment for each crisis that is known to be not handled and for which no solicitation has been sent to the administrator and the coordinators for more than a predefined maximum delay.')
2	the reminder period for the concerned crisis is initialized.

Figure 2.8 shows the use case diagram for the oeSollicitateCrisisHandling subfunction use case

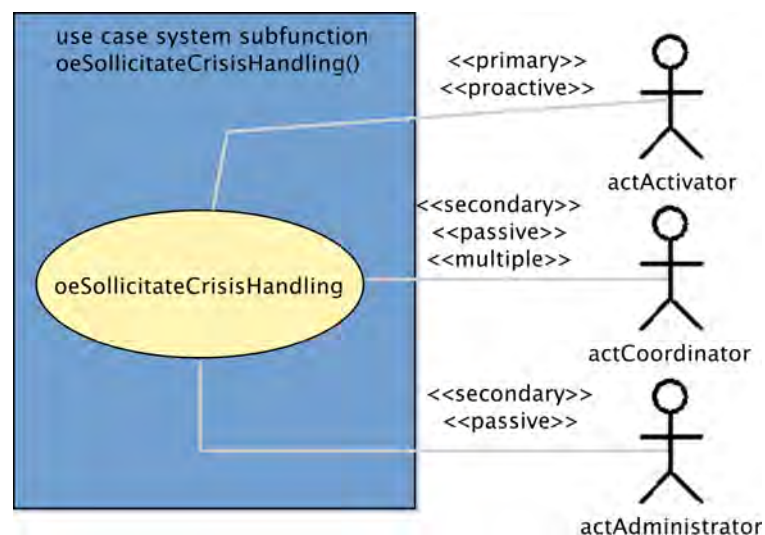


Figure 2.8: oeSollicitateCrisisHandling subfunction use case



### 2.3.2 Use Case Instance(s)

#### 2.3.2.1 Use-Case Instance - uciSimpleAndCompletePart01:suDeployAndRun

First part of a use case instance for the summary use case `suDeployAndRun` illustrating a simple and complete interaction scenario primarily handled by an administrator in a concrete situation.

SUMMARY USE-CASE INSTANCE	
<b><i>Instantiated Use Case</i></b> suDeployAndRun	
<b><i>Instance ID</i></b> uciSimpleAndCompletePart01	
<b><i>Remarks</i></b>	
a	shows the system initialization and the first administrative tasks by the administrator.
b	The unique and always existing <code>actMsrCreator</code> actor instance (named here <code>theCreator</code> ) requests the initialization of the system and its environment (made of one administrator identified here by <code>bill</code> ), one activator actor (identified by <code>theClock</code> ) and indicating that the number of communication company actor instances for the system's environment is 4 (one of them is identified here by <code>tango</code> )
c	the administrator logs in to initialize a coordinator
d	an alert is received. Time is going on without having the coordinator handling the alert which lets the proactive actor trigger the automatic solicitation of crisis handling.
e	this first part stops before the coordinator logs in the system.

Figure 2.9 shows the sequence diagram representing the first part of a simple and complete use case instance for the summary use case `suDeployAndRun`.

#### 2.3.2.2 Use-Case Instance - uciSimpleAndCompletePart02:suDeployAndRun

Second part of a simple and complete use case instance for the summary use case `suDeployAndRun` illustrating a simple and complete interaction scenario primarily handled by an administrator in a concrete situation.

SUMMARY USE-CASE INSTANCE	
<b><i>Instantiated Use Case</i></b> suDeployAndRun	
<b><i>Instance ID</i></b> uciSimpleAndCompletePart02	
<b><i>Remarks</i></b>	
a	starts when the coordinator logs in the system until the full handling of all the existing crisis.
b	shows an instantiated case of handling of a crisis by a coordinator until its closure after reporting.

Figure 2.10 shows the sequence diagram representing the second part of a simple and complete use case instance for the summary use case `suDeployAndRun`.

#### 2.3.2.3 Use-Case Instance - uciugSecurelyUseSystem:ugSecurelyUseSystem



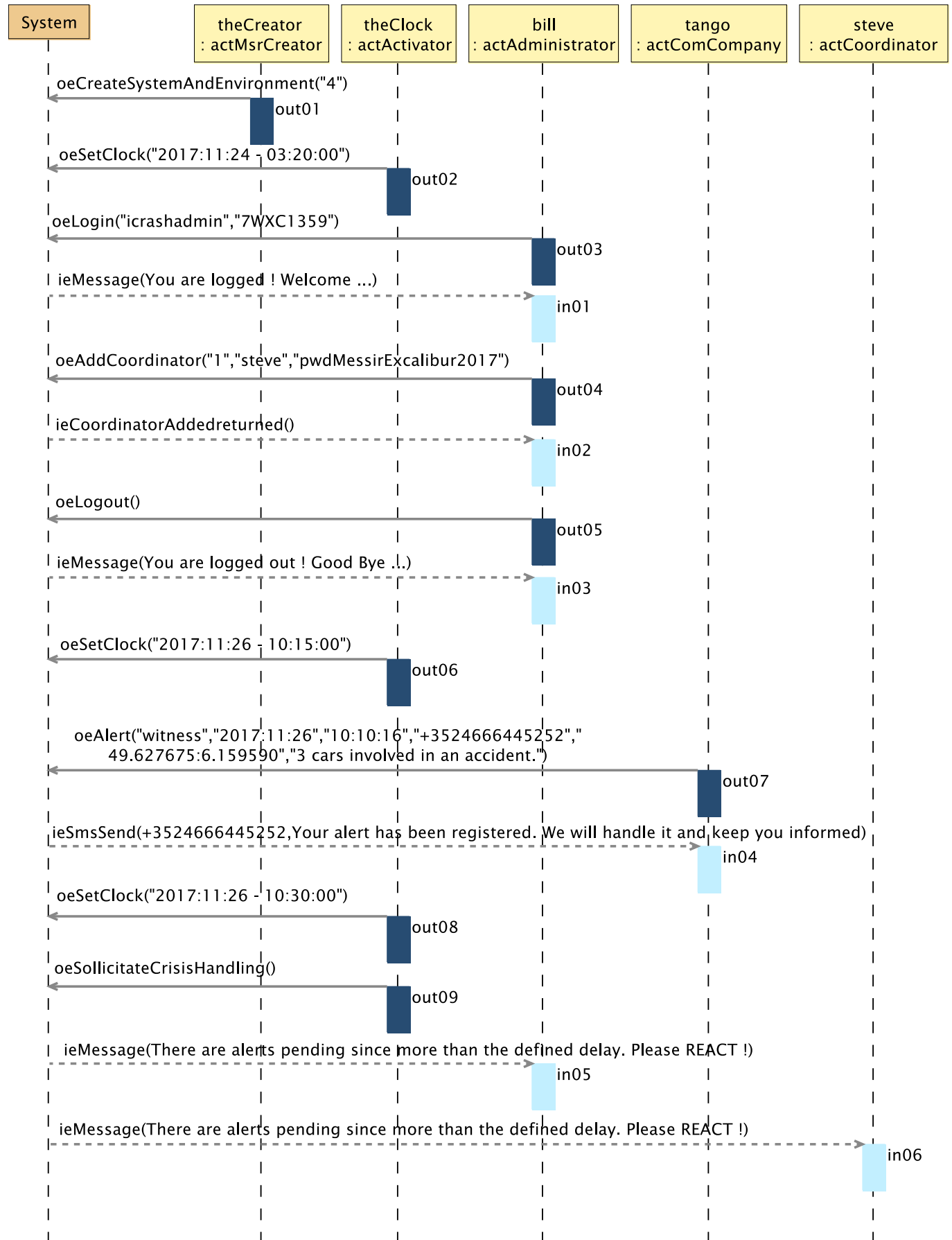


Figure 2.9: uci-suDeployAndRun-uciSimpleAndComplete-Part01

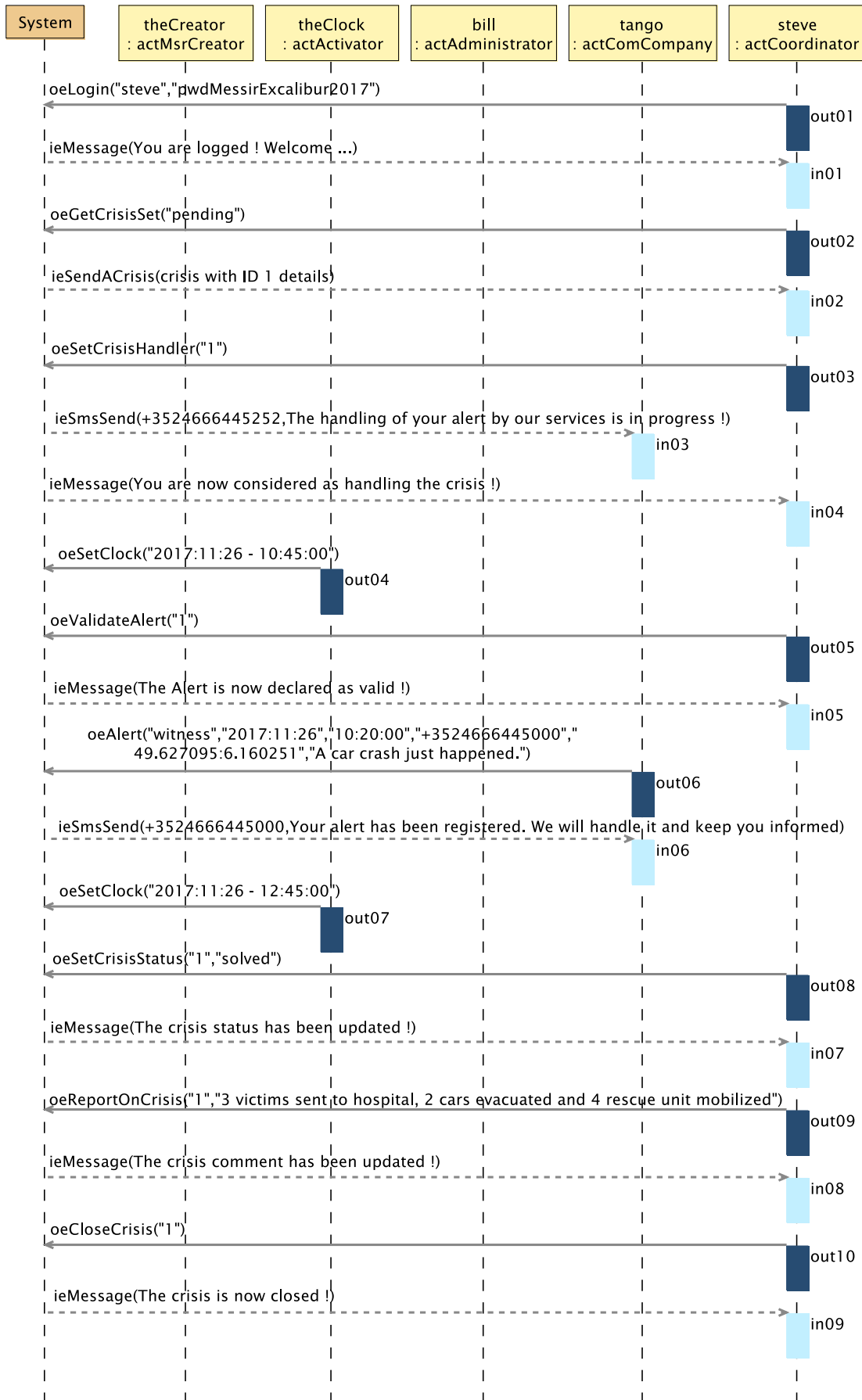


Figure 2.10: uci-suDeployAndRun-uciSimpleAndComplete-Part02 use case instance sequence diagram

USERGOAL USE-CASE INSTANCE
<i>Instantiated Use Case</i> ugSecurelyUseSystem
<i>Instance ID</i> uciugSecurelyUseSystem

Figure 2.11

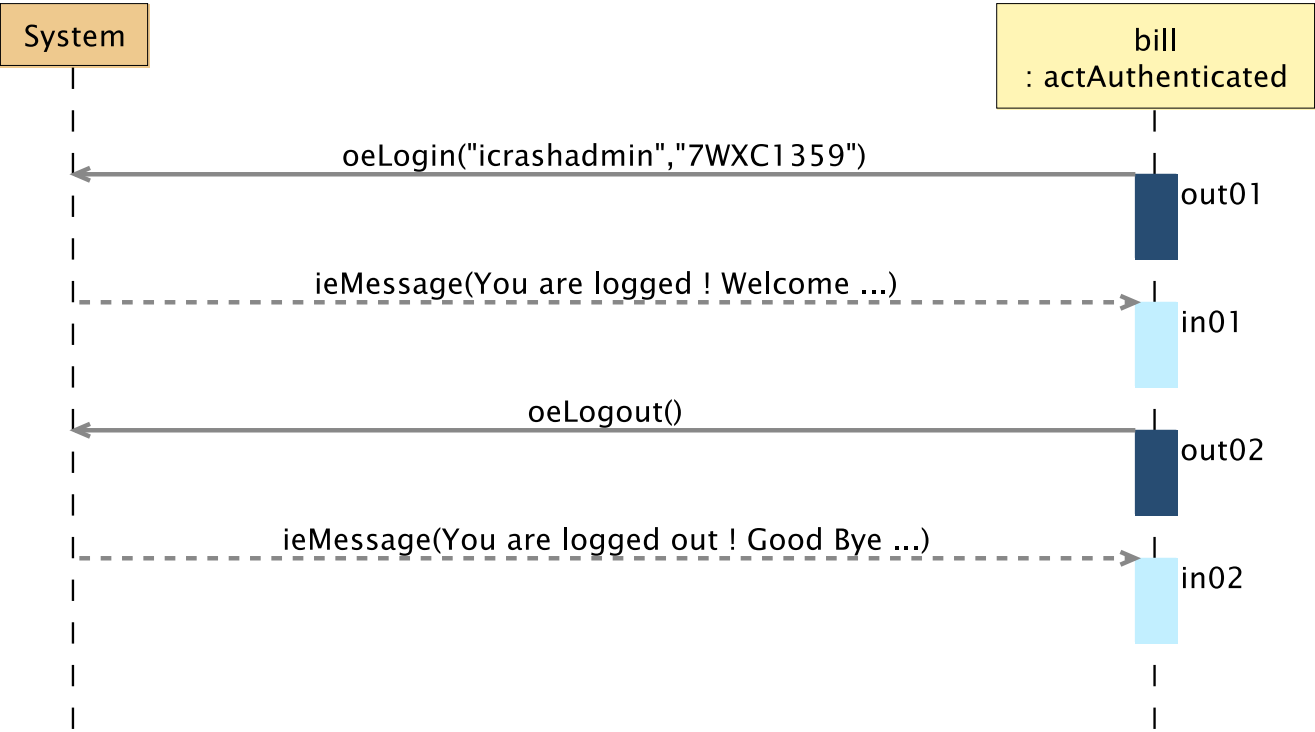


Figure 2.11:

## Chapter 3

# Environment Model

We provide below the view(s) defined for the **Messip** environment model (cf. [1]) of the system.

### 3.1 Local view 01

Figure 3.1 shows the local view giving the second part of the environment model of the system in term of its state class, actors with their input and output interfaces and all related associations.

### 3.2 Local view 02

Figure 3.2 shows the local view giving the second part the environment model of the system in term of its state class, actors with their input and output interfaces and all related associations.

### 3.3 Local view 03

Figure 3.3 shows the local view for the administrator actor and interfaces

### 3.4 Local view 04

Figure 3.4 shows the local view for the coordinator actor and interfaces

### 3.5 Local view 05

Figure 3.5 shows the local view for the authenticated actor and interfaces

### 3.6 Global view 01

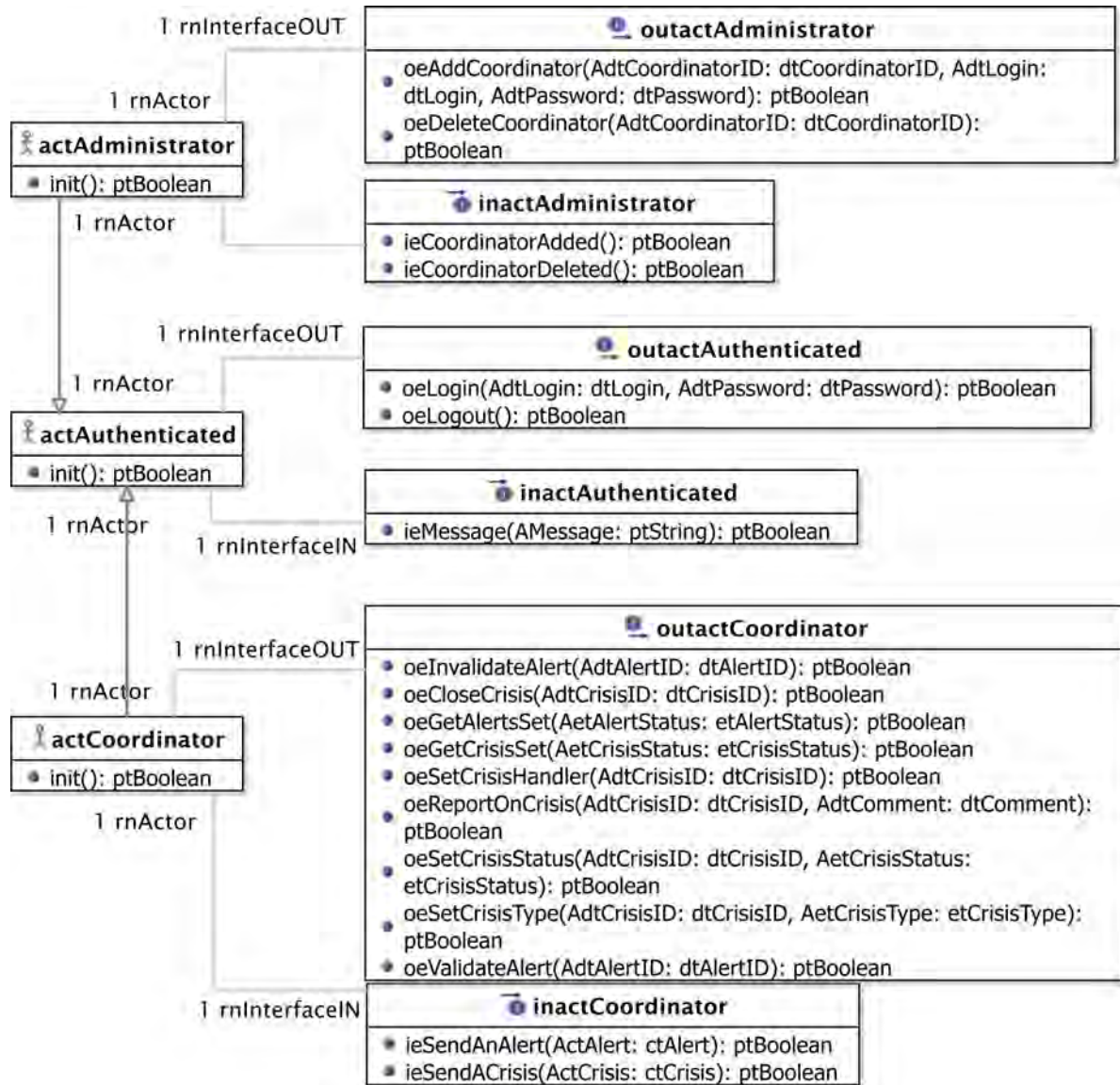


Figure 3.1: Environment Model - Local View 01. environment model local view - Part 1.

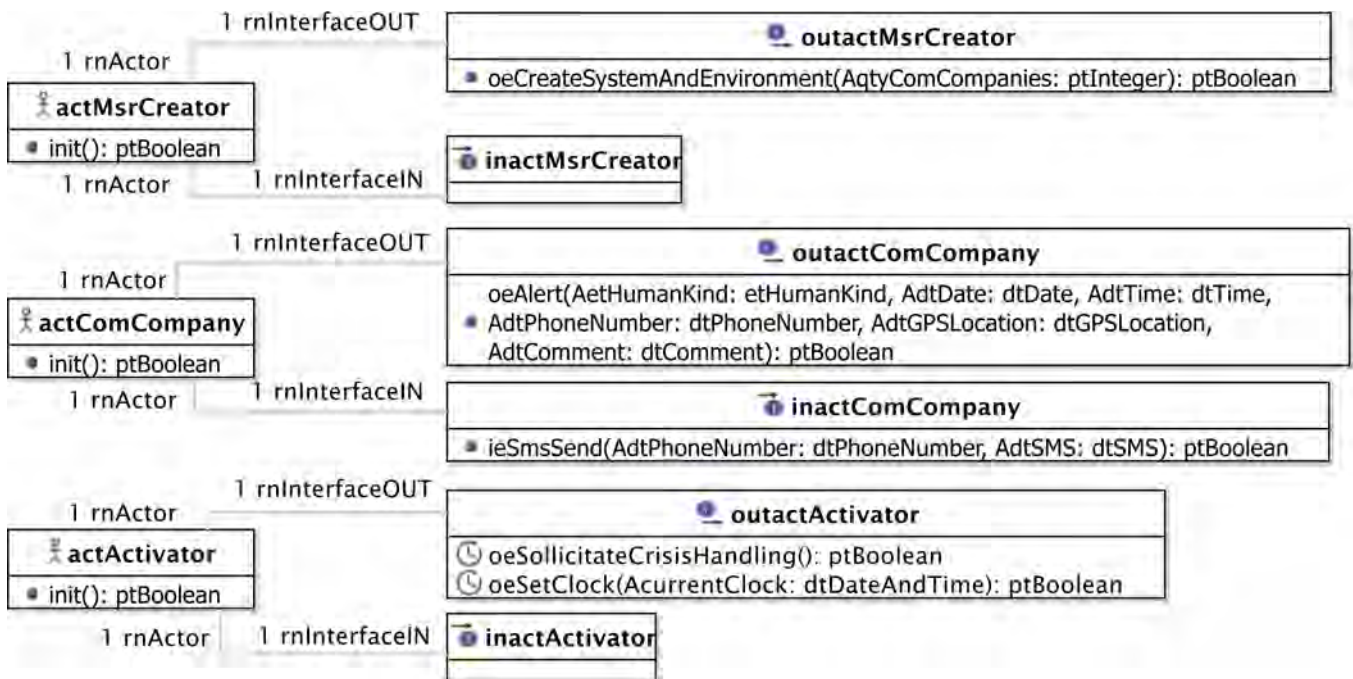


Figure 3.2: Environment Model - Local View 02. environment model local view - Part 2.

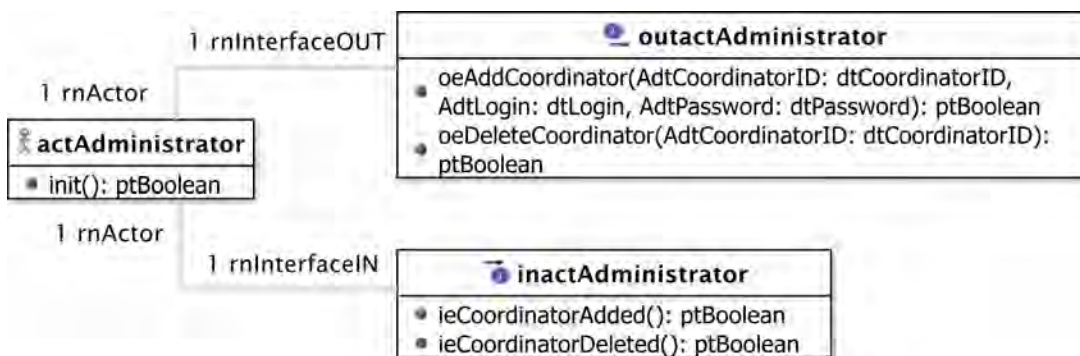


Figure 3.3: Environment Model - Local View 03. administrator actor environment model view.

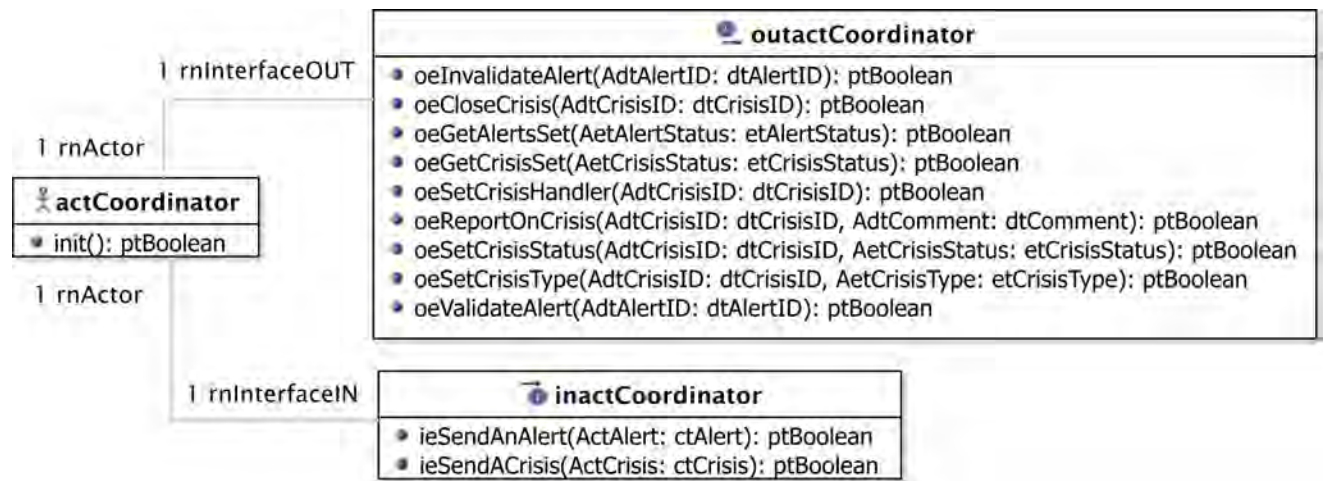


Figure 3.4: Environment Model - Local View 04. coordinator actor environment model view.

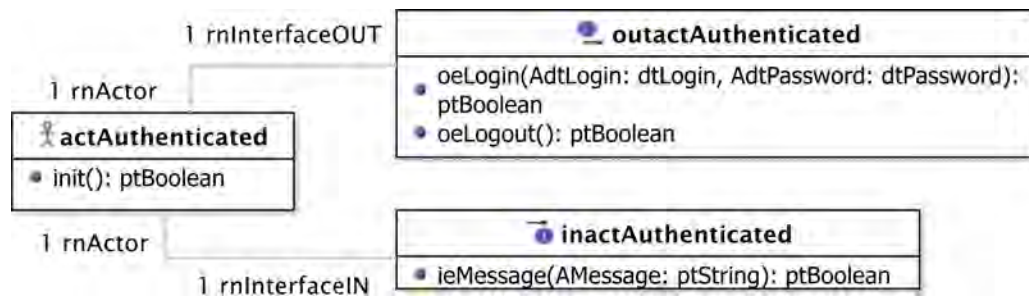


Figure 3.5: Environment Model - Local View 05. authenticated actor environment model local view.



Figure 3.6 shows a global view for all actors with their relationships with ctState

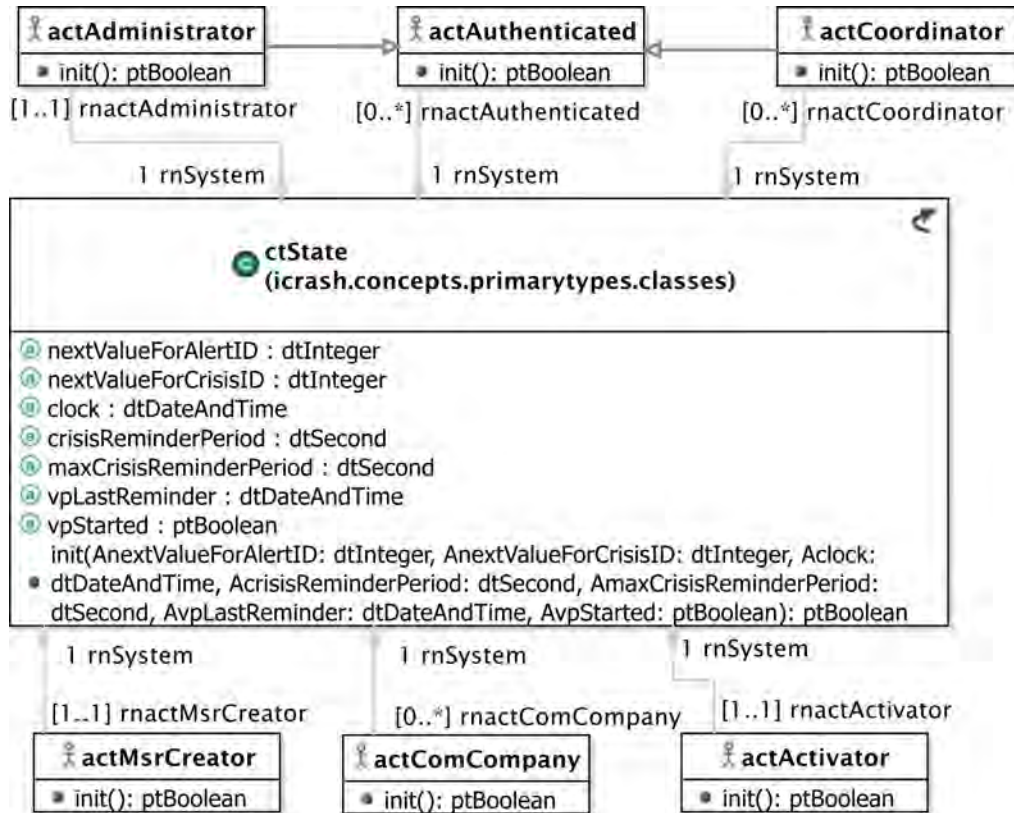


Figure 3.6: Environment Model - Global View 01. em-gv-01 environment model global view.

## 3.7 Actors and Interfaces Descriptions

We provide for the given views the description of the actors together with their associated input and output interface descriptions.

### 3.7.1 actActivator Actor

ACTOR	
<b>actActivator</b>	
represents a logical actor for time automatic message sending based on system's or environment status.	
OutputInterfaces	
OUT 1	<b>[proactive] oeSollicitateCrisisHandling() :ptBoolean</b> used to avoid crisis to stay too long in an not handled status.
OUT 2	<b>[proactive] oeSetClock(AcurrentClock :dtDateAndTime) :ptBoolean</b> used to update the system's time

### 3.7.2 actAdministrator Actor

ACTOR	
<b><i>actAdministrator</i></b> represents an actor responsible of administration tasks for the <i>iCrash</i> system.	
<b><i>Extends</i></b> icrash.environment.actAuthenticated	
<b><i>OutputInterfaces</i></b>	
OUT 1	<b>oeAddCoordinator (AdtCoordinatorID:dtCoordinatorID, AdtLogin:dtLogin, AdtPassword:dtPassword) :ptBoolean</b> sent to add a new coordinator in the system's post state and environment's post state.
OUT 2	<b>oeDeleteCoordinator (AdtCoordinatorID:dtCoordinatorID) :ptBoolean</b> sent to delete an existing coordinator in the system's post state and environment's post state.
<b><i>InputInterfaces</i></b>	
IN 1	<b>ieCoordinatorAdded() :ptBoolean</b> its reception confirms the creation of the requested coordinator.
IN 2	<b>ieCoordinatorDeleted() :ptBoolean</b> its reception confirms the deletion of the requested coordinator.

### 3.7.3 actAuthenticated Actor

ACTOR	
<b><i>actAuthenticated</i></b> abstract actor providing reusable input and output interfaces for actors that need to authenticate themselves.	
<b><i>OutputInterfaces</i></b>	
OUT 1	<b>oeLogin (AdtLogin:dtLogin, AdtPassword:dtPassword) :ptBoolean</b> sent to request authorization to request access secured system operations.
OUT 2	<b>oeLogout () :ptBoolean</b> sent to end the secured access to specific system operations.
<b><i>InputInterfaces</i></b>	
IN 1	<b>ieMessage (AMessage:ptString) :ptBoolean</b> allows for receiving general textual messages.

### 3.7.4 actComCompany Actor

ACTOR	
<b><i>actComCompany</i></b> represents the communication company stakeholder ensuring the input/ouput of textual messages with humans having communicaiton devices.	
<b><i>OutputInterfaces</i></b>	
OUT 1	<b>oeAlert (AetHumanKind:etHumanKind, AdtDate:dtDate, AdtTime:dtTime, AdtPhoneNumber:dtPhoneNumber, AdtGPSLocation:dtGPSLocation, AdtComment : dtComment) :ptBoolean</b> sent to alert of a potential crisis situation.
<b><i>InputInterfaces</i></b>	
IN 1	<b>ieSmsSend (AdtPhoneNumber:dtPhoneNumber, AdtSMS:dtSMS) :ptBoolean</b>

*continues in next page ...*

**...Actor table continuation**

allows for receiving textual messages to be dispatched to the communication company customers having the provided phone number.

**3.7.5 actCoordinator Actor**

ACTOR	
<b>actCoordinator</b>	
represents actor responsible of handling one or several crisis for the <i>iCrash</i> system.	
<b>Extends</b>	
icrash.environment.actAuthenticated	
<b>OutputInterfaces</b>	
OUT 1	<b>oeInvalidateAlert (AdtAlertID:dtAlertID) :ptBoolean</b> sent to indicate that an alert should be considered as closed.
OUT 2	<b>oeCloseCrisis (AdtCrisisID:dtCrisisID) :ptBoolean</b> sent to indicate that a crisis should be considered as closed.
OUT 3	<b>oeGetAlertsSet (AetAlertStatus:etAlertStatus) :ptBoolean</b> sent to request all the ctAlert instances having a specific status.
OUT 4	<b>oeGetCrisisSet (AetCrisisStatus:etCrisisStatus) :ptBoolean</b> sent to request all the ctCrisis instances having a specific status.
OUT 5	<b>oeSetCrisisHandler (AdtCrisisID:dtCrisisID) :ptBoolean</b> sent to declare himself as been the handler of a crisis having the specified id.
OUT 6	<b>oeReportOnCrisis (AdtCrisisID:dtCrisisID, AdtComment:dtComment) :ptBoolean</b> sent to update the textual information available for a specific handled crisis.
OUT 7	<b>oeSetCrisisStatus (AdtCrisisID:dtCrisisID, AetCrisisStatus:etCrisisStatus) :ptBoolean</b> sent to define the handling status of a specific crisis.
OUT 8	<b>oeSetCrisisType (AdtCrisisID:dtCrisisID, AetCrisisType:etCrisisType) :ptBoolean</b> sent to define the gravity type of a specific crisis.
OUT 9	<b>oeValidateAlert (AdtAlertID:dtAlertID) :ptBoolean</b> sent to indicate that a specific alert is not a fake.
<b>InputInterfaces</b>	
IN 1	<b>ieSendAnAlert (ActAlert:ctAlert) :ptBoolean</b> allows for receiving a requested ctAlert instance.
IN 2	<b>ieSendACrisis (ActCrisis:ctCrisis) :ptBoolean</b> allows for receiving a requested ctCrisis instance.

**3.7.6 actMsrCreator Actor**

ACTOR	
<b>actMsrCreator</b>	
Represents the creator stakeholder in charge of state and environment initialization.	
<b>OutputInterfaces</b>	
OUT 1	<b>oeCreateSystemAndEnvironment (AqtyComCompanies:ptInteger) :ptBoolean</b> sent to request the initialization of the system's class instances and the environment actors instances.



# Chapter 4

## Concept Model

### 4.1 PrimaryTypes-Classes

#### 4.1.1 Local view 01

Figure [4.1](#) shows the local view on all the primary types class types.

#### 4.1.2 Local view 02

Figure [4.2](#) shows the local view of the ctState primary type class type.

#### 4.1.3 Local view 03

Figure [4.3](#) shows the local view of the ctAlert primary type class type.

#### 4.1.4 Local view 04

Figure [4.4](#) shows the local view of the ctCrisis primary type class type.

#### 4.1.5 Global view 01

Figure [4.5](#) shows the global view on primary types class types showing the association(s) types with the actor classes of the environment model.

### 4.2 PrimaryTypes-Datatypes

#### 4.2.1 Local view 06

Figure [4.6](#)

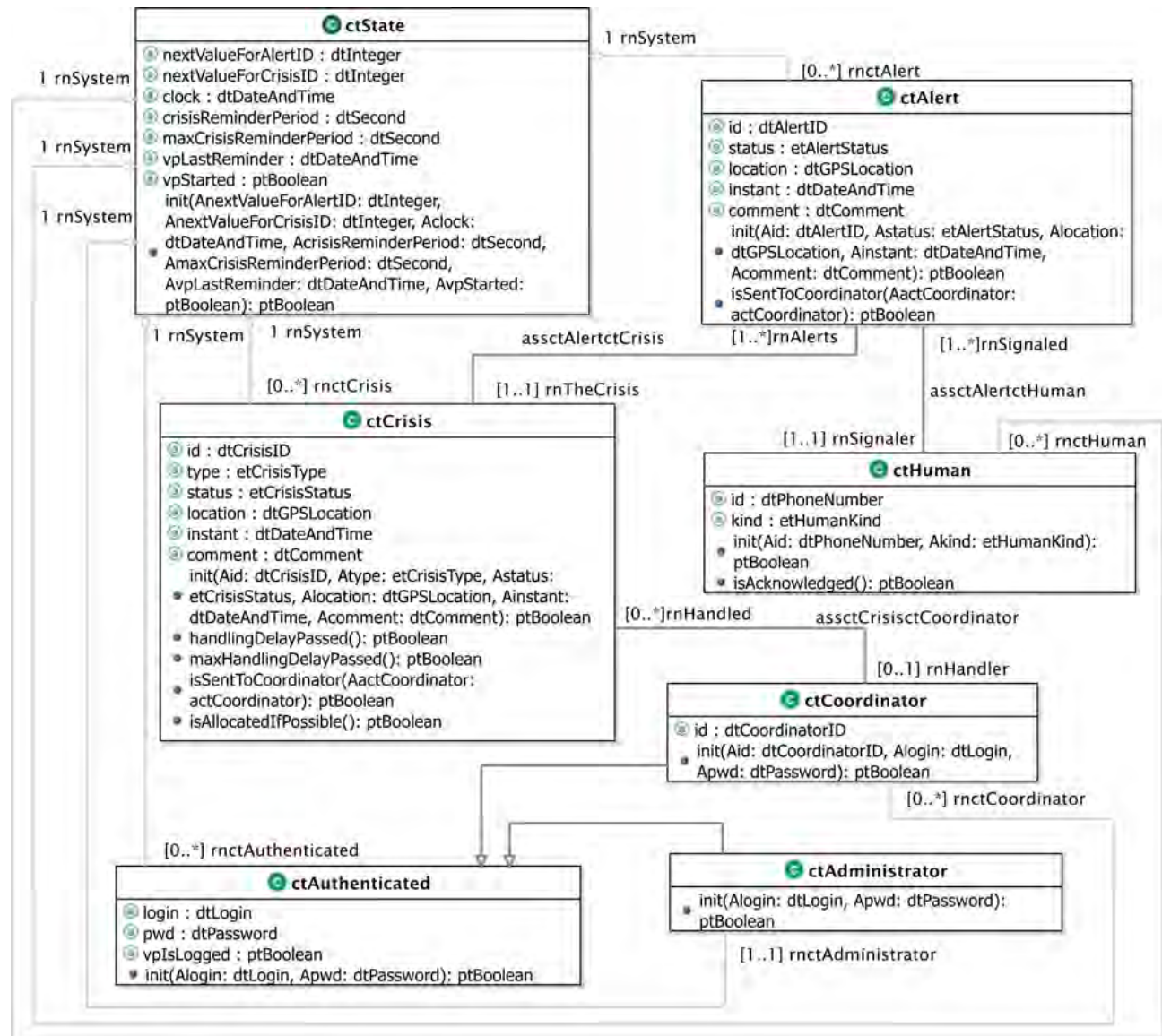


Figure 4.1: Concept Model - PrimaryTypes-Classes local view 01. Local view of all the primary types class types .

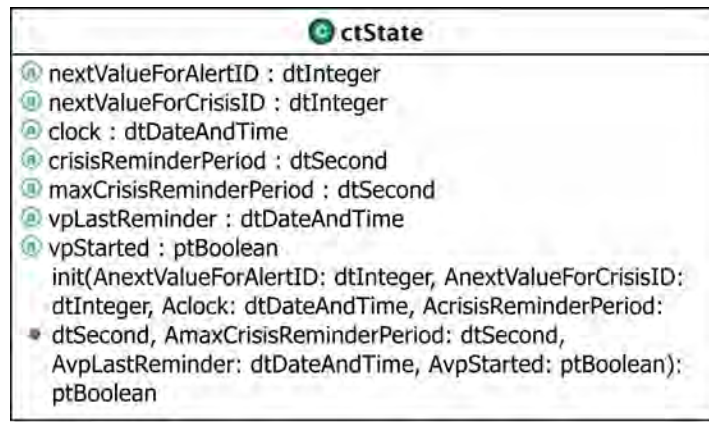


Figure 4.2: Concept Model - PrimaryTypes-Classes local view 02. local view of the `ctState` primary type.

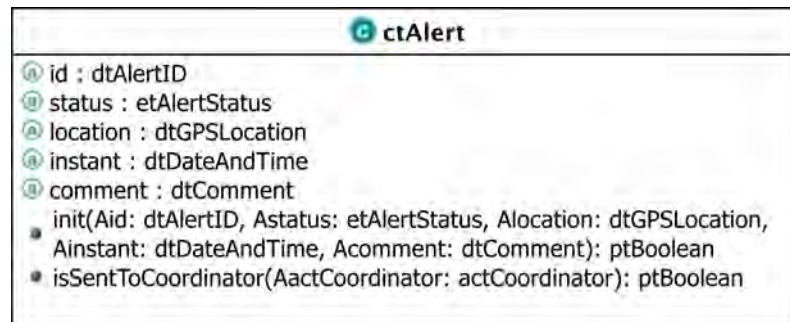


Figure 4.3: Concept Model - PrimaryTypes-Classes local view 03. local view of the `ctAlert` primary type.

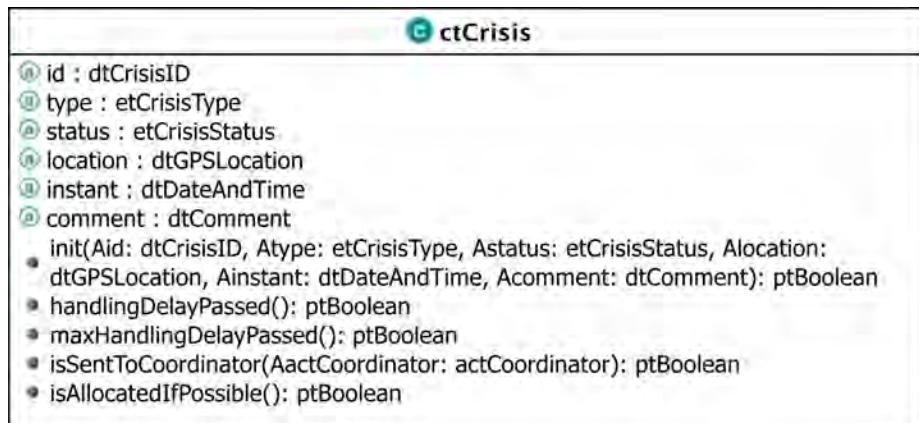


Figure 4.4: Concept Model - PrimaryTypes-Classes local view 04. local view of the `ctCrisis` primary type.



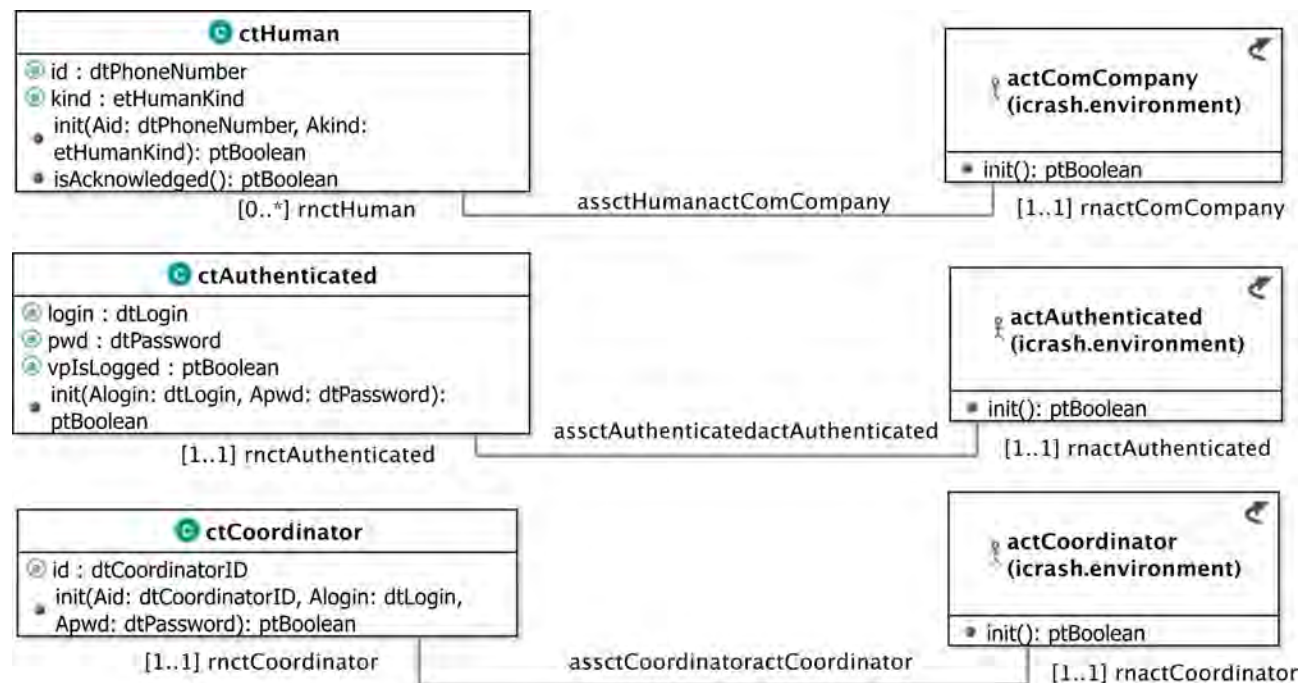


Figure 4.5: Concept Model - PrimaryTypes-Classes global view 01. Primary types class types global view - cm-pt-ct-gv-01 .

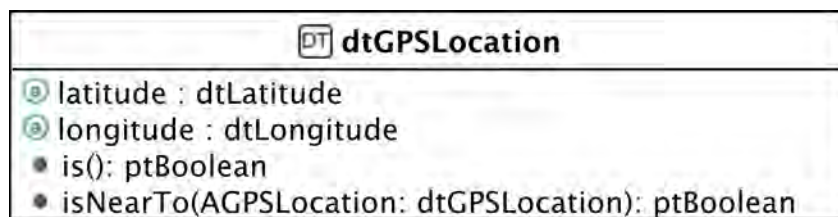


Figure 4.6: Concept Model - PrimaryTypes-Datatypes local view 06. .

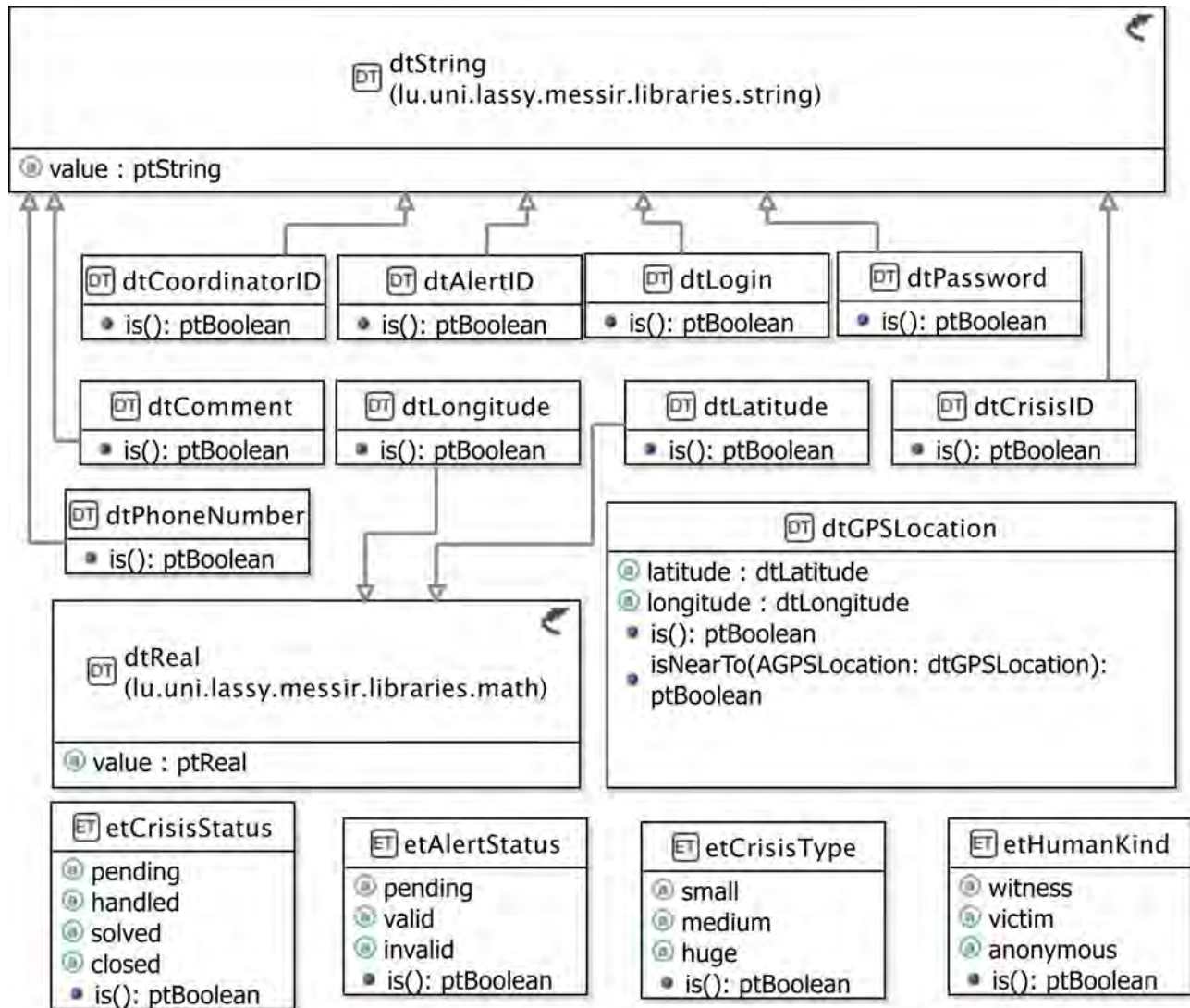


Figure 4.7: Concept Model - PrimaryTypes-Datatypes global view 01. global view of primary types datatype types - cm-pt-dt-gv-01 .

### 4.2.2 Global view 01

Figure 4.7 shows a global view on the *iCrash* primary types datatype types.

## 4.3 SecondaryTypes-Datatypes

### 4.3.1 Local view 01

Figure 4.8 shows the local view of the secondary types datatype types.

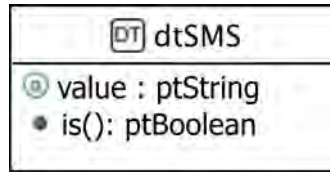


Figure 4.8: Concept Model - SecondaryTypes-Datatypes local view 01. Local view of the secondary types datatype types.

## 4.4 Concept Model Types Descriptions

This section provides the textual descriptions of all the types defined in the concept model and that can be part of the graphical views provided.

### 4.4.1 Primary types - Class types descriptions

The table below is providing comments on the graphical views given for the class types of the primary types. Type logical operations are precisely specified in the operation model.

CLASSES	
<b><i>ctAdministrator</i></b> used to characterize internally the entity that is responsible of administrating the <i>iCrash</i> system.	
<i>extends</i>	icrash.concepts.primarytypes.classes.ctAuthenticated
operation	<b>init(Alogin:dtLogin, Apwd:dtPassword):ptBoolean</b> used to initialize the current object as a new instance of the ctAdministrator type.
<b><i>ctAlert</i></b> Used to model crisis alerts sent by any human having communication capability using communication companies belonging to the system's environment	
attribute	<b>comment: dtComment</b> a textual description providing unstructured information on the alert.
attribute	<b>id: dtAlertID</b> the alert unique identification information.
attribute	<b>instant: dtDateAndTime</b> the date and time at which the alert notification has been sent.
attribute	<b>location: dtGPSLocation</b>

*continues in next page ...*

**... Classes table continuation**

	the position of the alert provided by the space-based satellite navigation system used by the human using the communication company to inform the <i>iCrash</i> system of a crisis.
attribute	<b>status: etAlertStatus</b>
	the alert validation status
operation	<b>init (Aid:dtAlertID, Astatus:etAlertStatus, Alocation:dtGPSLocation, Ainstant:dtDateAndTime, Acomment:dtComment) :ptBoolean</b>
	used to initialize the current object as a new instance of the ctAlert type.
operation	<b>isSentToCoordinator (AactCoordinator:actCoordinator) :ptBoolean</b>
	used to provide a given coordinator with current alert information.
<b>ctAuthenticated</b>	
used to model system's representation about actors that need to authenticate to access some specific functionalities.	
attribute	<b>login: dtLogin</b>
	an identifier for authentication.
attribute	<b>pwd: dtPassword</b>
	a key for authentication.
attribute	<b>vpIsLogged: ptBoolean</b>
	used to determine the access status.
operation	<b>init (Alogin:dtLogin, Apwd:dtPassword) :ptBoolean</b>
	used to initialize the current object as a new instance of the ctAuthenticated type.
<b>ctCoordinator</b>	
used to model system's representation about the actors that have the responsibility to handle alerts and crisis.	
extends	icrash.concepts.primarytypes.classes.ctAuthenticated
attribute	<b>id: dtCoordinatorID</b>
	a unique identification information.
operation	<b>init (Aid:dtCoordinatorID, Alogin:dtLogin, Apwd:dtPassword) :ptBoolean</b>
	used to initialize the current object as a new instance of the ctCoordinator type.
<b>ctCrisis</b>	
Used to model crisis that are inferred from the reception of at least one alert message. Crisis aer entities that are handled by the <i>iCrash</i> system.	
attribute	<b>comment: dtComment</b>
	a textual description providing unstructured information on the crisis handling.
attribute	<b>id: dtCrisisID</b>
	the crisis unique identification information.
attribute	<b>instant: dtDateAndTime</b>
	the date and time at which the first related alert notification has been sent.
attribute	<b>location: dtGPSLocation</b>
	the position of the crisis equal by the one of the first alert received and associated to the crisis.
attribute	<b>status: etCrisisStatus</b>
	the crisis handling status.
attribute	<b>type: etCrisisType</b>
	an indication of the gravity of the crisis.
operation	<b>handlingDelayPassed() :ptBoolean</b>

**continues in next page ...**

**... Classes table continuation**

operation	used to determine if the crisis stood too longly in a pending status since last reminder. <b>init (Aid:dtCrisisID, Atype:etCrisisType, Astatus:etCrisisStatus, Alocation:dtGPSLocation, Ainstant:dtDateAndTime, Acomment:dtComment) :ptBoolean</b>
operation	used to initialize the current object as a new instance of the ctAlert type. <b>isAllocatedIfPossible() :ptBoolean</b>
operation	used to allocate a crisis to a coordinator if any or to alert the administrator of crisis waiting to be handled. <b>isSentToCoordinator (AactCoordinator:actCoordinator) :ptBoolean</b>
operation	used to provide a given coordinator with current crisis information. <b>maxHandlingDelayPassed() :ptBoolean</b>
	used to determine if the crisis stood too longly in a pending status since its creation.
<b>ctHuman</b>	
used to model system's representation about the indirect actors that has alerted of potential crisis.	
attribute	<b>id: dtPhoneNumber</b> the number of the communication device used to send an alert to <i>iCrash</i> system.
attribute	<b>kind: etHumanKind</b> role with respect to the alert notified.
operation	<b>init (Aid:dtPhoneNumber, Akind:etHumanKind) :ptBoolean</b> init: used to initialize the current object as a new instance of the ctHuman type.
<b>ctState</b>	
used to model the system. Each system specified using <b>Messip</b> must include a ctState class for which there is only one instance at any state of the abstract machine after creation.	
attribute	<b>clock: dtDateAndTime</b> used to represent the system local time.
attribute	<b>crisisReminderPeriod: dtSecond</b> used to define the delay between two reminders after which a reminder must be sent to the administrator and to the known coordinators to encourage them to handle the crisis.
attribute	<b>maxCrisisReminderPeriod: dtSecond</b> used to define the maximum delay after which the crisis is randomly allocated to a coordinator if any or an alert message is sent to the administrator in order to encourage him to add coordinators.
attribute	<b>nextValueForAlertID: dtInteger</b> nextValueForAlertID: dtInteger: used to associate each alert declared with a unique identification value.
attribute	<b>nextValueForCrisisID: dtInteger</b> used to associate each crisis declared with a unique identification value.
attribute	<b>vpLastReminder: dtDateAndTime</b> date and time of the last reminder.
attribute	<b>vpStarted: ptBoolean</b> used to avoid reacting to an actor message if the system is not started (i.e. oeCreateSystemAndEnvironment not executed).
operation	<b>init (AnextValueForAlertID:dtInteger, AnextValueForCrisisID:dtInteger, Aclock:dtDateAndTime, AcrisisReminderPeriod:dtSecond, AmaxCrisisReminderPeriod:dtSecond, AvpLastReminder:dtDateAndTime, AvpStarted:ptBoolean) :ptBoolean</b>

*continues in next page ...*

**... Classes table continuation**

used to initialize the current object as a new instance of the ctState type.
--

**4.4.2 Primary types - Datatypes types descriptions**

The table below is providing comments on the graphical views given for the datatype types of the primary types.

DATATYPES	
<b>dtAlertID</b> A string used to identify alerts.	
extends	dtString
operation	<b>is() :ptBoolean</b> used to determine which strings are considered as valid alert identifiers.
<b>dtComment</b> a datatype made of a string value used to receive,store and send textual information about crisis and alerts.	
extends	dtString
operation	<b>is() :ptBoolean</b> used to determine which strings are considered as valid comments.
<b>dtCoordinatorID</b> A string used to identify coordinators.	
extends	dtString
operation	<b>is() :ptBoolean</b> used to determine which strings are considered as valid coordinators identifiers.
<b>dtCrisisID</b> A string used to identify crisis.	
extends	dtString
operation	<b>is() :ptBoolean</b> used to determine which strings are considered as valid crisis identifiers.
<b>dtGPSLocation</b> used to define coordinates of geograpical positions on earth. It is defined a couple made of a latitude and a longitude.	
attribute	<b>latitude: dtLatitude</b> for the latitude part of the coordinate.
attribute	<b>longitude: dtLongitude</b> for the longitude part of the coordinate.
operation	<b>is() :ptBoolean</b> used to determine which couples are considered as valid dtGPSLocation values.
operation	<b>isNearTo(AGPSLocation:dtGPSLocation) :ptBoolean</b> used to determine if locations are considered enough close to be treated as equivalent in the application domain context.
<b>dtLatitude</b> used to define a latitude value of a geograpical positions on earth.	
extends	dtReal
operation	<b>is() :ptBoolean</b> used to determine which strings are considered as valid dtLatitude.
<b>dtLogin</b> a login string used to authenticate an <i>iCrash</i> user	

**continues in next page ...**

**... Datatypes table continuation**

<i>extends</i>	dtString
operation	<b>is () :ptBoolean</b> used to determine which strings are considered as valid dtLogin.
<b>dtLongitude</b> used to define a longitude value of a geographical positions on earth.	
<i>extends</i>	dtReal
operation	<b>is () :ptBoolean</b> used to determine which strings are considered as valid dtLongitude.
<b>dtPassword</b> a password string used to authenticate an <i>iCrash</i> user	
<i>extends</i>	dtString
operation	<b>is () :ptBoolean</b> used to determine which strings are considered as valid dtPassword.
<b>dtPhoneNumber</b> a string used to store the phone number from the human declaring the crisis or the alert.	
<i>extends</i>	dtString
operation	<b>is () :ptBoolean</b> used to determine which strings are considered as valid dtPhoneNumber.

ENUMERATIONS	
<b>etAlertStatus</b> this type is used to indicate the different validation status of an alert.	
operation	<b>is () :ptBoolean</b> used to determine which litteral belongs to the enumeration.
<b>etCrisisStatus</b> this type is used to indicate the different handling status of a crisis.	
operation	<b>is () :ptBoolean</b> used to determine which litteral belongs to the enumeration.
<b>etCrisisType</b> this type is used to indicate the different types of a crisis.	
operation	<b>is () :ptBoolean</b> used to determine which litteral belongs to the enumeration.
<b>etHumanKind</b> this type is used to indicate the kind of human that informs about a car crash crisis.	
operation	<b>is () :ptBoolean</b> used to determine which litteral belongs to the enumeration.

**4.4.3 Primary types - Association types descriptions**

The table below is providing comments on the association types of the primary types.

UNDIRECTED ASSOCIATIONS
<b>assctAlerttctCrisis</b> a crisis is related to one or more alerts as the alerts judged to concern all the same crisis due to their location. An alert alerts exactly one crisis.
<b>assctAlerttctHuman</b>

*continues in next page ...*



**... Undirected associations table continuation**

	alerts are notified by human through the communication company. We need to keep an internal representation of those human to allow for communication of alert handling.
<b><i>assctAuthenticatedactAuthenticated</i></b>	mainly used to determine if the login request of an authenticated actor can be granted based on the given credentials and the registered ones.
<b><i>assctCoordinatoractCoordinator</i></b>	frequent messages must be sent to coordinator especially in relation to crisis they handle.
<b><i>assctCrisisactCoordinator</i></b>	at any point in time we need to know if a coordinator is handling existing crisis or not.
<b><i>assctHumanactComCompany</i></b>	in order to communicate with humans who informed about potential crisis, we need to record the communication company to use to send them messages.

**4.4.4 Primary types - Aggregation types descriptions**

There are no aggregation types for the primary types.

**4.4.4.1 Primary types - Composition types descriptions**

There are no composition types for the primary types.

**4.4.5 Secondary types - Class types descriptions**

There are no elements in this category in the system analysed.

**4.4.6 Secondary types - Datatypes types descriptions**

The table below is providing comments on the graphical views given for the datatype types of the secondary types.

DATATYPES	
<b><i>dtSMS</i></b>	
a datatype made of a string value used to send textual information to human mobile devices.	
attribute	<b>value: ptString</b> the textual information.
operation	<b>is():ptBoolean</b> used to determine which strings are considered as valid comments.

**4.4.7 Secondary types - Association types descriptions**

There are no association types for the secondary types.

**4.4.8 Secondary types - Aggregation types descriptions**

There are no aggregation types for the secondary types.

**4.4.9 Secondary types - Composition types descriptions**

There are no composition types for the secondary types.



## Chapter 5

# Operation Model

This section contains the operation schemes of each operation defined in either an actor, its output interface, in a primary or secondary type (class, datatype or enumeration types). The **Messip** OCL code listing is joined to the comment table.

### 5.1 Environment - Out Interface Operation Scheme for actActivator

#### 5.1.1 Operation Model for oeSetClock

The `oeSetClock` operation has the following properties:

OPERATION	
<b><i>oeSetClock/proactive/</i></b>	
An active message used to statically set the date and time information in the system's state.	
<b><i>Parameters</i></b>	
1	<b>AcurentClock: dtDateAndTime</b> the date and time to be considered as the actual one.
<b><i>Return type</i></b>	
ptBoolean	
<b><i>Pre-Condition (protocol)</i></b>	
PreP 1	the system is supposed to be created and initialized and the provided date and time value is greater than the one known by the system.
<b><i>Pre-Condition (functional)</i></b>	
PreF 1	none
<b><i>Post-Condition (functional)</i></b>	
PostF 1	the ctState instance post-state is updated to have its clock attribute equal to the given date and time.
<b><i>Post-Condition (protocol)</i></b>	
PostP 1	none

The listing 5.1 provides the **Messip** (MCL-oriented) specification of the operation.

```
1
2 /* Pre Protocol:*/
3 preP{let TheSystem: ctState in
```

```

4  let AvpStarted: ptBoolean in
5
6  /* PreP01 */
7  self.rnActor.rnSystem = TheSystem
8  and self.rnActor.rnSystem.vpStarted = AvpStarted
9  and AvpStarted = true
10 and TheSystem.clock.lt (AcurrentClock) }
11
12 /* Pre Functional:*/
13 preF{true}
14
15 /* Post Functional:*/
16 postF{let TheSystem: ctState in
17   self.rnActor.rnSystem = TheSystem
18 }
19 /* PostF01 */
20 and TheSystem@post.clock = AcurrentClock}
21
22 /* Post Protocol:*/
23 postP{ true}

```

Listing 5.1: **Messip** (MCL-oriented) specification of the operation *oeSetClock*.

### 5.1.2 Operation Model for *oeSolicitCrisisHandling*

The *oeSolicitCrisisHandling* operation has the following properties:

OPERATION	
<b><i>oeSolicitCrisisHandling[proactive]</i></b>	
A proactive message (message of a pro-active actor with no parameter triggered automatically if the pre protocol condition is true) used to avoid crisis to stay too long in an not handled status.	
<b><i>Return type</i></b>	
ptBoolean	
<b><i>Pre-Condition (protocol)</i></b>	
PreP 1	the system is started
PreP 2	there exist some crisis that are in pending status and for which the duration between the current ctState clock information and the last reminder is greater than the crisis reminder period duration.
<b><i>Pre-Condition (functional)</i></b>	
PreF 1	none
<b><i>Post-Condition (functional)</i></b>	
PostF 1	if there exist coordinators and crisis who stood in a not handled status more than the maximum allowed time then those crisis are randomly allocated to the existing coordinators.
PostF 2	for all other crisis who stood too longly in a not handled status but not more than the maximum delay allowed then a reminder message is sent to the administrator and all coordinator actors of the environment to solicitate handling of those crisis.
<b><i>Post-Condition (protocol)</i></b>	
PostP 1	the value of the last reminder known by the system at post state is the system's clock value.

The listing 5.2 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Pre Protocol:*/

```

```

3  preP{let TheSystem: ctState in
4    let AvpStarted: ptBoolean in
5    let ColctCrisisToHandle:
6      Bag(ctCrisis) in
7
8    self.rnActor.rnSystem = TheSystem
9
10   /* PreP01 */
11   and TheSystem.vpStarted
12
13   /* PreP02 */
14   and TheSystem.rnctCrisis->select(handlingDelayPassed())
15     = ColctCrisisToHandle
16   and ColctCrisisToHandle->size().geq(1)
17
18   /* Pre Functional:*/
19   preF{true}
20
21   /* Post Functional:*/
22   postF{let TheSystem: ctState in
23     let AMessageForCrisisHandlers: dtComment in
24     let ColctCrisisToAllocateIfPossible:Bag(ctCrisis) in
25
26     self.rnActor.rnSystem = TheSystem
27     /* PostF01 */
28     and TheSystem.rnctCrisis->select(maxHandlingDelayPassed())
29       = ColctCrisisToAllocateIfPossible
30     and ColctCrisisToAllocateIfPossible->forall(isAllocatedIfPossible())
31
32     /* PostF02 */
33     and TheSystem.rnctCrisis->select(handlingDelayPassed())
34       = ColctCrisisToHandle
35
36     and ColctCrisisToHandle->msrColSubtract(ColctCrisisToAllocateIfPossible)
37       = ColctCrisisToRemind
38
39     and if (ColctCrisisToRemind->size().geq(1))
40       then (AMessageForCrisisHandlers.value
41         ='There are alerts pending since more than the defined delay. Please REACT !'
42         and TheSystem.rnactAdministrator.
43           rnInterfaceIN^ieMessage(AMessageForCrisisHandlers)
44           and TheSystem.rnactCoordinator
45             ->forall(rnInterfaceIN^ieMessage(AMessageForCrisisHandlers))
46         )
47       else true
48     endif}
49
50   /* Post Protocol:*/
51   postP{ let TheSystem: ctState in
52     let TheClock: dtDateAndTime in
53
54     self.rnActor.rnSystem = TheSystem
55     and TheSystem.clock = TheClock
56     and TheSystem@post.vpLastReminder = TheClock}

```

Listing 5.2: **Messip** (MCL-oriented) specification of the operation *oeSollicitateCrisisHandling*.

Figure 5.1 shows concept model elements in the scope of the *oeSollicitateCrisisHandling* operation

## 5.2 Environment - Out Interface Operation Scheme for actAdministrator

### 5.2.1 Operation Model for oeAddCoordinator

The *oeAddCoordinator* operation has the following properties:

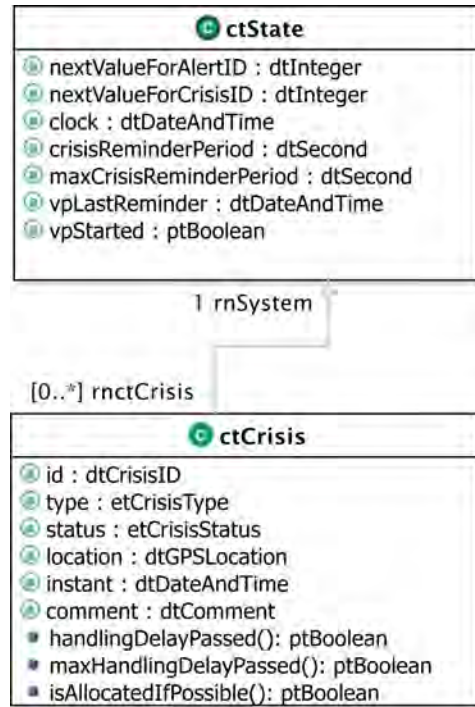


Figure 5.1: oeSollicitateCrisisHandling operation scope

OPERATION	
<b>oeAddCoordinator</b>	
sent to add a new coordinator in the system's post state and environment's post state.	
<b>Parameters</b>	
1	<b>AdtCoordinatorID: dtCoordinatorID</b> used to initialize the id field
2	<b>AdtLogin: dtLogin</b> used to initialize the login field
3	<b>AdtPassword: dtPassword</b> used to initialize the password field
<b>Return type</b>	
ptBoolean	
<b>Pre-Condition (protocol)</b>	
PreP 1	the system is started
PreP 2	the actor logged previously and did not log out ! (i.e. the associated ctAdministrator instance is considered logged)
<b>Pre-Condition (functional)</b>	
PreF 1	it is supposed that there cannot exist a ctCoordinator instance with the same id attribute as the one the administrator wants to delete.
<b>Post-Condition (functional)</b>	
PostF 1	the environment has a new instance of coordinator actor allowing for input/output message communication with the system.
PostF 2	the system's state has a new instance of ctCoordinator initialized with the given values.
PostF 3	the new actor instance and ctCoordinator instance are related.

*continues in next page ...*

**... Operation table continuation**

PostF 4	the new actor instance and ctCoordinator instance are related according to the authenticated association.
PostF 5	the administrator actor is informed about the satisfaction of its request.
<b>Post-Condition (protocol)</b>	
PostP 1	none

The listing 5.3 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Pre Protocol:*/
3 preP{let TheSystem: ctState in
4   let TheActor:actAdministrator in
5
6   self.rnActor.rnSystem = TheSystem
7   and self.rnActor = TheActor
8
9 /* PreP01 */
10  and TheSystem.vpStarted = true
11 /* PreP02 */
12  and TheActor.rnctAuthenticated.vpIsLogged = true}
13
14 /* Pre Functional:*/
15 preF{let TheSystem: ctState in
16   let TheActor:actAdministrator in
17   let ColctCoordinators:Bag(ctCoordinator) in
18
19   self.rnActor.rnSystem = TheSystem
20   and self.rnActor = TheActor
21 /* PreF01 */
22   and TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
23     = ColctCoordinators
24   and ColctCoordinators->isEmpty() = true}
25
26 /* Post Functional:*/
27 postF{let TheSystem: ctState in
28   let TheactCoordinator:actCoordinator in
29   let ThectCoordinator:ctCoordinator in
30   self.rnActor.rnSystem = TheSystem
31   and self.rnActor = TheActor
32 /* PostF01 */
33   TheactCoordinator.init()
34 /* PostF02 */
35   and ThectCoordinator.init(AdtCoordinatorID,AdtLogin,AdtPassword)
36
37 /* PostF03 */
38   and TheactCoordinator@post.rnctCoordinator = ThectCoordinator
39
40 /* PostF04 */
41   and ThectCoordinator@post.rnactAuthenticated = TheactCoordinator
42
43 /* PostF05 */
44   and TheActor.rnInterfaceIN^ieCoordinatorAdded()
45
46 /* Post Protocol:*/
47 postP{ true}

```

Listing 5.3: **Messip** (MCL-oriented) specification of the operation *oeAddCoordinator*.

### 5.2.2 Operation Model for oeDeleteCoordinator

The *oeDeleteCoordinator* operation has the following properties:



OPERATION	
<b><i>oeDeleteCoordinator</i></b>	
sent to delete an existing coordinator in the system's post state and environment's post state.	
<b><i>Parameters</i></b>	
1	<b>AdtCoordinatorID: dtCoordinatorID</b> used for ctCoordinator instance retrieval
<b><i>Return type</i></b>	
ptBoolean	
<b><i>Pre-Condition (protocol)</i></b>	
PreP 1	the system is started
PreP 2	the actor logged previously and did not log out ! (i.e. the associated ctAdministrator instance is considered logged)
<b><i>Pre-Condition (functional)</i></b>	
PreF 1	it is supposed that there exist one ctCoordinator instance with the same id attribute than the one the administrator wants to create.
<b><i>Post-Condition (functional)</i></b>	
PostF 1	the ctCoordinator class instance having the required id do not belong anymore to the post state as well as is related actCoordinator actor instance.
PostF 2	the administrator actor is informed about the satisfaction of its request.
<b><i>Post-Condition (protocol)</i></b>	
PostP 1	none

The listing 5.4 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Pre Protocol:*/
3 preP{let TheSystem: ctState in
4   let TheActor:actAdministrator in
5
6   self.rnActor.rnSystem = TheSystem
7   and self.rnActor = TheActor
8
9 /* PreP01 */
10  and TheSystem.vpStarted = true
11 /* PreP02 */
12  and TheActor.rnctAuthenticated.vpIsLogged = true}
13
14 /* Pre Functional:*/
15 preF{let TheSystem: ctState in
16   let TheActor:actAdministrator in
17
18   self.rnActor.rnSystem = TheSystem
19   and self.rnActor = TheActor
20 /* PreF01 */
21   TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
22   = ColctCoordinators
23   and ColctCoordinators->size().eq(1)}
24
25 /* Post Functional:*/
26 postF{let TheSystem: ctState in
27   let TheActor:actAdministrator in
28   let ThectCoordinator:ctCoordinator in
29   self.rnActor.rnSystem = TheSystem
30   and self.rnActor = TheActor
31 /* PostF01 */

```

```

32 TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
33 = ThectCoordinator
34 and ThectCoordinator.rnactCoordinator->forall(msrIsKilled)
35 and ThectCoordinator.msrIsKilled
36
37 /* PostF02 */
38 and TheActor.rnInterfaceIN^ieCoordinatorDeleted()
39
40 /* Post Protocol:*/
41 /* PostP01 */
42 and true}
43
44 /* Post Protocol:*/
45 postP{ true}

```

Listing 5.4: **Messip** (MCL-oriented) specification of the operation *oeDeleteCoordinator*.

## 5.3 Environment - Out Interface Operation Scheme for actAuthenticated

### 5.3.1 Operation Model for oeLogin

The *oeLogin* operation has the following properties:

OPERATION	
<i>oeLogin</i>	
sent to request authorization to request access secured system operations.	
Parameters	
1	<b>AdtLogin: dtLogin</b> first information used to determine accessibility rights for the actual actor.
2	<b>AdtPassword: dtPassword</b> second information used to determine accessibility rights for the actual actor.
Return type	
ptBoolean	
Pre-Condition (protocol)	
PreP 1	the system is started
PreP 2	the actor is not already logged in ! (i.e. the associated ctAuthenticated instance is not considered logged)
Pre-Condition (functional)	
PreF 1	none
Post-Condition (functional)	
PostF 1	if the login and password provided by the actor correspond to the ones that belong to the ctAuthenticated instance he is related to then a welcome message is sent to the actor (n.b. the logged status is changed as a post-protocol condition); else the actor is notified that he gave incorrect data and all the administrator actors existing in the environnement are notified of an intrusion tentative.
Post-Condition (protocol)	
PostP 1	if the authentication information is correct then the actor is known to be logged in ! (i.e. the associated ctAuthenticated instance with given login and password is considered logged)

The listing 5.5 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Pre Protocol:*/
3 preP{let TheSystem: ctState in
4   let TheActor:actAuthenticated in
5   self.rnActor.rnSystem = TheSystem
6   and self.rnActor = TheActor
7
8 /* PreP01 */
9   and TheSystem.vpStarted = true
10 /* PreP02 */
11   and TheActor.rnctAuthenticated.vpIsLogged = false}
12
13 /* Pre Functional:*/
14 preF{/* PreF01 */
15 true}
16
17 /* Post Functional:*/
18 postF{let TheSystem: ctState in
19   let TheactAuthenticated:actAuthenticated in
20
21   let AptStringMessageForTheactAuthenticated: ptString in
22   let AptStringMessageForTheactAdministrator:ptString in
23
24   self.rnActor.rnSystem = TheSystem
25   and self.rnActor = TheactAuthenticated
26
27   and /* PostF01 */
28     if (TheactAuthenticated.rnctAuthenticated.pwd
29       = AdtPassword
30       and TheactAuthenticated.rnctAuthenticated.login
31       = AdtLogin
32     )
33     then (AptStringMessageForTheactAuthenticated.eq('You are logged ! Welcome ...'))
34     and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
35     )
36     else (AptStringMessageForTheactAuthenticated
37       .eq('Wrong identification information ! Please try again ...')
38       and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
39       and AptStringMessageForTheactAdministrator.eq('Intrusion tentative !')
40       and TheSystem.rnactAdministrator
41       .rnInterfaceIN^ieMessage(AptStringMessageForTheactAdministrator)
42     )
43   endif}
44
45 /* Post Protocol:*/
46 postP{ let TheSystem: ctState in
47   let TheactAuthenticated:actAuthenticated in
48
49   self.rnActor.rnSystem = TheSystem
50   and self.rnActor = TheactAuthenticated
51 /* PostP01 */
52   if (TheactAuthenticated.rnctAuthenticated.pwd = AdtPassword
53     and TheactAuthenticated.rnctAuthenticated.login = AdtLogin
54   )
55   then (TheactAuthenticated.rnctAuthenticated@post.vpIsLogged = true)
56   else true
57   endif}

```

Listing 5.5: **Messip** (MCL-oriented) specification of the operation *oeLogin*.

### 5.3.2 Operation Model for oeLogout

The *oeLogout* operation has the following properties:

OPERATION	
<i>oeLogout</i>	
sent to end the secured access to specific system operations.	
<i>Return type</i>	
ptBoolean	
<i>Pre-Condition (protocol)</i>	
PreP 1	the system is started
PreP 2	the actor is currently logged in ! (i.e. the associated ctAuthenticated instance is considered logged)
<i>Pre-Condition (functional)</i>	
PreF 1	
<i>Post-Condition (functional)</i>	
PostF 1	a logout confirmation message is sent to the actor (n.b. the logged status is changed as a post-protocol condition)
<i>Post-Condition (protocol)</i>	
PostP 1	the actor is known to be logged out ! (i.e. the associated ctAuthenticated instance with given login and password is considered logged out)

The listing 5.6 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Pre Protocol:*/
3 preP(let TheSystem: ctState in
4   let TheActor:actAdministrator in
5   self.rnActor.rnSystem = TheSystem
6   and self.rnActor = TheActor
7
8 /* PreP01 */
9   and TheSystem.vpStarted = true
10 /* PreP02 */
11   and TheActor.rnctAuthenticated.vpIsLogged = true}
12
13 /* Pre Functional:*/
14 preF{/* PreF01 */
15   true}
16
17 /* Post Functional:*/
18 postF(let TheSystem: ctState in
19   let TheactAuthenticated:actAuthenticated in
20   let AptStringMessageForTheactAuthenticated: ptString in
21
22   self.rnActor.rnSystem = TheSystem
23   and self.rnActor = TheactAuthenticated
24
25 /* PostF01 */
26   AptStringMessageForTheactAuthenticated.eq('You are logged out ! Good Bye ...')
27   and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated) }
28
29 /* Post Protocol:*/
30 postP{ let TheSystem: ctState in
31   let TheactAuthenticated:actAuthenticated in
32
33   self.rnActor.rnSystem = TheSystem
34   and self.rnActor = TheactAuthenticated.asSet
35 /* PostP01 */

```

36 TheactAuthenticated.rnctAuthenticated@post.vpIsLogged = **false**}

Listing 5.6: **Messip** (MCL-oriented) specification of the operation *oeLogout*.

## 5.4 Environment - Out Interface Operation Scheme for actComCompany

### 5.4.1 Operation Model for oeAlert

The *oeAlert* operation has the following properties:

OPERATION	
<b><i>oeAlert</i></b>	
Any human having a phone able to connect to the communication companies using the <i>iCrash</i> system can send his company an sms message with structured information in order to declare an alert.	
<b><i>Parameters</i></b>	
1	<b>AetHumanKind: etHumanKind</b> the kind of human informing of an alert.
2	<b>AdtDate: dtDate</b> the date of the alert
3	<b>AdtTime: dtTime</b> the time of the alert
4	<b>AdtPhoneNumber: dtPhoneNumber</b> the phone number of the human sending the alert SMS message
5	<b>AdtGPSLocation: dtGPSLocation</b> the GPS position of the phone at the date and time the message was sent.
6	<b>AdtComment: dtComment</b> a free text message sent by the human providing information on the alert that he wants to declare
<b><i>Return type</i></b>	
ptBoolean	
<b><i>Pre-Condition (protocol)</i></b>	
PreP 1	the system is supposed to be created and initialized.
<b><i>Pre-Condition (functional)</i></b>	
PreF 1	the date and time the alert is declared is supposed to be in the past with respect to the current time known by the system.
<b><i>Post-Condition (functional)</i></b>	
PostF 1	the ctState attribute for the next value for alert IDs is incremented by one at post.
PostF 2	a new alert instance exists in the post state with status pending, instant information (resp. GPS location and comment) based on date and time provided (resp. position and comment); and with alert ID being a string conversion of the dtInteger value available in the pre state in the ctState instance.
PostF 3	if there exist no already registered alert near to the alert currently declared then a new crisis is added in the post state and initialized with: its ID being the one provided by the ctState instance (which is incremented by one in the post state), its type considered as small, its status being pending, its declared time being the same than the alert and a default comment indicating that a report will come later on. else the crisis to which the new alert must be related to is the one related to any alert nearby in the pre-state.

*continues in next page ...*

**... Operation table continuation**

PostF 4	the post state relates the new alert to the previously characterized crisis.
PostF 5	if there is no ctHuman instance having same phone number and same kind in the pre-state then a new one is added in the post-state with given phone number and kind and is associated to the communication company actor used to declare the alert. else the pre-state one is chosen
PostF 6	and this specified ctHuman is related to the new alert thus indicating he has signled the alert.
<b>Post-Condition (protocol)</b>	
PostP 1	none

The listing 5.7 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Pre Protocol:*/
3 preP{let TheSystem: ctState in
4   self.rnActor.rnSystem = TheSystem
5
6 /* PreP01 */
7   and TheSystem.vpStarted = true}
8
9 /* Pre Functional:*/
10 preF{let TheSystem: ctState in
11   self.rnActor.rnSystem = TheSystem
12
13 /* PreF01 */
14   and (TheSystem.clock.date.gt(AdtDate)
15     or (TheSystem.clock.date.eq(AdtDate)
16       and TheSystem.clock.time.gt(AdtTime)
17     )
18   )}
19
20 /* Post Functional:*/
21 postF{let TheSystem: ctState in
22
23   let ActHuman:ctHuman in
24   let TheactComCompany:actComCompany in
25   let ActAlert:ctAlert in
26   let AAlertInstant:dtDateAndTime in
27   let AetAlertStatus:etAlertStatus in
28   let ActAlertNearBy:ctAlert in
29   let ActCrisis:ctCrisis in
30   let AdtCrisisID:dtCrisisID in
31   let AetCrisisType:etCrisisType in
32   let AetCrisisStatus:etCrisisStatus in
33   let ACrisisInstant:dtDateAndTime in
34   let ACrisisdComment:dtComment in
35   let AptStringMessage:ptString in
36   let AdtSMS:dtSMS in
37   let AdtAlertID:dtAlertID in
38
39   self.rnActor.rnSystem = TheSystem
40   and self.rnActor = TheactComCompany
41 /* PostF01 */
42   TheSystem.nextValueForAlertID=PrenextValueForAlertID
43   and PrenextValueForAlertID.add(1) = PostnextValueForAlertID
44   and TheSystem@post.nextValueForAlertID = PostnextValueForAlertID
45
46 /* PostF02 */
47   and AAlertInstant.date=AdtDate
48   and AAlertInstant.time=AdtTime

```

```

49
50 and AetAlertStatus=pending
51
52 and TheSystem.nextValueForAlertID.todtString().eq(AdtAlertID)
53
54 and ActAlert.init(AdtAlertID,
55     AetAlertStatus,
56     AdtGPSLocation,
57     AAlertInstant,
58     AdtComment)
59
60 /* PostF03 */
61 and TheSystem.rnctAlert.select(location.isNearTo(AdtGPSLocation)) = ColctAlertsNearBy
62 and if (ColctAlertsNearBy->size()=0)
63     then (TheSystem.nextValueForCrisisID = PrenextValueForCrisisID
64         and PrenextValueForCrisisID.add(1) = PostnextValueForCrisisID
65         and TheSystem@post.nextValueForCrisisID = PostnextValueForCrisisID
66         and TheSystem.nextValueForCrisisID.todtString().eq(AdtCrisisID)
67         and AdtCrisisType = small
68         and AetCrisisStatus = pending
69         and ACrisisInstant= AAlertInstant
70         and ACrisisdtComment = 'no reporting yet defined'
71         and ActCrisis.init( AdtCrisisID,
72             AdtCrisisType,
73             AetCrisisStatus,
74             AdtGPSLocation,
75             ACrisisInstant,
76             ACrisisdtComment)
77     )
78 else (ColctAlertsNearBy.rnTheCrisis->msrAny(true) = ActCrisis)
79 endif
80
81 /* PostF04 */
82 and ActAlert@post.rnTheCrisis = ActCrisis
83
84 /* PostF05 */
85 and TheSystem.rnctHuman->select(id.eq(AdtPhoneNumber)) = HumanCol1
86
87 and HumanCol1->select(kind.etEq(AetHumanKind)) = HumanCol2
88 and if (HumanCol2->msrIsEmpty)
89     then (ActHuman.init(AdtPhoneNumber,AetHumanKind)
90         and ActHuman@post.rnactComCompany = TheactComCompany
91     )
92 else (HumanCol2->any(true) = ActHuman)
93 endif
94
95 and ActHuman.rnSignaled->msrIncluding(ActAlert) = ColAlerts
96
97 and ActHuman@post.rnSignaled = ColAlerts
98
99 /* PostF06 */
100 AdtSMS.value = 'Your alert has been registered. We will handle it and keep you informed'
101 and TheactComCompany.rnInterfaceIN^ieSmsSend(AdtPhoneNumber,AdtSMS)
102
103 /* Post Protocol:*/
104 postP{ true}

```

Listing 5.7: **Messip** (MCL-oriented) specification of the operation *oeAlert*.

Figure 5.2 shows concept model elements in the scope of the *oeAlert* operation

Figure 5.3 shows concept model elements in the scope of the *oeAlert* operation



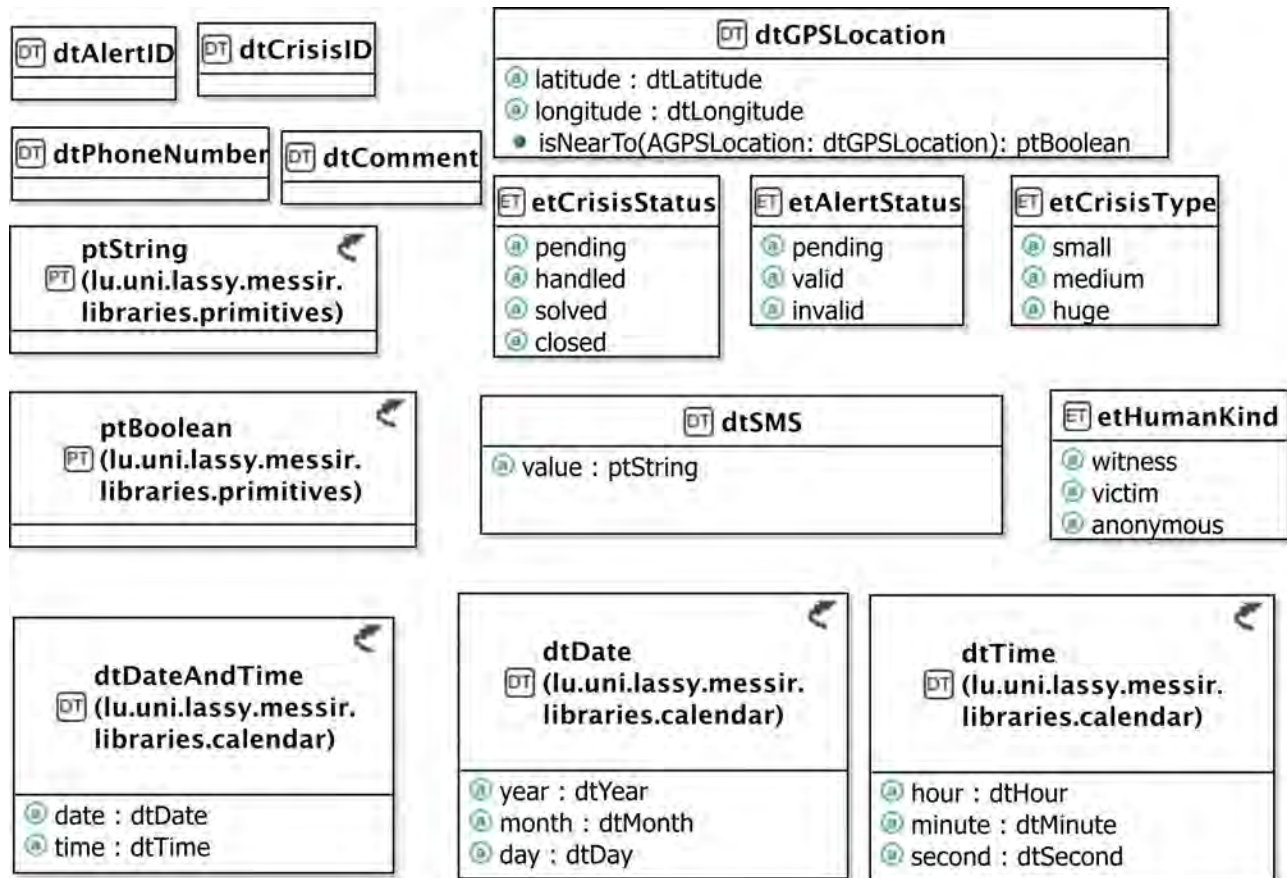


Figure 5.2: oeAlert operation scope

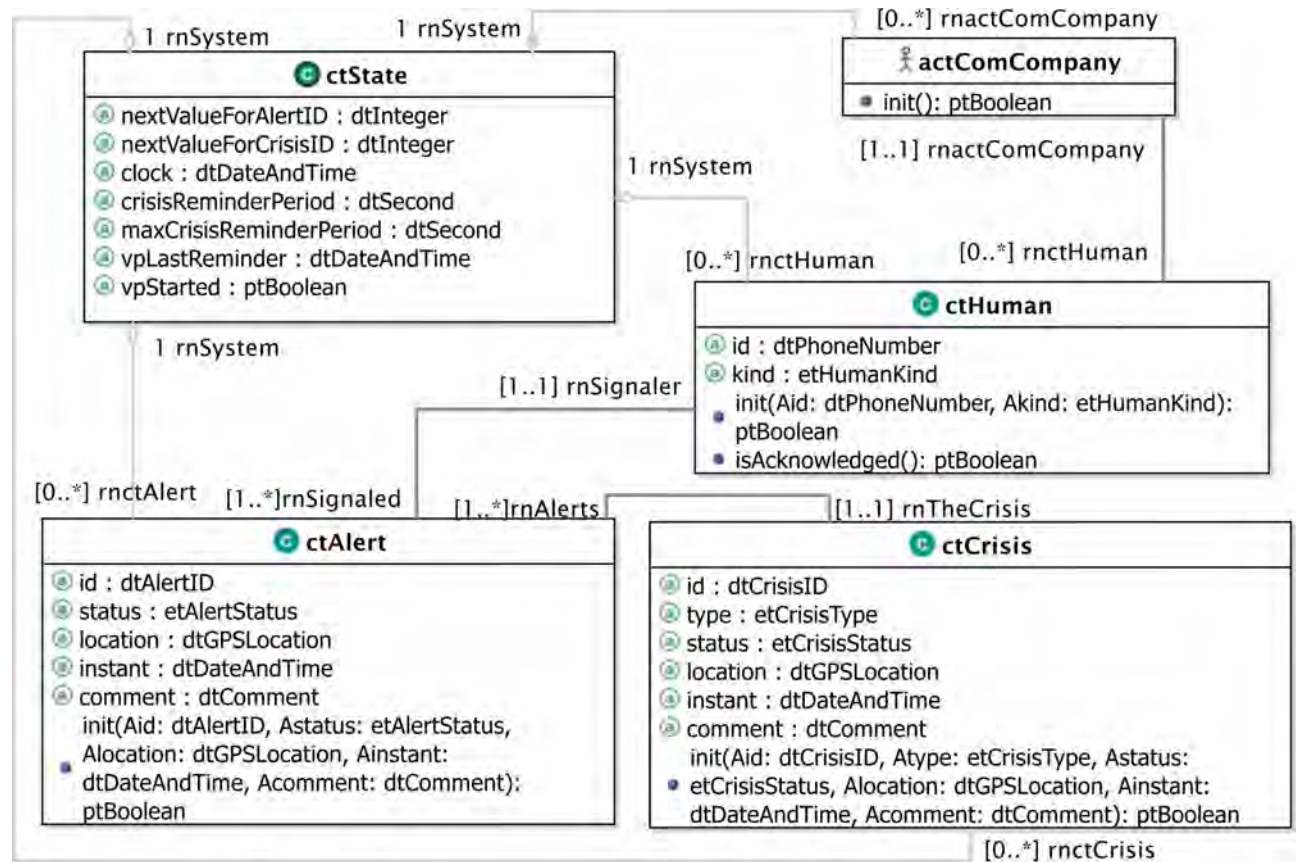


Figure 5.3: oeAlert operation scope

## 5.5 Environment - Out Interface Operation Scheme for actCoordinator

### 5.5.1 Operation Model for oeCloseCrisis

The oeCloseCrisis operation has the following properties:

OPERATION	
<b><i>oeCloseCrisis</i></b>	
sent to indicate that a crisis should be considered as closed.	
<b><i>Parameters</i></b>	
1	<b>AdtCrisisID: dtCrisisID</b> the identification information used to determine the crisis to close
<b><i>Return type</i></b>	
ptBoolean	
<b><i>Pre-Condition (protocol)</i></b>	
PreP 1	the system is started
PreP 2	the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged)
<b><i>Pre-Condition (functional)</i></b>	
PreF 1	it is supposed that there exist one ctCrisis instance with the same id attribute value as the one provided by the coordinator actor who wants to close.
<b><i>Post-Condition (functional)</i></b>	
PostF 1	the ctCrisis class instance having the provided id is considered closed in the post state.
PostF 2	There is no handler declared in the system as associated to the crisis.
PostF 3	all the alert instances associated to this crisis do not belong any more to the system's post state.
PostF 4	the coordinator actor is informed about the satisfaction of its request.
<b><i>Post-Condition (protocol)</i></b>	
PostP 1	none

### 5.5.2 Operation Model for oeGetAlertsSet

The oeGetAlertsSet operation has the following properties:

OPERATION	
<b><i>oeGetAlertsSet</i></b>	
sent to request all the ctAlert instances having a specific status.	
<b><i>Parameters</i></b>	
1	<b>AetAlertStatus: etAlertStatus</b> the criteria used to select the alerts to send back to the actor
<b><i>Return type</i></b>	
ptBoolean	
<b><i>Pre-Condition (protocol)</i></b>	
PreP 1	the system is started
PreP 2	the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged)
<b><i>Pre-Condition (functional)</i></b>	

*continues in next page ...*

**... Operation table continuation**

PreF 1	none
<b>Post-Condition (functional)</b>	
PostF 1	the post state is the one obtained by satisfying the <code>isSentToCoordinator</code> predicate for each alert having the provided status and for the actor sending the message. (cf. specification of <code>isSentToCoordinator</code> predicate given for the <code>ctAlert</code> type.
<b>Post-Condition (protocol)</b>	
PostP 1	none

**5.5.3 Operation Model for `oeGetCrisisSet`**

The `oeGetCrisisSet` operation has the following properties:

OPERATION	
<b><i>oeGetCrisisSet</i></b> sent to request all the <code>ctCrisis</code> instances having a specific status.	
<b>Parameters</b>	
1	<b>AetCrisisStatus: etCrisisStatus</b> the status information used to determine the crisis to send back to the actor
<b>Return type</b>	
ptBoolean	
<b>Pre-Condition (protocol)</b>	
PreP 1	the system is started
PreP 2	the actor logged previously and did not log out ! (i.e. the associated <code>ctCoordinator</code> instance is considered logged)
<b>Pre-Condition (functional)</b>	
PreF 1	none
<b>Post-Condition (functional)</b>	
PostF 1	the post state is the one obtained by satisfying the <code>isSentToCoordinator</code> predicate for each crisis having the provided status and for the actor sending the message <code>ieSendACrisis</code> . (cf. specification of <code>isSentToCoordinator</code> predicate given for the <code>ctCrisis</code> type.
<b>Post-Condition (protocol)</b>	
PostP 1	none

**5.5.4 Operation Model for `oeInvalidateAlert`**

The `oeInvalidateAlert` operation has the following properties:

OPERATION	
<b><i>oeInvalidateAlert</i></b> sent to indicate that an alert should be considered as closed.	
<b>Parameters</b>	
1	<b>AdtAlertID: dtAlertID</b> the identification information used to determine the alert to close
<b>Return type</b>	
ptBoolean	

*continues in next page ...*

**... Operation table continuation**

<b>Pre-Condition (protocol)</b>	
PreP 1	the system is started
PreP 2	the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged)
<b>Pre-Condition (functional)</b>	
PreF 1	it is supposed that there exist one ctAlert instance with the same id attribute value as the one provided by the coordinator actor who wants to close.
<b>Post-Condition (functional)</b>	
PostF 1	the ctAlert class instance having the provided id is considered closed in the post state.
PostF 2	the coordinator actor is informed about the satisfaction of its request.
<b>Post-Condition (protocol)</b>	
PostP 1	none

**5.5.5 Operation Model for oeReportOnCrisis**

The oeReportOnCrisis operation has the following properties:

<b>OPERATION</b>	
<b>oeReportOnCrisis</b>	
sent to update the textual information available for a specific handled crisis.	
<b>Parameters</b>	
1	<b>AdtCrisisID: dtCrisisID</b> the identification information used to determine the crisis to report on
2	<b>AdtComment: dtComment</b> the textual information commenting the crisis
<b>Return type</b>	
ptBoolean	
<b>Pre-Condition (protocol)</b>	
PreP 1	the system is started
PreP 2	the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged)
<b>Pre-Condition (functional)</b>	
PreF 1	it is supposed that there exist one crisis in the pre state having the given id.
<b>Post-Condition (functional)</b>	
PostF 1	the comment attribute of the crisis instance having the given id is replaced by the given one and the requesting actor is notified of this update.
<b>Post-Condition (protocol)</b>	
PostP 1	none

**5.5.6 Operation Model for oeSetCrisisHandler**

The oeSetCrisisHandler operation has the following properties:

<b>OPERATION</b>	
<b>oeSetCrisisHandler</b>	
sent to declare himself as been the handler of a crisis having the specified id.	

*continues in next page ...*

**... Operation table continuation**

<b>Parameters</b>	
1	<b>AdtCrisisID: dtCrisisID</b> the identification information used to determine the crisis
<b>Return type</b>	
ptBoolean	
<b>Pre-Condition (protocol)</b>	
PreP 1	the system is started
PreP 2	the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged)
<b>Pre-Condition (functional)</b>	
PreF 1	there exist one crisis having the given id in the pre-state.
<b>Post-Condition (functional)</b>	
PostF 1	the ctCrisis instance having the provided id is in handled status at poststate and is associated to the actor that sends the message (which himself is notified with a textual message as confirmation).
PostF 2	All the alerts related to this crisis are sent to the actor such that he can decide how to handle them.
PostF 3	if the crisis was already handled at pre-sate then the associated handler actor is notified about the change of handler for one of his crisis (n.b. it might be the same even if not relevant).
PostF 4	a message is sent to the communication company for any human related to an alert associated to the crisis. A human will receive as many messages as alerts he sent despite the fact that they might relate to the same crisis (i.e. one alert, one acknowledgement).
<b>Post-Condition (protocol)</b>	
PostP 1	none

**5.5.7 Operation Model for oeSetCrisisStatus**

The oeSetCrisisStatus operation has the following properties:

<b>OPERATION</b>	
<b>oeSetCrisisStatus</b> sent to define the handling status of a specific crisis.	
<b>Parameters</b>	
1	<b>AdtCrisisID: dtCrisisID</b> the identification information used to determine the crisis
2	<b>AetCrisisStatus: etCrisisStatus</b> the new status value
<b>Return type</b>	
ptBoolean	
<b>Pre-Condition (protocol)</b>	
PreP 1	the system is started
PreP 2	the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged)
<b>Pre-Condition (functional)</b>	
PreF 1	it is supposed that there exist one crisis in the pre state having the given id.

*continues in next page ...*

**... Operation table continuation**

<b>Post-Condition (functional)</b>	
PostF 1	the crisis status attribute of the crisis instance having the given id is replaced by the given one and the requesting actor is notified of this update.
<b>Post-Condition (protocol)</b>	
PostP 1	none

**5.5.8 Operation Model for oeSetCrisisType**

The oeSetCrisisType operation has the following properties:

<b>OPERATION</b>	
<b>oeSetCrisisType</b> sent to define the gravity type of a specific crisis.	
<b>Parameters</b>	
1	<b>AdtCrisisID: dtCrisisID</b> the identification information used to determine the crisis
2	<b>AetCrisisType: etCrisisType</b> the new type value
<b>Return type</b>	
ptBoolean	
<b>Pre-Condition (protocol)</b>	
PreP 1	the system is started
PreP 2	the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged)
<b>Pre-Condition (functional)</b>	
PreF 1	it is supposed that there exist one crisis in the pre state having the given id.
<b>Post-Condition (functional)</b>	
PostF 1	the crisis type attribute of the crisis instance having the given id is replaced by the given one and the requesting actor is notified of this update.
<b>Post-Condition (protocol)</b>	
PostP 1	none

**5.5.9 Operation Model for oeValidateAlert**

The oeValidateAlert operation has the following properties:

<b>OPERATION</b>	
<b>oeValidateAlert</b> sent to indicate that a specific alert is not a fake.	
<b>Parameters</b>	
1	<b>AdtAlertID: dtAlertID</b> the identification information used to determine the alert instance
<b>Return type</b>	
ptBoolean	
<b>Pre-Condition (protocol)</b>	
PreP 1	the system is started

*continues in next page ...*



**... Operation table continuation**

PreP 2	the actor logged previously and did not log out ! (i.e. the associated ctCoordinator instance is considered logged)
<b>Pre-Condition (functional)</b>	
PreF 1	it is supposed that there exist one ctAlert instance with the same id attribute value as the one provided by the coordinator actor who wants to validate.
<b>Post-Condition (functional)</b>	
PostF 1	the ctAlert class instance having the provided id is considered as valid in the post state and the coordinator actor is informed about the satisfaction of its request.
<b>Post-Condition (protocol)</b>	
PostP 1	none

## 5.6 Environment - Out Interface Operation Scheme for actMsrCreator

### 5.6.1 Operation Model for oeCreateSystemAndEnvironment

The oeCreateSystemAndEnvironment operation has the following properties:

OPERATION	
<b>oeCreateSystemAndEnvironment</b>	
sent to request the initialization of the system's class instances and the environment actors instances.	
<b>Parameters</b>	
1	<b>AqtyComCompanies: ptInteger</b> the quantity of communication companies to create in the environment
<b>Return type</b>	
ptBoolean	
<b>Pre-Condition (protocol)</b>	
PreP 1	none
<b>Pre-Condition (functional)</b>	
PreF 1	none
<b>Post-Condition (functional)</b>	
PostF 1	the ctState instance is initialized with the integer 1 for the crisis and alert counters used for their identifications, a value for the clock corresponding to a default initial time (i.e. January 1st, 1970) the crisis reminder period is set to 300 seconds, the maximum crisis reminder period is fixed to 1200 seconds (i.e. 20 minutes), an initial value for the automatic reminder period equal to the current date and time and the system is considered in a started state. <b>Those predicates must be satisfied first since all the other depend on the existence of a ctState instance !</b>
PostF 2	the actMsrCreator actor instance is initiated (remember that since the oeCreateSystemAndEnvironment is a special event its role is to make consistent the post state thus creating the actor and its interfaces is required even though the sending of this message logically would need the actor and its interfaces to already exist ...).
PostF 3	the environment for communication company actors, in the post state, is made of AqtyComCompanies instances allowing for receiving and sending messages to humans.
PostF 4	the environment for administrator actors, in the post state, is made of one instance.
PostF 5	the environment for activator actors, in the post state, is made of one instance allowing for automatic message sending based on current system's and environment state'.

**continues in next page ...**

**... Operation table continuation**

PostF 6	the set of ctAdministrator instances at post is made of one instance initialized with 'icrashadmin' (resp. '7WXC1359') for login (resp. password) values.
PostF 7	the association between ctAdministrator and actAdministrator is made of one couple made of the conjointly specified instances.
<b>Post-Condition (protocol)</b>	
PostP 1	none is given since the only protocol variable to be modified in the post state is the one initialized with the ctState instance (i.e. vpStarted).

The listing 5.8 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Pre Protocol:*/
3 preP{true}
4
5 /* Pre Functional:*/
6 preF{true}
7
8 /* Post Functional:*/
9 postF{let TheSystem: ctState in
10 let AactMsrCreator: actMsrCreator in
11 let AactAdministrator: actAdministrator in
12 let AnextValueForAlertID: dtInteger in
13 let AnextValueForCrisisID: dtInteger in
14 let Aclock: dtDateAndTime in
15 let AcrisisReminderPeriod: dtSecond in
16 let AmaxCrisisReminderPeriod: dtSecond in
17 let AvpStarted: ptBoolean in
18
19 /* PostF01 -- MUST ALWAYS BE MADE FIRST -- */
20 AnextValueForAlertID.value.eq(1)
21 and AnextValueForCrisisID.value.eq(1)
22 and Aclock.date.year.value = 1970
23 and Aclock.date.month.value = 01
24 and Aclock.date.day.value = 01
25 and Aclock.time.hour.value = 00
26 and Aclock.time.minute.value = 00
27 and Aclock.time.second.value = 00
28
29 and AcrisisReminderPeriod.value.eq(300)
30 and AmaxCrisisReminderPeriod.value.eq(1200)
31 and AvpStarted = true
32 and TheSystem.init(AnextValueForAlertID,
33 AnextValueForCrisisID,
34 Aclock,
35 AcrisisReminderPeriod,
36 AmaxCrisisReminderPeriod,
37 Aclock,
38 AvpStarted
39 )
40 /* PostF02*/
41 and AactMsrCreator.init()
42 /* PostF03 */
43 and let AactComCompanyCol: Bag(actComCompany) in
44 AactComCompanyCol->size() = AqtyComCompanies
45 AactComCompanyCol->forall(init())
46 /* PostF04*/
47 and AactAdministrator.init()
48 /* PostF05*/
49 and let AactActivator:actActivator in
50 AactActivator.init()
51 /* PostF06 */

```

```

52 and let ActAdministrator:ctAdministrator in
53   let AdtLogin:dtLogin in
54   let AdtPassword:dtPassword in
55   AdtLogin.value.eq('icrashadmin')
56   and AdtPassword.value.eq('7WXC1359')
57   and ActAdministrator.init(AdtLogin,AdtPassword)
58 /* PostF07*/
59 and ActAdministrator@post.rnactAuthenticated = AactAdministrator}
60
61 /* Post Protocol:*/
62 postP{ true}

```

Listing 5.8: **Messip** (MCL-oriented) specification of the operation *oeCreateSystemAndEnvironment*.

Figure 5.4 shows all the concept model elements in the scope of the *oeCreateSystemAndEnvironment* operation

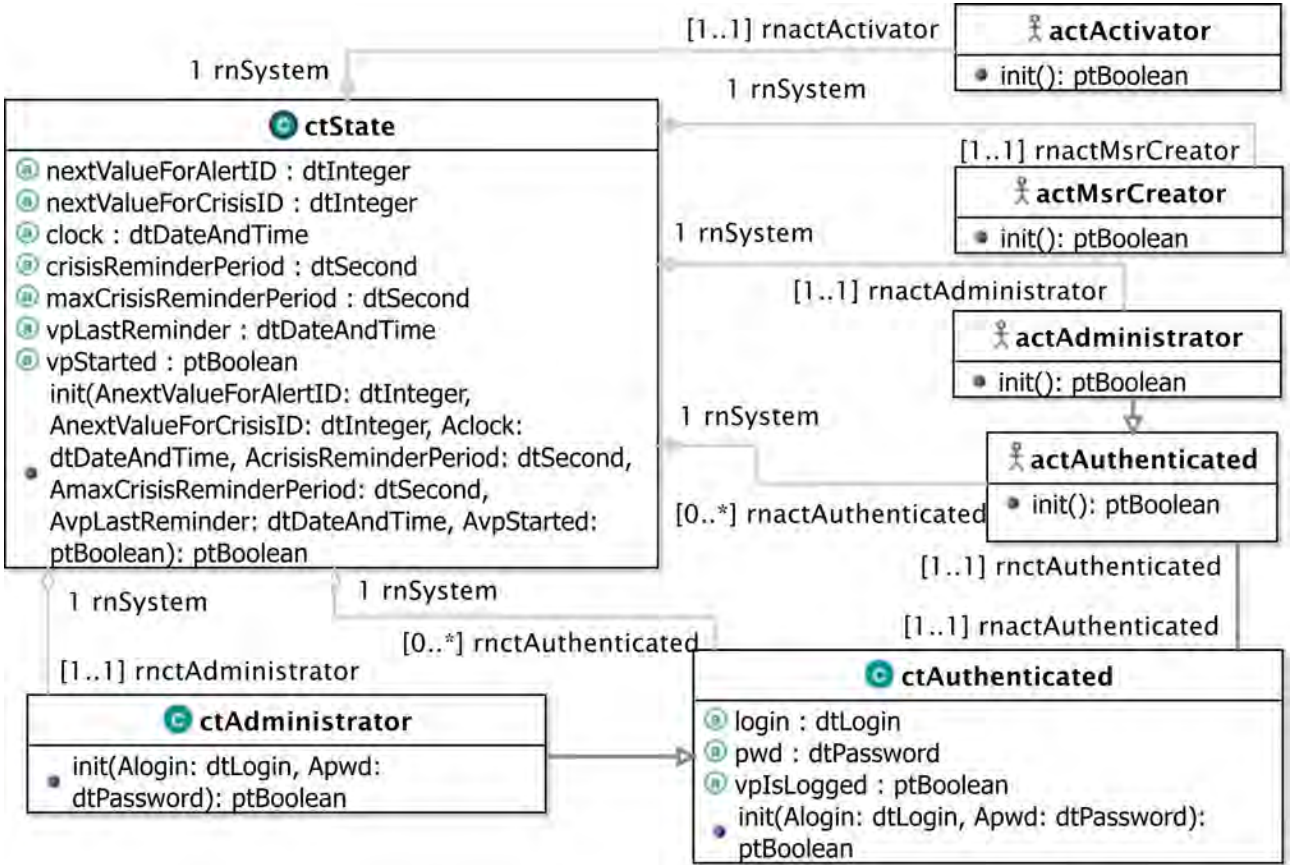


Figure 5.4: *oeCreateSystemAndEnvironment* operation scope

## 5.7 Environment - Actor Operation Scheme for actMsrCreator

### 5.7.1 Operation Model for init

The *init* operation has the following properties:

OPERATION
<i>init</i> used to create an instance of the actor together with its interface instances and update the associations with the <code>ctState</code> instance.
<i>Return type</i>
ptBoolean

## 5.8 Primary Types - Operation Schemes for Class ctAdministrator

### 5.8.1 Operation Model for init

The `init` operation has the following properties:

OPERATION
<i>init</i> used to initialize the current object as a new instance of the ctAdministrator type.
<i>Parameters</i>
1 <b>Alogin: dtLogin</b> used to initialize the login field
2 <b>Apwd: dtPassword</b> used to initialize the password field
<i>Return type</i>
ptBoolean
<i>Post-Condition (functional)</i>
PostF 1    true iff the system poststate includes the current object as a new ctAdministrator instance having its login and password attributes equal to the one provided as parameters and its vpIsLogged attribute equal to false.

The listing 5.9 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2  /* Post Functional:*/
3  postF{if
4  (
5  let Self:ctAdministrator in
6  /* Post F01 */
7  Self.login(Alogin)
8  and Self.pwd = Apwd
9  and Self.vpIsLogged = false
10
11 /* Post F02 */
12 and (Self.oclIsNew and self = Self)
13 )
14 then (result = true)
15 else (result = false)
16 endif}

```

Listing 5.9: **Messip** (MCL-oriented) specification of the operation *init*.

## 5.9 Primary Types - Operation Schemes for Class ctAlert

### 5.9.1 Operation Model for init

The `init` operation has the following properties:

OPERATION	
<i>init</i> used to initialize the current object as a new instance of the ctAlert type.	
<i>Parameters</i>	
1	<b>Aid: dtAlertID</b> used to initialize the id field
2	<b>Astatus: etAlertStatus</b> used to initialize the status field
3	<b>Alocation: dtGPSLocation</b> used to initialize the location field
4	<b>Ainstant: dtDateAndTime</b> used to initialize the instant field
5	<b>Acomment: dtComment</b> used to initialize the comment field
<i>Return type</i>	
ptBoolean	
<i>Post-Condition (functional)</i>	
PostF 1	true iff the system poststate includes the current object as a new ctAlert instance having its attributes equal to the ones provided as parameters.

The listing 5.10 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{if
4 (
5 /* Post F01 */
6 let Self:ctAlert in
7 Self.id = Aid
8 and Self.status = Astatus
9 and Self.location = Alocation
10 and Self.instant = Ainstant
11 and Self.comment = Acomment
12 /* Post F02 */
13 and (Self.oclIsNew and self = Self)
14 )
15 then (result = true)
16 else (result = false)
17 endif}
```

Listing 5.10: **Messip** (MCL-oriented) specification of the operation *init*.

### 5.9.2 Operation Model for isSentToCoordinator

The `isSentToCoordinator` operation has the following properties:

OPERATION	
<b><i>isSentToCoordinator</i></b>	
used to provide a given coordinator with current alert information.	
<b><i>Parameters</i></b>	
1	<b>AactCoordinator: actCoordinator</b> the message destination
<b><i>Return type</i></b>	
ptBoolean	
<b><i>Post-Condition (functional)</i></b>	
PostF 1	true iff the message ieSendAnAlert is sent to the input interface of the given coordinator actor with the current alert as parameter value.

The listing 5.11 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{if
4 (
5 /* Post F01 */
6 AactCoordinator.rnInterfaceIN.ieSendAnAlert(self)
7 )
8 then (result = true)
9 else (result = false)
10 endif}

```

Listing 5.11: **Messip** (MCL-oriented) specification of the operation *isSentToCoordinator*.

## 5.10 Primary Types - Operation Schemes for Class ctAuthenticated

### 5.10.1 Operation Model for init

The `init` operation has the following properties:

OPERATION	
<b><i>init</i></b>	
used to initialize the current object as a new instance of the ctAuthenticated type.	
<b><i>Parameters</i></b>	
1	<b>Alogin: dtLogin</b> used to initialize the login field
2	<b>Apwd: dtPassword</b> used to initialize the password field
<b><i>Return type</i></b>	
ptBoolean	
<b><i>Post-Condition (functional)</i></b>	
PostF 1	true iff the system poststate includes the current object as a new ctAuthenticated instance having its attributes equal to the ones provided as parameters.

## 5.11 Primary Types - Operation Schemes for Class ctCoordinator

### 5.11.1 Operation Model for init

The `init` operation has the following properties:

OPERATION	
<i>init</i> used to initialize the current object as a new instance of the ctCoordinator type.	
<i>Parameters</i>	
1	<b>Aid: dtCoordinatorID</b> used to initialize the id field
2	<b>Alogin: dtLogin</b> used to initialize the login field
3	<b>Apwd: dtPassword</b> used to initialize the password field
<i>Return type</i>	
ptBoolean	
<i>Post-Condition (functional)</i>	
PostF 1	true iff the system poststate includes the current object as a new ctCoordinator instance having its attributes equal to the ones provided as parameters.

The listing 5.12 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{if
4 (
5 /* Post F01 */
6 let Self:ctCoordinator in
7 Self.id = Aid
8 and Self.login = Alogin
9 and Self.pwd = Apwd
10 and Self.vpIsLogged = false
11 /* Post F02 */
12 and (Self.oclIsNew and self = Self)
13 )
14 then (result = true)
15 else (result = false)
16 endif}

```

Listing 5.12: **Messip** (MCL-oriented) specification of the operation *init*.

## 5.12 Primary Types - Operation Schemes for Class ctCrisis

### 5.12.1 Operation Model for init

The `init` operation has the following properties:

OPERATION
<i>continues in next page ...</i>

**... Operation table continuation**

<b>init</b>	
used to initialize the current object as a new instance of the ctCrisis type.	
<b>Parameters</b>	
1	<b>Aid: dtCrisisID</b> used to initialize the id field
2	<b>Atype: etCrisisType</b> used to initialize the type field
3	<b>Astatus: etCrisisStatus</b> used to initialize the status field
4	<b>Alocation: dtGPSLocation</b> used to initialize the location field
5	<b>Ainstant: dtDateAndTime</b> used to initialize the instant field
6	<b>Acomment: dtComment</b> used to initialize the comment field
<b>Return type</b>	
ptBoolean	
<b>Post-Condition (functional)</b>	
PostF 1	true iff the system poststate includes the current object as a new ctCrisis instance having its attributes equal to the ones provided as parameters.

The listing 5.13 provides the **Mess1p** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{if
4 (
5 /* Post F01 */
6 let Self:ctCrisis in
7 Self.id = Aid
8 and Self.type = Atype
9 and Self.status = Astatus
10 and Self.location = Alocation
11 and Self.instant = Ainstant
12 and Self.comment = Acomment
13 /* Post F02 */
14 and (Self.ocliIsNew and self = Self)
15 )
16 then (result = true)
17 else (result = false)
18 endif}

```

Listing 5.13: **Mess1p** (MCL-oriented) specification of the operation *init*.

### 5.12.2 Operation Model for handlingDelayPassed

The `handlingDelayPassed` operation has the following properties:

OPERATION
<b>handlingDelayPassed</b> used to determine if the crisis stood too longly in a pending status since last reminder.

*continues in next page ...*



... **Operation table continuation**

<i>Return type</i>	
ptBoolean	
<i>Post-Condition (functional)</i>	
PostF 1	true iff the crisis is in pending status and if the duration between the current ctState clock information and the last reminder is greater than the crisis reminder period duration.

The listing 5.14 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{let TheSystem:ctState in
4 let CurrentClockSecondsQty:dtInteger in
5 let vpLastReminderSecondsQty:dtInteger in
6 let CrisisReminderPeriod:dtSecond in
7 if
8 ( /* Post F01 */
9 self.rnSystem = TheSystem
10 and self.status = pending
11 and TheSystem.clock.toSecondsQty() = CurrentClockSecondsQty
12 and TheSystem.vpLastReminder.toSecondsQty() = vpLastReminderSecondsQty
13 and TheSystem.crisisReminderPeriod = CrisisReminderPeriod
14 and CurrentClockSecondsQty.sub(vpLastReminderSecondsQty).gt(CrisisReminderPeriod) = true
15 )
16 then (result = true)
17 else (result = false)
18 endif}

```

Listing 5.14: **Messip** (MCL-oriented) specification of the operation *handlingDelayPassed*.

### 5.12.3 Operation Model for maxHandlingDelayPassed

The maxHandlingDelayPassed operation has the following properties:

OPERATION	
<b><i>maxHandlingDelayPassed</i></b>	
used to determine if the crisis stood too longly in a pending status since its creation.	
<i>Return type</i>	
ptBoolean	
<i>Post-Condition (functional)</i>	
PostF 1	true iff the crisis is in pending status and if the duration between the current ctState clock information and the crisis instant is greater than the maximum reminder period duration.

The listing 5.15 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{let TheSystem:ctState in
4 let CurrentClockSecondsQty:dtInteger in
5 let CrisisInstantSecondsQty:dtInteger in
6 let MaxCrisisReminderPeriod:dtSecond in

```

```

7 if
8 ( /* Post F01 */
9   self.rnSystem = TheSystem
10  and self.status = pending
11  and TheSystem.clock.toSecondsQty() = CurrentClockSecondsQty
12  and Self.instant.toSecondsQty() = CrisisInstantSecondsQty
13  and TheSystem.maxCrisisReminderPeriod = MaxCrisisReminderPeriod
14  and CurrentClockSecondsQty.sub(CrisisInstantSecondsQty)
15    .gt(MaxCrisisReminderPeriod)
16 )
17 then (result = true)
18 else (result = false)
19 endif}

```

Listing 5.15: **Messip** (MCL-oriented) specification of the operation *maxHandlingDelayPassed*.

#### 5.12.4 Operation Model for isSentToCoordinator

The *isSentToCoordinator* operation has the following properties:

OPERATION	
<i>isSentToCoordinator</i>	
used to provide a given coordinator with current crisis information.	
<i>Parameters</i>	
1	<b>AactCoordinator: actCoordinator</b> the message destination actor
<i>Return type</i>	
ptBoolean	
<i>Post-Condition (functional)</i>	
PostF 1	true iff the message <i>ieSendACrisis</i> is sent by the simulator to the input interface of the given coordinator actor with the current crisis as parameter value.

The listing 5.16 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{if
4 (
5   /* Post F01 */
6   AactCoordinator.rnInterfaceIN.ieSendACrisis(self)
7 )
8 then (result = true)
9 else (result = false)
10 endif}

```

Listing 5.16: **Messip** (MCL-oriented) specification of the operation *isSentToCoordinator*.

#### 5.12.5 Operation Model for isAllocatedIfPossible

The *isAllocatedIfPossible* operation has the following properties:

OPERATION
<i>continues in next page ...</i>

**... Operation table continuation**

<b><i>isAllocatedIfPossible</i></b>	
used to allocate a crisis to a coordinator if any or to alert the administrator of crisis waiting to be handled.	
<b><i>Return type</i></b>	
ptBoolean	
<b><i>Post-Condition (functional)</i></b>	
PostF 1	true iff the duration between the crisis creation and the system's clock is greater than the maximum delay defined and
PostF 2	if there exist at least one coordinator then (a) the post state associates to the crisis any of the existing coordinators and (b) the coordinator is informed that he is now the handlers of the crisis whose ID is communicated
PostF 3	else a message is sent to all known administrators to request creation of new coordinators.

The listing 5.17 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{if (
4 /* Post F01 */
5 self.maxHandlingDelayPassed()
6 and
7 if (TheSystem.rnactCoordinator->msrIsEmpty = false)
8 then (
9 /* Post F02 */
10 TheSystem.rnactCoordinator->msrAny(true) = TheCoordinatorActor
11 and TheCoordinatorActor.rnctCoordinator = TheCoordinator
12 and self@post.rnHandler = TheCoordinator
13 and self@post.status = handled
14 and self.id.value = TheCrisisIDptString
15 and 'You are now considered as handling the crisis having ID: '
16 .ptStringConcat(TheCrisisIDptString) = TheMessage
17 and TheCoordinatorActor.rnInterfaceIN.ieMessage(TheMessage)
18 )
19 else ( /* Post F03 */
20 TheSystem.rnactAdministrator
21 ->forAll(rnInterfaceIN.ieMessage('Please add new coordinators to handle pending crisis !'))
22 )
23 endif
24 )
25 then (result = true)
26 else (result = false)
27 endif}

```

Listing 5.17: **Messip** (MCL-oriented) specification of the operation *isAllocatedIfPossible*.

## 5.13 Primary Types - Operation Schemes for Class ctHuman

### 5.13.1 Operation Model for init

The `init` operation has the following properties:

OPERATION
-----------

*continues in next page ...*

**... Operation table continuation**

<b><i>init</i></b> used to initialize the current object as a new instance of the ctHuman type.	
<b><i>Parameters</i></b>	
1	<b>Aid: dtPhoneNumber</b> used to initialize the id field
2	<b>Akind: etHumanKind</b> used to initialize the kind field
<b><i>Return type</i></b>	
ptBoolean	
<b><i>Post-Condition (functional)</i></b>	
PostF 1	true iff the system poststate includes the current object as a new ctHuman instance having its attributes equal to the ones provided as parameters.

The listing 5.18 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{if
4 (
5 /* Post F01 */
6 let Self:ctHuman in
7
8 Self.id = Aid
9 and Self.kind = Akind
10
11 /* Post F02 */
12 and (Self.ocliIsNew and self = Self)
13 )
14 then (result = true)
15 else (result = false)
16 endif}

```

Listing 5.18: **Messip** (MCL-oriented) specification of the operation *init*.

### 5.13.2 Operation Model for isAcknowledged

The *isAcknowledged* operation has the following properties:

OPERATION	
<b><i>isAcknowledged</i></b> used to specify the property of having sent an alert acknowledge message to the human having declared the alert through its own communication company.	
<b><i>Return type</i></b>	
ptBoolean	
<b><i>Post-Condition (functional)</i></b>	
PostF 1	true iff the message ieSmsSend is sent to the related input interface of the related communication company actor with the human phone number and the generic message 'The handling of your alert by our services is in progress !'

## 5.14 Primary Types - Operation Schemes for Class ctState

### 5.14.1 Operation Model for init

The `init` operation has the following properties:

OPERATION	
<i>init</i>	
used to initialize the current object as a new instance of the ctState type.	
Parameters	
1	<b>AnextValueForAlertID: dtInteger</b> used to initialize the nextValueForAlertID field
2	<b>AnextValueForCrisisID: dtInteger</b> used to initialize the nextValueForCrisisID field
3	<b>Aclock: dtDateAndTime</b> used to initialize the clock field
4	<b>AcrisisReminderPeriod: dtSecond</b> used to initialize the crisisReminderPeriod field
5	<b>AmaxCrisisReminderPeriod: dtSecond</b> used to initialize the maxCrisisReminderPeriod field
6	<b>AvpLastReminder: dtDateAndTime</b> used to initialize the vpLastReminder field
7	<b>AvpStarted: ptBoolean</b> used to initialize the vpStarted field
Return type	
ptBoolean	
Post-Condition (functional)	
PostF 1	true iff the system poststate includes the current object as a new ctState instance having its attributes equal to the ones provided as parameters.

The listing 5.19 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{if
4 (
5 /* Post F01 */
6 let Self:ctState in
7
8 Self.nextValueForAlertID = AnextValueForAlertID
9 and Self.nextValueForCrisisID = AnextValueForCrisisID
10 and Self.clock = Aclock
11 and Self.crisisReminderPeriod = AcrisisReminderPeriod
12 and Self.maxCrisisReminderPeriod = AmaxCrisisReminderPeriod
13 and Self.vpLastReminder = AvpLastReminder
14 and Self.vpStarted = AvpStarted
15
16 and (Self.oclIsNew and self = Self)
17 )
18 then (result = true)
19 else (result = false)

```

```
20 endif}
```

Listing 5.19: **Mess1p** (MCL-oriented) specification of the operation *init*.

## 5.15 Primary Types - Operation Schemes for Datatype dtAlertID

### 5.15.1 Operation Model for is

The *is* operation has the following properties:

OPERATION	
<i>is</i>	used to determine which strings are considered as valid alert identifiers.
<i>Return type</i>	ptBoolean
<i>Post-Condition (functional)</i>	PostF 1 if the length of the value attribute of a dtAlertID is a ptInteger greater than zero and lower or equal to 20 then the operation returns the ptBoolean true, else the ptBoolean false.

The listing 5.20 provides the **Mess1p** (MCL-oriented) specification of the operation.

```
1
2 /* Post Functional:*/
3 postF{let TheResult: ptBoolean in
4   ( if
5     ( AdtValue.value.length().gt(0)
6       and AdtValue.value.length().leq(20)
7     )
8     then (TheResult = true)
9     else (TheResult = false)
10    endif
11    result = TheResult
12  ) }
```

Listing 5.20: **Mess1p** (MCL-oriented) specification of the operation *is*.

## 5.16 Primary Types - Operation Schemes for Datatype dtComment

### 5.16.1 Operation Model for is

The *is* operation has the following properties:

OPERATION	
<i>is</i>	used to determine which strings are considered as valid comments.
<i>Return type</i>	ptBoolean
<i>Post-Condition (functional)</i>	PostF 1 true iff the length of the string value is not more than 160 characters.

The listing 5.21 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{let TheResult: ptBoolean in
4   ( if
5     ( MaxLength = 160
6       and AdtValue.value.length().leq(MaxLength)
7     )
8     then (TheResult = true)
9     else (TheResult = false)
10    endif
11    result = TheResult
12  )}

```

Listing 5.21: **Messip** (MCL-oriented) specification of the operation *is*.

## 5.17 Primary Types - Operation Schemes for Datatype dtCoordinatorID

### 5.17.1 Operation Model for *is*

The *is* operation has the following properties:

OPERATION	
<i>is</i>	used to determine which string are considered as valid alert identifiers.
<i>Return type</i>	ptBoolean
<i>Post-Condition (functional)</i>	
PostF 1	if the length of the value attribute of a dtCoordinatorID is a ptInteger greater than zero and lower or equal to 5 then the operation returns the ptBoolean true, else the ptBoolean false.

The listing 5.22 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{let TheResult: ptBoolean in
4   ( if
5     ( AdtValue.value.length().gt(0)
6       and AdtValue.value.length().leq(5)
7     )
8     then (TheResult = true)
9     else (TheResult = false)
10    endif
11    result = TheResult
12  )}

```

Listing 5.22: **Messip** (MCL-oriented) specification of the operation *is*.

## 5.18 Primary Types - Operation Schemes for Datatype dtCrisisID

### 5.18.1 Operation Model for is

The `is` operation has the following properties:

OPERATION	
<i>is</i>	used to determine which strings are considered as valid crisis identifiers.
<i>Return type</i>	
	ptBoolean
<i>Post-Condition (functional)</i>	
PostF 1	if the length of the value attribute of a dtCrisisID is a ptInteger greater than zero and lower or equal to 10 than the operation returns the ptBoolean true, else the ptBoolean false.

The listing 5.23 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{let TheResult: ptBoolean in
4   ( if
5     ( AdtValue.value.length().gt(0)
6       and AdtValue.value.length().leq(10)
7     )
8     then (TheResult = true)
9     else (TheResult = false)
10    endif
11    result = TheResult
12  ) }
```

Listing 5.23: **Messip** (MCL-oriented) specification of the operation *is*.

## 5.19 Primary Types - Operation Schemes for Datatype dtGPSLocation

### 5.19.1 Operation Model for is

The `is` operation has the following properties:

OPERATION	
<i>is</i>	used to determine which couples are considered as valid dtGPSLocation values.
<i>Return type</i>	
	ptBoolean
<i>Post-Condition (functional)</i>	
PostF 1	true if both latitude and longitude are valid values according to their <code>is</code> operation.

The listing 5.24 provides the **Messip** (MCL-oriented) specification of the operation.



```

1
2 /* Post Functional:*/
3 postF{let TheResult: ptBoolean in
4   ( if
5     ( AdtValue.latitude.is()
6       and AdtValue.longitude.is
7     )
8     then (TheResult = true)
9     else (TheResult = false)
10   endif
11   result = TheResult
12 ) }

```

Listing 5.24: **Messip** (MCL-oriented) specification of the operation *is*.

### 5.19.2 Operation Model for *isNearTo*

The *isNearTo* operation has the following properties:

OPERATION	
<b><i>isNearTo</i></b>	
used to determine if locations are considered enough close to be treated as equivalent in the application domain context. In the context of the iCrash system, we compute the distance between two GPS locations using the following Haversine formula. (more details can be found at: <a href="http://www.movable-type.co.uk/scripts/latlong.html">http://www.movable-type.co.uk/scripts/latlong.html</a> and <a href="http://www.gpsvisualizer.com/calculators#distance">http://www.gpsvisualizer.com/calculators#distance</a> )	
<b><i>Parameters</i></b>	
1	<b>AGPSLocation: dtGPSLocation</b> the GPS location to be compared to.
<b><i>Return type</i></b>	
ptBoolean	
<b><i>Post-Condition (functional)</i></b>	
PostF 1	if the Haversine formula $(\text{ACOS}(\text{SIN}(\text{lat1}) * \text{SIN}(\text{lat2}) + \text{COS}(\text{lat1}) * \text{COS}(\text{lat2}) * \text{COS}(\text{lon2} - \text{lon1})) * 6371$ , in which latitudes and longitudes are in radians applied to the two dtGPS coordinates is lower to 100 meters) then the predicate is true and false otherwise.

The listing 5.25 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{let TheResult: ptBoolean in true
4   let EarthRadius: dtReal in
5   let MaxDistance: dtReal in
6   let ComparedLatitude: dtLatitude in
7   let ComparedLongitude: dtLongitude in
8   let R1: dtReal in let R1a: dtReal in
9   let R2: dtReal in let R2a: dtReal in
10
11   ( if
12     ( EarthRadius.value = 6371
13       and MaxDistance.value = 100
14
15       and AdtValue.latitude = ComparedLatitude
16       and AdtValue.longitude = ComparedLongitude
17       and Self.latitude.sin() = R1a
18       and AdtValue.latitude.sin().mul(R1a) = R1
19       and Self.latitude.cos() = R2a

```

```

20      and AdtValue.latitude.cos().mul(R2a) = R2
21
22      and AdtValue.longitude = ComparedLongitude
23      and Self.longitude.sub(ComparedLongitude).cos().mul(R2)
24      .add(R1).acos().mul(EarthRadius).sub(MaxDistance)
25      .value.leq(0)
26    )
27    then (TheResult = true)
28    else (TheResult = false)
29    endif
30    result = TheResult
31  } }

```

Listing 5.25: **Messip** (MCL-oriented) specification of the operation *isNearTo*.

## 5.20 Primary Types - Operation Schemes for Datatype dtLatitude

### 5.20.1 Operation Model for is

The *is* operation has the following properties:

OPERATION
<i>is</i> used to determine which strings are considered as valid dtLatitude.
<i>Return type</i> ptBoolean
<i>Post-Condition (functional)</i> PostF 1     is true if the value is a real in the interval $[-90.0, +90.0]$ .

The listing 5.26 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2  /* Post Functional:*/
3  postF{let TheResult: ptBoolean in
4    ( if
5      ( AdtValue.value.geq(-90.0)
6        and AdtValue.value.leq(+90.0)
7      )
8      then (TheResult = true)
9      else (TheResult = false)
10     endif
11     result = TheResult
12   ) }

```

Listing 5.26: **Messip** (MCL-oriented) specification of the operation *is*.

## 5.21 Primary Types - Operation Schemes for Datatype dtLogin

### 5.21.1 Operation Model for is

The *is* operation has the following properties:

OPERATION
<i>is</i> used to determine which strings are considered as valid dtLogin.
<i>Return type</i>
ptBoolean
<i>Post-Condition (functional)</i>
PostF 1      is true of the length of the string value is not more than 20 characters.

The listing 5.27 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{let TheResult: ptBoolean in
4     let MaxLength: ptInteger in
5     ( if
6         ( MaxLength = 20
7           and AdtValue.value.length().leq(MaxLength)
8         )
9         then (TheResult = true)
10        else (TheResult = false)
11        endif
12        result = TheResult
13    ) }
```

Listing 5.27: **Messip** (MCL-oriented) specification of the operation *is*.

## 5.22 Primary Types - Operation Schemes for Datatype dtLongitude

### 5.22.1 Operation Model for is

The *is* operation has the following properties:

OPERATION
<i>is</i> used to determine which strings are considered as valid dtLongitude.
<i>Return type</i>
ptBoolean
<i>Post-Condition (functional)</i>
PostF 1      is true if the value is a real in the interval [-180.0 , +180.0].

The listing 5.28 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{let TheResult: ptBoolean in
4     ( if
5         ( AdtValue.value.geq(-180.0)
6           and AdtValue.value.leq(+180.0)
7         )
8     ) }
```

```
8      then (TheResult = true)
9      else (TheResult = false)
10     endif
11     result = TheResult
12  })
```

Listing 5.28: **Messip** (MCL-oriented) specification of the operation *is*.

5.23 Primary Types - Operation Schemes for Datatype dtPassword

5.23.1 Operation Model for is

The *is* operation has the following properties:

OPERATION
<i>is</i> used to determine which strings are considered as valid dtPassword.
<i>Return type</i> ptBoolean
<i>Post-Condition (functional)</i> PostF 1     is true of the length of the string value is at least 6 characters long.

The listing 5.29 provides the **Messip** (MCL-oriented) specification of the operation.

```
1
2 /* Post Functional:*/
3 postF{let TheResult: ptBoolean in
4     let MinLength: ptInteger in
5     ( if
6         ( MinLength = 6
7         and AdtValue.value.length().geq(MinLength)
8         )
9         then (TheResult = true)
10        else (TheResult = false)
11        endif
12        result = TheResult
13    ) }
```

Listing 5.29: **Messip** (MCL-oriented) specification of the operation *is*.

5.24 Primary Types - Operation Schemes for Datatype dtPhoneNumber

5.24.1 Operation Model for is

The *is* operation has the following properties:

OPERATION
<i>is</i> used to determine which strings are considered as valid dtPhoneNumber.
<i>Return type</i>

*continues in next page ...*

**... Operation table continuation**

ptBoolean
<b>Post-Condition (functional)</b>
PostF 1      is true of the length of the string value is from 4 to 30 characters. No standard is applied !

The listing 5.30 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{let TheResult: ptBoolean in
4   ( if
5     ( AdtValue.value.length().gt(4)
6       and AdtValue.value.length().leq(30)
7     )
8     then (TheResult = true)
9     else (TheResult = false)
10   endif
11   result = TheResult
12 ) }
```

Listing 5.30: **Messip** (MCL-oriented) specification of the operation *is*.

## 5.25 Primary Types - Operation Schemes for Enumeration etAlertStatus

### 5.25.1 Operation Model for is

The *is* operation has the following properties:

OPERATION
<i>is</i> used to determine which litteral belongs to the enumeration.
<b>Return type</b>
ptBoolean
<b>Post-Condition (functional)</b>
PostF 1      true iff the value is equal to one of the following values: pending, valid, invalid

The listing 5.31 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{let TheResult: ptBoolean in
4   ( if
5     ( self = pending
6       or self = valid
7       or self = invalid
8     )
9     then (TheResult = true)
10    else (TheResult = false)
11  endif
```

```
12     result = TheResult
13 }
```

Listing 5.31: **Messip** (MCL-oriented) specification of the operation *is*.

5.26 Primary Types - Operation Schemes for Enumeration etCrisisStatus

5.26.1 Operation Model for is

The *is* operation has the following properties:

OPERATION
<i>is</i> used to determine which litteral belongs to the enumeration.
<i>Return type</i> ptBoolean
<i>Post-Condition (functional)</i> PostF 1 true iff the value is equal to one of the following values: pending, handled, solved, closed.

The listing 5.32 provides the **Messip** (MCL-oriented) specification of the operation.

```
1
2 /* Post Functional:*/
3 postF{let TheResult: ptBoolean in
4   ( if
5     ( self = pending
6       or self = handled
7       or self = solved
8       or self = closed
9     )
10    then (TheResult = true)
11    else (TheResult = false)
12    endif
13    result = TheResult
14  ) }
```

Listing 5.32: **Messip** (MCL-oriented) specification of the operation *is*.

5.27 Primary Types - Operation Schemes for Enumeration etCrisisType

5.27.1 Operation Model for is

The *is* operation has the following properties:

OPERATION
<i>is</i> used to determine which litteral belongs to the enumeration.

*continues in next page ...*

**... Operation table continuation**

<i>Return type</i>
ptBoolean
<i>Post-Condition (functional)</i>
PostF 1      true iff the value is equal to one of the following values: <code>small</code> , <code>medium</code> , <code>huge</code>

The listing 5.33 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{let TheResult: ptBoolean in
4   ( if
5     ( self = small
6       or self = medium
7       or self = huge
8     )
9     then (TheResult = true)
10    else (TheResult = false)
11  endif
12  result = TheResult
13 }
```

Listing 5.33: **Messip** (MCL-oriented) specification of the operation *is*.

## 5.28 Primary Types - Operation Schemes for Enumeration etHumanKind

### 5.28.1 Operation Model for is

The *is* operation has the following properties:

OPERATION
<i>is</i> used to determine which literal belongs to the enumeration.
<i>Return type</i>
ptBoolean
<i>Post-Condition (functional)</i>
PostF 1      true iff the value is equal to one of the following values: <code>witness</code> , <code>victim</code> , <code>anonym</code>

The listing 5.34 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{let TheResult: ptBoolean in
4   ( if
5     ( self = witness
6       or self = victim
7       or self = anonymous
8     )
9     then (TheResult = true)
```

```

10     else (TheResult = false)
11     endif
12     result = TheResult
13 }

```

Listing 5.34: **Messip** (MCL-oriented) specification of the operation *is*.

## 5.29 Secondary Types - Operation Schemes for Classes

There are no elements in this category in the system analysed.

## 5.30 Secondary Types - Operation Schemes for Datatype dtSMS

### 5.30.1 Operation Model for *is*

The *is* operation has the following properties:

OPERATION
<i>is</i> used to determine which strings are considered as valid comments
<i>Return type</i> ptBoolean
<i>Post-Condition (functional)</i> PostF 1      true iff the length of the string value is not more than 160 characters.

The listing 5.35 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{let TheResult: ptBoolean in
4     let MaxLength: ptInteger in
5     ( if
6         ( MaxLength = 160
7         and AdtValue.value.length() .leq (MaxLength)
8         )
9         then (TheResult = true)
10        else (TheResult = false)
11        endif
12        result = TheResult
13    ) }

```

Listing 5.35: **Messip** (MCL-oriented) specification of the operation *is*.

## 5.31 Secondary Types - Operation Schemes for Enumerations

There are no elements in this category in the system analysed.





# Chapter 6

## Test Model(s)

### 6.1 Test Model for testcase01

this positive test case intends to verify the correctness of the execution of a simple instance of the suDeployAndRun use case.

#### 6.1.1 Test Steps Specification

##### 6.1.1.1 testcase01-ts01oeCreateSystemAndEnvironment-actMsrCreator.outactMsrCreator.oeCreateSy

The testcase01-ts01oeCreateSystemAndEnvironment-actMsrCreator.outactMsrCreator.oeCreat has the following properties:

TEST STEP	
<i>ts01oeCreateSystemAndEnvironment</i> This test step initializes the system state and environment.	
<i>Test Sent Message</i>	
TSM 1	<b>out:Creator</b>  sends to system  <b>actMsrCreator.outactMsrCreator.oeCreateSystemAndEnvironment</b> (AqtyComCompanies)
<i>Variables</i>	
V 1	<b>Creator:icrash.environment.actMsrCreator</b> only actMsrtCreator actors can trigger the system and environment creation and initialization.
<i>Constraints</i>	
C 1	the number of communication company actor instances present in the environment is equal to four to represent all the communication companies available in Luxembourg.
<i>Oracle Constraints</i>	
OC 1	true for testing only the executability (is available and can be triggered) of the operation.

The listing 6.1 provides the **Messip** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   Creator:actMsrCreator
4   AqtyComCompanies: ptInteger
5 }
6
7 constraints{
8   AqtyComCompanies = 4
9 }
10
11 oracle{
12   constraints{
13     true
14   }
15 }

```

Listing 6.1: **Messip** (MCL-oriented) specification of the test step *testcase01-ts01oeCreateSystemAndEnvironment*.

#### 6.1.1.2 testcase01-ts02oeSetClock-actActivator.outactActivator.oeSetClock

The *testcase01-ts02oeSetClock-actActivator.outactActivator.oeSetClock* has the following properties:

TEST STEP	
<i>ts02oeSetClock</i> test the update of the current time.	
<i>Test Sent Message</i>	
TSM 1	<b>out:TheActor</b>  sends to system  <b>actActivator.outactActivator.oeSetClock (ACurrentClock)</b>
<i>Variables</i>	
V 1	<b>TheActor:actActivator</b> proactive actor responsible of requesting the update of the system's clock.
<i>Constraints</i>	
C 1	TheActor is any instance existing in the current environment status. ACurrentClock is a fixed date equal to the 24th November 2017 at 15:20:00 using a 24-hours notation <sup>1</sup> .
C 2	
<i>Oracle Constraints</i>	
OC 1	true for testing only the executability (is available and can be triggered) of the operation.

The listing 6.2 provides the **Messip** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor:actActivator
4   ACurrentClock:dtDateAndTime

```

<sup>1</sup>for more details see the ISO 8601 Data elements and interchange formats – Information interchange – Representation of dates and times - <http://www.iso.org/iso/home/standards/iso8601.htm>

```

5  }
6
7  constraints{
8    TheActor=TheSystem.rnactActivator->any2 (true)
9    ACurrentClock.date.year.value = 2017
10   ACurrentClock.date.month.value = 11
11   ACurrentClock.date.day.value = 24
12   ACurrentClock.time.hour.value = 15
13   ACurrentClock.time.minute.value = 20
14   ACurrentClock.time.second.value = 00
15 }
16
17 oracle{
18   constraints{
19     true
20   }
21 }

```

Listing 6.2: **Messip** (MCL-oriented) specification of the test step *testcase01-ts02oeSetClock*.

### 6.1.1.3 testcase01-ts03oeLogin-actAdministrator.outactAdministrator.oeLogin

The *testcase01-ts03oeLogin-actAdministrator.outactAdministrator.oeLogin* has the following properties:

TEST STEP	
<i>ts03oeLogin</i>	
test the authenticated access of the administrator	
<i>Test Sent Message</i>	
TSM 1	<b>out:TheActor</b>  sends to system  <b>actAdministrator.outactAdministrator.oeLogin</b> (AdtLogin, AdtPassword)
<i>Variables</i>	
V 1	<b>TheActor:actAdministrator</b> an actAdministor actor as subtype of actAuthenticated can send oeLogin messages to the system.
<i>Constraints</i>	
C 1	TheActor is any actAdministrator instance existing in the environment. It is thus expected that there exist at least one.
C 2	AdtLogin has its value attribute equal to the primitive string 'icrashadmin' (which is the correct administrator login known by the system after the step one.)
C 3	AdtPassword has its value attribute equal to the primitive string '7WXC1359' (which is the correct administrator password known by the system after the step one.)
<i>Oracle Constraints</i>	
OC 1	the AMessage value is expected to be equal to the primitive string 'You are logged ! Welcome ...'
OC 2	TheActor receives from system ieMessage(AMessage)

The listing 6.3 provides the **Messip** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actAdministrator
4   AdtLogin:dtLogin
5   AdtPassword:dtPassword
6 }
7
8 constraints{
9   TheActor=TheSystem.rnactAdministrator->any2(true)
10  AdtLogin.value.eq('icrashadmin')
11  AdtPassword.value.eq('7WXC1359')
12 }
13
14 oracle{
15   variables{
16     AMessage:ptString
17   }
18   constraints{
19     AMessage = 'You are logged ! Welcome ...'
20     TheActor.inactAdministrator.ieMessage(AMessage)
21   }
22 }

```

Listing 6.3: **Messir** (MCL-oriented) specification of the test step *testcase01-ts03oeLogin*.

#### 6.1.1.4 testcase01-ts04oeAddCoordinator-actAdministrator.outactAdministrator.oeAddCoordinator

The `testcase01-ts04oeAddCoordinator-actAdministrator.outactAdministrator.oeAddCoordinator` has the following properties:

TEST STEP	
<i>ts04oeAddCoordinator</i> to test the add of a new coordinator by an administrator.	
<i>Test Sent Message</i>	
TSM 1	<b>out:TheActor</b>  sends to system  <b>actAdministrator.outactAdministrator.oeAddCoordinator</b> (AdtCoordinatorID, AdtLogin, AdtPassword)
<i>Variables</i>	
V 1	<b>TheActor:actAdministrator</b> actAdministor actors as being the only one allowed to add coordinators.
<i>Constraints</i>	
C 1	TheActor is any <code>actAdministrator</code> instance existing in the environment. It is expected that there exists at least one which is the same during all the test case. C 2    AdtCoordinatorID is equal to 1 to set the new coordinator ID C 3    AdtLogin has its value attribute equal to the primitive string 'steve' which is the ID defined for the new coordinator. C 4    AdtPassword has its value attribute equal to the primitive string 'pwdMessirExcalibur2017' which is the password to be set for steve.
C 2	
C 3	
C 4	
<i>Oracle Constraints</i>	
OC 1	the administrator should have been acknowledged for the adding of the new coordinator.

The listing 6.4 provides the **Messirp** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actAdministrator
4   AdtCoordinatorID : dtCoordinatorID
5   AdtLogin:dtLogin
6   AdtPassword:dtPassword
7 }
8
9 constraints{
10  TheActor = TheSystem.rnactAdministrator->any2(true)
11  AdtCoordinatorID.value.eq('1')
12  AdtLogin.value.eq('steve')
13  AdtPassword.value.eq('pwdMessirExcalibur2017')
14 }
15
16 oracle{
17   constraints{
18     TheActor.inactAdministrator.ieCoordinatorAdded()
19   }
20 }
```

Listing 6.4: **Messirp** (MCL-oriented) specification of the test step *testcase01-ts04oeAddCoordinator*.

#### 6.1.1.5 testcase01-ts05oeLogout-actAdministrator.outactAdministrator.oeLogout

The `testcase01-ts05oeLogout-actAdministrator.outactAdministrator.oeLogout` has the following properties:

TEST STEP	
<b><i>ts05oeLogout</i></b>	
to test the logout of a connected administrator.	
<b><i>Test Sent Message</i></b>	
TSM 1	<b>out:TheActor</b>  sends to system  <b>actAdministrator.outactAdministrator.oeLogout ()</b>
<b><i>Variables</i></b>	
V 1	<b>TheActor:actAdministrator</b> an actAdministor actor as subtype of actAuthenticated can send oeLogout messages to the system.
<b><i>Constraints</i></b>	
C 1	TheActor is any <code>actAdministrator</code> instance existing in the environment. It is expected that there exists at least one which is the same during all the test case.
<b><i>Oracle Constraints</i></b>	
OC 1	the <code>AMessage</code> value is expected to be equal to the primitive string 'You are logged out ! Good Bye ...'
OC 2	the administrator should have received the messahe <code>AMessage</code> .

The listing 6.5 provides the **Messiq** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actAdministrator
4 }
5
6 constraints{
7   TheActor = TheSystem.rnactAdministrator->any2 (true)
8 }
9
10 oracle{
11   variables{
12     AMessage:ptString
13   }
14   constraints{
15     AMessage = 'You are logged out ! Good Bye ...'
16     TheActor.inactAdministrator.ieMessage (AMessage)
17   }
18 }

```

Listing 6.5: **Messiq** (MCL-oriented) specification of the test step *testcase01-ts05oeLogout*.

#### 6.1.1.6 testcase01-ts06oeSetClock02-actActivator.outactActivator.oeSetClock

The *testcase01-ts06oeSetClock02-actActivator.outactActivator.oeSetClock* has the following properties:

TEST STEP	
<i>ts06oeSetClock02</i>	
test the update of the current time.	
Test Sent Message	
TSM 1	<b>out:TheActor</b>  <b>sends to system</b>  <b>actActivator.outactActivator.oeSetClock (ACurrentClock)</b>
Variables	
V 1	<b>TheActor:icrash.environment.actActivator</b> proactive actors responsible of requesting the update of the system's clock.
Constraints	
C 1	TheActor is any instance existing in the current environment status.
C 2	ACurrentClock is a fixed date equal to the 26th November 2017 at 10:15:00 using a 24-hours notation.
Oracle Constraints	
OC 1	true for testing only the executability (is available and can be triggered) of the operation.

The listing 6.6 provides the **Messiq** (MCL-oriented) specification of the test step.

```

1
2 variables{

```

```

3 TheActor:actActivator
4 ACurrentClock:dtDateAndTime
5 }
6
7 constraints{
8   TheActor=TheSystem.rnactActivator->any2(true)
9   ACurrentClock.date.year.value = 2017
10  ACurrentClock.date.month.value = 11
11  ACurrentClock.date.day.value = 26
12  ACurrentClock.time.hour.value = 10
13  ACurrentClock.time.minute.value = 15
14  ACurrentClock.time.second.value = 00
15 }
16
17 oracle{
18   constraints{
19     true
20   }
21 }

```

Listing 6.6: **Messip** (MCL-oriented) specification of the test step *testcase01-ts06oeSetClock02*.

#### 6.1.1.7 testcase01-ts07oeAlert1-actComCompany.outactComCompany.oeAlert

The *testcase01-ts07oeAlert1-actComCompany.outactComCompany.oeAlert* has the following properties:

TEST STEP	
<b><i>ts07oeAlert1</i></b>	
tests the declaration of a new alert functionality.	
Test Sent Message	
TSM 1	<b>out:TheActor</b>  <b>sends to system</b>  <b>actComCompany.outactComCompany.oeAlert</b> (AetHumanKind, AdtDate, AdtTime, AdtPhoneNumber, AdtGPSLocation, AdtComment)
Variables	
V 1	<b>TheActor:actComCompany</b> actComCompany actors transfer alert declaration messages.
Constraints	
C 1	TheActor is any instance existing in the current environment status. It is expected to exist at least one.
C 2	AetHumanKind is equal to witness
C 3	AdtDate is equal to the 26th of November 2017
C 4	AdtTime is equal to 10:10:16 using a 24-hours.
C 5	AdtPhoneNumber is equal to the ptString value '+3524666445252'.
C 6	AdtGPSLocation is equal to (49.627675 , 6.159590).
C 7	AdtComment is equal to '3 cars involved in an accident.'
Oracle Constraints	
OC 1	AdtSMS is equal to the ptString 'Your alert has been registered. We will handle it and keep you informed'.

*continues in next page ...*



**... Test Step table continuation**

OC 2	AdtSMS is sent to the phone number AdtPhoneNumber using the communication company having sent the alert using its ieSmsSend input message.
------	--

The listing 6.7 provides the **Mess1p** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actComCompany
4   AetHumanKind:etHumanKind
5   AdtDate:dtDate
6   AdtTime:dtTime
7   AdtPhoneNumber:dtPhoneNumber
8   AdtGPSLocation:dtGPSLocation
9   AdtComment:dtComment
10 }
11
12 constraints{
13   TheActor = TheSystem.rnactComCompany->any2(true)
14   AetHumanKind = witness
15   AdtDate.year.value = 2017
16   AdtDate.month.value = 11
17   AdtDate.day.value = 26
18   AdtTime.hour.value = 10
19   AdtTime.minute.value = 10
20   AdtTime.second.value = 16
21   AdtPhoneNumber.value = '+3524666445252'
22   AdtGPSLocation.latitude.value = 49.627675
23   AdtGPSLocation.longitude.value = 6.159590
24   AdtComment.value = '3 cars involved in an accident.'
25 }
26
27 oracle{
28   variables{
29     AdtSMS:dtSMS
30   }
31   constraints{
32     AdtSMS.value = 'Your alert has been registered. We will handle it and keep you informed'
33     TheActor.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
34   }
35 }

```

Listing 6.7: **Mess1p** (MCL-oriented) specification of the test step *testcase01-ts07oeAlert1*.

#### 6.1.1.8 testcase01-ts08oeSetClock03-actActivator.outactActivator.oeSetClock

The `testcase01-ts08oeSetClock03-actActivator.outactActivator.oeSetClock` has the following properties:

TEST STEP
<i>ts08oeSetClock03</i> test the update of the current time.
<i>Test Sent Message</i>

*continues in next page ...*

**... Test Step table continuation**

TSM 1	<b>out:TheActor</b>  <b>sends to system</b>  <b>actActivator.outactActivator.oeSetClock (ACurrentClock)</b>
<b>Variables</b>	
V 1	<b>TheActor:actActivator</b> proactive actor responsible of requesting the update of the system's clock.
<b>Constraints</b>	
C 1	TheActor is any instance existing in the current environment status.
C 2	ACurrentClock is a fixed date equal to the 26th November 2017 at 10:30:00 using a 24-hours notation.
<b>Oracle Constraints</b>	
OC 1	true for testing only the executability (is available and can be triggered) of the operation.

The listing 6.8 provides the **Messip** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor:actActivator
4   ACurrentClock:dtDateAndTime
5 }
6
7 constraints{
8   TheActor=TheSystem.rnactActivator->any2 (true)
9   ACurrentClock.date.year.value = 2017
10  ACurrentClock.date.month.value = 11
11  ACurrentClock.date.day.value = 26
12  ACurrentClock.time.hour.value = 10
13  ACurrentClock.time.minute.value = 30
14  ACurrentClock.time.second.value = 00
15 }
16
17 oracle{
18   constraints{
19     true
20   }
21 }
```

Listing 6.8: **Messip** (MCL-oriented) specification of the test step *testcase01-ts08oeSetClock03*.

#### 6.1.1.9 testcase01-ts09oeSollicitateCrisisHandling-actActivator.outactActivator.oeSollicitateCrisisHandling

The testcase01-ts09oeSollicitateCrisisHandling-actActivator.outactActivator.oeSollicitateCrisisHandling has the following properties:

TEST STEP
<i>ts09oeSollicitateCrisisHandling</i> test the proactive sollicitation to handle an alert.
<b>Test Sent Message</b>

*continues in next page ...*

**... Test Step table continuation**

TSM 1	<b>out:TheActor</b> sends to system <b>actActivator.outactActivator.oeSollicitateCrisisHandling ()</b>
<b>Variables</b>	
V 1	<b>TheActor:icrash.environment.actActivator</b> proactive actor responsible of triggering solicitation functionality.
<b>Constraints</b>	
C 1	TheActor is any instance existing in the current environment status. It is expected to exist at least one.
<b>Oracle Variables</b>	
OV 1	<b>TheAdministrator:actAdministrator</b> actAdministrator actors can be sollicitated to handle alerts.
OV 2	<b>TheCoordinator:actCoordinator</b> actCoordinator actors can be sollicitated to handle alerts.
OV 3	<b>AMessageForCrisisHandlers:ptString</b> messages sent to sollicitated actors are of type ptString.
<b>Oracle Constraints</b>	
OC 1	TheAdministrator is any instance existing in the current environment status. It is expected to exist at least one.
OC 2	TheCoordinator is any instance existing in the current environment status. It is expected to exist at least one.
OC 3	AMessageForCrisisHandlers is equal to the ptString 'There are alerts pending since more than the defined delay. Please REACT !'
OC 4	TheCoordinator and TheAdministrator have received the message AMessageForCrisisHandlers.

The listing 6.9 provides the **Messip** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actActivator
4 }
5
6 constraints{
7   TheActor = TheSystem.rnactActivator->any2(true)
8 }
9
10 oracle{
11   variables{
12     TheAdministrator:actAdministrator
13     TheCoordinator:actCoordinator
14     AMessageForCrisisHandlers:ptString
15   }
16   constraints{
17     TheAdministrator = TheSystem.rnactAdministrator->any2(true)
18     TheCoordinator = TheSystem.rnactCoordinator->any2(true)
19     AMessageForCrisisHandlers = 'There are alerts pending since more than the defined delay. Please
      REACT !'
20     TheAdministrator.inactAdministrator.ieMessage(AMessageForCrisisHandlers)

```

```

21 TheCoordinator.inactAdministrator.ieMessage(AMessageForCrisisHandlers)
22 }
23 }

```

Listing 6.9: **Messir** (MCL-oriented) specification of the test step *testcase01-ts09oeSollicitateCrisisHandling*.

#### 6.1.1.10 testcase01-ts10oeLogin02-actAuthenticated.outactAuthenticated.oeLogin

The testcase01-ts10oeLogin02-actAuthenticated.outactAuthenticated.oeLogin has the following properties:

TEST STEP	
<b><i>ts10oeLogin02</i></b>	
test the authenticated access of the coordinator	
<b><i>Test Sent Message</i></b>	
TSM 1	<b>out:TheActor</b> sends to system <b>actAuthenticated.outactAuthenticated.oeLogin</b> (AdtLogin, AdtPassword)
<b><i>Variables</i></b>	
V 1	<b>TheActor:actCoordinator</b> an actCoordinator actor as subtype of actAuthenticated can send oeLogin messages to the system.
<b><i>Constraints</i></b>	
C 1	TheActor is any actAdministrator instance existing in the environment. It is thus expected that there exist at least one.
C 2	AdtLogin has its value attribute equal to the primitive string 'icrashadmin' (which is the correct administrator login known by the system after the step one.)
C 3	AdtPassword has its value attribute equal to the primitive string '7WXC1359' (which is the correct administrator password known by the system after the step one.)
<b><i>Oracle Constraints</i></b>	
OC 1	the AMessage value is expected to be equal to the primitive string 'You are logged ! Welcome ...'

The listing 6.10 provides the **Messir** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actCoordinator
4   AdtLogin:dtLogin
5   AdtPassword:dtPassword
6 }
7
8 constraints{
9   TheActor = TheSystem.rnactCoordinator->select(a | a.rnctCoordinator.login.value.eq('steve'))->any2
10  (true)
11  AdtLogin.value.eq('steve')
12  AdtPassword.value.eq('pwdMessirExcalibur2017')

```

```

12 }
13
14 oracle{
15   variables{
16     AMessage:ptString
17   }
18   constraints{
19     AMessage = 'You are logged ! Welcome ...'
20     TheActor.inactAuthenticated.ieMessage(AMessage)
21   }
22 }

```

Listing 6.10: **Messip** (MCL-oriented) specification of the test step *testcase01-ts10oeLogin02*.

#### 6.1.1.11 testcase01-ts11oeGetCrisisSet-actCoordinator.outactCoordinator.oeGetCrisisSet

The *testcase01-ts11oeGetCrisisSet-actCoordinator.outactCoordinator.oeGetCrisisSet* has the following properties:

TEST STEP	
<i>ts11oeGetCrisisSet</i> cf. actor documentation	
<i>Test Sent Message</i>	
TSM 1	<b>out:TheActor</b>  <b>sends to system</b>  <b>actCoordinator.outactCoordinator.oeGetCrisisSet (AetCrisisStatus)</b>
<i>Variables</i>	
V 1	<b>TheActor:icrash.environment.actCoordinator</b> cf. actor documentation
V 2	<b>AetCrisisStatus:icrash.concepts.primarytypes.datatypes.etCrisisStatus</b> cf. actor documentation
V 3	<b>ActCrisis:icrash.concepts.primarytypes.classes.ctCrisis</b> cf. actor documentation
<i>Constraints</i>	
C 1	TheActor is the coordinator actor related to a coordinator in the system's state having steve as login value
C 2	AetCrisisStatus value is pending
<i>Oracle Constraints</i>	
OC 1	ActCrisis is any ctCrisis instance that has been sent to TheActor.

The listing 6.11 provides the **Messip** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actCoordinator
4   AetCrisisStatus : etCrisisStatus
5 }
6
7 constraints{

```

```

8 TheActor=TheSystem.rnactCoordinator
9   ->select(a | a.rnctCoordinator.login.value.eq('steve'))
10  ->any2(true)
11 AetCrisisStatus = pending
12 }
13
14 oracle{
15   variables{
16     ActCrisis:ctCrisis
17   }
18   constraints{
19     TheActor.inactCoordinator.ieSendACrisis(ActCrisis)
20   }
21 }

```

Listing 6.11: **Messir** (MCL-oriented) specification of the test step *testcase01-ts11oeGetCrisisSet*.

#### 6.1.1.12 testcase01-ts12oeSetCrisisHandler-actCoordinator.outactCoordinator.oeSetCrisisHandler

The *testcase01-ts12oeSetCrisisHandler-actCoordinator.outactCoordinator.oeSetCrisisHandler* has the following properties:

TEST STEP	
<i>ts12oeSetCrisisHandler</i>	
cf. actor documentation	
Test Sent Message	
TSM 1	<b>out:TheActor</b>  <b>sends to system</b>  <b>actCoordinator.outactCoordinator.oeSetCrisisHandler (AdtCrisisID)</b>
Variables	
V 1	<b>TheActor:icrash.environment.actCoordinator</b> cf. actor documentation
V 2	<b>TheComCompany:icrash.environment.actComCompany</b> cf. actor documentation
V 3	<b>TheCoordinator:icrash.environment.actCoordinator</b> cf. actor documentation
V 4	<b>AdtCrisisID:icrash.concepts.primarytypes.datatypes.dtCrisisID</b> cf. actor documentation
V 5	<b>AMessage:lu.uni.lassy.messir.libraries.primitives.ptString</b> cf. actor documentation
V 6	<b>AdtPhoneNumber:icrash.concepts.primarytypes.datatypes.dtPhoneNumber</b> cf. actor documentation
V 7	<b>AdtSMS:icrash.concepts.secondarytypes.datatypes.dtSMS</b> cf. actor documentation
V 8	<b>ActAlert:icrash.concepts.primarytypes.classes.ctAlert</b> cf. actor documentation
Constraints	
C 1	TheActor is the coordinator actor related to a coordinator in the system's state having steve as login value
C 2	AdtCrisisID as a value of 1

*continues in next page ...*

**... Test Step table continuation**

C 3	AMessage is the string 'You are now considered as handling the crisis !'
C 4	AdtPhoneNumber
C 5	AdtSMS has for value the string 'The handling of your alert by our services is in progress !'
<b>Oracle Constraints</b>	
OC 1	there is a communication company actor that received the message ieSmsSend(AdtPhoneNumber,AdtSMS)
OC 2	there is a coordinator actor that received an alert using the message ieSendAnAlert(ActAlert)

The listing 6.12 provides the **Messip** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actCoordinator
4   AdtCrisisID : dtCrisisID
5 }
6
7 constraints{
8   TheActor=TheSystem.rnactCoordinator
9   ->select(a | a.rnctCoordinator.login.value.eq('steve'))
10  ->any2(true)
11 }
12
13 oracle{
14   variables{
15     AMessage:ptString
16     AdtPhoneNumber:dtPhoneNumber
17     AdtSMS:dtSMS
18     ActAlert:ctAlert
19     TheComCompany: actComCompany
20     TheCoordinator:actCoordinator
21   }
22   constraints{
23     AMessage = 'You are now considered as handling the crisis !'
24     AdtSMS.value = 'The handling of your alert by our services is in progress !'
25     TheComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
26     TheCoordinator.inactCoordinator.ieSendAnAlert(ActAlert)
27     TheActor.inactAuthenticated.ieMessage(AMessage)
28   }
29 }
```

Listing 6.12: **Messip** (MCL-oriented) specification of the test step *testcase01-ts12oeSetCrisisHandler*.

**6.1.1.13 testcase01-ts13oeSetClock04-actActivator.outactActivator.oeSetClock**

The testcase01-ts13oeSetClock04-actActivator.outactActivator.oeSetClock has the following properties:

TEST STEP
<i>ts13oeSetClock04</i>
cf. actor documentation
<i>Test Sent Message</i>

*continues in next page ...*

**... Test Step table continuation**

TSM 1	<b>out:TheActor</b>  <b>sends to system</b>  <b>actActivator.outactActivator.oeSetClock (ACurrentClock)</b>
<b>Variables</b>	
V 1	<b>TheActor:icrash.environment.actActivator</b> cf. actor documentation
V 2	<b>ACurrentClock:lu.uni.lassy.messir.libraries.calendar.dtDateAndTime</b> cf. actor documentation
<b>Constraints</b>	
C 1	TheActor
C 2	ACurrentClock

The listing 6.13 provides the **Messip** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor:actActivator
4   ACurrentClock:dtDateAndTime
5 }
6
7 constraints{
8   TheActor=TheSystem.rnactActivator->any2(true)
9   ACurrentClock.date.year.value = 2017
10  ACurrentClock.date.month.value = 11
11  ACurrentClock.date.day.value = 26
12  ACurrentClock.time.hour.value = 10
13  ACurrentClock.time.minute.value = 45
14  ACurrentClock.time.second.value = 00
15 }
16
17 oracle{
18   constraints{
19     true
20   }
21 }
```

Listing 6.13: **Messip** (MCL-oriented) specification of the test step *testcase01-ts13oeSetClock04*.

**6.1.1.14 testcase01-ts14oeValidateAlert-actCoordinator.outactCoordinator.oeValidateAlert**

The *testcase01-ts14oeValidateAlert-actCoordinator.outactCoordinator.oeValidateAlert* has the following properties:

TEST STEP
<i>ts14oeValidateAlert</i> cf. actor documentation
Test Sent Message

*continues in next page ...*



**... Test Step table continuation**

TSM 1	<b>out:TheActor</b>  sends to system  <b>actCoordinator.outactCoordinator.oeValidateAlert (AdtAlertID)</b>
<b>Variables</b>	
V 1	<b>TheActor:icrash.environment.actCoordinator</b> cf. actor documentation
V 2	<b>AdtAlertID:icrash.concepts.primarytypes.datatypes.dtAlertID</b> cf. actor documentation
V 3	<b>AMessage:lu.uni.lassy.messir.libraries.primitives.ptString</b> cf. actor documentation
<b>Constraints</b>	
C 1	TheActor is the coordinator actor related to a coordinator in the system's state having steve as login value
C 2	AdtAlertID
C 3	AMessage
<b>Oracle Constraints</b>	
OC 1	

The listing 6.14 provides the **Messir** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actCoordinator
4   AdtAlertID : dtAlertID
5 }
6
7 constraints{
8   TheActor=TheSystem.ractCoordinator
9   ->select(a | a.rnctCoordinator.login.value.eq('steve'))
10  ->any2(true)
11 }
12
13 oracle{
14   variables{
15     AMessage:ptString
16   }
17   constraints{
18     AMessage = 'The Alert is now declared as valid !'
19     TheActor.actAuthenticated.inactAuthenticated.ieMessage(AMessage)
20   }
21 }

```

Listing 6.14: **Messir** (MCL-oriented) specification of the test step *testcase01-ts14oeValidateAlert*.

#### 6.1.1.15 testcase01-ts15oeAlert2-actComCompany.outactComCompany.oeAlert

The *testcase01-ts15oeAlert2-actComCompany.outactComCompany.oeAlert* has the following properties:

TEST STEP	
<i>ts15oeAlert2</i> cf. actor documentation	
Test Sent Message	
TSM 1	<b>out:TheActor</b>  sends to system  <b>actComCompany.outactComCompany.oeAlert</b> (AetHumanKind, AdtDate, AdtTime, AdtPhoneNumber, AdtGPSLocation, AdtComment)
Variables	
V 1	<b>TheActor:icrash.environment.actComCompany</b> cf. actor documentation
V 2	<b>AetHumanKind:icrash.concepts.primarytypes.datatypes.etHumanKind</b> cf. actor documentation
V 3	<b>AdtDate:lu.uni.lassy.messir.libraries.calendar.dtDate</b> cf. actor documentation
V 4	<b>AdtTime:lu.uni.lassy.messir.libraries.calendar.dtTime</b> cf. actor documentation
V 5	<b>AdtPhoneNumber:icrash.concepts.primarytypes.datatypes.dtPhoneNumber</b> cf. actor documentation
V 6	<b>AdtGPSLocation:icrash.concepts.primarytypes.datatypes.dtGPSLocation</b> cf. actor documentation
V 7	<b>AdtComment:icrash.concepts.primarytypes.datatypes.dtComment</b> cf. actor documentation
V 8	<b>AdtSMS:icrash.concepts.secondarytypes.datatypes.dtSMS</b> cf. actor documentation
Constraints	
C 1	TheActor
C 2	AetHumanKind
C 3	AdtDate
C 4	AdtTime
C 5	AdtPhoneNumber
C 6	AdtGPSLocation
C 7	AdtComment
C 8	AdtSMS
Oracle Constraints	
OC 1	

The listing 6.15 provides the **Messir** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actComCompany
4   AetHumanKind:etHumanKind
5   AdtDate:dtDate
6   AdtTime:dtTime

```

```

7  AdtPhoneNumber:dtPhoneNumber
8  AdtGPSLocation:dtGPSLocation
9  AdtComment:dtComment
10 }
11
12 constraints{
13   TheActor = TheSystem.rnactComCompany->any2(true)
14   AetHumanKind = witness
15   AdtDate.year.value = 2017
16   AdtDate.month.value = 11
17   AdtDate.day.value = 26
18   AdtTime.hour.value = 10
19   AdtTime.minute.value = 20
20   AdtTime.second.value = 00
21   AdtPhoneNumber.value = '+3524666445000'
22   AdtGPSLocation.latitude.value = 49.627095
23   AdtGPSLocation.longitude.value = 6.160251
24   AdtComment.value = 'A car crash just happened.'
25 }
26
27 oracle{
28   variables{
29     AdtSMS:dtSMS
30   }
31   constraints{
32     AdtSMS.value = 'Your alert has been registered. We will handle it and keep you informed'
33     TheActor.actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
34   }
35 }

```

Listing 6.15: **Messir** (MCL-oriented) specification of the test step *testcase01-ts15oeAlert2*.

#### 6.1.1.16 testcase01-ts16oeSetClock05-actActivator.outactActivator.oeSetClock

The *testcase01-ts16oeSetClock05-actActivator.outactActivator.oeSetClock* has the following properties:

TEST STEP	
<i>ts16oeSetClock05</i> cf. actor documentation	
<i>Test Sent Message</i>	
TSM 1	<b>out:TheActor</b>  <b>sends to system</b>  <b>actActivator.outactActivator.oeSetClock (ACurrentClock)</b>
<i>Variables</i>	
V 1	<b>TheActor:icrash.environment.actActivator</b> cf. actor documentation
V 2	<b>ACurrentClock:lu.uni.lassy.messir.libraries.calendar.dtDateAndTime</b> cf. actor documentation
<i>Constraints</i>	
C 1	<b>TheActor</b>
C 2	<b>ACurrentClock</b>

The listing 6.16 provides the **Messir** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor:actActivator
4   ACurrentClock:dtDateAndTime
5 }
6
7 constraints{
8   TheActor=TheSystem.rnactActivator->any2 (true)
9   ACurrentClock.date.year.value = 2017
10  ACurrentClock.date.month.value = 11
11  ACurrentClock.date.day.value = 26
12  ACurrentClock.time.hour.value = 12
13  ACurrentClock.time.minute.value = 45
14  ACurrentClock.time.second.value = 00
15 }
16
17 oracle{
18   constraints{
19     true
20   }
21 }
```

Listing 6.16: **Messir** (MCL-oriented) specification of the test step *testcase01-ts16oeSetClock05*.

#### 6.1.1.17 testcase01-ts17oeSetCrisisStatus-actCoordinator.outactCoordinator.oeSetCrisisStatus

The *testcase01-ts17oeSetCrisisStatus-actCoordinator.outactCoordinator.oeSetCrisisStatus* has the following properties:

TEST STEP	
<i>ts17oeSetCrisisStatus</i> cf. actor documentation	
Test Sent Message	
TSM 1	<b>out:TheActor</b>  sends to system  <b>actCoordinator.outactCoordinator.oeSetCrisisStatus</b> (AdtCrisisID, AetCrisisStatus)
Variables	
V 1	<b>TheActor:icrash.environment.actCoordinator</b> cf. actor documentation
V 2	<b>AdtCrisisID:icrash.concepts.primarytypes.datatypes.dtCrisisID</b> cf. actor documentation
V 3	<b>AetCrisisStatus:icrash.concepts.primarytypes.datatypes.etCrisisStatus</b> cf. actor documentation
V 4	<b>AMessage:lu.uni.lassy.messir.libraries.primitives.ptString</b> cf. actor documentation
Constraints	
C 1	TheActor is the coordinator actor related to a coordinator in the system's state having steve as login value
C 2	AdtCrisisID

*continues in next page ...*

... **Test Step table continuation**

C 3	AetCrisisStatus
C 4	AMessage
<b>Oracle Constraints</b>	
OC 1	

The listing 6.17 provides the **Messip** (MCL-oriented) specification of the test step.

```
1
2 variables{
3   TheActor : actCoordinator
4   AdtCrisisID : dtCrisisID
5   AetCrisisStatus : etCrisisStatus
6 }
7
8 constraints{
9   TheActor=TheSystem.rnactCoordinator
10      ->select(a | a.rnctCoordinator.login.value.eq('steve'))
11      ->any2(true)
12 }
13
14 oracle{
15   variables{
16     AMessage:ptString
17   }
18   constraints{
19     AMessage = 'The crisis status has been updated !'
20     TheActor.inactAuthenticated.ieMessage(AMessage)
21   }
22 }
```

Listing 6.17: **Messip** (MCL-oriented) specification of the test step *testcase01-ts17oeSetCrisisStatus*.

6.1.1.18 **testcase01-ts18oeReportOnCrisis-actCoordinator.outactCoordinator.oeReportOnCrisis**

The `testcase01-ts18oeReportOnCrisis-actCoordinator.outactCoordinator.oeReportOnCrisis` has the following properties:

TEST STEP	
<i>ts18oeReportOnCrisis</i> cf. actor documentation	
<b>Test Sent Message</b>	
TSM 1	<div>out:TheActor</div> <div>sends to system</div> <div><b>actCoordinator.outactCoordinator.oeReportOnCrisis</b> (AdtCrisisID, AdtComment)</div>
<b>Variables</b>	
V 1	<div>TheActor:icrash.environment.actCoordinator</div> <div>cf. actor documentation</div>
V 2	<div>AdtCrisisID:icrash.concepts.primarytypes.datatypes.dtCrisisID</div>

*continues in next page ...*

**... Test Step table continuation**

V 3	cf. actor documentation <b>AdtComment:icrash.concepts.primarytypes.datatypes.dtComment</b>
V 4	cf. actor documentation <b>AMessage:lu.uni.lassy.messir.libraries.primitives.ptString</b> cf. actor documentation
<b>Constraints</b>	
C 1	TheActor is the coordinator actor related to a coordinator in the system's state having steve as login value
C 2	AdtCrisisID
C 3	AdtComment
C 4	AMessage
<b>Oracle Constraints</b>	
OC 1	

The listing 6.18 provides the **Messir** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actCoordinator
4   AdtCrisisID : dtCrisisID
5   AdtComment : dtComment
6 }
7
8 constraints{
9   TheActor=TheSystem.rnactCoordinator
10      ->select(a | a.rnctCoordinator.login.value.eq('steve'))
11      ->any2(true)
12 }
13
14 oracle{
15   variables{
16     AMessage:ptString
17   }
18   constraints{
19     AMessage = 'The crisis comment has been updated !'
20     TheActor.inactAuthenticated.ieMessage(AMessage)
21   }
22 }
```

Listing 6.18: **Messir** (MCL-oriented) specification of the test step *testcase01-ts18oeReportOnCrisis*.

**6.1.1.19 testcase01-ts19oeCloseCrisis-actCoordinator.outactCoordinator.oeCloseCrisis**

The *testcase01-ts19oeCloseCrisis-actCoordinator.outactCoordinator.oeCloseCrisis* has the following properties:

TEST STEP
<i>ts19oeCloseCrisis</i> cf. actor documentation
<i>Test Sent Message</i>

*continues in next page ...*

**... Test Step table continuation**

TSM 1	<b>out:TheActor</b>  sends to system  <b>actCoordinator.outactCoordinator.oeCloseCrisis (AdtCrisisID)</b>
<b>Variables</b>	
V 1	<b>TheActor:icrash.environment.actCoordinator</b> cf. actor documentation
V 2	<b>AdtCrisisID:icrash.concepts.primarytypes.datatypes.dtCrisisID</b> cf. actor documentation
V 3	<b>AMessage:lu.uni.lassy.messir.libraries.primitives.ptString</b> cf. actor documentation
<b>Constraints</b>	
C 1	TheActor is the coordinator actor related to a coordinator in the system's state having steve as login value
C 2	AdtCrisisID
C 3	AMessage
<b>Oracle Constraints</b>	
OC 1	

The listing 6.19 provides the **Messirp** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actCoordinator
4   AdtCrisisID : dtCrisisID
5 }
6
7 constraints{
8   TheActor=TheSystem.rnactCoordinator
9     ->select (a | a.rnactCoordinator.login.value.eq('steve'))
10    ->any2(true)
11 }
12
13 oracle{
14   variables{
15     AMessage:ptString
16   }
17   constraints{
18     AMessage = 'The crisis is now closed !'
19     TheActor.inactAuthenticated.ieMessage(AMessage)
20   }
21 }

```

Listing 6.19: **Messirp** (MCL-oriented) specification of the test step *testcase01-ts19oeCloseCrisis*.

### 6.1.2 Test Case Instance - instance01

### 6.1.3 Test Case Instance - instance01Part01

Figure 6.1 Sequence diagram representing the first part of a simple and complete testcase instance for *iCrash*.

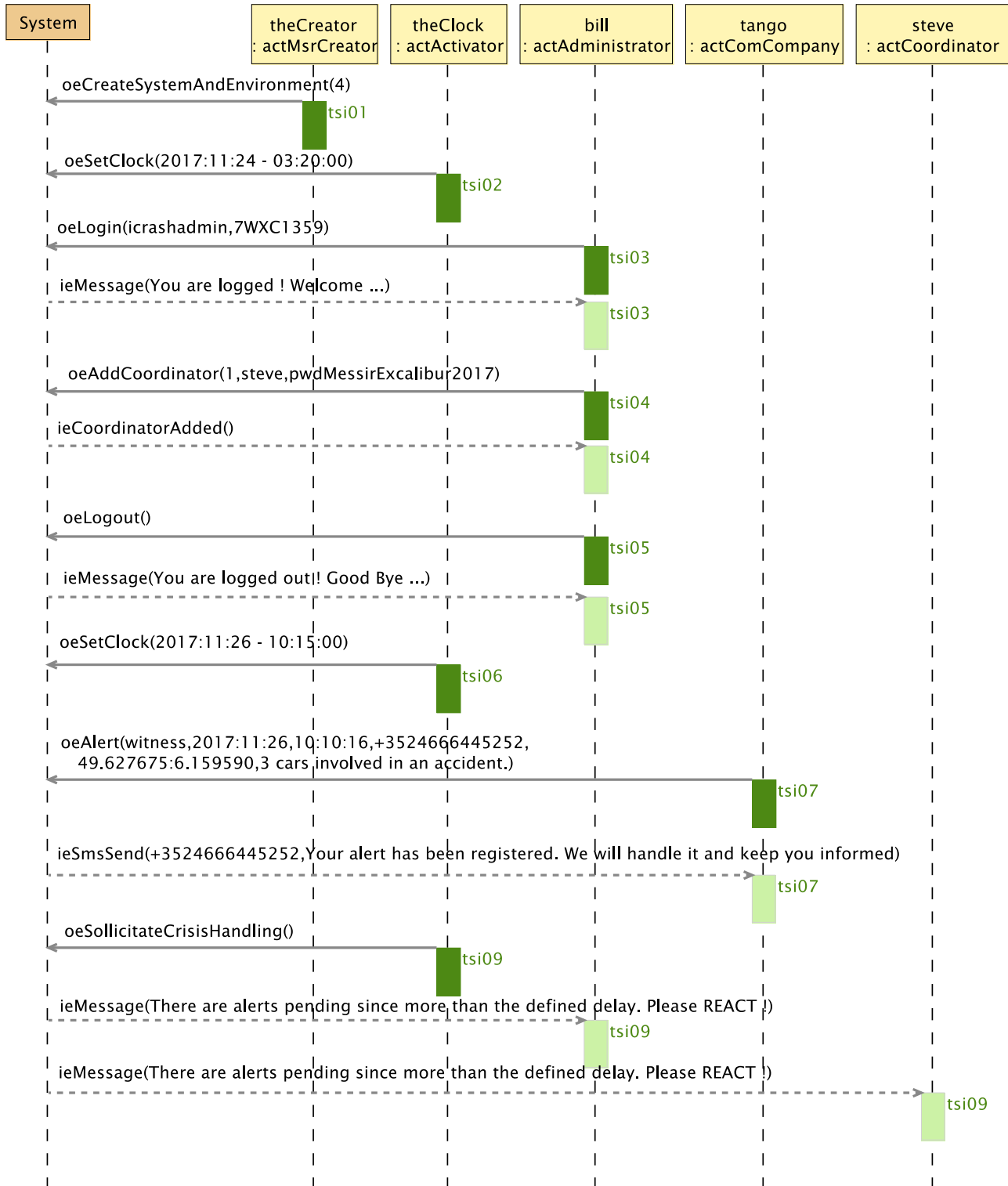


Figure 6.1: tci-testcase01-instance01-Part01 testcase instance sequence diagram



#### 6.1.4 Test Case Instance - instance01Part02

Figure 6.2 Sequence diagram representing the second part of a simple and complete testcase instance for *iCrash*.

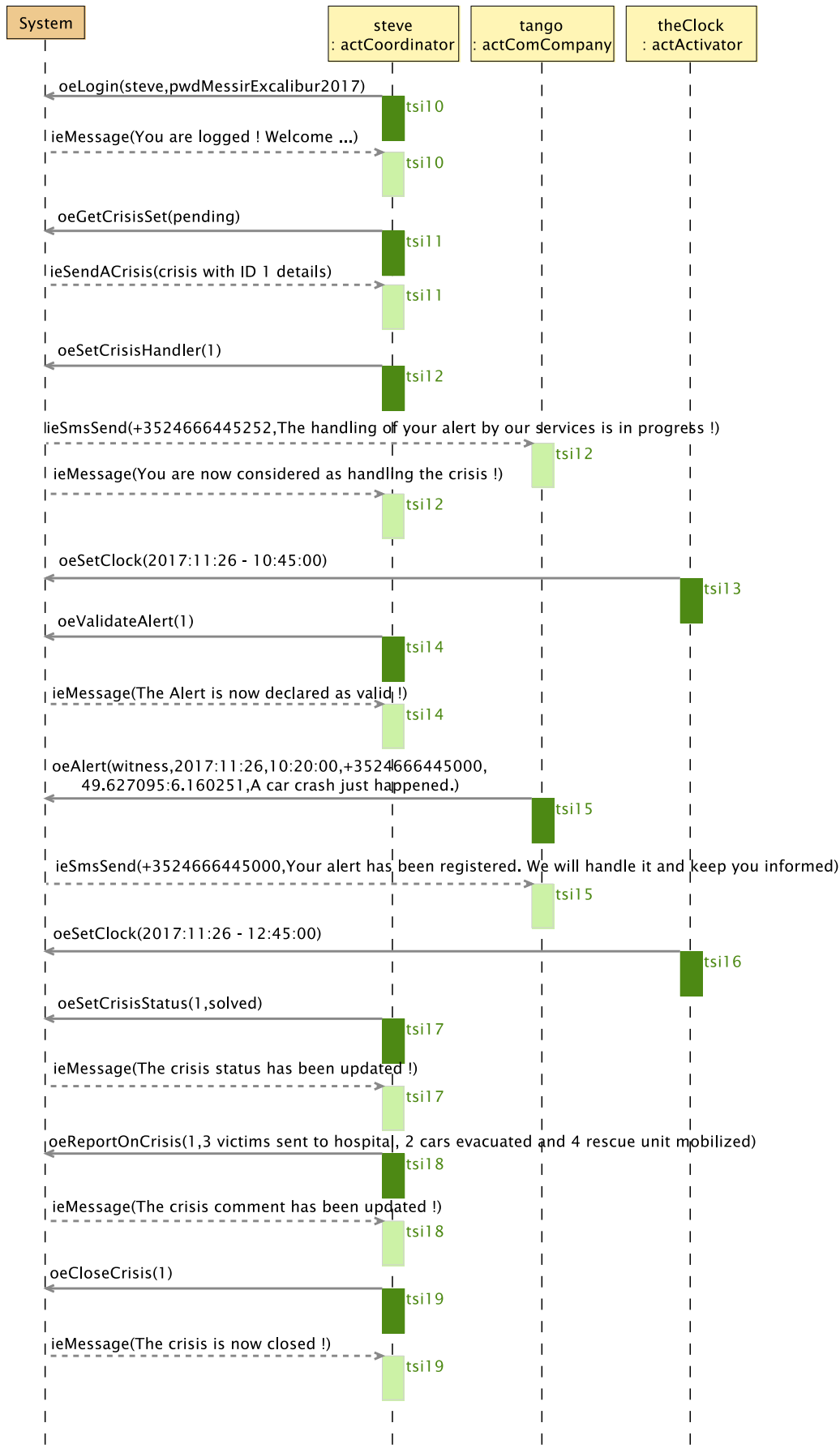


Figure 6.2: tci-testcase01-instance01-Part02 testcase instance sequence diagram



# Chapter 7

## Additional Constraints

### 7.1 Quality Constraints

Description of all the constraints that concern the required quality criteria according to their ISO definition [3].

#### 7.1.1 Functional suitability

Constraints on the degree to which the product provides functions that meet stated and implied needs when the product is used under specified conditions.

##### 7.1.1.1 Functional completeness

List of requirements on the degree to which the set of functions covers all the specified tasks and user objectives.

1. (to be filled)

##### 7.1.1.2 Functional correctness

List of requirements on the degree to which the set of functions covers all the specified tasks and user objectives.

1. (to be filled)

##### 7.1.1.3 Functional appropriateness

List of requirements on the degree to which the functions facilitate the accomplishment of specified tasks and objectives.

1. (to be filled)

#### 7.1.2 Performance efficiency

Constraints on the performance relative to the amount of resources used under stated conditions

##### 7.1.2.1 Time behaviour

List of requirements on the degree to which the response and processing times and throughput rates of a product or system, when performing its functions, meet requirements.

1. (to be filled)

#### **7.1.2.2 Resource utilization**

List of requirements on the degree to which the amounts and types of resources used by a product or system, when performing its functions, meet requirements.

1. (to be filled)

#### **7.1.2.3 Capacity**

List of requirements on the degree to which the maximum limits of a product or system parameter meet requirements.

1. (to be filled)

### **7.1.3 Compatibility**

Constraints on the degree to which a product, system or component can exchange information with other products, systems or components, and/or perform its required functions, while sharing the same hardware or software environment.

#### **7.1.3.1 Co-existence**

List of requirements on the degree to which a product can perform its required functions efficiently while sharing a common environment and resources with other products, without detrimental impact on any other product.

1. (to be filled)

#### **7.1.3.2 Interoperability**

List of requirements on the degree to which two or more systems, products or components can exchange information and use the information that has been exchanged.

1. (to be filled)

### **7.1.4 Usability**

Constraints on the usability degree to which a product or system can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.

#### **7.1.4.1 Appropriateness recognizability**

List of requirements on the degree to which users can recognize whether a product or system is appropriate for their needs.

1. (to be filled)

#### **7.1.4.2 Learnability**

List of requirements on the degree to which a product or system can be used by specified users to achieve specified goals of learning to use the product or system with effectiveness, efficiency, freedom from risk and satisfaction in a specified context of use.

1. (to be filled)

**7.1.4.3 Operability**

List of requirements on the degree to which a product or system has attributes that make it easy to operate and control.

1. (to be filled)

**7.1.4.4 User error protection**

List of requirements on the degree to which a system protects users against making errors.

1. (to be filled)

**7.1.4.5 User interface aesthetics**

List of requirements on the degree to which a user interface enables pleasing and satisfying interaction for the user.

1. (to be filled)

**7.1.4.6 Accessibility**

List of requirements on the degree to which a product or system can be used by people with the widest range of characteristics and capabilities to achieve a specified goal in a specified context of use.

1. (to be filled)

**7.1.5 Reliability**

Constraints on the degree to which a system, product or component performs specified functions under specified conditions for a specified period of time.

**7.1.5.1 Maturity**

List of requirements on the degree to which a system, product or component meets needs for reliability under normal operation.

1. (to be filled)

**7.1.5.2 Availability**

List of requirements on the degree to which a system, product or component is operational and accessible when required for use.

1. (to be filled)

**7.1.5.3 Fault tolerance**

List of requirements on the degree to which a system, product or component operates as intended despite the presence of hardware or software faults.

1. (to be filled)

#### **7.1.5.4 Recoverability**

List of requirements on the degree to which, in the event of an interruption or a failure, a product or system can recover the data directly affected and re-establish the desired state of the system.

1. (to be filled)

#### **7.1.6 Security**

Contraints on the degree to which a product or system protects information and data so that persons or other products or systems have the degree of data access appropriate to their types and levels of authorization.

##### **7.1.6.1 Confidentiality**

List of requirements on the degree to which a product or system ensures that data are accessible only to those authorized to have access.

1. (to be filled)

##### **7.1.6.2 Integrity**

List of requirements on the degree to which a system, product or component prevents unauthorized access to, or modification of, computer programs or data.

1. (to be filled)

##### **7.1.6.3 Non-repudiation**

List of requirements on the degree to which actions or events can be proven to have taken place, so that the events or actions cannot be repudiated later.

1. (to be filled)

##### **7.1.6.4 Accountability**

List of requirements on the degree to which the actions of an entity can be traced uniquely to the entity.

1. (to be filled)

##### **7.1.6.5 Authenticity**

List of requirements on the degree to which the identity of a subject or resource can be proved to be the one claimed.

1. (to be filled)

#### **7.1.7 Maintainability**

Contraints on the degree of effectiveness and efficiency with which a product or system can be modified by the intended maintainers.

**7.1.7.1 Modularity**

List of requirements on the degree to which a system or computer program is composed of discrete components such that a change to one component has minimal impact on other components.

1. (to be filled)

**7.1.7.2 Reusability**

List of requirements on the degree to which an asset can be used in more than one system, or in building other assets.

1. (to be filled)

**7.1.7.3 Analysability**

List of requirements on the degree of effectiveness and efficiency with which it is possible to assess the impact on a product or system of an intended change to one or more of its parts, or to diagnose a product for deficiencies or causes of failures, or to identify parts to be modified.

1. (to be filled)

**7.1.7.4 Modifiability**

List of requirements on the degree to which a product or system can be effectively and efficiently modified without introducing defects or degrading existing product quality.

1. (to be filled)

**7.1.7.5 Testability**

List of requirements on the degree of effectiveness and efficiency with which test criteria can be established for a system, product or component and tests can be performed to determine whether those criteria have been met.

1. (to be filled)

**7.1.8 Portability**

Constraints on the degree of effectiveness and efficiency with which a system, product or component can be transferred from one hardware, software or other operational or usage environment to another.

**7.1.8.1 Adaptability**

List of requirements on the degree to which a product or system can effectively and efficiently be adapted for different or evolving hardware, software or other operational or usage environments.

1. (to be filled)

**7.1.8.2 Installability**

List of requirements on the degree of effectiveness and efficiency with which a product or system can be successfully installed and/or uninstalled in a specified environment.

1. (to be filled)



### 7.1.8.3 Replaceability

List of requirements on the degree to which a product can replace another specified software product for the same purpose in the same environment.

1. (to be filled)

## 7.2 Other Constraints

Any other unclassified constraints judged as required for the product under development.

## Appendix A

# Undocumented Messir Specification Elements

### A.1 Undocumented Use Case Instances

#### A.1.1 Undocumented User-Goal Level Use Case Instances

- usecases.uciugSecurelyUseSystem.uciugSecurelyUseSystem

#### A.1.2 Undocumented Use Case Instance Views

- uci-uciugSecurelyUseSystem

### A.2 Undocumented Concept Model Views

- cm-pt-dt-lv-02-dtGPSLocation

### A.3 Undocumented Test-Case Instance Specifications

- lu.uni.lassy.excalibur.examples.icrash.tests.testcase01.instance01.instance01
- lu.uni.lassy.excalibur.examples.icrash.tests.testcase01.instance01.instance01Part01
- lu.uni.lassy.excalibur.examples.icrash.tests.testcase01.instance01.instance01Part02



## Appendix B

Specification project  
lu.uni.lassy.excalibur.examples.icrash

## B.1 Use Cases Model

This section contains the use cases elicited during the requirements elicitation phase. The use cases are textually described as suggested by the **Messing** method and inspired by the standard Cokburn template [2].

### B.1.1 Use Cases

#### B.1.1.1 subfunction-oeCloseCrisis

the actCoordinator’s goal is to declare a crisis as closed.

USE-CASE DESCRIPTION	
<i>Name</i>	oeCloseCrisis
<i>Scope</i>	system
<i>Level</i>	subfunction
<i>Primary actor(s)</i>	
1	actCoordinator[active]
<i>Goal(s) description</i>	
the actCoordinator’s goal is to declare a crisis as closed.	
<i>Protocol condition(s)</i>	
1	
<i>Pre-condition(s)</i>	
1	
<i>Main post-condition(s)</i>	
1	
<i>Additional Information</i>	
none	

Figure B.1 shows the use case diagram for the oeCloseCrisis subfunction use case

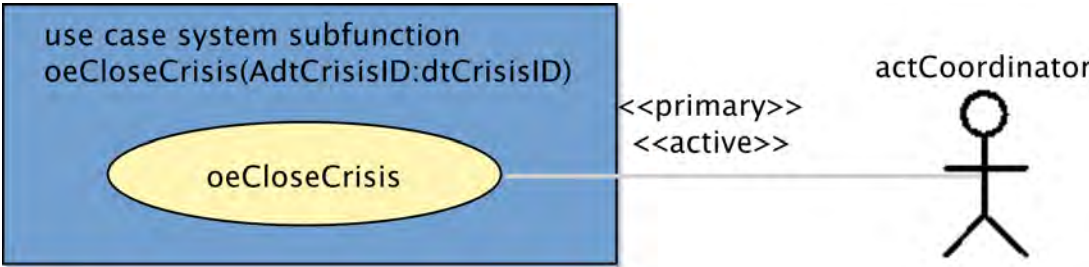


Figure B.1: oeCloseCrisis subfunction use case

# Appendix C

## Messir Specification Files Listing

### C.1 File ./src-gen/messir-spec/.views.msr

```
1 //
2 //DON'T TOUCH THIS FILE !!!
3 //
4 package uuid7e0d382938204f3c9036c123484468fb {
5   Concept Model {}
6 }
```

Listing C.1: Messir Spec. file .views.msr.

### C.2 File ./src-gen/messir-spec/operations/concepts/secondarytypes-datatypes/dtSMS.msr

```
1 package icrash.operations.concepts.secondarytypes.datatypes.dtSMS{
2
3   import lu.uni.lassy.messir.libraries.primitives
4   import lu.uni.lassy.messir.libraries.calendar
5   import lu.uni.lassy.messir.libraries.math
6
7   import icrash.concepts.primarytypes.datatypes
8   import icrash.concepts.primarytypes.classes
9   import icrash.concepts.secondarytypes.datatypes
10  import icrash.concepts.secondarytypes.classes
11
12  Operation Model {
13    operation: icrash.concepts.secondarytypes.datatypes.dtSMS.is():ptBoolean{
14      postF{
15        let TheResult: ptBoolean in
16        let MaxLength: ptInteger in
17        ( if
18          ( MaxLength = 160
19            and AdtValue.value.length().leq(MaxLength)
20          )
21          then (TheResult = true)
22          else (TheResult = false)
23        endif
24        result = TheResult
25      )}
26    prolog{ "src/Operations/Concepts/SecondaryTypesDatatypes/SecondaryTypesDatatypes-dtSMS-is.pl"}
27  }
28 }
29 }
```

Listing C.2: Messir Spec. file dtSMS.msr.

### C.3 File ./src-gen/messir-spec/operations/environment/environment-actActivator-oeSetClock.msr

```

1 package icrash.operations.environment.actActivator.oeSetClock {
2
3 import icrash.environment
4
5 import lu.uni.lassy.messir.libraries.primitives
6 import lu.uni.lassy.messir.libraries.calendar
7 import lu.uni.lassy.messir.libraries.math
8
9 import icrash.concepts.primarytypes.datatypes
10 import icrash.concepts.primarytypes.classes
11
12 Operation Model {
13
14 operation: actActivator.outactActivator.oeSetClock(AcurrentClock:dtDateAndTime):ptBoolean
15 {
16 preP{
17 let TheSystem: ctState in
18 let AvpStarted: ptBoolean in
19
20 /* PreP01 */
21 self.rnActor.rnSystem = TheSystem
22 and self.rnActor.rnSystem.vpStarted = AvpStarted
23 and AvpStarted = true
24 and TheSystem.clock.lt(AcurrentClock)
25 }
26 preF{true}
27
28 postF{
29 let TheSystem: ctState in
30 self.rnActor.rnSystem = TheSystem
31
32 /* PostF01 */
33 and TheSystem@post.clock = AcurrentClock
34 }
35 postP{true}
36
37 prolog{"src/Operations/Environment/OUT/outactActivator-oeSetClock.pl"}
38
39 }
40 }
41 }

```

Listing C.3: Messir Spec. file environment-actActivator-oeSetClock.msr.

### C.4 File ./src-gen/messir-spec/operations/environment/environment-actActivator-oeSollicitateCrisisHandling.msr

```

1 package icrash.operations.environment.actActivator.oeSollicitateCrisisHandling {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7
8 import icrash.concepts.primarytypes.datatypes
9 import icrash.concepts.primarytypes.classes
10 import icrash.environment
11
12 Operation Model {
13
14 operation: actActivator.outactActivator.oeSollicitateCrisisHandling():ptBoolean
15 {
16 preP{
17 let TheSystem: ctState in

```

```

18 let AvpStarted: ptBoolean in
19 let ColctCrisisToHandle:
20     Bag(ctCrisis) in
21
22 self.rnActor.rnSystem = TheSystem
23
24 /* PreP01 */
25 and TheSystem.vpStarted
26
27 /* PreP02 */
28 and TheSystem.rnctCrisis->select(handlingDelayPassed())
29     = ColctCrisisToHandle
30 and ColctCrisisToHandle->size().geq(1)
31 }
32 preF{true}
33
34 postF{
35     let TheSystem: ctState in
36     let AMessageForCrisisHandlers: dtComment in
37     let ColctCrisisToAllocateIfPossible: Bag(ctCrisis) in
38
39     self.rnActor.rnSystem = TheSystem
40 /* PostF01 */
41 and TheSystem.rnctCrisis->select(maxHandlingDelayPassed())
42     = ColctCrisisToAllocateIfPossible
43 and ColctCrisisToAllocateIfPossible->forall(isAllocatedIfPossible())
44
45 /* PostF02 */
46 and TheSystem.rnctCrisis->select(handlingDelayPassed())
47     = ColctCrisisToHandle
48
49 and ColctCrisisToHandle->msrColSubtract(ColctCrisisToAllocateIfPossible)
50     = ColctCrisisToRemind
51
52 and if (ColctCrisisToRemind->size().geq(1))
53     then (AMessageForCrisisHandlers.value
54         ='There are alerts pending since more than the defined delay. Please REACT !'
55         and TheSystem.rnactAdministrator.
56             rnInterfaceIN^ieMessage(AMessageForCrisisHandlers)
57             and TheSystem.rnactCoordinator
58                 ->forall(rnInterfaceIN^ieMessage(AMessageForCrisisHandlers))
59         )
60     else true
61 endif
62 }
63 postP{
64     let TheSystem: ctState in
65     let TheClock: dtDateAndTime in
66
67     self.rnActor.rnSystem = TheSystem
68     and TheSystem.clock = TheClock
69     and TheSystem@post.vpLastReminder = TheClock
70 }
71
72 prolog{"src/Operations/Environment/OUT/outactActivator-oeSollicitateCrisisHandling.pl"}
73 }
74 }
75 }

```

Listing C.4: Messir Spec. file environment-actActivator-oeSollicitateCrisisHandling.msr.

## C.5 File ./src-gen/messir-spec/operations/environment/environment-actAdministrator-oeAddCoordinator.msr

```

1 package icrash.operations.environment.actAdministrator.oeAddCoordinator {
2
3 import lu.uni.lassy.messir.libraries.primitives
4

```



```

5 import icrash.concepts.primarytypes.datatypes
6 import icrash.concepts.primarytypes.classes
7 import icrash.environment
8
9 Operation Model {
10
11 operation: actAdministrator.outactAdministrator.oeAddCoordinator(AdtCoordinatorID:dtCoordinatorID,
    AdtLogin:dtLogin, AdtPassword:dtPassword):ptBoolean
12 {
13 preP{
14 let TheSystem: ctState in
15 let TheActor:actAdministrator in
16
17 self.rnActor.rnSystem = TheSystem
18 and self.rnActor = TheActor
19
20 /* PreP01 */
21 and TheSystem.vpStarted = true
22 /* PreP02 */
23 and TheActor.rnctAuthenticated.vpIsLogged = true
24 }
25 preF{
26 let TheSystem: ctState in
27 let TheActor:actAdministrator in
28 let ColctCoordinators:Bag(ctCoordinator) in
29
30 self.rnActor.rnSystem = TheSystem
31 and self.rnActor = TheActor
32 /* PreF01 */
33 and TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
34   = ColctCoordinators
35 and ColctCoordinators->isEmpty() = true
36 }
37 postF{
38 let TheSystem: ctState in
39 let TheactCoordinator:actCoordinator in
40 let ThectCoordinator:ctCoordinator in
41 self.rnActor.rnSystem = TheSystem
42 and self.rnActor = TheActor
43 /* PostF01 */
44 TheactCoordinator.init()
45 /* PostF02 */
46 and ThectCoordinator.init(AdtCoordinatorID,AdtLogin,AdtPassword)
47
48 /* PostF03 */
49 and TheactCoordinator@post.rnctCoordinator = ThectCoordinator
50
51 /* PostF04 */
52 and ThectCoordinator@post.rnactAuthenticated = TheactCoordinator
53
54 /* PostF05 */
55 and TheActor.rnInterfaceIN^ieCoordinatorAdded()
56 }
57 postP{true}
58
59 prolog{"src/Operations/Environment/OUT/outactAdministrator-oeAddCoordinator.pl"}
60 }
61 }
62 }

```

Listing C.5: Messir Spec. file environment-actAdministrator-oeAddCoordinator.msr.

## C.6 File ./src-gen/messir-spec/operations/environment/environment-actAdministrator-oeDeleteCoordinator.msr

```

1 package icrash.operations.environment.actAdministrator.oeDeleteCoordinator {
2
3 import lu.uni.lassy.messir.libraries.primitives

```

```

4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.calendar
6
7 import icrash.environment
8
9 import icrash.concepts.primarytypes.datatypes
10 import icrash.concepts.primarytypes.classes
11
12 Operation Model {
13
14 operation: actAdministrator.outactAdministrator.oeDeleteCoordinator(AdtCoordinatorID:dtCoordinatorID
    ):ptBoolean
15 {
16 preP{
17   let TheSystem: ctState in
18   let TheActor:actAdministrator in
19
20   self.rnActor.rnSystem = TheSystem
21   and self.rnActor = TheActor
22
23 /* PreP01 */
24 and TheSystem.vpStarted = true
25 /* PreP02 */
26 and TheActor.rnctAuthenticated.vpIsLogged = true
27 }
28 preF{
29   let TheSystem: ctState in
30   let TheActor:actAdministrator in
31
32   self.rnActor.rnSystem = TheSystem
33   and self.rnActor = TheActor
34 /* PreF01 */
35 TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
36 = ColctCoordinators
37 and ColctCoordinators->size().eq(1)
38 }
39 postF{
40   let TheSystem: ctState in
41   let TheActor:actAdministrator in
42   let ThectCoordinator:ctCoordinator in
43   self.rnActor.rnSystem = TheSystem
44   and self.rnActor = TheActor
45 /* PostF01 */
46 TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
47 = ThectCoordinator
48 and ThectCoordinator.rnactCoordinator->forAll(msrIsKilled)
49 and ThectCoordinator.msrIsKilled
50
51 /* PostF02 */
52 and TheActor.rnInterfaceIN^ieCoordinatorDeleted()
53
54 /* Post Protocol:*/
55 /* PostP01 */
56 and true
57 }
58 postP{true}
59
60 prolog{"src/Operations/Environment/OUT/outactAdministrator-oeDeleteCoordinator.pl"}
61 }
62 }
63 }

```

Listing C.6: Messir Spec. file environment-actAdministrator-oeDeleteCoordinator.msr.

## C.7 File ./src-gen/messir-spec/operations/environment/environment-actAuthenticated.msr

```

1 package icrash.operations.environment.actAuthenticated{

```

```

2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 import icrash.concepts.primarytypes.datatypes
6 import icrash.concepts.primarytypes.classes
7 import icrash.concepts.secondarytypes.datatypes
8 import icrash.concepts.secondarytypes.classes
9 import icrash.environment
10
11 Operation Model {
12
13 operation: actAuthenticated.outactAuthenticated.oeLogin(AdtLogin:dtLogin, AdtPassword:dtPassword):
    ptBoolean
14 {
15 preP{
16 let TheSystem: ctState in
17 let TheActor:actAuthenticated in
18 self.rnActor.rnSystem = TheSystem
19 and self.rnActor = TheActor
20
21 /* PreP01 */
22 and TheSystem.vpStarted = true
23 /* PreP02 */
24 and TheActor.rnctAuthenticated.vpIsLogged = false
25 }
26 preF{
27 /* PreF01 */
28 true
29 }
30 postF{
31 let TheSystem: ctState in
32 let TheactAuthenticated:actAuthenticated in
33
34 let AptStringMessageForTheactAuthenticated: ptString in
35 let AptStringMessageForTheactAdministrator:ptString in
36
37 self.rnActor.rnSystem = TheSystem
38 and self.rnActor = TheactAuthenticated
39
40 and /* PostF01 */
41 if (TheactAuthenticated.rnctAuthenticated.pwd
42     = AdtPassword
43     and TheactAuthenticated.rnctAuthenticated.login
44     = AdtLogin
45     )
46 then (AptStringMessageForTheactAuthenticated.eq('You are logged ! Welcome ...')
47     and TheactAuthenticated.rnInterfaceIN^ieMessage (AptStringMessageForTheactAuthenticated)
48     )
49 else (AptStringMessageForTheactAuthenticated
50     .eq('Wrong identification information ! Please try again ...')
51     and TheactAuthenticated.rnInterfaceIN^ieMessage (AptStringMessageForTheactAuthenticated)
52     and AptStringMessageForTheactAdministrator.eq('Intrusion tentative !')
53     and TheSystem.rnactAdministrator
54     .rnInterfaceIN^ieMessage (AptStringMessageForTheactAdministrator)
55     )
56 endif
57 }
58 postP{
59 let TheSystem: ctState in
60 let TheactAuthenticated:actAuthenticated in
61
62 self.rnActor.rnSystem = TheSystem
63 and self.rnActor = TheactAuthenticated
64 /* PostP01 */
65 if (TheactAuthenticated.rnctAuthenticated.pwd = AdtPassword
66     and TheactAuthenticated.rnctAuthenticated.login = AdtLogin
67     )
68 then (TheactAuthenticated.rnctAuthenticated@post.vpIsLogged = true)
69 else true
70 endif

```

```

71 }
72 prolog{"src/Operations/Environment/OUT/outactAuthenticated-oeLogin.pl"}
73 }
74 /*-----*/
75
76 operation: actAuthenticated.outactAuthenticated.oeLogout():ptBoolean{
77
78 preP{
79   let TheSystem: ctState in
80   let TheActor:actAdministrator in
81   self.rnActor.rnSystem = TheSystem
82   and self.rnActor = TheActor
83
84 /* PreP01 */
85   and TheSystem.vpStarted = true
86 /* PreP02 */
87   and TheActor.rnctAuthenticated.vpIsLogged = true
88 }
89 preF{
90 /* PreF01 */
91 true
92 }
93 postF{
94   let TheSystem: ctState in
95   let TheactAuthenticated:actAuthenticated in
96   let AptStringMessageForTheactAuthenticated: ptString in
97
98   self.rnActor.rnSystem = TheSystem
99   and self.rnActor = TheactAuthenticated
100
101 /* PostF01 */
102 AptStringMessageForTheactAuthenticated.eq('You are logged out ! Good Bye ...')
103   and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
104 }
105 postP{
106   let TheSystem: ctState in
107   let TheactAuthenticated:actAuthenticated in
108
109   self.rnActor.rnSystem = TheSystem
110   and self.rnActor = TheactAuthenticated.asSet
111 /* PostP01 */
112   TheactAuthenticated.rnctAuthenticated@post.vpIsLogged = false
113 }
114 prolog{"src/Operations/Environment/OUT/outactAuthenticated-oeLogout.pl"}
115 }
116 }
117 }

```

Listing C.7: Messir Spec. file environment-actAuthenticated.msr.

## C.8 File ./src-gen/messir-spec/operations/environment/environment-actComCompany.msr

```

1 // Do not add/remove lines because code is inserted in slides
2
3 package icrash.operations.environment.actComCompany{
4
5 import lu.uni.lassy.messir.libraries.primitives
6 import lu.uni.lassy.messir.libraries.calendar
7 import lu.uni.lassy.messir.libraries.math
8
9 import icrash.concepts.primarytypes.datatypes
10 import icrash.concepts.primarytypes.classes
11 import icrash.concepts.secondarytypes.datatypes
12
13 import icrash.environment
14
15 Operation Model {

```

```

16
17 operation: actComCompany.outactComCompany.oeAlert (
18   AetKind:etHumanKind,
19   AdtMyDate:dtDate,
20   AdtTime:dtTime,
21   AdtPhoneNumber:dtPhoneNumber,
22   AdtGPSLocation:dtGPSLocation,
23   AdtComment:dtComment
24 ):ptBoolean{
25
26 preP{
27   let TheSystem: ctState in
28   self.rnActor.rnSystem = TheSystem
29
30 /* PreP01 */
31 and TheSystem.vpStarted = true
32 }
33 preF{
34   let TheSystem: ctState in
35   self.rnActor.rnSystem = TheSystem
36
37 /* PreF01 */
38 and (TheSystem.clock.date.gt(AdtDate)
39       or (TheSystem.clock.date.eq(AdtDate)
40           and TheSystem.clock.time.gt(AdtTime)
41           )
42       )
43 }
44 postF{
45   let TheSystem: ctState in
46
47   let ActHuman:ctHuman in
48   let TheactComCompany:actComCompany in
49   let ActAlert:ctAlert in
50   let AAlertInstant:dtDateAndTime in
51   let AetAlertStatus:etAlertStatus in
52   let ActAlertNearBy:ctAlert in
53   let ActCrisis:ctCrisis in
54   let AdtCrisisID:dtCrisisID in
55   let AetCrisisType:etCrisisType in
56   let AetCrisisStatus:etCrisisStatus in
57   let ACrisisInstant:dtDateAndTime in
58   let ACrisisdtComment:dtComment in
59   let AptStringMessage:ptString in
60   let AdtSMS:dtSMS in
61   let AdtAlertID:dtAlertID in
62
63   self.rnActor.rnSystem = TheSystem
64   and self.rnActor = TheactComCompany
65 /* PostF01 */
66 TheSystem.nextValueForAlertID=PrenextValueForAlertID
67 and PrenextValueForAlertID.add(1) = PostnextValueForAlertID
68 and TheSystem@post.nextValueForAlertID = PostnextValueForAlertID
69
70 /* PostF02 */
71 and AAlertInstant.date=AdtDate
72 and AAlertInstant.time=AdtTime
73
74 and AetAlertStatus=pending
75
76 and TheSystem.nextValueForAlertID.todtString().eq(AdtAlertID)
77
78 and ActAlert.init(AdtAlertID,
79                   AetAlertStatus,
80                   AdtGPSLocation,
81                   AAlertInstant,
82                   AdtComment)
83
84 /* PostF03 */
85 and TheSystem.rnctAlert.select(location.isNearTo(AdtGPSLocation)) = ColctAlertsNearBy

```

```

86 and if (ColctAlertsNearBy->size()==0)
87 then (TheSystem.nextValueForCrisisID = PrenextValueForCrisisID
88 and PrenextValueForCrisisID.add(1) = PostnextValueForCrisisID
89 and TheSystem@post.nextValueForCrisisID = PostnextValueForCrisisID
90 and TheSystem.nextValueForCrisisID.todtString().eq(AdtCrisisID)
91 and AdtCrisisType = small
92 and AetCrisisStatus = pending
93 and ACrisisInstant= AAlertInstant
94 and ACrisisdtComment = 'no reporting yet defined'
95 and ActCrisis.init( AdtCrisisID,
96 AdtCrisisType,
97 AetCrisisStatus,
98 AdtGPSLocation,
99 ACrisisInstant,
100 ACrisisdtComment)
101 )
102 else (ColctAlertsNearBy.rnTheCrisis->msrAny(true) = ActCrisis)
103 endif
104
105 /* PostF04 */
106 and ActAlert@post.rnTheCrisis = ActCrisis
107
108 /* PostF05 */
109 and TheSystem.rnctHuman->select(id.eq(AdtPhoneNumber)) = HumanCol1
110
111 and HumanCol1->select(kind.etEq(AetHumanKind)) = HumanCol2
112 and if (HumanCol2->msrIsEmpty)
113 then (ActHuman.init(AdtPhoneNumber,AetHumanKind)
114 and ActHuman@post.rnactComCompany = TheactComCompany
115 )
116 else (HumanCol2->any(true) = ActHuman)
117 endif
118
119 and ActHuman.rnSignaled->msrIncluding(ActAlert) = ColAlerts
120
121 and ActHuman@post.rnSignaled = ColAlerts
122
123 /* PostF06 */
124 AdtSMS.value = 'Your alert has been registered. We will handle it and keep you informed'
125 and TheactComCompany.rnInterfaceIN^ieSmsSend(AdtPhoneNumber,AdtSMS)
126 }
127 /* Post Protocol:*/
128 /* PostP01 */
129 postP{true}
130
131 prolog("src/Operations/Environment/OUT/outactComCompany-oeAlert.pl")
132 }
133 }
134 }

```

Listing C.8: Messir Spec. file environment-actComCompany.msr.

## C.9 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeCloseCrisis.msr

```

1 package icrash.operations.environment.actCoordinator.oeCloseCrisis {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.environment
9
10 Operation Model {
11
12 operation: actCoordinator.outactCoordinator.oeCloseCrisis(AdtCrisisID:dtCrisisID):ptBoolean{
13 prolog("src/Operations/Environment/OUT/outactCoordinator-oeCloseCrisis.pl")

```

```

14 }
15 }
16 }

```

Listing C.9: Messir Spec. file environment-actCoordinator-oeCloseCrisis.msr.

## C.10 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeGetAlertsSet.msr

```

1 package icrash.operations.environment.actCoordinator.oeGetAlertsSet {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7
8 import icrash.concepts.primarytypes.datatypes
9 import icrash.environment
10
11 Operation Model {
12
13 operation: actCoordinator.outactCoordinator.oeGetAlertsSet (AetAlertStatus:etAlertStatus):ptBoolean{
14 prolog{"src/Operations/Environment/OUT/outactCoordinator-oeGetAlertsSet.pl"}
15 }
16 }
17 }

```

Listing C.10: Messir Spec. file environment-actCoordinator-oeGetAlertsSet.msr.

## C.11 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeGetCrisisSet.msr

```

1 package icrash.operations.environment.actCoordinator.oeGetCrisisSet {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.environment
9
10 Operation Model {
11
12 operation: actCoordinator.outactCoordinator.oeGetCrisisSet (AetCrisisStatus:etCrisisStatus):ptBoolean
13 {
14 prolog{"src/Operations/Environment/OUT/outactCoordinator-oeGetCrisisSet.pl"}
15 }
16 }

```

Listing C.11: Messir Spec. file environment-actCoordinator-oeGetCrisisSet.msr.

## C.12 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeInvalidateAlert.msr

```

1 package icrash.operations.environment.actCoordinator.oeInvalidateAlert {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.environment
9

```

```

10 Operation Model {
11
12 operation: actCoordinator.outactCoordinator.oeInvalidateAlert (AdtAlertID:dtAlertID) :ptBoolean{
13 prolog("src/Operations/Environment/OUT/outactCoordinator-oeInvalidateAlert.pl")
14 }
15 }
16 }

```

Listing C.12: Messir Spec. file environment-actCoordinator-oeInvalidateAlert.msr.

## C.13 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeReportOnCrisis.msr

```

1 package icrash.operations.environment.actCoordinator.oeReportOnCrisis {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.environment
9
10 Operation Model {
11
12 operation: actCoordinator.outactCoordinator.oeReportOnCrisis(AdtCrisisID:dtCrisisID, AdtComment:
    dtComment) :ptBoolean{
13 prolog("src/Operations/Environment/OUT/outactCoordinator-oeReportOnCrisis.pl")
14 }
15
16 }
17 }

```

Listing C.13: Messir Spec. file environment-actCoordinator-oeReportOnCrisis.msr.

## C.14 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeSetCrisisHandler.msr

```

1 package icrash.operations.environment.actCoordinator.oeSetCrisisHandler {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7
8 import icrash.concepts.primarytypes.datatypes
9 import icrash.concepts.primarytypes.classes
10 import icrash.concepts.secondarytypes.datatypes
11 import icrash.environment
12
13 Operation Model {
14
15 operation: actCoordinator.outactCoordinator.oeSetCrisisHandler(AdtCrisisID:dtCrisisID) :ptBoolean{
16 prolog("src/Operations/Environment/OUT/outactCoordinator-oeSetCrisisHandler.pl")
17 }
18
19 }
20 }

```

Listing C.14: Messir Spec. file environment-actCoordinator-oeSetCrisisHandler.msr.

## C.15 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeSetCrisisStatus.msr



```

1 package icrash.operations.environment.actCoordinator.oeSetCrisisStatus {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.environment
9
10 Operation Model {
11
12 operation: actCoordinator.outactCoordinator.oeSetCrisisStatus(AdtCrisisID:dtCrisisID,
    AetCrisisStatus:etCrisisStatus):ptBoolean{
13 prolog{"src/Operations/Environment/OUT/outactCoordinator-oeSetCrisisStatus.pl"}
14 }
15
16 }
17 }

```

Listing C.15: Messir Spec. file environment-actCoordinator-oeSetCrisisStatus.msr.

## C.16 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeSetCrisisType.msr

```

1 package icrash.operations.environment.actCoordinator.oeSetCrisisType {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.environment
9
10 Operation Model {
11
12 operation: actCoordinator.outactCoordinator.oeSetCrisisType(AdtCrisisID:dtCrisisID, AetCrisisType:
    etCrisisType):ptBoolean{
13 prolog{"src/Operations/Environment/OUT/outactCoordinator-oeSetCrisisType.pl"}
14 }
15
16 }
17 }

```

Listing C.16: Messir Spec. file environment-actCoordinator-oeSetCrisisType.msr.

## C.17 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeValidateAlert.msr

```

1 package icrash.operations.environment.actCoordinator.oeValidateAlert {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.environment
9
10 Operation Model {
11
12 operation: actCoordinator.outactCoordinator.oeValidateAlert(AdtAlertID:dtAlertID):ptBoolean{
13 prolog{"src/Operations/Environment/OUT/outactCoordinator-oeValidateAlert.pl"}
14 }
15
16 }
17 }

```

Listing C.17: Messir Spec. file environment-actCoordinator-oeValidateAlert.msr.

## C.18 File ./src-gen/messir-spec/operations/environment/environment-actMsrCreator-init.msr

```

1 package icrash.operations.icrash.environment.actMsrCreator.init {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import icrash.environment
5
6 Operation Model {
7
8 operation: actMsrCreator.init():ptBoolean{}
9 // generic operation provided by the simulator
10 }
11 }

```

Listing C.18: Messir Spec. file environment-actMsrCreator-init.msr.

## C.19 File ./src-gen/messir-spec/operations/environment/environment-actMsrCreator-oeCreateSystemAndEnvironment.msr

```

1 package icrash.operations.environment.actMsrCreator.oeCreateSystemAndEnvironment{
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.calendar
6
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.concepts.primarytypes.classes
9 import icrash.concepts.secondarytypes.datatypes
10 import icrash.concepts.secondarytypes.classes
11 import icrash.environment
12
13 Operation Model {
14
15 operation: actMsrCreator.outactMsrCreator.oeCreateSystemAndEnvironment (AqtyComCompanies:ptInteger) :
    ptBoolean
16 {preP{true}
17 preF{true}
18 postF{
19 let TheSystem: ctState in
20 let AactMsrCreator: actMsrCreator in
21 let AactAdministrator: actAdministrator in
22 let AnextValueForAlertID: dtInteger in
23 let AnextValueForCrisisID: dtInteger in
24 let Aclock: dtDateAndTime in
25 let AcrisisReminderPeriod: dtSecond in
26 let AmaxCrisisReminderPeriod: dtSecond in
27 let AvpStarted: ptBoolean in
28
29 /* PostF01 -- MUST ALWAYS BE MADE FIRST -- */
30 AnextValueForAlertID.value.eq(1)
31 and AnextValueForCrisisID.value.eq(1)
32 and Aclock.date.year.value = 1970
33 and Aclock.date.month.value = 01
34 and Aclock.date.day.value = 01
35 and Aclock.time.hour.value = 00
36 and Aclock.time.minute.value = 00
37 and Aclock.time.second.value = 00
38
39 and AcrisisReminderPeriod.value.eq(300)
40 and AmaxCrisisReminderPeriod.value.eq(1200)
41 and AvpStarted = true
42 and TheSystem.init(AnextValueForAlertID,
43                    AnextValueForCrisisID,
44                    Aclock,
45                    AcrisisReminderPeriod,
46                    AmaxCrisisReminderPeriod,

```



```

34         AdtLogin:dtLogin ,
35         AdtPassword:dtPassword ):ptBoolean
36
37     operation oeDeleteCoordinator(
38         AdtCoordinatorID:dtCoordinatorID ):ptBoolean
39 }
40
41 input interface inactAdministrator{
42
43     operation ieCoordinatorAdded():ptBoolean
44     operation ieCoordinatorDeleted():ptBoolean
45 }
46
47
48 actor actCoordinator
49     role rnactCoordinator
50     cardinality [0..*]
51     extends actAuthenticated(
52
53     operation init():ptBoolean
54
55     output interface outactCoordinator{
56         operation oeInvalidateAlert(AdtAlertID:dtAlertID ):ptBoolean
57         operation oeCloseCrisis(AdtCrisisID:dtCrisisID ):ptBoolean
58         operation oeGetAlertsSet (AetAlertStatus:etAlertStatus ):ptBoolean
59         operation oeGetCrisisSet (AetCrisisStatus:etCrisisStatus ):ptBoolean
60         operation oeSetCrisisHandler(AdtCrisisID:dtCrisisID ):ptBoolean
61         operation oeReportOnCrisis(
62             AdtCrisisID:dtCrisisID ,
63             AdtComment:dtComment
64             ):ptBoolean
65         operation oeSetCrisisStatus(
66             AdtCrisisID:dtCrisisID ,
67             AetCrisisStatus:etCrisisStatus
68             ):ptBoolean
69         operation oeSetCrisisType(
70             AdtCrisisID:dtCrisisID ,
71             AetCrisisType:etCrisisType
72             ):ptBoolean
73         operation oeValidateAlert(AdtAlertID:dtAlertID ):ptBoolean
74     }
75
76     input interface inactCoordinator{
77         operation ieSendAnAlert (ActAlert:ctAlert ):ptBoolean
78         operation ieSendACrisis(ActCrisis:ctCrisis ):ptBoolean
79     }
80 }
81
82 actor actComCompany role rnactComCompany cardinality [0..*]{
83
84     operation init():ptBoolean
85
86     output interface outactComCompany{
87         operation oeAlert(
88             AetHumanKind:etHumanKind ,
89             AdtDate:dtDate ,
90             AdtTime:dtTime ,
91             AdtPhoneNumber:dtPhoneNumber ,
92             AdtGPSLocation:dtGPSLocation ,
93             AdtComment:dtComment
94             ):ptBoolean
95     }
96
97     input interface inactComCompany{
98         operation ieSmsSend(AdtPhoneNumber:dtPhoneNumber ,
99             AdtSMS:dtSMS
100             ):ptBoolean
101     }
102 }
103

```

```

104 actor actAuthenticated role rnactAuthenticated cardinality [0..*]{
105
106   operation init():ptBoolean
107
108   output interface outactAuthenticated{
109     operation oeLogin(AdtLogin:dtLogin , AdtPassword:dtPassword ):ptBoolean
110     operation oeLogout():ptBoolean
111   }
112
113   input interface inactAuthenticated{
114     operation ieMessage(AMessage:ptString):ptBoolean
115   }
116 }
117
118 actor actActivator[proactive] role rnactActivator cardinality [1..1]{
119
120   operation init():ptBoolean
121
122   output interface outactActivator{
123     proactive operation oeSolicitCrisisHandling():ptBoolean
124     proactive operation oeSetClock(AcurrentClock:dtDateAndTime ):ptBoolean
125   }
126
127   input interface inactActivator{
128   }
129 }
130 }
131 }

```

Listing C.20: Messir Spec. file environment.msr.

## C.21 File `./src-gen/messir-spec/concepts/primarytypes-associations.msr`

```

1 package icrash.concepts.primarytypes.associations {
2
3   import icrash.concepts.primarytypes.datatypes
4   import icrash.concepts.primarytypes.classes
5   import icrash.environment
6   import lu.uni.lassy.messir.libraries.primitives
7
8   Concept Model {
9
10    Primary Types{
11
12    // Internal
13
14    association assctAlertctCrisis
15    ctAlert(rnAlerts)[1..*]
16    ctCrisis (rnTheCrisis)[1..1]
17
18    association assctAlertctHuman
19    ctAlert(rnSignaled)[1..*]
20    ctHuman (rnSignaler)[1..1]
21
22    association assctCrisisctCoordinator
23    ctCrisis(rnHandled)[0..*]
24    ctCoordinator(rnHandler)[0..1]
25
26    // With Actors
27
28    association assctHumanactComCompany
29    ctHuman(rnctHuman)[0..*]
30    actComCompany(rnactComCompany)[1..1]
31
32    association assctCoordinatoractCoordinator
33    ctCoordinator(rnctCoordinator)[1..1]
34    actCoordinator(rnactCoordinator)[1..1]

```

```

35
36 association assctAuthenticatedactAuthenticated
37     ctAuthenticated(rnctAuthenticated) [1..1]
38     actAuthenticated(rnactAuthenticated) [1..1]
39
40 }
41 }
42 }

```

Listing C.21: Messir Spec. file primarytypes-associations.msr.

## C.22 File ./src-gen/messir-spec/operations/concepts/primarytypes-classes/primarytypes-classes-ctAdministrator.msr

```

1 package icrash.operations.concepts.primarytypes.classes.ctAdministrator{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 import icrash.concepts.primarytypes.datatypes
6 import icrash.concepts.primarytypes.classes
7
8 Operation Model {
9
10 operation: icrash.concepts.primarytypes.classes.ctAdministrator.init(
11   Alogin:dtLogin ,
12   Apwd:dtPassword
13   ):ptBoolean{
14 postF{
15 if
16 (
17 let Self:ctAdministrator in
18 /* Post F01 */
19 Self.login(Alogin)
20 and Self.pwd = Apwd
21 and Self.vpIsLogged = false
22
23 /* Post F02 */
24 and (Self.oclIsNew and self = Self)
25 )
26 then (result = true)
27 else (result = false)
28 endif
29 }
30 prolog{ "src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctAdministrator-init.pl"}
31 }
32 }
33 }

```

Listing C.22: Messir Spec. file primarytypes-classes-ctAdministrator.msr.

## C.23 File ./src-gen/messir-spec/operations/concepts/primarytypes-classes/primarytypes-classes-ctAlert.msr

```

1 package icrash.operations.concepts.primarytypes.classes.ctAlert{
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.calendar
5
6 import icrash.concepts.primarytypes.datatypes
7 import icrash.concepts.primarytypes.classes
8
9 import icrash.environment
10
11 Operation Model {
12

```

```

13 operation: icrash.concepts.primarytypes.classes.ctAlert.init (Aid:dtAlertID , Astatus:etAlertStatus ,
    Allocation:dtGPSLocation , Ainstant:dtDateAndTime , Acomment:dtComment
14 ):ptBoolean{
15 postF{
16 if
17 (
18 /* Post F01 */
19 let Self:ctAlert in
20 Self.id = Aid
21 and Self.status = Astatus
22 and Self.location = Allocation
23 and Self.instant = Ainstant
24 and Self.comment = Acomment
25 /* Post F02 */
26 and (Self.ocllsNew and self = Self)
27 )
28 then (result = true)
29 else (result = false)
30 endif
31 }
32 prolog {"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctAlert-init.pl"}
33 }
34
35 operation: icrash.concepts.primarytypes.classes.ctAlert.isSentToCoordinator (AactCoordinator:
    actCoordinator ):ptBoolean
36 {
37 postF{
38 if
39 (
40 /* Post F01 */
41 AactCoordinator.rnInterfaceIN.ieSendAnAlert (self)
42 )
43 then (result = true)
44 else (result = false)
45 endif
46 }
47 prolog {"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctAlert-isSentToCoordinator.
    pl"}
48
49 }
50 }
51 }

```

Listing C.23: Messir Spec. file primarytypes-classes-ctAlert.msr.

## C.24 File ./src-gen/messir-spec/operations/concepts/primarytypes-classes/primarytypes-classes-ctAuthenticated.msr

```

1 package icrash.operations.concepts.primarytypes.classes.ctAuthenticated {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import icrash.concepts.primarytypes.datatypes
5 import icrash.concepts.primarytypes.classes
6
7 Operation Model {
8
9 operation: icrash.concepts.primarytypes.classes.ctAuthenticated.init (Alogin:dtLogin, Apwd:dtPassword
    ):ptBoolean{
10 prolog {"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctAuthenticated-init.pl"}
11 }
12 }
13
14 }

```

Listing C.24: Messir Spec. file primarytypes-classes-ctAuthenticated.msr.

## C.25 File ./src-gen/messir-spec/operations/concepts/primarytypes-classes/primarytypes-classes-ctCoordinator.msr

```

1 package icrash.operations.concepts.primarytypes.classes.ctCoordinator.init {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import icrash.concepts.primarytypes.datatypes
5 import icrash.concepts.primarytypes.classes
6
7 Operation Model {
8
9 operation: icrash.concepts.primarytypes.classes.ctCoordinator.init (Aid:dtCoordinatorID, Alogin:
    dtLogin, Apwd:dtPassword):ptBoolean
10 {
11 postF{
12 if
13 (
14 /* Post F01 */
15 let Self:ctCoordinator in
16 Self.id = Aid
17 and Self.login = Alogin
18 and Self.pwd = Apwd
19 and Self.vpIsLogged = false
20 /* Post F02 */
21 and (Self.ocIsNew and self = Self)
22 )
23 then (result = true)
24 else (result = false)
25 endif}
26 prolog("src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctCoordinator-init.pl")
27 }
28 }
29 }

```

Listing C.25: Messir Spec. file primarytypes-classes-ctCoordinator.msr.

## C.26 File ./src-gen/messir-spec/operations/concepts/primarytypes-classes/primarytypes-classes-ctCrisis.msr

```

1 package icrash.operations.concepts.primarytypes.classes.ctCrisis {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.calendar
6
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.concepts.primarytypes.classes
9 import icrash.concepts.secondarytypes.datatypes
10 import icrash.concepts.secondarytypes.classes
11 import lu.uni.lassy.messir.libraries.primitives
12
13 import icrash.environment
14
15 Operation Model {
16 //-----
17 operation: icrash.concepts.primarytypes.classes.ctCrisis.init (
18     Aid:dtCrisisID,
19     Atype:etCrisisType,
20     Astatus:etCrisisStatus,
21     Alocation:dtGPSLocation,
22     Ainstant:dtDateAndTime,
23     Acomment:dtComment
24     ):ptBoolean{
25 postF{
26 if
27 (

```



```

28 /* Post F01 */
29 let Self:ctCrisis in
30 Self.id = Aid
31 and Self.type = Atype
32 and Self.status = Astatus
33 and Self.location = Alocation
34 and Self.instant = Ainstant
35 and Self.comment = Acomment
36 /* Post F02 */
37 and (Self.ocllsNew and self = Self)
38 )
39 then (result = true)
40 else (result = false)
41 endif}
42 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctCrisis-init.pl"}}
43 //-----
44 operation: icrash.concepts.primarytypes.classes.ctCrisis.handlingDelayPassed():ptBoolean
45 {
46 postF{
47 let TheSystem:ctState in
48 let CurrentClockSecondsQty:dtInteger in
49 let vpLastReminderSecondsQty:dtInteger in
50 let CrisisReminderPeriod:dtSecond in
51 if
52 ( /* Post F01 */
53 self.rnSystem = TheSystem
54 and self.status = pending
55 and TheSystem.clock.toSecondsQty() = CurrentClockSecondsQty
56 and TheSystem.vpLastReminder.toSecondsQty() = vpLastReminderSecondsQty
57 and TheSystem.crisisReminderPeriod = CrisisReminderPeriod
58 and CurrentClockSecondsQty.sub(vpLastReminderSecondsQty).gt(CrisisReminderPeriod) = true
59 )
60 then (result = true)
61 else (result = false)
62 endif
63 }
64 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctCrisis-handlingDelayPassed
        .pl"}}
65 //-----
66 operation: icrash.concepts.primarytypes.classes.ctCrisis.maxHandlingDelayPassed():ptBoolean
67 {
68 postF{
69 let TheSystem:ctState in
70 let CurrentClockSecondsQty:dtInteger in
71 let CrisisInstantSecondsQty:dtInteger in
72 let MaxCrisisReminderPeriod:dtSecond in
73 if
74 ( /* Post F01 */
75 self.rnSystem = TheSystem
76 and self.status = pending
77 and TheSystem.clock.toSecondsQty() = CurrentClockSecondsQty
78 and Self.instant.toSecondsQty() = CrisisInstantSecondsQty
79 and TheSystem.maxCrisisReminderPeriod = MaxCrisisReminderPeriod
80 and CurrentClockSecondsQty.sub(CrisisInstantSecondsQty)
81     .gt(MaxCrisisReminderPeriod)
82 )
83 then (result = true)
84 else (result = false)
85 endif
86 }
87 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctCrisis-
        maxHandlingDelayPassed.pl"}}
88 //-----
89 operation: icrash.concepts.primarytypes.classes.ctCrisis.isSentToCoordinator(AactCoordinator:
        actCoordinator):ptBoolean
90 {
91 postF{
92 if
93 (
94 /* Post F01 */

```

```

95 AactCoordinator.rnInterfaceIN.ieSendACrisis(self)
96 )
97 then (result = true)
98 else (result = false)
99 endif}
100 prolog("src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctCrisis-isSentToCoordinator
    .pl" }}
101 //-----
102 operation: icrash.concepts.primarytypes.classes.ctCrisis.isAllocatedIfPossible():ptBoolean
103 {
104 postF{
105 if (
106 /* Post F01 */
107 self.maxHandlingDelayPassed()
108 and
109 if (TheSystem.rnactCoordinator->msrIsEmpty = false)
110 then (
111 /* Post F02 */
112 TheSystem.rnactCoordinator->msrAny(true) = TheCoordinatorActor
113 and TheCoordinatorActor.rnctCoordinator = TheCoordinator
114 and self@post.rnHandler = TheCoordinator
115 and self@post.status = handled
116 and self.id.value = TheCrisisIDptString
117 and 'You are now considered as handling the crisis having ID: '
118 .ptStringConcat(TheCrisisIDptString) = TheMessage
119 and TheCoordinatorActor.rnInterfaceIN^ieMessage(TheMessage)
120 )
121 else ( /* Post F03 */
122 TheSystem.rnactAdministrator
123 ->forAll(rnInterfaceIN.ieMessage('Please add new coordinators to handle pending crisis !'))
124 )
125 endif
126 )
127 then (result = true)
128 else (result = false)
129 endif
130 }
131 prolog("src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctCrisis-
    isAllocatedIfPossible.pl" }
132 }
133 }
134 }

```

Listing C.26: Messir Spec. file primarytypes-classes-ctCrisis.msr.

## C.27 File ./src-gen/messir-spec/operations/concepts/primarytypes-classes/primarytypes-classes-ctHuman.msr

```

1 package icrash.operations.concepts.primarytypes.classes.ctHuman.init {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import icrash.concepts.primarytypes.datatypes
5
6 import icrash.concepts.primarytypes.classes
7
8 Operation Model {
9
10 operation: icrash.concepts.primarytypes.classes.ctHuman.init(Aid:dtPhoneNumber, Akind:etHumanKind):
    ptBoolean
11 {
12 postF{
13 if
14 (
15 /* Post F01 */
16 let Self:ctHuman in
17
18 Self.id = Aid
19 and Self.kind = Akind

```

```

20
21 /* Post F02 */
22 and (Self.ocllsNew and self = Self)
23 )
24 then (result = true)
25 else (result = false)
26 endif
27 }
28 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctHuman-init.pl"}
29 }
30 operation: icrash.concepts.primarytypes.classes.ctHuman.isAcknowledged():ptBoolean{
31 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctHuman-isAcknowledged.pl"}
32 }
33 }
34 }

```

Listing C.27: Messir Spec. file primarytypes-classes-ctHuman.msr.

## C.28 File ./src-gen/messir-spec/operations/concepts/primarytypes-classes/primarytypes-classes-ctState.msr

```

1 package icrash.operations.concepts.primarytypes.classes.ctState{
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.calendar
5 import lu.uni.lassy.messir.libraries.math
6
7 import icrash.concepts.primarytypes.classes
8
9 Operation Model {
10
11 operation: icrash.concepts.primarytypes.classes.ctState.init(
12   AnextValueForAlertID: dtInteger,
13   AnextValueForCrisisID: dtInteger ,
14   dtAclock:dtDateAndTime,
15   AcrisisReminderPeriod: dtSecond,
16   AmaxCrisisReminderPeriod: dtSecond ,
17   AvpLastReminder: dtDateAndTime ,
18   AvpStarted:ptBoolean ):ptBoolean{
19 postF{
20 if
21 (
22 /* Post F01 */
23 let Self:ctState in
24
25 Self.nextValueForAlertID = AnextValueForAlertID
26 and Self.nextValueForCrisisID = AnextValueForCrisisID
27 and Self.clock = Aclock
28 and Self.crisisReminderPeriod = AcrisisReminderPeriod
29 and Self.maxCrisisReminderPeriod = AmaxCrisisReminderPeriod
30 and Self.vpLastReminder = AvpLastReminder
31 and Self.vpStarted = AvpStarted
32
33 and (Self.ocllsNew and self = Self)
34 )
35 then (result = true)
36 else (result = false)
37 endif
38 }
39 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctState-init.pl" }
40 }
41 }
42 }

```

Listing C.28: Messir Spec. file primarytypes-classes-ctState.msr.

## C.29 File ./src-gen/messir-spec/concepts/primarytypes-classes.msr

```

1 package icrash.concepts.primarytypes.classes {
2
3 import icrash.concepts.primarytypes.datatypes
4 import icrash.environment
5 import lu.uni.lassy.messir.libraries.primitives
6 import lu.uni.lassy.messir.libraries.math
7 import lu.uni.lassy.messir.libraries.calendar
8
9 Concept Model {
10
11 Primary Types{
12
13 state class ctState {
14     attribute nextValueForAlertID:dtInteger
15     attribute nextValueForCrisisID:dtInteger
16     attribute clock:dtDateAndTime
17     attribute crisisReminderPeriod:dtSecond
18     attribute maxCrisisReminderPeriod:dtSecond
19     attribute vpLastReminder:dtDateAndTime
20     attribute vpStarted:ptBoolean
21
22 operation init( AnextValueForAlertID:dtInteger,
23                 AnextValueForCrisisID:dtInteger,
24                 Aclock:dtDateAndTime,
25                 AcrisisReminderPeriod:dtSecond ,
26                 AmaxCrisisReminderPeriod:dtSecond ,
27                 AvpLastReminder:dtDateAndTime ,
28                 AvpStarted:ptBoolean ): ptBoolean
29 }
30
31 class ctAlert role rnctAlert cardinality [0..*]{
32     attribute id:dtAlertID
33     attribute status: etAlertStatus
34     attribute location:dtGPSLocation
35     attribute instant:dtDateAndTime
36     attribute comment:dtComment
37
38 operation init( Aid:dtAlertID ,
39                 Astatus:etAlertStatus ,
40                 Alocation:dtGPSLocation ,
41                 Ainstant:dtDateAndTime ,
42                 Acomment:dtComment ):ptBoolean
43 operation isSentToCoordinator(AactCoordinator:actCoordinator ):ptBoolean
44
45 }
46
47 class ctCrisis role rnctCrisis cardinality [0..*]{
48     attribute id:dtCrisisID
49     attribute type:etCrisisType
50     attribute status: etCrisisStatus
51     attribute location:dtGPSLocation
52     attribute instant:dtDateAndTime
53     attribute comment:dtComment
54
55 operation init(
56     Aid:dtCrisisID ,
57     Atype:etCrisisType ,
58     Astatus:etCrisisStatus ,
59     Alocation:dtGPSLocation ,
60     Ainstant:dtDateAndTime ,
61     Acomment:dtComment ):ptBoolean
62
63 operation handlingDelayPassed():ptBoolean
64 operation maxHandlingDelayPassed():ptBoolean
65 operation isSentToCoordinator(AactCoordinator:actCoordinator ):ptBoolean
66 operation isAllocatedIfPossible():ptBoolean
67 }
68
69 class ctHuman role rnctHuman cardinality [0..*]{
70     attribute id:dtPhoneNumber

```

```

71  attribute kind:etHumanKind
72
73  operation init(
74      Aid:dtPhoneNumber ,
75      Akind:etHumanKind ):ptBoolean
76  operation isAcknowledged():ptBoolean
77  }
78
79  class ctAuthenticated
80      role rnctAuthenticated
81      cardinality [0..*]{
82
83      attribute login:dtLogin
84      attribute pwd: dtPassword
85      attribute vpIsLogged:ptBoolean
86
87      operation init(
88          Alogin:dtLogin ,
89          Apwd:dtPassword ):ptBoolean
90  }
91
92  class ctCoordinator
93      role rnctCoordinator
94      cardinality [0..*]
95      extends ctAuthenticated{
96
97      attribute id:dtCoordinatorID
98
99      operation init(
100          Aid:dtCoordinatorID ,
101          Alogin:dtLogin ,
102          Apwd:dtPassword ):ptBoolean
103  }
104
105  class ctAdministrator
106      role rnctAdministrator
107      cardinality [1..1]
108      extends ctAuthenticated{
109
110      operation init(
111          Alogin:dtLogin ,
112          Apwd:dtPassword ):ptBoolean
113  }
114  }
115  }
116  }

```

Listing C.29: Messir Spec. file primarytypes-classes.msr.

### C.30 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtAlertID.msr

```

1 package icrash.operations.concepts.primarytypes.datatypes.dtAlertID{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7 operation: icrash.concepts.primarytypes.datatypes.dtAlertID.is():ptBoolean{
8
9 postF{
10 let TheResult: ptBoolean in
11 ( if
12   ( AdtValue.value.length().gt(0)
13   and AdtValue.value.length().leq(20)
14 )
15 then (TheResult = true)
16 else (TheResult = false)

```

```

17  endif
18  result = TheResult
19  })
20  prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtAlertID-is.pl"}
21  }
22  }
23  }

```

Listing C.30: Messir Spec. file primarytypes-datatypes-dtAlertID.msr.

## C.31 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtComment.msr

```

1 package icrash.operations.concepts.primarytypes.datatypes.dtComment{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7 operation: icrash.concepts.primarytypes.datatypes.dtComment.is():ptBoolean{
8
9 postF{
10 let TheResult: ptBoolean in
11 ( if
12 ( MaxLength = 160
13 and AdtValue.value.length().leq(MaxLength)
14 )
15 then (TheResult = true)
16 else (TheResult = false)
17 endif
18 result = TheResult
19 )
20 }
21 prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtComment-is.pl"}
22 }
23 }
24 }

```

Listing C.31: Messir Spec. file primarytypes-datatypes-dtComment.msr.

## C.32 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtCoordinatorID.msr

```

1 package icrash.operations.concepts.primarytypes.datatypes.dtCoordinatorID{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6 operation: icrash.concepts.primarytypes.datatypes.dtCoordinatorID.is():ptBoolean{
7
8 postF{
9 let TheResult: ptBoolean in
10 ( if
11 ( AdtValue.value.length().gt(0)
12 and AdtValue.value.length().leq(5)
13 )
14 then (TheResult = true)
15 else (TheResult = false)
16 endif
17 result = TheResult
18 )
19 }
20 prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtCoordinatorID-is.pl"}
21 }
22 }

```

23 }

Listing C.32: Messir Spec. file primarytypes-datatypes-dtCoordinatorID.msr.

### C.33 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtCrisisID.msr

```

1 package icrash.operations.concepts.primarytypes.datatypes.dtCrisisID{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7   operation: icrash.concepts.primarytypes.datatypes.dtCrisisID.is():ptBoolean{
8
9   postF{
10     let TheResult: ptBoolean in
11     ( if
12       ( AdtValue.value.length().gt(0)
13         and AdtValue.value.length().leq(10)
14       )
15       then (TheResult = true)
16       else (TheResult = false)
17     endif
18     result = TheResult
19   )
20 }
21 prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtCrisisID-is.pl"}
22 }
23 }
24 }
```

Listing C.33: Messir Spec. file primarytypes-datatypes-dtCrisisID.msr.

### C.34 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtGPSLocation.msr

```

1 package icrash.operations.concepts.primarytypes.datatypes.dtGPSLocation{
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5
6 import icrash.concepts.primarytypes.datatypes
7 import icrash.concepts.primarytypes.classes
8 import icrash.concepts.secondarytypes.datatypes
9 import icrash.concepts.secondarytypes.classes
10
11 Operation Model {
12
13   operation: icrash.concepts.primarytypes.datatypes.dtGPSLocation.is():ptBoolean{
14   postF{
15     let TheResult: ptBoolean in
16     ( if
17       ( AdtValue.latitude.is()
18         and AdtValue.longitude.is()
19       )
20       then (TheResult = true)
21       else (TheResult = false)
22     endif
23     result = TheResult
24   )
25 }
26 prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtGPSLocation-is.pl"}
27 }
28 operation: icrash.concepts.primarytypes.datatypes.dtGPSLocation.isNearTo(aGPSLocation:
    dtGPSLocation):ptBoolean{
```

```

29  postF{
30      let TheResult: ptBoolean in true
31      let EarthRadius: dtReal in
32      let MaxDistance: dtReal in
33      let ComparedLatitude: dtLatitude in
34      let ComparedLongitude: dtLongitude in
35      let R1: dtReal in let R1a: dtReal in
36      let R2: dtReal in let R2a: dtReal in
37
38      ( if
39      ( EarthRadius.value = 6371
40        and MaxDistance.value = 100
41
42        and AdtValue.latitude = ComparedLatitude
43        and AdtValue.longitude = ComparedLongitude
44        and Self.latitude.sin() = R1a
45        and AdtValue.latitude.sin().mul(R1a) = R1
46        and Self.latitude.cos() = R2a
47        and AdtValue.latitude.cos().mul(R2a) = R2
48
49        and AdtValue.longitude = ComparedLongitude
50        and Self.longitude.sub(ComparedLongitude).cos().mul(R2)
51          .add(R1).acos().mul(EarthRadius).sub(MaxDistance)
52          .value.leq(0)
53      )
54      then (TheResult = true)
55      else (TheResult = false)
56      endif
57      result = TheResult
58  )
59  }
60  prolog{ "src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtGPSLocation-isNearTo
        .pl" }
61  }
62  operation: icrash.concepts.primarytypes.datatypes.dtLatitude.is():ptBoolean{
63  postF{
64      let TheResult: ptBoolean in
65      ( if
66      ( AdtValue.value.geq(-90.0)
67        and AdtValue.value.leq(+90.0)
68      )
69      then (TheResult = true)
70      else (TheResult = false)
71      endif
72      result = TheResult
73  ) }
74  prolog{ "src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtLatitude-is.pl" }
75  }
76  operation: icrash.concepts.primarytypes.datatypes.dtLongitude.is():ptBoolean{
77  postF{
78      let TheResult: ptBoolean in
79      ( if
80      ( AdtValue.value.geq(-180.0)
81        and AdtValue.value.leq(+180.0)
82      )
83      then (TheResult = true)
84      else (TheResult = false)
85      endif
86      result = TheResult
87  ) }
88  prolog{ "src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtLongitude-is.pl" }
89  }
90  }
91  }

```

Listing C.34: Messir Spec. file primarytypes-datatypes-dtGPSLocation.msr.



### C.35 File `./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtLogin.msr`

```

1 package icrash.operations.concepts.primarytypes.datatypes.dtLogin{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7 operation: icrash.concepts.primarytypes.datatypes.dtLogin.is():ptBoolean{
8 postF{
9 let TheResult: ptBoolean in
10 let MaxLength: ptInteger in
11 ( if
12 ( MaxLength = 20
13 and AdtValue.value.length().leq(MaxLength)
14 )
15 then (TheResult = true)
16 else (TheResult = false)
17 endif
18 result = TheResult
19 )
20 }
21 prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtLogin-is.pl"}
22 }
23 }
24 }

```

Listing C.35: Messir Spec. file `primarytypes-datatypes-dtLogin.msr`.

### C.36 File `./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtPassword.msr`

```

1 package icrash.operations.concepts.primarytypes.datatypes.dtPassword{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7 operation: icrash.concepts.primarytypes.datatypes.dtPassword.is():ptBoolean{
8 postF{
9 let TheResult: ptBoolean in
10 let MinLength: ptInteger in
11 ( if
12 ( MinLength = 6
13 and AdtValue.value.length().geq(MinLength)
14 )
15 then (TheResult = true)
16 else (TheResult = false)
17 endif
18 result = TheResult
19 )
20 }
21 prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtPassword-is.pl"}
22 }
23 }
24 }

```

Listing C.36: Messir Spec. file `primarytypes-datatypes-dtPassword.msr`.

### C.37 File `./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtPhoneNumber.msr`

```

1 package icrash.operations.concepts.primarytypes.datatypes.dtPhoneNumber{

```

```

2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7   operation: icrash.concepts.primarytypes.datatypes.dtPhoneNumber.is():ptBoolean{
8
9   postF{
10    let TheResult: ptBoolean in
11    ( if
12      ( AdtValue.value.length().gt(4)
13        and AdtValue.value.length().leq(30)
14      )
15      then (TheResult = true)
16      else (TheResult = false)
17    endif
18    result = TheResult
19  )
20 }
21 prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtPhoneNumber-is.pl"}
22 }
23 }
24 }

```

Listing C.37: Messir Spec. file primarytypes-datatypes-dtPhoneNumber.msr.

## C.38 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-etAlertStatus.msr

```

1 package icrash.operations.concepts.primarytypes.datatypes.etAlertStatus{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7   operation: icrash.concepts.primarytypes.datatypes.etAlertStatus.is():ptBoolean{
8   postF{
9     let TheResult: ptBoolean in
10    ( if
11      ( self = pending
12        or self = valid
13        or self = invalid
14      )
15      then (TheResult = true)
16      else (TheResult = false)
17    endif
18    result = TheResult
19  )
20 }
21 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesDatatypes-etAlertStatus-is.pl"}
22 }
23 }
24 }

```

Listing C.38: Messir Spec. file primarytypes-datatypes-etAlertStatus.msr.

## C.39 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-etCrisisStatus.msr

```

1 package icrash.operations.concepts.primarytypes.datatypes.etCrisisStatus{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7   operation: icrash.concepts.primarytypes.datatypes.etCrisisStatus.is():ptBoolean{

```

```

8  postF{
9    let TheResult: ptBoolean in
10   ( if
11     ( self = pending
12       or self = handled
13       or self = solved
14       or self = closed
15     )
16     then (TheResult = true)
17     else (TheResult = false)
18     endif
19     result = TheResult
20   )
21 }
22 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesDatatypes-etCrisisStatus-is.pl"}
23 }
24 }
25 }

```

Listing C.39: Messir Spec. file primarytypes-datatypes-etCrisisStatus.msr.

## C.40 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-etCrisisType.msr

```

1 package icrash.operations.concepts.primarytypes.datatypes.etCrisisType{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7 operation: icrash.concepts.primarytypes.datatypes.etCrisisType.is():ptBoolean{
8 postF{
9   let TheResult: ptBoolean in
10  ( if
11    ( self = small
12      or self = medium
13      or self = huge
14    )
15    then (TheResult = true)
16    else (TheResult = false)
17    endif
18    result = TheResult
19  )
20 }
21 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesDatatypes-etCrisisType-is.pl"}
22 }
23 }
24 }

```

Listing C.40: Messir Spec. file primarytypes-datatypes-etCrisisType.msr.

## C.41 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-etHumanKind.msr

```

1 package icrash.operations.concepts.primarytypes.datatypes.etHumanKind{
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 Operation Model {
6
7 operation: icrash.concepts.primarytypes.datatypes.etHumanKind.is():ptBoolean{
8 postF{
9   let TheResult: ptBoolean in
10  ( if
11    ( self = witness
12      or self = victim

```

```

13     or self = anonymous
14 )
15 then (TheResult = true)
16 else (TheResult = false)
17 endif
18 result = TheResult
19 })
20 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesDatatypes-etHumanKind-is.pl"}
21 }
22 }
23 }

```

Listing C.41: Messir Spec. file primarytypes-datatypes-etHumanKind.msr.

## C.42 File `./src-gen/messir-spec/concepts/primarytypes-datatypes.msr`

```

1 package icrash.concepts.primarytypes.datatypes {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.string
5 import lu.uni.lassy.messir.libraries.math
6 import lu.uni.lassy.messir.libraries.calendar
7
8 Concept Model {
9
10 Primary Types {
11
12     datatype dtAlertID extends dtString {
13         operation is():ptBoolean
14     }
15     datatype dtCrisisID extends dtString {
16         operation is():ptBoolean
17     }
18     datatype dtLogin extends dtString {
19         operation is():ptBoolean
20     }
21     datatype dtPassword extends dtString {
22         operation is():ptBoolean
23     }
24     datatype dtCoordinatorID extends dtString {
25         operation is():ptBoolean
26     }
27     datatype dtPhoneNumber extends dtString {
28         operation is():ptBoolean
29     }
30     datatype dtComment extends dtString {
31         operation is():ptBoolean
32     }
33     datatype dtLatitude extends dtReal {
34         operation is():ptBoolean
35     }
36     datatype dtLongitude extends dtReal {
37         operation is():ptBoolean
38     }
39     datatype dtGPSLocation {
40         attribute latitude: dtLatitude
41         attribute longitude: dtLongitude
42         operation is():ptBoolean
43         operation isNearTo(AGPSLocation:dtGPSLocation ):ptBoolean
44     }
45
46     enum etCrisisStatus {
47         constants["pending", "handled", "solved","closed"]
48         operation is():ptBoolean
49     }
50     enum etAlertStatus {
51         constants["pending", "valid", "invalid"]

```

```

52     operation is():ptBoolean
53 }
54 enum etCrisisType {
55     constants["small", "medium", "huge"]
56     operation is():ptBoolean
57 }
58 enum etHumanKind {
59     constants["witness", "victim", "anonymous"]
60     operation is():ptBoolean
61 }
62 }
63 }
64 }

```

Listing C.42: Messir Spec. file primarytypes-datatypes.msr.

### C.43 File `./src-gen/messir-spec/concepts/secondarytypes-associations.msr`

```

1 package icrash.concepts.secondarytypes.associations {
2
3     Concept Model {
4
5         Secondary Types{
6
7         }
8     }
9 }

```

Listing C.43: Messir Spec. file secondarytypes-associations.msr.

### C.44 File `./src-gen/messir-spec/concepts/secondarytypes-classes.msr`

```

1 package icrash.concepts.secondarytypes.classes {
2
3     Concept Model {
4
5         Secondary Types{
6
7         }
8     }
9 }

```

Listing C.44: Messir Spec. file secondarytypes-classes.msr.

### C.45 File `./src-gen/messir-spec/concepts/secondarytypes-datatypes.msr`

```

1 package icrash.concepts.secondarytypes.datatypes {
2
3     import lu.uni.lassy.messir.libraries.primitives
4     import lu.uni.lassy.messir.libraries.string
5
6     import icrash.concepts.primarytypes.datatypes
7
8     Concept Model {
9
10         Secondary Types {
11
12             datatype dtSMS {
13                 attribute value: ptString
14                 operation is():ptBoolean
15             }

```

```

16 }
17 }
18 }

```

Listing C.45: Messir Spec. file secondarytypes-datatypes.msr.

## C.46 File ./src-gen/messir-spec/usecases/subfunctions-usecases.msr

```

1 package icrash.usecases.subfunctions {
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 import icrash.concepts.primarytypes.datatypes
6 import icrash.concepts.primarytypes.classes
7 import icrash.concepts.secondarytypes.datatypes
8 import lu.uni.lassy.messir.libraries.primitives
9 import lu.uni.lassy.messir.libraries.math
10 import lu.uni.lassy.messir.libraries.calendar
11
12 import icrash.environment
13
14 Use Case Model {
15
16 //-----
17 use case system subfunction oeAddCoordinator(AdtCoordinatorID:dtCoordinatorID, AdtLogin:dtLogin,
    AdtPassword:dtPassword) {
18     actor actAdministrator[primary,active]
19     returned messages {
20         ieCoordinatorAdded() returned to actAdministrator
21     }
22 }
23 //-----
24 use case system subfunction oeAlert(
25     AetKind:etHumanKind,
26     AdtMyDate:dtDate,
27     AdtTime:dtTime,
28     AdtPhoneNumber:dtPhoneNumber,
29     AdtGPSLocation:dtGPSLocation,
30     AdtComment:dtComment) {
31     actor actComCompany[primary,active]
32     returned messages {
33         ieSmsSend(AdtPhoneNumber,AdtSMS) returned to actComCompany
34     }
35 }
36 //-----
37 use case system subfunction oeInvalidateAlert(AdtAlertID:dtAlertID) {
38     actor actCoordinator[primary,active]
39     actor actComCompany[secondary,passive]
40     returned messages {
41         ieMessage(AMessage) returned to actCoordinator
42     }
43 }
44 //-----
45 use case system subfunction oeCloseCrisis(AdtCrisisID:dtCrisisID) {
46     actor actCoordinator[primary,active]
47     returned messages {
48         ieMessage(AMessage) returned to actCoordinator
49     }
50 }
51 //-----
52 use case system subfunction oeCreateSystemAndEnvironment(AqtyComCompanies:ptInteger) {
53     actor actMsrCreator[primary,active]
54 }
55 //-----
56 use case system subfunction oeDeleteCoordinator(AdtCoordinatorID:dtCoordinatorID) {
57     actor actAdministrator[primary,active]
58     returned messages {
59         ieCoordinatorDeleted() returned to actAdministrator
60     }
61 }

```

```

61 //-----
62 use case system subfunction oeGetAlertsSet (AetAlertStatus:etAlertStatus) {
63   actor actCoordinator[primary,active]
64   returned messages {
65     ieSendAnAlert (ActAlert) returned to actCoordinator
66   }
67 }
68 //-----
69 use case system subfunction oeGetCrisisSet (AetCrisisStatus:etCrisisStatus) {
70   actor actCoordinator[primary,active]
71   returned messages {
72     ieSendACrisis (ActCrisis) returned to actCoordinator
73   }
74 }
75 //-----
76 use case system subfunction oeSetCrisisHandler (AdtCrisisID:dtCrisisID) {
77   actor actCoordinator[primary,active]
78   actor actCoordinator[secondary,passive]
79   actor actComCompany[secondary,passive,multiple]
80   returned messages {
81     ieMessage (AMessage)
82     returned to actCoordinator
83     ieSendAnAlert (ActAlert)
84     returned to actCoordinator
85     ieSmsSend (AdtPhoneNumber,AdtSMS)
86     returned to actComCompany
87   }
88 }
89 //-----
90 use case system subfunction oeLogin (AdtLogin:dtLogin , AdtPassword:dtPassword) {
91   actor actAuthenticated[primary,active]
92   returned messages {
93     ieMessage (AMessage) returned to actAuthenticated
94   }
95 }
96 //-----
97 use case system subfunction oeLogout () {
98   actor actAuthenticated[primary,active]
99   returned messages {
100     ieMessage (AMessage) returned to actAuthenticated
101   }
102 }
103 //-----
104 use case system subfunction oeReportOnCrisis (AdtCrisisID:dtCrisisID,AdtComment:dtComment) {
105   actor actCoordinator[primary,active]
106   returned messages {
107     ieMessage (AMessage) returned to actCoordinator
108   }
109 }
110 //-----
111 use case system subfunction oeSetClock (AcurrentClock:dtDateAndTime) {
112   actor actActivator[primary,proactive]
113 }
114 //-----
115 use case system subfunction oeSetCrisisStatus (AdtCrisisID:dtCrisisID ,AetCrisisStatus:
    etCrisisStatus) {
116   actor actCoordinator[primary,active]
117   returned messages {
118     ieMessage (AMessage) returned to actCoordinator
119   }
120 }
121 //-----
122 use case system subfunction oeSollicitateCrisisHandling () {
123   actor actActivator[primary,proactive]
124   actor actCoordinator[secondary,passive,multiple]
125   actor actAdministrator[secondary,passive]
126   returned messages {
127     ieMessage (AMessage) returned to actCoordinator
128     //ieMessage (AMessage) returned to actAdministrator
129   }

```

```

130 }
131 //-----
132 use case system subfunction oeValidateAlert (AdtAlertID:dtAlertID) {
133   actor actCoordinator[primary,active]
134   returned messages {
135     ieMessage (AMessage) returned to actCoordinator
136   }
137 }
138 }
139
140 }

```

Listing C.46: Messir Spec. file subfunctions-usecases.msr.

## C.47 File ./src-gen/messir-spec/test/tc-testcase01.msr

```

1 package lu.uni.lassy.excalibur.examples.icrash.tests.testcase01 {
2
3 import lu.uni.lassy.messir.libraries.string
4 import lu.uni.lassy.messir.libraries.primitives
5 import lu.uni.lassy.messir.libraries.math
6 import lu.uni.lassy.messir.libraries.calendar
7
8 import icrash.concepts.primarytypes.associations
9 import icrash.concepts.primarytypes.classes
10 import icrash.concepts.primarytypes.datatypes
11 import icrash.concepts.secondarytypes.datatypes
12 import icrash.environment
13
14 Test Model{
15   test case testcase01 order 01 {
16 //-----
17   test step ts01oeCreateSystemAndEnvironment order 01 {
18     variables{
19       Creator:actMsrCreator
20       AqtyComCompanies: ptInteger
21     }
22     constraints{
23       AqtyComCompanies = 4
24     }
25     test message{
26       out:Creator sends to system actMsrCreator.outactMsrCreator.oeCreateSystemAndEnvironment (
27         AqtyComCompanies)
28     }
29     oracle{
30       constraints{
31         true
32       }
33     }
34     prolog{"src/Tests/system/01/system-sim-01-01-oeCreateSystemAndEnvironment.pl"}
35 }
36 //-----
37 test step ts02oeSetClock order 02{
38   variables{
39     TheActor:actActivator
40     ACurrentClock:dtDateAndTime
41   }
42   constraints{
43     TheActor=TheSystem.rnactActivator->any2(true)
44
45     ACurrentClock.date.year.value = 2017
46     ACurrentClock.date.month.value = 11
47     ACurrentClock.date.day.value = 24
48     ACurrentClock.time.hour.value = 15
49     ACurrentClock.time.minute.value = 20
50     ACurrentClock.time.second.value = 00
51   }
52   test message{
53     out:TheActor sends to system actActivator.outactActivator.oeSetClock (ACurrentClock)

```



```

53     }
54     oracle{
55         constraints{
56             true
57         }
58     }
59 }
60 //-----
61
62 test step ts03oeLogin order 03{
63     variables{
64         TheActor : actAdministrator
65         AdtLogin:dtLogin
66         AdtPassword:dtPassword
67     }
68     constraints{
69         TheActor=TheSystem.rnactAdministrator->any2(true)
70         AdtLogin.value.eq('icrashadmin')
71         AdtPassword.value.eq('7WXC1359')
72     }
73     test message{
74         out:TheActor sends to system actAdministrator.outactAdministrator.oeLogin(AdtLogin,AdtPassword)
75     }
76     oracle{
77         variables{
78             AMessage:ptString
79         }
80         constraints{
81             AMessage = 'You are logged ! Welcome ...'
82             TheActor.inactAdministrator.ieMessage(AMessage)
83         }
84     }
85 }
86 //-----
87 test step ts04oeAddCoordinator order 04{
88     variables{
89         TheActor : actAdministrator
90         AdtCoordinatorID : dtCoordinatorID
91         AdtLogin:dtLogin
92         AdtPassword:dtPassword
93     }
94     constraints{
95         TheActor = TheSystem.rnactAdministrator->any2(true)
96         AdtCoordinatorID.value.eq('1')
97         AdtLogin.value.eq('steve')
98         AdtPassword.value.eq('pwdMessirExcalibur2017')
99     }
100    test message{
101        out:TheActor
102        sends to system actAdministrator.outactAdministrator.oeAddCoordinator
103                                (AdtCoordinatorID,
104                                AdtLogin,
105                                AdtPassword)
106    }
107    oracle{
108        constraints{
109            TheActor.inactAdministrator.ieCoordinatorAdded()
110        }
111    }
112 }
113 //-----
114 test step ts05oeLogout order 05{
115     variables{
116         TheActor : actAdministrator
117     }
118     constraints{
119         TheActor = TheSystem.rnactAdministrator->any2(true)
120     }
121     test message{
122         out:TheActor sends to system actAdministrator.outactAdministrator.oeLogout()

```

```

123     }
124     oracle{
125         variables{
126             AMessage:ptString
127         }
128         constraints{
129             AMessage = 'You are logged out ! Good Bye ...'
130             TheActor.inactAdministrator.ieMessage(AMessage)
131         }
132     }
133 }
134 //-----
135 test step ts06oeSetClock02 order 06{
136     variables{
137         TheActor:actActivator
138         ACurrentClock:dtDateAndTime
139     }
140     constraints{
141         TheActor=TheSystem.rnactActivator->any2(true)
142         ACurrentClock.date.year.value = 2017
143         ACurrentClock.date.month.value = 11
144         ACurrentClock.date.day.value = 26
145         ACurrentClock.time.hour.value = 10
146         ACurrentClock.time.minute.value = 15
147         ACurrentClock.time.second.value = 00
148     }
149     test message{
150         out:TheActor sends to system actActivator.outactActivator.oeSetClock(ACurrentClock)
151     }
152     oracle{
153         constraints{
154             true
155         }
156     }
157 }
158 //-----
159 test step ts07oeAlert1 order 07{
160     variables{
161         TheActor : actComCompany
162         AetHumanKind:etHumanKind
163         AdtDate:dtDate
164         AdtTime:dtTime
165         AdtPhoneNumber:dtPhoneNumber
166         AdtGPSLocation:dtGPSLocation
167         AdtComment:dtComment
168     }
169     constraints{
170         TheActor = TheSystem.rnactComCompany->any2(true)
171         AetHumanKind = witness
172         AdtDate.year.value = 2017
173         AdtDate.month.value = 11
174         AdtDate.day.value = 26
175         AdtTime.hour.value = 10
176         AdtTime.minute.value = 10
177         AdtTime.second.value = 16
178         AdtPhoneNumber.value = '+3524666445252'
179         AdtGPSLocation.latitude.value = 49.627675
180         AdtGPSLocation.longitude.value = 6.159590
181         AdtComment.value = '3 cars involved in an accident.'
182     }
183     test message{
184         out:TheActor
185         sends to system actComCompany.outactComCompany.oeAlert( AetHumanKind,
186                                     AdtDate,
187                                     AdtTime,
188                                     AdtPhoneNumber,
189                                     AdtGPSLocation,
190                                     AdtComment)
191     }
192     oracle{

```

```

193     variables{
194         AdtSMS:dtSMS
195     }
196     constraints{
197         AdtSMS.value = 'Your alert has been registered. We will handle it and keep you informed'
198         TheActor.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
199     }
200 }
201 }
202 //-----
203 test step ts08oeSetClock03 order 08{
204     variables{
205         TheActor:actActivator
206         ACurrentClock:dtDateAndTime
207     }
208     constraints{
209         TheActor=TheSystem.rnactActivator->any2(true)
210         ACurrentClock.date.year.value = 2017
211         ACurrentClock.date.month.value = 11
212         ACurrentClock.date.day.value = 26
213         ACurrentClock.time.hour.value = 10
214         ACurrentClock.time.minute.value = 30
215         ACurrentClock.time.second.value = 00
216     }
217     test message{
218         out:TheActor sends to system actActivator.outactActivator.oeSetClock(ACurrentClock)
219     }
220     oracle{
221         constraints{
222             true
223         }
224     }
225 }
226 //-----
227 test step ts09oeSollicitateCrisisHandling order 09{
228     variables{
229         TheActor : actActivator
230     }
231     constraints{
232         TheActor = TheSystem.rnactActivator->any2(true)
233     }
234     test message{
235         out:TheActor sends to system actActivator.outactActivator.oeSollicitateCrisisHandling()
236     }
237     oracle{
238         variables{
239             TheAdministrator:actAdministrator
240             TheCoordinator:actCoordinator
241             AMessageForCrisisHandlers:ptString
242         }
243         constraints{
244             TheAdministrator = TheSystem.rnactAdministrator->any2(true)
245             TheCoordinator = TheSystem.rnactCoordinator->any2(true)
246             AMessageForCrisisHandlers = 'There are alerts pending since more than the defined delay. Please
                REACT !'
247
248             TheAdministrator.inactAdministrator.ieMessage(AMessageForCrisisHandlers)
249             TheCoordinator.inactAdministrator.ieMessage(AMessageForCrisisHandlers)
250
251 /* this oracle should be written like this:
252
253     oracle{
254         variables{
255             TheAdministrator:actAdministrator
256             AMessageForCrisisHandlers:ptString
257         }
258         constraints{
259             AMessageForCrisisHandlers = 'There are alerts pending since more than the defined delay. Please
                REACT !'
260             TheAdministrator = TheSystem.rnactAdministrator->any2(true)

```

```

261
262     TheSystem.rnactCoordinator->forAll(TheCoordinator:actCoordinator | TheCoordinator.
actAuthenticated.inactAuthenticated.ieMessage(AMessage))
263
264     // receives from system is for step instances
265
266 */
267 }
268 }
269 }
270 //-----
271 test step ts10oeLogin02 order 10{
272     variables{
273         TheActor : actCoordinator
274         AdtLogin:dtLogin
275         AdtPassword:dtPassword
276     }
277     constraints{
278         TheActor = TheSystem.rnactCoordinator->select(a | a.rnctCoordinator.login.value.eq('steve'))->
any2(true)
279         AdtLogin.value.eq('steve')
280         AdtPassword.value.eq('pwdMessirExcalibur2017')
281     }
282     test message{
283         out:TheActor sends to system actAuthenticated.outactAuthenticated.oeLogin(AdtLogin,AdtPassword)
284     }
285     oracle{
286         variables{
287             AMessage:ptString
288         }
289         constraints{
290             AMessage = 'You are logged ! Welcome ...'
291             TheActor.inactAuthenticated.ieMessage(AMessage)
292         }
293     }
294 }
295 //-----
296 test step ts11oeGetCrisisSet order 11{
297     variables{
298         TheActor : actCoordinator
299         AetCrisisStatus : etCrisisStatus
300     }
301     constraints{
302         TheActor=TheSystem.rnactCoordinator
303         ->select(a | a.rnctCoordinator.login.value.eq('steve'))
304         ->any2(true)
305         AetCrisisStatus = pending
306     }
307     test message{
308         out:TheActor sends to system actCoordinator.outactCoordinator.oeGetCrisisSet(AetCrisisStatus)
309     }
310     oracle{
311 //TODO - make consistent with test step implementation by adding Prolog code for input messages
312         variables{
313             ActCrisis:ctCrisis
314         }
315         constraints{
316             TheActor.inactCoordinator.ieSendACrisis(ActCrisis)
317         }
318     }
319 }
320 //-----
321 test step ts12oeSetCrisisHandler order 12{
322     variables{
323         TheActor : actCoordinator
324         AdtCrisisID : dtCrisisID
325     }
326     constraints{
327         TheActor=TheSystem.rnactCoordinator
328         ->select(a | a.rnctCoordinator.login.value.eq('steve'))

```

```

329     ->any2(true)
330     //and AdtCrisisID.value= '1'
331 }
332 test message{
333     out:TheActor sends to system actCoordinator.outactCoordinator.oeSetCrisisHandler(AdtCrisisID)
334 }
335 oracle{
336     variables{
337         AMessage:ptString
338         AdtPhoneNumber:dtPhoneNumber
339         AdtSMS:dtSMS
340         ActAlert:ctAlert
341
342         TheComCompany: actComCompany
343         TheCoordinator:actCoordinator
344     }
345     constraints{
346         AMessage = 'You are now considered as handling the crisis !'
347         AdtSMS.value = 'The handling of your alert by our services is in progress !'
348         TheComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
349         TheCoordinator.inactCoordinator.ieSendAnAlert(ActAlert)
350         TheActor.inactAuthenticated.ieMessage(AMessage)
351     }
352 }
353 }
354 //-----
355 test step ts13oeSetClock04 order 13{
356     variables{
357         TheActor:actActivator
358         ACurrentClock:dtDateAndTime
359     }
360     constraints{
361         TheActor=TheSystem.rnactActivator->any2(true)
362         ACurrentClock.date.year.value = 2017
363         ACurrentClock.date.month.value = 11
364         ACurrentClock.date.day.value = 26
365         ACurrentClock.time.hour.value = 10
366         ACurrentClock.time.minute.value = 45
367         ACurrentClock.time.second.value = 00
368     }
369     test message{
370         out:TheActor sends to system actActivator.outactActivator.oeSetClock(ACurrentClock)
371     }
372     oracle{
373         constraints{
374             true
375         }
376     }
377 }
378 //-----
379 test step ts14oeValidateAlert order 14{
380     variables{
381         TheActor : actCoordinator
382         AdtAlertID : dtAlertID
383     }
384     constraints{
385         TheActor=TheSystem.rnactCoordinator
386         ->select(a | a.rnctCoordinator.login.value.eq('steve'))
387         ->any2(true)
388         //and AdtAlertID.value= '1'
389     }
390     test message{
391         out:TheActor sends to system actCoordinator.outactCoordinator.oeValidateAlert(AdtAlertID)
392     }
393     oracle{
394         variables{
395             AMessage:ptString
396         }
397         constraints{
398             AMessage = 'The Alert is now declared as valid !'

```

```

399     TheActor.actAuthenticated.inactAuthenticated.ieMessage(AMessage)
400 }
401 }
402 }
403 //-----
404 test step ts15oeAlert2 order 15{
405     variables{
406         TheActor : actComCompany
407         AetHumanKind:etHumanKind
408         AdtDate:dtDate
409         AdtTime:dtTime
410         AdtPhoneNumber:dtPhoneNumber
411         AdtGPSLocation:dtGPSLocation
412         AdtComment:dtComment
413     }
414     constraints{
415         TheActor = TheSystem.rnactComCompany->any2(true)
416         AetHumanKind = witness
417         AdtDate.year.value = 2017
418         AdtDate.month.value = 11
419         AdtDate.day.value = 26
420         AdtTime.hour.value = 10
421         AdtTime.minute.value = 20
422         AdtTime.second.value = 00
423         AdtPhoneNumber.value = '+3524666445000'
424         AdtGPSLocation.latitude.value = 49.627095
425         AdtGPSLocation.longitude.value = 6.160251
426         AdtComment.value = 'A car crash just happened.'
427     }
428     test message{
429         out:TheActor
430         sends to system actComCompany.outactComCompany.oeAlert( AetHumanKind,
431                                     AdtDate,
432                                     AdtTime,
433                                     AdtPhoneNumber,
434                                     AdtGPSLocation,
435                                     AdtComment)
436     }
437     oracle{
438         variables{
439             AdtSMS:dtSMS
440         }
441         constraints{
442             AdtSMS.value = 'Your alert has been registered. We will handle it and keep you informed'
443             TheActor.actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
444         }
445     }
446 }
447 //-----
448 test step ts16oeSetClock05 order 16{
449     variables{
450         TheActor:actActivator
451         ACurrentClock:dtDateAndTime
452     }
453     constraints{
454         TheActor=TheSystem.rnactActivator->any2(true)
455         ACurrentClock.date.year.value = 2017
456         ACurrentClock.date.month.value = 11
457         ACurrentClock.date.day.value = 26
458         ACurrentClock.time.hour.value = 12
459         ACurrentClock.time.minute.value = 45
460         ACurrentClock.time.second.value = 00
461     }
462     test message{
463         out:TheActor sends to system actActivator.outactActivator.oeSetClock(ACurrentClock)
464     }
465     oracle{
466         constraints{
467             true
468         }
469     }

```

```

469     }
470 }
471 //-----
472 test step ts17oeSetCrisisStatus order 17{
473     variables{
474         TheActor : actCoordinator
475         AdtCrisisID : dtCrisisID
476         AetCrisisStatus : etCrisisStatus
477     }
478     constraints{
479         TheActor=TheSystem.rnactCoordinator
480         ->select(a | a.rnctCoordinator.login.value.eq('steve'))
481         ->any2(true)
482         //and AdtCrisisID.value= '1'
483         //and AetCrisisStatus = solved
484     }
485     test message{
486         out:TheActor sends to system actCoordinator.outactCoordinator.oeSetCrisisStatus(AdtCrisisID,
487         AetCrisisStatus)
488     }
489     oracle{
490         variables{
491             AMessage:ptString
492         }
493         constraints{
494             AMessage = 'The crisis status has been updated !'
495             TheActor.inactAuthenticated.ieMessage(AMessage)
496         }
497     }
498 //-----
499 test step ts18oeReportOnCrisis order 18{
500     variables{
501         TheActor : actCoordinator
502         AdtCrisisID : dtCrisisID
503         AdtComment : dtComment
504     }
505     constraints{
506         TheActor=TheSystem.rnactCoordinator
507         ->select(a | a.rnctCoordinator.login.value.eq('steve'))
508         ->any2(true)
509         //and AdtCrisisID.value= '1'
510         //and AdtComment.value = '3 victims sent to hospital, 2 cars evacuated and 4 rescue unit
mobilized'
511     }
512     test message{
513         out:TheActor sends to system actCoordinator.outactCoordinator.oeReportOnCrisis(AdtCrisisID,
514         AdtComment)
515     }
516     oracle{
517         variables{
518             AMessage:ptString
519         }
520         constraints{
521             AMessage = 'The crisis comment has been updated !'
522             TheActor.inactAuthenticated.ieMessage(AMessage)
523         }
524     }
525 //-----
526 test step ts19oeCloseCrisis order 19{
527     variables{
528         TheActor : actCoordinator
529         AdtCrisisID : dtCrisisID
530     }
531     constraints{
532         TheActor=TheSystem.rnactCoordinator
533         ->select(a | a.rnctCoordinator.login.value.eq('steve'))
534         ->any2(true)
535         //and AdtCrisisID.value= '1'

```

```

536     }
537     test message{
538         out:TheActor sends to system actCoordinator.outactCoordinator.oeCloseCrisis(AdtCrisisID)
539     }
540     oracle{
541         variables {
542             AMessage:ptString
543         }
544         constraints{
545             AMessage = 'The crisis is now closed !'
546             TheActor.inactAuthenticated.ieMessage(AMessage)
547         }
548     }
549 }
550 }
551 }
552 }

```

Listing C.47: Messir Spec. file tc-testcase01.msr.

## C.48 File ./src-gen/messir-spec/test/tci-testcase01-instance01.msr

```

1 package lu.uni.lassy.excalibur.examples.icrash.tests.testcase01.instance01 {
2
3 import lu.uni.lassy.messir.libraries.string
4 import lu.uni.lassy.messir.libraries.primitives
5 import lu.uni.lassy.messir.libraries.math
6 import lu.uni.lassy.messir.libraries.calendar
7
8 import icrash.concepts.primarytypes.associations
9 import icrash.concepts.primarytypes.classes
10 import icrash.concepts.primarytypes.datatypes
11 import lu.uni.lassy.excalibur.examples.icrash.tests.testcase01
12 import icrash.environment
13
14 Test Model {
15     test case instance instance01:testcase01{
16 //-----
17     test step instance tsi01:testcase01.ts01oeCreateSystemAndEnvironment{
18         variables {
19             theCreator:testcase01.ts01oeCreateSystemAndEnvironment.Creator = "theCreator"
20             AqtyComCompanies : testcase01.ts01oeCreateSystemAndEnvironment.AqtyComCompanies="4"
21         }
22         oracle {
23             satisfaction = "true"
24         }
25         test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
26     }
27 //-----
28     test step instance tsi02: testcase01.ts02oeSetClock{
29         variables {
30             theClock:testcase01.ts02oeSetClock.TheActor = "theClock"
31             ACurrentClock : testcase01.ts02oeSetClock.ACurrentClock= "2017:11:24 - 03:20:00"
32         }
33         oracle {
34             satisfaction = "true"
35         }
36         test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
37     }
38 //-----
39     test step instance tsi03: testcase01.ts03oeLogin{
40         variables {
41             bill:testcase01.ts03oeLogin.TheActor="bill"
42             AdtLogin : testcase01.ts03oeLogin.AdtLogin= "icrashadmin"
43             AdtPassword : testcase01.ts03oeLogin.AdtPassword= "7WXC1359"
44         }
45         oracle {
46             satisfaction = "true"
47             received message {

```



```

48     AMessage : testcase01.ts03oeLogin.AMessage= 'You are logged ! Welcome ...'
49     tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
50 }
51 }
52 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
53 }
54 //-----
55 test step instance tsi04: testcase01.ts04oeAddCoordinator{
56     variables {
57         reuse tsi03.bill as testcase01.ts04oeAddCoordinator.TheActor
58         AdtCoordinatorID : testcase01.ts04oeAddCoordinator.AdtCoordinatorID = "1"
59         AdtLogin :testcase01.ts04oeAddCoordinator.AdtLogin= "steve"
60         AdtPassword : testcase01.ts04oeAddCoordinator.AdtPassword = "pwdMessirExcalibur2017"
61     }
62     oracle {
63         satisfaction = "true"
64         received message {
65             tsi03.bill received from system actAdministrator.inactAdministrator.ieCoordinatorAdded()
66         }
67     }
68     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
69 }
70 //-----
71 test step instance tsi05: testcase01.ts05oeLogout{
72     variables {
73         reuse tsi03.bill as testcase01.ts05oeLogout.TheActor
74     }
75     oracle {
76         satisfaction = "true"
77         received message {
78             AMessage : testcase01.ts05oeLogout.AMessage= 'You are logged out ! Good Bye ...'
79             tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
80         }
81     }
82     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
83 }
84 //-----
85 test step instance tsi06: testcase01.ts06oeSetClock02{
86     variables {
87         reuse tsi02.theClock as testcase01.ts06oeSetClock02.TheActor
88         ACurrentClock : testcase01.ts06oeSetClock02.ACurrentClock= "2017:11:26 - 10:15:00"
89     }
90     oracle {
91         satisfaction = "true"
92     }
93     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
94 }
95 //-----
96 test step instance tsi07: testcase01.ts07oeAlert1{
97     variables {
98         tango:testcase01.ts07oeAlert1.TheActor ="tango"
99         AetHumanKind : testcase01.ts07oeAlert1.AetHumanKind = "witness"
100        AdtDate : testcase01.ts07oeAlert1.AdtDate = "2017:11:26"
101        AdtTime : testcase01.ts07oeAlert1.AdtTime = "10:10:16"
102        AdtPhoneNumber : testcase01.ts07oeAlert1.AdtPhoneNumber = "+3524666445252"
103        AdtGPSLocation : testcase01.ts07oeAlert1.AdtGPSLocation = "49.627675:6.159590"
104        AdtComment : testcase01.ts07oeAlert1.AdtComment = "3 cars involved in an accident."
105    }
106    oracle {
107        satisfaction = "true"
108        received message {
109            AdtSMS : testcase01.ts07oeAlert1.AdtSMS= 'Your alert has been registered. We will handle it and
110            keep you informed'
111            tsi07.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
112        }
113    }
114    test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
115 }
116

```

```

117 //-----
118 test step instance tsi08: testcase01.ts08oeSetClock03{
119     variables {
120         reuse tsi02.theClock as testcase01.ts08oeSetClock03.ACurrentClock
121         ACurrentClock : testcase01.ts08oeSetClock03.ACurrentClock = "2017:11:26 - 10:30:00"
122     }
123     oracle {
124         satisfaction = "true"
125     }
126     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
127 }
128 //-----
129 test step instance tsi09: testcase01.ts09oeSollicitateCrisisHandling{
130     variables {
131         reuse tsi02.theClock as testcase01.ts09oeSollicitateCrisisHandling.TheActor
132         steve: testcase01.ts09oeSollicitateCrisisHandling.TheCoordinator = "steve"
133         reuse tsi03.bill as testcase01.ts09oeSollicitateCrisisHandling.TheAdministrator
134     }
135     oracle {
136         satisfaction = "true"
137         received message {
138             AMessageForCrisisHandlers : testcase01.ts09oeSollicitateCrisisHandling.
139             AMessageForCrisisHandlers= 'There are alerts pending since more than the defined delay. Please
140             REACT !'
141             tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(
142             AMessageForCrisisHandlers)
143             tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(
144             AMessageForCrisisHandlers)
145         }
146     }
147     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
148 }
149 //-----
150 test step instance tsi10: testcase01.ts10oeLogin02{
151     variables {
152         reuse tsi09.steve as testcase01.ts10oeLogin02.TheActor
153         AdtLogin : testcase01.ts10oeLogin02.AdtLogin = "steve"
154         AdtPassword : testcase01.ts10oeLogin02.AdtPassword= "pwdMessirExcalibur2017"
155     }
156     oracle {
157         satisfaction = "true"
158         received message {
159             AMessage : testcase01.ts10oeLogin02.AMessage= 'You are logged ! Welcome ...'
160             tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage (AMessage)
161         }
162     }
163     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
164 }
165 //-----
166 test step instance tsi11: testcase01.ts11oeGetCrisisSet{
167     variables {
168         reuse tsi09.steve as testcase01.ts11oeGetCrisisSet.TheActor
169         AetCrisisStatus : testcase01.ts11oeGetCrisisSet.AetCrisisStatus = "pending"
170     }
171     oracle {
172         satisfaction = "true"
173         received message {
174             ActCrisis : testcase01.ts11oeGetCrisisSet.ActCrisis= "crisis with ID 1 details"
175             tsi09.steve received from system actCoordinator.inactCoordinator.ieSendACrisis(ActCrisis)
176         }
177     }
178     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
179 }
180 //-----
181 test step instance tsi12: testcase01.ts12oeSetCrisisHandler{
182     variables {
183         reuse tsi09.steve as testcase01.ts12oeSetCrisisHandler.TheActor

```

```

183     AdtCrisisID : testcase01.ts12oeSetCrisisHandler.AdtCrisisID = "1"
184
185     reuse tsi07.tango as testcase01.ts12oeSetCrisisHandler.TheComCompany
186
187 }
188 oracle {
189     satisfaction = "true"
190     received message {
191         AMessage : testcase01.ts12oeSetCrisisHandler.AMessage= 'You are now considered as handling the
192         crisis !'
193         AdtSMS : testcase01.ts12oeSetCrisisHandler.AdtSMS= 'The handling of your alert by our services
194         is in progress !'
195         AdtPhoneNumber : testcase01.ts12oeSetCrisisHandler.AdtPhoneNumber= "+3524666445252"
196
197         tsi07.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
198         tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
199     }
200 }
201 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
202 }
203 //-----
204 test step instance tsi13: testcase01.ts13oeSetClock04{
205     variables {
206         reuse tsi02.theClock as testcase01.ts13oeSetClock04.TheActor
207         ACurrentClock : testcase01.ts13oeSetClock04.ACurrentClock = "2017:11:26 - 10:45:00"
208     }
209     oracle {
210         satisfaction = "true"
211     }
212     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
213 }
214 //-----
215 test step instance tsi14: testcase01.ts14oeValidateAlert{
216     variables {
217         reuse tsi09.steve as testcase01.ts14oeValidateAlert.TheActor
218         AdtAlertID : testcase01.ts14oeValidateAlert.AdtAlertID = "1"
219     }
220     oracle {
221         satisfaction = "true"
222         received message {
223             AMessage : testcase01.ts14oeValidateAlert.AMessage= 'The Alert is now declared as valid !'
224             tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
225         }
226     }
227     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
228 }
229 //-----
230 test step instance tsi15: testcase01.ts15oeAlert2{
231     variables {
232         reuse tsi07.tango as testcase01.ts15oeAlert2.TheActor
233         AetHumanKind : testcase01.ts15oeAlert2.AetHumanKind ="witness"
234         AdtDate : testcase01.ts15oeAlert2.AdtDate= "2017:11:26"
235         AdtTime : testcase01.ts15oeAlert2.AdtTime= "10:20:00"
236         AdtPhoneNumber : testcase01.ts15oeAlert2.AdtPhoneNumber= "+3524666445000"
237         AdtGPSLocation : testcase01.ts15oeAlert2.AdtGPSLocation= "49.627095:6.160251"
238         AdtComment : testcase01.ts15oeAlert2.AdtComment= "A car crash just happened."
239     }
240     message {
241         tsi07.tango sent to system testcase01.ts15oeAlert2.out : actComCompany.outactComCompany.oeAlert (
242             AetHumanKind,AdtDate,AdtTime,AdtPhoneNumber,AdtGPSLocation,AdtComment)
243     }
244     oracle {
245         satisfaction = "true"
246         received message {
247             AdtSMS : testcase01.ts15oeAlert2.AdtSMS= 'Your alert has been registered. We will handle it and
248             keep you informed'
249             tsi07.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)

```

```

249
250     }
251 }
252 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
253 }
254 //-----
255 test step instance tsi16: testcase01.ts16oeSetClock05{
256 variables {
257 reuse tsi02.theClock as testcase01.ts16oeSetClock05.TheActor
258 ACurrentClock : testcase01.ts16oeSetClock05.ACurrentClock = "2017:11:26 - 12:45:00"
259 }
260 oracle {
261 satisfaction = "true"
262 received message {
263
264 }
265 }
266 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
267 }
268 //-----
269 test step instance tsi17: testcase01.ts17oeSetCrisisStatus{
270 variables {
271 reuse tsi09.steve as testcase01.ts17oeSetCrisisStatus.TheActor
272 AdtCrisisID : testcase01.ts17oeSetCrisisStatus.AdtCrisisID = "1"
273 AetCrisisStatus : testcase01.ts17oeSetCrisisStatus.AetCrisisStatus= "solved"
274 }
275 oracle {
276 satisfaction = "true"
277 received message {
278 AMessage : testcase01.ts17oeSetCrisisStatus.AMessage= "The crisis status has been updated !"
279 tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage (AMessage)
280 }
281 }
282 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
283 }
284 //-----
285 test step instance tsi18: testcase01.ts18oeReportOnCrisis{
286 variables {
287 reuse tsi09.steve as testcase01.ts18oeReportOnCrisis.TheActor
288 AdtCrisisID : testcase01.ts18oeReportOnCrisis.AdtCrisisID = "1"
289 AdtComment : testcase01.ts18oeReportOnCrisis.AdtComment= "3 victims sent to hospital, 2 cars
evacuated and 4 rescue unit mobilized"
290 }
291 oracle {
292 satisfaction = "true"
293 received message {
294 AMessage : testcase01.ts18oeReportOnCrisis.AMessage= 'The crisis comment has been updated !'
295 tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage (AMessage)
296
297 }
298 }
299 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
300 }
301 //-----
302 test step instance tsi19: testcase01.ts19oeCloseCrisis{
303 variables {
304 reuse tsi09.steve as testcase01.ts19oeCloseCrisis.TheActor
305 AdtCrisisID : testcase01.ts19oeCloseCrisis.AdtCrisisID = "1"
306 }
307 oracle {
308 satisfaction = "true"
309 received message {
310 AMessage : testcase01.ts19oeCloseCrisis.AMessage= 'The crisis is now closed !'
311
312 tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage (AMessage)
313
314 }
315 }
316 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
317 }

```

```

318
319 }
320 //-----
321 //-----
322 //-----
323 test case instance instance01Part01:testcase01{
324 //-----
325 test step instance tsi01:testcase01.ts01oeCreateSystemAndEnvironment{
326 variables {
327   theCreator:testcase01.ts01oeCreateSystemAndEnvironment.Creator = "theCreator"
328   AqtyComCompanies : testcase01.ts01oeCreateSystemAndEnvironment.AqtyComCompanies="4"
329 }
330 oracle {
331   satisfaction = "true"
332 }
333 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
334 }
335 //-----
336 test step instance tsi02: testcase01.ts02oeSetClock{
337 variables {
338   theClock:testcase01.ts02oeSetClock.TheActor = "theClock"
339   ACurrentClock : testcase01.ts02oeSetClock.ACurrentClock= "2017:11:24 - 03:20:00"
340 }
341 oracle {
342   satisfaction = "true"
343 }
344 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
345 }
346 //-----
347 test step instance tsi03: testcase01.ts03oeLogin{
348 variables {
349   bill:testcase01.ts03oeLogin.TheActor="bill"
350   AdtLogin : testcase01.ts03oeLogin.AdtLogin= "icrashadmin"
351   AdtPassword : testcase01.ts03oeLogin.AdtPassword= "7WXC1359"
352 }
353 oracle {
354   satisfaction = "true"
355   received message {
356     AMessage : testcase01.ts03oeLogin.AMessage= 'You are logged ! Welcome ...'
357     tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
358   }
359 }
360 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
361 }
362 //-----
363 test step instance tsi04: testcase01.ts04oeAddCoordinator{
364 variables {
365   reuse tsi03.bill as testcase01.ts04oeAddCoordinator.TheActor
366   AdtCoordinatorID : testcase01.ts04oeAddCoordinator.AdtCoordinatorID = "1"
367   AdtLogin :testcase01.ts04oeAddCoordinator.AdtLogin= "steve"
368   AdtPassword : testcase01.ts04oeAddCoordinator.AdtPassword = "pwdMessirExcalibur2017"
369 }
370 oracle {
371   satisfaction = "true"
372   received message {
373     tsi03.bill received from system actAdministrator.inactAdministrator.ieCoordinatorAdded()
374   }
375 }
376 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
377 }
378 //-----
379 test step instance tsi05: testcase01.ts05oeLogout{
380 variables {
381   reuse tsi03.bill as testcase01.ts05oeLogout.TheActor
382 }
383 oracle {
384   satisfaction = "true"
385   received message {
386     AMessage : testcase01.ts05oeLogout.AMessage= 'You are logged out ! Good Bye ...'
387     tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)

```

```

388     }
389 }
390 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
391 }
392 //-----
393 test step instance tsi06: testcase01.ts06oeSetClock02{
394     variables {
395         reuse tsi02.theClock as testcase01.ts06oeSetClock02.TheActor
396         ACurrentClock : testcase01.ts06oeSetClock02.ACurrentClock= "2017:11:26 - 10:15:00"
397     }
398     oracle {
399         satisfaction = "true"
400     }
401     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
402 }
403 //-----
404 test step instance tsi07: testcase01.ts07oeAlert1{
405     variables {
406         tango:testcase01.ts07oeAlert1.TheActor ="tango"
407         AetHumanKind : testcase01.ts07oeAlert1.AetHumanKind = "witness"
408         AdtDate : testcase01.ts07oeAlert1.AdtDate = "2017:11:26"
409         AdtTime : testcase01.ts07oeAlert1.AdtTime = "10:10:16"
410         AdtPhoneNumber : testcase01.ts07oeAlert1.AdtPhoneNumber = "+3524666445252"
411         AdtGPSLocation : testcase01.ts07oeAlert1.AdtGPSLocation = "49.627675:6.159590"
412         AdtComment : testcase01.ts07oeAlert1.AdtComment = "3 cars involved in an accident."
413     }
414     oracle {
415         satisfaction = "true"
416         received message {
417             AdtSMS : testcase01.ts07oeAlert1.AdtSMS= 'Your alert has been registered. We will handle it and
418             keep you informed'
419             tsi07.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
420         }
421     }
422     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
423 }
424 //-----
425 test step instance tsi08: testcase01.ts08oeSetClock03{
426     variables {
427         reuse tsi02.theClock as testcase01.ts08oeSetClock03.ACurrentClock
428         ACurrentClock : testcase01.ts08oeSetClock03.ACurrentClock = "2017:11:26 - 10:30:00"
429     }
430     oracle {
431         satisfaction = "true"
432     }
433     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
434 }
435 //-----
436 test step instance tsi09: testcase01.ts09oeSollicitateCrisisHandling{
437     variables {
438         reuse tsi02.theClock as testcase01.ts09oeSollicitateCrisisHandling.TheActor
439         steve:testcase01.ts09oeSollicitateCrisisHandling.TheCoordinator ="steve"
440         reuse tsi03.bill as testcase01.ts09oeSollicitateCrisisHandling.TheAdministrator
441     }
442     oracle {
443         satisfaction = "true"
444         received message {
445             AMessageForCrisisHandlers : testcase01.ts09oeSollicitateCrisisHandling.
446             AMessageForCrisisHandlers= 'There are alerts pending since more than the defined delay. Please
447             REACT !'
448             tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(
449             AMessageForCrisisHandlers)
450             tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(
451             AMessageForCrisisHandlers)
452         }
453     }
454     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}

```

```

453 }
454 }
455
456 //-----
457 //-----
458 //-----
459 test case instance instance01Part02:testcase01{
460
461 test step instance ts110: testcase01.ts10oeLogin02{
462 variables {
463     steve : testcase01.ts10oeLogin02.TheActor
464     AdtLogin : testcase01.ts10oeLogin02.AdtLogin = "steve"
465     AdtPassword : testcase01.ts10oeLogin02.AdtPassword= "pwdMessirExcalibur2017"
466 }
467 oracle {
468     satisfaction = "true"
469     received message {
470         AMessage : testcase01.ts10oeLogin02.AMessage= 'You are logged ! Welcome ...'
471         steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
472     }
473 }
474 }
475 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
476 }
477 //-----
478 test step instance ts111: testcase01.ts11oeGetCrisisSet{
479 variables {
480     reuse ts110.steve as testcase01.ts11oeGetCrisisSet.TheActor
481     AetCrisisStatus : testcase01.ts11oeGetCrisisSet.AetCrisisStatus = "pending"
482 }
483 oracle {
484     satisfaction = "true"
485     received message {
486         ActCrisis : testcase01.ts11oeGetCrisisSet.ActCrisis= "crisis with ID 1 details"
487         ts110.steve received from system actCoordinator.inactCoordinator.ieSendACrisis(ActCrisis)
488     }
489 }
490 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
491 }
492 //-----
493 test step instance ts112: testcase01.ts12oeSetCrisisHandler{
494 variables {
495     reuse ts110.steve as testcase01.ts12oeSetCrisisHandler.TheActor
496     AdtCrisisID : testcase01.ts12oeSetCrisisHandler.AdtCrisisID = "1"
497     tango : testcase01.ts12oeSetCrisisHandler.TheComCompany
498 }
499 oracle {
500     satisfaction = "true"
501     received message {
502         AMessage : testcase01.ts12oeSetCrisisHandler.AMessage= 'You are now considered as handling the
                    crisis !'
503         AdtSMS : testcase01.ts12oeSetCrisisHandler.AdtSMS= 'The handling of your alert by our services
                    is in progress !'
504         AdtPhoneNumber : testcase01.ts12oeSetCrisisHandler.AdtPhoneNumber= "+3524666445252"
505
506         tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
507         ts110.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
508     }
509 }
510 }
511 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
512 }
513 //-----
514 test step instance ts113: testcase01.ts13oeSetClock04{
515 variables {
516     theClock : testcase01.ts13oeSetClock04.TheActor
517     ACurrentClock : testcase01.ts13oeSetClock04.ACurrentClock = "2017:11:26 - 10:45:00"
518 }
519 oracle {
520     satisfaction = "true"

```

```

521 }
522 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
523 }
524 //-----
525 test step instance ts14: testcase01.ts14oeValidateAlert{
526   variables {
527     reuse ts10.steve as testcase01.ts14oeValidateAlert.TheActor
528     AdtAlertID : testcase01.ts14oeValidateAlert.AdtAlertID = "1"
529   }
530   oracle {
531     satisfaction = "true"
532     received message {
533       AMessage : testcase01.ts14oeValidateAlert.AMessage= 'The Alert is now declared as valid !'
534       ts10.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
535     }
536   }
537 }
538 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
539 }
540 //-----
541 test step instance ts15: testcase01.ts15oeAlert2{
542   variables {
543     reuse ts12.tango as testcase01.ts15oeAlert2.TheActor
544     AetHumanKind : testcase01.ts15oeAlert2.AetHumanKind ="witness"
545     AdtDate : testcase01.ts15oeAlert2.AdtDate= "2017:11:26"
546     AdtTime : testcase01.ts15oeAlert2.AdtTime= "10:20:00"
547     AdtPhoneNumber : testcase01.ts15oeAlert2.AdtPhoneNumber= "+3524666445000"
548     AdtGPSLocation : testcase01.ts15oeAlert2.AdtGPSLocation= "49.627095:6.160251"
549     AdtComment : testcase01.ts15oeAlert2.AdtComment= "A car crash just happened."
550   }
551   message {
552     ts12.tango sent to system testcase01.ts15oeAlert2.out : actComCompany.outactComCompany.oeAlert (
553       AetHumanKind,AdtDate,AdtTime,AdtPhoneNumber,AdtGPSLocation,AdtComment)
554   }
555   oracle {
556     satisfaction = "true"
557     received message {
558       AdtSMS : testcase01.ts15oeAlert2.AdtSMS= 'Your alert has been registered. We will handle it and
559         keep you informed'
560       ts12.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
561     }
562   }
563   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
564 }
565 //-----
566 test step instance ts16: testcase01.ts16oeSetClock05{
567   variables {
568     reuse ts13.theClock as testcase01.ts16oeSetClock05.TheActor
569     ACurrentClock : testcase01.ts16oeSetClock05.ACurrentClock = "2017:11:26 - 12:45:00"
570   }
571   oracle {
572     satisfaction = "true"
573     received message {
574     }
575   }
576 }
577 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
578 }
579 //-----
580 test step instance ts17: testcase01.ts17oeSetCrisisStatus{
581   variables {
582     reuse ts10.steve as testcase01.ts17oeSetCrisisStatus.TheActor
583     AdtCrisisID : testcase01.ts17oeSetCrisisStatus.AdtCrisisID = "1"
584     AetCrisisStatus : testcase01.ts17oeSetCrisisStatus.AetCrisisStatus= "solved"
585   }
586   oracle {
587     satisfaction = "true"
588     received message {

```



```

589     AMessage : testcase01.ts17oeSetCrisisStatus.AMessage= "The crisis status has been updated !"
590     tsil0.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
591   }
592 }
593 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
594 }
595 //-----
596 test step instance tsil8: testcase01.ts18oeReportOnCrisis{
597   variables {
598     reuse tsil0.steve as testcase01.ts18oeReportOnCrisis.TheActor
599     AdtCrisisID : testcase01.ts18oeReportOnCrisis.AdtCrisisID = "1"
600     AdtComment : testcase01.ts18oeReportOnCrisis.AdtComment= "3 victims sent to hospital, 2 cars
601     evacuated and 4 rescue unit mobilized"
602   }
603   oracle {
604     satisfaction = "true"
605     received message {
606       AMessage : testcase01.ts18oeReportOnCrisis.AMessage= 'The crisis comment has been updated !'
607       tsil0.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
608     }
609   }
610   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
611 }
612 //-----
613 test step instance tsil9: testcase01.ts19oeCloseCrisis{
614   variables {
615     reuse tsil0.steve as testcase01.ts19oeCloseCrisis.TheActor
616     AdtCrisisID : testcase01.ts19oeCloseCrisis.AdtCrisisID = "1"
617   }
618   oracle {
619     satisfaction = "true"
620     received message {
621       AMessage : testcase01.ts19oeCloseCrisis.AMessage= 'The crisis is now closed !'
622     }
623     tsil0.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
624   }
625 }
626 }
627 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
628 }
629 }
630 }
631 }
632 }
633 }

```

Listing C.48: Messir Spec. file tci-testcase01-instance01.msr.

## C.49 File `./src-gen/messir-spec/usecases/usecase-suDeployAndRun.msr`

```

1 package icrash.usecases.suDeployAndRun {
2 import icrash.concepts.primarytypes.datatypes
3 import icrash.environment
4 import icrash.usecases.suGlobalCrisisHandling
5 import icrash.usecases.ugAdministrateTheSystem
6 import icrash.usecases.subfunctions
7
8 Use Case Model {
9   use case system summary suDeployAndRun() {
10     actor actAdministrator[primary, active]
11     actor actMsrCreator[secondary, active]
12     actor actCoordinator[secondary, active, multiple]
13     actor actActivator[secondary, proactive]
14     actor actComCompany[secondary, active]
15
16     reuse oeCreateSystemAndEnvironment[1..1]

```

```

17 reuse ugAdministrateTheSystem[1..*]
18 reuse suGlobalCrisisHandling[1..*]
19 reuse oeSetClock[1..*]
20 reuse oeSollicitateCrisisHandling[0..*]
21 reuse oeAlert[1..*]
22
23 step a: actMsrCreator executes oeCreateSystemAndEnvironment
24 step b: actAdministrator executes ugAdministrateTheSystem
25 step c: actComCompany executes oeAlert
26 step d: actActivator executes oeSetClock
27 step ^e: actActivator executes oeSollicitateCrisisHandling
28 step f: actCoordinator executes suGlobalCrisisHandling
29
30 ordering constraint
31   "step (a) must be always the first step."
32 ordering constraint
33   "step (f) can be executed by different actCoordinator actors."
34 ordering constraint
35   "if (e) then previously (d)."
36 }
37 //-----
38 //-----
39 //-----
40 use case instance uciSimpleAndComplete : suDeployAndRun {
41   actors {
42     theCreator : actMsrCreator
43     theClock : actActivator
44     bill : actAdministrator
45     tango : actComCompany
46     steve : actCoordinator
47   }
48   use case steps {
49     //-----
50     theCreator
51     executed instance of subfunction
52       oeCreateSystemAndEnvironment("4"){}
53     //-----
54     theClock
55     executed instance of subfunction
56       oeSetClock("2017:11:24 - 03:20:00"){}
57     //-----
58     bill
59     executed instance of subfunction
60       oeLogin("icrashadmin","7WXC1359"){
61         ieMessage('You are logged ! Welcome ...') returned to bill
62       }
63     //-----
64     bill
65     executed instance of subfunction
66       oeAddCoordinator("1","steve","pwdMessirExcalibur2017"){
67         ieCoordinatorAddedreturned returned to bill
68       }
69     //-----
70     bill
71     executed instance of subfunction
72       oeLogout{
73         ieMessage('You are logged out ! Good Bye ...') returned to bill
74       }
75     //-----
76     theClock
77     executed instance of subfunction
78       oeSetClock("2017:11:26 - 10:15:00"){}
79     //-----
80     tango
81     executed instance of subfunction
82       oeAlert("witness","2017:11:26","10:10:16","+3524666445252",
83         "49.627675:6.159590","3 cars involved in an accident."){
84         ieSmsSend("+3524666445252","Your alert has been registered. We will handle it and keep you
85         informed") returned to tango
86       }

```

```

86 //-----
87 theClock
88 executed instanceof subfunction
89 oeSetClock("2017:11:26 - 10:30:00"){ }
90 //-----
91 theClock
92 executed instanceof subfunction
93 oeSollicitateCrisisHandling{
94 ieMessage("There are alerts pending since more than the defined delay. Please REACT !")
95 returned to bill
96 ieMessage("There are alerts pending since more than the defined delay. Please REACT !")
97 returned to steve
98 }
99 //-----
100 steve
101 executed instanceof subfunction
102 oeLogin("steve","pwdMessirExcalibur2017"){
103 ieMessage('You are logged ! Welcome ...') returned to steve
104 }
105 //-----
106 steve
107 executed instanceof subfunction
108 oeGetCrisisSet("pending"){
109 ieSendACrisis("crisis with ID 1 details") returned to steve
110 }
111 //-----
112 steve
113 executed instanceof subfunction
114 oeSetCrisisHandler("1"){
115 ieSmsSend("+3524666445252","The handling of your alert by our services is in progress !")
116 returned to tango
117 ieMessage("You are now considered as handling the crisis !")
118 returned to steve
119 }
120 //-----
121 theClock
122 executed instanceof subfunction
123 oeSetClock("2017:11:26 - 10:45:00"){ }
124 //-----
125 steve
126 executed instanceof subfunction
127 oeValidateAlert("1"){
128 ieMessage('The Alert is now declared as valid !')
129 returned to steve
130 }
131 //-----
132 tango
133 executed instanceof subfunction
134 oeAlert("witness","2017:11:26","10:20:00","+3524666445000",
135 "49.627095:6.160251","A car crash just happened."){
136 ieSmsSend("+3524666445000","Your alert has been registered. We will handle it and keep you
informed") returned to tango
137 }
138 //-----
139 theClock
140 executed instanceof subfunction
141 oeSetClock("2017:11:26 - 12:45:00"){ }
142 //-----
143 steve
144 executed instanceof subfunction
145 oeSetCrisisStatus("1","solved"){
146 ieMessage('The crisis status has been updated !')
147 returned to steve
148 }
149 //-----
150 steve
151 executed instanceof subfunction
152 oeReportOnCrisis("1","3 victims sent to hospital, 2 cars evacuated and 4 rescue unit
mobilized"){
153 ieMessage('The crisis comment has been updated !')

```

```

154         returned to steve
155     }
156 //-----
157     steve
158     executed instanceof subfunction
159     oeCloseCrisis("1"){
160         ieMessage('The crisis is now closed !')
161         returned to steve
162     }
163
164 }
165 }
166 //-----
167 //-----
168 //-----
169 use case instance uciSimpleAndCompletePart01 : suDeployAndRun{
170
171     actors {
172         theCreator : actMsrCreator
173         theClock : actActivator
174         bill : actAdministrator
175         tango : actComCompany
176         steve : actCoordinator
177     }
178     use case steps {
179 //-----
180         theCreator
181         executed instanceof subfunction
182         oeCreateSystemAndEnvironment("4"){
183 //-----
184         theClock
185         executed instanceof subfunction
186         oeSetClock("2017:11:24 - 03:20:00"){
187 //-----
188         bill
189         executed instanceof subfunction
190         oeLogin("icrashadmin","7WXC1359"){
191             ieMessage('You are logged ! Welcome ...') returned to bill
192         }
193 //-----
194         bill
195         executed instanceof subfunction
196         oeAddCoordinator("1","steve","pwdMessirExcalibur2017"){
197             ieCoordinatorAddedreturned returned to bill
198         }
199 //-----
200         bill
201         executed instanceof subfunction
202         oeLogout{
203             ieMessage('You are logged out ! Good Bye ...') returned to bill
204         }
205 //-----
206         theClock
207         executed instanceof subfunction
208         oeSetClock("2017:11:26 - 10:15:00"){
209 //-----
210         tango
211         executed instanceof subfunction
212         oeAlert("witness","2017:11:26","10:10:16","+3524666445252",
213             "49.627675:6.159590","3 cars involved in an accident."){
214             ieSmsSend("+3524666445252","Your alert has been registered. We will handle it and keep you
215             informed") returned to tango
216         }
217 //-----
218         theClock
219         executed instanceof subfunction
220         oeSetClock("2017:11:26 - 10:30:00"){
221 //-----
222         theClock
223         executed instanceof subfunction

```

```

223     oeSollicitateCrisisHandling{
224         ieMessage("There are alerts pending since more than the defined delay. Please REACT !")
225         returned to bill
226         ieMessage("There are alerts pending since more than the defined delay. Please REACT !")
227         returned to steve
228     }
229 }
230 }
231 //-----
232 //-----
233 //-----
234 use case instance ucisSimpleAndCompletePart02 : suDeployAndRun{
235     actors {
236         theCreator : actMsrCreator
237         theClock : actActivator
238         bill : actAdministrator
239         tango : actComCompany
240         steve : actCoordinator
241     }
242     use case steps {
243         -----
244         steve
245         executed instance of subfunction
246         oeLogin("steve","pwdMessirExcalibur2017"){
247             ieMessage('You are logged ! Welcome ...') returned to steve
248         }
249         -----
250         steve
251         executed instance of subfunction
252         oeGetCrisisSet("pending"){
253             ieSendACrisis("crisis with ID 1 details") returned to steve
254         }
255         -----
256         steve
257         executed instance of subfunction
258         oeSetCrisisHandler("1"){
259             ieSmsSend("+3524666445252","The handling of your alert by our services is in progress !")
260             returned to tango
261             ieMessage("You are now considered as handling the crisis !")
262             returned to steve
263         }
264         -----
265         theClock
266         executed instance of subfunction
267         oeSetClock("2017:11:26 - 10:45:00"){ }
268         -----
269         steve
270         executed instance of subfunction
271         oeValidateAlert("1"){
272             ieMessage('The Alert is now declared as valid !')
273             returned to steve
274         }
275         -----
276         tango
277         executed instance of subfunction
278         oeAlert("witness","2017:11:26","10:20:00","+3524666445000",
279             "49.627095:6.160251","A car crash just happened."){
280             ieSmsSend("+3524666445000","Your alert has been registered. We will handle it and keep you
281             informed") returned to tango
282         }
283         -----
284         theClock
285         executed instance of subfunction
286         oeSetClock("2017:11:26 - 12:45:00"){ }
287         -----
288         steve
289         executed instance of subfunction
290         oeSetCrisisStatus("1","solved"){
291             ieMessage('The crisis status has been updated !')

```

```

292         returned to steve
293     }
294 //-----
295     steve
296     executed instanceof subfunction
297     oeReportOnCrisis("1","3 victims sent to hospital, 2 cars evacuated and 4 rescue unit
mobilized"){
298         ieMessage('The crisis comment has been updated !')
299         returned to steve
300     }
301 //-----
302     steve
303     executed instanceof subfunction
304     oeCloseCrisis("1"){
305         ieMessage('The crisis is now closed !')
306         returned to steve
307     }
308 }
309 }
310 }
311 }
312 }

```

Listing C.49: Messir Spec. file usecase-suDeployAndRun.msr.

## C.50 File `./src-gen/messir-spec/usecases/usecase-suGlobalCrisisHandling.msr`

```

1 package icrash.usecases.suGlobalCrisisHandling {
2 import lu.uni.lassy.messir.libraries.primitives
3 import icrash.environment
4 import icrash.usecases.subfunctions
5 import icrash.usecases.ugSecurelyUseSystem
6 import icrash.usecases.ugManageCrisis
7 import icrash.usecases.ugMonitor
8
9 Use Case Model {
10 use case system summary
11 suGlobalCrisisHandling() {
12 actor actCoordinator[primary,active]
13
14 reuse ugSecurelyUseSystem[1..*]
15 reuse ugMonitor[1..*]
16 reuse ugManageCrisis[1..*]
17
18 step a: actCoordinator
19     executes ugSecurelyUseSystem
20 step b: actCoordinator
21     executes ugMonitor
22 step c: actCoordinator
23     executes ugManageCrisis
24
25 ordering constraint
26 "steps (a) (b) and (c) executions are interleaved
27 (steps (b) and (c) have their protocol constrained by steps of (a))."
28 ordering constraint
29 "steps (a) (b) and (c) can be executed multiple times."
30 }
31 }}

```

Listing C.50: Messir Spec. file usecase-suGlobalCrisisHandling.msr.

## C.51 File `./src-gen/messir-spec/usecases/usecase-ugAdministrateTheSystem.msr`

```

1 package icrash.usecases.ugAdministrateTheSystem {

```

```

2
3 import icrash.environment
4 import icrash.usecases.ugSecurelyUseSystem
5 import icrash.usecases.subfunctions
6
7 Use Case Model {
8
9   use case system usergoal
10   ugAdministrateTheSystem() {
11     actor actAdministrator[primary,active]
12
13     reuse ugSecurelyUseSystem[1..*]
14     reuse oeAddCoordinator[1..*]
15     reuse oeDeleteCoordinator[0..*]
16
17     step a: actAdministrator
18       executes ugSecurelyUseSystem
19     step b: actAdministrator
20       executes oeAddCoordinator
21     step c: actAdministrator
22       executes oeDeleteCoordinator
23
24     ordering constraint
25       "steps (a) (b) and (c) executions are interleaved
26       (steps (b) and (c) have their protocol constrained
27       by steps of (a))."
28     ordering constraint
29       "steps (a) (b) and (c) can be executed multiple times."
30   }
31 }
32 }

```

Listing C.51: Messir Spec. file usecase-ugAdministrateTheSystem.msr.

## C.52 File `./src-gen/messir-spec/usecases/usecase-ugManageCrisis.msr`

```

1 package icrash.usecases.ugManageCrisis {
2
3   import icrash.environment
4   import icrash.usecases.subfunctions
5
6   Use Case Model {
7
8     use case system usergoal ugManageCrisis() {
9       actor actCoordinator[primary, active]
10
11       reuse oeValidateAlert[0..*]
12       reuse oeSetCrisisStatus[0..*]
13       reuse oeSetCrisisHandler[0..*]
14       reuse oeReportOnCrisis[0..*]
15       reuse oeCloseCrisis[0..*]
16       reuse oeInvalidateAlert[0..*]
17
18       step a: actCoordinator executes oeValidateAlert
19       step b: actCoordinator executes oeSetCrisisStatus
20       step c: actCoordinator executes oeSetCrisisHandler
21       step d: actCoordinator executes oeReportOnCrisis
22       step f: actCoordinator executes oeCloseCrisis
23       step g: actCoordinator executes oeInvalidateAlert
24
25       ordering constraint "managing a crisis is doing one of the indicated use cases."
26
27     }
28
29   }
30 }

```

Listing C.52: Messir Spec. file usecase-ugManageCrisis.msr.

## C.53 File ./src-gen/messir-spec/usecases/usecase-ugMonitor.msr

```

1 package icrash.usecases.ugMonitor {
2
3   import icrash.environment
4   import icrash.usecases.subfunctions
5
6   Use Case Model {
7     use case system usergoal ugMonitor() {
8       actor icrash.environment.actCoordinator[primary, active]
9
10      reuse oeGetCrisisSet[0..*]
11      reuse oeGetAlertsSet[0..*]
12
13      step a: icrash.environment.actCoordinator executes oeGetAlertsSet
14      step b: icrash.environment.actCoordinator executes oeGetCrisisSet
15    }
16  }
17 }

```

Listing C.53: Messir Spec. file usecase-ugMonitor.msr.

## C.54 File ./src-gen/messir-spec/usecases/usecase-ugSecurelyUseSystem.msr

```

1 package icrash.usecases.ugSecurelyUseSystem {
2
3   import icrash.environment
4   import icrash.usecases.subfunctions
5
6   Use Case Model {
7
8     use case system usergoal
9     ugSecurelyUseSystem() {
10
11     actor actAuthenticated[primary, active]
12
13     reuse oeLogin[1..1]
14     reuse oeLogout[1..1]
15
16     step a: actAuthenticated
17       executes oeLogin
18     step b: actAuthenticated
19       executes oeLogout
20
21     ordering constraint
22     "step (a) must always precede step (b)."

```

Listing C.54: Messir Spec. file usecase-ugSecurelyUseSystem.msr.

## C.55 File ./src-gen/messir-spec/usecases/usecaseinstance-ugSecurelyUseSystem-uciugSecurelyUseSystem.msr

```

1 package usecases.uciugSecurelyUseSystem {
2   import icrash.usecases.ugSecurelyUseSystem
3   import icrash.usecases.ugSecurelyUseSystem
4   import icrash.concepts.primarytypes.datatypes
5   import icrash.environment
6   import icrash.usecases.suGlobalCrisisHandling
7   import icrash.usecases.ugAdministrateTheSystem
8   import icrash.usecases.subfunctions
9

```



```

10 Use Case Model {
11
12 //-----
13 use case instance uciugSecurelyUseSystem : ugSecurelyUseSystem {
14   actors {
15     bill:actAuthenticated
16   }
17   use case steps {
18 //-----
19     bill
20     executed instance of subfunction
21       oeLogin("icrashadmin","7WXC1359"){
22         ieMessage('You are logged ! Welcome ...') returned to bill
23       }
24 //-----
25     bill
26     executed instance of subfunction
27       oeLogout{
28         ieMessage('You are logged out ! Good Bye ...') returned to bill
29       }
30   }
31 }
32 }
33 }

```

Listing C.55: Messir Spec. file usecaseinstance-ugSecurelyUseSystem-uciugSecurelyUseSystem.msr.

## Appendix D

# Listing of the Prolog Files Referenced in the Operation Model Specification

### D.1 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactActivator/oeSetClock.pl

```
1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5%-----
6msrop(outactActivator,
7  oeSetClock,
8  [preProtocol,Self,
9   AcurrentClock
10 ],
11 []):-
12/* Pre Protocol:*/
13/* PreP01 */
14 msrVar(ctState,TheSystem),
15 msrVar(ptBoolean,AvpStarted),
16
17 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
18
19 msrNav([Self],[rnActor,rnSystem,vpStarted],[AvpStarted]),
20 AvpStarted = [ptBoolean,true],
21
22 msrNav([TheSystem],
23  [clock,lt,[AcurrentClock]],
24  [[ptBoolean,true]])
25 .
26
27msrop(outactActivator,
28  oeSetClock,
29  [preFunctional,Self,
30   AcurrentClock
31 ],
32 []):-
33/* Pre Functional:*/
34/* PreF01 */
35true.
36
37msrop(outactActivator,
38  oeSetClock,
39  [post,Self,
40   AcurrentClock
41 ],
42 []):-
43
```

```

44 msrVar(ctState, TheSystem),
45
46/* Post Functional:*/
47
48 msrNav([Self], [rnActor, rnSystem], [TheSystem]),
49
50/* PostF01 */
51 msrNav([TheSystem],
52     [msmAtPost, clock],
53     [AcurrentClock]),
54
55/* Post Protocol:*/
56/* PostP01 */
57 true
58 .

```

Listing D.1: Prolog file outactActivator-oeSetClock.pl.

## D.2 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactActivator-oeSolicitCrisisHandling.pl

```

1 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5%-----
6
7msrop(outactActivator,
8     oeSolicitCrisisHandling,
9     [preProtocol, Self
10     ],
11     []):-
12/* Pre Protocol:*/
13 msrVar(ctState, TheSystem),
14 msrNav([Self], [rnActor, rnSystem], [TheSystem]),
15
16 msrVarCol(ctCrisis, _, ColctCrisisToHandle),
17
18/* PreP01 */
19 msrNav([TheSystem],
20     [vpStarted],
21     [[ptBoolean, true]]),
22
23/* PreP02 */
24 msrNav([TheSystem],
25     [rnctCrisis, msrSelect,
26     handlingDelayPassed, []
27     ],
28     ColctCrisisToHandle),
29
30 msrNav(ColctCrisisToHandle,
31     [msrSize, geq, [[ptInteger, 1]]],
32     [[ptBoolean, true]])
33.
34
35msrop(outactActivator,
36     oeSolicitCrisisHandling,
37     [preFunctional, Self
38     ],
39     []):-
40/* Pre Functional:*/
41/* PreF01 */
42true.
43
44msrop(outactActivator,
45     oeSolicitCrisisHandling,
46     [post, Self
47     ],

```

```

48     []):-
49
50     msrVar(ctState,TheSystem),
51     msrVar(dtComment,AMessageForCrisisHandlers),
52     msrVar(dtDateAndTime, TheClock),
53     msrVarCol(ctCrisis,_,ColctCrisisToAllocateIfPossible),
54
55 /* Post Functional:*/
56     msrNav([Self],[rnActor,rnSystem],[TheSystem]),
57
58 /* PostF01 */
59     msrNav([TheSystem],
60         [rnctCrisis,msrSelect,
61             maxHandlingDelayPassed,[],
62             ],
63         ColctCrisisToAllocateIfPossible),
64
65     msrNav(ColctCrisisToAllocateIfPossible,
66         [msrForAll,isAllocatedIfPossible,[],
67             [[ptBoolean,true]]],
68
69 /* PostF02 */
70     msrNav([TheSystem],
71         [rnctCrisis,msrSelect,
72             handlingDelayPassed,[],
73             ],
74         ColctCrisisToHandle),
75
76     msrNav(ColctCrisisToHandle,
77         [msrColSubtract,[ColctCrisisToAllocateIfPossible]
78             ],
79         ColctCrisisToRemind),
80
81     (msrNav(ColctCrisisToRemind,
82         [msrSize,geq,[[ptInteger,1]]],
83         [[ptBoolean,true]])
84     -> (msrNav([AMessageForCrisisHandlers],
85         [value],
86         [[ptString,'There are alerts pending since more than the defined delay. Please REACT !']]),
87
88         msrNav([TheSystem],
89             [rnactAdministrator,rnInterfaceIN,
90                 ieMessage,[AMessageForCrisisHandlers]
91             ],
92             [[ptBoolean,true]]),
93
94         msrNav([TheSystem],
95             [rnactCoordinator,msrForAll,rnInterfaceIN,
96                 ieMessage,[AMessageForCrisisHandlers]
97             ],
98             [[ptBoolean,true]]))
99     )
100 ; true
101 ),
102
103 /* Post Protocol:*/
104 /* PostP01 */
105     msrNav([TheSystem],
106         [clock],
107         [TheClock]),
108
109     msrNav([TheSystem],
110         [msmAtPost,vpLastReminder],
111         [TheClock])
112 .

```

Listing D.2: Prolog file outactActivator-oeSollicitateCrisisHandling.pl.

### D.3 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactAdminCoordinator.pl

```

1 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2 /* DISCONTIGUOUS PREDICATES */
3 :- multifile msrop/4.
4 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5 %-----
6 msrop(outactAdministrator,
7   oeAddCoordinator,
8   [preProtocol,Self,
9     AdtCoordinatorID,
10    AdtLogin,
11    AdtPassword
12   ],
13   []):-
14 /* Pre Protocol:*/
15 msrVar(ctState,TheSystem),
16 msrVar(actAdministrator,TheActor),
17 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
18 msrNav([Self],[rnActor],[TheActor]),
19
20 /* PreP01 */
21 msrNav([TheSystem],
22   [vpStarted],
23   [[ptBoolean,true]]),
24
25 /* PreP02 */
26 msrNav([TheActor],
27   [rnctAuthenticated,vpIsLogged],
28   [[ptBoolean,true]]),
29
30 .
31
32 msrop(outactAdministrator,
33   oeAddCoordinator,
34   [preFunctional,Self,
35     AdtCoordinatorID,
36     AdtLogin,
37     AdtPassword
38   ],
39   []):-
40 /* Pre Functional:*/
41 msrVar(ctState,TheSystem),
42 msrVar(actAdministrator,TheActor),
43 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
44 msrNav([Self],[rnActor],[TheActor]),
45 /* PreF01 */
46 msrNav([TheSystem],
47   [rnctCoordinator,
48     msrSelect,id,eq,[AdtCoordinatorID]],
49     ColctCoordinators),
50 msrNav(ColctCoordinators,
51   [msrIsEmpty],
52   [[ptBoolean,true]]),
53 .
54
55 msrop(outactAdministrator,
56   oeAddCoordinator,
57   [post,Self,
58     AdtCoordinatorID,
59     AdtLogin,
60     AdtPassword
61   ],
62   []):-
63
64 /* Post Functional:*/
65 msrVar(ctState,TheSystem),
66 msrVar(actAdministrator,TheActor),

```

```

67 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
68 msrNav([Self],[rnActor],[TheActor]),
69
70 msrVar(actCoordinator,TheactCoordinator),
71 msrVar(ctCoordinator,ThectCoordinator),
72
73/* PostF01 */
74 msrNav([TheactCoordinator],
75     [init,[],
76     [[ptBoolean,true]]]),
77
78/* PostF02 */
79 msrNav([ThectCoordinator],
80     [init,[AdtCoordinatorID,AdtLogin,AdtPassword]],
81     [[ptBoolean,true]]),
82
83/* PostF03 */
84 msrNav([TheactCoordinator],
85     [msmAtPost,rnctCoordinator],
86     [ThectCoordinator]),
87
88/* PostF04 */
89 msrNav([ThectCoordinator],
90     [msmAtPost,rnactAuthenticated],
91     [TheactCoordinator]),
92
93/* PostF05 */
94 msrNav([TheActor],
95     [rnInterfaceIN,
96     ieCoordinatorAdded,[],
97     [[ptBoolean,true]]]),
98
99 /* Post Protocol:*/
100/* PostP01 */
101 true
102 .

```

Listing D.3: Prolog file outactAdministrator-oeAddCoordinator.pl.

## D.4 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactAdministrator-oeDeleteCoordinator.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5-----
6msrop(outactAdministrator,
7     oeDeleteCoordinator,
8     [preProtocol,Self,
9     AdtCoordinatorID
10    ],
11    []):-
12/* Pre Protocol:*/
13 msrVar(ctState,TheSystem),
14 msrVar(actAdministrator,TheActor),
15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
16 msrNav([Self],[rnActor],[TheActor]),
17
18/* PreP01 */
19 msrNav([TheSystem],
20     [vpStarted],
21     [[ptBoolean,true]]),
22
23 msrNav([TheActor],
24     [rnctAuthenticated,vpIsLogged],
25     [[ptBoolean,true]])
26.

```



```

2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5%-----
6msrop(outactAuthenticated,
7    oeLogin,
8    [preProtocol, Self,
9     AdtLogin,
10    AdtPassword
11    ],
12    []):-
13/* Pre Protocol:*/
14 msrVar(ctState,TheSystem),
15 msrVar(actAuthenticated,TheactAuthenticated),
16 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
17 msrNav([Self],[rnActor],[TheactAuthenticated]),
18
19 /* PreP01 */
20 msrNav([TheSystem],
21    [vpStarted],
22    [[ptBoolean,true]]),
23
24 msrNav([TheactAuthenticated],
25    [rnctAuthenticated,vpIsLogged],
26    [[ptBoolean,false]])
27 .
28
29msrop(outactAuthenticated,
30    oeLogin,
31    [preFunctional, Self,
32     AdtLogin,
33     AdtPassword
34     ],
35    []):-
36/* Pre Functional:*/
37/* PreF01 */
38true
39.
40
41msrop(outactAuthenticated,
42    oeLogin,
43    [post,Self,
44     AdtLogin,
45     AdtPassword
46     ],
47    []):-
48
49 msrVar(ctState,TheSystem),
50 msrVar(actAuthenticated,TheactAuthenticated),
51
52 msrVar(ptString,AptStringMessageForTheactAuthenticated),
53 msrVar(ptString,AptStringMessageForTheactAdministrator),
54
55/* Post Functional:*/
56
57 msrNav([Self],[rnActor],[TheactAuthenticated]),
58 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
59
60/* PostF01 */
61
62 ( (msrNav([TheactAuthenticated],
63    [rnctAuthenticated,pwd],
64    [AdtPassword]),
65    msrNav([TheactAuthenticated],
66    [rnctAuthenticated,login],
67    [AdtLogin])
68 )
69 -> ( msrNav([AptStringMessageForTheactAuthenticated],
70    [eq,[[ptString, 'You are logged ! Welcome ...']],
71    [[ptBoolean,true]]),

```



```

72   msrNav([TheactAuthenticated],
73       [rnInterfaceIN,
74       ieMessage,[AptStringMessageForTheactAuthenticated]],
75       [[ptBoolean,true]])
76   )
77 ; ( msrNav([AptStringMessageForTheactAuthenticated],
78       [eq,[[ptString,'Wrong identification information ! Please try again ...']],
79       [[ptBoolean,true]]],
80   msrNav([TheactAuthenticated],
81       [rnInterfaceIN,
82       ieMessage,[AptStringMessageForTheactAuthenticated]],
83       [[ptBoolean,true]]],
84   msrNav([AptStringMessageForTheactAdministrator],
85       [eq,[[ptString,'Intrusion tentative !']],
86       [[ptBoolean,true]]],
87   msrNav([TheSystem],
88       [rnactAdministrator,rnInterfaceIN,
89       ieMessage,[AptStringMessageForTheactAdministrator]],
90       [[ptBoolean,true]])
91   )
92   )
93   ),
94   )
95   /* Post Protocol:*/
96   /* PostP01 */
97   ( (msrNav([TheactAuthenticated],
98       [rnctAuthenticated,pwd],
99       [AdtPassword]),
100   msrNav([TheactAuthenticated],
101       [rnctAuthenticated,login],
102       [AdtLogin])
103   )
104   -> (msrNav([TheactAuthenticated],
105       [rnctAuthenticated,msmAtPost,vpIsLogged],
106       [[ptBoolean,true]])
107   )
108   ; true
109   )
110   .

```

Listing D.5: Prolog file outactAuthenticated-oeLogin.pl.

## D.6 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactAuthenticated-oeLogout.pl

```

1 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2 /* DISCONTIGUOUS PREDICATES */
3 :- multifile msrop/4.
4 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5 %-----
6 msrop(outactAuthenticated,
7     oeLogout,
8     [preProtocol,Self
9     ],
10    []) :-
11 /* Pre Protocol:*/
12 msrVar(ctState,TheSystem),
13 msrVar(actAuthenticated,TheActor),
14 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
15 msrNav([Self],[rnActor],[TheActor]),
16
17 /* PreP01 */
18 msrNav([TheSystem],
19     [vpStarted],
20     [[ptBoolean,true]]],
21
22 msrNav([TheActor],
23     [rnctAuthenticated,vpIsLogged],

```

```

24      [[ptBoolean,true]])
25 .
26
27msrop(outactAuthenticated,
28      oeLogout,
29      [preFunctional,Self
30      ],
31      []):-
32/* Pre Functional:*/
33/* PreF01 */
34true
35.
36
37msrop(outactAuthenticated,
38      oeLogout,
39      [post,Self
40      ],
41      []):-
42
43msrVar(ctState,TheSystem),
44msrVar(actAuthenticated,TheactAuthenticated),
45
46msrVar(ptString,AptStringMessageForTheactAuthenticated),
47
48/* Post Functional:*/
49msrNav([Self],[rnActor],[TheactAuthenticated]),
50msrNav([Self],[rnActor,rnSystem],[TheSystem]),
51
52/* PostF01 */
53msrNav([AptStringMessageForTheactAuthenticated],
54      [eq,[[ptString,'You are logged out ! Good Bye ...']],
55      [[ptBoolean,true]]),
56msrNav([TheactAuthenticated],
57      [rnInterfaceIN,
58      ieMessage,[AptStringMessageForTheactAuthenticated]],
59      [[ptBoolean,true]]),
60
61/* Post Protocol:*/
62/* PostP01 */
63msrNav([TheactAuthenticated],
64      [rnctAuthenticated,msmAtPost,vpIsLogged],
65      [[ptBoolean,false]])
66.

```

Listing D.6: Prolog file outactAuthenticated-oeLogout.pl.

## D.7 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactComC oeAlert.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5%-----
6nico(A):-
7 trace,
8 write('here'),
9 write('\n').
10
11msrop(outactComCompany,
12      oeAlert,
13      [preProtocol,Self,
14      AetHumanKind,
15      AdtDate,
16      AdtTime,
17      AdtPhoneNumber,
18      AdtGPSLocation,
19      AdtComment

```

```

20 ],
21 []):-
22/* Pre Protocol:*/
23 msrVar(ctState,TheSystem),
24 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
25/* PreP01 */
26 msrNav([TheSystem],
27 [vpStarted],
28 [[ptBoolean,true]])
29 .
30
31msrop(outactComCompany,
32 oeAlert,
33 [preFunctional,Self,
34 AetHumanKind,
35 AdtDate,
36 AdtTime,
37 AdtPhoneNumber,
38 AdtGPSLocation,
39 AdtComment
40 ],
41 []):-
42/* Pre Functional:*/
43/* PreF01 */
44 msrVar(ctState,TheSystem),
45 msrNav([Self],
46 [msmAtPre,rnActor,rnSystem],
47 [TheSystem]),
48
49 ( msrNav([TheSystem],[clock,date,gt,[AdtDate]],[[ptBoolean,true]])
50 ; (msrNav([TheSystem],[clock,date,eq,[AdtDate]],[[ptBoolean,true]])
51 , msrNav([TheSystem],[clock,time,gt,[AdtTime]],[[ptBoolean,true]])
52 )
53 )
54.
55
56msrop(outactComCompany,
57 oeAlert,
58 [post,Self,
59 AetHumanKind,
60 AdtDate,
61 AdtTime,
62 AdtPhoneNumber,
63 AdtGPSLocation,
64 AdtComment
65 ],
66 []):-
67
68 msrVar(ctState,TheSystem),
69 msrVar(ctHuman,ActHuman),
70 msrVar(actComCompany,TheactComCompany),
71 msrVar(ctAlert,ActAlert),
72 msrVar(dtDateAndTime,AAAlertInstant),
73 msrVar(etAlertStatus,AetAlertStatus),
74% msrVar(ctAlert,ActAlertNearBy),
75 msrVar(ctCrisis,ActCrisis),
76 msrVar(dtCrisisID,AdtCrisisID),
77% msrVar(etCrisisType,AetCrisisType),
78 msrVar(etCrisisStatus,AetCrisisStatus),
79 msrVar(dtDateAndTime,ACrisisInstant),
80 msrVar(dtComment,ACrisisdtComment),
81% msrVar(ptString,AptStringMessage),
82 msrVar(dtSMS,AdtSMS),
83 msrVar(dtAlertID,AdtAlertID),
84
85% msrVar(ptInteger,TheNextptIntegerValue),
86% msrVar(ptInteger,UpdatedNextptIntegerValue),
87% msrVar(inactComCompany,TheComCompanyIN),
88% msrVar(dtComment,TheCommentStored),
89% msrVar(dtString,TheCommentStoreddtString),

```

```

90
91/* Post Functional:*/
92
93 msrNav([Self],[rnActor],[TheactComCompany]),
94 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
95
96/* PostF01 */
97 msrNav([TheSystem],
98     [nextValueForAlertID],
99     [PrenextValueForAlertID]),
100 msrNav([PrenextValueForAlertID],
101     [add,[dtInteger,[value,[ptInteger,1]],[]]],
102     [PostnextValueForAlertID]),
103 msrNav([TheSystem],
104     [msmAtPost,nextValueForAlertID],
105     [PostnextValueForAlertID]),
106
107 /* PostF02 */
108 msrNav([AAlertInstant],[date],[AdtDate]),
109 msrNav([AAlertInstant],[time],[AdtTime]),
110
111 msrNav([AetAlertStatus],
112     [],
113     [[etAlertStatus,pending]]),
114
115 msrNav([TheSystem],
116     [nextValueForAlertID],
117     [todtString,[],eq,[AdtAlertID]],
118     [[ptBoolean,true]]),
119
120 msrNav([ActAlert],
121     [init,[AdtAlertID],
122         AetAlertStatus,
123         AdtGPSLocation,
124         AAlertInstant,
125         AdtComment]],
126     [[ptBoolean,true]]),
127
128 /* PostF03 */
129 msrNav([TheSystem],
130     [rnctAlert,
131         msrSelect,location,isNearTo,[AdtGPSLocation]],
132         ColctAlertsNearBy),
133
134 ( (msrNav(ColctAlertsNearBy,
135     [msrIsEmpty],
136     [[ptBoolean,true]])
137 )
138 -> (
139     msrNav([TheSystem],
140         [nextValueForCrisisID],
141         [PrenextValueForCrisisID]),
142     msrNav([PrenextValueForCrisisID],
143         [add,[dtInteger,[value,[ptInteger,1]],[]]],
144         [PostnextValueForCrisisID]),
145     msrNav([TheSystem],
146         [msmAtPost,nextValueForCrisisID],
147         [PostnextValueForCrisisID]),
148
149     msrNav([TheSystem],
150         [nextValueForCrisisID],
151         [todtString,[],eq,[AdtCrisisID]],
152         [[ptBoolean,true]]),
153
154     msrNav([AdtCrisisType],[[]],[[etCrisisType,small]]),
155     msrNav([AetCrisisStatus],[[]],[[etCrisisStatus,pending]]),
156     msrNav([ACrisisInstant],[[]],[AAlertInstant]),
157     msrNav([ACrisisdtComment],
158         [value],
159         [[ptString,'no reporting yet defined']]),

```

```

160   msrNav([ActCrisis],[init,[AdtCrisisID,
161       AdtCrisisType,
162       AetCrisisStatus,
163       AdtGPSLocation,
164       ACrisisInstant,
165       ACrisisdComment]],
166       [[ptBoolean,true]])
167
168   )
169 ; (
170   msrNav(ColctAlertsNearBy,
171       [rnTheCrisis,msrAny,msrTrue],
172       [ActCrisis])
173   )
174 ),
175
176 /* PostF04 */
177
178 msrNav([ActAlert],
179     [msmAtPost,rnTheCrisis],
180     [ActCrisis]),
181
182 /* PostF05 */
183
184 msrNav([TheSystem],
185     [rnctHuman,
186     msrSelect,id,eq,[AdtPhoneNumber]],
187     HumanColl),
188
189 msrNav(HumanColl,
190     [msrSelect,kind,etEq,[AetHumanKind]],
191     HumanCol2),
192
193 (msrNav(HumanCol2,[msrIsEmpty],[ptBoolean,true]))
194 -> (msrNav([ActHuman],
195     [init,[AdtPhoneNumber,AetHumanKind]],
196     [[ptBoolean,true]]),
197     msrNav([ActHuman],
198     [msmAtPost,rnactComCompany],
199     [TheactComCompany])
200   )
201 ; msrNav(HumanCol2,
202     [msrAny],
203     [ActHuman])
204 ),
205
206 msrNav([ActHuman],
207     [rnSignaled,msrIncluding,[ActAlert]],
208     ColAlerts),
209
210 msrNav([ActHuman],
211     [msmAtPost,rnSignaled],
212     ColAlerts),
213
214 /* PostF06 */
215 msrNav([AdtSMS],
216     [value],
217     [[ptString, 'Your alert has been registered. We will handle it and keep you informed']]),
218 msrNav([TheactComCompany],
219     [rnInterfaceIN,
220     ieSmsSend,[AdtPhoneNumber,
221     AdtSMS]], [ptBoolean,true]),
222
223 /*
224
225 */
226
227 /* Post Protocol:*/
228 /* PostP01 */
229 true

```

Listing D.7: Prolog file outactComCompany-oeAlert.pl.

## D.8 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCoord oeCloseCrisis.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5%-----
6msrop(outactCoordinator,
7      oeCloseCrisis,
8      [preProtocol,Self,
9        AdtCrisisID
10     ],
11     []):-
12/* Pre Protocol:*/
13 msrVar(ctState,TheSystem),
14 msrVar(actCoordinator,TheActor),
15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
16 msrNav([Self],[rnActor],[TheActor]),
17
18/* PreP01 */
19 msrNav([TheSystem],
20       [vpStarted],
21       [[ptBoolean,true]]),
22
23/* PreP02 */
24 msrNav([TheActor],
25       [rnctAuthenticated,vpIsLogged],
26       [[ptBoolean,true]])
27.
28
29msrop(outactCoordinator,
30      oeCloseCrisis,
31      [preFunctional,Self,
32        AdtCrisisID
33     ],
34     []):-
35/* Pre Functional:*/
36 msrVar(ctState,TheSystem),
37 msrVar(actCoordinator,TheActor),
38
39 msrVar(dtCrisisID,AdtCrisisID),
40
41 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
42 msrNav([Self],[rnActor],[TheActor]),
43
44/* PreF01 */
45 msrNav([TheSystem],
46       [rnctCrisis,
47         msrSelect,
48         id,eq,[AdtCrisisID]
49      ],
50       ColCrisis),
51
52 msrNav(ColCrisis,
53       [msrSize,eq,[[ptInteger,1]]],
54       [[ptBoolean,true]])
55.
56
57msrop(outactCoordinator,
58      oeCloseCrisis,
59      [post,Self,
60        AdtCrisisID
61     ],

```

```

62     []):-
63
64 /* Post Functional:*/
65 msrVar(ctState,TheSystem),
66 msrVar(actCoordinator,TheActor),
67
68 msrVar(ctCrisis,TheCrisis),
69 msrVar(dtCrisisID,AdtCrisisID),
70
71 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
72 msrNav([Self],[rnActor],[TheActor]),
73
74 /* PostF01 */
75 msrNav([TheSystem],
76     [rnctCrisis,
77         msrSelect,
78         id,eq,[AdtCrisisID]],
79     [TheCrisis]),
80
81 msrNav([TheCrisis],
82     [msmAtPost,status],
83     [[etCrisisStatus,closed]]),
84
85 /* PostF02 */
86 msrNav([TheCrisis],
87     [msmAtPost,rnHandler],
88     []),
89
90 /* PostF03 */
91 msrNav([TheCrisis],
92     [rnAlerts,msrForAll,msrIsKilled],
93     [[ptBoolean,true]]),
94
95 /* PostF04 */
96 msrNav([TheActor],
97     [rnInterfaceIN,
98         ieMessage,[[ptString,'The crisis is now closed !']]
99     ],
100     [[ptBoolean,true]]),
101
102 /* Post Protocol:*/
103 /* PostP01 */
104 true
105 .

```

Listing D.8: Prolog file outactCoordinator-oeCloseCrisis.pl.

## D.9 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCoordinator-oeGetAlertsSet.pl

```

1 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2 /* DISCONTIGUOUS PREDICATES */
3 :- multifile msrop/4.
4 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5 %-----
6 msrop(outactCoordinator,
7     oeGetAlertsSet,
8     [preProtocol,Self,
9         AetAlertStatus
10     ],
11     []):-
12 /* Pre Protocol:*/
13 msrVar(ctState,TheSystem),
14 msrVar(actCoordinator,TheActor),
15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
16 msrNav([Self],[rnActor],[TheActor]),
17
18 /* PreP01 */

```

```

19 msrNav([TheSystem],
20     [vpStarted],
21     [[ptBoolean,true]]),
22
23 msrNav([TheActor],
24     [rnctAuthenticated, vpIsLogged],
25     [[ptBoolean,true]])
26.
27
28msrop(outactCoordinator,
29     oeGetAlertsSet,
30     [preFunctional, Self,
31     AetAlertStatus
32     ],
33     []):-
34/* Pre Functional:*/
35/* PreF01 */
36true
37.
38
39msrop(outactCoordinator,
40     oeGetAlertsSet,
41     [post, Self,
42     AetAlertStatus
43     ],
44     []):-
45
46/* Post Functional:*/
47 msrVar(ctState, TheSystem),
48 msrVar(actCoordinator, TheActor),
49 msrNav([Self], [rnActor, rnSystem], [TheSystem]),
50 msrNav([Self], [rnActor], [TheActor]),
51
52/* PostF01 */
53 msrNav([TheSystem],
54     [rnctAlert,
55     msrSelect,
56     status, etEq, [AetAlertStatus]],
57     ColAlertSet),
58
59 msrNav(ColAlertSet,
60     [msrForAll, isSentToCoordinator, [TheActor]],
61     [[ptBoolean,true]]),
62
63 /* Post Protocol:*/
64/* PostP01 */
65 true
66 .

```

Listing D.9: Prolog file outactCoordinator-oeGetAlertsSet.pl.

## D.10 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCoordinator-oeGetCrisisSet.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5%-----
6msrop(outactCoordinator,
7     oeGetCrisisSet,
8     [preProtocol, Self,
9     AetCrisisStatus
10     ],
11     []):-
12/* Pre Protocol:*/
13 msrVar(ctState, TheSystem),
14 msrVar(actCoordinator, TheActor),

```



```

15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
16 msrNav([Self],[rnActor],[TheActor]),
17
18/* PreP01 */
19 msrNav([TheSystem],
20     [vpStarted],
21     [[ptBoolean,true]]),
22
23 msrNav([TheActor],
24     [rnctAuthenticated,vpIsLogged],
25     [[ptBoolean,true]])
26.
27
28msrop(outactCoordinator,
29     oeGetCrisisSet,
30     [preFunctional,Self,
31     AetCrisisStatus
32     ],
33     []):-
34/* Pre Functional:*/
35/* PreF01 */
36true
37.
38
39msrop(outactCoordinator,
40     oeGetCrisisSet,
41     [post,Self,
42     AetCrisisStatus
43     ],
44     []):-
45
46/* Post Functional:*/
47 msrVar(ctState,TheSystem),
48 msrVar(actCoordinator,TheActor),
49 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
50 msrNav([Self],[rnActor],[TheActor]),
51
52/* PostF01 */
53 msrNav([TheSystem],
54     [rnctCrisis,
55     msrSelect,
56     status,etEq,[AetCrisisStatus]],
57     ColCrisisSet),
58
59 msrNav(ColCrisisSet,
60     [msrForAll,isSentToCoordinator,[TheActor]],
61     [[ptBoolean,true]]),
62
63/* Post Protocol:*/
64/* PostP01 */
65 true
66.

```

Listing D.10: Prolog file outactCoordinator-oeGetCrisisSet.pl.

## D.11 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCoordinator-oeInvalidateAlert.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5-----
6msrop(outactCoordinator,
7     oeInvalidateAlert,
8     [preProtocol,Self,
9     AdtAlertID
10    ],

```

```

11  []):-
12 /* Pre Protocol:*/
13 msrVar(ctState,TheSystem),
14 msrVar(actCoordinator,TheActor),
15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
16 msrNav([Self],[rnActor],[TheActor]),
17
18 /* PreP01 */
19 msrNav([TheSystem],
20        [vpStarted],
21        [[ptBoolean,true]]),
22
23 /* PreP02 */
24 msrNav([TheActor],
25        [rnctAuthenticated,vpIsLogged],
26        [[ptBoolean,true]]),
27 .
28
29 msrop(outactCoordinator,
30        oeInvalidateAlert,
31        [preFunctional,Self,
32         AdtAlertID
33         ],
34        []):-
35 /* Pre Functional:*/
36 msrVar(ctState,TheSystem),
37 msrVar(actCoordinator,TheActor),
38
39 msrVar(dtAlertID,AdtAlertID),
40
41 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
42 msrNav([Self],[rnActor],[TheActor]),
43
44 /* PreF01 */
45 msrNav([TheSystem],
46        [rnctAlert,
47         msrSelect,
48         id,eq,[AdtAlertID]
49         ],
50        ColAlert),
51
52 msrNav(ColAlert,
53        [msrSize,eq,[[ptInteger,1]]],
54        [[ptBoolean,true]]),
55 .
56
57 msrop(outactCoordinator,
58        oeInvalidateAlert,
59        [post,Self,
60         AdtAlertID
61         ],
62        []):-
63
64 /* Post Functional:*/
65 msrVar(ctState,TheSystem),
66 msrVar(actCoordinator,TheActor),
67
68 msrVar(ctAlert,TheAlert),
69 msrVar(dtAlertID,AdtAlertID),
70
71 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
72 msrNav([Self],[rnActor],[TheActor]),
73
74 /* PostF01 */
75 msrNav([TheSystem],
76        [rnctAlert,
77         msrSelect,
78         id,eq,[AdtAlertID]],
79        [TheAlert]),
80

```

```

81 msrNav([TheAlert],
82     [msmAtPost, status],
83     [[etAlertStatus, invalid]]),
84
85 /* PostF02 */
86 msrNav([TheActor],
87     [rnInterfaceIN,
88     ieMessage, [[ptString, 'The alert is now declared as invalid !']]
89     ],
90     [[ptBoolean, true]]),
91
92 /* Post Protocol:*/
93 /* PostP01 */
94 true
95 .

```

Listing D.11: Prolog file outactCoordinator-oeInvalidateAlert.pl.

## D.12 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCoordinator-oeReportOnCrisis.pl

```

1 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2 /* DISCONTIGUOUS PREDICATES */
3 :- multifile msrop/4.
4 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5 %-----
6 msrop(outactCoordinator,
7     oeReportOnCrisis,
8     [preProtocol, Self,
9     AdtCrisisID,
10    AdtComment
11    ],
12    []):-
13 /* Pre Protocol:*/
14 msrVar(ctState, TheSystem),
15 msrVar(actCoordinator, TheActor),
16 msrNav([Self], [rnActor, rnSystem], [TheSystem]),
17 msrNav([Self], [rnActor], [TheActor]),
18
19 /* PreP01 */
20 msrNav([TheSystem],
21     [vpStarted],
22     [[ptBoolean, true]]),
23
24 msrNav([TheActor],
25     [rnctAuthenticated, vpIsLogged],
26     [[ptBoolean, true]])
27 .
28
29 msrop(outactCoordinator,
30     oeReportOnCrisis,
31     [preFunctional, Self,
32     AdtCrisisID,
33     AdtComment
34     ],
35     []):-
36 /* Pre Functional:*/
37 msrVar(ctState, TheSystem),
38 msrVar(actCoordinator, TheActor),
39
40 msrVar(dtCrisisID, AdtCrisisID),
41
42 msrNav([Self], [rnActor, rnSystem], [TheSystem]),
43 msrNav([Self], [rnActor], [TheActor]),
44
45 /* PreF01 */
46 msrNav([TheSystem],
47     [rnctCrisis,

```

```

48     msrSelect,
49     id,eq,[AdtCrisisID]
50 ],
51 ColCrisis),
52
53 msrNav(ColCrisis,
54     [msrSize,eq,[[ptInteger,1]]],
55     [[ptBoolean,true]])
56 .
57
58 msrop(outactCoordinator,
59     oeReportOnCrisis,
60     [post,Self,
61         AdtCrisisID,
62         AdtComment
63     ],
64     []) :-
65
66 /* Post Functional:*/
67 msrVar(ctState,TheSystem),
68 msrVar(actCoordinator,TheActor),
69
70 msrVar(ctCrisis,TheCrisis),
71 msrVar(dtCrisisID,AdtCrisisID),
72 msrVar(dtComment,AdtComment),
73
74 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
75 msrNav([Self],[rnActor],[TheActor]),
76
77 /* PostF01 */
78 msrNav([TheSystem],
79     [rnctCrisis,
80         msrSelect,
81         id,eq,[AdtCrisisID]],
82     [TheCrisis]),
83
84 msrNav([TheCrisis],
85     [msmAtPost,comment],
86     [AdtComment]),
87
88 msrNav([TheActor],
89     [rnInterfaceIN,
90         ieMessage,[[ptString,'The crisis comment has been updated !']]
91     ],
92     [[ptBoolean,true]]),
93
94 /* Post Protocol:*/
95 /* PostP01 */
96 true
97 .

```

Listing D.12: Prolog file outactCoordinator-oeReportOnCrisis.pl.

## D.13 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCoordinator-oeSetCrisisHandler.pl

```

1 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2 /* DISCONTIGUOUS PREDICATES */
3 :- multifile msrop/4.
4 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5 %-----
6 msrop(outactCoordinator,
7     oeSetCrisisHandler,
8     [preProtocol,Self,
9         AdtCrisisID
10     ],
11     []) :-
12 /* Pre Protocol:*/

```

```

13 msrVar(ctState,TheSystem),
14 msrVar(actCoordinator,TheActor),
15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
16 msrNav([Self],[rnActor],[TheActor]),
17
18/* PreP01 */
19 msrNav([TheSystem],
20     [vpStarted],
21     [[ptBoolean,true]]),
22
23 msrNav([TheActor],
24     [rnctAuthenticated,vpIsLogged],
25     [[ptBoolean,true]])
26.
27
28msrop(outactCoordinator,
29     oeSetCrisisHandler,
30     [preFunctional,Self,
31         AdtCrisisID
32     ],
33     []):-
34/* Pre Functional:*/
35 msrVar(ctState,TheSystem),
36 msrVar(actCoordinator,TheActor),
37
38 msrVar(dtCrisisID,AdtCrisisID),
39
40 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
41 msrNav([Self],[rnActor],[TheActor]),
42
43/* PreF01 */
44 msrNav([TheSystem],
45     [rnctCrisis,
46         msrSelect,
47         id,eq,[AdtCrisisID]
48     ],
49     ColCrisis),
50
51 msrNav(ColCrisis,
52     [msrSize,eq,[[ptInteger,1]]],
53     [[ptBoolean,true]])
54.
55
56msrop(outactCoordinator,
57     oeSetCrisisHandler,
58     [post,Self,
59         AdtCrisisID
60     ],
61     []):-
62
63/* Post Functional:*/
64 msrVar(ctState,TheSystem),
65 msrVar(actCoordinator,TheActor),
66 msrVar(ctCoordinator,TheCoordinator),
67 msrVar(ctCoordinator,TheCurrentHandler),
68
69 msrVar(ctCrisis,TheCrisis),
70 msrVar(dtCrisisID,AdtCrisisID),
71
72 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
73 msrNav([Self],[rnActor],[TheActor]),
74
75/* PostF01 */
76 msrNav([TheSystem],
77     [rnctCrisis,
78         msrSelect,
79         id,eq,[AdtCrisisID]],
80     [TheCrisis]),
81
82 msrNav([TheCrisis],

```

```

83     [msmAtPost,status],
84     [[etCrisisStatus,handed]]),
85
86     msrNav([TheActor],
87           [rnctCoordinator],
88           [TheCoordinator]),
89     msrNav([TheCrisis],
90           [msmAtPost,rnHandler],
91           [TheCoordinator]),
92
93     msrNav([TheActor],
94           [rnInterfaceIN,
95            ieMessage,[[ptString,'You are now considered as handling the crisis !']]
96           ],
97           [[ptBoolean,true]]),
98
99     /* PostF02 */
100    msrNav([TheCrisis],
101          [rnAlerts,msrForAll,isSentToCoordinator,[TheActor]],
102          [[ptBoolean,true]]),
103
104    /* PostF03 */
105    ( msrNav([TheCrisis],
106          [rnHandler,msrSize,eq,[[ptInteger,1]]],
107          [[ptBoolean,true]])
108      -> (msrNav([TheCrisis],
109                [rnHandler],
110                [TheCurrentHandler]),
111         msrNav([TheCurrentHandler],
112                [rnactCoordinator,rnInterfaceIN,
113                 ieMessage,[[ptString,'One of the crisis you were handling is now handled by one of your
114                 colleagues!']]
115                ],
116                [[ptBoolean,true]])
117     )
118   ),
119
120   /* PostF04 */
121   msrNav([TheCrisis],
122         [rnAlerts,rnSignaler,msrForAll,isAcknowledged,[]],
123         [[ptBoolean,true]]),
124
125   /* Post Protocol:*/
126   /* PostP01 */
127   true
128   .

```

Listing D.13: Prolog file outactCoordinator-oeSetCrisisHandler.pl.

## D.14 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCoordinator-oeSetCrisisStatus.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5%-----
6msrop(outactCoordinator,
7      oeSetCrisisStatus,
8      [preProtocol,Self,
9       AdtCrisisID,
10       AetCrisisStatus
11       ],
12      []):-
13/* Pre Protocol:*/
14 msrVar(ctState,TheSystem),
15 msrVar(actCoordinator,TheActor),

```

```

16 msrNav([Self], [rnActor, rnSystem], [TheSystem]),
17 msrNav([Self], [rnActor], [TheActor]),
18
19/* PreP01 */
20 msrNav([TheSystem],
21     [vpStarted],
22     [[ptBoolean, true]]),
23
24 msrNav([TheActor],
25     [rnctAuthenticated, vpIsLogged],
26     [[ptBoolean, true]])
27.
28
29msrop(outactCoordinator,
30     oeSetCrisisStatus,
31     [preFunctional, Self,
32         AdtCrisisID,
33         AetCrisisStatus
34     ],
35     []):-
36/* Pre Functional:*/
37 msrVar(ctState, TheSystem),
38 msrVar(actCoordinator, TheActor),
39
40 msrVar(dtCrisisID, AdtCrisisID),
41
42 msrNav([Self], [rnActor, rnSystem], [TheSystem]),
43 msrNav([Self], [rnActor], [TheActor]),
44
45/* PreF01 */
46 msrNav([TheSystem],
47     [rnctCrisis,
48         msrSelect,
49         id, eq, [AdtCrisisID]
50     ],
51     ColCrisis),
52
53 msrNav(ColCrisis,
54     [msrSize, eq, [[ptInteger, 1]]],
55     [[ptBoolean, true]])
56.
57
58msrop(outactCoordinator,
59     oeSetCrisisStatus,
60     [post, Self,
61         AdtCrisisID,
62         AetCrisisStatus
63     ],
64     []):-
65
66/* Post Functional:*/
67 msrVar(ctState, TheSystem),
68 msrVar(actCoordinator, TheActor),
69
70 msrVar(ctCrisis, TheCrisis),
71 msrVar(dtCrisisID, AdtCrisisID),
72 msrVar(etCrisisStatus, AetCrisisStatus),
73
74 msrNav([Self], [rnActor, rnSystem], [TheSystem]),
75 msrNav([Self], [rnActor], [TheActor]),
76
77/* PostF01 */
78 msrNav([TheSystem],
79     [rnctCrisis,
80         msrSelect,
81         id, eq, [AdtCrisisID]],
82     [TheCrisis]),
83
84 msrNav([TheCrisis],
85     [msmAtPost, status],

```

```

86     [AetCrisisStatus]),
87
88     msrNav([TheActor],
89     [rnInterfaceIN,
90     ieMessage,[[ptString,'The crisis status has been updated !']]
91     ],
92     [[ptBoolean,true]]),
93
94 /* Post Protocol:*/
95 /* PostP01 */
96 true
97 .

```

Listing D.14: Prolog file outactCoordinator-oeSetCrisisStatus.pl.

## D.15 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCoordinator-oeSetCrisisType.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5%-----
6msrop(outactCoordinator,
7     oeSetCrisisType,
8     [preProtocol,Self,
9     AdtCrisisID,
10     AetCrisisType
11     ],
12     []):-
13 /* Pre Protocol:*/
14 msrVar(ctState,TheSystem),
15 msrVar(actCoordinator,TheActor),
16 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
17 msrNav([Self],[rnActor],[TheActor]),
18
19 /* PreP01 */
20 msrNav([TheSystem],
21     [vpStarted],
22     [[ptBoolean,true]]),
23
24 msrNav([TheActor],
25     [rnctAuthenticated,vpIsLogged],
26     [[ptBoolean,true]]),
27 .
28
29msrop(outactCoordinator,
30     oeSetCrisisType,
31     [preFunctional,Self,
32     AdtCrisisID,
33     AetCrisisType
34     ],
35     []):-
36 /* Pre Functional:*/
37 msrVar(ctState,TheSystem),
38 msrVar(actCoordinator,TheActor),
39
40 msrVar(dtCrisisID,AdtCrisisID),
41
42 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
43 msrNav([Self],[rnActor],[TheActor]),
44
45 /* PreF01 */
46 msrNav([TheSystem],
47     [rnctCrisis,
48     msrSelect,
49     id,eq,[AdtCrisisID]
50     ],

```



```

51     ColCrisis),
52
53     msrNav(ColCrisis,
54         [msrSize,eq,[[ptInteger,1]]],
55         [[ptBoolean,true]])
56 .
57
58 msrop(outactCoordinator,
59     oeSetCrisisType,
60     [post,Self,
61         AdtCrisisID,
62         AetCrisisType
63     ],
64     []) :-
65
66 /* Post Functional:*/
67 msrVar(ctState,TheSystem),
68 msrVar(actCoordinator,TheActor),
69
70 msrVar(ctCrisis,TheCrisis),
71 msrVar(dtCrisisID,AdtCrisisID),
72 msrVar(etCrisisType,AetCrisisType),
73
74 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
75 msrNav([Self],[rnActor],[TheActor]),
76
77 /* PostF01 */
78 msrNav([TheSystem],
79     [rnctCrisis,
80         msrSelect,
81         id,eq,[AdtCrisisID]],
82     [TheCrisis]),
83
84 msrNav([TheCrisis],
85     [msmAtPost,type],
86     [AetCrisisType]),
87
88 msrNav([TheActor],
89     [rnInterfaceIN,
90         ieMessage,[[ptString,'The crisis type has been updated !']],
91         ],
92     [[ptBoolean,true]]),
93
94 /* Post Protocol:*/
95 /* PostP01 */
96 true
97 .

```

Listing D.15: Prolog file outactCoordinator-oeSetCrisisType.pl.

## D.16 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCoordinator-oeValidateAlert.pl

```

1 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2 /* DISCONTIGUOUS PREDICATES */
3 :- multifile msrop/4.
4 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5 %-----
6 msrop(outactCoordinator,
7     oeValidateAlert,
8     [preProtocol,Self,
9         AdtAlertID
10    ],
11    []) :-
12 /* Pre Protocol:*/
13 msrVar(ctState,TheSystem),
14 msrVar(actCoordinator,TheActor),
15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),

```

```

16 msrNav([Self],[rnActor],[TheActor]),
17
18/* PreP01 */
19 msrNav([TheSystem],
20     [vpStarted],
21     [[ptBoolean,true]]),
22
23 msrNav([TheActor],
24     [rnctAuthenticated,vpIsLogged],
25     [[ptBoolean,true]])
26.
27
28msrop(outactCoordinator,
29     oeValidateAlert,
30     [preFunctional,Self,
31         AdtAlertID
32     ],
33     []):-
34/* Pre Functional:*/
35 msrVar(ctState,TheSystem),
36 msrVar(actCoordinator,TheActor),
37
38 msrVar(dtAlertID,AdtAlertID),
39
40 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
41 msrNav([Self],[rnActor],[TheActor]),
42
43/* PreF01 */
44 msrNav([TheSystem],
45     [rnctAlert,
46         msrSelect,
47         id,eq,[AdtAlertID]
48     ],
49     ColAlerts),
50
51 msrNav(ColAlerts,
52     [msrSize,eq,[[ptInteger,1]]],
53     [[ptBoolean,true]])
54.
55
56msrop(outactCoordinator,
57     oeValidateAlert,
58     [post,Self,
59         AdtAlertID
60     ],
61     []):-
62
63/* Post Functional:*/
64 msrVar(ctState,TheSystem),
65 msrVar(actCoordinator,TheActor),
66
67 msrVar(ctAlert,TheAlert),
68 msrVar(dtAlertID,AdtAlertID),
69
70 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
71 msrNav([Self],[rnActor],[TheActor]),
72
73/* PostF01 */
74 msrNav([TheSystem],
75     [rnctAlert,
76         msrSelect,
77         id,eq,[AdtAlertID]],
78     [TheAlert]),
79
80 msrNav([TheAlert],
81     [msmAtPost,status],
82     [[etAlertStatus,valid]]),
83
84 msrNav([TheActor],
85     [rnInterfaceIN,

```

```

86     ieMessage, [[ptString, 'The Alert is now declared as valid !']]
87     ],
88     [[ptBoolean, true]]),
89
90 /* Post Protocol:*/
91 /* PostP01 */
92 true
93 .

```

Listing D.16: Prolog file outactCoordinator-oeValidateAlert.pl.

## D.17 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactMsrCreator-oeCreateSystemAndEnvironment.pl

```

1 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2 /* DISCONTIGUOUS PREDICATES */
3 :- multifile msrop/4.
4 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5 /*
6 /*****
7 MsrCreatorActor
8 *****/
9
10 /*** createSystemAndEnvironment ***/
11
12 msrop(outactMsrCreator,
13     oeCreateSystemAndEnvironment,
14     [preFunctional, _Self, _AqtyComCompanies],
15     []):-
16     true.
17
18 msrop(outactMsrCreator,
19     oeCreateSystemAndEnvironment,
20     [preProtocol, _Self, _AqtyComCompanies],
21     []):-
22     true.
23
24 msrop(outactMsrCreator,
25     oeCreateSystemAndEnvironment,
26     [post, _Self, AqtyComCompanies],
27     []):-
28
29     msrVar(ctState, TheSystem),
30     msrVar(actMsrCreator, AactMsrCreator),
31     msrVar(actAdministrator, AactAdministrator),
32
33     msrVar(dtInteger, AnextValueForAlertID),
34     msrVar(dtInteger, AnextValueForCrisisID),
35     msrVar(dtDateAndTime, Aclock),
36     msrVar(dtSecond, AcrisisReminderPeriod),
37     msrVar(dtSecond, AmaxCrisisReminderPeriod),
38     msrVar(ptBoolean, AvpStarted),
39
40 /* PostF01 -- MUST ALWAYS BE MADE FIRST -- */
41 msrNav([AnextValueForAlertID],
42     [value, eq, [[ptInteger, 1]]],
43     [[ptBoolean, true]]),
44
45 msrNav([AnextValueForCrisisID],
46     [value, eq, [[ptInteger, 1]]],
47     [[ptBoolean, true]]),
48
49 msrNav([Aclock],
50     [date, year, value],
51     [[ptInteger, 1970]]),
52 msrNav([Aclock],
53     [date, month, value],
54     [[ptInteger, 01]]),

```

```

55msrNav([Aclock],
56     [date,day,value],
57     [[ptInteger,01]]),
58
59msrNav([Aclock],
60     [time,hour,value],
61     [[ptInteger,00]]),
62msrNav([Aclock],
63     [time,minute,value],
64     [[ptInteger,00]]),
65msrNav([Aclock],
66     [time,second,value],
67     [[ptInteger,00]]),
68
69 msrNav([AcrisisReminderPeriod],
70     [value,eq,[[ptInteger,300]]],
71     [[ptBoolean,true]]),
72
73 msrNav([AmaxCrisisReminderPeriod],
74     [value,eq,[[ptInteger,1200]]],
75     [[ptBoolean,true]]),
76
77 msrNav([AvpStarted],
78     [],
79     [[ptBoolean,true]]),
80
81 msrNav([TheSystem],
82     [init,[AnextValueForAlertID,
83         AnextValueForCrisisID,
84         Aclock,
85         AcrisisReminderPeriod,
86         AmaxCrisisReminderPeriod,
87         Aclock,
88         AvpStarted]
89     ],
90     [[ptBoolean,true]]),
91
92 /* PostF02*/
93 msrNav([AactMsrCreator],
94     [init,[]],
95     [[ptBoolean,true]]),
96
97 /* PostF03 */
98 msrVarCol(actComCompany,AqtyComCompanies,AactComCompanyCol),
99
100 msrNav(AactComCompanyCol,
101     [msrForAll,init,[]],
102     [[ptBoolean,true]]),
103
104 /* PostF04*/
105 msrNav([AactAdministrator],
106     [init,[]],
107     [[ptBoolean,true]]),
108
109 /* PostF05*/
110 msrVar(actActivator,AactActivator),
111 msrNav([AactActivator],
112     [init,[]],
113     [[ptBoolean,true]]),
114
115 /* PostF06 */
116 msrVar(ctAdministrator,ActAdministrator),
117 msrVar(dtLogin,AdtLogin),
118 msrVar(dtPassword,AdtPassword),
119
120 msrNav([AdtLogin],
121     [value,eq,[[ptString,'icrashadmin']]],
122     [[ptBoolean,true]]),
123
124 msrNav([AdtPassword],

```

```

125     [value,eq,[[ptString,'7WXC1359']],
126     [[ptBoolean,true]]),
127
128 msrNav([ActAdministrator],
129     [init,[AdtLogin,AdtPassword]],
130     [[ptBoolean,true]]),
131
132 /* PostF07*/
133 msrNav([ActAdministrator],
134     [msmAtPost,rnactAuthenticated],
135     [AactAdministrator]),
136
137 /* Post Protocol:*/
138 /* PostP01 */
139 true
140 .

```

Listing D.17: Prolog file outactMsrCreator-oeCreateSystemAndEnvironment.pl.

## D.18 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses/ctAdministrator-init.pl

```

1 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2 /* DISCONTIGUOUS PREDICATES */
3 :- multifile msrop/4.
4 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6 msrop(ctAdministrator,init,[Self,
7     Alogin,
8     Apwd],
9     Result):-
10 (
11 msrVar(ctAdministrator,Self),
12
13 /* Post F01 */
14 msrNav([Self],[login],[Alogin]),
15 msrNav([Self],[pwd],[Apwd]),
16 msrNav([Self],[vpIsLogged],[[ptBoolean,false]]),
17
18 /* Post F02 */
19 msrNav([Self],[msrIsNew],[Self])
20 )
21 -> Result = [ptBoolean,true]
22 ; Result = [ptBoolean,false]
23 .

```

Listing D.18: Prolog file PrimaryTypesClasses-ctAdministrator-init.pl.

## D.19 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses/ctAlert-init.pl

```

1 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2 /* DISCONTIGUOUS PREDICATES */
3 :- multifile msrop/4.
4 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6 msrop(ctAlert,init,[Self,
7     Aid,
8     Astatus,
9     Alocation,
10    Ainstant,
11    Acomment],
12    Result):-
13
14 /* Post F01 */
15 (

```

```

16msrVar(ctAlert,Self),
17
18msrNav([Self],[id],[Aid]),
19msrNav([Self],[status],[Astatus]),
20msrNav([Self],[location],[Alocation]),
21msrNav([Self],[instant],[Ainstant]),
22msrNav([Self],[comment],[Acomment]),
23
24/* Post F02 */
25 msrNav([Self],[msrIsNew],[Self])
26)
27-> Result = [ptBoolean,true]
28; Result = [ptBoolean,false]
29.

```

Listing D.19: Prolog file PrimaryTypesClasses-ctAlert-init.pl.

## D.20 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses-ctAlert-isSentToCoordinator.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6msrop(ctAlert,isSentToCoordinator,[Self,AactCoordinator],
7     Result):-
8
9/* Post F01 */
10(
11 msrNav([AactCoordinator],
12     [rnInterfaceIN,ieSendAnAlert,[Self]],
13     [[ptBoolean,true]])
14)
15-> Result = [ptBoolean,true]
16; Result = [ptBoolean,false]
17.

```

Listing D.20: Prolog file PrimaryTypesClasses-ctAlert-isSentToCoordinator.pl.

## D.21 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses-ctAuthenticated-init.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6msrop(ctAuthenticated,init,[Self,
7     Alogin,
8     Apwd],
9     Result):-
10
11/* Post F01 */
12(
13msrVar(ctAuthenticated,Self),
14
15msrNav([Self],[login],[Alogin]),
16msrNav([Self],[pwd],[Apwd]),
17msrNav([Self],[vpIsLogged],[[ptBoolean,false]]),
18
19/* Post F02 */
20 msrNav([Self],[msrIsNew],[Self])
21)
22-> Result = [ptBoolean,true]
23; Result = [ptBoolean,false]

```

24.

Listing D.21: Prolog file PrimaryTypesClasses-ctAuthenticated-init.pl.

## D.22 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses-ctCoordinator-init.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6msrop(ctCoordinator,init,[Self,
7      Aid,
8      Alogin,
9      Apwd],
10     Result):-
11
12/* Post F01 */
13(
14msrVar(ctCoordinator,Self),
15
16msrNav([Self],[id],[Aid]),
17msrNav([Self],[login],[Alogin]),
18msrNav([Self],[pwd],[Apwd]),
19msrNav([Self],[vpIsLogged],[[ptBoolean,false]]),
20
21/* Post F02 */
22 msrNav([Self],[msrIsNew],[Self])
23)
24-> Result = [ptBoolean,true]
25; Result = [ptBoolean,false]
26.

```

Listing D.22: Prolog file PrimaryTypesClasses-ctCoordinator-init.pl.

## D.23 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses-ctCrisis-handlingDelayPassed.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6msrop(ctCrisis,handlingDelayPassed,[Self],
7     Result):-
8
9/* Post F01 */
10(
11 msrVar(ctState,TheSystem),
12 msrVar(dtInteger,CurrentClockSecondsQty),
13 msrVar(dtInteger,LastReminderSecondsQty),
14 msrVar(dtSecond,CrisisReminderPeriod),
15
16 msrNav([Self],[rnSystem],[TheSystem]),
17
18 msrNav([Self],
19      [status],
20      [[etCrisisStatus,pending]]),
21
22 msrNav([TheSystem],
23      [clock,toSecondsQty,[]],
24      [CurrentClockSecondsQty]),
25
26 msrNav([TheSystem],
27      [vpLastReminder,toSecondsQty,[]],

```

```

28     [LastReminderSecondsQty]),
29
30     msrNav([TheSystem],
31     [crisisReminderPeriod],
32     [CrisisReminderPeriod]),
33
34     msrNav([CurrentClockSecondsQty],
35     [sub, [LastReminderSecondsQty],
36     gt, [CrisisReminderPeriod]
37     ],
38     [[ptBoolean, true]])
39
40)
41-> Result = [ptBoolean, true]
42; Result = [ptBoolean, false]
43.

```

Listing D.23: Prolog file PrimaryTypesClasses-ctCrisis-handlingDelayPassed.pl.

## D.24 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses-ctCrisis-init.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6msrop(ctCrisis, init, [Self,
7     Aid,
8     Atype,
9     Astatus,
10    Allocation,
11    Ainstant,
12    Acomment],
13    Result):-
14
15/* Post F01 */
16(
17msrVar(ctCrisis, Self),
18
19msrNav([Self], [id], [Aid]),
20msrNav([Self], [type], [Atype]),
21msrNav([Self], [status], [Astatus]),
22msrNav([Self], [location], [Allocation]),
23msrNav([Self], [instant], [Ainstant]),
24msrNav([Self], [comment], [Acomment]),
25
26/* Post F02 */
27 msrNav([Self], [msrIsNew], [Self])
28)
29-> Result = [ptBoolean, true]
30; Result = [ptBoolean, false]
31.

```

Listing D.24: Prolog file PrimaryTypesClasses-ctCrisis-init.pl.

## D.25 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses-ctCrisis-isAllocatedIfPossible.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6msrop(ctCrisis, isAllocatedIfPossible, [Self],
7    Result):-

```





```

2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6msrop(ctCrisis,isSentToCoordinator,[Self,AactCoordinator],
7    Result):-
8
9/* Post F01 */
10(
11    msrNav([AactCoordinator],
12        [rnInterfaceIN,ieSendACrisis,[Self]],
13        [[ptBoolean,true]])
14)
15-> Result = [ptBoolean,true]
16; Result = [ptBoolean,false]
17.

```

Listing D.26: Prolog file PrimaryTypesClasses-ctCrisis-isSentToCoordinator.pl.

## D.27 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses-ctCrisis-maxHandlingDelayPassed.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6msrop(ctCrisis,maxHandlingDelayPassed,[Self],
7    Result):-
8
9/* Post F01 */
10(
11    msrVar(ctState,TheSystem),
12    msrVar(dtInteger,CurrentClockSecondsQty),
13    msrVar(dtInteger,CrisisInstantSecondsQty),
14    msrVar(dtSecond,MaxCrisisReminderPeriod),
15
16    msrNav([Self],[rnSystem],[TheSystem]),
17
18    msrNav([Self],
19        [status],
20        [[etCrisisStatus,pending]]),
21
22    msrNav([TheSystem],
23        [clock,toSecondsQty,[]],
24        [CurrentClockSecondsQty]),
25
26    msrNav([Self],
27        [instant,toSecondsQty,[]],
28        [CrisisInstantSecondsQty]),
29
30    msrNav([TheSystem],
31        [maxCrisisReminderPeriod],
32        [MaxCrisisReminderPeriod]),
33
34    msrNav([CurrentClockSecondsQty],
35        [sub,[CrisisInstantSecondsQty],
36            gt,[MaxCrisisReminderPeriod]
37            ],
38        [[ptBoolean,true]])
39
40)
41-> Result = [ptBoolean,true]
42; Result = [ptBoolean,false]
43.

```

Listing D.27: Prolog file PrimaryTypesClasses-ctCrisis-maxHandlingDelayPassed.pl.

## D.28 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses-ctHuman-init.pl

```

1 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2 /* DISCONTIGUOUS PREDICATES */
3 :- multifile msrop/4.
4 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6 msrop(ctHuman, init, [Self,
7     Aid,
8     Akind],
9     Result) :-
10
11 /* Post F01 */
12 (
13 msrVar(ctHuman, Self),
14
15 msrNav([Self], [id], [Aid]),
16 msrNav([Self], [kind], [Akind]),
17
18 /* Post F02 */
19 msrNav([Self], [msrIsNew], [Self])
20 )
21 -> Result = [ptBoolean, true]
22 ; Result = [ptBoolean, false]
23 .

```

Listing D.28: Prolog file PrimaryTypesClasses-ctHuman-init.pl.

## D.29 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses-ctHuman-isAcknowledged.pl

```

1 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2 /* DISCONTIGUOUS PREDICATES */
3 :- multifile msrop/4.
4 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6 msrop(ctHuman, isAcknowledged, [Self], Result) :-
7
8 /* Post F01 */
9 (msrVar(dtPhoneNumber, AdtPhoneNumber),
10 msrVar(dtSMS, AdtSMS),
11
12 msrNav([Self],
13     [id, eq, [AdtPhoneNumber]],
14     [[ptBoolean, true]]),
15 msrNav([AdtSMS],
16     [value, eq, [[ptString, 'The handling of your alert by our services is in progress !']]],
17     [[ptBoolean, true]]),
18 msrNav([Self],
19     [rnactComCompany, rnInterfaceIN, ieSmsSend, [AdtPhoneNumber, AdtSMS]],
20     [[ptBoolean, true]])
21 )
22 -> Result = [ptBoolean, true]
23 ; Result = [ptBoolean, false]
24 .

```

Listing D.29: Prolog file PrimaryTypesClasses-ctHuman-isAcknowledged.pl.

## D.30 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses-ctState-init.pl

```

1 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2 /* DISCONTIGUOUS PREDICATES */
3 :- multifile msrop/4.

```

```

4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6msrop(ctState,init,[Self,
7      AnextValueForAlertID,
8      AnextValueForCrisisID,
9      Aclock,
10     AcrisisReminderPeriod,
11     AmaxCrisisReminderPeriod,
12     AvpLastReminder,
13     AvpStarted],
14   Result):-
15
16 /* Post F01 */
17 (
18   msrVar(ctState,Self),
19
20   msrNav([Self],[nextValueForAlertID],[AnextValueForAlertID]),
21   msrNav([Self],[nextValueForCrisisID],[AnextValueForCrisisID]),
22   msrNav([Self],[clock],[Aclock]),
23   msrNav([Self],[crisisReminderPeriod],[AcrisisReminderPeriod]),
24   msrNav([Self],[maxCrisisReminderPeriod],[AmaxCrisisReminderPeriod]),
25   msrNav([Self],[vpLastReminder],[AvpLastReminder]),
26   msrNav([Self],[vpStarted],[AvpStarted]),
27
28   msrNav([Self],[msrIsNew],[Self])
29 )
30-> Result = [ptBoolean,true]
31; Result = [ptBoolean,false]
32.

```

Listing D.30: Prolog file PrimaryTypesClasses-ctState-init.pl.

## D.31 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypes/dtAlertID-is.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6msrop(dtAlertID,is,[AdtValue],Result):-
7% msd01
8msrVar(ptBoolean,TheResult),
9(
10 ( msrNav([AdtValue],
11   [value,length,[],gt,[ptInteger,0]],
12   [ptBoolean,true]),
13   msrNav([AdtValue],
14   [value,length,[],leq,[ptInteger,20]],
15   [ptBoolean,true])
16 )
17 -> (TheResult = [ptBoolean,true])
18 ; (TheResult = [ptBoolean,false])
19 ),
20TheResult = Result
21.
22
23/*
24 ?- X = [dtAlertID,[],[[dtString,[value,[ptString,'0123456789']],[]]],[]],
25msrNav([X],[is,[],[Result]]).
26
27X = [dtAlertID,[],[[dtString,[value,[ptString,'0123456789']],[]]],[]],
28Result = [ptBoolean,true] ?
29
30yes
31
32 ?- X = [dtAlertID,[],[[dtString,[value,[ptString,'012345678901234567890123456789']],[]]],[]],
33msrNav([X],[is,[],[Result]]).

```

```

34
35X = [dtAlertID, [], [[dtString, [[value, [ptString, '012345678901234567890123456789']], []]], []]],
36Result = [ptBoolean, false] ?
37
38yes
39*/

```

Listing D.31: Prolog file PrimaryTypesDatatypes-dtAlertID-is.pl.

## D.32 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypes-dtComment-is.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5% dtComment
6
7%msd01
8msrop(dtComment, is, [AdtValue], Result):-
9  msrVar(ptBoolean, TheResult),
10 msrVar(ptInteger, MaxLength),
11 (
12   (
13     (
14       MaxLength = [ptInteger, 160],
15       msrNav([AdtValue],
16         [value, length, [], leq, [MaxLength]],
17         [[ptBoolean, true]])
18     )
19     -> TheResult = [ptBoolean, true]
20     ; TheResult = [ptBoolean, false]
21   )
22 ),
23 Result = TheResult
24.
25
26/*
27| ?- X = [dtComment, [], [[dtString, [[value, [ptString, 'I broke my leg ! Please help ...']], []]], []]],
28msrNav([X], [is, []], [Result]).
29X = [dtComment, [], [[dtString, [[value, [ptString, 'I broke my leg ! Please help ...']], []]], []]],
30Result = [ptBoolean, true] ?
31yes
32
33| ?- X = [dtComment, [], [[dtString, [[value, [ptString, 'I broke my leg when I was running with my dog
to go to the skate park because my friends called me on my mobile phone and told me that a skate
star was doing triple back flips.'']], []]], []]],
34msrNav([X], [is, []], [Result]).
35X = [dtComment, [], [[dtString, [[value, [ptString, 'I broke my leg when I was running with my dog to go
to the skate park because my friends called me on my mobile phone and told me that a skate star
was doing triple back flips.'']], []]], []]],
36Result = [ptBoolean, false] ?
37yes
38*/

```

Listing D.32: Prolog file PrimaryTypesDatatypes-dtComment-is.pl.

## D.33 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypes-dtCoordinatorID-is.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6msrop(dtCoordinatorID, is, [AdtValue], Result):-

```

D.34 File `./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypeCrisisID-is.pl`

D.35 File `./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypeIsLocation-is.pl`

[illegible]

```

6%% dtPhoneNumber
7
8% msd01
9msrop(dtGPSLocation,is,[AdtValue],Result):-
10msrVar(ptBoolean,TheResult),
11(
12 (
13     msrNav([AdtValue],
14         [latitude,is,[]],
15         [[ptBoolean,true]]),
16     msrNav([AdtValue],
17         [longitude,is,[]],
18         [[ptBoolean,true]])
19 )
20 -> TheResult = [ptBoolean,true]
21 ; TheResult = [ptBoolean,false]
22),
23
24 Result = TheResult
25.

```

Listing D.35: Prolog file PrimaryTypesDatatypes-dtGPSLocation-is.pl.

## D.36 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypes-dtGPSLocation-isNearTo.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6%% dtGPSLocation
7
8msrop(dtGPSLocation,isNearTo,[Self,AdtValue],Result):-
9msrVar(ptBoolean,TheResult),
10msrVar(dtReal,EarthRadius),
11msrVar(dtReal,MaxDistance),
12
13msrVar(dtLatitude,ComparedLatitude),
14msrVar(dtLongitude,ComparedLongitude),
15
16msrVar(dtReal,R1),msrVar(dtReal,R1a),
17msrVar(dtReal,R2),msrVar(dtReal,R2a),
18
19(
20 (
21 (
22     % msd01
23     msrNav([EarthRadius],[value],[[ptReal,6371]]),
24     msrNav([MaxDistance],[value],[[ptReal,100]]),
25
26     msrNav([AdtValue],[latitude],[ComparedLatitude]),
27     msrNav([AdtValue],[longitude],[ComparedLongitude]),
28
29     msrNav([Self],[latitude,sin,[],[R1a]],
30     msrNav([AdtValue],[latitude,sin,[],mul,[R1a]], [R1]),
31
32     msrNav([Self],[latitude,cos,[],[R2a]],
33     msrNav([AdtValue],[latitude,cos,[],mul,[R2a]], [R2]),
34
35     msrNav([AdtValue],[longitude],[ComparedLongitude]),
36     msrNav([Self],[longitude,sub,[ComparedLongitude],cos,[],mul,[R2],
37         add,[R1],
38         acos,[],
39         mul,[EarthRadius],
40         sub,[MaxDistance],
41         value,leq,[[ptReal,0]]],
42         [[ptBoolean,true]])

```

```

43     )
44     -> TheResult = [ptBoolean,true]
45     ; TheResult = [ptBoolean,false]
46 )
47),
48 Result = TheResult
49.

```

Listing D.36: Prolog file PrimaryTypesDatatypes-dtGPSLocation-isNearTo.pl.

## D.37 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypes-dtLatitude-is.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6% msd01
7msrop(dtLatitude,is,[AdtValue],Result):-
8msrVar(ptBoolean,TheResult),
9(
10 ( msrNav([AdtValue],
11     [value,geq,[[ptReal,-90.0]]],
12     [[ptBoolean,true]]),
13   msrNav([AdtValue],
14     [value,leq,[[ptReal,+90.0]]],
15     [[ptBoolean,true]])
16 )
17 -> (TheResult = [ptBoolean,true])
18 ; (TheResult = [ptBoolean,false])
19),
20Result = TheResult
21.

```

Listing D.37: Prolog file PrimaryTypesDatatypes-dtLatitude-is.pl.

## D.38 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypes-dtLogin-is.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5%% dtComment
6
7%msd01
8msrop(dtLogin,is,[AdtValue],Result):-
9 msrVar(ptBoolean,TheResult),
10 msrVar(ptInteger,MaxLength),
11(
12 (
13   (
14     MaxLength = [ptInteger,20],
15     msrNav([AdtValue],
16         [value,length,[],leq,[MaxLength]],
17         [[ptBoolean,true]])
18   )
19   -> TheResult = [ptBoolean,true]
20   ; TheResult = [ptBoolean,false]
21 )
22),
23 Result = TheResult
24.
25/*
26| ?- X = [dtLogin,[],[[dtString,[value,[ptString,'01234567']],[]]]],

```



```

27msrNav([X],[is,[]],[Result]).
28X = [dtLogin,[],[[dtString,[value,[ptString,'01234567']],[]]],[]],
29Result = [ptBoolean,true] ?
30yes
31
32| ?- X = [dtLogin,[],[[dtString,[value,[ptString,'01234567a']],[]]],[]],
33msrNav([X],[is,[]],[Result]).
34X = [dtLogin,[],[[dtString,[value,[ptString,'01234567a']],[]]],[]],
35Result = [ptBoolean,false] ?
36yes
37*/

```

Listing D.38: Prolog file PrimaryTypesDatatypes-dtLogin-is.pl.

### D.39 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypes-dtLongitude-is.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6% dtPhoneNumber
7
8% msd01
9msrop(dtLongitude,is,[AdtValue],Result):-
10msrVar(ptBoolean,TheResult),
11(
12 ( msrNav([AdtValue],
13   [value,geq,[ptReal,-180.0]]),
14   [ptBoolean,true]),
15 msrNav([AdtValue],
16   [value,leq,[ptReal,+180.0]]),
17   [ptBoolean,true])
18 )
19 -> (TheResult = [ptBoolean,true])
20 ; (TheResult = [ptBoolean,false])
21),
22
23 Result = TheResult
24.

```

Listing D.39: Prolog file PrimaryTypesDatatypes-dtLongitude-is.pl.

### D.40 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypes-dtPassword-is.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5% dtComment
6
7%msd01
8msrop(dtPassword,is,[AdtValue],Result):-
9 msrVar(ptBoolean,TheResult),
10 msrVar(ptInteger,MinLength),
11(
12 (
13   (
14     MinLength = [ptInteger,6],
15     msrNav([AdtValue],
16       [value,length,[],geq,[MinLength]]),
17     [ptBoolean,true])
18   )
19   -> TheResult = [ptBoolean,true]

```

```

20      ; TheResult = [ptBoolean,false]
21  )
22),
23 Result = TheResult
24.
25/*
26| ?- X = [dtPassword,[],[[dtString,[[value,[ptString,'012345']]],[]]]],
27msrNav([X],[is,[],[Result]]).
28X = [dtPassword,[],[[dtString,[[value,[ptString,'012345']]],[]]]],
29Result = [ptBoolean,true] ?
30yes
31
32| ?- X = [dtPassword,[],[[dtString,[[value,[ptString,'01234']]],[]]]],
33msrNav([X],[is,[],[Result]]).
34X = [dtPassword,[],[[dtString,[[value,[ptString,'01234']]],[]]]],
35Result = [ptBoolean,false] ?
36yes
37*/

```

Listing D.40: Prolog file PrimaryTypesDatatypes-dtPassword-is.pl.

D.41 File `./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatype/dtPhoneNumber-is.pl`

```

1%*****
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%*****
5
6%% dtPhoneNumber
7
8% msd01
9msrop(dtPhoneNumber,is,[AdtValue],Result):-
10msrVar(ptBoolean,TheResult),
11(
12 ( msrNav([AdtValue],
13     [value,length,[],gt,[[ptInteger,4]]],
14     [[ptBoolean,true]]),
15   msrNav([AdtValue],
16     [value,length,[],leq,[[ptInteger,30]]],
17     [[ptBoolean,true]]))
18 )
19
20 -> TheResult = [ptBoolean,true]
21 ; TheResult = [ptBoolean,false]
22),
23 Result = TheResult
24.
25/*
26| ?- X = [dtPhoneNumber,[],[[dtString,[value,[ptString,'(+352) 46 66 44 60 00']],[]]]],
27msrNav([X],[is,[],[Result]]).
28
29X = [dtPhoneNumber,[],[[dtString,[value,[ptString,'(+352) 46 66 44 60 00']],[]]]],
30
31Result = [ptBoolean,true] ?
32
33yes
34*/

```

Listing D.41: Prolog file PrimaryTypesDatatypes-dtPhoneNumber-is.pl.

D.42 File `./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses`  
`etAlertStatus-is.pl`

2/\* DISCONTIGUOUS PREDICATES \*/

```

3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6%% etAlertStatus
7
8% msd01
9msrop(etAlertStatus,is,[AdtValue],Result):-
10msrVar(ptBoolean,TheResult),
11(
12  (
13    member(AdtValue,[pending, valid, invalid])
14  )
15 -> TheResult = [ptBoolean,true]
16 ; TheResult = [ptBoolean,false]
17),
18 Result = TheResult
19.

```

Listing D.42: Prolog file PrimaryTypesDatatypes-etAlertStatus-is.pl.

## D.43 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesCla etCrisisStatus-is.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6%% etCrisisStatus
7
8% msd01
9msrop(etCrisisStatus,is,[AdtValue],Result):-
10msrVar(ptBoolean,TheResult),
11(
12  (
13    member(AdtValue,[pending, handled, solved, closed])
14  )
15 -> TheResult = [ptBoolean,true]
16 ; TheResult = [ptBoolean,false]
17),
18 Result = TheResult
19.

```

Listing D.43: Prolog file PrimaryTypesDatatypes-etCrisisStatus-is.pl.

## D.44 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesCla etCrisisType-is.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6%% etCrisisType
7
8% msd01
9msrop(etCrisisType,is,[AdtValue],Result):-
10msrVar(ptBoolean,TheResult),
11(
12  (
13    member(AdtValue,[small, medium, huge])
14  )
15 -> TheResult = [ptBoolean,true]
16 ; TheResult = [ptBoolean,false]
17),
18 Result = TheResult

```

19.

Listing D.44: Prolog file PrimaryTypesDatatypes-etCrisisType-is.pl.

## D.45 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses etHumanKind-is.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6%% etHumanKind
7
8% msd01
9msrop(etHumanKind,is,[AdtValue],Result):-
10msrVar(ptBoolean,TheResult),
11(
12  (
13    member(AdtValue,[witness,victim,anonymous])
14  )
15  -> TheResult = [ptBoolean,true]
16  ; TheResult = [ptBoolean,false]
17),
18Result = TheResult
19.

```

Listing D.45: Prolog file PrimaryTypesDatatypes-etHumanKind-is.pl.

## D.46 File ./src-gen/prolog-ref-spec/Operations/Concepts/SecondaryTypesData dtSMS-is.pl

```

1%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5%% dtComment
6
7%msd01
8msrop(dtSMS,is,[AdtValue],Result):-
9  msrVar(ptBoolean,TheResult),
10 msrVar(ptInteger,MaxLength),
11(
12  (
13    (
14      MaxLength = [ptInteger,160],
15      msrNav([AdtValue],
16        [value,length,[],leq,[MaxLength]],
17        [[ptBoolean,true]])
18    )
19    -> TheResult = [ptBoolean,true]
20    ; TheResult = [ptBoolean,false]
21  )
22),
23Result = TheResult
24.

```

Listing D.46: Prolog file SecondaryTypesDatatypes-dtSMS-is.pl.



# Glossary

<i><b>abstract actor</b></i> an actor that is not . . . . .	22
<i><b>actor</b></i> An actor is a person, organization, or external system that plays a role in one or more interactions with the system . . . . .	18
<i><b>direct actor</b></i> an actor that interacts directly with the system. It thus belongs to the environment.	22
<i><b>indirect actor</b></i> an actor that interacts indirectly with the system through a direct actor. It thus belongs the domain but not to the environment. . . . .	22
<i><b>system operation</b></i> a functionality of the system that can be triggered by a message sent by an actor belonging to the environment. . . . .	18



# Bibliography

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- [3] ISO/IEC: ISO/IEC 25010 - Systems and software engineering - Systems and software Quality Requirements and Evaluation (SQuaRE) - System and software quality models. (2011) ISO/IEC 13211-1.