

Laboratory for Advanced Software Systems  
University of Luxembourg



*iCrash* :  
A Crisis Management Case Study  
**MESSIR** Analysis Document  
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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 crises. 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 an 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.

<b>USE-CASE DESCRIPTION</b>	
<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[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.

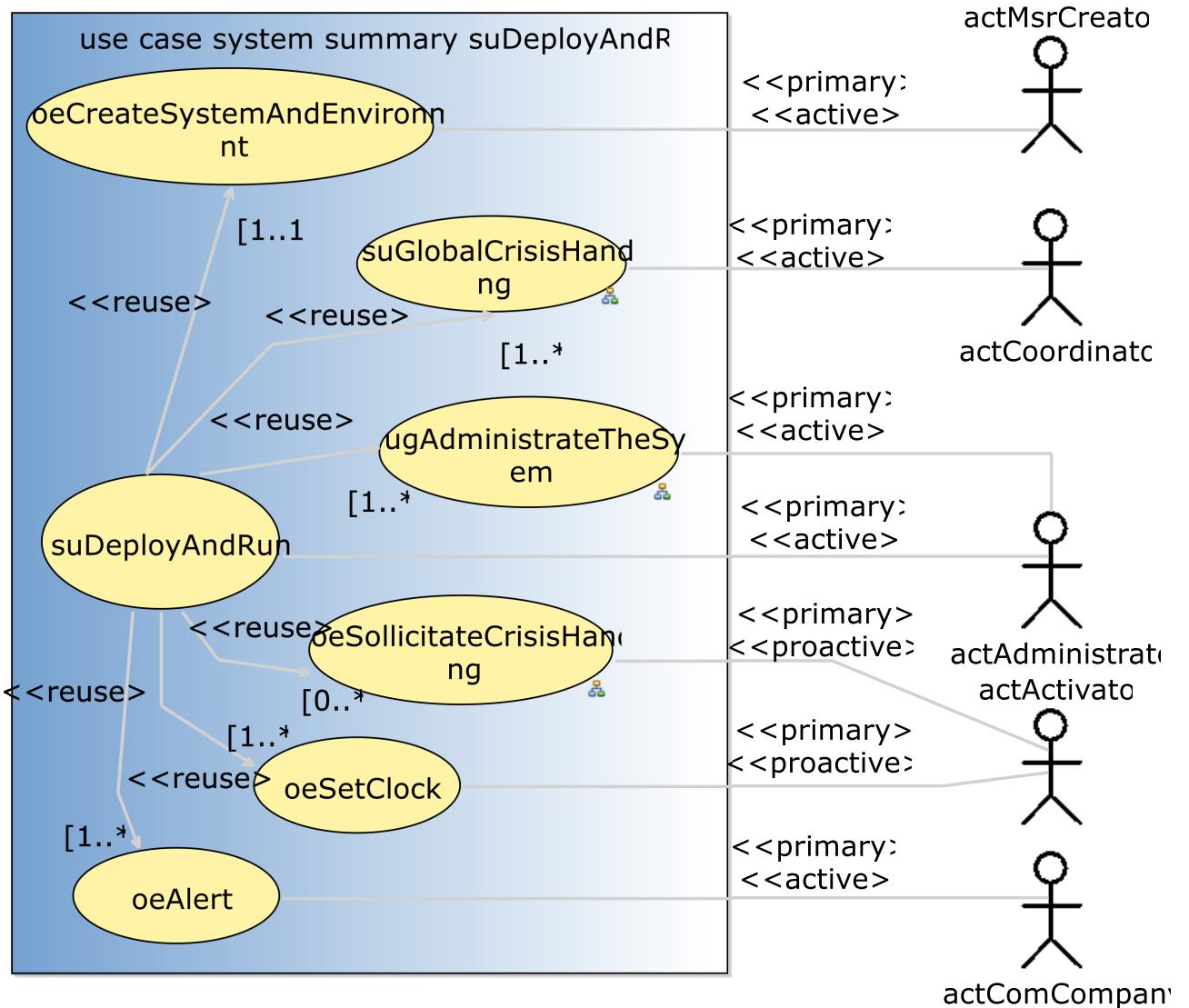


Figure 2.1: suDeployAndRun summary use case

<b>USE-CASE DESCRIPTION</b>	
<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 [1..*]</u>
2	<u>ugMonitor [1..*]</u>
3	<u>ugManageCrisis [1..*]</u>
<b>Protocol condition(s)</b>	
1	the iCrash system has been deployed
2	the coordinator actor involved 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-ugAdministateTheSystem

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>USE-CASE DESCRIPTION</b>	
<i>Name</i>	ugAdministateTheSystem
<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 [1..*]</u>
2 <u>oeAddCoordinator [1..*]</u>
3 <u>oeDeleteCoordinator [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      modifications have been made to the system and its environment concerning existing or new coordinators.
<b>Main Steps</b>
a      the actor <code>actAdministrator</code> executes the <u>ugSecurelyUseSystem</u> use case
b      the actor <code>actAdministrator</code> executes the <u>oeAddCoordinator</u> use case
c      the actor <code>actAdministrator</code> 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	
Name	ugManageCrisis
Scope	system
Level	usergoal
<b>Primary actor(s)</b>	
1	<code>actCoordinator[active]</code>
<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 [0..*]</u>
2	<u>oeSetCrisisStatus [0..*]</u>
3	<u>oeSetCrisisHandler [0..*]</u>
4	<u>oeReportOnCrisis [0..*]</u>
5	<u>oeCloseCrisis [0..*]</u>
6	<u>oeInvalidateAlert [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>	

*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 <code>oeValidateAlert</code> use case
b	the actor <code>actCoordinator</code> executes the <code>oeSetCrisisStatus</code> use case
c	the actor <code>actCoordinator</code> executes the <code>oeSetCrisisHandler</code> use case
d	the actor <code>actCoordinator</code> executes the <code>oeReportOnCrisis</code> use case
e	the actor <code>actCoordinator</code> executes the <code>oeCloseCrisis</code> use case
f	the actor <code>actCoordinator</code> executes the <code>oeInvalidateAlert</code> 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	
Name	ugMonitor
Scope	system
Level	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	<code>oeGetCrisisSet [0..*]</code>
2	<code>oeGetAlertsSet [0..*]</code>
<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 <code>oeGetAlertsSet</code> use case
b	the actor <code>actCoordinator</code> executes the <code>oeGetCrisisSet</code> 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.

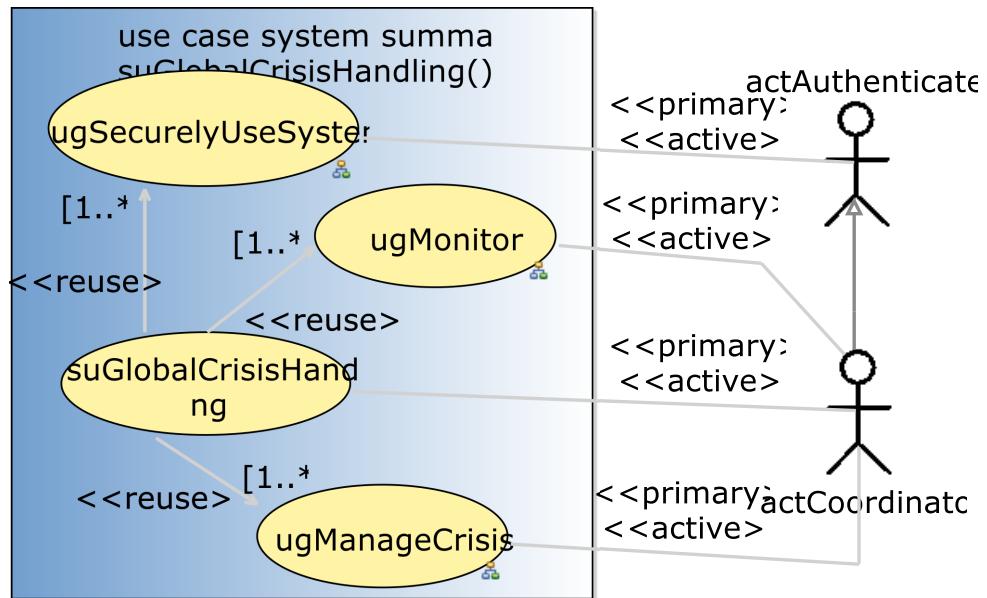


Figure 2.2: suGlobalCrisisHandling user goal use case

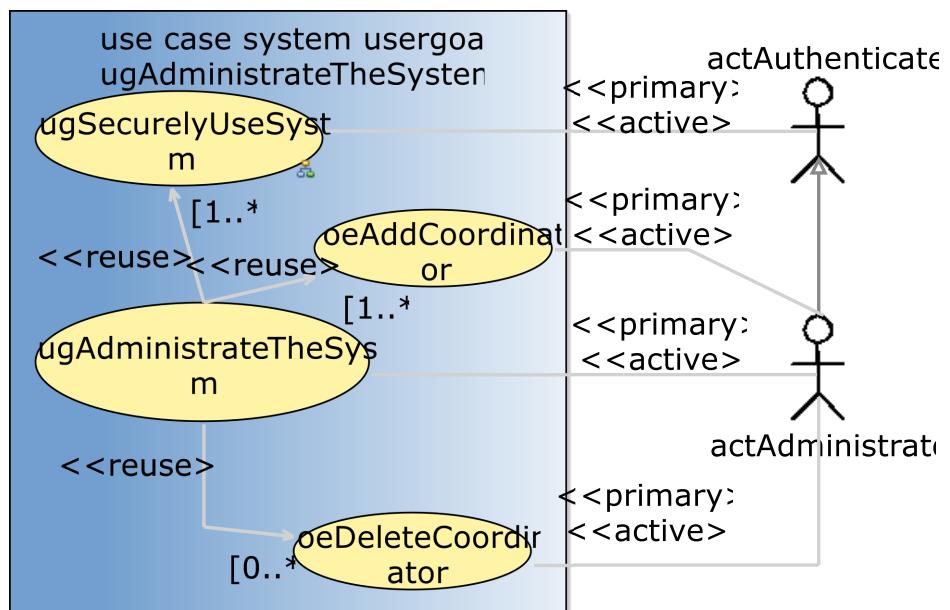


Figure 2.3: ugAdministateTheSystem user goal use case

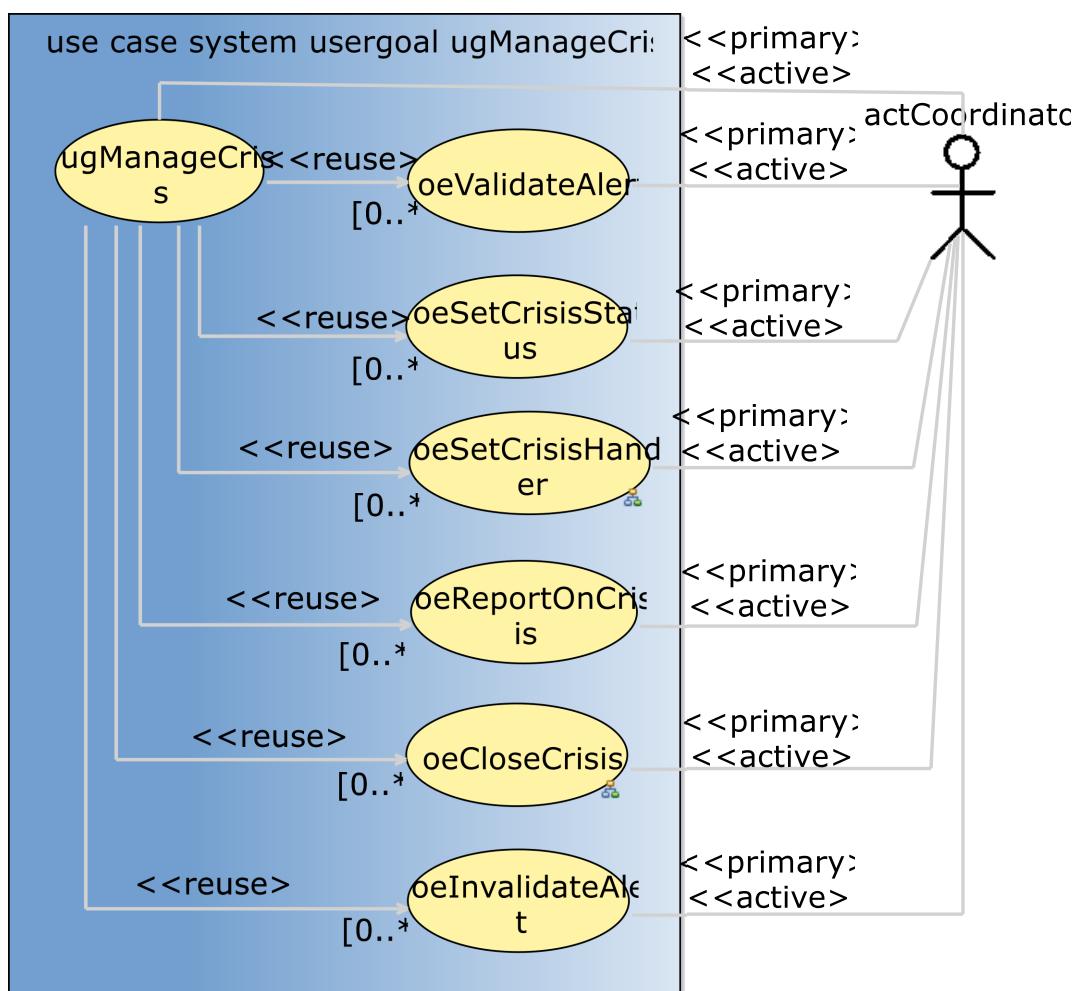


Figure 2.4: ugManageCrisis user goal use case

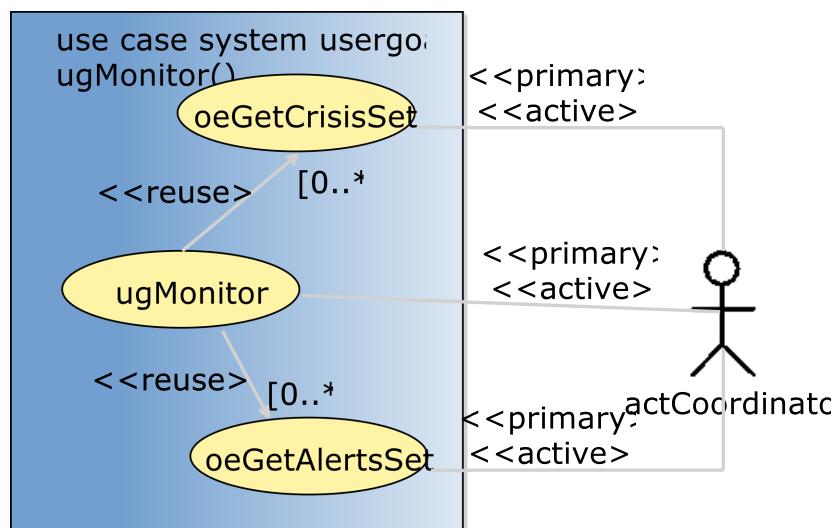


Figure 2.5: ugMonitor user goal use case

USE-CASE DESCRIPTION	
Name	ugSecurelyUseSystem
Scope	system
Level	usergoal
<i>Primary actor(s)</i>	
1	actAuthenticated[active]
<i>Goal(s) description</i>	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.
<i>Reuse</i>	
1	<u>oeLogin [1..1]</u>
2	<u>oeLogout [1..1]</u>
<i>Protocol condition(s)</i>	
1	the iCrash system has been deployed
<i>Pre-condition(s)</i>	
1	none
<i>Main post-condition(s)</i>	
1	the actAuthenticated is known by the system not to be logged.
<i>Main Steps</i>	
a	the actor <code>actAuthenticated</code> executes the <u>oeLogin</u> use case
b	the actor <code>actAuthenticated</code> executes the <u>oeLogout</u> use case
<i>Steps Ordering Constraints</i>	
1	step (a) must always precede step (b).

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

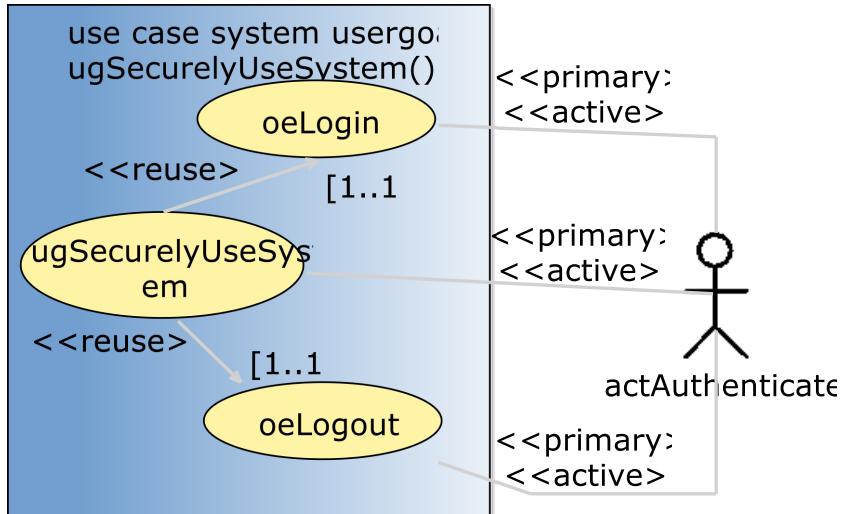


Figure 2.6: ugSecurelyUseSystem user goal use case

### 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	
Name	oeSetCrisisHandler
Scope	system
Level	subfunction
<i>Parameters</i>	
AdtCrisisID: dtCrisisID 1	
<i>Primary actor(s)</i>	
1	actCoordinator[active]
<i>Secondary actor(s)</i>	
1	actCoordinator[passive]
2	actComCompany[passive, multiple]
<i>Goal(s) description</i>	
goal is to declare himself as been the handler of a crisis having the specified id.	
<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 2.7 shows the use case diagram for the oeSetCrisisHandler subfunction use case

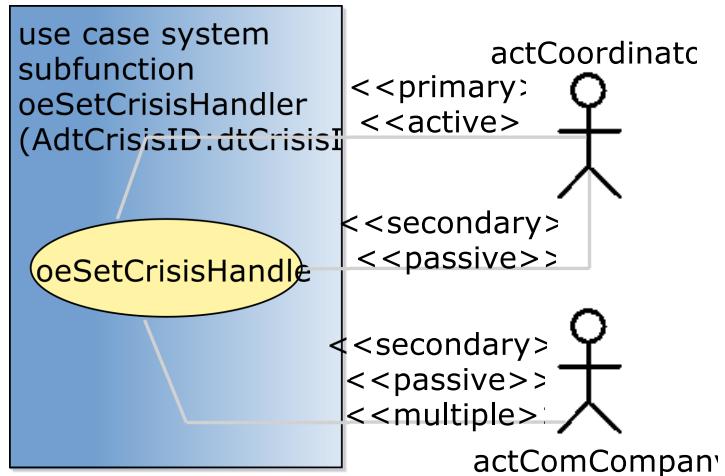


Figure 2.7: oeSetCrisisHandler subfunction use case

### 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
<i>Primary actor(s)</i>	
1	actActivator[proactive]
<i>Secondary actor(s)</i>	
1	actCoordinator[passive, multiple]
2	actAdministrator[passive]
<i>Goal(s) description</i>	the actActivator's goal is to decrease the number of unhandled crisis.
<i>Protocol condition(s)</i>	
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.
<i>Pre-condition(s)</i>	
1	none
<i>Main post-condition(s)</i>	
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

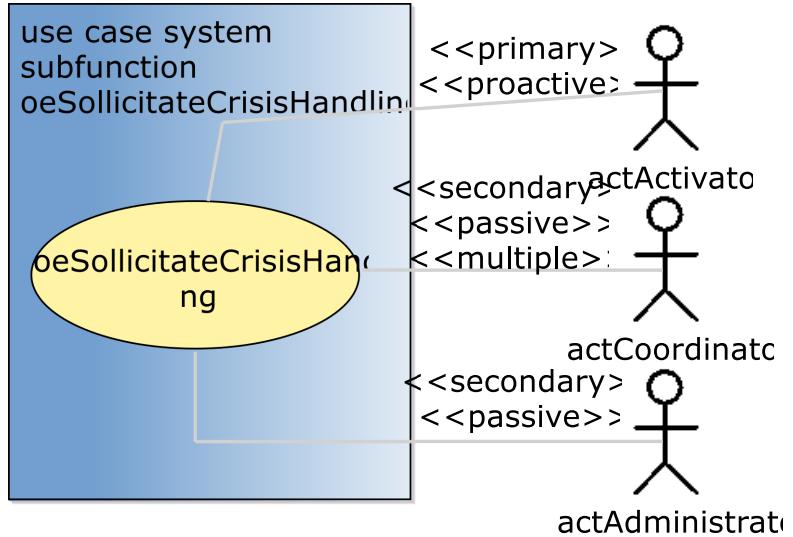


Figure 2.8: oeSollicitateCrisisHandling subfunction use case

### 2.3.2 Use Case Instance(s)

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

Figure 2.9

#### 2.3.2.2 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.

<b>SUMMARY USE-CASE INSTANCE</b>	
<b>Instantiated Use Case</b>	<code>suDeployAndRun</code>
<b>Instance ID</b>	<code>uciSimpleAndCompletePart01</code>
<b>Remarks</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 let's the proactive actor trigger the automatic solicitation of crisis handling.
e	this first part stops before the coordinator logs in the system.

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

#### 2.3.2.3 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.

<b>SUMMARY USE-CASE INSTANCE</b>	
<b>Instantiated Use Case</b>	<code>suDeployAndRun</code>
<b>Instance ID</b>	<code>uciSimpleAndCompletePart02</code>
<b>Remarks</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 2.11 shows the sequence diagram representing the second part of a simple and complete use



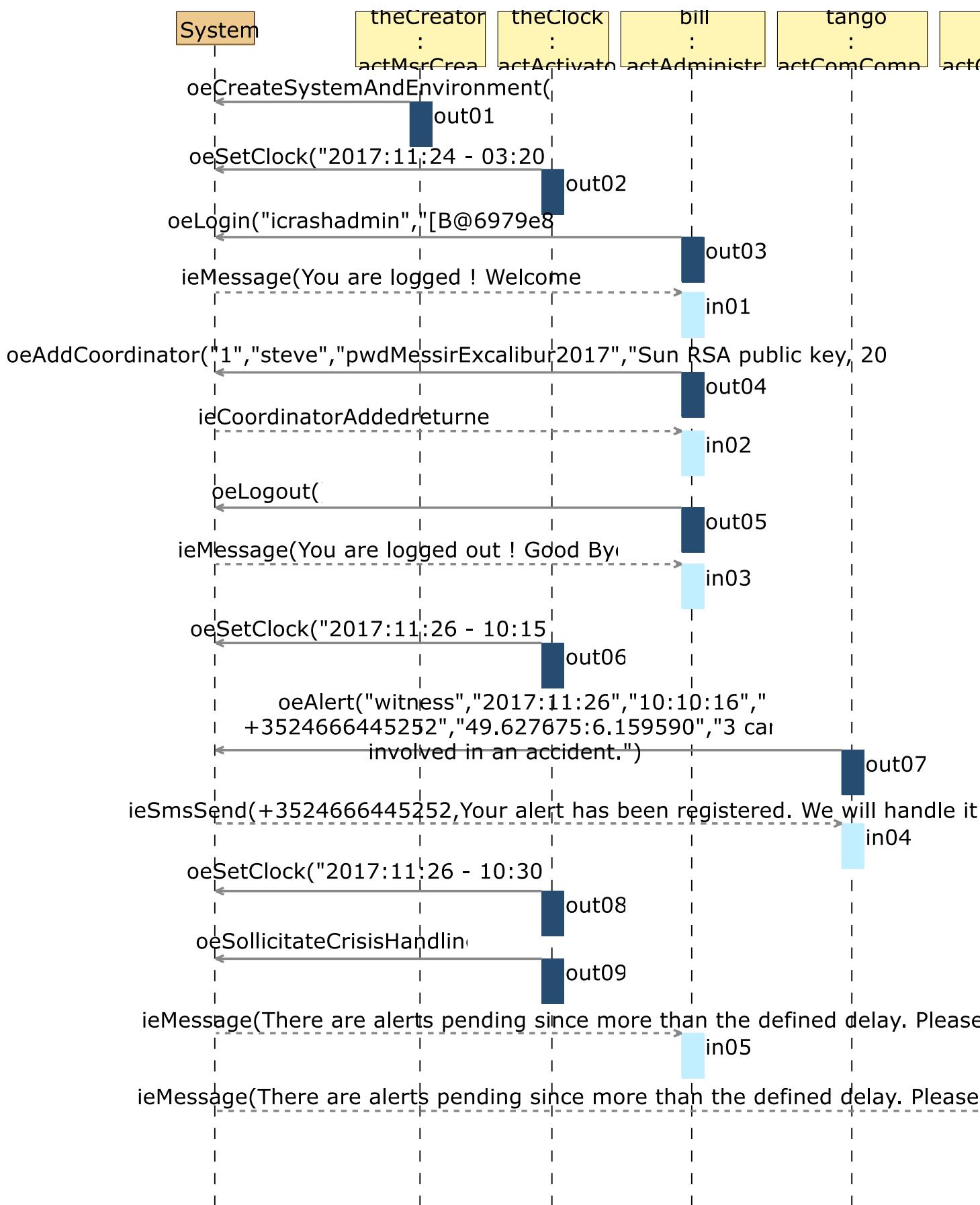


Figure 2.10: uci-suDeployAndRun-uciSimpleAndComplete-Part01

case instance for the summary use case `suDeployAndRun`.

#### 2.3.2.4 Use-Case Instance - `uciugSecurelyUseSystem:ugSecurelyUseSystem`

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

Figure 2.12

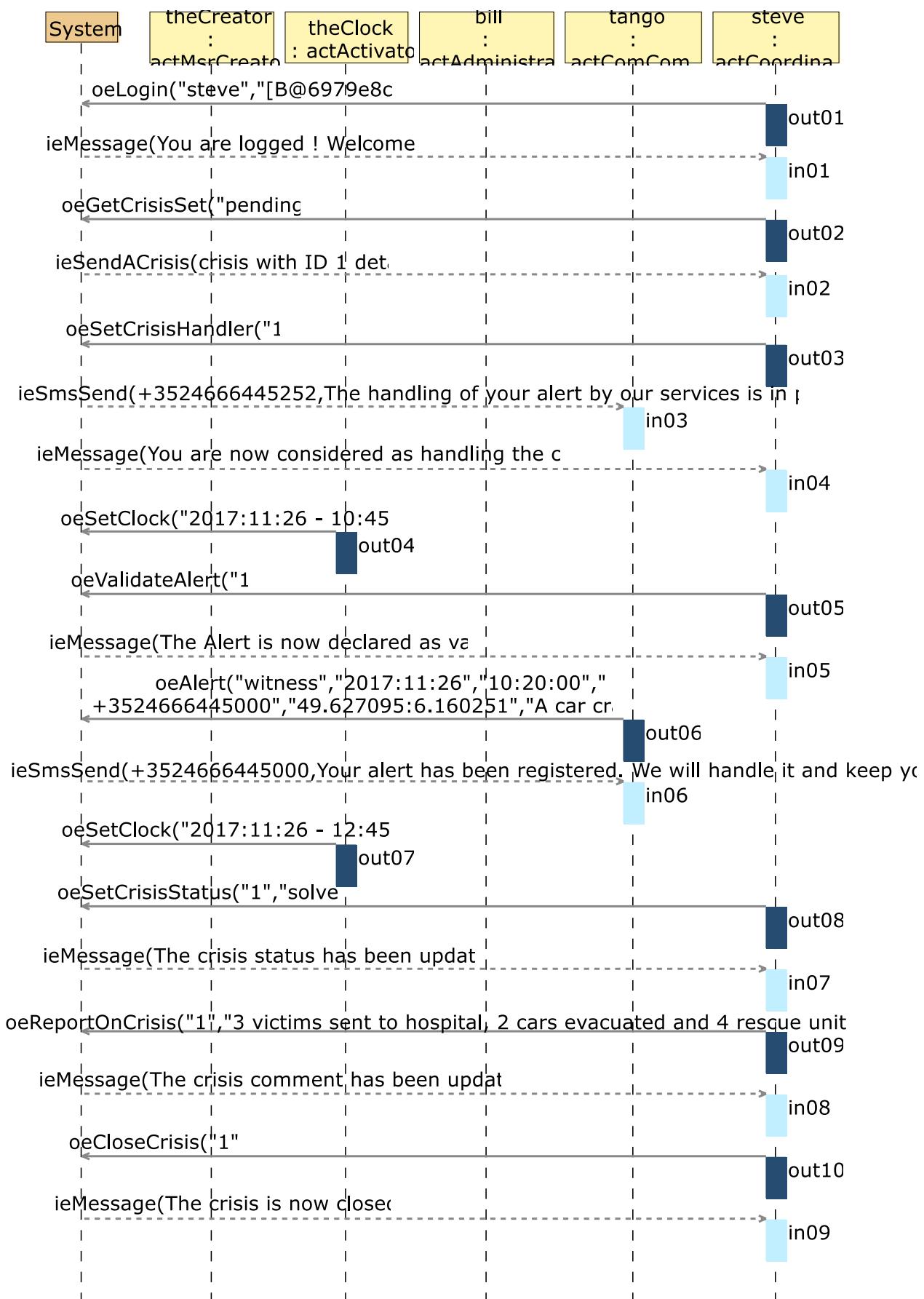


Figure 2.11: uci-suDeployAndRun-uciSimpleAndComplete-Part02 use case instance sequence diagram

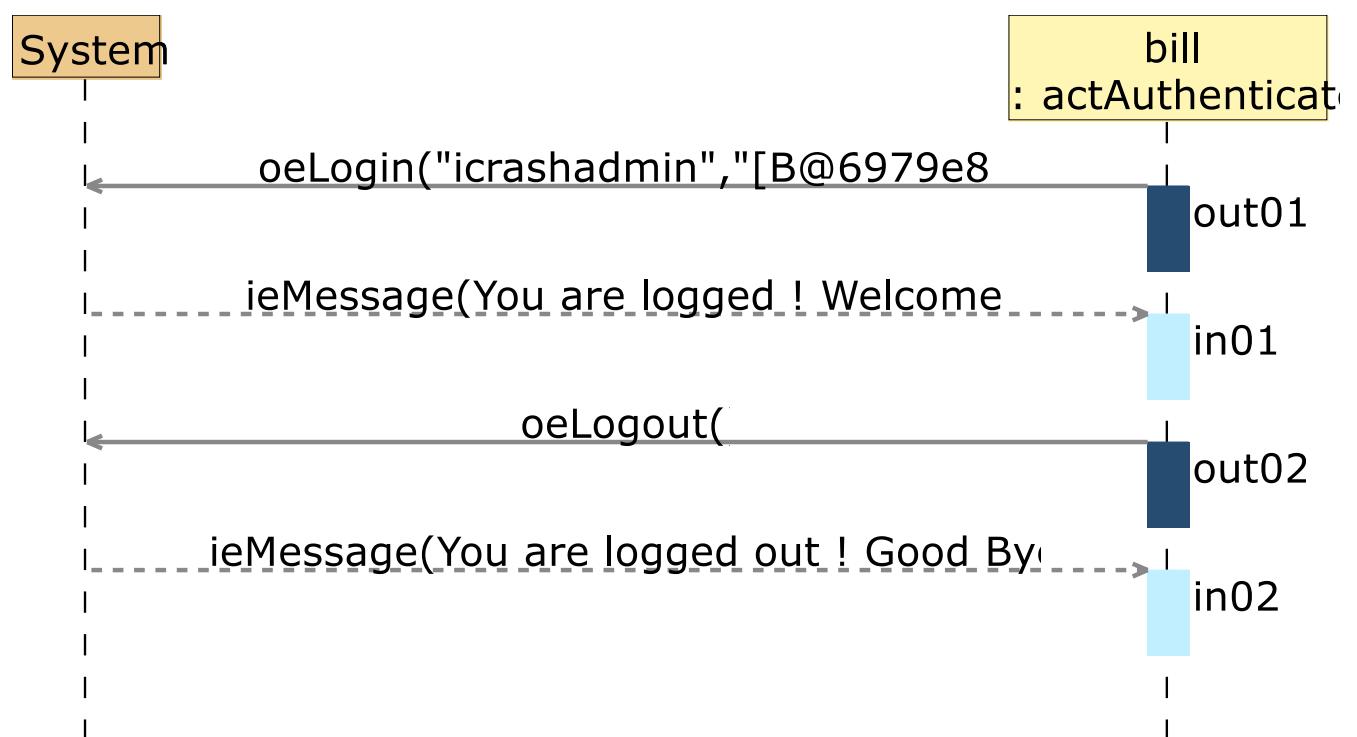


Figure 2.12:

# 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

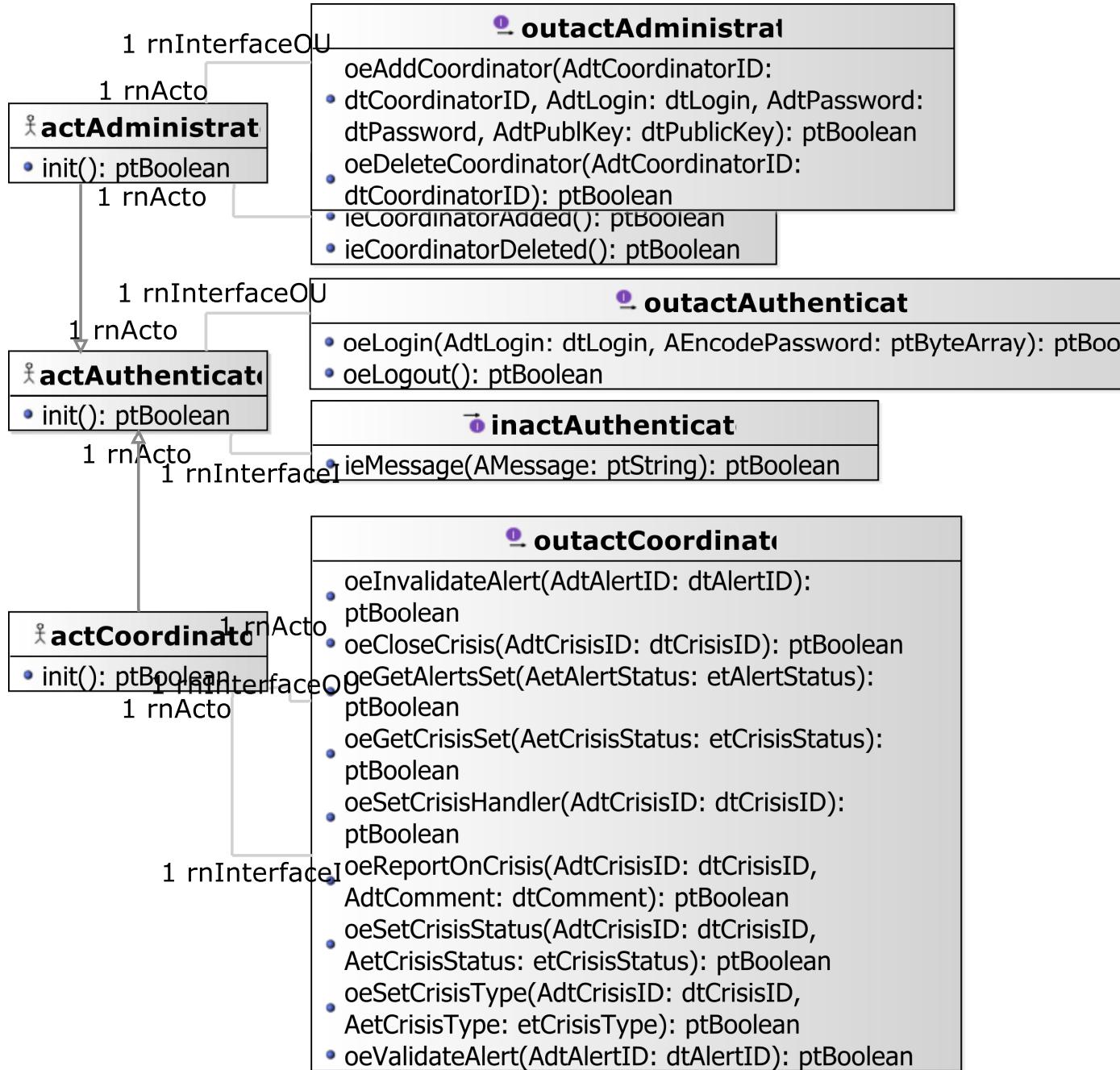


Figure 3.1: Environment Model - Local View 01. environment model local view - Part 1.

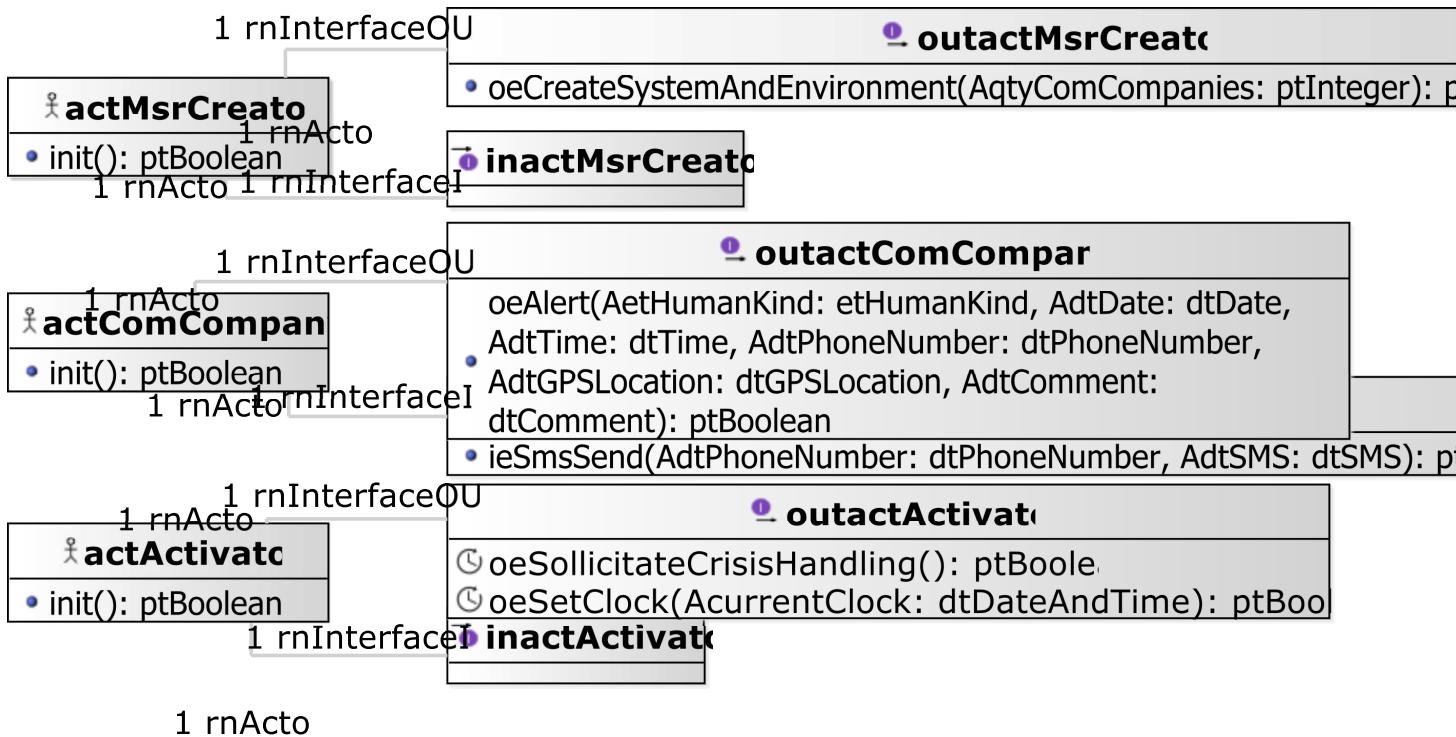


Figure 3.2: Environment Model - Local View 02. environment model local view - Part 2.

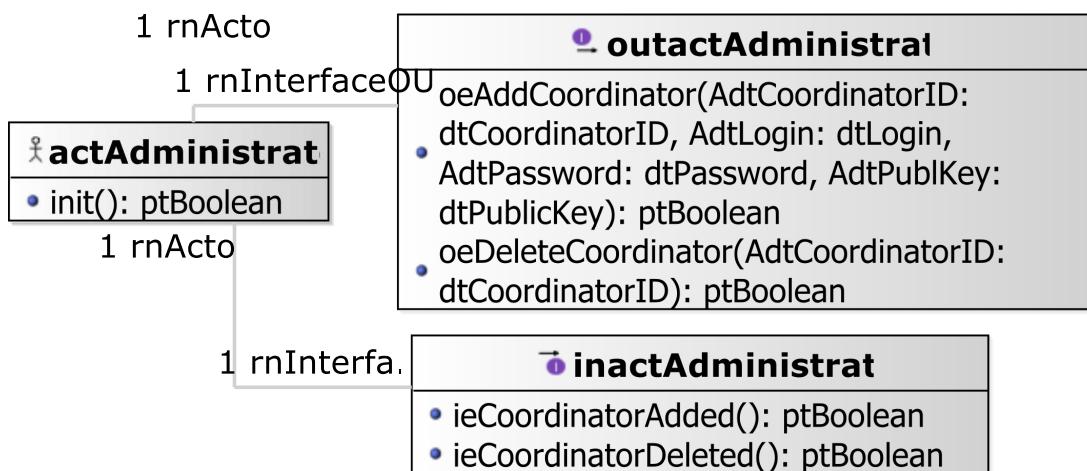


Figure 3.3: Environment Model - Local View 03. administrator actor environment model view.

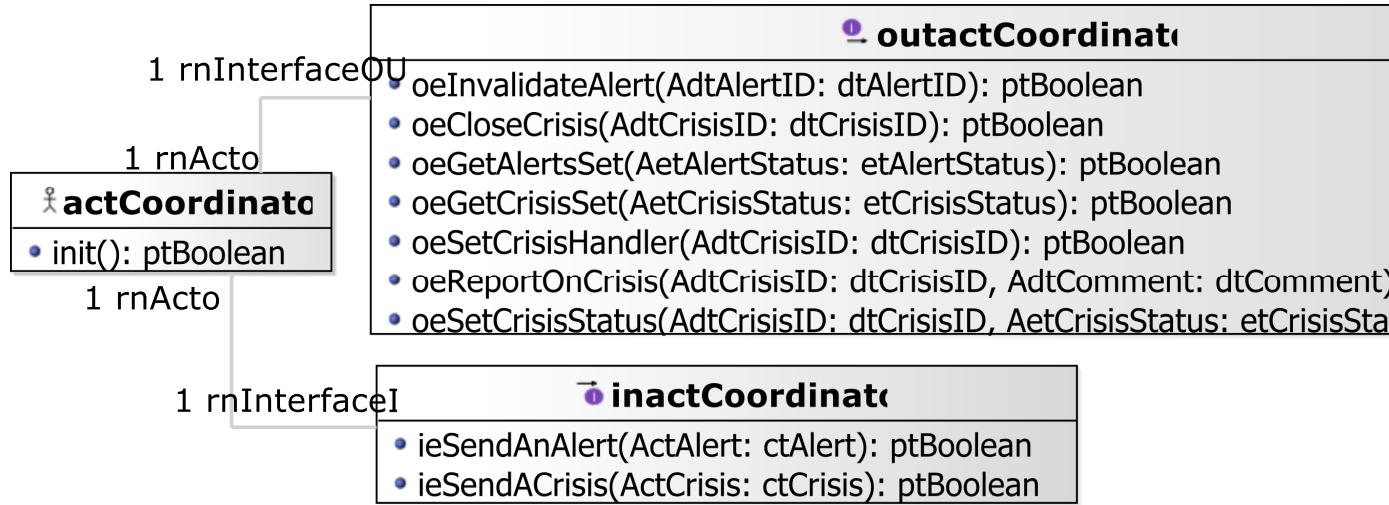


Figure 3.4: Environment Model - Local View 04. coordinator actor environment model view.

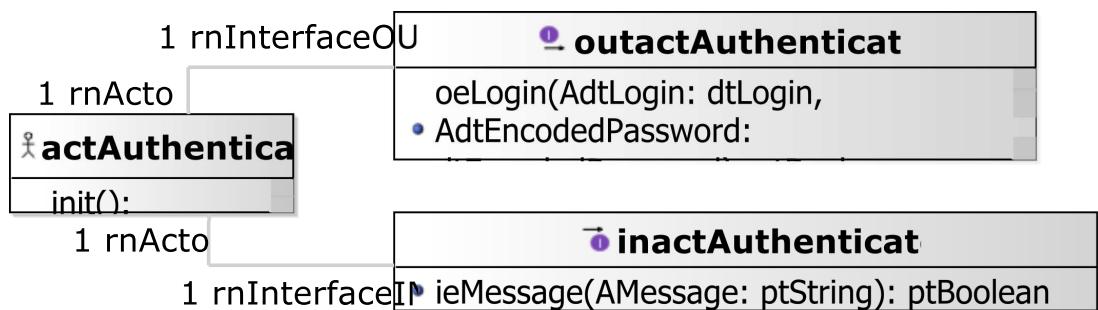


Figure 3.5: Environment Model - Local View 05. authenticated actor environment model local view.

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

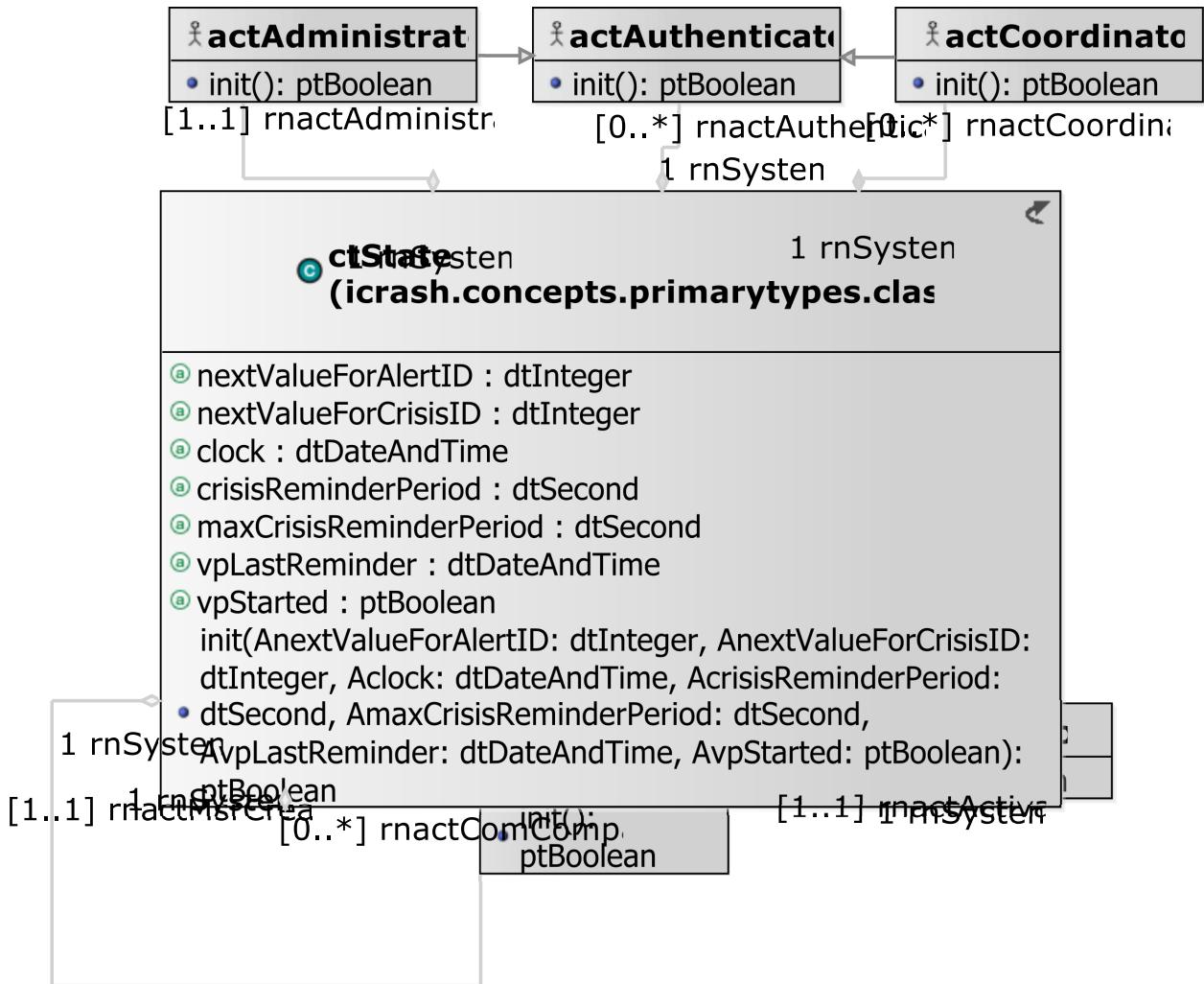


Figure 3.6: Environment Model - Global View 01. em-gv-01 environment model global view.

## 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.
<i>OutputInterfaces</i>

*continues in next page ...*

**... Actor table continuation**

OUT 1	<b>[proactive] oeSolicitCrisisHandling():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**

<b>ACTOR</b>	
<b>actAdministrator</b>	
represents an actor responsible of administration tasks for the <i>iCrash</i> system.	
<i>Extends</i>	
icrash.environment.actAuthenticated	
<i>OutputInterfaces</i>	
OUT 1	<b>oeAddCoordinator(AdtCoordinatorID:dtCoordinatorID, AdtLogin:dtLogin, AdtPassword:dtPassword, AdtPublKey:dtPublicKey):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.
<i>InputInterfaces</i>	
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**

<b>ACTOR</b>	
<b>actAuthenticated</b>	
abstract actor providing reusable input and output interfaces for actors that need to authenticate themselves.	
<i>OutputInterfaces</i>	
OUT 1	<b>oeLogin(AdtLogin:dtLogin, AdtEncodedPassword:dtEncodedPassword):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.
<i>InputInterfaces</i>	
IN 1	<b>ieMessage(AMessage:ptString):ptBoolean</b> allows for receiving general textual messages.

**3.7.4 actComCompany Actor**

<b>ACTOR</b>	
<b>actComCompany</b>	
represents the communication company stakeholder ensuring the input/ouput of textual messages with humans having communication devices.	

*continues in next page ...*

*...Actor table continuation*

<i>OutputInterfaces</i>	
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.
<i>InputInterfaces</i>	
IN 1	<b>ieSmssSend(AdtPhoneNumber:dtPhoneNumber, AdtSMS:dtSMS):ptBoolean</b> allows for receiving textual messages to be dispatched to the communication company customers having the provided phone number.

3.7.5 **actCoordinator Actor**

ACTOR
<i>actCoordinator</i>
represents actor responsible of handling one or several crisis for the <i>iCrash</i> system.
<i>Extends</i>
icrash.environment.actAuthenticated
<i>OutputInterfaces</i>
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.
<i>InputInterfaces</i>
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 **actMobileCoordinator Actor**

ACTOR
<i>actMobileCoordinator</i>

*continues in next page ...*

### *...Actor table continuation*

represents actor responsible of handling one or several crisis for the *iCrash* system from mobile GUI.

### *Extends*

## icrash.environment.actCoordinator

## *OutputInterfaces*

OUT 1

`oeSaveUpdates(AdtCoordinatorId:dtCoordinatorID,  
AdtCoordinatorFirstName1:dtCoordinatorFirstName,  
AdtCoordinatorLastName:dtCoordinatorLastName):ptBoolean`  
sent to update the information about a specific coordinator.

*rfaces*

## *Input Interfaces*

IN 1

**ieSendUpdatedInformation( ):ptBoolean**

receives a message about updated information.

### 3.7.7 `actMsrCreator` Actor

<b>ACTOR</b>	
<i>actMsrCreator</i>	Represents the creator stakeholder in charge of state and environment initialization.
<i>OutputInterfaces</i>	
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

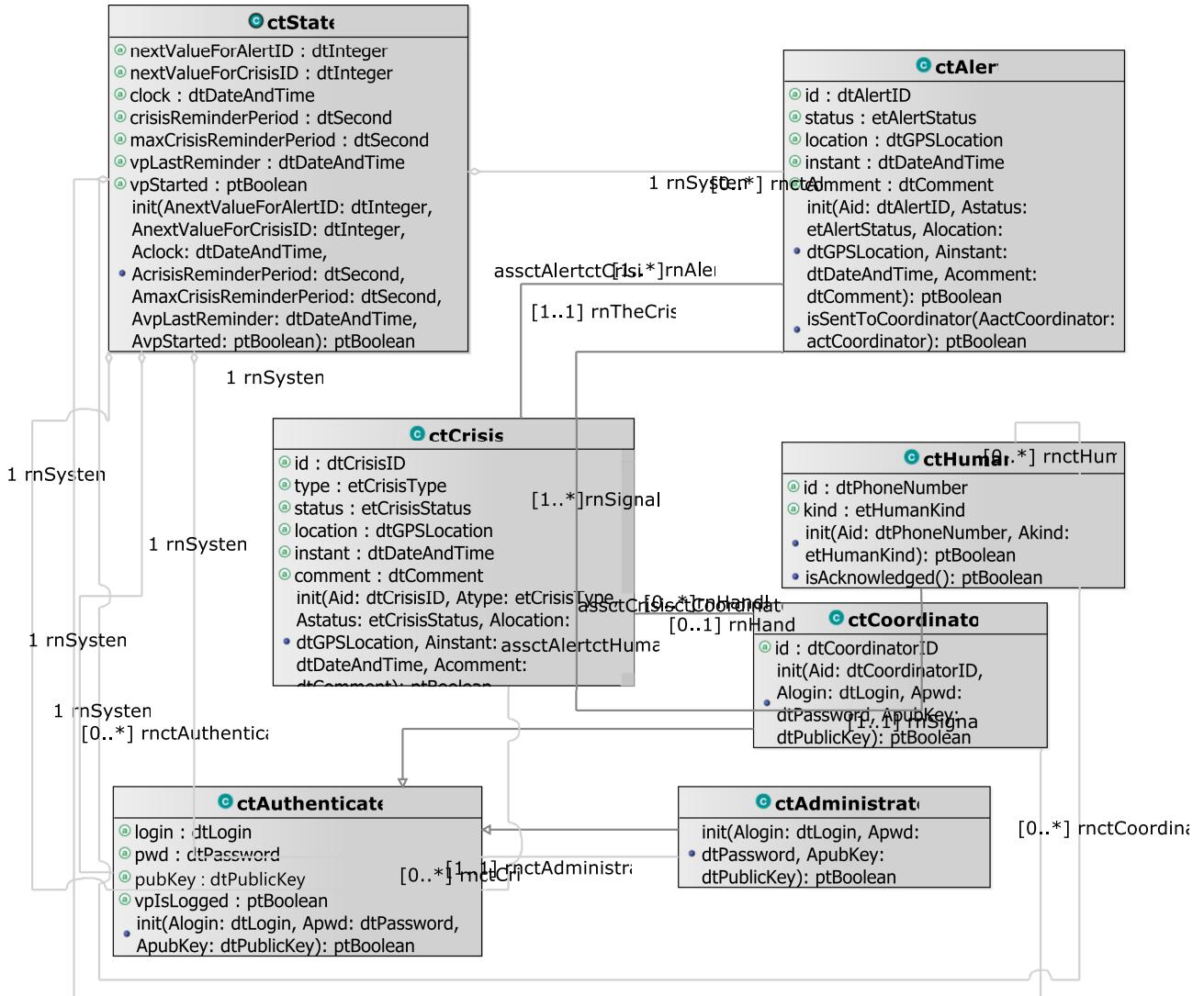


Figure 4.1: Concept Model - PrimaryTypes-Classes local view 01. Local view of all the primary types class types .

ctState	
④	nextValueForAlertID : dtInteger
④	nextValueForCrisisID : dtInteger
④	clock : dtDateAndTime
④	crisisReminderPeriod : dtSecond
④	maxCrisisReminderPeriod : dtSecond
④	vpLastReminder : dtDateAndTime
④	vpStarted : ptBoolean
	init(AnextValueForAlertID: dtInteger, AnextValueForCrisisID: dtInteger, Aclock:

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

ctAler	
④	id : dtAlertID
④	status : etAlertStatus
④	location : dtGPSLocation
④	instant : dtDateAndTime
④	comment : dtComment
	init(Aid: dtAlertID, Astatus: etAlertStatus, <del>Alocation: dtGPSLocation</del> , <del>Ainstant:</del>

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

ctCrisis	
④	id : dtCrisisID
④	type : etCrisisType
④	status : etCrisisStatus
④	location : dtGPSLocation
④	instant : dtDateAndTime
④	comment : dtComment
	init(Aid: dtCrisisID, Atype: etCrisisType, Astatus: • etCrisisStatus, Alocation: dtGPSLocation, Ainstant: dtDateAndTime, Acomment: dtComment): ptBoolean

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

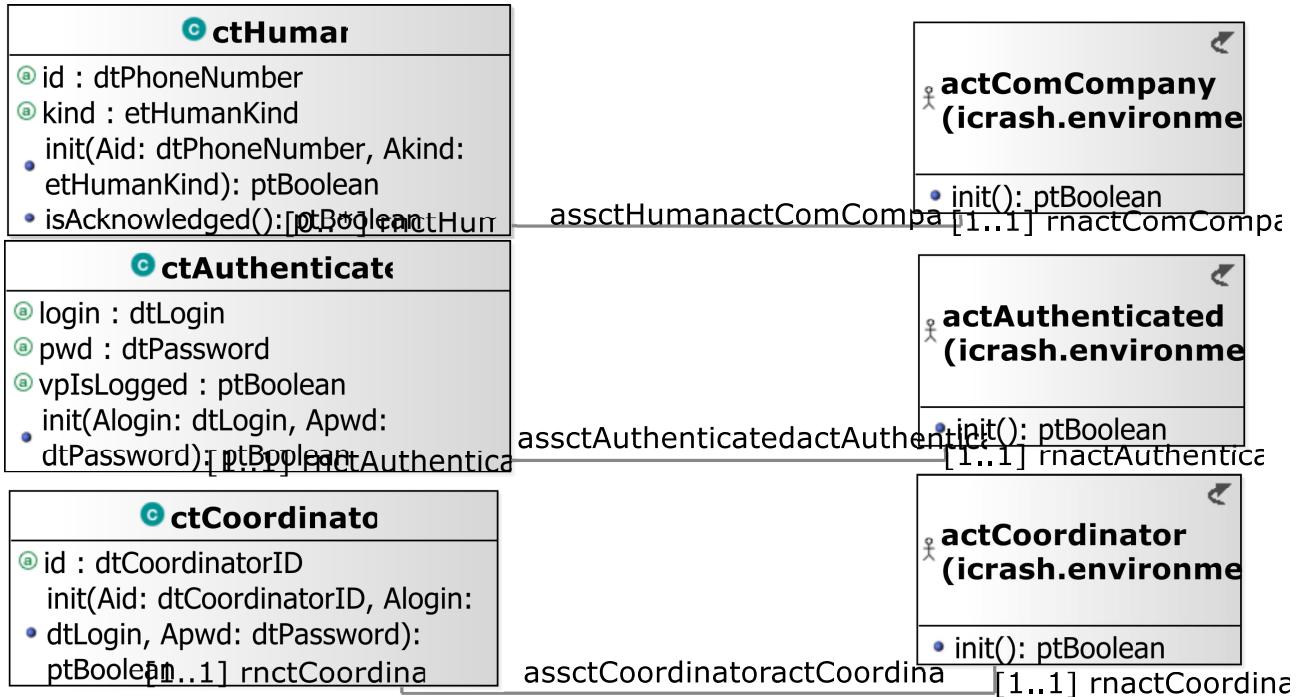


Figure 4.5: Concept Model - PrimaryTypes-Classes global view 01. Primary types class types global view - cm-pt-ct-gv-01 .



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

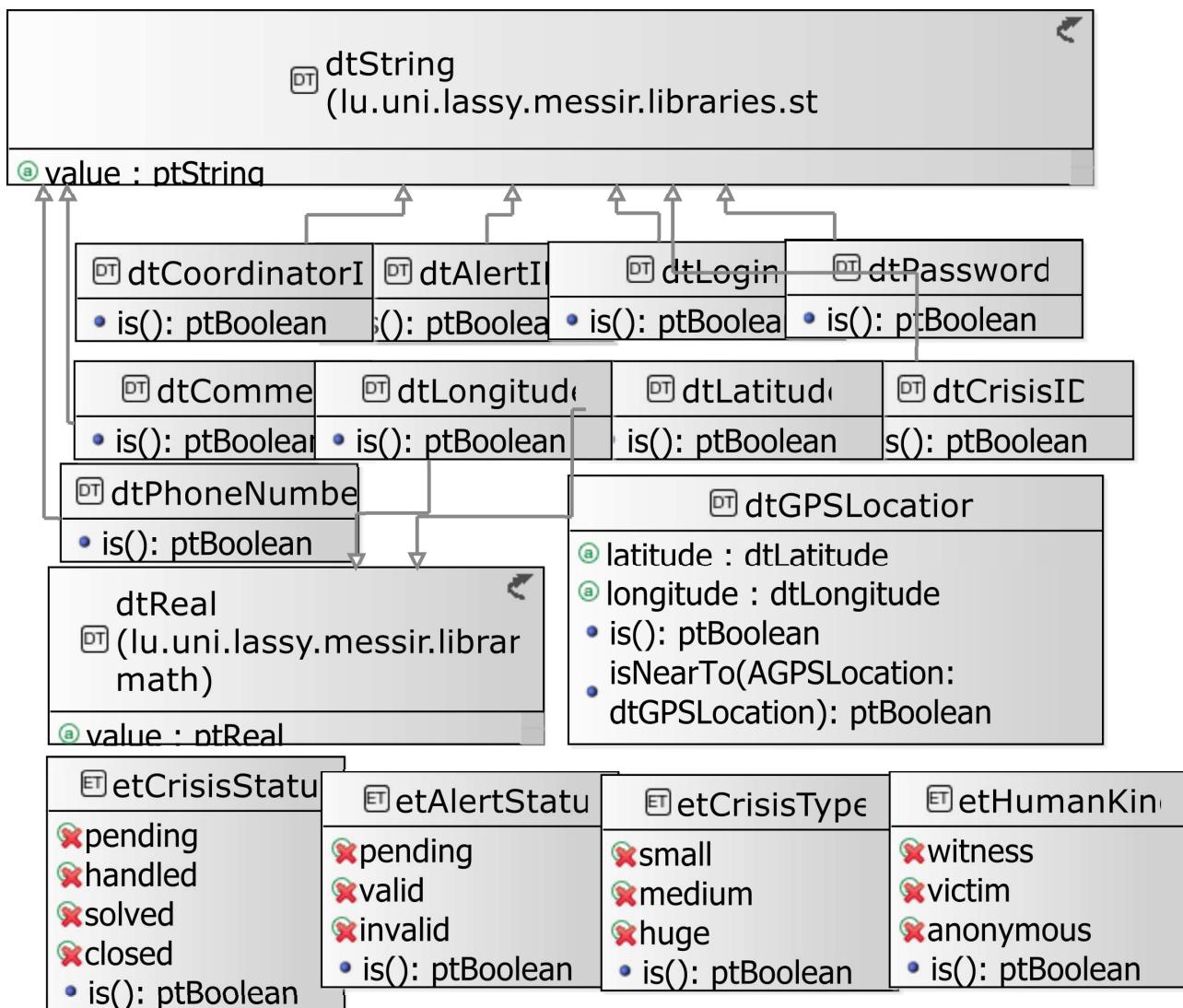


Figure 4.7: Concept Model - PrimaryTypes-Datatypes global view 01. global view of primary types datatype types - cm-pt-dt-gv-01 .

### 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.

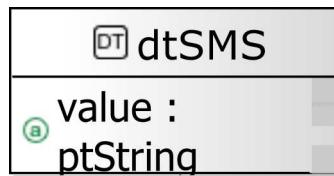


Figure 4.8: Concept Model - SecondaryTypes-Datatypes local view 01. Local view of the secondary types datatype types.

## 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	
<i>ctAdministrator</i>	
used to characterize internally the entity that is responsible of administrating the <i>iCrash</i> system.	
extends	icrash.concepts.primarytypes.classes.ctAuthenticated
operation	<b>init(Alogin:dtLogin, Apwd:dtPassword, ApubKey:dtPublicKey):ptBool</b> used to initialize the current object as a new instance of the ctAdministrator type.
<i>ctAlert</i>	
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>	
operation		the alert validation status <b>init(Aid:dtAlertID, Astatus:etAlertStatus, Alocation:dtGPSLocation, Ainstant:dtDateAndTime, Acomment:dtComment):ptBoolean</b>
operation		used to initialize the current object as a new instance of the ctAlert type. <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, ApubKey:dtPublicKey):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>firstName: dtCoordinatorFirstName</b>	A string used to represent first names of coordinators.
attribute	<b>id: dtCoordinatorID</b>	a unique identification information.
attribute	<b>lastName: dtCoordinatorLastName</b>	A string used to represent last name of coordinators..
operation	<b>init(Aid:dtCoordinatorID, Alogin:dtLogin, Apwd:dtPassword, ApubKey:dtPublicKey):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 are 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>	

*continues in next page ...*

**... Classes table continuation**

attribute	the crisis handling status.
operation	<b>type: etCrisisType</b> an indication of the gravity of the crisis.
operation	<b>handlingDelayPassed():ptBoolean</b> 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.
operation	<b>isSentToCoordinator(AactCoordinator:actCoordinator):ptBoolean</b> used to provide a given coordinator with current crisis information.
operation	<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>ctKeyValuePair</b>	
	The class that stores pair of keys and allows to encode or decode a message
operation	<b>decodeMsg(pwd:dtEncodedPassword, publicKey:dtPublicKey):ptBoolean</b> decodes encoded password
<b>ctState</b>	
	used to model the system. Each system specified using <b>Mess1P</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>

*continues in next page ...*

**... Classes table continuation**

attribute	date and time of the last reminder. <b>vpStarted: ptBoolean</b>
operation	used to avoid reacting to an actor message if the system is not started (i.e. oeCreateSystemAndEnvironment not executed). <b>init(AnextValueForAlertID:dtInteger, AnextValueForCrisisID:dtInteger, Aclock:dtDateAndTime, AcrisisReminderPeriod:dtSecond, AmaxCrisisReminderPeriod:dtSecond, AvpLastReminder:dtDateAndTime, AvpStarted:ptBoolean):ptBoolean</b>
	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>dtByteArray</b>	
attribute	<b>value: ptString</b>
<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>dtCoordinatorFirstName</b>	A string used to represent first names of coordinators.
extends	dtString
operation	<b>is():ptBoolean</b> used to determine which strings are considered as valid first name.
<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>dtCoordinatorLastName</b>	A string used to represent last name of coordinators.
extends	dtString
operation	<b>is():ptBoolean</b> used to determine which strings are considered as valid coordinators last name.
<b>dtCrisisID</b>	

***continues in next page ...***

***... Datatypes table continuation***

A string used to identify crisis.
<p><i>extends</i> dtString</p> <p><i>operation</i> <b>is():ptBoolean</b></p> <p>used to determine which strings are considered as valid crisis identifiers.</p>
<p><b><i>dtEncodedPassword</i></b></p> <p>a encoded password byte array used to authentify an <i>iCrash</i> user</p> <p><i>extends</i> dtByteArray</p> <p><i>operation</i> <b>eq():ptBoolean</b></p> <p>used to determine if two encoded passwords a equals to each other</p>
<p><b><i>dtGPSLocation</i></b></p> <p>used to define coordinates of geographical positions on earth. It is defined a couple made of a latitude and a longitude.</p>
<p><i>attribute</i> <b>latitude: dtLatitude</b></p> <p>for the latitude part of the coordinate.</p> <p><i>attribute</i> <b>longitude: dtLongitude</b></p> <p>for the longitude part of the coordinate.</p> <p><i>operation</i> <b>is():ptBoolean</b></p> <p>used to determine which couples are considered as valid dtGPSLocation values.</p> <p><i>operation</i> <b>isNearTo(AGPSLocation:dtGPSLocation):ptBoolean</b></p> <p>used to determine if locations are considered enough close to be treated as equivalent in the application domain context.</p>
<p><b><i>dtLatitude</i></b></p> <p>used to define a latitude value of a geographical positions on earth.</p>
<p><i>extends</i> dtReal</p> <p><i>operation</i> <b>is():ptBoolean</b></p> <p>used to determine which strings are considered as valid dtLatitude.</p>
<p><b><i>dtLogin</i></b></p> <p>a login string used to authentify an <i>iCrash</i> user</p>
<p><i>extends</i> dtString</p> <p><i>operation</i> <b>is():ptBoolean</b></p> <p>used to determine which strings are considered as valid dtLogin.</p>
<p><b><i>dtLongitude</i></b></p> <p>used to define a longitude value of a geographical positions on earth.</p>
<p><i>extends</i> dtReal</p> <p><i>operation</i> <b>is():ptBoolean</b></p> <p>used to determine which strings are considered as valid dtLongitude.</p>
<p><b><i>dtPassword</i></b></p> <p>a password string used to authentify an <i>iCrash</i> user</p>
<p><i>extends</i> dtString</p> <p><i>operation</i> <b>is():ptBoolean</b></p> <p>used to determine which strings are considered as valid dtPassword.</p>
<p><b><i>dtPhoneNumber</i></b></p> <p>a string used to store the phone number from the human declaring the crisis or the alert.</p>
<p><i>extends</i> dtString</p> <p><i>operation</i> <b>is():ptBoolean</b></p> <p>used to determine which strings are considered as valid dtPhoneNumber.</p>
<b><i>dtPrivateKey</i></b>

***continues in next page ...***

**... Datatypes table continuation**

a private key string used to encode a password of an <i>iCrash</i> user
operation <b>is():ptBoolean</b>
<b>dtPublicKey</b>
a public key string used to decode a encoded password of an <i>iCrash</i> user
operation <b>is():ptBoolean</b>

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>assctAlertctCrisis</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>assctAlertctHuman</b>
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>assctAuthenticatedactAuthenticated</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>assctCoordinatoractCoordinator</b>
frequent messages must be sent to coordinator especially in relation to crisis they handle.
<b>assctCrisisctCoordinator</b>
at any point in time we need to know if a coordinator is handling existing crisis or not.
<b>assctHumanactComCompany</b>

***continues in next page ...***

***... Undirected associations table continuation***

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><i>value: ptString</i></b> the textual information.
operation	<b><i>is():ptBoolean</i></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>Parameters</b>	
1	<b>AcurrentClock: dtDateAndTime</b> the date and time to be considered as the actual one.
<b>Return type</b>	
ptBoolean	
<b>Pre-Condition (protocol)</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>Pre-Condition (functional)</b>	
PreF 1	none
<b>Post-Condition (functional)</b>	
PostF 1	the ctState instance post-state is updated to have its clock attribute equal to the given date and time.
<b>Post-Condition (protocol)</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 *oeSollicitateCrisisHandling*

The *oeSollicitateCrisisHandling* operation has the following properties:

OPERATION
<i>oeSollicitateCrisisHandling[proactive]</i>
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.
<i>Return type</i>
ptBoolean
<i>Pre-Condition (protocol)</i>
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.
<i>Pre-Condition (functional)</i>
PreF 1 none
<i>Post-Condition (functional)</i>
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 sollicitate handling of those crisis.
<i>Post-Condition (protocol)</i>
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:*/

```

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```

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:

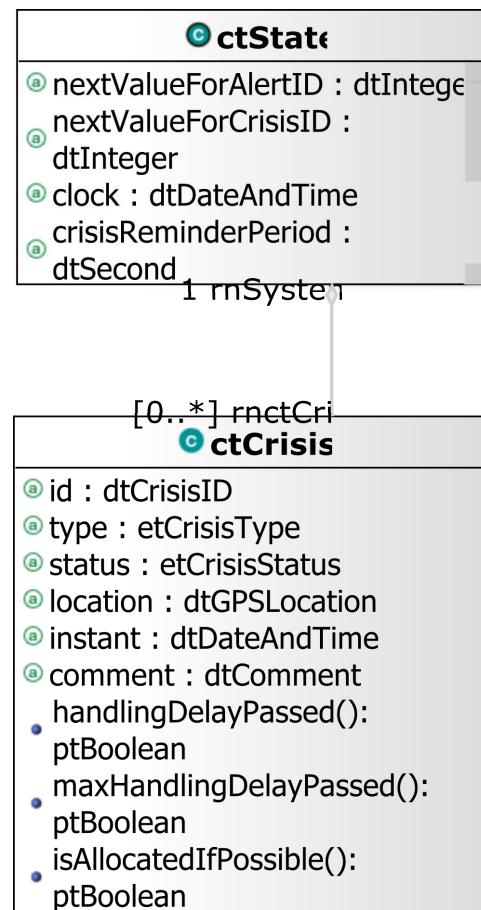


Figure 5.1: oeSollicitateCrisisHandling operation scope

<b>OPERATION</b>	
<b><i>oeAddCoordinator</i></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 <code>id</code> 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.
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  /* Pre Protocol:*/
2  prep{let TheSystem: ctState in
3  let TheActor:actAdministrator in
4
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, AdtPublKey)
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>Parameters</b>
1 <b>AdtCoordinatorID: dtCoordinatorID</b> used for ctCoordinator instance retrieval
<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 exist one ctCoordinator instance with the same <code>id</code> attribute than the one the administrator wants to create.
<b>Post-Condition (functional)</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>Post-Condition (protocol)</b>
PostP 1    none

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

```

1  /* Pre Protocol*/
2  preP{let TheSystem: ctState in
3   let TheActor:actAdministrator in
4
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.
<i>Parameters</i>

*continues in next page ...*

*... Operation table continuation*

1	<b>AdtLogin:</b> dtLogin first information used to determine accessibility rights for the actual actor.
2	<b>AdtEncodedPassword:</b> dtEncodedPassword second information used to determine accessibility rights for the actual actor.
<b>Return type</b>	
ptBoolean	
<b>Pre-Condition (protocol)</b>	
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)
<b>Pre-Condition (functional)</b>	
PreF 1	none
<b>Post-Condition (functional)</b>	
PostF 1	if the login and encoded 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 environement are notified of an intrusion temptative.
<b>Post-Condition (protocol)</b>	
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  /* Pre Protocol:*/
2  preP{let TheSystem: ctState in
3   let TheActor:actAuthenticated in
4   self.rnActor.rnSystem = TheSystem
5   and self.rnActor = TheActor
6
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   let AptStringMessageForTheactAuthenticated: ptString in
21   let AptStringMessageForTheactAdministrator:ptString in
22   let ctAuthPubKey:dtPublicKey in
23
24   self.rnActor.rnSystem = TheSystem
25   and self.rnActor = TheactAuthenticated
26   and TheactAuthenticated.rnctAuthenticated.pubKey = ctAuthPubKey
27
28 and /* PostF01 */
29   if (TheactAuthenticated.rnctAuthenticated.pwd
30     = TheSystem.rnCtKeyValuePair.decodeMsg(AEncodedPassword,ctAuthPubKey)

```

```

31     and TheactAuthenticated.rnctAuthenticated.login
32         = AdtLogin
33     )
34     then (AptStringMessageForTheactAuthenticated.eq('You are logged ! Welcome ...')
35         and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
36     )
37     else (AptStringMessageForTheactAuthenticated
38         .eq('Wrong identification information ! Please try again ...')
39         and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
40         and AptStringMessageForTheactAdministrator.eq('Intrusion tentative !')
41         and TheSystem.rnactAdministrator
42             .rnInterfaceIN^ieMessage(AptStringMessageForTheactAdministrator)
43         )
44     endif}
45
46 /* Post Protocol:*/
47 postP{ let TheSystem: ctState in
48 let TheactAuthenticated:actAuthenticated in
49
50 self.rnActor.rnSystem = TheSystem
51 and self.rnActor = TheactAuthenticated
52 /* PostP01 */
53 if (TheactAuthenticated.rnctAuthenticated.pwd = ctKeyPairs.decodeMsg(AEncodedPassword)
54     and TheactAuthenticated.rnctAuthenticated.login = AdtLogin
55     )
56 then (TheactAuthenticated.rnctAuthenticated@post.vpIsLogged = true)
57 else true
58 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
<b><i>oeLogout</i></b>
sent to end the secured access to specific system operations.
<b><i>Return type</i></b>
ptBoolean
<b><i>Pre-Condition (protocol)</i></b>
PreP 1 the system is started
PreP 2 the actor is currently logged in ! (i.e. the associated ctAuthenticated instance is considered logged)
<b><i>Pre-Condition (functional)</i></b>
PreF 1
<b><i>Post-Condition (functional)</i></b>
PostF 1 a logout confirmation message is sent to the actor (n.b. the logged status is changed as a post-protocol condition)
<b><i>Post-Condition (protocol)</i></b>
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  /* Pre Protocol:*/
2  preP{let TheSystem: ctState in
3   let TheActor:actAdministrator in
4   self.rnActor.rnSystem = TheSystem
5   and self.rnActor = TheActor
6
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:

<b>OPERATION</b>	
<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>Parameters</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

*continues in next page ...*

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### *... Operation table continuation*

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>Return type</b>	
ptBoolean	
<b>Pre-Condition (protocol)</b>	
PreP 1 the system is supposed to be created and initialized.	
<b>Pre-Condition (functional)</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>Post-Condition (functional)</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.
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 signed 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 ACrisisdtComment: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

```

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```

84 /* PostF05 */
85 and TheSystem.rnctHuman->select(id.eq(AdtPhoneNumber)) = HumanColl
86
87 and HumanColl->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: **Mess1p** (MCL-oriented) specification of the operation *oeAlert*.

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

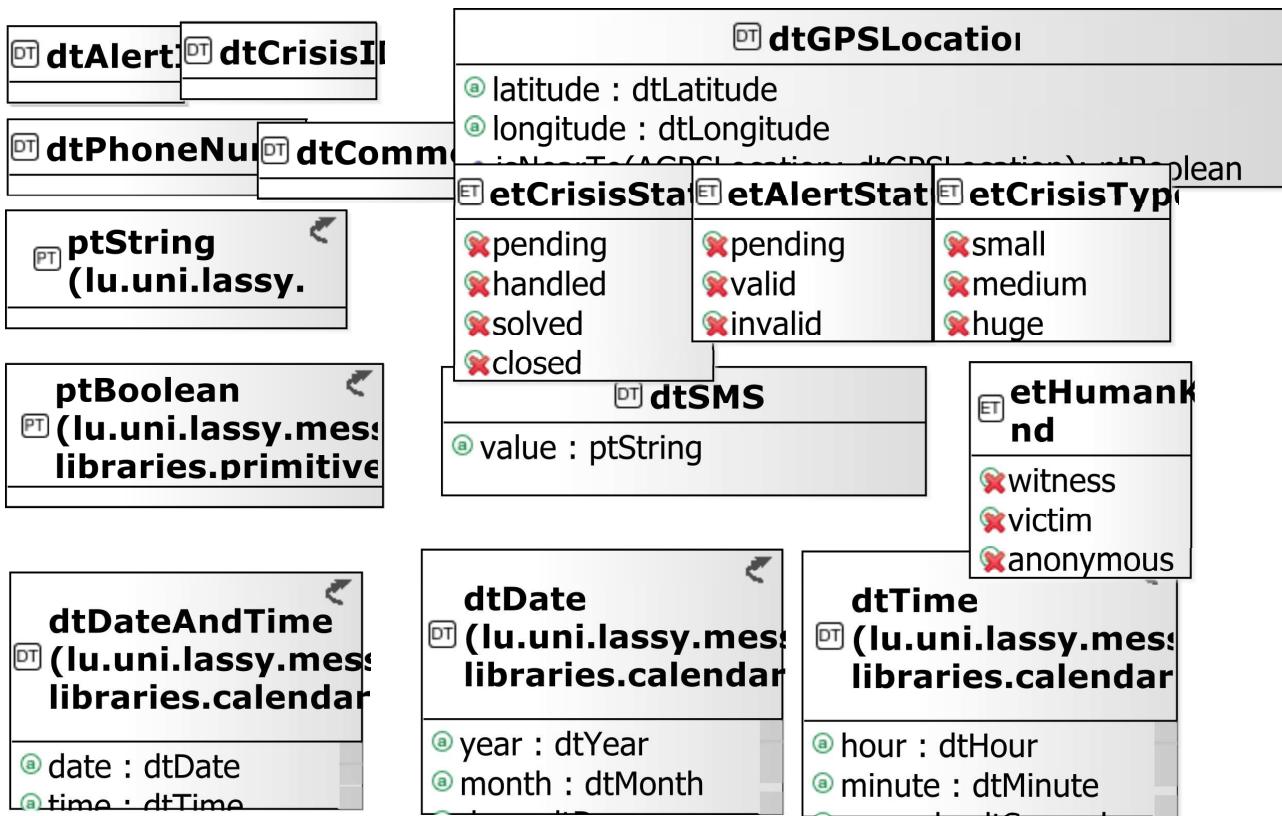


Figure 5.2: *oeAlert* operation scope

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

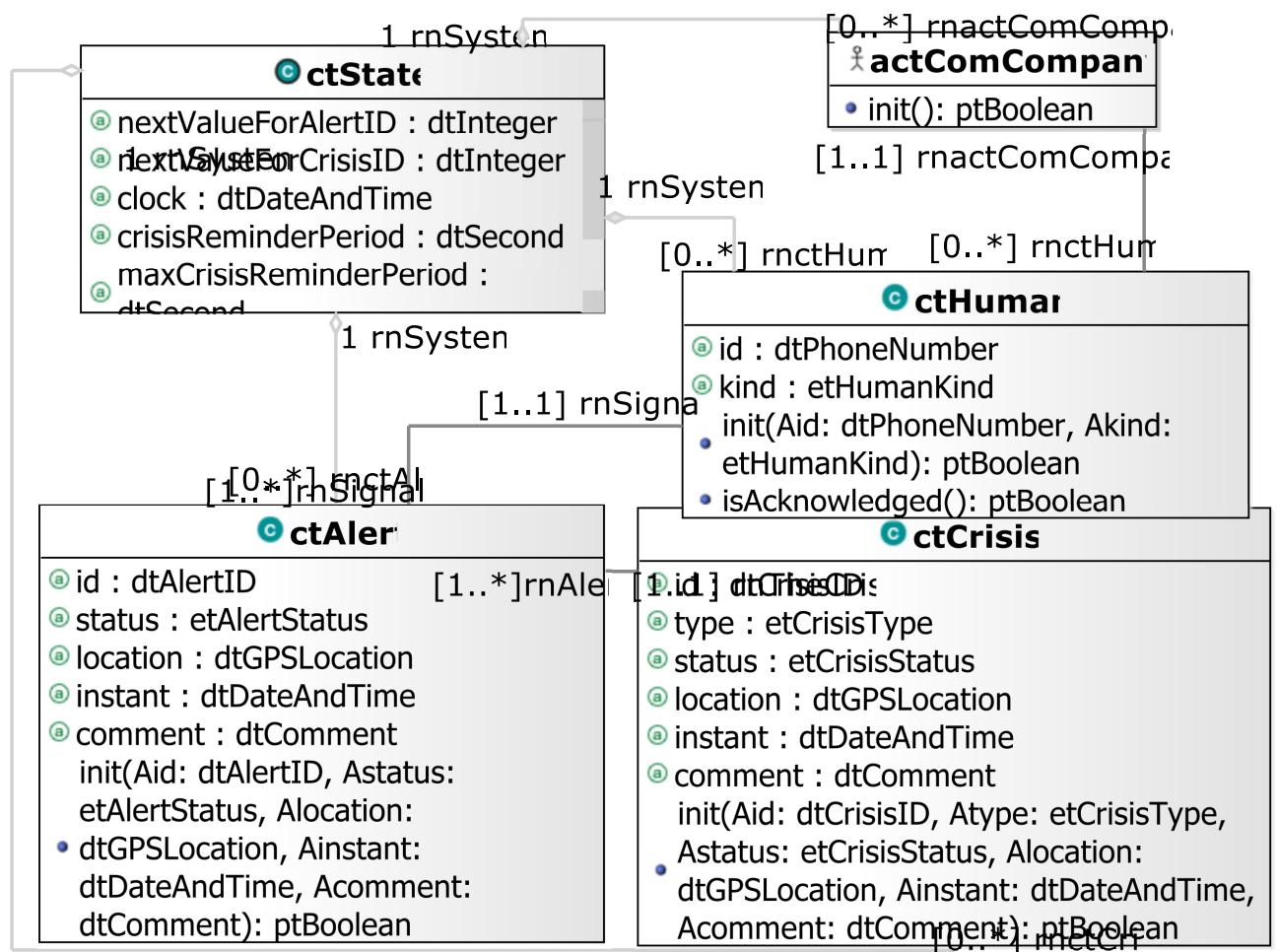


Figure 5.3: oeAlert operation scope

## 5.5 Environment - Out Interface Operation Scheme for actCoordinator

### 5.5.1 Operation Model for oeCloseCrisis

The `oeCloseCrisis` operation has the following properties:

<b>OPERATION</b>	
<b><i>oeCloseCrisis</i></b>	
sent to indicate that a crisis should be considered as closed.	
<b>Parameters</b>	
1	<b>AdtCrisisID: dtCrisisID</b> the identification information used to determine the crisis to close
<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 ctCrisis instance with the same <code>id</code> attribute value as the one provided by the coordinator actor who wants to close.
<b>Post-Condition (functional)</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>Post-Condition (protocol)</b>	
PostP 1	none

### 5.5.2 Operation Model for oeGetAlertsSet

The `oeGetAlertsSet` operation has the following properties:

<b>OPERATION</b>	
<b><i>oeGetAlertsSet</i></b>	
sent to request all the ctAlert instances having a specific status.	
<b>Parameters</b>	
1	<b>AetAlertStatus: etAlertStatus</b> the criteria used to select the alerts 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 ctCoordinator instance is considered logged)
<b>Pre-Condition (functional)</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:

<b>OPERATION</b>	
<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:

<b>OPERATION</b>	
<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><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 ctAlert instance with the same <code>id</code> attribute value as the one provided by the coordinator actor who wants to close.
<b><i>Post-Condition (functional)</i></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><i>Post-Condition (protocol)</i></b>	
PostP 1	none

**5.5.5 Operation Model for oeReportOnCrisis**

The `oeReportOnCrisis` operation has the following properties:

<b>OPERATION</b>	
<b><i>oeReportOnCrisis</i></b>	
sent to update the textual information available for a specific handled crisis.	
<b><i>Parameters</i></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><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 crisis in the pre state having the given id.
<b><i>Post-Condition (functional)</i></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><i>Post-Condition (protocol)</i></b>	
PostP 1	none

**5.5.6 Operation Model for oeSetCrisisHandler**

The `oeSetCrisisHandler` operation has the following properties:

<b>OPERATION</b>	
<b><i>oeSetCrisisHandler</i></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-state 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><i>oeSetCrisisStatus</i></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><i>Post-Condition (functional)</i></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><i>Post-Condition (protocol)</i></b>	
PostP 1	none

**5.5.8 Operation Model for oeSetCrisisType**

The `oeSetCrisisType` operation has the following properties:

<b>OPERATION</b>	
<b><i>oeSetCrisisType</i></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><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 crisis in the pre state having the given id.
<b><i>Post-Condition (functional)</i></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><i>Post-Condition (protocol)</i></b>	
PostP 1	none

**5.5.9 Operation Model for oeValidateAlert**

The `oeValidateAlert` operation has the following properties:

<b>OPERATION</b>	
<b><i>oeValidateAlert</i></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><i>Return type</i></b>	
ptBoolean	
<b><i>Pre-Condition (protocol)</i></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 actMobileCoordinator

### 5.6.1 Operation Model for oeSaveUpdates

The oeSaveUpdates operation has the following properties:

OPERATION	
<i>oeSaveUpdates</i>	
<b>Parameters</b>	
1	<b>AdtCoordinatorId:</b> dtCoordinatorID
2	<b>AdtCoordinatorFirstName:</b> dtCoordinatorFirstName
3	<b>AdtCoordinatorLastName:</b> dtCoordinatorLastName
<b>Return type</b>	
ptBoolean	
<b>Pre-Condition (protocol)</b>	
PreP 1	
<b>Pre-Condition (functional)</b>	
Pref 1	
<b>Post-Condition (functional)</b>	
PostF 1	
<b>Post-Condition (protocol)</b>	
PostP 1	

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

```

1
2 /* Pre Protocol:*/
3 preP{let TheSystem: ctState in
4   let TheActor:actMobileCoordinator in

```

```

5      self.rnActor.rnSystem = TheSystem
6      and self.rnActor = TheActor
7
8
9      /* PreP01 */
10     and TheSystem.vpStarted = true
11     /* PreP02 */
12     and TheActor.rnctAuthenticated.vpIsLogged = true}
13
14 /* Post Functional:*/
15 postF{let TheSystem: ctState in
16   let TheActor:actMobileCoordinator in
17   let ThectCoordinator:ctCoordinator in
18
19   self.rnActor.rnSystem = TheSystem
20   and self.rnActor = TheActor
21   /* PostF01 */
22   TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
23   = ThectCoordinator
24   and
25   ThectCoordinator.firstName = AdtCoordinatorFirstName
26
27   and TheActor.rnInterfaceIN^ieSendUpdatedInformation()}
28
29 /* Post Protocol:*/
30 postP{ true}

```

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

## 5.7 Environment - Out Interface Operation Scheme for actMsrCreator

### 5.7.1 Operation Model for oeCreateSystemAndEnvironment

The *oeCreateSystemAndEnvironment* operation has the following properties:

OPERATION
<i>oeCreateSystemAndEnvironment</i>
sent to request the initialization of the system's class instances and the environment actors instances.
<i>Parameters</i>
1      AqtyComCompanies: ptInteger the quantity of communication companies to create in the environment
<i>Return type</i>
ptBoolean
<i>Pre-Condition (protocol)</i>
PreP 1    none
<i>Pre-Condition (functional)</i>
PreF 1    none
<i>Post-Condition (functional)</i>
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>

*continues in next page ...*

**... Operation table continuation**

PostF 2	the <code>actMsrCreator</code> actor instance is initiated (remember that since the <code>oeCreateSystemAndEnvironment</code> 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 <code>AqtyComCompanies</code> 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'.
PostF 6	the set of <code>ctAdministrator</code> instances at post is made of one instance initialized with 'icrashadmin' (resp. '7WXC1359') for login (resp. password) values.
PostF 7	the association between <code>ctAdministrator</code> and <code>actAdministrator</code> is made of one couple made of the conjointly specified instances.

**Post-Condition (protocol)**

PostP 1	none is given since the only protocol variable to be modified in the post state is the one initialized with the <code>ctState</code> instance (i.e. <code>vpStarted</code> ).
---------	---

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

```

1  /* Pre Protocol:*/
2  preP{true}
3
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 let ApublicKey:dtPublicKey in
19
20 /* PostF01 -- MUST ALWAYS BE MADE FIRST -- */
21 AnextValueForAlertID.value.eq(1)
22 and AnextValueForCrisisID.value.eq(1)
23 and Aclock.date.year.value = 1970
24 and Aclock.date.month.value = 01
25 and Aclock.date.day.value = 01
26 and Aclock.time.hour.value = 00
27 and Aclock.time.minute.value = 00
28 and Aclock.time.second.value = 00
29
30 and AcrisisReminderPeriod.value.eq(300)
31 and AmaxCrisisReminderPeriod.value.eq(1200)
32 and AvpStarted = true
33 and TheSystem.init(AnextValueForAlertID,
34           AnextValueForCrisisID,
35           Aclock,
36           AcrisisReminderPeriod,
37           AmaxCrisisReminderPeriod,
38           Aclock,
```

```

39           AvpStarted
40       )
41 /* PostF02*/
42 and AactMsrCreator.init()
43 /* PostF03 */
44 and let AactComCompanyCol: Bag(actComCompany) in
45 AactComCompanyCol->size() = AqtyComCompanies
46 AactComCompanyCol-> forAll(init())
47 /* PostF04*/
48 and AactAdministrator.init()
49 and TheSystem.ctKeyPair.initForDecoding(ApublicKey, '[B@6979e8cb]')
50 /* PostF05*/
51 and let AactActivator:actActivator in
52 AactActivator.init()
53 /* PostF06 */
54 and let ActAdministrator:ctAdministrator in
55   let AdtLogin:dtLogin in
56     let AdtEncodedPassword:dtEncodedPassword in
57       AdtLogin.value.eq('icrashadmin')
58       and AdtEncodedPassword.value.eq(TheSystem.ctKeyPair.decodeMsg())
59       and ActAdministrator.init(AdtLogin,AdtPassword)
60 /* PostF07*/
61 and ActAdministrator@post.rnactAuthenticated = AactAdministrator
62
63 /* Post Protocol*/
64 postP{ true}

```

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

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

## 5.8 Environment - Actor Operation Scheme for actMsrCreator

### 5.8.1 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 <i>ctState</i> instance.
<i>Return type</i>
ptBoolean

## 5.9 Primary Types - Operation Schemes for Class ctAdministrator

### 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 <i>ctAdministrator</i> type.
<i>Parameters</i>
1           Alogin: dtLogin

*continues in next page ...*

**... Operation table continuation**

2	<b>Apwd: dtPassword</b> used to initialize the password 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 ctAdministrator instance having its login and password attributes equal to the one provided as parameters and its vpIsLogged attribute equal to false.

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

```

1  /* Post Functional:*/
2  postF{if
3  (
4    let Self:ctAdministrator in
5    /* Post F01 */
6    Self.login(Alogin)
7    and Self.pwd = Apwd
8    and Self.pubKey = ApublKey
9    and Self.vpIsLogged = false
10   endif}
11
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*.

## 5.10 Primary Types - Operation Schemes for Class ctAlert

### 5.10.1 Operation Model for init

The *init* operation has the following properties:

<b>OPERATION</b>	
<b>init</b>	
used to initialize the current object as a new instance of the ctAlert type.	
<b>Parameters</b>	
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

*continues in next page ...*

**... Operation table continuation**

5	Acomment: dtComment 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 ctAlert instance having its attributes equal to the ones provided as parameters.

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

```

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

```

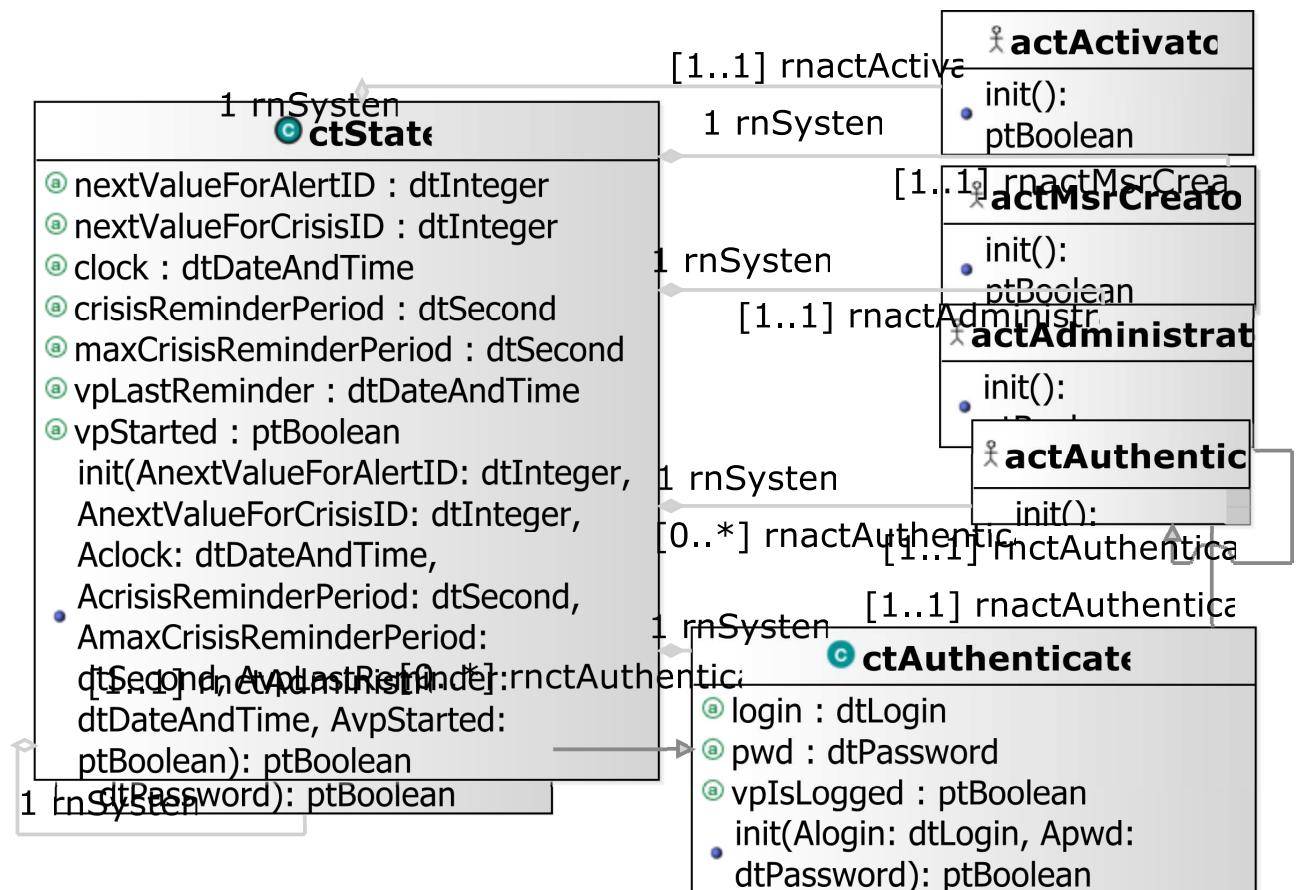
Listing 5.11: **Messip** (MCL-oriented) specification of the operation *init*.

### 5.10.2 Operation Model for isSentToCoordinator

The `isSentToCoordinator` operation has the following properties:

<b>OPERATION</b>
<b>isSentToCoordinator</b>
used to provide a given coordinator with current alert information.
<b>Parameters</b>
1      AactCoordinator: actCoordinator the message destination
<b>Return type</b>
ptBoolean
<b>Post-Condition (functional)</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 5.12 provides the **Messip** (MCL-oriented) specification of the operation.

Figure 5.4: `oeCreateSystemAndEnvironment` operation scope

```

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

```

Listing 5.12: **Messir** (MCL-oriented) specification of the operation *isSentToCoordinator*.

## 5.11 Primary Types - Operation Schemes for Class ctAuthenticated

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

## 5.12 Primary Types - Operation Schemes for Class ctCoordinator

### 5.12.1 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 <code>ctCoordinator</code> type.
<i>Parameters</i>	
1 <b>Aid:</b> <code>dtCoordinatorID</code>	used to initialize the id field
2 <b>Alogin:</b> <code>dtLogin</code>	used to initialize the login field
3 <b>Apwd:</b> <code>dtPassword</code>	used to initialize the password field
4 <b>ApubKey:</b> <code>dtPublicKey</code>	used to initialize the public key field

*continues in next page ...*

**... Operation table continuation**

<i>Return type</i>	
	ptBoolean
<i>Post-Condition (functional)</i>	
PostF 1	true if the system poststate includes the current object as a new ctCoordinator instance having its attributes equal to the ones provided as parameters.

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

```

1  /* Post Functional:*/
2  postF{if
3  (
4  /* Post F01 */
5  let Self:ctCoordinator in
6  Self.id = Aid
7  and Self.login = Alogin
8  and Self.pwd = Apwd
9  and Self.pubKey = ApubKey
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 5.13: **Messip** (MCL-oriented) specification of the operation *init*.

## 5.13 Primary Types - Operation Schemes for Class ctCrisis

### 5.13.1 Operation Model for init

The *init* operation has the following properties:

<b>OPERATION</b>	
<i>init</i>	used to initialize the current object as a new instance of the ctCrisis type.
<i>Parameters</i>	
1	<b>Aid:</b> dtCrisisID used to initialize the id field
2	<b>Atype:</b> etCrisisType used to initialize the type field
3	<b>Astatus:</b> etCrisisStatus used to initialize the status field
4	<b>Alocation:</b> dtGPSLocation used to initialize the location field
5	<b>Ainstant:</b> dtDateAndTime used to initialize the instant field
6	<b>Acomment:</b> dtComment used to initialize the comment field

*continues in next page ...*

*... Operation table continuation*

<i>Return type</i>
ptBoolean
<i>Post-Condition (functional)</i>
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 5.14 provides the **Messip** (MCL-oriented) specification of the operation.

```

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

```

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

### 5.13.2 Operation Model for handlingDelayPassed

The *handlingDelayPassed* operation has the following properties:

OPERATION
<i>handlingDelayPassed</i> used to determine if the crisis stood too longly in a pending status since last reminder.
<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 5.15 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2  postF{let TheSystem:ctState in
3  let CurrentClockSecondsQty:dtInteger in
4  let vLastReminderSecondsQty:dtInteger in
5  let CrisisReminderPeriod:dtSecond 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 5.15: **Messip** (MCL-oriented) specification of the operation *handlingDelayPassed*.

### 5.13.3 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.
<b><i>Return type</i></b>
<code>ptBoolean</code>
<b><i>Post-Condition (functional)</i></b>
PostF 1    true iff the crisis is in pending status and if the duration between the current <code>ctState</code> clock information and the crisis instant is greater than the maximum reminder period duration.

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

### 5.13.4 Operation Model for isSentToCoordinator

The `isSentToCoordinator` operation has the following properties:

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

The listing 5.17 provides the **Mess1p** (MCL-oriented) specification of the operation.

```

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

Listing 5.17: **Mess1p** (MCL-oriented) specification of the operation *isSentToCoordinator*.

### 5.13.5 Operation Model for *isAllocatedIfPossible*

The *isAllocatedIfPossible* operation has the following properties:

<b>OPERATION</b>	
<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 5.18 provides the **Mess1p** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2  postF{if (
3    /* Post F01 */
4    self.maxHandlingDelayPassed()
5    and
6    if (TheSystem.rnactCoordinator->msrIsEmpty = false)
7    then (
8      /* Post F02 */
9      TheSystem.rnactCoordinator->msrAny(true) = TheCoordinatorActor
10     and TheCoordinatorActor.rnctCoordinator = TheCoordinator
11     and self@post.rnHandler = TheCoordinator
12     and self@post.status = handled
13     and self.id.value = TheCrisisIDptString
14     and 'You are now considered as handling the crisis having ID: '
15       .ptStringConcat(TheCrisisIDptString) = TheMessage
16     and TheCoordinatorActor.rnInterfaceIN^ieMessage(TheMessage)
17   )
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 5.18: **Messip** (MCL-oriented) specification of the operation *isAllocatedIfPossible*.

## 5.14 Primary Types - Operation Schemes for Class ctHuman

### 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 <code>ctHuman</code> type.
<i>Parameters</i>	
1 <b>Aid: dtPhoneNumber</b>	used to initialize the <code>id</code> field
2 <b>Akind: etHumanKind</b>	used to initialize the <code>kind</code> 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 <code>ctHuman</code> 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  /* Post Functional:*/
2  postF{if (
3    /* Post F01 */

```

```

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.oclisNew and self = Self)
13 )
14 then (result = true)
15 else (result = false)
16 endif}

```

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

### 5.14.2 Operation Model for isAcknowledged

The *isAcknowledged* operation has the following properties:

OPERATION
<i>isAcknowledged</i>
used to specify the property of having sent an alert acknowledge message to the human having declared the alert through its own communication company.
<i>Return type</i>
ptBoolean
<i>Post-Condition (functional)</i>
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 !'

## 5.15 Primary Types - Operation Schemes for Class ctState

### 5.15.1 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.
<i>Parameters</i>
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>

*continues in next page ...*

**... Operation table continuation**

7	used to initialize the vpLastReminder field <b>AvpStarted: ptBoolean</b> used to initialize the vpStarted 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 ctState instance having its attributes equal to the ones provided as parameters.	

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

```

1  /* Post Functional:*/
2  postF{if
3  (
4    /* Post F01 */
5  let Self:ctState in
6
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 5.20: **Messir** (MCL-oriented) specification of the operation *init*.

## 5.16 Primary Types - Operation Schemes for Datatype dtAlertID

### 5.16.1 Operation Model for *is*

The *is* operation has the following properties:

<b>OPERATION</b>	
<i>is</i>	
used to determine which strings are considered as valid alert identifiers.	
<b>Return type</b>	
ptBoolean	
<b>Post-Condition (functional)</b>	
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 5.21 provides the **Messip** (MCL-oriented) specification of the operation.

```

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

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

## 5.17 Primary Types - Operation Schemes for Datatype dtComment

### 5.17.1 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 5.22 provides the **Messip** (MCL-oriented) specification of the operation.

```

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

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

## 5.18 Primary Types - Operation Schemes for Datatype dtCoordinatorFirstName

### 5.18.1 Operation Model for is

The `is` operation has the following properties:

OPERATION
<i>is</i>
<i>Return type</i>
ptBoolean
<i>Post-Condition (functional)</i>
PostF 1

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

```

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

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

## 5.19 Primary Types - Operation Schemes for Datatype dtCoordinatorID

### 5.19.1 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 than the operation returns the ptBoolean true, else the ptBoolean false.

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

```

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

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

## 5.20 Primary Types - Operation Schemes for Datatype dtCoordinatorLastName

### 5.20.1 Operation Model for *is*

The *is* operation has the following properties:

OPERATION
<i>is</i>
<i>Return type</i>
ptBoolean
<i>Post-Condition (functional)</i>
PostF 1

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

```

1  /* Post Functional:*/
2  postF{let TheResult: ptBoolean in
3    let MaxLength: ptInteger in
4    (if
5      ( MaxLength = 50
6        and AdtValue.value.length().leq(MaxLength)
7      )
8      then (TheResult = true)
9      else (TheResult = false)
10    endif
11   result = TheResult
12 }
13 }
```

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

## 5.21 Primary Types - Operation Schemes for Datatype dtCrisisID

### 5.21.1 Operation Model for *is*

The *is* operation has the following properties:

<b>OPERATION</b>	
<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 5.26 provides the **Messir** (MCL-oriented) specification of the operation.

```

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

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

## 5.22 Primary Types - Operation Schemes for Datatype dtGPSLocation

### 5.22.1 Operation Model for *is*

The *is* operation has the following properties:

<b>OPERATION</b>	
<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 is operation.

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

```

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

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

### 5.22.2 Operation Model for *isNearTo*

The *isNearTo* operation has the following properties:

OPERATION	
<i>isNearTo</i>	
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> )	
<i>Parameters</i>	
1	<b>AGPSLocation: dtGPSLocation</b> the GPS location to be compared to.
<i>Return type</i>	
ptBoolean	
<i>Post-Condition (functional)</i>	
PostF 1	if the Haversine formula ( $\text{ACOS}(\text{SIN}(\text{lat1}) * \text{SIN}(\text{lat2}) + \text{COS}(\text{lat1}) * \text{COS}(\text{lat2}) * \text{COS}(\text{lon2-lon1})) * 6371$ , 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 5.28 provides the **Messir** (MCL-oriented) specification of the operation.

```

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

```

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

## 5.23 Primary Types - Operation Schemes for Datatype dtLatitude

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

```

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

```

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

## 5.24 Primary Types - Operation Schemes for Datatype dtLogin

### 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 dtLogin.
<i>Return type</i>
ptBoolean
<i>Post-Condition (functional)</i>
PostF 1    is true if the length of the string value is not more than 20 characters.

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

```

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

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

## 5.25 Primary Types - Operation Schemes for Datatype dtLongitude

### 5.25.1 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 5.31 provides the **Messip** (MCL-oriented) specification of the operation.

```

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

```

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

```

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

## 5.26 Primary Types - Operation Schemes for Datatype dtPassword

### 5.26.1 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 if the length of the string value is at least 6 characters long.

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

```

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

```

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

## 5.27 Primary Types - Operation Schemes for Datatype dtPhoneNumber

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

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

```

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

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

## 5.28 Primary Types - Operation Schemes for Enumeration etAlertStatus

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

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

```

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

```

12     result = TheResult
13 }

```

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

## 5.29 Primary Types - Operation Schemes for Enumeration etCrisisStatus

### 5.29.1 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 5.35 provides the **Messip** (MCL-oriented) specification of the operation *is*.

```

1  /* Post Functional:*/
2  postF{let TheResult: ptBoolean in
3      if
4          ( self = pending
5          or self = handled
6          or self = solved
7          or self = closed
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*.

## 5.30 Primary Types - Operation Schemes for Enumeration etCrisisType

### 5.30.1 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***

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

The listing 5.36 provides the **Messip** (MCL-oriented) specification of the operation.

```

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

Listing 5.36: **Messip** (MCL-oriented) specification of the operation *is*.

## 5.31 Primary Types - Operation Schemes for Enumeration etHumanKind

### 5.31.1 Operation Model for *is*

The *is* operation has the following properties:

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

The listing 5.37 provides the **Messip** (MCL-oriented) specification of the operation.

```

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

```

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

```

Listing 5.37: **Messip** (MCL-oriented) specification of the operation *is*.

## 5.32 Secondary Types - Operation Schemes for Classes

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

## 5.33 Secondary Types - Operation Schemes for Datatype dtSMS

### 5.33.1 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 5.38 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2 postF{let TheResult: ptBoolean in
3   let MaxLength: ptInteger 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 5.38: **Messip** (MCL-oriented) specification of the operation *is*.

## 5.34 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.oeCreate

The `testcase01-ts01oeCreateSystemAndEnvironment-actMsrCreator.outactMsrCreator.oeCreate` 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	<p><b>out:Creator</b></p> <p>sends to system</p> <p><b>actMsrCreator.outactMsrCreator.oeCreateSystemAndEnvironment</b> (AqtyComCompanies)</p>
<i>Variables</i>	
V 1	<b>Creator:icrash.environment.actMsrCreator</b> only actMsrCreator 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 **Messir** (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:

<b>TEST STEP</b>	
<i>ts02oeSetClock</i>	
test the update of the current time.	
<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: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.
C 2	ACurrentClock is a fixed date equal to the 24th November 2017 at 15:20:00 using a 24-hours notation <sup>1</sup> .
<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:

<b>TEST STEP</b>	
<i>ts03oeLogin</i>	
test the authentified access of the administrator	
<i>Test Sent Message</i>	
TSM 1	<b>out:TheActor</b> sends to system <b>actAdministrator.outactAdministrator.oeLogin</b> (AdtLogin, AdtEncodedPassword)
<i>Variables</i>	
V 1	<b>TheActor:actAdministrator</b> an actAdministrator actor as subtype of actAuthenticated can send oeLogin messages to the system.
<i>Constraints</i>	
C 1	TheActor is any <code>actAdministrator</code> 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 <code>AMessage</code> 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 **Messir** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actAdministrator
4   AdtLogin:dtLogin
5   AdtEncodedPassword:dtEncodedPassword
6 }
7
8 constraints{
9   TheActor=TheSystem.rnactAdministrator->any2(true)
10  AdtLogin.value.eq('icrashadmin')
11  AdtEncodedPassword.value.eq('[B@6979e8cb')
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.oeAddCoord

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

<b>TEST STEP</b>	
<i>ts04oeAddCoordinator</i>	
to test the add of a new coordinator by an administrator.	
<i>Test Sent Message</i>	
TSM 1	<p><b>out:TheActor</b></p> <p>sends to system</p> <p><b>actAdministrator.outactAdministrator.oeAddCoordinator</b> (<code>AdtCoordinatorID</code>,  <code>AdtLogin</code>, <code>AdtPassword</code>, <code>AdtPublicKey</code>)</p>
<i>Variables</i>	
V 1	<p><b>TheActor:actAdministrator</b></p> <p>actAdministrator actors as being the only one allowed to add coordinators.</p>
<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.
<i>Oracle Constraints</i>	

*continues in next page ...*

**... Test Step table continuation**

OC 1	the administrator should have been acknowledged for the adding of the new coordinator.
------	--

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

```

1
2 variables{
3   TheActor : actAdministrator
4   AdtCoordinatorID : dtCoordinatorID
5   AdtLogin:dtLogin
6   AdtPassword:dtPassword
7   AdtPublicKey:dtPublicKey
8 }
9
10 constraints{
11   TheActor = TheSystem.rnactAdministrator->any2(true)
12   AdtCoordinatorID.value.eq('1')
13   AdtLogin.value.eq('steve')
14   AdtPassword.value.eq('pwdMessirExcalibur2017')
15   AdtPublicKey.value.eq('Sun RSA public key, 2048 bits ...')
16 }
17
18 oracle{
19   constraints{
20     TheActor.inactAdministrator.ieCoordinatorAdded()
21   }
22 }
```

Listing 6.4: **Messir** (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:

<b>TEST STEP</b>	
<i>ts05oeLogout</i>	
to test the logout of a connected administrator.	
<b>Test Sent Message</b>	
TSM 1	<b>out:TheActor</b> sends to system <b>actAdministrator.outactAdministrator.oeLogout ()</b>
<b>Variables</b>	
V 1	<b>TheActor:actAdministrator</b> an actAdministrator actor as subtype of actAuthenticated can send oeLogout messages to the system.
<b>Constraints</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.

***continues in next page ...***

**... Test Step table continuation**

<i>Oracle Constraints</i>	
OC 1	the AMessag 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 AMessag.

The listing 6.5 provides the **Messir** (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     AMessag:ptString
13   }
14   constraints{
15     AMessag = 'You are logged out ! Good Bye ...'
16     TheActor.inactAdministrator.ieMessage(AMessag)
17   }
18 }
```

Listing 6.5: **Messir** (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:

<b>TEST STEP</b>	
<b>ts06oeSetClock02</b>	
test the update of the current time.	
<b>Test Sent Message</b>	
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> proactive actors 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 10:15:00 using a 24-hours notation.

*continues in next page ...*

**... Test Step table continuation**

<i>Oracle Constraints</i>	
OC 1	true for testing only the executability (is available and can be triggered) of the operation.

The listing 6.6 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 = 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: **Messir** (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:

<b>TEST STEP</b>	
<b><i>ts07oeAlert1</i></b>	
tests the declaration of a new alert functionality.	
<b><i>Test Sent Message</i></b>	
TSM 1	<b>out:TheActor</b> <b>sends to system</b> <b>actComCompany.outactComCompany.oeAlert (AetHumanKind, AdtDate, AdtTime, AdtPhoneNumber, AdtGPSLocation, AdtComment)</b>
<b><i>Variables</i></b>	
V 1	<b>TheActor:actComCompany</b> actComCompany actors transfer alert declaration messages.
<b><i>Constraints</i></b>	
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

***continues in next page ...***

**... Test Step table continuation**

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'.
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 **Messip** (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: **Messip** (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:

<b>TEST STEP</b>	
<i>ts08oeSetClock03</i>	
test the update of the current time.	
<i>Test Sent Message</i>	
TSM 1	<p>out:<b>TheActor</b></p> <p>sends to system</p> <p><b>actActivator.outactActivator.oeSetClock (ACurrentClock)</b></p>
<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.
C 2	ACurrentClock is a fixed date equal to the 26th November 2017 at 10:30:00 using a 24-hours notation.
<i>Oracle Constraints</i>	
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.oeSollicitateCrisisH

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

<b>TEST STEP</b>
<i>continues in next page ...</i>

**... Test Step table continuation**

<b>ts09oeSollicitateCrisisHandling</b> test the proactive sollicitation to handle an alert.	
<b>Test Sent Message</b>	
TSM 1	<b>out:TheActor</b> <b>sends to system</b> <b>actActivator.outactActivator.oeSollicitateCrisisHandling ()</b>
<b>Variables</b>	
V 1	<b>TheActor:icrash.environment.actActivator</b> proactive actor responsible of triggering sollicitation 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 **Mess1R** (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: **Messip** (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:

<b>TEST STEP</b>	
<i>ts10oeLogin02</i>	
test the authentified access of the coordinator	
<i>Test Sent Message</i>	
TSM 1	<b>out:TheActor</b> <b>sends to system</b> <b>actAuthenticated.outactAuthenticated.oeLogin</b> (AdtLogin, AdtEncodedPassword)
<i>Variables</i>	
V 1	<b>TheActor:actCoordinator</b> an actCoordinator actor as subtype of actAuthenticated can send oeLogin messages to the system.
<i>Constraints</i>	
C 1	TheActor is any <code>actAdministrator</code> 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 <code>AMessage</code> value is expected to be equal to the primitive string 'You are logged ! Welcome ...'

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

```

1
2 variables{
3   TheActor : actCoordinator
4   AdtLogin:dtLogin
5   AdtEncodedPassword:dtEncodedPassword
```

```

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  AdtEncodedPassword.value.eq('[B@6979e8cb')
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: **Messir** (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:

<b>TEST STEP</b>	
<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 **Messir** (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:

<b>TEST STEP</b>	
<i>ts12oeSetCrisisHandler</i>	
cf. actor documentation	
<i>Test Sent Message</i>	
TSM 1	<p><b>out:</b>TheActor</p> <p>sends to system</p> <p><b>actCoordinator.outactCoordinator.oeSetCrisisHandler</b> (<b>AdtCrisisID</b>)</p>
<i>Variables</i>	
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>

*continues in next page ...*

**... Test Step table continuation**

	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 as a value of 1
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>	
TSM 1	<p>out:TheActor</p> <p>sends to system</p> <p><b>actActivator.outactActivator.oeSetClock (ACurrentClock)</b></p>
<i>Variables</i>	
V 1	TheActor:icrash.environment.actActivator cf. actor documentation
V 2	<b>ACurrentClock:lu.uni.lassy.messir.libraries.calendar.dtDateAndTime</b> cf. actor documentation
<i>Constraints</i>	
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	
<i>continues in next page ...</i>	

*... Test Step table continuation*

<i>Test Sent Message</i>	
TSM 1	<b>out:</b> TheActor sends to system <b>actCoordinator.outactCoordinator.oeValidateAlert</b> (AdtAlertID)
<i>Variables</i>	
V 1	<b>TheActor:</b> icrash.environment.actCoordinator cf. actor documentation
V 2	<b>AdtAlertID:</b> icrash.concepts.primarytypes.datatypes.dtAlertID cf. actor documentation
V 3	<b>AMessage:</b> lu.uni.lassy.messir.libraries.primitives.ptString 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	AdtAlertID
C 3	AMessage
<i>Oracle Constraints</i>	
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.rnactCoordinator
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:

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

<b>TEST STEP</b>	
<i>ts16oeSetClock05</i>	
cf. actor documentation	
<b><i>Test Sent Message</i></b>	
TSM 1	<p><b>out:TheActor</b></p> <p>sends to system</p> <p><b>actActivator.outactActivator.oeSetClock (ACurrentClock)</b></p>
<b><i>Variables</i></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><i>Constraints</i></b>	
C 1	TheActor
C 2	ACurrentClock

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:

<b>TEST STEP</b>	
<i>ts17oeSetCrisisStatus</i> cf. actor documentation	
<b>Test Sent Message</b>	
TSM 1	<b>out:TheActor</b> sends to system <b>actCoordinator.outactCoordinator.oeSetCrisisStatus</b> (AdtCrisisID, AetCrisisStatus)
<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>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
<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

*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  variables{
2   TheActor : actCoordinator
3   AdtCrisisID : dtCrisisID
4   AetCrisisStatus : etCrisisStatus
5   }
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:

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

***continues in next page ...***

**... Test Step table continuation**

V 3	cf. actor documentation <b>AdtComment:icrash.concepts.primarytypes.datatypes.dtComment</b> cf. actor documentation
V 4	<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	<p><b>out:</b>TheActor</p> <p>sends to system</p> <p><b>actCoordinator.outactCoordinator.oeCloseCrisis (AdtCrisisID)</b></p>
<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 **Messir** (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   }
17   constraints{
18     AMessage = 'The crisis is now closed !'
19     TheActor.inactAuthenticated.ieMessage(AMessage)
20   }
21 }
```

Listing 6.19: **Messir** (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*.

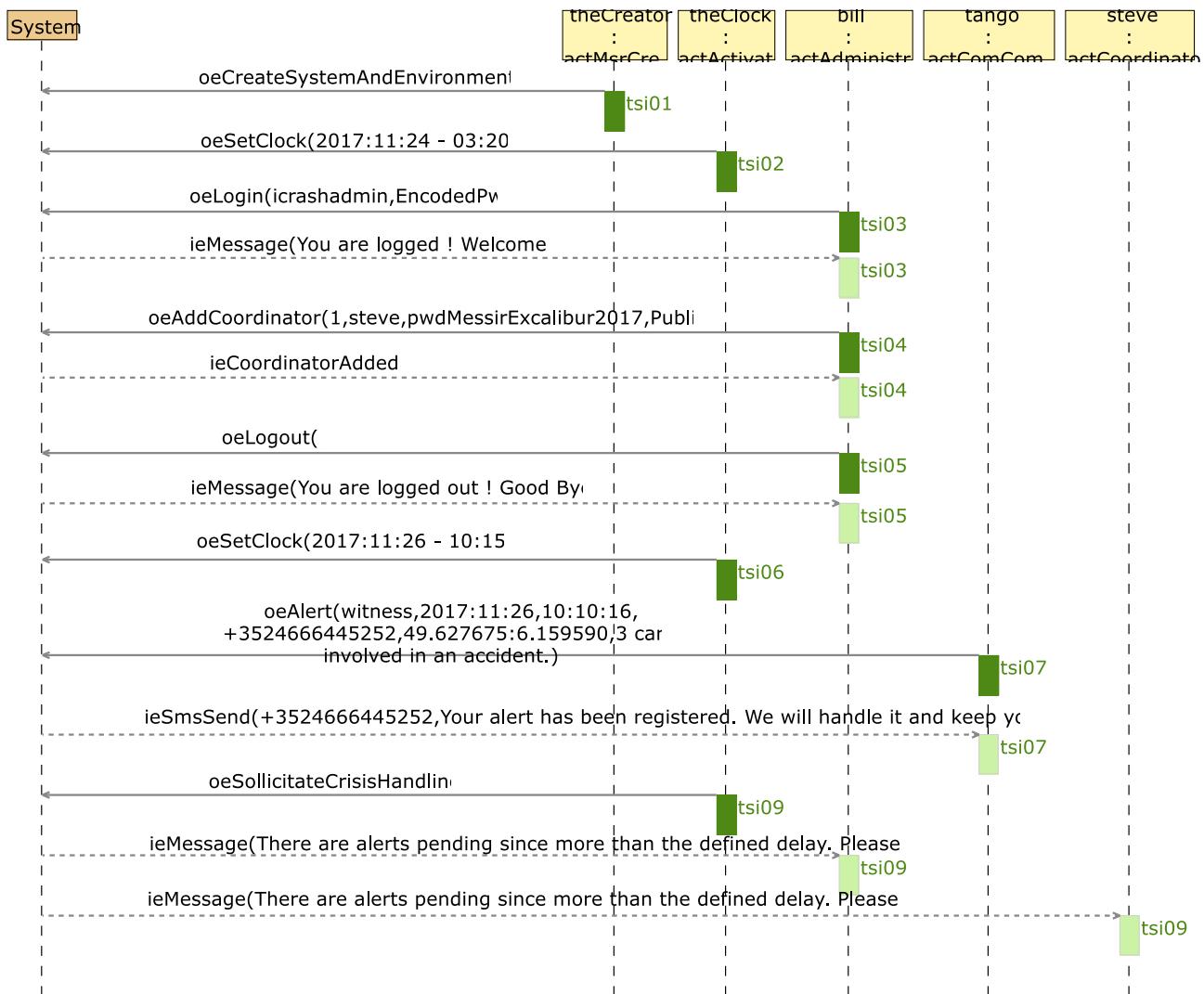


Figure 6.1: tci-testcase01-instance01-Part01 testcase instance sequence diagram

#### 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**

Constraints 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**

Constraints 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-uciSimpleAndComplete
- uci-uciugSecurelyUseSystem

### A.2 Undocumented Primary Types

#### A.2.1 Undocumented Primary Datatype Types

- icrash.concepts.primarytypes.datatypes.dtByteArray

### A.3 Undocumented Concept Model Views

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

### A.4 Undocumented Operation Specifications

- icrash.concepts.primarytypes.datatypes.dtCoordinatorFirstName.is
- icrash.concepts.primarytypes.datatypes.dtCoordinatorLastName.is
- icrash.concepts.primarytypes.datatypes.dtEncodedPassword.eq
- icrash.concepts.primarytypes.datatypes.dtPrivateKey.is
- icrash.concepts.primarytypes.datatypes.dtPublicKey.is
- icrash.environment.actMobileCoordinator.outactMobileCoordinator.oeSaveUpdates

## A.5 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 **Messip** 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	<code>actCoordinator[active]</code>
<i>Goal(s) description</i>	
the <code>actCoordinator</code> 's goal is to declare a crisis as closed.	
<i>Protocol condition(s)</i>	
1	the iCrash system has been deployed.
<i>Pre-condition(s)</i>	
1	none
<i>Main post-condition(s)</i>	
1	the crisis is known by the system to be closed.
2	a message <code>iEMessage(AMessage)</code> is sent to the <code>actCoordinator</code> to inform him that his crisis is now considered as closed.

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

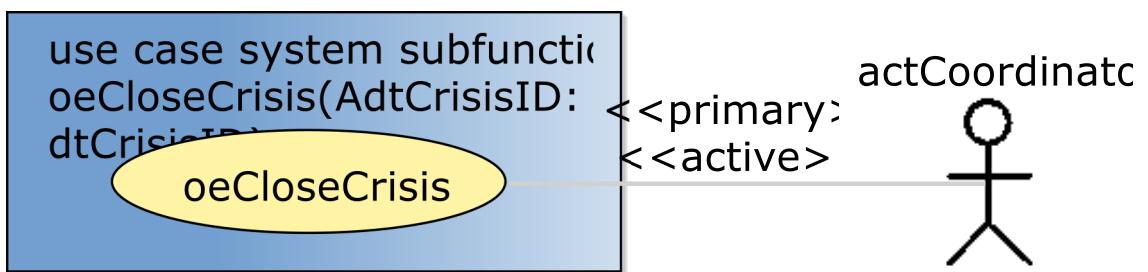


Figure B.1: oeCloseCrisis subfunction use case

## 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-datatatypes/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
```

## C.5. FILE /SRC-GEN/MESSIR-SPEC.../ENVIRONMENT-ACTADMINISTRATOR-OEADDCOORDINATOR.MSR

```

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,
12   AdtLogin:dtLogin, AdtPassword:dtPassword, AdtPublKey:dtPublicKey):ptBoolean
13 {
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, AdtPublKey)
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

```

## C.7 FILE /SRC-GEN/MESSIR-SPEC/OPERATIONS.../ENVIRONMENT-ACTAUTHENTICATED.MSR141

```

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
15 ) :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, AEncodedPassword:
14     dtEncodedPassword):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 let AptStringMessageForTheactAuthenticated: ptString in
34 let AptStringMessageForTheactAdministrator:ptString in
35 let ctAuthPubKey:dtPublicKey in
36
37 self.rnActor.rnSystem = TheSystem
38 and self.rnActor = TheactAuthenticated
39 and TheactAuthenticated.rnctAuthenticated.pubKey = ctAuthPubKey
40
41 and /* PostF01 */
42 if (TheactAuthenticated.rnctAuthenticated.pwd
43 = TheSystem.rnCtKeyPair.decodeMsg(AEncodedPassword,ctAuthPubKey)
44 and TheactAuthenticated.rnctAuthenticated.login
45 = AdtLogin
46 )
47 then (AptStringMessageForTheactAuthenticated.eq('You are logged ! Welcome ...')
48 and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
49 )
50 else (AptStringMessageForTheactAuthenticated
51 .eq('Wrong identification information ! Please try again ...')
52 and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
53 and AptStringMessageForTheactAdministrator.eq('Intrusion tentative !')
54 and TheSystem.rnactAdministrator
55 .rnInterfaceIN^ieMessage(AptStringMessageForTheactAdministrator)
56 )
57 endif
58 }
59 postP{
60 let TheSystem: ctState in
61 let TheactAuthenticated:actAuthenticated in
62
63 self.rnActor.rnSystem = TheSystem
64 and self.rnActor = TheactAuthenticated
65 /* PostP01 */
66 if (TheactAuthenticated.rnctAuthenticated.pwd = ctKeyPairs.decodeMsg(AEncodedPassword)
67 and TheactAuthenticated.rnctAuthenticated.login = AdtLogin
68 )
69 then (TheactAuthenticated.rnctAuthenticated@post.vpIsLogged = true)
70 else true

```

## C.8. FILE /SRC-GEN/MESSIR-SPEC/OPERATIONS/ENVIRONMENT/ENVIRONMENT-ACTCOMCOMPANY

```

71 endif
72 }
73 prolog{"src/Operations/Environment/OUT/outactAuthenticated-oeLogin.pl"}
74 }
75 /*-----*/
76
77 operation: actAuthenticated.outactAuthenticated.oeLogout():ptBoolean{
78
79 preP{
80 let TheSystem: ctState in
81 let TheActor:actAdministrator in
82 self.rnActor.rnSystem = TheSystem
83 and self.rnActor = TheActor
84
85 /* PreP01 */
86 and TheSystem.vpStarted = true
87 /* PreP02 */
88 and TheActor.rnctAuthenticated.vpIsLogged = true
89 }
90 preF{
91 /* PreF01 */
92 true
93 }
94 postF{
95 let TheSystem: ctState in
96 let TheactAuthenticated:actAuthenticated in
97 let AptStringMessageForTheactAuthenticated: ptString in
98
99 self.rnActor.rnSystem = TheSystem
100 and self.rnActor = TheactAuthenticated
101
102 /* PostF01 */
103 AptStringMessageForTheactAuthenticated.eq('You are logged out ! Good Bye ...')
104 and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
105 }
106 postP{
107 let TheSystem: ctState in
108 let TheactAuthenticated:actAuthenticated in
109
110 self.rnActor.rnSystem = TheSystem
111 and self.rnActor = TheactAuthenticated.asset
112 /* PostP01 */
113 TheactAuthenticated.rnctAuthenticated@post.vpIsLogged = false
114 }
115 prolog{"src/Operations/Environment/OUT/outactAuthenticated-oeLogout.pl"}
116 }
117 }
118 }

```

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 */

```

## C.9. FILE /SRC-GEN/MESSIR-SPEC.../ENVIRONMENT-ACTCOORDINATOR-OECLOSECRISIS.MSR145

```

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)) = HumanColl
110
111 and HumanColl->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
```

### C.13 FILE /SRC-GEN/MESSIR-SPEC.../ENVIRONMENT-ACTCOORDINATOR-OEREPORTONCRISIS.MSR

```
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:
13 dtComment):ptBoolean{
14 prolog{"src/Operations/Environment/OUT/outactCoordinator-oeReportOnCrisis.pl"}
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-actMobileCoordinator-oeSaveUpdates.msr

```

1 package icrash.environment.operations.actMobileCoordinator.outactMobileCoordinator.oeSaveUpdates {
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.classes
8 import icrash.environment
9 import icrash.concepts.primarytypes.datatypes
10
11 Operation Model {
12
13     operation: icrash.environment.actMobileCoordinator.outactMobileCoordinator.oeSaveUpdates(
14         AdtCoordinatorId:dtCoordinatorID, AdtCoordinatorFirstName:dtCoordinatorFirstName,
15         AdtCoordinatorLastName:dtCoordinatorLastName):ptBoolean{
16         prep{
17             let TheSystem: ctState in
18             let TheActor:actMobileCoordinator 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         postF{
29             let TheSystem: ctState in
30             let TheActor:actMobileCoordinator in
31             let ThectCoordinator:ctCoordinator in
32
33             self.rnActor.rnSystem = TheSystem
34             and self.rnActor = TheActor
35             /* PostF01 */
36             TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
37             = ThectCoordinator
38             and
39             ThectCoordinator.firstName = AdtCoordinatorFirstName
40             and TheActor.rnInterfaceIN^ieSendUpdatedInformation()
41         }
42         postP{true}
43     }
44 }
45 }
```

Listing C.18: Messir Spec. file environment-actMobileCoordinator-oeSaveUpdates.msr.

## C.19 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.19: Messir Spec. file environment-actMsrCreator-init.msr.

## C.20 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):
16     ptBoolean
17 {preP{true}
18 preF{true}
19 postF{
20     let TheSystem: ctState in
21     let AactMsrCreator: actMsrCreator in
22     let AactAdministrator: actAdministrator in
23     let AnextValueForAlertID: dtInteger in
24     let AnextValueForCrisisID: dtInteger in
25     let Aclock: dtDateAndTime in
26     let AcrisisReminderPeriod: dtSecond in
27     let AmaxCrisisReminderPeriod: dtSecond in
28     let AvpStarted: ptBoolean in
29     let ApublicKey:dtPublicKey in
30
31     /* PostF01 -- MUST ALWAYS BE MADE FIRST -- */
32     AnextValueForAlertID.value.eq(1)
33     and AnextValueForCrisisID.value.eq(1)
34     and Aclock.date.year.value = 1970
35     and Aclock.date.month.value = 01
36     and Aclock.date.day.value = 01
37     and Aclock.time.hour.value = 00
38     and Aclock.time.minute.value = 00
39     and Aclock.time.second.value = 00
40
41     and AcrisisReminderPeriod.value.eq(300)
42     and AmaxCrisisReminderPeriod.value.eq(1200)
43     and AvpStarted = true
44     and TheSystem.init(AnextValueForAlertID,
45         AnextValueForCrisisID,
46         Aclock,
47         AcrisisReminderPeriod,
48         AmaxCrisisReminderPeriod,
49         Aclock,
50         AvpStarted
51     )
52     /* PostF02*/
53     and AactMsrCreator.init()
54     /* PostF03 */
55     and let AactComCompanyCol: Bag(actComCompany) in
56     AactComCompanyCol->size() = AqtyComCompanies
57     AactComCompanyCol-> forAll(init())
58     /* PostF04*/
59     and AactAdministrator.init()
60     and TheSystem.ctKeyPair.initForDecoding(ApublicKey, '[B@6979e8cb')
```

```

61 and let AactActivator:actActivator in
62 AactActivator.init()
63 /* PostF06 */
64 and let ActAdministrator:ctAdministrator in
65   let AdtLogin:dtLogin in
66   let AdtEncodedPassword:dtEncodedPassword in
67   AdtLogin.value.eq('icrashadmin')
68   and AdtEncodedPassword.value.eq(TheSystem.ctKeyPair.decodeMsg())
69   and ActAdministrator.init(AdtLogin,AdtPassword)
70 /* PostF07*/
71 and ActAdministrator@post.rnactAuthenticated = AactAdministrator}
72 postP{true}
73
74 prolog{ "src/Operations/Environment/OUT/outactMsrCreator-oeCreateSystemAndEnvironment.pl"}
75
76 }
77 }
78
79 }
```

Listing C.20: Messir Spec. file environment-actMsrCreator-oeCreateSystemAndEnvironment.msr.

## C.21 File ./src-gen/messir-spec/environment/environment.msr

```

1 package icrash.environment{
2
3 import icrash.concepts.primarytypes.datatypes
4 import icrash.concepts.primarytypes.classes
5 import icrash.concepts.secondarytypes.datatypes
6 import lu.uni.lassy.messir.libraries.primitives
7 import lu.uni.lassy.messir.libraries.math
8 import lu.uni.lassy.messir.libraries.calendar
9
10 Environment Model {
11
12   actor actMsrCreator role rnactMsrCreator cardinality [1..1] {
13
14     operation init():ptBoolean
15
16     input interface inactMsrCreator {
17   }
18     output interface outactMsrCreator {
19       operation oeCreateSystemAndEnvironment(AqtyComCompanies:ptInteger ):ptBoolean
20     }
21   }
22
23   actor actAdministrator
24     role rnactAdministrator
25     cardinality [1..1]
26     extends actAuthenticated {
27
28     operation init():ptBoolean
29
30     output interface outactAdministrator{
31
32       operation oeAddCoordinator(
33         AdtCoordinatorID:dtCoordinatorID ,
34         AdtLogin:dtLogin ,
35         AdtPassword:dtPassword ,
36         AdtPublKey:dtPublicKey):ptBoolean
37
38       operation oeDeleteCoordinator(
39         AdtCoordinatorID:dtCoordinatorID ):ptBoolean
40     }
41
42     input interface inactAdministrator{
43
44       operation ieCoordinatorAdded():ptBoolean
45       operation ieCoordinatorDeleted():ptBoolean
46 }
```

```

46     }
47   }
48
49 actor actCoordinator
50   role rnactCoordinator
51   cardinality [0..*]
52   extends actAuthenticated{
53
54   operation init():ptBoolean
55
56   output interface outactCoordinator{
57     operation oeInvalidateAlert(AdtAlertID:dtAlertID ):ptBoolean
58     operation oeCloseCrisis(AdtCrisisID:dtCrisisID ):ptBoolean
59     operation oeGetAlertsSet(AetAlertStatus:etAlertStatus ):ptBoolean
60     operation oeGetCrisisSet(AetCrisisStatus:etCrisisStatus ):ptBoolean
61     operation oeSetCrisisHandler(AdtCrisisID:dtCrisisID ):ptBoolean
62     operation oeReportOnCrisis(
63       AdtCrisisID:dtCrisisID ,
64       AdtComment:dtComment
65       ):ptBoolean
66     operation oeSetCrisisStatus(
67       AdtCrisisID:dtCrisisID ,
68       AetCrisisStatus:etCrisisStatus
69       ):ptBoolean
70     operation oeSetCrisisType(
71       AdtCrisisID:dtCrisisID ,
72       AetCrisisType:etCrisisType
73       ):ptBoolean
74     operation oeValidateAlert(AdtAlertID:dtAlertID ):ptBoolean
75   }
76
77   input interface inactCoordinator{
78     operation ieSendAnAlert(ActAlert:ctAlert ):ptBoolean
79     operation ieSendACrisis(ActCrisis:ctCrisis ):ptBoolean
80   }
81 }
82
83 actor actMobileCoordinator
84   role rnactMobileCoordinator
85   cardinality [0..*]
86   extends actCoordinator{
87
88   operation init():ptBoolean
89
90   output interface outactMobileCoordinator{
91     operation oeSaveUpdates(
92       AdtCoordinatorId:dtCoordinatorID,
93       AdtCoordinatorFirstName:dtCoordinatorFirstName,
94       AdtCoordinatorLastName:dtCoordinatorLastName
95       ):ptBoolean
96   }
97
98   input interface inactMobileCoordinator{
99     operation ieSendUpdatedInformation():ptBoolean
100   }
101 }
102
103 actor actComCompany role rnactComCompany cardinality [0..*]{
104
105   operation init():ptBoolean
106
107   output interface outactComCompany{
108     operation oeAlert(
109       AetHumanKind:etHumanKind ,
110       AdtDate:dtDate ,
111       AdtTime:dtTime ,
112       AdtPhoneNumber:dtPhoneNumber ,
113       AdtGPSLocation:dtGPSLocation ,
114       AdtComment:dtComment
115       ):ptBoolean

```

## C.22. FILE /SRC-GEN/MESSIR-SPEC/CONCEPTS/PRIMARYTYPES-ASSOCIATIONS.MSR153

```

116    }
117
118    input interface inactComCompany{
119        operation ieSmsSend(AdtPhoneNumber:dtPhoneNumber ,
120            AdtSMS:dtSMS
121            ):ptBoolean
122    }
123 }
124
125 actor actAuthenticated role rnactAuthenticated cardinality [0..*]{
126
127     operation init():ptBoolean
128
129     output interface outactAuthenticated{
130         operation oeLogin(AdtLogin:dtLogin , AdtEncodedPassword:dtEncodedPassword):ptBoolean
131         operation oeLogout():ptBoolean
132     }
133
134     input interface inactAuthenticated{
135         operation ieMessage(AMessage:ptString):ptBoolean
136     }
137 }
138
139 actor actActivator[proactive] role rnactActivator cardinality [1..1]{
140
141     operation init():ptBoolean
142
143     output interface outactActivator{
144         proactive operation oeSollicitateCrisisHandling():ptBoolean
145         proactive operation oeSetClock(AcurrentClock:dtDateAndTime ):ptBoolean
146     }
147
148     input interface inactActivator{
149     }
150 }
151 }
152 }
```

Listing C.21: Messir Spec. file environment.msr.

## C.22 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 assctCrisiscctCoordinator
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.22: Messir Spec. file primarytypes-associations.msr.

### C.23 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   ApublKey:dtPublicKey
14   ):ptBoolean{
15 postF{
16   if
17   (
18     let Self:ctAdministrator in
19     /* Post F01 */
20     Self.login(Alogin)
21     and Self.pwd = Apwd
22     and Self.pubKey = ApublKey
23     and Self.vpIsLogged = false
24
25     /* Post F02 */
26     and (Self.oclIsNew and self = Self)
27   )
28   then (result = true)
29   else (result = false)
30   endif
31 }
32 prolog{ "src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctAdministrator-init.pl"
33 }
34 }
35 }
```

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

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

```

1 package icrash.operations.concepts.primarytypes.classes.ctAlert{
2
```

## C.25. FILE /SRC-GEN/MESSIR-SPEC.../PRIMARYTYPES-CLASSES-CTAUTHENTICATED.MSR155

```

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 ,
   Alocation: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 = Alocation
23 and Self.instant = Ainstant
24 and Self.comment = Acomment
25 /* Post F02 */
26 and (Self.oclIsNew 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.24: Messir Spec. file primarytypes-classes-ctAlert.msr.

## C.25 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
   , ApubKey:dtPublicKey):ptBoolean{

```

```

10 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctAuthenticated-init.pl"
11 }
12 }
13 }
14 }
```

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

### C.26 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:
10 dtLogin, Apwd:dtPassword, ApubKey:dtPublicKey):ptBoolean
11 {
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.pubKey = ApubKey
20 and Self.vpIsLogged = false
21 /* Post F02 */
22 and (Self.oclIsNew and self = Self)
23 )
24 then (result = true)
25 else (result = false)
26 endif}
27 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctCoordinator-init.pl"}
28 }
29 }
30 }
```

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

### C.27 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,
```

C.27. FILE /SRC-GEN/MESSIR-SPEC/OPERATIONS.../PRIMARYTYPES-CLASSES-CTCRISIS.MSR157

```
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.oclIsNew 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.27: Messir Spec. file primarytypes-classes-ctCrisis.msr.

## C.28 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
```

C.29. FILE /SRC-GEN/MESSIR-SPEC/OPERATIONS.../PRIMARYTYPES-CLASSES-CTSTATE.MSR159

```

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.oclIsNew 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.28: Messir Spec. file primarytypes-classes-ctHuman.msr.

## C.29 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.oclIsNew 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.29: Messir Spec. file primarytypes-classes-ctState.msr.

### C.30 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 pubKey: dtPublicKey
86   attribute vpIsLogged:ptBoolean
87
88   operation init(
89     Alogin:dtLogin ,
90     Apwd:dtPassword ,
91     ApubKey:dtPublicKey):ptBoolean
92 }
93
94 class ctCoordinator
95   role rnctCoordinator
96   cardinality [0..*]
97   extends ctAuthenticated{
98
99   attribute id:dtCoordinatorID
100  attribute firstName:dtCoordinatorFirstName
101  attribute lastName:dtCoordinatorLastName
102
103 operation init(
104   Aid:dtCoordinatorID ,
105   Alogin:dtLogin ,
106   Apwd:dtPassword ,
107   ApubKey:dtPublicKey):ptBoolean
108 }
109
110 class ctAdministrator
111   role rnctAdministrator
112   cardinality [1..1]
113   extends ctAuthenticated{
114
115   operation init(
116     Alogin:dtLogin ,
117     Apwd:dtPassword ,
118     ApubKey:dtPublicKey):ptBoolean
119 }
120
121 class ctKeyValuePair
122   role rnctKeyValuePair
123   cardinality[1..1]{
124
125   operation decodeMsg(pwd:dtEncodedPassword,
126                         publicKey:dtPublicKey):ptBoolean
127 }
128 }
129 }
```

```
130 }
```

Listing C.30: Messir Spec. file primarytypes-classes.msr.

### C.31 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.31: Messir Spec. file primarytypes-datatypes-dtAlertID.msr.

### C.32 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.32: Messir Spec. file primarytypes-datatypes-dtComment.msr.

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

```

1 package icrash.concepts.primarytypes.datatypes.operations.datatypes.dtCoordinatorFirstName.is {
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 Operation Model {
9
10 operation: icrash.concepts.primarytypes.datatypes.dtCoordinatorFirstName.is():ptBoolean{
11 postP{
12     let TheResult: ptBoolean in
13     let MaxLength: ptInteger in
14     ( if
15         ( MinLength = 20
16             and AdtValue.value.length().leq(MinLength)
17         )
18         then (TheResult = true)
19         else (TheResult = false)
20     endif
21     result = TheResult
22 }
23 }
24 }
25 }
26 }
```

Listing C.33: Messir Spec. file primarytypes-datatatypes-dtCoordinatorFirstName-is.msr.

### C.34 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatatypes-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 postP{
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.34: Messir Spec. file primarytypes-datatatypes-dtCoordinatorID.msr.

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

```

1 package icrash.concepts.primarytypes.datatypes.operations.datatypes.dtCoordinatorLastName.is {
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 Operation Model {
9
10 operation: icrash.concepts.primarytypes.datatypes.dtCoordinatorLastName.is():ptBoolean{
11 postF{
12     let TheResult: ptBoolean in
13     let MaxLength: ptInteger in
14     ( if
15         ( MaxLength = 50
16             and AdtValue.value.length().leq(MaxLength)
17         )
18         then (TheResult = true)
19         else (TheResult = false)
20     endif
21     result = TheResult
22   )
23 }
24 }
25 }
26 }
```

Listing C.35: Messir Spec. file primarytypes-datatypes-dtCoordinatorLastName-is.msr.

### C.36 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.36: Messir Spec. file primarytypes-datatypes-dtCrisisID.msr.

## C.37 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatatypes/primarytypes-datatatypes-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:
29         dtGPSLocation):ptBoolean{
30         postF{
31             let TheResult: ptBoolean in true
32             let EarthRadius: dtReal in
33             let MaxDistance: dtReal in
34             let ComparedLatitude: dtLatitude in
35             let ComparedLongitude: dtLongitude in
36             let R1: dtReal in let R1a: dtReal in
37             let R2: dtReal in let R2a: dtReal in
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
61         .pl"}
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.37: Messir Spec. file primarytypes-datatypes-dtGPSLocation.msr.

### C.38 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.38: Messir Spec. file primarytypes-datatypes-dtLogin.msr.

### C.39 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
```

#### C.40. FILE /SRC-GEN/MESSIR-SPEC.../PRIMARYTYPES-DATATYPES-DTPHONENUMBER.MSR167

```
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.39: Messir Spec. file primarytypes-datatypes-dtPassword.msr.

#### C.40 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.40: Messir Spec. file primarytypes-datatypes-dtPhoneNumber.msr.

#### C.41 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.41: Messir Spec. file primarytypes-datatypes-etAlertStatus.msr.

#### C.42 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.42: Messir Spec. file primarytypes-datatypes-etCrisisStatus.msr.

#### C.43 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    endif
16    result = TheResult
17  )
18 }
19 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesDatatypes-etCrisisType-is.pl"}
20 }
```

#### C.44. FILE /SRC-GEN/MESSIR-SPEC/OPERATIONS.../PRIMARYTYPES-DATATYPES-ETHUMANKIND.MSR

```
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.43: Messir Spec. file primarytypes-datatatypes-etCrisisType.msr.

#### C.44 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.44: Messir Spec. file primarytypes-datatypes-etHumanKind.msr.

#### C.45 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 dtCoordinatorFirstName extends dtString {
28   operation is():ptBoolean
29 }
30 datatype dtCoordinatorLastName extends dtString {
31   operation is():ptBoolean
32 }
33 datatype dtPhoneNumber extends dtString {
34   operation is():ptBoolean
35 }
36 datatype dtComment extends dtString {
37   operation is():ptBoolean
38 }
39 datatype dtLatitude extends dtReal {
40   operation is():ptBoolean
41 }
42 datatype dtLongitude extends dtReal {
43   operation is():ptBoolean
44 }
45 datatype dtGPSLocation {
46   attribute latitude: dtLatitude
47   attribute longitude: dtLongitude
48   operation is():ptBoolean
49   operation isNearTo(AGPSLocation:dtGPSLocation ):ptBoolean
50 }
51
52 datatype dtPublicKey {
53   attribute publKey:ptString
54   operation is():ptBoolean
55 }
56
57
58 datatype dtPrivateKey {
59   attribute privKey:ptString
60   operation is():ptBoolean
61 }
62
63 datatype dtEncodedPassword extends dtByteArray {
64
65   external operation eq():ptBoolean
66 }
67
68 datatype dtByteArray {
69   attribute value: ptString
70 }
71
72
73 enum etCrisisStatus {
74   constants["pending", "handled", "solved","closed"]
75   operation is():ptBoolean
76 }
77 enum etAlertStatus {
78   constants["pending", "valid", "invalid"]
79   operation is():ptBoolean
80 }
81 enum etCrisisType {
82   constants["small", "medium", "huge"]
83   operation is():ptBoolean
84 }
85 enum etHumanKind {
86   constants["witness", "victim", "anonymous"]
87   operation is():ptBoolean
88 }
89
90 }
```

91 }

Listing C.45: Messir Spec. file primarytypes-datatatypes.msr.

#### C.46 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.46: Messir Spec. file secondarytypes-associations.msr.

#### C.47 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.47: Messir Spec. file secondarytypes-classes.msr.

#### C.48 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.48: Messir Spec. file secondarytypes-datatypes.msr.

#### C.49 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,
18     AdtPassword:dtPassword, AdtPublicKey:dtPublicKey){
19     actor actAdministrator[primary,active]
20     returned messages {
21         ieCoordinatorAdded() returned to actAdministrator
22     }
23 }
24 //-----
25 use case system subfunction oeAlert(
26     AetKind:etHumanKind,
27     AdtMyDate:dtDate,
28     AdtTime:dtTime,
29     AdtPhoneNumber:dtPhoneNumber,
30     AdtGPSLocation:dtGPSLocation,
31     AdtComment:dtComment) {
32     actor actComCompany[primary,active]
33     returned messages {
34         ieSmsSend(AdtPhoneNumber,AdtSMS) returned to actComCompany
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 use case system subfunction oeCreateSystemAndEnvironment(AqtyComCompanies:ptInteger) {
52     actor actMsrCreator[primary,active]
53 }
54 //-----
55 use case system subfunction oeDeleteCoordinator(AdtCoordinatorID:dtCoordinatorID) {
56     actor actAdministrator[primary,active]
57     returned messages {
58         ieCoordinatorDeleted() returned to actAdministrator
59     }
60 }
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 , AdtEncodedPassword:dtEncodedPassword) {
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:
116   etCrisisStatus) {
117   actor actCoordinator[primary,active]
118   returned messages {
119     ieMessage(AMessage) returned to actCoordinator
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.49: Messir Spec. file subfunctions-usecases.msr.

## C.50 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       prolog{"src/Tests/system/01/system-sim-01-01-oeCreateSystemAndEnvironment.pl"}
34     }
35 //-----
36   test step ts02oeSetClock order 02{
37     variables{
38       TheActor:actActivator
39       ACurrentClock:dtDateAndTime
40     }
41     constraints{
42       TheActor=TheSystem.rnactActivator->any2(true)
43
44       ACurrentClock.date.year.value = 2017
45       ACurrentClock.date.month.value = 11
46       ACurrentClock.date.day.value = 24
47       ACurrentClock.time.hour.value = 15
48       ACurrentClock.time.minute.value = 20
49       ACurrentClock.time.second.value = 00
50     }
51     test message{
52       out:TheActor sends to system actActivator.outactActivator.oeSetClock(ACurrentClock)
53     }
54     oracle{
55       constraints{
56         true
57       }
58     }
59   }
60 //-----
61   test step ts03oeLogin order 03{

```

```

63  variables{
64      TheActor : actAdministrator
65      AdtLogin:dtLogin
66      AdtEncodedPassword:dtEncodedPassword
67  }
68  constraints{
69      TheActor=TheSystem.rnactAdministrator->any2(true)
70      AdtLogin.value.eq('icrashadmin')
71      AdtEncodedPassword.value.eq('[B@6979e8cb')
72  }
73  test message{
74      out:TheActor sends to system actAdministrator.outactAdministrator.oeLogin(AdtLogin,
75      AdtEncodedPassword)
76  }
77  oracle{
78      variables{
79          AMessag:ptString
80      }
81      constraints{
82          AMessag = 'You are logged ! Welcome ...'
83          TheActor.inactAdministrator.ieMessage(AMessag)
84      }
85  }
86 //-----
87 test step ts04oeAddCoordinator order 04{
88     variables{
89         TheActor : actAdministrator
90         AdtCoordinatorID : dtCoordinatorID
91         AdtLogin:dtLogin
92         AdtPassword:dtPassword
93         AdtPublicKey:dtPublicKey
94     }
95     constraints{
96         TheActor = TheSystem.rnactAdministrator->any2(true)
97         AdtCoordinatorID.value.eq('1')
98         AdtLogin.value.eq('steve')
99         AdtPassword.value.eq('pwdMessirExcalibur2017')
100        AdtPublicKey.value.eq('Sun RSA public key, 2048 bits ...')
101    }
102    test message{
103        out:TheActor
104        sends to system actAdministrator.outactAdministrator.oeAddCoordinator
105            (AdtCoordinatorID,
106                AdtLogin,
107                AdtPassword,
108                AdtPublicKey)
109    }
110    oracle{
111        constraints{
112            TheActor.inactAdministrator.ieCoordinatorAdded()
113        }
114    }
115  }
116 //-----
117 test step ts05oeLogout order 05{
118     variables{
119         TheActor : actAdministrator
120     }
121     constraints{
122         TheActor = TheSystem.rnactAdministrator->any2(true)
123     }
124     test message{
125         out:TheActor sends to system actAdministrator.outactAdministrator.oeLogout()
126     }
127     oracle{
128         variables{
129             AMessag:ptString
130         }
131         constraints{

```

```

132     AMessage = 'You are logged out ! Good Bye ...'
133     TheActor.inactAdministrator.ieMessage(AMessage)
134   }
135 }
136 }
137 //-----
138 test step ts06oeSetClock02 order 06{
139   variables{
140     TheActor:actActivator
141     ACurrentClock:dtDateAndTime
142   }
143   constraints{
144     TheActor=TheSystem.rnactActivator->any2(true)
145     ACurrentClock.date.year.value = 2017
146     ACurrentClock.date.month.value = 11
147     ACurrentClock.date.day.value = 26
148     ACurrentClock.time.hour.value = 10
149     ACurrentClock.time.minute.value = 15
150     ACurrentClock.time.second.value = 00
151   }
152   test message{
153     out:TheActor sends to system actActivator.outactActivator.oeSetClock(ACurrentClock)
154   }
155   oracle{
156     constraints{
157       true
158     }
159   }
160 }
161 //-----
162 test step ts07oeAlert1 order 07{
163   variables{
164     TheActor : actComCompany
165     AetHumanKind:etHumanKind
166     AdtDate:dtDate
167     AdtTime:dtTime
168     AdtPhoneNumber:dtPhoneNumber
169     AdtGPSLocation:dtGPSlocation
170     AdtComment:dtComment
171   }
172   constraints{
173     TheActor = TheSystem.rnactComCompany->any2(true)
174     AetHumanKind = witness
175     AdtDate.year.value = 2017
176     AdtDate.month.value = 11
177     AdtDate.day.value = 26
178     AdtTime.hour.value = 10
179     AdtTime.minute.value = 10
180     AdtTime.second.value = 16
181     AdtPhoneNumber.value = '+3524666445252'
182     AdtGPSLocation.latitude.value = 49.627675
183     AdtGPSLocation.longitude.value = 6.159590
184     AdtComment.value = '3 cars involved in an accident.'
185   }
186   test message{
187     out:TheActor
188     sends to system actComCompany.outactComCompany.oeAlert( AetHumanKind,
189                               AdtDate,
190                               AdtTime,
191                               AdtPhoneNumber,
192                               AdtGPSLocation,
193                               AdtComment)
194   }
195   oracle{
196     variables{
197       AdtSMS:dtSMS
198     }
199     constraints{
200       AdtSMS.value = 'Your alert has been registered. We will handle it and keep you informed'
201       TheActor.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)

```

```

202     }
203   }
204 }
205 //-----
206 test step ts08oeSetClock03 order 08{
207   variables{
208     TheActor:actActivator
209     ACurrentClock:dtDateAndTime
210   }
211   constraints{
212     TheActor=TheSystem.rnactActivator->any2(true)
213     ACurrentClock.date.year.value = 2017
214     ACurrentClock.date.month.value = 11
215     ACurrentClock.date.day.value = 26
216     ACurrentClock.time.hour.value = 10
217     ACurrentClock.time.minute.value = 30
218     ACurrentClock.time.second.value = 00
219   }
220   test message{
221     out:TheActor sends to system actActivator.outactActivator.oeSetClock(ACurrentClock)
222   }
223   oracle{
224     constraints{
225       true
226     }
227   }
228 }
229 //-----
230 test step ts09oeSollicitateCrisisHandling order 09{
231   variables{
232     TheActor : actActivator
233   }
234   constraints{
235     TheActor = TheSystem.rnactActivator->any2(true)
236   }
237   test message{
238     out:TheActor sends to system actActivator.outactActivator.oeSollicitateCrisisHandling()
239   }
240   oracle{
241     variables{
242       TheAdministrator:actAdministrator
243       TheCoordinator:actCoordinator
244       AMessagForCrisisHandlers:ptString
245     }
246     constraints{
247       TheAdministrator = TheSystem.rnactAdministrator->any2(true)
248       TheCoordinator = TheSystem.rnactCoordinator->any2(true)
249       AMessagForCrisisHandlers = 'There are alerts pending since more than the defined delay. Please
REACT !'
250
251       TheAdministrator.inactAdministrator.ieMessage(AMessagForCrisisHandlers)
252       TheCoordinator.inactAdministrator.ieMessage(AMessagForCrisisHandlers)
253
254 /* this oracle should be written like this:
255
256   oracle{
257     variables{
258       TheAdministrator:actAdministrator
259       AMessagForCrisisHandlers:ptString
260     }
261     constraints{
262       AMessagForCrisisHandlers = 'There are alerts pending since more than the defined delay. Please
REACT !'
263       TheAdministrator = TheSystem.rnactAdministrator->any2(true)
264
265       TheSystem.rnactCoordinator->forAll(TheCoordinator:actCoordinator | TheCoordinator.
actAuthenticated.inactAuthenticated.ieMessage(AMessag))
266
267       // receives from system is for step instances
268

```

```

269  */
270 }
271 }
272 }
273 //-----
274 test step ts10oeLogin02 order 10{
275   variables{
276     TheActor : actCoordinator
277     AdtLogin:dtLogin
278     AdtEncodedPassword:dtEncodedPassword
279   }
280   constraints{
281     TheActor = TheSystem.rnactCoordinator->select(a | a.rnctCoordinator.login.value.eq('steve'))->
282     any2(true)
283     AdtLogin.value.eq('steve')
284     AdtEncodedPassword.value.eq('[B@6979e8cb')
285   }
286   test message{
287     out:TheActor sends to system actAuthenticated.outactAuthenticated.oeLogin(AdtLogin,
288     AdtEncodedPassword)
289   }
290   oracle{
291     variables{
292       AMesssage:ptString
293     }
294     constraints{
295       AMesssage = 'You are logged ! Welcome ...'
296       TheActor.inactAuthenticated.ieMessage(AMesssage)
297     }
298   }
299 //-
300 test step ts11oeGetCrisisSet order 11{
301   variables{
302     TheActor : actCoordinator
303     AetCrisisStatus : etCrisisStatus
304   }
305   constraints{
306     TheActor=TheSystem.rnactCoordinator
307     ->select(a | a.rnctCoordinator.login.value.eq('steve'))
308     ->any2(true)
309     AetCrisisStatus = pending
310   }
311   test message{
312     out:TheActor sends to system actCoordinator.outactCoordinator.oeGetCrisisSet(AetCrisisStatus)
313   }
314 //TODO - make consistent with test step implementation by adding Prolog code for input messages
315   variables{
316     ActCrisis:ctCrisis
317   }
318   constraints{
319     TheActor.inactCoordinator.ieSendACrisis(ActCrisis)
320   }
321 }
322 }
323 //-
324 test step ts12oeSetCrisisHandler order 12{
325   variables{
326     TheActor : actCoordinator
327     AdtCrisisID : dtCrisisID
328   }
329   constraints{
330     TheActor=TheSystem.rnactCoordinator
331     ->select(a | a.rnctCoordinator.login.value.eq('steve'))
332     ->any2(true)
333     //and AdtCrisisID.value= '1'
334   }
335   test message{
336     out:TheActor sends to system actCoordinator.outactCoordinator.oeSetCrisisHandler(AdtCrisisID)

```

```

337     }
338     oracle{
339       variables{
340         AMessage:ptString
341         AdtPhoneNumber:dtPhoneNumber
342         AdtSMS:dtSMS
343         ActAlert:ctAlert
344
345         TheComCompany: actComCompany
346         TheCoordinator:actCoordinator
347       }
348       constraints{
349         AMessage = 'You are now considered as handling the crisis !'
350         AdtSMS.value = 'The handling of your alert by our services is in progress !'
351         TheComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
352         TheCoordinator.inactCoordinator.ieSendAnAlert(ActAlert)
353         TheActor.inactAuthenticated.ieMessage(AMessage)
354       }
355     }
356   }
357 //-----
358 test step ts13oeSetClock04 order 13{
359   variables{
360     TheActor:actActivator
361     ACurrentClock:dtDateAndTime
362   }
363   constraints{
364     TheActor=TheSystem.rnactActivator->any2(true)
365     ACurrentClock.date.year.value = 2017
366     ACurrentClock.date.month.value = 11
367     ACurrentClock.date.day.value = 26
368     ACurrentClock.time.hour.value = 10
369     ACurrentClock.time.minute.value = 45
370     ACurrentClock.time.second.value = 00
371   }
372   test message{
373     out:TheActor sends to system actActivator.outactActivator.oeSetClock(ACurrentClock)
374   }
375   oracle{
376     constraints{
377       true
378     }
379   }
380 }
381 //-----
382 test step ts14oeValidateAlert order 14{
383   variables{
384     TheActor : actCoordinator
385     AdtAlertID : dtAlertID
386   }
387   constraints{
388     TheActor=TheSystem.rnactCoordinator
389     ->select(a | a.rnctCoordinator.login.value.eq('steve'))
390     ->any2(true)
391     //and AdtAlertID.value= '1'
392   }
393   test message{
394     out:TheActor sends to system actCoordinator.outactCoordinator.oeValidateAlert(AdtAlertID)
395   }
396   oracle{
397     variables{
398       AMessage:ptString
399     }
400     constraints{
401       AMessage = 'The Alert is now declared as valid !'
402       TheActor.actAuthenticated.inactAuthenticated.ieMessage(AMessage)
403     }
404   }
405 }
406 //-----

```

```

407 test step ts15oeAlert2 order 15{
408     variables{
409         TheActor : actComCompany
410         AetHumanKind:etHumanKind
411         AdtDate:dtDate
412         AdtTime:dtTime
413         AdtPhoneNumber:dtPhoneNumber
414         AdtGPSLocation:dtGPSlocation
415         AdtComment:dtComment
416     }
417     constraints{
418         TheActor = TheSystem.rnactComCompany->any2(true)
419         AetHumanKind = witness
420         AdtDate.year.value = 2017
421         AdtDate.month.value = 11
422         AdtDate.day.value = 26
423         AdtTime.hour.value = 10
424         AdtTime.minute.value = 20
425         AdtTime.second.value = 00
426         AdtPhoneNumber.value = '+3524666445000'
427         AdtGPSLocation.latitude.value = 49.627095
428         AdtGPSLocation.longitude.value = 6.160251
429         AdtComment.value = 'A car crash just happened.'
430     }
431     test message{
432         out:TheActor
433         sends to system actComCompany.outactComCompany.oeAlert( AetHumanKind,
434                                         AdtDate,
435                                         AdtTime,
436                                         AdtPhoneNumber,
437                                         AdtGPSLocation,
438                                         AdtComment)
439     }
440     oracle{
441         variables{
442             AdtSMS:dtsMS
443         }
444         constraints{
445             AdtSMS.value = 'Your alert has been registered. We will handle it and keep you informed'
446             TheActor.actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
447         }
448     }
449 }
450 //-----
451 test step ts16oeSetClock05 order 16{
452     variables{
453         TheActor:actActivator
454         ACurrentClock:dtDateAndTime
455     }
456     constraints{
457         TheActor=TheSystem.rnactActivator->any2(true)
458         ACurrentClock.date.year.value = 2017
459         ACurrentClock.date.month.value = 11
460         ACurrentClock.date.day.value = 26
461         ACurrentClock.time.hour.value = 12
462         ACurrentClock.time.minute.value = 45
463         ACurrentClock.time.second.value = 00
464     }
465     test message{
466         out:TheActor sends to system actActivator.outactActivator.oeSetClock(ACurrentClock)
467     }
468     oracle{
469         constraints{
470             true
471         }
472     }
473 }
474 //-----
475 test step ts17oeSetCrisisStatus order 17{
476     variables{

```

```

477     TheActor : actCoordinator
478     AdtCrisisID : dtCrisisID
479     AetCrisisStatus : etCrisisStatus
480   }
481 constraints{
482   TheActor=TheSystem.rnactCoordinator
483   ->select(a | a.rnctCoordinator.login.value.eq('steve'))
484   ->any2(true)
485   //and AdtCrisisID.value= '1'
486   //and AetCrisisStatus = solved
487 }
488 test message{
489   out:TheActor sends to system actCoordinator.outactCoordinator.oeSetCrisisStatus(AdtCrisisID,
AetCrisisStatus)
490 }
491 oracle{
492   variables{
493     AMessage:ptString
494   }
495   constraints{
496     AMessage = 'The crisis status has been updated !'
497     TheActor.inactAuthenticated.ieMessage(AMessage)
498   }
499 }
500 }
501 //-----
502 test step ts18oeReportOnCrisis order 18{
503   variables{
504     TheActor : actCoordinator
505     AdtCrisisID : dtCrisisID
506     AdtComment : dtComment
507   }
508   constraints{
509     TheActor=TheSystem.rnactCoordinator
510     ->select(a | a.rnctCoordinator.login.value.eq('steve'))
511     ->any2(true)
512     //and AdtCrisisID.value= '1'
513     //and AdtComment.value = '3 victims sent to hospital, 2 cars evacuated and 4 rescue unit
mobilized'
514   }
515   test message{
516     out:TheActor sends to system actCoordinator.outactCoordinator.oeReportOnCrisis(AdtCrisisID,
AdtComment)
517   }
518   oracle{
519     variables{
520       AMessage:ptString
521     }
522     constraints{
523       AMessage = 'The crisis comment has been updated !'
524       TheActor.inactAuthenticated.ieMessage(AMessage)
525     }
526   }
527 }
528 //-----
529 test step ts19oeCloseCrisis order 19{
530   variables{
531     TheActor : actCoordinator
532     AdtCrisisID : dtCrisisID
533   }
534   constraints{
535     TheActor=TheSystem.rnactCoordinator
536     ->select(a | a.rnctCoordinator.login.value.eq('steve'))
537     ->any2(true)
538     //and AdtCrisisID.value= '1'
539   }
540   test message{
541     out:TheActor sends to system actCoordinator.outactCoordinator.oeCloseCrisis(AdtCrisisID)
542   }
543   oracle{

```

```

544     variables {
545         AMessage:ptString
546     }
547     constraints{
548         AMessage = 'The crisis is now closed !'
549         TheActor.inactAuthenticated.ieMessage(AMessage)
550     }
551   }
552 }
553 }
554 }
555 }
```

Listing C.50: Messir Spec. file tc-testcase01.msr.

### C.51 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         AdtEncodedPassword : testcase01.ts03oeLogin.AdtEncodedPassword= "[B@6979e8cb"
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     AdtPublicKey : testcase01.ts04oeAddCoordinator.AdtPublicKey = "Sun RSA public key, 2048 bits ...
62   }
63   oracle {
64     satisfaction = "true"
65     received message {
66       tsi03.bill received from system actAdministrator.inactAdministrator.ieCoordinatorAdded()
67     }
68   }
69   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
70 }

71 /**
72  test step instance tsi05: testcase01.ts05oeLogout{
73   variables {
74     reuse tsi03.bill as testcase01.ts05oeLogout.TheActor
75   }
76   oracle {
77     satisfaction = "true"
78     received message {
79       AMesssage : testcase01.ts05oeLogout.AMessage= 'You are logged out ! Good Bye ...'
80       tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
81     }
82   }
83   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
84 }

85 /**
86  test step instance tsi06: testcase01.ts06oeSetClock02{
87   variables {
88     reuse tsi02.theClock as testcase01.ts06oeSetClock02.TheActor
89     ACurrentClock : testcase01.ts06oeSetClock02.ACurrentClock= "2017:11:26 - 10:15:00"
90   }
91   oracle {
92     satisfaction = "true"
93   }
94   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
95 }

96 /**
97  test step instance tsi07: testcase01.ts07oeAlert1{
98   variables {
99     tango:testcase01.ts07oeAlert1.TheActor ="tango"
100    AetHumanKind : testcase01.ts07oeAlert1.AetHumanKind = "witness"
101    AdtDate : testcase01.ts07oeAlert1.AdtDate = "2017:11:26"
102    AdtTime : testcase01.ts07oeAlert1.AdtTime = "10:10:16"
103    AdtPhoneNumber : testcase01.ts07oeAlert1.AdtPhoneNumber = "+3524666445252"
104    AdtGPSLocation : testcase01.ts07oeAlert1.AdtGPSLocation = "49.627675:6.159590"
105    AdtComment : testcase01.ts07oeAlert1.AdtComment = "3 cars involved in an accident."
106   }
107  oracle {
108    satisfaction = "true"
109    received message {
110      AdtSMS : testcase01.ts07oeAlert1.AdtSMS= 'Your alert has been registered. We will handle it and
keep you informed'
111      tsi07.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
112    }
113  }
114 }
115 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
116 }

118 /**
119  test step instance tsi08: testcase01.ts08oeSetClock03{
120   variables {

```

```

121  reuse tsi02.theClock as testcase01.ts08oeSetClock03.ACurrrentClock
122  ACurrentClock : testcase01.ts08oeSetClock03.ACurrrentClock = "2017:11:26 - 10:30:00"
123 }
124 oracle {
125   satisfaction = "true"
126 }
127 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
128 }
129 //-
130 test step instance tsi09: testcase01.ts09oeSollicitateCrisisHandling{
131 variables {
132   reuse tsi02.theClock as testcase01.ts09oeSollicitateCrisisHandling.TheActor
133   steve:testcase01.ts09oeSollicitateCrisisHandling.TheCoordinator ="steve"
134   reuse tsi03.bill as testcase01.ts09oeSollicitateCrisisHandling.TheAdministrator
135 }
136 oracle {
137   satisfaction = "true"
138   received message {
139     AMessageForCrisisHandlers : testcase01.ts09oeSollicitateCrisisHandling.
140     AMessageForCrisisHandlers= 'There are alerts pending since more than the defined delay. Please
141     REACT !'
142     tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(
143       AMessageForCrisisHandlers)
144     tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(
145       AMessageForCrisisHandlers)
146   }
147 }
148 //-
149 test step instance tsi10: testcase01.ts10oeLogin02{
150 variables {
151   reuse tsi09.steve as testcase01.ts10oeLogin02.TheActor
152   AdtLogin : testcase01.ts10oeLogin02.AdtLogin = "steve"
153   AdtEncodedPassword : testcase01.ts10oeLogin02.AdtEncodedPassword= "[B@6979e8cb"
154 }
155 oracle {
156   satisfaction = "true"
157   received message {
158     AMessage : testcase01.ts10oeLogin02.AMessage= 'You are logged ! Welcome ...'
159     tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
160   }
161 }
162 }
163 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
164 }
165 //-
166 test step instance ts111: 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
184   AdtCrisisID : testcase01.ts12oeSetCrisisHandler.AdtCrisisID = "1"
185   reuse tsi07.tango as testcase01.ts12oeSetCrisisHandler.TheComCompany

```

```

187
188    }
189  oracle {
190    satisfaction = "true"
191    received message {
192      AMessage : testcase01.ts12oeSetCrisisHandler.AMessage= 'You are now considered as handling the
193      crisis !'
194      AdtSMS : testcase01.ts12oeSetCrisisHandler.AdtSMS= 'The handling of your alert by our services
195      is in progress !'
196      AdtPhoneNumber : testcase01.ts12oeSetCrisisHandler.AdtPhoneNumber= "+3524666445252"
197
198      tsi07.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
199      tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
200    }
201  }
202  test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
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 }
228  test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
229 }
230 //-----
231 test step instance tsi15: testcase01.ts15oeAlert2{
232  variables {
233    reuse tsi07.tango as testcase01.ts15oeAlert2.TheActor
234    AetHumanKind : testcase01.ts15oeAlert2.AetHumanKind ="witness"
235    AdtDate : testcase01.ts15oeAlert2.AdtDate= "2017:11:26"
236    AdtTime : testcase01.ts15oeAlert2.AdtTime= "10:20:00"
237    AdtPhoneNumber : testcase01.ts15oeAlert2.AdtPhoneNumber= "+3524666445000"
238    AdtGPSLocation : testcase01.ts15oeAlert2.AdtGPSLocation= "49.627095:6.160251"
239    AdtComment : testcase01.ts15oeAlert2.AdtComment= "A car crash just happened."
240  }
241  message {
242    tsi07.tango sent to system testcase01.ts15oeAlert2.out : actComCompany.outactComCompany.oeAlert(
243      AetHumanKind,AdtDate,AdtTime,AdtPhoneNumber,AdtGPSLocation,AdtComment)
244  }
245  oracle {
246    satisfaction = "true"
247    received message {
248      AdtSMS : testcase01.ts15oeAlert2.AdtSMS= 'Your alert has been registered. We will handle it and
249      keep you informed'
250      tsi07.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
251    }
252 }

```

```

253     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
254   }
255 //-----
256 test step instance tsi16: testcase01.ts16oeSetClock05{
257   variables {
258     reuse tsi02.theClock as testcase01.ts16oeSetClock05.TheActor
259     ACurrentClock : testcase01.ts16oeSetClock05.ACurrentClock = "2017:11:26 - 12:45:00"
260   }
261   oracle {
262     satisfaction = "true"
263     received message {
264
265   }
266 }
267   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
268 }
269 //-----
270 test step instance tsi17: testcase01.ts17oeSetCrisisStatus{
271   variables {
272     reuse tsi09.steve as testcase01.ts17oeSetCrisisStatus.TheActor
273     AdtCrisisID : testcase01.ts17oeSetCrisisStatus.AdtCrisisID = "1"
274     AetCrisisStatus : testcase01.ts17oeSetCrisisStatus.AetCrisisStatus= "solved"
275   }
276   oracle {
277     satisfaction = "true"
278     received message {
279       AMesssage : testcase01.ts17oeSetCrisisStatus.AMessage= "The crisis status has been updated !"
280       tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMesssage)
281     }
282   }
283   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
284 }
285 //-----
286 test step instance tsi18: testcase01.ts18oeReportOnCrisis{
287   variables {
288     reuse tsi09.steve as testcase01.ts18oeReportOnCrisis.TheActor
289     AdtCrisisID : testcase01.ts18oeReportOnCrisis.AdtCrisisID = "1"
290     AdtComment : testcase01.ts18oeReportOnCrisis.AdtComment= "3 victims sent to hospital, 2 cars
291     evacuated and 4 rescue unit mobilized"
292   }
293   oracle {
294     satisfaction = "true"
295     received message {
296       AMesssage : testcase01.ts18oeReportOnCrisis.AMessage= 'The crisis comment has been updated !'
297       tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMesssage)
298     }
299   }
300   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
301 }
302 //-----
303 test step instance tsi19: testcase01.ts19oeCloseCrisis{
304   variables {
305     reuse tsi09.steve as testcase01.ts19oeCloseCrisis.TheActor
306     AdtCrisisID : testcase01.ts19oeCloseCrisis.AdtCrisisID = "1"
307   }
308   oracle {
309     satisfaction = "true"
310     received message {
311       AMesssage : testcase01.ts19oeCloseCrisis.AMessage= 'The crisis is now closed !'
312       tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMesssage)
313     }
314   }
315   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
316 }
317 //-----
318 }
```

```

322 //-----
323 //-
324 test case instance instance01Part01: testcase01{
325 //-
326 test step instance tsi01: testcase01.ts01oeCreateSystemAndEnvironment{
327 variables {
328 theCreator: testcase01.ts01oeCreateSystemAndEnvironment.Creator = "theCreator"
329 AqtyComCompanies : testcase01.ts01oeCreateSystemAndEnvironment.AqtyComCompanies="4"
330 }
331 oracle {
332 satisfaction = "true"
333 }
334 test results { pre-protocol = "true" pre-functional = "true" post-functional = "true" }
335 }
336 //-
337 test step instance tsi02: testcase01.ts02oeSetClock{
338 variables {
339 theClock: testcase01.ts02oeSetClock.TheActor = "theClock"
340 ACurrentClock : testcase01.ts02oeSetClock.ACurrentClock= "2017:11:24 - 03:20:00"
341 }
342 oracle {
343 satisfaction = "true"
344 }
345 test results { pre-protocol = "true" pre-functional = "true" post-functional = "true" }
346 }
347 //-
348 test step instance tsi03: testcase01.ts03oeLogin{
349 variables {
350 bill: testcase01.ts03oeLogin.TheActor="bill"
351 AdtLogin : testcase01.ts03oeLogin.AdtLogin= "icrashadmin"
352 AdtEncodedPassword : testcase01.ts03oeLogin.AdtEncodedPassword= " _ t 9 > ; ( "
353 *W!5 YT "
354 }
355 oracle {
356 satisfaction = "true"
357 received message {
358 AMessag : testcase01.ts03oeLogin.AMessage= 'You are logged ! Welcome ...'
359 tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(AMessag)
360 }
361 test results { pre-protocol = "true" pre-functional = "true" post-functional = "true" }
362 }
363 //-
364 test step instance tsi04: testcase01.ts04oeAddCoordinator{
365 variables {
366 reuse tsi03.bill as testcase01.ts04oeAddCoordinator.TheActor
367 AdtCoordinatorID : testcase01.ts04oeAddCoordinator.AdtCoordinatorID = "1"
368 AdtLogin : testcase01.ts04oeAddCoordinator.AdtLogin= "steve"
369 AdtPassword : testcase01.ts04oeAddCoordinator.AdtPassword = "pwdMessirExcalibur2017"
370 AdtPublicKey : testcase01.ts04oeAddCoordinator.AdtPublicKey = "Sun RSA public key, 2048 bits ..."
371 }
372 oracle {
373 satisfaction = "true"
374 received message {
375 tsi03.bill received from system actAdministrator.inactAdministrator.ieCoordinatorAdded()
376 }
377 }
378 test results { pre-protocol = "true" pre-functional = "true" post-functional = "true" }
379 }
380 //-
381 test step instance tsi05: testcase01.ts05oeLogout{
382 variables {
383 reuse tsi03.bill as testcase01.ts05oeLogout.TheActor
384 }
385 oracle {
386 satisfaction = "true"
387 received message {
388 AMessag : testcase01.ts05oeLogout.AMessage= 'You are logged out ! Good Bye ...'
389 tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(AMessag)
390 }

```

```

391     }
392     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
393   }
394 /**
395 test step instance tsi06: testcase01.ts06oeSetClock02{
396   variables {
397     reuse tsi02.theClock as testcase01.ts06oeSetClock02.TheActor
398     ACurrentClock : testcase01.ts06oeSetClock02.ACurrentClock= "2017:11:26 - 10:15:00"
399   }
400   oracle {
401     satisfaction = "true"
402   }
403   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
404 }
405 /**
406 test step instance tsi07: testcase01.ts07oeAlert1{
407   variables {
408     tango:testcase01.ts07oeAlert1.TheActor ="tango"
409     AetHumanKind : testcase01.ts07oeAlert1.AetHumanKind = "witness"
410     AdtDate : testcase01.ts07oeAlert1.AdtDate = "2017:11:26"
411     AdtTime : testcase01.ts07oeAlert1.AdtTime = "10:10:16"
412     AdtPhoneNumber : testcase01.ts07oeAlert1.AdtPhoneNumber = "+3524666445252"
413     AdtGPSLocation : testcase01.ts07oeAlert1.AdtGPSLocation = "49.627675:6.159590"
414     AdtComment : testcase01.ts07oeAlert1.AdtComment = "3 cars involved in an accident."
415   }
416   oracle {
417     satisfaction = "true"
418     received message {
419       AdtSMS : testcase01.ts07oeAlert1.AdtSMS= 'Your alert has been registered. We will handle it and keep you informed'
420       tsi07.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
421     }
422   }
423 }
424   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
425 }
426
427 /**
428 test step instance tsi08: testcase01.ts08oeSetClock03{
429   variables {
430     reuse tsi02.theClock as testcase01.ts08oeSetClock03.ACurrentClock
431     ACurrentClock : testcase01.ts08oeSetClock03.ACurrentClock = "2017:11:26 - 10:30:00"
432   }
433   oracle {
434     satisfaction = "true"
435   }
436   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
437 }
438 /**
439 test step instance tsi09: testcase01.ts09oeSollicitateCrisisHandling{
440   variables {
441     reuse tsi02.theClock as testcase01.ts09oeSollicitateCrisisHandling.TheActor
442     steve:testcase01.ts09oeSollicitateCrisisHandling.TheCoordinator ="steve"
443     reuse tsi03.bill as testcase01.ts09oeSollicitateCrisisHandling.TheAdministrator
444   }
445   oracle {
446     satisfaction = "true"
447     received message {
448       AMessagForCrisisHandlers : testcase01.ts09oeSollicitateCrisisHandling.
449       AMessagForCrisisHandlers= 'There are alerts pending since more than the defined delay. Please REACT !'
450       tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(
451         AMessagForCrisisHandlers)
452       tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(
453         AMessagForCrisisHandlers)
454     }
455   }
456   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
457 }
```

```

456     }
457
458 // -----
459 // -----
460 // -----
461 test case instance instance01Part02: testcase01{
462
463 test step instance tsi10: testcase01.ts10oeLogin02{
464     variables {
465         steve : testcase01.ts10oeLogin02.TheActor
466         AdtLogin : testcase01.ts10oeLogin02.AdtLogin = "steve"
467         AdtEncodedPassword : testcase01.ts10oeLogin02.AdtEncodedPassword= "[B@6979e8cb"
468     }
469     oracle {
470         satisfaction = "true"
471         received message {
472             AMassage : testcase01.ts10oeLogin02.AMassage= 'You are logged ! Welcome ...'
473             steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMassage)
474         }
475     }
476 }
477 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
478 }
479 // -----
480 test step instance tsi11: testcase01.ts11oeGetCrisisSet{
481     variables {
482         reuse tsi10.steve as testcase01.ts11oeGetCrisisSet.TheActor
483         AetCrisisStatus : testcase01.ts11oeGetCrisisSet.AetCrisisStatus = "pending"
484     }
485     oracle {
486         satisfaction = "true"
487         received message {
488             ActCrisis : testcase01.ts11oeGetCrisisSet.ActCrisis= "crisis with ID 1 details"
489             tsi10.steve received from system actCoordinator.inactCoordinator.ieSendACrisis(ActCrisis)
490         }
491     }
492     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
493 }
494 // -----
495 test step instance tsi12: testcase01.ts12oeSetCrisisHandler{
496     variables {
497         reuse tsi10.steve as testcase01.ts12oeSetCrisisHandler.TheActor
498         AdtCrisisID : testcase01.ts12oeSetCrisisHandler.AdtCrisisID = "1"
499         tango : testcase01.ts12oeSetCrisisHandler.TheComCompany
500     }
501     oracle {
502         satisfaction = "true"
503         received message {
504             AMassage : testcase01.ts12oeSetCrisisHandler.AMassage= 'You are now considered as handling the
505             crisis !'
506             AdtSMS : testcase01.ts12oeSetCrisisHandler.AdtSMS= 'The handling of your alert by our services
507             is in progress !'
508             AdtPhoneNumber : testcase01.ts12oeSetCrisisHandler.AdtPhoneNumber= "+3524666445252"
509             tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
510             tsi10.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMassage)
511         }
512     }
513     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
514 }
515 // -----
516 test step instance tsi13: testcase01.ts13oeSetClock04{
517     variables {
518         theClock : testcase01.ts13oeSetClock04.TheActor
519         ACurrentClock : testcase01.ts13oeSetClock04.ACurrentClock = "2017:11:26 - 10:45:00"
520     }
521     oracle {
522         satisfaction = "true"
523     }

```

```

524     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
525   }
526 //-----
527   test step instance tsi14: testcase01.ts14oeValidateAlert{
528     variables {
529       reuse ts10.steve as testcase01.ts14oeValidateAlert.TheActor
530       AdtAlertID : testcase01.ts14oeValidateAlert.AdtAlertID = "1"
531     }
532     oracle {
533       satisfaction = "true"
534       received message {
535         AMessage : testcase01.ts14oeValidateAlert.AMessage= 'The Alert is now declared as valid !'
536         ts10.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
537       }
538     }
539   }
540   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
541 }
542 //-----
543   test step instance tsi15: testcase01.ts15oeAlert2{
544     variables {
545       reuse ts12.tango as testcase01.ts15oeAlert2.TheActor
546       AetHumanKind : testcase01.ts15oeAlert2.AetHumanKind ="witness"
547       AdtDate : testcase01.ts15oeAlert2.AdtDate= "2017:11:26"
548       AdtTime : testcase01.ts15oeAlert2.AdtTime= "10:20:00"
549       AdtPhoneNumber : testcase01.ts15oeAlert2.AdtPhoneNumber= "+3524666445000"
550       AdtGPSLocation : testcase01.ts15oeAlert2.AdtGPSLocation= "49.627095:6.160251"
551       AdtComment : testcase01.ts15oeAlert2.AdtComment= "A car crash just happened."
552     }
553     message {
554       ts12.tango sent to system testcase01.ts15oeAlert2.out : actComCompany.outactComCompany.oeAlert(
555         AetHumanKind,AdtDate,AdtTime,AdtPhoneNumber,AdtGPSLocation,AdtComment)
556     }
557     oracle {
558       satisfaction = "true"
559       received message {
560         AdtSMS : testcase01.ts15oeAlert2.AdtSMS= 'Your alert has been registered. We will handle it and
561         keep you informed'
562         ts12.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
563       }
564     }
565     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
566   }
567 //-----
568   test step instance tsi16: testcase01.ts16oeSetClock05{
569     variables {
570       reuse ts13.theClock as testcase01.ts16oeSetClock05.TheActor
571       ACurrentClock : testcase01.ts16oeSetClock05.ACurrentClock = "2017:11:26 - 12:45:00"
572     }
573     oracle {
574       satisfaction = "true"
575       received message {
576
577     }
578   }
579   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
580 }
581 //-----
582   test step instance tsi17: testcase01.ts17oeSetCrisisStatus{
583     variables {
584       reuse ts10.steve as testcase01.ts17oeSetCrisisStatus.TheActor
585       AdtCrisisID : testcase01.ts17oeSetCrisisStatus.AdtCrisisID = "1"
586       AetCrisisStatus : testcase01.ts17oeSetCrisisStatus.AetCrisisStatus= "solved"
587     }
588     oracle {
589       satisfaction = "true"
590       received message {
591         AMessage : testcase01.ts17oeSetCrisisStatus.AMessage= "The crisis status has been updated !"

```

```

592     tsi10.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
593   }
594 }
595 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
596 }
597 //-----
598 test step instance tsi18: testcase01.ts18oeReportOnCrisis{
599 variables {
600   reuse tsi10.steve as testcase01.ts18oeReportOnCrisis.TheActor
601   AdtCrisisID : testcase01.ts18oeReportOnCrisis.AdtCrisisID = "1"
602   AdtComment : testcase01.ts18oeReportOnCrisis.AdtComment= "3 victims sent to hospital, 2 cars
evacuated and 4 rescue unit mobilized"
603 }
604 oracle {
605   satisfaction = "true"
606   received message {
607     AMessage : testcase01.ts18oeReportOnCrisis.AMessage= 'The crisis comment has been updated !'
608     tsi10.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
609   }
610 }
611 }
612 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
613 }
614 //-----
615 test step instance tsi19: testcase01.ts19oeCloseCrisis{
616 variables {
617   reuse tsi10.steve as testcase01.ts19oeCloseCrisis.TheActor
618   AdtCrisisID : testcase01.ts19oeCloseCrisis.AdtCrisisID = "1"
619 }
620 oracle {
621   satisfaction = "true"
622   received message {
623     AMessage : testcase01.ts19oeCloseCrisis.AMessage= 'The crisis is now closed !'
624   }
625   tsi10.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
626 }
627 }
628 }
629 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
630 }
631
632 }
633 }
634
635 }

```

Listing C.51: Messir Spec. file tci-testcase01-instance01.msr.

## C.52 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 ugAdministateTheSystem
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 instanceof subfunction
52       oeCreateSystemAndEnvironment("4"){}
53   //
54     theClock
55     executed instanceof subfunction
56       oeSetClock("2017:11:24 - 03:20:00"){}
57   //
58     bill
59     executed instanceof subfunction
60       oeLogin("icrashadmin", "[B@6979e8cb"){}
61       ieMessage('You are logged ! Welcome ...') returned to bill
62     }
63   //
64     bill
65     executed instanceof subfunction
66       oeAddCoordinator("1", "steve", "pwdMessirExcalibur2017", "Sun RSA public key, 2048 bits ..."){}
67       ieCoordinatorAddedreturned returned to bill
68     }
69   //
70     bill
71     executed instanceof subfunction
72       oeLogout{
73         ieMessage('You are logged out ! Good Bye ...') returned to bill
74       }
75   //
76     theClock
77     executed instanceof subfunction
78       oeSetClock("2017:11:26 - 10:15:00"){}
79   //
80     tango
81     executed instanceof 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   //

```

```

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", "[B@6979e8cb"]){
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", "[B@6979e8cb"){
191         ieMessage('You are logged ! Welcome ...') returned to bill
192     }
193 //-
194     bill
195     executed instanceof subfunction
196     oeAddCoordinator("1", "steve", "pwdMessirExcalibur2017", "Sun RSA public key, 2048 bits..."){
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
224     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 uciSimpleAndCompletePart02 : 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 //-----
245   steve
246   executed instanceof subfunction
247     oeLogin("steve", "[B@6979e8cb"]){
248       ieMessage('You are logged ! Welcome ...') returned to steve
249     }
250 //-----
251   steve
252   executed instanceof subfunction
253     oeGetCrisisSet("pending"){
254       ieSendACrisis("crisis with ID 1 details") returned to steve
255     }
256 //-----
257   steve
258   executed instanceof subfunction
259     oeSetCrisisHandler("1"){
260       ieSmsSend("+3524666445252", "The handling of your alert by our services is in progress !")
261       returned to tango
262       ieMessage("You are now considered as handling the crisis !")
263       returned to steve
264     }
265 //-----
266   theclock
267   executed instanceof subfunction
268     oeSetClock("2017:11:26 - 10:45:00"){}
269 //-----
270   steve
271   executed instanceof subfunction
272     oeValidateAlert("1"){
273       ieMessage('The Alert is now declared as valid !')
274       returned to steve
275     }
276 //-----
277   tango
278   executed instanceof subfunction
279     oeAlert("witness", "2017:11:26", "10:20:00", "+3524666445000",
280       "49.627095:6.160251", "A car crash just happened."){
281       ieSmsSend("+3524666445000", "Your alert has been registered. We will handle it and keep you
282       informed") returned to tango
283     }
284 //-----
285   theClock
286   executed instanceof subfunction
287     oeSetClock("2017:11:26 - 12:45:00"){}
288 //-----
289   steve
290   executed instanceof subfunction
291     oeSetCrisisStatus("1", "solved"){
292       ieMessage('The crisis status has been updated !')
293       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.52: Messir Spec. file usecase-suDeployAndRun.msr.

### C.53 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.53: Messir Spec. file usecase-suGlobalCrisisHandling.msr.

### C.54 File [./src-gen/messir-spec/usecases/usecase-ugAdministrateTheSystem.msr](#)

```

1 package icrash.usecases.ugAdministrateTheSystem {
```

```

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.54: Messir Spec. file usecase-ugAdministrateTheSystem.msr.

## C.55 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.55: Messir Spec. file usecase-ugManageCrisis.msr.

### C.56 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.56: Messir Spec. file usecase-ugMonitor.msr.

### C.57 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)."
23 }
24 }
25 }
```

Listing C.57: Messir Spec. file usecase-ugSecurelyUseSystem.msr.

### C.58 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 }
```

### C.58. FILE /SRC-GEN.../USECASEINSTANCE-UGSECURELYUSESYSTEM-UCIUGSECURELYUSESYSTEM

```
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 instanceof subfunction
21       oeLogin("icrashadmin", "[B@6979e8cb") {
22         ieMessage('You are logged ! Welcome ...') returned to bill
23     }
24 //-----
25   bill
26     executed instanceof subfunction
27       oeLogout{
28         ieMessage('You are logged out ! Good Bye ...') returned to bill
29     }
30   }
31 }
32 }
33 }
```

Listing C.58: 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/outactActi oeSetClock.pl

```
1 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2 /* DISCONTIGUOUS PREDICATES */
3 :- multifile msrop/4.
4 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5 %-----%
6 msrop(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
27 msrop(outactActivator,
28     oeSetClock,
29     [preFunctional,Self,
30      AcurrentClock
31     ],
32     []):-!
33 /* Pre Functional:*/
34 /* PreF01 */
35 true.
36
37 msrop(outactActivator,
38     oeSetClock,
39     [post,Self,
40      AcurrentClock
41     ],
42     []):-!
```

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```

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-oeSollicitateCrisisHandling.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
6
7msrop(outactActivator,
8    oeSollicitateCrisisHandling,
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    oeSollicitateCrisisHandling,
37    [preFunctional,Self
38   ],
39   []):-!
40/* Pre Functional:*/
41/* PreF01 */
42true.
43
44msrop(outactActivator,
45    oeSollicitateCrisisHandling,
46    [post,Self
47   ],

```

## D.2. FILE /SRC-GEN/PROLOG-REF-SPEC.../OUTACTACTIVATOR-OESOLLICITATECRISISHANDLING.PL

```

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  
65msrNav(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/outactoeAddCoordinator.pl

```

1%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%
5%-----%
6msrop(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
32msrop(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
55msrop(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),

```

#### D.4. FILE /SRC-GEN/PROLOG-REF-SPEC.../OUTACTADMINISTRATOR-OEDELETECOORDINATOR.PL

```

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.

```

```

27
28 msrop(outactAdministrator,
29     oeDeleteCoordinator,
30     [preFunctional,Self,
31      AdtCoordinatorID
32      ],
33      []):-!
34 /* Pre Functional:*/
35 msrVar(ctState,TheSystem),
36 msrVar(actAdministrator,TheActor),
37 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
38 msrNav([Self],[rnActor],[TheActor]),
39
40 /* PreF01 */
41 msrNav([TheSystem],
42     [rnctCoordinator,
43      msrSelect,id,eq,[AdtCoordinatorID]],
44      ColctCoordinators),
45
46 msrNav(ColctCoordinators,
47     [msrSize,eq,[[ptInteger,1]]],
48     [[ptBoolean,true]]).
49
50 msrop(outactAdministrator,
51     oeDeleteCoordinator,
52     [post,Self,
53      AdtCoordinatorID
54      ],
55      []):-!
56
57 /* Post Functional:*/
58 msrVar(ctState,TheSystem),
59 msrVar(actAdministrator,TheActor),
60 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
61 msrNav([Self],[rnActor],[TheActor]),
62
63 /* PostF01 */
64 msrNav([TheSystem],
65     [rnctCoordinator,
66      msrSelect,id,eq,[AdtCoordinatorID]],
67      [ThectCoordinator]),
68
69 msrNav([ThectCoordinator],
70     [rnactCoordinator,msrForAll,msrIsKilled,
71     [[ptBoolean,true]]),
72
73 msrNav([ThectCoordinator],
74     [msrIsKilled,
75     [[ptBoolean,true]]),
76
77 /* PostF02 */
78 msrNav([TheActor],
79     [rnInterfaceIN,
80      ieCoordinatorDeleted,[]
81      ],
82     [[ptBoolean,true]]),
83
84 /* Post Protocol:*/
85 /* PostP01 */
86 true
87 .

```

Listing D.4: Prolog file outactAdministrator-oeDeleteCoordinator.pl.

## D.5 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactAdministrator-oeLogin.pl

## D.5. FILE /SRC-GEN/PROLOG-REF-SPEC/OPERATIONS.../OUTACTAAUTHENTICATED-OELOGIN.PL207

```
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     msrNav([TheactAuthenticated],
92         [rnctAuthenticated,rnInterfaceIN,
93             ieMessage,[AptStringMessageForTheactAdministrator]],
94             [[ptBoolean,true]]))
95 ),
96 /* 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-----
6msrop(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],

```

## D.7 FILE /SRC-GEN/PROLOG-REF-SPEC/OPERATIONS.../OUTACTCOMCOMPANY-OEALERT.PL209

```

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
43 msrVar(ctState,TheSystem),
44 msrVar(actAuthenticated,TheactAuthenticated),
45
46 msrVar(ptString,AptStringMessageForTheactAuthenticated),
47
48/* Post Functional:*/
49 msrNav([Self],[rnActor],[TheactAuthenticated]),
50 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
51
52/* PostF01 */
53 msrNav([AptStringMessageForTheactAuthenticated],
54     [eq,[[ptString,'You are logged out ! Good Bye ...']]],

55     [[ptBoolean,true]]),
56 msrNav([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/outactComCompany-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
```

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```
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  
31 msrop(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  
56 msrop(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,AAlertInstant),  
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),
```

D.7. FILE /SRC-GEN/PROLOG-REF-SPEC/OPERATIONS.../OUTACTCOMCOMPANY-OEALERT.PL211

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```

160   msrNav([ActCrisis],[init,[AdtCrisisID,
161             AdtCrisisType,
162             AetCrisisStatus,
163             AdtGPSLocation,
164             ACrisisInstant,
165             ACrisisdtComment]],,
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
206msrNav([ActHuman],
207           [rnSignaled,msrIncluding,[ActAlert]],
208             ColAlerts),
209
210msrNav([ActHuman],
211           [msmAtPost,rnSignaled],
212             ColAlerts),
213
214 /* PostF06 */
215msrNav([AdtSMS],
216           [value],
217             [[ptString,'Your alert has been registered. We will handle it and keep you informed']])),
218msrNav([TheactComCompany],
219             [rnInterfaceIN,
220               ieSmsSend,[AdtPhoneNumber,
221                           AdtSMS]],[[ptBoolean,true]]),
222
223 /*
224 */
225 /*
226 */
227 /* Post Protocol:*/
228 /* PostP01 */
229 true

```

## D.8. FILE /SRC-GEN/PROLOG-REF-SPEC/OPERATIONS.../OUTACTCOORDINATOR-OECLOSECRISIS.PL

230 .

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

## D.8 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactCo 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    ],
```

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```

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/outact oeGetAlertsSet.pl

```

1%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */  
3:- multifile msrop/4.  
4%%%%%%%%%%%%%%%
5-----  
6msrop(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 */

```

## D.10. FILE /SRC-GEN/PROLOG-REF-SPEC/OPERATIONS.../OUTACTCOORDINATOR-OEGETCRISISSET

```

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 */
36 true
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 */
36 true
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/outac oeInvalidateAlert.pl

```

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

```

## D.11. FILE /SRC-GEN/PROLOG-REF-SPEC.../OUTACTCOORDINATOR-OEINVALIDATEALERT.PL217

```
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-----
6msrop(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
29msrop(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,

```

### D.13. FILE /SRC-GEN/PROLOG-REF-SPEC.../OUTACTCOORDINATOR-OESETCRISISHANDLER.PL219

```

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  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/outactCo oeSetCrisisHandler.pl

```

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

```

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```

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],

```

#### D.14. FILE /SRC-GEN/PROLOG-REF-SPEC.../OUTACTCOORDINATOR-OESETCRISISSTATUS.PL221

```

83      [msmAtPost,status],
84      [[etCrisisStatus,handled]]),
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     [[ptBoolean,true]])
116     )
117 ; true
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/outactCo 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),

```

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```
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     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
58 msrop(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],
```

## D.15. FILE /SRC-GEN/PROLOG-REF-SPEC.../OUTACTCOORDINATOR-OESETCRISISTYPE.PL223

```

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/outactCo 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
58msrop(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/* DISCONTINUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%
5-----
6msrop(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]),

```

D.16. FILE /SRC-GEN/PROLOG-REF-SPEC.../OUTACTCOORDINATOR-OEVALIDATEALERT.PL225

```
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/outactCoordinator-oeCreateSystemAndEnvironment.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5/*
6*****
7MSRCreatorActor
8*****
9
10/*** createSystemAndEnvironment ***/
11
12msrop(outactMsrCreator,
13    oeCreateSystemAndEnvironment,
14    [preFunctional,_Self,_AqtyComCompanies],
15    []):-_
16  true.
17
18msrop(outactMsrCreator,
19    oeCreateSystemAndEnvironment,
20    [preProtocol,_Self,_AqtyComCompanies],
21    []):-_
22  true.
23
24msrop(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
49msrNav([Aclock],
50     [date,year,value],
51     [[ptInteger,1970]]),
52msrNav([Aclock],
53     [date,month,value],
54     [[ptInteger,01]]),

```

D.17. FILE /SRC-GEN.../OUTACTMSRCREATOR-OECREATESYSTEMANDENVIRONMENT.PL227

```
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,[],[[[ptBoolean,true]]]),
95
96
97 /* PostF03 */
98 msrVarCol(actComCompany,AqtyComCompanies,AactComCompanyCol),
99
100 msrNav(AactComCompanyCol,
101    [msrForAll,init,[],[[[ptBoolean,true]]]),
102
103
104 /* PostF04*/
105 msrNav([AactAdministrator],
106    [init,[],[[[ptBoolean,true]]]),
107
108
109 /* PostF05*/
110 msrVar(actActivator,AactActivator),
111 msrNav([AactActivator],
112    [init,[],[[[ptBoolean,true]]]),
113
114
115/* PostF06 */
116 msrVar(ctAdministrator,ActAdministrator),
117 msrVar(dtLogin,AdtLogin),
118 msrVar(dtPassword,AdtPassword),
119
120 msrNav([AdtLogin],
121    [value,eq,[[[ptString,'icrashadmin']]],[[ptBoolean,true]]),
122
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  

6msrop(ctAdministrator,init,[Self,  

7           Alogin,  

8           Apwd],  

9           Result):-  

10( 11msrVar(ctAdministrator,Self),  

12  

13/* Post F01 */  

14msrNav([Self],[login],[Alogin]),  

15msrNav([Self],[pwd],[Apwd]),  

16msrNav([Self],[vpIsLogged],[[ptBoolean,false]]),  

17  

18/* Post F02 */  

19msrNav([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  

6msrop(ctAlert,init,[Self,  

7           Aid,  

8           Astatus,  

9           Alocation,  

10          Ainstant,  

11          Acomment],  

12           Result):-  

13  

14/* Post F01 */  

15(

```

## D.20. FILE /SRC-GEN.../PRIMARYTYPESCLASSES-CTALERT-ISSENTTOCOORDINATOR.PL229

```

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/PrimaryTypesC 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/PrimaryTypesC tCrisis-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,[]],

```

#### D.24. FILE /SRC-GEN/PROLOG-REF-SPEC.../PRIMARYTYPESCLASSES-CTCRISIS-INIT.PL231

```

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   Alocation,
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],[Alocation]),
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):-
```

```

8(
9  msrVar(ctState,TheSystem),
10 msrNav([Self],[rnSystem],[TheSystem]),
11
12 msrVar(actCoordinator,TheCoordinatorActor),
13 msrVar(ctCoordinator,TheCoordinator),
14 msrVar(ptString,TheMessage),
15 msrVar(ptString,TheCrisisIDptString),
16
17 (
18 /* Post F01 */
19 msrNav([Self],
20     [maxHandlingDelayPassed,[],[[ptBoolean,true]]),
21
22 ( msrNav([TheSystem],
23     [rnactCoordinator,msrIsEmpty],
24     [[ptBoolean,false]])
25 -> (
26     /* Post F02 */
27     msrNav([TheSystem],
28         [rnactCoordinator,msrAny,msrTrue],
29         [TheCoordinatorActor]),
30
31     msrNav([TheCoordinatorActor],
32         [rnctCoordinator],
33         [TheCoordinator]),
34
35     msrNav([Self],
36         [msmAtPost,rnHandler],
37         [TheCoordinator]),
38
39     msrNav([Self],
40         [msmAtPost,status],
41         [[etCrisisStatus,handled]]),
42
43     msrNav([Self],
44         [id,value],
45         [TheCrisisIDptString]),
46
47     msrNav([[ptString,'You are now considered as handling the crisis having ID: ']],
48         [ptStringConcat,[TheCrisisIDptString]],
49         [TheMessage]),
50
51     msrNav([TheCoordinatorActor],
52         [rnInterfaceIN,
53         ieMessage,[TheMessage]
54         ],
55         [[ptBoolean,true]]))
56   )
57 )
58 ; ( /* Post F03 */
59   msrNav([TheSystem],
60     [rnactAdministrator,msrForAll,rnInterfaceIN,
61     ieMessage,[[ptString,'Please add new coordinators to handle pending crisis !']]],
62     [[ptBoolean,true]])
63 )
64 )
65 )
66 )
67-> Result = [ptBoolean,true]
68 ; Result = [ptBoolean,false]
69 .

```

Listing D.25: Prolog file PrimaryTypesClasses-ctCrisis-isAllocatedIfPossible.pl.

## D.26 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesC ctCrisis-isSentToCoordinator.pl

## D.27. FILE /SRC-GEN.../PRIMARYTYPESCLASSES-CTCRISIS-MAXHANDLINGDELAYPASSED.PL233

```

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.

```

D.31. FILE /SRC-GEN/PROLOG-REF-SPEC.../PRIMARYTYPESDATATYPES-DTALERTID-IS.PL235

```

1%%%%%%%
2
3msrop(ctState,init,[Self,
4                      AnextValueForAlertID,
5                      AnextValueForCrisisID,
6                      Aclock,
7                      AcrisisReminderPeriod,
8                      AmaxCrisisReminderPeriod,
9                      AvpLastReminder,
10                     AvpStarted],
11                     Result):- 
12
13 /* Post F01 */
14 (
15
16 msrVar(ctState,Self),
17
18 msrNav([Self],[nextValueForAlertID],[AnextValueForAlertID]),
19 msrNav([Self],[nextValueForCrisisID],[AnextValueForCrisisID]),
20 msrNav([Self],[clock],[Aclock]),
21 msrNav([Self],[crisisReminderPeriod],[AcrisisReminderPeriod]),
22 msrNav([Self],[maxCrisisReminderPeriod],[AmaxCrisisReminderPeriod]),
23 msrNav([Self],[vpLastReminder],[AvpLastReminder]),
24 msrNav([Self],[vpStarted],[AvpStarted]),
25
26 msrNav([Self],[msrIsNew],[Self])
27
28
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/PrimaryTypesData  
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 ),
20 TheResult = 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]).
```

Listing D.31: Prolog file PrimaryTypesDatatypes-dtAlertID-is.pl.

D.32 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDtComment-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/PrimaryTypesIDtCoordinatorID-is.pl

```
1 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
2 /* DISCONTIGUOUS PREDICATES */
3 :- multifile msrop/4.
4 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
5
6 msrop(dtCoordinatorID,js,[AdtValue],Result):-
```

```
7% msd01
8 msrVar(ptBoolean, TheResult),
9(
10 ( msrNav([AdtValue],
11   [value,length,[],gt,[[ptInteger,0]]]),
12   [[ptBoolean,true]]),
13 msrNav([AdtValue],
14   [value,length,[],leq,[[ptInteger,5]]]),
15   [[ptBoolean,true]])
16 )
17 -> (TheResult = [ptBoolean,true])
18 ; (TheResult = [ptBoolean,false])
19 ),
20 TheResult = Result
21 .
```

Listing D.33: Prolog file PrimaryTypesDatatypes-dtCoordinatorID-is.pl.

D.34 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesData  
dtCrisisID-is.pl

```

1%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%
5
6msrop(dtCrisisID,is,[AdtValue],Result):-
7% msd01
8 msrVar(ptBoolean,TheResult),
9(
10 ( msrNav([AdtValue],
11   [value,length,[],gt,[[ptInteger,0]]],
12   [[ptBoolean,true]]),
13 msrNav([AdtValue],
14   [value,length,[],leq,[[ptInteger,10]]],
15   [[ptBoolean,true]])
16 )
17 -> (TheResult = [ptBoolean,true])
18 ; (TheResult = [ptBoolean,false])
19),
20 TheResult = Result
21.
22/*
23| ?- X = [dtCrisisID,[],[[dtString,[[value,[ptString,'0123456789']]]],[],[],[]]],  

24msrNav([X],[is,[],[Result]).  

25X = [dtCrisisID,[],[[dtString,[[value,[ptString,'0123456789']]]],[],[],[]]],  

26Result = [ptBoolean,true] ?  

27yes  

28
29| ?- X = [dtCrisisID,[],[[dtString,[[value,[ptString,'0123456789a']]]],[],[],[]]],  

30msrNav([X],[is,[],[Result]).  

31X = [dtCrisisID,[],[[dtString,[[value,[ptString,'0123456789a']]]],[],[],[]]],  

32Result = [ptBoolean,false] ?  

33yes  

34*/

```

Listing D.34: Prolog file PrimaryTypesDatatypes-dtCrisisID-is.pl.

D.35 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesData  
dtGPSLocation-is.pl

```
1%-----  
2/* DISCONTIGUOUS PREDICATES */  
3:- multifile msrop/4.  
4%-----  
5
```

```

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/PrimaryTypesDtGPSLocation-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]])

```

### D.37. FILE /SRC-GEN/PROLOG-REF-SPEC.../PRIMARYTYPESDATATYPES-DTLATITUDE-IS.PL239

```
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/PrimaryTypesData 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/PrimaryTypesData 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/PrimaryTypesDtLongitude-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/PrimaryTypesDtPassword-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]

```

#### D.41. FILE /SRC-GEN/PROLOG-REF-SPEC.../PRIMARYTYPESDATATYPES-DTPHONENUMBER-IS.PL24

```
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/PrimaryTypesData 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/PrimaryTypesClass etAlertStatus-is.pl

```
1%%%%%%%%%%%%%
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/PrimaryTypesC 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/PrimaryTypesC 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

```

#### D.45. FILE /SRC-GEN/PROLOG-REF-SPEC.../PRIMARYTYPESDATATYPES-ETHUMANKIND-IS.PL243

19.

Listing D.44: Prolog file PrimaryTypesDatatypes-etCrisisType-is.pl.

#### D.45 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClass 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),
18 Result = TheResult
19.
```

Listing D.45: Prolog file PrimaryTypesDatatypes-etHumanKind-is.pl.

#### D.46 File ./src-gen/prolog-ref-spec/Operations/Concepts/SecondaryTypesDa 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),
23 Result = TheResult
24.
```

Listing D.46: Prolog file SecondaryTypesDatatypes-dtSMS-is.pl.



# Glossary

<b><i>abstract actor</i></b> an actor that is not . . . . .	22
<b><i>actor</i></b> An actor is a person, organization, or external system that plays a role in one or more interactions with the system . . . . .	18
<b><i>direct actor</i></b> an actor that interacts directly with the system. It thus belongs to the environment.	22
<b><i>indirect actor</i></b> an actor that interacts indirectly with the system through a direct actor. It thus belongs the domain but not to the environment. . . . .	22
<b><i>system operation</i></b> a functionality of the system that can be triggered by a message sent by an actor belonging to the environment. . . . .	18



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