



iCrash :
A Crisis Management Case Study
MESSIR Analysis Document
- v 1.4 -

(Report type: Simulation)

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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 ???. The ***iCrash*** concepts used to represent the any persistent or transient information is given in Section ???. 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 ???.

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 ??, 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 a informal introduction to the **Messir** 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 **Messir** 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 actors¹:

- `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 **Messir** 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.

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

USE-CASE DESCRIPTION	
<i>Name</i>	suDeployAndRun
<i>Scope</i>	system
<i>Level</i>	summary
Primary actor(s)	
1	actAdministrator [active]
Secondary actor(s)	
1	actMsrCreator [active]
2	actCoordinator [active, multiple]
3	actActivator [proactive]
4	actComCompany [active]
Goal(s) description	
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.	
Reuse	
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>
Protocol condition(s)	
1	the iCrash system has never been deployed and used
Pre-condition(s)	
1	none
Main post-condition(s)	
1	the iCrash system has been created and has handled the crisis situations for which it received alerts through the communication company.
Main Steps	
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
Steps Ordering Constraints	
1	step (a) must be always the first step.
2	step (f) can be executed by different actCoordinator actors.
3	if (e) then previously (d).

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

2.3.1.2 summary-suGlobalCrisisHandling

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

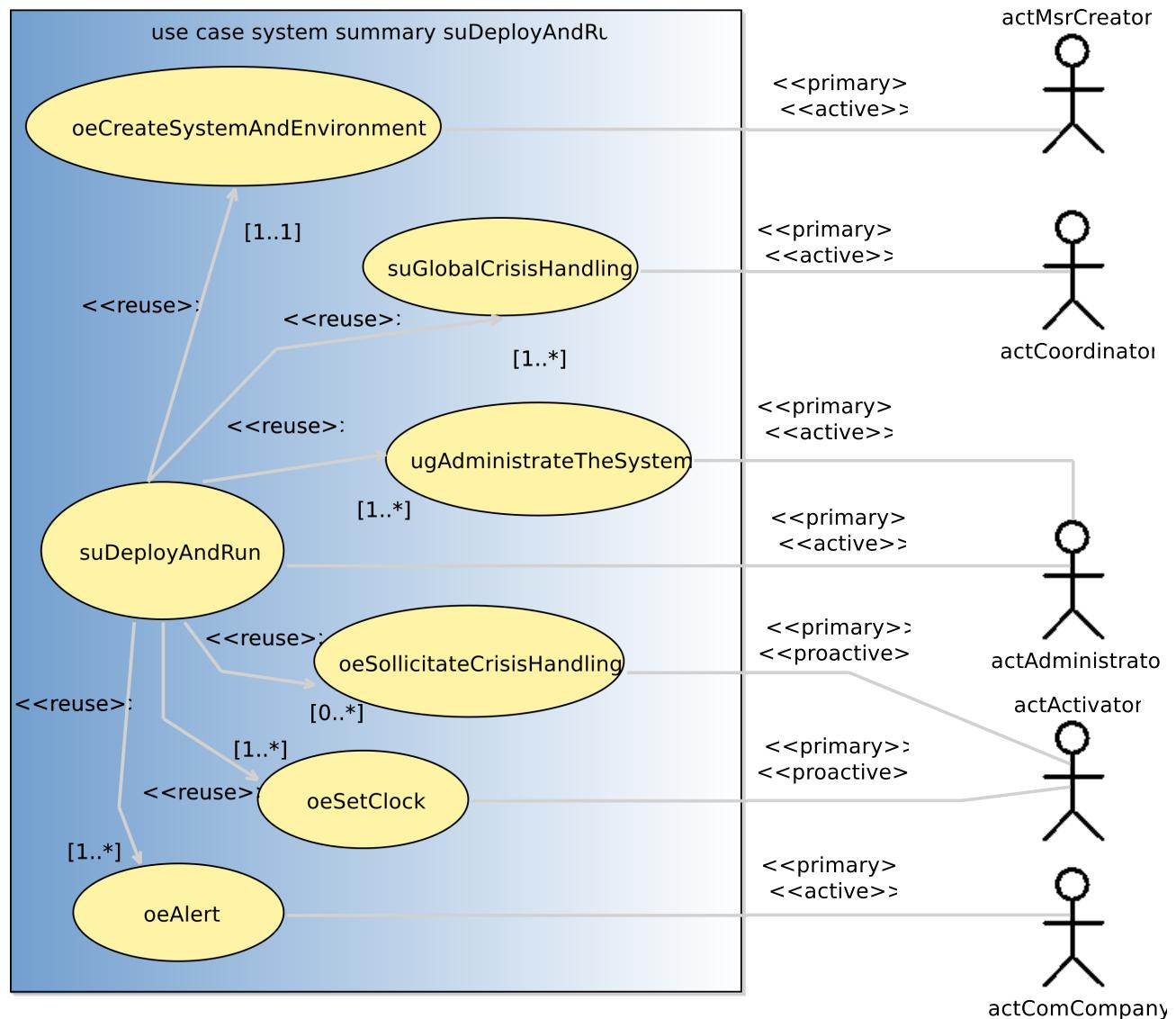


Figure 2.1: suDeployAndRun summary use case

USE-CASE DESCRIPTION	
<i>Name</i>	suGlobalCrisisHandling
<i>Scope</i>	system
<i>Level</i>	summary
Primary actor(s)	
1	actCoordinator [active]
Goal(s) description	
the actCoordinator's goal is to monitor the alerts received and the corresponding crisis in order to act as necessary to handle the crisis.	
Reuse	
1	ugSecurelyUseSystem [1..*]
2	ugMonitor [1..*]
3	ugManageCrisis [1..*]
Protocol condition(s)	
1	the iCrash system has been deployed
2	the coordinator actor involved in the use case has been declared by the actor actAdministrator
Pre-condition(s)	
1	none
Main post-condition(s)	
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.
Main Steps	
a	the actor actCoordinator executes the ugSecurelyUseSystem use case
b	the actor actCoordinator executes the ugMonitor use case
c	the actor actCoordinator executes the ugManageCrisis use case
Steps Ordering Constraints	
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.

USE-CASE DESCRIPTION	
<i>Name</i>	ugAdministateTheSystem
<i>Scope</i>	system
<i>Level</i>	usergoal
Primary actor(s)	
1	actAdministrator [active]
Goal(s) description	
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

Reuse
1 <u>ugSecurelyUseSystem [1..*]</u>
2 <u>oeAddCoordinator [1..*]</u>
3 <u>oeDeleteCoordinator [0..*]</u>
Protocol condition(s)
1 the iCrash system has been deployed
Pre-condition(s)
1 none
Main post-condition(s)
1 modifications have been made to the system and its environment concerning existing or new coordinators.
Main Steps
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
Steps Ordering Constraints
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
Primary actor(s)	
1	<code>actCoordinator[active]</code>
Goal(s) description	
The goal is to do an action that makes the handling of a crisis or an alert progress.	
Reuse	
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>
Protocol condition(s)	
1	the iCrash system has been deployed
Pre-condition(s)	
1	none
Main post-condition(s)	

continues in next page ...

... Use-Case Description table continuation

1	there exist one alert or one crisis whose related information has been changed.
Main Steps	
a	the actor actCoordinator executes the <u>oeValidateAlert</u> use case
b	the actor actCoordinator executes the <u>oeSetCrisisStatus</u> use case
c	the actor actCoordinator executes the <u>oeSetCrisisHandler</u> use case
d	the actor actCoordinator executes the <u>oeReportOnCrisis</u> use case
e	the actor actCoordinator executes the <u>oeCloseCrisis</u> use case
f	the actor actCoordinator executes the <u>oeInvalidateAlert</u> use case
Steps Ordering Constraints	
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
Primary actor(s)	
1	actCoordinator[active]
Goal(s) description	
the actCoordinator's goal is to get the detailed list of existing crisis or alerts to decide on next actions to undertake.	
Reuse	
1	<u>oeGetCrisisSet</u> [0..*]
2	<u>oeGetAlertsSet</u> [0..*]
Protocol condition(s)	
1	the iCrash system has been deployed
Pre-condition(s)	
1	none
Main post-condition(s)	
1	none
Main Steps	
a	the actor actCoordinator executes the <u>oeGetAlertsSet</u> use case
b	the actor actCoordinator executes the <u>oeGetCrisisSet</u> use case

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

2.3.1.6 usergoal-ugSecurelyUseSystem

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

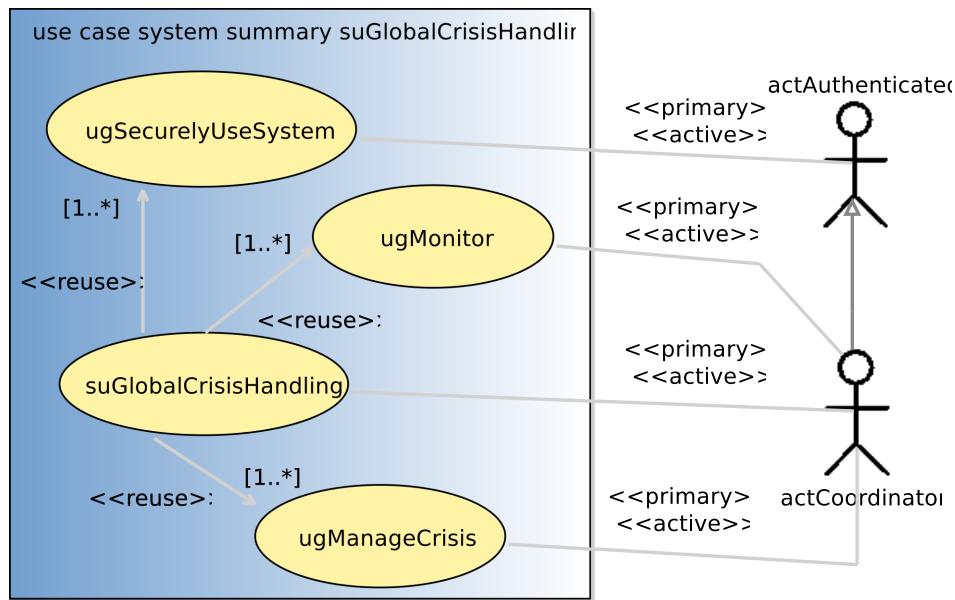


Figure 2.2: suGlobalCrisisHandling user goal use case

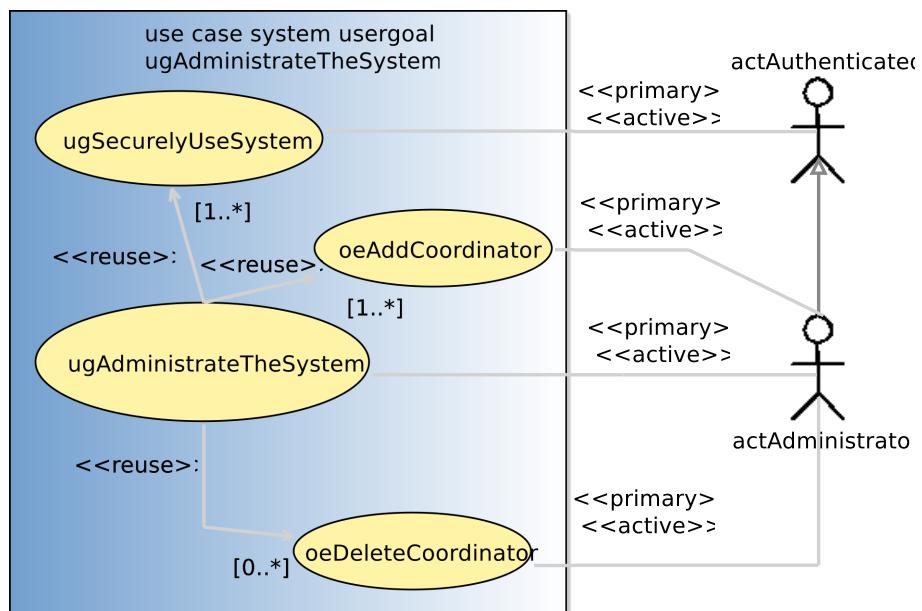


Figure 2.3: ugAdministateTheSystem user goal use case

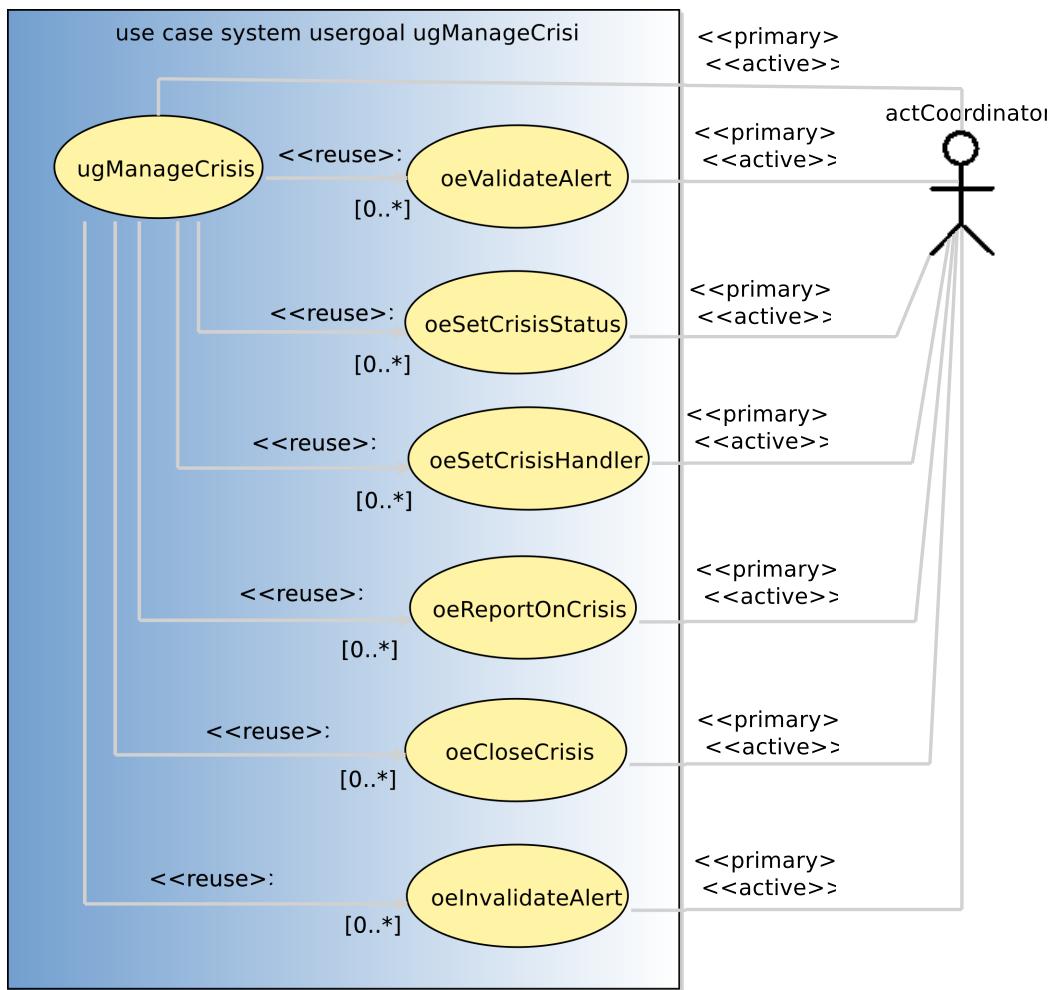


Figure 2.4: ugManageCrisi user goal use case

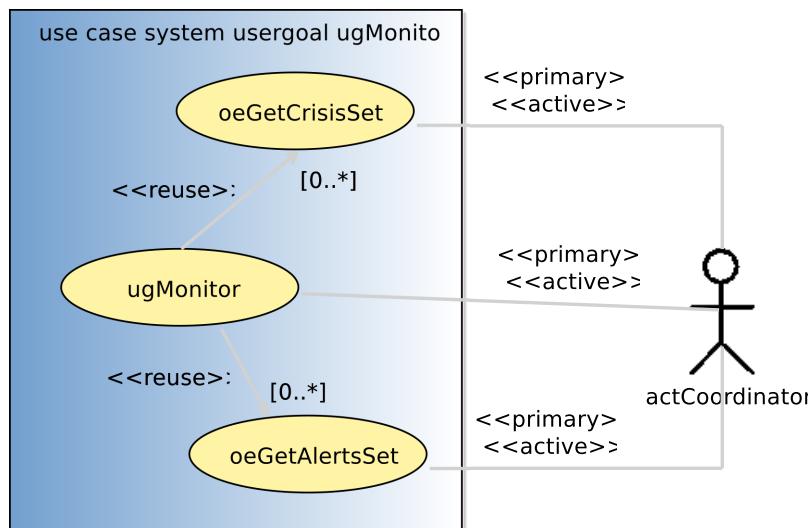


Figure 2.5: ugMonitor user goal use case

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	oeLogin [1..1]
2	oeLogout [1..1]
<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 actAuthenticated executes the oeLogin use case
b	the actor actAuthenticated executes the oeLogout 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

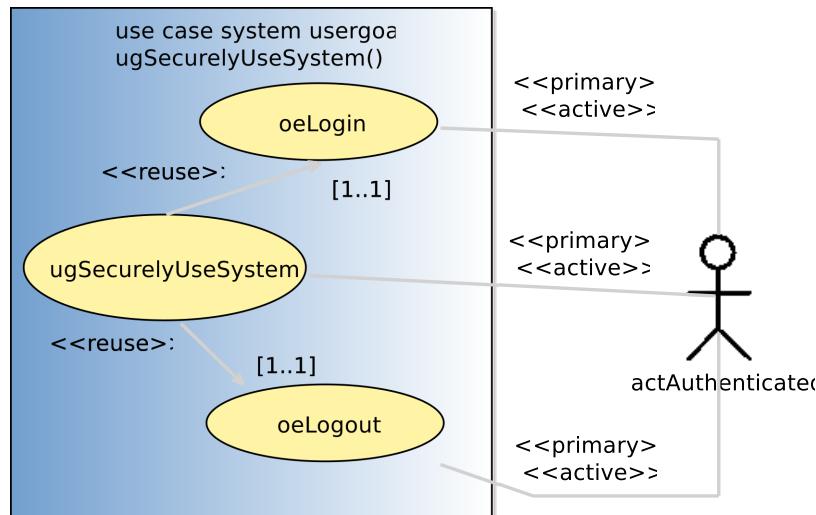


Figure 2.6: ugSecurelyUseSystem user goal use case

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

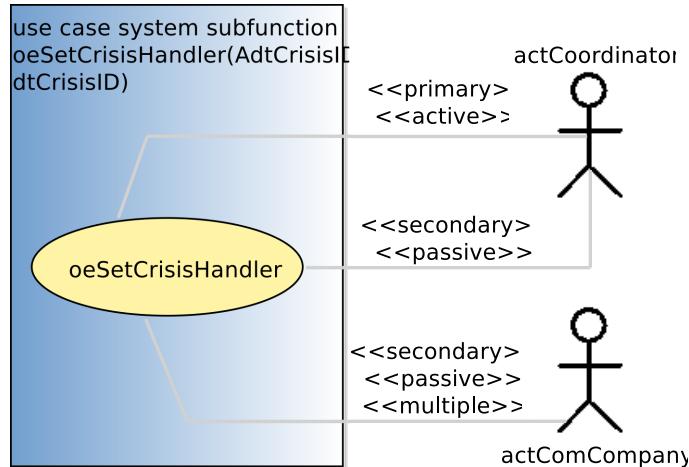


Figure 2.7: oeSetCrisisHandler subfunction use case

2.3.1.8 subfunction-oeSollicitateCrisisHandling

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

USE-CASE DESCRIPTION	
Name	oeSollicitateCrisisHandling
Scope	system
Level	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

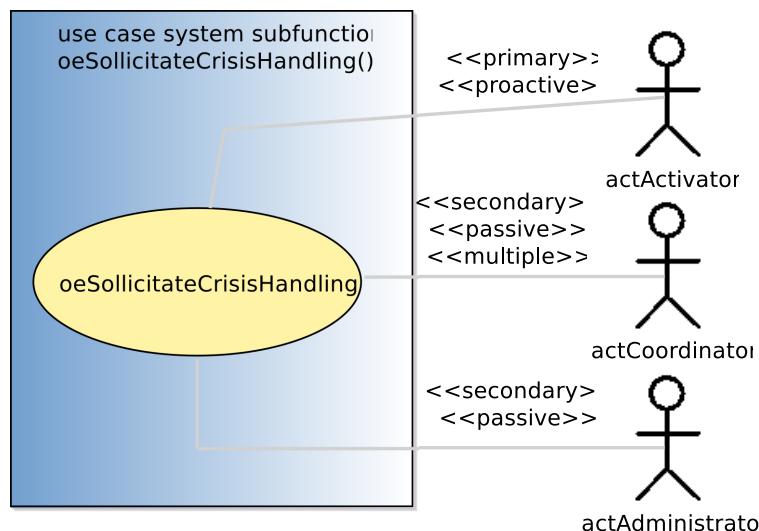


Figure 2.8: oeSollicitateCrisisHandling subfunction use case

2.3.2 Use Case Instance(s)

2.3.2.1 Use-Case Instance - uciSimpleAndCompletePart01:suDeployAndRun

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

SUMMARY USE-CASE INSTANCE	
<i>Instantiated Use Case</i>	
<code>suDeployAndRun</code>	
<i>Instance ID</i>	
<code>uciSimpleAndCompletePart01</code>	
<i>Remarks</i>	
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 sollicitation of crisis handling.
e	this first part stops before the coordinator logs in the system.

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

2.3.2.2 Use-Case Instance - uciSimpleAndCompletePart02:suDeployAndRun

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

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

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

2.3.2.3 Use-Case Instance - uciugSecurelyUseSystem:ugSecurelyUseSystem

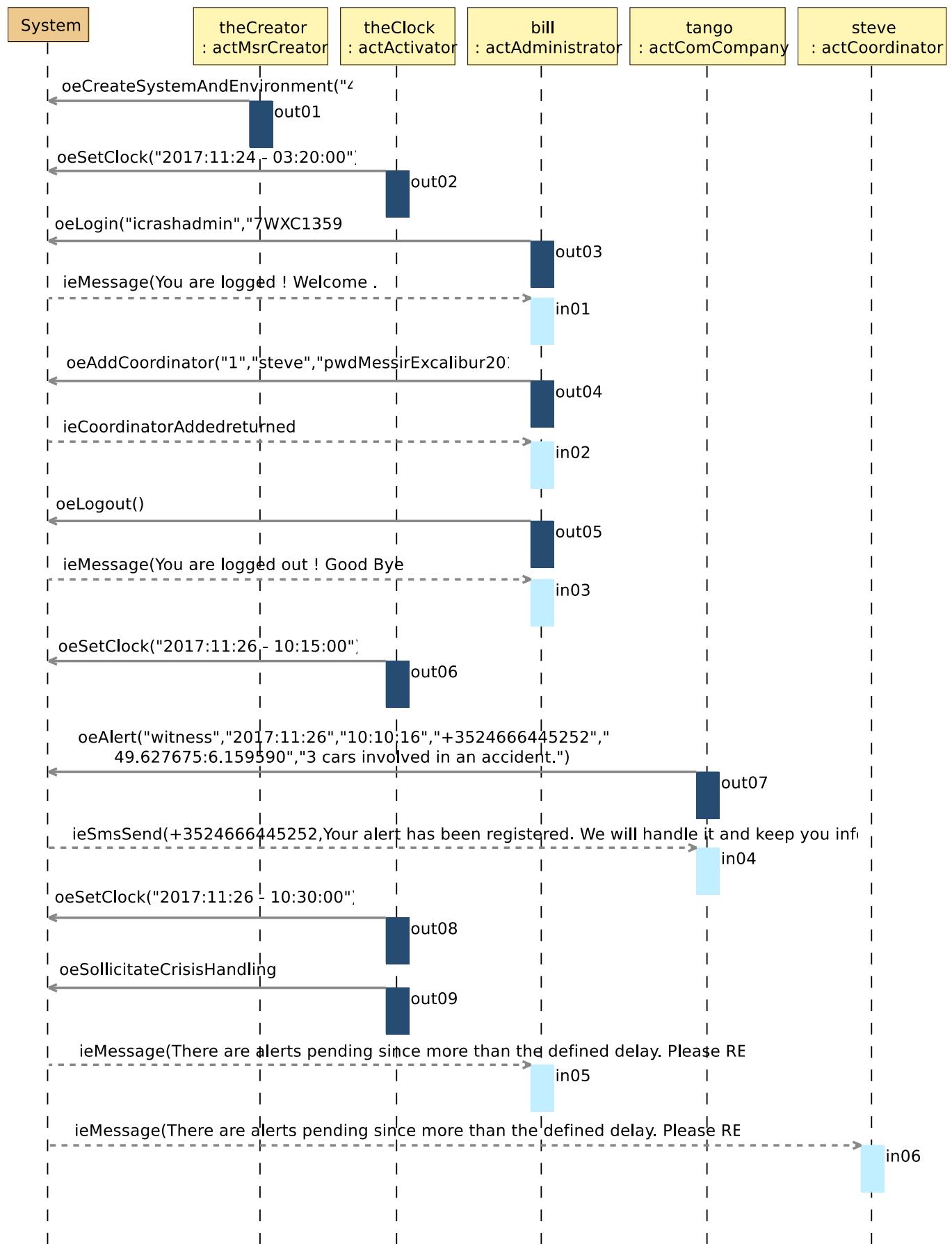


Figure 2.9: uci-suDeployAndRun-uciSimpleAndComplete-Part01

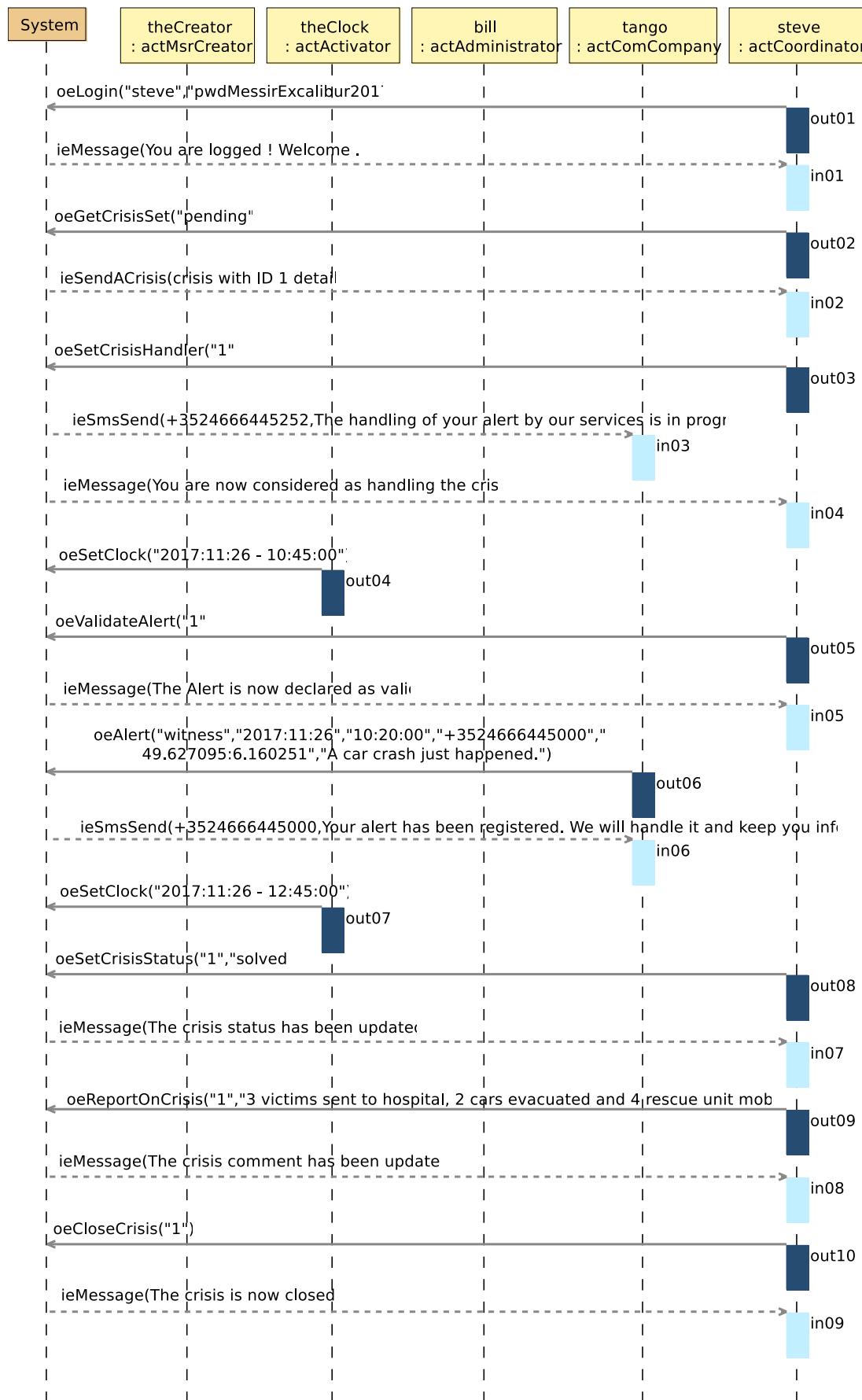


Figure 2.10: uci-suDeployAndRun-uciSimpleAndComplete-Part02 use case instance sequence diagram

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

Figure 2.11

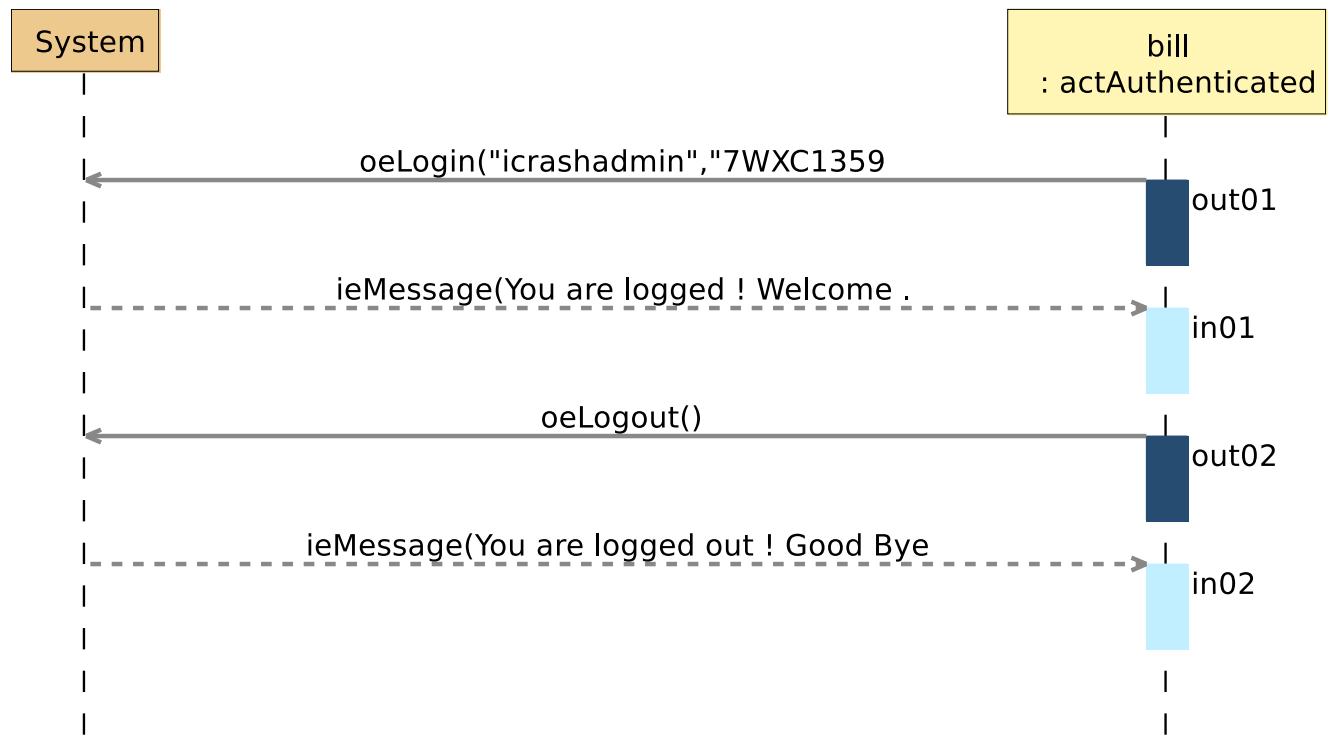


Figure 2.11:

Chapter 3

Environment Model

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

3.1 Local view 01

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

3.2 Local view 02

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

3.3 Local view 03

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

3.4 Local view 04

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

3.5 Local view 05

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

3.6 Global view 01

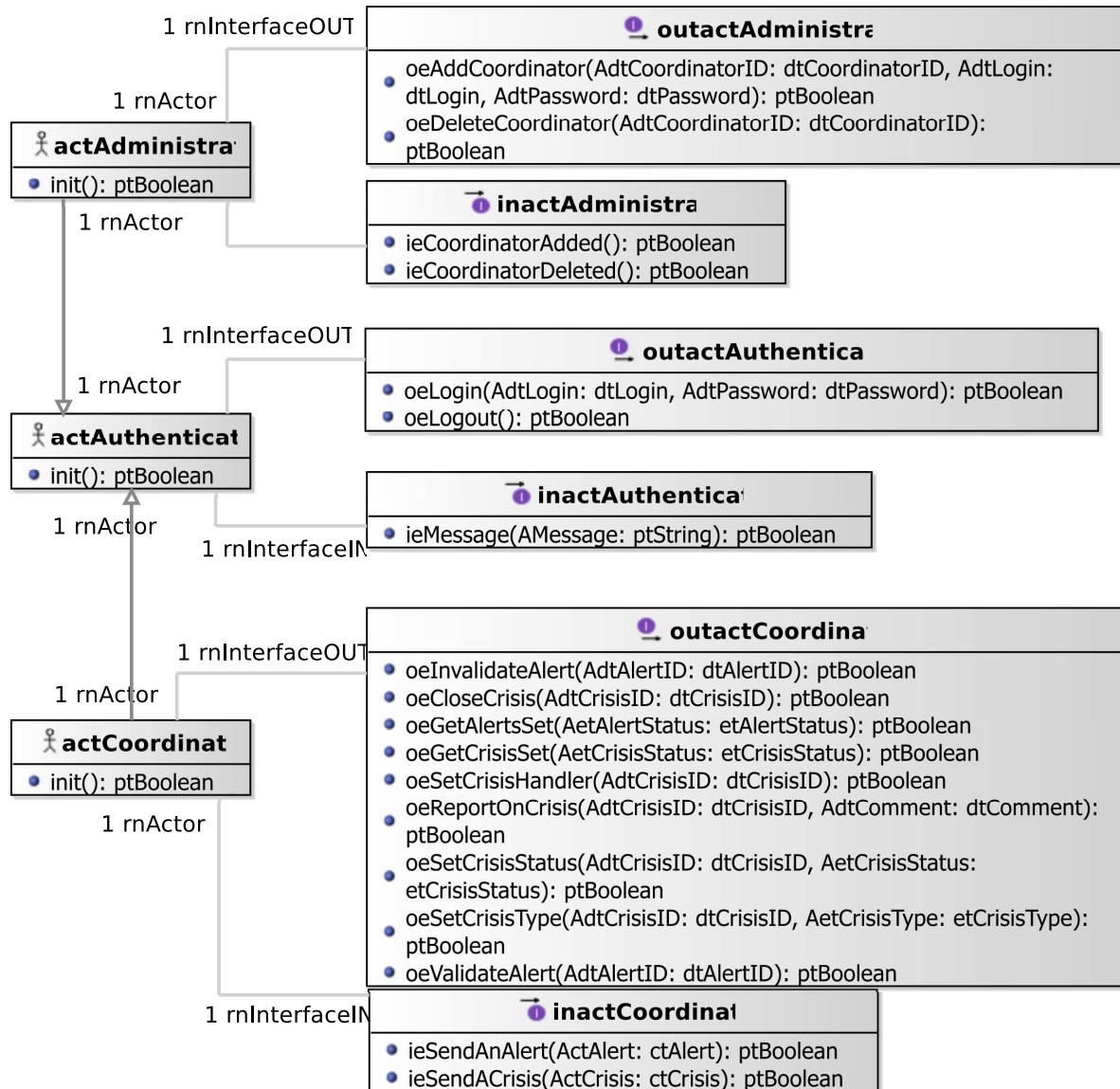


Figure 3.1: Environment Model - Local View 01. environment model local view - Part 1.

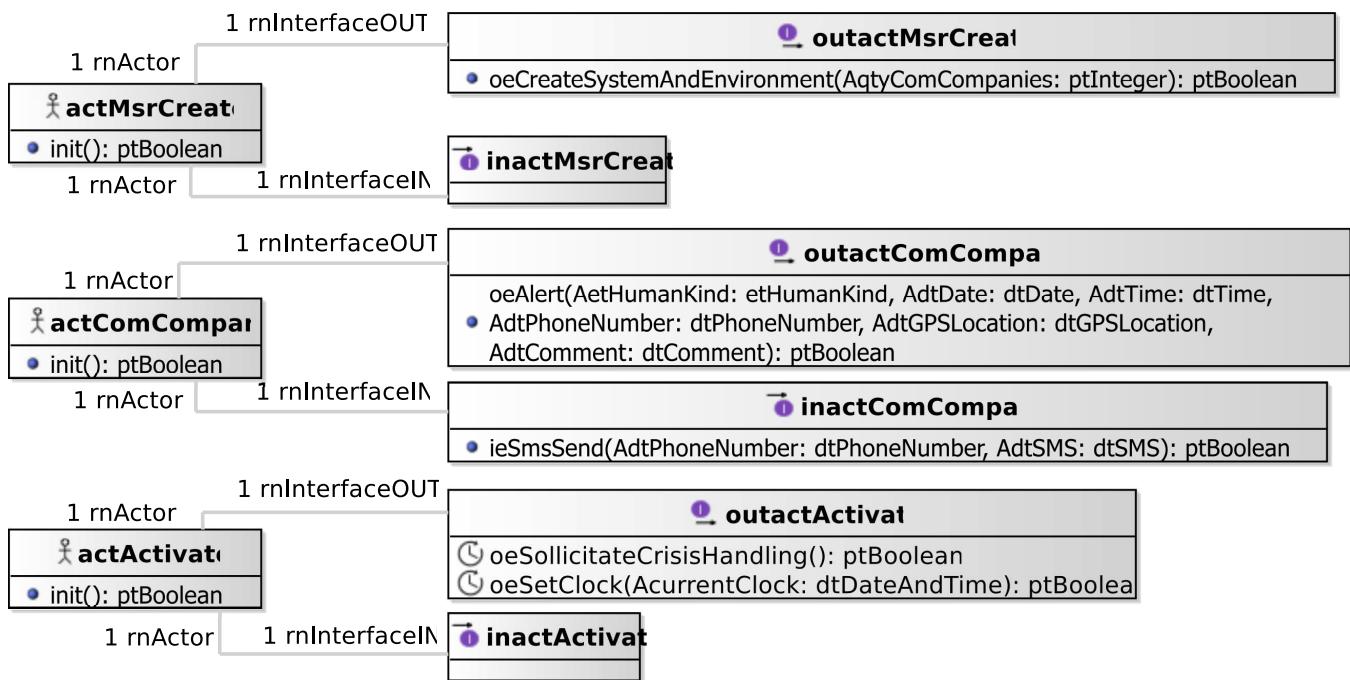


Figure 3.2: Environment Model - Local View 02. environment model local view - Part 2.

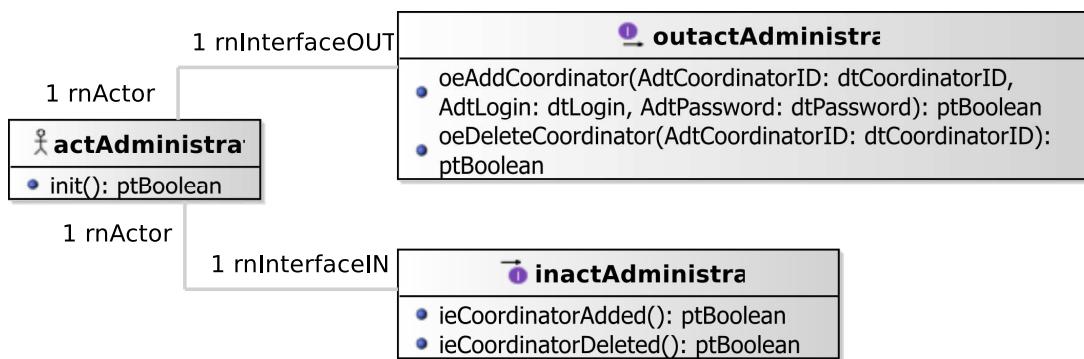


Figure 3.3: Environment Model - Local View 03. administrator actor environment model view.

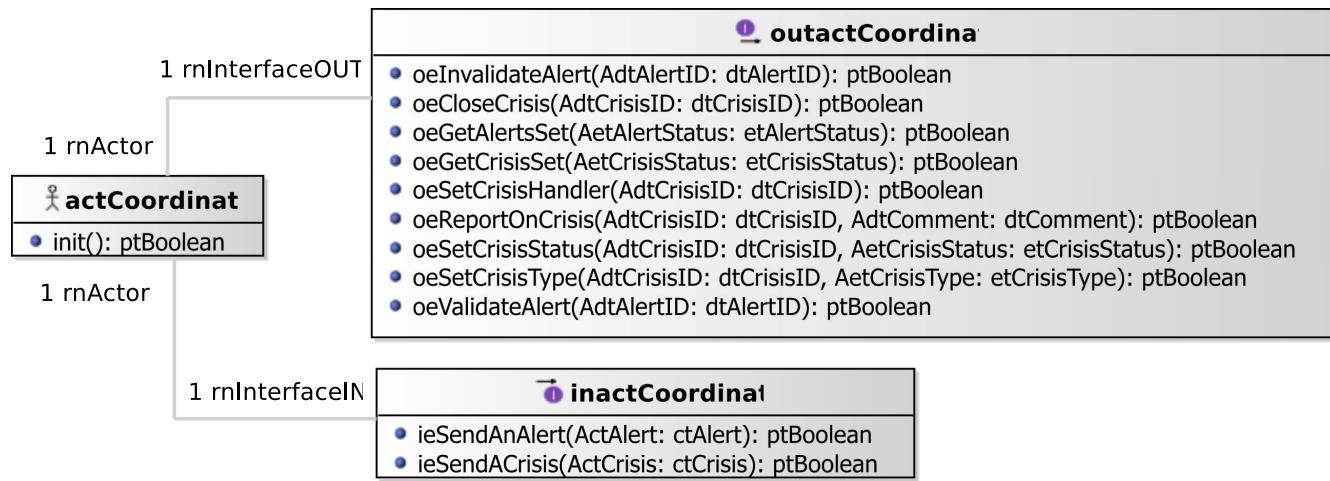


Figure 3.4: Environment Model - Local View 04. coordinator actor environment model view.

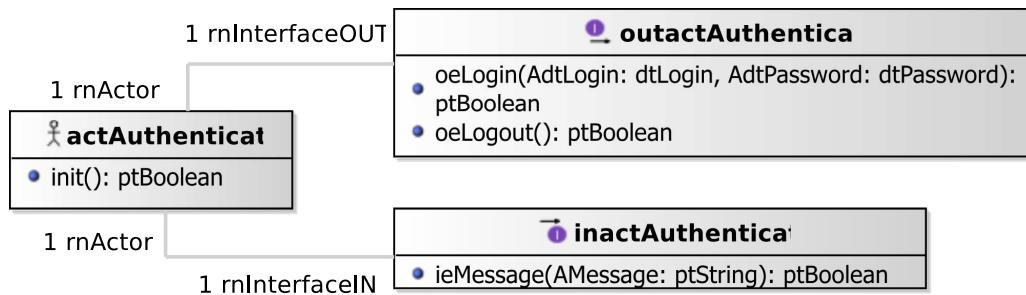


Figure 3.5: Environment Model - Local View 05. authenticated actor environment model local view.

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

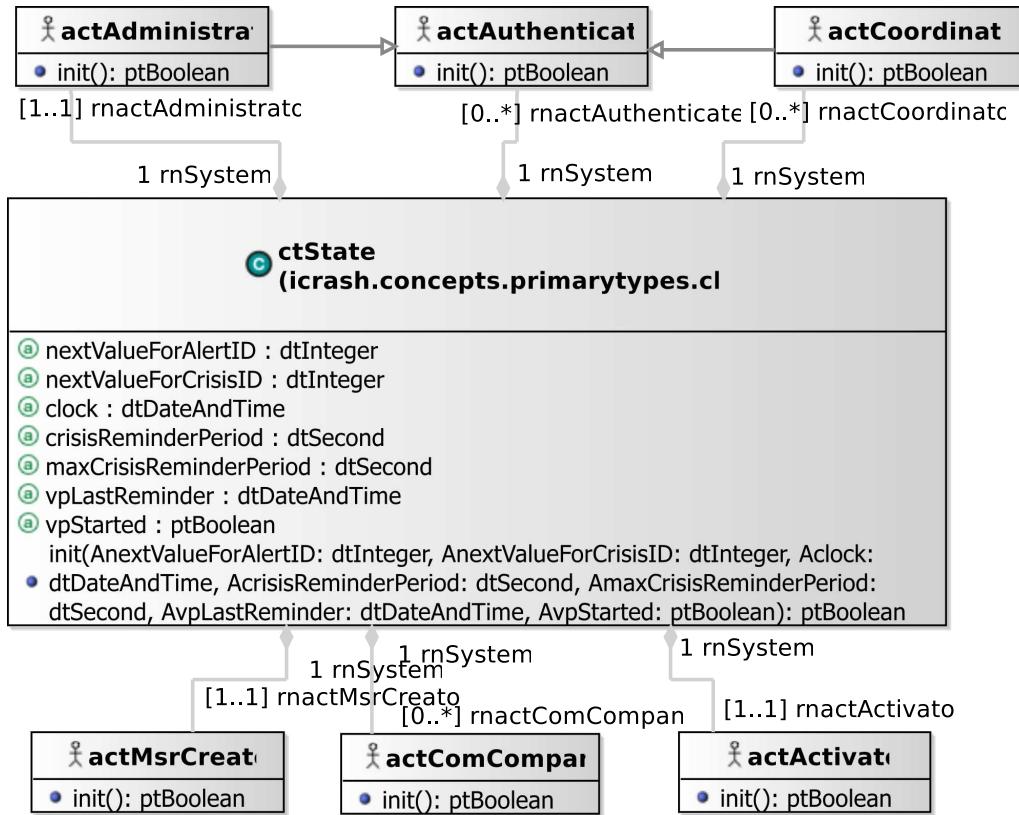


Figure 3.6: Environment Model - Global View 01. em-gv-01 environment model global view.

3.7 Actors and Interfaces Descriptions

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

3.7.1 **actActivator** Actor

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

3.7.2 **actAdministrator** Actor

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

3.7.3 **actAuthenticated** Actor

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

3.7.4 **actComCompany** Actor

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

...Actor table continuation

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

3.7.5 actCoordinator Actor

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

3.7.6 actMsrCreator Actor

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

Chapter 4

Concept Model

4.1 PrimaryTypes-Classes

4.1.1 Local view 01

Figure 4.1 shows the local view on all the primary types class types.

4.1.2 Local view 02

Figure 4.2 shows the local view of the ctState primary type class type.

4.1.3 Local view 03

Figure 4.3 shows the local view of the ctAlert primary type class type.

4.1.4 Local view 04

Figure 4.4 shows the local view of the ctCrisis primary type class type.

4.1.5 Global view 01

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

4.2 PrimaryTypes-Datatypes

4.2.1 Local view 06

Figure 4.6

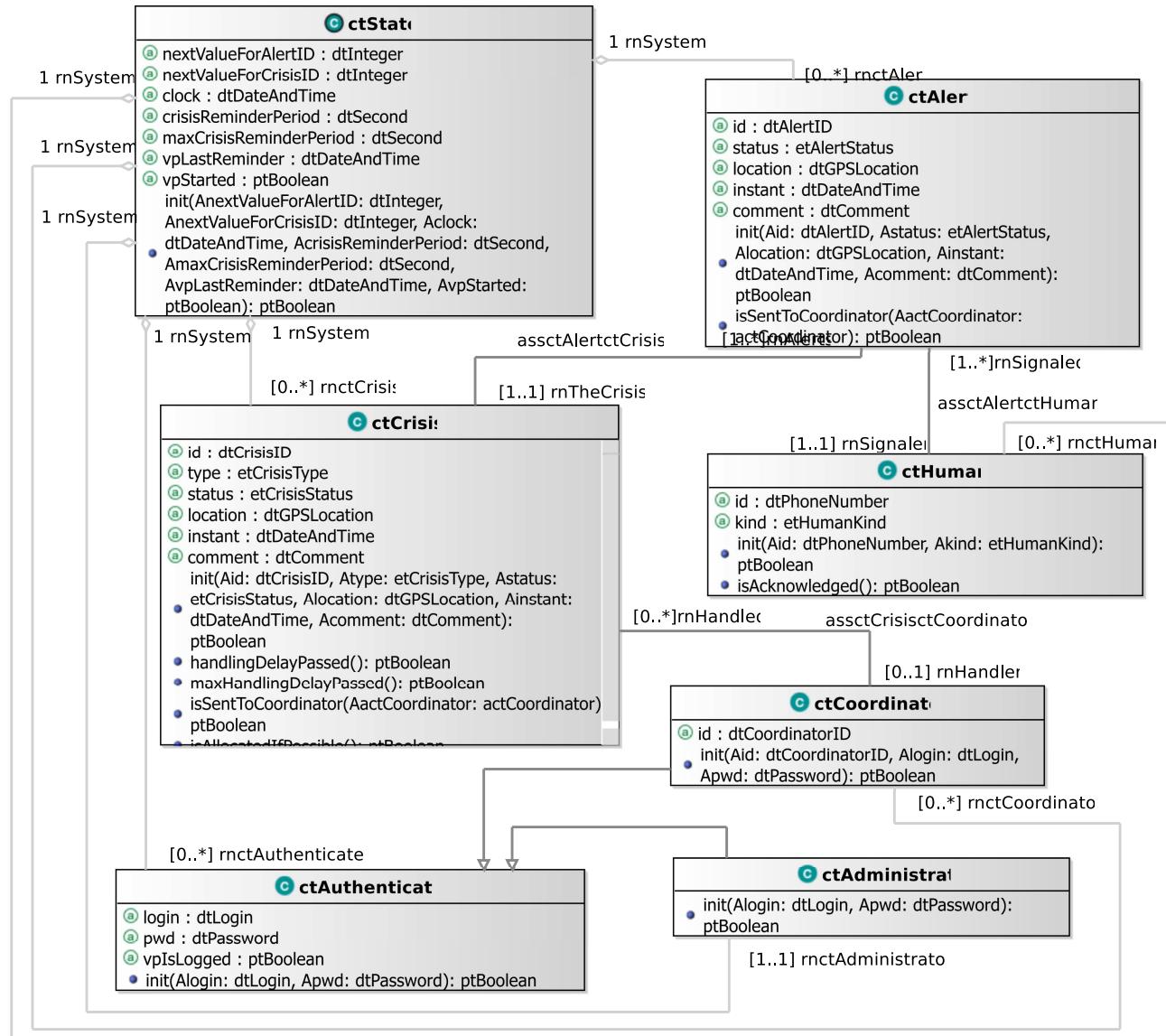


Figure 4.1: Concept Model - PrimaryTypes-Classes local view 01. Local view of all the primary types class types .

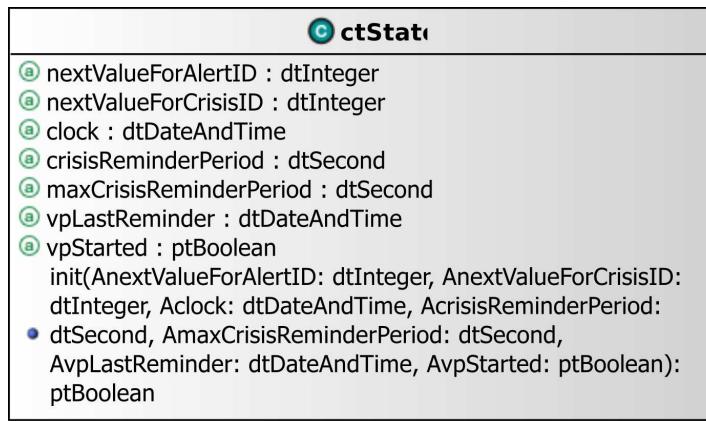


Figure 4.2: Concept Model - PrimaryTypes-Classes local view 02. local view of the ctState primary type.

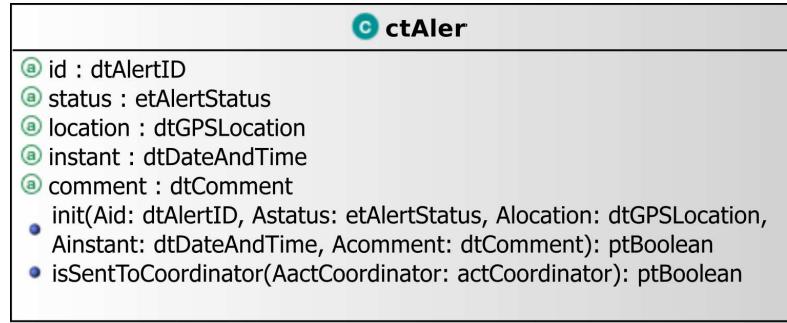


Figure 4.3: Concept Model - PrimaryTypes-Classes local view 03. local view of the ctAlert primary type.

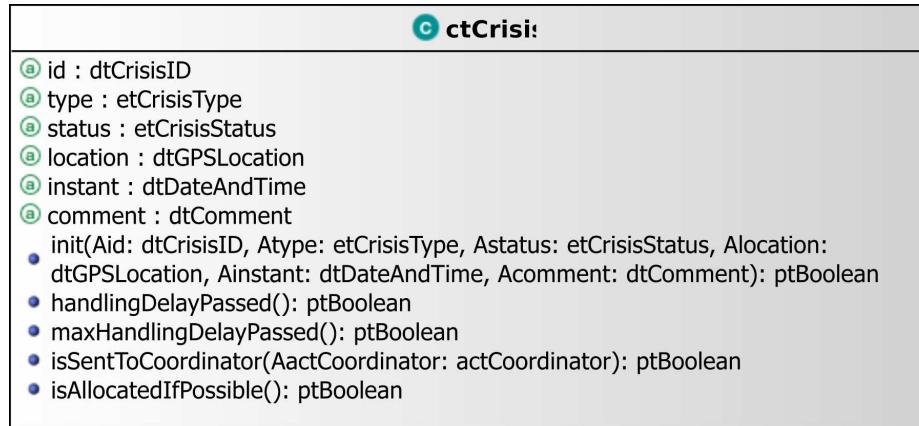


Figure 4.4: Concept Model - PrimaryTypes-Classes local view 04. local view of the ctCrisis primary type.

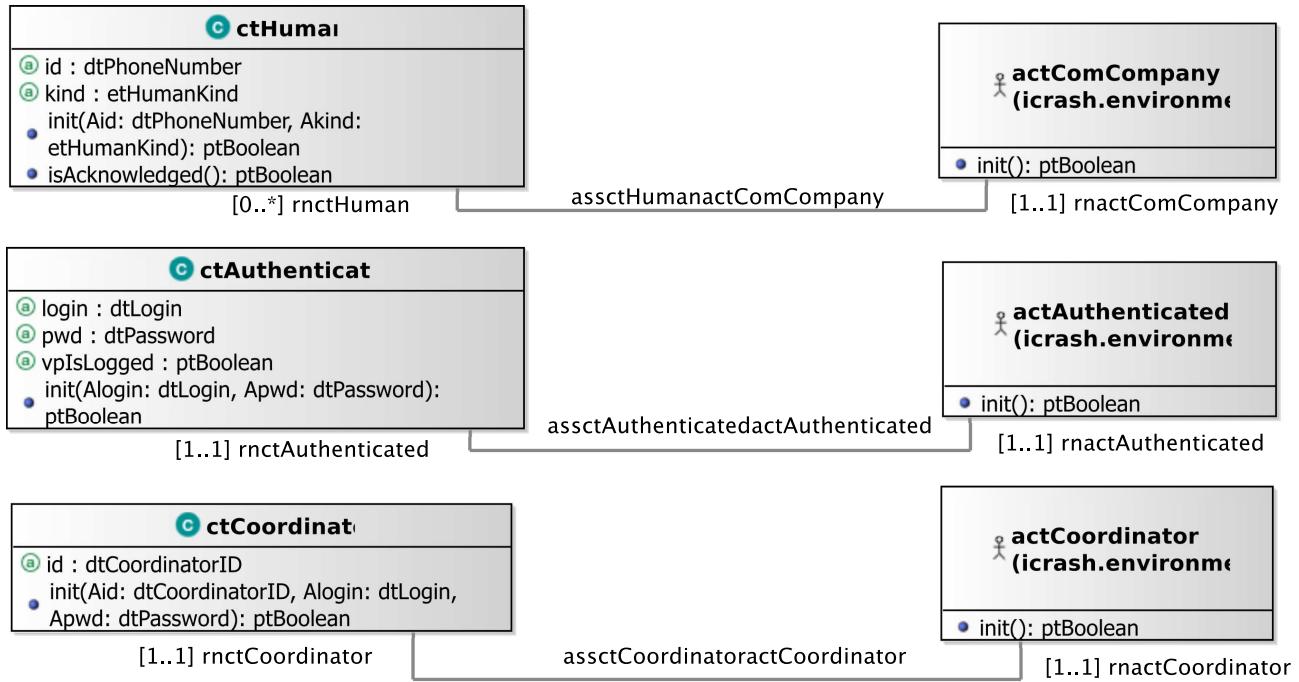


Figure 4.5: Concept Model - PrimaryTypes-Classes global view 01. Primary types class types global view - cm-pt-ct-gv-01 .



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

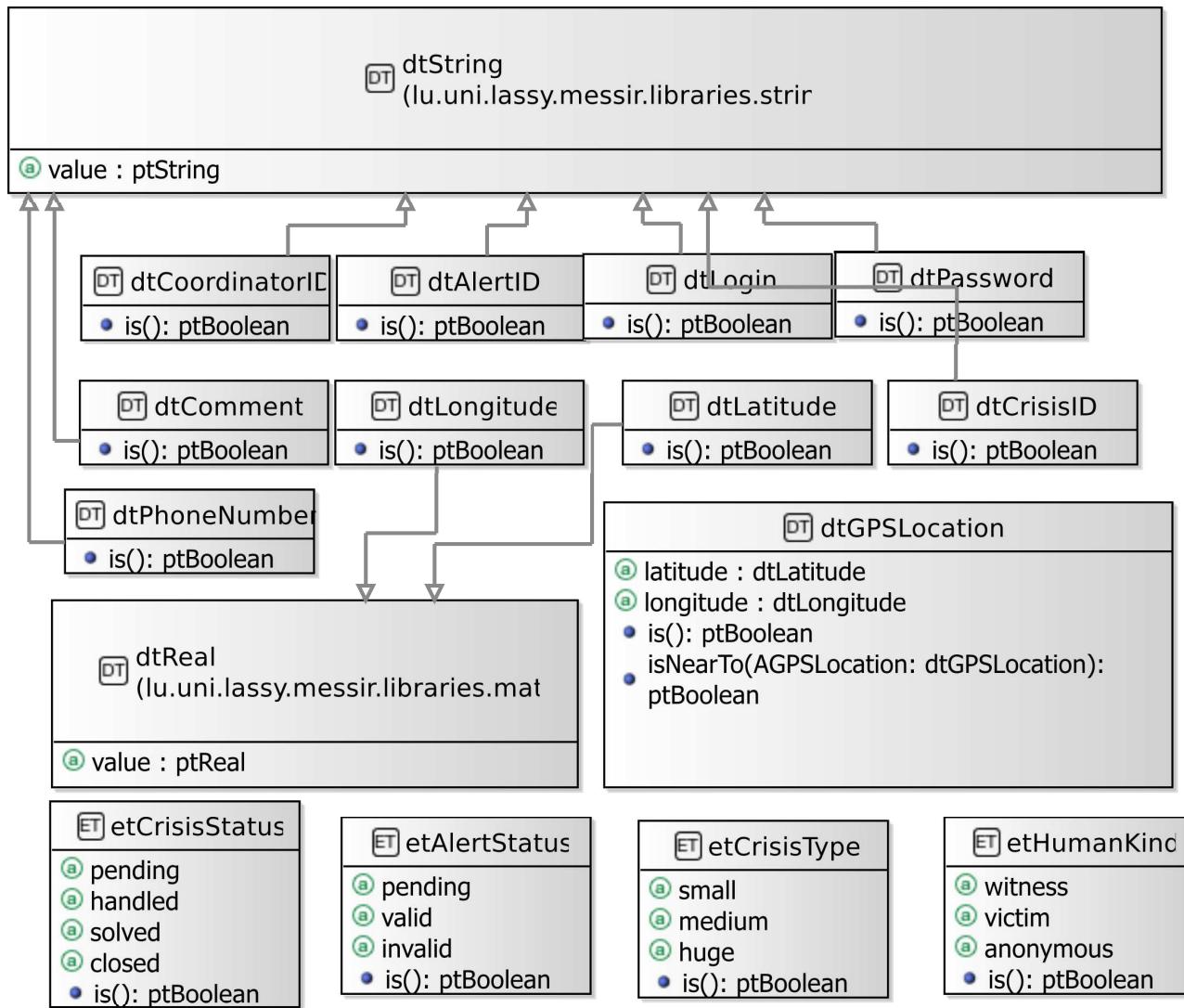


Figure 4.7: Concept Model - PrimaryTypes-Datatypes global view 01. global view of primary types datatype types - cm-pt-dt-gv-01 .

4.2.2 Global view 01

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

4.3 SecondaryTypes-Datatypes

4.3.1 Local view 01

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

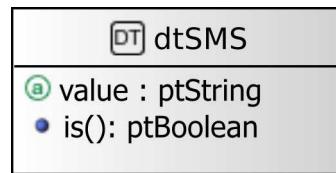


Figure 4.8: Concept Model - SecondaryTypes-Datatypes local view 01. Local view of the secondary types datatype types.

4.4 Concept Model Types Descriptions

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

4.4.1 Primary types - Class types descriptions

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

CLASSES	
<i>ctAdministrator</i>	
used to characterize internally the entity that is responsible of administrating the <i>iCrash</i> system.	
<i>extends</i>	icrash.concepts.primarytypes.classes.ctAuthenticated
operation	init (Alogin:dtLogin, Apwd:dtPassword) :ptBoolean
	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	comment: dtComment
	a textual description providing unstructured information on the alert.
attribute	id: dtAlertID
	the alert unique identification information.
attribute	instant: dtDateAndTime
	the date and time at which the alert notification has been sent.
attribute	location: dtGPSLocation

continues in next page ...

... Classes table continuation

attribute	status: etAlertStatus the alert validation status
operation	init(Aid:dtAlertID, Astatus:etAlertStatus, Alocation:dtGPSLocation, Ainstant:dtDateAndTime, Acomment:dtComment) :ptBoolean used to initialize the current object as a new instance of the ctAlert type.
operation	isSentToCoordinator(AactCoordinator:actCoordinator) :ptBoolean used to provide a given coordinator with current alert information.
ctAuthenticated	
used to model system's representation about actors that need to authenticate to access some specific functionalities.	
attribute	login: dtLogin an identifier for authentication.
attribute	pwd: dtPassword a key for authentication.
attribute	vpIsLogged: ptBoolean used to determine the access status.
operation	init(Alogin:dtLogin, Apwd:dtPassword) :ptBoolean used to initialize the current object as a new instance of the ctAuthenticated type.
ctCoordinator	
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	id: dtCoordinatorID a unique identification information.
operation	init(Aid:dtCoordinatorID, Alogin:dtLogin, Apwd:dtPassword) :ptBoolean used to initialize the current object as a new instance of the ctCoordinator type.
ctCrisis	
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	comment: dtComment a textual description providing unstructured information on the crisis handling.
attribute	id: dtCrisisID the crisis unique identification information.
attribute	instant: dtDateAndTime the date and time at which the first related alert notification has been sent.
attribute	location: dtGPSLocation the position of the crisis equal by the one of the first alert received and associated to the crisis.
attribute	status: etCrisisStatus the crisis handling status.
attribute	type: etCrisisType an indication of the gravity of the crisis.
operation	handlingDelayPassed() :ptBoolean

continues in next page ...

... Classes table continuation

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

continues in next page ...

... Classes table continuation

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

4.4.2 Primary types - Datatypes types descriptions

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

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

continues in next page ...

... Datatypes table continuation

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

ENUMERATIONS***etAlertStatus***

this type is used to indicate the different validation status of an alert.

operation **is() :ptBoolean**

used to determine which litteral belongs to the enumeration.

etCrisisStatus

this type is used to indicate the different handling status of a crisis.

operation **is() :ptBoolean**

used to determine which litteral belongs to the enumeration.

etCrisisType

this type is used to indicate the different types of a crisis.

operation **is() :ptBoolean**

used to determine which litteral belongs to the enumeration.

etHumanKind

this type is used to indicate the kind of human that informs about a car crash crisis.

operation **is() :ptBoolean**

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.

ASSOCIATIONS***assctAlertctHuman***

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.

assctAuthenticatedactAuthenticated*continues in next page ...*

...Associations table continuation

<i>assctCoordinatoractCoordinator</i>	mainly used to determine if the login request of an authenticated actor can be granted based on the given credentials and the registered ones.
---------------------------------------	--

<i>assctCoordinatoractCoordinator</i>	frequent messages must be sent to coordinator especially in relation to crisis they handle.
---------------------------------------	---

<i>assctCrisisctCoordinator</i>	at any point in time we need to know if a coordinator is handling existing crisis or not.
---------------------------------	---

<i>assctHumanactComCompany</i>	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	
<i>dtSMS</i>	
attribute	value: ptString the textual information.
operation	is():ptBoolean 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	
<i>oeSetClock[proactive]</i>	
An active message used to statically set the date and time information in the system's state.	
Parameters	
1	AcurrentClock: dtDateAndTime the date and time to be considered as the actual one.
Return type	
ptBoolean	
Pre-Condition (protocol)	
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.
Pre-Condition (functional)	
PreF 1	none
Post-Condition (functional)	
PostF 1	the ctState instance post-state is updated to have its clock attribute equal to the given date and time.
Post-Condition (protocol)	
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: **Messir** (MCL-oriented) specification of the operation *oeSetClock*.

The listing 5.2 provides the **Messir** (Prolog-oriented) implementation of the operation.

```

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

```

```

42      []):-  

43  

44 msrVar(ctState,TheSystem),  

45  

46 /* Post Functional:*/  

47  

48 msrNav([Self],[rnActor,rnSystem],[TheSystem]),  

49  

50 /* PostF01 */  

51 msrNav([TheSystem],  

52     [msmAtPost,clock],  

53     [AcurrentClock]),  

54  

55 /* Post Protocol:*/  

56 /* PostP01 */  

57 true  

58 .

```

Listing 5.2: **Messip** (Prolog-oriented) implementation 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 5.3 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  

2 /* Pre Protocol:*/  

3 preP{let TheSystem: ctState in  

4 let AvpStarted: ptBoolean in  

5 let ColctCrisisToHandle:

```

```

6     Bag(ctCrisis) in
7
8     self.rnActor.rnSystem = TheSystem
9
10    /* PreP01 */
11    and TheSystem.vpStarted
12
13    /* PreP02 */
14    and TheSystem.rnctCrisis->select(handlingDelayPassed())
15        = ColctCrisisToHandle
16    and ColctCrisisToHandle->size().geq(1)
17
18    /* Pre Functional:*/
19    preF{true}
20
21    /* Post Functional:*/
22    postF{let TheSystem: ctState in
23        let AMesssageForCrisisHandlers: dtComment in
24        let ColctCrisisToAllocateIfPossible:Bag(ctCrisis) in
25
26        self.rnActor.rnSystem = TheSystem
27        /* PostFO1 */
28        and TheSystem.rnctCrisis->select(maxHandlingDelayPassed())
29            = ColctCrisisToAllocateIfPossible
30        and ColctCrisisToAllocateIfPossible->forAll(isAllocatedIfPossible())
31
32        /* PostFO2 */
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 (AMesssageForCrisisHandlers.value
41                ='There are alerts pending since more than the defined delay. Please REACT !'
42            and TheSystem.rnactAdministrator.
43                rnInterfaceIN^ieMessage(AMesssageForCrisisHandlers)
44            and TheSystem.rnactCoordinator
45                ->forAll(rnInterfaceIN^ieMessage(AMesssageForCrisisHandlers))
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 5.3: **Messsir** (MCL-oriented) specification of the operation *oeSollicitateCrisisHandling*.

The listing 5.4 provides the **Messsir** (Prolog-oriented) implementation of the operation.

```

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  

35 msrop(outactActivator,  

36     oeSollicitateCrisisHandling,  

37     [preFunctional,Self  

38     ],  

39     []):-  

40 /* Pre Functional:*/  

41 /* PreF01 */  

42 true.  

43  

44 msrop(outactActivator,  

45     oeSollicitateCrisisHandling,  

46     [post,Self  

47     ],  

48     []):-  

49  

50 msrVar(ctState,TheSystem),  

51 msrVar(dtComment,AMessageForCrisisHandlers),  

52 msrVar(dtDateAndTime, TheClock),  

53 msrVarCol(ctCrisis,_,ColctCrisisToAllocateIfPossible),  

54  

55 /* Post Functional:*/  

56 msrNav([Self],[rnActor,rnSystem],[TheSystem]),  

57  

58 /* PostF01 */  

59 msrNav([TheSystem],  

60     [rnctCrisis,msrSelect,  

61      maxHandlingDelayPassed,[]  

62 ],  

63     ColctCrisisToAllocateIfPossible),  

64  

65 msrNav(ColctCrisisToAllocateIfPossible,  

66     [msrForAll,isAllocatedIfPossible,[],  

67     [[ptBoolean,true]]),  

68  

69 /* PostF02 */  

70 msrNav([TheSystem],  

71     [rnctCrisis,msrSelect,  

72      handlingDelayPassed,[]  

73 ],  

74     ColctCrisisToHandle),  

75  

76 msrNav(ColctCrisisToHandle,  

77     [msrColSubtract,[ColctCrisisToAllocateIfPossible]  

78     ],  

79     ColctCrisisToRemind),  

80

```

```

81 (msrNav([ColctCrisisToRemind,
82   [msrSize,geq,[[ptInteger,1]]],
83   [[ptBoolean,true]]]
84 -> (msrNav([AMessageForCrisisHandlers],
85   [value],
86   [[ptString,'There are alerts pending since more than the defined delay. Please REACT !']])),
87
88 msrNav([TheSystem],
89   [rnactAdministrator,rnInterfaceIN,
90   ieMessage,[AMessageForCrisisHandlers]
91 ],
92   [[ptBoolean,true]]),
93
94 msrNav([TheSystem],
95   [rnactCoordinator,msrForAll,rnInterfaceIN,
96   ieMessage,[AMessageForCrisisHandlers]
97 ],
98   [[ptBoolean,true]]))
99 )
100 ; true
101 ),
102
103 /* Post Protocol:*/
104 /* PostP01 */
105 msrNav([TheSystem],
106   [clock],
107   [TheClock]),
108
109 msrNav([TheSystem],
110   [msmAtPost,vpLastReminder],
111   [TheClock])
112 .

```

Listing 5.4: **Messir** (Prolog-oriented) implementation of the operation *oeSollicitateCrisisHandling*.

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

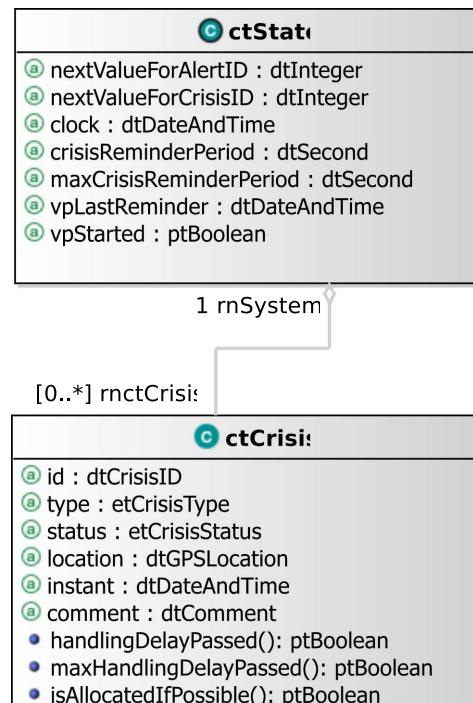


Figure 5.1: *oeSollicitateCrisisHandling* operation scope

5.2 Environment - Out Interface Operation Scheme for actAdministrator

5.2.1 Operation Model for oeAddCoordinator

The oeAddCoordinator operation has the following properties:

OPERATION	
<i>oeAddCoordinator</i>	
sent to add a new coordinator in the system's post state and environment's post state.	
Parameters	
1	AdtCoordinatorID: dtCoordinatorID used to initialize the id field
2	AdtLogin: dtLogin used to initialize the login field
3	AdtPassword: dtPassword used to initialize the password field
Return type	
ptBoolean	
Pre-Condition (protocol)	
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)
Pre-Condition (functional)	
PreF 1	it is supposed that there cannot exist a ctCoordinator instance with the same id attribute as the one the administrator wants to delete.
Post-Condition (functional)	
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.
Post-Condition (protocol)	
PostP 1	none

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

The listing 5.6 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

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
32 msrop(outactAdministrator,
33 oeAddCoordinator,
34 [prefunctional, Self,
35 AdtCoordinatorID,
36 AdtLogin,
37 AdtPassword
38 ],
39 []):-.
40/* Pre Functional:*/
41 msrVar(ctState, TheSystem),
42 msrVar(actAdministrator, TheActor),
43 msrNav([Self], [rnActor, rnSystem], [TheSystem]),
44 msrNav([Self], [rnActor], [TheActor]),
45/* PreF01 */
46 msrNav([TheSystem],
47     [rnctCoordinator,
48     msrSelect, id, eq, [AdtCoordinatorID]],
49     ColctCoordinators),
50 msrNav(ColctCoordinators,
51     [msrIsEmpty],
52     [[ptBoolean, true]]))
53 .
54
55 msrop(outactAdministrator,
56 oeAddCoordinator,
57 [post, Self,
58 AdtCoordinatorID,
59 AdtLogin,
60 AdtPassword
61 ],
62 []):-.
63
64/* Post Functional:*/
65 msrVar(ctState, TheSystem),
66 msrVar(actAdministrator, TheActor),
67 msrNav([Self], [rnActor, rnSystem], [TheSystem]),
68 msrNav([Self], [rnActor], [TheActor]),
69
70 msrVar(actCoordinator, TheactCoordinator),
71 msrVar(ctCoordinator, ThectCoordinator),
72
73/* PostF01 */
74 msrNav([TheactCoordinator],
75     [init, []],
76     [[ptBoolean, true]]),
77
78/* PostF02 */
79 msrNav([ThectCoordinator],
80     [init, [AdtCoordinatorID, AdtLogin, AdtPassword]],
81     [[ptBoolean, true]]),
82
83/* PostF03 */
84 msrNav([TheactCoordinator],
85     [msmAtPost, rnctCoordinator],
86     [ThectCoordinator]),
87
88/* PostF04 */
89 msrNav([ThectCoordinator],
90     [msmAtPost, rnactAuthenticated],
91     [TheactCoordinator]),
92
93/* PostF05 */
94 msrNav([TheActor],

```

```

95     [rnInterfaceIN,
96      ieCoordinatorAdded, []],
97     [[ptBoolean,true]]),
98
99 /* Post Protocol:*/
100/* PostP01 */
101true
102.

```

Listing 5.6: **Messip** (Prolog-oriented) implementation of the operation *oeAddCoordinator*.

5.2.2 Operation Model for oeDeleteCoordinator

The *oeDeleteCoordinator* operation has the following properties:

OPERATION
<i>oeDeleteCoordinator</i>
sent to delete an existing coordinator in the system's post state and environment's post state.
<i>Parameters</i>
1 AdtCoordinatorID: dtCoordinatorID used for ctCoordinator instance retrieval
<i>Return type</i>
ptBoolean
<i>Pre-Condition (protocol)</i>
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)
<i>Pre-Condition (functional)</i>
PreF 1 it is supposed that there exist one ctCoordinator instance with the same id attribute than the one the administrator wants to create.
<i>Post-Condition (functional)</i>
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.
<i>Post-Condition (protocol)</i>
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   let TheActor:actAdministrator in
5
6   self.rnActor.rnSystem = TheSystem
7   and self.rnActor = TheActor
8
9 /* PreP01 */
10 and TheSystem.vpStarted = true
11 /* PreP02 */
12 and TheActor.rnctAuthenticated.vpIsLogged = true}
13

```

```

14 /* Pre Functional:*/
15 preF{let TheSystem: ctState in
16   let TheActor:actAdministrator in
17
18   self.rnActor.rnSystem = TheSystem
19   and self.rnActor = TheActor
20 /* PreF01 */
21 TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
22 = ColctCoordinators
23 and ColctCoordinators->size().eq(1)}
24
25 /* Post Functional:*/
26 postF{let TheSystem: ctState in
27   let TheActor:actAdministrator in
28   let ThectCoordinator:ctCoordinator in
29   self.rnActor.rnSystem = TheSystem
30   and self.rnActor = TheActor
31 /* PostF01 */
32 TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
33 = ThectCoordinator
34 and ThectCoordinator.rnactCoordinator->forAll(msrIsKilled)
35 and ThectCoordinator.msrIsKilled
36
37 /* PostF02 */
38 and TheActor.rnInterfaceIN^ieCoordinatorDeleted()
39
40 /* Post Protocol:*/
41 /* PostP01 */
42 and true}
43
44 /* Post Protocol:*/
45 postP{ true}

```

Listing 5.7: **Messir** (MCL-oriented) specification of the operation *oeDeleteCoordinator*.

The listing 5.8 provides the **Messir** (Prolog-oriented) implementation of the operation.

```

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
28msrop(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
50msrop(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 5.8: **Messir** (Prolog-oriented) implementation of the operation *oeDeleteCoordinator*.

5.3 Environment - Out Interface Operation Scheme for actAuthenticated

5.3.1 Operation Model for oeLogin

The *oeLogin* operation has the following properties:

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

The listing 5.9 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
21   let AptStringMessageForTheactAuthenticated: ptString in
22   let AptStringMessageForTheactAdministrator:ptString in
23
24   self.rnActor.rnSystem = TheSystem
25   and self.rnActor = TheactAuthenticated

```

```

26
27  and /* PostF01 */
28    if (TheactAuthenticated.rnctAuthenticated.pwd
29      = AdtPassword
30      and TheactAuthenticated.rnctAuthenticated.login
31      = AdtLogin
32    )
33    then (AptStringMessageForTheactAuthenticated.eq('You are logged ! Welcome ...')
34      and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
35    )
36    else (AptStringMessageForTheactAuthenticated
37      .eq('Wrong identification information ! Please try again ...')
38      and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
39      and AptStringMessageForTheactAdministrator.eq('Intrusion tentative !')
40      and TheSystem.rnactAdministrator
41        .rnInterfaceIN^ieMessage(AptStringMessageForTheactAdministrator)
42    )
43  endif
44
45 /* Post Protocol:*/
46 postP{ let TheSystem: ctState in
47   let TheactAuthenticated:actAuthenticated in
48
49   self.rnActor.rnSystem = TheSystem
50   and self.rnActor = TheactAuthenticated
51 /* PostP01 */
52   if (TheactAuthenticated.rnctAuthenticated.pwd = AdtPassword
53     and TheactAuthenticated.rnctAuthenticated.login = AdtLogin
54   )
55   then (TheactAuthenticated.rnctAuthenticated@post.vpIsLogged = true)
56   else true
57 endif}
```

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

The listing 5.10 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
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 */
38 true
39 .
40
41 msrop(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
85   msrNav([AptStringMessageForTheactAdministrator],
86           [eq,[[ptString,'Intrusion tentative !']]],
87           [[ptBoolean,true]]),
88   msrNav([TheSystem],
89           [rnactAdministrator,rnInterfaceIN,
90            ieMessage,[AptStringMessageForTheactAdministrator]],
91           [[ptBoolean,true]])
92 )
93 ),
94
95 /* Post Protocol:*/
96 /* PostP01 */
97 ( msrNav([TheactAuthenticated],
98           [rnctAuthenticated,pwd],
99           [AdtPassword]),

```

```

100   msrNav([TheactAuthenticated],
101       [rnctAuthenticated,login],
102       [AdtLogin])
103   )
104 -> (msrNav([TheactAuthenticated],
105       [rnctAuthenticated,msmAtPost, vpIsLogged],
106       [[ptBoolean,true]])
107   )
108 ; true
109 )
110 .

```

Listing 5.10: **Messip** (Prolog-oriented) implementation of the operation *oeLogin*.

5.3.2 Operation Model for oeLogout

The *oeLogout* operation has the following properties:

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

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

```

1
2 /* Pre Protocol:*/
3 prep{let TheSystem: ctState in
4   let TheActor:actAdministrator in
5   self.rnActor.rnSystem = TheSystem
6   and self.rnActor = TheActor
7
8 /* PreP01 */
9   and TheSystem.vpStarted = true
10  /* PreP02 */
11  and TheActor.rnctAuthenticated.vpIsLogged = true}
12
13 /* Pre Functional:*/
14 prep{/* 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  /* Post F01 */
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  /* Post P01 */
36  TheactAuthenticated.rnctAuthenticated@post.vpIsLogged = false}

```

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

The listing 5.12 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

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/* Pre P01 */
18 msrNav([TheSystem],
19     [vpStarted],
20     [[ptBoolean,true]]),
21 .
22 msrNav([TheActor],
23     [rnctAuthenticated,vpIsLogged],
24     [[ptBoolean,true]]),
25 .
26 .
27msrop(outactAuthenticated,
28    oeLogout,
29    [preFunctional,Self
30    ],
31   []):- !.
32/* Pre Functional:*/
33/* PreF01 */
34true
35.
36.
37msrop(outactAuthenticated,
38    oeLogout,
39    [post,Self
40    ],
41   []):- !.

```

```

42
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 5.12: **Messir** (Prolog-oriented) implementation of the operation *oeLogout*.

5.4 Environment - Out Interface Operation Scheme for actComCompany

5.4.1 Operation Model for oeAlert

The *oeAlert* operation has the following properties:

OPERATION	
<i>oeAlert</i>	
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.	
Parameters	
1	AetHumanKind: etHumanKind the kind of human informing of an alert.
2	AdtDate: dtDate the date of the alert
3	AdtTime: dtTime the time of the alert
4	AdtPhoneNumber: dtPhoneNumber the phone number of the human sending the alert SMS message
5	AdtGPSLocation: dtGPSLocation the GPS position of the phone at the date and time the message was sent.
6	AdtComment: dtComment a free text message sent by the human providing information on the alert that he wants to declare
Return type	
ptBoolean	
Pre-Condition (protocol)	

continues in next page ...

...Operation table continuation

PreP 1	the system is supposed to be created and initialized.
<i>Pre-Condition (functional)</i>	
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.
<i>Post-Condition (functional)</i>	
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.
<i>Post-Condition (protocol)</i>	
PostP 1	none

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

```

1  /* Pre Protocol:*/
2  preP{let TheSystem: ctState in
3    self.rnActor.rnSystem = TheSystem
4
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
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 5.13: **Messip** (MCL-oriented) specification of the operation *oeAlert*.

The listing 5.14 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5%-----%
6nico(A):-%
7 trace,
8 write('here'),
9 write('\n').
10
11msrop(contactComCompany,
12     oeAlert,
13     [preProtocol,Self,
14      AetHumanKind,
15      AdtDate,
16      AdtTime,
17      AdtPhoneNumber,
18      AdtGPSLocation,
19      AdtComment
20      ],
21     []):-%
22/* Pre Protocol:*/
23 msrVar(ctState,TheSystem),
24 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
25/* PreP01 */
26 msrNav([TheSystem],
27     [vpStarted],
28     [[ptBoolean,true]])
29 .
30
31msrop(contactComCompany,
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),
90
91/* Post Functional:*/
92
93 msrNav([Self],[rnActor],[TheactComCompany]),
94 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
95
96/* PostF01 */
97 msrNav([TheSystem],
98     [nextValueForAlertID],
99     [PrenextValueForAlertID]),
100 msrNav([PrenextValueForAlertID],
101     [add,[[dtInteger,[[value,[ptInteger,1]]],[],[]]],
102     [PostnextValueForAlertID]),
103 msrNav([TheSystem],
104     [msmAtPost,nextValueForAlertID],
105     [PostnextValueForAlertID]),
106
107 /* PostF02 */
108 msrNav([AAlertInstant],[date],[AdtDate]),
109 msrNav([AAlertInstant],[time],[AdtTime]),
110
111 msrNav([AetAlertStatus],
112     [],
113     [[etAlertStatus,pending]]),
114
115 msrNav([TheSystem],
116     [nextValueForAlertID,
117      todtString,[],eq,[AdtAlertID]],
118     [[ptBoolean,true]]),
119
120 msrNav([ActAlert],
121     [init,[AdtAlertID,
122             AetAlertStatus,

```

```

123     AdtGPSLocation,
124     AAlertInstant,
125     AdtComment]],,
126     [[ptBoolean,true]]),
127
128 /* PostF03 */
129 msrNav([TheSystem],
130     [rnctAlert,
131      msrSelect,location,isNearTo,[AdtGPSLocation]],
132     ColctAlertsNearBy),
133
134 ( (msrNav(ColctAlertsNearBy,
135     [msrIsEmpty],
136     [[ptBoolean,true]]))
137 )
138 -> (
139     msrNav([TheSystem],
140         [nextValueForCrisisID],
141         [PrenextValueForCrisisID]),
142     msrNav([PrenextValueForCrisisID],
143         [add,[[dtInteger,[[value,[ptInteger,1]]],[],[]]],
144         [PostnextValueForCrisisID]),
145     msrNav([TheSystem],
146         [msmAtPost,nextValueForCrisisID],
147         [PostnextValueForCrisisID]),
148
149     msrNav([TheSystem],
150         [nextValueForCrisisID,
151          todtString,[],eq,[AdtCrisisID]],
152         [[ptBoolean,true]]),
153
154     msrNav([AdtCrisisType],[],[[etCrisisType,small]]),
155     msrNav([AetCrisisStatus],[],[[etCrisisStatus,pending]]),
156     msrNav([ACrisisInstant],[],[AAAlertInstant]),
157     msrNav([ACrisisdtComment],
158         [value],
159         [[ptString,'no reporting yet defined']])),
160     msrNav([ActCrisis],[init,[AdtCrisisID,
161         AdtCrisisType,
162         AetCrisisStatus,
163         AdtGPSLocation,
164         ACrisisInstant,
165         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     HumanCol1),
188
189 msrNav(HumanCol1,
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
230 .

```

Listing 5.14: **Messir** (Prolog-oriented) implementation of the operation *oeAlert*.

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

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

5.5 Environment - Out Interface Operation Scheme for actCoordinator

5.5.1 Operation Model for *oeCloseCrisis*

The *oeCloseCrisis* operation has the following properties:

OPERATION
<i>oeCloseCrisis</i>
sent to indicate that a crisis should be considered as closed.
<i>Parameters</i>
1 AdtCrisisID: dtCrisisID the identification information used to determine the crisis to close
<i>Return type</i>

continues in next page ...

... Operation table continuation

ptBoolean
<i>Pre-Condition (protocol)</i>
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)
<i>Pre-Condition (functional)</i>
PreF 1 it is supposed that there exist one ctCrisis instance with the same id attribute value as the one provided by the coordinator actor who wants to close.
<i>Post-Condition (functional)</i>
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.
<i>Post-Condition (protocol)</i>
PostP 1 none

The listing 5.15 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

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

```

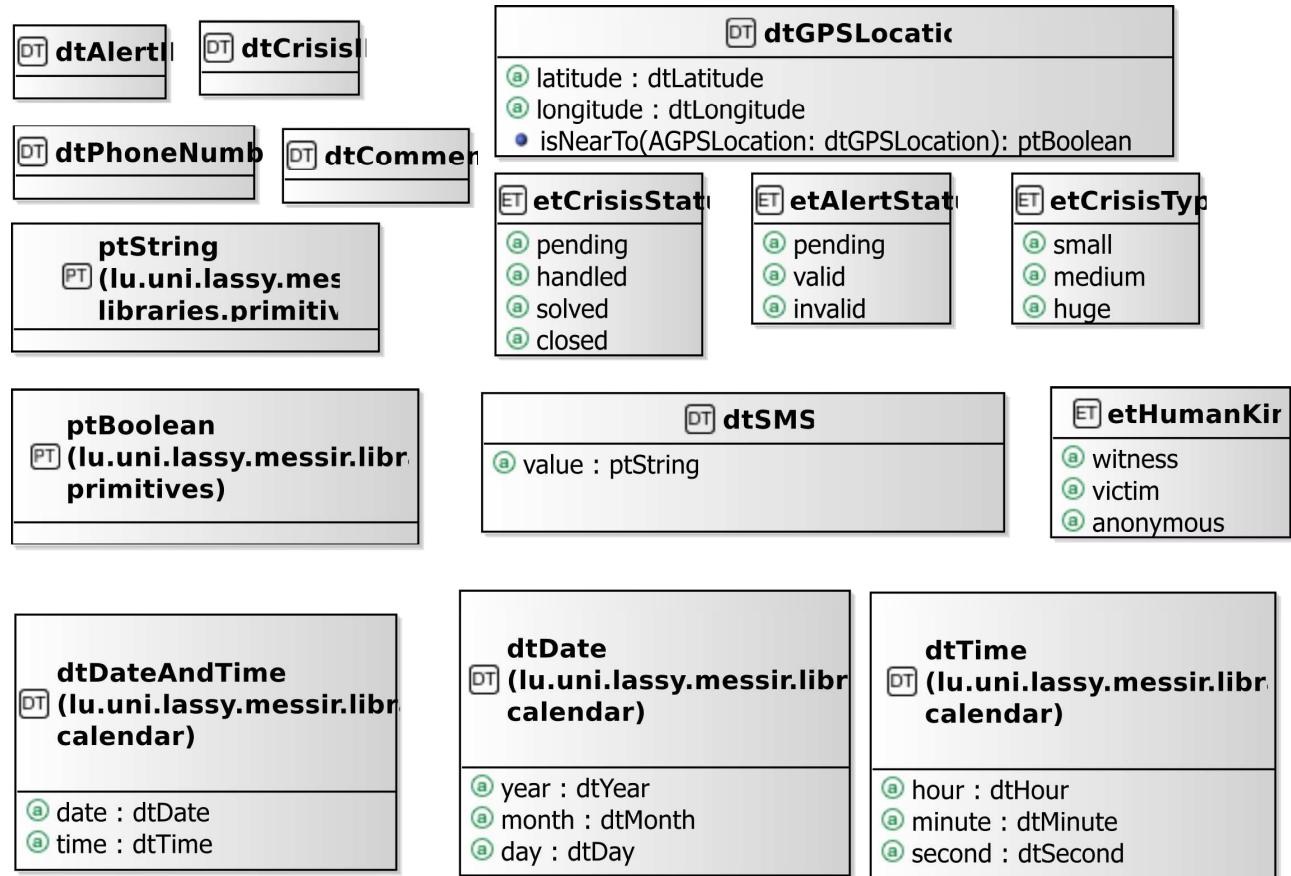


Figure 5.2: oeAlert operation scope

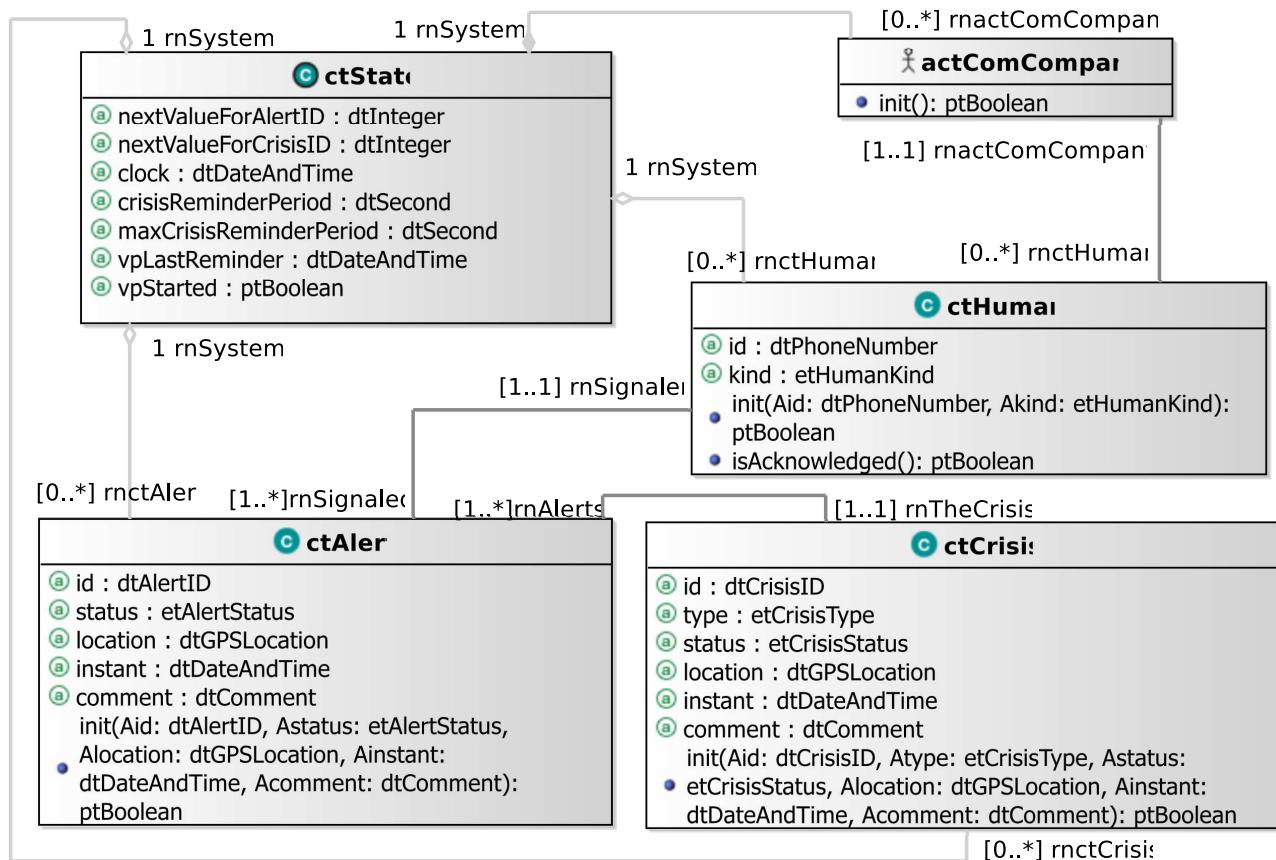


Figure 5.3: oeAlert operation scope

```

39 msrVar(dtCrisisID,AdtCrisisID),
40
41 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
42 msrNav([Self],[rnActor],[TheActor]),
43
44/* PreF01 */
45 msrNav([TheSystem],
46     [rnctCrisis,
47      msrSelect,
48      id,eq,[AdtCrisisID]
49    ],
50    ColCrisis),
51
52 msrNav(ColCrisis,
53     [[msrSize,eq,[[ptInteger,1]]],
54      [[ptBoolean,true]]])
55 .
56
57msrop(outactCoordinator,
58 oeCloseCrisis,
59 [post,Self,
60 AdtCrisisID
61 ],
62 []):-.
63
64/* Post Functional:*/
65 msrVar(ctState,TheSystem),
66 msrVar(actCoordinator,TheActor),
67
68 msrVar(ctCrisis,TheCrisis),
69 msrVar(dtCrisisID,AdtCrisisID),
70
71 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
72 msrNav([Self],[rnActor],[TheActor]),
73
74/* PostF01 */
75 msrNav([TheSystem],
76     [rnctCrisis,
77      msrSelect,
78      id,eq,[AdtCrisisID]],
79      [TheCrisis]),
80
81 msrNav([TheCrisis],
82     [[msmAtPost,status],
83      [[etCrisisStatus,closed]]]),
84
85/* PostF02 */
86 msrNav([TheCrisis],
87     [[msmAtPost,rnHandler],
88      []]),
89
90 /* PostF03 */
91 msrNav([TheCrisis],
92     [[rnAlerts,msrForAll,msrIsKilled],
93      [[ptBoolean,true]]]),
94
95/* PostF04 */
96 msrNav([TheActor],
97     [rnInterfaceIN,
98      ieMessage,[[ptString,'The crisis is now closed !']]
99    ],
100   [[ptBoolean,true]]),
101
102/* Post Protocol:*/
103/* PostP01 */
104 true
105 .

```

Listing 5.15: **Messir** (Prolog-oriented) implementation of the operation *oeCloseCrisis*.

5.5.2 Operation Model for oeGetAlertsSet

The oeGetAlertsSet operation has the following properties:

OPERATION	
oeGetAlertsSet	
sent to request all the ctAlert instances having a specific status.	
Parameters	
1	AetAlertStatus: etAlertStatus the criteria used to select the alerts to send back to the actor
Return type	
ptBoolean	
Pre-Condition (protocol)	
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)
Pre-Condition (functional)	
PreF 1	none
Post-Condition (functional)	
PostF 1	the post state is the one obtained by satisfying the isSentToCoordinator predicate for each alert having the provided status and for the actor sending the message. (cf. specification of isSentToCoordinator predicate given for the ctAlert type).
Post-Condition (protocol)	
PostP 1	none

The listing 5.16 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

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 */
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
39 msrop(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 5.16: **Messip** (Prolog-oriented) implementation of the operation *oeGetAlertsSet*.

5.5.3 Operation Model for *oeGetCrisisSet*

The *oeGetCrisisSet* operation has the following properties:

OPERATION	
<i>oeGetCrisisSet</i>	
sent to request all the <i>ctCrisis</i> instances having a specific status.	
Parameters	
1 AetCrisisStatus: etCrisisStatus	the status information used to determine the crisis to send back to the actor
Return type	
ptBoolean	
Pre-Condition (protocol)	
PreP 1	the system is started
PreP 2	the actor logged previously and did not log out ! (i.e. the associated <i>ctCoordinator</i> instance is considered logged)
Pre-Condition (functional)	
PreF 1	none
Post-Condition (functional)	

continues in next page ...

...Operation table continuation

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.)
<i>Post-Condition (protocol)</i>	
PostP 1	none

The listing 5.17 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
6msrop(outactCoordinator,
7    oeGetCrisisSet,
8    [preProtocol,Self,
9     AetCrisisStatus
10    ],
11    []):-!
12/* Pre Protocol:*/
13 msrVar(ctState,TheSystem),
14 msrVar(actCoordinator,TheActor),
15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
16 msrNav([Self],[rnActor],[TheActor]),
17
18/* PreP01 */
19 msrNav([TheSystem],
20    [vpStarted],
21    [[ptBoolean,true]]),
22
23 msrNav([TheActor],
24    [rnctAuthenticated,vpIsLogged],
25    [[ptBoolean,true]]),
26.
27
28msrop(outactCoordinator,
29    oeGetCrisisSet,
30    [preFunctional,Self,
31     AetCrisisStatus
32    ],
33    []):-!
34/* Pre Functional:*/
35/* PreF01 */
36true
37 .
38
39msrop(outactCoordinator,
40    oeGetCrisisSet,
41    [post,Self,
42     AetCrisisStatus
43    ],
44    []):-!
45
46/* Post Functional:*/
47 msrVar(ctState,TheSystem),
48 msrVar(actCoordinator,TheActor),
49 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
50 msrNav([Self],[rnActor],[TheActor]),
51
52/* PostF01 */

```

```

53 msrNav([TheSystem],
54   [rnctCrisis,
55    msrSelect,
56    status,etEq,[AetCrisisStatus]],
57    ColCrisisSet),
58
59 msrNav(ColCrisisSet,
60   [msrForAll,isSentToCoordinator,[TheActor]],
61   [[ptBoolean,true]]),
62
63 /* Post Protocol:*/
64/* PostP01 */
65 true
66 .

```

Listing 5.17: **Messip** (Prolog-oriented) implementation of the operation *oeGetCrisisSet*.

5.5.4 Operation Model for oeInvalidateAlert

The *oeInvalidateAlert* operation has the following properties:

OPERATION
<i>oeInvalidateAlert</i>
sent to indicate that an alert should be considered as closed.
<i>Parameters</i>
1 AdtAlertID: dtAlertID the identification information used to determine the alert to close
<i>Return type</i>
ptBoolean
<i>Pre-Condition (protocol)</i>
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)
<i>Pre-Condition (functional)</i>
PreF 1 it is supposed that there exist one ctAlert instance with the same id attribute value as the one provided by the coordinator actor who wants to close.
<i>Post-Condition (functional)</i>
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.
<i>Post-Condition (protocol)</i>
PostP 1 none

The listing 5.18 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

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

```

```

10      ],
11      []):- 
12 /* Pre Protocol:*/
13 msrVar(ctState,TheSystem),
14 msrVar(actCoordinator,TheActor),
15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
16 msrNav([Self],[rnActor],[TheActor]),
17 .
18 /* PreP01 */
19 msrNav([TheSystem],
20     [vpStarted],
21     [[ptBoolean,true]]),
22 .
23 /* PreP02 */
24 msrNav([TheActor],
25     [rnctAuthenticated,vpIsLogged],
26     [[ptBoolean,true]]),
27 .
28 .
29 msrop(outactCoordinator,
30     oeInvalidateAlert,
31     [preFunctional,Self,
32     AdtAlertID
33     ],
34     []):- 
35 /* Pre Functional:*/
36 msrVar(ctState,TheSystem),
37 msrVar(actCoordinator,TheActor),
38 .
39 msrVar(dtAlertID,AdtAlertID),
40 .
41 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
42 msrNav([Self],[rnActor],[TheActor]),
43 .
44 /* PreF01 */
45 msrNav([TheSystem],
46     [rnctAlert,
47     msrSelect,
48     id,eq,[AdtAlertID]
49     ],
50     ColAlert),
51 .
52 msrNav(ColAlert,
53     [msrSize,eq,[[ptInteger,1]]],
54     [[ptBoolean,true]]),
55 .
56 .
57 msrop(outactCoordinator,
58     oeInvalidateAlert,
59     [post,Self,
60     AdtAlertID
61     ],
62     []):- 
63 .
64 /* Post Functional:*/
65 msrVar(ctState,TheSystem),
66 msrVar(actCoordinator,TheActor),
67 .
68 msrVar(ctAlert,TheAlert),
69 msrVar(dtAlertID,AdtAlertID),
70 .
71 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
72 msrNav([Self],[rnActor],[TheActor]),
73 .
74 /* PostF01 */
75 msrNav([TheSystem],
76     [rnctAlert,
77     msrSelect,
78     id,eq,[AdtAlertID]],
79     [TheAlert]),

```

```

80
81 msrNav([TheAlert],
82     [msmAtPost,status],
83     [[etAlertStatus,invalid]]),
84
85 /* PostF02 */
86 msrNav([TheActor],
87     [rnInterfaceIN,
88     ieMessage,[[ptString,'The alert is now declared as invalid !']])
89 ],
90 [[ptBoolean,true]]),
91
92 /* Post Protocol:*/
93 /* PostP01 */
94 true
95 .

```

Listing 5.18: **Messip** (Prolog-oriented) implementation of the operation *oeInvalidateAlert*.

5.5.5 Operation Model for oeReportOnCrisis

The *oeReportOnCrisis* operation has the following properties:

OPERATION	
<i>oeReportOnCrisis</i>	
sent to update the textual information available for a specific handled crisis.	
Parameters	
1	AdtCrisisID: dtCrisisID the identification information used to determine the crisis to report on
2	AdtComment: dtComment the textual information commenting the crisis
<i>Return type</i>	
ptBoolean	
<i>Pre-Condition (protocol)</i>	
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)
<i>Pre-Condition (functional)</i>	
PreF 1	it is supposed that there exist one crisis in the pre state having the given id.
<i>Post-Condition (functional)</i>	
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.
<i>Post-Condition (protocol)</i>	
PostP 1	none

The listing 5.19 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

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

```

```

6(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,
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 5.19: **Messip** (Prolog-oriented) implementation of the operation *oeReportOnCrisis*.

5.5.6 Operation Model for *oeSetCrisisHandler*

The *oeSetCrisisHandler* operation has the following properties:

OPERATION	
<i>oeSetCrisisHandler</i>	
sent to declare himself as been the handler of a crisis having the specified id.	
Parameters	
1	AdtCrisisID: dtCrisisID the identification information used to determine the crisis
Return type	
ptBoolean	
Pre-Condition (protocol)	
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)
Pre-Condition (functional)	
PreF 1	there exist one crisis having the given id in the pre-state.
Post-Condition (functional)	
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).

continues in next page ...

...Operation table continuation***Post-Condition (protocol)***

PostP 1	none
---------	------

The listing 5.20 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

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

```

59     AdtCrisisID
60   ],
61   []):- 
62
63/* Post Functional:*/
64 msrVar(ctState,TheSystem),
65 msrVar(actCoordinator,TheActor),
66 msrVar(ctCoordinator,TheCoordinator),
67 msrVar(ctCoordinator,TheCurrentHandler),
68
69 msrVar(ctCrisis,TheCrisis),
70 msrVar(dtCrisisID,AdtCrisisID),
71
72 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
73 msrNav([Self],[rnActor],[TheActor]),
74
75/* PostF01 */
76 msrNav([TheSystem],
77   [rnctCrisis,
78    msrSelect,
79    id,eq,[AdtCrisisID]],
80   [TheCrisis]),
81
82 msrNav([TheCrisis],
83   [msmAtPost,status],
84   [[etCrisisStatus,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 5.20: **Mess1P** (Prolog-oriented) implementation of the operation *oeSetCrisisHandler*.

5.5.7 Operation Model for *oeSetCrisisStatus*

The *oeSetCrisisStatus* operation has the following properties:

OPERATION	
<i>oeSetCrisisStatus</i>	
sent to define the handling status of a specific crisis.	
<i>Parameters</i>	
1	AdtCrisisID: dtCrisisID the identification information used to determine the crisis
2	AetCrisisStatus: etCrisisStatus the new status value
<i>Return type</i>	
ptBoolean	
<i>Pre-Condition (protocol)</i>	
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)
<i>Pre-Condition (functional)</i>	
PreF 1	it is supposed that there exist one crisis in the pre state having the given id.
<i>Post-Condition (functional)</i>	
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.
<i>Post-Condition (protocol)</i>	
PostP 1	none

The listing 5.21 provides the **Mess1P** (Prolog-oriented) implementation of the operation.

```

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

```

```

21     [vpStarted],
22     [[ptBoolean,true]]),
23
24 msrNav([TheActor],
25     [rnctAuthenticated,vpIsLogged],
26     [[ptBoolean,true]])
27.
28
29msrop(outactCoordinator,
30 oeSetCrisisStatus,
31 [preFunctional,Self,
32 AdtCrisisID,
33 AetCrisisStatus
34 ],
35 []):-!
36 /* Pre Functional:*/
37 msrVar(ctState,TheSystem),
38 msrVar(actCoordinator,TheActor),
39
40 msrVar(dtCrisisID,AdtCrisisID),
41
42 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
43 msrNav([Self],[rnActor],[TheActor]),
44
45 /* PreF01 */
46 msrNav([TheSystem],
47     [rnctCrisis,
48      msrSelect,
49      id,eq,[AdtCrisisID]
50    ],
51    ColCrisis),
52
53 msrNav(ColCrisis,
54     [msrSize,eq,[[ptInteger,1]]],
55     [[ptBoolean,true]])
56 .
57
58msrop(outactCoordinator,
59 oeSetCrisisStatus,
60 [post,Self,
61 AdtCrisisID,
62 AetCrisisStatus
63 ],
64 []):-!
65
66 /* Post Functional:*/
67 msrVar(ctState,TheSystem),
68 msrVar(actCoordinator,TheActor),
69
70 msrVar(ctCrisis,TheCrisis),
71 msrVar(dtCrisisID,AdtCrisisID),
72 msrVar(etCrisisStatus,AetCrisisStatus),
73
74 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
75 msrNav([Self],[rnActor],[TheActor]),
76
77 /* PostF01 */
78 msrNav([TheSystem],
79     [rnctCrisis,
80      msrSelect,
81      id,eq,[AdtCrisisID]],
82      [TheCrisis]),
83
84 msrNav([TheCrisis],
85     [msmAtPost,status],
86     [AetCrisisStatus]),
87
88 msrNav([TheActor],
89     [rnInterfaceIN,
90      ieMessage,[[ptString,'The crisis status has been updated !']]
```

```

91     ],
92     [[ptBoolean,true]]),
93
94/* Post Protocol:*/
95/* PostP01 */
96 true
97 .

```

Listing 5.21: **Messip** (Prolog-oriented) implementation of the operation *oeSetCrisisStatus*.

5.5.8 Operation Model for *oeSetCrisisType*

The *oeSetCrisisType* operation has the following properties:

OPERATION	
<i>oeSetCrisisType</i>	
sent to define the gravity type of a specific crisis.	
Parameters	
1	AdtCrisisID: dtCrisisID the identification information used to determine the crisis
2	AetCrisisType: etCrisisType the new type value
Return type	
ptBoolean	
Pre-Condition (protocol)	
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)
Pre-Condition (functional)	
PreF 1	it is supposed that there exist one crisis in the pre state having the given id.
Post-Condition (functional)	
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.
Post-Condition (protocol)	
PostP 1	none

The listing 5.22 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

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 5.22: **Messip** (Prolog-oriented) implementation of the operation *oeSetCrisisType*.

5.5.9 Operation Model for oeValidateAlert

The *oeValidateAlert* operation has the following properties:

OPERATION
<i>oe ValidateAlert</i>
sent to indicate that a specific alert is not a fake.
Parameters
1 AdtAlertID: dtAlertID the identification information used to determine the alert instance
Return type
ptBoolean
Pre-Condition (protocol)
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)
Pre-Condition (functional)
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.
Post-Condition (functional)
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.
Post-Condition (protocol)
PostP 1 none

The listing 5.23 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS 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]),  

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 5.23: **Messip** (Prolog-oriented) implementation of the operation *oeValidateAlert*.

5.6 Environment - Out Interface Operation Scheme for actMsrCreator

5.6.1 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.	
Parameters	
1	AqtyComCompanies: ptInteger the quantity of communication companies to create in the environment
Return type	
ptBoolean	
Pre-Condition (protocol)	
PreP 1	none
Pre-Condition (functional)	
PreF 1	none
Post-Condition (functional)	
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. Those predicates must be satisfied first since all the other depend on the existence of a ctState instance !
PostF 2	the actMsrCreator actor instance is initiated (remember that since the <i>oeCreateSystemAndEnvironment</i> is a special event its role is to make consistent the post state thus creating the actor and its interfaces is required even though the sending of this message logically would need the actor and its interfaces to already exist ...).
PostF 3	the environment for communication company actors, in the post state, is made of AqtyComCompanies instances allowing for receiving and sending messages to humans.
PostF 4	the environment for administrator actors, in the post state, is made of one instance.
PostF 5	the environment for activator actors, in the post state, is made of one instance allowing for automatic message sending based on current system's and environment state'.

continues in next page ...

... Operation table continuation

PostF 6	the set of ctAdministrator instances at post is made of one instance initialized with 'icrashadmin' (resp. '7WXC1359') for login (resp. password) values.
PostF 7	the association between ctAdministrator and actAdministrator is made of one couple made of the conjointly specified instances.

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 ctState instance (i.e. vpStarted).
---------	--

The listing 5.24 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
19  /* PostF01 -- MUST ALWAYS BE MADE FIRST -- */
20  AnextValueForAlertID.value.eq(1)
21  and AnextValueForCrisisID.value.eq(1)
22  and Aclock.date.year.value = 1970
23  and Aclock.date.month.value = 01
24  and Aclock.date.day.value = 01
25  and Aclock.time.hour.value = 00
26  and Aclock.time.minute.value = 00
27  and Aclock.time.second.value = 00
28
29  and AcrisisReminderPeriod.value.eq(300)
30  and AmaxCrisisReminderPeriod.value.eq(1200)
31  and AvpStarted = true
32  and TheSystem.init(AnextValueForAlertID,
33    AnextValueForCrisisID,
34    Aclock,
35    AcrisisReminderPeriod,
36    AmaxCrisisReminderPeriod,
37    Aclock,
38    AvpStarted
39  )
40  /* PostF02*/
41  and AactMsrCreator.init()
42  /* PostF03 */
43  and let AactComCompanyCol: Bag(actComCompany) in
44  AactComCompanyCol->size() = AqtyComCompanies
45  AactComCompanyCol-> forAll(init())
46  /* PostF04*/
47  and AactAdministrator.init()
48  /* PostF05*/
49  and let AactActivator:actActivator in
50  AactActivator.init()
51  /* PostF06 */

```

```

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

```

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

The listing 5.25 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5/*
6*****MSRCreatorActor
7*****
8*****
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]]),
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([ActMsrCreator],
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']]],
122   [[ptBoolean,true]]),
123
124 msrNav([AdtPassword],
125   [value,eq,[[ptString,'7WXC1359']]],
126   [[ptBoolean,true]]),
127
128 msrNav([ActAdministrator],
129   [init,[AdtLogin,AdtPassword]],
130   [[ptBoolean,true]]),
131
132 /* PostF07*/
133 msrNav([ActAdministrator],
134   [msmAtPost,rnactAuthenticated],
135   [AactAdministrator]),
136
137/* Post Protocol:*/
138/* PostP01 */
139true
140.

```

Listing 5.25: **Messir** (Prolog-oriented) implementation of the operation *oeCreateSystemAndEnvironment*.

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

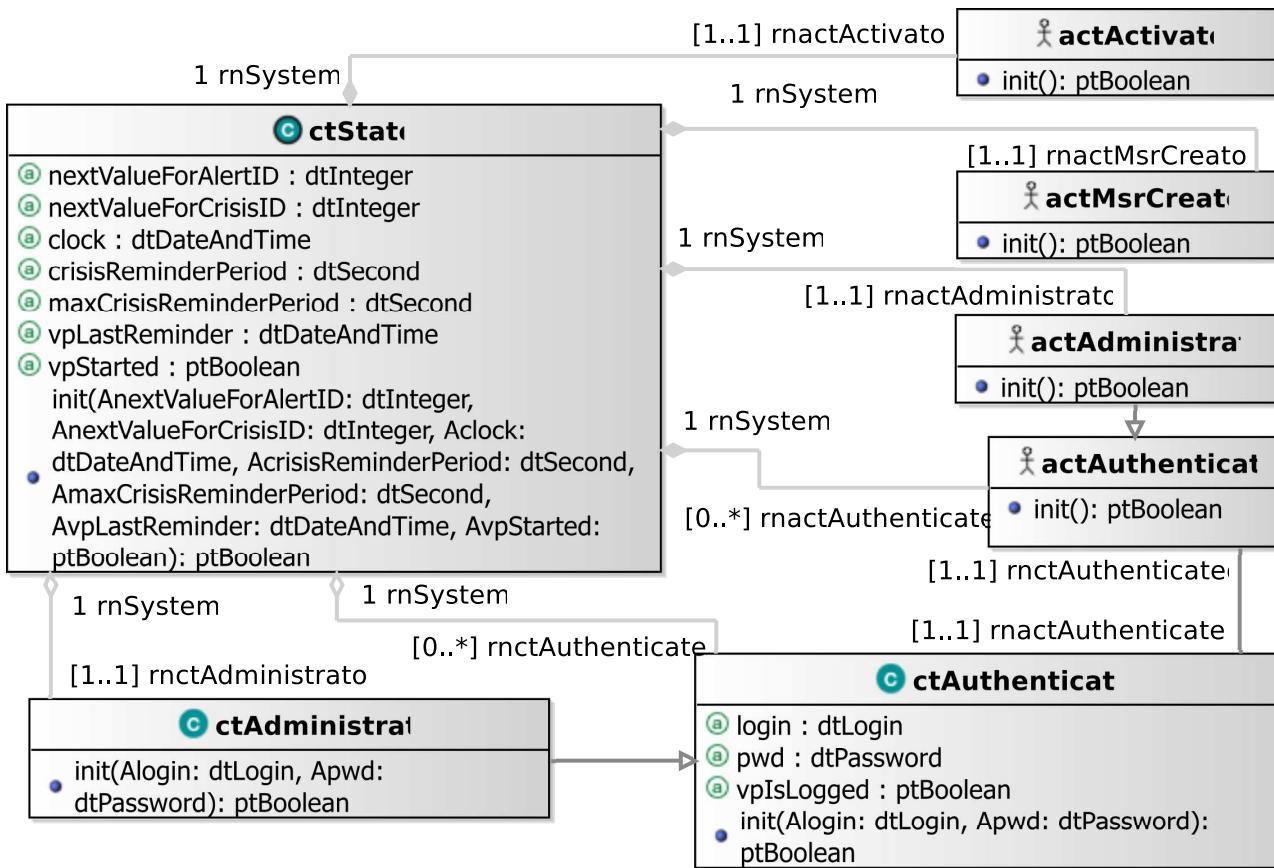


Figure 5.4: *oeCreateSystemAndEnvironment* operation scope

5.7 Environment - Actor Operation Scheme for actMsrCreator

5.7.1 Operation Model for init

The `init` operation has the following properties:

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

5.8 Primary Types - Operation Schemes for Class ctAdministrator

5.8.1 Operation Model for init

The `init` operation has the following properties:

OPERATION
<i>init</i>
used to initialize the current object as a new instance of the <code>ctAdministrator</code> type.
<i>Parameters</i>
1 Alogin: dtLogin used to initialize the login field 2 Apwd: dtPassword 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>ctAdministrator</code> instance having its login and password attributes equal to the one provided as parameters and its <code>vpIsLogged</code> attribute equal to false.

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

```

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

```

```
16 endif}
```

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

The listing 5.27 provides the **Messip** (Prolog-oriented) implementation of the operation.

```
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 */
19 msrNav([Self],[msrIsNew],[Self])
20)
21-> Result = [ptBoolean,true]
22; Result = [ptBoolean,false]
23.
```

Listing 5.27: **Messip** (Prolog-oriented) implementation of the operation *init*.

5.9 Primary Types - Operation Schemes for Class ctAlert

5.9.1 Operation Model for init

The *init* operation has the following properties:

OPERATION
<i>init</i>
used to initialize the current object as a new instance of the ctAlert type.
<i>Parameters</i>
1 Aid: dtAlertID used to initialize the id field 2 Astatus: etAlertStatus used to initialize the status field 3 Alocation: dtGPSLocation used to initialize the location field 4 Ainstant: dtDateAndTime used to initialize the instant field 5 Acomment: dtComment used to initialize the comment field
<i>Return type</i>
ptBoolean

continues in next page ...

... Operation table continuation**Post-Condition (functional)**

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 5.28 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
11 and Self.comment = Acomment
12 /* Post F02 */
13 and (Self.oclIsNew and self = Self)
14 )
15 then (result = true)
16 else (result = false)
17 endif}

```

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

The listing 5.29 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

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(
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 5.29: **Messip** (Prolog-oriented) implementation of the operation *init*.

5.9.2 Operation Model for `isSentToCoordinator`

The `isSentToCoordinator` operation has the following properties:

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

The listing 5.30 provides the **Mess1P** (MCL-oriented) specification of the operation.

```

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 5.30: **Mess1P** (MCL-oriented) specification of the operation *isSentToCoordinator*.

The listing 5.31 provides the **Mess1P** (Prolog-oriented) implementation of the operation.

```

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 5.31: **Mess1P** (Prolog-oriented) implementation of the operation *isSentToCoordinator*.

5.10 Primary Types - Operation Schemes for Class ctAuthenticated

5.10.1 Operation Model for init

The `init` operation has the following properties:

OPERATION	
<i>init</i>	
used to initialize the current object as a new instance of the <code>ctAuthenticated</code> type.	
<i>Parameters</i>	
1	Alogin: dtLogin used to initialize the login field
2	Apwd: dtPassword 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.

The listing 5.32 provides the **Messir** (Prolog-oriented) implementation of the operation.

```

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 */
20msrNav([Self],[msrIsNew],[Self])
21)
22-> Result = [ptBoolean,true]
23; Result = [ptBoolean,false]
24.

```

Listing 5.32: **Messir** (Prolog-oriented) implementation of the operation `init`.

5.11 Primary Types - Operation Schemes for Class ctCoordinator

5.11.1 Operation Model for init

The `init` operation has the following properties:

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

The listing 5.33 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.vpIsLogged = false
10 /* Post F02 */
11 and (Self.oclIsNew and self = Self)
12 )
13 )
14 then (result = true)
15 else (result = false)
16 endif}
```

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

The listing 5.34 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

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 5.34: **Messir** (Prolog-oriented) implementation of the operation *init*.

5.12 Primary Types - Operation Schemes for Class ctCrisis

5.12.1 Operation Model for init

The *init* operation has the following properties:

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

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

```

1
2 /* Post Functional:*/
3 postF{if
4 (
5 /* Post F01 */
6 let Self:ctCrisis in
7 Self.id = Aid
8 and Self.type = Atype

```

```

9  and Self.status = Astatus
10 and Self.location = Alocation
11 and Self.instant = Ainstant
12 and Self.comment = Acomment
13 /* Post F02 */
14 and (Self.oclIsNew and self = Self)
15 )
16 then (result = true)
17 else (result = false)
18 endif}

```

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

The listing 5.36 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

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 5.36: **Messip** (Prolog-oriented) implementation of the operation *init*.

5.12.2 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>

continues in next page ...

... Operation table continuation

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 5.37 provides the **Messir** (MCL-oriented) specification of the operation.

```

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

```

Listing 5.37: **Messir** (MCL-oriented) specification of the operation *handlingDelayPassed*.

The listing 5.38 provides the **Messir** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(ctCrisis,handlingDelayPassed,[Self],
7      Result):-!
8
9/* Post F01 */
10(
11 msrVar(ctState,TheSystem),
12 msrVar(dtInteger,CurrentClockSecondsQty),
13 msrVar(dtInteger,LastReminderSecondsQty),
14 msrVar(dtSecond,CrisisReminderPeriod),
15
16 msrNav([Self],[rnSystem],[TheSystem]),
17
18 msrNav([Self],
19         [status],
20         [[etCrisisStatus,pending]]),
21
22 msrNav([TheSystem],
23         [clock,toSecondsQty,[],],
24         [CurrentClockSecondsQty]),
25
26 msrNav([TheSystem],
27         [vpLastReminder,toSecondsQty,[],],
28         [LastReminderSecondsQty]),
29
30 msrNav([TheSystem],
31         [crisisReminderPeriod],

```

```

32     [CrisisReminderPeriod]),
33
34 msrNav([CurrentClockSecondsQty],
35     [sub, [LastReminderSecondsQty],
36      gt, [CrisisReminderPeriod]
37    ],
38    [[ptBoolean,true]])
39
40)
41-> Result = [ptBoolean,true]
42; Result = [ptBoolean,false]
43.

```

Listing 5.38: **Messip** (Prolog-oriented) implementation of the operation *handlingDelayPassed*.

5.12.3 Operation Model for maxHandlingDelayPassed

The *maxHandlingDelayPassed* operation has the following properties:

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

The listing 5.39 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 5.39: **Messip** (MCL-oriented) specification of the operation *maxHandlingDelayPassed*.

The listing 5.40 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

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 5.40: **Messir** (Prolog-oriented) implementation of the operation *maxHandlingDelayPassed*.

5.12.4 Operation Model for *isSentToCoordinator*

The *isSentToCoordinator* operation has the following properties:

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

```

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

```

Listing 5.41: **Messip** (MCL-oriented) specification of the operation *isSentToCoordinator*.

The listing 5.42 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%%%
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 5.42: **Messip** (Prolog-oriented) implementation of the operation *isSentToCoordinator*.

5.12.5 Operation Model for *isAllocatedIfPossible*

The *isAllocatedIfPossible* operation has the following properties:

OPERATION	
<i>isAllocatedIfPossible</i>	
used to allocate a crisis to a coordinator if any or to alert the administrator of crisis waiting to be handled.	
<i>Return type</i>	
ptBoolean	
<i>Post-Condition (functional)</i>	
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 5.43 provides the **Messip** (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 5.43: **Messip** (MCL-oriented) specification of the operation *isAllocatedIfPossible*.

The listing 5.44 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

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,[],],
21        [[ptBoolean,true]]),
22
23  ( msrNav([TheSystem],
24            [rnactCoordinator,msrIsEmpty],
25            [[ptBoolean,false]]))
26  -> (
27    /* Post F02 */
28    msrNav([TheSystem],
29            [rnactCoordinator,msrAny,msrTrue],
30            [TheCoordinatorActor]),
31

```

```

32   msrNav([TheCoordinatorActor],
33           [rnctCoordinator],
34           [TheCoordinator]),
35
36   msrNav([Self],
37           [msmAtPost,rnHandler],
38           [TheCoordinator]),
39
40   msrNav([Self],
41           [msmAtPost,status],
42           [[etCrisisStatus,handled]]),
43
44   msrNav([Self],
45           [id,value],
46           [TheCrisisIDptString]),
47
48   msrNav([[ptString,'You are now considered as handling the crisis having ID: ']],
49           [ptStringConcat,[TheCrisisIDptString]],
50           [TheMessage]),
51
52   msrNav([TheCoordinatorActor],
53           [rnInterfaceIN,
54           ieMessage,[TheMessage]
55           ],
56           [[ptBoolean,true]])
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 5.44: **Messip** (Prolog-oriented) implementation of the operation *isAllocatedIfPossible*.

5.13 Primary Types - Operation Schemes for Class ctHuman

5.13.1 Operation Model for init

The `init` operation has the following properties:

OPERATION	
<i>init</i>	used to initialize the current object as a new instance of the <code>ctHuman</code> type.
Parameters	
1	Aid: dtPhoneNumber used to initialize the id field
2	Akind: etHumanKind used to initialize the kind field
Return type	
<code>ptBoolean</code>	
Post-Condition (functional)	
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 5.45 provides the **Messir** (MCL-oriented) specification of the operation.

```

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

The listing 5.46 provides the **Messir** (Prolog-oriented) implementation of the operation.

```

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

```

Listing 5.46: **Messir** (Prolog-oriented) implementation of the operation *init*.

5.13.2 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

continues in next page ...

...Operation table continuation

<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 !'

The listing 5.47 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1% % % % % % % % % % % % % % % % %
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4% % % % % % % % % % % % % % % % %
5
6msrop(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 5.47: **Messip** (Prolog-oriented) implementation of the operation *isAcknowledged*.

5.14 Primary Types - Operation Schemes for Class ctState

5.14.1 Operation Model for init

The *init* operation has the following properties:

OPERATION	
<i>init</i>	used to initialize the current object as a new instance of the ctState type.
Parameters	
1 AnextValueForAlertID: dtInteger	used to initialize the nextValueForAlertID field
2 AnextValueForCrisisID: dtInteger	used to initialize the nextValueForCrisisID field
3 Aclock: dtDateAndTime	used to initialize the clock field
4 AcrisisReminderPeriod: dtSecond	used to initialize the crisisReminderPeriod field

continues in next page ...

... Operation table continuation

5	AmaxCrisisReminderPeriod: dtSecond used to initialize the maxCrisisReminderPeriod field
6	AvpLastReminder: dtDateAndTime used to initialize the vpLastReminder field
7	AvpStarted: ptBoolean used to initialize the vpStarted 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 ctState instance having its attributes equal to the ones provided as parameters.

The listing 5.48 provides the **Messir** (MCL-oriented) specification of the operation.

```

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

```

Listing 5.48: **Messir** (MCL-oriented) specification of the operation *init*.

The listing 5.49 provides the **Messir** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(ctState,init,[Self,
7           AnextValueForAlertID,
8           AnextValueForCrisisID,
9           Aclock,
10          AcrisisReminderPeriod,
11          AmaxCrisisReminderPeriod,
12          AvpLastReminder,
13          AvpStarted],
14          Result):-
15
16 /* Post F01 */

```

```

17(
18 msrVar(ctState,Self),
19
20 msrNav([Self], [nextValueForAlertID], [AnextValueForAlertID]),
21 msrNav([Self], [nextValueForCrisisID], [AnextValueForCrisisID]),
22 msrNav([Self], [clock], [Aclock]),
23 msrNav([Self], [crisisReminderPeriod], [AcrisisReminderPeriod]),
24 msrNav([Self], [maxCrisisReminderPeriod], [AmaxCrisisReminderPeriod]),
25 msrNav([Self], [vpLastReminder], [AvpLastReminder]),
26 msrNav([Self], [vpStarted], [AvpStarted]),
27
28 msrNav([Self], [msrIsNew], [Self])
29)
30-> Result = [ptBoolean,true]
31; Result = [ptBoolean,false]
32.

```

Listing 5.49: **Messip** (Prolog-oriented) implementation of the operation *init*.

5.15 Primary Types - Operation Schemes for Datatype dtAlertID

5.15.1 Operation Model for *is*

The *is* operation has the following properties:

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

The listing 5.50 provides the **Messip** (MCL-oriented) specification of the operation.

```

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

```

Listing 5.50: **Messip** (MCL-oriented) specification of the operation *is*.

The listing 5.51 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(dtAlertID,is,[AdtValue],Result):-
7% msd01
8msrVar(ptBoolean,TheResult),
9(
10 ( msrNav([AdtValue],
11   [value,length,[],gt,[[ptInteger,0]]],
12   [[ptBoolean,true]]),
13   msrNav([AdtValue],
14   [value,length,[],leq,[[ptInteger,20]]],
15   [[ptBoolean,true]]))
16 )
17 -> (TheResult = [ptBoolean,true])
18 ; (TheResult = [ptBoolean,false])
19),
20TheResult = Result
21.
22
23/*
24| ?- X = [dtAlertID,[],[[dtString,[[value,[ptString,'0123456789']]],[[]]]],
25msrNav([X],[is,[]],[Result]).
26
27X = [dtAlertID,[],[[dtString,[[value,[ptString,'0123456789']]],[[]]]],
28Result = [ptBoolean,true] ?
29
30yes
31
32| ?- X = [dtAlertID,[],[[dtString,[[value,[ptString,'012345678901234567890123456789']]],[[]]]],
33msrNav([X],[is,[]],[Result]).
34
35X = [dtAlertID,[],[[dtString,[[value,[ptString,'012345678901234567890123456789']]],[[]]]],
36Result = [ptBoolean,false] ?
37
38yes
39*/

```

Listing 5.51: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.16 Primary Types - Operation Schemes for Datatype dtComment

5.16.1 Operation Model for *is*

The *is* operation has the following properties:

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

The listing 5.52 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 self.value.length().leq(MaxLength)
6      )
7    )
8    then (TheResult = true)
9    else (TheResult = false)
10   endif
11   result = TheResult
12 }

```

Listing 5.52: **Messip** (MCL-oriented) specification of the operation *is*.

The listing 5.53 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

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
34to go to the skate park because my friends called me on my mobile phone and told me that a skate
35star was doing triple back flips.']]],[[]]]],%
36msrNav([X],[is,[],[Result]).%
37X = [dtComment,[],[[dtString,[[value,[ptString,'I broke my leg when I was running with my dog to go
38to the skate park because my friends called me on my mobile phone and told me that a skate star
39was doing triple back flips.']]],[[]]]],%
40Result = [ptBoolean,false] ?%
41yes
42*/

```

Listing 5.53: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.17 Primary Types - Operation Schemes for Datatype dtCoordinatorID

5.17.1 Operation Model for *is*

The *is* operation has the following properties:

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

The listing 5.54 provides the **Messip** (MCL-oriented) specification of the operation.

```

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

Listing 5.54: **Messip** (MCL-oriented) specification of the operation *is*.

The listing 5.55 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(dtCoordinatorID,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,5]]],
15   [[ptBoolean,true]])
16 )
17 -> (TheResult = [ptBoolean,true])
18 ; (TheResult = [ptBoolean,false])
19 ),
20 TheResult = Result
```

21.

Listing 5.55: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.18 Primary Types - Operation Schemes for Datatype dtCrisisID

5.18.1 Operation Model for *is*

The *is* operation has the following properties:

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

The listing 5.56 provides the **Messip** (MCL-oriented) specification of the operation.

```

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

Listing 5.56: **Messip** (MCL-oriented) specification of the operation *is*.

The listing 5.57 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

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 5.57: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.19 Primary Types - Operation Schemes for Datatype dtGPSLocation

5.19.1 Operation Model for *is*

The *is* operation has the following properties:

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

The listing 5.58 provides the **Messip** (MCL-oriented) specification of the operation.

```

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

```

Listing 5.58: **Messip** (MCL-oriented) specification of the operation *is*.

The listing 5.59 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

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 5.59: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.19.2 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: http://www.movable-type.co.uk/scripts/latlong.html and http://www.gpsvisualizer.com/calculators#distance)
<i>Parameters</i>
1 AGPSLocation: dtGPSLocation the GPS location to be compared to.
<i>Return type</i>
ptBoolean
<i>Post-Condition (functional)</i>
PostF 1 if the Haversine formula ($\text{ACOS}(\text{SIN}(\text{lat1}) * \text{SIN}(\text{lat2}) + \text{COS}(\text{lat1}) * \text{COS}(\text{lat2}) * \text{COS}(\text{lon2} - \text{lon1})) * 6371$, in which latitudes and longitudes are in radians applied to the two dtGPS coordinates is lower to 100 meters) then the predicate is true and false otherwise.

The listing 5.60 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/

```

```

3 postF{let TheResult: ptBoolean in true
4   let EarthRadius: dtReal in
5   let MaxDistance: dtReal in
6   let ComparedLatitude: dtLatitude in
7   let ComparedLongitude: dtLongitude in
8   let R1: dtReal in let R1a: dtReal in
9   let R2: dtReal in let R2a: dtReal in
10
11  ( if
12    ( EarthRadius.value = 6371
13      and MaxDistance.value = 100
14
15      and self.latitude = ComparedLatitude
16      and self.longitude = ComparedLongitude
17      and self.latitude.sin() = R1a
18      and self.latitude.sin().mul(R1a) = R1
19      and self.latitude.cos() = R2a
20      and self.latitude.cos().mul(R2a) = R2
21
22      and self.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 5.60: **Messir** (MCL-oriented) specification of the operation *isNearTo*.

The listing 5.61 provides the **Messir** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6% dtGPSLocation
7
8msrop(dtGPSLocation,isNearTo,[Self,AdtValue],Result):-
9msrVar(ptBoolean,TheResult),
10msrVar(dtReal,EarthRadius),
11msrVar(dtReal,MaxDistance),
12
13msrVar(dtLatitude,ComparedLatitude),
14msrVar(dtLongitude,ComparedLongitude),
15
16msrVar(dtReal,R1),msrVar(dtReal,R1a),
17msrVar(dtReal,R2),msrVar(dtReal,R2a),
18
19(
20(
21(
22  % msd01
23  msrNav([EarthRadius],[value],[[ptReal,6371]]),
24  msrNav([MaxDistance],[value],[[ptReal,100]]),
25
26  msrNav([AdtValue],[latitude],[ComparedLatitude]),
27  msrNav([AdtValue],[longitude],[ComparedLongitude]),
28
29  msrNav([Self],[latitude,sin,[],[R1a]]),
30  msrNav([AdtValue],[latitude,sin,[],mul,[R1a]], [R1]),
31
32  msrNav([Self],[latitude,cos,[],[R2a]]),

```

```

33  msrNav([AdtValue],[latitude,cos,[],mul,[R2a]], [R2]),
34
35  msrNav([AdtValue],[longitude],[ComparedLongitude]),
36  msrNav([Self],[longitude,sub,[ComparedLongitude],cos,[],mul,[R2],
37    add,[R1],
38    acos,[] ,
39    mul,[EarthRadius],
40    sub,[MaxDistance],
41    value,leq,[[ptReal,0]]],
42    [[ptBoolean,true]])
43  )
44  -> TheResult = [ptBoolean,true]
45  ; TheResult = [ptBoolean,false]
46  )
47),
48 Result = TheResult
49.

```

Listing 5.61: **Messir** (Prolog-oriented) implementation of the operation *isNearTo*.

5.20 Primary Types - Operation Schemes for Datatype dtLatitude

5.20.1 Operation Model for *is*

The *is* operation has the following properties:

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

The listing 5.62 provides the **Messir** (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 5.62: **Messir** (MCL-oriented) specification of the operation *is*.

The listing 5.63 provides the **Messir** (Prolog-oriented) implementation of the operation.

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 5.63: **Messir** (Prolog-oriented) implementation of the operation *is*.

5.21 Primary Types - Operation Schemes for Datatype dtLogin

5.21.1 Operation Model for *is*

The *is* operation has the following properties:

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

The listing 5.64 provides the **Messir** (MCL-oriented) specification of the operation.

```

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

```

Listing 5.64: **Messir** (MCL-oriented) specification of the operation *is*.

The listing 5.65 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

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     MaxLength = [ptInteger,20],
14     msrNav([AdtValue],
15       [value,length,[],leq,[MaxLength]],
16       [[ptBoolean,true]])
17   )
18   -> TheResult = [ptBoolean,true]
19   ; TheResult = [ptBoolean,false]
20
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 5.65: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.22 Primary Types - Operation Schemes for Datatype dtLongitude

5.22.1 Operation Model for *is*

The *is* operation has the following properties:

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

The listing 5.66 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      then (TheResult = true)
8      else (TheResult = false)
9    endif
10   result = TheResult
11 }
12 }
```

Listing 5.66: **Messip** (MCL-oriented) specification of the operation *is*.

The listing 5.67 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

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 5.67: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.23 Primary Types - Operation Schemes for Datatype dtPassword

5.23.1 Operation Model for *is*

The *is* operation has the following properties:

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

The listing 5.68 provides the **Messir** (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 self.value.length() .geq(MinLength)
7              )
8          )
9          then (TheResult = true)
10         else (TheResult = false)
11         endif
12         result = TheResult
13     ) }
```

Listing 5.68: **Messir** (MCL-oriented) specification of the operation *is.*

The listing 5.69 provides the **Messir** (Prolog-oriented) implementation of the operation.

Listing 5.69: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.24 Primary Types - Operation Schemes for Datatype dtPhoneNumber

5.24.1 Operation Model for is

The `is` operation has the following properties:

OPERATION
<i>is</i>
used to determine which strings are considered as valid <code>dtPhoneNumber</code> .
<i>Return type</i>
<code>ptBoolean</code>
<i>Post-Condition (functional)</i>
PostF 1 is true of the length of the string value is from 4 to 30 characters. No standard is applied !

The listing 5.70 provides the **Messip** (MCL-oriented) specification of the operation.

```

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

Listing 5.70: **Messip** (MCL-oriented) specification of the operation `is`.

The listing 5.71 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

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 5.71: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.25 Primary Types - Operation Schemes for Enumeration etAlertStatus

5.25.1 Operation Model for *is*

The *is* operation has the following properties:

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

The listing 5.72 provides the **Messip** (MCL-oriented) specification of the operation.

```

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

```

Listing 5.72: **Messip** (MCL-oriented) specification of the operation *is*.

The listing 5.73 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

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 5.73: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.26 Primary Types - Operation Schemes for Enumeration etCrisisStatus

5.26.1 Operation Model for *is*

The *is* operation has the following properties:

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

The listing 5.74 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2 /* Post Functional:*/
3 postF{let TheResult: ptBoolean in
4     (
5         if
6             ( self = pending
7             or self = handled
8             or self = solved
9             or self = closed
10            )
11            then (TheResult = true)
12            else (TheResult = false)
13        endif
14        result = TheResult
15    )}
```

Listing 5.74: **Messip** (MCL-oriented) specification of the operation *is*.

The listing 5.75 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

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 5.75: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.27 Primary Types - Operation Schemes for Enumeration etCrisisType

5.27.1 Operation Model for *is*

The *is* operation has the following properties:

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

The listing 5.76 provides the **Messip** (MCL-oriented) specification of the operation.

```

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

```

Listing 5.76: **Messip** (MCL-oriented) specification of the operation *is*.

The listing 5.77 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6%% etCrisisType
7
8% msd01
9msrop(etCrisisType,is,[AdtValue],Result):-%
10msrVar(ptBoolean,TheResult),
11(
12  (
13    member(AdtValue,[small, medium, huge])
14  )
15 -> TheResult = [ptBoolean,true]
16 ; TheResult = [ptBoolean,false]
17),
18 Result = TheResult
19.

```

Listing 5.77: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.28 Primary Types - Operation Schemes for Enumeration etHumanKind

5.28.1 Operation Model for *is*

The *is* operation has the following properties:

OPERATION
<i>is</i>
used to determine which 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: witness, victim, anonym

The listing 5.78 provides the **Messip** (MCL-oriented) specification of the operation.

```

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

```

Listing 5.78: **Messip** (MCL-oriented) specification of the operation *is*.

The listing 5.79 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

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 5.79: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.29 Secondary Types - Operation Schemes for Classes

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

5.30 Secondary Types - Operation Schemes for Datatype dtSMS

5.30.1 Operation Model for *is*

The *is* operation has the following properties:

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

The listing 5.80 provides the **Messip** (MCL-oriented) specification of the operation.

```

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

```

```

11      endif
12      result = TheResult
13  ) }

```

Listing 5.80: **Messip** (MCL-oriented) specification of the operation *is*.

The listing 5.81 provides the **Messip** (Prolog-oriented) implementation of the operation.

```

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 5.81: **Messip** (Prolog-oriented) implementation of the operation *is*.

5.31 Secondary Types - Operation Schemes for Enumerations

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

Chapter 6

Test Model(s)

6.1 Test Model for testcase01

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

6.1.1 Test Steps Specification

6.1.1.1 testcase01-ts01oeCreateSystemAndEnvironment-actMsrCreator.outactMsrCreator.oeCreateSy

The testcase01-ts01oeCreateSystemAndEnvironment-actMsrCreator.outactMsrCreator.oeCreateSy 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>out:Creator</p> <p>sends to system</p> <p>actMsrCreator.outactMsrCreator.oeCreateSystemAndEnvironment (AqtyComCompanies)</p>
<i>Variables</i>	
V 1	Creator:icrash.environment.actMsrCreator 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 **Messip** (MCL-oriented) specification of the test step.

```

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

```

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

The listing 6.2 provides the **Messir** (Prolog-oriented) implementation of the test step.

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrTest/1.
4%%%%%%%%%%%%%
5
6%-----7:-msrTestAddStep([system,sim,1,1]).8%-----9msrTest([[system,sim,1,1],
10      [target,oeCreateSystemAndEnvironment],
11      [context,Context],
12      [inputParameters,InputParameters],
13      [outputParameters,OutputParameters],
14      [comments,Comments],
15      TestResult]
16    ):-17%-----18(
19 (
20% Step 0
21
22%% Context Declaration
23%% N.A.
24
25%% Input Parameters Declaration
26msrVar(ptInteger,AqtyComCompanies),
27
28%% Output Parameters Declaration
29%% N.A.
30
31%% Context Specification
32%% N.A.
33
34%% Input Parameters Specification
35AqtyComCompanies = [ptInteger,4],
36
37%% Output Parameters Specification
38%% N.A.
39
40%% Test Specification
41Target = launchCreateSystemAndEnvironment,
42ParametersList =
43[ [AqtyComCompanies],
44 Result
45], !,

```

```

46GoalGet=..[Target | ParametersList],
47
48%% Oracle specification
49OracleGet=..[true]
50)
51->
52%% Test Interpretation
53((GoalGet,!)
54-> ((OracleGet,!)
55 -> TestResult = [success]
56 ; TestResult = [failedAtOracle])
57; TestResult = [failedAtGoal]
58)
59; TestResult = [failedAtTestDeclarationOrSpecification]
60),
61%% Test Outcome
62Context = [],
63InputParameters = ['AqtyComCompanies',AqtyComCompanies],
64OutputParameters = [],
65Comments = 'System launch ! '
66.

```

Listing 6.2: **Messir** (Prolog-oriented) implementation of the test step *testcase01-ts01oeCreateSystemAndEnvironment*.

6.1.1.2 testcase01-ts02oeSetClock-actActivator.outactActivator.oeSetClock

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

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

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

¹for 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>

```

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 = 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 6.3: **Messip** (MCL-oriented) specification of the test step *testcase01-ts02oeSetClock*.

6.1.1.3 testcase01-ts03oeLogin-actAdministrator.outactAdministrator.oeLogin

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

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

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

```

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

Listing 6.4: **Messir** (MCL-oriented) specification of the test step *testcase01-ts03oeLogin*.

6.1.1.4 testcase01-ts04oeAddCoordinator-actAdministrator.outactAdministrator.oeAddCoordinator

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

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

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 6.5 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 }
8
9 constraints{
10  TheActor = TheSystem.rnactAdministrator->any2(true)
11  AdtCoordinatorID.value.eq('1')
12  AdtLogin.value.eq('steve')
13  AdtPassword.value.eq('pwdMessirExcalibur2017')
14 }
15
16 oracle{
17   constraints{
18     TheActor.inactAdministrator.ieCoordinatorAdded()
19   }
20 }
```

Listing 6.5: **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:

TEST STEP	
<i>ts05oeLogout</i>	
to test the logout of a connected administrator.	
<i>Test Sent Message</i>	
TSM 1	<p>out:TheActor</p> <p>sends to system</p> <p>actAdministrator.outactAdministrator.oeLogout ()</p>
<i>Variables</i>	
V 1	TheActor:actAdministrator an actAdministrator actor as subtype of actAuthenticated can send oeLogout messages to the system.
<i>Constraints</i>	
C 1	TheActor is any actAdministrator instance existing in the environment. It is expected that there exists at least one which is the same during all the test case.
<i>Oracle Constraints</i>	

continues in next page ...

... Test Step table continuation

OC 1	the AMessage 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 AMessage.

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

```

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

Listing 6.6: **Messip** (MCL-oriented) specification of the test step *testcase01-ts05oeLogout*.

6.1.1.6 testcase01-ts06oeSetClock02-actActivator.outactActivator.oeSetClock

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

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

The listing 6.7 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 = 15
14  ACurrentClock.time.second.value = 00
15 }
16
17 oracle{
18   constraints{
19     true
20   }
21 }
```

Listing 6.7: **Messip** (MCL-oriented) specification of the test step *testcase01-ts06oeSetClock02*.

6.1.1.7 testcase01-ts07oeAlert1-actComCompany.outactComCompany.oeAlert

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

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

continues in next page ...

... Test Step table continuation

<i>Oracle Constraints</i>	
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 6.8 provides the **Messir** (MCL-oriented) specification of the test step.

```

1
2 variables{
3   TheActor : actComCompany
4   AetHumanKind:eHumanKind
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 6.8: **Messir** (MCL-oriented) specification of the test step *testcase01-ts07oeAlert1*.

6.1.1.8 testcase01-ts08oeSetClock03-actActivator.outactActivator.oeSetClock

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

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

continues in next page ...

... Test Step table continuation

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

The listing 6.9 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 6.9: **Messip** (MCL-oriented) specification of the test step *testcase01-ts08oeSetClock03*.

6.1.1.9 testcase01-ts09oeSollicitateCrisisHandling-actActivator.outactActivator.oeSollicitateCrisis

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

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

continues in next page ...

... Test Step table continuation

TSM 1	out:TheActor sends to system actActivator.outactActivator.oeSollicitateCrisisHandling ()
Variables	
V 1	TheActor:icrash.environment.actActivator proactive actor responsible of triggering sollicitation functionality.
Constraints	
C 1	TheActor is any instance existing in the current environment status. It is expected to exist at least one.
Oracle Variables	
OV 1	TheAdministrator:actAdministrator actAdministrator actors can be sollicitated to handle alerts.
OV 2	TheCoordinator:actCoordinator actCoordinator actors can be sollicitated to handle alerts.
OV 3	AMessageForCrisisHandlers:ptString messages sent to sollicitated actors are of type ptString.
Oracle Constraints	
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 6.10 provides the **Messip** (MCL-oriented) specification of the test step.

```

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

```

```

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

Listing 6.10: **Messir** (MCL-oriented) specification of the test step *testcase01-ts09oeSollicitateCrisisHandling*.

6.1.1.10 testcase01-ts10oeLogin02-actAuthenticated.outactAuthenticated.oeLogin

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

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

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

```

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

```

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

Listing 6.11: **Messip** (MCL-oriented) specification of the test step *testcase01-ts10oeLogin02*.

6.1.1.11 testcase01-ts11oeGetCrisisSet-actCoordinator.outactCoordinator.oeGetCrisisSet

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

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

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

```

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

```

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

Listing 6.12: **Messir** (MCL-oriented) specification of the test step *testcase01-ts11oeGetCrisisSet*.

6.1.1.12 testcase01-ts12oeSetCrisisHandler-actCoordinator.outactCoordinator.oeSetCrisisHandler

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

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

continues in next page ...

... Test Step table continuation

C 3	AMessage is the string 'You are now considered as handling the crisis !'
C 4	AdtPhoneNumber
C 5	AdtSMS has for value the string 'The handling of your alert by our services is in progress !'
Oracle Constraints	
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 6.13 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 6.13: **Messip** (MCL-oriented) specification of the test step *testcase01-ts12oeSetCrisisHandler*.

6.1.1.13 testcase01-ts13oeSetClock04-actActivator.outactActivator.oeSetClock

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

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

continues in next page ...

... Test Step table continuation

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

The listing 6.14 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 = 45
14  ACurrentClock.time.second.value = 00
15 }
16
17 oracle{
18   constraints{
19     true
20   }
21 }
```

Listing 6.14: **Messir** (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>Test Sent Message</i>

continues in next page ...

... Test Step table continuation

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

The listing 6.15 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 6.15: **Messir** (MCL-oriented) specification of the test step *testcase01-ts14oeValidateAlert*.

6.1.1.15 testcase01-ts15oeAlert2-actComCompany.outactComCompany.oeAlert

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

TEST STEP	
<i>ts15oeAlert2</i> cf. actor documentation	
Test Sent Message	
TSM 1	<p>out:TheActor</p> <p>sends to system</p> <p>actComCompany.outactComCompany.oeAlert (AetHumanKind, AdtDate, AdtTime, AdtPhoneNumber, AdtGPSLocation, AdtComment)</p>
Variables	
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
Constraints	
C 1	TheActor
C 2	AetHumanKind
C 3	AdtDate
C 4	AdtTime
C 5	AdtPhoneNumber
C 6	AdtGPSLocation
C 7	AdtComment
C 8	AdtSMS
Oracle Constraints	
OC 1	

The listing 6.16 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 6.16: **Messir** (MCL-oriented) specification of the test step *testcase01-ts15oeAlert2*.

6.1.1.16 testcase01-ts16oeSetClock05-actActivator.outactActivator.oeSetClock

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

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

The listing 6.17 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 6.17: **Messir** (MCL-oriented) specification of the test step *testcase01-ts16oeSetClock05*.

6.1.1.17 testcase01-ts17oeSetCrisisStatus-actCoordinator.outactCoordinator.oeSetCrisisStatus

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

TEST STEP	
<i>ts17oeSetCrisisStatus</i>	
cf. actor documentation	
<i>Test Sent Message</i>	
TSM 1	<p>out:TheActor</p> <p>sends to system</p> <p>actCoordinator.outactCoordinator.oeSetCrisisStatus (AdtCrisisID, AetCrisisStatus)</p>
<i>Variables</i>	
V 1	TheActor:icrash.environment.actCoordinator cf. actor documentation
V 2	AdtCrisisID:icrash.concepts.primarytypes.datatypes.dtCrisisID cf. actor documentation
V 3	AetCrisisStatus:icrash.concepts.primarytypes.datatypes.etCrisisStatus cf. actor documentation
V 4	AMessage: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	AdtCrisisID

continues in next page ...

... Test Step table continuation

C 3	AetCrisisStatus
C 4	AMessage
Oracle Constraints	
OC 1	

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

```

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

Listing 6.18: **Messip** (MCL-oriented) specification of the test step *testcase01-ts17oeSetCrisisStatus*.

6.1.1.18 testcase01-ts18oeReportOnCrisis-actCoordinator.outactCoordinator.oeReportOnCrisis

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

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

... Test Step table continuation

V 3	cf. actor documentation AdtComment:icrash.concepts.primarytypes.datatypes.dtComment
V 4	cf. actor documentation AMessage:lu.uni.lassy.messir.libraries.primitives.ptString cf. actor documentation
Constraints	
C 1	TheActor is the coordinator actor related to a coordinator in the system's state having steve as login value
C 2	AdtCrisisID
C 3	AdtComment
C 4	AMessage
Oracle Constraints	
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   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 6.19: **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	out: TheActor sends to system actCoordinator.outactCoordinator.oeCloseCrisis (AdtCrisisID)
<i>Variables</i>	
V 1	TheActor: icrash.environment.actCoordinator cf. actor documentation
V 2	AdtCrisisID: icrash.concepts.primarytypes.datatypes.dtCrisisID cf. actor documentation
V 3	AMessage: 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	AdtCrisisID
C 3	AMessage
<i>Oracle Constraints</i>	
OC 1	

The listing 6.20 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 6.20: **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*.

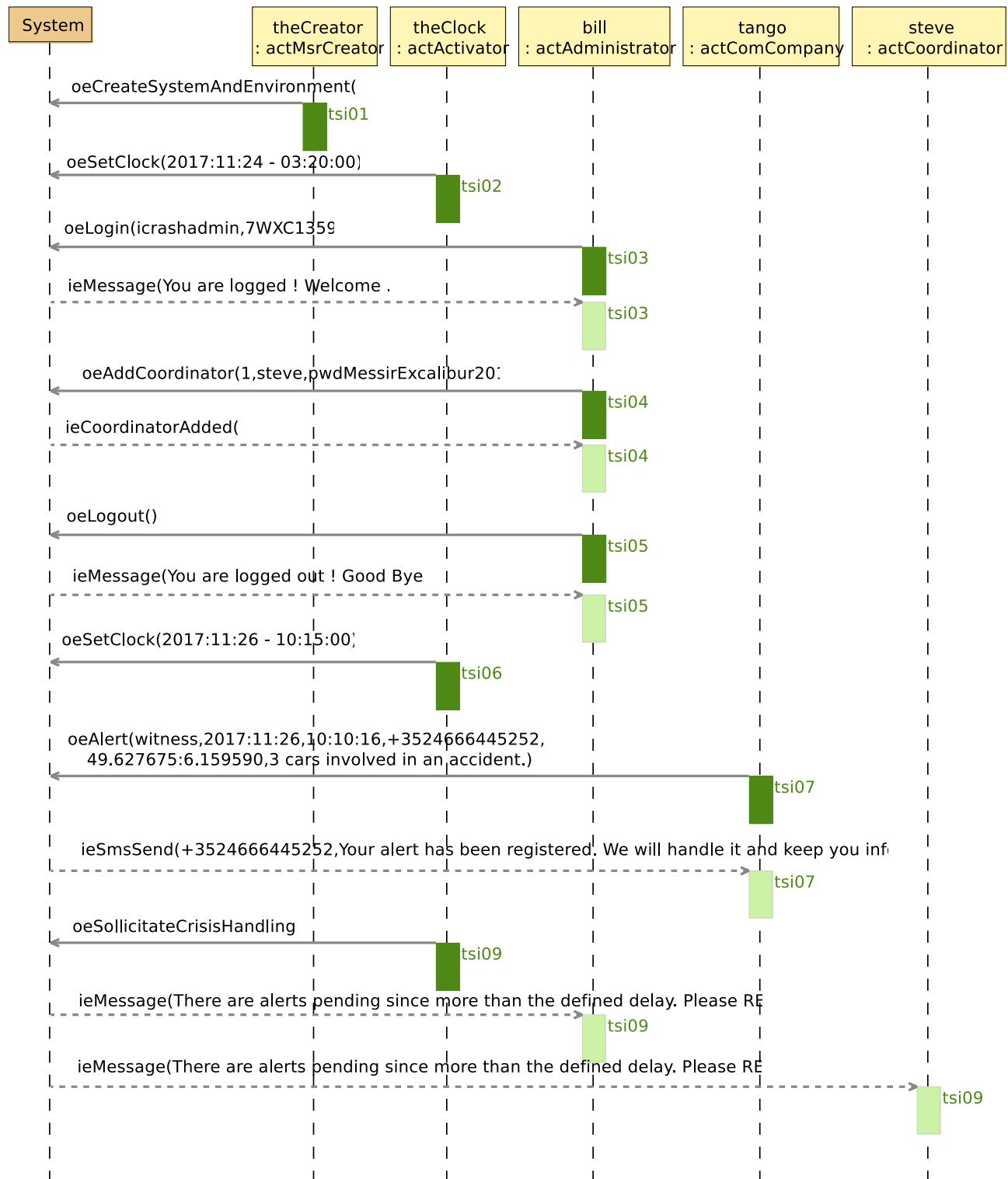


Figure 6.1: tci-testcase01-instance01-Part01 testcase instance sequence diagram

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*.

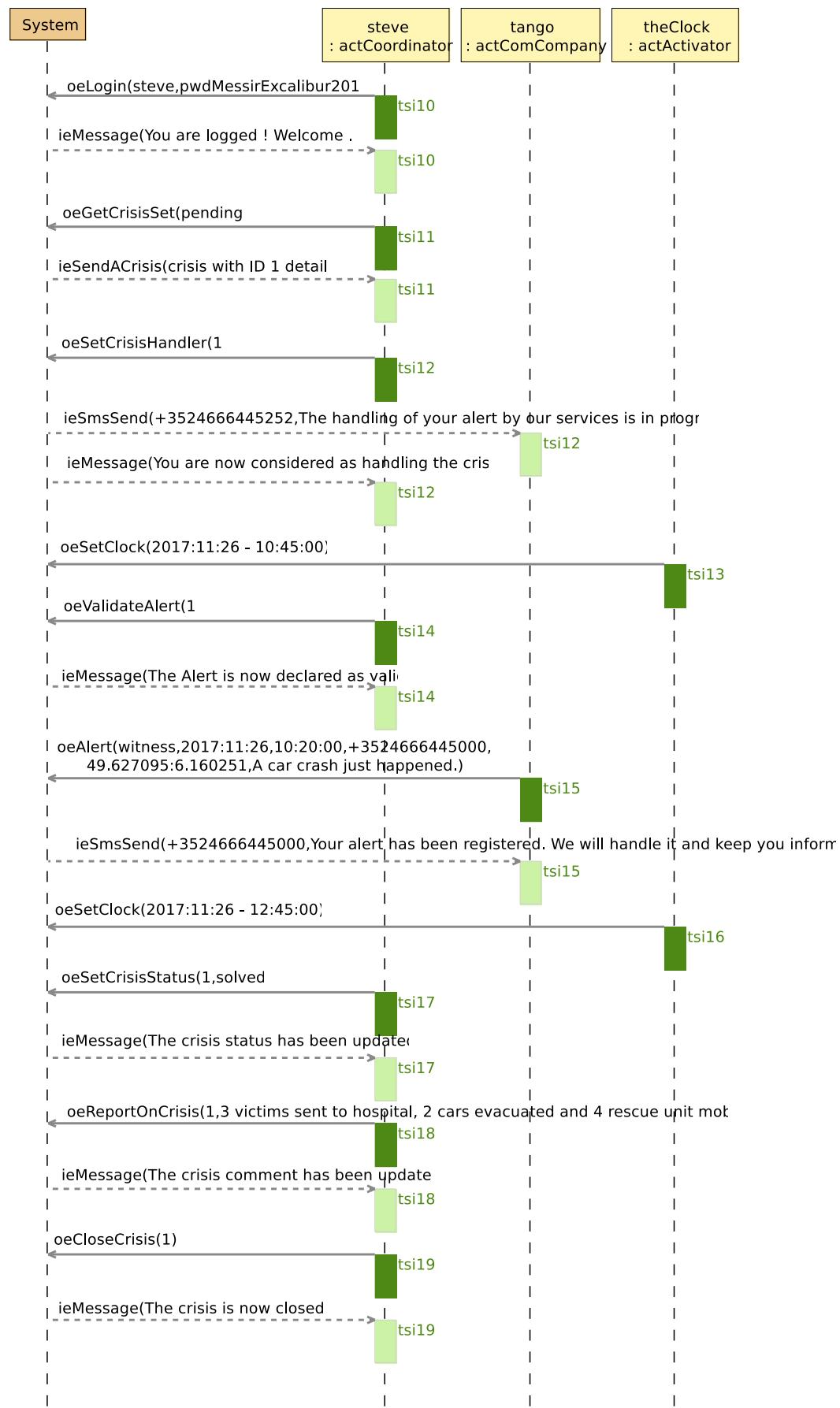


Figure 6.2: tci-testcase01-instance01-Part02 testcase instance sequence diagram

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-uciugSecurelyUseSystem

A.2 Undocumented Concept Model Views

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

A.3 Undocumented Test-Case Instance Specifications

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

Appendix B

Specification project
`lu.uni.lassy.icrash.spec.messir.reference`

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 **Messir** 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	
Name	oeCloseCrisis
Scope	system
Level	subfunction
<i>Primary actor(s)</i>	
1	actCoordinator[active]
<i>Goal(s) description</i>	
the actCoordinator's goal is to declare a crisis as closed.	
<i>Protocol condition(s)</i>	
1	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 ieMessage (AMessage) is sent to the actCoordinator 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

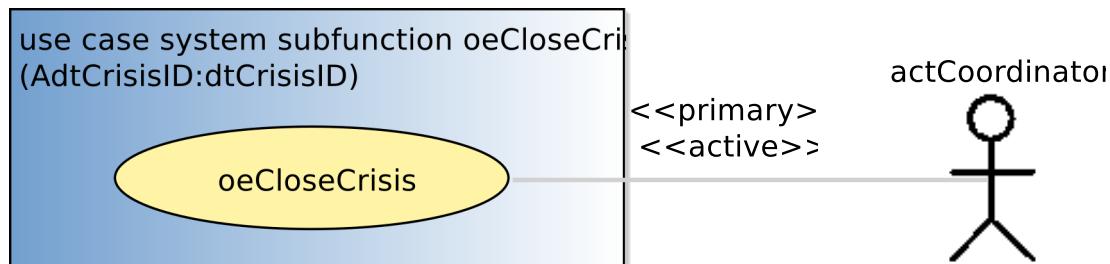


Figure B.1: oeCloseCrisis subfunction use case

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 self.value.length().leq(MaxLength)  
20         )  
21       then (TheResult = true)  
22       else (TheResult = false)  
23       endif  
24       result = TheResult  
25     })  
26   prolog{ "src/Operations/Concepts/SecondaryTypesDatatypes/SecondaryTypesDatatypes-dtSMS-is.pl"}  
27 }  
28 }  
29 }
```

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

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

```

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

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

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

```

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

```

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

```

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

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

```

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

```

```

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

```

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

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

```

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

```

```

4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.calendar
6
7 import icrash.environment
8
9 import icrash.concepts.primarytypes.datatypes
10 import icrash.concepts.primarytypes.classes
11
12 Operation Model {
13
14 operation: actAdministrator.outactAdministrator.oeDeleteCoordinator(AdtCoordinatorID:dtCoordinatorID
15 ) :ptBoolean
16 {
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 ThetcCoordinator:ctCoordinator in
43     self.rnActor.rnSystem = TheSystem
44     and self.rnActor = TheActor
45 /* PostF01 */
46     TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
47     = ThetcCoordinator
48     and ThetcCoordinator.rnactCoordinator->forAll(msrIsKilled)
49     and ThetcCoordinator.msrIsKilled
50
51 /* PostF02 */
52     and TheActor.rnInterfaceIN^ieCoordinatorDeleted()
53
54 /* Post Protocol:*/
55 /* PostP01 */
56     and true
57 }
58 postP{true}
59
60 prolog{"src/Operations/Environment/OUT/outactAdministrator-oeDeleteCoordinator.pl"}
61 }
62     }
63 }

```

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

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

```

1 package icrash.operations.environment.actAuthenticated{

```

```

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

```

```

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

```

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

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

```

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

```

```

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

```

```

86 and if (ColctAlertsNearBy->size()=0)
87   then (TheSystem.nextValueForCrisisID = PrenextValueForCrisisID
88     and PrenextValueForCrisisID.add(1) = PostnextValueForCrisisID
89     and TheSystem@post.nextValueForCrisisID = PostnextValueForCrisisID
90     and TheSystem.nextValueForCrisisID.todtString().eq(AdtCrisisID)
91     and AdtCrisisType = small
92     and AetCrisisStatus = pending
93     and ACrisisInstant= AAlertInstant
94     and ACrisisdtComment = 'no reporting yet defined'
95     and ActCrisis.init( AdtCrisisID,
96       AdtCrisisType,
97       AetCrisisStatus,
98       AdtGPSLocation,
99       ACrisisInstant,
100      ACrisisdtComment)
101    )
102 else (ColctAlertsNearBy.rnTheCrisis->msrAny(true) = ActCrisis)
103 endif
104
105 /* PostF04 */
106 and ActAlert@post.rnTheCrisis = ActCrisis
107
108 /* PostF05 */
109 and TheSystem.rnctHuman->select(id.eq(AdtPhoneNumber)) = 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 post{true}
130
131 prolog{"src/Operations/Environment/OUT/outactComCompany-oeAlert.pl"}
132 }
133 }
134 }

```

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

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

```

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

```

```

14 }
15 }
16 }
```

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

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

```

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

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

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

```

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

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

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

```

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

```

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

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

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

```

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

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

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

```

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

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

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

```

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

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

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

```

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

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

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

```

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

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

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

```

1 package icrash.operations.environment.actMsrCreator.oeCreateSystemAndEnvironment{
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.calendar
6
7 import icrash.concepts.primarytypes.datatypes
8 import icrash.concepts.primarytypes.classes
9 import icrash.concepts.secondarytypes.datatypes
10 import icrash.concepts.secondarytypes.classes
11 import icrash.environment
12
13 Operation Model {
14
15 operation: actMsrCreator.outactMsrCreator.oeCreateSystemAndEnvironment(AqtyComCompanies:ptInteger):
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
30     /* PostF01 -- MUST ALWAYS BE MADE FIRST -- */
31     AnextValueForAlertID.value.eq(1)
32     and AnextValueForCrisisID.value.eq(1)
33     and Aclock.date.year.value = 1970
34     and Aclock.date.month.value = 01
35     and Aclock.date.day.value = 01
36     and Aclock.time.hour.value = 00
37     and Aclock.time.minute.value = 00
38     and Aclock.time.second.value = 00
39
40     and AcrisisReminderPeriod.value.eq(300)
41     and AmaxCrisisReminderPeriod.value.eq(1200)
42     and AvpStarted = true
43     and TheSystem.init(AnextValueForAlertID,
44         AnextValueForCrisisID,
45         Aclock,
46         AcrisisReminderPeriod,
47         AmaxCrisisReminderPeriod,
```

```

47         Aclock,
48         AvpStarted
49     )
50 /* PostF02*/
51 and AactMsrCreator.init()
52 /* PostF03 */
53 and let AactComCompanyCol: Bag(actComCompany) in
54 AactComCompanyCol->size() = AqtyComCompanies
55 AactComCompanyCol-> forAll(init())
56 /* PostF04*/
57 and AactAdministrator.init()
58 /* PostF05*/
59 and let AactActivator:actActivator in
60 AactActivator.init()
61 /* PostF06 */
62 and let ActAdministrator:ctAdministrator in
63   let AdtLogin:dtLogin in
64     let AdtPassword:dtPassword in
65       AdtLogin.value.eq('icrashadmin')
66       and AdtPassword.value.eq('7WXC1359')
67       and ActAdministrator.init(AdtLogin,AdtPassword)
68 /* PostF07*/
69 and ActAdministrator@post.rnactAuthenticated = AactAdministrator
70 postP{true}
71
72 prolog{ "src/Operations/Environment/OUT/outactMsrCreator-oeCreateSystemAndEnvironment.pl"}
73
74 }
75 }
76
77 }

```

Listing C.19: Messir Spec. file environment-actMsrCreator-oeCreateSystemAndEnvironment.msr.

C.20 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 ):ptBoolean
36
37     operation oeDeleteCoordinator(
38         AdtCoordinatorID:dtCoordinatorID ):ptBoolean
39     }
40
41 input interface inactAdministrator{
42
43     operation ieCoordinatorAdded():ptBoolean
44     operation ieCoordinatorDeleted():ptBoolean
45     }
46 }
47
48 actor actCoordinator
49     role rnactCoordinator
50     cardinality [0..*]
51     extends actAuthenticated{
52
53     operation init():ptBoolean
54
55     output interface outactCoordinator{
56         operation oeInvalidateAlert(AdtAlertID:dtAlertID ):ptBoolean
57         operation oeCloseCrisis(AdtCrisisID:dtCrisisID ):ptBoolean
58         operation oeGetAlertsSet(AetAlertStatus:etAlertStatus ):ptBoolean
59         operation oeGetCrisisSet(AetCrisisStatus:etCrisisStatus ):ptBoolean
60         operation oeSetCrisisHandler(AdtCrisisID:dtCrisisID ):ptBoolean
61         operation oeReportOnCrisis(
62             AdtCrisisID:dtCrisisID ,
63             AdtComment:dtComment
64             ):ptBoolean
65         operation oeSetCrisisStatus(
66             AdtCrisisID:dtCrisisID ,
67             AetCrisisStatus:etCrisisStatus
68             ):ptBoolean
69         operation oeSetCrisisType(
70             AdtCrisisID:dtCrisisID ,
71             AetCrisisType:etCrisisType
72             ):ptBoolean
73         operation oeValidateAlert(AdtAlertID:dtAlertID ):ptBoolean
74     }
75
76     input interface inactCoordinator{
77         operation ieSendAnAlert(ActAlert:ctAlert ):ptBoolean
78         operation ieSendACrisis(ActCrisis:ctCrisis ):ptBoolean
79     }
80 }
81
82 actor actComCompany role rnactComCompany cardinality [0..*]{
83
84     operation init():ptBoolean
85
86     output interface outactComCompany{
87         operation oeAlert(
88             AetHumanKind:etHumanKind ,
89             AdtDate:dtDate ,
90             AdtTime:dtTime ,
91             AdtPhoneNumber:dtPhoneNumber ,
92             AdtGPSLocation:dtGPSLocation ,
93             AdtComment:dtComment
94             ):ptBoolean
95     }
96
97     input interface inactComCompany{
98         operation ieSmsSend(AdtPhoneNumber:dtPhoneNumber ,
99             AdtSMS:dtSMS
100             ):ptBoolean
101     }
102 }
103

```

```

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

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

C.21 File [./src-gen/messir-spec/concepts/primarytypes-associations.msr](#)

```

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

```

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

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

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

```

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

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

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

```

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

```

13 operation: icrash.concepts.primarytypes.classes.ctAlert.init(Aid:dtAlertID , Astatus:etAlertStatus ,
   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.23: Messir Spec. file primarytypes-classes-ctAlert.msr.

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

```

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

```

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

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

```

1 package icrash.operations.concepts.primarytypes.classes.ctCoordinator.init {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import icrash.concepts.primarytypes.datatypes
5 import icrash.concepts.primarytypes.classes
6
7 Operation Model {
8
9 operation: icrash.concepts.primarytypes.classes.ctCoordinator.init(Aid:dtCoordinatorID, Alogin:
10 dtLogin, Apwd:dtPassword):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.vpIsLogged = false
20 /* Post F02 */
21 and (Self.oclIsNew and self = Self)
22 )
23 then (result = true)
24 else (result = false)
25 endif}
26 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctCoordinator-init.pl"}
27 }
28 }
29 }
```

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

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

```

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

```

28 /* Post F01 */
29 let Self:ctCrisis in
30 Self.id = Aid
31 and Self.type = Atype
32 and Self.status = Astatus
33 and Self.location = Alocation
34 and Self.instant = Ainstant
35 and Self.comment = Acomment
36 /* Post F02 */
37 and (Self.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
101 .pl" }
102 //-----
103 operation: icrash.concepts.primarytypes.classes.ctCrisis.isAllocatedIfPossible():ptBoolean
104 {
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-
132 isAllocatedIfPossible.pl"}
133 }
134 }

```

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

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

```

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

```

```

20
21 /* Post F02 */
22 and (Self.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.27: Messir Spec. file primarytypes-classes-ctHuman.msr.

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

```

1 package icrash.operations.concepts.primarytypes.classes.ctState{
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.calendar
5 import lu.uni.lassy.messir.libraries.math
6
7 import icrash.concepts.primarytypes.classes
8
9 Operation Model {
10
11 operation: icrash.concepts.primarytypes.classes.ctState.init(
12 AnextValueForAlertID: dtInteger,
13 AnextValueForCrisisID: dtInteger ,
14 dtAclock:dtDateAndTime,
15 AcrisisReminderPeriod: dtSecond ,
16 AmaxCrisisReminderPeriod: dtSecond ,
17 AvpLastReminder: dtDateAndTime ,
18 AvpStarted:ptBoolean ):ptBoolean{
19 postF{
20 if
21 (
22 /* Post F01 */
23 let Self:ctState in
24
25 Self.nextValueForAlertID = AnextValueForAlertID
26 and Self.nextValueForCrisisID = AnextValueForCrisisID
27 and Self.clock = Aclock
28 and Self.crisisReminderPeriod = AcrisisReminderPeriod
29 and Self.maxCrisisReminderPeriod = AmaxCrisisReminderPeriod
30 and Self.vpLastReminder = AvpLastReminder
31 and Self.vpStarted = AvpStarted
32
33 and (Self.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.28: Messir Spec. file primarytypes-classes-ctState.msr.

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

```

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

```

```

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

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

C.30 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatYPES/primarytypes-datatypeS-dtAlertID.msr

```

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

```

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

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

C.31 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatype-primarytypes-datatype-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 self.value.length().leq(MaxLength)
14         )
15         then (TheResult = true)
16         else (TheResult = false)
17       endif
18       result = TheResult
19     )
20   }
21   prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtComment-is.pl"}
22 }
23 }
24 }
```

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

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

```

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

23 }

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

C.33 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatatypes-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         ( self.value.length().gt(0)
13           and self.value.length().leq(10)
14         )
15         then (TheResult = true)
16         else (TheResult = false)
17       endif
18       result = TheResult
19     )
20   }
21   prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtCrisisID-is.pl"}
22 }
23 }
24 }
```

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

C.34 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/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         ( self.latitude.is()
18           and self.longitude.is
19         )
20         then (TheResult = true)
21         else (TheResult = false)
22       endif
23       result = TheResult
24     )
25   }
26   prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtGPSLocation-is.pl"}
27 }
28   operation: icrash.concepts.primarytypes.datatypes.dtGPSLocation.isNearTo(aGPSLocation:
dtGPSLocation):ptBoolean{
```

```

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

```

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

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

```

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

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

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

```

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

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

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

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

```

1
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        ( self.value.length().gt(4)
13          and self.value.length().leq(30)
14        )
15        then (TheResult = true)
16        else (TheResult = false)
17      endif
18      result = TheResult
19    )
20  }
21  prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtPhoneNumber-is.pl"}
22 }
23 }
24 }
```

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

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

```

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

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

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

```

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

```

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

```

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

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

```

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

```

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

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

```

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

```

```

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

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

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

```

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

```

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

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

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

```

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

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

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

```

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

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

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

```

1 package icrash.concepts.secondarytypes.datatypes {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.string
5
6 import icrash.concepts.primarytypes.datatypes
7
8 Concept Model {
9
10   Secondary Types {
11
12     datatype dtSMS {
13       attribute value: ptString
14       operation is():ptBoolean
15     }
16 }
```

```

16 }
17 }
18 }
```

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

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

```

1 package icrash.usecases.subfunctions {
2
3 import lu.uni.lassy.messir.libraries.primitives
4
5 import icrash.concepts.primarytypes.datatypes
6 import icrash.concepts.primarytypes.classes
7 import icrash.concepts.secondarytypes.datatypes
8 import lu.uni.lassy.messir.libraries.primitives
9 import lu.uni.lassy.messir.libraries.math
10 import lu.uni.lassy.messir.libraries.calendar
11
12 import icrash.environment
13
14 Use Case Model {
15
16 //-
17 use case system subfunction oeAddCoordinator(AdtCoordinatorID:dtCoordinatorID, AdtLogin:dtLogin,
18     AdtPassword:dtPassword) {
19     actor actAdministrator[primary,active]
20     returned messages {
21         ieCoordinatorAdded() returned to actAdministrator
22     }
23 //-
24 use case system subfunction oeAlert(
25     AetKind:etHumanKind,
26     AdtMyDate:dtDate,
27     AdtTime:dtTime,
28     AdtPhoneNumber:dtPhoneNumber,
29     AdtGPSLocation:dtGPSLocation,
30     AdtComment:dtComment) {
31     actor actComCompany[primary,active]
32     returned messages {
33         ieSmsSend(AdtPhoneNumber,AdtSMS) returned to actComCompany
34     }
35 }
36 //-
37 use case system subfunction oeInvalidateAlert(AdtAlertID:dtAlertID) {
38     actor actCoordinator[primary,active]
39     actor actComCompany[secondary,passive]
40     returned messages {
41         ieMessage(AMessage) returned to actCoordinator
42     }
43 }
44 //-
45 use case system subfunction oeCloseCrisis(AdtCrisisID:dtCrisisID) {
46     actor actCoordinator[primary,active]
47     returned messages {
48         ieMessage(AMessage) returned to actCoordinator
49     }
50 }
51 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 , AdtPassword:dtPassword) {
91   actor actAuthenticated[primary,active]
92   returned messages {
93     ieMessage(AMessage) returned to actAuthenticated
94   }
95 }
96 //-----
97 use case system subfunction oeLogout() {
98   actor actAuthenticated[primary,active]
99   returned messages {
100    ieMessage(AMessage) returned to actAuthenticated
101  }
102 }
103 //-----
104 use case system subfunction oeReportOnCrisis(AdtCrisisID:dtCrisisID,AdtComment:dtComment) {
105   actor actCoordinator[primary,active]
106   returned messages {
107     ieMessage(AMessage) returned to actCoordinator
108   }
109 }
110 //-----
111 use case system subfunction oeSetClock(AcurrentClock:dtDateAndTime) {
112   actor actActivator[primary,proactive]
113 }
114 //-----
115 use case system subfunction oeSetCrisisStatus(AdtCrisisID:dtCrisisID ,AetCrisisStatus:
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.46: Messir Spec. file subfunctions-usecases.msr.

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

```

1 package lu.uni.lassy.excalibur.examples.icrash.tests.testcase01 {
2
3 import lu.uni.lassy.messir.libraries.string
4 import lu.uni.lassy.messir.libraries.primitives
5 import lu.uni.lassy.messir.libraries.math
6 import lu.uni.lassy.messir.libraries.calendar
7
8 import icrash.concepts.primarytypes.associations
9 import icrash.concepts.primarytypes.classes
10 import icrash.concepts.primarytypes.datatypes
11 import icrash.concepts.secondarytypes.datatypes
12 import icrash.environment
13
14 Test Model{
15   test case testcase01 order 01 {
16 /**
17   test step ts01oeCreateSystemAndEnvironment order 01 {
18     variables{
19       Creator:actMsrCreator
20       AqtyComCompanies: ptInteger
21     }
22     constraints{
23       AqtyComCompanies = 4
24     }
25     test message{
26       out:Creator sends to system actMsrCreator.outactMsrCreator.oeCreateSystemAndEnvironment(
27         AqtyComCompanies)
28     }
29     oracle{
30       constraints{
31         true
32       }
33     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
62 test step ts03oeLogin order 03{
63   variables{
64     TheActor : actAdministrator
65     AdtLogin:dtLogin
66     AdtPassword:dtPassword
67   }
68   constraints{
69     TheActor=TheSystem.rnactAdministrator->any2(true)
70     AdtLogin.value.eq('icrashadmin')
71     AdtPassword.value.eq('7WXC1359')
72   }
73   test message{
74     out:TheActor sends to system actAdministrator.outactAdministrator.oeLogin(AdtLogin,AdtPassword)
75   }
76 oracle{
77   variables{
78     AMessage:ptString
79   }
80   constraints{
81     AMessage = 'You are logged ! Welcome ...'
82     TheActor.inactAdministrator.ieMessage(AMessage)
83   }
84 }
85 }
86 //-----
87 test step ts04oeAddCoordinator order 04{
88   variables{
89     TheActor : actAdministrator
90     AdtCoordinatorID : dtCoordinatorID
91     AdtLogin:dtLogin
92     AdtPassword:dtPassword
93   }
94   constraints{
95     TheActor = TheSystem.rnactAdministrator->any2(true)
96     AdtCoordinatorID.value.eq('1')
97     AdtLogin.value.eq('steve')
98     AdtPassword.value.eq('pwdMessirExcalibur2017')
99   }
100  test message{
101    out:TheActor
102    sends to system actAdministrator.outactAdministrator.oeAddCoordinator
103      (AdtCoordinatorID,
104        AdtLogin,
105        AdtPassword)
106  }
107 oracle{
108   constraints{
109     TheActor.inactAdministrator.ieCoordinatorAdded()
110   }
111 }
112 }
113 //-----
114 test step ts05oeLogout order 05{
115   variables{
116     TheActor : actAdministrator
117   }
118   constraints{
119     TheActor = TheSystem.rnactAdministrator->any2(true)
120   }
121   test message{
122     out:TheActor sends to system actAdministrator.outactAdministrator.oeLogout()

```



```

193     variables{
194         AdtSMS:dtSMS
195     }
196     constraints{
197         AdtSMS.value = 'Your alert has been registered. We will handle it and keep you informed'
198         TheActor.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
199     }
200 }
201 }
202 //-----
203 test step ts08oeSetClock03 order 08{
204     variables{
205         TheActor:actActivator
206         ACurrentClock:dtDateAndTime
207     }
208     constraints{
209         TheActor=TheSystem.rnactActivator->any2(true)
210         ACurrentClock.date.year.value = 2017
211         ACurrentClock.date.month.value = 11
212         ACurrentClock.date.day.value = 26
213         ACurrentClock.time.hour.value = 10
214         ACurrentClock.time.minute.value = 30
215         ACurrentClock.time.second.value = 00
216     }
217     test message{
218         out:TheActor sends to system actActivator.outactActivator.oeSetClock(ACurrentClock)
219     }
220     oracle{
221         constraints{
222             true
223         }
224     }
225 }
226 //-----
227 test step ts09oeSollicitateCrisisHandling order 09{
228     variables{
229         TheActor : actActivator
230     }
231     constraints{
232         TheActor = TheSystem.rnactActivator->any2(true)
233     }
234     test message{
235         out:TheActor sends to system actActivator.outactActivator.oeSollicitateCrisisHandling()
236     }
237     oracle{
238         variables{
239             TheAdministrator:actAdministrator
240             TheCoordinator:actCoordinator
241             AMesssageForCrisisHandlers:ptString
242         }
243         constraints{
244             TheAdministrator = TheSystem.rnactAdministrator->any2(true)
245             TheCoordinator = TheSystem.rnactCoordinator->any2(true)
246             AMesssageForCrisisHandlers = 'There are alerts pending since more than the defined delay. Please
REACT !'
247
248             TheAdministrator.inactAdministrator.ieMessage(AMesssageForCrisisHandlers)
249             TheCoordinator.inactAdministrator.ieMessage(AMesssageForCrisisHandlers)
250
251 /* this oracle should be written like this (not currently possible due to grammar limitations:
252
253     oracle{
254         variables{
255             TheAdministrator:actAdministrator
256             AMesssageForCrisisHandlers:ptString
257         }
258         constraints{
259             AMesssageForCrisisHandlers = 'There are alerts pending since more than the defined delay. Please
REACT !'
260             TheAdministrator = TheSystem.rnactAdministrator->any2(true)

```

```

261
262     TheSystem.rnactCoordinator->forAll(TheCoordinator:actCoordinator | TheCoordinator.
263         actAuthenticated.inactAuthenticated.ieMessage(AMessage))
264     */
265 }
266 }
267 }
268 //-----
269 test step ts10oeLogin02 order 10{
270     variables{
271         TheActor : actCoordinator
272         AdtLogin:dtLogin
273         AdtPassword:dtPassword
274     }
275     constraints{
276         TheActor = TheSystem.rnactCoordinator->select(a | a.rnctCoordinator.login.value.eq('steve'))->
277         any2(true)
278         AdtLogin.value.eq('steve')
279         AdtPassword.value.eq('pwdMessirExcalibur2017')
280     }
281     test message{
282         out:TheActor sends to system actAuthenticated.outactAuthenticated.oeLogin(AdtLogin,AdtPassword)
283     }
284     oracle{
285         variables{
286             AMessage:ptString
287         }
288         constraints{
289             AMessage = 'You are logged ! Welcome ...'
290             TheActor.inactAuthenticated.ieMessage(AMessage)
291         }
292     }
293 //-----
294 test step ts11oeGetCrisisSet order 11{
295     variables{
296         TheActor : actCoordinator
297         AetCrisisStatus : etCrisisStatus
298     }
299     constraints{
300         TheActor=TheSystem.rnactCoordinator
301         ->select(a | a.rnctCoordinator.login.value.eq('steve'))
302         ->any2(true)
303         AetCrisisStatus = pending
304     }
305     test message{
306         out:TheActor sends to system actCoordinator.outactCoordinator.oeGetCrisisSet(AetCrisisStatus)
307     }
308     oracle{
309 //TODO - make consistent with test step implementation by adding Prolog code for input messages
310         variables{
311             ActCrisis:ctCrisis
312         }
313         constraints{
314             TheActor.inactCoordinator.ieSendACrisis(ActCrisis)
315         }
316     }
317 }
318 //-----
319 test step ts12oeSetCrisisHandler order 12{
320     variables{
321         TheActor : actCoordinator
322         AdtCrisisID : dtCrisisID
323     }
324     constraints{
325         TheActor=TheSystem.rnactCoordinator
326         ->select(a | a.rnctCoordinator.login.value.eq('steve'))
327         ->any2(true)
328         //and AdtCrisisID.value= '1'

```

```

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

```

```

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

```

```

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

```

```

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

```

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

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

```

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

```

```

50      }
51    }
52    test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
53  }
54 //-----
55 test step instance tsi04: testcase01.ts04oeAddCoordinator{
56   variables {
57     reuse tsi03.bill as testcase01.ts04oeAddCoordinator.TheActor
58     AdtCoordinatorID : testcase01.ts04oeAddCoordinator.AdtCoordinatorID = "1"
59     AdtLogin : testcase01.ts04oeAddCoordinator.AdtLogin= "steve"
60     AdtPassword : testcase01.ts04oeAddCoordinator.AdtPassword = "pwdMessirExcalibur2017"
61   }
62   oracle {
63     satisfaction = "true"
64     received message {
65       tsi03.bill received from system actAdministrator.inactAdministrator.ieCoordinatorAdded()
66     }
67   }
68   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
69 }
70 //-----
71 test step instance tsi05: testcase01.ts05oeLogout{
72   variables {
73     reuse tsi03.bill as testcase01.ts05oeLogout.TheActor
74   }
75   oracle {
76     satisfaction = "true"
77     received message {
78       AMessage : testcase01.ts05oeLogout.AMessage= 'You are logged out ! Good Bye ...'
79       tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
80     }
81   }
82   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
83 }
84 //-----
85 test step instance tsi06: testcase01.ts06oeSetClock02{
86   variables {
87     reuse tsi02.theClock as testcase01.ts06oeSetClock02.TheActor
88     ACurrentClock : testcase01.ts06oeSetClock02.ACurrentClock= "2017:11:26 - 10:15:00"
89   }
90   oracle {
91     satisfaction = "true"
92   }
93   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
94 }
95 //-----
96 test step instance tsi07: testcase01.ts07oeAlert1{
97   variables {
98     tango:testcase01.ts07oeAlert1.TheActor ="tango"
99     AetHumanKind : testcase01.ts07oeAlert1.AetHumanKind = "witness"
100    AdtDate : testcase01.ts07oeAlert1.AdtDate = "2017:11:26"
101    AdtTime : testcase01.ts07oeAlert1.AdtTime = "10:10:16"
102    AdtPhoneNumber : testcase01.ts07oeAlert1.AdtPhoneNumber = "+3524666445252"
103    AdtGPSLocation : testcase01.ts07oeAlert1.AdtGPSLocation = "49.627675:6.159590"
104    AdtComment : testcase01.ts07oeAlert1.AdtComment = "3 cars involved in an accident."
105  }
106  oracle {
107    satisfaction = "true"
108    received message {
109      AdtSMS : testcase01.ts07oeAlert1.AdtSMS= 'Your alert has been registered. We will handle it and
keep you informed'
110      tsi07.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
111    }
112  }
113 }
114   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
115 }
116 //-----
117 test step instance tsi08: testcase01.ts08oeSetClock03{

```

```

119  variables {
120    reuse tsi02.theClock as testcase01.ts08oeSetClock03.ACurrrentClock
121    ACurrentClock : testcase01.ts08oeSetClock03.ACurrrentClock = "2017:11:26 - 10:30:00"
122  }
123  oracle {
124    satisfaction = "true"
125  }
126  test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
127  }
128 //-----
129 test step instance tsi09: testcase01.ts09oeSollicitateCrisisHandling{
130  variables {
131    reuse tsi02.theClock as testcase01.ts09oeSollicitateCrisisHandling.TheActor
132    reuse tsi03.bill as testcase01.ts09oeSollicitateCrisisHandling.TheAdministrator
133  }
134  oracle {
135    satisfaction = "true"
136    received message {
137      steve:testcase01.ts09oeSollicitateCrisisHandling.TheCoordinator ="steve"
138      AMesssageForCrisisHandlers : testcase01.ts09oeSollicitateCrisisHandling.
139      AMesssageForCrisisHandlers= 'There are alerts pending since more than the defined delay. Please
140      REACT !'
141      tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(
142      AMesssageForCrisisHandlers)
143      tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(
144      AMesssageForCrisisHandlers)
145    }
146  }
147 //-----
148 test step instance tsi10: testcase01.ts10oeLogin02{
149  variables {
150    reuse tsi09.steve as testcase01.ts10oeLogin02.TheActor
151    AdtLogin : testcase01.ts10oeLogin02.AdtLogin = "steve"
152    AdtPassword : testcase01.ts10oeLogin02.AdtPassword= "pwdMessirExcalibur2017"
153  }
154  oracle {
155    satisfaction = "true"
156    received message {
157      AMesssage : testcase01.ts10oeLogin02.AMesssage= 'You are logged ! Welcome ...'
158      tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMesssage)
159    }
160  }
161  }
162  test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
163  }
164 //-----
165 test step instance tsi11: testcase01.ts11oeGetCrisisSet{
166  variables {
167    reuse tsi09.steve as testcase01.ts11oeGetCrisisSet.TheActor
168    AetCrisisStatus : testcase01.ts11oeGetCrisisSet.AetCrisisStatus = "pending"
169  }
170  oracle {
171    satisfaction = "true"
172    received message {
173      ActCrisis : testcase01.ts11oeGetCrisisSet.ActCrisis= "crisis with ID 1 details"
174      tsi09.steve received from system actCoordinator.inactCoordinator.ieSendACrisis(ActCrisis)
175    }
176  }
177  test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
178  }
179 //-----
180 test step instance tsi12: testcase01.ts12oeSetCrisisHandler{
181  variables {
182    reuse tsi09.steve as testcase01.ts12oeSetCrisisHandler.TheActor
183    AdtCrisisID : testcase01.ts12oeSetCrisisHandler.AdtCrisisID = "1"
184

```

```

185     reuse tsi07.tango as testcase01.ts12oeSetCrisisHandler.TheComCompany
186
187 }
188 oracle {
189     satisfaction = "true"
190     received message {
191         AMessage : testcase01.ts12oeSetCrisisHandler.AMessage= 'You are now considered as handling the
192         crisis !'
193         AdtSMS : testcase01.ts12oeSetCrisisHandler.AdtSMS= 'The handling of your alert by our services
194         is in progress !'
195         AdtPhoneNumber : testcase01.ts12oeSetCrisisHandler.AdtPhoneNumber= "+3524666445252"
196
197         tsi07.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
198         tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
199     }
200     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
201 }
202 //-----
203 test step instance tsi13: testcase01.ts13oeSetClock04{
204     variables {
205         reuse tsi02.theClock as testcase01.ts13oeSetClock04.TheActor
206         ACurrentClock : testcase01.ts13oeSetClock04.ACurrentClock = "2017:11:26 - 10:45:00"
207     }
208     oracle {
209         satisfaction = "true"
210     }
211     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
212 }
213 //-----
214 test step instance tsi14: testcase01.ts14oeValidateAlert{
215     variables {
216         reuse tsi09.steve as testcase01.ts14oeValidateAlert.TheActor
217         AdtAlertID : testcase01.ts14oeValidateAlert.AdtAlertID = "1"
218     }
219     oracle {
220         satisfaction = "true"
221         received message {
222             AMessage : testcase01.ts14oeValidateAlert.AMessage= 'The Alert is now declared as valid !'
223             tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
224         }
225     }
226     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
227 }
228 }
229 //-----
230 test step instance tsi15: testcase01.ts15oeAlert2{
231     variables {
232         reuse tsi07.tango as testcase01.ts15oeAlert2.TheActor
233         AetHumanKind : testcase01.ts15oeAlert2.AetHumanKind ="witness"
234         AdtDate : testcase01.ts15oeAlert2.AdtDate= "2017:11:26"
235         AdtTime : testcase01.ts15oeAlert2.AdtTime= "10:20:00"
236         AdtPhoneNumber : testcase01.ts15oeAlert2.AdtPhoneNumber= "+3524666445000"
237         AdtGPSLocation : testcase01.ts15oeAlert2.AdtGPSLocation= "49.627095:6.160251"
238         AdtComment : testcase01.ts15oeAlert2.AdtComment= "A car crash just happened."
239     }
240     message {
241         tsi07.tango sent to system testcase01.ts15oeAlert2.out : actComCompany.outactComCompany.oeAlert(
242             AetHumanKind,AdtDate,AdtTime,AdtPhoneNumber,AdtGPSLocation,AdtComment)
243     }
244     oracle {
245         satisfaction = "true"
246         received message {
247             AdtSMS : testcase01.ts15oeAlert2.AdtSMS= 'Your alert has been registered. We will handle it and
248             keep you informed'
249             tsi07.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
250         }

```

```

251     }
252     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
253   }
254 //-----
255 test step instance tsi16: testcase01.ts16oeSetClock05{
256   variables {
257     reuse tsi02.theClock as testcase01.ts16oeSetClock05.TheActor
258     ACurrentClock : testcase01.ts16oeSetClock05.ACurrentClock = "2017:11:26 - 12:45:00"
259   }
260   oracle {
261     satisfaction = "true"
262     received message {
263       }
264     }
265   }
266   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
267 }
268 //-----
269 test step instance tsi17: testcase01.ts17oeSetCrisisStatus{
270   variables {
271     reuse tsi09.steve as testcase01.ts17oeSetCrisisStatus.TheActor
272     AdtCrisisID : testcase01.ts17oeSetCrisisStatus.AdtCrisisID = "1"
273     AetCrisisStatus : testcase01.ts17oeSetCrisisStatus.AetCrisisStatus= "solved"
274   }
275   oracle {
276     satisfaction = "true"
277     received message {
278       AMesssage : testcase01.ts17oeSetCrisisStatus.AMessage= "The crisis status has been updated !"
279       tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
280     }
281   }
282   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
283 }
284 //-----
285 test step instance tsi18: testcase01.ts18oeReportOnCrisis{
286   variables {
287     reuse tsi09.steve as testcase01.ts18oeReportOnCrisis.TheActor
288     AdtCrisisID : testcase01.ts18oeReportOnCrisis.AdtCrisisID = "1"
289     AdtComment : testcase01.ts18oeReportOnCrisis.AdtComment= "3 victims sent to hospital, 2 cars
290     evacuated and 4 rescue unit mobilized"
291   }
292   oracle {
293     satisfaction = "true"
294     received message {
295       AMesssage : testcase01.ts18oeReportOnCrisis.AMessage= 'The crisis comment has been updated !'
296       tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
297     }
298   }
299   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
300 }
301 //-----
302 test step instance tsi19: testcase01.ts19oeCloseCrisis{
303   variables {
304     reuse tsi09.steve as testcase01.ts19oeCloseCrisis.TheActor
305     AdtCrisisID : testcase01.ts19oeCloseCrisis.AdtCrisisID = "1"
306   }
307   oracle {
308     satisfaction = "true"
309     received message {
310       AMesssage : testcase01.ts19oeCloseCrisis.AMessage= 'The crisis is now closed !'
311     }
312     tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
313   }
314 }
315 }
316 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
317 }
318 }
319 }

```

```

320 //-----
321 //-----
322 //-----
323 test case instance instance01Part01:testcase01{
324 //-
325   test step instance tsi01: testcase01.ts01oeCreateSystemAndEnvironment{
326     variables {
327       theCreator: testcase01.ts01oeCreateSystemAndEnvironment.Creator = "theCreator"
328       AqtyComCompanies : testcase01.ts01oeCreateSystemAndEnvironment.AqtyComCompanies="4"
329     }
330     oracle {
331       satisfaction = "true"
332     }
333     test results { pre-protocol = "true" pre-functional = "true" post-functional = "true" }
334   }
335 //-----
336   test step instance tsi02: testcase01.ts02oeSetClock{
337     variables {
338       theClock: testcase01.ts02oeSetClock.TheActor = "theClock"
339       ACurrentClock : testcase01.ts02oeSetClock.ACurrentClock= "2017:11:24 - 03:20:00"
340     }
341     oracle {
342       satisfaction = "true"
343     }
344     test results { pre-protocol = "true" pre-functional = "true" post-functional = "true" }
345   }
346 //-----
347   test step instance tsi03: testcase01.ts03oeLogin{
348     variables {
349       bill: testcase01.ts03oeLogin.TheActor="bill"
350       AdtLogin : testcase01.ts03oeLogin.AdtLogin= "icrashadmin"
351       AdtPassword : testcase01.ts03oeLogin.AdtPassword= "7WXC1359"
352     }
353     oracle {
354       satisfaction = "true"
355       received message {
356         AMessge : testcase01.ts03oeLogin.AMessage= 'You are logged ! Welcome ...'
357         tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(AMessge)
358       }
359     }
360     test results { pre-protocol = "true" pre-functional = "true" post-functional = "true" }
361   }
362 //-----
363   test step instance tsi04: testcase01.ts04oeAddCoordinator{
364     variables {
365       reuse tsi03.bill as testcase01.ts04oeAddCoordinator.TheActor
366       AdtCoordinatorID : testcase01.ts04oeAddCoordinator.AdtCoordinatorID = "1"
367       AdtLogin : testcase01.ts04oeAddCoordinator.AdtLogin= "steve"
368       AdtPassword : testcase01.ts04oeAddCoordinator.AdtPassword = "pwdMessirExcalibur2017"
369     }
370     oracle {
371       satisfaction = "true"
372       received message {
373         tsi03.bill received from system actAdministrator.inactAdministrator.ieCoordinatorAdded()
374       }
375     }
376     test results { pre-protocol = "true" pre-functional = "true" post-functional = "true" }
377   }
378 //-----
379   test step instance tsi05: testcase01.ts05oeLogout{
380     variables {
381       reuse tsi03.bill as testcase01.ts05oeLogout.TheActor
382     }
383     oracle {
384       satisfaction = "true"
385       received message {
386         AMessge : testcase01.ts05oeLogout.AMessage= 'You are logged out ! Good Bye ...'
387         tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(AMessge)
388       }
389     }

```

```

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

```

455
456 //-----
457 //-----
458 //-
459 test case instance instance01Part02:testcase01{
460
461     test step instance ts10: testcase01.ts10oeLogin02{
462         variables {
463             steve : testcase01.ts10oeLogin02.TheActor
464             AdtLogin : testcase01.ts10oeLogin02.AdtLogin = "steve"
465             AdtPassword : testcase01.ts10oeLogin02.AdtPassword= "pwdMessirExcalibur2017"
466         }
467         oracle {
468             satisfaction = "true"
469             received message {
470                 AMessage : testcase01.ts10oeLogin02.AMessage= 'You are logged ! Welcome ...'
471                 steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
472             }
473         }
474     }
475     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
476 }
477 //-
478     test step instance ts11: testcase01.ts11oeGetCrisisSet{
479         variables {
480             reuse ts10.steve as testcase01.ts11oeGetCrisisSet.TheActor
481             AetCrisisStatus : testcase01.ts11oeGetCrisisSet.AetCrisisStatus = "pending"
482         }
483         oracle {
484             satisfaction = "true"
485             received message {
486                 ActCrisis : testcase01.ts11oeGetCrisisSet.ActCrisis= "crisis with ID 1 details"
487                 ts10.steve received from system actCoordinator.inactCoordinator.ieSendACrisis(ActCrisis)
488             }
489         }
490         test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
491     }
492 //-
493     test step instance ts12: testcase01.ts12oeSetCrisisHandler{
494         variables {
495             reuse ts10.steve as testcase01.ts12oeSetCrisisHandler.TheActor
496             AdtCrisisID : testcase01.ts12oeSetCrisisHandler.AdtCrisisID = "1"
497         }
498         oracle {
499             satisfaction = "true"
500             received message {
501                 tango : testcase01.ts12oeSetCrisisHandler.TheComCompany
502                 AMessage : testcase01.ts12oeSetCrisisHandler.AMessage= 'You are now considered as handling the
503                 crisis !'
504                 AdtSMS : testcase01.ts12oeSetCrisisHandler.AdtSMS= 'The handling of your alert by our services
505                 is in progress !'
506                 AdtPhoneNumber : testcase01.ts12oeSetCrisisHandler.AdtPhoneNumber= "+3524666445252"
507
508                 tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
509                 ts10.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
510             }
511         }
512         test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
513 //-
514     test step instance ts13: testcase01.ts13oeSetClock04{
515         variables {
516             theClock : testcase01.ts13oeSetClock04.TheActor
517             ACurrentClock : testcase01.ts13oeSetClock04.ACurrentClock = "2017:11:26 - 10:45:00"
518         }
519         oracle {
520             satisfaction = "true"
521         }
522     }
523 
```

```

523     }
524 /**
525 test step instance tsi14: testcase01.ts14oeValidateAlert{
526   variables {
527     reuse tsi10.steve as testcase01.ts14oeValidateAlert.TheActor
528     AdtAlertID : testcase01.ts14oeValidateAlert.AdtAlertID = "1"
529   }
530   oracle {
531     satisfaction = "true"
532     received message {
533       AMesssage : testcase01.ts14oeValidateAlert.AMessage= 'The Alert is now declared as valid !'
534       tsi10.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
535     }
536   }
537 }
538 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
539 }

540 /**
541 test step instance tsi15: testcase01.ts15oeAlert2{
542   variables {
543     reuse tsi12.tango as testcase01.ts15oeAlert2.TheActor
544     AetHumanKind : testcase01.ts15oeAlert2.AetHumanKind ="witness"
545     AdtDate : testcase01.ts15oeAlert2.AdtDate= "2017:11:26"
546     AdtTime : testcase01.ts15oeAlert2.AdtTime= "10:20:00"
547     AdtPhoneNumber : testcase01.ts15oeAlert2.AdtPhoneNumber= "+3524666445000"
548     AdtGPSLocation : testcase01.ts15oeAlert2.AdtGPSLocation= "49.627095:6.160251"
549     AdtComment : testcase01.ts15oeAlert2.AdtComment= "A car crash just happened."
550   }
551   message {
552     tsi12.tango sent to system testcase01.ts15oeAlert2.out : actComCompany.outactComCompany.oeAlert(
553       AetHumanKind,AdtDate,AdtTime,AdtPhoneNumber,AdtGPSLocation,AdtComment)
554   }
555   oracle {
556     satisfaction = "true"
557     received message {
558       AdtSMS : testcase01.ts15oeAlert2.AdtSMS= 'Your alert has been registered. We will handle it and
keep you informed'
559       tsi12.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
560     }
561   }
562 }
563 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
564 }

565 /**
566 test step instance tsi16: testcase01.ts16oeSetClock05{
567   variables {
568     reuse tsi13.theClock as testcase01.ts16oeSetClock05.TheActor
569     ACurrentClock : testcase01.ts16oeSetClock05.ACurrentClock = "2017:11:26 - 12:45:00"
570   }
571   oracle {
572     satisfaction = "true"
573     received message {
574   }
575   }
576 }
577 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
578 }

579 /**
580 test step instance tsi17: testcase01.ts17oeSetCrisisStatus{
581   variables {
582     reuse tsi10.steve as testcase01.ts17oeSetCrisisStatus.TheActor
583     AdtCrisisID : testcase01.ts17oeSetCrisisStatus.AdtCrisisID = "1"
584     AetCrisisStatus : testcase01.ts17oeSetCrisisStatus.AetCrisisStatus= "solved"
585   }
586   oracle {
587     satisfaction = "true"
588     received message {
589       AMesssage : testcase01.ts17oeSetCrisisStatus.AMessage= "The crisis status has been updated !"
590       tsi10.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)

```

```

591     }
592   }
593   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
594 }
595 //-
596 test step instance tsi18: testcase01.ts18oeReportOnCrisis{
597   variables {
598     reuse tsi10.steve as testcase01.ts18oeReportOnCrisis.TheActor
599     AdtCrisisID : testcase01.ts18oeReportOnCrisis.AdtCrisisID = "1"
600     AdtComment : testcase01.ts18oeReportOnCrisis.AdtComment= "3 victims sent to hospital, 2 cars
601     evacuated and 4 rescue unit mobilized"
602   }
603   oracle {
604     satisfaction = "true"
605     received message {
606       AMessage : testcase01.ts18oeReportOnCrisis.AMessage= 'The crisis comment has been updated !'
607       tsi10.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
608     }
609   }
610   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
611 }
612 //-
613 test step instance tsi19: testcase01.ts19oeCloseCrisis{
614   variables {
615     reuse tsi10.steve as testcase01.ts19oeCloseCrisis.TheActor
616     AdtCrisisID : testcase01.ts19oeCloseCrisis.AdtCrisisID = "1"
617   }
618   oracle {
619     satisfaction = "true"
620     received message {
621       AMessage : testcase01.ts19oeCloseCrisis.AMessage= 'The crisis is now closed !'
622       tsi10.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
623     }
624   }
625   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
626 }
627 }
628 }
629 }
630 }
631 }
632 }
633 }

```

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

C.49 File [./src-gen/messir-spec/usecases/usecase-suDeployAndRun.msr](#)

```

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

```

```

19  reuse oeSetClock[1...*]
20  reuse oeSollicitateCrisisHandling[0...*]
21  reuse oeAlert[1...*]
22
23  step a: actMsrCreator executes oeCreateSystemAndEnvironment
24  step b: actAdministrator executes 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","7WXC1359"){
61         ieMessage('You are logged ! Welcome ...') returned to bill
62       }
63   //-
64     bill
65     executed instanceof subfunction
66       oeAddCoordinator("1","steve","pwdMessirExcalibur2017") {
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   //-
88     theClock

```

```

88     executed instanceof subfunction
89         oeSetClock("2017:11:26 - 10:30:00"){}
90     //-----
91     theClock
92     executed instanceof subfunction
93         oeSollicitateCrisisHandling{
94             ieMessage("There are alerts pending since more than the defined delay. Please REACT !")
95             returned to bill
96             ieMessage("There are alerts pending since more than the defined delay. Please REACT !")
97             returned to steve
98         }
99     //-----
100    steve
101    executed instanceof subfunction
102        oeLogin("steve", "pwdMessirExcalibur2017") {
103            ieMessage('You are logged ! Welcome ...') returned to steve
104        }
105    //-----
106    steve
107    executed instanceof subfunction
108        oeGetCrisisSet("pending"){
109            ieSendACrisis("crisis with ID 1 details") returned to steve
110        }
111    //-----
112    steve
113    executed instanceof subfunction
114        oeSetCrisisHandler("1"){
115            ieSmsSend("+3524666445252", "The handling of your alert by our services is in progress !")
116            returned to tango
117            ieMessage("You are now considered as handling the crisis !")
118            returned to steve
119        }
120    //-----
121    theClock
122    executed instanceof subfunction
123        oeSetClock("2017:11:26 - 10:45:00"){}
124    //-----
125    steve
126    executed instanceof subfunction
127        oeValidateAlert("1"){
128            ieMessage('The Alert is now declared as valid !')
129            returned to steve
130        }
131    //-----
132    tango
133    executed instanceof subfunction
134        oeAlert("witness", "2017:11:26", "10:20:00", "+3524666445000",
135            "49.627095:6.160251", "A car crash just happened."){
136            ieSmsSend("+3524666445000", "Your alert has been registered. We will handle it and keep you
informed") returned to tango
137        }
138    //-----
139    theClock
140    executed instanceof subfunction
141        oeSetClock("2017:11:26 - 12:45:00"){}
142    //-----
143    steve
144    executed instanceof subfunction
145        oeSetCrisisStatus("1", "solved"){
146            ieMessage('The crisis status has been updated !')
147            returned to steve
148        }
149    //-----
150    steve
151    executed instanceof subfunction
152        oeReportOnCrisis("1", "3 victims sent to hospital, 2 cars evacuated and 4 rescue unit
mobilized"){
153            ieMessage('The crisis comment has been updated !')
154            returned to steve
155        }

```

```

156 // -----
157     steve
158     executed instanceof subfunction
159         oeCloseCrisis("1"){
160             ieMessage('The crisis is now closed !')
161             returned to steve
162         }
163     }
164 }
165 //}
166 // -----
167 // -----
168 // -----
169 use case instance uciSimpleAndCompletePart01 : suDeployAndRun{
170
171     actors {
172         theCreator : actMsrCreator
173         theClock : actActivator
174         bill : actAdministrator
175         tango : actComCompany
176         steve : actCoordinator
177     }
178     use case steps {
179     /
180         theCreator
181         executed instanceof subfunction
182             oeCreateSystemAndEnvironment("4"){}
183     /
184         theClock
185         executed instanceof subfunction
186             oeSetClock("2017:11:24 - 03:20:00"){}
187     /
188         bill
189         executed instanceof subfunction
190             oeLogin("icrashadmin","7WXC1359"){
191                 ieMessage('You are logged ! Welcome ...') returned to bill
192             }
193     /
194         bill
195         executed instanceof subfunction
196             oeAddCoordinator("1","steve","pwdMessirExcalibur2017"){
197                 ieCoordinatorAddedreturned returned to bill
198             }
199     /
200         bill
201         executed instanceof subfunction
202             oeLogout{
203                 ieMessage('You are logged out ! Good Bye ...') returned to bill
204             }
205     /
206         theClock
207         executed instanceof subfunction
208             oeSetClock("2017:11:26 - 10:15:00"){}
209     /
210         tango
211         executed instanceof subfunction
212             oeAlert("witness","2017:11:26","10:10:16","+3524666445252",
213                 "49.627675:6.159590","3 cars involved in an accident."){
214                 ieSmsSend("+3524666445252","Your alert has been registered. We will handle it and keep you
215                 informed") returned to tango
216             }
217     /
218         theClock
219         executed instanceof subfunction
220             oeSetClock("2017:11:26 - 10:30:00"){}
221     /
222         theClock
223         executed instanceof subfunction
224             oeSollicitateCrisisHandling(
225                 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", "pwdMessirExcalibur2017"){
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
294     }

```

```

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

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

C.50 File [./src-gen/messir-spec/usecases/usecase-suGlobalCrisisHandling.msr](#)

```

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

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

C.51 File [./src-gen/messir-spec/usecases/usecase-ugAdministrateTheSystem.msr](#)

```

1 package icrash.usecases.ugAdministrateTheSystem {
2
3   import icrash.environment
```

```

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

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

C.52 File ugManageCrisis.msr

./src-gen/messir-spec/usecases/usecase-

```

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

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

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

```

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

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

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

```

1 package icrash.usecases.ugSecurelyUseSystem {
2
3 import icrash.environment
4 import icrash.usecases.subfunctions
5
6 Use Case Model {
7
8 use case system usergoal
9 ugSecurelyUseSystem() {
10
11 actor actAuthenticated[primary,active]
12
13 reuse oeLogin[1..1]
14 reuse oeLogout[1..1]
15
16 step a: actAuthenticated
17   executes oeLogin
18 step b: actAuthenticated
19   executes oeLogout
20
21 ordering constraint
22 "step (a) must always precede step (b)."
23 }
24 }
25 }
```

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

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

```

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

```
10 Use Case Model {
11 //-----
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","7WXC1359"){
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.55: Messir Spec. file usecaseinstance-ugSecurelyUseSystem-uciugSecurelyUseSystem.msr.

Appendix D

Listing of the Prolog Files Referenced in the Operation Model Specification

D.1

File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactActivatorSetClock.pl

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

```

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

```

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

D.2 File ./src-gen/prolog-ref-spec/Operations/Environment/OUT/outactActivator-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   ],

```

```

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/outactAdm oeAddCoordinator.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),

```

```

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
28msrop(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
50msrop(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

%%%%%%%%%%%%%

```

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
85     msrNav([AptStringMessageForTheactAdministrator],
86         [eq,[[ptString,'Intrusion tentative !']]],,
87         [[ptBoolean,true]]),
88     msrNav([TheSystem],
89         [rnactAdministrator,rnInterfaceIN,
90          ieMessage, [AptStringMessageForTheactAdministrator]],
91          [[ptBoolean,true]])
92    )
93 ),
94
95 /* Post Protocol:*/
96/* PostP01 */
97 ( (msrNav([TheactAuthenticated],
98     [rnctAuthenticated,pwd],
99     [AdtPassword]),
100 msrNav([TheactAuthenticated],
101     [rnctAuthenticated,login],
102     [AdtLogin])
103 )
104 -> (msrNav([TheactAuthenticated],
105     [rnctAuthenticated,msmAtPost,vpIsLogged],
106     [[ptBoolean,true]])
107   )
108 ; true
109 )
110 .

```

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

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

```

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

```

```

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/outactComCoeAlert.pl

```

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

```

```

20      ],
21      []):-  

22 /* Pre Protocol:-/  

23 msrVar(ctState,TheSystem),  

24 msrNav([Self],[rnActor,rnSystem],[TheSystem]),  

25 /* PreP01 */  

26 msrNav([TheSystem],  

27     [vpStarted],  

28     [[ptBoolean,true]]))  

29 .  

30  

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),

```

```

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

```

```

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

```

230 .

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

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

```

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

```

```

62      []):-  

63  

64 /* Post Functional: */  

65 msrVar(ctState,TheSystem),  

66 msrVar(actCoordinator,TheActor),  

67  

68 msrVar(ctCrisis,TheCrisis),  

69 msrVar(dtCrisisID,AdtCrisisID),  

70  

71 msrNav([Self],[rnActor,rnSystem],[TheSystem]),  

72 msrNav([Self],[rnActor],[TheActor]),  

73  

74 /* PostF01 */  

75 msrNav([TheSystem],  

76     [rnctCrisis,  

77      msrSelect,  

78      id,eq,[AdtCrisisID]],  

79     [TheCrisis]),  

80  

81 msrNav([TheCrisis],  

82     [msmAtPost,status],  

83     [[etCrisisStatus,closed]]),  

84  

85 /* PostF02 */  

86 msrNav([TheCrisis],  

87     [msmAtPost,rnHandler],  

88     []),  

89  

90 /* PostF03 */  

91 msrNav([TheCrisis],  

92     [rnAlerts,msrForAll,msrIsKilled],  

93     [[ptBoolean,true]]),  

94  

95 /* PostF04 */  

96 msrNav([TheActor],  

97     [rnInterfaceIN,  

98      ieMessage,[[ptString,'The crisis is now closed !']]  

99    ],  

100   [[ptBoolean,true]]),  

101  

102 /* Post Protocol: */  

103 /* PostP01 */  

104 true  

105 .

```

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

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

```

1%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */  

3:- multifile msrop/4.  

4%%%%%%%%%%%%%%%
5-----  

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 */

```

```

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

```

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

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

```

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

```

```

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

```

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

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

```

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

```

```

11  []):-  

12 /* Pre Protocol:*/  

13 msrVar(ctState,TheSystem),  

14 msrVar(actCoordinator,TheActor),  

15 msrNav([Self],[rnActor,rnSystem],[TheSystem]),  

16 msrNav([Self],[rnActor],[TheActor]),  

17  

18 /* PreP01 */  

19 msrNav([TheSystem],  

20     [vpStarted],  

21     [[ptBoolean,true]]),  

22  

23 /* PreP02 */  

24 msrNav([TheActor],  

25     [rnctAuthenticated,vpIsLogged],  

26     [[ptBoolean,true]]))  

27.  

28  

29 msrop(outactCoordinator,  

30     oeInvalidateAlert,  

31     [preFunctional,Self,  

32      AdtAlertID  

33      ],  

34      []):-  

35 /* Pre Functional:*/  

36 msrVar(ctState,TheSystem),  

37 msrVar(actCoordinator,TheActor),  

38  

39 msrVar(dtAlertID,AdtAlertID),  

40  

41 msrNav([Self],[rnActor,rnSystem],[TheSystem]),  

42 msrNav([Self],[rnActor],[TheActor]),  

43  

44 /* PreF01 */  

45 msrNav([TheSystem],  

46     [rnctAlert,  

47      msrSelect,  

48      id,eq,[AdtAlertID]  

49      ],  

50      ColAlert),  

51  

52 msrNav(ColAlert,  

53     [msrSize,eq,[[ptInteger,1]]],  

54     [[ptBoolean,true]]))  

55 .  

56  

57 msrop(outactCoordinator,  

58     oeInvalidateAlert,  

59     [post,Self,  

60      AdtAlertID  

61      ],  

62      []):-  

63  

64 /* Post Functional:*/  

65 msrVar(ctState,TheSystem),  

66 msrVar(actCoordinator,TheActor),  

67  

68 msrVar(ctAlert,TheAlert),  

69 msrVar(dtAlertID,AdtAlertID),  

70  

71 msrNav([Self],[rnActor,rnSystem],[TheSystem]),  

72 msrNav([Self],[rnActor],[TheActor]),  

73  

74 /* PostF01 */  

75 msrNav([TheSystem],  

76     [rnctAlert,  

77      msrSelect,  

78      id,eq,[AdtAlertID]],  

79      [TheAlert]),  

80

```

```

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

```

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

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

```

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

```

```

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/outactCoordinator-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:*/

```

```

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

```

```

83     [msmAtPost, status],
84     [[etCrisisStatus, 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/outactCoordinator-oeSetCrisisStatus.pl

```

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

```

```

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

```

```

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

```

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

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

```

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

```

```

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

```

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

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

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5-----
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]),

```

```

16 msrNav([Self], [rnActor], [TheActor]),
17
18/* PreP01 */
19 msrNav([TheSystem],
20     [vpStarted],
21     [[ptBoolean,true]]),
22
23 msrNav([TheActor],
24     [rnctAuthenticated,vpiIsLogged],
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 */
92true
93 .

```

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

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

```

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

```

```

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

```

```

125      [value,eq,[[ptString,'7WXC1359']]],  

126      [[ptBoolean,true]]),  

127  

128 msrNav([ActAdministrator],  

129     [init,[AdtLogin,AdtPassword]],  

130     [[ptBoolean,true]]),  

131  

132 /* PostF07 */  

133 msrNav([ActAdministrator],  

134     [msmAtPost,rnactAuthenticated],  

135     [AactAdministrator]),  

136  

137 /* Post Protocol:*/  

138 /* PostP01 */  

139 true  

140 .

```

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

D.18 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClass-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 */  

19 msrNav([Self],[msrIsNew],[Self])  

20)  

21-> Result = [ptBoolean,true]  

22; Result = [ptBoolean,false]  

23.

```

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

D.19 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClass-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 (

```

```

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

```

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

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

```

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

```

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

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

```

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

```

24.

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

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

```

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

```

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

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

```

1%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%
5
6msrop(ctCrisis,handlingDelayPassed,[Self],
7     Result):-
8
9/* Post F01 */
10(
11 msrVar(ctState,TheSystem),
12 msrVar(dtInteger,CurrentClockSecondsQty),
13 msrVar(dtInteger,LastReminderSecondsQty),
14 msrVar(dtSecond,CrisisReminderPeriod),
15
16 msrNav([Self],[rnSystem],[TheSystem]),
17
18 msrNav([Self],
19      [status],
20      [[etCrisisStatus,pending]]),
21
22 msrNav([TheSystem],
23      [clock,toSecondsQty,[],],
24      [CurrentClockSecondsQty]),
25
26 msrNav([TheSystem],
27      [vpLastReminder,toSecondsQty,[]],

```

```

28     [LastReminderSecondsQty]),
29
30 msrNav([TheSystem],
31   [crisisReminderPeriod],
32   [CrisisReminderPeriod]),
33
34 msrNav([CurrentClockSecondsQty],
35   [sub, [LastReminderSecondsQty],
36     gt, [CrisisReminderPeriod]
37   ],
38   [[ptBoolean,true]])
39
40)
41-> Result = [ptBoolean,true]
42; Result = [ptBoolean,false]
43.

```

Listing D.23: Prolog file PrimaryTypesClasses-ctCrisis-handlingDelayPassed.pl.

D.24 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses-ctCrisis-init.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6msrop(ctCrisis,init,[Self,
7    Aid,
8    Atype,
9    Astatus,
10   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,[]],
21 [[ptBoolean,true]]),
22
23 ( msrNav([TheSystem],
24 [rnactCoordinator,msrIsEmpty],
25 [[ptBoolean,false]])
26 -> (
27 /* Post F02 */
28 msrNav([TheSystem],
29 [rnactCoordinator,msrAny,msrTrue],
30 [TheCoordinatorActor]),
31
32 msrNav([TheCoordinatorActor],
33 [rnctCoordinator],
34 [TheCoordinator]),
35
36 msrNav([Self],
37 [msmAtPost,rnHandler],
38 [TheCoordinator]),
39
40 msrNav([Self],
41 [msmAtPost,status],
42 [[etCrisisStatus,handled]]),
43
44 msrNav([Self],
45 [id,value],
46 [TheCrisisIDptString]),
47
48 msrNav([[ptString,'You are now considered as handling the crisis having ID: ']],
49 [ptStringConcat,[TheCrisisIDptString]],
50 [TheMessage]),
51
52 msrNav([TheCoordinatorActor],
53 [rnInterfaceIN,
54 ieMessage,[TheMessage]
55 ],
56 [[ptBoolean,true]])
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/PrimaryTypesClass-ctCrisis-isSentToCoordinator.pl

%%%%%%%%%%%%%

```

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]],[[ptBoolean,true]])
13)
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
6msrop(ctHuman,init,[Self,
7          Aid,
8          Akind],
9      Result):-!
10
11/* Post F01 */
12(
13msrVar(ctHuman,Self),
14
15msrNav([Self],[id],[Aid]),
16msrNav([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
6msrop(ctHuman,isAcknowledged,[Self],Result):-
7
8/* Post F01 */
9(msrVar(dtPhoneNumber,AdtPhoneNumber),
10 msrVar(dtSMS,AdtSMS),
11
12 msrNav([Self],
13         [id,eq,[AdtPhoneNumber]],
14         [[ptBoolean,true]]),
15 msrNav([AdtSMS],
16         [value,eq,[[ptString,'The handling of your alert by our services is in progress !']]],
17         [[ptBoolean,true]]),
18 msrNav([Self],
19         [rnactComCompany,rnInterfaceIN,ieSmsSend,[AdtPhoneNumber,AdtSMS]],
20         [[ptBoolean,true]]),
21)
22-> Result = [ptBoolean,true]
23; Result = [ptBoolean,false]
24.
```

Listing D.29: Prolog file PrimaryTypesClasses-ctHuman-isAcknowledged.pl.

D.30 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses-ctState-init.pl

```

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

```

4%%%%%%%%%%%%%%%
5
6msrop(ctState,init,[Self,
7      AnextValueForAlertID,
8      AnextValueForCrisisID,
9      Aclock,
10     AcrisisReminderPeriod,
11     AmaxCrisisReminderPeriod,
12     AvpLastReminder,
13     AvpStarted],
14   Result):-
15
16 /* Post F01 */
17(
18 msrVar(ctState,Self),
19
20 msrNav([Self],[nextValueForAlertID],[AnextValueForAlertID]),
21 msrNav([Self],[nextValueForCrisisID],[AnextValueForCrisisID]),
22 msrNav([Self],[clock],[Aclock]),
23 msrNav([Self],[crisisReminderPeriod],[AcrisisReminderPeriod]),
24 msrNav([Self],[maxCrisisReminderPeriod],[AmaxCrisisReminderPeriod]),
25 msrNav([Self],[vpLastReminder],[AvpLastReminder]),
26 msrNav([Self],[vpStarted],[AvpStarted]),
27
28 msrNav([Self],[msrIsNew],[Self])
29)
30-> Result = [ptBoolean,true]
31; Result = [ptBoolean,false]
32.

```

Listing D.30: Prolog file PrimaryTypesClasses-ctState-init.pl.

D.31 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDataty... dtAlertID-is.pl

```

1%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%
5
6msrop(dtAlertID,is,[AdtValue],Result):-
7% msd01
8msrVar(ptBoolean,TheResult),
9(
10 ( msrNav([AdtValue],
11   [value,length,[],gt,[[ptInteger,0]]],
12   [[ptBoolean,true]]),
13   msrNav([AdtValue],
14   [value,length,[],leq,[[ptInteger,20]]],
15   [[ptBoolean,true]])
16 )
17 -> (TheResult = [ptBoolean,true])
18 ; (TheResult = [ptBoolean,false])
19),
20TheResult = Result
21.
22
23/*
24| ?- X = [dtAlertID,[],[[dtString,[[value,[ptString,'0123456789']]]],[]]],,
25msrNav([X],[is,[],[Result]).
26
27X = [dtAlertID,[],[[dtString,[[value,[ptString,'0123456789']]]],[]]],,
28Result = [ptBoolean,true] ?
29
30yes
31
32| ?- X = [dtAlertID,[],[[dtString,[[value,[ptString,'012345678901234567890123456789']]]],[]]],,
33msrNav([X],[is,[],[Result]).
```

```

34
35X = [dtAlertID, [], [[dtString, [[value, [ptString, '012345678901234567890123456789']]]], []]],,
36Result = [ptBoolean, false] ?
37
38yes
39*/

```

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

D.32 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypes-dtComment-is.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5%% dtComment
6
7msd01
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,[],leg,[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 ...']]],[[]]]],[],[Result]].
28msrNav([X],[is,[],[Result]]).
29X = [dtComment,[],[[dtString,[[value,[ptString,'I broke my leg ! Please help ...']]],[[]]]],[],[Result] = [ptBoolean,true] ?
30Result = [ptBoolean,true] ?
31yes
32
33| ?- X = [dtComment,[],[[dtString,[[value,[ptString,'I broke my leg when I was running with my dog
34      to go to the skate park because my friends called me on my mobile phone and told me that a skate
35      star was doing triple back flips.']]],[[]]]],[],[Result]].
36msrNav([X],[is,[],[Result]]).
37X = [dtComment,[],[[dtString,[[value,[ptString,'I broke my leg when I was running with my dog to go
38      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.']]],[[]]]],[],[Result] = [ptBoolean,false] ?
39yes
38*/

```

Listing D.32: Prolog file PrimaryTypesDatatypes-dtComment-is.pl.

D.33 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypes-dtCoordinatorID-is.pl

```

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

```

```

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/PrimaryTypesDatatypes-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/PrimaryTypesDatatypes-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/PrimaryTypesDatatypes-dtGPSLocation-isNearTo.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6%% dtGPSLocation
7
8msrop(dtGPSLocation, isNearTo, [Self, AdtValue], Result) :-
9msrVar(ptBoolean, TheResult),
10msrVar(dtReal, EarthRadius),
11msrVar(dtReal, MaxDistance),
12
13msrVar(dtLatitude, ComparedLatitude),
14msrVar(dtLongitude, ComparedLongitude),
15
16msrVar(dtReal, R1), msrVar(dtReal, R1a),
17msrVar(dtReal, R2), msrVar(dtReal, R2a),
18
19(
20(
21(
22    % msd01
23    msrNav([EarthRadius], [value], [[ptReal, 6371]]),
24    msrNav([MaxDistance], [value], [[ptReal, 100]]),
25
26    msrNav([AdtValue], [latitude], [ComparedLatitude]),
27    msrNav([AdtValue], [longitude], [ComparedLongitude]),
28
29    msrNav([Self], [latitude, sin, [], [R1a]]),
30    msrNav([AdtValue], [latitude, sin, [], mul, [R1a]], [R1]),
31
32    msrNav([Self], [latitude, cos, [], [R2a]]),
33    msrNav([AdtValue], [latitude, cos, [], mul, [R2a]], [R2]),
34
35    msrNav([AdtValue], [longitude], [ComparedLongitude]),
36    msrNav([Self], [longitude, sub, [ComparedLongitude], cos, [], mul, [R2],
37        add, [R1],
38        acos, [],
39        mul, [EarthRadius],
40        sub, [MaxDistance],
41        value, leq, [[ptReal, 0]]],
42        [[ptBoolean, true]])

```

```

43      )
44      -> TheResult = [ptBoolean,true]
45      ; TheResult = [ptBoolean,false]
46  )
47),
48 Result = TheResult
49.

```

Listing D.36: Prolog file PrimaryTypesDatatypes-dtGPSLocation-isNearTo.pl.

D.37 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypes-dtLatitude-is.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6% msd01
7msrop(dtLatitude,is,[AdtValue],Result):-%
8msrVar(ptBoolean,TheResult),
9(
10 ( msrNav([AdtValue],
11   [value,ged,[[ptReal,-90.0]]],
12   [[ptBoolean,true]]),
13  msrNav([AdtValue],
14   [value,leq,[[ptReal,+90.0]]],
15   [[ptBoolean,true]])
16 )
17 -> (TheResult = [ptBoolean,true])
18 ; (TheResult = [ptBoolean,false])
19),
20Result = TheResult
21.

```

Listing D.37: Prolog file PrimaryTypesDatatypes-dtLatitude-is.pl.

D.38 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypes-dtLogin-is.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5% dtComment
6
7%msd01
8msrop(dtLogin,is,[AdtValue],Result):-%
9 msrVar(ptBoolean,TheResult),
10 msrVar(ptInteger,MaxLength),
11 (
12  (
13    (
14      MaxLength = [ptInteger,20],
15      msrNav([AdtValue],
16        [value,length,[],leq,[MaxLength]],
17        [[ptBoolean,true]]))
18  )
19  -> TheResult = [ptBoolean,true]
20  ; TheResult = [ptBoolean,false]
21 )
22),
23 Result = TheResult
24.
25/*
26| ?- X = [dtLogin,[],[[dtString,[[value,[ptString,'01234567']]],[[]]]],
```

```

27msrNav([X],[is,[],[Result]).
28X = [dtLogin,[],[[dtString,[[value,[ptString,'01234567']]]],[],[],[],],
29Result = [ptBoolean,true] ?
30yes
31
32| ?- X = [dtLogin,[],[[dtString,[[value,[ptString,'01234567a']]]],[],[],[],],
33msrNav([X],[is,[],[Result]).
34X = [dtLogin,[],[[dtString,[[value,[ptString,'01234567a']]]],[],[],[],],
35Result = [ptBoolean,false] ?
36yes
37*/

```

Listing D.38: Prolog file PrimaryTypesDatatypes-dtLogin-is.pl.

D.39 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypes-dtLongitude-is.pl

```

1%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%
5
6%% dtPhoneNumber
7
8% msd01
9msrop(dtLongitude,is,[AdtValue],Result):-
10msrVar(ptBoolean,TheResult),
11(
12 ( msrNav([AdtValue],
13   [value,geq,[[ptReal,-180.0]]],
14   [[ptBoolean,true]]),
15 msrNav([AdtValue],
16   [value,leq,[[ptReal,+180.0]]],
17   [[ptBoolean,true]]))
18 )
19 -> (TheResult = [ptBoolean,true])
20 ; (TheResult = [ptBoolean,false])
21),
22
23 Result = TheResult
24.

```

Listing D.39: Prolog file PrimaryTypesDatatypes-dtLongitude-is.pl.

D.40 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypes-dtPassword-is.pl

```

1%%%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%%%
5%% dtComment
6
7%msd01
8msrop(dtPassword,is,[AdtValue],Result):-
9 msrVar(ptBoolean,TheResult),
10 msrVar(ptInteger,MinLength),
11 (
12 (
13   (
14     MinLength = [ptInteger,6],
15     msrNav([AdtValue],
16       [value,length,[],geq,[MinLength]],
17       [[ptBoolean,true]]))
18   )
19   -> TheResult = [ptBoolean,true]

```

```

20      ; TheResult = [ptBoolean, false]
21  )
22),
23 Result = TheResult
24.
25/*
26| ?- X = [dtPassword, [], [[dtString, [[value, [ptString, '012345']]]], []]], 
27msrNav([X], [is, []], [Result]).
28X = [dtPassword, [], [[dtString, [[value, [ptString, '012345']]]], []]], 
29Result = [ptBoolean, true] ?
30yes
31
32| ?- X = [dtPassword, [], [[dtString, [[value, [ptString, '01234']]]], []]], 
33msrNav([X], [is, []], [Result]).
34X = [dtPassword, [], [[dtString, [[value, [ptString, '01234']]]], []]], 
35Result = [ptBoolean, false] ?
36yes
37*/

```

Listing D.40: Prolog file PrimaryTypesDatatypes-dtPassword-is.pl.

D.41 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesDatatypes-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]).
28X = [dtPhoneNumber, [], [[dtString, [[value, [ptString, '(+352) 46 66 44 60 00']]]], []]], 
29Result = [ptBoolean,true] ?
30
31yes
32
33yes
34*/

```

Listing D.41: Prolog file PrimaryTypesDatatypes-dtPhoneNumber-is.pl.

D.42 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClassesAndAlertStatus-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/PrimaryTypesClassifications/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/PrimaryTypesClassifications/etCrisisType-is.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6% etCrisisType
7
8% msd01
9msrop(etCrisisType,is,[AdtValue],Result) :-
10msrVar(ptBoolean,TheResult),
11(
12 (
13 member(AdtValue,[small, medium, huge]))
14 )
15 -> TheResult = [ptBoolean,true]
16 ; TheResult = [ptBoolean,false]
17),
18 Result = TheResult
```

19.

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

D.45 File ./src-gen/prolog-ref-spec/Operations/Concepts/PrimaryTypesClasses etHumanKind-is.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5
6%% etHumanKind
7
8% msd01
9msrop(etHumanKind,is,[AdtValue],Result) :-
10msrVar(ptBoolean,TheResult),
11(
12(
13    member(AdtValue,[witness,victim,anonymous])
14)
15 -> TheResult = [ptBoolean,true]
16 ; TheResult = [ptBoolean,false]
17),
18 Result = TheResult
19.

```

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

D.46 File ./src-gen/prolog-ref-spec/Operations/Concepts/SecondaryTypesDatatypesdtSMS-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

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

Bibliography

- [1] Guelfi, N.: Messir: A Scientific Method for the Software Engineer. to be published (2017)
- [2] Armour, F., Miller, G.: Advanced Use Case Modeling: Software Systems. Addison-Wesley (2001)
- [3] ISO/IEC: ISO/IEC 25010 - Systems and software engineering - Systems and software Quality Requirements and Evaluation (SQuaRE) - System and software quality models. (2011) ISO/IEC 13211-1.