



iCrash :
A Crisis Management Case Study
MESSIR Analysis Document
- v 1.4 -
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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 [?]. 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 [?]. 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 [?] 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 [?].

2.3.1 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.

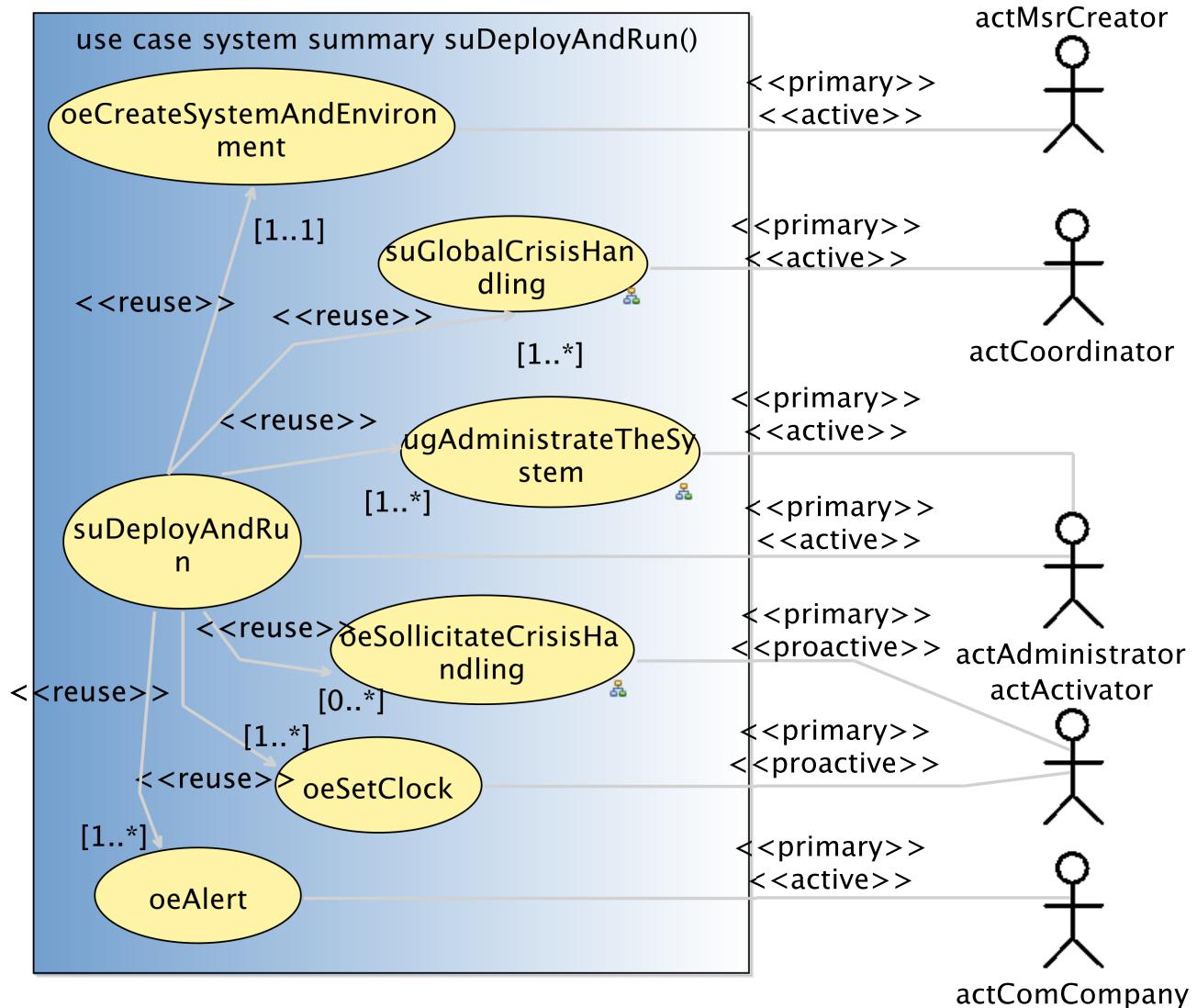
¹The naming conventions in **Messir** propose to start each type name by lowercase letters indicating the meta model type used (i.e. `act` for actors, `ct` for class type,). In addition to ease the reading it makes the translational semantics into Prolog code more straightforward.

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>
7	<u>oeMakeFullReport [0..*]</u>
Protocol condition(s)	
1	the iCrash system has been deployed
Pre-condition(s)	
1	none

continues in next page ...

... Use-Case Description table continuation

Main post-condition(s)
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
g the actor actCoordinator executes the <u>oeMakeFullReport</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 [0..*]</u>
2	<u>oeGetAlertsSet [0..*]</u>
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

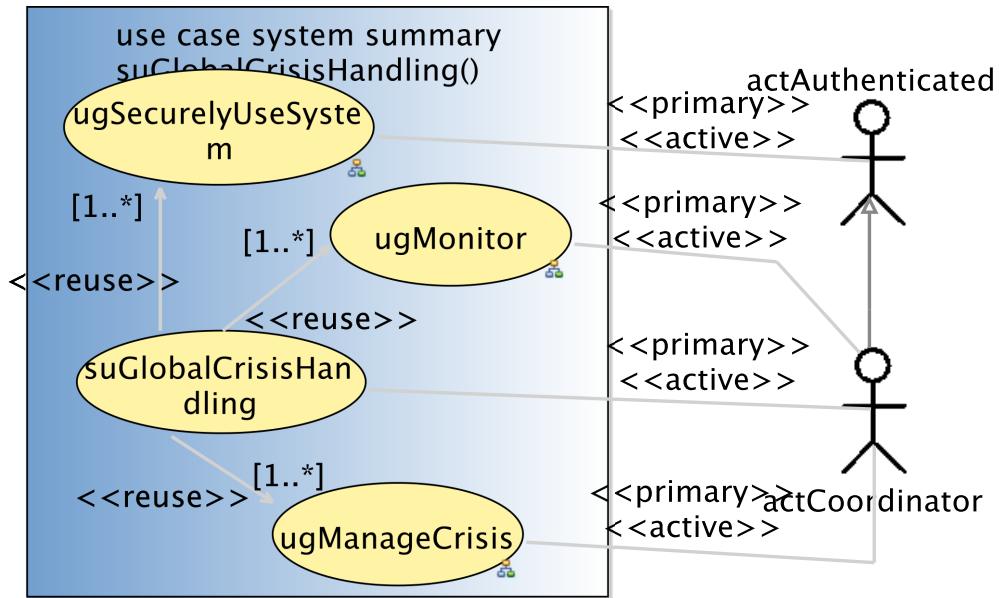


Figure 2.2: suGlobalCrisisHandling user goal use case

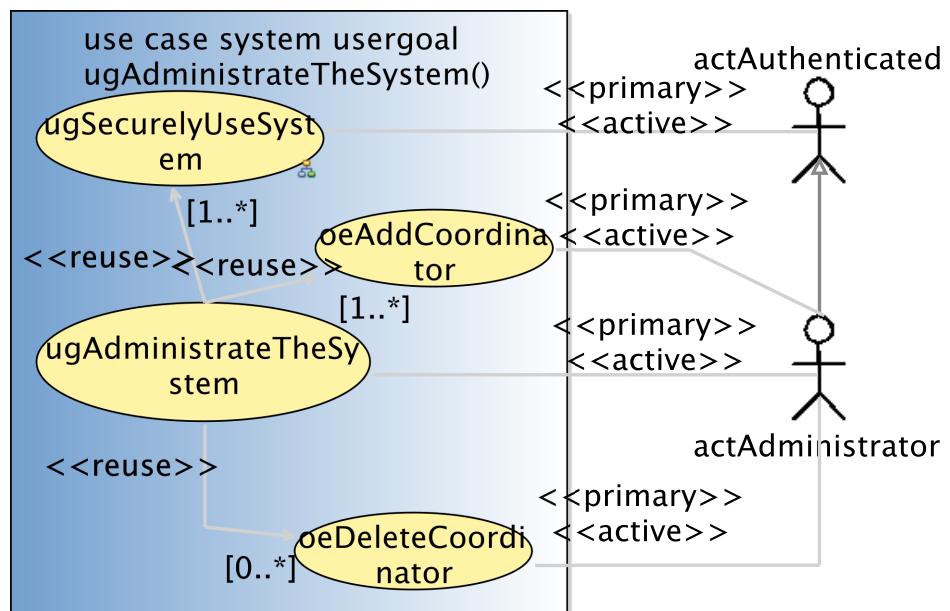


Figure 2.3: ugAdministateTheSystem user goal use case

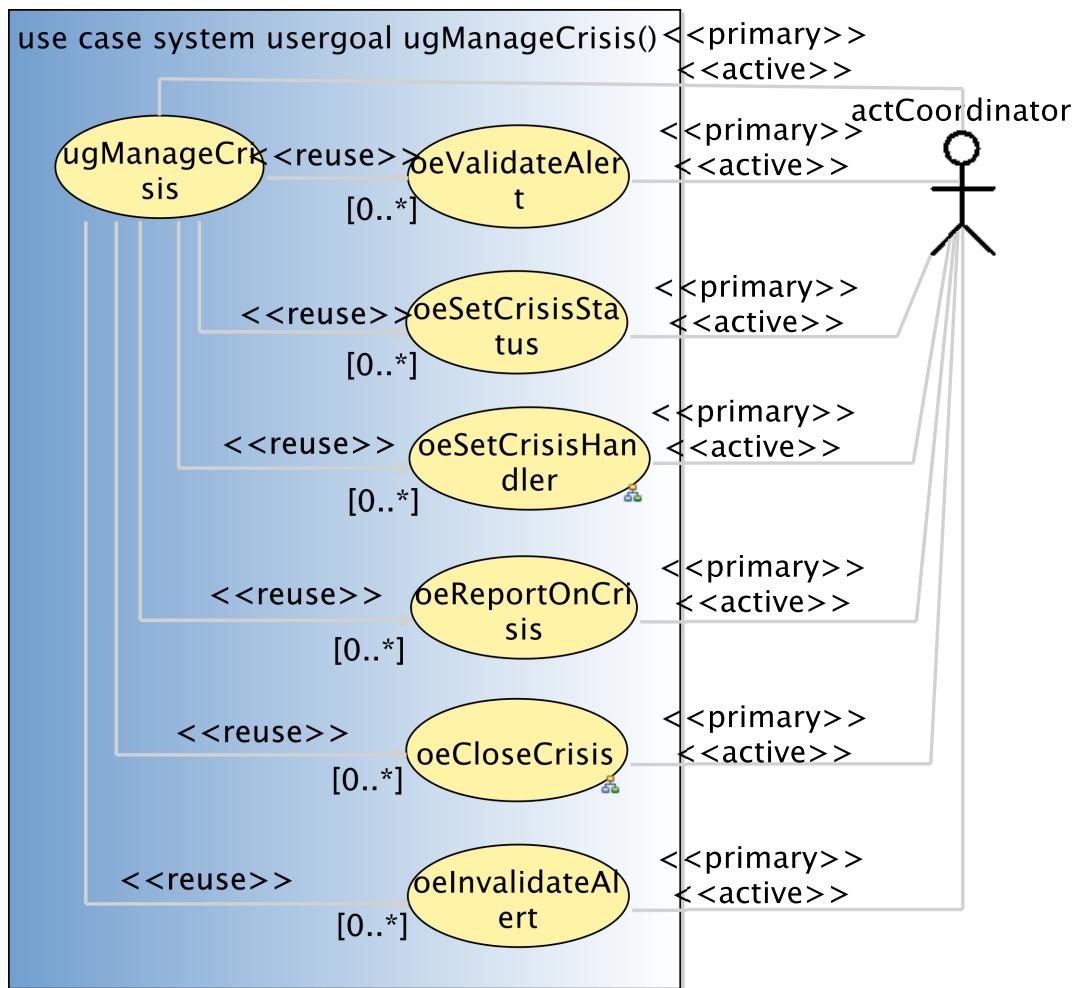


Figure 2.4: ugManageCrisis user goal use case

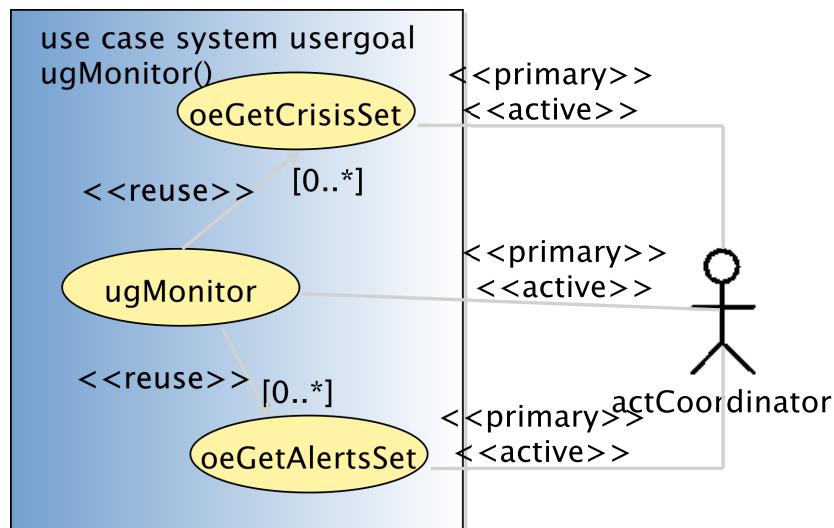


Figure 2.5: ugMonitor user goal use case

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.

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

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

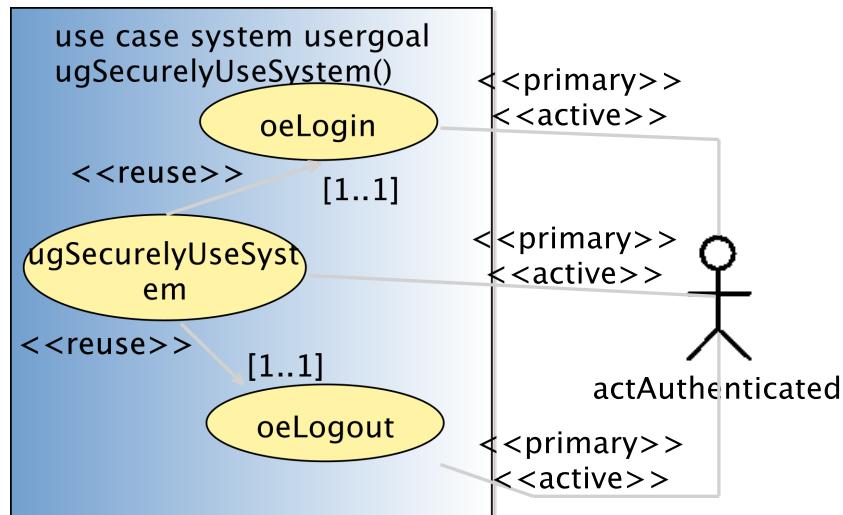


Figure 2.6: ugSecurelyUseSystem user goal use case

2.3.1.7 subfunction-oeMakeFullReport

USE-CASE DESCRIPTION	
Name	oeMakeFullReport
Scope	system
Level	subfunction
<i>Parameters</i>	
AdtCrisisID:	dtCrisisID 1
AdtEmail:	dtEmail 2
<i>Primary actor(s)</i>	
1	actCoordinator[active]
<i>Goal(s) description</i>	
<i>Protocol condition(s)</i>	
1	
<i>Pre-condition(s)</i>	
1	
<i>Main post-condition(s)</i>	
1	
<i>Additional Information</i>	
none	

2.3.1.8 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>	

continues in next page ...

... Use-Case Description table continuation

1
Additional Information
none

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

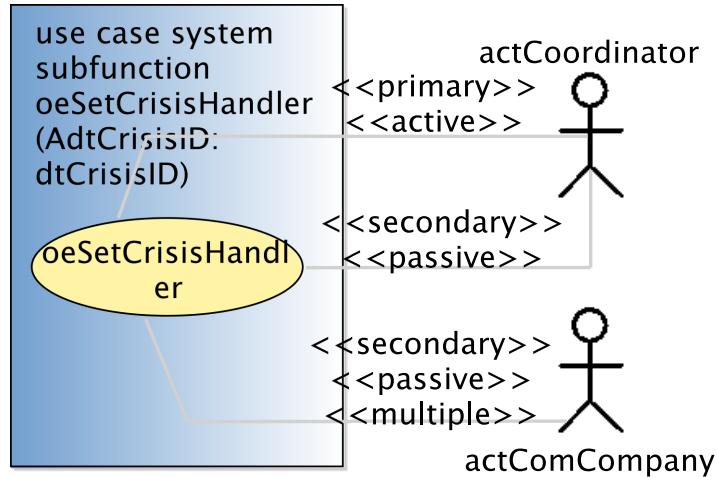


Figure 2.7: oeSetCrisisHandler subfunction use case

2.3.1.9 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>	

continues in next page ...

... Use-Case Description table continuation

- | | |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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

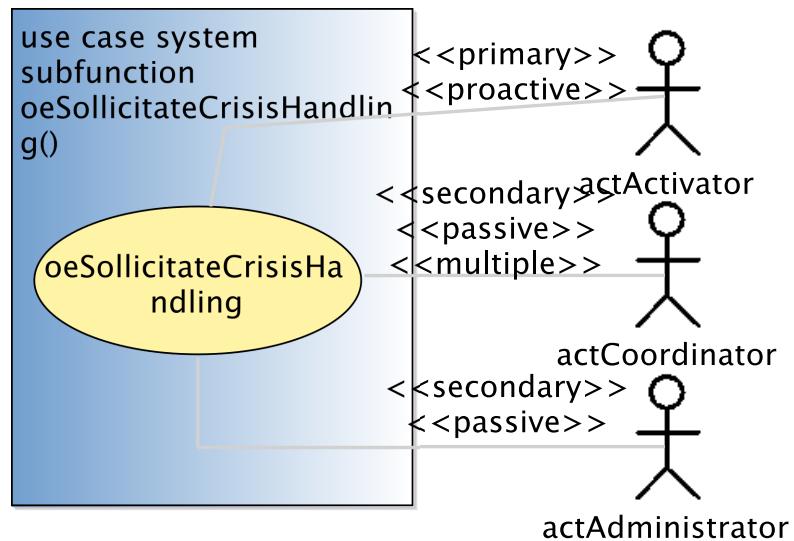


Figure 2.8: oeSollicitateCrisisHandling subfunction use case

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 solicitation of crisis handling.
e	this first part stops before the coordinator logs in the system.

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

2.3.2.2 Use-Case Instance - uciSimpleAndCompletePart02:suDeployAndRun

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

SUMMARY USE-CASE INSTANCE	
<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

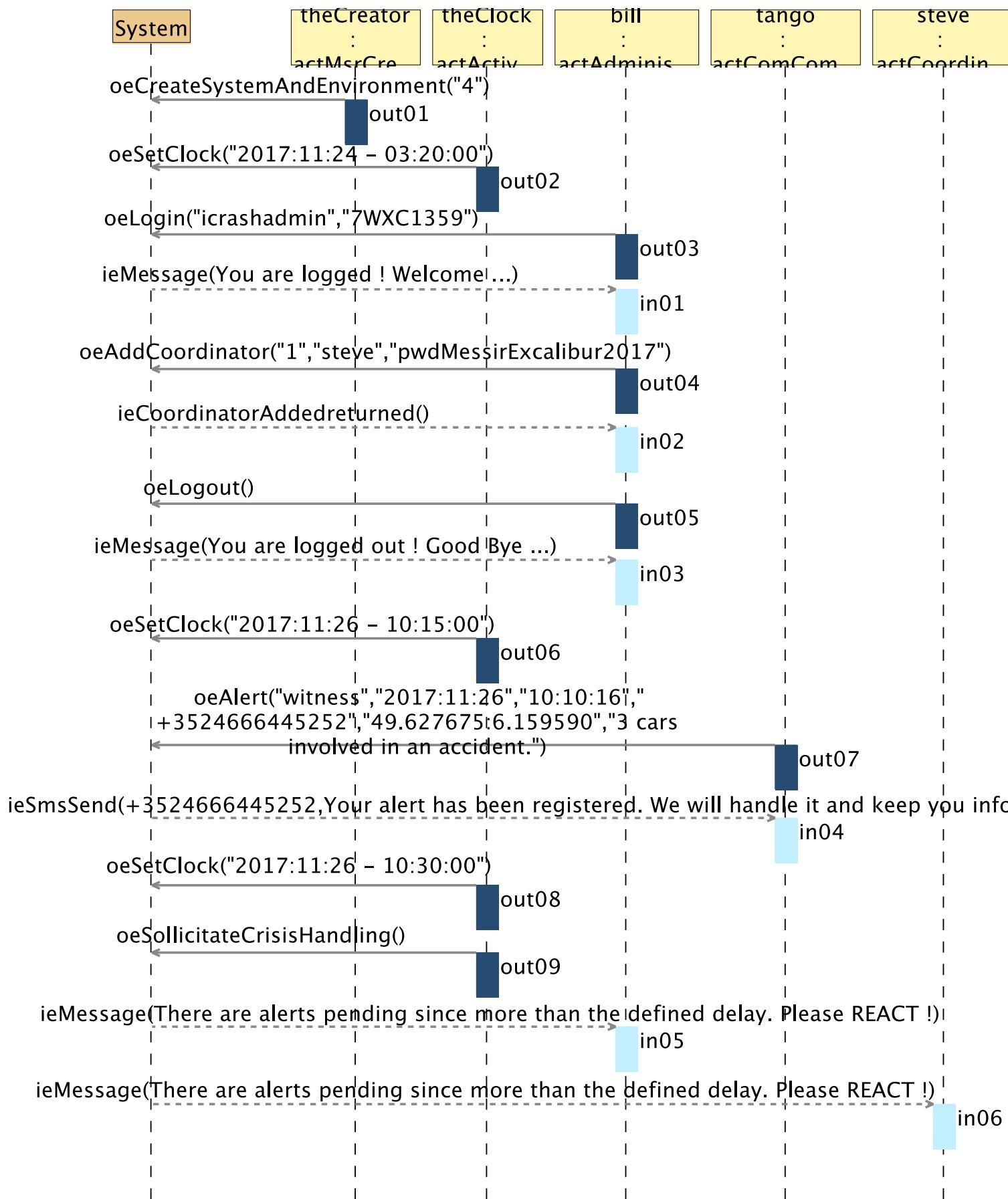


Figure 2.9: uci-suDeployAndRun-uciSimpleAndComplete-Part01

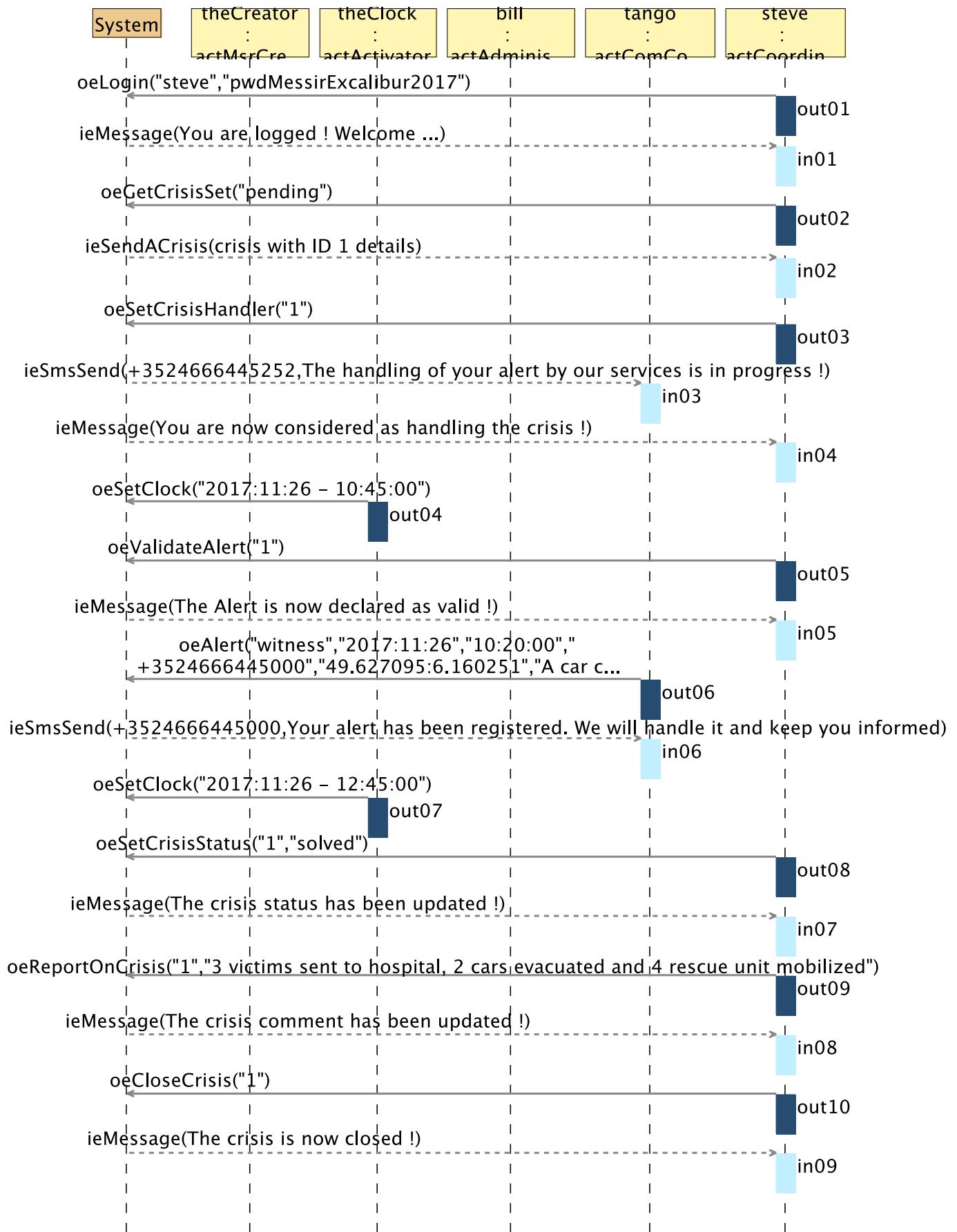


Figure 2.10: uci-suDeployAndRun-uciSimpleAndComplete-Part02 use case instance sequence diagram

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. [?]) 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

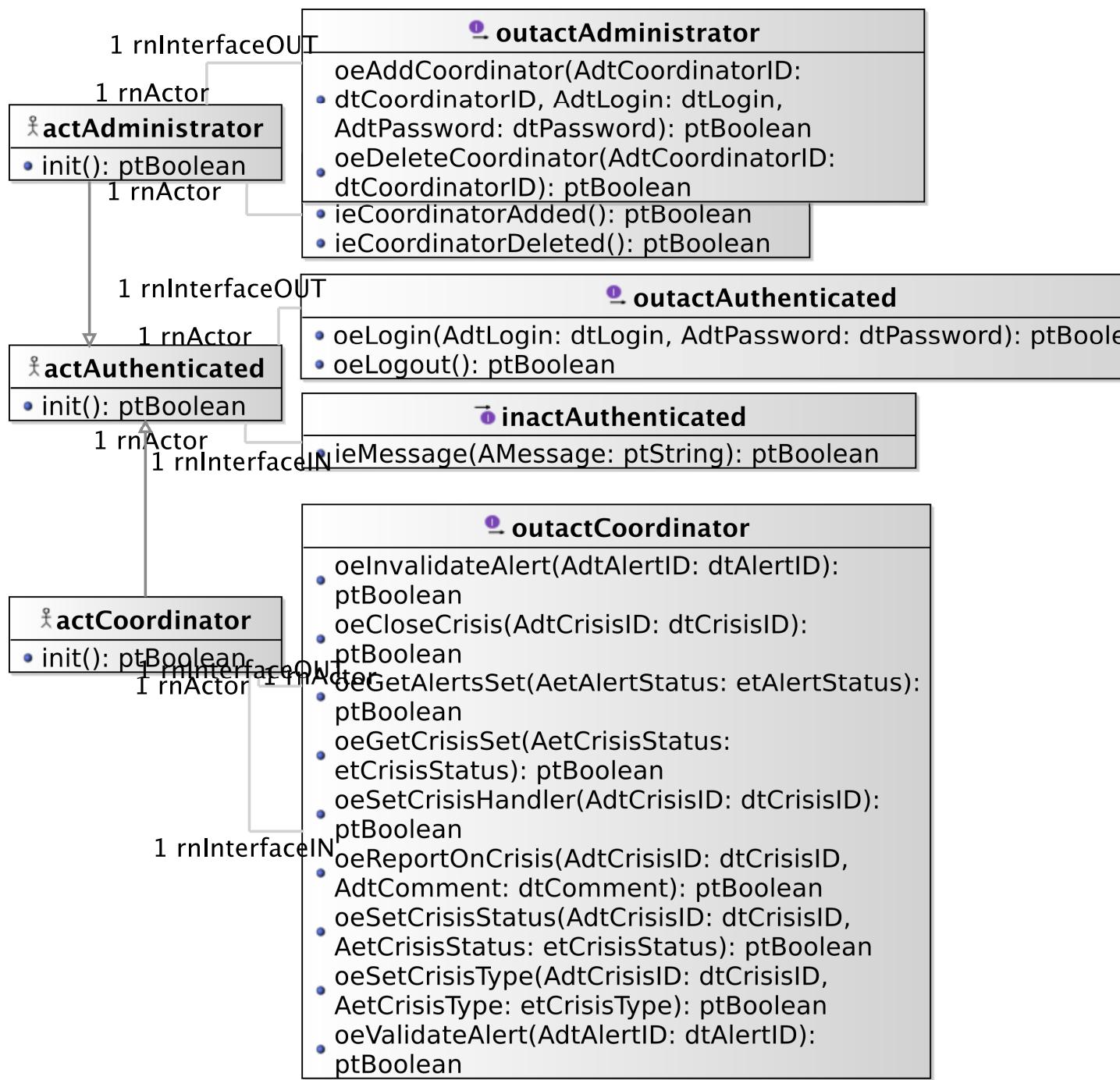


Figure 3.1: Environment Model - Local View 01. environment model local view - Part 1.

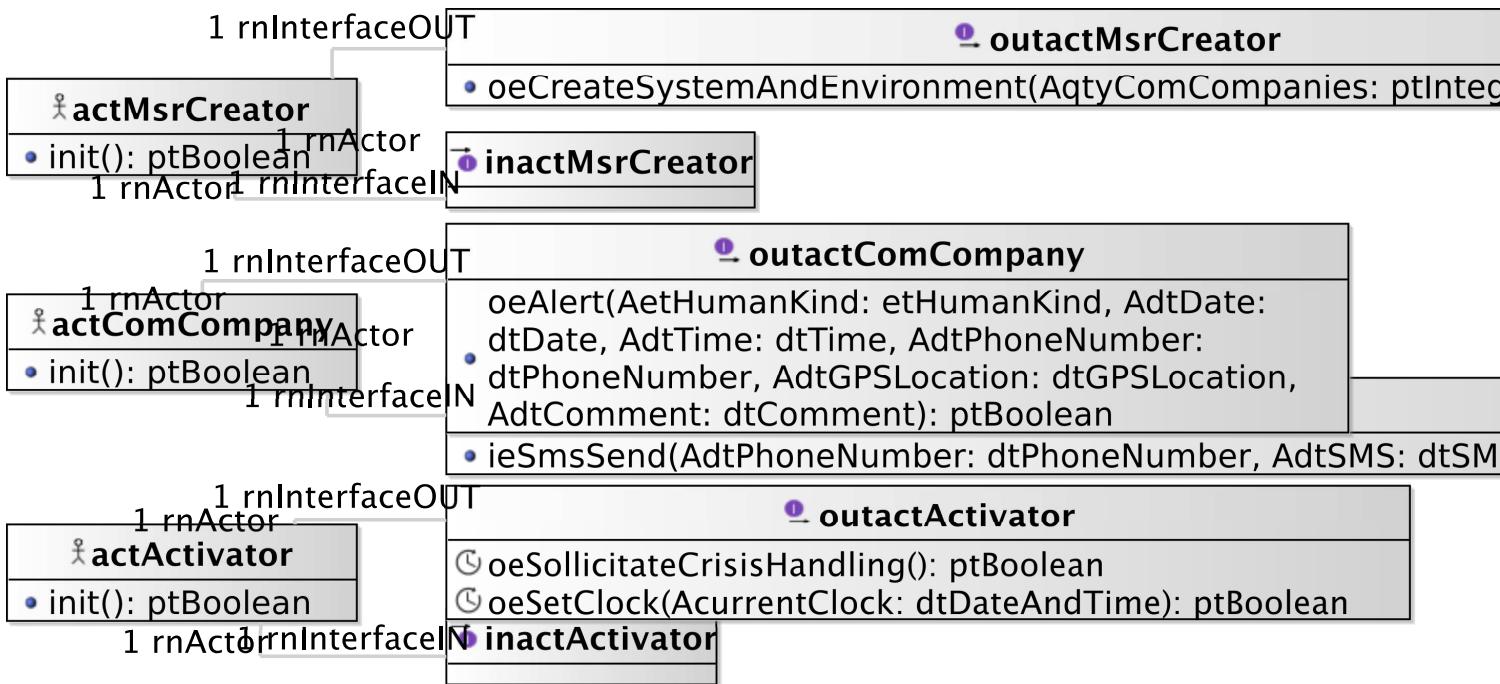


Figure 3.2: Environment Model - Local View 02. environment model local view - Part 2.

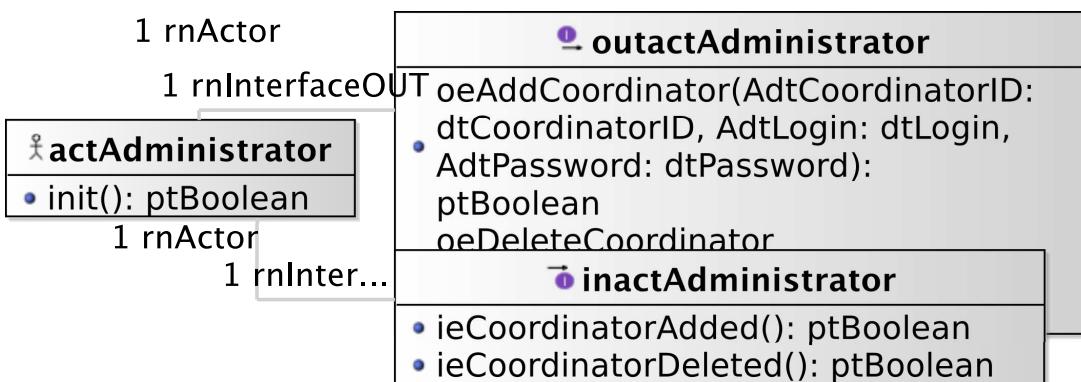


Figure 3.3: Environment Model - Local View 03. administrator actor environment model view.

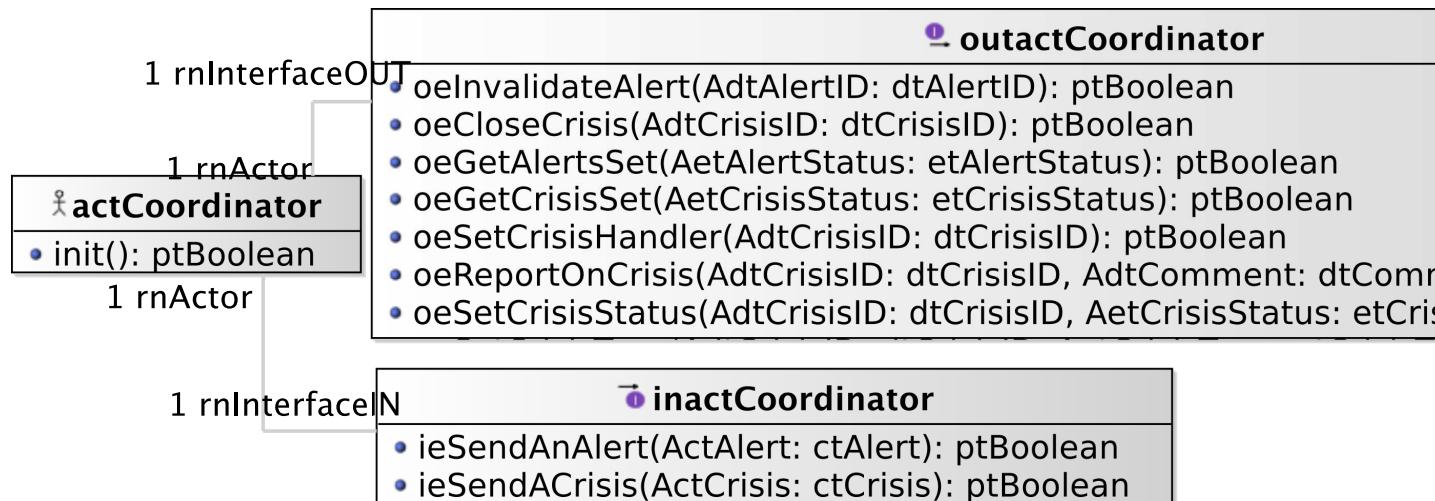


Figure 3.4: Environment Model - Local View 04. coordinator actor environment model view.

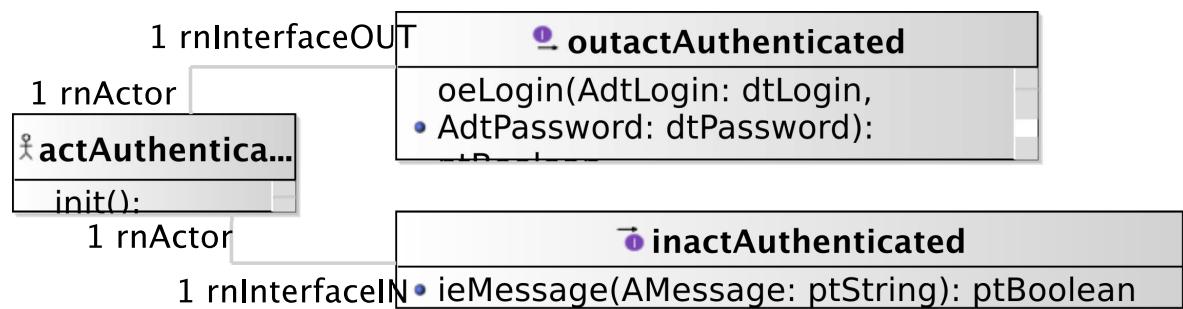


Figure 3.5: Environment Model - Local View 05. authenticated actor environment model local view.

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

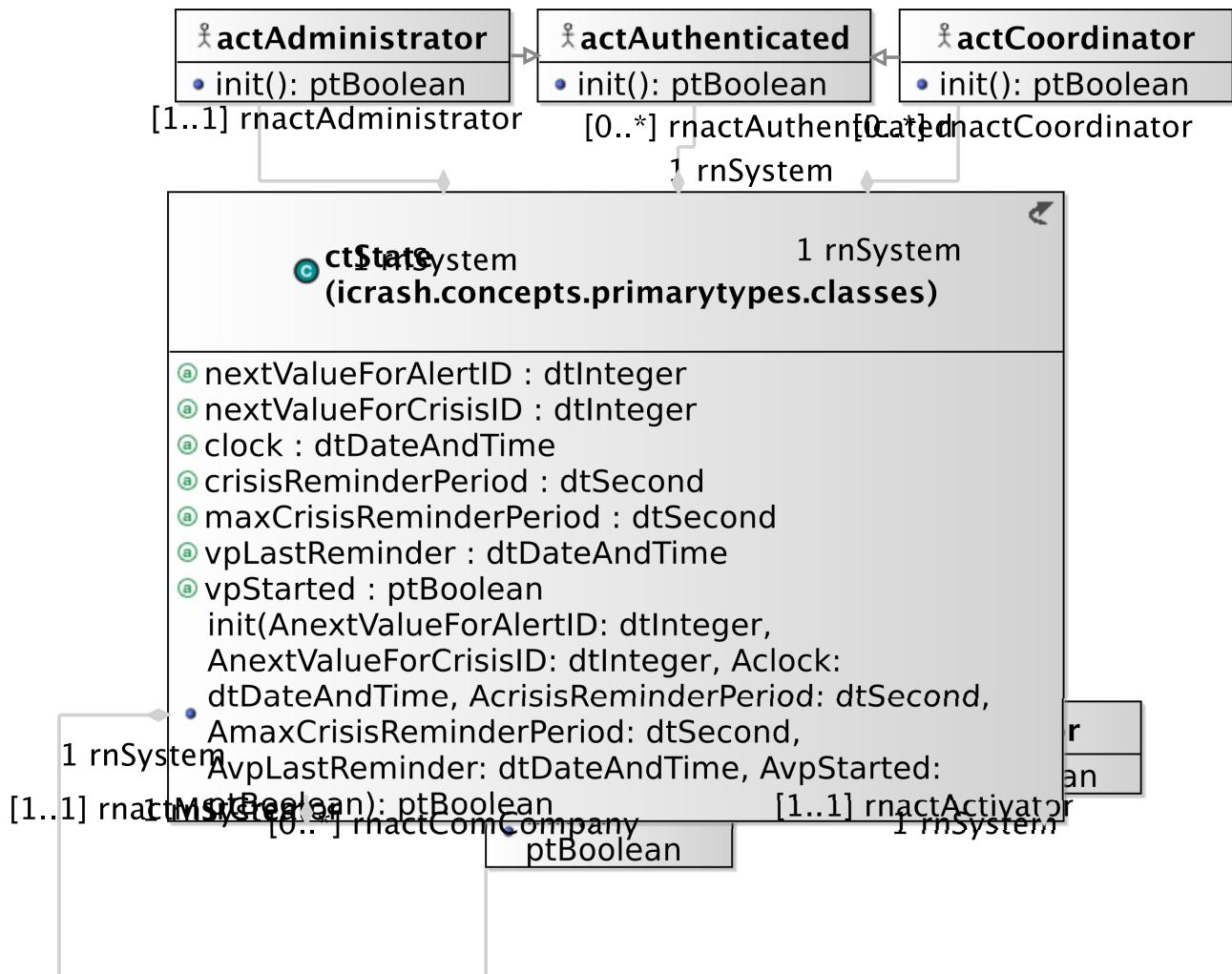


Figure 3.6: Environment Model - Global View 01. em-gv-01 environment model global view.

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.
<i>OutputInterfaces</i>

continues in next page ...

...Actor table continuation

OUT 1	[proactive] oeSolicitCrisisHandling() :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, AetBiometricAuthType:etBiometricAuthType, AdtBiometrics:dtBiometrics) :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, AetBiometricAuthType:etBiometricAuthType, AdtBiometrics:dtBiometrics) :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>continues in next page ...</i>

...Actor table continuation

<i>actComCompany</i>	represents the communication company stakeholder ensuring the input/ouput of textual messages with humans having communication 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	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

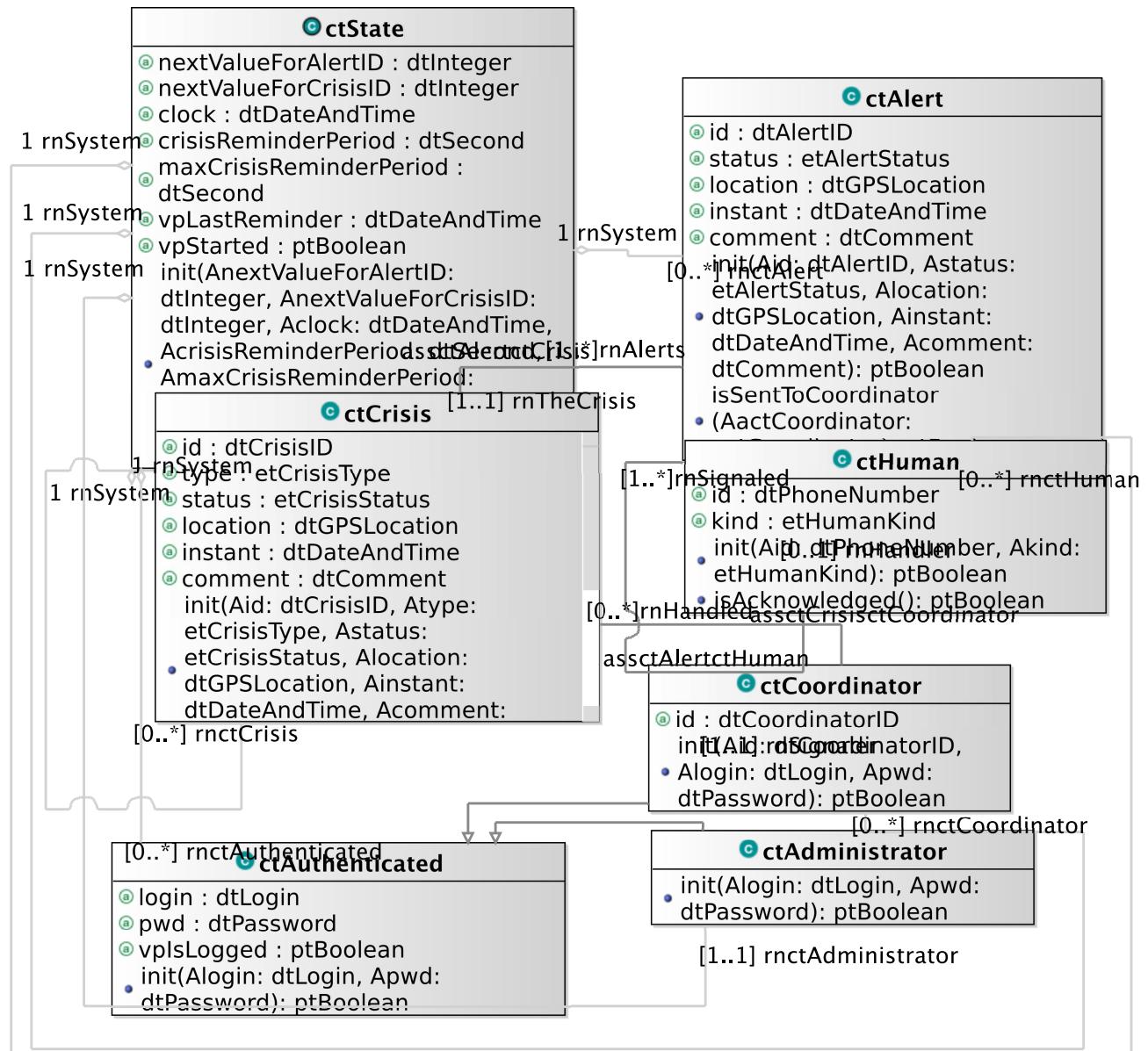


Figure 4.1: Concept Model - PrimaryTypes-Classes local view 01. Local view of all the primary types class types .

c ctState	
⑧	nextValueForAlertID : dtInteger
⑧	nextValueForCrisisID : dtInteger
⑧	clock : dtDateAndTime
⑧	crisisReminderPeriod : dtSecond
⑧	maxCrisisReminderPeriod : dtSecond
⑧	vpLastReminder : dtDateAndTime
⑧	vpStarted : ptBoolean
	init(AnextValueForAlertID: dtInteger,
	AnextValueForCrisisID: dtInteger,

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

c ctAlert	
⑧	id : dtAlertID
⑧	status : etAlertStatus
⑧	location : dtGPSLocation
⑧	instant : dtDateAndTime
⑧	comment : dtComment
	init(Aid: dtAlertID, Astatus: etAlertStatus,
	Alocation: dtGPSLocation, Ainstant:

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

c ctCrisis	
⑧	id : dtCrisisID
⑧	type : etCrisisType
⑧	status : etCrisisStatus
⑧	location : dtGPSLocation
⑧	instant : dtDateAndTime
⑧	comment : dtComment
	init(Aid: dtCrisisID, Atype: etCrisisType, Astatus:
	etCrisisStatus, Alocation: dtGPSLocation, Ainstant:
	dtDateAndTime, Acomment: dtComment):
	ntBoolean

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

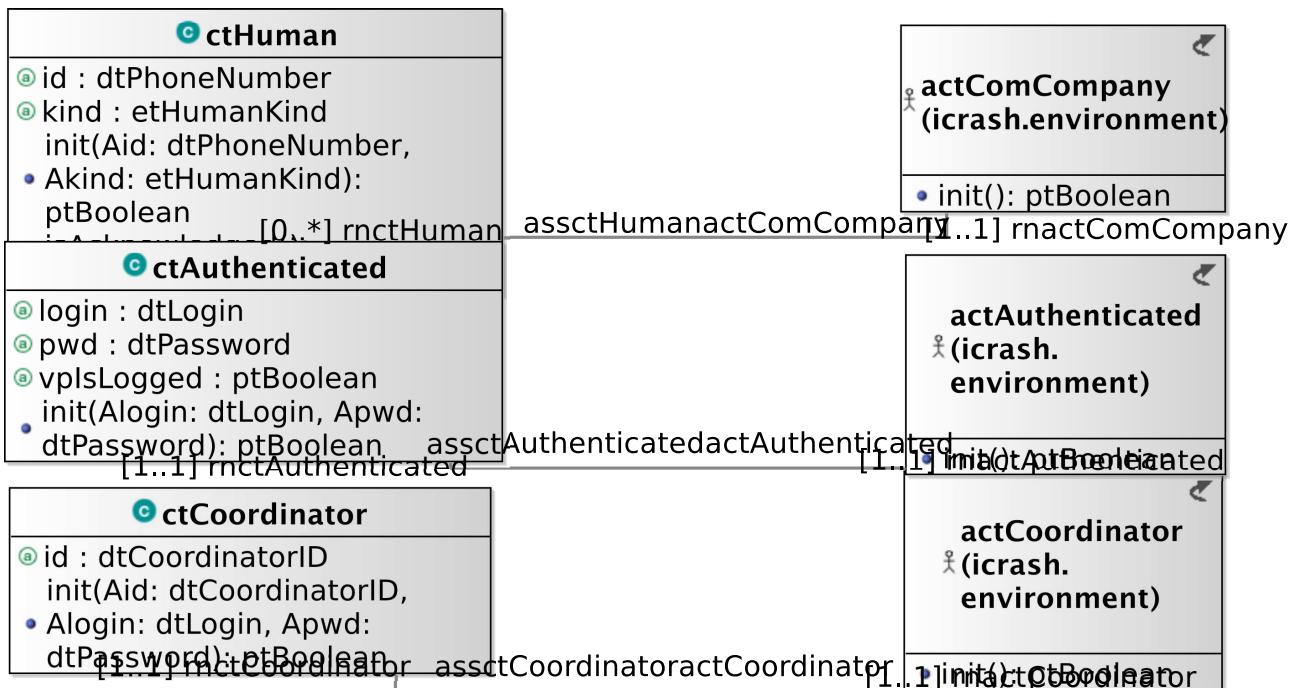


Figure 4.5: Concept Model - PrimaryTypes-Classes global view 01. Primary types class types global view - cm-pt-ct-gv-01 .

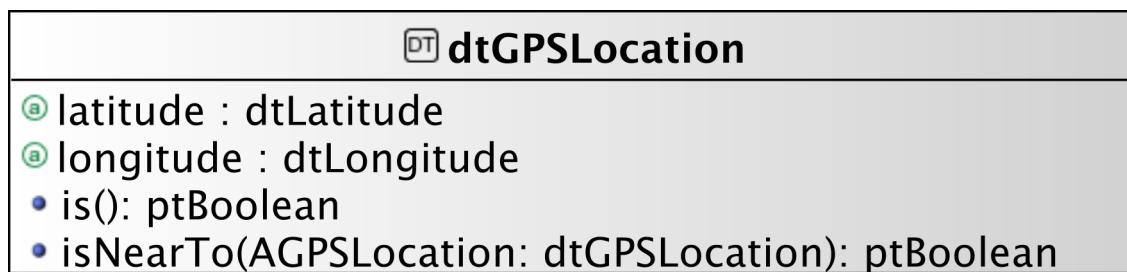


Figure 4.6: Concept Model - PrimaryTypes-Datatypes local view 06. .

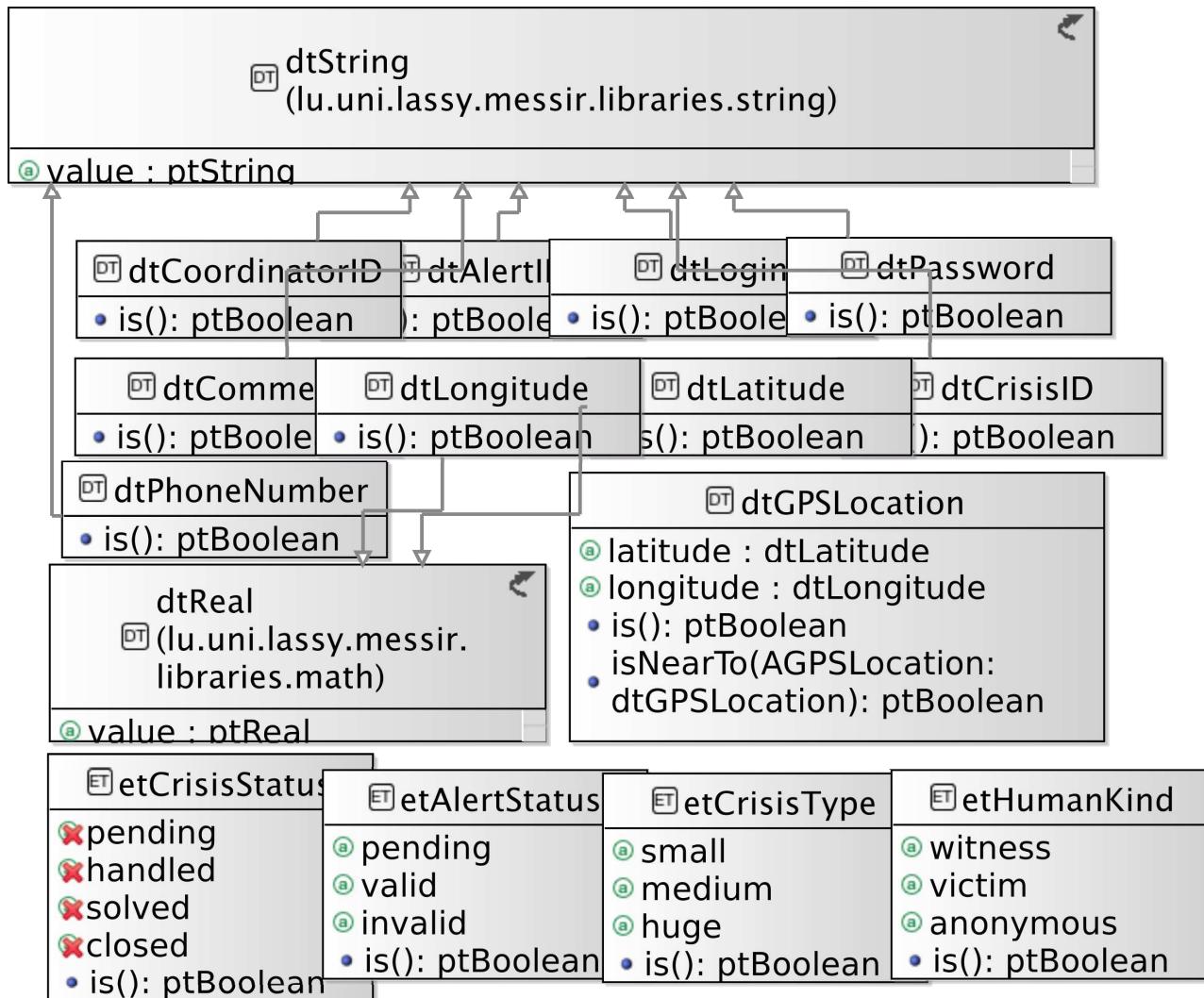


Figure 4.7: Concept Model - PrimaryTypes-Datatypes global view 01. global view of primary types datatype types - cm-pt-dt-gv-01 .

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>clReport</i>	
attribute	crisisID: dtCrisisID
attribute	id: dtReportID
attribute	information: ptString
attribute	location: dtGPSLocation
attribute	recipient: dtEmail
attribute	status: etCrisisStatus
attribute	type: etCrisisType

continues in next page ...

... Classes table continuation

operation	init (Aid:dtReportID, AcrisisID:dtCrisisID, Arecipient:dtEmail, Alocation:dtGPSLocation, Astatus:etCrisisStatus, Atype:etCrisisType, Ainformation:ptString) :ptBoolean
<i>ctAdministrator</i>	
	used to characterize internally the entity that is responsible of administrating the <i>iCrash</i> system.
extends	icrash.concepts.primarytypes.classes.ctAuthenticated
operation	init (Alogin:dtLogin, Apwd:dtPassword, Abiometrics:dtBiometrics) :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 the position of the alert provided by the space-based satellite navigation system used by the human using the communication company to inform the <i>iCrash</i> system of a crisis.
attribute	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.
<i>ctAuthenticated</i>	
	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, AauthType:etBiometricAuthType, Abiometrics:dtBiometrics) :ptBoolean
	used to initialize the current object as a new instance of the ctAuthenticated type.
<i>ctCoordinator</i>	
	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.

continues in next page ...

... Classes table continuation

operation	init(Aid:dtCoordinatorID, Alogin:dtLogin, Apwd:dtPassword, AauthType:etBiometricAuthType, Abiometrics:dtBiometrics) :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 to 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 used to determine if the crisis stood too long in a pending status since last reminder.
operation	init(Aid:dtCrisisID, Atype:etCrisisType, Astatus:etCrisisStatus, Alocation:dtGPSLocation, Ainstant:dtDateAndTime, Acomment:dtComment) :ptBoolean used to initialize the current object as a new instance of the ctAlert type.
operation	isAllocatedIfPossible() :ptBoolean used to allocate a crisis to a coordinator if any or to alert the administrator of crisis waiting to be handled.
operation	isSentToCoordinator(AactCoordinator:actCoordinator) :ptBoolean used to provide a given coordinator with current crisis information.
operation	maxHandlingDelayPassed() :ptBoolean used to determine if the crisis stood too long in a pending status since its creation.
ctHuman	
	used to model system's representation about the indirect actors that have 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

continues in next page ...

... Classes table continuation

	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 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	
dtAlertID	A string used to identify alerts.
operation	is () :ptBoolean used to determine which strings are considered as valid alert identifiers.
dtBiometrics	
attribute	speechRecord: dtSpeechRecord
operation	is () :ptBoolean
dtComment	
a datatype made of a string value used to receive, store and send textual information about crisis and alerts.	
operation	is () :ptBoolean used to determine which strings are considered as valid comments.
dtCoordinatorID	
A string used to identify coordinators.	
operation	is () :ptBoolean used to determine which strings are considered as valid coordinators identifiers.

continues in next page ...

... Datatypes table continuation

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

... Enumerations table continuation

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

4.4.3 Primary types - Association types descriptions

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

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

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.	
<i>Parameters</i>	
1	AcurrentClock: dtDateAndTime the date and time to be considered as the actual one.
<i>Return type</i>	
ptBoolean	
<i>Pre-Condition (protocol)</i>	
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.
<i>Pre-Condition (functional)</i>	
PreF 1	none
<i>Post-Condition (functional)</i>	
PostF 1	the ctState instance post-state is updated to have its clock attribute equal to the given date and time.
<i>Post-Condition (protocol)</i>	
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.bnSystem = TheSystem
8  and self.rnActor.bnSystem.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.bnSystem = 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*.

5.1.2 Operation Model for *oeSollicitateCrisisHandling*

The *oeSollicitateCrisisHandling* operation has the following properties:

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

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

```

1  /* Pre Protocol:*/
2

```

```

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

```

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

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

5.2 Environment - Out Interface Operation Scheme for actAdministrator

5.2.1 Operation Model for *oeAddCoordinator*

The *oeAddCoordinator* operation has the following properties:

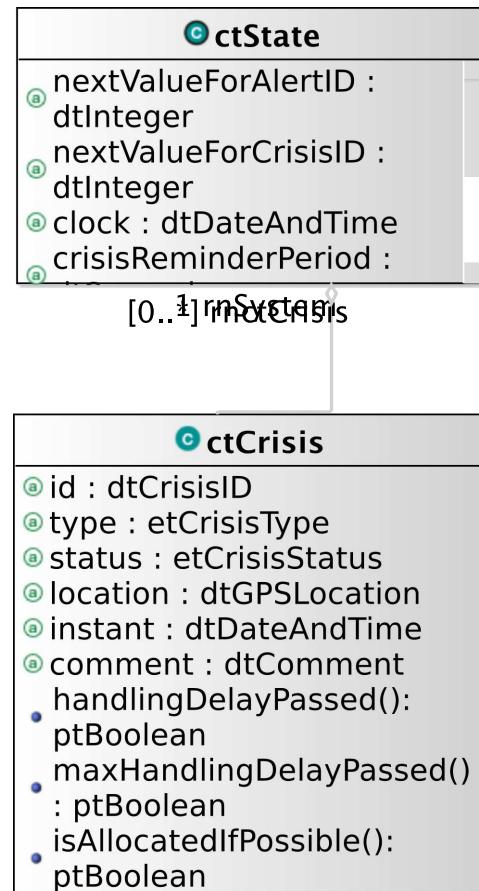


Figure 5.1: oeSollicitateCrisisHandling operation scope

OPERATION	
<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 5.3 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Pre Protocol:*/
2  preP{let TheSystem: ctState in
3    let TheActor:actAdministrator in
4
5
6    self.rnActor.rnSystem = TheSystem
7    and self.rnActor = TheActor
8
9  /* PreP01 */
10   and TheSystem.vpStarted = true
11  /* PreP02 */
12  and TheActor.rnctAuthenticated.vpIsLogged = true)
13
14 /* Pre Functional:*/
15 preF{let TheSystem: ctState in
16  let TheActor:actAdministrator in
17  let ColctCoordinators:Bag(ctCoordinator) in
18
19  self.rnActor.rnSystem = TheSystem
20  and self.rnActor = TheActor

```

```

21 /* PreF01 */
22 and TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
23     = ColctCoordinators
24 and ColctCoordinators->isEmpty() = true
25
26 /* Post Functional:*/
27 postF{let TheSystem: ctState in
28   let TheactCoordinator:actCoordinator in
29   let ThectCoordinator:ctCoordinator in
30   self.rnActor.rnSystem = TheSystem
31   and self.rnActor = TheActor
32 /* PostF01 */
33   TheactCoordinator.init()
34 /* PostF02 */
35   and ThectCoordinator.init(AdtCoordinatorID,AdtLogin,AdtPassword,AetBiometricAuthType,AdtBiometrics
36   )
37 /* PostF03 */
38   and TheactCoordinator@post.rnctCoordinator = ThectCoordinator
39
40 /* PostF04 */
41   and ThectCoordinator@post.rnactAuthenticated = TheactCoordinator
42
43 /* PostF05 */
44   and TheActor.rnInterfaceIN^ieCoordinatorAdded()
45
46 /* Post Protocol:*/
47 postP{ true}
```

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

5.2.2 Operation Model for oeDeleteCoordinator

The *oeDeleteCoordinator* operation has the following properties:

OPERATION
<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 5.4 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Pre Protocol*/
2  preP{let TheSystem: ctState in
3    let TheActor:actAdministrator in
4
5
6    self.rnActor.rnSystem = TheSystem
7    and self.rnActor = TheActor
8
9  /* PreP01 */
10   and TheSystem.vpStarted = true
11  /* Prep02 */
12  and TheActor.rnctAuthenticated.vpIsLogged = true}
13
14 /* Pre Functional*/
15 preF{let TheSystem: ctState in
16  let TheActor:actAdministrator in
17
18  self.rnActor.rnSystem = TheSystem
19  and self.rnActor = TheActor
20 /* Pref01 */
21  TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
22  = ColctCoordinators
23  and ColctCoordinators->size().eq(1)}
24
25 /* Post Functional*/
26 postF{let TheSystem: ctState in
27  let TheActor:actAdministrator in
28  let ThectCoordinator:ctCoordinator in
29  self.rnActor.rnSystem = TheSystem
30  and self.rnActor = TheActor
31 /* PostF01 */
32  TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
33  = ThectCoordinator
34  and ThectCoordinator.rnactCoordinator->forAll(msrIsKilled)
35  and ThectCoordinator.msrIsKilled
36
37 /* PostF02 */
38  and TheActor.rnInterfaceIN^ieCoordinatorDeleted()
39
40 /* Post Protocol*/
41 /* PostP01 */
42  and true}
43
44 /* Post Protocol*/
45 postP{ true}

```

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

5.3 Environment - Out Interface Operation Scheme for actAuthenticated

5.3.1 Operation Model for oeLogin

The *oeLogin* operation has the following properties:

OPERATION
<i>oeLogin</i>
sent to request authorization to request access secured system operations.
<i>Parameters</i>

continues in next page ...

... Operation table continuation

1	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 5.5 provides the **Mess1P** (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  /* PreP01 */
8  and TheSystem.vpStarted = true
9  /* PreP02 */
10 and TheActor.rnctAuthenticated.vpIsLogged = false}
11
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     and TheactAuthenticated.rnctAuthenticated.biometricAuthType
33     = AetBiometricAuthType
34     and TheactAuthenticated.rnctAuthenticated.biometrics
35     = AdtBiometrics
36   )
37   then (AptStringMessageForTheactAuthenticated.eq('You are logged ! Welcome ...')
38     and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
39   )
40   else (AptStringMessageForTheactAuthenticated
41     .eq('Wrong identification information ! Please try again ...')
42     and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
43     and AptStringMessageForTheactAdministrator.eq('Intrusion tentative !')
44     and TheSystem.rnactAdministrator
45     .rnInterfaceIN^ieMessage(AptStringMessageForTheactAdministrator)
46   )
47 endif}
48
49 /* Post Protocol:*/
50 postP{ let TheSystem: ctState in
51   let TheactAuthenticated:actAuthenticated in
52
53   self.rnActor.rnSystem = TheSystem
54   and self.rnActor = TheactAuthenticated
55 /* PostP01 */
56   if (TheactAuthenticated.rnctAuthenticated.pwd = AdtPassword
57     and TheactAuthenticated.rnctAuthenticated.login = AdtLogin
58     and TheactAuthenticated.rnctAuthenticated.biometricAuthType = AetBiometricAuthType
59     and TheactAuthenticated.rnctAuthenticated.biometrics = AdtBiometrics
60   )
61   then (TheactAuthenticated.rnctAuthenticated@post.vpIsLogged = true)
62   else true
63 endif}

```

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

5.3.2 Operation Model for *oeLogout*

The *oeLogout* operation has the following properties:

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

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

```

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

```

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

5.4 Environment - Out Interface Operation Scheme for actComCompany

5.4.1 Operation Model for oeAlert

The *oeAlert* operation has the following properties:

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

continues in next page ...

...Operation table continuation

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

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

```

1
2 /* Pre Protocol:*/
3 preP{let TheSystem: ctState in
4   self.rnActor.rnSystem = TheSystem
5
6 /* Prep01 */
7   and TheSystem.vpStarted = true}
8
9 /* Pre Functional:*/
10 preP{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 5.7: **Messir** (MCL-oriented) specification of the operation *oeAlert*.

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

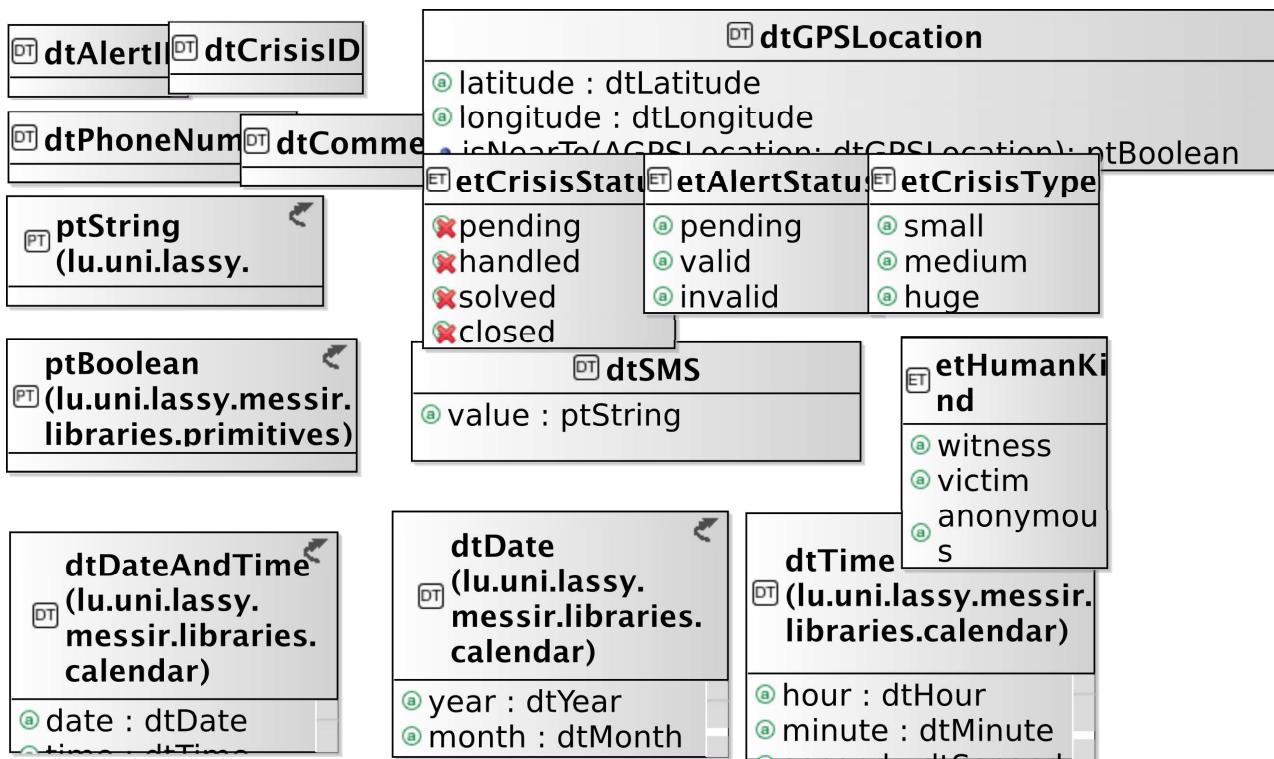


Figure 5.2: oeAlert operation scope

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

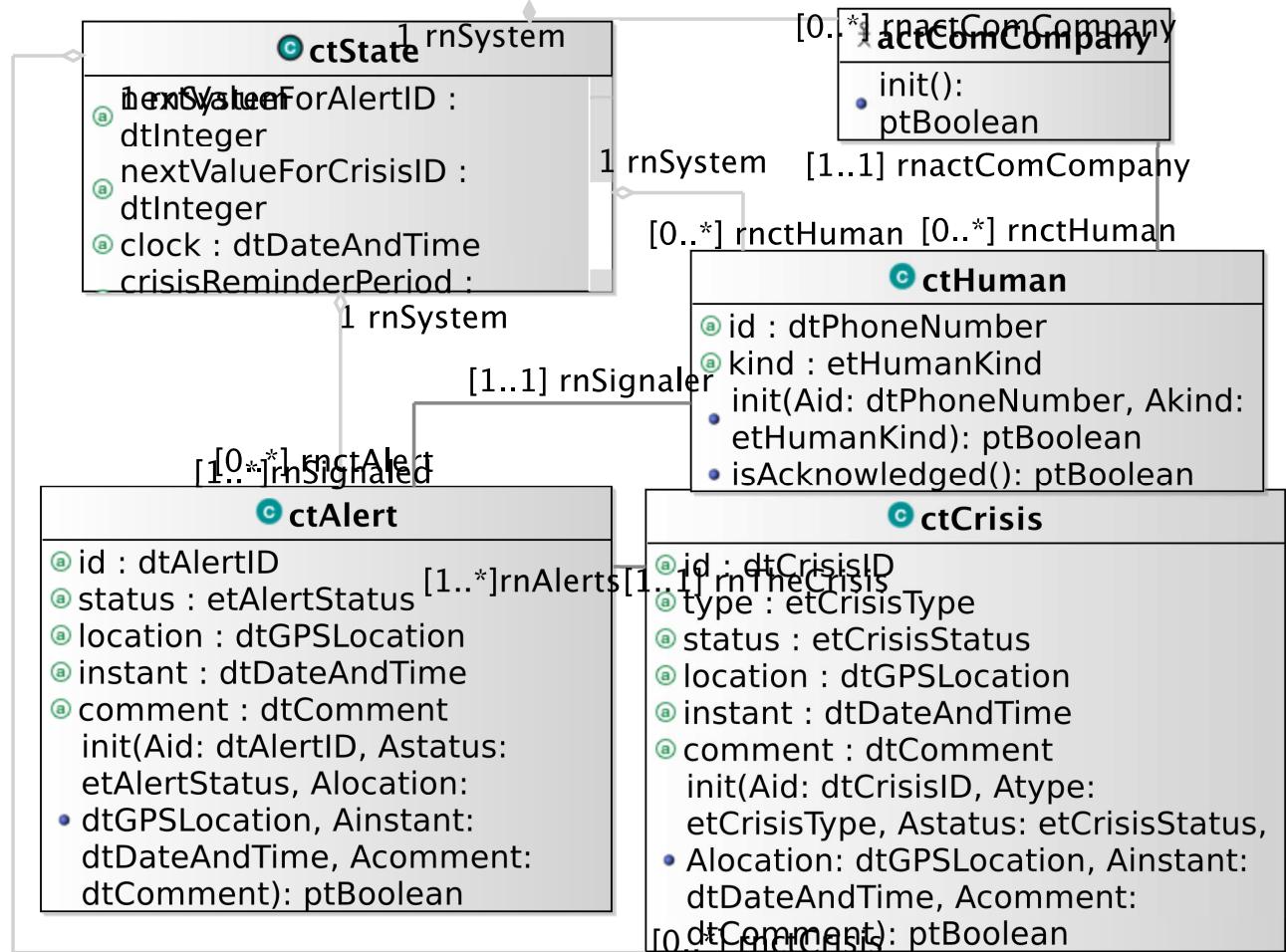


Figure 5.3: oeAlert operation scope

5.5 Environment - Out Interface Operation Scheme for actCoordinator

5.5.1 Operation Model for oeCloseCrisis

The oeCloseCrisis operation has the following properties:

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

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)	

continues in next page ...

... Operation table continuation

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

5.5.3 Operation Model for oeGetCrisisSet

The `oeGetCrisisSet` operation has the following properties:

OPERATION
<i>oeGetCrisisSet</i>
sent to request all the <code>ctCrisis</code> 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
<code>ptBoolean</code>
Pre-Condition (protocol)
PreP 1 the system is started PreP 2 the actor logged previously and did not log out ! (i.e. the associated <code>ctCoordinator</code> instance is considered logged)
Pre-Condition (functional)
PreF 1 none
Post-Condition (functional)
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.
Post-Condition (protocol)
PostP 1 none

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.
Parameters
1 AdtAlertID: dtAlertID the identification information used to determine the alert to close
Return type
<code>ptBoolean</code>

continues in next page ...

... Operation table continuation

<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

5.5.5 Operation Model for oeMakeFullReport

The oeMakeFullReport operation has the following properties:

OPERATION	
<i>oeMakeFullReport</i>	
Parameters	
1	AdtCrisisID: dtCrisisID
2	AdtEmail: dtEmail
Return type	
ptBoolean	
<i>Pre-Condition (protocol)</i>	
PreP 1	
<i>Pre-Condition (functional)</i>	
PreF 1	
<i>Post-Condition (functional)</i>	
PostF 1	
<i>Post-Condition (protocol)</i>	
PostP 1	

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

```

1
2 /* Pre Protocol:*/
3 prep{let TheSystem: ctState in
4   let TheActor:actCoordinator 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:actCoordinator in
17   let ColctCrises:Bag(ctCrisis) in
18
19   self.rnActor.rnSystem = TheSystem
20   and self.rnActor = TheActor
21  /* Pref01 */
22  and TheSystem.rnctCrisis->select(id.eq(AdtCrisisID))
23    = ColctCrises
24  and ColctCrises->isEmpty() = true}
25
26  /* Post Functional:*/
27 postF{let TheSystem: ctState in
28   let TheActor:actCoordinator in
29   let TheclReport:clReport in
30   self.rnActor.rnSystem = TheSystem
31   and self.rnActor = TheActor
32  /* PostF01 */
33  TheclReport.init()
34  /* PostF02 */
35  and TheclReport.init(AdtReportID,AdtCrisisID,AdtEmail,AdtGPSLocation,AetCrisisStatus,
36    AetCrisisType,AptString)
37  /* PostF03 */
38  and TheActor.rnInterfaceIN^ieFullReportMade()}
39
40  /* Post Protocol:*/
41 postP{ true}

```

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

5.5.6 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.	
<i>Parameters</i>	
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>	

continues in next page ...

...Operation table continuation

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.
Post-Condition (protocol)	
PostP 1	none

5.5.7 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).
Post-Condition (protocol)	
PostP 1	none

5.5.8 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.	
Parameters	
1	AdtCrisisID: dtCrisisID

continues in next page ...

... Operation table continuation

2	AetCrisisStatus: etCrisisStatus the new status 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 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.	
Post-Condition (protocol)	
PostP 1 none	

5.5.9 Operation Model for oeSetCrisisType

The `oeSetCrisisType` operation has the following properties:

OPERATION	
oeSetCrisisType	
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	

5.5.10 Operation Model for oeValidateAlert

The `oeValidateAlert` operation has the following properties:

OPERATION	
<i>oeValidateAlert</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

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)	

continues in next page ...

... Operation table continuation

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 oeCreateSystemAndEnvironment is a special event its role is to make consistent the post state thus creating the actor and its interfaces is required even though the sending of this message logically would need the actor and its interfaces to already exist ...).
PostF 3	the environment for communication company actors, in the post state, is made of AqtyComCompanies instances allowing for receiving and sending messages to humans.
PostF 4	the environment for administrator actors, in the post state, is made of one instance.
PostF 5	the environment for activator actors, in the post state, is made of one instance allowing for automatic message sending based on current system's and environment state'.
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 5.9 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Pre Protocol:*/
2  preP{true}
3
4
5  /* Pre Functional:*/
6  preF{true}
7
8  /* Post Functional:*/
9  postF{let TheSystem: ctState in
10   let AactMsrCreator: actMsrCreator in
11   let AactAdministrator: actAdministrator in
12   let AnextValueForAlertID: dtInteger in
13   let AnextValueForCrisisID: dtInteger in
14   let Aclock: dtDateAndTime in
15   let AcrisisReminderPeriod: dtSecond in
16   let AmaxCrisisReminderPeriod: dtSecond in
17   let AvpStarted: ptBoolean in
18
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 5.9: **Messir** (MCL-oriented) specification of the operation *oeCreateSystemAndEnvironment*.

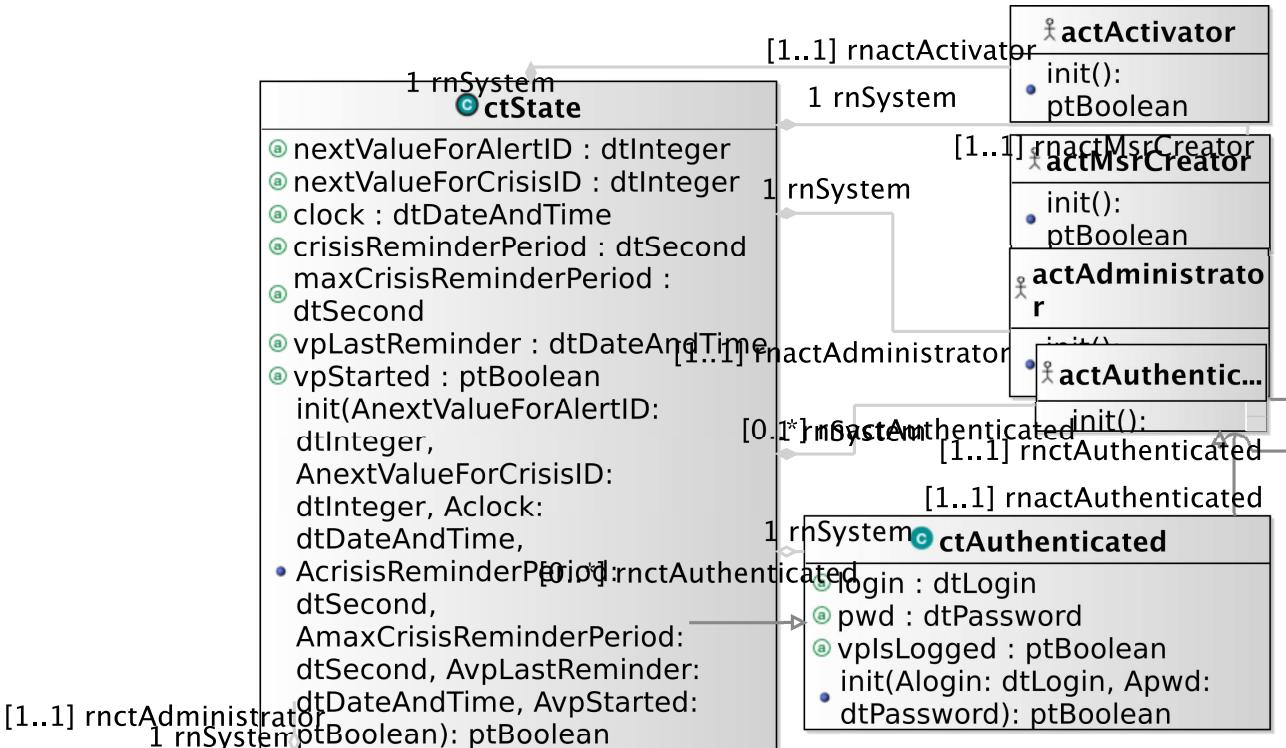
Figure 5.4 shows all the concept model elements in the scope of the *oeCreateSystemAndEnvironment* operation

5.7 Environment - Actor Operation Scheme for *actActivator*

5.7.1 Operation Model for *init*

The *init* operation has the following properties:

OPERATION
<i>init</i>
used to initialize the current object as a new instance of the <i>actActivator</i> type.
<i>Return type</i>
ptBoolean
<i>Post-Condition (functional)</i>
PostF 1 true iff the system poststate includes the current object as a new <i>actActivator</i> instance having its attributes equal to the ones provided as parameters.

Figure 5.4: `oeCreateSystemAndEnvironment` operation scope

5.8 Environment - Actor Operation Scheme for `actAdministrator`

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>actAdministrator</code> type.
<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>actAdministrator</code> instance having its attributes equal to the ones provided as parameters.

5.9 Environment - Actor Operation Scheme for `actAuthenticated`

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 <code>actAuthenticated</code> type.
<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>actAuthenticated</code> instance having its attributes equal to the ones provided as parameters.

5.11 Environment - Actor Operation Scheme for actCoordinator

5.11.1 Operation Model for init

The `init` operation has the following properties:

OPERATION	
<i>init</i>	used to initialize the current object as a new instance of the <code>actCoordinator</code> type.
<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>actCoordinator</code> instance having its attributes equal to the ones provided as parameters.

5.12 Environment - Actor Operation Scheme for actMsrCreator

5.12.1 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>

5.13 Primary Types - Operation Schemes for Class clReport

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>clReport</code> type.
<i>Parameters</i>	
1	Aid: <code>dtReportID</code>
2	AcrisisID: <code>dtCrisisID</code>
3	Arecipient: <code>dtEmail</code>
4	Alocation: <code>dtGPSLocation</code>
5	Astatus: <code>etCrisisStatus</code>
6	Atype: <code>etCrisisType</code>

continues in next page ...

... Operation table continuation

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

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

```

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

```

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

5.14 Primary Types - Operation Schemes for Class ctAdministrator

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 ctAdministrator 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>	
ptBoolean	
<i>Post-Condition (functional)</i>	

continues in next page ...

...Operation table continuation

PostF 1	true iff the system poststate includes the current object as a new ctAdministrator instance having its login and password attributes equal to the one provided as parameters and its vpIsLogged attribute equal to false.
---------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

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

```

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

```

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

5.15 Primary Types - Operation Schemes for Class ctAlert

5.15.1 Operation Model for init

The *init* operation has the following properties:

OPERATION	
<i>init</i>	used to initialize the current object as a new instance of the ctAlert type.
Parameters	
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
Return type	
ptBoolean	
Post-Condition (functional)	

continues in next page ...

... Operation table continuation

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

```

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

```

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

5.15.2 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 5.13 provides the **Messip** (MCL-oriented) specification of the operation.

```

1
2  /* Post Functional:*/
3  postF{if
4  (
5  /* Post F01 */
6  AactCoordinator.rnInterfaceIN.ieSendAnAlert(self)
7 )

```

```

8 then (result = true)
9 else (result = false)
10 endif}

```

Listing 5.13: **Messip** (MCL-oriented) specification of the operation *isSentToCoordinator*.

5.16 Primary Types - Operation Schemes for Class ctAuthenticated

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

5.17 Primary Types - Operation Schemes for Class ctCoordinator

5.17.1 Operation Model for init

The `init` operation has the following properties:

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

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

```

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

```

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

5.18 Primary Types - Operation Schemes for Class ctCrisis

5.18.1 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 5.15 provides the **Messip** (MCL-oriented) specification of the operation.

```

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

```

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

5.18.2 Operation Model for handlingDelayPassed

The *handlingDelayPassed* operation has the following properties:

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

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

```

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

```

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

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

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

```

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

```

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

5.18.4 Operation Model for isSentToCoordinator

The `isSentToCoordinator` operation has the following properties:

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

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

5.18.5 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 5.19 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 5.19: **Messip** (MCL-oriented) specification of the operation *isAllocatedIfPossible*.

5.19 Primary Types - Operation Schemes for Class ctHuman

5.19.1 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 ctHuman type.	
<i>Parameters</i>	
1	Aid: dtPhoneNumber used to initialize the id field
2	Akind: etHumanKind used to initialize the kind 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 ctHuman instance having its attributes equal to the ones provided as parameters.

The listing 5.20 provides the **Messip** (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 5.20: **Messip** (MCL-oriented) specification of the operation *init*.

5.19.2 Operation Model for isAcknowledged

The *isAcknowledged* operation has the following properties:

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

5.20 Primary Types - Operation Schemes for Class ctState

5.20.1 Operation Model for init

The `init` operation has the following properties:

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

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

```

1
2 /* Post Functional:*/
3 postF{if
4 (

```

```

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

```

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

5.21 Primary Types - Operation Schemes for Datatype dtAlertID

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

```

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

```

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

5.22 Primary Types - Operation Schemes for Datatype dtBiometrics

5.22.1 Operation Model for *is*

The *is* operation has the following properties:

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

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

```

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

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

5.23 Primary Types - Operation Schemes for Datatype dtComment

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

```

1  /* Post Functional:*/
2  postF{let TheResult: ptBoolean in
```

```

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

```

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

5.24 Primary Types - Operation Schemes for Datatype dtCoordinatorID

5.24.1 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 5.25 provides the **Messip** (MCL-oriented) specification of the operation.

```

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

```

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

5.25 Primary Types - Operation Schemes for Datatype dtCrisisID

5.25.1 Operation Model for *is*

The *is* operation has the following properties:

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

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

```

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

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

5.26 Primary Types - Operation Schemes for Datatype dtEmail

5.26.1 Operation Model for *is*

The *is* operation has the following properties:

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

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

```

1  /* Post Functional:*/
2  postF{let TheResult: ptBoolean in
3    if
4      ( AdtValue.value.matchType("email")
5      )
6    then (TheResult = true)
```

```

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

```

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

5.27 Primary Types - Operation Schemes for Datatype dtGPSLocation

5.27.1 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 5.28 provides the **Messip** (MCL-oriented) specification of the operation.

```

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

```

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

5.27.2 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>

continues in next page ...

...Operation table continuation

1	AGPSLocation: dtGPSLocation the GPS location to be compared to.
Return type	
ptBoolean	
Post-Condition (functional)	
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 5.29 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2  postF {let TheResult: ptBoolean in true
3    let EarthRadius: dtReal in
4    let MaxDistance: dtReal in
5    let ComparedLatitude: dtLatitude in
6    let ComparedLongitude: dtLongitude in
7    let R1: dtReal in let R1a: dtReal in
8    let R2: dtReal in let R2a: dtReal in
9
10   (
11     if
12       (EarthRadius.value = 6371
13         and MaxDistance.value = 100
14
15         and AdtValue.latitude = ComparedLatitude
16         and AdtValue.longitude = ComparedLongitude
17         and Self.latitude.sin() = R1a
18         and AdtValue.latitude.sin().mul(R1a) = R1
19         and Self.latitude.cos() = R2a
20         and AdtValue.latitude.cos().mul(R2a) = R2
21
22         and AdtValue.longitude = ComparedLongitude
23         and Self.longitude.sub(ComparedLongitude).cos().mul(R2)
24           .add(R1).acos().mul(EarthRadius).sub(MaxDistance)
25           .value.leq(0)
26     )
27     then (TheResult = true)
28     else (TheResult = false)
29     endif
30     result = TheResult
31   )}
```

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

5.28 Primary Types - Operation Schemes for Datatype dtLatitude

5.28.1 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.

continues in next page ...

... Operation table continuation

Return type
ptBoolean
Post-Condition (functional)
PostF 1 is true if the value is a real in the interval [-90.0 , +90.0].

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

```

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

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

5.29 Primary Types - Operation Schemes for Datatype dtLogin

5.29.1 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.
Return type
ptBoolean
Post-Condition (functional)
PostF 1 is true of the length of the string value is not more than 20 characters.

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

```

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

```

12     result = TheResult
13 }

```

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

5.30 Primary Types - Operation Schemes for Datatype dtLongitude

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 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 5.32 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 }

```

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

5.31 Primary Types - Operation Schemes for Datatype dtPassword

5.31.1 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 5.33 provides the **Messip** (MCL-oriented) specification of the operation.

```

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

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

5.32 Primary Types - Operation Schemes for Datatype dtPhoneNumber

5.32.1 Operation Model for *is*

The *is* operation has the following properties:

OPERATION
<i>is</i>
used to determine which strings are considered as valid dtPhoneNumber.
<i>Return type</i>
ptBoolean
<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 5.34 provides the **Messip** (MCL-oriented) specification of the operation.

```

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

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

5.33 Primary Types - Operation Schemes for Datatype dtReportID

5.33.1 Operation Model for is

The *is* operation has the following properties:

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

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

```

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

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

5.34 Primary Types - Operation Schemes for Enumeration etAlertStatus

5.34.1 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 5.36 provides the **Messip** (MCL-oriented) specification of the operation.

```

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

5.35 Primary Types - Operation Schemes for Enumeration etBiometricAuthType

5.35.1 Operation Model for *is*

The *is* operation has the following properties:

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

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

```

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

```

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

5.36 Primary Types - Operation Schemes for Enumeration etCrisisStatus

5.36.1 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 5.38 provides the **Messip** (MCL-oriented) specification of the operation.

```

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

Listing 5.38: **Messip** (MCL-oriented) specification of the operation *is*.

5.37 Primary Types - Operation Schemes for Enumeration etCrisisType

5.37.1 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 5.39 provides the **Messip** (MCL-oriented) specification of the operation.

```

1  /* Post Functional:*/
2  postF{let TheResult: ptBoolean in
3  }
```

```

4   ( if
5     ( self = small
6     or self = medium
7     or self = huge
8   )
9   then (TheResult = true)
10  else (TheResult = false)
11  endif
12  result = TheResult
13 ) }

```

Listing 5.39: **Messip** (MCL-oriented) specification of the operation *is*.

5.38 Primary Types - Operation Schemes for Enumeration etHumanKind

5.38.1 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, anonymous

The listing 5.40 provides the **Messip** (MCL-oriented) specification of the operation.

```

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

```

Listing 5.40: **Messip** (MCL-oriented) specification of the operation *is*.

5.39 Secondary Types - Operation Schemes for Classes

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

5.40 Secondary Types - Operation Schemes for Datatype dtSMS

5.40.1 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>
<code>ptBoolean</code>
<i>Post-Condition (functional)</i>
<code>PostF 1</code> true iff the length of the string value is not more than 160 characters.

The listing 5.41 provides the **Messip** (MCL-oriented) specification of the operation.

```

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

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

5.41 Secondary Types - Operation Schemes for Datatype dtSpeechRecord

5.41.1 Operation Model for is

The `is` operation has the following properties:

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

The listing 5.42 provides the **Messip** (MCL-oriented) specification of the operation.

```
1  /* Post Functional:*/
2  postF{let TheResult: ptBoolean in
3    (
4      if ( AdtValue.value.geq(300) and AdtValue.value.leq(3400) )
5        then (TheResult = true)
6        else (TheResult = false)
7        endif
8
9      result = TheResult
10    ) }
```

Listing 5.42: **Messip** (MCL-oriented) specification of the operation *is*.

5.42 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*.

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

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

```

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

```

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>

```

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

```

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

6.1.1.3 testcase01-ts03oeLogin-actAdministrator.outactAdministrator.oeLogin

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

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

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

```

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

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

6.1.1.4 testcase01-ts04oeAddCoordinator-actAdministrator.outactAdministrator.oeAddCoordinator

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

TEST STEP	
<i>ts04oeAddCoordinator</i>	
to test the add of a new coordinator by an administrator.	
<i>Test Sent Message</i>	
TSM 1	<p>out:TheActor</p> <p>sends to system</p> <p>actAdministrator.outactAdministrator.oeAddCoordinator (AdtCoordinatorID, AdtLogin, AdtPassword)</p>
<i>Variables</i>	
V 1	<p>TheActor:actAdministrator</p> <p>actAdministrator actors as being the only one allowed to add coordinators.</p>
<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.
C 2	AdtCoordinatorID is equal to 1 to set the new coordinator ID
C 3	AdtLogin has its value attribute equal to the primitive string 'steve' which is the ID defined for the new coordinator.
C 4	AdtPassword has its value attribute equal to the primitive string 'pwdMessirExcalibur2017' which is the password to be set for steve.
<i>Oracle Constraints</i>	
OC 1	the administrator should have been acknowledged for the adding of the new coordinator.

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

```

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

Listing 6.4: **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	out:TheActor sends to system actAdministrator.outactAdministrator.oeLogout ()
<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>	
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 message AMessae.

The listing 6.5 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 6.5: **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	
<i>ts06oeSetClock02</i>	
test the update of the current time.	
<i>Test Sent Message</i>	
TSM 1	out:TheActor sends to system actActivator.outactActivator.oeSetClock (ACurrentClock)
<i>Variables</i>	
V 1	TheActor:icrash.environment.actActivator proactive actors responsible of requesting the update of the system's clock.
<i>Constraints</i>	
C 1	TheActor is any instance existing in the current environment status.
C 2	ACurrentClock is a fixed date equal to the 26th November 2017 at 10:15:00 using a 24-hours notation.
<i>Oracle Constraints</i>	
OC 1	true for testing only the executability (is available and can be triggered) of the operation.

The listing 6.6 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 6.6: **Messir** (MCL-oriented) specification of the test step *testcase01-ts06oeSetClock02*.

6.1.1.7 testcase01-ts07oeAlert1-actComCompany.outactComCompany.oeAlert

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

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

continues in next page ...

... Test Step table continuation

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

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

```

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

Listing 6.7: **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 6.8 provides the **Messip** (MCL-oriented) specification of the test step.

```

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

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

6.1.1.9 testcase01-ts09oeSollicitateCrisisHandling-actActivator.outactActivator.oeSollicitateCrisisHand

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

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

Test Sent Message

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 AMessagForCrisisHandlers.

The listing 6.9 provides the **Mess1P** (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     AMessagForCrisisHandlers:ptString
15   }
16   constraints{
17     TheAdministrator = TheSystem.rnactAdministrator->any2(true)
18     TheCoordinator = TheSystem.rnactCoordinator->any2(true)
19     AMessagForCrisisHandlers = 'There are alerts pending since more than the defined delay. Please
                                  REACT !'
20   TheAdministrator.inactAdministrator.ieMessage(AMessagForCrisisHandlers)

```

```

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

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

6.1.1.10 testcase01-ts10oeLogin02-actAuthenticated.outactAuthenticated.oeLogin

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

TEST STEP	
<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 (AdtLogin, AdtPassword)</p>
<i>Variables</i>	
V 1	<p>TheActor:actCoordinator</p> <p>an actCoordinator 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 ...'

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

```

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

```

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

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

6.1.1.11 testcase01-ts11oeGetCrisisSet-actCoordinator.outactCoordinator.oeGetCrisisSet

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

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

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

```

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

```

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

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

6.1.1.12 testcase01-ts12oeSetCrisisHandler-actCoordinator.outactCoordinator.oeSetCrisisHandler

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

TEST STEP	
<i>ts12oeSetCrisisHandler</i> cf. actor documentation	
<i>Test Sent Message</i>	
TSM 1	out:TheActor sends to system actCoordinator.outactCoordinator.oeSetCrisisHandler (AdtCrisisID)
<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 6.12 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     AdtPhoneNumber:dtPhoneNumber
17     AdtSMS:dtSMS
18     ActAlert:ctAlert
19     TheComCompany: actComCompany
20     TheCoordinator:actCoordinator
21   }
22   constraints{
23     AMessage = 'You are now considered as handling the crisis !'
24     AdtSMS.value = 'The handling of your alert by our services is in progress !'
25     TheComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
26     TheCoordinator.inactCoordinator.ieSendAnAlert(ActAlert)
27     TheActor.inactAuthenticated.ieMessage(AMessage)
28   }
29 }
```

Listing 6.12: **Messir** (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>
<i>Variables</i>	
V 1	TheActor:icrash.environment.actActivator cf. actor documentation
V 2	ACurrentClock:lu.uni.lassy.messir.libraries.calendar.dtDateAndTime cf. actor documentation
<i>Constraints</i>	
C 1	TheActor
C 2	ACurrentClock

The listing 6.13 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 6.13: **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	<p>out:TheActor</p> <p>sends to system</p> <p>actCoordinator.outactCoordinator.oeValidateAlert (AdtAlertID)</p>
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 6.14 provides the **Messir** (MCL-oriented) specification of the test step.

```

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

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

6.1.1.15 testcase01-ts15oeAlert2-actComCompany.outactComCompany.oeAlert

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

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

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

```

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

```

```

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

```

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

6.1.1.16 testcase01-ts16oeSetClock05-actActivator.outactActivator.oeSetClock

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

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

```

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

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

6.1.1.17 testcase01-ts17oeSetCrisisStatus-actCoordinator.outactCoordinator.oeSetCrisisStatus

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

TEST STEP	
<i>ts17oeSetCrisisStatus</i>	
cf. actor documentation	
<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 6.17 provides the **Messip** (MCL-oriented) specification of the test step.

```

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

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

6.1.1.18 testcase01-ts18oeReportOnCrisis-actCoordinator.outactCoordinator.oeReportOnCrisis

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

TEST STEP	
<i>ts18oeReportOnCrisis</i>	
cf. actor documentation	
<i>Test Sent Message</i>	
TSM 1	<p>out:TheActor</p> <p>sends to system</p> <p>actCoordinator.outactCoordinator.oeReportOnCrisis (AdtCrisisID, AdtComment)</p>
<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
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 6.18 provides the **Messir** (MCL-oriented) specification of the test step.

```

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

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

6.1.1.19 testcase01-ts19oeCloseCrisis-actCoordinator.outactCoordinator.oeCloseCrisis

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

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

continues in next page ...

... Test Step table continuation

TSM 1	<p>out:TheActor</p> <p>sends to system</p> <p>actCoordinator.outactCoordinator.oeCloseCrisis (AdtCrisisID)</p>
Variables	
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
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	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 }
6
7 constraints{
8   TheActor=TheSystem.rnactCoordinator
9     ->select(a | a.rnctCoordinator.login.value.eq('steve'))
10    ->any2(true)
11 }
12
13 oracle{
14   variables{
15     AMessage:ptString
16   }
17   constraints{
18     AMessage = 'The crisis is now closed !'
19     TheActor.inactAuthenticated.ieMessage(AMessage)
20   }
21 }
```

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

6.1.2 Test Case Instance - instance01

6.1.3 Test Case Instance - instance01Part01

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



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

6.1.4 Test Case Instance - instance01Part02

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



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

Chapter 7

Additional Constraints

7.1 Quality Constraints

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

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 Cases

A.1.1 Undocumented Subfunction Level Use Cases

- icrash.usecases.subfunctions.oeMakeFullReport

A.2 Undocumented Use Case Instances

A.2.1 Undocumented User-Goal Level Use Case Instances

- usecases.uciugSecurelyUseSystem.uciugSecurelyUseSystem

A.2.2 Undocumented Use Case Instance Views

- uci-uciugSecurelyUseSystem

A.3 Undocumented Primary Types

A.3.1 Undocumented Primary Classe Types

- icrash.concepts.primarytypes.classes.clReport

A.3.2 Undocumented Primary Datatype Types

- icrash.concepts.primarytypes.datatypes.dtBiometrics
- icrash.concepts.primarytypes.datatypes.dtEmail
- icrash.concepts.primarytypes.datatypes.dtReportID

A.3.3 Undocumented Primary Enumeration Types

- icrash.concepts.primarytypes.datatypes.etBiometricAuthType

A.4 Undocumented Primary Relationships

A.4.1 Undocumented Primary Type Associations

- icrash.concepts.primarytypes.associations.assctAlertctCrisis

A.5 Undocumented Secondary Types

A.5.1 Undocumented Secondary Datatype Types

- icrash.concepts.secondarytypes.datatypes.dtSpeechRecord

A.6 Undocumented Concept Model Views

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

A.7 Undocumented Operation Specifications

- icrash.concepts.primarytypes.datatypes.dtBiometrics.is
- icrash.concepts.primarytypes.datatypes.dtEmail.is
- icrash.concepts.primarytypes.datatypes.dtReportID.is
- icrash.concepts.secondarytypes.datatypes.dtSpeechRecord.is
- icrash.concepts.primarytypes.datatypes.etBiometricAuthType.is
- icrash.environment.actCoordinator.outactCoordinator.oeMakeFullReport

A.8 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
ru.iu.bachelor.sed.group01.icrash

B.1 Use Cases Model

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

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

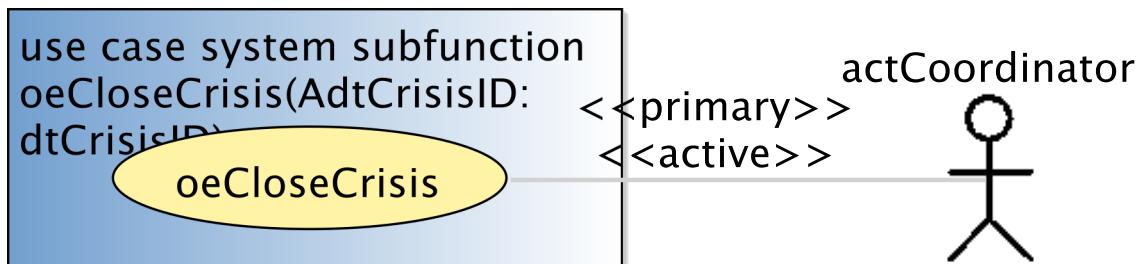


Figure B.1: oeCloseCrisis subfunction use case

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

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

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

```

1 package icrash.environment.operations.environment.actActivator.init {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7
8 Operation Model {
9
10 operation: icrash.environment.actActivator.init():ptBoolean{
11 // include below the specification information (pre,post or ocl or prolog)
12
13 }
14 }
15 }
```

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

C.4 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.4: Messir Spec. file environment-actActivator-oeSetClock.msr.

C.5 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.5: Messir Spec. file environment-actActivator-oeSollicitateCrisisHandling.msr.

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

```

1 package icrash.environment.operations.environment.actAdministrator.init {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7
8 Operation Model {
9
10 operation: icrash.environment.actAdministrator.init():ptBoolean{
11 // include below the specification information (pre,post or ocl or prolog)
12
13 }
14 }
15 }

```

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

C.7 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, AetBiometricAuthType:etBiometricAuthType,
13 AdtBiometrics:dtBiometrics):ptBoolean
14 }
15 preP{
16 let TheSystem: ctState in
17 let TheActor:actAdministrator in
18
19 self.rnActor.rnSystem = TheSystem
20 and self.rnActor = TheActor
21 /* PreP01 */
22 and TheSystem.vpStarted = true
23 /* PreP02 */
24 and TheActor.rnctAuthenticated.vpIsLogged = true
25 }
26 preF{
27 let TheSystem: ctState in
28 let TheActor:actAdministrator in
29 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,AetBiometricAuthType,AdtBiometrics)
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.7: Messir Spec. file environment-actAdministrator-oeAddCoordinator.msr.

C.8 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   preP{
18     let TheSystem: ctState in
19     let TheActor:actAdministrator in
20     self.rnActor.rnSystem = TheSystem
21     and self.rnActor = TheActor
22
23 /* PreP01 */
24     and TheSystem.vpStarted = true
25 /* PreP02 */
26     and TheActor.rnctAuthenticated.vpIsLogged = true
27 }
```

```

28 pref{
29   let TheSystem: ctState in
30   let TheActor:actAdministrator in
31
32   self.rnActor.rnSystem = TheSystem
33   and self.rnActor = TheActor
34   /* PreF01 */
35   TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
36   = ColctCoordinators
37   and ColctCoordinators->size() .eq(1)
38 }
39 postF{
40   let TheSystem: ctState in
41   let TheActor:actAdministrator in
42   let ThectCoordinator:ctCoordinator in
43   self.rnActor.rnSystem = TheSystem
44   and self.rnActor = TheActor
45   /* PostF01 */
46   TheSystem.rnctCoordinator->select(id.eq(AdtCoordinatorID))
47   = ThectCoordinator
48   and ThectCoordinator.rnactCoordinator->forAll(msrIsKilled)
49   and ThectCoordinator.msrIsKilled
50
51   /* Post Protocol:*/
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.8: Messir Spec. file environment-actAdministrator-oeDeleteCoordinator.msr.

C.9 File ./src-gen/messir-spec/operations/environment/environment-actAuthenticated-init.msr

```

1 package icrash.environment.operations.environment.actAuthenticated.init {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7
8 Operation Model {
9
10   operation: icrash.environment.actAuthenticated.init():ptBoolean{
11     // include below the specification information (pre, post or ocl or prolog)
12
13   }
14 }
15 }
```

Listing C.9: Messir Spec. file environment-actAuthenticated-init.msr.

C.10 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   AetBiometricAuthType:etBiometricAuthType, AdtBiometrics:dtBiometrics):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   and TheactAuthenticated.rnctAuthenticated.biometricAuthType
46   = AetBiometricAuthType
47   and TheactAuthenticated.rnctAuthenticated.biometrics
48   = AdtBiometrics
49 )
50 then (AptStringMessageForTheactAuthenticated.eq('You are logged ! Welcome ...')
51   and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
52   )
53 else (AptStringMessageForTheactAuthenticated
54   .eq('Wrong identification information ! Please try again ...')
55   and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
56   and AptStringMessageForTheactAdministrator.eq('Intrusion tentative !')
57   and TheSystem.rnactAdministrator
58   .rnInterfaceIN^ieMessage(AptStringMessageForTheactAdministrator)
59   )
60 endif
61 }
62 postP{
63 let TheSystem: ctState in
64 let TheactAuthenticated:actAuthenticated in
65
66 self.rnActor.rnSystem = TheSystem
67 and self.rnActor = TheactAuthenticated
68 /* PostP01 */
69 if (TheactAuthenticated.rnctAuthenticated.pwd = AdtPassword
70   and TheactAuthenticated.rnctAuthenticated.login = AdtLogin
71   and TheactAuthenticated.rnctAuthenticated.biometricAuthType = AetBiometricAuthType
72   and TheactAuthenticated.rnctAuthenticated.biometrics = AdtBiometrics

```

```

73      )
74  then (TheactAuthenticated.rnctAuthenticated@post.vpIsLogged = true)
75 else true
76 endif
77 }
78 prolog{"src/Operations/Environment/OUT/outactAuthenticated-oeLogin.pl"}
79 }
80 /* -----
81
82 operation: actAuthenticated.outactAuthenticated.oeLogout():ptBoolean{
83
84 preP{
85 let TheSystem: ctState in
86 let TheActor:actAdministrator in
87 self.rnActor.rnSystem = TheSystem
88 and self.rnActor = TheActor
89
90 /* PreP01 */
91 and TheSystem.vpStarted = true
92 /* PreP02 */
93 and TheActor.rnctAuthenticated.vpIsLogged = true
94 }
95 preF{
96 /* PreF01 */
97 true
98 }
99 postF{
100 let TheSystem: ctState in
101 let TheactAuthenticated:actAuthenticated in
102 let AptStringMessageForTheactAuthenticated: ptString in
103
104 self.rnActor.rnSystem = TheSystem
105 and self.rnActor = TheactAuthenticated
106
107 /* PostF01 */
108 AptStringMessageForTheactAuthenticated.eq('You are logged out ! Good Bye ...')
109 and TheactAuthenticated.rnInterfaceIN^ieMessage(AptStringMessageForTheactAuthenticated)
110 }
111 postP{
112 let TheSystem: ctState in
113 let TheactAuthenticated:actAuthenticated in
114
115 self.rnActor.rnSystem = TheSystem
116 and self.rnActor = TheactAuthenticated.asset
117 /* PostP01 */
118 TheactAuthenticated.rnctAuthenticated@post.vpIsLogged = false
119 }
120 prolog{"src/Operations/Environment/OUT/outactAuthenticated-oeLogout.pl"}
121 }
122 }
123 }
```

Listing C.10: Messir Spec. file environment-actAuthenticated.msr.

C.11 File ./src-gen/messir-spec/operations/environment/environment-actComCompany-init.msr

```

1 package icrash.environment.operations.environment.actComCompany.init {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7
8 Operation Model {
9
10 operation: icrash.environment.actComCompany.init():ptBoolean{
11 // include below the specification information (pre,post or ocl or prolog)
```

```

12
13  }
14 }
15 }
```

Listing C.11: Messir Spec. file environment-actComCompany-init.msr.

C.12 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 postP{true}
130
131 prolog{"src/Operations/Environment/OUT/outactComCompany-oeAlert.pl"}
132 }
133 }
134 }
```

Listing C.12: Messir Spec. file environment-actComCompany.msr.

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

```

1 package icrash.environment.operations.environment.actCoordinator.init {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7
8 Operation Model {
9
10 operation: icrash.environment.actCoordinator.init():ptBoolean{
11 // include below the specification information (pre,post or ocl or prolog)
12
13 }
14 }
15 }
```

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

C.14 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.14: Messir Spec. file environment-actCoordinator-oeCloseCrisis.msr.

C.15 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.15: Messir Spec. file environment-actCoordinator-oeGetAlertsSet.msr.

C.16 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.16: Messir Spec. file environment-actCoordinator-oeGetCrisisSet.msr.

C.17 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.17: Messir Spec. file environment-actCoordinator-oeInvalidateAlert.msr.

C.18 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeMakeFullReport.msr

```

1 package icrash.environment.operations.actCoordinator.outactCoordinator.oeMakeFullReport {
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.concepts.primarytypes.classes
9 import icrash.environment
10
11 Operation Model {
12
13     operation: icrash.environment.actCoordinator.outactCoordinator.oeMakeFullReport(AdtCrisisID:
14         dtCrisisID, AdtEmail:dtEmail):ptBoolean{
15         // include below the specification information (pre,post or ocl or prolog)
16         preP{
17             let TheSystem: ctState in
18             let TheActor:actCoordinator 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
29         preF{
30             let TheSystem: ctState in
31             let TheActor:actCoordinator in
32             let ColctCrises:Bag(ctCrisis) in
33
34             self.rnActor.rnSystem = TheSystem
35             and self.rnActor = TheActor
36             /* PreF01 */
37             and TheSystem.rnctCrisis->select(id.eq(AdtCrisisID))
38             = ColctCrises
39             and ColctCrises->isEmpty() = true
40         }
41
42         postF{
43             let TheSystem: ctState in
44             let TheActor:actCoordinator in
45             let TheclReport:clReport in
46             self.rnActor.rnSystem = TheSystem
47             and self.rnActor = TheActor
48             /* PostF01 */
49             TheclReport.init()
50             /* PostF02 */
51             and TheclReport.init(AdtReportID,AdtCrisisID,AdtEmail,AdtGPSLocation,AetCrisisStatus,
52             AetCrisisType,AptString)
53             /* PostF03 */
54             and TheActor.rnInterfaceIN^ieFullReportMade()
55         }
56         postP{
57             true
58         }
59     }
60 }

```

Listing C.18: Messir Spec. file environment-actCoordinator-oeMakeFullReport.msr.

C.19 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.19: Messir Spec. file environment-actCoordinator-oeReportOnCrisis.msr.

C.20 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.20: Messir Spec. file environment-actCoordinator-oeSetCrisisHandler.msr.

C.21 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeSetCrisisStatus.msr

```

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

Listing C.21: Messir Spec. file environment-actCoordinator-oeSetCrisisStatus.msr.

C.22 File ./src-gen/messir-spec/operations/environment/environment-actCoordinator-oeSetCrisisType.msr

```

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

Listing C.22: Messir Spec. file environment-actCoordinator-oeSetCrisisType.msr.

C.23 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.23: Messir Spec. file environment-actCoordinator-oeValidateAlert.msr.

C.24 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.24: Messir Spec. file environment-actMsrCreator-init.msr.

C.25 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,
48                         Aclock,
49                         AvpStarted
50                     )
51     /* PostF02*/
52     and AactMsrCreator.init()
53     /* PostF03 */
54     and let AactComCompanyCol: Bag(actComCompany) in
55     AactComCompanyCol->size() = AqtyComCompanies
56     AactComCompanyCol-> forAll(init())
57     /* PostF04*/
58     and AactAdministrator.init()
59     /* PostF05*/
60     and let AactActivator:actActivator in
61     AactActivator.init()
62     /* PostF06 */
63     and let ActAdministrator:ctAdministrator in
64     let AdtLogin:dtLogin in
65     let AdtPassword:dtPassword in
66     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.25: Messir Spec. file environment-actMsrCreator-oeCreateSystemAndEnvironment.msr.

C.26 File ./src-gen/messir-spec/environment/environment.msr

```

1 package icrash.environment{
2
3 import icrash.concepts.primarytypes.datatypes
4 import icrash.concepts.primarytypes.classes
5 import icrash.concepts.secondarytypes.datatypes
6 import lu.uni.lassy.messir.libraries.primitives
7 import lu.uni.lassy.messir.libraries.math
8 import lu.uni.lassy.messir.libraries.calendar
9
10 Environment Model {
11
12 actor actMsrCreator role rnactMsrCreator cardinality [1..1] {
13
14 operation init():ptBoolean
15
16 input interface inactMsrCreator {
17 }
18 output interface outactMsrCreator {
19   operation oeCreateSystemAndEnvironment(AqtyComCompanies:ptInteger ):ptBoolean
20 }
21 }
22
23 actor actAdministrator
24   role rnactAdministrator
25   cardinality [1..1]
26   extends actAuthenticated {
27
28 operation init():ptBoolean
29
30 output interface outactAdministrator{
31
32   operation oeAddCoordinator(
33     AdtCoordinatorID:dtCoordinatorID ,
34     AdtLogin:dtLogin ,
35     AdtPassword:dtPassword ,
36     AetBiometricAuthType:etBiometricAuthType ,
37     AdtBiometrics:dtBiometrics ):ptBoolean
38
39   operation oeDeleteCoordinator(
40     AdtCoordinatorID:dtCoordinatorID ):ptBoolean
41 }
42
43 input interface inactAdministrator{
44
45   operation ieCoordinatorAdded():ptBoolean
46   operation ieCoordinatorDeleted():ptBoolean
47 }
48 }
49
50 actor actCoordinator
51   role rnactCoordinator
52   cardinality [0..*]

```

```

53     extends actAuthenticated{
54
55     operation init():ptBoolean
56
57     output interface outactCoordinator{
58         operation oeInvalidateAlert(AdtAlertID:dtAlertID ):ptBoolean
59         operation oeCloseCrisis(AdtCrisisID:dtCrisisID ):ptBoolean
60         operation oeGetAlertsSet(AetAlertStatus:etAlertStatus ):ptBoolean
61         operation oeGetCrisisSet(AetCrisisStatus:etCrisisStatus ):ptBoolean
62         operation oeSetCrisisHandler(AdtCrisisID:dtCrisisID ):ptBoolean
63         operation oeReportOnCrisis(
64             AdtCrisisID:dtCrisisID ,
65             AdtComment:dtComment
66             ):ptBoolean
67         operation oeSetCrisisStatus(
68             AdtCrisisID:dtCrisisID ,
69             AetCrisisStatus:etCrisisStatus
70             ):ptBoolean
71         operation oeSetCrisisType(
72             AdtCrisisID:dtCrisisID ,
73             AetCrisisType:etCrisisType
74             ):ptBoolean
75         operation oeValidateAlert(AdtAlertID:dtAlertID ):ptBoolean
76         operation oeMakeFullReport(
77             AdtCrisisID:dtCrisisID ,
78             AdtEmail:dtEmail
79             ):ptBoolean
80     }
81
82     input interface inactCoordinator{
83         operation ieSendAnAlert(ActAlert:ctAlert ):ptBoolean
84         operation ieSendACrisis(ActCrisis:ctCrisis ):ptBoolean
85         operation ieFullReportMade():ptBoolean
86     }
87 }
88
89 actor actComCompany role rnactComCompany cardinality [0..*]{
90
91     operation init():ptBoolean
92
93     output interface outactComCompany{
94         operation oeAlert(
95             AetHumanKind:etHumanKind ,
96             AdtDate:dtDate ,
97             AdtTime:dtTime ,
98             AdtPhoneNumber:dtPhoneNumber ,
99             AdtGPSLocation:dtGPSLocation ,
100            AdtComment:dtComment
101            ):ptBoolean
102     }
103
104     input interface inactComCompany{
105         operation ieSmsSend(AdtPhoneNumber:dtPhoneNumber ,
106             AdtSMS:dtSMS
107             ):ptBoolean
108     }
109 }
110
111 actor actAuthenticated role rnactAuthenticated cardinality [0..*]{
112
113     operation init():ptBoolean
114
115     output interface outactAuthenticated{
116         operation oeLogin(AdtLogin:dtLogin , AdtPassword:dtPassword , AetBiometricAuthType:
117             etBiometricAuthType , AdtBiometrics:dtBiometrics):ptBoolean
118         operation oeLogout():ptBoolean
119     }
120
121     input interface inactAuthenticated{
122         operation ieMessage(AMessage:ptString):ptBoolean

```

```

122     }
123 }
124
125 actor actActivator[proactive] role rnactActivator cardinality [1..1] {
126
127   operation init():ptBoolean
128
129   output interface outactActivator{
130     proactive operation oeSollicitateCrisisHandling():ptBoolean
131     proactive operation oeSetClock(AcurrentClock:dtDateAndTime ):ptBoolean
132   }
133
134   input interface inactActivator{
135   }
136 }
137 }
138 }
```

Listing C.26: Messir Spec. file environment.msr.

C.27 File [./src-gen/messir-spec/concepts/primarytypes-associations.msr](#)

```

1 package icrash.concepts.primarytypes.associations {
2
3 import icrash.concepts.primarytypes.datatypes
4 import icrash.concepts.primarytypes.classes
5 import icrash.environment
6 import lu.uni.lassy.messir.libraries.primitives
7
8 Concept Model {
9
10 Primary Types{
11
12 // Internal
13
14 association assctAlertctCrisis
15   ctAlert(rnAlerts)[1...*]
16   ctCrisis (rnTheCrisis)[1..1]
17
18 association assctAlertctHuman
19   ctAlert(rnSignaled)[1...*]
20   cthuman (rnSignaler)[1..1]
21
22 association assctCrisiscctCoordinator
23   ctCrisis(rnHandled)[0...*]
24   ctCoordinator(rnHandler)[0..1]
25
26 // With Actors
27
28 association assctHumanactComCompany
29   ctHuman(rnctHuman) [0...*]
30   actComCompany(rnactComCompany) [1..1]
31
32 association assctCoordinatoractCoordinator
33   ctCoordinator(rnctCoordinator) [1..1]
34   actCoordinator(rnactCoordinator) [1..1]
35
36 association assctAuthenticatedactAuthenticated
37   ctAuthenticated(rnctAuthenticated) [1..1]
38   actAuthenticated(rnactAuthenticated) [1..1]
39
40 }
41 }
42 }
```

Listing C.27: Messir Spec. file primarytypes-associations.msr.

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

```

1 package icrash.concepts.primarytypes.classes.operations.classes.clReport.init {
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.concepts.secondarytypes.classes
12
13 import icrash.environment
14
15 Operation Model {
16 //-----
17 operation: icrash.concepts.primarytypes.classes.clReport.init(
18   Aid:dtReportID,
19   AcrisisID:dtCrisisID,
20   Arecipient:dtEmail,
21   Alocation:dtGPSLocation,
22   Astatus:etCrisisStatus,
23   Atype:etCrisisType,
24   Ainformation:ptString
25 ) :ptBoolean{
26   postF{
27     if
28     (
29       /* Post F01 */
30       let Self:ctCrisis in
31       Self.id = Aid
32       and Self.crisisID = AcrisisID
33       and Self.recipient = Arecipient
34       and Self.type = Atype
35       and Self.status = Astatus
36       and Self.location = Alocation
37       and Self.information = Ainformation
38       /* Post F02 */
39       and (Self.oclisNew and self = Self)
40     )
41     then (result = true)
42     else (result = false)
43     endif
44   }
45
46 }
47 }
48 }
```

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

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

```

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

C.30 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 ,
14     Alocation:dtGPSLocation , Ainstant:dtDateAndTime , Acomment:dtComment
15   ):ptBoolean{
16   postF{
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:
36   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.30: Messir Spec. file primarytypes-classes-ctAlert.msr.

C.31 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
    , AauthType:etBiometricAuthType, Abiometrics:dtBiometrics):ptBoolean{
10 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctAuthenticated-init.pl"}
11 }
12 }
13
14 }

```

Listing C.31: Messir Spec. file primarytypes-classes-ctAuthenticated.msr.

C.32 File ./src-gen/messir-spec/operations/concepts/primarytypes-classes/primarytypes-classes-ctCoordinator.msr

```

1 package icrash.operations.concepts.primarytypes.classes.ctCoordinator.init {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import icrash.concepts.primarytypes.datatypes
5 import icrash.concepts.primarytypes.classes
6
7 Operation Model {
8
9 operation: icrash.concepts.primarytypes.classes.ctCoordinator.init(Aid:dtCoordinatorID, Alogin:
    dtLogin, Apwd:dtPassword, AauthType:etBiometricAuthType, Abiometrics:dtBiometrics):ptBoolean
10 {
11 postF{
12 if
13 (
14 /* Post F01 */
15 let Self:ctCoordinator in
16 Self.id = Aid
17 and Self.login = Alogin
18 and Self.pwd = Apwd
19 and Self.authType = AauthType
20 and Self.biometrics = Abiometrics
21 and Self.vpIsLogged = false

```

```

22 /* Post F02 */
23 and (Self.oclIsNew and self = Self)
24 )
25 then (result = true)
26 else (result = false)
27 endif}
28 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctCoordinator-init.pl"}
29 }
30 }
31 }

```

Listing C.32: Messir Spec. file primarytypes-classes-ctCoordinator.msr.

C.33 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)
           .gt(MaxCrisisReminderPeriod)
81
82 )
83 then (result = true)
84 else (result = false)
85 endif
86 }
87 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctCrisis-
       maxHandlingDelayPassed.pl"}
88 //-
89 operation: icrash.concepts.primarytypes.classes.ctCrisis.isSentToCoordinator(AactCoordinator:
       actCoordinator):ptBoolean
90 {
91 postF{
92 if
93 (
94 /* Post F01 */
95 AactCoordinator.rnInterfaceIN.ieSendACrisis(self)
96 )
97 then (result = true)
98 else (result = false)
99 endif
100 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctCrisis-isSentToCoordinator
        .pl" }
101 //-
102 operation: icrash.concepts.primarytypes.classes.ctCrisis.isAllocatedIfPossible():ptBoolean
103 {
104 postF{
105 if (
106 /* Post F01 */
107 self.maxHandlingDelayPassed()
108 and
109 if (TheSystem.rnactCoordinator->msrIsEmpty = false)
110 then (
111 /* Post F02 */
112 TheSystem.rnactCoordinator->msrAny(true) = TheCoordinatorActor
113 and TheCoordinatorActor.rnctCoordinator = TheCoordinator
114 and self@post.rnHandler = TheCoordinator
115 and self@post.status = handled
116 and self.id.value = TheCrisisIDptString
117 and 'You are now considered as handling the crisis having ID: '
           .ptStringConcat(TheCrisisIDptString) = TheMessage
118

```

```

119     and TheCoordinatorActor.rnInterfaceIN^ieMessage(TheMessage)
120   )
121 else ( /* Post F03 */
122   TheSystem.rnactAdministrator
123   ->forall(rnInterfaceIN.ieMessage('Please add new coordinators to handle pending crisis !'))
124   )
125 endif
126 )
127 then (result = true)
128 else (result = false)
129 endif
130 }
131 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesClasses-ctCrisis-
           isAllocatedIfPossible.pl"}
132 }
133 }
134 }
```

Listing C.33: Messir Spec. file primarytypes-classes-ctCrisis.msr.

C.34 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.34: Messir Spec. file primarytypes-classes-ctHuman.msr.

C.35 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.35: Messir Spec. file primarytypes-classes-ctState.msr.

C.36 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 import icrash.concepts.secondarytypes.datatypes
9
10 Concept Model {
11
12 Primary Types{
13
14 state class ctState {
15 attribute nextValueForAlertID:dtInteger
16 attribute nextValueForCrisisID:dtInteger
17 attribute clock:dtDateAndTime
18 attribute crisisReminderPeriod:dtSecond
19 attribute maxCrisisReminderPeriod:dtSecond
20 attribute vpLastReminder:dtDateAndTime
21 attribute vpStarted:ptBoolean
22
23 operation init( AnextValueForAlertID:dtInteger,
24 AnextValueForCrisisID:dtInteger,
```

```

25         Aclock:dtDateAndTime,
26         AcrisisReminderPeriod:dtSecond ,
27         AmaxCrisisReminderPeriod:dtSecond ,
28         AvpLastReminder:dtDateAndTime ,
29         AvpStarted:ptBoolean ): ptBoolean
30     }
31
32 class ctAlert role rnctAlert cardinality [0..*]{
33     attribute id:dtAlertID
34     attribute status: etAlertStatus
35     attribute location:dtGPSLocation
36     attribute instant:dtDateAndTime
37     attribute comment:dtComment
38
39     operation init(    Aid:dtAlertID ,
40         Astatus:etAlertStatus ,
41         Alocation:dtGPSLocation ,
42         Ainstant:dtDateAndTime ,
43         Acomment:dtComment ):ptBoolean
44     operation isSentToCoordinator(AactCoordinator:actCoordinator ):ptBoolean
45
46 }
47
48 class ctCrisis role rnctCrisis cardinality [0..*]{
49     attribute id:dtCrisisID
50     attribute type:etCrisisType
51     attribute status: etCrisisStatus
52     attribute location:dtGPSLocation
53     attribute instant:dtDateAndTime
54     attribute comment:dtComment
55
56     operation init(
57         Aid:dtCrisisID ,
58         Atype:etCrisisType ,
59         Astatus:etCrisisStatus ,
60         Alocation:dtGPSLocation ,
61         Ainstant:dtDateAndTime ,
62         Acomment:dtComment ):ptBoolean
63
64     operation handlingDelayPassed():ptBoolean
65     operation maxHandlingDelayPassed():ptBoolean
66     operation isSentToCoordinator(AactCoordinator:actCoordinator ):ptBoolean
67     operation isAllocatedIfPossible():ptBoolean
68 }
69
70 class ctHuman role rnctHuman cardinality [0..*]{
71     attribute id:dtPhoneNumber
72     attribute kind:etHumanKind
73
74     operation init(
75         Aid:dtPhoneNumber ,
76         Akind:etHumanKind ):ptBoolean
77     operation isAcknowledged():ptBoolean
78 }
79
80 class ctAuthenticated
81     role rnctAuthenticated
82     cardinality [0..*]{
83
84     attribute login:dtLogin
85     attribute pwd: dtPassword
86     attribute vpIsLogged:ptBoolean
87     attribute authType:etBiometricAuthType
88     attribute biometrics:dtBiometrics
89
90     operation init(
91         Alogin:dtLogin ,
92         Apwd:dtPassword ,
93         AauthType:etBiometricAuthType ,
94         Abiometrics:dtBiometrics ):ptBoolean

```

```

95     }
96
97     class ctCoordinator
98       role rnctCoordinator
99       cardinality [0..*]
100      extends ctAuthenticated{
101
102      attribute id:dtCoordinatorID
103
104      operation init(
105        Aid:dtCoordinatorID ,
106        Alogin:dtLogin ,
107        Apwd:dtPassword ,
108        AauthType:etBiometricAuthType ,
109        Abiometrics:dtBiometrics ):ptBoolean
110    }
111
112    class ctAdministrator
113      role rnctAdministrator
114      cardinality [1..1]
115      extends ctAuthenticated{
116
117      operation init(
118        Alogin:dtLogin ,
119        Apwd:dtPassword ,
120        Abiometrics:dtBiometrics ):ptBoolean
121    }
122    class clReport role rnclReport cardinality[0 .. *] {
123      attribute id:dtReportID
124      attribute crisisID:dtCrisisID
125      attribute recipient:dtEmail
126      attribute location:dtGPSLocation
127      attribute status:etCrisisStatus
128      attribute type:etCrisisType
129      attribute information:ptString
130      operation init(
131        Aid:dtReportID,
132        AcrisisID:dtCrisisID,
133        Arecipient:dtEmail,
134        Alocation:dtGPSLocation,
135        Astatus:etCrisisStatus,
136        Atype:etCrisisType,
137        Ainformation:ptString
138      ):ptBoolean
139    }
140  }
141 }
142 }
```

Listing C.36: Messir Spec. file primarytypes-classes.msr.

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

```

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

```

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.37: Messir Spec. file primarytypes-datatypes-dtAlertID.msr.

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

```

1 package icrash.concepts.primarytypes.datatypes.operations.datatype.dtBiometrics.is {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7
8 Operation Model {
9
10 operation: icrash.concepts.primarytypes.datatypes.dtBiometrics.is():ptBoolean{
11 // include below the specification information (pre,post or ocl or prolog)
12 postF {
13   let TheResult: ptBoolean in
14   (
15     if ( AdtValue.speechRecord.is() )
16     then (TheResult = true)
17     else (TheResult = false)
18   endif
19
20   result = TheResult
21   )
22 }
23 }
24 }
25 }
```

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

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

```

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

```

21 prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtComment-is.pl"}
22 }
23 }
24 }
```

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

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

```

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

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

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

```

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

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

C.42 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatatypes/primarytypes-datatatypes-dtEmail-is.msr

```

1 package icrash.concepts.primarytypes.datatypes.operations.datatypes.dtEmail.is {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7
8 Operation Model {
9
10 operation: icrash.concepts.primarytypes.datatypes.dtEmail.is():ptBoolean{
11 // include below the specification information (pre,post or ocl or prolog)
12 postF{
13 let TheResult: ptBoolean in
14 ( if
15 ( AdtValue.value.matchType("email")
16 )
17 then (TheResult = true)
18 else (TheResult = false)
19 endif
20 result = TheResult
21 )
22 }
23 }
24 }
25 }
```

Listing C.42: Messir Spec. file primarytypes-datatatypes-dtEmail-is.msr.

C.43 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatatypes/primarytypes-datatatypes-dtGPSLocation.msr

```

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

```

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

Listing C.43: Messir Spec. file primarytypes-datatypes-dtGPSLocation.msr.

C.44 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtLogin.msr

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

```

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

Listing C.44: Messir Spec. file primarytypes-datatypes-dtLogin.msr.

C.45 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtPassword.msr

```

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

Listing C.45: Messir Spec. file primarytypes-datatypes-dtPassword.msr.

C.46 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtPhoneNumber.msr

```

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

```

8
9  postF{
10 let TheResult: ptBoolean in
11 ( if
12   ( AdtValue.value.length().gt(4)
13     and AdtValue.value.length().leq(30)
14   )
15   then (TheResult = true)
16   else (TheResult = false)
17   endif
18   result = TheResult
19 )
20 }
21 prolog{"src/Operations/Concepts/PrimaryTypesDatatypes/PrimaryTypesDatatypes-dtPhoneNumber-is.pl"}
22 }
23 }
24 }
```

Listing C.46: Messir Spec. file primarytypes-datatypes-dtPhoneNumber.msr.

C.47 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-dtReportID-is.msr

```

1 package icrash.concepts.primarytypes.datatypes.operations.datatypes.dtReportID.is {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7
8 Operation Model {
9
10 operation: icrash.concepts.primarytypes.datatypes.dtReportID.is():ptBoolean{
11 // include below the specification information (pre,post or ocl or prolog)
12
13 postF{
14   let TheResult: ptBoolean in
15   ( if
16     ( AdtValue.value.length().gt(0)
17       and AdtValue.value.length().leq(10)
18     )
19     then (TheResult = true)
20     else (TheResult = false)
21   endif
22   result = TheResult
23 )
24 }
25 }
26 }
27 }
```

Listing C.47: Messir Spec. file primarytypes-datatypes-dtReportID-is.msr.

C.48 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.48: Messir Spec. file primarytypes-datatatypes-etAlertStatus.msr.

C.49 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-etBiometricAuthType-is.msr

```

1 package icrash.concepts.primarytypes.datatypes.operations.datatypes.etBiometricAuthType.is {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.math
5 import lu.uni.lassy.messir.libraries.string
6 import lu.uni.lassy.messir.libraries.calendar
7
8 Operation Model {
9
10 operation: icrash.concepts.primarytypes.datatypes.etBiometricAuthType.is():ptBoolean{
11 // include below the specification information (pre,post or ocl or prolog)
12 postF {
13 let TheResult: ptBoolean in
14 (
15 if ( self = mandatory or self = optional )
16 then (TheResult = true)
17 else (TheResult = false)
18 endif
19
20 result = TheResult
21 )
22 }
23 }
24 }
25 }
```

Listing C.49: Messir Spec. file primarytypes-datatypes-etBiometricAuthType-is.msr.

C.50 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 (
11 if
12 ( self = pending
13 or self = handled
14 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.50: Messir Spec. file primarytypes-datatatypes-etCrisisStatus.msr.

C.51 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-etCrisisType.msr

```

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

Listing C.51: Messir Spec. file primarytypes-datatatypes-etCrisisType.msr.

C.52 File ./src-gen/messir-spec/operations/concepts/primarytypes-datatypes/primarytypes-datatypes-etHumanKind.msr

```

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

```

19      ) }
20 prolog{"src/Operations/Concepts/PrimaryTypesClasses/PrimaryTypesDatatypes-etHumanKind-is.pl"}
21 }
22 }
23 }
```

Listing C.52: Messir Spec. file primarytypes-datatatypes-etHumanKind.msr.

C.53 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   import icrash.concepts.secondarytypes.datatypes
8
9   Concept Model {
10
11   Primary Types {
12
13     datatype dtAlertID {
14       operation is():ptBoolean
15     }
16     datatype dtCrisisID {
17       operation is():ptBoolean
18     }
19     datatype dtLogin {
20       operation is():ptBoolean
21     }
22     datatype dtPassword {
23       operation is():ptBoolean
24     }
25     datatype dtCoordinatorID {
26       operation is():ptBoolean
27     }
28     datatype dtPhoneNumber {
29       operation is():ptBoolean
30     }
31     datatype dtComment {
32       operation is():ptBoolean
33     }
34     datatype dtLatitude {
35       operation is():ptBoolean
36     }
37     datatype dtLongitude {
38       operation is():ptBoolean
39     }
40     datatype dtGPSLocation {
41       attribute latitude: dtLatitude
42       attribute longitude: dtLongitude
43       operation is():ptBoolean
44       operation isNearTo(AGPSLocation:dtGPSLocation ):ptBoolean
45     }
46     datatype dtBiometrics {
47       attribute speechRecord: dtSpeechRecord
48       operation is():ptBoolean
49     }
50
51     enum etCrisisStatus {
52       constants["pending", "handled", "solved", "closed"]
53       operation is():ptBoolean
54     }
55     enum etAlertStatus {
56       constants["pending", "valid", "invalid"]
57       operation is():ptBoolean
58   }
```

```

58     }
59     enum etCrisisType {
60       constants["small", "medium", "huge"]
61       operation is():ptBoolean
62     }
63     enum etHumanKind {
64       constants["witness", "victim", "anonymous"]
65       operation is():ptBoolean
66     }
67     enum etBiometricAuthType {
68       constants["mandatory", "optional"]
69       operation is():ptBoolean
70     }
71     datatype dtReportID {
72       operation is():ptBoolean
73     }
74     datatype dtEmail {
75       operation is():ptBoolean
76     }
77   }
78 }
79 }
```

Listing C.53: Messir Spec. file primarytypes-datatatypes.msr.

C.54 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.54: Messir Spec. file secondarytypes-associations.msr.

C.55 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.55: Messir Spec. file secondarytypes-classes.msr.

C.56 File ./src-gen/messir-spec/operations/concepts/secondarytypes-datatypes/secondarytypes-datatypes-dtSpeechRecord-is.msr

```

1 package icrash.concepts.secondarytypes.datatypes.operations.datatypes.dtSpeechRecord.is {
2
3   import lu.uni.lassy.messir.libraries.primitives
4   import lu.uni.lassy.messir.libraries.math
5   import lu.uni.lassy.messir.libraries.string
6   import lu.uni.lassy.messir.libraries.calendar
```

```

7
8 Operation Model {
9
10 operation: icrash.concepts.secondarytypes.datatypes.dtSpeechRecord.is():ptBoolean{
11 // include below the specification information (pre,post or ocl or prolog)
12 postF{
13     let TheResult: ptBoolean in
14     (
15         if ( AdtValue.value.geq(300) and AdtValue.value.leq(3400) )
16             then (TheResult = true)
17             else (TheResult = false)
18         endif
19
20     result = TheResult
21   )
22 }
23 }
24 }
25 }
```

Listing C.56: Messir Spec. file secondarytypes-datatype-dtSpeechRecord-is.msr.

C.57 File ./src-gen/messir-spec/concepts/secondarytypes-datatypes.msr

```

1 package icrash.concepts.secondarytypes.datatypes {
2
3 import lu.uni.lassy.messir.libraries.primitives
4 import lu.uni.lassy.messir.libraries.string
5
6 import icrash.concepts.primarytypes.datatypes
7
8 Concept Model {
9
10 Secondary Types {
11
12 datatype dtSMS {
13     attribute value: ptString
14     operation is():ptBoolean
15   }
16
17 datatype dtSpeechRecord {
18     attribute value: ptString
19     operation is():ptBoolean
20   }
21 }
22 }
23 }
```

Listing C.57: Messir Spec. file secondarytypes-datatypes.msr.

C.58 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, AetBiometricAuthType:etBiometricAuthType, AdtBiometrics:dtBiometrics) {
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, AetBiometricAuthType
91 :etBiometricAuthType, AdtBiometrics:dtBiometrics) {
92   actor actAuthenticated[primary,active]
93   returned messages {
94     ieMessage(AMessage) returned to actAuthenticated
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 use case system subfunction oeMakeFullReport(AdtCrisisID:dtCrisisID , AdtEmail:dtEmail) {
140   actor actCoordinator[primary, active]
141   returned messages {
142     ieFullReportMade() returned to actCoordinator
143   }
144 }
145 }
146
147 }

```

Listing C.58: Messir Spec. file subfunctions-usecases.msr.

C.59 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()
123     }
124     oracle{
125         variables{
126             AMessage:ptString
127         }
128         constraints{
129             AMessage = 'You are logged out ! Good Bye ...'
130             TheActor.inactAdministrator.ieMessage(AMessage)
131         }
132     }
133  }
134 /**
135 test step ts06oeSetClock02 order 06{
136     variables{
137         TheActor:actActivator

```

```

138     ACurrentClock:dtDateAndTime
139   }
140 constraints{
141   TheActor=TheSystem.rnactActivator->any2(true)
142   ACurrentClock.date.year.value = 2017
143   ACurrentClock.date.month.value = 11
144   ACurrentClock.date.day.value = 26
145   ACurrentClock.time.hour.value = 10
146   ACurrentClock.time.minute.value = 15
147   ACurrentClock.time.second.value = 00
148   }
149 test message{
150   out:TheActor sends to system actActivator.outactActivator.oeSetClock(ACurrentClock)
151   }
152 oracle{
153   constraints{
154   true
155   }
156   }
157   }
158 //-----
159 test step ts07oeAlert1 order 07{
160   variables{
161     TheActor : actComCompany
162     AetHumanKind:etHumanKind
163     AdtDate:dtDate
164     AdtTime:dtTime
165     AdtPhoneNumber:dtPhoneNumber
166     AdtGPSLocation:dtGPSLocation
167     AdtComment:dtComment
168   }
169   constraints{
170     TheActor = TheSystem.rnactComCompany->any2(true)
171     AetHumanKind = witness
172     AdtDate.year.value = 2017
173     AdtDate.month.value = 11
174     AdtDate.day.value = 26
175     AdtTime.hour.value = 10
176     AdtTime.minute.value = 10
177     AdtTime.second.value = 16
178     AdtPhoneNumber.value = '+3524666445252'
179     AdtGPSLocation.latitude.value = 49.627675
180     AdtGPSLocation.longitude.value = 6.159590
181     AdtComment.value = '3 cars involved in an accident.'
182   }
183   test message{
184   out:TheActor
185   sends to system actComCompany.outactComCompany.oeAlert( AetHumanKind,
186                                         AdtDate,
187                                         AdtTime,
188                                         AdtPhoneNumber,
189                                         AdtGPSLocation,
190                                         AdtComment)
191   }
192   oracle{
193   variables{
194     AdtSMS:dtSMS
195   }
196   constraints{
197     AdtSMS.value = 'Your alert has been registered. We will handle it and keep you informed'
198     TheActor.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
199   }
200   }
201   }
202 //-----
203 test step ts08oeSetClock03 order 08{
204   variables{
205     TheActor:actActivator
206     ACurrentClock:dtDateAndTime
207   }

```

```

208 constraints{
209     TheActor=TheSystem.rnactActivator->any2(true)
210     ACurrentClock.date.year.value = 2017
211     ACurrentClock.date.month.value = 11
212     ACurrentClock.date.day.value = 26
213     ACurrentClock.time.hour.value = 10
214     ACurrentClock.time.minute.value = 30
215     ACurrentClock.time.second.value = 00
216 }
217 test message{
218     out:TheActor sends to system actActivator.outactActivator.oeSetClock(ACurrentClock)
219 }
220 oracle{
221     constraints{
222         true
223     }
224 }
225 }
226 /**
227 test step ts09oeSollicitateCrisisHandling order 09{
228     variables{
229         TheActor : actActivator
230     }
231     constraints{
232         TheActor = TheSystem.rnactActivator->any2(true)
233     }
234     test message{
235         out:TheActor sends to system actActivator.outactActivator.oeSollicitateCrisisHandling()
236     }
237     oracle{
238         variables{
239             TheAdministrator:actAdministrator
240             TheCoordinator:actCoordinator
241             AMessagForCrisisHandlers:ptString
242         }
243         constraints{
244             TheAdministrator = TheSystem.rnactAdministrator->any2(true)
245             TheCoordinator = TheSystem.rnactCoordinator->any2(true)
246             AMessagForCrisisHandlers = 'There are alerts pending since more than the defined delay. Please
REACT !'
247
248             TheAdministrator.inactAdministrator.ieMessage(AMessagForCrisisHandlers)
249             TheCoordinator.inactAdministrator.ieMessage(AMessagForCrisisHandlers)
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             AMessagForCrisisHandlers:ptString
257         }
258         constraints{
259             AMessagForCrisisHandlers = 'There are alerts pending since more than the defined delay. Please
REACT !'
260             TheAdministrator = TheSystem.rnactAdministrator->any2(true)
261
262             TheSystem.rnactCoordinator->forAll(TheCoordinator:actCoordinator | TheCoordinator.
actAuthenticated.inactAuthenticated.ieMessage(AMessage))
263
264 */
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       AMessage:ptString
490     }
491     constraints{
492       AMessage = 'The crisis status has been updated !'
493       TheActor.inactAuthenticated.ieMessage(AMessage)
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       AMessage:ptString
518     }
519     constraints{
520       AMessage = 'The crisis comment has been updated !'
521       TheActor.inactAuthenticated.ieMessage(AMessage)
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.59: Messir Spec. file tc-testcase01.msr.

C.60 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         AMesssage : 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       AMesssage : 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 //-----
118 test step instance tsi08: testcase01.ts08oeSetClock03{
119   variables {
120     reuse tsi02.theClock as testcase01.ts08oeSetClock03.ACurrentClock
121     ACurrentClock : testcase01.ts08oeSetClock03.ACurrentClock = "2017:11:26 - 10:30:00"
122   }
123   oracle {
124     satisfaction = "true"
125   }
126   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
127 }
128 //-----
129 test step instance tsi09: testcase01.ts09oeSollicitateCrisisHandling{
130   variables {
131     reuse tsi02.theClock as testcase01.ts09oeSollicitateCrisisHandling.TheActor
132     reuse tsi03.bill as testcase01.ts09oeSollicitateCrisisHandling.TheAdministrator

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133 }
134 oracle {
135     satisfaction = "true"
136     received message {
137         steve:testcase01.ts09oeSollicitateCrisisHandling.TheCoordinator ="steve"
138         AMessagForCrisisHandlers : testcase01.ts09oeSollicitateCrisisHandling.
139         AMessagForCrisisHandlers= 'There are alerts pending since more than the defined delay. Please
140         REACT !'
141     }
142     tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(
143     AMessagForCrisisHandlers)
144     tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(
145     AMessagForCrisisHandlers)
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             AMessag : testcase01.ts10oeLogin02.AMessag= 'You are logged ! Welcome ...'
158             tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessag)
159         }
160     }
161 }
162 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
163 }
164 //-----
165 test step instance ts111: 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 ts112: 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             AMessag : testcase01.ts12oeSetCrisisHandler.AMessag= '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             tsi07.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
197             tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessag)

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197     }
198   }
199 }
200 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
201 }
202 //-----
203 test step instance tsil3: 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 tsil4: 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       AMesssage : testcase01.ts14oeValidateAlert.AMessage= 'The Alert is now declared as valid !'
223       tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
224     }
225   }
226 }
227 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
228 }
229 //-----
230 test step instance tsil5: 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= "+352466645000"
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 tsil6: 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   }

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265     }
266     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
267   }
268 //-----
269   test step instance tsi17: testcase01.ts17oeSetCrisisStatus{
270     variables {
271       reuse tsi09.steve as testcase01.ts17oeSetCrisisStatus.TheActor
272       AdtCrisisID : testcase01.ts17oeSetCrisisStatus.AdtCrisisID = "1"
273       AetCrisisStatus : testcase01.ts17oeSetCrisisStatus.AetCrisisStatus= "solved"
274     }
275     oracle {
276       satisfaction = "true"
277       received message {
278         AMessage : testcase01.ts17oeSetCrisisStatus.AMessage= "The crisis status has been updated !"
279         tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
280       }
281     }
282     test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
283   }
284 //-----
285   test step instance tsi18: testcase01.ts18oeReportOnCrisis{
286     variables {
287       reuse tsi09.steve as testcase01.ts18oeReportOnCrisis.TheActor
288       AdtCrisisID : testcase01.ts18oeReportOnCrisis.AdtCrisisID = "1"
289       AdtComment : testcase01.ts18oeReportOnCrisis.AdtComment= "3 victims sent to hospital, 2 cars
290       evacuated and 4 rescue unit mobilized"
291     }
292     oracle {
293       satisfaction = "true"
294       received message {
295         AMessage : 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         AMessage : testcase01.ts19oeCloseCrisis.AMessage= 'The crisis is now closed !'
311         tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
312       }
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"}
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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       AMesssage : testcase01.ts03oeLogin.AMessage= 'You are logged ! Welcome ...'
357       tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
358     }
359   }
360   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
361 }
362 //-----
363 test step instance tsi04: testcase01.ts04oeAddCoordinator{
364   variables {
365     reuse tsi03.bill as testcase01.ts04oeAddCoordinator.TheActor
366     AdtCoordinatorID : testcase01.ts04oeAddCoordinator.AdtCoordinatorID = "1"
367     AdtLogin : testcase01.ts04oeAddCoordinator.AdtLogin= "steve"
368     AdtPassword : testcase01.ts04oeAddCoordinator.AdtPassword = "pwdMessirExcalibur2017"
369   }
370   oracle {
371     satisfaction = "true"
372     received message {
373       tsi03.bill received from system actAdministrator.inactAdministrator.ieCoordinatorAdded()
374     }
375   }
376   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
377 }
378 //-----
379 test step instance tsi05: testcase01.ts05oeLogout{
380   variables {
381     reuse tsi03.bill as testcase01.ts05oeLogout.TheActor
382   }
383   oracle {
384     satisfaction = "true"
385     received message {
386       AMesssage : testcase01.ts05oeLogout.AMessage= 'You are logged out ! Good Bye ...'
387       tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
388     }
389   }
390   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
391 }
392 //-----
393 test step instance tsi06: testcase01.ts06oeSetClock02{
394   variables {
395     reuse tsi02.theClock as testcase01.ts06oeSetClock02.TheActor
396     ACurrentClock : testcase01.ts06oeSetClock02.ACurrentClock= "2017:11:26 - 10:15:00"
397   }
398   oracle {
399     satisfaction = "true"
400   }
401   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
402 }
403 //-----

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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       AMessagForCrisisHandlers : testcase01.ts09oeSollicitateCrisisHandling.
447       AMessagForCrisisHandlers= 'There are alerts pending since more than the defined delay. Please REACT !'
448       tsi03.bill received from system actAuthenticated.inactAuthenticated.ieMessage(
449         AMessagForCrisisHandlers)
450       tsi09.steve received from system actAuthenticated.inactAuthenticated.ieMessage(
451         AMessagForCrisisHandlers)
452     }
453   }
454 }
455
456 //-----
457 //-----
458 //-----
459 test case instance instance01Part02: testcase01{
460
461   test step instance tsi10: 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"

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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 //-
515 test step instance ts13: testcase01.ts13oeSetClock04{
516   variables {
517     theClock : testcase01.ts13oeSetClock04.TheActor
518     ACurrentClock : testcase01.ts13oeSetClock04.ACurrentClock = "2017:11:26 - 10:45:00"
519   }
520   oracle {
521     satisfaction = "true"
522   }
523   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
524 }
525 //-
526 test step instance ts14: testcase01.ts14oeValidateAlert{
527   variables {
528     reuse ts10.steve as testcase01.ts14oeValidateAlert.TheActor
529     AdtAlertID : testcase01.ts14oeValidateAlert.AdtAlertID = "1"
530   }
531   oracle {
532     satisfaction = "true"
533     received message {
534       AMessage : testcase01.ts14oeValidateAlert.AMessage= 'The Alert is now declared as valid !'
535       ts10.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
536     }

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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
559       keep you informed'
560       tsi12.tango received from system actComCompany.inactComCompany.ieSmsSend(AdtPhoneNumber,AdtSMS)
561     }
562   }
563   test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
564 }
565 //-----
566 test step instance 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"

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```

604     received message {
605         AMessage : testcase01.ts18oeReportOnCrisis.AMessage= 'The crisis comment has been updated !'
606         tsi10.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
607     }
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         }
623         tsi10.steve received from system actAuthenticated.inactAuthenticated.ieMessage(AMessage)
624     }
625 }
626 }
627 test results {pre-protocol = "true" pre-functional = "true" post-functional = "true"}
628 }
629
630 }
631 }
632
633 }

```

Listing C.60: Messir Spec. file tci-testcase01-instance01.msr.

C.61 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.ugAdministateTheSystem
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 ugAdministateTheSystem[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", "mandatory", "billSpeechRecord.wav") {
61         ieMessage('You are logged ! Welcome ...') returned to bill
62       }
63 //-
64   bill
65     executed instanceof subfunction
66       oeAddCoordinator("1", "steve", "pwdMessirExcalibur2017", "optional", "steveSpeechRecord.wav") {
67         ieCoordinatorAdded() 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       }
86 //-
87   theClock
88     executed instanceof subfunction
89       oeSetClock("2017:11:26 - 10:30:00") {}
90 //-
91   theClock
92     executed instanceof subfunction
93       oeSollicitateCrisisHandling{
94         ieMessage("There are alerts pending since more than the defined delay. Please REACT !")
95         returned to bill
96         ieMessage("There are alerts pending since more than the defined delay. Please REACT !")
97         returned to steve
98       }
99 //-
100  steve
101    executed instanceof subfunction

```

```

102     oeLogin("steve","pwdMessirExcalibur2017","optional","steveSpeechRecord.wav") {
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     oeMakeFullReport("1","contact@police.public.lu"){
160         ieFullReportMade()
161         returned to steve
162     }
163 //-----
164     steve
165     executed instanceof subfunction
166     oeCloseCrisis("1"){
167         ieMessage('The crisis is now closed !')
168         returned to steve
169     }

```

```

170
171     }
172   }
173 //-
174 //-
175 //-
176 use case instance uciSimpleAndCompletePart01 : suDeployAndRun{
177
178   actors {
179     theCreator : actMsrCreator
180     theClock : actActivator
181     bill : actAdministrator
182     tango : actComCompany
183     steve : actCoordinator
184   }
185   use case steps {
186 //-
187   theCreator
188     executed instanceof subfunction
189       oeCreateSystemAndEnvironment("4") {}
190 //-
191   theClock
192     executed instanceof subfunction
193       oeSetClock("2017:11:24 - 03:20:00") {}
194 //-
195   bill
196     executed instanceof subfunction
197       oeLogin("icrashadmin", "7WXC1359", "mandatory", "billSpeechRecord.wav") {
198         ieMessage('You are logged ! Welcome ...') returned to bill
199       }
200 //-
201   bill
202     executed instanceof subfunction
203       oeAddCoordinator("1", "steve", "pwdMessirExcalibur2017", "optional", "steveSpeechRecord.wav") {
204         ieCoordinatorAdded() returned to bill
205       }
206 //-
207   bill
208     executed instanceof subfunction
209       oeLogout{
210         ieMessage('You are logged out ! Good Bye ...') returned to bill
211       }
212 //-
213   theClock
214     executed instanceof subfunction
215       oeSetClock("2017:11:26 - 10:15:00") {}
216 //-
217   tango
218     executed instanceof subfunction
219       oeAlert("witness", "2017:11:26", "10:10:16", "+3524666445252",
220         "49.627675:6.159590", "3 cars involved in an accident."){
221         ieSmsSend("+3524666445252", "Your alert has been registered. We will handle it and keep you
222         informed") returned to tango
223       }
224 //-
225   theClock
226     executed instanceof subfunction
227       oeSetClock("2017:11:26 - 10:30:00") {}
228 //-
229   theClock
230     executed instanceof subfunction
231       oeSollicitateCrisisHandling{
232         ieMessage("There are alerts pending since more than the defined delay. Please REACT !")
233         returned to bill
234         ieMessage("There are alerts pending since more than the defined delay. Please REACT !")
235         returned to steve
236       }
237     }
238 //-

```

```

239 //-----
240 //-----
241 use case instance uciSimpleAndCompletePart02 : suDeployAndRun{
242   actors {
243     theCreator : actMsrCreator
244     theClock : actActivator
245     bill : actAdministrator
246     tango : actComCompany
247     steve : actCoordinator
248   }
249   use case steps {
250
251 //-----
252   steve
253   executed instanceof subfunction
254     oeLogin("steve", "pwdMessirExcalibur2017", "optional", "steveSpeechRecord.wav") {
255       ieMessage('You are logged ! Welcome ...') returned to steve
256     }
257 //-----
258   steve
259   executed instanceof subfunction
260     oeGetCrisisSet("pending"){
261       ieSendACrisis("crisis with ID 1 details") returned to steve
262     }
263 //-----
264   steve
265   executed instanceof subfunction
266     oeSetCrisisHandler("1"){
267       ieSmsSend("+3524666445252", "The handling of your alert by our services is in progress !")
268       returned to tango
269       ieMessage("You are now considered as handling the crisis !")
270       returned to steve
271     }
272 //-----
273   theClock
274   executed instanceof subfunction
275     oeSetClock("2017:11:26 - 10:45:00"){}
276 //-----
277   steve
278   executed instanceof subfunction
279     oeValidateAlert("1"){
280       ieMessage('The Alert is now declared as valid !')
281       returned to steve
282     }
283 //-----
284   tango
285   executed instanceof subfunction
286     oeAlert("witness", "2017:11:26", "10:20:00", "+3524666445000",
287       "49.627095:6.160251", "A car crash just happened.")
288     ieSmsSend("+3524666445000", "Your alert has been registered. We will handle it and keep you
289     informed") returned to tango
290 //-----
291   theClock
292   executed instanceof subfunction
293     oeSetClock("2017:11:26 - 12:45:00"){}
294 //-----
295   steve
296   executed instanceof subfunction
297     oeSetCrisisStatus("1", "solved") {
298       ieMessage('The crisis status has been updated !')
299       returned to steve
300     }
301 //-----
302   steve
303   executed instanceof subfunction
304     oeReportOnCrisis("1", "3 victims sent to hospital, 2 cars evacuated and 4 rescue unit
305     mobilized"){
306       ieMessage('The crisis comment has been updated !')
307       returned to steve

```

```

307      }
308 //-----
309      steve
310      executed instanceof subfunction
311          oeMakeFullReport("1","contact@police.public.lu") {
312              ieFullReportMade()
313              returned to steve
314          }
315 //-----
316      steve
317      executed instanceof subfunction
318          oeCloseCrisis("1") {
319              ieMessage('The crisis is now closed !')
320              returned to steve
321          }
322
323      }
324  }
325 }
326 }
```

Listing C.61: Messir Spec. file usecase-suDeployAndRun.msr.

C.62 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.62: Messir Spec. file usecase-suGlobalCrisisHandling.msr.

C.63 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.63: Messir Spec. file usecase-ugAdministrateTheSystem.msr.

C.64 File ./src-gen/messir-spec/usecases/usecase-ugManageCrisis.msr

```

1 package icrash.usecases.ugManageCrisis {
2
3 import icrash.environment
4 import icrash.usecases.subfunctions
5
6 Use Case Model {
7
8 use case system usergoal ugManageCrisis() {
9 actor actCoordinator[primary, active]
10
11 reuse oeValidateAlert[0...*]
12 reuse oeSetCrisisStatus[0...*]
13 reuse oeSetCrisisHandler[0...*]
14 reuse oeReportOnCrisis[0...*]
15 reuse oeCloseCrisis[0...*]
16 reuse oeInvalidateAlert[0...*]
17 reuse oeMakeFullReport[0...*]
18
19 step a: actCoordinator executes oeValidateAlert
20 step b: actCoordinator executes oeSetCrisisStatus
21 step c: actCoordinator executes oeSetCrisisHandler
22 step d: actCoordinator executes oeReportOnCrisis
23 step f: actCoordinator executes oeCloseCrisis
24 step g: actCoordinator executes oeInvalidateAlert
25 step h: actCoordinator executes oeMakeFullReport
26
27 ordering constraint "managing a crisis is doing one of the indicated use cases."
28
29 }
30
31 }
32 }

```

Listing C.64: Messir Spec. file usecase-ugManageCrisis.msr.

C.65 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.65: Messir Spec. file usecase-ugMonitor.msr.

C.66 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.66: Messir Spec. file usecase-ugSecurelyUseSystem.msr.

C.67 File ./src-gen/messir-spec/usecases/usecaseinstance-ugSecurelyUseSystem-uciugSecurelyUseSystem.msr

```

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

```
10 Use Case Model {
11
12 //-----
13 use case instance uciugSecurelyUseSystem : ugSecurelyUseSystem {
14   actors {
15     bill:actAuthenticated
16   }
17   use case steps {
18   //-----
19     bill
20     executed instanceof subfunction
21       oeLogin("icrashadmin","7WXC1359","mandatory","speechRecord.wav") {
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.67: 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    []):-!
```

```

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

```

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

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

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

```

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      todString, [], eq, [AdtAlertID]],
117     [[ptBoolean, true]]),
118
119
120 msrNav([ActAlert],
121     [init, [AdtAlertID,
122             AetAlertStatus,
123             AdtGPSLocation,
124             AAlerInstant,
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]]], []]], [PostnextValueForCrisisID]),
144     [PostnextValueForCrisisID]),
145   msrNav([TheSystem],
146     [msmAtPost, nextValueForCrisisID],
147     [PostnextValueForCrisisID]),
148
149   msrNav([TheSystem],
150     [nextValueForCrisisID,
151      todString, [], eq, [AdtCrisisID]],
152     [[ptBoolean, true]]),
153
154   msrNav([AdtCrisisType], [], [[etCrisisType, small]]),
155   msrNav([AetCrisisStatus], [], [[etCrisisStatus, pending]]),
156   msrNav([ACrisisInstant], [], [AAlerInstant]),
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         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/outactCoordinator-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
28 msrop(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 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 -----
6 msrop(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
28 msrop(outactCoordinator,
29     oeGetCrisisSet,
30     [preFunctional,Self,
31     AetCrisisStatus
32     ],
33     []):-!
34 /* Pre Functional:*/
35 /* PreF01 */
36 true
37 .
38
39 msrop(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/outactCoeInvalidateAlert.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
29 msrop(outactCoordinator,
30     oeSetCrisisStatus,
31     [preFunctional,Self,
32     AdtCrisisID,
33     AetCrisisStatus
34     ],
35     []):-!
36 /* Pre Functional:*/
37 msrVar(ctState,TheSystem),
38 msrVar(actCoordinator,TheActor),
39
40 msrVar(dtCrisisID,AdtCrisisID),
41
42 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
43 msrNav([Self],[rnActor],[TheActor]),
44
45 /* PreF01 */
46 msrNav([TheSystem],
47     [rnctCrisis,
48     msrSelect,
49     id,eq,[AdtCrisisID]
50     ],
51     ColCrisis),
52
53 msrNav(ColCrisis,
54     [msrSize,eq,[[ptInteger,1]]],
55     [[ptBoolean,true]]))
56 .
57
58 msrop(outactCoordinator,
59     oeSetCrisisStatus,
60     [post,Self,
61     AdtCrisisID,
62     AetCrisisStatus
63     ],
64     []):-!
65
66 /* Post Functional:*/
67 msrVar(ctState,TheSystem),
68 msrVar(actCoordinator,TheActor),
69
70 msrVar(ctCrisis,TheCrisis),
71 msrVar(dtCrisisID,AdtCrisisID),
72 msrVar(etCrisisStatus,AetCrisisStatus),
73
74 msrNav([Self],[rnActor,rnSystem],[TheSystem]),
75 msrNav([Self],[rnActor],[TheActor]),
76
77 /* PostF01 */
78 msrNav([TheSystem],
79     [rnctCrisis,
80     msrSelect,
81     id,eq,[AdtCrisisID]],
82     [TheCrisis]),
83
84 msrNav([TheCrisis],
85     [msmAtPost,status],

```

```

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 */
92 true
93 .

```

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

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

```

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

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

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

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

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

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

msrop(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/SecondaryTypesData dtSMS-is.pl

```

1%%%%%%%%%%%%%
2/* DISCONTIGUOUS PREDICATES */
3:- multifile msrop/4.
4%%%%%%%%%%%%%
5%% dtComment
6
7%msd01
8msrop(dtSMS,is,[AdtValue],Result) :-
9 msrVar(ptBoolean,TheResult),
10 msrVar(ptInteger,MaxLength),
11(
12(
13(
14    MaxLength = [ptInteger,160],
15    msrNav([AdtValue],
16        [value,length,[],leq,[MaxLength]],
17        [[ptBoolean,true]]))
18)
19 -> TheResult = [ptBoolean,true]
20 ; TheResult = [ptBoolean,false]
21 )
22),
23 Result = TheResult
24.

```

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

