

University of Helsinki

Department of Computer Science

Software Engineering Project xPerf

# User Manual

Tommi Koivula

Antti Levomäki

Juha Mondolin

Timo Suomela

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## Version history

Version	Date	Comments	Author
0.1	4.5.2003	First version	Antti Levomäki Timo Suomela
0.2	5.5.2003	More content and typos fixed	Antti Levomäki
0.3	9.5.2003	Error messages filled in, appendices added	Antti Levomäki Juha Mondolin
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0.5	11.5.2003	DTD, memory-and disk requirements added.	Tommi Koivula
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## 1. Introduction

MAISA is a research and development project aiming at developing methods for the measurement of software quality at the design level [1]. The metrics are computed from the system's architectural description, predicting the quality attributes of the system derived from it. Most notably, size and performance metrics are addressed.

MAISA calculates metrics from UML models. The models can be made with many different programs, and the models can be saved in different formats. MAISA has a plugin based file importing system, which allows users to write readers for the UML fileformats they need. This manual introduces Prolog and XMI plugins.

## 2. Making XMI documents for MAISA

MAISA does not support everything that can be expressed with UML. This chapter describes things that must be taken into account when making XMI documents for MAISA.

### 2.1. Class diagram

- Attributes and parameters types cannot be objects described in the project.
- UML allows classes to be defined as private. The plugin does not read this information.

### 2.2. Sequence diagram

- Taggedvalues are required for objects and stimulus.

### 2.3. Activity diagram

- Current version of XMIActivityDiagramReader does not support substates(that is states within a state) because ArgoUML doesn't support them.
- In current version a signal related to a diagram is defined as a tagged value because ArgoUML v0.12 does not support signals. Other CASE-tools may provide functionality that is not supported by ArgoUML v0.12, using any of these features might cause the reading of an XMI file to fail.
- Problems with activity diagrams exported from Rational Rose are described in Appendix C

## 3. Installing plugins

All available plugins are loaded at startup, based on a configuration file *maisareaders.properties*. The properties file contains an entry for each configured reader class. Each property name is a symbolic name for the reader implementation and each value is the fully qualified classname of the corresponding implementation. The location the properties file is determined in the following way:

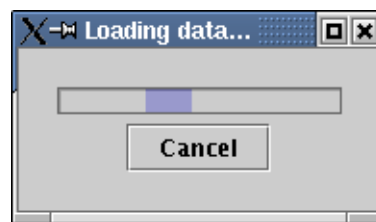
1. If the environment variable *maisareaders.configuration* is set, its value is interpreted to be the URL of a suitable properties file.
2. The current classpath is searched for a resource named *maisareaders.properties*.

3. The current working directory is searched for a file named *maisareaders.properties*

Instructions for making new reader plugins can be found from the Maintenance manual[2].

## 4. Loading a project/diagram

Files are loaded by selecting **File-> Open-> Project/Diagram** in MAISA's main window. Opening a single file reads all diagrams from that file, and opening a directory opens all files from the directory as a project. If opening a file takes more than 2 seconds, a progress bar is displayed:



Loading can be cancelled by clicking the cancel-button displayed below the progress bar.

### 4.1. Loading a XMI-document that contains a DTD-reference

If XMI-document contains a DTD-reference, DTD will be also read. References to DTDs can be canonical or absolute URLs. Canonical URLs are relative to project directory. If a proper DTD cannot be found, error message "*Empty project*" will be shown, because none of reader modules can handle it.

### 4.2. Loading big projects

When loading big files there two limitations. First, there must be enough memory in current Java Virtual Machine. Default size for Virtual Machine memory is 64 megabytes.

With this memory size it is possible to load files that are smaller than 30 megabytes. If there is not enough memory MAISA-tool will stop abnormally. Memory size of Virtual Machine can be changed when starting MAISA-tool in Windows or Linux with command:

```
$ java -Xmxn MAISA.MAISA_tool
```

Parameter `-Xmxn` sets the size of memory allocation pool to  $n$  megabytes.

Second limitation is that there must be free space and possibility to write in project directory that contains XMI-documents. Free space is needed for a temp file that is created during XMI parsing. The size of the temp file is the same as size of the XMI-document being read. If there is not enough free space read operation will stop and error message will be shown.

## 5. Troubleshooting

This section describes possible error messages and what might cause them.

### 5.1. General

General	
Error message	Description
Could not load coordinates file [ <code>&lt;file_name&gt;</code> ], [ <code>&lt;reason&gt;</code> ]	Consulting the named file did not yield a (mandatory) coordinate definition for a class diagram.
No document readers defined. Consult MAISA documentation for reader configuration.	The MAISA system is misconfigured, consult the MAISA users manual.

Could not find reader class [<class_name>]: [<reason>]	The named reader class is defined in the MAISA configuration but can not be found in the classpath.
Could not instantiate reader class [<class_name>]: [<reason>]	The named reader class is defined in the MAISA configuration but can not be instantiated.
Could not load reader list from resource [<resource_name>]: [<reason>]	The named resource did not yield a valid reader configuration.
Could not load reader list from URL [<url_name>]: [<reason>]	The given URL did not yield a valid reader configuration.
No readers could be loaded, check your configuration	The MAISA system is misconfigured, consult the MAISA user manual.

## 5.2. XMI Plugin (xmiDocumentReader.class)

List of possible error messages and their causes when opening files with the XMI plugin, grouped by diagram type:

State diagram	
Error message	Description
Transition is missing id	A transition element is defined but is missing the xmi.id attribute.
Missing source state reference <state_id> in transition <transition_id>	A transition element is defined but is missing a source state element reference
Missing target state reference <state_id> in transition <transition_id>	A transition element is defined but is missing a target state element reference
Illegal source state reference <state_id> in transition <transition_id>	A transition element refers to a non-existent source state element.
Illegal target state reference <state_id> in transition <transition_id>	A transition element refers to a non-existent target state element.
Illegal transition reference <transition_id> in guard <guard_name>	A guard is defined without an enclosing transition.



State machine has no id	A state machine element is defined but is missing the xmi.id attribute.
Vertex is missing id	A vertex element is defined but is missing the xmi.id attribute.
Attribute <attribute_name> is missing from element <element_name>	The named element is missing the named attribute.

<b>Class diagram</b>	
<b>Error message</b>	<b>Description</b>
Classdiagram: [attribute name] attribute is missing from element [element]	A required attribute is missing
Fatal error in XMIClassDiagramReader.	
The class that operation [operations id] belongs to not found	A method is defined outside the class/interface it belongs to
Project cannot be null.	Internal error
XMIClassDiagramReader can not read [element name] element.	Internal error

<b>Collaboration and sequence diagrams</b>	
<b>Error message</b>	<b>Description</b>
Collaboration: [attributes name] attribute is missing from element [elements name]	A required attribute is missing

Illegal value of 'loop.[taggedvalues name] in loop.	Value of the taggedvalue could not be converted to an integer
Illegal number of tokens in 'loop.[taggedvalues name]'	Illegal number of tokens separated by a ' _ ' found.
Undefined values in loop [loops name]	Undefined required values for the loop
Behavioral_Elements.Collaborations. Message.sender not defined in message [message ID]	Message sender not found
Undefined values in counter for message [message ID]	Undefined required values for the counter
Class diagram not found	Class diagram is not defined
Illegal CallAction [callaction ID]	Reference to an undefined CallAction in a stimulus
Stimulus [stimulus ID] orderNumber == NULL"	Undefined or illegal orderNumber for stimulus
Illegal from or to elements in message [stimulus ID]	Undefined or illegal sender/receiver in stimulus
Stimulus [stimulus ID] has an illegal variable parameter	Illegal variable parameter defined for stimulus
Stimulus [stimulus ID] has an illegal object parameter	Illegal object parameter defined for stimulus
Object [classifierRole ID] references to undefined class [class ID]	Objects base class definition not found from class diagram

<b>Activity diagram</b>	
<b>Error message</b>	<b>Description</b>
Project cannot be null	
attribute is missing from element [element name]	
Loopstate was not found from the diagram.	
Activitystate was not found from the diagram.	

Transition was not found from the diagram.	
Target or source of the transition was not found from the diagram.	
Activity diagram has no id	
Owner of the activitydiagram has no id.	
Activitystate has no id.	
Pseudostate has no id.	
Finalstate has no id.	
Transition has no id.	
Missing transition source reference	
Missing transition target reference.	
Probability-tag of the transition was found but the value was null.	
A expression of a guard was null.	
Signal has no id.	
Signal was found but the value was null.	

### 5.3. Prolog plugin (PrologDocumentReader.class)

All possible error messages when using the PrologDocumentReader.

## Appendix A: TaggedValues read from XMI diagrams

### Class diagram

No taggedvalues

### Sequence diagram

A sequence diagram can contain loops. For each loop the next taggedvalues are needed.

Name	Value	Description	Owner
Loop.firstMessageNumber	Loops name (id) and a number (n) separated by a _. For example: loop1_1	Number of the first message in the loop	Behavioral_Elements .Collaborations .Collaboration
Loop.lastMessageNumber	Loops name (id) and a number (n) separated by a _. For example: loop1_4	Number of the last message in the loop	Behavioral_Elements .Collaborations .Collaboration
Loop.minimum	Loops name (id) and a number (n) separated by a _. For example: loop_12	The loop is executed at least n times	Behavioral_Elements .Collaborations .Collaboration

Loop.maximum	Loops name (id) and a number (n) separated by a _. For example: loop_32	The loop is executed at most n times	Behavioral_Elements .Collaborations .Collaboration
Loop.typical	Loops name (id) and a number (n) separated by a _. For example: loop_20	The loop is typically executed n times	Behavioral_Elements .Collaborations .Collaboration

An objects lifetime is defined with the following taggedvalues.

Name	Value	Description	Owner
Lifetime .firstMessageNumber	Number (n)	Number of the first message related to this object	Behavioral_Elements .Common_Behavior .Object
Lifetime .lastMessageNumber	Number (n)	Number of the last message related to this object	Behavioral_Elements .Common_Behavior .Object

The following taggedvalues are required for a stimulus:

<b>Name</b>	<b>Value</b>	<b>Description</b>	<b>Owner</b>
OrderNumber	Number (n)	Order number of the message	Behavioral_Elements .Common_Behavior .Stimulus
Constraint.time	Number (n)	The message required n units of time.	Behavioral_Elements .Common_Behavior .Stimulus
Realtime.minimum	Number (n)	Minimal processing and transferring time of the message	Behavioral_Elements .Common_Behavior .Stimulus
Realtime.maximum	Number (n)	Maximal processing and transferring time of the message	Behavioral_Elements .Common_Behavior .Stimulus
Realtime.typical	Number (n)	Typical processing and transferring time of the message	Behavioral_Elements .Common_Behavior .Stimulus

The following taggedvalue may be present in a stimulation:

Name	Value	Description	Owner
Guard	String	Guard	Behavioral_Elements .Common_Behavior .Stimulus

Parameters and return values of a message are defined with the following taggedvalues:

Name	Value	Description	Owner
Parameter.Variable.name	Order number of the parameter (n) and its name (s) separated by a _. For example: '1_integer' or '2_float'	Variable parameter of a message, whose order number is n and name s	Behavioral_Elements .Common_Behavior .Stimulus
Parameter.Object.name	Order number of the parameter (n) and its name (s) separated by a _. For example: '1_Object' or '2_String'	Object parameter of a message, whose order number is n and name s	Behavioral_Elements .Common_Behavior .Stimulus
ReturnValue	String	Return value	Behavioral_Elements

			.Common_Behavior .Stimulus
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## Collaboration diagram

Collaboration diagrams messages need the following taggedvalues:

<b>Nimi</b>	<b>Arvo</b>	<b>Kuvaus</b>	<b>Omistaja</b>
Predecessor	Number (n)	Order number of the preceding message	Behavioral_Elements .Collaborations .Message
Guard	String	Guard related to the message	Behavioral_Elements .Collaborations .Message
OrderNumber	Number (n)	Order number of the message	Behavioral_Elements .Collaborations .Message
Probability	Number (n)	Probability of the message	Behavioral_Elements .Collaborations .Message



Stereotype	String	Stereotype of the message	Behavioral_Elements .Collaborations .Message
Counter.minimum	Number (n)	The loop is executed at least n times	Behavioral_Elements .Collaborations .Message
Counter.maximum	Number (n)	The loop is executed at most n times.	Behavioral_Elements .Collaborations .Message
Counter.typical	Number (n)	The loop is typically executed n times	Behavioral_Elements .Collaborations .Message

### State diagram

No taggedvalues.

### Activity diagram

Taggedvalues related to activity diagrams.

These values represent the boundaries for the time consumed in the state.

The values should be positive integers(?). All values should be given.

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<b>Nimi</b>	<b>Arvo</b>	<b>Kuvaus</b>	<b>Omistaja</b>
Realtime.minimum	Number (n)	States execution requires at least n units of time.	Behavioral_Elements .Activity_Graphs .ActionState
Realtime.maximum	Number (n)	States execution takes at most n units of time.	Behavioral_Elements .Activity_Graphs .ActionState
Realtime.typical	Number(n)	States execution typically takes n units of time	Behavioral_Elements .Activity_Graphs .ActionState

These values represent the boundaries to looping. All values should be given:

<b>Name</b>	<b>Value</b>	<b>Description</b>	<b>Owner</b>
Loop.minimum	Number (n)	The loop (state) will be executed at least n times.	Behavioral_Elements .Activity_Graphs .ActionState
Loop.maximum	Number (n)	The loop (state) will be executed at most n times	Behavioral_Elements .Activity_Graphs .ActionState

Loop.typical	Number (n)	The loop (state) will typically be executed n times	Behavioral_Elements .Activity_Graphs .ActionState
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Activity diagrams transitions need the following taggedvalue:

<b>Nimi</b>	<b>Arvo</b>	<b>Kuvaus</b>	<b>Omistaja</b>
Probability	Arvo [0.0...1.0]	This value represents the probability of a transition. The sum of probabilities of the transitions leaving from one state should be exactly 1. The value of a probability should be between 0 and 1.	Behavioral_Elements .State_Machines .Transition

<b>Nimi</b>	<b>Arvo</b>	<b>Kuvaus</b>	<b>Omistaja</b>
Signal	String	This tagged value describes a signal related to the diagram. The value should be either SEND or RECEIVE.	Behavioral_Elements .Activity_Graphs .ActivityGraph

## Appendix B: Data read from UML diagrams

### Class diagram

- **Generalization:**
  - o ID
  - o *Reference to subclass*
  - o *Reference to superclass*
- **Datatype:**
  - o ID
  - o Name
- **Class:**
  - o ID
  - o Name
  - o Visibility {public | private | protected}
  - o Abstract {true | false}
  - o **Operations:**
    - ID
    - Name
    - Visibility {public | private | protected}
    - Abstract {true | false}
    - Static {classifier | instance}
    - **Parameters:**
      - ID
      - Name
      - Type of the parameter
      - *Reference to datatype*
  - o **Attributes:**
    - ID
    - Name
    - Static {classifier | instance }
    - *Reference to datatype*
- **Stereotype:**

- ID
- Name
- **Interface:**
  - ID
  - Name
  - **Operations (see Class->Operations)**
- **Package:**
  - ID
  - Name
- **Associations:**
  - ID
  - **Associations end:**
    - ID
    - Type {none | aggregate | composite}
    - Multiplicity (for example: 1..\*)
    - *Reference to class*
- **Dependencies:**
  - ID
  - Name
  - *Reference to client*
  - *Reference to supplier*
  - **Stereotype**
    - ID
    - Name

## Sequence diagram

- **Diagram:**
  - Name
  - **Loops:**
    - Number of the first message
    - Number of the last message
    - Minimum number of repetitions
    - Maximum number of repetitions

- Typical number of repetitions
- **Objects:**
  - ID
  - *Reference to base class*
  - **Lifetime:**
    - Number of the first message related to the object
    - Number of the last message related to the object
- **Links:**
  - ID
  - Name
  - **Ends of the link:**
    - ID
    - *Reference to Object*
- **Stimulations:**
  - ID
  - Name
  - *Reference to sender*
  - *Reference to receiver*
  - *Reference to link*
  - *Reference to call*
  - Ordernumber of the stimulation
  - Lifetime of the stimulation
  - **Execution time:**
    - Minimum execution time
    - Maximum execution time
    - Typical execution time
  - **Parameters**
    - Parameters order number
    - **Variable parameters**
      - Name
    - **Object parameters**
      - Name
  - Return value

- **Calls:**
  - ID
  - Name
  - *Reference to stimulation*

## Collaboration diagram

### - Collaboration diagram

- ID
- Name
- **Role:**
  - ID
  - Name
  - *Reference to base class*
  - *Reference to send messages*
  - *Reference to received messages*
- **Associations - (see class diagram)**
- **Interaction**
  - ID
  - Name
  - **Message**
    - ID
    - Name
    - *Reference to sender role*
    - *Reference to receiver role*
    - *Reference to carrier association*
    - TaggedValue: predecessor
    - TaggedValue: guard
    - TaggedValue: probability
    - TaggedValue: Counter.minimum
    - TaggedValue: Counter.typical
    - TaggedValue: Counter.maximum



- TaggedValue: stereotype
- TaggedValue: orderNumber

## State diagram

### - State diagram

- ID
- *Reference to models element*
- **Composite state**
  - ID
  - *Reference to state machine*
  - **Pseudostate (only if type is 'initial')**
    - ID
    - Name
    - *Reference to composite state*
    - *Reference to leaving transitions*
  - **Normal state**
    - ID
    - Name
    - *Reference to composite state*
    - *Reference to arriving transition*
    - *Reference to leaving transition*
    - **Actions when arriving**
      - ID
      - Name
    - **Actions when leaving - see previous**
    - **Actions while in state - see previous**
  - **Composite states final state**
    - ID
    - Name
    - *Reference to composite state enclosing the final state*
    - *Reference to transition entering the final state*
- **State transition**

- ID
- Name
- Guard
- *Reference to state machine which owns the transition*
- *Reference to the transitions source state*
- *Reference to the transitions target state*

## Activity diagram

### - Activity diagram

- ID
- **Activity state**
  - ID
  - *Reference to composite state*
  - *Reference to leaving transition*
  - *Reference to arriving transition*
- **Composite state**
  - ID
  - *Reference to state machine*
  - **Pseudo state**
    - ID
    - *Reference to composite state*
    - *Reference to leaving transition*
    - *Reference to arriving transition*
  - **Composite states final state**
    - ID
    - Name
    - *Reference to composite state enclosing the final state*
    - *Reference to arriving transition*
- **Transition**
  - ID
  - *Reference to the statemachine which owns the transition*
  - *Reference to the transitions source state*
  - *Reference to the transitions target state*

- **Guard**
  - ID
  - *Reference to transition*
  - Guard expression
- **Taggedvalues**
  - Minimal execution time of an activity state
  - Maximal execution time of an activity state
  - Typical execution time of an activity state
  - Probability of a transition
  - Decision, based on which the transition is selected
  - Loop state
  - Minimal number of loops
  - Maximal number of loops
  - Typical number of loops
  - Signal

## Appendix C: Problems with MAISA and Rational Rose

The current implementation of MAISA XMI-importer does not support activity states that can be expanded to other diagrams, such as activity-, collaboration, or statediagrams. These features does not exist because the CASE-tool supported in the xPerf-project was ArgoUML v0.12 that had no such functionality. However the estimation of memory consumption in MAISA is based on activitydiagrams which require bindings to other diagrams. The required relations are:

Activitydiagram -> Classdiagram  
(and optionally Activitydiagram -> Collaboration diagram)

AND

Activitystate -> Collaboration diagram

OR

Activitystate -> Subactivity diagram  
(and optionally Subactivitystate -> Collaboration diagram)

Additionally Rational Rose does not support a state of an activitydiagram (or statediagram) to be expanded to a collaborationdiagram. It is also difficult, if not impossible, to use tagged values for this binding because identifiers(xmi.id) of the UML-elements are not known before the XMI-document is generated. In other words the reference(xmi.id) to the collaboration diagram should be available from the activity- or subactivitystate that is bind to it. This is not the case with current version(v2002.05.20) of Rational Rose.