FMC and UML

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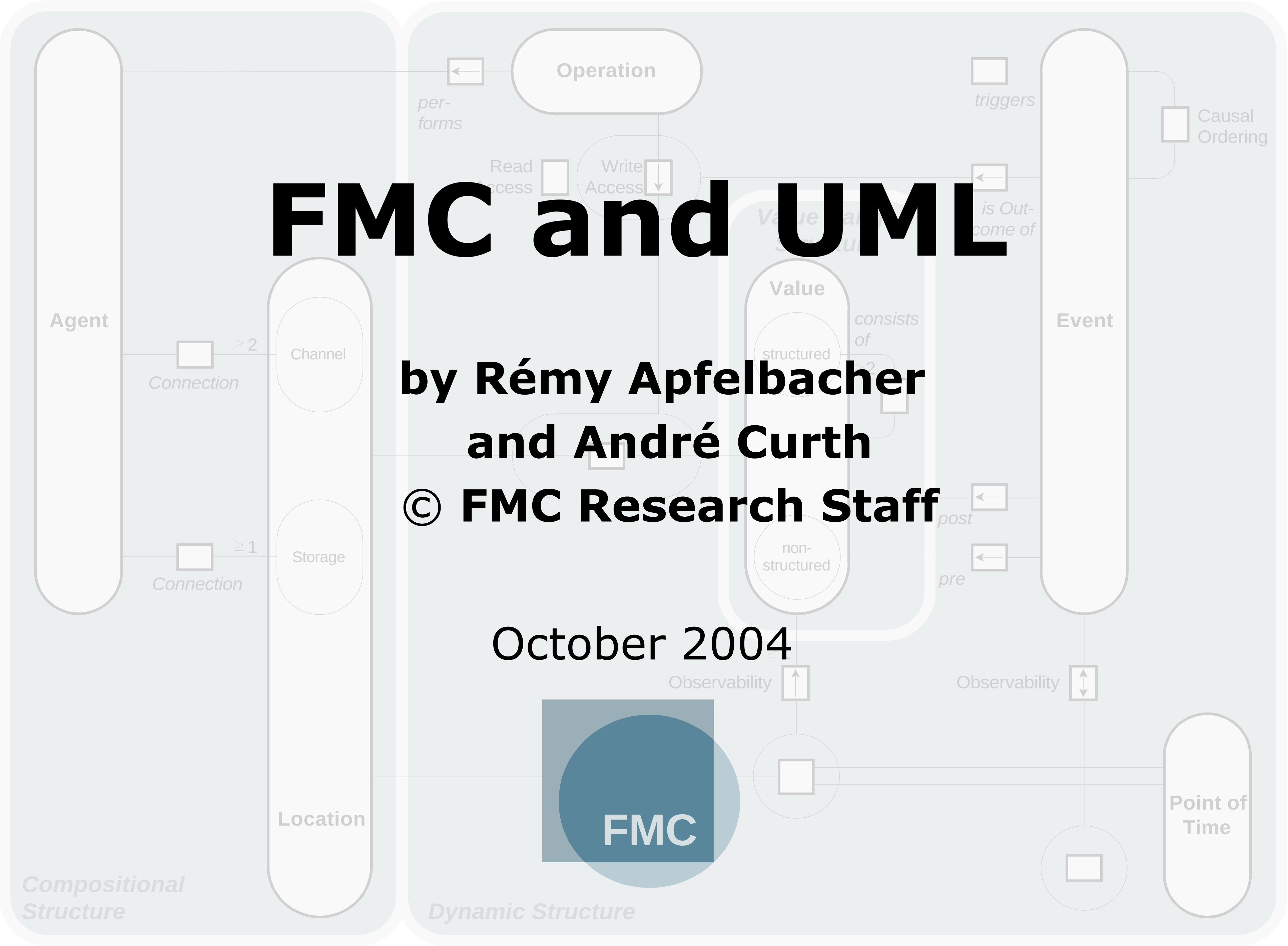


Audience

- This presentation serves as pragmatic introduction why FMC in necessary alongside UML.
- Intended for readers that have some basic knowledge about FMC and UML.
- In the example FMC block diagrams and UML package and class diagrams are used.

Summary

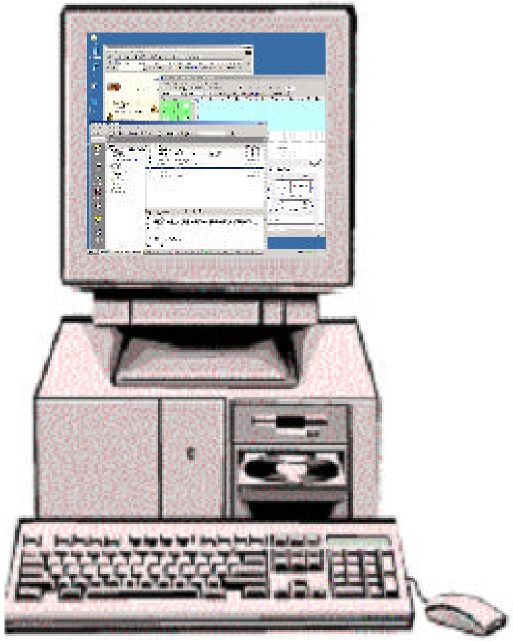
- FMC and UML do **not** compete against each other
- Different fields of concerns:
  - **FMC for system-related structures**
  - **UML for software-related structures**
- FMC and UML should be applied complementarily

Outline

1. **System and Software**
    1. Distinction between a system and its description
    2. Analogy
    3. Conclusion
2. **Practical application of UML**
3. **Classification of FMC and UML**
4. **Example of cooperation of FMC and UML**
5. **Bibliography**

1. System and Software

1.1. Distinction between a system and its description



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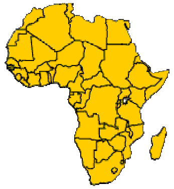
```
class  ConstraintSolver {
public:
  static ConstraintSolver*  Instance();

  void  Solve();
  void  AddConstraint(
         Graphic* startConnection,
         Graphic*  endConnection
  );
  void  RemoveConstraint(
         Graphic* startConnection,
         Graphic*  endConnection
  );
  ConstraintSolverMemento* CreateMemento();
  void  SetMemento(ConstraintSolverMemento*);
private:
  // nontrivial state and operations enforcing
  // connectivity semantics
};
```

The **system** (=dynamic system) emerges from the execution of the software.

The **software** (=source code) is a computer-understandable description of the dynamic system.

1. System and Software

1.2. Analogy



- **Africa (System)**
  - **structural elements:** countries, climate, vegetation...

- **Book about Africa (Software)**
  - **structural elements:** chapters, pages, lines ...

I. Africa can be described in a book.

II. The structure of Africa differs from the structure of the book.

III. Understanding the structure of the book does not mean understanding Africa.

↯ Understanding a book differs from understanding a software.

1. System and Software

1.2. Analogy

I. Africa can be described in a book.

- The herein described Africa is formed in the mind of the reader.
- This book can be written in different languages and nonetheless express the same notions.
- The book must contain statements about Africa.

+ The book describes Africa like software describes a system.

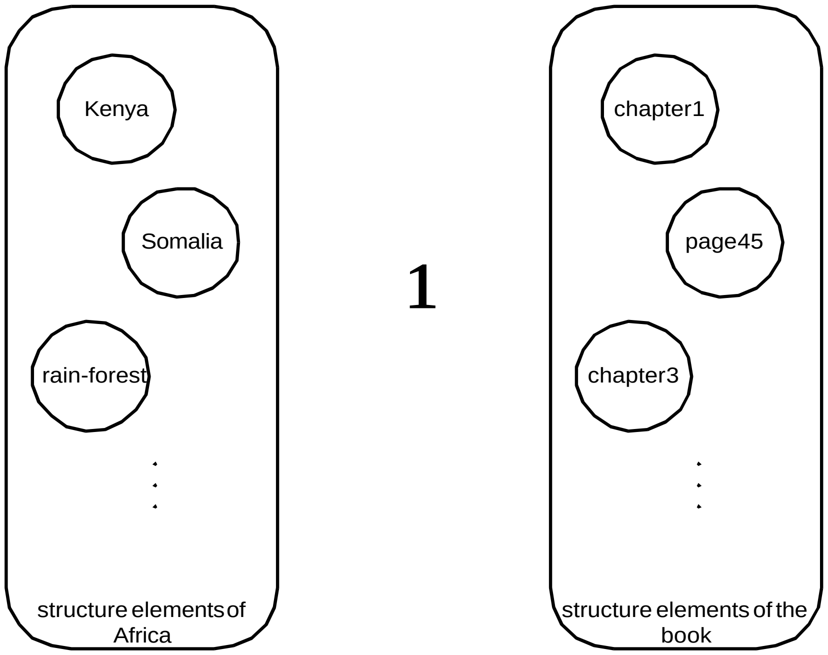
+ The system emerges when a computer executes the software.

+ The software can be written in different languages describing the same system.

1. System and Software

1.2. Analogy

II. The structure of Africa differs from the structure of the book.



- The structure of Africa and the structure of the book are two completely disjoint areas.
- The book could potentially be written in form of a travelogue having a structure with totally different characteristics.

1. System and Software

1.2. Analogy

III. Understanding the structure of the book does not mean understanding Africa.

- Understanding the structure of the book is simple but it does not help to understand Africa.
- To understand the described Africa one must read the book.

1. System and Software

1.2. Analogy

ϟ **Understanding a book differs from understanding a software.**

- Africa can be understood by humans reading its description because the book was made for this purpose.

- A system described only by its software can not be effectively understood by humans because this type of description was made to be understood by machines and is usually too complex.

- Also understanding the software's structure is not as trivial as understanding the structure of a book also due to its complexity.

- As seen in the analogy understanding the software's structure is insufficient for understanding the system.

1. System and Software

1.3. Conclusion

Thus, there is the need for a description of the

system structure
and
software structure

made for humans.

Outline

1. **System and Software**
2. **Practical application of UML**
    1. Scope
    2. Visual relevance
    3. Placement in the software life cycle
    4. Conclusion
3. **Classification of FMC and UML**
4. **Example of cooperation of FMC and UML**
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2. Practical application of UML

2.1. Scope

- **UML is used to design object-orientated software.**
  - *“The majority of UML diagrams I see are class diagrams. […] the most useful parts of the UML: class diagrams and sequence diagrams.” [1]*
  - *“…UML’s power derived from the ability of its class modeling language to describe high-level concepts in terms of classes of objects and their properties and relationships while directly modeling programming language artifacts in OO languages…”[2]*
- **UML is very well suited for describing the relationships between elements of object-oriented software**
  - some elements: package, class, component, ...
  - some relations: import, generalization, association, implements, ...
- **Nearly all programming level constructs have a direct counterpart in UML**

2. Practical application of UML

2.1. Scope

- **UML is not used in practice for system-related descriptions (architecture).**
  - *"…the UML specification is a collection of definitions of different kinds of specifications, not different kinds of system phenomena." [3]*
  - Recent researches in industrial environment discover the use of ***ad-hoc notations*** in the architecture phase. [4]
- **There is a need for architecture descriptions**
  - Why is UML not used in practice for the architecture phase?
- **UML is not well suited for system descriptions**
  - too tight connection to the programming level
  - model elements and relationships for system-related entities are missing

2. Practical application of UML

2.2. Visual relevance

- **UML class or sequence diagrams are immediately associated with software structures and not with system structures.**

- **Real-life UML class diagrams -- usually tool supported -- tend to show too many details of classes and their dependencies:**
  - cumbersome
  - overcrowded
  - complex

2. Practical application of UML

2.3. Placement in the software life cycle

- **UML is applied late in the life cycle because**
  - it is not adequate for system-related descriptions
  - most widely used for software related issues
    - UML Class Diagrams
    - UML Sequence Diagrams

2. Practical application of UML

2.4. Conclusion

- **UML is not and can not be used to describe systems. Nevertheless concepts for this are needed.**
- **A visual distinction between software and system related descriptions would be advantageous:**
  - visual separation of semantically different fields

Outline

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2. **Practical application of UML**
3. **Classification of FMC and UML**
    1. Scope of FMC
    2. Visual relevance of FMC
    3. Placement in the software life cycle
    4. Conclusion
4. **Example of cooperation of FMC and UML**
5. **Bibliography**

3. Classification of FMC and UML

3.1. Scope of FMC

- **FMC serves primarily for describing systems in a comprehensible way and thus decreases communication problems due to**
  - a fundamental and precise terminology
  - a precise graphical notation optimised for human comprehension
  - a comprehensible model reflecting the structures of the overall system

- **FMC differs essentially from UML since it is**
  - not software but system-related
  - paradigm independent
  - located on a higher level allowing very abstract models
  - semiformal

3. Classification of FMC and UML

3.2. Visual relevance of FMC

- **There is no widely accepted standard regarding the notation and terminology for the architecture phase within the software life cycle.**

- **FMC offers 3 diagram types with only a few arc and node types.**
  - tool independent
  - hand drawings can be made easily

- **FMC diagrams are directly correlated to system structures and not to software structures by the reader.**

3. Classification of FMC and UML

3.3. Placement in the software life cycle

Software Life Cycle

... Analysis	Architecture	Design	Coding ...
Requirement tables	FMC	UML mainly Class Diagrams and Sequence Diagrams	
system-related structures description of the dynamic systems, which arises from the execution of a program		software-related structures description of an object orientated program	

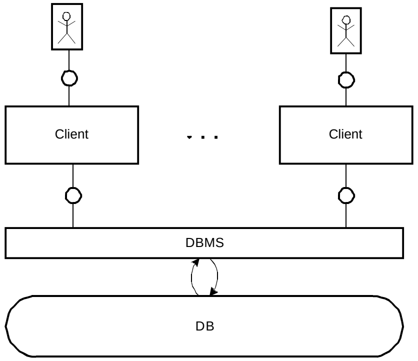
FMC fills the gap

3. Classification of FMC and UML

3.4. Conclusion

FMC

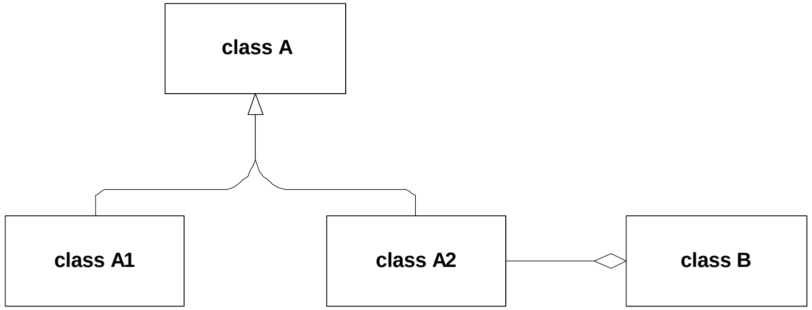
is suited for describing system-related structures



- **System**
  - **structural elements:** agent, storage, operation, values …

UML

is suited for describing software-related structures



- **Software**
  - **structural elements:** classes, files, packages …

3. Classification of FMC and UML

3.4. Conclusion

- **FMC and UML are not mutually exclusive since they are applicable in different phases in the software development cycle.**

- **FMC and UML are complementary.**

Outline

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2. **Practical application of UML**
3. **Classification of FMC and UML**
4. **Example of cooperation of FMC and UML**
    1. Introduction
    2. UML description of the software
    3. FMC description of the system
    4. Classification of the UML description
    5. Conclusion
5. **Bibliography**

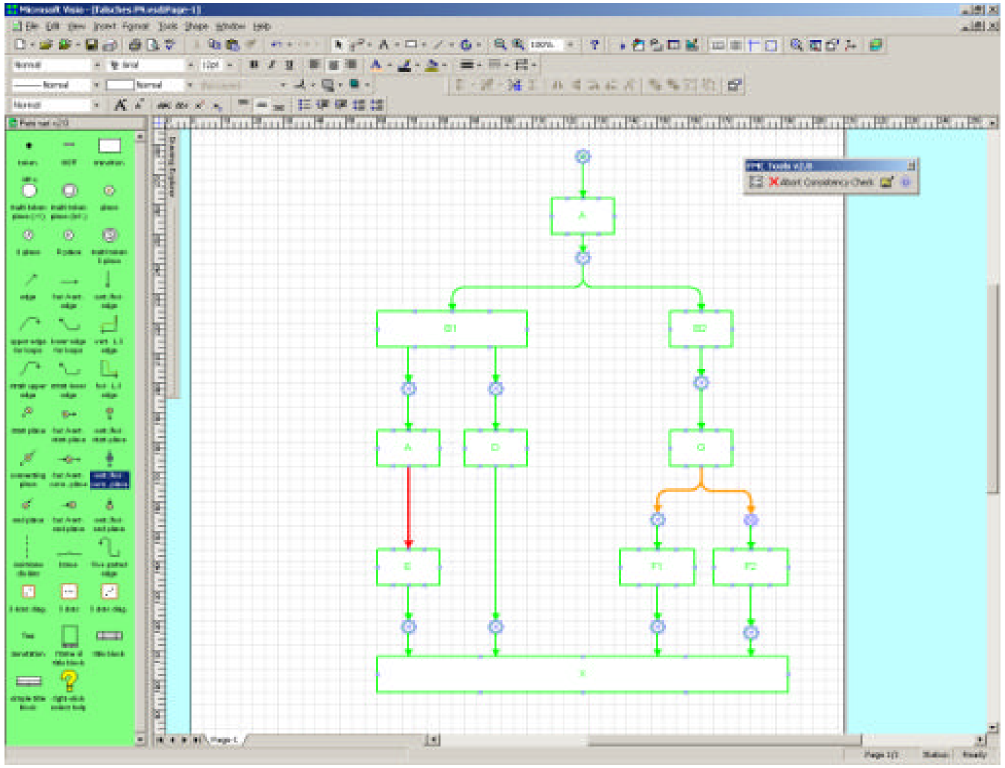
4. Example of cooperation of FMC and UML

4.1. Introduction

FMC

Example: Consistency Checker of the FMC Support Tools

- Checks FMC-drawings drawn in Visio for notational mistakes
- colours incorrect elements



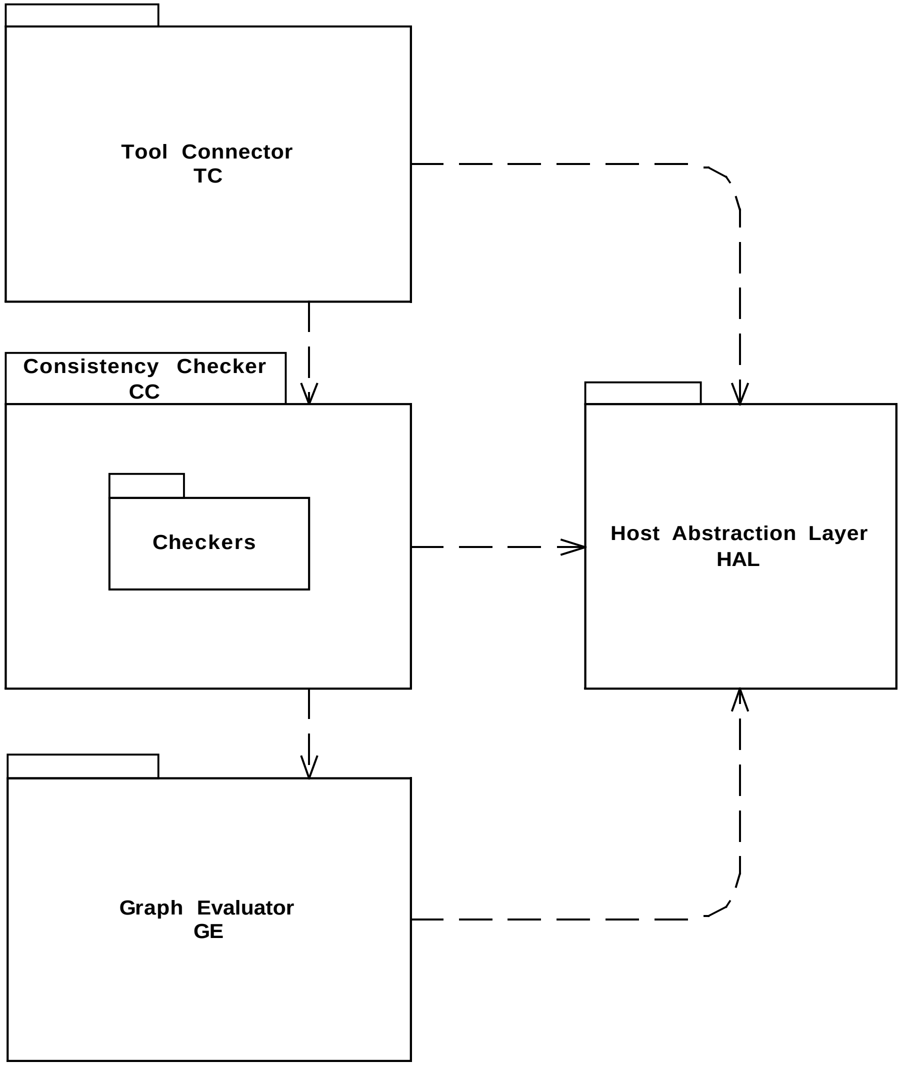
4. Example of cooperation of FMC and UML

4.2. UML description of the software

How long do you think it will take you to understand the system described by the following UML package and class diagram?

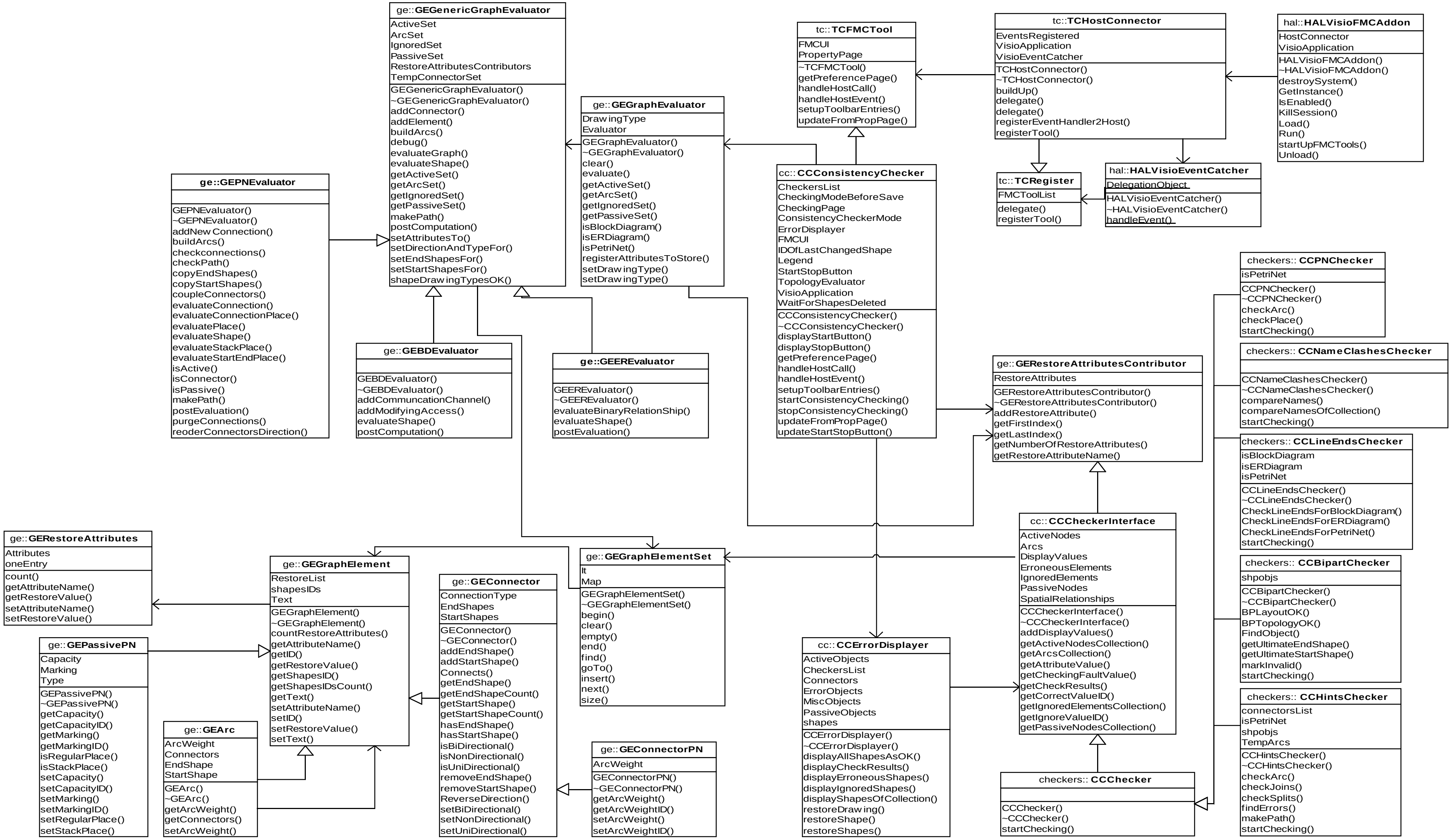
4. Example of cooperation of FMC and UML

4.2. UML description of the software



4. Example of cooperation of FMC and UML

4.2. UML description of the software



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GEPNEvaluator()
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checkconnections()
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postEvaluation()
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FMCUI
PropertyPage
~TCFMCTool()
getPreferencePage()
handleHostCall()
handleHostEvent()
setupToolbarEntries()
updateFromPropPage()

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EventsRegistered
VisioApplication
VisioEventCatcher
TCHostConnector()
~TCHostConnector()
buildUp()
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CheckersList
CheckingModeBeforeSave
CheckingPage
ConsistencyCheckerMode
ErrorDisplayer
FMCUI
IDOfLastChangedShape
Legend
StartStopButton
TopologyEvaluator
VisioApplication
WaitForShapesDeleted
CCConsistencyChecker()
~CCConsistencyChecker()
displayStartButton()
displayStopButton()
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handleHostCall()
handleHostEvent()
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startConsistencyChecking()
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startChecking()

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compareNames()
compareNamesOfCollection()
startChecking()

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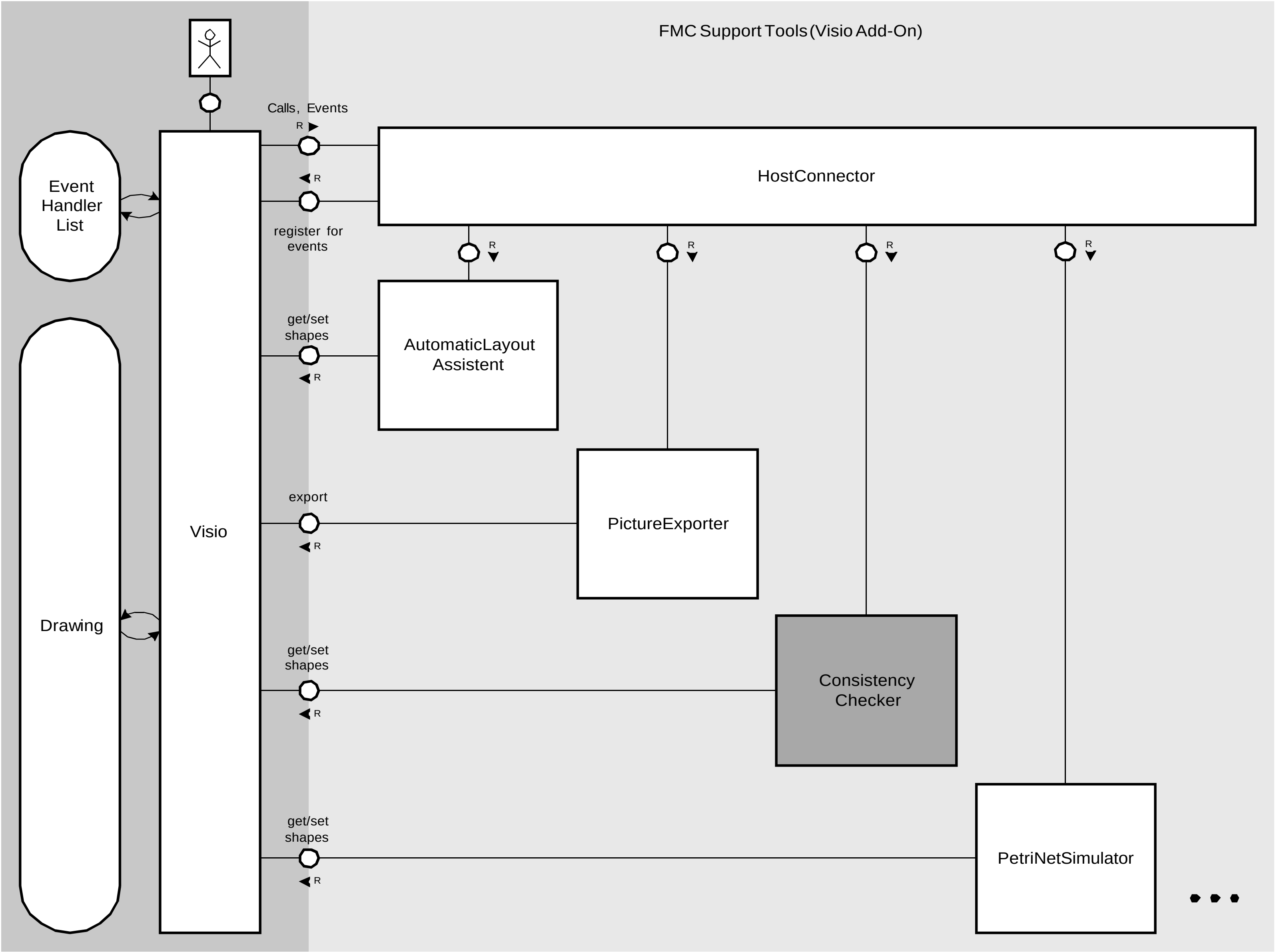
4. Example of cooperation of FMC and UML

4.3. FMC description of the system

How long will you need to understand the system with the following FMC diagrams?

4. Example of cooperation of FMC and UML

4.3. FMC description of the system



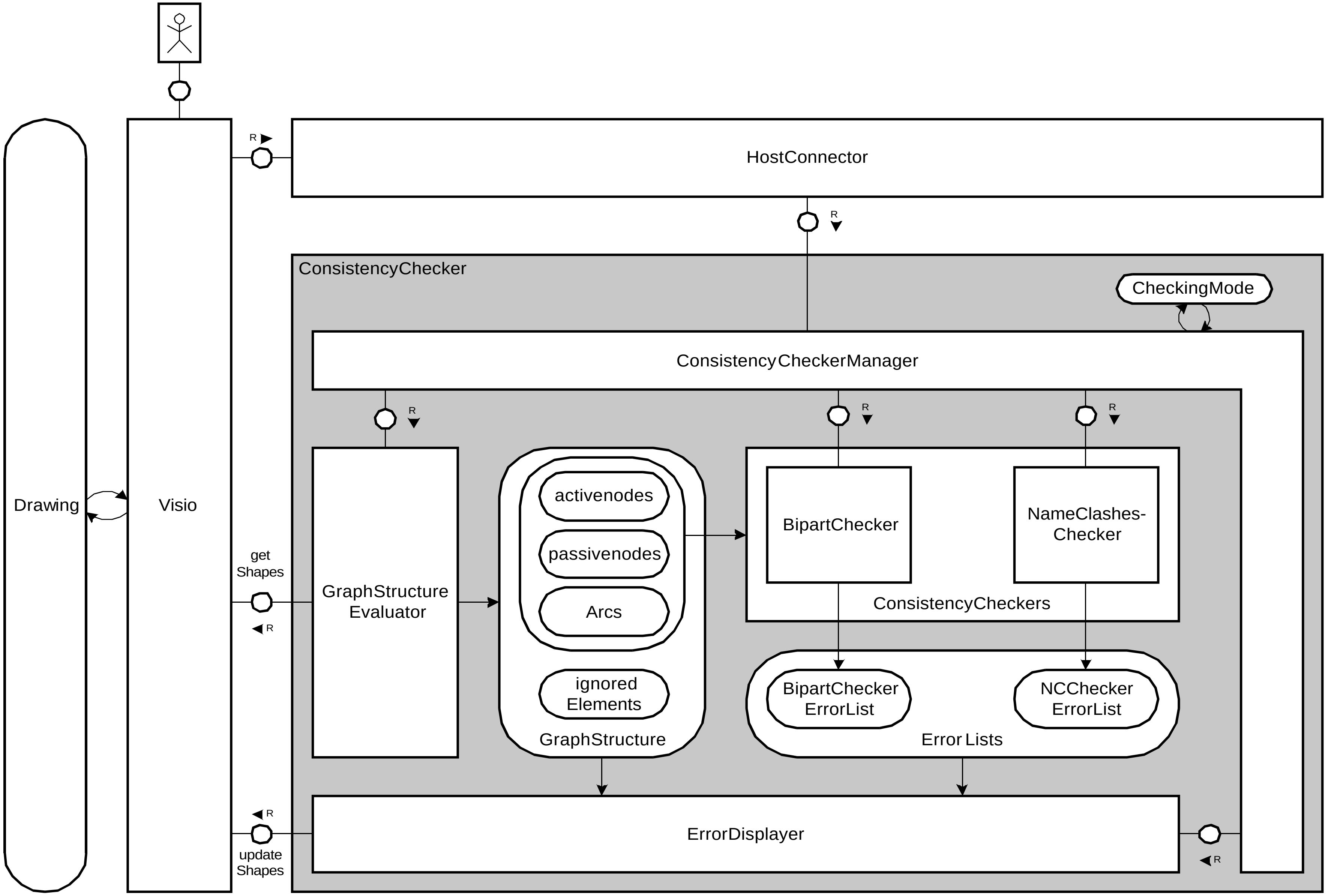
4. Example of cooperation of FMC and UML

4.3. FMC description of the system

- **additional annotations:**
  - *Visio* informs the *Host Connector* about occurrences of registered events.
  - The *Host Connector* dispatches them to all the *Tools*.

4. Example of cooperation of FMC and UML

4.3. FMC description of the system



4. Example of cooperation of FMC and UML

4.3. FMC description of the system

FMC

- **additional annotations:**

1. The *User* triggers the start of the checking process. The trigger is forwarded by *Visio* and the *Host Connector* to the *Consistency Checker*.

2. *Graph Structure Evaluator* fills the *Graph Structure*.

3. *Checkers* verify the *Graph Structure* and fill the *Error Lists*.

4. *Error Displayer* colours the shapes in the drawing according to the current *Error Lists* and the *Graph Structure*.

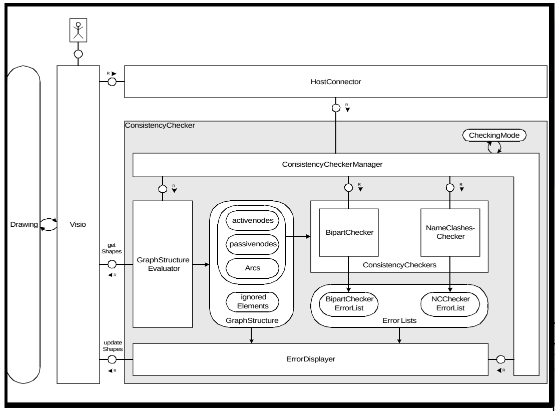
4. Example of cooperation of FMC and UML

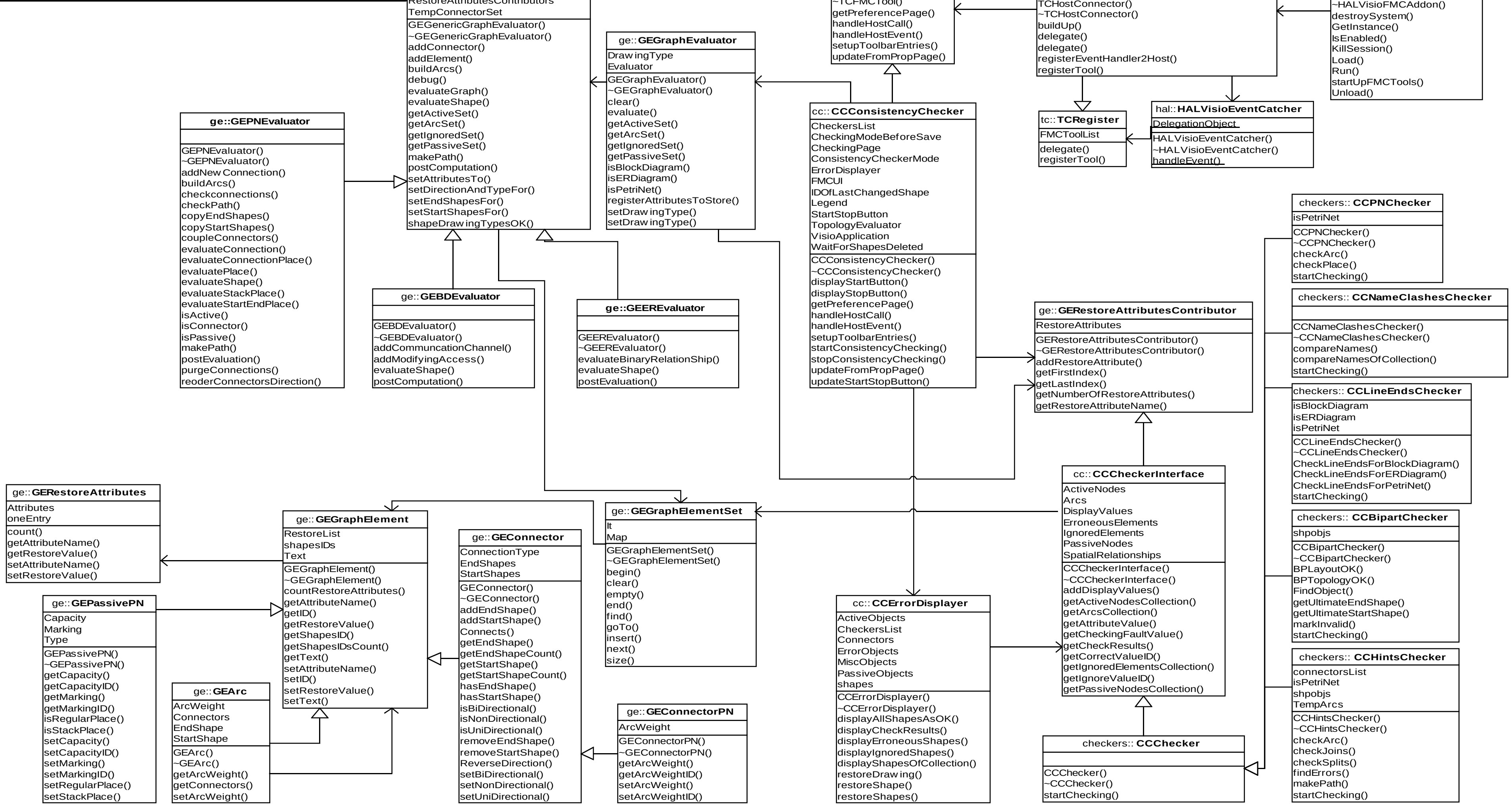
4.4. Classification of the UML description

How are the UML diagram and the FMC diagram correlated?

4. Example of cooperation of FMC and UML

4.4. Classification of the UML description





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compareNames()
compareNamesOfCollection()
startChecking()

checkers:: **CCLineEndsChecker**
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cc::**CCCheckerInterface**
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IgnoredElements
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Attributes
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RestoreList
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ge::**GEConnector**
ConnectionType
EndShapes
StartShapes
GEConnector()
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hasEndShape()
hasStartShape()
isBiDirectional()
isNonDirectional()
isUniDirectional()
removeEndShape()
removeStartShape()
ReverseDirection()
setBiDirectional()
setNonDirectional()
setUniDirectional()

checkers:: **CCBipartChecker**
shpobjs
CCBipartChecker()
~CCBipartChecker()
BPLayoutOK()
BPTopologyOK()
FindObject()
getUltimateEndShape()
getUltimateStartShape()
markInvalid()
startChecking()

ge::**GEPassivePN**
Capacity
Marking
Type
GEPassivePN()
~GEPassivePN()
getCapacity()
getCapacityID()
getMarking()
getMarkingID()
isRegularPlace()
isStackPlace()
setCapacity()
setCapacityID()
setMarking()
setMarkingID()
setRegularPlace()
setStackPlace()

ge::**GEArc**
ArcWeight
Connectors
EndShape
StartShape
GEArc()
~GEArc()
getArcWeight()
getConnectors()
setArcWeight()

cc::**CCErrorDisplayer**
ActiveObjects
CheckersList
Connectors
ErrorObjects
MiscObjects
PassiveObjects
shapes
CCErrorDisplayer()
~CCErrorDisplayer()
displayAllShapesAsOK()
displayCheckResults()
displayErroneousShapes()
displayIgnoredShapes()
displayShapesOfCollection()
restoreDraw ing()
restoreShape()
restoreShapes()

ge::**GEConnectorPN**
ArcWeight
GEConnectorPN()
~GEConnectorPN()
getArcWeight()
getArcWeightID()
setArcWeight()
setArcWeightID()

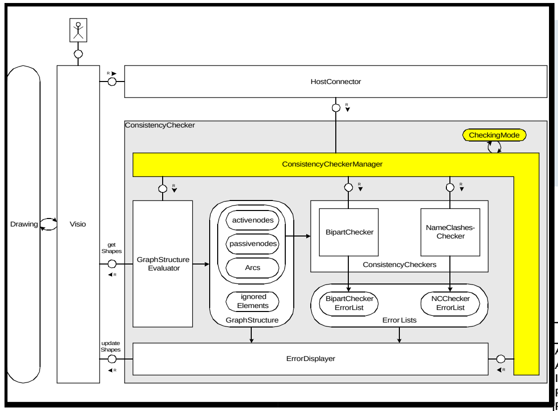
checkers:: **CCChecker**
CCChecker()
~CCChecker()
startChecking()

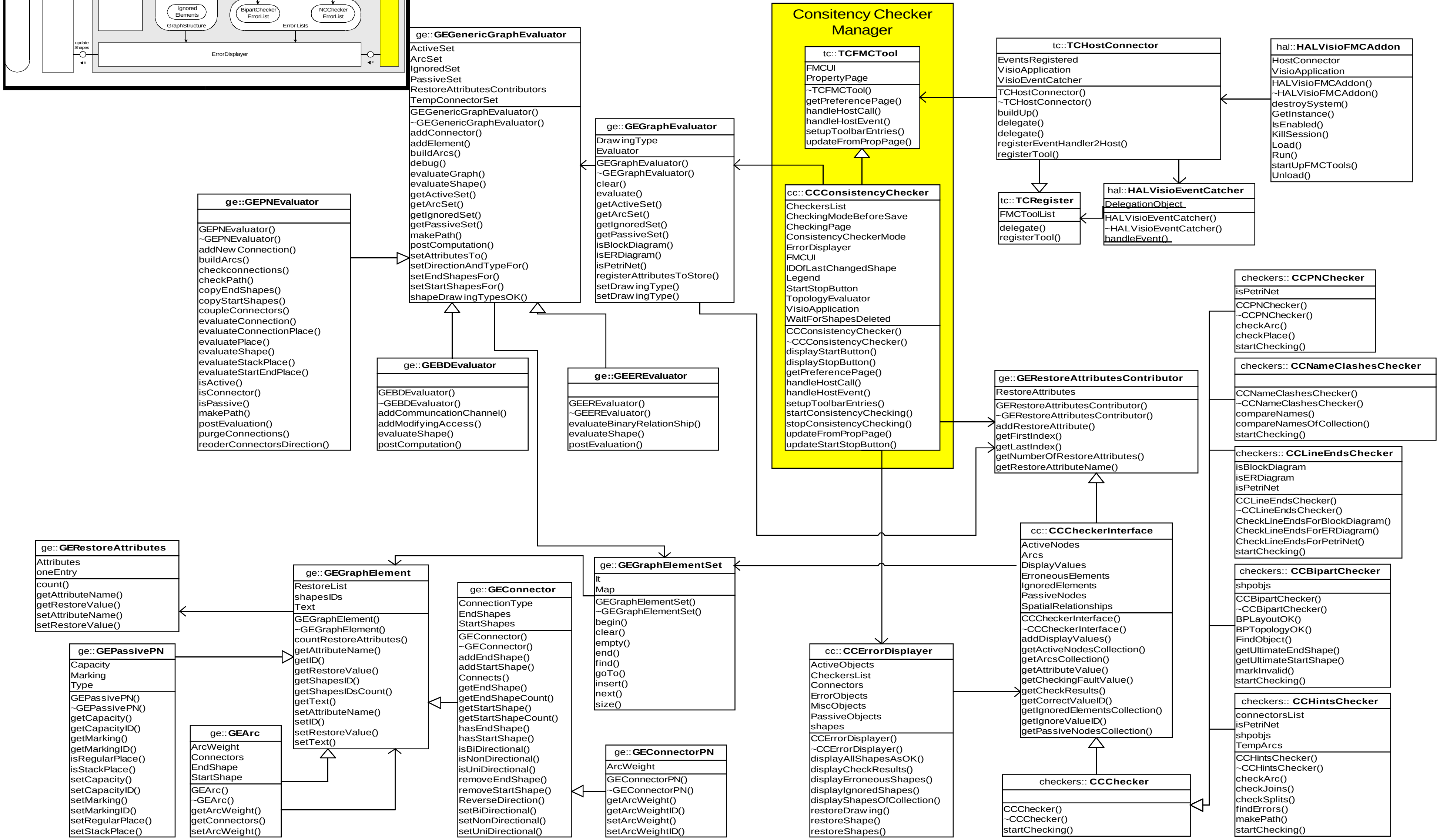
checkers:: **CCHintsChecker**
connectorsList
isPetriNet
shpobjs
TempArcs
CCHintsChecker()
~CCHintsChecker()
checkArc()
checkJoins()
checkSplits()
findErrors()
makePath()
startChecking()

4. Example of cooperation of FMC and UML

4.4. Classification of the UML description

The Consistency Checker Manager and its Checking Mode are basically realized by one class.





Consitency Checker Manager

tc::**TCFMCTool**
FMCUI
PropertyPage
~TCFMCTool()
getPreferencePage()
handleHostCall()
handleHostEvent()
setupToolbarEntries()
updateFromPropPage()

cc::**CCConsistencyChecker**
CheckersList
CheckingModeBeforeSave
CheckingPage
ConsistencyCheckerMode
ErrorDisplayer
FMCUI
IDOfLastChangedShape
Legend
StartStopButton
TopologyEvaluator
VisioApplication
WaitForShapesDeleted
CCConsistencyChecker()
~CCConsistencyChecker()
displayStartButton()
displayStopButton()
getPreferencePage()
handleHostCall()
handleHostEvent()
setupToolbarEntries()
startConsistencyChecking()
stopConsistencyChecking()
updateFromPropPage()
updateStartStopButton()

ge::**GEGenericGraphEvaluator**
ActiveSet
ArcSet
IgnoredSet
PassiveSet
RestoreAttributesContributors
TempConnectorSet
GEGenericGraphEvaluator()
~GEGenericGraphEvaluator()
addConnector()
addElement()
buildArcs()
debug()
evaluateGraph()
evaluateShape()
getActiveSet()
getArcSet()
getIgnoredSet()
getPassiveSet()
makePath()
postComputation()
setAttributesTo()
setDirectionAndTypeFor()
setEndShapesFor()
setStartShapesFor()
shapeDrawingTypesOK()

ge::**GEGraphEvaluator**
DrawingType
Evaluator
GEGraphEvaluator()
~GEGraphEvaluator()
clear()
evaluate()
getActiveSet()
getArcSet()
getIgnoredSet()
getPassiveSet()
isBlockDiagram()
isERDiagram()
isPetriNet()
registerAttributesToStore()
setDrawingType()
setDrawingType()

ge::**GEPNEvaluator**
GEPNEvaluator()
~GEPNEvaluator()
addNewConnection()
buildArcs()
checkconnections()
checkPath()
copyEndShapes()
copyStartShapes()
coupleConnectors()
evaluateConnection()
evaluateConnectionPlace()
evaluatePlace()
evaluateShape()
evaluateStackPlace()
evaluateStartEndPlace()
isActive()
isConnector()
isPassive()
makePath()
postEvaluation()
purgeConnections()
reoderConnectorsDirection()

ge::**GEBDEvaluator**
GEBDEvaluator()
~GEBDEvaluator()
addCommunicationChannel()
addModifyingAccess()
evaluateShape()
postComputation()

ge::**GEEREvaluator**
GEEREvaluator()
~GEEREvaluator()
evaluateBinaryRelationShip()
evaluateShape()
postEvaluation()

tc::**TCHostConnector**
EventsRegistered
VisioApplication
VisioEventCatcher
TCHostConnector()
~TCHostConnector()
buildUp()
delegate()
delegate()
registerEventHandler2Host()
registerTool()

hal::**HALVisioFMCAddon**
HostConnector
VisioApplication
HALVisioFMCAddon()
~HALVisioFMCAddon()
destroySystem()
GetInstance()
IsEnabled()
KillSession()
Load()
Run()
startUpFMCTools()
Unload()

tc::**TCRegister**
FMCToolList
delegate()
registerTool()

hal::**HALVisioEventCatcher**
DelegationObject
HALVisioEventCatcher()
~HALVisioEventCatcher()
handleEvent()

checkers:: **CCPNChecker**
isPetriNet
CCPNChecker()
~CCPNChecker()
checkArc()
checkPlace()
startChecking()

checkers:: **CCNameClashesChecker**
CCNameClashesChecker()
~CCNameClashesChecker()
compareNames()
compareNamesOfCollection()
startChecking()

ge::**GERestoreAttributesContributor**
RestoreAttributes
GERestoreAttributesContributor()
~GERestoreAttributesContributor()
addRestoreAttribute()
getFirstIndex()
getLastIndex()
getNumberOfRestoreAttributes()
getRestoreAttributeName()

checkers:: **CCLineEndsChecker**
isBlockDiagram
isERDiagram
isPetriNet
CCLineEndsChecker()
~CCLineEndsChecker()
CheckLineEndsForBlockDiagram()
CheckLineEndsForERDiagram()
CheckLineEndsForPetriNet()
startChecking()

cc::**CCCheckerInterface**
ActiveNodes
Arcs
DisplayValues
ErroneousElements
IgnoredElements
PassiveNodes
SpatialRelationships
CCCheckerInterface()
~CCCheckerInterface()
addDisplayValues()
getActiveNodesCollection()
getArcsCollection()
getAttributeValue()
getCheckingFaultValue()
getCheckResults()
getCorrectValueID()
getIgnoredElementsCollection()
getIgnoreValueID()
getPassiveNodesCollection()

checkers:: **CCBipartChecker**
shpobjs
CCBipartChecker()
~CCBipartChecker()
BPLayoutOK()
BPTopologyOK()
FindObject()
getUltimateEndShape()
getUltimateStartShape()
markInvalid()
startChecking()

checkers:: **CCHintsChecker**
connectorsList
isPetriNet
shpobjs
TempArcs
CCHintsChecker()
~CCHintsChecker()
checkArc()
checkJoins()
checkSplits()
findErrors()
makePath()
startChecking()

checkers:: **CCChecker**
CCChecker()
~CCChecker()
startChecking()

cc::**CCErrorDisplayer**
ActiveObjects
CheckersList
Connectors
ErrorObjects
MiscObjects
PassiveObjects
shapes
CCErrorDisplayer()
~CCErrorDisplayer()
displayAllShapesAsOK()
displayCheckResults()
displayErroneousShapes()
displayIgnoredShapes()
displayShapesOfCollection()
restoreDrawing()
restoreShape()
restoreShapes()

ge::**GERestoreAttributes**
Attributes
oneEntry
count()
getAttributeName()
getRestoreValue()
setAttributeName()
setRestoreValue()

ge::**GEGraphElement**
RestoreList
shapesIDs
Text
GEGraphElement()
~GEGraphElement()
countRestoreAttributes()
getAttributeName()
getID()
getRestoreValue()
getShapesID()
getShapesIDsCount()
getText()
setAttributeName()
setID()
setRestoreValue()
setText()

ge::**GEGraphElementSet**
It
Map
GEGraphElementSet()
~GEGraphElementSet()
begin()
clear()
empty()
end()
find()
goTo()
insert()
next()
size()

ge::**GEConnector**
ConnectionType
EndShapes
StartShapes
GEConnector()
~GEConnector()
addEndShape()
addStartShape()
Connects()
getEndShape()
getEndShapeCount()
getStartShape()
getStartShapeCount()
hasEndShape()
hasStartShape()
isBiDirectional()
isNonDirectional()
isUniDirectional()
removeEndShape()
removeStartShape()
ReverseDirection()
setBiDirectional()
setNonDirectional()
setUniDirectional()

ge::**GEPassivePN**
Capacity
Marking
Type
GEPassivePN()
~GEPassivePN()
getCapacity()
getCapacityID()
getMarking()
getMarkingID()
isRegularPlace()
isStackPlace()
setCapacity()
setCapacityID()
setMarking()
setMarkingID()
setRegularPlace()
setStackPlace()

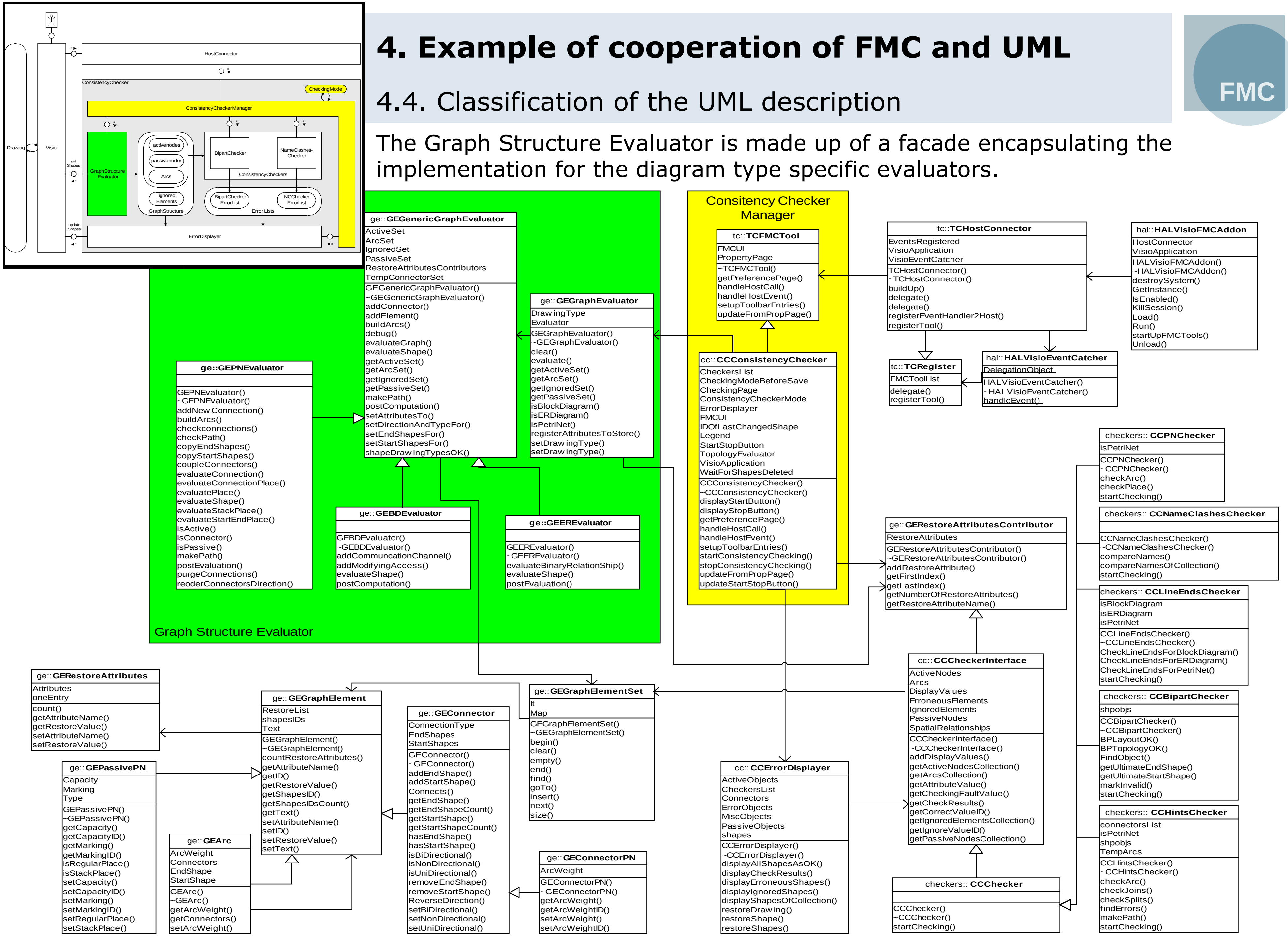
ge::**GEArc**
ArcWeight
Connectors
EndShape
StartShape
GEArc()
~GEArc()
getArcWeight()
getConnectors()
setArcWeight()

ge::**GEConnectorPN**
ArcWeight
GEConnectorPN()
~GEConnectorPN()
getArcWeight()
getArcWeightID()
setArcWeight()
setArcWeightID()

4. Example of cooperation of FMC and UML

4.4. Classification of the UML description

The Graph Structure Evaluator is made up of a facade encapsulating the implementation for the diagram type specific evaluators.



ge::**GEGenericGraphEvaluator**
ActiveSet
ArcSet
IgnoredSet
PassiveSet
RestoreAttributesContributors
TempConnectorSet
GEGenericGraphEvaluator()
~GEGenericGraphEvaluator()
addConnector()
addElement()
buildArcs()
debug()
evaluateGraph()
evaluateShape()
getActiveSet()
getArcSet()
getIgnoredSet()
getPassiveSet()
makePath()
postComputation()
setAttributesTo()
setDirectionAndTypeFor()
setEndShapesFor()
setStartShapesFor()
shapeDraw ingTypesOK()

ge::**GEGraphEvaluator**
Draw ingType
Evaluator
GEGraphEvaluator()
~GEGraphEvaluator()
clear()
evaluate()
getActiveSet()
getArcSet()
getIgnoredSet()
getPassiveSet()
isBlockDiagram()
isERDiagram()
isPetriNet()
registerAttributesToStore()
setDraw ingType()
setDraw ingType()

ge::GEPNEvaluator
GEPNEvaluator()
~GEPNEvaluator()
addNew Connection()
buildArcs()
checkconnections()
checkPath()
copyEndShapes()
copyStartShapes()
coupleConnectors()
evaluateConnection()
evaluateConnectionPlace()
evaluatePlace()
evaluateShape()
evaluateStackPlace()
evaluateStartEndPlace()
isActive()
isConnector()
isPassive()
makePath()
postEvaluation()
purgeConnections()
reoderConnectorsDirection()

ge::**GEBDEvaluator**
GEBDEvaluator()
~GEBDEvaluator()
addCommuncationChannel()
addModifyingAccess()
evaluateShape()
postComputation()

ge::GEEREvaluator
GEEREvaluator()
~GEEREvaluator()
evaluateBinaryRelationShip()
evaluateShape()
postEvaluation()

tc::**TCFMCTool**
FMCUI
PropertyPage
~TCFMCTool()
getPreferencePage()
handleHostCall()
handleHostEvent()
setupToolbarEntries()
updateFromPropPage()

cc::**CCConsistencyChecker**
CheckersList
CheckingModeBeforeSave
CheckingPage
ConsistencyCheckerMode
ErrorDisplayer
FMCUI
IDOfLastChangedShape
Legend
StartStopButton
TopologyEvaluator
VisioApplication
WaitForShapesDeleted
CCConsistencyChecker()
~CCConsistencyChecker()
displayStartButton()
displayStopButton()
getPreferencePage()
handleHostCall()
handleHostEvent()
setupToolbarEntries()
startConsistencyChecking()
stopConsistencyChecking()
updateFromPropPage()
updateStartStopButton()

tc::**TCHostConnector**
EventsRegistered
VisioApplication
VisioEventCatcher
TCHostConnector()
~TCHostConnector()
buildUp()
delegate()
delegate()
registerEventHandler2Host()
registerTool()

hal::**HALVisioFMCAddon**
HostConnector
VisioApplication
HALVisioFMCAddon()
~HALVisioFMCAddon()
destroySystem()
GetInstance()
IsEnabled()
KillSession()
Load()
Run()
startUpFMCTools()
Unload()

tc::**TCRegister**
FMCToolList
delegate()
registerTool()

hal::**HALVisioEventCatcher**
DelegationObject
HALVisioEventCatcher()
~HALVisioEventCatcher()
handleEvent()

checkers:: **CCPNChecker**
isPetriNet
CCPNChecker()
~CCPNChecker()
checkArc()
checkPlace()
startChecking()

checkers:: **CCNameClashesChecker**
CCNameClashesChecker()
~CCNameClashesChecker()
compareNames()
compareNamesOfCollection()
startChecking()

ge::**GERestoreAttributesContributor**
RestoreAttributes
GERestoreAttributesContributor()
~GERestoreAttributesContributor()
addRestoreAttribute()
getFirstIndex()
getLastIndex()
getNumberOfRestoreAttributes()
getRestoreAttributeName()

checkers:: **CCLineEndsChecker**
isBlockDiagram
isERDiagram
isPetriNet
CCLineEndsChecker()
~CCLineEndsChecker()
CheckLineEndsForBlockDiagram()
CheckLineEndsForERDiagram()
CheckLineEndsForPetriNet()
startChecking()

cc::**CCCheckerInterface**
ActiveNodes
Arcs
DisplayValues
ErroneousElements
IgnoredElements
PassiveNodes
SpatialRelationships
CCCheckerInterface()
~CCCheckerInterface()
addDisplayValues()
getActiveNodesCollection()
getArcsCollection()
getAttributeValue()
getCheckingFaultValue()
getCheckResults()
getCorrectValueID()
getIgnoredElementsCollection()
getIgnoreValueID()
getPassiveNodesCollection()

checkers:: **CCBipartChecker**
shpobjs
CCBipartChecker()
~CCBipartChecker()
BPLayoutOK()
BPTopologyOK()
FindObject()
getUltimateEndShape()
getUltimateStartShape()
markInvalid()
startChecking()

checkers:: **CCHintsChecker**
connectorsList
isPetriNet
shpobjs
TempArcs
CCHintsChecker()
~CCHintsChecker()
checkArc()
checkJoins()
checkSplits()
findErrors()
makePath()
startChecking()

checkers:: **CCChecker**
CCChecker()
~CCChecker()
startChecking()

cc::**CCErrorDisplayer**
ActiveObjects
CheckersList
Connectors
ErrorObjects
MiscObjects
PassiveObjects
shapes
CCErrorDisplayer()
~CCErrorDisplayer()
displayAllShapesAsOK()
displayCheckResults()
displayErroneousShapes()
displayIgnoredShapes()
displayShapesOfCollection()
restoreDraw ing()
restoreShape()
restoreShapes()

ge::**GEGraphElementSet**
It
Map
GEGraphElementSet()
~GEGraphElementSet()
begin()
clear()
empty()
end()
find()
goTo()
insert()
next()
size()

ge::**GERestoreAttributes**
Attributes
oneEntry
count()
getAttributeName()
getRestoreValue()
setAttributeName()
setRestoreValue()

ge::**GEGraphElement**
RestoreList
shapesIDs
Text
GEGraphElement()
~GEGraphElement()
countRestoreAttributes()
getAttributeName()
getID()
getRestoreValue()
getShapesID()
getShapesIDsCount()
getText()
setAttributeName()
setID()
setRestoreValue()
setText()

ge::**GEConnector**
ConnectionType
EndShapes
StartShapes
GEConnector()
~GEConnector()
addEndShape()
addStartShape()
Connects()
getEndShape()
getEndShapeCount()
getStartShape()
getStartShapeCount()
hasEndShape()
hasStartShape()
isBiDirectional()
isNonDirectional()
isUniDirectional()
removeEndShape()
removeStartShape()
ReverseDirection()
setBiDirectional()
setNonDirectional()
setUniDirectional()

ge::**GEPassivePN**
Capacity
Marking
Type
GEPassivePN()
~GEPassivePN()
getCapacity()
getCapacityID()
getMarking()
getMarkingID()
isRegularPlace()
isStackPlace()
setCapacity()
setCapacityID()
setMarking()
setMarkingID()
setRegularPlace()
setStackPlace()

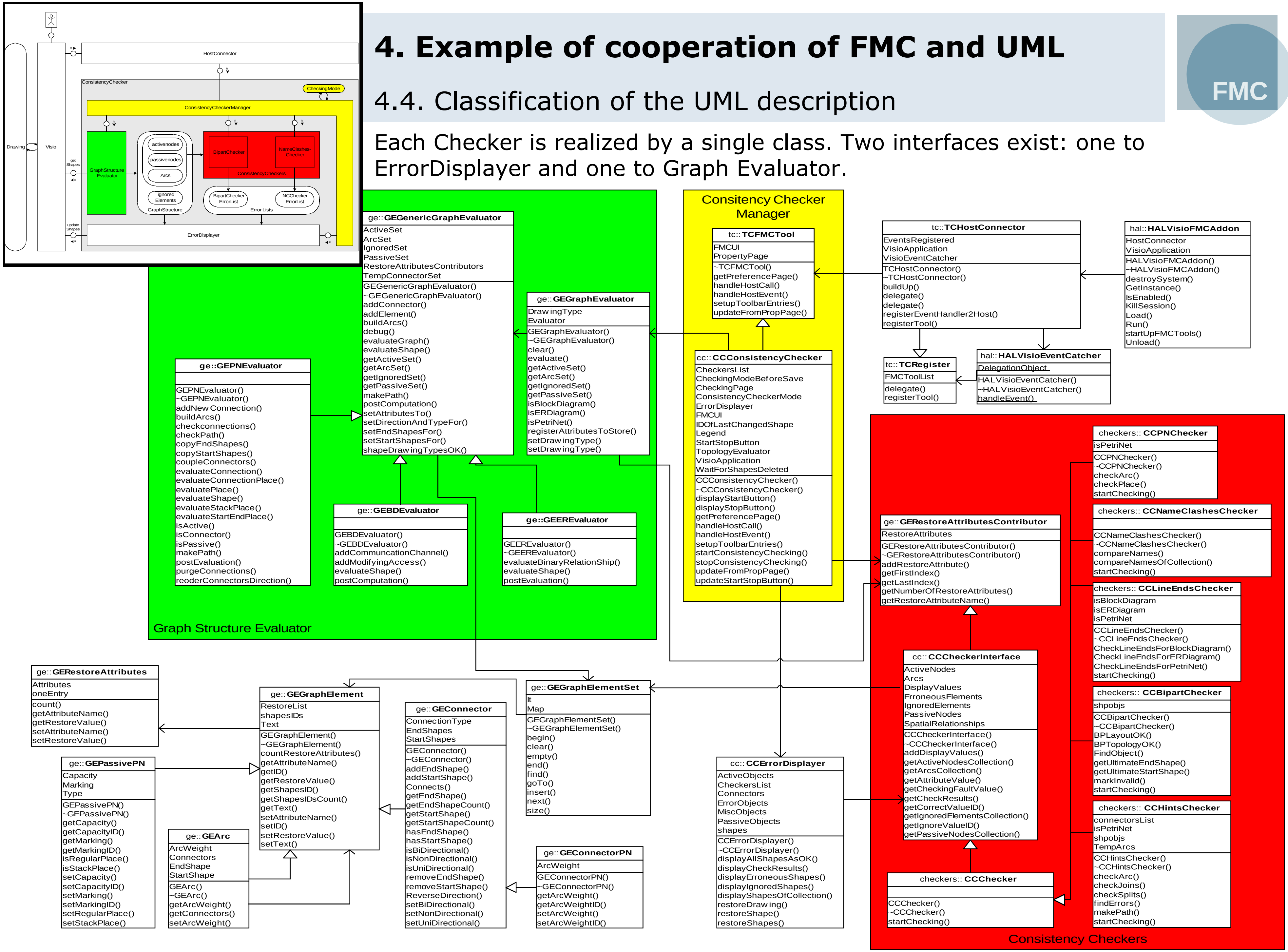
ge::**GEArc**
ArcWeight
Connectors
EndShape
StartShape
GEArc()
~GEArc()
getArcWeight()
getConnectors()
setArcWeight()

ge::**GEConnectorPN**
ArcWeight
GEConnectorPN()
~GEConnectorPN()
getArcWeight()
getArcWeightID()
setArcWeight()
setArcWeightID()

4. Example of cooperation of FMC and UML

4.4. Classification of the UML description

Each Checker is realized by a single class. Two interfaces exist: one to ErrorDisplayer and one to Graph Evaluator.



Graph Structure Evaluator

ge::GEGenericGraphEvaluator
ActiveSet
ArcSet
IgnoredSet
PassiveSet
RestoreAttributesContributors
TempConnectorSet
GEGenericGraphEvaluator()
~GEGenericGraphEvaluator()
addConnector()
addElement()
buildArcs()
debug()
evaluateGraph()
evaluateShape()
getActiveSet()
getArcSet()
getIgnoredSet()
getPassiveSet()
makePath()
postComputation()
setAttributesTo()
setDirectionAndTypeFor()
setEndShapesFor()
setStartShapesFor()
shapeDraw ingTypesOK()

ge::GEGraphEvaluator
Draw ingType
Evaluator
GEGraphEvaluator()
~GEGraphEvaluator()
clear()
evaluate()
getActiveSet()
getArcSet()
getIgnoredSet()
getPassiveSet()
isBlockDiagram()
isERDiagram()
isPetriNet()
registerAttributesToStore()
setDraw ingType()
setDraw ingType()

ge::GEPNEvaluator
GEPNEvaluator()
~GEPNEvaluator()
addNew Connection()
buildArcs()
checkconnections()
checkPath()
copyEndShapes()
copyStartShapes()
coupleConnectors()
evaluateConnection()
evaluateConnectionPlace()
evaluatePlace()
evaluateShape()
evaluateStackPlace()
evaluateStartEndPlace()
isActive()
isConnector()
isPassive()
makePath()
postEvaluation()
purgeConnections()
reoderConnectorsDirection()

ge::GEBDEvaluator
GEBDEvaluator()
~GEBDEvaluator()
addCommunchationChannel()
addModifyingAccess()
evaluateShape()
postComputation()

ge::GEEREvaluator
GEEREvaluator()
~GEEREvaluator()
evaluateBinaryRelationShip()
evaluateShape()
postEvaluation()

Consitency Checker Manager

tc::TCFMCTool
FMCUI
PropertyPage
~TCFMCTool()
getPreferencePage()
handleHostCall()
handleHostEvent()
setupToolbarEntries()
updateFromPropPage()

cc::CCConsistencyChecker
CheckersList
CheckingModeBeforeSave
CheckingPage
ConsistencyCheckerMode
ErrorDisplayer
FMCUI
IDOfLastChangedShape
Legend
StartStopButton
TopologyEvaluator
VisioApplication
WaitForShapesDeleted
CCConsistencyChecker()
~CCConsistencyChecker()
displayStartButton()
displayStopButton()
getPreferencePage()
handleHostCall()
handleHostEvent()
setupToolbarEntries()
startConsistencyChecking()
stopConsistencyChecking()
updateFromPropPage()
updateStartStopButton()

tc::TCHostConnector
EventsRegistered
VisioApplication
VisioEventCatcher
TCHostConnector()
~TCHostConnector()
buildUp()
delegate()
delegate()
registerEventHandler2Host()
registerTool()

hal::HALVisioFMCAddon
HostConnector
VisioApplication
HALVisioFMCAddon()
~HALVisioFMCAddon()
destroySystem()
GetInstance()
IsEnabled()
KillSession()
Load()
Run()
startUpFMCTools()
Unload()

tc::TCRegister
FMCToolList
delegate()
registerTool()

hal::HALVisioEventCatcher
DelegationObject
HALVisioEventCatcher()
~HALVisioEventCatcher()
handleEvent()

Consistency Checkers

checkers:: CCPNChecker
isPetriNet
CCPNChecker()
~CCPNChecker()
checkArc()
checkPlace()
startChecking()

checkers:: CCNameClashesChecker
CCNameClashesChecker()
~CCNameClashesChecker()
compareNames()
compareNamesOfCollection()
startChecking()

ge::GERestoreAttributesContributor
RestoreAttributes
GERestoreAttributesContributor()
~GERestoreAttributesContributor()
addRestoreAttribute()
getFirstIndex()
getLastIndex()
getNumberOfRestoreAttributes()
getRestoreAttributeName()

checkers:: CCLineEndsChecker
isBlockDiagram
isERDiagram
isPetriNet
CCLineEndsChecker()
~CCLineEndsChecker()
CheckLineEndsForBlockDiagram()
CheckLineEndsForERDiagram()
CheckLineEndsForPetriNet()
startChecking()

cc::CCCheckerInterface
ActiveNodes
Arcs
DisplayValues
ErroneousElements
IgnoredElements
PassiveNodes
SpatialRelationships
CCCheckerInterface()
~CCCheckerInterface()
addDisplayValues()
getActiveNodesCollection()
getArcsCollection()
getAttributeValue()
getCheckingFaultValue()
getCheckResults()
getCorrectValueID()
getIgnoredElementsCollection()
getIgnoreValueID()
getPassiveNodesCollection()

checkers:: CCBipartChecker
shpobjs
CCBipartChecker()
~CCBipartChecker()
BPLayoutOK()
BPTopologyOK()
FindObject()
getUltimateEndShape()
getUltimateStartShape()
markInvalid()
startChecking()

checkers:: CCHintsChecker
connectorsList
isPetriNet
shpobjs
TempArcs
CCHintsChecker()
~CCHintsChecker()
checkArc()
checkJoins()
checkSplits()
findErrors()
makePath()
startChecking()

checkers:: CCChecker
CCChecker()
~CCChecker()
startChecking()

ge::GERestoreAttributes
Attributes
oneEntry
count()
getAttributeName()
getRestoreValue()
setAttributeName()
setRestoreValue()

ge::GEGraphElement
RestoreList
shapesIDs
Text
GEGraphElement()
~GEGraphElement()
countRestoreAttributes()
getAttributeName()
getID()
getRestoreValue()
getShapesID()
getShapesIDsCount()
getText()
setAttributeName()
setID()
setRestoreValue()
setText()

ge::GEGraphElementSet
It
Map
GEGraphElementSet()
~GEGraphElementSet()
begin()
clear()
empty()
end()
find()
goTo()
insert()
next()
size()

ge::GEConnector
ConnectionType
EndShapes
StartShapes
GEConnector()
~GEConnector()
addEndShape()
addStartShape()
Connects()
getEndShape()
getEndShapeCount()
getStartShape()
getStartShapeCount()
hasEndShape()
hasStartShape()
isBiDirectional()
isNonDirectional()
isUniDirectional()
removeEndShape()
removeStartShape()
ReverseDirection()
setBiDirectional()
setNonDirectional()
setUniDirectional()

ge::GEPassivePN
Capacity
Marking
Type
GEPassivePN()
~GEPassivePN()
getCapacity()
getCapacityID()
getMarking()
getMarkingID()
isRegularPlace()
isStackPlace()
setCapacity()
setCapacityID()
setMarking()
setMarkingID()
setRegularPlace()
setStackPlace()

ge::GEArc
ArcWeight
Connectors
EndShape
StartShape
GEArc()
~GEArc()
getArcWeight()
getConnectors()
setArcWeight()

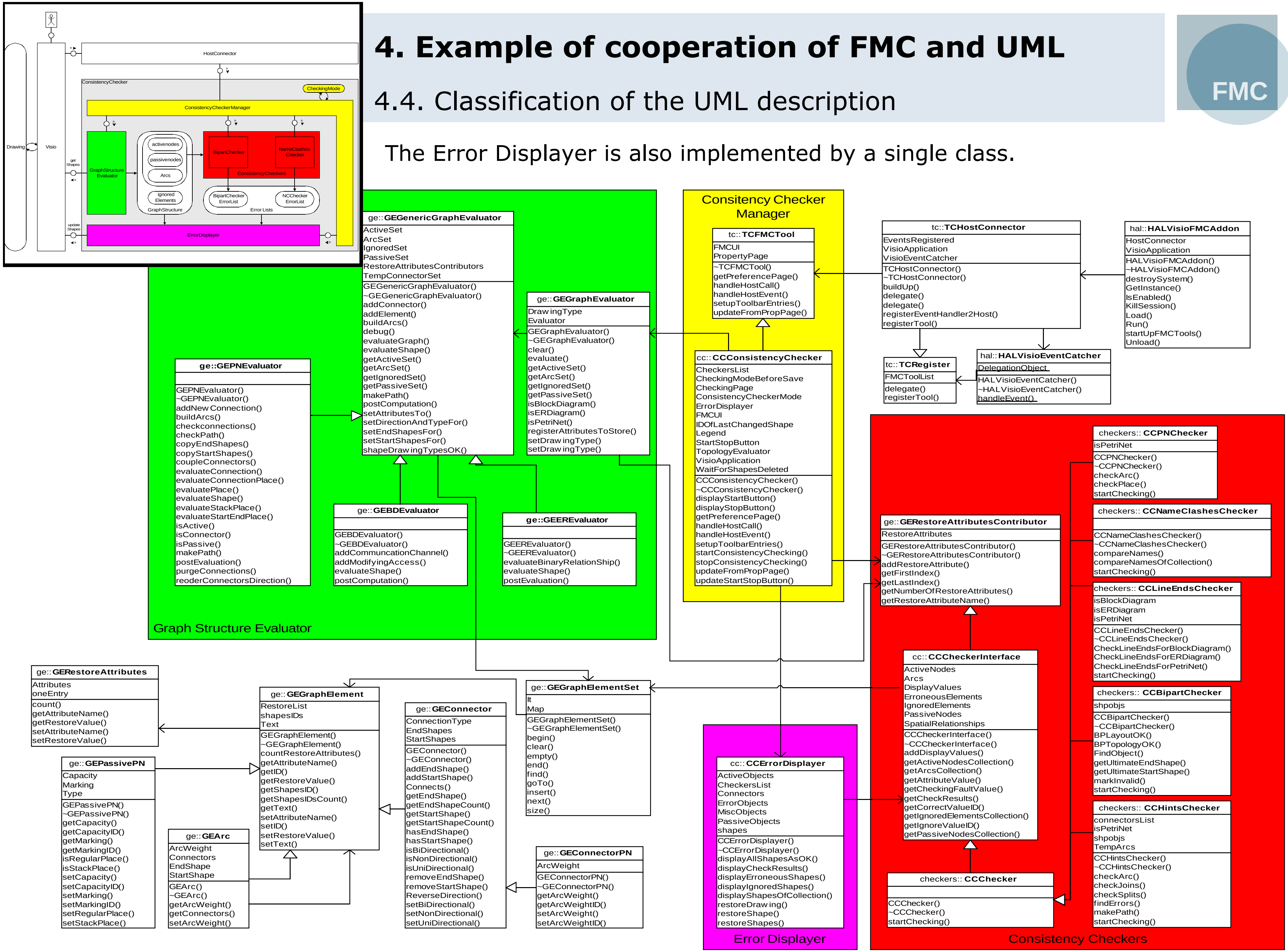
ge::GEConnectorPN
ArcWeight
GEConnectorPN()
~GEConnectorPN()
getArcWeight()
getArcWeightID()
setArcWeight()
setArcWeightID()

cc::CCErrorDisplayer
ActiveObjects
CheckersList
Connectors
ErrorObjects
MiscObjects
PassiveObjects
shapes
CCErrorDisplayer()
~CCErrorDisplayer()
displayAllShapesAsOK()
displayCheckResults()
displayErroneousShapes()
displayIgnoredShapes()
displayShapesOfCollection()
restoreDraw ing()
restoreShape()
restoreShapes()

4. Example of cooperation of FMC and UML

4.4. Classification of the UML description

The Error Displayer is also implemented by a single class.



Graph Structure Evaluator

ge::**GEGenericGraphEvaluator**
ActiveSet
ArcSet
IgnoredSet
PassiveSet
RestoreAttributesContributors
TempConnectorSet
GEGenericGraphEvaluator()
~GEGenericGraphEvaluator()
addConnector()
addElement()
buildArcs()
debug()
evaluateGraph()
evaluateShape()
getActiveSet()
getArcSet()
getIgnoredSet()
getPassiveSet()
makePath()
postComputation()
setAttributesTo()
setDirectionAndTypeFor()
setEndShapesFor()
setStartShapesFor()
shapeDrawingTypesOK()

ge::**GEGraphEvaluator**
DrawingType
Evaluator
GEGraphEvaluator()
~GEGraphEvaluator()
clear()
evaluate()
getActiveSet()
getArcSet()
getIgnoredSet()
getPassiveSet()
isBlockDiagram()
isERDiagram()
isPetriNet()
registerAttributesToStore()
setDrawingType()
setDrawingType()

ge::**GEPNEvaluator**
GEPNEvaluator()
~GEPNEvaluator()
addNewConnection()
buildArcs()
checkconnections()
checkPath()
copyEndShapes()
copyStartShapes()
coupleConnectors()
evaluateConnection()
evaluateConnectionPlace()
evaluatePlace()
evaluateShape()
evaluateStackPlace()
evaluateStartEndPlace()
isActive()
isConnector()
isPassive()
makePath()
postEvaluation()
purgeConnections()
reoderConnectorsDirection()

ge::**GEBDEvaluator**
GEBDEvaluator()
~GEBDEvaluator()
addCommuncationChannel()
addModifyingAccess()
evaluateShape()
postComputation()

ge::**GEEREvaluator**
GEEREvaluator()
~GEEREvaluator()
evaluateBinaryRelationShip()
evaluateShape()
postEvaluation()

Consitency Checker Manager

tc::**TCFMCTool**
FMCUI
PropertyPage
~TCFMCTool()
getPreferencePage()
handleHostCall()
handleHostEvent()
setupToolbarEntries()
updateFromPropPage()

cc::**CCConsistencyChecker**
CheckersList
CheckingModeBeforeSave
CheckingPage
ConsistencyCheckerMode
ErrorDisplayer
FMCUI
IDOfLastChangedShape
Legend
StartStopButton
TopologyEvaluator
VisioApplication
WaitForShapesDeleted
CCConsistencyChecker()
~CCConsistencyChecker()
displayStartButton()
displayStopButton()
getPreferencePage()
handleHostCall()
handleHostEvent()
setupToolbarEntries()
startConsistencyChecking()
stopConsistencyChecking()
updateFromPropPage()
updateStartStopButton()

tc::**TCHostConnector**
EventsRegistered
VisioApplication
VisioEventCatcher
TCHostConnector()
~TCHostConnector()
buildUp()
delegate()
delegate()
registerEventHandler2Host()
registerTool()

hal::**HALVisioFMCAddon**
HostConnector
VisioApplication
HALVisioFMCAddon()
~HALVisioFMCAddon()
destroySystem()
GetInstance()
IsEnabled()
KillSession()
Load()
Run()
startUpFMCTools()
Unload()

tc::**TCRegister**
FMCToolList
delegate()
registerTool()

hal::**HALVisioEventCatcher**
DelegationObject
HALVisioEventCatcher()
~HALVisioEventCatcher()
handleEvent()

Consistency Checkers

checkers:: **CCPNChecker**
isPetriNet
CCPNChecker()
~CCPNChecker()
checkArc()
checkPlace()
startChecking()

checkers:: **CCNameClashesChecker**
CCNameClashesChecker()
~CCNameClashesChecker()
compareNames()
compareNamesOfCollection()
startChecking()

ge::**GERestoreAttributesContributor**
RestoreAttributes
GERestoreAttributesContributor()
~GERestoreAttributesContributor()
addRestoreAttribute()
getFirstIndex()
getLastIndex()
getNumberOfRestoreAttributes()
getRestoreAttributeName()

checkers:: **CCLineEndsChecker**
isBlockDiagram
isERDiagram
isPetriNet
CCLineEndsChecker()
~CCLineEndsChecker()
CheckLineEndsForBlockDiagram()
CheckLineEndsForERDiagram()
CheckLineEndsForPetriNet()
startChecking()

cc::**CCCheckerInterface**
ActiveNodes
Arcs
DisplayValues
ErroneousElements
IgnoredElements
PassiveNodes
SpatialRelationships
CCCheckerInterface()
~CCCheckerInterface()
addDisplayValues()
getActiveNodesCollection()
getArcsCollection()
getAttributeValue()
getCheckingFaultValue()
getCheckResults()
getCorrectValueID()
getIgnoredElementsCollection()
getIgnoreValueID()
getPassiveNodesCollection()

checkers:: **CCBipartChecker**
shpobjs
CCBipartChecker()
~CCBipartChecker()
BPLayoutOK()
BPTopologyOK()
FindObject()
getUltimateEndShape()
getUltimateStartShape()
markInvalid()
startChecking()

checkers:: **CCHintsChecker**
connectorsList
isPetriNet
shpobjs
TempArcs
CCHintsChecker()
~CCHintsChecker()
checkArc()
checkJoins()
checkSplits()
findErrors()
makePath()
startChecking()

checkers:: **CCChecker**
CCChecker()
~CCChecker()
startChecking()

Error Displayer

cc::**CCErrorDisplayer**
ActiveObjects
CheckersList
Connectors
ErrorObjects
MiscObjects
PassiveObjects
shapes
CCErrorDisplayer()
~CCErrorDisplayer()
displayAllShapesAsOK()
displayCheckResults()
displayErroneousShapes()
displayIgnoredShapes()
displayShapesOfCollection()
restoreDrawing()
restoreShape()
restoreShapes()

ge::**GERestoreAttributes**
Attributes
oneEntry
count()
getAttributeName()
getRestoreValue()
setAttributeName()
setRestoreValue()

ge::**GEGraphElement**
RestoreList
shapesIDs
Text
GEGraphElement()
~GEGraphElement()
countRestoreAttributes()
getAttributeName()
getID()
getRestoreValue()
getShapesID()
getShapesIDsCount()
getText()
setAttributeName()
setID()
setRestoreValue()
setText()

ge::**GEGraphElementSet**
It
Map
GEGraphElementSet()
~GEGraphElementSet()
begin()
clear()
empty()
end()
find()
goTo()
insert()
next()
size()

ge::**GEPassivePN**
Capacity
Marking
Type
GEPassivePN()
~GEPassivePN()
getCapacity()
getCapacityID()
getMarking()
getMarkingID()
isRegularPlace()
isStackPlace()
setCapacity()
setCapacityID()
setMarking()
setMarkingID()
setRegularPlace()
setStackPlace()

ge::**GEArc**
ArcWeight
Connectors
EndShape
StartShape
GEArc()
~GEArc()
getArcWeight()
getConnectors()
setArcWeight()

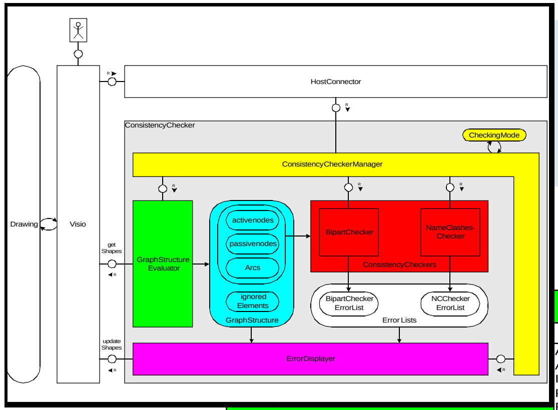
ge::**GEConnector**
ConnectionType
EndShapes
StartShapes
GEConnector()
~GEConnector()
addEndShape()
addStartShape()
Connects()
getEndShape()
getEndShapeCount()
getStartShape()
getStartShapeCount()
hasEndShape()
hasStartShape()
isBiDirectional()
isNonDirectional()
isUniDirectional()
removeEndShape()
removeStartShape()
ReverseDirection()
setBiDirectional()
setNonDirectional()
setUniDirectional()

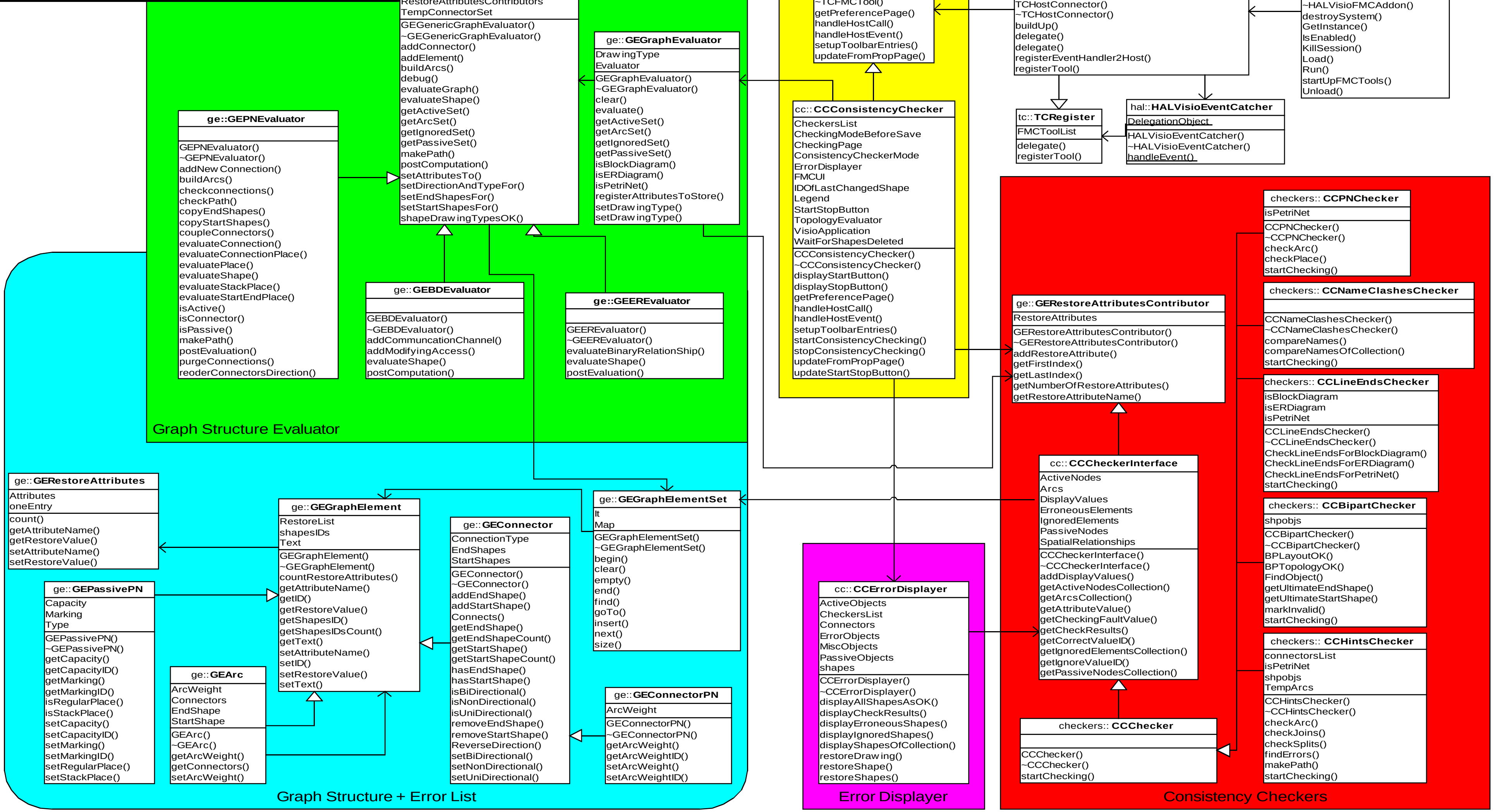
ge::**GEConnectorPN**
ArcWeight
GEConnectorPN()
~GEConnectorPN()
getArcWeight()
getArcWeightID()
setArcWeight()
setArcWeightID()

4. Example of cooperation of FMC and UML

4.4. Classification of the UML description

The Graph Structure is realized by various classes building up lists of graph elements and the graph elements themselves.




Graph Structure Evaluator

ge::GEGenericGraphEvaluator
ActiveSet
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getPassiveSet()
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isPetriNet()
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setDraw ingType()
setDraw ingType()

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evaluateConnectionPlace()
evaluatePlace()
evaluateShape()
evaluateStackPlace()
evaluateStartEndPlace()
isActive()
isConnector()
isPassive()
makePath()
postEvaluation()
purgeConnections()
reoderConnectorsDirection()

ge::GEBDEvaluator
GEBDEvaluator()
~GEBDEvaluator()
addCommuncationChannel()
addModifyingAccess()
evaluateShape()
postComputation()

ge::GEEREvaluator
GEEREvaluator()
~GEEREvaluator()
evaluateBinaryRelationShip()
evaluateShape()
postEvaluation()

Consitency Checker Manager

tc::TCFMCTool
FMCUI
PropertyPage
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getPreferencePage()
handleHostCall()
handleHostEvent()
setupToolbarEntries()
updateFromPropPage()

cc::CCConsistencyChecker
CheckersList
CheckingModeBeforeSave
CheckingPage
ConsistencyCheckerMode
ErrorDisplayer
FMCUI
IDOfLastChangedShape
Legend
StartStopButton
TopologyEvaluator
VisioApplication
WaitForShapesDeleted
CCConsistencyChecker()
~CCConsistencyChecker()
displayStartButton()
displayStopButton()
getPreferencePage()
handleHostCall()
handleHostEvent()
setupToolbarEntries()
startConsistencyChecking()
stopConsistencyChecking()
updateFromPropPage()
updateStartStopButton()

tc::TCHostConnector
EventsRegistered
VisioApplication
VisioEventCatcher
TCHostConnector()
~TCHostConnector()
buildUp()
delegate()
delegate()
registerEventHandler2Host()
registerTool()

hal::HALVisioFMCAddon
HostConnector
VisioApplication
HALVisioFMCAddon()
~HALVisioFMCAddon()
destroySystem()
GetInstance()
IsEnabled()
KillSession()
Load()
Run()
startUpFMCTools()
Unload()

tc::TCRegister
FMCToolList
delegate()
registerTool()

hal::HALVisioEventCatcher
DelegationObject
HALVisioEventCatcher()
~HALVisioEventCatcher()
handleEvent()

Consistency Checkers

checkers:: CCPNChecker
isPetriNet
CCPNChecker()
~CCPNChecker()
checkArc()
checkPlace()
startChecking()

checkers:: CCNameClashesChecker
CCNameClashesChecker()
~CCNameClashesChecker()
compareNames()
compareNamesOfCollection()
startChecking()

ge::GERestoreAttributesContributor
RestoreAttributes
GERestoreAttributesContributor()
~GERestoreAttributesContributor()
addRestoreAttribute()
getFirstIndex()
getLastIndex()
getNumberOfRestoreAttributes()
getRestoreAttributeName()

checkers:: CCLineEndsChecker
isBlockDiagram
isERDiagram
isPetriNet
CCLineEndsChecker()
~CCLineEndsChecker()
CheckLineEndsForBlockDiagram()
CheckLineEndsForERDiagram()
CheckLineEndsForPetriNet()
startChecking()

cc::CCCheckerInterface
ActiveNodes
Arcs
DisplayValues
ErroneousElements
IgnoredElements
PassiveNodes
SpatialRelationships
CCCheckerInterface()
~CCCheckerInterface()
addDisplayValues()
getActiveNodesCollection()
getArcsCollection()
getAttributeValue()
getCheckingFaultValue()
getCheckResults()
getCorrectValueID()
getIgnoredElementsCollection()
getIgnoreValueID()
getPassiveNodesCollection()

checkers:: CCBipartChecker
shpobjs
CCBipartChecker()
~CCBipartChecker()
BPLayoutOK()
BPTopologyOK()
FindObject()
getUltimateEndShape()
getUltimateStartShape()
markInvalid()
startChecking()

checkers:: CCHintsChecker
connectorsList
isPetriNet
shpobjs
TempArcs
CCHintsChecker()
~CCHintsChecker()
checkArc()
checkJoins()
checkSplits()
findErrors()
makePath()
startChecking()

checkers:: CCChecker
CCChecker()
~CCChecker()
startChecking()

Error Displayer

cc::CCErrorDisplayer
ActiveObjects
CheckersList
Connectors
ErrorObjects
MiscObjects
PassiveObjects
shapes
CCErrorDisplayer()
~CCErrorDisplayer()
displayAllShapesAsOK()
displayCheckResults()
displayErroneousShapes()
displayIgnoredShapes()
displayShapesOfCollection()
restoreDraw ing()
restoreShape()
restoreShapes()

Graph Structure + Error List

ge::GERestoreAttributes
Attributes
oneEntry
count()
getAttributeName()
getRestoreValue()
setAttributeName()
setRestoreValue()

ge::GEGraphElement
RestoreList
shapesIDs
Text
GEGraphElement()
~GEGraphElement()
countRestoreAttributes()
getAttributeName()
getID()
getRestoreValue()
getShapesID()
getShapesIDsCount()
getText()
setAttributeName()
setID()
setRestoreValue()
setText()

ge::GEGraphElementSet
It
Map
GEGraphElementSet()
~GEGraphElementSet()
begin()
clear()
empty()
end()
find()
goTo()
insert()
next()
size()

ge::GEPassivePN
Capacity
Marking
Type
GEPassivePN()
~GEPassivePN()
getCapacity()
getCapacityID()
getMarking()
getMarkingID()
isRegularPlace()
isStackPlace()
setCapacity()
setCapacityID()
setMarking()
setMarkingID()
setRegularPlace()
setStackPlace()

ge::GEArc
ArcWeight
Connectors
EndShape
StartShape
GEArc()
~GEArc()
getArcWeight()
getConnectors()
setArcWeight()

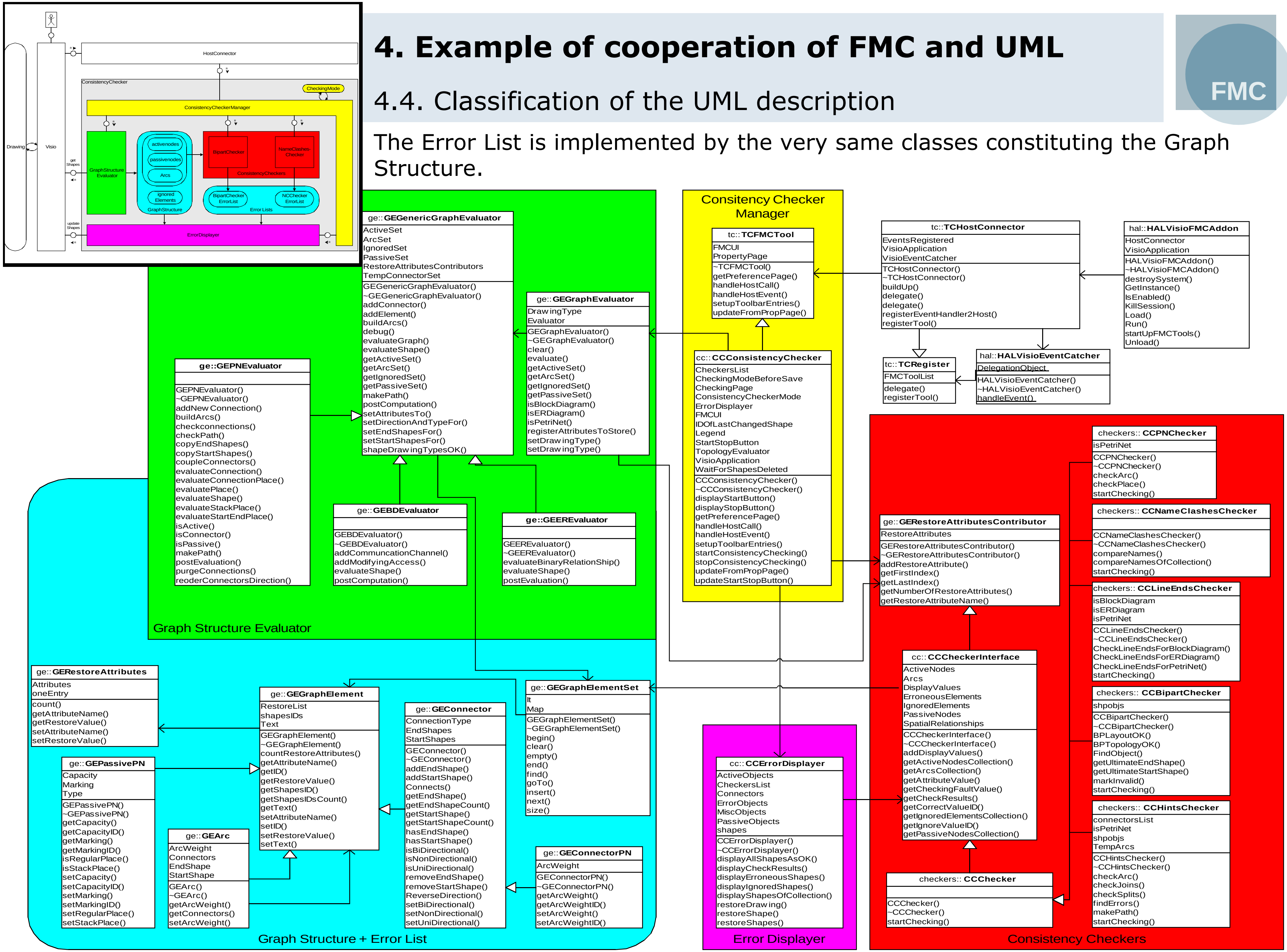
ge::GEConnector
ConnectionType
EndShapes
StartShapes
GEConnector()
~GEConnector()
addEndShape()
addStartShape()
Connects()
getEndShape()
getEndShapeCount()
getStartShape()
getStartShapeCount()
hasEndShape()
hasStartShape()
isBiDirectional()
isNonDirectional()
isUniDirectional()
removeEndShape()
removeStartShape()
ReverseDirection()
setBiDirectional()
setNonDirectional()
setUniDirectional()

ge::GEConnectorPN
ArcWeight
GEConnectorPN()
~GEConnectorPN()
getArcWeight()
getArcWeightID()
setArcWeight()
setArcWeightID()

4. Example of cooperation of FMC and UML

4.4. Classification of the UML description

The Error List is implemented by the very same classes constituting the Graph Structure.



Graph Structure Evaluator

ge::**GEGenericGraphEvaluator**
ActiveSet
ArcSet
IgnoredSet
PassiveSet
RestoreAttributesContributors
TempConnectorSet
GEGenericGraphEvaluator()
~GEGenericGraphEvaluator()
addConnector()
addElement()
buildArcs()
debug()
evaluateGraph()
evaluateShape()
getActiveSet()
getArcSet()
getIgnoredSet()
getPassiveSet()
makePath()
postComputation()
setAttributesTo()
setDirectionAndTypeFor()
setEndShapesFor()
setStartShapesFor()
shapeDraw ingTypesOK()

ge::**GEGraphEvaluator**
Draw ingType
Evaluator
GEGraphEvaluator()
~GEGraphEvaluator()
clear()
evaluate()
getActiveSet()
getArcSet()
getIgnoredSet()
getPassiveSet()
isBlockDiagram()
isERDiagram()
isPetriNet()
registerAttributesToStore()
setDraw ingType()
setDraw ingType()

ge::**GEPNEvaluator**
GEPNEvaluator()
~GEPNEvaluator()
addNew Connector()
buildArcs()
checkconnections()
checkPath()
copyEndShapes()
copyStartShapes()
coupleConnectors()
evaluateConnection()
evaluateConnectionPlace()
evaluatePlace()
evaluateShape()
evaluateStackPlace()
evaluateStartEndPlace()
isActive()
isConnector()
isPassive()
makePath()
postEvaluation()
purgeConnections()
reoderConnectorsDirection()

ge::**GEBDEvaluator**
GEBDEvaluator()
~GEBDEvaluator()
addCommuncationChannel()
addModifyingAccess()
evaluateShape()
postComputation()

ge::GEEREvaluator
GEEREvaluator()
~GEEREvaluator()
evaluateBinaryRelationShip()
evaluateShape()
postEvaluation()

Consitency Checker Manager

tc::**TCFMCTool**
FMCUI
PropertyPage
~TCFMCTool()
getPreferencePage()
handleHostCall()
handleHostEvent()
setupToolbarEntries()
updateFromPropPage()

cc::**CCConsistencyChecker**
CheckersList
CheckingModeBeforeSave
CheckingPage
ConsistencyCheckerMode
ErrorDisplayer
FMCUI
IDOfLastChangedShape
Legend
StartStopButton
TopologyEvaluator
VisioApplication
WaitForShapesDeleted
CCConsistencyChecker()
~CCConsistencyChecker()
displayStartButton()
displayStopButton()
getPreferencePage()
handleHostCall()
handleHostEvent()
setupToolbarEntries()
startConsistencyChecking()
stopConsistencyChecking()
updateFromPropPage()
updateStartStopButton()

tc::**TCHostConnector**
EventsRegistered
VisioApplication
VisioEventCatcher
TCHostConnector()
~TCHostConnector()
buildUp()
delegate()
delegate()
registerEventHandler2Host()
registerTool()

hal::**HALVisioFMCAddon**
HostConnector
VisioApplication
HALVisioFMCAddon()
~HALVisioFMCAddon()
destroySystem()
GetInstance()
IsEnabled()
KillSession()
Load()
Run()
startUpFMCTools()
Unload()

tc::**TCRegister**
FMCToolList
delegate()
registerTool()

hal::**HALVisioEventCatcher**
DelegationObject
HALVisioEventCatcher()
~HALVisioEventCatcher()
handleEvent()

Graph Structure + Error List

ge::**GERestoreAttributes**
Attributes
oneEntry
count()
getAttributeName()
getRestoreValue()
setAttributeName()
setRestoreValue()

ge::**GEGraphElement**
RestoreList
shapesIDs
Text
GEGraphElement()
~GEGraphElement()
countRestoreAttributes()
getAttributeName()
getID()
getRestoreValue()
getShapesID()
getShapesIDsCount()
getText()
setAttributeName()
setID()
setRestoreValue()
setText()

ge::**GEConnector**
ConnectionType
EndShapes
StartShapes
GEConnector()
~GEConnector()
addEndShape()
addStartShape()
Connects()
getEndShape()
getEndShapeCount()
getStartShape()
getStartShapeCount()
hasEndShape()
hasStartShape()
isBiDirectional()
isNonDirectional()
isUniDirectional()
removeEndShape()
removeStartShape()
ReverseDirection()
setBiDirectional()
setNonDirectional()
setUniDirectional()

ge::**GEGraphElementSet**
It
Map
GEGraphElementSet()
~GEGraphElementSet()
begin()
clear()
empty()
end()
find()
goTo()
insert()
next()
size()

ge::**GEPassivePN**
Capacity
Marking
Type
GEPassivePN()
~GEPassivePN()
getCapacity()
getCapacityID()
getMarking()
getMarkingID()
isRegularPlace()
isStackPlace()
setCapacity()
setCapacityID()
setMarking()
setMarkingID()
setRegularPlace()
setStackPlace()

ge::**GEArc**
ArcWeight
Connectors
EndShape
StartShape
GEArc()
~GEArc()
getArcWeight()
getConnectors()
setArcWeight()

ge::**GEConnectorPN**
ArcWeight
GEConnectorPN()
~GEConnectorPN()
getArcWeight()
getArcWeightID()
setArcWeight()
setArcWeightID()

Error Displayer

cc::**CCErrorDisplayer**
ActiveObjects
CheckersList
Connectors
ErrorObjects
MiscObjects
PassiveObjects
shapes
CCErrorDisplayer()
~CCErrorDisplayer()
displayAllShapesAsOK()
displayCheckResults()
displayErroneousShapes()
displayIgnoredShapes()
displayShapesOfCollection()
restoreDraw ing()
restoreShape()
restoreShapes()

Consistency Checkers

ge::**GERestoreAttributesContributor**
RestoreAttributes
GERestoreAttributesContributor()
~GERestoreAttributesContributor()
addRestoreAttribute()
getFirstIndex()
getLastIndex()
getNumberOfRestoreAttributes()
getRestoreAttributeName()

cc::**CCCheckerInterface**
ActiveNodes
Arcs
DisplayValues
ErroneousElements
IgnoredElements
PassiveNodes
SpatialRelationships
CCCheckerInterface()
~CCCheckerInterface()
addDisplayValues()
getActiveNodesCollection()
getArcsCollection()
getAttributeValue()
getCheckingFaultValue()
getCheckResults()
getCorrectValueID()
getIgnoredElementsCollection()
getIgnoreValueID()
getPassiveNodesCollection()

checkers:: **CCChecker**
CCChecker()
~CCChecker()
startChecking()

checkers:: **CCPNChecker**
isPetriNet
CCPNChecker()
~CCPNChecker()
checkArc()
checkPlace()
startChecking()

checkers:: **CCNameClashesChecker**
CCNameClashesChecker()
~CCNameClashesChecker()
compareNames()
compareNamesOfCollection()
startChecking()

checkers:: **CCLineEndsChecker**
isBlockDiagram
isERDiagram
isPetriNet
CCLineEndsChecker()
~CCLineEndsChecker()
CheckLineEndsForBlockDiagram()
CheckLineEndsForERDiagram()
CheckLineEndsForPetriNet()
startChecking()

checkers:: **CCBipartChecker**
shpobjs
CCBipartChecker()
~CCBipartChecker()
BPLayoutOK()
BPTopologyOK()
FindObject()
getUltimateEndShape()
getUltimateStartShape()
markInvalid()
startChecking()

checkers:: **CCHintsChecker**
connectorsList
isPetriNet
shpobjs
TempArcs
CCHintsChecker()
~CCHintsChecker()
checkArc()
checkJoins()
checkSplits()
findErrors()
makePath()
startChecking()

4. Example of cooperation of FMC and UML

4.5. Conclusion

- Understanding the system's structure helps to understand the software's structure.

- In the example relationships between both have been made explicit by using identical names.

- This example showed a possible way for visualising the connection between FMC and UML diagrams.
  - The FMC drawing elements are reused within the UML-class diagram

5. Bibliography

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