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HUSACCT Tool

HU Architecture Compliance Tool

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Architecture Notebook Analyse Component

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Table of Contents

1. Introduction

HUSACCTS software is software with which you can check the architecture of software development projects. You can define an architecture on pre-hand, analyse an existing project, and compare these two to see if there are any architecture flaws in your project.

The software is divided into different pieces, each having a team of students assigned to develop. This document is purely about the analyse part of the software. The analyse part means the scanning of an existing project on a file system, and convert it into a domain model the entire application can use. We will describe how we do this in this document.
Because there are multiple teams working on this project, the architecture notebook is a good communication document for communication with other teams.

Finally, it are two teams that will have to develop the analyse part of the software. There is one Java team and one C# team. Because of the research about the tools that we can use to generate AST's*, the first part of the design and development of the HUSACCT analyse-component will be performed by both teams. When the decisions about the tools to use are made, each team will split up and proceed with the development of their own component.

2. Architectural Significant Requirements

The requirements for the Analyse part of the HUSACCT 2012 tool are described in this chapter. Figure 1.1. gives a basic overview of the architectural significant requirements for this component.

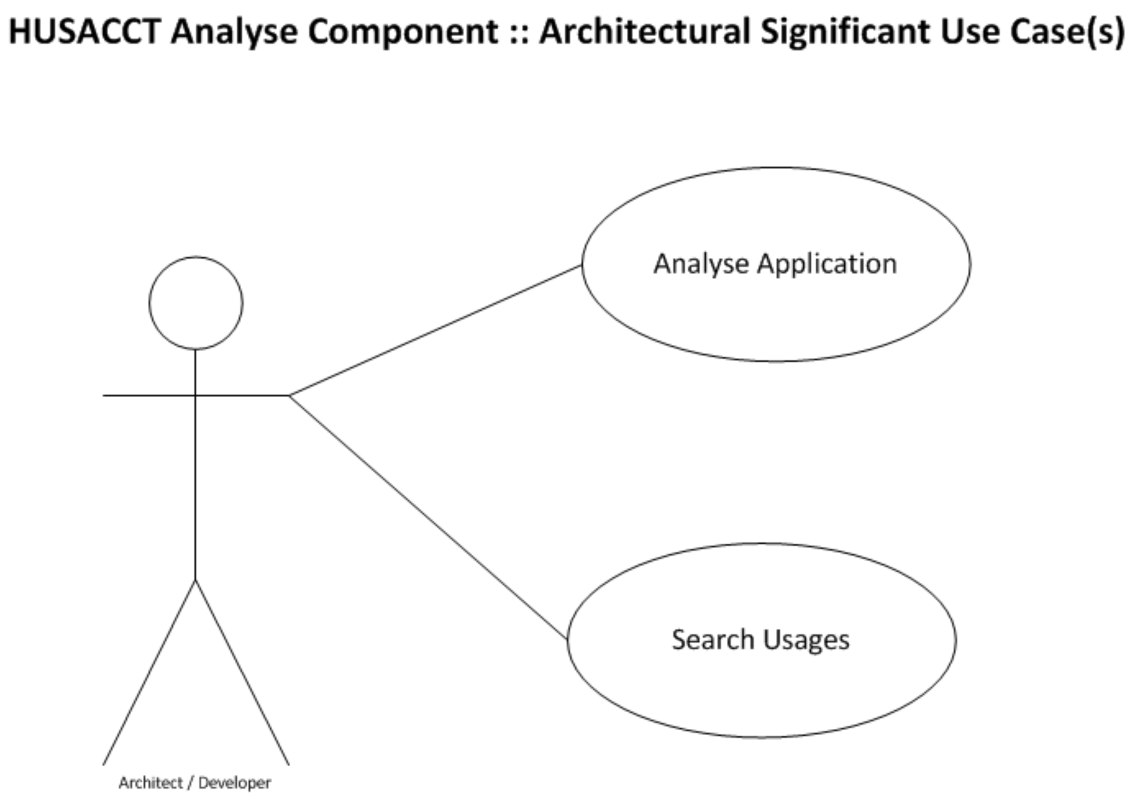

HUSACCT Analyse Component :: Architectural Significant Use Case(s)
Analyse Application
Search Usages
Architect / Developer

Figure 1.1. Architectural Significant Functional Requirements for the HUSACCT-tool Analyse-component

2.1 Functional Requirements

The following **functional** requirements are dependency recognitions that the analyse part of the HUSACCT tool must recognize when analyzing code. Except for rule number 5.9 these are all rules from the 'V3ISTO 2012: HUSACCT Requirements' document.

Listing 1.1. HUSACCT Analyse Functional Requirements	
5.1	Invocation of a method/constructor
5.2	Access of a property or field
5.3	Extending a class/struct
5.4	Implementing an interface
5.5	Declaration
5.6	Annotation of an attribute
5.7	Import
5.8	Throw an exception of a class
5.9	Indirect dependencies i.e. an extend of an extend

2.2 Non Functional Requirements

These non functional requirements are filtered out of the 'V3ISTO 2012: HUSACCT Requirements' document.

Listing 1.2. HUSACCT Analyse Non-Functional Requirements		
#	ISO 9123 attr.	Requirement
2.1	Maturity	The tool must not go down in case of a failure, but generate a meaningful error message.
2.2	Fault Tolerance	There must be no restrictions in the size of the project regarding number of classes, lines of code, components...
4.1	Time behavior	Tools must not take long (<= 15 min; 1.000.000 LOC) to analyse/validate the code, and to generate an error report.
5.1	Analyseability Testability	Taking over the development of the tool by other development teams must be unproblematic.
5.2	Changeability	The tool must be easily extendable to other code languages.

3. Decisions & Justification

This chapter explains the decisions that were made and their justifications. They are based on the non funtional requirements. They will give a clear overview of the decisions made to meet some of the requirements. The requirements that are not explained in the table below are usually self-explanatory and thus not reviewed.

Listing 2.1. HUSACCT Analyse Decisions & Justifications

Decision	Justification (Non-Functional Requirement)
String filters will be used for incoming calls, so the validate component can quickly analyse the filter and return the right information. These filters are also used to filter information to certain conditions.	#4.1
While developing this tool, Test Driven Design will be used so a story could be told through other developers with the tests. Learning tests will also be used. The guides given in 'Clean Code' will be used as well as to deliver as clean code as possible.	#5.1
Famix will be used as an independent data domain model structure. With Famix we are able to translate different programming languages into one complete domain model, which an upper layer can use.	#5.2
The mappers will process codebases in two steps. At first, the codebase will be converted in an AST (Abstract Syntax Tree). The second step is to convert the AST to the FAMIX-model. Using this steps, it will be easier for developers to replace the FAMIX-model with another model.	#5.2

4. Usage of Design Patterns.

Listing 3.1. HUSACCT Analyse Design Patterns

Pattern	Reason
Service Layer Pattern	When a component of another team asks us for a piece of analysed information from the the Famix Domain, we will have to give this back. The call to fetch data is handled by a wrapper around the domain. This wrapper will know about the domain, fetch the correct data from it's objects, transforms it into a DTO and give it back upwards to where the call came from.
Builder Pattern	The analyse part has to be able to analyse Java and C# code. In the future though, extention towards analysing other programming languages must be easy. A builder pattern will be used to instantiate or construct the correct mapper, based on a String-parameter that represents the programming-language.
Strategy Pattern	In order to enable different implementations of analysing source-code, the strategy-pattern was used in combination with the builder=pattern. All existing mapper implement the analyse-functionality in their own way.
Assembler Pattern	To have a somewhat loose coupled architecture, the assembler pattern will be used to decouple DTO's from the controlling service. The idea is that each DTO has it's own controller class, that controls the DTO.

5. Physical Classes

The physical classes describe the classes that are in the analyse part of the HUSACCT software. This is purely based on the FAMIX model. The blue classes describe the classes that are needed for Java and C#. The red classes describe extra classes that might be needed for C#. For a new programming language to be added, it is very possible it just fits within this domain. If not, the domain must be expanded for that specific programming language. Although this is not desirable, the domain has a certain abstraction factor which makes it easy to implement new classes.

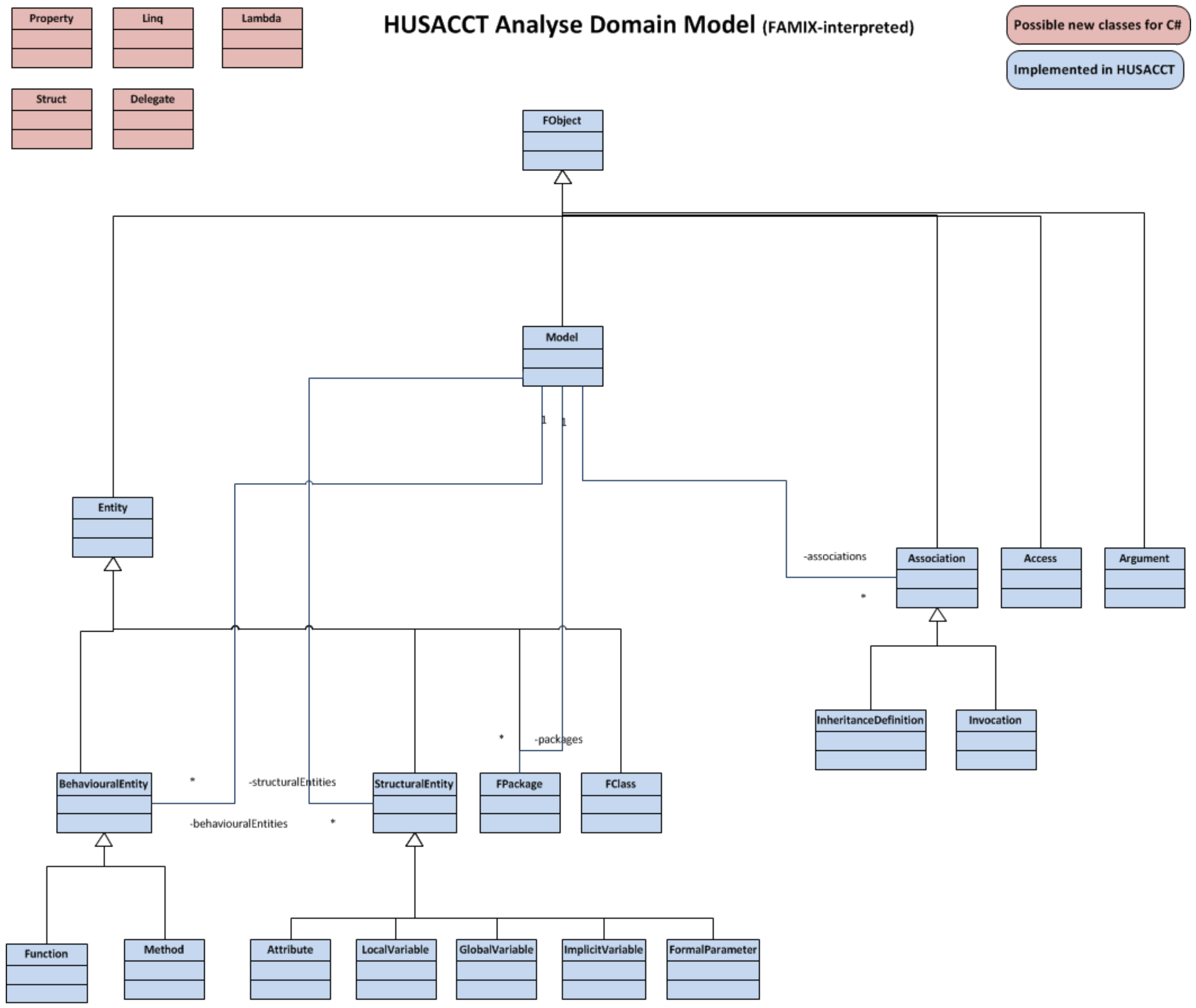


Figure 2.1. HUSACCT FAMIX-Classes with possible new classes

Figure 2.2 shows an overview of all the physical classes that will be implemented in the CodeMappers. This class-diagram also shows the implementation of a builder-pattern in combination with a strategy-pattern.

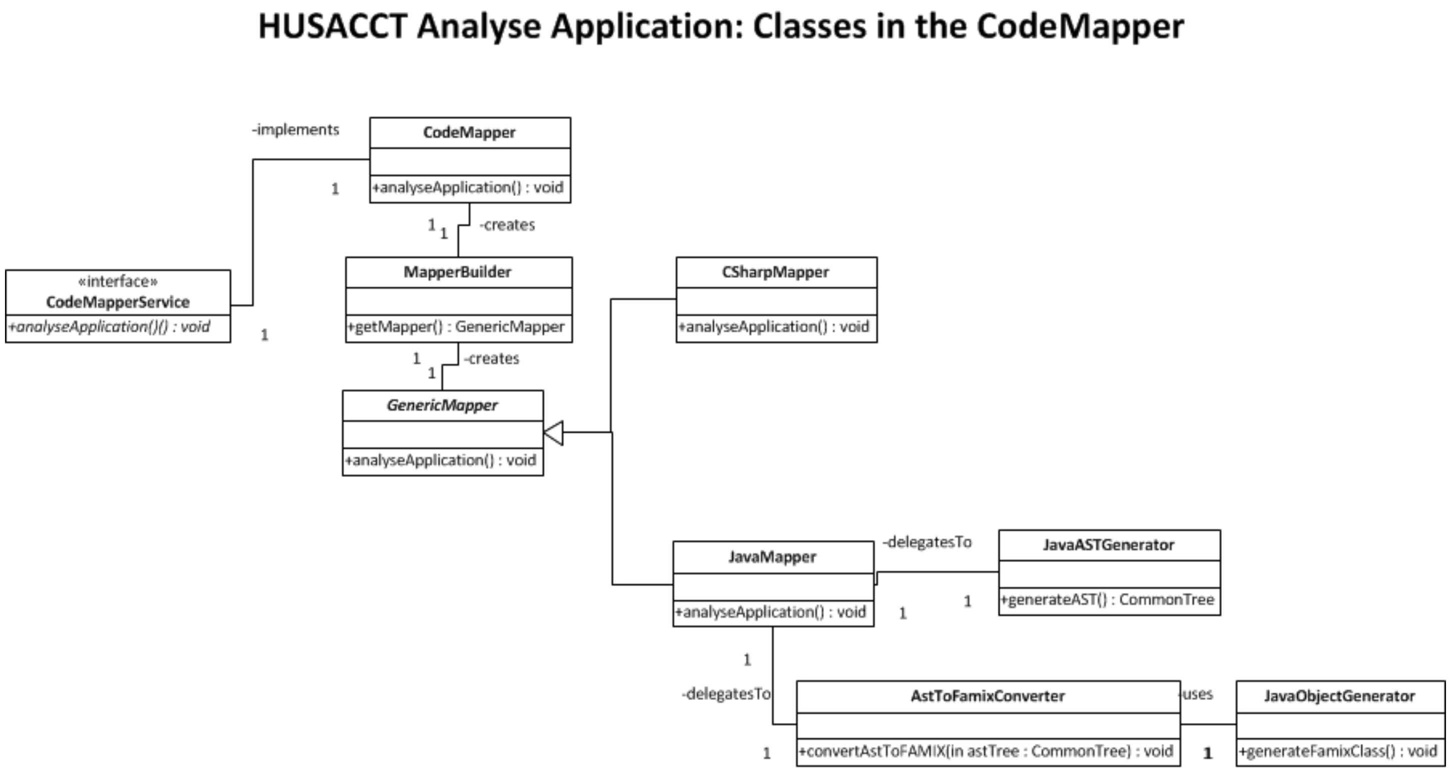

HUSACCT Analyse Application: Classes in the CodeMapper
-implements
CodeMapper
+analyseApplication() : void
1
1
1
-creates
«interface»
CodeMapperService
+analyseApplication()() : void
1
MapperBuilder
+getMapper() : GenericMapper
1
1
-creates
CSharpMapper
+analyseApplication() : void
GenericMapper
+analyseApplication() : void
JavaMapper
+analyseApplication() : void
-delegatesTo
JavaASTGenerator
+generateAST() : CommonTree
1
1
1
-delegatesTo
AstToFamixConverter
+convertAstToFAMIX(in astTree : CommonTree) : void
1
uses
JavaObjectGenerator
+generateFamixClass() : void
1

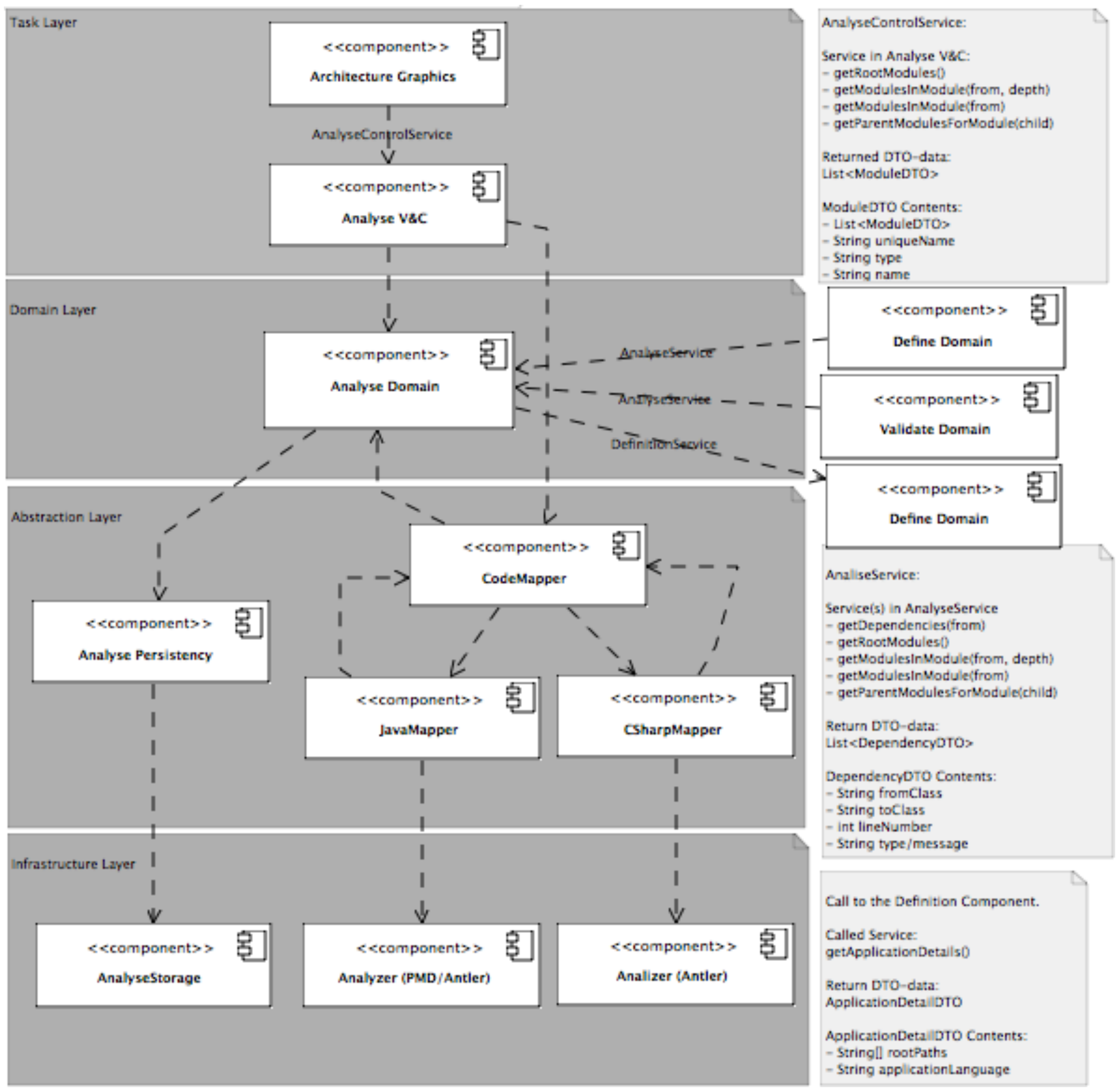
Figure 2.2. HUSACCT Analyse CodeMapper-classes

6. Software Partitioning

Partitioning the system helps to manage its complexity by using the well-known "divide and conquer" strategy. Breaking the process into smaller and more manageable pieces, makes development easier.
Layers are hierarchical partitions of the functionality of the system with certain rules regarding how relationships can be formed between them.
Components provide a way to isolate specific sets of functionality within units that can be distributed and installed separately from other functionality.

3.1. Physical Components and Layers

Logical Layers and their mapping to the Physical environment. All of the components will be build with Java.



AnalyseControlService:

Service in Analyse V&C:
- getRootModules()
- getModulesInModule(from, depth)
- getModulesInModule(from)
- getParentModulesForModule(child)

Returned DTO-data:
List<ModuleDTO>

ModuleDTO Contents:
- List<ModuleDTO>
- String uniqueName
- String type
- String name

AnaliseService:

Service(s) in AnalyseService
- getDependencies(from)
- getRootModules()
- getModulesInModule(from, depth)
- getModulesInModule(from)
- getParentModulesForModule(child)

Return DTO-data:
List<DependencyDTO>

DependencyDTO Contents:
- String fromClass
- String toClass
- int lineNumber
- String type/message

Call to the Definition Component.

Called Service:
getApplicationDetails()

Return DTO-data:
ApplicationDetailDTO

ApplicationDetailDTO Contents:
- String[] rootPaths
- String applicationLanguage

Figure 3.1. HUSACCT Analyse Partitioning, Interfaces & Data Transfer Objects