Emergent Architecture Design

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1 Introduction

This document contains the architecture design for group 3 of the Tygron Virtual Humans project. In this document we will describe our goals during this project and how these relate to the goals of the other project groups. We will give an overview of the current architecture of GOAL as represented on the goal-hub repository on github.com. Finally, we will show how the Gamygdala engine fits into the GOAL reasoning cycle, and where our other major modifications will be done.

The Tygron Virtual Humans context project aims to build a proof-of-concept system that provides the Tygron City Planner game with virtual agents in the GOAL environment whose decisions are influenced by emotions rendered by Gamygdala. This group will develop the integration of the Gamygdala engine in the GOAL programming language and environment. This extended programming environment will be used by project group 1 (led by Paul Verkooijen) to write a set of agents whose decisions in the Tygron game are influenced by their emotional state. Our main purpose in this project is to provide the tools required so this group can, without having to invest time in understanding the architecture or inner workings of either GOAL or Gamygdala, use an agent's emotional state in their decisionmaking process. It is important our work renders output in the same syntax as that of the Gamygdala-plugin group led by Tom Harting so the agent group can write similar agents for both versions of GOAL-Gamygdala.

2 Goals

As stated in the introduction, our role is a supporting one, so our goal is to support group 1 as well as possible and make working with this extended GOAL environment intuitive and similar to working with the existing GOAL language and environment that they have experience with. Throughout the project, as our understanding of the structure of goal and the workings of gamygdala grew, we have been able to formulate clearly defined sub-goals to accomplish this task:

- Integration of group 2's Gamygdala port in the GOAL package.
- Rendering emotions for existing GOAL agents with Gamygdala without any manual configuration or modification.
- Processing emotions into the belief base so that agents can reason with/about them, just like they would with percepts.
- Generating a default emotion configuration file that can be modified to tune the Gamygdala engine to the environment of a particular (set of) agent(s).
- Extending GOAL IDE so the emotional state of an agent can be read in the GOAL programming environment.

3 Software Architecture

This section describes various properties of the architecture of the software packages we have used or modified in this project, as well as the guidelines we have set up to ensure code quality and make use of the capabilities of the version control system we use.

3.1 Programming languages

Most of the development of this part of the project will be done in the Java language. The existing GOAL packages are compatible with Java 7, and therefore backwards compatible with Java 8. Gamygdala was originally written in Javascript, but we use the port to Java written by group 4. This makes development considerably easier because this port can be inserted into existing GOAL packages or referenced as a dependency in Maven projects, and we do not need to interface between Java and Javascript programs. Our modifications will be made in various packages of the GOAL architecture described in the Packages section. We need to gain some understanding of ANTLR to be able to parse configuration for Gamygdala in GOAL at runtime.

3.2 Continuous Integration

We have chosen to use git as our version control system. All project members have worked with it before and will not need much time to get reacquainted with the system. The entire GOAL project is hosted on github.com, which is the reason we chose github for our hosting too. Cloning the existing GOAL repositories into the Tygron Virtual Humans project was a simple task compared to the work of downloading all the source code and setting it up on a different hosting service. For continuous execution of the test suite we have chosen to use TravisCI

3.3 Testing

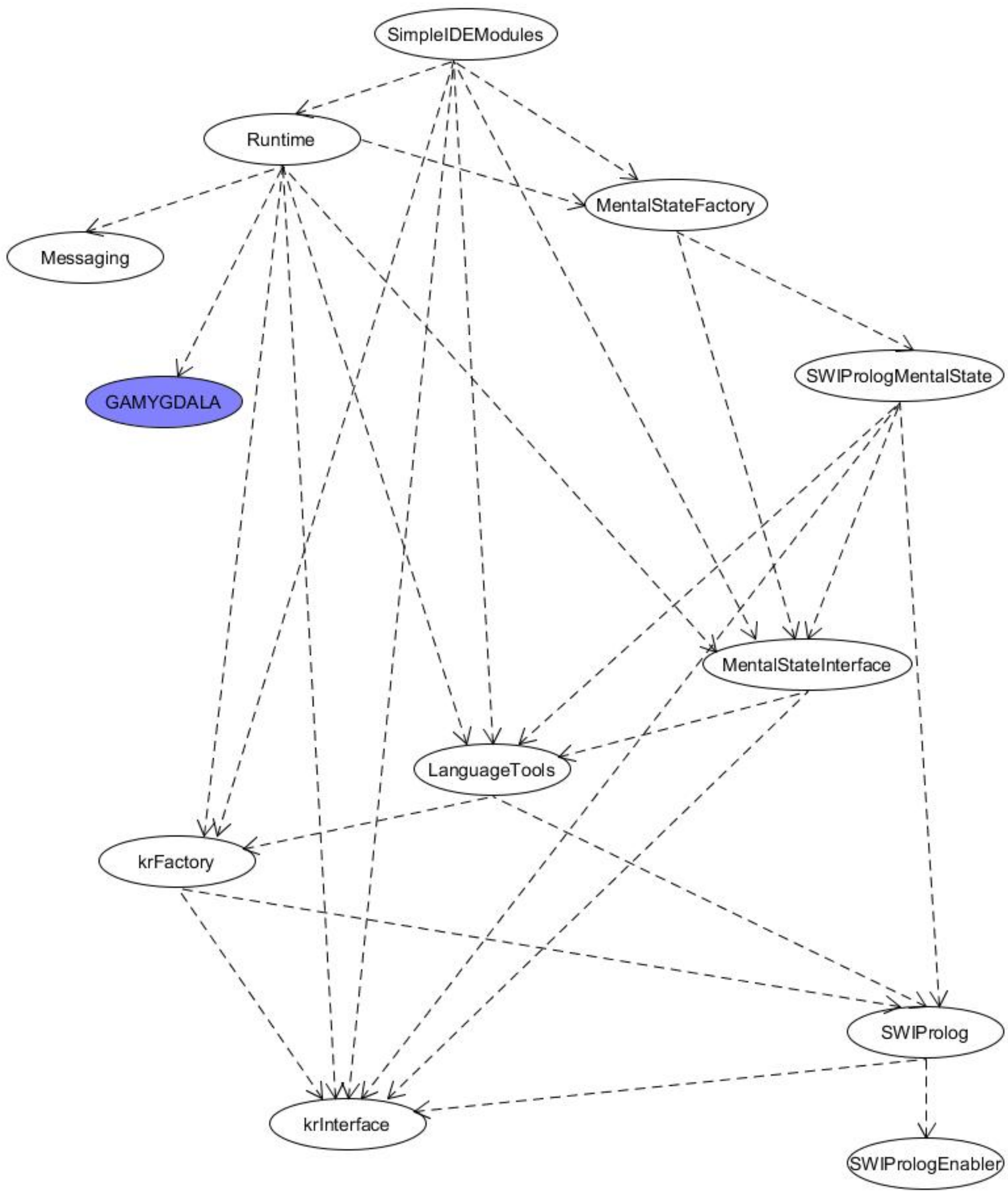
Through writing a suite of unit and integration tests we will ensure correctness of the methods and structures we add to GOAL. Since our job is to create an integration of two existing pieces of software, functionality is the most important word for our team. It should be noted that this is a proof of concept, and the time frame for this project is limited, even more so because the group that depends on our functionality will also need time to work with this GOAL version to build their agent before the end of the project. As we focus on making sure the other groups receive the necessary features on time, some of them might be implemented quickly and dirtily. We would rather have code that ought to be rewritten sometime but works now to provide the function of a Virtual Human's gamygdala than spending a lot of time writing code that the other group cannot use because of time pressure. SCRUM seems to be the appropriate project management tool for this quick, iterative approach. Testing of the modified software packages will be done mostly in the JUnit framework, seeing as we are writing Java code. Because of the large pre-existing code base, its high complexity and the relatively low test coverage over these approximately 20.000 lines we have decided that achieving high coverage on the GOAL project is not feasible within the time frame of this project. We will focus on achieving high unit test coverage on the methods we modify (as stated in the definition of done in the product vision, aiming for >75%), and writing integration tests that specifically target added functionality with the (faulty) assumption the pre-existing code is completely debugged, instead of spending an inordinate amount of time checking whether GOAL works as intended. Testing of the Gamygdala port was the responsibility of group 4, and they have achieved good test coverage on it.

3.4 Code Quality

During this project our group will use the pull request method to develop and review code. This procedure ensures that code quality is maintained on the release branch of every github repository relevant to the project since no changes can be made without first being reviewed. This section describes the method by which we create and process these requests. When an issue is created on github for for example new functionality, bug fixes, lack of tests or any other reason, any group member can claim the issue and open a new branch on the repository. In this personal branch modifications are made only by this group member, the changes are committed, Continuous Integration will run our test suite and the results are displayed on TravisCI and github. When the group member has finished his modification and the tests pass, he may create a pull request to merge these changes into the master branch. At least two group members other than the one making the request then review the changes and may comment on them if they have any additions or spot a mistake, prompting the requester to modify his branch accordingly. The pull request is reviewed once more, and this cycle is continued until there are no more suggestions for improvement. Then the pull request is OK'd and merged into master branch, after which the group member is free to claim another issue. This method enables the group to work more efficiently by separating several steps of the development process. Issues are created as they appear during work hours. Group members can claim issues and work on their issues on individual branches without having to communicate about who is doing what or which files in the branch are currently being modified, which means working out of the office is much less of a hassle than it would have been if we had to keep track of this by hand. Code review is also streamlined by pull requests. For every pull request a list of changes is generated and shown on the same page, so analyzing the changes made is only a matter of a bit of scrolling. Compared to having to look through changed files manually or running git diff from the command line this is a huge improvement. With this overview and the checks ran by TravisCI, it is only a matter of a few seconds to see if a change is correct or needs some more attention. We will attempt to keep the amount of changes in every pull request as small as possible to make reviewing them an easy task.

3.5 Packages

This section gives an overview of the structure of the GOAL project, and lists the repositories in it we will modify. Here GAMYGDALA is represented as a stand-alone repository, but for convenience we have inserted it into the runtime package.



Throughout the project we have updated this list of changed packages which resulted in the following:

3.5.1 Runtime

The packages from the runtime repository:

goal.core.mentalstate: Here we extended functionality so goals that are added to agents are also added to the Gamygdala engine. When goals are achieved or dropped this is also send to the Gamygdala engine.
goal.core.agent: This package was modified so that each time an agent is created it is added to Gamygdala if it does not yet exist in Gamygdala.
goal.core.runtime.service.agent: This package is where percepts are handled and where we insert the emotions rendered by the gamygdala engine into their own EmotionBase, which is similar to the PerceptBase in the aspects that it will be flushed and repopulated every cycle and the agent should be able to reason about emotions just like reasoning about percepts.
goal.tools: This packages contains classes needed to run mas2g files. These were adjusted to parse our emotion configuration file before the agents start running so that this configuration is available to Gamygdala.

3.5.2 Grammar

The packages from the grammar repository:

languageTools.parser.relationParser: This is a subpackage we have added to the parser package to parse our emotion configuration files. It contains the parser itself and the classes needed to store the information we parsed.
languageTools.exceptions.relationParser: A package we added to contain the new exceptions thrown by our parser.
languageTools.analyzer: This is a part of the ANTLR framework, here the parsed files are analyzed and handled correctly, this needed to be modified to properly store our emotion configuration file and to allow for our own predicates to be used to query emotions.
languageTools.program.agent.mas: This stores information about the parsed mas files, this needed to be modified to be able to hold the parsed information that will be passed to it by the languageTools.analyzer package.
In this package we also modified the ANTRL .g4 files. These files define how the .mas2g and .goal should be parsed these had to be modified to accommodate our emotion configuration.

3.5.3 MentalState

This repository needs to be modified to add the EmotionBase to the list of basetypes and will need to be extended so that prolog can do its calculations with these. GOAL has multiple bases for knowledge and beliefs and percepts (and now emotion) whereas prolog only has one knowledge base, which means all knowledge, beliefs, percepts and emotions need to be inserted into the same base before it is handed down to prolog as one knowledge base.

3.5.4 SimpleIDE

We have chosen to modify the SimpleIDE, as this would be slightly less work than modifying the Eclipse plugin, in our estimation adding GUI elements to it is fairly straightforward. We will need to add a tab like the one for percepts which displays the emotions an agent is feeling.

4 Design patterns

This section will give a short discussion on the design patterns used in our project. Since the project was about modifying existing code we sadly enough didn't have many opportunities to use design patterns in an interesting way since we mostly just had to follow the structure already given to us by GOAL.

4.1 Singleton

Singleton was used twice in our program.
First the emotion configuration is a singleton this is useful because it makes it so that this configuration is easily accessible anywhere in the program to get settings like the default values from it. Logically speaking a GOAL program can also only run with one active configuration so the singleton pattern makes sense
Secondly the singleton pattern was used for the Gamygdala instance, again this makes sense since that means we can easily access this instance anywhere in the program to for example ask it to update the emotions and again there should never be more than one Gamygdala instance in our program so singleton makes sense. We proposed this idea to the group that made the Gamygdala port and they liked it so afterwards it was implemented as the default way of using Gamygdala in their repository as well.

References

[1] GOAL programming language `http://ii.tudelft.nl/trac/goal`

[2] Gamygdala emotion engine `http://ii.tudelft.nl/~joostb/gamygdala/index.html`

[3] ANTLR, another tool for language recognition `http://www.antlr.org`

[4] github, the online git hosting service `http://www.github.com`