Alloy and Formal methods of Web development







AIM

- To show the advantages of modelling during the development of an application.
- More emphasis on the requirements.
- To remove the bugs directly during development process rather than during the production of the app.
- To show that modular development helps in pipelining and automation.

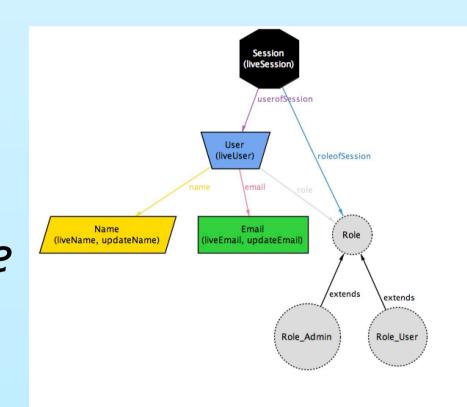
INTRODUCTION

Alloy and formal methods of web development:

This Web-application is a simple user directory. It allows users have role, name, email. This app has many functionalities such as add, update, delete show users etc,. It is written in python.

Alloy is a tool for relational modelling which uses expressive login based notations.

We used alloy to show the various constrains that a application model faces while designing it. eg. 1. Can users have same name or email? . 2. How many roles a user can have?



-The Alloy Analyzer generated metamodel of the app showing the relations of all the entities in the app

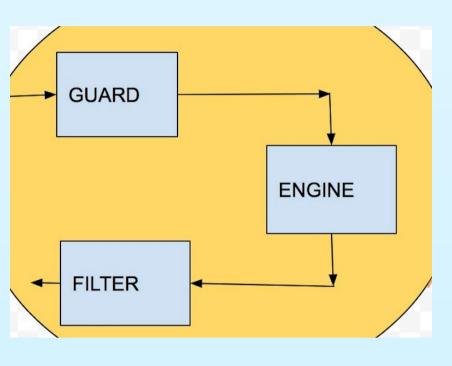
Motivation to model our app in a specification language(like Alloy) is that it helps us in checking the correctness of our data-model before actually writing the real code. Also, the client may ask us to add new requirements or constraints and there is a necessity to check whether the new constraints don't break the constraints of the previously present requirements.

METHODS

Routing: All the operations in the app follow a workflow, i.e, an instruction is generated from the REST API and sent to the components. The app has 2 components,

Guard: This does all the checks such as type check, auth check and state check depending upon the type of instruction.

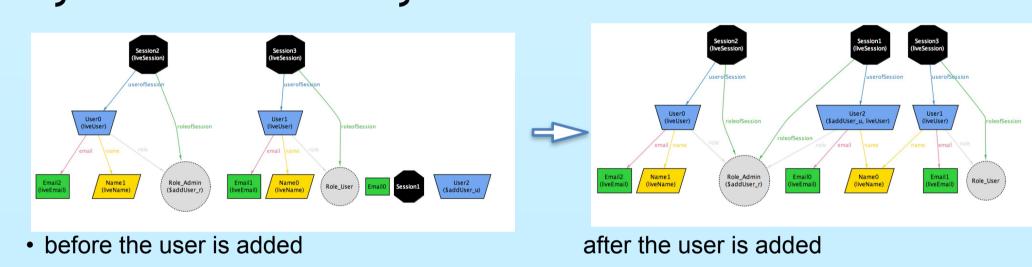
Engine: This does the operations on the entities and



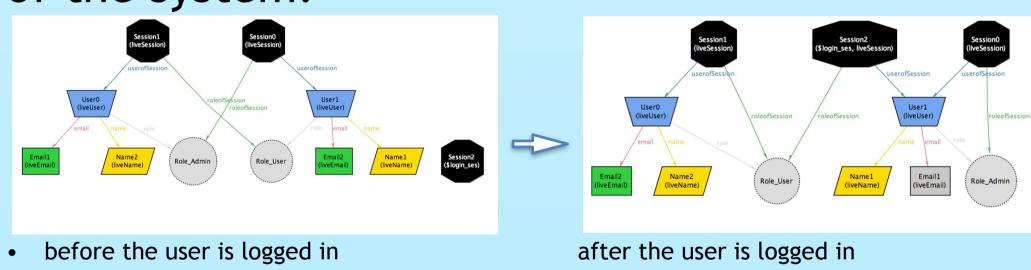
Alloy Model

returns the result.

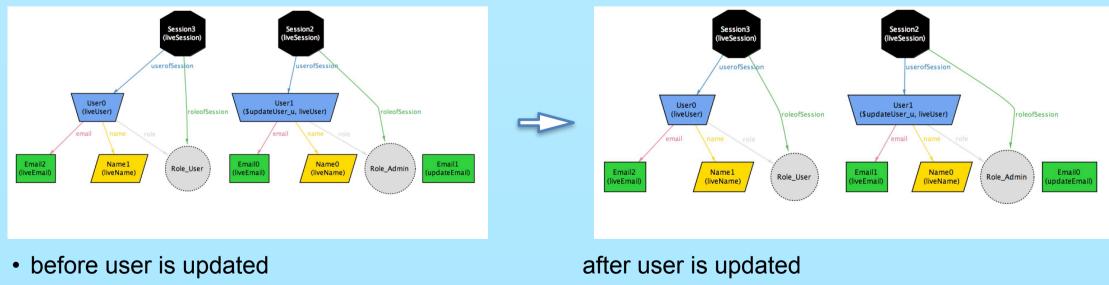
Add user: This example shows user being added by the admin in system.



<u>User Login</u>: This example shows user login inside of the system.

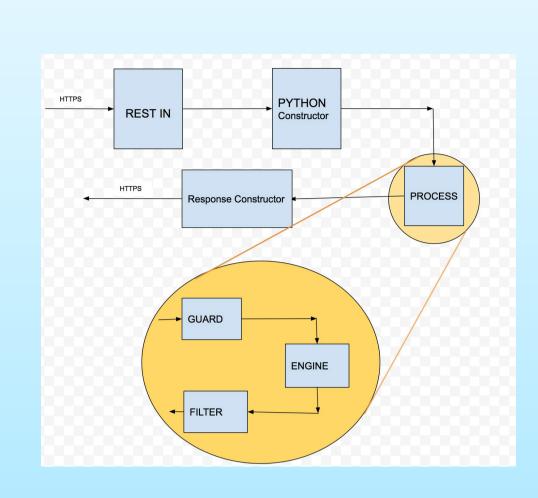


<u>Update user:</u> This example shows user credentials being updated by the admin in system.



MODULAR DEVELOPMENT

<u>Modular development</u> is a technique which is used to break down our app into independent modules which can perform a task. We combine all such modules in a certain order(i.e, we generate a *workflow*) to get a certain operation done.



workflow of the app

RESULTS

- Completed all the necessary routes (12 routes) and their tests (totally 114 tests) in the web-app-short-course.
- The routes are successfully built modularly.
- Relational modelling helped us in defining a better database for the app and also helped in achieving the requirements without any bugs.

CONCLUSIONS

- Our work shows how using a specification language to model our app helps us in understanding the requirements better.
- Modelling in Alloy and modular development helps in automating the process of developing an application by giving some inputs and requirements.
- Modular development helps in achieving pipelining as each module is independent and can be used according to the operation.



Developers name: Anirudh Reddy, Shubh Maheshwari Mentors: Professor Venkatesh Choppella, Thirumal Ravula