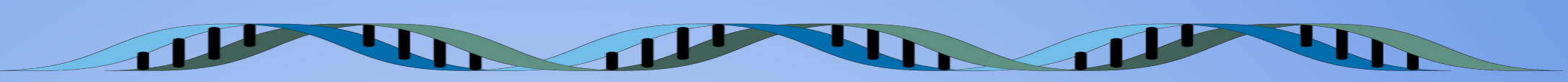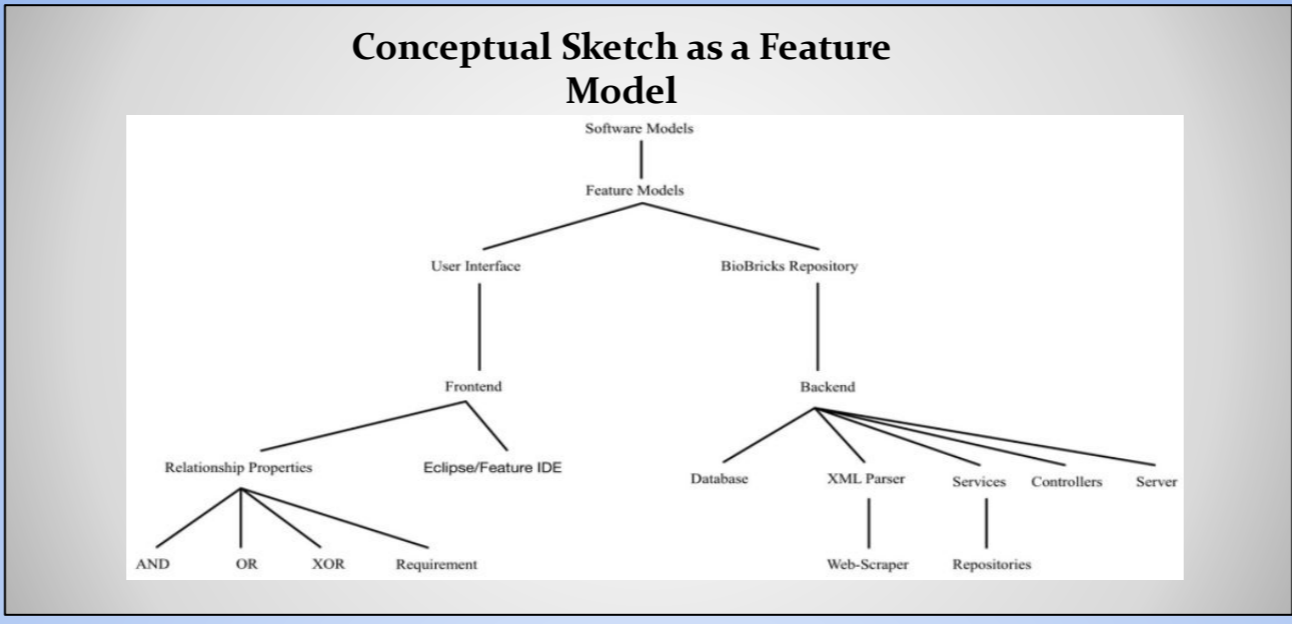# DNA To Feature Models

Team: SD-DEC20-22
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Introduction

- Synthetic Biology is a growing field worldwide
- Scientists worldwide are using synthetic biology to create and make discoveries never-before seen
- Software Product Lines are a set of software systems with the intrinsic value of features pertaining to the satisfaction of certain needs.
- Fundamentals include: commonality, variability, and a hierarchical model.
- A set of these SPLs are called families of SPLs. A subset of SPLs are Feature Models.
- Scientists require a way to present Feature Models.
- **Feature Modeling** is an organization tool that allows feature representation in a hierarchical tree
- **Our goal** is to create an Eclipse plugin that creates Feature Models based on existing models found in the BioBricks Repository
- Successful implementation allows biologists and scientists to view various models from BioBricks in an organized hierarchy

Intended Users and Uses

The main users are scientists that build biological models of living organisms with specific desired properties. The goal of this project aims to be an aid for everyone interested in building DNA Feature Models without any restriction.
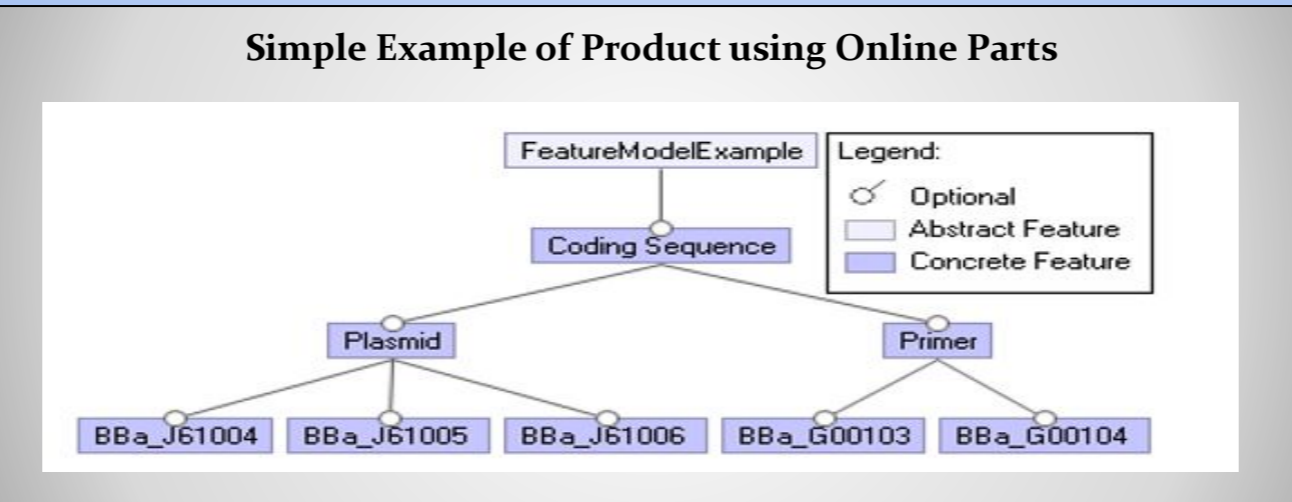
Project standards

We followed a set of standards to ensure development of a product that is safe and adheres to the consumer preferences and expectations; while also ensuring a reliable, and organized workflow for the engineers and the consumer.

These are the standards we followed:

- IEEE Engineering Standards
- IEEE Software Engineering Standards

Design Approach

- Research and analysis of papers to design an architectural blueprint of the project [1]
- Organic Software Product Lines and Principles of Feature Modeling provided information for the project
- Project includes: software product line engineering, BioBricks repository, and FeatureIDE
- Solid comprehension software product line will include data scraping and parsing datas to database
- SQL server database is used to contain database
- For parsing data: Java and XML programming was used to provide multiple methods
- XML tree builder program that is transferred directly to FeatureIDE to build model(s) from parts

Conceptual Sketch as a Feature Model

Design Requirements

Functional Requirements:
- Extract BioBricks part data using web scraper and XML extraction
- Automatically parse scraped part info into objects and populate the database
- Construct BioBricks Feature Models through FeatureIDE
- Create Software Product Lines from models using a simple GUI

Non-functional Requirements:
- Ensure part database' capacity, security and accessibility to establish easy upgradability and data fetching
- Efficient and fast response time for web scraping, XML extraction and Feature Model construction
- Ability to handle many clients accessing the server without hindering performance

Testing

- Functionality testing
  Created test cases that asses all function implemented and ensures correct functionality
- Mockito Tests
  Used to test part information parsing and database behavior
- Review of full code
  Presented code to a professional for review and criticism
- CI/CD
  Keeps the server running automatically and detects compiling issues on recent pushes to the Git
  Immediately push latest updates to code.
- Code analysis:
  Testing the code with a software called PMD Java that reveals security vulnerabilities and concurrency issues
- JUnit Tests
  Verify the wanted construction of feature models

Current Results from the Frontend. Data Extracted from Database

Simple Example of Product using Online Parts

Resources and operation Requirements

- MacOS 10.9 and above, any Linux OS, and Windows 7 and above
- Eclipse Integrated Development Environment
- Java Runtime Environment
- FeatureIDE Plugin for Eclipse Integrated Development Environment.
- MySQL Database
- Server Hosting
- Mockito Testing
- [1] "DNA as Features: Organic Software Product Lines" M. Cashman, M. B. Cohen et. al.
- [2] "Principles of Feature Modeling"J. Krüger et. al.