

Simbiome: A Structured Resource Inventory System

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INTRODUCTION

Simbiome is a trusted, online electronic resource inventory system that organizes and presents relevant resources for physics-based simulation of biomedical structures and related entities in biology and life sciences. It is part of the Simbios dissemination effort and is available online at <http://simbiome.org>. The code to run the site¹, as well as the underlying Ruby on Rails web framework², are all open source and available under the MIT license³.

Simbiome is designed to manage a set of structured, versioned resources, with curation by a group of people. Simbiome's architecture provides:

- **Easy, Distributed Maintenance:** The resources must be easy to maintain over time, otherwise the data quickly becomes outdated.
- **Quality Metrics:** Simbios wants to present the best-of-breed examples of available resources, so curation and approvals are integrated into the process.
- **Agility:** The data models, controlling logic, and web presentation components are separated and easily changed, making it easy to reuse the system for different types of resources.

RESULTS

Simbiome currently has 81 resources, and Figure 1 shows a screen shot of the working system. Each entry catalogs metadata about a software tool or library, a data source, or an online resource available to the community. People can search and submit entries to the system, and the content is curated by Simbios staff.

Data Model

Simbiome has 15 database tables. 7 tables store the data model for each resource and the remaining are used to support users, permissions and other features within the Simbiome. The complete schema and data models are available online.^{1, see also 4}

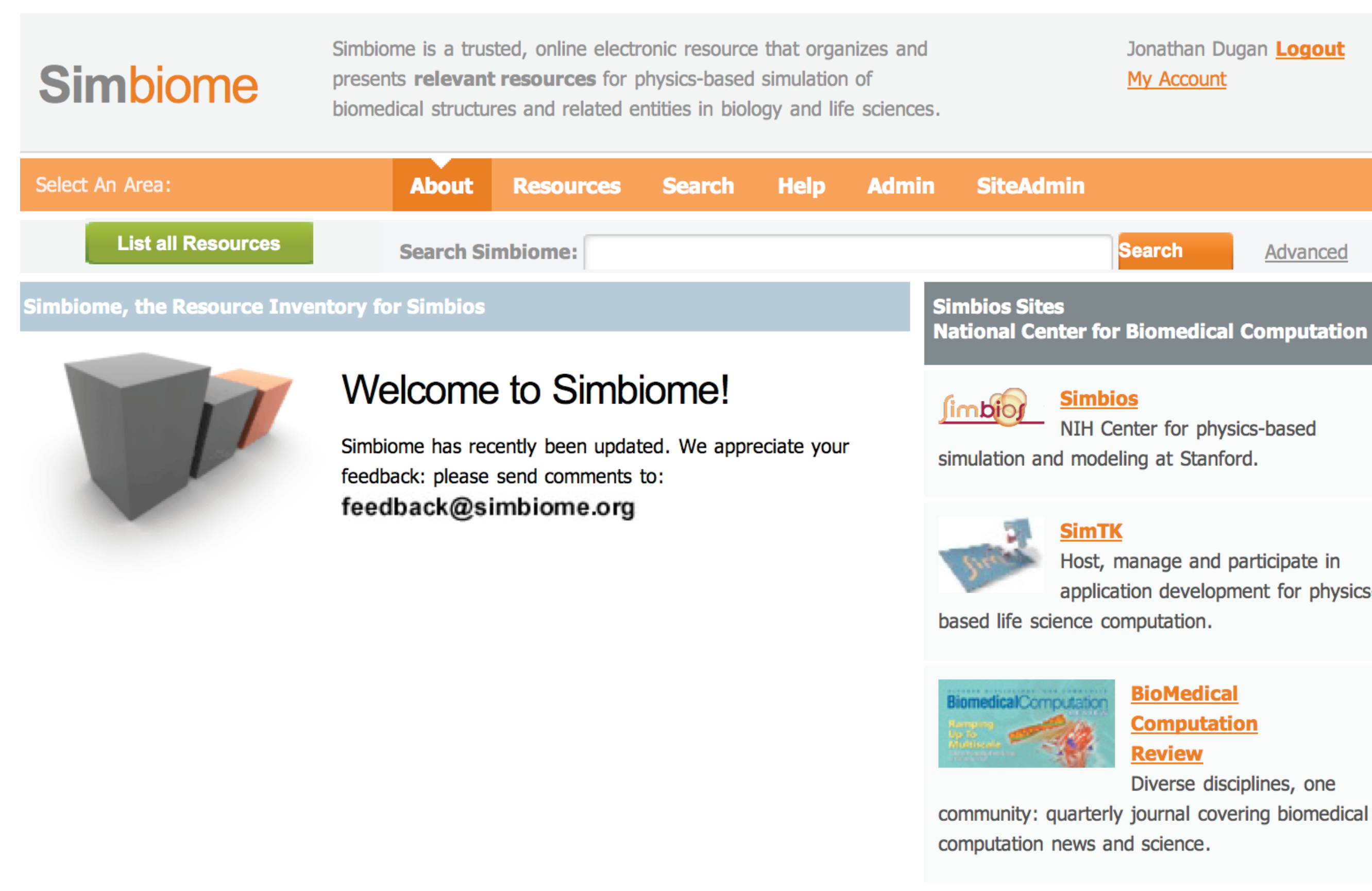


Figure 1: Screen shot of the Simbiome.org website

RESULTS

System Features

- **Users, Authentication and Authorization:** Simbiome has a complete user model that supports role-based access control. Simbiome supports complex authorization expressions using a simple language for specifying roles and the rights accompanying those roles.

Current roles include:

- Site Admin
 - Master Curator
 - Curator of Resource
 - Submitter
 - Owner of Resource
- } Simbios Staff Only

- **Versioning and Drafts:** Public submissions and changes are routed for approvals by the curation team. All changes are tracked over time. Curators can review specific differences in the data model between drafts and old versions.

- **Search:** Simbiome has search capability employing weights for each data element, and the site is searchable by external search engines.

- **Ontology Relations:** Simbiome supports relations between entries. Entries are marked as *similar* when they provide similar function, and *related* when there exists a more general relationship between them.

- **Feedback:** Registered users and public visitors are encouraged to provide feedback on entries using flags, which are reviewed by curators.

METHODS

Data Collection Process

Suggestions for initial entries were solicited from Simbios Staff. Initial content was collected from publications and websites and entered manually. All content was reviewed and edited for quality and neutral point of view. For all resources outside Simbios, content owners were contacted and encouraged to create user accounts and edit their Simbios entry.

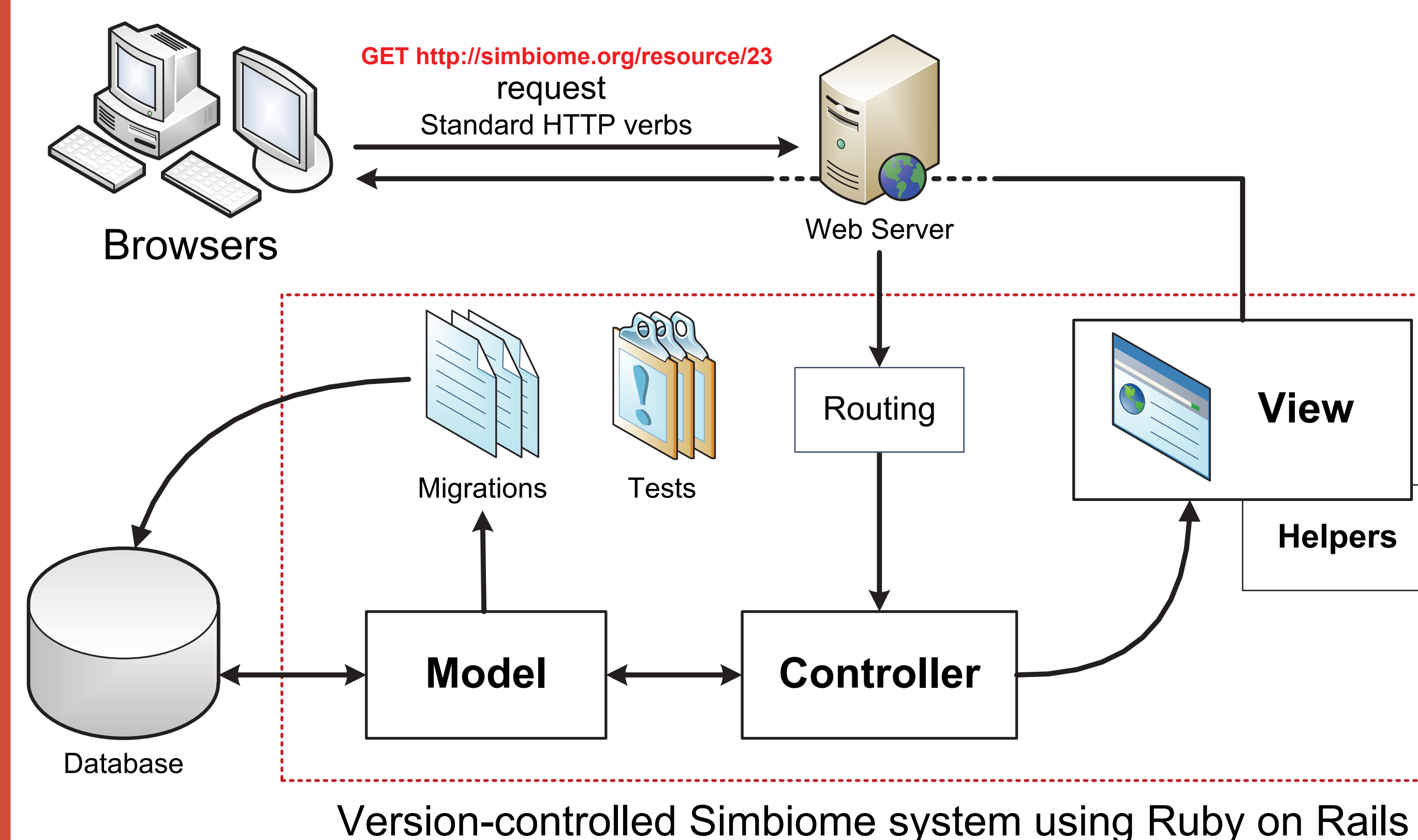


Figure 2: Architecture of Simbiome leveraging the Ruby on Rails framework.

METHODS

Ruby on Rails

Simbiome is built with the object-oriented language, Ruby, and a web development framework called Ruby on Rails. The Rails framework incorporates many systematic best practices for web development and includes a native object-relational mapping tool for easy integration with databases. The primary benefits to using Rails are fast development times, ease and flexibility in changing and maintaining data models and presentation, fewer lines of code, and deep support for testing.

Architecture

Figure 2 show the system architecture. Simbiome separates the Model, View, and Controller. This separation facilitates reuse and refactoring by other centers for their particular needs. All elements are maintained under version control, including the database schema, which is versioned through migrations, a feature in the Rails framework. The view is written in rHTML, which is primarily HTML with embedded view-related Ruby or Javascript code.

FUTURE: Reuse and Interoperability through REST

Simbiome employs a simple, REST architectural style.⁵ Resources in the inventory are directly accessible "nouns" (simbiome.org/resource/23), which currently supports GET operations. Future work will allow these resources and other data models (e.g. organizations, users, comments) to be manipulated through the standard HTTP "verbs" GET, POST, PUT, and DELETE.

This RESTful architectural style will be fully embraced in the next generation of Ruby on Rails, and Simbiome will provide a simple REST API that others can easily program against to manipulate our data. REST APIs have been used by Amazon, Google, Yahoo, and other companies providing web services, and we feel its simplicity will greatly enhance collaboration across centers.

CONCLUSIONS

- Simbiome provides a Resource Inventory system for software tools and data for physics-based life science simulation.
- The system employs an agile web development framework, making it easy to maintain and to reuse for other types of resources.
- Simbiome supports public dissemination and distributed maintenance and approval of resources.
- Future work will include a rating system and user submission of written comments on existing entries, and moving to a more RESTful architecture that provides simple web APIs to access and edit content.

LINKS

- 1 <https://simtk.org/svn/simbiome>
- 2 <http://www.rubyonrails.org>
- 3 <http://www.opensource.org/licenses/mit-license.php>
- 4 http://na-mic.org/Wiki/index.php/SDIWG:NCBC_Software_Classification_SimbiosTemplate
- 5 <http://www.xfront.com/REST-Web-Services.html>

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